MATOC TASK ORDER

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VOLUME 3 OF 3

SPECIFICATIONS

FOR

WEAPONS RESEARCH EXPERIMENTATION CONTROL CENTER (WRECC)

EGLIN AIR FORCE BASE, FLORIDA
(OKALOOSA COUNTY)

"GOOD ENGINEERING RESULTS IN A BETTER ENVIRONMENT"

US Army Corps of Engineers ®
Mobile District

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SECTION 31 00 00

EARTHWORK
02/21

PART 1 GENERAL

1.1 MEASUREMENT PROCEDURES

1.2 PAYMENT PROCEDURES

Payment will constitute full compensation for all labor, equipment, tools, supplies, and incidentals necessary to complete the work as a lump sum.

1.3 CRITERIA FOR BIDDING

Base bids on the following criteria:

a. Surface elevations are as indicated.

b. Ground water elevations indicated by the boring log were those existing at the time subsurface investigations were made and do not necessarily represent ground water elevation at the time of construction. Ground water elevation is approximately 20 feet below existing surface elevation.

c. Soil material characteristics are indicated on the boring logs and by the laboratory test data.

d. Hard materials and rock are not anticipated to be encountered in the excavations.

1.4 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	(2017) 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 WOOD PROTECTION ASSOCIATION (AWPA)

AWPA P5	(2015) Standard for Waterborne Preservatives

ASTM INTERNATIONAL (ASTM)

ASTM C136/C136M	(2014) Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM D1140	(2017) Standard Test Methods for Determining the Amount of Material Finer than 75-µm (No. 200) Sieve in Soils by Washing
ASTM D1556/D1556M	(2015; E 2016) Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method
ASTM D1557	(2012; E 2015) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3) (2700 kN-m/m3)
ASTM D2487	(2017) Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D422	(1963; R 2007; E 2014; E 2014) Particle-Size Analysis of Soils
ASTM D4318	(2017; E 2018) Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D4972	(2018) Standard Test Methods for pH of Soils
ASTM D6938	(2017a) Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA 600/4-79/020	(1983) Methods for Chemical Analysis of Water and Wastes
EPA SW-846.3-3	(1999, Third Edition, Update III-A) Test Methods for Evaluating Solid Waste: Physical/Chemical Methods

1.5 DEFINITIONS

1.5.1 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, SM, SW-SM, SC, CL and any dual classification thereof. Satisfactory materials for grading comprise stones less than 8 inches, except for fill material for pavements which comprise stones less than3 inches in any dimension.

1.5.2 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.

1.5.3 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/C136M and ASTM D1140.

1.5.4 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 the3/4 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.

1.5.5 Topsoil

If suitable topsoil is not available within the limits of the work area, it should generally be the Contractor's option to either treat the soil of the graded areas with fertilizer and supplements so as to be conducive to turf establishment and maintenance, or to transport topsoil to the project site.

Material suitable for topsoils obtained from offsite areas or excavations 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. The soils pH must be tested in accordance with ASTM D4972

Organic matter shall contain 5 to 10 percent as determined by the topsoil composition tests of the Organic Carbon, 6A, Chemical Analysis Method described in DOA SSIR 42. Maximum particle size, 3/4 inch, with maximum 3 percent retained on 1/4 inch screen.

1.5.6 Unstable Material

Any localized areas beneath structures that are too soft or too wet to provide a stable fill, or subgrade soils that exhibit pumping action when construction equipment passes over should be aerated and reconditioned to provide a stable condition. If reasonable efforts, as determined by the Contracting Officer, do not produce a stable condition, this material is

considered unstable, requiring undercutting to a stable subgrade.

1.5.7 Select Granular Material

1.5.7.1 General Requirements

Select granular material consist of well graded sand, gravel, crushed gravel, crushed stone, or crushed slag composed of hard, tough, and durable particles, and shall contain no more than 10% by weight of material passing a No. 200 sieve and no less than 95% by weight passing the 1 inch sieve.

1.5.8 Bedding & Initial Backfill Material for roadway Pipes

Bedding and initial backfill consists of select granular material or satisfactory materials free from rocks 1 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 fill material of stones larger than 1/4 inches in any dimension or as recommended by the pipe manufacturer, whichever is smaller.

1.5.9 Pile Supported Structure

Structure where both the foundation and floor slab are pile supported will follow the requirements recommended in Auger Cast-in-Place Piles (UFGS 31 63 16).

1.6 SYSTEM DESCRIPTION

Subsurface soil boring logs are appended to the specification. The subsoil investigation report and samples of materials taken from subsurface investigations may be examined upon approval of submitted request. These data represent the best subsurface information available; however, variations may exist in the subsurface between boring locations.

1.6.1 Classification of Excavation

No excavated materials, free of organics and other and deleterious materials and satisfying the specifications of select fill may be stock piled for re-use beneath structures.

1.6.2 Dewatering Work Plan

Submit procedures for accomplishing dewatering work.

1.7 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Shoring; G, DO

Dewatering Work Plan; G, DO

SD-03 Product Data

Utilization of Excavated Materials; G
Opening of any Excavation or Borrow Pit; G
Shoulder Construction; G

SD-06 Test Reports

Testing; G
Borrow Site Testing; G

topsoil composition tests

SD-07 Certificates

Testing; G

PART 2 PRODUCTS

2.1 ADDITIONAL REQUIREMENTS FOR OFFSITE SOILS

Test offsite soils brought in for use as backfill for Total Petroleum Hydrocarbons (TPH), Benzene, Toluene, Ethyl Benzene, and Xylene (BTEX) and full Toxicity Characteristic Leaching Procedure (TCLP) including ignitability, corrosivity and reactivity. Backfill shall contain a maximum of 100 parts per million (ppm) of total petroleum hydrocarbons (TPH) and a maximum of 10 ppm of the sum of Benzene, Toluene, Ethyl Benzene, and Xylene (BTEX) and shall pass the TCPL test. Determine TPH concentrations by using EPA 600/4-79/020 Method 418.1. Determine BTEX concentrations by using EPA SW-846.3-3 Method 5030/8020. Perform TCLP in accordance with EPA SW-846.3-3 Method 1311. Provide Borrow Site Testing for TPH, BTEX and TCLP from a composite sample of material from the borrow site, with at least one test from each borrow site. Do not bring material onsite until test results have been approved by the Contracting Officer.

2.2 BURIED WARNING AND IDENTIFICATION TAPE

Provide polyethylene plastic and metallic core or metallic-faced, acid- and alkali-resistant, polyethylene plastic warning tape manufactured specifically for warning and identification of buried utility lines. Provide tape on rolls, 3 inches 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

Warning Tape Color Codes	
Blue	Water Systems
Green	Sewer Systems
White	Steam Systems
Gray	Compressed Air

2.2.1 Warning Tape for Metallic Piping

Provide acid and alkali-resistant polyethylene plastic tape conforming to the width, color, and printing requirements specified above, with a minimum thickness of 0.003 inch and a minimum strength of 1500 psi lengthwise, and 1250 psi crosswise, with a maximum 350 percent elongation.

2.2.2 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.

2.3 DETECTION WIRE FOR NON-METALLIC PIPING

Insulate a single strand, solid copper detection wire with a minimum of 12 AWG.

2.4 MATERIAL FOR RIP-RAP

Provide Filter fabric and rock conforming to DOT specification for construction of riprap protection and as indicated in the plans.

2.5 CAPILLARY WATER BARRIER

A minimum 15-mil thick vapor barrier and a 6-inch capillary water barrier consisting of clean, crushed, nonporous rock, crushed gravel, or uncrushed gravel with a maximum particle size of 1.5 inches and no more than 2 percent by weight passing the 3/16 inch size (No. 4) sieve.

2.6 PIPE CASING

2.6.1 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. Protective coating is not required on casing pipe.

2.6.2 Wood Supports

Treated Yellow Pine or Douglas Fir, rough, structural grade. Provide wood with nonleaching water-borne pressure preservative (ACA or CCA) and

treatment conforming to AWPA P5. 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 inches. 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 inches in diameter, and other materials that would interfere with planting and maintenance operations.

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 Ditches, Gutters, and Channel Changes

Finish excavation of ditches, gutters, and channel changes by cutting accurately to the cross sections, grades, and elevations. Do not excavate ditches and gutters below grades shown. Backfill the excessive open ditch or gutter excavation with satisfactory, thoroughly compacted, material or with suitable stone or cobble to grades shown. Dispose excavated material as shown or as directed, except in no case allow material be deposited a maximum4 feet from edge of a ditch. Maintain excavations free from detrimental quantities of leaves, brush, sticks, trash, and other debris until final acceptance of the work.

3.2.2 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.

3.2.3 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. Construct storm drainage features (ponds/basins) at the earliest stages of site development, and throughout construction grade the construction area to provide positive surface water runoff away from the construction activity and/or provide temporary ditches, swales, and other drainage features and equipment as required to maintain dry soils. 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 protect the subgrade to permit construction to proceed.

3.2.4 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. Do not permit French drains, sumps, ditches or trenches within3 feet of the foundation of any structure, except with specific written approval, and after specific contractual provisions for restoration of the foundation area have been made. Employ ground water 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 2feet below the working level. Operate dewatering system continuously until construction work below existing water levels is complete. Submit performance records weekly.

3.2.5 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 3feet 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 3 feet high. Excavate trench walls 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 than24 inches inside diameter, and do not exceed36 inches plus pipe outside diameter for sizes larger than24 inches 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.

3.2.5.1 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 inches or greater in any dimension, or as recommended by the pipe manufacturer, whichever is smaller, to avoid point bearing.

3.2.5.2 Removal of Unyielding Material

Where unyielding material is encountered in the bottom of the trench, remove such material 4 inches below the required grade and replaced with suitable materials as provided in paragraph BACKFILLING AND COMPACTION.

3.2.5.3 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.

3.2.5.4 Excavation for Appurtenances

Provide excavation for manholes, catch-basins, inlets, or similar structures sufficient to leave at least12 inches clear between the outer structure surfaces and the face of the excavation or support members. Clean rock or loose debris and cut to a firm surface either level, stepped, or serrated, as shown or as directed. Remove loose disintegrated rock and thin strata. When concrete or masonry is to be placed in an excavated area, take special care not to disturb the bottom of the excavation. Do not excavate to the final grade level until just before the concrete or masonry is to be placed.

3.2.6 Underground Utilities

The Contractor is responsible for movement of construction machinery and equipment over pipes and utilities during construction. Perform work adjacent to non-Government utilities as indicated in accordance with procedures outlined by utility company. Report damage to utility lines or subsurface construction immediately to the Contracting Officer.

3.2.7 Structural Excavation and Building Slab Subgrade Preparation

a. Grade beams and footings should be neatly excavated if possible. If neat excavation is not possible, the foundation should be properly formed. If a toothed bucket is used, excavation with this bucket should be stopped approximately 6 inches above final grade and the grade beam/footing excavation completed with a smooth-mouthed bucket or by hand labor. Debris in the bottom of the excavation should be removed prior to steal placement.
b. The foundation excavation should be sloped sufficiently to create internal sumps for runoff collection and removal. If surface runoff water or groundwater seepage in excess of 1/2 inch accumulates at the bottom of the foundation excavation, it should be collected, removed, and not allowed to adversely affect the quality of the bearing surface.
c. During stripping operations, it is recommended that the on-site excavated soils be completely removed and stockpiled for reuse as fill in general areas outside of building/pavement areas. Excavated materials satisfying

the criteria for select fill can be used beneath foundations, buildings and pavements.

d. All footings and slab foundations shall be excavated a minimum of 24 inches beneath the planned bearing level. The footing excavation shall extend laterally beyond the footing perimeter a minimum of 2 feet at the excavation level. Backfilling shall use satisfactory fill compacted to 95 percent of the material's Modified Proctor Density as per ASTM D-1557. The entire building area shall be undercut a minimum of 36 inches below existing grade. The excavation shall extend a minimum of 5 feet beyond the perimeter of the building. Backfill material shall be satisfactory fill compacted to 95 percent of the material's Modified Proctor Density as per ASTM D-1557.

e. A polyethylene vapor barrier (15-mil thick) and a minimum 6-inch capillary water barrier shall be provided beneath (interior) floor slabs supported on-grade. The vapor barrier and capillary water barrier are not required for exterior slabs-on-grade that are open/exposed to the elements (e.g. mechanical equipment pads, generator pads etc. which are not subject to heated and/or cooled interior spaces) and not connected to the building. The 6-inch capillary water barrier shall consist of clean crushed, nonporous rock, crushed gravel, or uncrushed gravel with a maximum particle size of 1.5 inches and no more than 2 percent by weight passing the 3/16 inch size (No. 4) sieve.

f. Prior to placement and compaction of fill and prior to floor slab construction, the soil subgrade should be thoroughly proofrolled with a 20-ton vibrating roller. The above subgrade preparation recommendations should be applied to an area extending a minimum of 5 feet outside of the building and canopy areas, including attached walkways and any other architectural elements.

3.3 OPENING AND DRAINAGE OF EXCAVATION AND BORROW PITS

Notify the Contracting Officer sufficiently in advance of the opening of any excavation or borrow pit or borrow areas 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.

3.4 SHORING

Shoring is not anticipated in construction of this project. If the contractor elects to perform shored excavations then, shoring shall not be permitted without prior written approval of a licensed Geotechnical engineer. Install shoring as necessary to protect workman, adjacent paving, structures and utilities. Remove shoring, bracing and sheeting as excavations are Backfilled, in a manner to prevent caving.

3.4.1 Geotechnical Engineer

The Contractor shall hire a Professional Geotechnical Engineer and testing laboratory to provide inspection of excavations, monitor fill placement and soil compaction, sample and test construction materials, and inspect soil/groundwater conditions throughout construction. The Geotechnical Engineer is responsible for performing pre-construction and periodic site visits throughout construction to assess site conditions.

3.5 SHORING

Shoring is not anticipated in construction of this project. If the contractor elects to perform shore excavations then, shoring shall not be permitted without prior written approval of a licensed Geotechnical Engineer. Install shoring as necessary to protect workman, adjacent paving, structures and utilities. Remove shoring, bracing and sheeting as excavations are Backfilled, in a manner to prevent caving.

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 unsatisfactory materials as specified. Keep stockpiles in a neat and well drained condition, giving due consideration to drainage at all times. Clear, and grub, 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. Roughen the level surfaces, and cut the sloped surfaces, as indicated, into rough steps or benches to provide a satisfactory bond.

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 inches 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 inches, 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 inches and compact it as specified for the adjacent fill.

3.8.2 Frozen Material

Do not place material on surfaces that are muddy, frozen, or contain frost. This prohibition encompasses all foundation types, including the natural ground, all prepared subgrades (whether in an excavation area or on an embankment) and all layers of previously placed and compacted earth fill which become the foundations for successive layers of each fill. All material that freezes or has been subjected to freeze-thaw action during the construction work, or during periods of temporary shutdowns, such as, but not limited to, nights, holidays, weekends, winter shutdowns, or earthwork operations, shall be removed to a minimum depth in accordance

with the latest UFC 3-301-01 and replaced with new material. Alternatively, the material shall be thawed, dried, reworked, and recompacted to the specified criteria before additional material is placed. The Contracting Officer will determine when placement of fill shall cease due to cold weather. The Contracting Officer may elect to use average daily air temperatures, and/or physical observation of the soils for this determination. Till material shall not contain frozen clumps of soil, snow, or ice.

3.9 UTILIZATION OF EXCAVATED MATERIALS

Dispose unsatisfactory materials by removing from Government property. Reu se satisfactory material removed from excavations, insofar as practicable, in the construction of fills, embankments, subgrade's, shoulders, bedding (as backfill), and for similar purposes. Submit procedure and location for disposal of unused satisfactory material. Do not waste any satisfactory excavated material without specific written authorization.

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 inches below finished grade; under pavements and slabs, bury tape6 inches below top of subgrade.

3.10.2 Buried Detection Wire

Bury detection wire directly above non-metallic piping at a distance not to exceed12 inches 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 of3 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, in successive horizontal layers of loose material not more than 12 inches in depth for motored compaction equipment and 4 inches for hand compaction equipment. Compact to at least 90 percent laboratory maximum density as per ASTM D1557 for cohesive materials or 95 percent laboratory maximum density as per ASTM D1557 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 and 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 the grade shown. Backfill the trench to 2 feet above the top of pipe prior to performing the required pressure tests. Leave the joints and couplings uncovered during the pressure test. Do not

complete backfilling of the trench until all specified tests are performed.

3.11.1.1 Replacement of Unyielding Material

Replace unyielding material removed from the bottom of the trench with select granular material or initial fill 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 inches loose thickness.

3.11.1.3 Bedding and Initial Backfill for Utility Pipe Installation

Place initial fill material and compact it with approved tampers to a height of at leastone 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.

3.11.1.4 Final Backfill

Fill the remainder of the trench, except for special materials for roadways with satisfactory material. Place backfill material and compact as follows:

3.11.1.4.1 Roadways

Place backfill up to the required elevation as specified. Compaction by water flooding is not permitted.

3.11.1.4.2 Sidewalks, Turfed or Seeded Areas and Miscellaneous Areas

Deposit backfill in layers of a maximum of 12 inches loose thickness, and compact it to 85 percent maximum density of ASTM D1557 for cohesive soils and 90 percent maximum density of ASTM D1557 for cohesionless soils. Compaction by water jetting is not permitted.

3.11.2 Backfill for Appurtenances

After the manhole, catch basin, inlet, or similar structure has been constructed and the concrete has been allowed to cure for 7 days, place backfill in such a manner that the structure is not be damaged by the shock of falling earth. Deposit the backfill material, compact it as specified for final backfill, and bring up the backfill evenly on all sides of the structure to prevent eccentric loading and excessive stress.

3.12 EMBANKMENTS

3.12.1 Earth Embankments & Backfill of Undercuts

Construct earth embankments and backfill of undercut from satisfactory materials free of organic or frozen material and rocks with any dimension greater than3 inches. Place the material in successive horizontal layers of loose material not more than12 inches in depth. Spread each layer uniformly on a soil surface that has been moistened or aerated as necessary, and scarified or otherwise broken up so that the fill will bond with the surface on which it is placed. After spreading, plow, disk, or

otherwise break up each layer; moisten or aerate as necessary; thoroughly mix; and compact to at least 90 percent laboratory maximum density as per ASTM D1557 for cohesive materials or 95 percent laboratory maximum density as per ASTM D1557 for cohesionless materials.

Compaction requirements for the upper portion of earth embankments forming subgrade for pavements are identical with those requirements specified in paragraph SUBGRADE PREPARATION. Finish compaction by steel-wheeled rollers, vibratory compactors, or other approved equipment.

3.13 SUBGRADE PREPARATION

3.13.1 Proof Rolling

Finish proof rolling on an exposed subgrade free of surface water (wet conditions resulting from rainfall) which would promote degradation of an otherwise acceptable subgrade and following a period of rain-free dry weather. Perform proof rolling after rough grade has been established in cut areas and prior to placement of fill in fill areas and after the subgrade has been prepared as specified. Proof rolling should be conducted immediately following the subgrade compaction operation, when the moisture content of the subgrade soil is within the specified limits. Notify the Contracting Officer a minimum of 3 days prior to proof rolling. Perform proof rolling in the presence of the Contractor's Geotechnical Engineer. Proof roll subgrade with an 8-ton (minimum weight) or 10 ton (maximum weight) vibratory smooth roller. Operate the roller in a systematic manner to ensure three (3) passes over all areas, and at speeds between 2.5 to 3.5 mph. In the building and parking areas provide one-half of the passes made with the roller in a direction perpendicular to other passes. In road areas, the subgrade shall be rolled by passes of the roller parallel to the centerline beginning at one side of the roadway. Each pass shall overlap the preceding pass to ensure complete coverage.

Proof rolling shall be terminated whenever subgrade moisture is excessive. The moisture content of the subgrade soil shall be checked within any area indicated to be unstable. Any areas that deflect, rut or pump excessively during proof rolling shall be brought to satisfactory stability by additional processing, curing and compaction, or by removal and replacement of unsuitable materials, as directed by the Contracting Officer. The re-worked area shall then be proof rolled.

3.13.2 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. 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, the surface of the subgrade for roadways shall not show deviations 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.

3.13.3 Compaction

Finish compaction by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment. Except for paved areas, compact each layer of the embankment to at least 95 percent of laboratory maximum density as per ASTM D1557.

3.13.3.1 Subgrade for Pavements

Compact subgrade for pavements to at least 95 percent of the material's laboratory determined maximum density as per ASTM D1557 for a depth of 12 inches.

3.13.3.2 Subgrade for Shoulders

Compact subgrade for shoulders to at least 95 percent of the material's laboratory determined maximum density for the depth below the surface of shoulder shown.

3.14 SHOULDER CONSTRUCTION

Construct shoulders of satisfactory excavated or borrow material or as otherwise shown or specified. Submit advanced notice on shoulder construction for rigid pavements. Construct shoulders immediately after adjacent paving is complete. In the case of rigid pavements, do not construct shoulders until permission of the Contracting Officer has been obtained. Compact the entire shoulder area to at least the percentage of maximum density as specified in paragraph SUBGRADE PREPARATION above, for specific ranges of depth below the surface of the shoulder. Finish compaction by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment. Finish shoulder construction in proper sequence in such a manner that adjacent ditches will be drained effectively and that no damage of any kind is done to the adjacent completed pavement. Align the completed shoulders true to grade and shaped to drain in conformity with the cross section shown.

3.15 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 turfing materials. Repair graded, topsoiled, or backfilled areas prior to acceptance of the work, and re-established grades to the required elevations and slopes.

3.15.1 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.

3.15.2 Capillary Water Barrier

Place a 6 inch thick capillary water barrier under concrete slabs and area-way slabs directly on the subgrade and compact with a minimum of two passes of a hand-operated plate-type vibratory compactor or a small (2 ton maximum weight) vibratory smooth roller..

3.15.3 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.

3.16 PLACING TOPSOIL

On areas to receive topsoil, prepare the compacted subgrade soil to a 2 inches depth for bonding of topsoil with subsoil. Spread topsoil evenly to a thickness of 4 inch and grade to the elevations and slopes shown on the civil drawings. Do not spread topsoil when frozen or excessively wet or dry.

3.17 TESTING

Perform testing by a Corps validated commercial testing laboratory or the Contractor's validated testing facility. Submit qualifications of the Corps validated commercial testing laboratory or the Contractor's validated testing facilities. 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.

a. Determine field in-place density in accordance with ASTM D1556/D1556M, ASTM D1557 and ASTM D6938. When ASTM D6938 is used, check the calibration curves and adjust using only the sand cone method as described in ASTM D1556/D1556M. ASTM D6938 results in a wet unit weight of soil in determining the moisture content of the soil when using this method.

b. Check the calibration curves furnished with the moisture gauges along with density calibration checks as described in ASTM D6938; check the calibration of both the density and moisture gauges at the beginning of a job on each different type of material encountered and at intervals as directed by the Contracting Officer. 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.

c. 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.

3.17.1 Fill and Backfill Material Gradation

One test per 5000 cubic yards stockpiled or in-place source material. Determine gradation of fill and backfill material in accordance with ASTM D422 and ASTM D1140.

3.17.2 In-Place Densities

a. One test per 2000 square feet, or fraction thereof, of each lift of fill or backfill areas compacted by other than hand-operated machines.

b. One test per 100 square feet, or fraction thereof, of each lift of fill or backfill areas compacted by hand-operated machines.

c. One test per 1000 linear feet, or fraction thereof, of each lift of embankment or backfill for roads.

3.17.3 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.

3.17.4 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. One representative test per 500 cubic yards of fill and backfill, or when any change in material occurs which may affect the optimum moisture content or laboratory maximum density.

3.17.5 Tolerance Tests for Subgrades

Perform continuous checks on the degree of finish specified in paragraph SUBGRADE PREPARATION during construction of the subgrades.

3.18 DISPOSITION OF SURPLUS MATERIAL

Remove surplus material or other soil material not required or suitable for filling or backfilling, and brush, refuse, stumps, roots, and timber from Government property and delivered to a licensed/permitted facility or to a location approved by the Contracting Officer.

-- End of Section --

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SECTION 31 11 00

CLEARING AND GRUBBING
11/18

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. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Tree Wound Paint

1.2 DELIVERY, STORAGE, AND HANDLING

Deliver materials to the site, and handle in a manner which will maintain the materials in their original manufactured or fabricated condition until ready for use.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Tree Wound Paint

Use bituminous based paint from standard manufacture specially formulated for tree wounds.

PART 3 EXECUTION

3.1 PREPARATION

3.1.1 Protection

3.1.1.1 Roads and Walks

Keep roads and walks free of dirt and debris at all times.

3.1.1.2 Trees, Shrubs, and Existing Facilities

Provide protection in accordance with Section 01 57 19 TEMPORARY ENVIRONMENTAL CONTROLS.

3.1.1.3 Utility Lines

Protect existing utility lines that are indicated to remain from damage. Notify the Contracting Officer immediately of damage to or an encounter with an unknown existing utility line. The Contractor is responsible for the repair of damage to existing utility lines that are indicated or made known to the Contractor prior to start of clearing and grubbing operations. When utility lines which are to be removed are encountered within the area of operations, notify the Contracting Officer in ample time to minimize interruption of the service. Refer to Section 01 57 19 TEMPORARY ENVIRONMENTAL CONTROLS for additional utility protection.

3.2 CLEARING

Clearing consists of the felling, trimming, and cutting of trees into sections and the satisfactory disposal of the trees and other vegetation designated for removal, including downed timber, snags, brush, and rubbish occurring within the areas to be cleared. Clearing also includes the removal and disposal of structures that obtrude, encroach upon, or otherwise obstruct the work. Cut off flush with or below the original ground surface trees, stumps, roots, brush, and other vegetation in areas to be cleared, except such trees and vegetation as may be indicated or directed to be left standing. Trim dead branches 1-1/2 inches or more in diameter on trees designated to be left standing within the cleared areas and trim all branches to the heights indicated or directed. Neatly cut close to the bole of the tree or main branches, limbs and branches to be trimmed. Paint, with an approved tree-wound paint, cuts more than 1-1/2 inches in diameter. .

3.2.1 Tree Removal

Where indicated or directed, trees and stumps that are designated as trees shall be removed from areas outside those areas designated for clearing and grubbing. This work includes the felling of such trees and the removal of their stumps and roots as specified in paragraph GRUBBING. Dispose of trees as specified in paragraph DISPOSAL OF MATERIALS.

3.2.2 Grubbing

Grubbing consists of the removal and disposal of stumps, roots larger than 3 inches in diameter, and matted roots from the designated grubbing areas. Remove material to be grubbed, together with logs and other organic or metallic debris not suitable for foundation purposes, to a depth of not less than 18 inches below the original surface level of the ground in areas indicated to be grubbed and in areas indicated as construction areas under this contract, such as areas for buildings, and areas to be paved. Fill depressions made by grubbing with suitable material and compact to make the surface conform with the original adjacent surface of the ground.

3.3 DISPOSAL OF MATERIALS

Dispose of excess materials in accordance with the approved solid waste management permit and include those materials in the solid waste management report.

All wood or wood like materials, except for salable timber, remaining from clearing, prunning or grubbing such as limbs, tree tops, roots, stumps,

logs, rotten wood, and other similiar materials shall become the property of the Contractor and disposed of as specified. All non-saleable timber and wood or wood like materials remaining from timber harvesting such as limbs, tree tops, roots, stumps, logs, rotten wood, and other similiar materials shall become the property of the Contractor and disposed as specified.

-- End of Section --

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SECTION 31 31 16.13

CHEMICAL TERMITE CONTROL
04/19

PART 1 GENERAL

1.1 REFERENCES

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

U.S. DEPARTMENT OF DEFENSE (DOD)

DODI 4150.07 (2008; Change 1-2017; Change 2-2018) DOD Pest Management Program

1.2 ADMINISTRATIVE REQUIREMENTS

Coordinate work related to final grades, landscape plantings, foundations, or any other alterations to finished construction which might alter the condition of treated soils with this specification.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance with Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Termiticide Application Plan; G

SD-03 Product Data

Termiticides

SD-05 Design Data

Mixing Formulation

SD-06 Test Reports

Soil Moisture

Calibration Test

SD-07 Certificates

Qualifications; G

Foundation Exterior

Utilities and Vents

Crawl and Plenum Air Spaces

List of Equipment

SD-08 Manufacturer's Instructions

Termiticides

SD-11 Closeout Submittals

Verification of Measurement

Warranty

Pest Management Report

1.4 QUALITY CONTROL

1.4.1 Regulatory Requirements

Comply with DODI 4150.07 for requirements on Contractor's licensing, certification, and record keeping. Maintain daily records using the Pest Management Maintenance Record, DD Form 1532-1, or a computer generated equivalent, and submit copies of records when requested by the Contracting Officer. These forms may be obtained from the main web site: http://www.dtic.mil/whs/directives/forms/eforms/dd1532-1.pdf

1.4.2 Qualifications

For the application of pesticides, use the services of an applicator whose principal business is pest control. The applicator must be commercially certified in the state where the work is to be performed as required by DODI 4150.07. Termiticide applicators must also be certified in the U.S. Environmental Protection Agency (EPA) pesticide applicator category which includes structural pest control. Submit a copy of the pest control business license and pesticide applicator certificates.

1.4.3 Safety Requirements

Formulate, treat, and dispose of termiticides and their containers in accordance with label directions. Draw water for formulating only from sites designated by the Contracting Officer, and fit the filling hose with a backflow preventer meeting local plumbing codes or standards. Perform filling operations under the direct and continuous observation of a contractor's representative to prevent overflow. Secure pesticides and related materials under lock and key when unattended. Ensure that proper protective clothing and equipment are worn and used during all phases of termiticide application. Dispose of used pesticide containers off Government property.

1.5 DELIVERY, STORAGE, AND HANDLING

1.5.1 Delivery

Deliver termiticide material to the site in the original unopened containers bearing legible labels indicating the EPA registration number, manufacturer's registered uses and in new or otherwise good condition as

supplied by the manufacturer or formulator.

1.5.2 Inspection

Inspect termiticides upon arrival at the job site for conformity to type and quality in accordance with paragraph TERMITICIDES. Each label must bear evidence of registration under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), as amended or under appropriate regulations of the host county. Inspect other materials for conformance with specified requirements. Remove unacceptable materials from the job site.

1.5.3 Storage

Storage of pesticides on the installation will not be permitted unless it is written into the contract.

1.5.4 Handling

Handle and mix termiticides in accordance with the manufacturer's label and SDS, preventing contamination by dirt, water, and organic material. Protect termiticides from weather elements as recommended by the manufacturer's label and SDS. Spill kits must be maintained on pest control vehicles and must be available at the mixing site. Conduct termiticide mixing in an area with adequate spill containment.

1.6 SITE CONDITIONS

The following site conditions determine the acceptable time of application.

1.6.1 Soil Moisture

Test soils to be treated immediately before application. Test soil moisture content to a minimum depth of 3 inches. The soil moisture must be as recommended by the termiticide manufacturer. Application of thetermiticide is not permitted when soil moisture content exceeds manufacturer's recommendations.

1.6.2 Runoff and Wind Drift

Application of termiticide will not be permitted during or immediately following heavy rains, when conditions may allow runoff, or create an environmental hazard or when average wind speed exceeds 10 miles per hour. Termiticide is not permitted to enter water systems, aquifers, or endanger humans or animals.

1.7 WARRANTY

Provide a 5 year written warranty against infestations or reinfestations by subterranean termites of the buildings or building additions constructed under this contract. Include in the warranty annual inspections of the buildings or building additions during the warranty period. If live subterranean termite infestation or subterranean termite damage is discovered during the warranty period, and the soil and building conditions have not been altered in the interim:

a. Retreat the site and perform other treatment as may be necessary for elimination of subterranean termite infestation;

b. Repair damage caused by termite infestation; and

c. Reinspect the building approximately 180 days after the re-treatment.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

Chemical termite control uses liquid termiticide treatments applied to the soil to form a continuous chemical barrier in the soil around both sides of the foundation. The application can be surface applied or rodded and trenched. This barrier prevents foraging termites from reaching the foundation and piers. Only the soil adjacent to these foundation elements is treated. For slab construction (including foundations, patios and garages), the entire soil (or gravel) surface is treated before the vapor barrier is installed and the slab poured over it. Soil treatment is coordinated with all building activities from foundation construction through final grading of the soil around the building's exterior. In order for the treatment to be effective, the final phase of the application must be done after final grading and sometimes after landscaping is completed so that the treated soil is not disturbed.

2.2 MATERIALS

2.2.1 Termiticides

Provide termiticides currently registered by the EPA or approved for such use by the appropriate agency of the host county and as approved by the Contracting Officer. Select non-repellant termiticides for maximum effectiveness and duration after application. Select a termiticide that is suitable for the soil and climatic conditions at the project site and apply at the highest labeled rate. Submit manufacturer's label and Safety Data Sheet (SDS) for termiticides proposed for use.

PART 3 EXECUTION

3.1 PREPARATION

Eliminate food sources by removing debris from clearing and grubbing and post construction wood scraps such as ground stakes, form boards, and scrap lumber from the site, before termiticide application begins.

3.1.1 Verification

Before work starts, verify that final grades are as indicated and smooth grading has been completed in accordance with Section 31 00 00 EARTHWORK. Finely grade soil and remove particles larger than 1 inch. Compact soil particles to eliminate soil movement.

3.1.2 Foundation Exterior

If the exterior perimeter treatment is applied when the horizontal barrier is applied it will be damaged or removed before construction is completed. The exterior foundation perimeter treatment will have to occur in phases when any pads, porches, aprons, sidewalks, final grading or landscape planting are simultaneously involved adjacent to the building foundation. This treatment area should be coordinated after all major construction but before any pads, porches, or other items requiring special consideration are poured adjacent to the foundation walls. Submit written verification that final grading, landscape planting and other

items adjacent to the foundation will not disturb treatment of the soil on the exterior sides of foundation walls, grade beams, and similar structures.

3.1.3 Utilities and Vents

Turn off and block HVAC ducts and vents located in treatment area prior to application, to protect people and animals from termiticide. Submit written verification that the HVAC ducts and vents, water and sewer lines, and plumbing have been turned off or blocked prior to applying termiticide.

3.1.4 Crawl and Plenum Air Spaces

Submit written verification that crawl and plenum air spaces have been located and identified prior to applying termiticide.

3.1.5 Application Plan

Prior to commencing application of termiticide, submit a Termiticide Application Plan addressing the following items:

a. proposed sequence of treatment work including dates and times of application
b. termiticide trade name
c. EPA registration number
d. chemical composition
e. concentration of original and diluted material
f. formulation
g. manufacturer's recommended application rates
h. regional requirements
i. application rate of active ingredients
j. method of application
k. area or volume to be treated
l. amount to be applied
m. copy of the pest control business license
n. copy of the pesticide applicator certificates

3.2 APPLICATION

For areas to be treated, establish complete and unbroken vertical and horizontal soil poison barriers between the soil and all portions of the intended structure which may allow termite access to wood and wood related products. Make applications to crawl spaces in accordance with label directions. Applications to crawl space areas that are used as plenum air spaces will not be permitted.

3.2.1 Equipment Calibration and Tank Measurement

Submit a list of equipment to be used. Conduct calibration test on the application equipment to be used immediately prior to commencement of termiticide application. Measure the volume and contents of the application tank. Testing must confirm that the application equipment is operating within the manufacturer's specifications and meets the specified requirements. Submit written certification of the equipment calibration test results within 1 week of testing. Where results from the equipment calibration and tank measurements tests are unsatisfactory, re-treatment will be required.

3.2.2 Mixing and Application

Perform all work related to formulating, mixing, and application in the presence of the Contracting Officer and a DOD certified pesticide applicator, Pest Management QAE/PAR, or Integrated Pest Management Coordinator. Submit mixing formulation:

a. Quantity of pesticide used.

b. Rate of dispersion.

c. Percent of use.

d. Total amount used.

A closed system is recommended as it prevents the termiticide from coming into contact with the applicator or other persons. Only use water from designated locations. Fit filling hoses with a backflow preventer meeting local plumbing codes or standards. Prevent overflow during the filling operation. Spill kits must be maintained on pest control vehicles and must be available at the mixing site. Termiticide mixing must be conducted in an area that has been designated by the Government representative and that has adequate spill containment. Inspect the application equipment for applying termiticides prior to each day of use for leaks, clogging, wear, or damage. Immediately perform repairs on the application equipment to prevent or eliminate leaks and clogging.

3.2.2.1 Application Method

3.2.2.1.1 Surface Application

Use surface application for establishing horizontal barriers. Apply surface applicants as a coarse spray and provide uniform distribution over the soil surface. Termiticide must penetrate a minimum of 1 inch into the soil, or as recommended by the manufacturer. If soils are treated to a depth less than specified or approved, repeat work performed to the depth specified at no additional cost to the Government.

3.2.2.1.2 Rodding and Trenching

Use rodding and trenching for establishing vertical soil barriers. Trenching must be to the depth of the foundation footing. Width of trench must be as recommended by the manufacturer, or as indicated. Rodding or other approved method may be implemented for saturating the base of the trench with termiticide. Backfill the trench immediately after termiticide has reached maximum penetration as recommended by the manufacturer. If maximum penetration is not achieved, as recommended by the manufacturer, repeat work performed to maximum penetration as recommended by the manufacturer at no additional cost to the Government. Backfill in 6 inch rises or layers. Treat each rise or layer with termiticide.

3.2.3 Sampling

The Contracting Officer may draw samples for analysis, at any time and without prior notice, from stocks at the job site to determine if the amount of active ingredient specified on the label is being applied. When analysis, performed by the Government, indicates samples contain less than the amount of active ingredient specified on the label, repeat work

performed with pesticides conforming to this specification at no additional cost to the Government.

3.2.4 Vapor Barriers and Waterproof Membranes

Apply termiticide prior to placement of a vapor barrier or waterproof membrane.

3.2.5 Placement of Concrete

Place concrete covering treated soils as soon as the termiticide has reached maximum penetration into the soil as recommended by the manufacturer.

3.2.6 Clean Up, Disposal, And Protection

Once application has been completed, proceed with clean up and protection of the site without delay.

3.2.6.1 Clean Up

Clean the site of all material associated with the treatment measures, according to label instructions, and as indicated. Remove and dispose of excess and waste material off Government property.

3.2.6.2 Disposal of Termiticide

Dispose of residual termiticides and containers off Government property, and in accordance with label instructions and EPA criteria.

3.3 FIELD QUALITY CONTROL

3.3.1 Verification of Measurement

Once termiticide application has been completed, measure tank contents to determine the remaining volume. The total volume measurement of used contents for the application must equal the application rate established in the application plan. Submit written verification that the volume of termiticide used meets the application rate established in the application plan.

3.3.2 Inspection

3.3.2.1 Technical Representative

Provide a technical representative who is a DOD certified pesticide applicator or Pest Management Quality Assurance Evaluator (QAE)/Performance Assessment Representative (PAR). The technical representative must be present at all meetings concerning treatment measures for subterranean termites and during treatment application. Contact the Integrated Pest Management Coordinator prior to starting work.

3.4 CLOSEOUT ACTIVITIES

Upon completion of this work, submit the Pest Management Report DD Form 1532, or an equivalent computer product, to the Integrated Pest Management Coordinator. This form identifies the target pest, type of operation, brand name and manufacturer of pesticide, formulation, concentration or rate of application used.

3.5 PROTECTION

3.5.1 Protection of Treated Area

Immediately after the application, protect the area from other use by erecting barricades as required or directed. Provide signage in accordance with Section 10 14 00.10 EXTERIOR SIGNAGE. Place signage inside the entrances to crawl spaces and identify the space as treated with termiticide and not safe for children or animals. Cover treated areas with plastic if slab is not to be poured immediately following termiticide application.

3.5.2 Disturbance of Treated Soils

Re-treat soil and fill material disturbed after treatment before placement of slabs or other covering structures.

-- End of Section --

SECTION 32 01 19.61

SEALING OF JOINTS IN RIGID PAVEMENT
11/19

PART 1 GENERAL

1.1 REFERENCES

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

ASTM INTERNATIONAL (ASTM)

ASTM C603	(2014; R 2019) Standard Test Method for Extrusion Rate and Application Life of Elastomeric Sealants
ASTM C639	(2001; R 2011) Rheological (Flow) Properties of Elastomeric Sealants
ASTM C661	(2015) Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer
ASTM C679	(2003; E 2009; R 2009) Tack-Free Time of Elastomeric Sealants
ASTM C719	(2014; R 2019) Standard Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants Under Cyclic Movement (Hockman Cycle)
ASTM C792	(2004; R 2008) Effects of Heat Aging on Weight Loss, Cracking, and Chalking of Elastomeric Sealants
ASTM C793	(2005; R 2017) Standard Test Method for Effects of Laboratory Accelerated Weathering on Elastomeric Joint Sealants
ASTM C920	(2018) Standard Specification for Elastomeric Joint Sealants
ASTM C1016	(2014) Standard Test Method for Determination of Water Absorption of Sealant Backing (Joint Filler) Material
ASTM C1193	(2013) Standard Guide for Use of Joint Sealants
ASTM D412	(2016) Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension
ASTM D789	(2015) Determination of Relative Viscosity and Moisture Content of Polyamide (PA)

ASTM D903	(1998; R 2017) Standard Test Method for Peel or Stripping Strength of Adhesive Bonds
ASTM D5249	(2010; R 2016) Standard Specification for Backer Material for Use with Cold-and Hot-Applied Joint Sealants in Portland-Cement Concrete and Asphalt Joints
ASTM D5329	(2016) Standard Test Methods for Sealants and Fillers, Hot-Applied, for Joints and Cracks in Asphalt Pavements and Portland Cement Concrete Pavements
ASTM D5893/D5893M	(2016) Standard Specification for Cold Applied, Single Component, Chemically Curing Silicone Joint Sealant for Portland Cement Concrete Pavements
ASTM D6690	(2015) Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements

U.S. ARMY CORPS OF ENGINEERS (USACE)

COE CRD-C 525	(1989) Corps of Engineers Test Method for Evaluation of Hot-Applied Joint Sealants for Bubbling Due to Heating

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Sealants

Submit catalog cuts, specifications, Safety Data Sheets and other information documenting conformance to Contract requirements.

Manufacturer's Recommendations

SD-04 Samples

Sealants

Provide for testing a 5-gal sample of each sealant with associated primer to the Contracting Officer a minimum of 60 days prior to its use on the job. Provide factory-sealed containers with a factory applied label showing the following information:

Name of sealant

Identification of component, or primer

Specification number and type

Manufacturer's name

Manufacturer's lot and batch number

Date of Manufacture (month and year)

Shelf life retest date (month and year)

List of hazardous components

Quantity of material in container (volume)

Storage instructions

Instructions for use

Blocking Media/Backup Materials

Backer Rod

Bond Breaking Tapes

SD-06 Test Reports

Sealants

SD-07 Certificates

Equipment List

SD-08 Manufacturer's Instructions

Sealants

Provide instructions that include, but not limited to: storage requirements, ambient temperature and humidity ranges, and moisture condition of joints for successful installation; requirements for preparation of joints; safe heating temperature; mixing instructions; installation equipment and procedures; application and disposal requirements; compatibility of sealant with filler material; curing requirements; and restrictions to be adhered to in order to reduce hazards to personnel or to the environment. Submit instructions at least 30 days prior to use.

1.3 QUALITY ASSURANCE

1.3.1 Test Requirements

Test the sealant and backup or separating material for conformance with the referenced material specification. Perform testing of the materials in an approved independent laboratory and submit certified copies of the test reports for approval 30 days prior to the use of the materials at the job site. Submit samples to be retained by the Government for possible future testing if the materials appear defective during or after application.

Conformance with the requirements of the laboratory tests specified does not constitute final acceptance of the materials. Base final acceptance on the performance of the in-place materials. Submit samples of the materials (sealant, primer if required, and backup material), in sufficient quantity for testing and approval 30 days prior to the beginning of work. Do not use material until it has been approved.

1.4 DELIVERY, STORAGE, AND HANDLING

Inspect materials delivered to the site for visible damage, and unload and store with a minimum of handling. Deliver joint materials in original sealed containers and protect from freezing or overheating. Provide jobsite storage facilities capable of maintaining temperature ranges within manufacturers recommendations.

1.5 ENVIRONMENTAL REQUIREMENTS

Do not proceed with work when weather conditions detrimentally affect the quality of cleaning joints or applying sealants. Proceed with joint preparation and sealing only when weather conditions are in accordance with manufacturer's instructions. Install joint sealant to dry surfaces and protect sealant and bond breakers from moisture.

1.6 TRAFFIC CONTROL

Do not permit vehicular or heavy equipment traffic on the pavement in the area of the joints being sealed during the protection and curing period of the sealant. Permit traffic on the pavement at the end of the curing period.

PART 2 PRODUCTS

2.1 SEALANTS

Use materials for sealing cracks in accordance with ASTM D6690 and ASTM D5893/D5893M based on the type of area as follows:

Area	Sealing Material
All areas	ASTM D6690, Type II and ASTM D5329/ COE CRD-C 525
All areas	ASTM D5893/D5893M

Use self leveling, non-acid curing silicone sealant meeting the following requirements in accordance with ASTM C920 or ASTM C1193:

TEST	TEST METHOD	REQUIREMENTS
Weight Loss	ASTM C792 Modified (see Note 1 below)	10 percent max.
Flow	ASTM C639 (Type I)	Smooth and level

TEST	TEST METHOD	REQUIREMENTS
Extrusion Rate	ASTM C603	30 sec. max.
Tack Free Time	ASTM C679	5 hours max.
Hardness (Shore 00) (see Note 2 below)	ASTM C661	30 - 80
Tensile Stress at 150 Percent Elongation (see Note 2 below)	ASTM D412 (Die C)	30 psi max.
Percent Elongation (see Note 2 below)	ASTM D412 (Die C)	700 min.
Accelerated Weathering	ASTM C793	Pass 5000 hours
Bond and Movement Capability	ASTM C719	Pass 10 cycles at plus 50 percent movement (no adhesion or cohesion failure)
Peel	ASTM D903	Minimum 20 psi of width with at least 75 percent cohesive failure

NOTES:
1. Percent weight loss of wet (uncured) sample after placing in forced-draft oven maintained at 158 degrees plus 1 degree F for two hours.

2. Specimen cured 21 days at 73 degrees plus 1 degree F and 50 percent plus 5 percent humidity.

ACCELERATED WEATHERING FACTORY TEST REPORT. For the Accelerated Weathering test, in lieu of testing of actual sealant to be used on the project, it is permitted to submit a report of a factory test, performed within two years of Contract award.

2.2 PRIMERS

Use primers in accordance with the recommendation of the manufacturer.

2.3 BOND BREAKERS

2.3.1 Blocking Media/Backup Materials

Provide backup (joint filler) material that is a compressible, nonshrinking, nonstaining, nonabsorbing, nonreactive material with the sealant. Use backup material compliant with ASTM D5249. Use material with a melting point at least 5 degrees F greater than the pouring temperature of the sealant being used when tested in accordance with ASTM D789. Use material with a water absorption of not more than 5 percent of the sample weight when tested in accordance with ASTM C1016. Use backup (joint filler) material that is 25 plus or minus 5 percent larger in diameter than the nominal width of the crack. Use blocking media consistent with the sealant manufacturer's installation instructions.

2.3.2 Bond Breaking Tapes

Provide a bond breaking tape or separating material that is a flexible, nonshrinkable, nonabsorbing, nonstaining, and nonreacting adhesive-backed tape. Use material with a melting point at least 5 degrees F greater than the pouring temperature of the sealant being used when tested in accordance with ASTM D789. Use bond breaker tape approximately 1/8 in wider than the nominal width of the joint and that does not bond to the sealant. Use bond breaking tape shall be consistent with the sealant manufacturer's installation instructions.

PART 3 EXECUTION

3.1 EXECUTING EQUIPMENT

Submit equipment list and description of the equipment to be used and a statement from the supplier of the sealant that the proposed equipment is acceptable for installing the specified sealant. Use equipment for heating, mixing, and installing seals in accordance with the instructions provided by the sealant manufacturer. Provide equipment, tools, and accessories necessary to clean existing joints and install liquid joint sealants. Maintain machines, tools, and other equipment in proper working condition. Submit a list of proposed equipment to be used in performance of construction work including descriptive data, 14 days prior to use on the project.

3.1.1 Joint Cleaning Equipment

3.1.1.1 Tractor-Mounted Routing and Plowing Tool

Use routing tools for removing old sealant from the joints, of such shape and dimensions and so mounted on the tractor that do not damage the sides of the joints. Use tools designed to be adjusted to remove the old material to varying depths and widths as required. Use equipment capable of maintaining accurate cutting depth and width control. Use a joint plow equipped with a spring or hydraulic mechanism to release pressure on the tool prior to spalling the concrete. Do not permit the use of V-shaped tools or rotary impact routing devices. Permit the use of hand-operated spindle routing devices to clean and enlarge random cracks.

3.1.1.2 Concrete Saw

Provide a self-propelled power saw, with water-cooled diamond or abrasive saw blades, for cutting joints to the depths and widths specified, for refacing joints, cleaning sawed joints where sandblasting does not provide a clean joint, widening, or deepening existing joints as specified without damaging the sides, bottom, or top edge of joints. Permit single or gang type blades with one or more blades mounted in tandem for fast cutting. Select saw adequately powered and sized to cut specified opening with not more than two passes of the saw through the joint.

3.1.1.3 Sandblasting Equipment

Include with the sandblasting equipment an air compressor, hose, and long-wearing venturi-type nozzle of proper size, shape and opening. Do not permit the maximum nozzle opening to exceed 1/4 in. Use a portable air compressor capable of providing not less than 150 cfm and maintaining a line pressure of not less than 90 psi at the nozzle while in use. Demonstrate compressor capability, under job conditions, before approval. Use a compressor equipped with traps that maintain the compressed air free

of oil and water. Use a nozzle with an adjustable guide that holds the nozzle aligned with the joint approximately 1 in above the pavement surface. Adjust the height, angle of inclination and the size of the nozzle to secure satisfactory results.

3.1.1.4 Waterblasting Equipment

Include with the waterblasting equipment a trailer-mounted water tank, pumps, high-pressure hose, wand with safety release cutoff control, nozzle, and auxiliary water resupply equipment. Provide water tank and auxiliary resupply equipment of sufficient capacity to permit continuous operations. Use a nozzle with an adjustable guide that holds the nozzle aligned with the joint approximately 1 in above the pavement surface. Adjust the height, angle of inclination and the size of the nozzle to obtain satisfactory results. Use a pressure gauge mounted at the pump that shows the pressure in psi at which the equipment is operating.

3.1.1.5 Air Compressor

Use a portable air compressor capable of operating the sandblasting equipment and capable of blowing out sand, water, dust adhering to sidewalls of concrete, and other objectionable materials from the joints. Use a compressor that provides air at a pressure not less than 90 psi and a minimum rate of 150 cubic ft of air per minute at the nozzles and free of oil.

3.1.1.6 Vacuum Sweeper

Use a self-propelled, vacuum pickup sweeper capable of completely removing loose sand, water, joint material, and debris from pavement surface.

3.1.1.7 Hand Tools

Permit the use of hand tools, such as brooms and chisels, when approved, for removing defective sealant from a crack and repairing or cleaning the crack faces.

3.1.2 Sealing Equipment

Use joint sealing equipment of a type required by the sealant manufacturer's installation instructions. Use equipment capable of installing sealant to the depths, widths and tolerances indicated. Do not proceed with joint sealing when malfunctions are noted until the malfunctions are corrected.

3.1.2.1 Hot-Poured Sealing Equipment

Use mobile unit applicators equipped with a double-boiler, agitator-type kettle with an oil medium in the outer space for heat transfer for heating and installing ASTM D6690 joint sealant materials; a direct-connected pressure-type extruding device with a nozzle shaped for inserting in the joint to be filled; positive temperature devices for controlling the temperature of the transfer oil and sealant; and a recording thermometer for indicating the temperature of the sealant. Use an applicator unit designed so that the sealant circulates through the delivery hose and returns to the inner kettle when not in use.

3.1.2.2 Cold-Applied, Single-Component Sealing Equipment

Use equipment for installing ASTM D5893/D5893M single component joint sealants that consists of an extrusion pump, air compressor, following plate, hoses, and nozzle for transferring the sealant from the storage container into the joint opening. Use a nozzle with dimensions that allows the tip of the nozzle to extend into the joint to allow sealing from the bottom of the joint to the top. Maintain the initially approved equipment in good working condition, serviced in accordance with the supplier's instructions, and unaltered in any way without obtaining prior approval. Use lined hoses and seals to prevent moisture penetration and withstand pumping pressures. Use equipment free of contamination from previously used or other type sealant. Permit use of small hand-held air-powered equipment (i.e., caulking guns) for small applications.

3.2 PREPARATION OF JOINTS

Unless otherwise indicated, remove existing material, saw, clean and reseal joints. Do not proceed with final cleaning operations by more than one working day in advance of sealant. Clean joints by removing existing joint sealing compound, bond-breakers, dirt, laitance, curing compound, filler, and protrusions of hardened concrete from the sides and upper edges of the joint space to be sealed and other foreign material with the equipment. Do not permit cleaning procedures that damage joints or previously repaired patches by chipping or spalling. Remove existing sealant to the required depth. Precise shape and size of existing joints vary, and conditions of joint walls and edges vary and include but are not limited to rounding, square edges, sloping, chips, voids, depressions, and projections.

3.2.1 Sawing

3.2.1.1 Refacing of Joints

Accomplish facing of joints using a concrete saw as specified in paragraph EQUIPMENT Provide exposure of newly clean concrete through removal. Remove burrs and irregularities from sides of joint faces. Stiffen the blade with a sufficient number of dummy (used) blades or washers. Clean, immediately following the sawing operation, the joint opening using a water jet to remove saw cuttings and debris and adjacent concrete surface. Protect adjacent previously cleaned joint spaces from receiving water and debris during the cleaning operation.

3.2.1.2 Refacing of Random Cracks

Accomplish sawing of the cracks using a power-driven concrete saw as specified in paragraph EQUIPMENT. Use a saw blade 6 in or less in diameter to enable the saw to follow the trace of the crack. Stiffen the blade with dummy (or used) blades or washers. Immediately following the sawing operation, clean the crack opening using a water jet to remove saw cuttings and debris.

3.2.2 Final Cleaning of Joints

3.2.2.1 Sandblasting

Following removal of existing sealant, and sawing, and immediately before

resealing, clean newly exposed concrete joint faces and pavement surface extending to a mimimum of 1/2 in up to 2 in from each joint edge by sandblasting until concrete surfaces in the joint space are free of sealants, dust, dirt, water and other foreign materials that prevent bonding of new sealants to the concrete. Use sand particles of the proper size and quality for the work. Perform sandblasting with specified nozzles, air compressor, and other appurtenant equipment. Position nozzles to clean the joint faces. Make at least two passes; one for each joint face. Make as many passes as required for proper cleaning. Immediately prior to sealing the joint, blow out the joint spaces with compressed air until completely free of sand, water, and dust. Install joint sealants to dry joints. Replace expansion joint filler material damaged in performing the work with new materials of the same type and dimensions as the existing material, or with appropriate blocking media.

3.2.3 Bond Breaker

At the time the joints receive the final cleaning and are dry, install bond breaker material as indicated with a steel wheel or other approved device.

3.2.3.1 Blocking Media (Backer Rod) (Except for Expansion Joints)

When the joint opening is of a greater depth than indicated for the sealant depth, plug or seal off the lower portion of the joint opening using a blocking media/back-up material to prevent the entrance of the sealant below the specified depth. Take care to ensure that the blocking media/backup material is placed at the specified depth and is not stretched or twisted during installation.

3.2.3.2 Bond Breaking Tape

Where inserts or filler materials contain bitumen, or the depth of the joint opening does not allow for the use of a backup material, insert a bond breaker separating tape to prevent incompatibility with the filler materials and three-sided adhesion of the sealant. Bond the tape to the bottom of the joint opening to prevent it from floating up into the new sealant.

3.2.4 Rate of Progress of Joint Preparation

Limit the stages of joint preparation, including sandblasting, air pressure cleaning and placing of the back-up material to only that lineal footage that can be sealed during the same day.

3.2.5 Disposal of Debris

Sweep pavement surface to remove excess joint material, dirt, water, sand, and other debris by vacuum sweepers or hand brooms. Remove the debris immediately to a point off station. .

3.3 PREPARATION OF SEALANT

3.3.1 Hot-Poured Sealants

Heat hot-poured sealing materials in accordance with ASTM D6690 and with safe heating temperature ranges recommended by the manufacturer. Withdraw and waste sealant that has been overheated or subjected to heating for over 3 hours or that remain in the applicator at the end of the day's

operation. Heat sealant in specified equipment.

3.3.2 Single-Component, Cold-Applied Sealants

Inspect the ASTM D5893/D5893M sealant and containers prior to use. Reject materials that contain water, hard caking of any separated constituents, nonreversible jell, or materials that are otherwise unsatisfactory. Do not reject sealants that exhibit settlement of constituents in a soft mass that can be readily and uniformly remixed in the field with simple tools.

3.4 INSTALLATION OF SEALANT

3.4.1 Time of Application

After approval of the test section, seal joints immediately following final cleaning and placing of bond breakers. Commence sealing joints when walls are dust free and dry, and when weather conditions meet sealant manufacturer's instructions. If the above conditions cannot be met, or when rain interrupts sealing operations, reclean and permit the joints to dry prior to installing the sealant.

3.4.2 Sealing Joints

Do not install joint sealant until joints to be sealed have been inspected and approved. Install bond breaker just prior to pouring sealant. Fill the joints with sealant from bottom up until joints are uniformly filled solid from bottom to top using the specified equipment for the type of sealant required. Fill joints to 1/8 in plus or minus 1/16 in below top of pavement, and without formation of voids or entrapped air. Do not permit gravity methods or pouring pots to be used to install the sealant material. Except as otherwise permitted, tool the sealant immediately after application to provide firm contact with the joint walls and to form the indicated sealant profile below the pavement surface. Remove excess sealant that has been inadvertently spilled on the pavement surface. Do not permit traffic over newly sealed pavement until authorized. When a primer is recommended by the manufacturer, apply it evenly to the joint faces in accordance with the manufacturer's recommendations. Check sealed joints frequently to ensure that newly installed sealant is cured to a tack-free condition within the specified time. Protect new sealant from rain during curing period.

3.5 INSPECTION/FIELD QUALITY CONTROL

3.5.1 Joint Cleaning

Inspect joints during the cleaning process to correct improper equipment and cleaning techniques that damage the concrete pavement in any manner. Approve cleaned joints prior to installation of the separating or back-up material and joint sealant.

3.5.2 Sampling Sealant

Obtain a one gal sample of each type of sealant on the project from material used for each 10,000 linear ft or less of joints sealed. Store samples according to sealant manufacturer's instructions. Retain samples until final acceptance of the work.

3.5.3 Sealant Application Equipment

Inspect the application equipment to ensure conformance to temperature requirements, proper proportioning and mixing (if two-component sealant) and proper installation. Suspend operations if there is evidences of bubbling, improper installation, or failure to cure or set until causes of the deficiencies are determined and corrected.

3.5.4 Joint Sealant

Inspect the joint sealant for proper rate of cure and set, bonding to the joint walls, cohesive separation within the sealant, reversion to liquid, entrapped air and voids. Remove sealants exhibiting these deficiencies prior to the final acceptance of the project from the joint, wasted, and replace at no additional cost to the Government. Obtain approval for each joint seal installation.

3.6 ACCEPTANCE

Reject sealer that fails to cure properly, or fails to bond to joint walls, or reverts to the uncured state, or fails in cohesion, or shows excessive air voids, blisters, surface defects, swelling, or other deficiencies, or is not properly recessed within indicated tolerances. Remove rejected sealer and reclean and reseal joints. Perform removal and reseal work promptly by and at the expense of the Contractor.

3.7 CLEAN-UP

Upon completion of the project, remove unused materials from the site and leave the pavement in a clean condition.

-- End of Section --

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SECTION 32 05 33

LANDSCAPE ESTABLISHMENT
08/17

PART 1 GENERAL

1.1 DEFINITIONS

1.1.1 Pesticide

Any substance or mixture of substances, including biological control agents, that may prevent, destroy, repel, or mitigate pests and are specifically labeled for use by the U.S. Environmental Protection Agency (EPA). Also, any substance used as a plant regulator, defoliant, disinfectant, or biocide. Examples of pesticides include fumigants, herbicides, insecticides, fungicides, nematicides, molluscicides and rodenticides.

1.1.2 Stand of Turf

95 percent ground cover of the established species.

1.2 RELATED REQUIREMENTS

Section 32 92 19 SEEDING andSection 32 92 23 SODDING applies to this section for installation of seed andsod requirements, with additions and modifications herein.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance with Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Integrated Pest Management Plan; G RO

SD-03 Product Data

Fertilizer; G RO

Mulches Topdressing

Organic Mulch Materials

SD-07 Certificates

Maintenance Inspection Report

Plant Quantities; G RO

SD-11 Closeout Submittals

1.4 DELIVERY, STORAGE AND HANDLING

1.4.1 Delivery

Deliver fertilizer to the site in original containers bearing manufacturer's chemical analysis, name, trade name, or trademark, and indication of conformance to state and federal laws. Instead of containers, fertilizer may be furnished in bulk with a certificate indicating the above information.

1.4.2 Storage

1.4.2.1 Fertilizer, Lime, and Mulch Storage

Store material in designated areas. Store lime and fertilizer in cool, dry locations away from contaminants.

1.4.3 Handling

Do not drop or dump materials from vehicles.

PART 2 PRODUCTS

2.1 POST-PLANT FERTILIZER

2.1.1 Granular Fertilizer

Organic, granular controlled release fertilizer containing the following minimum percentages, by weight, of plant food nutrients:

__13___ percent available nitrogen
__13___ percent available phosphorus
__13___ percent available potassium

2.2 WATER

Source of water must be approved by the Contracting Officer, and be of suitable quality for irrigation.

2.3 MULCHES TOPDRESSING

Free from noxious weeds, mold, or other deleterious materials.

2.3.1 Organic Mulch Materials

Provide pine straw mulch, from site when available. Wood cellulose fiber must be processed to contain no growth or germination-inhibiting factors, dyed with non-toxic, biodegradable dye to an appropriate color to

facilitate visual metering of materials application. Paper-based hydraulic mulch must contain a minimum of 100 percent post-consumer recycled content. Wood-based hydraulic mulch must contain a minimum of 100 percent total recovered materials content.

2.3.2 Recycled Organic Mulch

Recycled mulch may include compost, tree trimmings, or pine needles with a gradation that passes through a 2-1/2 by 2-1/2 inch screen. Clean recycled mulch of all sticks a minimum one inch in diameter and plastic materials a minimum 3 inch length. The material must be treated to retard the growth of mold and fungi.

2.4 PESTICIDES

Submit an Integrated Pest Management Plan, including weed and pest management strategies . Use biological pest controls as approved in the Plan.

PART 3 EXECUTION

3.1 EXTENT OF WORK

Provide landscape construction maintenance to include mowing, edging, overseeding, aeration, fertilizing, watering, weeding, pruning, and for all newly installed landscape areas , unless indicated otherwise, and at all areas inside or outside the limits of the construction that are disturbed by the Contractor's operations.

3.1.1 Policing

Police all landscaped areas. Policing includes removal of leaves, branches and limbs regardless of length or diameter, dead vegetation, paper, trash, cigarette butts, garbage, rocks or other debris. Collected debris must be promptly removed and disposed of at an approved disposal site.

3.1.2 Drainage System Maintenance

Remove all obstructions from surface and subsurface drain lines to allow water to flow unrestricted in swales, . Remove grates and clear debris in catch basins. Open drainage channels are to be maintained free of all debris and vegetation at all times. Edges of these channels must be clear of any encroachment by vegetation.

3.2 GROUNDCOVER ESTABLISHMENT PERIOD

Groundcover establishment period will commence on the date that inspection by the Contracting Officer shows that the new turf furnished under this contract has been satisfactorily installed to a 95 percent stand of coverage. The establishment period must continue for a period of 365 days.

3.2.1 Frequency of Maintenance

Begin maintenance immediately after turf has been installed . Inspect area s once a week during the installation and establishment period and perform needed maintenance promptly.

3.2.2 Promotion of Growth

Maintain groundcover in a manner that promotes proper health, growth, natural color. Turf must have a neat uniform manicured appearance, free of bare areas, ruts, holes, weeds, pests, dead vegetation, debris, and unwanted vegetation that present an unsightly appearance. Mow, remove excess clippings, eradicate weeds, water, fertilize, overseed, aerate, topdress and perform other operations necessary to promote growth, as approved by Contracting Officer and consistent with approved Integrated Pest Management Plan. Remove noxious weeds common to the area from planting areas by mechanical means.

3.2.3 Mowing

3.2.3.1 Turf

Mow turf at a uniform finished height. Mow turfed areas to a minimum average height of 2 inches when average height of grass becomes 3 inches for spring/summer maintenance and to a minimum average height of 2 inches when the average height of grass reaches 3 inches for fall andwinter maintenance. The height of turf is measured from the soil. Perform mowing of turf in a manner that prevents scalping, rutting, bruising, uneven and rough cutting. Prior to mowing, all rubbish, debris, trash, leaves, rocks, paper, and limbs or branches on a turf area must be picked up and disposed. Adjacent paved areas must be swept/vacuumed clean.

3.2.4 Turf Edging and Trimming

Perimeter of sidewalks, driveways, curbs, and other paved surfaces must be edged. Uniformly edge these areas to prevent encroachment of vegetation onto paved surfaces and to provide a clear cut division line between planter beds, turf, and ground cover. Edging is to be accomplished in a manner that prevents scalping, rutting, bruising, uneven and rough cutting. Perform edging on the same day that turf is mowed. Use of string line trimmers is permitted in "soft" areas such as an edge between turfgrass and a planter bed. Exercise care to avoid damage to any plant materials, structures, and other landscape features.

Trimming around trees, fences, poles, walls,and other similar objects is to be accomplished to match the height and appearance of surrounding mowed turf growth. Trimming must be performed on the same day the turf's mowed. Care must be exercised to avoid "Girdling" trees located in turf areas. The use of protective tree collars on trees in turf areas may be utilized as a temporary means to avoid injury to tree trunks. At the end of the plant establishment period Contractor will be responsible for removing all protective tree collars.

3.2.5 Post-Fertilizer Application

Apply turf fertilizer in a manner that promotes health, growth, vigor, color and appearance of cultivated turf areas. The method of application, fertilizer type and frequencies must be determined by the laboratory soil analysis results the requirements of the particular turf species. Organic fertilizer must be used. In the event that organic fertilizer is not producing the desired effect, the Contractor must contract the Contracting Officer for approval prior to the use of a synthetic type of fertilizer. Apply fertilizer by approved methods in accordance with the manufacturer's recommendations.

3.2.6 Turf Watering

The Contractor shall perform irrigation in a manner that promotes the health, growth, color and appearance of cultivated vegetation and that complies with all Federal, State, and local water agencies and authorities directives. The Contractor must be responsible to prevent over watering, water run-off, erosion, and ponding due to excessive quantities or rate of application. Abide by state, local or other water conservation regulations or restrictions in force during the establishment period. Adjust irrigation controllers to comply with the water conservation regulations schedule.

3.2.7 Turf Aeration

Upon completion of weed eradication operations and Contracting Officer's approval to proceed, aerate turf areas by approved device. Core, by pulling soil plugs, to a minimum depth of 3 inches. Leave all soil plugs that are produced in the turf area.

3.2.8 Turf Clearance Area

Trees located in turf areas must be maintained with a growth free clearance of 18 inches from the tree trunk base. The use of mechanical weed whips to accomplish the turf growth free bed area is prohibited.

3.2.9 Replanting

Replant in accordance with Section 32 92 19 SEEDING and within specified planting dates areas which do not have a satisfactory stand of turf.

3.2.10 Final Inspection and Acceptance

Final inspection will be make upon written request from the Contractor at least 10 days prior to the last day of the turf establishment period. Final turf acceptance will be based upon a satisfactory stand of turf.

3.3 EXTERIOR PLANT ESTABLISHMENT PERIOD

The exterior plant establishment period will commence on the date that inspection by the Contracting Officer shows that the new plants furnished under this contract have been satisfactorily installed and must continue for a period of 365 days.

3.3.1 Frequency of Maintenance

Begin maintenance immediately after plants have been installed. Inspect exterior plants at least once a week during the installation and establishment period and perform needed maintenance promptly.

3.3.2 Promotion of Plant Growth and Vigor

Water, prune, fertilize, mulch, adjust stakes, guys and turnbuckles, eradicate weeds and perform other operations necessary to promote plant growth, and vigor.

3.3.3 Slope Erosion Control Maintenance

Provide slope erosion control maintenance to prevent undermining of all slopes in newly landscaped and natural growth areas. Maintenance tasks include immediate repairs to weak spots in sloped areas, and maintaining clean, clear and graded berms, and terraces to intercept and direct water flow to prevent development of large gullies and slope erosion.

3.3.4 Final Inspection

Final inspection will be made upon written request from the Contractor at least 10 days prior to the last day of the establishment period. Final inspection will be based upon satisfactory health and growth of plants and on the following:

3.3.4.1 Remedial Work

Remedial measures directed by the Contracting Officer to ensure plant material survival and promote healthy growth have been completed.

3.4 FIELD QUALITY CONTROL

3.4.1 Maintenance Inspection Report

Provide maintenance inspection report to assure that landscape maintenance is being performed in accordance with the specifications and in the best interest of plant growth and survivability. Site observations must be documented at the start of the establishment period, then quarterly following the start, and at the end of establishment period. Submit results of site observation visits to the Contracting Officer within 7 calendar days of each site observation visit.

3.4.2 Plant Quantities

Provide Contracting Officer with the number of plant quantities. In addition, provide total exterior area of hardscape and landscaping such as turf and total number of shrubs.

-- End of Section --

SECTION 32 11 23

GRADED CRUSHED AGGREGATE BASE COURSE
08/17

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO T 180	(2017) 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
AASHTO T 88	(2013) Standard Method of Test for Particle Size Analysis of Soils

ASTM INTERNATIONAL (ASTM)

ASTM C117	(2017) 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 C88	(2018) Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM D1556/D1556M	(2015; E 2016) Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method

ASTM D1557	(2012; E 2015) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3) (2700 kN-m/m3)
ASTM D2167	(2015) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D2487	(2017) Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D4318	(2017; E 2018) Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D5821	(2013; R 2017) Standard Test Method for Determining the Percentage of Fractured Particles in Coarse Aggregate
ASTM D6938	(2017a) Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
ASTM D75/D75M	(2014) Standard Practice for Sampling Aggregates
ASTM E11	(2016) Standard Specification for Woven Wire Test Sieve Cloth and Test Sieves

1.2 DEFINITIONS

For the purposes of this specification, the following definitions apply.

1.2.1 Graded-Crushed Aggregate Base Course

Graded-crushed aggregate (GCA) base course is well graded, crushed, durable aggregate uniformly moistened and mechanically stabilized by compaction.

1.2.2 Degree of Compaction

Degree of compaction required, except as noted in the second sentence, is expressed as a percentage of the maximum laboratory dry density obtained by the test procedure presented in ASTM D1557 abbreviated as a percent of laboratory maximum dry 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, the degree of compaction for material having more than 30 percent by weight of their particles retained on the 3/4 inch sieve will be expressed as a percentage of the laboratory maximum dry density in accordance with AASHTO T 180 Method D and corrected with AASHTO T 224.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control

approval.. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Plant, Equipment, and Tools; G RO

SD-06 Test Reports

Initial Tests; G RO
In-Place Tests; G RO

1.4 EQUIPMENT, TOOLS, AND MACHINES

All plant, equipment, and tools used in the performance of the work will be subject to approval by the Contracting Officer before the work is started. Maintain all plant, equipment, and tools in satisfactory working condition at all times. Submit a list of proposed equipment, including descriptive data. Use equipment capable of minimizing segregation, producing the required compaction, meeting grade controls, thickness control, and smoothness requirements as set forth herein.

1.5 QUALITY ASSURANCE

Sampling and testing are the responsibility of the Contractor. Perform sampling and testing using a laboratory approved in accordance with Section 01 45 00.00 10 QUALITY CONTROL. Work requiring testing will not be permitted until the testing laboratory has been inspected and approved. Test the materials to establish compliance with the specified requirements and perform testing at the specified frequency. The Contracting Officer may specify the time and location of the tests. Furnish copies of test results to the Contracting Officer within 24 hours of completion of the tests.

1.5.1 Sampling

Take samples for laboratory testing in conformance with ASTM D75/D75M. When deemed necessary, the sampling will be observed by the Contracting Officer.

1.5.2 Tests

Perform the following tests in conformance with applicable standards.

1.5.2.1 Sieve Analysis

Perform sieve analysis in conformance with ASTM C117 and ASTM C136/C136M using sieves conforming to ASTM E11. Perform particle-size analysis of the soils in conformance with AASHTO T 88.

1.5.2.2 Liquid Limit and Plasticity Index

Determine liquid limit and plasticity index in accordance with ASTM D4318.

1.5.2.3 Moisture-Density Determinations

Determine the laboratory maximum dry density and optimum moisture content in accordance with paragraph DEGREE OF COMPACTION.

1.5.2.4 Field Density Tests

Measure field density in accordance with ASTM D1556/D1556M, ASTM D2167 or ASTM D6938. For the method presented in ASTM D1556/D1556M use the base plate as shown in the drawing. For the method presented in ASTM D6938 check the calibration curves and adjust them, if necessary, using only the sand cone method as described in paragraph Calibration, of the ASTM publication. Tests performed in accordance with ASTM D6938 result in a wet unit weight of soil and ASTM D6938 will be used to determine the moisture content of the soil. Also check the calibration curves furnished with the moisture gauges along with density calibration checks as described in ASTM D6938. Make the calibration checks of both the density and moisture gauges using the prepared containers of material method, as described in paragraph Calibration of ASTM D6938, on each different type of material being tested at the beginning of a job and at intervals as directed. Submit calibration curves and related test results prior to using the device or equipment being calibrated.

1.5.2.5 Wear Test

Perform wear tests on GCA course material in conformance with ASTM C131/C131M.

1.5.2.6 Soundness

Perform soundness tests on GCA in accordance with ASTM C88.

1.6 ENVIRONMENTAL REQUIREMENTS

Perform construction when the atmospheric temperature is above 35 degrees F. When the temperature falls below 35 degrees F, protect all completed areas by approved methods against detrimental effects of freezing. Correct completed areas damaged by freezing, rainfall, or other weather conditions to meet specified requirements.

PART 2 PRODUCTS

2.1 AGGREGATES

ProvideGCA consisting of clean, sound, durable particles of crushed stone, crushed gravel, angular sand, or other approved material. Provide GCA that is free of silt and clay as defined by ASTM D2487, organic matter, and other objectionable materials or coatings. The portion retained on the No. 4 sieve is known as coarse aggregate; that portion passing the No. 4 sieve is known as fine aggregate. When the coarse and fine aggregate is supplied form more than one source, provide aggregate from each source that meets the specified requirements.

2.1.1 Coarse Aggregate

Provide coarse aggregates with angular particles of uniform density. Separately stockpile coarse aggregate supplied from more than one source.

a. Crushed Gravel: Provide crushed gravel that has been manufactured by crushing gravels and that meets all the requirements specified below.

b. Crushed Stone: Provide crushed stone consisting of freshly mined quarry rock, meeting all the requirements specified below.

2.1.1.1 Graded-Crushed Aggregate Base Course

The percentage of loss of GCA coarse aggregate must not exceed 40 percent loss when tested in accordance with ASTM C131/C131M. Provide GCA coarse aggregate that does not exhibit a loss greater than 18 percent weighted average, at five cycles, when tested for soundness in magnesium sulfate, or 12 percent weighted average, at five cycles, when tested in sodium sulfate in accordance with ASTM C88. Provide aggregate that contains no more than 20 percent flat and elongated particles for the fraction retained on the 1/2 inch sieve nor 20 percent for the fraction passing the 1/2 inch sieve. A flat particle is one having a ratio of width to thickness greater than 3; an elongated particle is one having a ratio of length to width greater than 3. In the portion retained on each sieve specified, the crushed aggregate must contain at least 90 percent by weight of crushed pieces having two or more freshly fractured faces determined in accordance with ASTM D5821. When two fractures are contiguous, the angle between planes of the fractures must be at least 30 degrees in order to count as two fractured faces. Manufacture crushed gravel from gravel particles 90 percent of which by weight are retained on the maximum size sieve listed in TABLE 1.

2.1.2 Fine Aggregate

Provide fine aggregates consisting of angular particles of uniform density.

2.1.2.1 Graded-Crushed Aggregate Base Course

Provide GCA fine aggregate consisting of angular particles produced by crushing stone, or gravel that meets the requirements for wear and soundness specified for GCA coarse aggregate. Produce fine aggregate by crushing only particles larger than No. 4 sieve in size. Provide fine aggregate that contains at least 90 percent by weight of particles having two or more freshly fractured faces in the portion passing the No. 4 sieve and retained on the No. 10 sieve, and in the portion passing the No. 10 sieve and retained on the No. 40 sieve.

2.1.3 Gradation Requirements

Apply the specified gradation requirements to the completed base course. Provide aggregates that are continuously well graded within the limits specified in TABLE 1. Use sieves that conform to ASTM E11.

TABLE 1. GRADATION OF AGGREGATES

Percentage by Weight Passing Square-Mesh Sieve

Sieve Designation	No. 2
2 inch	----
1-1/2 inch	100
1 inch	60-100
1/2 inch	30-65
No. 4	20-50
No. 10	15-40
No. 40	5-25
No. 200	0-8

NOTE 1: Particles having diameters less than 0.02 mm must not be in excess of 3 percent by weight of the total sample tested as determined in accordance with AASHTO T 88.

NOTE 2: The values are based on aggregates of uniform specific gravity. If materials from different sources are used for the coarse and fine aggregates, test the materials in accordance with ASTM C127 and ASTM C128 to determine their specific gravities. Correct the percentages passing the various sieves as directed by the Contracting Officer if the specific gravities vary by more than 10 percent.

2.2 LIQUID LIMIT AND PLASTICITY INDEX

Apply liquid limit and plasticity index requirements to the completed course and to any component that is blended to meet the required gradation. The portion of any component or of the completed course passing the No. 40 sieve must be either nonplastic or have a liquid limit not greater than 25 and a plasticity index not greater than 5.

2.3 TESTS, INSPECTIONS, AND VERIFICATIONS

2.3.1 Initial Tests

Perform one of each of the following tests, on the proposed material prior to commencing construction, to demonstrate that the proposed material meets all specified requirements when furnished. Complete this testing for each source if materials from more than one source are proposed.

a. Sieve Analysis including 0.02 mm material.

b. Liquid limit and plasticity index.

c. Moisture-density relationship.

d. Wear.

e. Soundness.

Submit certified copies of test results for approval not less than 30 days before material is required for the work.

2.3.2 Approval of Material

Tentative approval of material will be based on initial test results.

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

When the GCA is constructed in more than one layer, clean the previously constructed layer of loose and foreign matter by sweeping with power sweepers or power brooms, except that hand brooms may be used in areas where power cleaning is not practicable. Provide adequate drainage during the entire period of construction to prevent water from collecting or standing on the working area.

3.2 OPERATION OF AGGREGATE SOURCES

Condition aggregate sources on private lands in accordance with local laws or authorities. Clearing, stripping, and excavating are the responsibility of the Contractor.

3.3 STOCKPILING MATERIAL

Clear and level storage sites prior to stockpiling of material. Stockpile all materials, including approved material available from excavation and grading, in the manner and at the locations designated. Stockpile aggregates on the cleared and leveled areas designated by the Contracting Officer to prevent segregation. Stockpile materials obtained from different sources separately.

3.4 PREPARATION OF UNDERLYING COURSE OR SUBGRADE

Clean the underlying course or subgrade of all foreign substances prior to constructing the base course(s). Do not construct base course(s) on underlying course or subgrade that is frozen. Construct the surface of the underlying course or subgrade to meet specified compaction and surface tolerances. Correct ruts or soft yielding spots in the underlying courses, areas having inadequate compaction, and deviations of the surface from the specified requirements set forth herein by loosening and removing soft or unsatisfactory material and adding approved material, reshaping to line and grade, and recompacting to specified density requirements. For cohesionless underlying courses or subgrades containing sands or gravels, as defined in ASTM D2487, stabilize the surface prior to placement of the base course(s). Stabilize by mixing GCA into the underlying course and compacting by approved methods. Consider the stabilized material as part of the underlying course and meet all requirements of the underlying course. Do not allow traffic or other operations to disturb the finished underlying course and maintain in a satisfactory condition until the base course is placed.

3.5 GRADE CONTROL

Provide a finished and completed base course conforming to the lines, grades, and cross sections shown. Place line and grade stakes as

necessary for control.

3.6 MIXING AND PLACING MATERIALS

Mix the coarse and fine aggregates in a stationary plant. Make adjustments in mixing procedures or in equipment, as directed, to obtain true grades, to minimize segregation or degradation, to obtain the required water content, and to insure a satisfactory base course meeting all requirements of this specification. Place the mixed material on the prepared subgrade or subbase in layers of uniform thickness with an approved spreader. Place the layers so that when compacted they will be true to the grades or levels required with the least possible surface disturbance. Where the base course is placed in more than one layer, clean the previously constructed layers of loose and foreign matter by sweeping with power sweepers, power brooms, or hand brooms, as directed. Make adjustments in placing procedures or equipment as may be directed by the Contracting Officer to obtain true grades, to minimize segregation and degradation, to adjust the water content, and to insure an acceptable base course.

3.7 LAYER THICKNESS

Compact the completed base course to the thickness indicated. No individual layer may be thicker than 6 inches nor be thinner than 3 inches in compacted thickness. Compact the base course(s) to a total thickness that is within 1/2 inch of the thickness indicated. Where the measured thickness is more than 1/2 inch deficient, correct such areas by scarifying, adding new material of proper gradation, reblading, and recompacting as directed. Where the measured thickness is more than 1/2 inch thicker than indicated, the course will be considered as conforming to the specified thickness requirements. The average job thickness will be the average of all thickness measurements taken for the job and must be within 1/4 inch of the thickness indicated. Measure the total thickness of the base course at intervals of one measurement for each 500 square yards of base course. Measure total thickness using 3 inch diameter test holes penetrating the base course.

3.8 COMPACTION

Compact each layer of the base course, as specified, with approved compaction equipment. Maintain water content during the compaction procedure to within plus or minus 2 percent of the optimum water content determined from laboratory tests as specified in this Section. Begin rolling at the outside edge of the surface and proceed to the center, overlapping on successive trips at least one-half the width of the roller. Slightly vary the length of alternate trips of the roller. Adjust speed of the roller as needed so that displacement of the aggregate does not occur. Compact mixture with hand-operated power tampers in all places not accessible to the rollers. Continue compaction until each layer is compacted through the full depth to at least 100 percent of laboratory maximum density. Make such adjustments in compacting or finishing procedures as may be directed by the Contracting Officer to obtain true grades, to minimize segregation and degradation, to reduce or increase water content, and to ensure a satisfactory base course. Remove any materials found to be unsatisfactory and replace with satisfactory material or rework, as directed, to meet the requirements of this specification.

3.9 EDGES OF BASE COURSE

Place the base course(s) so that the completed section will be a minimum of 1 feet wider, on all sides, than the next layer that will be placed above it. Place approved material along the outer edges of the base course in sufficient quantity to compact to the thickness of the course being constructed. When the course is being constructed in two or more layers, simultaneously roll and compact at least a 2 foot width of this shoulder material with the rolling and compacting of each layer of the base course, as directed.

3.10 FINISHING

Finish the surface of the top layer of base course after final compaction by cutting any overbuild to grade and rolling with a steel-wheeled roller or hand compactor as approved. Do not add thin layers of material to the top layer of base course to meet grade. If the elevation of the top layer of base course is 1/2 inch or more below grade, scarify the top layer to a depth of at least 3 inches and blend new material in and compact to bring to grade. Make adjustments to rolling and finishing procedures as directed by the Contracting Officer to minimize segregation and degradation, obtain grades, maintain moisture content, and insure an acceptable base course. Should the surface become rough, corrugated, uneven in texture, or traffic marked prior to completion, scarify the unsatisfactory portion and rework and recompact it or replace as directed.

3.11 SMOOTHNESS TEST

Construct the top layer so that the surface shows no deviations in excess of 1/2 inch from the required grade. Correct deviations exceeding this amount by removing material and replacing with new material, or by reworking existing material and compacting it to meet these specifications.

3.12 FIELD QUALITY CONTROL

3.12.1 In-Place Tests

Perform each of the following tests on samples taken from the placed and compactedGCA. Take samples and test at the rates indicated. Perform sampling and testing of recycled concrete aggregate at twice the specified frequency until the material uniformity is established.

a. Perform density tests on every lift of material placed and at a frequency of one set of tests for every 250 square yards, or portion thereof, of completed area.

b. Perform sieve analysis on every lift of material placed and at a frequency of one sieve analysis for every 500 square yards, or portion thereof, of material placed.

c. Perform liquid limit and plasticity index tests at the same frequency as the sieve analysis.

d. Measure the thickness of the base course at intervals providing at least one measurement for each 500 square yards of base course or part thereof. Measure the thickness using test holes, at least 3 inch in diameter through the base course.

3.12.2 Approval of Material

Final approval of the materials will be based on tests for gradation, liquid limit, and plasticity index performed on samples taken from the completed and fully compacted course(s).

3.13 TRAFFIC

Completed portions of the base course may be opened to limited traffic, provided there is no marring or distorting of the surface by the traffic. Do not allow heavy equipment on the completed base course except when necessary for construction. When it is necessary for heavy equipment to travel on the completed base course, protect the area against marring or damage to the completed work.

3.14 MAINTENANCE

Maintain the base course in a satisfactory condition until the full pavement section is completed and accepted. Immediately repair any defects and repeat repairs as often as necessary to keep the area intact. Retest any base course that was not paved over prior to the onset of winter to verify that it still complies with the requirements of this specification. Rework or replace any area of base course that is damaged as necessary to comply with this specification.

3.15 DISPOSAL OF UNSATISFACTORY MATERIALS

Dispose of any unsuitable materials that have been removed outside the limits of Government-controlled land. No additional payments will be made for materials that have to be replaced.

-- End of Section --

SECTION 32 13 13.06

PORTLAND CEMENT CONCRETE PAVEMENT FOR ROADS AND SITE FACILITIES
05/20

PART 1 GENERAL

1.1 UNIT PRICES

1.1.1 Measurement

The quantity of concrete to be paid for will be the volume of concrete in cubic yards including monolithic curb, where required, placed in the completed and accepted pavement. Concrete will be measured in place in the completed and accepted pavement only within the neat line dimensions shown in the plan and cross section. No deductions will be made for rounded edges or the space occupied by embedded items or voids.

1.1.2 Payment

Payment will be made at the contract price per cubic yard for the scheduled item. Payment will constitute full compensation for furnishing all materials, equipment, plant and tools, and for all labor and other incidentals necessary to complete the concrete pavement.

1.2 REFERENCES

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

AMERICAN CONCRETE INSTITUTE (ACI)

ACI 211.1	(1991; R 2009) Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete
ACI 305R	(2010) Guide to Hot Weather Concreting
ACI 306R	(2016) Guide to Cold Weather Concreting

ASTM INTERNATIONAL (ASTM)

ASTM A615/A615M	(2020) Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
ASTM A775/A775M	(2017) Standard Specification for Epoxy-Coated Steel Reinforcing Bars
ASTM A966/A966M	(2015; R 2020) Standard Test Method for Magnetic Particle Examination of Steel Forgings Using Alternating Current
ASTM C31/C31M	(2019a) Standard Practice for Making and Curing Concrete Test Specimens in the Field
ASTM C33/C33M	(2018) Standard Specification for Concrete

	Aggregates
ASTM C42/C42M	(2020) Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
ASTM C78/C78M	(2018) Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading)
ASTM C88	(2018) Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM C94/C94M	(2020) Standard Specification for Ready-Mixed Concrete
ASTM C143/C143M	(2020) Standard Test Method for Slump of Hydraulic-Cement Concrete
ASTM C150/C150M	(2020) Standard Specification for Portland Cement
ASTM C171	(2016) Standard Specification for Sheet Materials for Curing Concrete
ASTM C172/C172M	(2017) Standard Practice for Sampling Freshly Mixed Concrete
ASTM C231/C231M	(2017a) Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C260/C260M	(2010a; R 2016) Standard Specification for Air-Entraining Admixtures for Concrete
ASTM C309	(2011) Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C494/C494M	(2019) Standard Specification for Chemical Admixtures for Concrete
ASTM C595/C595M	(2020) Standard Specification for Blended Hydraulic Cements
ASTM C618	(2019) Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
ASTM C881/C881M	(2020) Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete
ASTM C989/C989M	(2018a) Standard Specification for Slag Cement for Use in Concrete and Mortars
ASTM C1017/C1017M	(2013; E 2015) Standard Specification for Chemical Admixtures for Use in Producing

	Flowing Concrete
ASTM C1077	(2017) Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation
ASTM C1240	(2020) Standard Specification for Silica Fume Used in Cementitious Mixtures
ASTM C1260	(2014) Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)
ASTM C1542/C1542M	(2019) Standard Test Method for Measuring Length of Concrete Cores
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	(2018) Standard Specification for Mixing Water Used in Production of Hydraulic Cement Concrete
ASTM D1751	(2004; E 2013; R 2013) Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
ASTM D2995	(1999; R 2009) Determining Application Rate of Bituminous Distributors
ASTM D6155	(2019) Nontraditional Coarse Aggregate for Bituminous Paving Mixtures

NATIONAL READY MIXED CONCRETE ASSOCIATION (NRMCA)

NRMCA QC 3	(2015) Quality Control Manual: Section 3, Plant Certifications Checklist: Certification of Ready Mixed Concrete Production Facilities

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance with Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Curing Materials

Epoxy Resin

Cementitious Materials; G, RO

Dowel Bars

Expansion Joint Filler

SD-04 Samples

SD-05 Design Data

Mix Design Report; G, RO

SD-06 Test Reports

Concrete Slump Tests

Concrete Uniformity

Flexural Strength

Air Content

SD-07 Certificates

Batch Tickets

NRMCA Certificate Of Conformance

1.4 QUALITY CONTROL

1.4.1 NRMCA Certificate of Conformance

Provide a batching and mixing plant consisting of a stationary-type central mix plant, including permanent installations and portable or relocatable plants installed on stable foundations. Provide a plant designed and operated to produce concrete within the specified tolerances, with a minimum capacity of 250 cubic yards per hour. Submit NRMCA Certificate of Conformance that conforms to the requirements of NRMCA QC 3 including provisions addressing:

1. Material Storage and Handling

2. Batching Equipment

3. Central Mixer

4. Ticketing System

5. Delivery System

1.4.2 Qualifications

1.4.2.1 Laboratory Accreditation

Perform sampling and testing using an approved commercial testing laboratory or on-site facilities that are accredited in accordance with ASTM C1077. Do not start work requiring testing until the facilities

have been inspected and approved. The Government will inspect all laboratories requiring validation for equipment and test procedures prior to the start of any concreting operations for conformance to ASTM C1077. Schedule and provide payment for laboratory inspections. Additional payment or a time extension due to failure to acquire the required laboratory validation is not allowed. Maintain this certification for the duration of the project.

1.4.2.2 Field Technicians

Provide field technicians meeting one of the following criteria:

a. Have at least one National Ready Mixed Concrete Association (NRMCA) certified concrete craftsman and at least one American Concrete Institute (ACI) Flatwork Finisher Certified craftsman on site, overseeing each placement crew during all concrete placement.

b. Have no less than three NRMCA certified concrete installers and at least two American Concrete Institute (ACI) Flatwork Finisher Certified installers on site working as members of each placement crew during all concrete placement.

1.4.3 Batch Tickets

Submit batch tickets for each load of ready-mixed concrete in accordance with ASTM C94/C94M.

1.5 DELIVERY, STORAGE, AND HANDLING

Deliver concrete paving in accordance with ASTM C94/C94M.

1.6 ACCEPTANCE

1.6.1 Tolerances

Acceptance of Portland cement concrete pavement is based on compliance with the tolerances presented in Table 1. Remove and replace concrete pavement represented by the failing tests or submit repair plan for approval.

Table 1

Measurement	Tolerance
PLASTIC CONCRETE	
Slump	plus 0, minus 1.5 inches
Air Content	plus/minus 1.5 percent
Flexural Strength	No individual specimen less than 100 psi below specified strength.
HARDENED CONCRETE	
Grade	plus/minus 0.05 feet from plan

Table 1	
Smoothness	No abrupt change exceeding 1/8 inch
Straightedge	Not more than 1/8 in for roads. Not more than 1/4 in for open storage areas.
Profilograph	Not more than 9 inches/mile
Thickness	minus 1/2 inch for pavement less than 8 inches thick.
Edge Slump	85 percent less than 1/4 inch and 100 percent less than 3/8 inch.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Cementitious Materials

2.1.1.1 Portland Cement

Conforming to ASTM C150/C150M, Type I or II .

2.1.1.2 Blended Cement

Provide blended cement conforming to ASTM C595/C595M, Type IP or IS, including the optional requirement for mortar expansion and sulfate soundness. Provide pozzolan added to the Type IP blend consisting of ASTM C618 Class F or Class N and that is interground with the cement clinker. Include in written statement from the manufacturer that the amount of pozzolan in the finished cement does not vary more than plus or minus 5 mass percent of the finished cement from lot to lot or within a lot. The percentage and type of mineral admixture used in the blend are not allowed to change from that submitted for the aggregate evaluation and mixture proportioning. The requirements of paragraph Supplementary Cementitious Materials (SCM) Content do not apply to the SCM content of blended cement.

2.1.1.3 Fly Ash and Pozzolan

Conforming to ASTM C618, Type F, or N, with a loss on ignition not exceeding 6 percent. Include test results in accordance with ASTM C618.

2.1.1.4 Ultra Fine Fly Ash and Ultra Fine Pozzolan

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

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

b. The average particle size not exceeding 6 microns.

c. Loss on ignition not exceeding 6 percent.

2.1.1.5 Silica Fume

Provide silica fume that conforms to ASTM C1240, including the optional limits on reactivity with cement alkalis. Provide silica fume as a dry, densified material or as a slurry. Provide the services of a manufacturer's technical representative, experienced in mixing, proportioning, placement procedures, and curing of concrete containing silica fume, at no expense to the Government. This representative is required to be present on the project prior to and during at least the first 4 days of concrete production and placement using silica fume.

2.1.1.6 Slag

Conforming to ASTM C989/C989M, Slag Cement (formerly Ground Granulated Blast Furnace Slag) Grade 100 or 120. Include test results in accordance with ASTM C989/C989M.

2.1.2 Water

Water conforming to ASTM C1602/C1602M.

2.1.3 Aggregate

2.1.3.1 Durability

Evaluate and test all fine and coarse aggregates to be used in all concrete for durability in accordance with ASTM C88. Provide fine and coarse aggregates with a maximum of 18 percent loss when subjected to 5 cycles using Magnesium Sulfate or a maximum of 12 percent loss when subjected to 5 cycles of Sodium Sulfate.

2.1.3.2 Alkali Reactivity Test

Evaluate and test fine and coarse aggregates to be used in all concrete for alkali-aggregate reactivity. Test all size groups and sources proposed for use.

a. Evaluate the fine and coarse aggregates separately, using ASTM C1260. Reject individual aggregates with test results that indicate an expansion of greater than 0.08 percent after 28 days of immersion in 1N NaOH solution, or perform additional testing as follows: utilize the proposed low alkali portland cement, blended cement, or SCM in combination with each individual aggregate. Test in accordance with ASTM C1567. Determine the quantity that meets all the requirements of these specifications and that lowers the expansion equal to or less than 0.08 percent after 28 days of immersion in a 1N NaOH solution. Base the mixture proportioning on the highest percentage of SCM required to mitigate ASR-reactivity.

b. If any of the above options does not lower the expansion to less than 0.08 percent after 28 days of immersion in a 1N NaOH solution, reject the aggregate(s) and submit new aggregate sources for retesting. Submit the results of testing for evaluation and acceptance.

2.1.3.3 Fine Aggregates

Conforming to the quality and gradation of ASTM C33/C33M.

2.1.3.4 Coarse Aggregates

Coarse aggregate consisting of crushed or uncrushed gravel, crushed stone, or a combination thereof. Provide coarse aggregate with a minimum of 25 percent recycled porcelain, concrete, stone, or other recycled material complying with ASTM D6155. Provide aggregates, as delivered to the mixers, consisting of clean, hard, uncoated particles. Wash coarse aggregate sufficient to remove dust and other coatings. Provide fine aggregate consisting of natural sand, manufactured sand, or a combination of the two, and composed of clean, hard, durable particles. Provide both coarse and fine aggregates meeting the requirements of ASTM C33/C33M.

a. Gradation: Provide coarse aggregate with a nominal maximum size of 1.0 inches. Grade and provide the individual aggregates in two or more size groups meeting the individual grading requirements of ASTM C33/C33M, Size No. 4 (1.5 to 0.75 inch) and Size No. 67 (0.75 inch to No. 4).

b. Quality: Conforming to ASTM C33/C33M, Class 4S.

2.1.4 Chemical Admixtures

2.1.4.1 Water Reducing Admixtures

Provide admixture conforming to ASTM C494/C494M: Type A, water reducing; Type B, retarding; Type C, accelerating; Type D, water-reducing and retarding; and Type E, water-reducing and accelerating admixture. Do not use calcium chloride admixtures. ASTM C494/C494M Type S specific performance admixtures and ASTM C1017/C1017M flowable admixtures are not allowed.

2.1.4.2 Air Entraining Admixture

Conforming to ASTM C260/C260M: Air-entraining.

2.1.4.3 High Range Water Reducing Admixture

ASTM C494/C494M Type F and G high range water reducing admixtures are not allowed.

2.1.5 Reinforcement

2.1.5.1 Dowel Bars

Dowel bars conforming to ASTM A615/A615M, Grade 40 for plain billet-steel bars of the size and length indicated. Remove all burrs and projections from the bars. Epoxy coat in accordance with ASTM A775/A775M.

2.1.5.2 Tie Bars

Billet or axle steel deformed bars conforming to ASTM A615/A615M or ASTM A966/A966M Grade 40 . Epoxy coat in accordance with ASTM A775/A775M.

2.1.6 Curing Materials

Provide curing materials consisting of:

2.1.6.1 White-Burlap-Polyethylene Sheet

Conforming to ASTM C171, 0.004 inch thick white opaque polyethylene bonded to 10 oz/linear yard (40 inch) wide burlap.

2.1.6.2 Liquid Membrane-Forming Compound

Conforming to ASTM C309, white pigmented, Type 2, Class B, free of paraffin or petroleum.

2.1.6.3 Liquid Chemical Sealer-Hardener Compound

Compound consisting of magnesium fluosilicate which when mixed with water seals and hardens the surface of the concrete. Do not use on exterior slabs exposed to freezing conditions.

2.1.7 Joint Fillers and Sealants

Provide as specified in Section 32 01 19.61 SEALING OF JOINTS IN RIGID PAVEMENT.

2.1.8 Biodegradable Form Release Agent

Provide form release agent that is colorless and biodegradable. Provide product that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces. Provide form release agent with a minimum of 87 percent biobased material and does not contain diesel fuel, petroleum-based lubricating oils, waxes, or kerosene.

2.1.9 Epoxy Resin

Provide epoxy-resin materials that consist of two-component materials conforming to the requirements of ASTM C881/C881M, Class as appropriate for each application temperature to be encountered, except that in addition, the materials meet the following requirements:

a. Type IV, Grade 3, for use for embedding dowels and anchor bolts.

b. Type III, Grade as approved, for use as patching materials for complete filling of spalls and other voids and for use in preparing epoxy resin mortar.

c. Type IV, Grade 1, for use for injecting cracks.

d. Type V, Grade as approved, for bonding freshly mixed portland cement concrete or mortar or freshly mixed epoxy resin concrete or mortar to hardened concrete.

2.1.10 Joint Materials

2.1.10.1 Expansion Joint Materials

Provide preformed expansion joint filler material conforming to ASTM D1751. Provide expansion joint filler that is 3/4 inch thick, unless otherwise indicated, and provided in a single full depth piece.

2.1.10.2 Slip Joint Material

Provide slip joint material that is 1/4 inch thick expansion joint filler, unless otherwise indicated, conforming to paragraph EXPANSION JOINT MATERIAL.

2.2 MIX DESIGN

Proportion concrete mix in accordance with ACI 211.1 except as modified herein.

2.2.1 Specified Concrete Properties

2.2.1.1 Flexural Strength

Provide concrete with a minimum flexural strength of 650 psi at 28 days of age.

2.2.1.2 Air Entrainment

Provide an entrained air content of 5.5 percent.

2.2.1.3 Slump

For fixed form and hand placement, provide a maximum slump of 3 inches.

2.2.1.4 Water/Cementitious Materials Ratio

Maximum allowable water-cementitious material ratio is 0.40 . The water-cementitious material ratio is based on absolute volume equivalency, where the ratio is determined using the weight of cement for a cement only mix, or using the total volume of cement plus pozzolan converted to an equivalent weight of cement by the absolute volume equivalency method described in ACI 211.1.

2.2.2 Mix Design Report

Perform trial design batches, mixture proportioning studies, testing, and include test results demonstrating that the proposed mixture proportions produce concrete of the qualities indicated. An existing mix design may be submitted if developed within the previous 12 months. Submit test results in a mix design report to include:

a. Coarse and fine aggregate gradations and plots.

b. Coarse and fine aggregate quality test results, include deleterious materials and ASR testing.

c. Mill certificates for cement and supplemental cementitious materials.

d. Certified test results for all proposed admixtures.

e. Specified flexural strength, slump, and air content.

f. Recommended proportions and volumes for proposed mixture and each of three trial water-cementitious materials ratios.

g. Individual beam breaks.

h. Flexural strength summaries and plots.

i. Historical record of test results, documenting production standard deviation (if available).

j. Narrative discussing methodology on how the mix design was developed.

2.2.3 Mix Verification

Mix verification tests may be performed by the Government. Provide quantities of cementitious materials, aggregates and admixtures as requested.

2.3 EQUIPMENT

2.3.1 Batching and Mixing

Provide stationary mixers or truck mixers. Provide a batch plant conforming to ASTM C94/C94M and as specified. Do not weigh water or measure cumulatively with another ingredient. Batch all concrete materials in accordance with ASTM C94/C94M requirements. Verify batching, mixers, mixing time, permitted reduction of mixing time, and concrete uniformity in accordance with the requirements of ASTM C94/C94M, and document in the initial weekly QC Report.

2.3.2 Transporting Equipment

Provide transporting equipment in conformance with ASTM C94/C94M and as specified herein. Transport concrete to the paving site in rear-dump trucks, in truck mixers designed with extra large blading and rear opening specifically for low slump concrete, or in agitators. Do not permit bottom-dump trucks for delivery of concrete.

2.3.3 Delivery Equipment

When concrete transport equipment cannot operate on the paving lane, provide side-delivery transport equipment consisting of self-propelled moving conveyors to deliver concrete from the transport equipment and discharge it in front of the paver. Do not permit front-end loaders, dozers, or similar equipment to distribute the concrete.

2.3.4 Paver-Finisher

Provide a heavy-duty, self-propelled paver-finisher machine designed specifically for paving and finishing high quality pavement and capable of spreading, consolidating, and shaping the plastic concrete to the desired cross section in one pass. Equip the paver-finisher with a full width "knock-down" auger, capable of operating in both directions, which will evenly spread the fresh concrete in front of the screed or extrusion plate. Gang-mount immersion vibrators at the front of the paver on a frame equipped with suitable controls so that all vibrators can be operated at any desired depth within the slab or completely withdrawn from the concrete. Automatically control the vibrators so they will be immediately stopped as forward motion of the paver ceases. Space the immersion vibrators across the paving lane as necessary to properly consolidate the concrete, but limit the clear distance between vibrators not to exceed 30 inches, and the outside vibrators not to exceed 12 inches from the edge of the lane. Vibrators may be pneumatic, gas driven, or electric, and operated at frequencies within the concrete between 6,000

and 7,000 vibrations per minute, with an amplitude of vibration such that noticeable vibrations occur at 1.5 foot radius when the vibrator is inserted in the concrete to the depth specified. Equip the paver-finisher with a transversely oscillating screed or an extrusion plate to shape, compact, and smooth the surface.

2.3.4.1 Paver-Finisher with Fixed Forms

Equip the paver-finisher with wheels designed to ride the forms, keep it aligned with the forms, and to prevent deformation of the forms.

2.3.4.2 Slipform Paver-Finisher

Provide a track-mounted slipform paver-finisher with automatic controls and padded tracks. Electronically reference horizontal alignment to a taut wire guideline. Electronically reference vertical alignment on both sides of the paver to a taut wire guideline, to an approved laser control system, or to a ski operating on a completed lane. Do not control from a slope-adjustment control or from the underlying material.

2.3.4.3 Other Types of Finishing Equipment

Heavy duty vibratory truss screeds may be approved for use if successfully demonstrated on the test section to consolidate the slab full depth and without segregation. Clary screeds, rotating tube floats, or laser screeds will not be allowed on the project. Provide hand floats that are not less than 12 feet long and 6 inches wide and stiffened to prevent flexing and warping.

2.3.4.4 Work Bridge

Provide a self-propelled work bridge capable of spanning the paving lane and supporting the workmen without excessive deflection.

2.3.5 Texturing Equipment

Provide texturing equipment as specified below.

2.3.5.1 Fabric Drag

Clean, reasonably new burlap measuring from 3 to 10 feet long, 2 feet wider than the width of the pavement, and securely attached to a separate wheel mounted frame spanning the paving lane or to one of the other similar pieces of equipment. Select dimension of burlap drag so that at least 3 feet of the material is in contact with the pavement.

2.3.5.2 Deep Texturing Equipment

Provide texturing equipment consisting of a stiff bristled broom which will produce true, even grooves. Mount this drag in a wheeled frame spanning the paving lane and constructed to mechanically pull the drag in a straight line across the paving lane perpendicular to the centerline.

2.3.6 Curing Equipment

Provide equipment for applying membrane-forming curing compound mounted on a self-propelled frame that spans the paving lane. Constantly agitate the curing compound reservoir mechanically (not air) during operation and provide a means for completely draining the reservoir. Provide a spraying

system that consists of a mechanically powered pump which maintains constant pressure during operation, an operable pressure gauge, and either a series of spray nozzles evenly spaced across the lane to provide uniformly overlapping coverage or a single spray nozzle which is mounted on a carriage which automatically traverses the lane width at a speed correlated with the forward movement of the overall frame. Protect all spray nozzles with wind screens. Calibrate the spraying system in accordance with ASTM D2995, Method A, for the rate of application required in subpart CURING AND PROTECTION. Provide hand-operated sprayers powered by compressed air supplied by a mechanical air compressor. Immediately replace curing equipment if it fails to apply an even coating of compound at the specified rate.

2.3.7 Sawing Equipment

Provide equipment for sawing joints and for other similar sawing of concrete consisting of standard diamond-type concrete saws mounted on a wheeled chassis which can be easily guided to follow the required alignment. Provide diamond tipped blades. If demonstrated to operate properly, abrasive blades may be used. Provide spares as required to maintain the required sawing rate. Early-entry saws may be used, subject to demonstration and approval. No change to the initial sawcut depth is permitted.

2.3.8 Straightedge

Furnish one 12 foot straightedge constructed of aluminum or magnesium alloy, having blades of box or box-girder cross section with flat bottom, adequately reinforced to insure rigidity and accuracy. Provide handles for operation on the pavement.

PART 3 EXECUTION

3.1 PREPARATION FOR PAVING

3.1.1 Weather Limitations

When windy conditions during paving appear probable, have equipment and material at the paving site to provide windbreaks, shading, fogging, or other action to prevent plastic shrinkage cracking or other damaging drying of the concrete.

3.1.1.1 Inclement Weather

Do not commence placing operations when heavy rain or other damaging weather conditions appear imminent. At all times when placing concrete, maintain on-site sufficient waterproof cover and means to rapidly place it over all unhardened concrete or concrete that might be damaged by rain. Suspend placement of concrete whenever rain, high winds, or other damaging weather commences to damage the surface or texture of the placed unhardened concrete, washes cement out of the concrete, or changes the water content of the surface concrete. Immediately cover and protect all unhardened concrete from the rain or other damaging weather. Completely remove and replace any slab damaged by rain or other weather full depth, by full slab width, to the nearest original joint.

3.1.1.2 Hot Weather

Maintain required concrete temperature in accordance with ACI 305R to

prevent evaporation rate from exceeding 0.2 pound of water per square foot of exposed concrete per hour. Cool ingredients before mixing, place concrete during cooler night time hours, or use other suitable means to control concrete temperature and prevent rapid drying of newly placed concrete. Water is not allowed to be added after the initial introduction of mixing water except, when on arrival at the job site, the slump is less than specified and the water-cement ratio is less than that given as a maximum in the approved mixture. Additional water may be added to bring the slump within the specified range provided the approved water-cement ratio is not exceeded. Inject water into the head of the mixer (end opposite the discharge opening) drum under pressure, and turn the drum or blades a minimum of 30 additional revolutions at mixing speed. The addition of water to the batch at any later time is not allowed. After placement, use fog spray, apply monomolecular film, or use other suitable means to reduce the evaporation rate. Start curing when surface of fresh concrete is sufficiently hard to permit curing without damage. Cool underlying material by sprinkling lightly with water before placing concrete. Follow practices found in ACI 305R.

3.1.1.3 Prevention of Plastic Shrinkage Cracking

During weather with low humidity, and particularly with high temperature and appreciable wind, develop and institute measures to prevent plastic shrinkage cracks from developing. If plastic shrinkage cracking occurs, halt further placement of concrete until protective measures are in place to prevent further cracking. Periods of high potential for plastic shrinkage cracking can be anticipated by use of ACI 305R. In addition to the protective measures specified in the previous paragraph, the concrete placement may be further protected by erecting shades and windbreaks and by applying fog sprays of water, the addition of monomolecular films, or wet covering. Apply monomolecular films after finishing is complete, do not use in the finishing process. Immediately commence curing procedures when such water treatment is stopped.

3.1.1.4 Cold Weather

Do not place concrete when ambient temperature is below 40 degrees F or when concrete is likely to be subjected to freezing temperatures within 24 hours. When authorized, when concrete is likely to be subjected to freezing within 24 hours after placing, heat concrete materials so that temperature of concrete when deposited is between 65 and 80 degrees F. Methods of heating materials are subject to approval. Do not heat mixing water above 165 degrees F. Remove lumps of frozen material and ice from aggregates before placing aggregates in mixer. Follow practices found in ACI 306R.

3.1.2 Conditioning of Underlying Material

Verify the underlying material, upon which concrete is to be placed is clean, damp, and free from debris, waste concrete or cement, frost, ice, and standing or running water. Prior to setting forms or placement of concrete, verify the underlying material is well drained and has been satisfactorily graded by string-line controlled, automated, trimming machine and uniformly compacted in accordance with the applicable Section of these specifications. Test the surface of the underlying material to crown, elevation, and density in advance of setting forms or of concrete placement using slip-form techniques. Trim high areas to proper elevation. Fill and compact low areas to a condition similar to that of surrounding grade, or fill with concrete monolithically with the

pavement. Low areas filled with concrete are not to be cored for thickness to avoid biasing the average thickness used for evaluation and payment adjustment. Rework and compact any underlying material disturbed by construction operations to specified density immediately in front of the paver. If a slipform paver is used, continue the same underlying material under the paving lane beyond the edge of the lane a sufficient distance that is thoroughly compacted and true to grade to provide a suitable trackline for the slipform paver and firm support for the edge of the paving lane.

3.1.3 Forms

Use steel forms, except that wood forms may be used for curves having a radius of 150 feet or less, and for fillets. Forms may be built up with metal or wood, added only to the base, to provide an increase in depth of not more than 25 percent. Provide forms with the base width not less than eight-tenths of the vertical height of the form, except that for forms 8 inches or less in vertical height, provide forms with a base width not less than the vertical height of the form. Provide wood forms adequate in strength and rigidly braced for curves and fillets. Set forms on firm material cut true to grade so that each form section when placed will be firmly in contact with the underlying layer for its entire base. Do not set forms on blocks or on built-up spots of underlying material. Set and secure forms in place with stakes or by other approved methods for overlay pavements and for other locations where forms are set on existing pavements. Carefully drill holes in existing pavements for form stakes without cracking or spalling the existing pavement. Prior to setting forms for paving operations, demonstrate the proposed form setting procedures at an approved location and do not proceed further until the proposed method is approved. Before placing the concrete, coat the contact surfaces of forms with a non-staining mineral oil, non-staining form coating compound, biodegradable form release agent, or two coats of nitro-cellulose lacquer. Check and correct grade elevations and alignment of the forms immediately before placing concrete.

3.1.4 Reinforcement

3.1.4.1 Dowel Bars

Install dowels with horizontal and vertical alignment plus or minus 1 inch. Except as otherwise specified, maintain location of dowels within a skew alignment of 1/4 inch over 1 foot length. Omit Dowels and tie bars when the center of the dowel tie bar is located within a horizontal distance from an intersecting joint equal to or less than one-fourth of the slab thickness. Maintain dowels in position during concrete placement and curing. Before concrete placement, thoroughly grease the entire length of each dowel secured in a dowel basket or fixed form.

3.1.4.2 Tie Bars

Install bars, accurately aligned horizontally and vertically, and to the tolerances shown on the drawings, at indicated locations.

3.1.4.3 Setting Slab Reinforcement

Position reinforcement on suitable chairs prior to concrete placement. At expansion, contraction and construction joints, place the reinforcement as indicated. Clean reinforcement free of mud, oil, scale or other foreign materials. Place reinforcement accurately and wire securely. Lap splices

12 inches minimum. Maintain the bar spacing from ends and sides of slabs and joints as indicated. If reinforcing for Continuously Reinforced Concrete Pavement (CRCP) is required, submit the entire operating procedure and proposed equipment for approval.

3.2 MEASURING, MIXING, CONVEYING, AND PLACING CONCRETE

3.2.1 Measuring

Conform to ASTM C94/C94M.

3.2.2 Mixing

Conform to ASTM C94/C94M, except as modified herein. Begin mixing within 30 minutes after cement has been added to aggregates. When the air temperature is greater than 85 degrees F, place concrete within 60 minutes. With approval, a hydration stabilizer admixture meeting the requirements of ASTM C494/C494M Type D, may be used to extend the placement time to 90 minutes. Additional water may be added to bring slump within required limits as specified in ASTM C94/C94M, provided that the specified water-cement ratio is not exceeded.

3.2.3 Conveying

Conform to ASTM C94/C94M.

3.2.4 Placing

Do not exceed a free vertical drop of 5 feet from the point of discharge. Deposit concrete either directly from the transporting equipment or by conveyor on to the pre-wetted subgrade or subbase, unless otherwise specified. Deposit the concrete between the forms to an approximately uniform height. Place concrete continuously at a uniform rate, without damage to the grade and without unscheduled stops except for equipment failure or other emergencies. If an unscheduled stop occurs within 10 feet of a previously placed expansion joint, remove concrete back to joint, repair any damage to grade, install a construction joint and continue placing concrete only after cause of the stop has been corrected.

3.3 PAVING

Construct pavement with paving and finishing equipment utilizing fixed forms .

3.3.1 Paving Plan

Submit for approval a paving plan identifying the following items:

a. A description of the placing and protection methods proposed when concrete is to be placed in or exposed to hot, cold, or rainy weather conditions.

b. A detailed paving sequence plan and proposed paving pattern showing all planned construction joints.

c. Plan and equipment proposed to control alignment of formed or sawn joints within the specified tolerances.

3.3.2 Required Results

Operate the paver-finisher to produce a thoroughly consolidated slab throughout, true to line and grade within specified tolerances. Adjust the paver-finishing operation to produce a surface finish free of irregularities, tears, voids of any kind, and other discontinuities, with only a minimum of paste at the surface. Do not permit multiple passes of the paver-finisher. Produce a finished surface requiring no hand finishing, other than the use of cutting straightedges, except in very infrequent instances. Do not apply water, other than true fog sprays (mist), to the concrete surface during paving and finishing.

3.3.3 Operation

When the paver is operated between or adjacent to previously constructed pavement (fill-in lanes), make provisions to prevent damage to the previously constructed pavement, including keeping the existing pavement surface free of debris, and placing rubber mats beneath the paver tracks. Operate transversely oscillating screeds and extrusion plates to overlap the existing pavement the minimum possible, but in no case more than 8 inches.

3.3.4 Consolidation

Immediately after spreading concrete, consolidate full depth with internal type vibrating equipment along the boundaries of all slabs regardless of slab thickness, and interior of all concrete slabs. For pavements less than 10 inches thick, operate vibrators at mid-depth parallel with or at a slight angle to the base course. For thicker pavements, angle vibrators toward the vertical, with vibrator tip preferably about 2 inches above the base course, and top of vibrator a few inches below pavement surface. Automatically control the vibrators or tamping units in front of the paver so that they stop immediately as forward motion ceases. Limit duration of vibration to that necessary to produce consolidation of concrete. Do not permit excessive vibration. Vibrate concrete in small, odd-shaped slabs or in locations inaccessible to the paver mounted vibration equipment with a hand-operated immersion vibrator operated from a bridge spanning the area. Do not operate vibrators at one location for more than 15 seconds. Do not use vibrators to transport or spread the concrete.

3.3.5 Fixed Form Paving

Spread and strike off concrete with with the paver. Shape the concrete to the specified and indicated cross section in one pass, and finish the surface and edges so that only a very minimum amount of hand finishing is required. Use single spud hand vibrators to consolidate the concrete adjacent to fixed forms as required to achieve a void-free formed edge. Do not allow vibrators to contact reinforcement, forms, or the grade during vibration.

3.3.6 Slipform Paving

Shape the concrete to the specified and indicated cross section in one pass, and finish the surface and edges so that only a very minimum amount of hand finishing is required. Do not install dowels by dowel inserters attached to the paver or by any other means of inserting the dowels into the plastic concrete.

3.4 JOINTS

3.4.1 Contraction Joints

Hold dowels and tie bars in longitudinal and transverse contraction joints within the paving lane securely in place by means of rigid metal basket assemblies. Weld the dowels and tie bars to the assembly or hold firmly by mechanical locking arrangements that will prevent them from becoming distorted during paving operations. Anchor the basket assemblies securely in the proper location.

3.4.2 Construction Joints - Fixed Form Paving

Install dowels and tie bars by the bonded-in-place method, supported by means of devices fastened to the forms. Do not permit installation by removing and replacing in preformed holes.

3.4.3 Dowels Installed In Hardened Concrete

Install by bonding the dowels into holes drilled into the hardened concrete. Drill holes into the hardened concrete approximately 1/8 inch greater in diameter than the dowels. Bond the dowels in the drilled holes using epoxy resin injected at the back of the hole before installing the dowel and extruded to the collar during insertion of the dowel so as to completely fill the void around the dowel. Application by buttering the dowel is not permitted. Hold the dowels in alignment at the collar of the hole, after insertion and before the epoxy resin hardens, by means of a suitable metal or plastic collar fitted around the dowel. Check the vertical alignment of the dowels by placing the straightedge on the surface of the pavement over the top of the dowel and measuring the vertical distance between the straightedge and the beginning and ending point of the exposed part of the dowel.

3.5 FINISHING CONCRETE

Start finishing operations immediately after placement of concrete. Use finishing machine, except hand finishing may be used in emergencies and for concrete slabs in inaccessible locations or of such shapes or sizes that machine finishing is impracticable. Immediately halt any operations which produce more than 1/8 inch of mortar-rich surface (defined as deficient in plus U.S. No. 4 sieve size aggregate) and modify the equipment, mixture, or procedures. Finish pavement surface on both sides of a joint to the same grade. Finish formed joints from a securely supported transverse bridge. Provide hand finishing equipment for use at all times.

3.5.1 Machine Finishing

Strike off and screed concrete to the required slope and cross-section by a power-driven transverse finishing machine. A transverse rotating tube or pipe is not permitted. Maintain elevation of concrete such that, when consolidated and finished, pavement surface will be adequately consolidated and at the required grade. Equip finishing machine with a screed which is readily and accurately adjustable for changes in pavement slope and compensation for wear and other causes. Do not permit excessive operation over an area, which will result in an excess of mortar and water being brought to the surface.

3.5.1.1 Equipment Operation

Maintain the travel of machine on the forms without lifting, wobbling, or other variation of the machine which tend to affect the precision of concrete finish. Keep the tops of the forms clean by a device attached to the machine. Maintain a uniform ridge of concrete ahead of the front screed for its entire length.

3.5.1.2 Joint Finish

Before concrete is hardened, correct edge slump of pavement, exclusive of edge rounding, in excess of 0.25 inches. Finish concrete surface on each side of construction joints to the same plane, and correct deviations before newly placed concrete has hardened.

3.5.1.3 Hand Finishing

Strike-off and screed surface of concrete to elevations slightly above finish grade so that when concrete is consolidated and finished, the pavement surface is at the indicated elevation. Vibrate entire surface until required compaction and reduction of surface voids is secured with a strike-off template. After initial finishing, further smooth and consolidate concrete by means of hand-operated longitudinal floats.

3.5.2 Texturing

Before the surface sheen has disappeared and before the concrete hardens, provide a texture to the surface of the pavement as described herein. After curing is complete, thoroughly broom all textured surfaces to remove all debris. Finish the concrete in areas of recesses for tie-down anchors, lighting fixtures, and other outlets in the pavement to provide a surface of the same texture as the surrounding area.

3.5.2.1 Burlap Drag Finish

Before concrete becomes non-plastic, finish the surface of the slab by dragging a strip of clean, wet burlap on the surface. Drag the surface so as to produce a finished surface with a fine granular or sandy texture without leaving disfiguring marks. Keep the burlap clean and saturated during use.

3.5.2.2 Brooming

Finish the surface of the slab by brooming the surface with a new wire broom at least 18 inches wide. Gently pull the broom over the surface of the pavement from edge to edge just before the concrete becomes non-plastic. Slightly overlap adjacent strokes of the broom. Broom perpendicular to centerline of pavement so that corrugations produced will be uniform in character and width, and not more than 1/16 inch in depth. Maintain broomed surface free from porous spots, irregularities, depressions, and small pockets or rough spots such as may be caused by accidentally disturbing particles of coarse aggregate embedded near the surface.

3.5.3 Edging

At the time the concrete has attained a degree of hardness suitable for edging, carefully finish slab edges, including edges at formed joints, with an edge having a maximum radius of 1/8 inch. When brooming is

specified for the final surface finish, edge transverse joints before starting brooming, then operate broom to obliterate as much as possible the mark left by the edging tool without disturbing the rounded corner left by the edger. Clean by removing loose fragments and soupy mortar from corners or edges of slabs which have crumbled and areas which lack sufficient mortar for proper finishing. Refill voids solidly with a mixture of suitable proportions and consistency and refinish. Remove unnecessary tool marks and edges. Smooth remaining edges true to line.

3.6 CURING AND PROTECTION

Protect concrete adequately from injurious action by sun, rain, flowing water, mechanical injury, tire marks and oil stains, and do not allow it to dry out from the time it is placed until the expiration of the minimum curing periods specified herein. Do not use membrane-forming compound on surfaces where its appearance would be objectionable, on surfaces to be painted, where coverings are to be bonded to concrete, or on concrete to which other concrete is to be bonded.

3.6.1 Moist Curing

Maintain concrete to be moist-cured continuously wet for the entire curing period, or until curing compound is applied, commencing immediately after finishing. If forms are removed before the end of the curing period, provide curing on unformed surfaces, using suitable materials. Cure surfaces by ponding, by continuous sprinkling, by continuously saturated burlap or cotton mats, or by continuously saturated plastic coated burlap. Provide burlap and mats that are clean and free from any contamination and completely saturated before being placed on the concrete. Lap sheets to provide full coverage. Provide an approved work system to ensure that moist curing is continuous 24 hours per day and that the entire surface is wet.

3.6.2 White-Burlap-Polyethylene Sheet

Wet entire exposed surface thoroughly with a fine spray of water, saturate burlap but do not have excessive water dripping off the burlap and then cover concrete with White-Burlap-Polyethylene Sheet, burlap side down. Lay sheets directly on concrete surface and overlap 12 inches. Make sheeting not less than 18 inches wider than concrete surface to be cured, and weight down on the edges and over the transverse laps to form closed joints. Repair or replace sheets when damaged during curing. Check daily to assure burlap has not lost all moisture. If moisture evaporates, resaturate burlap and re-place on pavement (limit re-saturation and re-placing to less than 10 minutes per sheet). Leave sheeting on concrete surface to be cured for at least 7 days.

3.6.3 Liquid Membrane-Forming Compound Curing

Apply compound immediately after surface loses its water sheen and has a dull appearance and before joints are sawed. Agitate curing compound thoroughly by mechanical means during use and apply uniformly in a two-coat continuous operation by suitable power-spraying equipment. Apply a total coverage for the two coats at least one gallon of undiluted compound per 200 square feet to produce a uniform, continuous, coherent film that will not check, crack, or peel and free from pinholes or other imperfections. The application of curing compound by hand-operated, mechanical powered pressure sprayers is permitted only on odd widths or shapes of slabs and on concrete surfaces exposed by the removal of forms.

When the application is made by hand-operated sprayers, apply a second coat in a direction approximately at right angles to the direction of the first coat. Apply an additional coat of compound immediately to areas where film is defective. Respray concrete surfaces that are subject to heavy rainfall within 3 hours after curing compound has been applied in the same manner.

3.6.4 Protection of Treated Surfaces

After the initial saw cut is complete and the slurry has been removed, respray the area with curing compound or restore the white burlap polyethylene sheet to maintain a continuous curing environment in the area of the sawn joints. Keep concrete surfaces to which liquid membrane-forming compounds have been applied free from vehicular traffic and other sources of abrasion for not less than 72 hours. Foot traffic is allowed after 24 hours for inspection purposes. Maintain continuity of coating for entire curing period and repair damage to coating immediately.

3.7 FIELD QUALITY CONTROL

3.7.1 Sampling

Collect samples of fresh concrete in accordance with ASTM C172/C172M during each working day as required to perform tests specified herein. Make test specimens in accordance with ASTM C31/C31M.

3.7.2 Consistency Tests

Perform concrete slump tests in accordance with ASTM C143/C143M. Take samples for slump determination from concrete during placement. Perform tests at the beginning of a concrete placement operation and for each batch (minimum) or every 20 cubic yards (maximum) of concrete to ensure that specification requirements are met. In addition, perform tests each time test beams are made.

3.7.3 Flexural Strength Tests

Test for flexural strength in accordance with ASTM C78/C78M. Fabricate and cure four test specimens in accordance with ASTM C31/C31M for each set of tests. Test two specimens at 7 days, and the other two at 28 days. Concrete strength will be considered satisfactory when the minimum of the 28-day test results equals or exceeds the specified 28-day flexural strength, and no individual strength test is less than the tolerance indicated on Table 1. If the ratio of the 7-day strength test to the specified 28-day strength is less than 65 percent, make necessary adjustments for conformance. Fabricate, cure and test a minimum of one set of four beams for each shift of concrete placement. Remove concrete which is determined to be defective, based on the strength acceptance criteria therein, and replace with acceptable concrete.

3.7.4 Air Content Tests

Test air-entrained concrete for air content at the same frequency as specified for slump tests. Determine percentage of air in accordance with ASTM C231/C231M on samples taken during placement of concrete in forms.

3.7.5 Surface Testing

Use the straightedge method for transverse testing, for longitudinal

testing where the length of each pavement lane is less than 200 feet, and at the ends of the paving limits for the project. Smoothness requirements do not apply over crowns, drainage structures, or similar penetrations. Maintain detailed notes of the testing results and submit a copy to the Government after each day's testing.

3.7.5.1 Straightedge Testing Method

Test the surface of the pavement with the straightedge to identify all surface irregularities exceeding the tolerances specified in Table 1. Test the entire area of the pavement in both a longitudinal and a transverse direction on parallel lines approximately 15 feet apart. Hold the straightedge in contact with the surface and move ahead one-half the length of the straightedge for each successive measurement. Determine the amount of surface irregularity by placing the straightedge on the pavement surface and allowing it to rest upon the two highest spots covered by its length and measuring the maximum gap between the straightedge and the pavement surface, in the area between these two high points.

3.7.6 Plan Grade Testing and Conformance

Within 5 days after each day's paving, test the finished surface of the pavement area by running lines of levels at intervals corresponding with every longitudinal and transverse joint to determine the elevation at each joint intersection. Record the results of this survey and submit a copy to the Government at the completion of the survey.

3.7.7 Edge Slump

Test the pavement surface to determine edge slump immediately after the concrete has hardened sufficiently to permit walking thereon. Perform testing with a minimum 12 foot straightedge to reveal irregularities exceeding the edge slump tolerance specified in Table 1. Determine the vertical edge slump at each free edge of each slipformed paving lane constructed. Place the straightedge transverse to the direction of paving and the end of the straightedge located at the edge of the paving lane. Record measurements at 5 to 10 foot spacings, as directed, commencing at the header where paving was started. Initially record measurements at 5 foot intervals in each lane. When no deficiencies are present after 5 measurements, the interval may be increased. The maximum interval is 10 feet. When any deficiencies exist, return the interval to 5 feet. In addition to the transverse edge slump determination above, at the same time, record the longitudinal surface smoothness of the joint on a continuous line 1 inch back from the joint line using the minimum 12 foot straightedge advanced one-half its length for each reading. Perform other tests of the exposed joint face to ensure that a uniform, true vertical joint face is attained. Properly reference all recorded measurements in accordance with paving lane identification and stationing, and submit a report within 24 hours after measurement is made. Identify areas requiring replacement within the report.

3.7.8 Test for Pavement Thickness

Take full depth cores of 4 inch diameter of concrete pavement every 500 square feet in accordance with ASTM C42/C42M. Measure thickness in accordance with ASTM C1542/C1542M. Record and submit testing, inspection, and evaluation of each core for surface paste, uniformity of aggregate distribution, segregation, voids, cracks, and depth of reinforcement or dowel (if present). Moisten the core with water to visibly expose the

aggregate and take a minimum of three photographs of the sides of the core, rotating the core approximately 120 degrees between photographs. Include a ruler for scale in the photographs. Submit plan view of location for each core.

3.7.9 Reinforcement

Inspect reinforcement prior to installation to verify it is free of loose flaky rust, loose scale, oil, mud, or other objectionable material.

3.7.10 Dowels

Inspect dowel placement prior to placing concrete to verify that dowels are of the size indicated, and are spaced, aligned and painted and oiled as specified. Do not permit dowels to exceed the tolerances shown in paragraph: DOWEL BARS.

-- End of Section --

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SECTION 32 16 19

CONCRETE CURBS, GUTTERS AND SIDEWALKS
05/18

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

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

ASTM INTERNATIONAL (ASTM)

ASTM A615/A615M	(2016) Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
ASTM A1064/A1064M	(2017) Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
ASTM C31/C31M	(2019) Standard Practice for Making and Curing Concrete Test Specimens in the Field
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/C172M	(2017) Standard Practice for Sampling Freshly Mixed Concrete
ASTM C173/C173M	(2016) Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
ASTM C231/C231M	(2017a) Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C309	(2011) Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C920	(2018) 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	(2018) Standard Specification for Preformed Sponge Rubber, Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction
ASTM D5893/D5893M	(2016) Standard Specification for Cold Applied, Single Component, Chemically Curing Silicone Joint Sealant for Portland Cement Concrete Pavements

INTERNATIONAL CODE COUNCIL (ICC)

ICC A117.1 COMM	(2017) Standard And Commentary Accessible and Usable Buildings and Facilities

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Concrete

SD-06 Test Reports

Field Quality Control

1.3 EQUIPMENT, TOOLS, AND MACHINES

1.3.1 General Requirements

Plant, equipment, machines, and tools used in the work will be subject to approval and must be maintained in a satisfactory working condition at all times. Use equipment capable of producing the required product, meeting grade controls, thickness control and smoothness requirements as specified. Discontinue using equipment that produces unsatisfactory results. Allow the Contracting Officer access at all times to the plant and equipment to ensure proper operation and compliance with specifications.

1.3.2 Slip Form Equipment

Slip form paver or curb forming machines, will be approved based on trial use on the job and must be self-propelled, automatically controlled, crawler mounted, and capable of spreading, consolidating, and shaping the plastic concrete to the desired cross section in one pass.

1.4 ENVIRONMENTAL REQUIREMENTS

1.4.1 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. Placement may begin when the air temperature reaches 35 degrees F and is rising, or is already above 40 degrees F. Make provisions to protect the concrete from freezing during the specified curing period. If necessary to place concrete when the temperature of the air, aggregates, or water is below 35 degrees F, placement and protection must be approved in writing. Approval will be contingent upon full conformance with the following provisions. Prepare and protect the underlying material so that it is entirely free of frost when the concrete is deposited. Heat mixing water and aggregates as necessary to result in the temperature of the in-place concrete being between 50 and 85 degrees F. Methods and equipment for heating must be approved. Use only aggregates that are free of ice, snow, and frozen lumps before entering the mixer. Provide covering or other means as needed to maintain 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.

1.4.2 Placing During Warm Weather

The temperature of the concrete as placed must not exceed 85 degrees F except where an approved retarder is used. Cool the mixing water and aggregates as necessary to maintain a satisfactory placing temperature. The placing temperature must not exceed 95 degrees F at any time.

PART 2 PRODUCTS

2.1 CONCRETE

Provide concrete conforming to the applicable requirements of Section 03 30 00 CAST-IN-PLACE CONCRETE except as otherwise specified. Concrete must have a minimum compressive strength of 3500 psi at 28 days. Size of aggregate must not exceed 1-1/2 inches. Submit copies of certified delivery tickets for all concrete used in the construction.

2.1.1 Air Content

Use concrete mixtures that have an 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

Use concrete with a slump of 3 inches plus or minus 1 inch for hand placed concrete or 1 inch plus or minus 1/2 inch for slipformed concrete as determined in accordance with ASTM C143/C143M.

2.1.3 Reinforcement Steel

Use reinforcement bars conforming to ASTM A615/A615M. Use wire mesh reinforcement conforming to ASTM A1064/A1064M.

2.2 CONCRETE CURING MATERIALS

2.2.1 Impervious Sheet Materials

Use impervious sheet materials conforming to ASTM C171, type optional, except that polyethylene film, if used, must be white opaque.

2.2.2 Burlap

Use burlap conforming to AASHTO M 182.

2.2.3 White Pigmented Membrane-Forming Curing Compound

Use white pigmented membrane-forming curing compound conforming to ASTM C309, Type 2.

2.3 CONCRETE PROTECTION MATERIALS

Use concrete protection materials consisting of 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

Use hard-pressed fiberboard contraction joint filler for curb and gutter.

2.4.2 Expansion Joint Filler, Premolded

Onless otherwise indicated, use 1/2 inch thick premolded expansion joint filler conforming to ASTM D1751 or ASTM D1752.

2.5 JOINT SEALANTS

Use cold-applied joint sealant conforming to ASTM C920 or ASTM D5893/D5893M.

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. Use wood or steel forms that are straight and of sufficient strength to resist springing during depositing and consolidating concrete.

2.6.1 Wood Forms

Use forms that are surfaced plank, 2 inches nominal thickness, straight and free from warp, twist, loose knots, splits or other defects. Use forms with a nominal length of 10 feet. Radius bends may be formed with 3/4 inch boards, laminated to the required thickness.

2.6.2 Steel Forms

Use channel-formed sections with a flat top surface and welded braces at each end and at not less than two intermediate points. Use forms with

interlocking and self-aligning ends. Provide flexible forms for radius forming, corner forms, form spreaders, and fillers as needed. Use forms with a nominal length of 10 feet and that have a minimum of 3 welded stake pockets per form. Use stake pins consisting of solid steel rods with chamfered heads and pointed tips designed for use with steel forms.

2.6.3 Sidewalk Forms

Use sidewalk forms that are of a height equal to the full depth of the finished sidewalk.

2.7 Detectable Warning System

Detectable Warning Systems shown on the Contract plans are to meet requirements of ICC A117.1 COMM - Section 705.

PART 3 EXECUTION

3.1 SUBGRADE PREPARATION

Construct subgrade to the specified grade and cross section prior to concrete placement.

3.1.1 Sidewalk Subgrade

Place and compact the subgrade in accordance with Section 31 00 00 EARTHWORK . Test the subgrade for grade and cross section with a template extending the full width of the sidewalk and supported between side forms.

3.1.2 Maintenance of Subgrade

Maintain subgrade in a smooth, compacted condition in conformity with the required section and established grade until the concrete is placed. The subgrade must be in a moist condition when concrete is placed. Prepare and protect subgrade so that it is 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. Use additional stakes and braces at corners, deep sections, and radius bends, as required. Use clamps, spreaders, and braces where required to ensure rigidity in the forms. Remove forms in a manner that will not injure the concrete. Do not use bars or heavy tools against the concrete when removing the forms. Promptly and satisfactorily repair concrete found to be defective after form removal. Clean forms and coat with form oil or biodegradable form release agent 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 1/8 inch in any 10 foot long section. After forms are set, grade and alignment must be checked with a 10 foot straightedge. Sidewalks must have a transverse slope as indicated with a max of 1/4 inch per foot Unless otherwise indicated, construct sidewalks that are located

adjacent to curbs with the low side adjacent to the curb. Do not remove side forms less than 12 hours after finishing has been completed.

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 must be of the thickness indicated. Use a strike-off guided by side forms after concrete has been placed in the forms to bring the surface to proper section to be compacted. Consolidate concrete by tamping and spading or with an approved vibrator. Finish the surface 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 or magnesium float or darby to a smooth and uniformly fine granular or sandy texture free of waves, irregularities, or tool marks. Produce a scored surface 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

Finish all slab edges, including those at formed joints, with an edger having a radius of 1/8 inch. Edge transverse joints before brooming. Eliminate the flat surface left by the surface face of the edger with brooming. Clean and solidly fill corners and edges which have crumbled and areas which lack sufficient mortar for proper finishing with a properly proportioned mortar mixture and then finish.

3.3.4 Surface and Thickness Tolerances

Finished surfaces must not vary more than 5/16 inch from the testing edge of a 10-foot straightedge. Permissible deficiency in section thickness will be up to 1/4 inch.

3.4 SIDEWALK JOINTS

Construct sidewalk joints to divide the surface into rectangular areas. Space transverse contraction joints at a distance equal to the sidewalk width or 5 feet on centers, whichever is less, and continuous across the slab. Construct longitudinal contraction joints along the centerline of all sidewalks 10 feet or more in width. Construct transverse expansion joints at sidewalk returns and opposite expansion joints in adjoining curbs. Where the sidewalk is not in contact with the curb, install transverse expansion joints as indicated. Form expansion joints around 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.

3.4.1 Sidewalk Contraction Joints

Form contraction joints 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. Unless otherwise approved or indicated, either use a jointer to cut the groove or saw a groove in the hardened concrete with a

power-driven saw. Construct sawed joints by sawing a groove in the concrete with a 1/8 inch blade. Provide an ample supply of saw blades on the jobsite before concrete placement is started. Provide at least one standby sawing unit in good working order at the jobsite at all times during the sawing operations.

3.4.2 Sidewalk Expansion Joints

Form expansion joints using 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. Hold joint filler in place with steel pins or other devices to prevent warping of the filler during floating and finishing. Immediately after finishing operations are completed, round joint edges using an edging tool having a radius of 1/8 inch. Remove any concrete over the joint filler. At the end of the curing period, clean the top of expansion joints and fill with cold-applied joint sealant. Use joint sealant that is gray or stone in color. Thoroughly clean the joint opening before the sealing material is placed. Do not spill sealing material on exposed surfaces of the concrete. Apply joint sealing material only when the concrete at the joint is surface dry and atmospheric and concrete temperatures are above 50 degrees F. Immediately remove any excess material on exposed surfaces of the concrete and clean the concrete surfaces.

3.4.3 Reinforcement Steel Placement

Accurately and securely fasten reinforcement steel in place with suitable supports and ties before the concrete is placed.

3.5 CURING AND PROTECTION

3.5.1 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 must be on hand and ready for use before actual concrete placement begins. Protect concrete as necessary to prevent cracking of the pavement due to temperature changes during the curing period.

3.5.1.1 Mat Method

Cover the entire exposed surface with two or more layers of burlap. Overlap mats at least 6 inches. Thoroughly wet the mat with water prior to placing on concrete surface and keep the mat continuously in a saturated condition and in intimate contact with concrete for not less than 7 days.

3.5.1.2 Impervious Sheeting Method

Wet the entire exposed surface with a fine spray of water and then cover with impervious sheeting material. Lay sheets directly on the concrete surface with the light-colored side up and overlapped 12 inches when a continuous sheet is not used. Use sheeting that is not less than 18-inches wider than the concrete surface to be cured. Secure sheeting using heavy wood planks or a bank of moist earth placed along edges and laps in the sheets. Satisfactorily repair or replace sheets that are torn or

otherwise damaged during curing. Sheeting must remain on the concrete surface to be cured for not less than 7 days.

3.5.1.3 Membrane Curing Method

Apply a uniform coating of white-pigmented membrane-curing compound to the entire exposed surface of the concrete as soon after finishing as the free water has disappeared from the finished surface. Coat formed surfaces immediately after the forms are removed and in no case longer than 1 hour after the removal of forms. Do not allow concrete surface to dry before application of the membrane. If drying has occurred, moisten the surface of the concrete with a fine spray of water and apply the curing compound as soon as the free water disappears. Apply curing compound in two coats by hand-operated pressure sprayers at a coverage of approximately 200 square feet/gallon for the total of both coats. Apply the second coat in a direction approximately at right angles to the direction of application of the first coat. The compound must form a uniform, continuous, coherent film that will not check, crack, or peel and must be free from pinholes or other imperfections. If pinholes, abrasion, or other discontinuities exist, apply an additional coat to the affected areas within 30 minutes. Respray concrete surfaces that are subjected to heavy rainfall within 3 hours after the curing compound has been applied by the method and at the coverage specified above. Respray areas where the curing compound is damaged by subsequent construction operations within the curing period. Take precautions necessary to ensure that the concrete is properly cured at sawed joints, and that no curing compound enters the joints. Tightly seal the top of the joint opening and the joint groove at exposed edges before the concrete in the region of the joint is resprayed with curing compound. Use a method used for sealing the joint groove that prevents loss of moisture from the joint during the entire specified curing period. Provide approved standby facilities for curing concrete pavement 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. Adequately protect concrete surfaces to which membrane-curing compounds have been applied during the entire curing period from pedestrian and vehicular traffic, except as required for joint-sawing operations and surface tests, and from other possible damage to the continuity of the membrane.

3.5.2 Backfilling

After curing, remove debris and backfill, grade, and compact the area adjoining the concrete to conform to the surrounding area in accordance with lines and grades indicated.

3.5.3 Protection

Protect completed concrete from damage until accepted. Repair damaged concrete and clean concrete discolored during construction. Remove and reconstruct concrete that is damaged for the entire length between regularly scheduled joints. Refinishing the damaged portion will not be acceptable. Dispose of removed material as directed.

3.5.4 Protective Coating

Apply a protective coating of linseed oil mixture 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. Moist cure concrete to

receive a protective coating.

3.5.4.1 Application

Complete curing and backfilling operation prior to applying two coats of protective coating. Concrete must be surface dry and clean before each application. Spray apply at a rate of 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 must be in accordance with the manufacturer's instructions. Protect coated surfaces from vehicular and pedestrian traffic until dry.

3.5.4.2 Precautions

Do not heat protective coating by direct application of flame or electrical heaters and protect the coating from exposure to open flame, sparks, and fire adjacent to open containers or applicators. Do not apply material at ambient or material temperatures lower than 50 degrees F.

3.6 FIELD QUALITY CONTROL

Submit copies of all test reports within 24 hours of completion of the test.

3.6.1 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 additional tests to ensure that the requirements of these specifications are met.

3.6.2 Concrete Testing

3.6.2.1 Strength Testing

Take concrete samples in accordance with ASTM C172/C172M not less than once a day nor less than once for every 250 cubic yards of concrete placed. Mold cylinders in accordance with ASTM C31/C31M for strength testing by an approved laboratory. Each strength test result must 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.

3.6.2.2 Air Content

Determine air content in accordance with ASTM C173/C173M or ASTM C231/C231M. Use ASTM C231/C231M with concretes and mortars made with relatively dense natural aggregates. Make two tests for air content on randomly selected batches of each class of concrete placed during each shift. Make additional tests when excessive variation in concrete workability is reported by the placing foreman or the Government inspector. Notify the placing forman if results are out of tolerance. The placing foreman must 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.

3.6.2.3 Slump Test

Perform two slump tests on randomly selected batches of each class of concrete for every 250 cubic yards, or fraction thereof, of concrete placed during each shift. Perform additional tests 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.

3.6.3 Thickness Evaluation

Determine the anticipated thickness of the concrete 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, construct the subgrade true to grade prior to concrete placement. The thickness will be determined by measuring each edge of the completed slab.

3.6.4 Surface Evaluation

Provide finished surfaces for each category of the completed work that are uniform in color and free of blemishes and form or tool marks.

3.7 SURFACE DEFICIENCIES AND CORRECTIONS

3.7.1 Thickness Deficiency

When measurements indicate that the completed concrete section is deficient in thickness by more than 1/4 inch the deficient section will be removed, between regularly scheduled joints, and replaced.

3.7.2 High Areas

In areas not meeting surface smoothness and plan grade requirements, reduce high areas 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 must not exceed 5 percent of the area of any integral slab, and the depth of grinding must not exceed 1/4 inch. Remove and replace pavement areas requiring grade or surface smoothness corrections in excess of the limits specified.

3.7.3 Appearance

Exposed surfaces of the finished work will be inspected by the Contracting Officer and deficiencies in appearance will be identified. Remove and replace areas which exhibit excessive cracking, discoloration, form marks, or tool marks or which are otherwise inconsistent with the overall appearances of the work.

3.8 DETECTABLE WARNING SYSTEM

Install Detectable Warning Systems required by Contract plans in accordance with ICC A117.1 COMM, Section 705, and by manufacturers' installation instructions.

-- End of Section --

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SECTION 32 17 23

PAVEMENT MARKINGS
08/16

PART 1 GENERAL

1.1 REFERENCES

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

ASTM INTERNATIONAL (ASTM)

ASTM D6628	(2003; R 2015) Standard Specification for Color of Pavement Marking Materials

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

SAE AMS-STD-595A	(2017) Colors used in Government Procurement

U.S. FEDERAL HIGHWAY ADMINISTRATION (FHWA)

MUTCD	(2015) Manual on Uniform Traffic Control Devices

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS TT-B-1325	(Rev D; Notice 1; Notice 2 2017) Beads (Glass Spheres) Retro-Reflective (Metric)
FS TT-P-1952	(2015; Rev F) Paint, Traffic and Airfield Markings, Waterborne

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Surface Preparation Equipment List; G

Application Equipment List; G

Exterior Surface Preparation

Safety Data Sheets; G

Waterborne Paint; G

Waterborne Paint; G

SD-07 Certificates

Qualifications; G

Waterborne Paint

Volatile Organic Compound, (VOC); G

SD-08 Manufacturer's Instructions

Waterborne Paint; G

1.3 QUALITY ASSURANCE

1.3.1 Regulatory Requirements

Submit certificate stating that the proposed pavement marking paint meets the Volatile Organic Compound, (VOC) regulations of the local Air Pollution Control District having jurisdiction over the geographical area in which the project is located. Submit Safety Data Sheets for each product.

1.3.2 Qualifications

Submit documentation certifying that pertinent personnel are qualified for equipment operation and handling of applicable chemicals. The documentation should include experience on five projects of similar size and scope with references for all personnel.

1.3.3 Qualifications For Airfield Marking Personnel

Submit documentation of qualifications in resume format a minimum of 14 days before pavement marking work is to be performed showing personnel who will be performing the work have experience working on airfields, operating mobile self-powered marking, cleaning, and paint removal equipment and performing these tasks. Include with resume a list of references complete with points of contact and telephone numbers. Provide certification for pavement marking machine operator and Foreman demonstrating experience successfully completing a minimum of two airfield pavement marking projects of similar size and scope. Provide documentation demonstrating personnel have a minimum of two years of experience operating similar equipment and performing the same or similar work in similar environments, similar in size and scope of the planned project. The Contracting Officer reserves the right to require additional proof of competency or to reject proposed personnel.

1.4 DELIVERY AND STORAGE

Deliver paint materials, thermoplastic compound materials, and reflective media in original sealed containers that plainly show the designated name, specification number, batch number, color, date of manufacture, manufacturer's directions, and name of manufacturer.

Provide storage facilities at the job site, only in areas approved by the Contracting Officer, for maintaining materials at temperatures recommended by the manufacturer.

1.5 PROJECT/SITE CONDITIONS

1.5.1 Environmental Requirements

1.5.1.1 Weather Limitations for Application

Apply pavement markings to clean, dry surfaces, and unless otherwise approved, only when the air and pavement surface temperature is at least 5 degrees F above the dew point and the air and pavement temperatures are within the limits recommended by the pavement marking manufacturer. Allow pavement surfaces to dry after water has been used for cleaning or rainfall has occurred prior to striping or marking. Test the pavement surface for moisture before beginning work each day and after cleaning. Do not commence marking until the pavement is sufficiently dry and the pavement condition has been approved by the Contracting Officer. Employ the "plastic wrap method" to test the pavement for moisture as specified in paragraph TESTING FOR MOISTURE.

1.5.1.2 Weather Limitations for Removal of Pavement Markings on Roads and Automotive Parking Areas

Pavement surface must be free of snow, ice, or slush; with a surface temperature of at least 40 degrees F and rising at the beginning of operations, except those involving shot or sand blasting or grinding. Cease operation during thunderstorms, or during rainfall, except for waterblasting and removal of previously applied chemicals. Cease waterblasting where surface water accumulation alters the effectiveness of material removal.

1.5.2 Traffic Controls

Place warning signs conforming to MUTCD near the beginning of the worksite and well ahead of the worksite for alerting approaching traffic from both directions. Place small markers along newly painted lines or freshly placed raised markers to control traffic and prevent damage to newly painted surfaces or displacement of raised pavement markers. Mark painting equipment with large warning signs indicating slow-moving painting equipment in operation.

When traffic must be rerouted or controlled to accomplish the work, provide necessary warning signs, flag persons, and related equipment for the safe passage of vehicles.

PART 2 PRODUCTS

2.1 EQUIPMENT

2.1.1 Surface Preparation and Paint Removal

2.1.1.1 Surface Preparation Equipment for Roads and Automotive Parking Areas

Submit a surface preparation equipment list by serial number, type, model, and manufacturer. Include descriptive data indicating area of coverage per pass, pressure adjustment range, tank and flow capacities, and safety precautions required for the equipment operation. Mobile equipment must allow for removal of markings without damaging the pavement surface or joint sealant. Maintain machines, tools, and equipment used in the

performance of the work in satisfactory operating condition.

2.1.1.1.1 Sandblasting Equipment

Use mobile sandblasting equipment capable of producing a pressurized stream of sand and air that effectively removes paint from the surface without filling voids with debris in asphalt or tar pavements or removing joint sealants in Portland cement concrete pavements. Include with the equipment and air compressor, hoses, and nozzles of adequate size and capacity for removing paint. Equip the compressor with traps and coalescing filters that maintain the compressed air free of oil and water.

2.1.1.1.2 Waterblasting Equipment

Use mobile waterblasting equipment capable of producing a pressurized stream of water that effectively removes paint from the pavement surface without significantly damaging the pavement. Provide equipment, tools, and machinery which are safe and in good working order at all times.

2.1.1.1.3 Grinding or Scarifying Equipment

Use equipment capable of removing surface contaminates, paint build-up, or extraneous markings from the pavement surface without leaving any residue. Clean the surface by hydro blast to remove surface contaminates and ash after a weed torch is used to remove paint.

2.1.1.1.4 Chemical Removal Equipment

Use chemical equipment capable of applying and removing chemicals and paint from the pavement surface, leaving only non-toxic biodegradable residue without scarring or other damage to the pavement or joints and joint seals.

2.1.2 Application Equipment

Submit application equipment list appropriate for the material(s) to be used. Include manufacturer's descriptive data and certification for the planned use that indicates area of coverage per pass, pressure adjustment range, tank and flow capacities, and all safety precautions required for operating and maintaining the equipment. Provide and maintain machines, tools, and equipment used in the performance of the work in satisfactory operating condition, or remove them from the work site. Provide mobile and maneuverable application equipment to the extent that straight lines can be followed and normal curves can be made in a true arc.

2.1.2.1 Paint Application Equipment

2.1.2.1.1 Hand-Operated, Push-Type Machines

Provide hand-operated push-type applicator machine of a type commonly used for application of water based paint or two-component, chemically curing paint, thermoplastic, or preformed tape, to pavement surfaces for small marking projects, such as legends and cross-walks, automotive parking areas, or surface painted signs. Provide applicator machine equipped with the necessary tanks and spraying nozzles capable of applying paint uniformly at coverage specified. Hand operated spray guns may be used in areas where push-type machines cannot be used.

2.1.2.2 Reflective Media Dispenser

Attach the dispenser for applying the reflective media to the paint dispenser and designed to operate automatically and simultaneously with the applicator through the same control mechanism. The bead applicator must be capable of adjustment and designed to provide uniform flow of reflective media over the full length and width of the stripe at the rate of coverage specified in paragraph APPLICATION.

2.1.2.3 Preformed Tape Application Equipment

Provide and use mechanical application equipment for the placement of preformed marking tape which is a mobile pavement marking machine specifically designed for use in applying pressure-sensitive pavement marking tape of varying widths. Equip the applicator with rollers, or other suitable compaction device to provide initial adhesion of the material with the pavement surface. Use additional tools and devices as needed to properly seat the applied material as recommended by the manufacturer.

2.2 MATERIALS

Use waterborne paint for roads. The maximum allowable VOC content of pavement markings is 150 grams per liter. Color of markings are indicated on the drawings and must conform to ASTM D6628 for roads and automotive parking areas and SAE AMS-STD-595A for airfields. Provide materials conforming to the requirements specified herein.

2.2.1 Waterborne Paint

FS TT-P-1952, Type I or II .

PART 3 EXECUTION

3.1 EXAMINATION

3.1.1 Testing for Moisture

Test the pavement surface for moisture before beginning pavement marking after each period of rainfall, fog, high humidity, or cleaning, or when the ambient temperature has fallen below the dew point. Do not commence marking until the pavement is sufficiently dry and the pavement condition has been approved by the Contracting Officer or authorized representative.

Employ the "plastic wrap method" to test the pavement for moisture as follows: Cover the pavement with a 12 inch by 12 inch section of clear plastic wrap and seal the edges with tape. After 15 minutes, examine the plastic wrap for any visible moisture accumulation inside the plastic. Do not begin marking operations until the test can be performed with no visible moisture accumulation inside the plastic wrap. Re-test surfaces when work has been stopped due to rain.

3.1.2 Surface Preparation Demonstration

Prior to surface preparation, demonstrate the proposed procedures and equipment. Prepare areas large enough to determine cleanliness and rate of cleaning. Perform a demonstration removal of pavement marking in an area designated by the Contracting Officer.

3.1.3 Application Rate Demonstration

During the Test Stripe Demonstration, demonstrate compliance with the application rates specified herein. Document the equipment speed and operating pressures required to meet the specified rates in each configuration of the equipment and provide a copy of the documentation to the Contracting Officer prior to proceeding with the work.

3.1.4 Level of Performance Demonstration

The Contracting Officer will be present at the application demonstrations to observe the results obtained and to validate the operating parameters of the vehicle(s) and equipment. If accepted by the Contracting Officer, the test stripe is the measure of performance required for this project. Do not proceed with the work until the demonstration results are satisfactory to the Contracting Officer.

3.2 EXTERIOR SURFACE PREPARATION

Allow new pavement surfaces to cure for a period of not less than 30 days before application of marking materials. Thoroughly clean surfaces to be marked before application of the paint. Remove dust, dirt, and other granular surface deposits by sweeping, blowing with compressed air, rinsing with water, or a combination of these methods as required. Remove existing paint markings, and other coatings adhering to the pavement by water blastingapproved chemical removal method.

3.2.1 Early Painting of Asphalt Pavements

For asphalt pavement systems requiring painting application at less than 30 days, apply the paint and beads at half the normal application rate, followed by a second application at the normal rate after 30 days.

3.3 APPLICATION

Apply pavement markings to dry pavements only.

3.3.1 Paint

Apply paint with approved equipment at rate of coverage specified herein. Provide guidelines and templates as necessary to control paint application. Take special precautions in marking numbers, letters, and symbols. Manually paint numbers, letters, and symbols. Sharply outline all edges of markings. The maximum drying time requirements of the paint specifications will be strictly enforced, to prevent undue softening of bitumen, and pickup, displacement, or discoloration by tires of traffic. If there is a deficiency in drying of the markings, painting operations must cease until the cause of the slow drying is determined and corrected.

3.3.1.1 Waterborne Paint

3.3.1.1.1 Roads

Apply paint at a rate of 105 plus or minus 5 square feet per gallon. Apply FS TT-B-1325 Type I (Gradation A) beads at a rate of 7 plus or minus 0.5 pounds of glass spheres per gallon.

3.3.2 Cleanup and Waste Disposal

Keep the worksite clean and free of debris and waste from the removal and application operations. Dispose of debris at approved sites.

3.4 FIELD QUALITY CONTROL

3.4.1 Sampling and Testing

As soon as the paint materials and reflective media are available for sampling, obtain by random selection from the sealed containers, two quart samples of each batch in the presence of the Contracting Officer. Accomplish adequate mixing prior to sampling to ensure a uniform, representative sample. A batch is defined as that quantity of material processed by the manufacturer at one time and identified by number on the label. Clearly identify samples by designated name, specification number, batch number, project contract number, intended use, and quantity involved.

At the discretion of the Contracting Officer, samples provided may be tested by the Government for verification.

3.4.2 Material Inspection

Examine material at the job site to determine that it is the material referenced in the report of test results or certificate of compliance. Provide test results substantiating conformance to the specified requirements with each certificate of compliance.

3.4.3 Dimensional Tolerances

Apply all markings in the standard dimensions provide in the drawings. New markings may deviate a maximum of 10 percent larger than the standard dimension. The maximum deviation allowed when painting over an old marking is up to 20 percent larger than the standard dimensions.

3.4.4 Bond Failure Verification

Inspect newly applied markings for signs of bond failure based on visual inspection and comparison to results from Test Stripe Demonstration paragraph.

3.4.5 Reflective Media and Coating Application Verification

Use a wet film thickness gauge to measure the application of wet paint. Use a microscope or magnifying glass to evaluate the embedment of glass beads in the paint. Verify the glass bead embedment with approximately 50 percent of the individual bead spheres embedded and 50 percent of the individual bead spheres exposed.

-- End of Section --

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SECTION 32 31 13

CHAIN LINK FENCES AND GATES
11/16

PART 1 GENERAL

1.1 REFERENCES

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

ASTM INTERNATIONAL (ASTM)

ASTM A90/A90M	(2013; R 2018) Standard Test Method for Weight Mass of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings
ASTM A116	(2011) Standard Specification for Metallic-Coated, Steel Woven Wire Fence Fabric
ASTM A153/A153M	(2016a) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A702	(2013) Standard Specification for Steel Fence Posts and Assemblies, Hot Wrought
ASTM A780/A780M	(2020) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
ASTM C94/C94M	(2020) Standard Specification for Ready-Mixed Concrete
ASTM F567	(2014a) Standard Practice for Installation of Chain Link Fence
ASTM F626	(2014) Standard Specification for Fence Fittings
ASTM F883	(2013) Padlocks
ASTM F1043	(2018) Standard Specification for Strength and Protective Coatings on Steel Industrial Fence Framework
ASTM F1083	(2018) Standard Specification for Pipe, Steel, Hot-Dipped Zinc Coated (Galvanized) Welded, for Fence Structures

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS RR-F-191/3	(Rev E; Am 1) Fencing, Wire and Post, Metal (Chain-Link Fence Posts, Top Rails and Braces)

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Fence Assembly; G RO

Location of Gate, Corner, End, and Pull Posts; G RO

Gate Assembly; G RO

Gate Hardware and Accessories; G RO

Erection/Installation Drawings; G RO

SD-03 Product Data

Fence Assembly; G RO

Gate Assembly; G RO

Gate Hardware and Accessories; G RO

Zinc Coating; G RO

Fabric; G RO

Stretcher Bars; G RO

Concrete; G RO

SD-04 Samples

Fabric; G RO
Line Posts; G RO

Sleeves; G RO

Top Rail; G RO
Tension Wire; G RO

Stretcher Bars; G RO

Gate Posts; G RO

Gate Hardware and Accessories; G RO

Padlocks; G RO

Wire Ties; G RO

SD-07 Certificates

Certificates of Compliance

SD-08 Manufacturer's Instructions

Fence Assembly

Gate Assembly

Hardware Assembly

Accessories

SD-11 Closeout Submittals

Recycled Material Content

1.3 QUALITY CONTROL

1.3.1 Certificates of Compliance

Submit certificates of compliance in accordance with the applicable reference standards and descriptions of this section for the following:

a. Zinc coating

b. PVC coating

c. Aluminum alloy coating

d. Fabric

e. Stretcher bars

f. Gate hardware and accessories

g. Concrete

1.4 DELIVERY, STORAGE, AND HANDLING

Deliver materials to site in an undamaged condition. Store materials off the ground to provide protection against oxidation caused by ground contact.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

Provide fencing materials conforming to the requirements of ASTM A116, ASTM A702, ASTM F626.

Submit reports of listing chain-link fencing and accessories regarding weight in ounces for zinc coating.

Submit manufacturer's catalog data for complete fence assembly, gate assembly, hardware assembly and accessories.

2.2 COMPONENTS

2.2.1 Fabric

Provide fabric consisting of No. 9-gage wires woven into a 2 inch diamond mesh, with dimensions of fabric and wire conforming to ASTM A116, with 1.20 ounces per square foot zinc galvanizing.

Provide one-piece fabric widths for fence heights up to 12 feet.

2.2.1.1 Top and Bottom Selvages

Provide knuckled selvages at top and bottom for fabric with 2 inch mesh and up to 60 inches high, and if over 60 inches high, provide twisted and barbed top selvage and knuckled bottom selvage.

Knuckle top and bottom selvages for 1-3/4 inch and 1 inch mesh fabric.

2.2.2 Line Posts

Minimum acceptable line posts are as follows:

Up to 6 feet high:

Grade A: 1.900 inch O.D. pipe weighing 2.72 pounds per linear foot.

Grade B: 2.375 inch O.D. pipe weighing 3.12 pounds per linear foot.

Over 6 feet high:

2.0 inch O.D. pipe weighing 3.65 pounds per linear foot.

2.2.3 End, Corner, and Pull Posts

Provide minimally acceptable end, corner, and pull posts as follows:

Up to 6 feet high:

Grade A: 2.375 inch O.D. pipe weighing 3.65 pounds per linear foot.

Grade B: 2.375 inch O.D. pipe weighing 3.12 pounds per linear foot.

Over 6 feet high:

Grade A: 2.875 inch O.D. pipe weighing 5.79 pounds per linear foot.

Grade B: 2.875 inch O.D. pipe weighing 4.64 pounds per linear foot.

2.2.4 Sleeves

Provide sleeves for setting into concrete construction of the same material as post sections, sized 1 inch greater than the diameter or dimension of the post. Weld flat plates to each sleeve base to provide anchorage and prevent intrusion of concrete.

2.2.5 Top Rail

Provide top rails with a minimum of 1.660 inches O.D. pipe rails. Provide expansion couplings 6 inches long at each joint in top rails.

2.2.6 Post-Brace Assembly

Provide bracing consisting of 1.660 inches O.D. pipe Grade A weighing 2.27 pounds per linear foot and 3/8 inch adjustable truss rods and turnbuckles.

2.2.7 Stretcher Bars

Provide bars that have one-piece lengths equal to the full height of the fabric with a minimum cross section of 3/16 by 3/4 inch, in accordance with ASTM F626.

2.2.8 Stretcher Bar Bands

Provide bar bands for securing stretcher bars to posts that are steel, wrought iron, or malleable iron spaced not over 15 inches on center. Bands may also be used in conjunction with special fittings for securing rails to posts. Provide bands with projecting edges chamfered or eased.

2.2.9 Post Tops

Provide tops that are steel, wrought iron, or malleable iron designed as a weathertight closure cap. Provide one cap for each post, unless equal protection is provided by a combination post-cap and wire supporting arm. Provide caps with an opening to permit through passage of the top rail.

2.2.10 Gate Posts

Provide a gate post for supporting each gate leaf as follows:

Over 13-feet and up to 18-feet wide:

Provide 6.625 inch O.D. pipe weighing 18.97 pounds per linear foot.

Over 18-feet wide:

Provide 8.625 inch O.D. pipe weighing 24.70 pounds per linear foot.

2.2.11 Gates

For gate leaves over 6 feet high or 6 feet wide, provide perimeter gate frames of 1.90 inch O.D. pipe Grade A weighing 2.72 pounds per linear foot.

Provide gate frame assembly that is welded or assembled with special malleable or pressed-steel fittings and rivets to provide rigid connections. Install fabric with stretcher bars at vertical edges; stretcher bars may also be used at top and bottom edges. Attach stretcher bars and fabric to gate frames on all sides at intervals not exceeding 15 inches. Attach hardware with rivets or by other means which provides equal security against breakage or removal.

Provide diagonal cross-bracing, consisting of 3/8 inch diameter adjustable-length truss rods on welded gate frames, where necessary to obtain frame rigidity without sag or twist. Provide nonwelded gate frames with diagonal bracing.

2.2.12 Gate Hardware and Accessories

Provide gate hardware and accessories that conforms to ASTM A116 and ASTM F626, and be as specified:

Provide pressed steel hinges to suit gate size, non-lift-off type, offset to permit 180-degree opening.

Provide latch that permits operation from either side of the gate, with a padlock eye provided as an integral part of the latch.

Provide stops and holders of malleable iron for vehicular gates. Provide stops that automatically engage the gate and hold it in the open position until manually released.

Provide double gates with a cane bolt and ground-set keeper, with latch or locking device and padlock eye designed as an integral part.

Provide manufacturer's standard heavy-duty track ball bearing hanger sheaves, overhead framing and supports, guides, stays, bracing, and accessories as required for easy operation of manual sliding gates.

2.2.13 Miscellaneous Hardware

Provide miscellaneous hot-dip galvanized hardware as required.

2.2.14 Wire Ties

Provide 11-gage galvanized steel wire for tying fabric to line posts,spaced 12 inches on center. For tying fabric to rails and braces, space wire ties 24 inches on center. For tying fabric to tension wire, space 0.105-inch hog rings 24 inches on center.

Manufacturer's standard procedure will be accepted if of equal strength and durability.

Provide wire ties constructed of the same material as the fencing fabric.

2.2.15 Padlocks

Provide padlocks conforming to ASTM F883, with chain.

2.3 MATERIALS

2.3.1 Zinc Coating

Provide hot-dip galvanized (after fabrication) ferrous-metal components and accessories, except as otherwise specified.

Provide zinc coating of weight not less than 1.94 ounces per square foot, as determined from the average result of two specimens, when tested in accordance with ASTM A90/A90M.

Provide zinc coating conforming to the requirements of the following:

a. Pipe: FS RR-F-191/3 Class 1 Grade A in accordance with ASTM F1083 .

b. Hardware and accessories: ASTM A153/A153M, Table 1

c. Surface: ASTM F1043

d. External: Type B-B surface zinc with organic coating, 0.97 ounce per square foot minimum thickness of acrylated polymer.

e. Internal: Surface zinc coating of 0.97 ounce per square foot minimum.

Provide galvanizing repair material that is cold-applied zinc-rich coating conforming to ASTM A780/A780M.

2.3.2 Tension Wire

Provide galvanized, coiled spring wire, No. 7-gage. Provide zinc coating that weighs not less than 1.2 ounces per square foot.

2.3.3 Concrete

Provide concrete conforming to ASTM C94/C94M, and obtaining a minimum 28-day compressive strength of 3,000 psi.

2.3.4 Grout

Provide grout of proportions one part portland cement to three parts clean, well-graded sand and a minimum amount of water to produce a workable mix.

PART 3 EXECUTION

Submit manufacturer's erection/installation drawings and instructions that detail proper assembly and materials in the design for fence, gate, hardware and accessories.

Provide complete installation conforming to ASTM F567.

3.1 PREPARATION

Ensure final grading and established elevations are complete prior to commencing fence installation.

3.2 INSTALLATION

3.2.1 Fence Installation

Install fence on prepared surfaces to line and grade indicated. Install fence in accordance with fence manufacturer's written installation instructions except as modified herein.

3.2.1.1 Post Spacing

Provide line posts spaced equidistantly apart, not exceeding 10 feet on center. Provide gate posts spaced as necessary for size of gate openings. Do not exceed 500 feet on straight runs between braced posts. Provide corner or pull posts, with bracing in both directions, for changes in direction of 15 degrees or more, or for abrupt changes in grade. Submit drawings showing location of gate, corner, end, and pull posts.

3.2.1.2 Top and Bottom Tension Wire

Install top and bottom tension wires before installing chain-link fabric, and pull wires taut. Place top and bottom tension wires within 8 inches of respective fabric line.

3.2.2 Excavation

Provide excavations for post footings which are drilled holes in virgin or compacted soil, of minimum sizes as indicated.

Space footings for line posts 10 feet on center maximum and at closer intervals when indicated, with bottoms of the holes approximately 3 inches below the bottoms of the posts. Set bottom of each post not less than 36 inches below finished grade when in firm, undisturbed soil. Set posts deeper, as required, in soft and problem soils and for heavy, lateral loads.

Uniformly spread soil from excavations adjacent to the fence line or on areas of Government property, as directed. When solid rock is encountered near the surface, drill into the rock at least 12 inches for line posts and at least 18 inches for end, pull, corner, and gate posts. Drill holes at least 1 inch greater in diameter than the largest dimension of the placed post.

If solid rock is below the soil overburden, drill to the full depth required except that penetration into rock need not exceed the minimum depths specified above.

3.2.3 Setting Posts

Remove loose and foreign materials from holes and moisten the soil prior to placing concrete.

Provide tops of footings that are trowel finished and sloped or domed to shed water away from posts. Set hold-open devices, sleeves, and other accessories in concrete.

Keep exposed concrete moist for at least 7 calendar days after placement or cured with a membrane curing material, as approved.

Grout all posts set into sleeved holes in concrete with an approved grouting material.

Maintain vertical alignment of posts in concrete construction until concrete has set.

3.2.3.1 Earth and Bedrock

Provide concrete bases of dimensions indicated on the manufactures installation drawings. Compact concrete to eliminate voids, and finish to a dome shape.

3.2.3.2 Bracing

Brace gate, corner, end, and pull posts to nearest post with a horizontal brace used as a compression member, placed at least 12 inches below top of fence, and two diagonal tension rods.

a. Tolerances

Provide posts that are straight and plumb within a vertical tolerance of 1/4 inch after the fabric has been stretched. Provide fencing and gates that are true to line with no more than 1/2 inch deviation from the established centerline between line posts. Repair defects as directed.

3.2.4 Concrete Strength

Provide concrete that has attained at least 75 percent of its minimum 28-day compressive strength, but in no case sooner than 7 calendar days after placement, before rails, tension wire, or fabric are installed. Do not stretch fabric and wires or hang gates until the concrete has attained its full design strength.

Take samples and test concrete to determine strength as specified.

3.2.5 Top Rails

Provide top rails that run continuously through post caps or extension arms, bending to radius for curved runs. Provide expansion couplings as recommended by the fencing manufacturer.

3.2.6 Brace Assembly

Provide bracing assemblies at end and gate posts and at both sides of corner and pull posts, with the horizontal brace located at midheight of the fabric.

Install brace assemblies so posts are plumb when the diagonal rod is under proper tension.

Provide two complete brace assemblies at corner and pull posts where required for stiffness and as indicated.

3.2.7 Tension Wire Installation

Install tension wire by weaving them through the fabric and tying them to each post with not less than 7-gage galvanized wire or by securing the wire to the fabric with 10-gage ties or clips spaced 24 inches on center.

3.2.8 Fabric Installation

Provide fabric in single lengths between stretch bars with bottom barbs placed approximately 1-1/2 inches above the ground line. Pull fabric taut and tied to posts, rails, and tension wire with wire ties and bands.

Install fabric on the security side of fence, unless otherwise directed.

Ensure fabric remains under tension after the pulling force is released.

3.2.9 Stretcher Bar Installation

Thread stretcher bars through or clamped to fabric 4 inches on center and secured to posts with metal bands spaced 15 inches on center.

3.2.10 Gate Installation

Install gates plumb, level, and secure, with full opening without

interference. Install ground set items in concrete for anchorage as recommended by the fence manufacturer. Adjust hardware for smooth operation and lubricated where necessary.

3.2.11 Tie Wires

Provide tie wires that are U-shaped to the pipe diameters to which attached. Twist ends of tie wires not less than two full turns and bent so as not to present a hazard.

3.2.12 Fasteners

Install nuts for tension bands and hardware on the side of the fence opposite the fabric side. Peen ends of bolts to prevent removal of nuts.

3.2.13 Zinc-Coating Repair

Clean and repair galvanized surfaces damaged by welding or abrasion, and cut ends of fabric, or other cut sections with specified galvanizing repair material applied in strict conformance with the manufacturer's printed instructions.

3.2.14 Accessories Installation

3.2.14.1 Post Caps

Design post caps to accommodate top rail. Install post caps as recommended by the manufacturer.

3.2.14.2 Padlocks

Provide padlocks for gate openings and provide chains that are securely attached to gate or gate posts. Provide padlocks keyed alike, and provide two keys for each padlock.

3.2.15 Grounding

Ground fencing as indicated on drawingsand specified.

Ground fences on each side of all gates, at each corner, at the closest approach to each building located within 50 feet of the fence, and where the fence alignment changes more than 15 degrees. Grounding locations can not exceed 650 feet. Bond each gate panel with a flexible bond strap to its gate post. Ground fences crossed by power lines of 600 volts or more at or near the point of crossing and at distances not exceeding 150 feet on each side of crossing. Provide ground conductor consisting of No. 6 AWG solid copper wire. Provide copper-clad steel rod grounding electrodes 3/4 inch by 10 foot long. Drive electrodes into the earth so that the top of the electrode is at least 6 inches below the grade. Where driving is impracticable, bury electrodes a minimum of 12 inches deep and radially from the fence, with top of the electrode not less than 2 feet or more than 8 feet from the fence. Clamp ground conductor to the fence and electrodes with bronze grounding clamps to create electrical continuity between fence posts, fence fabric, and ground rods. Total resistance of the fence to ground cannot exceed 25 ohms.

3.3 CLOSEOUT ACTIVITIES

Remove waste fencing materials and other debris from the work site.

Submit manufacturer's data indicating percentage of recycled material content in protective fence materials, including chain link fence, fabric, and gates to verify affirmative procurement compliance.

-- End of Section --

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SECTION 32 92 19

SEEDING
08/17

PART 1 GENERAL

1.1 REFERENCES

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

ASTM INTERNATIONAL (ASTM)

ASTM C602	(2013a) Agricultural Liming Materials
ASTM D4972	(2018) Standard Test Methods for pH of Soils

U.S. DEPARTMENT OF AGRICULTURE (USDA)

AMS Seed Act	(1940; R 1988; R 1998) Federal Seed Act
DOA SSIR 42	(1996) Soil Survey Investigation Report No. 42, Soil Survey Laboratory Methods Manual, Version 3.0

1.2 DEFINITIONS

1.2.1 Stand of Turf

95 percent ground cover of the established species.

1.3 RELATED REQUIREMENTS

Section 31 00 00 EARTHWORK, Section 32 92 23 SODDING, and Section 32 05 33 LANDSCAPE ESTABLISHMENT applies to this section for pesticide use and plant establishment requirements, with additions and modifications herein.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance with Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Fertilizer

Include physical characteristics, and recommendations.

SD-06 Test Reports

Topsoil Composition Tests (reports and recommendations).

SD-07 Certificates

State Certification and Approval for Seed

1.5 DELIVERY, STORAGE, AND HANDLING

1.5.1 Delivery

1.5.1.1 Seed Protection

Protect from drying out and from contamination during delivery, on-site storage, and handling.

1.5.1.2 Fertilizer and Lime Delivery

Deliver to the site in original, unopened containers bearing manufacturer's chemical analysis, name, trade name, trademark, and indication of conformance to state and federal laws. Instead of containers, fertilizer and lime may be furnished in bulk with certificate indicating the above information.

1.5.2 Storage

1.5.2.1 Seed, Fertilizer and Lime Storage

Store in cool, dry locations away from contaminants.

1.5.2.2 Topsoil

Prior to stockpiling topsoil, treat growing vegetation with application of appropriate specified non-selective herbicide. Clear and grub existing vegetation three to four weeks prior to stockpiling topsoil.

1.5.2.3 Handling

Do not drop or dump materials from vehicles.

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 Seed

Apply seed within twenty four hours after seed bed preparation.

PART 2 PRODUCTS

2.1 SEED

2.1.1 Classification

Provide State-certified seed of the latest season's crop delivered in original sealed packages, bearing producer's guaranteed analysis for percentages of mixtures, purity, germination, weedseed content, and inert material. Label in conformance with AMS Seed Act and applicable state seed laws. Wet, moldy, or otherwise damaged seed will be rejected. Field mixes will be acceptable when field mix is performed on site in the presence of the Contracting Officer .

2.1.2 Planting Dates

Planting Season	Planting Dates
Season 1	MAR-NOV
Temporary Seeding	MAR-NOV

2.1.3 Seed Purity

Botanical Name	Common Name	Minimum Percent Pure Seed	Minimum Percent Germination and Hard Seed	Maximum Percent Weed Seed
Paspalum Notatum	Argentine Bahia	95	85	5
Cynodon Dactylon	Bermudagrass	95	85	5

2.1.4 Seed Mixture by Weight

Planting Season	Variety	Percent (by Weight)
Season 1	Bahia	50%
	Bermuda	50%
Temporary Season	Rye (Grain)	100%

Proportion seed mixtures by weight. Temporary seeding must later be replaced by Season 1 plantings for a permanent stand of grass. The same requirements of turf establishment for Season 1 apply for temporary seeding.

2.2 TOPSOIL

2.2.1 On-Site Topsoil

Surface soil stripped and stockpiled on site and modified as necessary to meet the requirements specified for topsoil in paragraph COMPOSITION. When available topsoil must be existing surface soil stripped and stockpiled on-site in accordance with Section 31 00 00 EARTHWORK.

2.2.2 Off-Site Topsoil

Conform to requirements specified in paragraph COMPOSITION. Additional topsoil must be furnished by the Contractor .

2.2.3 Composition

Containing from 5 to 10 percent organic matter as determined by the topsoil composition tests of the Organic Carbon, 6A, Chemical Analysis Method described in DOA SSIR 42. Maximum particle size, 3/4 inch, with maximum 3 percent retained on 1/4 inch screen. The pH must be tested in accordance with ASTM D4972. Topsoil must be free of sticks, stones, roots, and other debris and objectionable materials. Other components must conform to the following limits:

Silt	25-50 percent
Clay	4 to 12 percent
Sand	70 to 82 percent
pH	5.5 to 7.0

Soluble Salts	600 ppm maximum

2.3 SOIL CONDITIONERS

Add conditioners to topsoil as required to bring into compliance with "composition" standard for topsoil as specified herein.

2.3.1 Lime

Commercial grade limestone containing a calcium carbonate equivalent (C.C.E.) as specified in ASTM C602 of not less than 140 and 110 percent.

2.3.2 Sulfur

100 percent elemental

2.3.3 Sand

Clean and free of materials harmful to plants.

2.4 FERTILIZER

2.4.1 Granular Fertilizer

Organic, granular controlled release fertilizer containing the following minimum percentages, by weight, of plant food nutrients:

As recommended by a soil analysis for 13 percent available nitrogen
As recommended by a soil analysis or 13 percent available phosphorus
As recommended by a soil analysis or 13 percent available potassium
As recommended by a soil analysis or 13 percent sulfur
As recommended by a soil analysis or 13 percent iron

2.5 MULCH

Mulch must be free from noxious weeds, mold, and other deleterious materials.

2.5.1 Straw

Stalks from oats, wheat, rye, barley, or rice. Furnish in air-dry condition and of proper consistency for placing with commercial mulch blowing equipment. Straw must contain no fertile seed.

2.5.2 Hay

Air-dry condition and of proper consistency for placing with commercial mulch blowing equipment. Hay must be sterile, containing no fertile seed.

2.6 WATER

Source of water must be approved by Contracting Officer and of suitable quality for irrigation, containing no elements toxic to plant life.

PART 3 EXECUTION

3.1 PREPARATION

3.1.1 EXTENT OF WORK

Provide soil preparation prior to planting (including soil conditioners as required), fertilizing, seeding, and surface topdressing 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.

3.1.1.1 Topsoil

Provide 4 inches of off-site topsoil to meet indicated finish grade. After areas have been brought to indicated finish grade, incorporate fertilizer into soil a minimum depth of 4 inches by disking, harrowing, tilling or other method approved by the Contracting Officer. Remove debris and stones larger than 3/4 inch in any dimension remaining on the surface after finish grading. Correct irregularities in finish surfaces to eliminate depressions. Protect finished topsoil areas from damage by vehicular or pedestrian traffic.

3.1.1.2 Soil Conditioner Application Rates

Apply soil conditioners at rates as determined by laboratory soil analysis of the soils at the job site. For bidding purposes only apply at rates for the following:

Lime As recommended by a soil analysis or 4000 pounds per acre.

3.1.1.3 Fertilizer Application Rates

Apply fertilizer at rates as determined by laboratory soil analysis of the soils at the job site. For bidding purposes only apply at rates for the following:

Organic Granular Fertilizer 60-lbs nutrient per acre or 1.4-lbs nutrient per 1000sq. ft.

3.2 SEEDING

3.2.1 Seed Application Seasons and Conditions

Immediately before seeding, restore soil to proper grade. Do not seed when ground is muddy or in an unsatisfactory condition for seeding. If special conditions exist that may warrant a variance in the above seeding dates or conditions, submit a written request to the Contracting Officer stating the special conditions and proposed variance. Apply seed within twenty four hours after seedbed preparation. Sow seed by approved sowing equipment. Sow one-half the seed in one direction, and sow remainder at right angles to the first sowing.

3.2.2 Seed Application Method

Seeding method must be broadcasted, drop seeding, and or drill seeding.

3.2.2.1 Broadcast and Drop Seeding

Seed must be uniformly broadcast at the rate of 65 pounds per acre or 1.5-lbs per 1000 sq. ft. Use broadcast or drop seeders. Sow one-half the seed in one direction, and sow remainder at right angles to the first sowing. Cover seed uniformly to a maximum depth of 1/4 inch in clay soils and 1/2 inch in sandy soils by means of spike-tooth harrow, cultipacker, raking or other approved devices.

3.2.3 Mulching

3.2.3.1 Hay or Straw Mulch

Hay or straw mulch must be spread uniformly at the rate of 2 tons per acre. Mulch must be spread by hand, blower-type mulch spreader, or other approved method. Mulching must be started on the windward side of relatively flat areas or on the upper part of steep slopes, and continued uniformly until the area is covered. The mulch must not be bunched or clumped. Sunlight must not be completely excluded from penetrating to the ground surface. All areas installed with seed must be mulched on the same day as the seeding. Mulch must be anchored immediately following spreading.

3.2.3.2 Mechanical Anchor

Mechanical anchor must be a V-type-wheel land packer; a scalloped-disk land packer designed to force mulch into the soil surface; or other suitable equipment.

3.2.4 Rolling

Immediately after seeding, 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.

3.2.5 Erosion Control Material

Install in accordance with manufacturer's instructions, where indicated or as directed by the Contracting Officer.

3.2.6 Watering

Start watering areas seeded as required by temperature and wind conditions. Apply water at a rate sufficient to insure thorough wetting of soil to a depth of 2 inches without run off. During the germination process, seed is to be kept actively growing and not allowed to dry out.

3.3 PROTECTION OF TURF AREAS

Immediately after turfing, protect area against traffic and other use.

3.4 RENOVATION OF EXISTING TURF AREA

3.4.1 Aeration

Upon completion of weed eradication operations and Contracting Officer's approval to proceed, aerate turf areas indicated , by approved device. Core, by pulling soil plugs, to a minimum depth of 2 inches. Leave all soil plugs, that are produced, in the turf area. Keep clean at all times

at least one paved pedestrian access route and one paved vehicular access route to each building. Clean all soil plugs off of other paving when work is complete.

3.4.2 Vertical Mowing

Upon completion of aerating operation and Contracting Officer's approval to proceed, vertical mow turf areas indicated, by approved device, to a depth of 1/2 inch above existing soil level, to reduce thatch build-up, grain, and surface compaction. Keep clean at all times at least one paved pedestrian access route and one paved vehicular access route to each building. Clean other paving when work is complete. Remove all debris generated during this operation off site.

3.4.3 Dethatching

Upon completion of aerating operation and Contracting Officer's approval to proceed, dethatch turf areas indicated, by approved device, to a depth of 1/2 inch below existing soil level, to reduce thatch build-up, grain, and surface compaction. Keep clean at all times at least one paved pedestrian access route and one paved vehicular access route to each building. Clean other paving when work is complete. Remove all debris generated during this operation off site.

3.5 RESTORATION

Restore to original condition existing turf areas which have been damaged during turf installation operations at the Contractor's expense. Keep clean at all times at least one paved pedestrian access route and one paved vehicular access route to each building. Clean other paving when work in adjacent areas is complete.

-- End of Section --

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.

ASTM INTERNATIONAL (ASTM)

ASTM D4972	(2018) Standard Test Methods for pH of Soils

TURFGRASS PRODUCERS INTERNATIONAL (TPI)

TPI GSS	(1995) Guideline Specifications to Turfgrass Sodding

U.S. DEPARTMENT OF AGRICULTURE (USDA)

DOA SSIR 42	(1996) Soil Survey Investigation Report No. 42, Soil Survey Laboratory Methods Manual, Version 3.0

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, , , Section 32 92 19 SEEDING, , , and Section 32 05 33 LANDSCAPE ESTABLISHMENT applies to this section for pesticide use and plant establishment requirements, with additions and modifications herein.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Fertilizer

Include physical characteristics, and recommendations.

SD-06 Test Reports

Topsoil composition tests (reports and recommendations).

SD-07 Certificates

Nursery or Sod farm 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.

1.5.1.2 Fertilizer and Lime Delivery

Deliver to the site in original, unopened containers bearing manufacturer's chemical analysis, name, trade name, trademark, and indication of conformance to state and federal laws. Instead of containers, fertilizer and lime may be furnished in bulk with certificate indicating the above information.

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.

1.5.2.2 Topsoil

Prior to stockpiling topsoil, treat growing vegetation with application of appropriate specified non-selective herbicide. Clear and grub existing vegetation three to four weeks prior to stockpiling topsoil.

1.5.2.3 Handling

Do not drop or dump materials from vehicles.

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. 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 Planting Dates

Lay sod from March to September for warm season spring planting and from October to November for cool season fall planting.

2.1.4 Composition

2.1.4.1 Proportion

Proportion grass species as follows.

Botanical Name	Common Name	Percent
Paspalum Notatum	Argentine Bahia	50
Cynodon dactylon	Bermuda	50

2.2 TOPSOIL

2.2.1 On-Site Topsoil

Surface soil stripped and stockpiled on site and modified as necessary to meet the requirements specified for topsoil in paragraph entitled "Composition." When available topsoil shall be existing surface soil stripped and stockpiled on-site in accordance with Section 31 00 00 EARTHWORK. No onsite topsoil is anticipated for this project.

2.2.2 Off-Site Topsoil

Conform to requirements specified in paragraph entitled "Composition." Additional topsoil shall be furnished by the Contractor.

2.2.3 Composition

Containing from 5 to 10 percent organic matter as determined by the topsoil composition tests of the Organic Carbon, 6A, Chemical Analysis Method described in DOA SSIR 42. Maximum particle size, 3/4 inch, with maximum 3 percent retained on 1/4 inch screen. The pH shall be tested in accordance with ASTM D4972. Topsoil shall be free of sticks, stones, roots, and other debris and objectionable materials. Other components

shall conform to the following limits:

Silt	7 to 17 percent
Clay	10-30 percent
Sand	70 to 82 percent
pH	5.5 to 7.0
Soluble Salts	600 ppm maximum

2.3 SOIL CONDITIONERS

Add conditioners to topsoil as required to bring into compliance with "composition" standard for topsoil as specified herein.

2.3.1 Lime

Commercial grade agricultural limestone t.

2.4 FERTILIZER

2.4.1 Granular Fertilizer

Organic, granular controlled release fertilizer containing the following minimum percentages, by weight, of plant food nutrients:

12 percent available nitrogen
6 percent available phosphorus
6 percent available potassium

2.5 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 soil preparation (including soil conditioners), fertilizing, and 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.

3.1.2 Soil Preparation

Provide 4 inches of off-site topsoil to meet indicated finish grade. After areas have been brought to indicated finish grade, incorporate fertilizer into soil a minimum depth of 4 inches by disking, harrowing, tilling or other method approved by the Contracting Officer. Remove debris and stones larger than 3/4 inch in any dimension remaining on the surface after

finish grading. Correct irregularities in finish surfaces to eliminate depressions. Protect finished topsoil areas from damage by vehicular or pedestrian traffic. Sod shall not be laid on untilled soil.

3.1.2.1 Soil Conditioner Application Rates

Lime 4000 pounds per acreor 92 pounds per 1000 square feet.Commercial Grade Lime 100 poiunds per 1000 square feet.

3.1.2.2 Fertilizer Application Rates

Apply commercial fertilizer at a ratio of 2-1-2 (N.P.K.). Apply at rates per the following:

Organic Granular Fertilizer 1 pound N (Nitrogen) P (Phosphorus) K (Potassium) per 1000 square feet or 65 pounds per acre.

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 or as approved by the COR; the placing of topsoil, smooth grading, and compaction requirements have been completed .

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. In addition, sod shall not be placed during times of drought.

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.

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. 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.

3.4 RESTORATION

Restore to original condition existing turf areas which have been damaged during turf installation operations. Keep clean at all times at least one paved pedestrian access route and one paved vehicular access route to each building. Clean other paving when work in adjacent areas is complete.

-- End of Section --

SECTION 33 11 00

WATER UTILITY DISTRIBUTION PIPING
02/18

PART 1 GENERAL
1.1 REFERENCES

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

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO HB-17	(2002; Errata 2003; Errata 2005, 17th Edition) Standard Specifications for Highway Bridges

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA B300	(2010; Addenda 2011) Hypochlorites
AWWA B301	(2010) Liquid Chlorine
AWWA C104/A21.4	(2016) 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	(2017) 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	(2017) Ductile-Iron Pipe, Centrifugally Cast
AWWA C153/A21.53	(2011) Ductile-Iron Compact Fittings for Water Service
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 C205	(2012) Cement-Mortar Protective Lining and Coating for Steel Water Pipe - 4 In. (100 mm) and Larger - Shop Applied
AWWA C206	(2017) Field Welding of Steel Water Pipe

AWWA C207	(2018) Standard for Steel Pipe Flanges for Waterworks Service, Sizes 4 in. through 144 in. (100 mm through 3600 mm)
AWWA C208	(2017) Dimensions for Fabricated Steel Water Pipe Fittings
AWWA C209	(2013) Cold-Applied Tape Coatings for the Exterior of Special Sections, Connections and Fitting for Steel Water Pipelines
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 C502	(2014) Dry-Barrel Fire Hydrants
AWWA C508	(2017) Swing-Check Valves for Waterworks Service, 2 In. Through 48-In. (50-mm Through 1,200-mm) NPS
AWWA C509	(2015) Resilient-Seated Gate Valves for Water Supply Service
AWWA C511	(2017) Reduced-Pressure Principle Backflow Prevention Assembly
AWWA C515	(2015) Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service
AWWA C550	(2017) Protective Interior Coatings for Valves and Hydrants
AWWA C600	(2017) Installation of Ductile-Iron Mains and Their Appurtenances
AWWA C602	(2011) Cement–Mortar Lining of Water Pipelines in Place—4 In. (100 mm) and Larger
AWWA C604	(2011) Installation of Buried Steel Water Pipe—4 In. (100 mm) and Larger
AWWA C605	(2014) Underground Installation of Polyvinyl Chloride (PVC) and Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe and Fittings
AWWA C606	(2015) Grooved and Shouldered Joints
AWWA C651	(2014) Standard for Disinfecting Water Mains
AWWA C655	(2009) Field Dechlorination

AWWA C800 (2014) Underground Service Line Valves and Fittings

AWWA C900 (2016) Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 In. Through 60 In. (100 mm Through 1,500 mm)

AWWA M11 (2016) Steel Pipe: A Guide for Design and Installation

AWWA M23 (2002; 2nd Ed) Manual: PVC Pipe - Design and Installation

AWWA M41 (2009; 3rd Ed) Ductile-Iron Pipe and Fittings

ASME INTERNATIONAL (ASME)

ASME B16.1 (2015) Gray Iron Pipe Flanges and Flanged Fittings Classes 25, 125, and 250

ASME B16.26 (2013) Standard for Cast Copper Alloy Fittings for Flared Copper Tubes

ASME B18.2.2 (2015) Nuts for General Applications: Machine Screw Nuts, Hex, Square, Hex Flange, and Coupling Nuts (Inch Series)

ASME B18.5.2.1M (2006; R 2011) Metric Round Head Short Square Neck Bolts

ASME B18.5.2.2M (1982; R 2010) Metric Round Head Square Neck Bolts

ASTM INTERNATIONAL (ASTM)

ASTM A307 (2014; E 2017) Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength

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

ASTM A48/A48M (2003; R 2012) Standard Specification for Gray Iron Castings

ASTM A536 (1984; R 2014) Standard Specification for Ductile Iron Castings

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

ASTM B61 (2015) Standard Specification for Steam or Valve Bronze Castings

ASTM B62 (2017) Standard Specification for Composition Bronze or Ounce Metal Castings

ASTM C1433 (2016b) Standard Specification for Precast

	Reinforced Concrete Monolithic Box Sections for Culverts, Storm Drains, and Sewers
ASTM C94/C94M	(2017a) Standard Specification for Ready-Mixed Concrete
ASTM D1784	(2011) Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
ASTM D1785	(2015; E 2018) Standard Specification for Poly(Vinyl Chloride) (PVC), Plastic Pipe, Schedules 40, 80, and 120
ASTM D2241	(2015) Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
ASTM D2466	(2017) Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
ASTM D2467	(2015) Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D2774	(2012) Underground Installation of Thermoplastic Pressure Piping
ASTM D2855	(2015) Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings
ASTM D3139	(1998; R 2011) Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
ASTM F1674	(2011) Standard Test Method for Joint Restraint Products for Use with PVC Pipe
ASTM F402	(2005; R 2012) Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings
ASTM F477	(2014) Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

FOUNDATION FOR CROSS-CONNECTION CONTROL AND HYDRAULIC RESEARCH (FCCCHR)

FCCCHR List	(continuously updated) List of Approved Backflow Prevention Assemblies
FCCCHR Manual	(10th Edition) Manual of Cross-Connection Control

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-80	(2013) Bronze Gate, Globe, Angle and Check Valves

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 24	(2016; ERTA 2016) Standard for the Installation of Private Fire Service Mains and Their Appurtenances

NSF INTERNATIONAL (NSF)

NSF 372	(2011) Drinking Water System Components - Lead Content
NSF/ANSI 14	(2017b) Plastics Piping System Components and Related Materials
NSF/ANSI 61	(2017) Drinking Water System Components - Health Effects

U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 3-600-01	(2016; with Change 1) Fire Protection Engineering for Facilities

UNDERWRITERS LABORATORIES (UL)

UL 246	(2011; Reprint Feb 2013) Hydrants for Fire-Protection Service
UL 262	(2004; Reprint Oct 2011) Gate Valves for Fire-Protection Service
UL 312	(2010; Reprint Mar 2018) UL Standard for Safety Check Valves for Fire-Protection Service

UNI-BELL PVC PIPE ASSOCIATION (UBPPA)

UBPPA UNI-PUB-08	(2016) Tapping Guide for PVC Pressure Pipe

1.2 DEFINITIONS

1.2.1 Water Transmission Mains

Water transmission mains include water piping having diameters greater than 14 inch, specific materials, methods of joining and any appurtenances deemed necessary for a satisfactory system.

1.2.2 Water Mains

Water mains include water piping having diameters 4 through 14 inch, specific materials, methods of joining and any appurtenances deemed necessary for a satisfactory system.

1.2.3 Water Service Lines

Water service lines include water piping from a water main to a building service at a point approximately 5 feet from building or the point indicated on the drawings, specific materials, methods of joining and any appurtenances deemed necessary for a satisfactory system.

1.2.4 Additional Definitions

For additional definitions refer to the definitions in the applicable referenced standard.

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

Connections; G, DO

SD-03 Product Data

Pipe, Fittings, Joints and Couplings; G, DO

Valves; G, DO

Valve Boxes; G, DO

Fire Hydrants; G, DO

Pipe Restraint; G, DO

Tapping Sleeves; G, DO

Corporation Stops; G, DO

Backflow Preventer; G, DO

Precast Concrete Thrust Blocks; G, DO

Disinfection Procedures; G, DO

SD-06 Test Reports

Backflow Preventer Tests; G, DO

Bacteriological Samples; G, DO

Leakage Test

Hydrostatic Test

SD-07 Certificates

Pipe, Fittings, Joints and Couplings

Shop-Applied Lining and Coating

Lining

Lining for Fittings

Valves

Fire Hydrants

Backflow Prevention Training Certificate

Backflow Tester Certification

Backflow Certificate

SD-08 Manufacturer's Instructions

Ductile Iron Piping

PVC Piping

PVC Piping For Service Lines

1.4 QUALITY CONTROL

1.4.1 Regulatory Requirements

Comply with NSF/ANSI 14 or NSF/ANSI 61 and NSF 372 for materials for potable water systems; comply with lead content requirements for "lead-free" plumbing as defined by the U.S. Safe Drinking Water Act effective January 2014. Provide materials bearing the seal of the National Sanitation Foundation (NSF) for potable water service.

Comply with NFPA 24 for materials, installation, and testing of fire main piping and components.

1.4.2 Qualifications

1.4.2.1 Backflow Preventers

1.4.2.1.1 Backflow Preventer Certificate

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

1.4.2.1.1.1 Backflow Tester Certificate

Prior to testing, submit to the Contracting Officer certification issued by the State or local regulatory agency attesting that the backflow tester has successfully completed a certification course sponsored by the regulatory agency.

1.4.2.1.1.2 Backflow Prevention Training Certificate

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

1.5 DELIVERY, STORAGE, AND HANDLING

1.5.1 Delivery and Storage

Inspect materials delivered to site for damage. Unload and store with minimum handling and in accordance with manufacturer's instructions. Store materials on site in enclosures or under protective covering. Store plastic piping, jointing materials and rubber gaskets under cover out of direct sunlight. Do not store materials directly on the ground. Keep inside of pipes, fittings, valves, fire hydrants, and other accessories free of dirt and debris.

1.5.2 Handling

Handle pipe, fittings, valves, fire hydrants, and other accessories in accordance with manufacturer's instructions and in a manner to ensure delivery to the trench in sound undamaged condition. Avoid injury to coatings and linings on pipe and fittings; make repairs if coatings or linings are damaged. Do not place other material, hooks, or pipe inside a pipe or fitting after the coating has been applied. Inspect the pipe for defects before installation. Carry, do not drag pipe to the trench. Use of pinch bars and tongs for aligning or turning pipe will be permitted only on the bare ends of the pipe. Clean the interior of pipe and accessories of foreign matter before being lowered into the trench and keep them clean during laying operations by plugging. Replace defective material without additional expense to the Government. Store rubber gaskets, not immediately installed, under cover or out of direct sunlight.

Handle ductile iron pipe, fittings, and accessories in accordance with AWWA C600 and AWWA M41. Handle PVC, fittings, and accessories in accordance with AWWA C605. Handle steel pipe, fittings and accessories in accordance with AWWA C604.

PART 2 PRODUCTS

2.1 MATERIALS

Provide all materials in accordance with AWWA C800 and as indicated herein. Provide valves and fittings with pressure ratings equivalent to the pressure ratings of the pipe.

2.1.1 Pipe, Fittings, Joints And Couplings

Submit manufacturer's standard drawings or catalog cuts, except submit both drawings and cuts for push-on and rubber-gasketed bell-and-spigot joints. Include information concerning gaskets with submittal for joints and couplings.

2.1.1.1 Ductile-Iron Piping

2.1.1.1.1 Pipe and Fittings

Pipe, except flanged pipe, AWWA C151/A21.51, Pressure Class 350. Flanged

pipe, AWWA C115/A21.15. Fittings, AWWA C110/A21.10 or AWWA C153/A21.53; fittings with push-on joint ends are to meet the same requirements as fittings with mechanical-joint ends, except for the factory modified bell design. Provide fittings with pressure ratings equivalent to that of the pipe. Provide compatible pipe ends and fittings for the specified joints. Provide cement-mortar lining, AWWA C104/A21.4, standard thickness on pipe and fittings.

2.1.1.1.2 Joints and Jointing Material

Provide push-on joints or mechanical joints for pipe and fittings unless otherwise indicated. Provide mechanical joints where indicated. Provide flanged joints where indicated.

a. Push-On Joints: Shape of pipe ends and fitting ends, gaskets, and lubricant for joint assembly as recommended in AWWA C111/A21.11.

b. Mechanical Joints: Dimensional and material requirements for pipe ends, glands, bolts and nuts, and gaskets as recommended in AWWA C111/A21.11.

c. Flanged Joints: Bolts, nuts, and gaskets for flanged connections as recommended in Appendix A of AWWA C115/A21.15. Provide AWWA C115/A21.15 ductile iron flanges and conform to ASME B16.1, Class 125. Provide ASTM A536 epoxy coated steel set screw flanges. Gasket and lubricants for set screw flanges, in accordance with mechanical-joint gaskets specified in AWWA C111/A21.11.

e. Sleeve-Type Mechanical Coupled Joints: As specified in the paragraph SLEEVE-TYPE MECHANICAL COUPLINGS.

2.1.1.2 Plastic Piping

2.1.1.2.1 PVCPiping

2.1.1.2.1.1 PVC Piping

AWWA C900 plain end or gasket bell end pipe meeting or exceeding ASTM D1784 cell class 12454, with a minimum Pressure Class 200 (DR21) with ductile iron outside diameter (DIOD).

2.1.1.2.1.2 Fittings for PVC Pipe

Gray iron or ductile iron fittings, AWWA C110/A21.10 with special fittings in accordance with Appendix B or AWWA C153/A21.53, with cement-mortar lining for fittings, AWWA C104/A21.4, standard thickness. Fittings with push-on joint ends are to conform to the same requirements as fittings with mechanical-joint ends, except for the factory modified bell design compatible for use with PVC pipe as specified.

2.1.1.2.1.3 Joints and Jointing Material for PVC

a. Push-on joints: Use jointing material in accordance with ASTM D3139 and AWWA C111/A21.11 between pipes, pipes and metal fittings, valves, and other accessories or compression-type joints/mechanical joints. Provide each joint connection with an elastomeric gasket compatible

for the bell or coupling used. Gaskets for push-on joints for pipe, ASTM F477. Gaskets for push-on joints and compression-type joints/mechanical joints for joint connections between pipe and metal fittings, valves, and other accessories, AWWA C111/A21.11, respectively, for push-on joints and mechanical joints.

b. Mechanical Joint: Use mechanically coupled joints having a sleeve-type mechanical coupling, as specified in the paragraph SLEEVE-TYPE MECHANICAL COUPLINGS, as an optional jointing method for plain-end PVC pipe, subject to the limitations specified for mechanically coupled joints using a sleeve-type mechanical coupling as specified for compression-type joints in ASTM D3139. Provide jointing material in accordance with AWWA C111/A21.11 between pipe and sleeve-type mechanical couplings.

2.1.1.2.2 PVC Piping for Service Lines

2.1.1.2.2.1 Pipe and Fittings

Provide ASTM D1784 cell class 12454 pipe and fittings of the same PVC material.

a. ASTM D1785, Schedule 40 with ASTM D2466 Schedule 40 or ASTM D2467 Schedule 80 fittings.

b. ASTM D2241 pipe and fittings with SDR as necessary to provide 150 psi minimum pressure rating with ASTM D2466 Schedule 40 or ASTM D2467 Schedule 80 fittings.

2.1.1.2.2.2 Joints and Connections

Fittings may be joined by the solvent-cement method or threading.

2.1.1.2.2.3 Solvent Joining

Provide solvent joints in accordance with ASTM D2855.

2.1.1.3 Steel Piping

2.1.1.3.1 Pipe and Fittings

Pipe, AWWA C200. Fittings, AWWA C208 and AWWA C200, with reference to the requirements specified therein for "Special Sections." Provide cement-mortar lining and coal-tar enamel coating on pipe and fittings in accordance with applicable AWWA standard. Provide cement-mortar lining on pipe and fittings for aboveground lines. Utilize pipe ends and fittings compatible for the joints and jointing materials used.

a. Utilize welded or seamless pipe with plain, or shouldered and grooved ends in accordance with AWWA C606 for use with mechanical couplings or bell-and-spigot ends with rubber gaskets. Provide bell-and-spigot ends for sizes less than 6 inches diameter in accordance with AWWA C200.

b. Provide fittings and specials made of the same material as the pipe. Use specials and fittings made of standard steel tube turns or segmentally welded sections, with ends to accommodate the type of couplings or joints specified for the pipe. Match the thickness rating of pipe fittings and specials to the thickness specified and the pressure rating calculated for the pipe with which they are used.

Provide identical protective materials for fittings and specials as specified for the pipe. Hand wrap, line, or coat specials and fittings that cannot be mechanically wrapped, lined, or coated using the same material used for the pipe with the same number of applications of each material, smoothly applied.

2.1.1.3.2 Wall Thickness for Pipe and Fittings

The minimum metal thickness for steel pipe wall is 0.25 inches, based on steel having a yield strength of 35,000 psi. Pipe has been designed for the following minimum conditions:

Pressure rating	350 psi
Earth cover	4 feet
Water hammer	40 percent of pressure rating
Live load	AASHTO H 20 truck loading
Allowable deflection	2 percent of nominal pipe diameter

Ensure that the wall thickness of fittings is equal to or greater than that required for the pipe. Reinforce fittings in accordance with methods given in AWWA M11, Chapter 13, "Supplementary Design Data and Details" when necessary to meet the pressure test requirements.

2.1.1.3.3 Joints and Jointing Material

Provide rubber-gasketed pipe and fitting bell-and-spigot joints, welded joints, or the mechanically coupled type using a sleeve-type mechanical coupling. Provide flanged joints where indicated.

a. Rubber-Gasketed Bell-and-Spigot Joints: Provide joints and pipe ends in accordance with the pipe manufacturer's standard for this type of joint, except that the joint is to also meet the requirements specified for rubber-gasketed joints and rubber gaskets in AWWA C200.

b. Welded Joints: Provide electrodes of the quality specified in AWWA C206.

c. Sleeve-Type Mechanical Coupled Joints: As specified in paragraph SLEEVE-TYPE MECHANICAL COUPLINGS.

e. Flanged Joints: Provide pipe ends with steel flanges, AWWA C207; Class D. Bolts and nuts for flanged connections, AWWA C207. Rubber gaskets, AWWA C207; asbestos gaskets are not allowed.

f. Insulating Joints: Designed to prevent metal-to-metal contact at the joint between adjacent sections of piping. Provide flange type joints with insulating gasket, insulating bolt sleeves, and insulating washers. Provide dielectric type gaskets, full face, and in other respects as recommended in the Appendix to AWWA C115/A21.15. Bolts and nuts as recommended in the Appendix

to AWWA C115/A21.15.

2.1.1.3.4 Lining and Coating:

a. Cement-Mortar Lining: AWWA C205, shop-applied. Materials for cement mortar lining in place as specified in AWWA C602.

b. Cement-Mortar Coating: AWWA C205, shop-applied.

c. Coal-Tar Enamel Coating: Except as otherwise specified, prepare, prime, and coat piping with hot-applied coal-tar enamel and a bonded double felt wraps in accordance with AWWA C203. Provide shop applied coating of fibrous-glass mat felt material as specified in Section 10 of AWWA C203. Do not use asbestos felt.

d. Coal-Tar Epoxy Coating: Clean, prime, and topcoat piping with coal-tar epoxy coating system in accordance with AWWA C210. Shop-apply coating.

2.1.2 Valves

Provide a protective interior coating in accordance with AWWA C550.

2.1.2.1 Gate Valves 3 Inch Size and Larger on Buried Piping

AWWA C500, AWWA C509, AWWA C515, or UL 262 and:

a. AWWA C500: nonrising stem type with double-disc gate and mechanical-joint ends or push-on joint ends compatible for the adjoining pipe

b. AWWA C509 or AWWA C515: nonrising stem type with mechanical-joint ends or resilient-seated gate valves 3 to 12 inches in size

c. UL 262: inside-screw type with operating nut, double-disc or split-wedge type gate, designed for a hydraulic working pressure of 175 psi, and have mechanical-joint ends or push-on joint ends as appropriate for the pipe to which it is joined.

Match materials for UL 262 gate valves to the reference standards specified in AWWA C500. Gate valves open by counterclockwise rotation of the valve stem. Stuffing boxes have 0-ring stem seals. Stuffing boxes are bolted and constructed so as to permit easy removal of parts for repair.Provide valve ends and gaskets for connection to sleeve-type mechanical couplings that conform to the requirements specified respectively for the joint or coupling. Where an indicator post is shown, provide an indicator post flange for AWWA C500, AWWA C509, or AWWA C515 gate valves conforming to the requirements of UL 262. Gate valves on service lines shall have ends compatible with joining to the pipe used Provide all valves from one manufacturer.

2.1.2.2 Gate Valves 3 Inch Size and Larger in Valve Pit(s) and Aboveground Locations

AWWA C500, AWWA C509, AWWA C515, or UL 262 and:

a. AWWA C500: nonrising stem type with solid-wedge gates and flanged ends

b. AWWA C509 or AWWA C515: nonrising stem type with flanged ends

c. UL 262: inside-screw type, with double-disc or split-wedgetype gate and flanged ends, and designed for a hydraulic working pressure of 175 psi

Match materials for UL 262 gate valves to the reference standards specified in AWWA C500. Gate valves are nonrising stem type or inside-screw type. Gate valves are solid-wedge gates. Provide gate valves with handwheels that open by counterclockwise rotation of the valve stem. Bolt and construct stuffing boxes so as to permit easy removal of parts for repair. Provide all valves from one manufacturer.

2.1.2.3 Check Valves

Provide a protective interior coating in accordance with AWWA C550. Swing-check type, AWWA C508 or UL 312 and:

a. AWWA C508: Iron or steel body and cover and flanged ends

Provide check valves with a clear port opening. Provide weight-loaded check valves. Class 125 flanges are to match ASME B16.1.Provide all check valves from one manufacturer.

2.1.2.4 Water Service Valves

2.1.2.4.1 Gate Valves Smaller than 3 Inch in Size on Buried Piping

Gate valves smaller than 3 inch size on Buried Piping MSS SP-80, Class 150, solid wedge, nonrising stem, with flanged or threaded end connections, a union on one side of the valve, and a handwheel operator.

2.1.2.4.2 Gate Valves Smaller Than 3 Inch Size in Valve Pits

MSS SP-80, Class 150, solid wedge, inside screw, rising stem. Provide valves with flanged or threaded end connections, a union on one side of the valve, and a handwheel operator.

2.1.2.4.3 Check Valves Smaller than 2 Inch in Size

Provide check valves with a minimum working pressure of 150 psi or as indicated with a clear waterway equal to the full nominal diameter of the valve. Valves open to permit flow when inlet pressure is greater than the discharge pressure, and close tightly to prevent return flow when discharge pressure exceeds inlet pressure. Cast the size of the valve, working pressure, manufacturer's name, initials, or trademark on the body of each valve.

Provide valves for screwed fittings, made of lead-free bronze and in conformance with MSS SP-80, Class 150, Types 3 and 4 compatible for the application.

2.1.2.5 Valve Boxes

Provide a valve box for each gate valve on buried piping, except where indicator post is shown. Construct adjustable valve boxes manufactured from cast iron or precast concrete of a size compatible for the valve on which it is used. Provide cast iron valve boxes with a minimum cover and

wall thickness of 3/16 inch and conforming to ASTM A48/A48M, Class 35B. Coat the cast-iron box with a heavy coat of bituminous paint. Provide a round head. Cast the word "FIRE WATER" on the lid. The minimum diameter of the shaft of the box is 5 1/4 inches. Provide ASTM C1433 precast concrete valve box. Provide precast concrete boxes installed in locations subjected to vehicular traffic to withstand AASHTO load designation as outlined in AASHTO HB-17.

2.1.2.6 Valve Pits

Construct the valve pits at locations indicated or as required above and in accordance with the details shown.

2.1.3 Fire Hydrants

2.1.3.1 Fire Hydrants

Provide fire hydrants where indicated. Paint fire hydrants with at least one coat of primer and two coats of enamel paint. Paint barrel and bonnet colors in accordance with UFC 3-600-01. Stencil fire hydrant number and main size on the fire hydrant barrel using black stencil paint. Provide signage in two-inch text stating "HYDRANT CONNECTED TO FIRE PUMP IN BUILDING XXX. ONLY FOR USE BY EGLIN FIRE DEPARTMENT." Permanently attach signage to hydrants.

2.1.3.1.1 Dry-Barrel Type Fire Hydrants

Provide Dry-barrel type fire hydrants, AWWA C502 or UL 246, "Base Valve" with 6 inch inlet, 5 1/4 inch valve opening, one 4 1/2 inch pumper connection, and two 2 1/2 inch hose connections.

Provide mechanical-joint end only inlet; with end matching requirements as specified in AWWA C502 or UL 246 for size and shape of operating nut, cap nuts, and threads on hose and pumper connections. Provide fire hydrants with frangible sections as mentioned in AWWA C502. Provide fire hydrant with special couplings joining upper and lower sections of fire hydrant barrel and upper and lower sections of fire hydrant stem that break from a force imposed by a moving vehicle.

2.1.4 Backflow Preventers

Provide a AWWA C511 reduced pressure principle type backflow preventer meeting the following requirements:

a. Size: 3in

The particular make, model, and size of backflow preventers to be installed must be included in the latest edition of the List of Approved Backflow Prevention Assemblies issued by the FCCCHR List and be accompanied by a backflow certificate of full approval from FCCCHR List. Select materials for piping, strainers, and valves used in assembly installation that are galvanically compatible. Materials joined, connected, or otherwise in contact are to have no greater than 0.25 V difference on the Anodic Index, unless separated by a dielectric type union or fitting.

2.1.4.1 Backflow Preventer Enclosure

Provide a heated enclosure meeting the following requirements:

a. The enclosure shall be of reinforced aluminum or fiberglass construction, providing access through doors and/or a hinged lid for testing/certification and being completely removable by hand for maintenance purposes.

b. The enclosure shall be structurally lined with a spray applied, or sandwhich laminated, unicellular, non-wicking, insulation and contain a thermostatically controlled heater mounted to the wall for protection to -30 degrees F. The heater shall be set to come on when the temperature drops to 40 degrees F.

c. Provide applicable GFI receptacle, U.L. STND 943-NEMA 3R, inside of the enclosure. The outlets shall be typical for outdoor use. Receptacle shall be mounted atleast 6" above any water discharge point and near the pipe riser on the heater connection side.

d. The enclosure shall contain drain openings at each end - sized to accommodate the maximum discharge of the backflow preventer and to open for discharge under the most severe conditions. These openings shall be protected against intrusion of either wind, debris, or animal. The enclosure shall be provided with means of permanent anchor and "lockable" access doors and/or lid to prohibit theft and/or vandalism.

e. The Contractor shall ensure that the backflow preventers and appurtenances will fit into the selected enclosure before installation.

f. Standard colors are white and beige. The Contractor shall coordinate with the C.O.R. to see which one of these colors to choose or if the Base wants to choose another color.

g. The enclosure shall be supported on a 10"x6" footer around the backflow preventer assembly. The footer shall extend 2" above finish grade. Bolt aluminum base angles through predrilled holes in the base either inside or outside the enclosure as desired. Use bolts, nuts, and lock washers.

h. The Contractor shall ensure that the access doors or opening front must be placed on the side of the valve requiring testing or maintenance access.

i. The Contractor shall use a carbide tipped concrete bit to drill through predrilled base mounting holes in the aluminum base angles or fiberglass base flanges. Insert "red head" expansion anchors and bolt firmly to the concrete.

j. Hot Box heater; heavy gauge steel case, aluminum grill and aluminized steel sheathed strip heaters; warm air convection; automatic thermostat, maintaining a +40 degrees F.

k. Heater installation - wall mounted through rear of casing (25" O/C).

l. Heater finish - corrosion resistant coating on steel.

m. Heater casing dimensions - 29" outside length x 2.625" outside depth x 5" outside height.

2.1.5 Disinfection

Chlorinating materials are to conform to: Chlorine, Liquid: AWWA B301; Hypochlorite, Calcium and Sodium: AWWA B300.

2.2 ACCESSORIES

2.2.1 Pipe Restraint

2.2.1.1 Thrust Blocks

Use ASTM C94/C94M concrete having a minimum compressive strength of 2,500 psi at 28 days.

2.2.1.2 Precast Thrust Blocks

Provide precast concrete thrust blocks.2.2.1.3 Joint Restraint

Provide restrained joints in accordance with NFPA 24, Chapter 10 and in accordance with ASTM F1674.

Provide mechanical joint restraint.

2.2.2 Protective Enclosures

Provide Freeze-Protection Enclosures that are insulated and designed to protect aboveground water piping, equipment, or specialties from freezing and damage, with heat source to maintain minimum internal temperature of 40 degrees F when external temperatures reach as low as 0 degree F.

2.2.2.1 Housing

Reinforced and insulated aluminum or fiberglass construction; with anchoring devices for attaching housing to concrete base, access doors with locking devices, sized to allow access and service of the protected unit, drain openings, and an electric heating cable or heater with self-limiting temperature control.

2.2.3 Tapping Sleeves

Provide cast gray, ductile, malleable iron or stainless steel, split-sleeve type tapping sleeves of the sizes indicated for connection to existing main with flanged or grooved outlet, and with bolts, follower rings and gaskets on each end of the sleeve. Utilize similar metals for bolts, nuts, and washers to minimize the possibility of galvanic corrosion. Provide dielectric gaskets where dissimilar metals adjoin. Provide a tapping sleeve assembly with a maximum working pressure of 150 psi. Provide bolts with square heads and hexagonal nuts. Longitudinal gaskets and mechanical joints with gaskets as recommended by the manufacturer of the sleeve. When using grooved mechanical tee, utilize an upper housing with full locating collar for rigid positioning which engages a machine-cut hole in pipe, encasing an elastomeric gasket which conforms to the pipe outside diameter around the hole and a lower housing with positioning lugs, secured together during assembly by nuts and bolts as specified, pre-torqued to 50 foot-pound.

2.2.4 Sleeve-Type Mechanical Couplings

Use couplings to join plain-end piping by compression of a ring gasket at

each end of the adjoining pipe sections. The coupling consists 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. Provide true circular middle ring and the follower rings sections free from irregularities, flat spots, and surface defects; provide for confinement and compression of the gaskets. For ductile iron and PVC pipe, the middle ring is cast-iron or steel; and the follower rings are malleable or ductile iron.For steel piping, the middle ring is steel and the follower rings are steel or malleable iron. Malleable and ductile iron are to meet the requirements of ASTM A47/A47M and ASTM A536, respectively. Use gaskets for resistance to set after installation and to meet the requirements specified for gaskets for mechanical joint in AWWA C111/A21.11. Provide track-head type bolts ASTM A307, Grade A, with nuts, ASTM A563, Grade A; or round-head square-neck type bolts, ASME B18.5.2.1M and ASME B18.5.2.2M with hex nuts, ASME B18.2.2. Provide 5/8 inch diameter bolts; minimum number of bolts for each coupling shall be as required for each pipe size. Shape bolt holes in follower rings to hold fast to the necks of the bolts used. Do not use mechanically coupled joints using a sleeve-type mechanical coupling as an optional method of jointing except where pipeline is adequately anchored to resist tension pull across the joint. Provide a tight flexible joint with mechanical couplings under reasonable conditions, such as pipe movements caused by expansion, contraction, slight settling or shifting in the ground, minor variations in trench gradients, and traffic vibrations. Match coupling strength to that of the adjoining pipeline.

2.2.5 Insulating Joints

Provide a rubber-gasketed insulating joint or dielectric coupling between pipe of dissimilar metals which will effectively prevent metal-to-metal contact between adjacent sections of piping.

2.2.6 Bonded Joints

For all ferrous pipe, provide a metallic bond at each joint, including joints made with flexible couplings, caulking, or rubber gaskets, of ferrous metallic piping to effect continuous conductivity. Provide Size 1/0 copper conductor thermal weld type bond wire designed for direct burial and shaped to stand clear of the joint.

2.2.7 Dielectric Fittings

Install dielectric fittings between threaded ferrous and nonferrous metallic pipe, fittings and valves, except where corporation stops join mains to prevent metal-to-metal contact of dissimilar metallic piping elements and compatible with the indicated working pressure.

2.2.8 Tracer Wire for Nonmetallic Piping

Provide a continuous bare copper or aluminum wire not less than 0.10 inch in diameter in sufficient length over each separate run of nonmetallic pipe.

2.2.9 Water Service Line Appurtenances

2.2.9.1 Corporation Stops

Ground key type; lead-free bronze, ASTM B61 or ASTM B62; compatible with

the working pressure of the system and solder-joint, or flared tube compression type joint. Threaded ends for inlet and outlet of corporation stops, AWWA C800; coupling nut for connection to flared copper tubing, ASME B16.26.

2.2.9.2 Curb or Service Stops

Ground key, round way, inverted key type; made of lead-free bronze, ASTM B61or ASTM B62; and compatible with the working pressure of the system. Provide compatible ends for connection to the service piping. Cast an arrow into body of the curb or service stop indicating direction of flow.

2.2.9.3 Service Clamps

Provide single or double flattened strap type service clamps used for repairing damaged cast-iron, steel or PVC pipe with a pressure rating not less than that of the pipe being repaired. Provide clamps with a galvanized malleable-iron body with cadmium plated straps and nuts and a rubber gasket cemented to the body.

2.2.9.4 Curb Boxes

Provide a curb box for each curb or service stop manufactured from cast iron, size capable of containing the stop where it is used. Provide a round head. Cast the word "WATER" on the lid. Factory coat the box with a heavy coat of bituminous paint.

PART 3 EXECUTION

3.1 PREPARATION

3.1.1 Connections to Existing System

Perform all connections to the work performed by ASUS under this contract in the presence of the Contracting Officer. There is currently no exisitng infrastructure. All work shall be coordinated with American States Utility Services Inc., the Eglin AFB water distribution maintenance contractor.

3.1.2 Operation of Existing Valves

Do not operate valves within or directly connected to the existing water system. American States Utility Services Inc., the Eglin AFB water distribution maintenance contractor, will operate any neccesary valves.

3.1.3 Earthwork

Perform earthwork operations in accordance with Section 31 00 00 EARTHWORK.

3.2 INSTALLATION

Install all materials in accordance with the applicable reference standard, manufacturers instructions and as indicated herein.

3.2.1 Piping

3.2.1.1 General Requirements

Install pipe, fittings, joints and couplings in accordance with the

applicable referenced standard, the manufacturer's instructions and as specified herein.

3.2.1.1.1 Termination of Water Lines

Terminate the work covered by this section at a point approximately 5 feet from the building, unless otherwise indicated.

Do not lay water lines in the same trench with gas lines, fuel lines, electric wiring, or any other utility. Where nonferrous metallic pipe (i.e., copper tubing) crosses any ferrous piping, provide a minimum vertical separation of 12 inches between pipes.

3.2.1.1.2 Pipe Laying and Jointing

Remove fins and burrs from pipe and fittings. Before placing in position, clean pipe, fittings, valves, and accessories, and maintain in a clean condition. Provide proper facilities for lowering sections of pipe into trenches. Under no circumstances is it permissible to drop or dump pipe, fittings, valves, or other water line material into trenches. Cut pipe cleanly, squarely, and accurately to the length established at the site and work into place without springing or forcing. Replace a pipe or fitting that does not allow sufficient space for installation of jointing material. Blocking or wedging between bells and spigots is not permitted. Lay bell-and-spigot pipe with the bell end pointing in the direction of laying. Grade the pipeline in straight lines; avoid the formation of dips and low points. Support pipe at the design elevation and grade. Secure firm, uniform support. Wood support blocking is not permitted. Lay pipe so that the full length of each section of pipe and each fitting rests solidly on the pipe bedding; excavate recesses to accommodate bells, joints, and couplings. Provide anchors and supports for fastening work into place. Make provision for expansion and contraction of pipelines. Keep trenches free of water until joints have been assembled. At the end of each work day, close open ends of pipe temporarily with wood blocks or bulkheads. Do not lay pipe when conditions of trench or weather prevent installation. Provide a minimum of 2 1/2 feet depth of cover over top of pipe.

3.2.1.1.3 Tracer Wire

Install a continuous length of tracer wire for the full length of each run of nonmetallic pipe. Attach wire to top of pipe in such manner that it will not be displaced during construction operations.

3.2.1.1.4 Connections to Existing Water Lines

Make connections to existing water lines after coordination with the facility and with a minimum interruption of service on the existing line. Make connections to existing lines under pressure in accordance with the recommended procedures of the manufacturer of the pipe being tapped and as indicated.

3.2.1.1.5 Sewer Manholes

No water piping is to pass through or come in contact with any part of a sewer manhole.

3.2.1.1.6 Water Piping Parallel With Sewer Piping

Where the location of the water line is not clearly defined by dimensions on the drawings, do not lay water line closer than 10 feet, horizontally, from any sewer line.

3.2.1.1.7 Water Piping Crossing Sewer Piping

Provide at least 18 inches above the top (crown) of the sewer piping and the bottom (invert) of the water piping whenever possible. Measure the distance edge-to-edge. Where water lines cross under gravity sewer lines, construct sewer line of AWWA compliant ductile iron water piping with rubber-gasketed joints and no joint located within 10 feet, horizontally, of the crossing. Lay water lines which cross sewer force mains and inverted siphons at least 2 feet above these sewer lines; when joints in the sewer line are closer than 3 feet horizontally from the water line relay the sewer line to ensure no joint closer than 3 feet.

3.2.1.1.8 Penetrations

Provide ductile-iron or Schedule 40 steel wall sleeves for pipe passing through walls of valve pits and structures. Fill annular space between walls and sleeves with rich cement mortar. Fill annular space between pipe and sleeves with mastic.

3.2.1.1.9 Flanged Pipe

Only install flanged pipe aboveground or with the flanges in valve pits.

3.2.1.2 Ductile-Iron Piping

Unless otherwise specified, install pipe and fittings in accordance with the paragraph GENERAL REQUIREMENTS and with the requirements of AWWA C600 for pipe installation, joint assembly, valve-and-fitting installation, and thrust restraint.

a. Jointing: Make push-on joints with the gaskets and lubricant specified for this type joint; assemble in accordance with the applicable requirements of AWWA C600 and AWWA M41 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 and AWWA M41 for joint assembly and the recommendations of Appendix A to AWWA C111/A21.11. Make flanged joints with the gaskets, bolts, and nuts specified for this type joint. Make flanged joints up tight; avoid undue strain on flanges, fittings, valves, and other equipment and accessories. Align bolt holes for each flanged joint. Use full size bolts for the bolt holes; use of undersized bolts 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 fitting has dimensions that do not allow the making of a flanged joint as specified, replace it. Use set screw flanges to make flanged joints where conditions prevent the use of full-length flanged pipe and assemble in accordance with the recommendations of the set screw flange manufacturer. During installation of set screw gasket provide for confinement and compression of gasket when joint to adjoining flange is made. Assemble joints made with sleeve-type mechanical couplings in accordance with the recommendations of the coupling manufacturer. Make grooved and

shouldered type joints with the couplings previously specified for this type joint connecting pipe with the grooved or shouldered ends specified for this type joint; assemble in accordance with the recommendations of the coupling manufacturer. Groove pipe in the field only with groove cutting equipment designed especially for the purpose and produced by a manufacturer of grooved joint couplings; secure approval for field-cut grooves before assembling the joint. Make insulating joints with the gaskets, sleeves, washers, bolts, and nuts previously specified for this type joint. Assemble insulating joints as specified for flanged joints, except that bolts with insulating sleeves are to be full size for the bolt holes. Ensure that there is no metal-to-metal contact between dissimilar metals after the joint has been assembled.

b. Allowable Deflection: Follow AWWA C600 and AWWA M41 for the maximum allowable deflection. If the alignment requires deflection in excess of the above limitations, provide special bends or a sufficient number of shorter lengths of pipe to achieve angular deflections within the limit set forth.

c. Exterior Protection: Completely encase buried ductile iron pipelines using Method A or B, with polyethylene film, in accordance with AWWA C105/A21.5.

3.2.1.3 PVC Water Main Pipe

Unless otherwise specified, install pipe and fittings in accordance with the paragraph GENERAL REQUIREMENTS and with the requirements of AWWA C605 for laying of pipe, joining PVC pipe to fittings and accessories, setting of fire hydrants, valves, and fittings; and with the recommendations for pipe joint assembly and appurtenance installation in AWWA M23, Chapter 7, "Installation."

a. Jointing: 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 metal fittings, valves, and other accessories, 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 a 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, valves, and other accessories in accordance with the requirements of AWWA C605 for joining PVC pipe to fittings and accessories and with the requirements of AWWA C600 for joint assembly. Make compression-type joints/mechanical joints with the gaskets, glands, bolts, nuts, and internal stiffeners previously specified for this type joint; assemble in accordance with the requirements of AWWA C605 for joining PVC pipe to fittings and accessories, with the 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. Assemble joints made with sleeve-type mechanical couplings in accordance with the recommendations of the coupling manufacturer using internal stiffeners as previously specified for compression-type joints.

b. Joint Offset: Construct joint offset in accordance AWWA C605. Do not exceed the minimum longitudinal bending as indicated by AWWA C605.

c. Fittings: Install in accordance with AWWA C605.

3.2.1.4 Steel Piping

Unless otherwise specified, install pipe and fittings in accordance with AWWA C604 and AWWA M11, Chapter 12, "Transportation, Installation, and Testing."

a. Jointing: Make rubber-gasketed bell-and-spigot joints with the gaskets previously specified for this type joint, using a lubricant recommended by the pipe manufacturer; assemble in accordance with the recommendations of the pipe manufacturer. Make welded joints in accordance with AWWA C206 and with the recommendations given for installation of pipe in AWWA M11, Chapter 12, "Transportation, Installation, and Testing." Assemble joints made with sleeve-type mechanical couplings in accordance with the recommendations of the coupling manufacturer. Make flanged joints with the gaskets, bolts, and nuts specified for this type joint. Make flanged joints up tight; avoid undue strain on flanges, fittings, valves, and other equipment and accessories. Align bolt holes for each flanged joint. Use full-size bolts for the bolt holes; use of undersized bolts is not permitted. Do not allow adjoining flange faces to be out of parallel to such degree that the flanged joint cannot be made watertight without straining the flange. Replace flanged pipe or fittings with dimensions that do not allow the making of a flanged joint as specified. Make insulating joints with the gaskets, sleeves, washers, bolts, and nuts specified for this type joint. Assemble insulating joints as specified for flanged joints, except that bolts with insulating sleeves are to be full size for the bolt holes. Ensure that there is no metal-to-metal contact between dissimilar metals after the joint has been assembled. Finish joints on piping with cement-mortar lining as specified in Appendix on Field Joints in AWWA C205. Finish joints on piping with coal-tar enamel or coal-tar epoxy coating by cleaning, priming, coating, and wrapping with a cold-applied tape coating matching the requirements of, and applied in accordance with AWWA C209.

b. Allowable Offsets: For pipe with bell-and-spigot rubber-gasket joints, maximum allowable deflections from a straight line or grade, as required by vertical curves, horizontal curves, or offsets is 5 degrees unless a lesser amount is recommended by the manufacturer. Form short-radius curves and closures with short lengths of pipe or fabricated specials specified.

c. Cement Mortar Lining: AWWA C205, shop applied.

3.2.1.5 Metallic Piping for Service Lines

Install pipe and fittings in accordance with the paragraph GENERAL REQUIREMENTS and with the applicable requirements of AWWA C600 for pipe installation, unless otherwise specified.

3.2.1.5.1 Screwed Joints

Make screwed joints up tight with a stiff mixture of graphite and oil,

inert filler and oil, or graphite compound; apply to male threads only or with PTFE Tape, for use with threaded pipe. Threads are to be full cut; do not leave more than three threads on the pipe exposed after assembling the joint.

3.2.1.5.2 Flanged Joints

Make flanged joints up tight, avoid undue strain on flanges, valves, fittings, and accessories.3.2.1.5.3 Protection of Buried Steel Service Line Piping

Prepare, prime, and coat exterior surface of zinc-coated steel pipe and associated fittings to be buried with hot-applied coal-tar enamel with a bonded double felt wraps in accordance with AWWA C203. For the felt wrap material, use fibrous-glass mat as specified in AWWA C203; use of asbestos felt will not be permitted. Use solvent wash only to remove oil, grease, and other extraneous matter from zinc-coated pipe and fittings.

3.2.1.6 Plastic Service Piping

Install pipe and fittings in accordance with the paragraph GENERAL REQUIREMENTS and with the applicable requirements of ASTM D2774, unless otherwise specified. Handle solvent cements used to join plastic piping in accordance with ASTM F402.

3.2.1.6.1 Jointing

Make plastic pipe joints to other pipe materials in accordance with the recommendations of the plastic pipe manufacturer.

3.2.1.6.2 Plastic Pipe Connections to Appurtenances

Connect plastic service lines to corporation stops and gate valves in accordance with the recommendations of the plastic pipe manufacturer.

3.2.1.7 Fire Protection Service Lines for Sprinkler Supplies

Connect water service lines used to supply building sprinkler systems for fire protection to the water main in accordance with NFPA 24.

3.2.1.8 Water Service Piping

3.2.1.8.1 Location

Connect water service piping to the building service where the building service has been installed. Where building service has not been installed, terminate water service lines approximately 5 feet from the building line at the points indicated; close such water service lines with plugs or caps.

3.2.1.8.2 Water Service Line Connections to Water Mains

Connect 3 inch water service lines to the main with a rigid connection and install a gate valve on service line below the frostline. Connect water service lines to ductile-iron water mains in accordance with AWWA C600 for service taps. Connect water service lines to PVC water mains in accordance with UBPPA UNI-PUB-08 and the recommendations of AWWA M23, Chapter 9, "Service Connections."

3.2.2 Backflow Preventers

Install backflow preventers of type, size, and capacity indicated a minimum of 12 inch and a maximum of 36 inch above concrete base. Include valves and test cocks. Install according to the manufacturers requirements and the requirements of plumbing and health department and authorities having jurisdiction. Support NPS 2 1/2 inch and larger backflow preventers, valves, and piping near floor with 12 inch minimum air gap, and on concrete piers or steel pipe supports. Do not install backflow preventers that have a relief drain in vault or in other spaces subject to flooding. Do not install by-pass piping around backflow preventers.

3.2.2.1 Backflow Preventer Enclosure

Install a level concrete base with top of concrete surface approximately 2 inches above grade. Install protective enclosure over valve and equipment. Anchor protective enclosure to concrete base.

3.2.3 Disinfection

Prior to disinfection, provide disinfection procedures, proposed neutralization and disposal methods of waste water from disinfection as part of the disinfection submittal. Disinfect new water piping and existing water piping affected by Contractor's operations in accordance with AWWA C651. Disinfect new water piping using the AWWA C651 continuous-feed method of chlorination. Ensure a free chlorine residual of not less than 10 parts per million after 24 hour holding period and prior to performing bacteriological tests.

3.2.4 Flushing

Perform bacteriological tests prior to flushing. Flush solution from the systems with domestic water until maximum residual chlorine content is within the range of 0.2 to 0.5 parts per million, the residual chlorine content of the distribution system, or acceptable for domestic use. Use AWWA C655 neutralizing chemicals.

3.2.5 Pipe Restraint

3.2.5.1 Concrete Thrust Blocks

Install concrete thrust blocks where indicated.

3.2.5.2 Restrained Joints

Install restrained joints in accordance with the manufacturer's instructions, NFPA 24, and where indicated.

3.2.6 Valves

3.2.6.1 Gate Valves

Install gate valves, AWWA C500 and UL 262, in accordance with the requirements of 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, AWWA C509 or AWWA C515, in accordance with the requirements of AWWA C600 for valve-and-fitting

installation and with the recommendations of the Appendix ("Installation, Operation, and Maintenance of Gate Valves") to AWWA C509 or AWWA C515. Install gate valves on PVC and PVCO water mains in accordance with the recommendations for appurtenance installation in AWWA M23, Chapter 7, "Installation." Make and assemble joints to gate valves as specified for making and assembling the same type joints between pipe and fittings.

3.2.6.2 Check Valves

Install check valves in accordance with the applicable requirements of AWWA C600 for valve-and-fitting installation. Make and assemble joints to check valves as specified for making and assembling the same type joints between pipe and fittings.

3.2.7 Fire Hydrants

Install fire hydrants in accordance with AWWA C600 for fire hydrant installation and as indicated. Make and assemble joints as specified for making and assembling the same type joints between pipe and fittings. Install fire hydrants with the 4 1/2 inch connections facing the adjacent paved surface. If there are two paved adjacent surfaces, install fire hydrants with the 4 1/2 inch connection facing the paved surface where the connecting main is located.

3.3 FIELD QUALITY CONTROL

3.3.1 Tests

Notify the Contracting Officer a minimum of five days in advance of hydrostatic testing. Coordinate the proposed method for disposal of waste water from hydrostatic testing. Perform field tests, and provide labor, equipment, and incidentals required for testing. Provide documentation that all items of work have been constructed in accordance with the Contract documents.

3.3.1.1 Hydrostatic Test

Test the water system in accordance with the applicable AWWA standard specified below. Where water mains provide fire service, test in accordance with the special testing requirements given in the paragraph SPECIAL TESTING REQUIREMENTS FOR FIRE SERVICE. Test ductile-iron water mains in accordance with the requirements of AWWA C600 for hydrostatic testing. The amount of leakage on ductile-iron pipelines with mechanical-joints or push-on joints is not to exceed the amounts given in AWWA C600; no leakage will be allowed at joints made by any other methods. Test PVC and PVCO plastic water systems made with PVC pipe in accordance with the requirements of AWWA C605 for pressure and leakage tests. The amount of leakage on pipelines made of PVC water main pipe is not to exceed the amounts given in AWWA C605, except that at joints made with sleeve-type mechanical couplings, no leakage will be allowed. Test water service lines in accordance with requirements of AWWA C600 for hydrostatic testing. No leakage will be allowed at plastic pipe joints, flanged joints, and screwed joints. Do not backfill utility trench or begin testing on any section of a pipeline where concrete thrust blocks have been provided until at least 7 days after placing of the concrete.

3.3.1.2 Leakage Test

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.

3.3.1.3 Bacteriological Testing

Perform bacteriological tests in accordance with AWWA C651. Analyze samples by a certified laboratory, and submit the results of the bacteriological samples.

3.3.1.4 Backflow Preventer Tests

After installation conduct Backflow Preventer Tests and provide test reports verifying that the installation meets the FCCCHR Manual Standards.

3.3.1.5 Special Testing Requirements for Fire Service

Test water mains and water service lines providing fire service or water and fire service in accordance with NFPA 24. The additional water added to the system must not exceed the limits given in NFPA 24

3.3.1.6 Tracer Wire Continuity Test

Test tracer wire for continuity after service connections have been completed and prior to final pavement or restoration. Verify that tracer wire is locatable with electronic utility locating equipment. Repair breaks or separations and re-test for continuity.

3.4 SYSTEM STARTUP

Water mains and appurtenances must be completely installed, disinfected, flushed, and satisfactory bacteriological sample results received prior to permanent connections being made to the active distribution system. Obtain approval by the Contracting Officer prior to the new water piping being placed into service.

3.5 CLEANUP

Upon completion of the installation of water lines and appurtenances, remove all debris and surplus materials resulting from the work.

-- End of Section --

SECTION 33 11 13

POTABLE WATER SUPPLY WELLS- CONSTRUCTED BY ASUS
08/17

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA 10084	(2017) Standard Methods for the Examination of Water and Wastewater
AWWA A100	(2015) Water Wells
AWWA B300	(2010; Addenda 2011) Hypochlorites
AWWA B301	(2010) Liquid Chlorine
AWWA C206	(2017) Field Welding of Steel Water Pipe
AWWA C654	(2013) Disinfection of Wells

ASTM INTERNATIONAL (ASTM)

ASTM A139/A139M	(2016) Standard Specification for Electric-Fusion (ARC)-Welded Steel Pipe (NPS 4 and over)
ASTM C136/C136M	(2019) Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM C150/C150M	(2020) Standard Specification for Portland Cement
ASTM D2487	(2017; E 2020) Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D2488	(2017; E 2018) Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)
ASTM D5088	(2020) Decontamination of Field Equipment Used at Nonradioactive Waste Sites

U.S. ARMY CORPS OF ENGINEERS (USACE)

CED TR GL-85-3	(1985) Geotechnical Descriptions of Rock and Rock Masses

1.2 ADMINISTRATIVE REQUIREMENTS

1.2.1 Notification

Notify the Contracting Officer 21 days prior to drilling. The Contractor is responsible for contacting the State of Florida in accordance with the applicable reporting requirements. The contractor is responsible for conducting all work specified herein in accordance with Northwest Florida Water Management District (NWFWMD) and Florida Department of Environmental Protection (FDEP) permitting requirements and regulations.

1.2.2 Delivery, Storage, and Handling

Store and maintain well materials in a clean, uncontaminated condition throughout the course of the project.

1.2.3 Project and Site Conditions

Access to each well site, including any utility clearance, permits, licenses, or other requirements and the payment thereof necessary for execution of the work, is the responsibility of the Contractor. Furnish a copy of all permits, licenses, and other legal requirements necessary for execution of the work 30 working days before commencement of the work. Visit the proposed well location to observe any condition that may hamper transporting equipment or personnel to the site. If clearing, or relocation is necessary, the Contractor, and the Contracting Officer must agree on a suitable clearing, or relocation plan, and the location of any required access road.

1.2.4 Water Well Design Requirements

1.2.4.1 Well Installation Plan

Submit a plan as specified herein describing the drilling methods, sampling, and well construction and well development 30 calendar days prior to beginning drilling operations. Mobilization activities may start prior to submittal of the plan. The plan must be approved and signed by an experienced geologist as specified in paragraph QUALIFICATIONS. Incorporate the following requirements into the Well Installation Plan and follow them in the field. The design of the well is to be based on the various aspects analyzed and contained in this plan (boring log, geotechnical report, sieve analysis, etc.). The plan must include, but not be limited to, a discussion of the following:

a. Description of well drilling methods, and installation procedures, including any temporary casing used, placement of seal materials, drill cuttings and fluids disposal, and soil and rock sample disposition.

b. Description of well construction materials, including well casing, centralizers, air line and gauge, tailpiece (if used), bentonite or drilling mud, drilling fluid additives (if used), drilling water, cement, and well protective measures.

c. Description of quality control procedures to be used for placement of seals in the boring, including depth measurements.

d. Forms intended for written boring logs, installation diagrams of wells, well development records, well sampling data records, state

well registration forms, and well abandonment records.

e. Description of contamination prevention and well materials and equipment decontamination procedures.

f. Description of protective cover surface completion procedures, including any special design criteria .

g. Description of intended well development methods.

h. List of applicable publications, including state and local regulations and standards.

i. List of personnel assignments for this project, and personnel qualifications.

j. Description of well decommissioning or abandonment procedures.

k. Description of well capacity testing techniques.

l. Description and discussion of geophysical techniques to be employed at the site.

m. Description of permanent pump to be installed, characteristic pump curve for the pump selected, and discussion of pump operating tests to be employed at the site to ensure required flows and pressured can be met.

n. Description of specific methods to be employed to control potential contamination or pollution arising from well installation activities.

o. Description of plumbness and alignment testing.

p. Description of specific methods employed to test for sand.

1.2.4.2 Test Wells

Before starting construction of the well, drill a test well boring of at least 4 inches in diameter at the location of the well into the target water bearing stratum. Drill test well in a manner to protect the subsurface from surface contamination. Carefully advance test well and sample to determine the presence of the upper aquiclude if one exists. Use the test well to determine the expected flow, optimum depth for flow, water quality, and to identify the strata encountered. Before conducting a capacity test, case the well in accordance with these specifications. Log test wells in accordance with paragraph BOREHOLE LOGS. A temporary casing may be used. If used, seat the temporary casing into the top of the rock. The test well may be converted to the permanent well, in accordance with these specifications. If the test well is not used for the permanent well, abandon the test well as specified in paragraph WELL DECOMMISSIONING OR ABANDONMENT.

1.2.4.3 Sampling for Geotechnical Analysis

Take samples of all materials penetrated by each drilled well or test well. Representative samples shall be collected at a minimum of every ten feet and at change of strata until reaching top of rock. Place sampled materials in airtight containers and label as specified in paragraph SAMPLE CONTAINERS. Deliver samples to the designated facility. Test

representative soil samples for grain-size distribution by mechanical means (sieves down to the No. 200 size according to ASTM C136/C136M). Perform laboratory classification of soils in accordance with ASTM D2487. Perform sampling to allow completion of the documents described in paragraph BOREHOLE LOGS.

1.2.5 Qualifications

Submit personnel qualification documentation. A geologist with at least 3 years experience in soil and rock logging, and well installation, registered in the state of Florida, must be on site at the well site during drilling, installation, and testing activities, and be responsible for all geophysical and borehole logging, drilling, well installation, developing and testing activities. Employ a driller licensed in the state of Florida, according to the state requirements. Document a minimum of three years of well installation experience.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval or information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Installation Diagrams; G.

SD-03 Product Data

Well Material

Cement and Bentonite Grout

Drilling Mud

SD-05 Design Data

Well Installation Plan; G, DO EN-GG

SD-06 Test Reports

Water Source; G.

Capacity Test G, DO EN-GG

Test For Plumbness And Alignment G, DO EN-GG

Water Quality Test

Sand Test G, DO EN-GG

Tests

SD-07 Certificates

Site Conditions

Project Photographs

Qualifications

Casing

Air Line And Gauge

SD-11 Closeout Submittals

Well Development Records G, DO EN-GG

Decommissioning or Abandonment Record

PART 2 PRODUCTS

2.1 CASING

All casing, screen, and other well material must be of compatible materials to prevent galvanic reaction between components of the completed well. Submit catalog data, and name of supplier, for casing, riser pipe, bentonite, cement, centralizers, surface protective covers, well vaults, locking caps, airline oil filters for pneumatic drilling, pumps, and chemical specifications on drill lubricants, tracers, disinfecting agents, and drill fluid additives, if used. Catalog data must include any information, supplied by the manufacturers or suppliers of the above listed items.

2.1.1 Steel Casing and Couplings

Steel casing must be new carbon steel, conforming to ASTM A139/A139M and nominal six inch diameter, 0.280 inch wall thickness. Joints must be either threaded and coupled, or field welded in accordance with AWWA C206. Provide casings with drive shoes.

2.2 CEMENT AND BENTONITE GROUT

2.2.1 Cement Grout

Provide cement grout consisting of Portland cement conforming to ASTM C150/C150M, Type I or II, sand and water. Proportion cement grout not to exceed 2 parts, by weight, of sand to 1 part of cement with not more than 6 gallons of water per 94 lb bag of Portland cement, with a mixture of such consistency that the well can be properly grouted. No more than 5 percent by weight of bentonite powder may be added to reduce shrinkage.

2.3 PERMANENT PUMP

Permanent pump must be an approved submersible type with a capacity sufficient to deliver 25 gpm. The pump shall operate with a discharge pressure such that the distribution system is pressurized to 70 psi at 25gpm or greater while also pressurizing the distribution system to 50 psi at 30gpm or greater. The pump controls shall turn the pump on when the distribution system pressure drops to 50 psi and turn the pump off when

the distribution pressure is increased to 70 psi. Connect the pump to the pump controls by a three-wire drop line. Provide polyethylene plastic pipe conforming to ASTM D2239 or galvanized steel pipe conforming to ASTM A53/A53M piping for the well drop line. Operate the pump on 230 volts, 60 Hz,3-phase power, with the motor of sufficient size to operate the pump under the maximum operating conditions without exceeding its rating. Equip the pump with necessary controls to provide for automatic operation of the pump. The pump and motor unit must be no larger than four inches in diameter at any point.

2.4 CONTAINERS FOR DRILL CUTTINGS AND CORED ROCK SAMPLES

2.4.1 Containers for Drill Cuttings

Drill cuttings and samples required for geotechnical purposes are to be sealed in air-tight pint size plastic containers. Place individual sample containers in partitioned cardboard boxes.

2.4.2 Labeling of Drill Cutting Containers

Label individual sample containers with the project name, date of sample, well number and depth at which the sample was taken. Label both the container and lid in permanent indelible ink. Label partitioned cardboard box with project number and well number.

PART 3 EXECUTION

3.1 PREPARATION

3.1.1 Protection of Existing Conditions

Maintain existing survey monuments , and protect them from damage from equipment and vehicular traffic. Repair any items damaged during this work. Prior to commencement of drilling, obtain written approval from the local utility companies to drill at each site, to avoid disturbing buried utilities.

3.1.2 Decontamination

Clean the drill rig, drill rods, drill bits, augers, temporary casing, well developing equipment, tremie pipes, grout pumping lines, and other associated equipment with high-pressure hot water/steam prior to drilling. Decontaminate in accordance with ASTM D5088. Decontaminate at a central decontamination station in an area that is remote from, and cross- or down-gradient from the well being drilled. Clean well casing with high-pressure hot water immediately prior to installation in the well. The use of factory sealed (plastic wrapped) well casing does not waive this requirement for pre-installation cleaning. Decontaminate samplers in accordance with the Sampling and Analysis Plan. Use water for cleaning from a Government approved source. Sample and test the water source used for cleaning for the constituents specified in the Sampling and Analysis Plan prior to use at the site.

3.1.3 Water Source

Submit decontamination and drilling water source analytical test results obtained from the Sampling and Analysis Plan, within 10_working days before beginning drilling operations. The Contractor is responsible for locating the source, obtaining the water from the source, transporting it

to, and storing it at the site.

3.2 DRILLING, CONSTRUCTION AND TESTING

3.2.1 Well Drilling and Construction

Locate the well as indicated on project drawings, and construct in accordance with these specifications. Install the well to prevent aquifer contamination by the drilling operation and equipment, intra- and inter-aquifer contamination, and vertical seepage of surface water adjacent to the well into the subsurface, especially the well intake zone.

If a well of the required capacity is not constructed, or if the well is abandoned because of loss of tools, or for any other cause, abandon the hole as specified in paragraph WELL DECOMMISSIONING OR ABANDONMENT.

3.2.1.1 General

a. Use the drilling method approved by the Contracting Officer and in conformance with all state and local standards for water well construction. Execute the work under the direct supervision of an experienced and Florida-licensed well driller. The drilling method must prevent the collapse of formation material against the well screen and casing during installation of the well.

b. The inside diameter of any temporary casing used must be sufficient to allow accurate placement of the riser, centralizer(s), and grout. Any drilling fluid additive used must be inorganic in nature, but phosphate free. Grease or oil on drill rods, casing, or auger joints is not permitted; however, PTFE tape or vegetable oil (in solid phase form) are acceptable. The drill rig must be free from leaks of fuel, hydraulic fluid, and oil which could contaminate the borehole, ground surface or drill tools.

c. Use casing pipe and joint couplings of compatible materials throughout each well.

d. The well must be an open bedrock well activated in the water-bearing stratum.

e. Drill the well straight, plumb, and circular from top to bottom. Initially drill the well from the ground surface to the top of rock and the bottom of the outer casing set at least two feet below top of rock. The hole below the outer casing must penetrate the water bearing stratum a sufficient depth to produce the required amount of water without causing excessive velocities through the aquifer.

f. During construction of the well, use precautions to prevent tampering with the well or entrance of foreign material. Prevent runoff from entering the well during construction.

g. If there is an interruption in work, such as overnight shutdown or inclement weather, close the well opening with a watertight uncontaminated cover. Secure the cover in place or weigh down so that it cannot be removed except with the aid of the drilling equipment or through the use of drill tools.

3.2.1.2 Setting Outer Casing

The outer casing must not be less than six inches in diameter. The hole must be of sufficient size to leave a concentric annular space of not less than 2-1/2inches and not more than six inches between the outside of the outer casing and the walls of the hole. Fill the annular space between the outer casing and the walls of the holes with cement grout. Acceptable methods of grouting are detailed in AWWA A100; select a method specifying the forcing of grout from the bottom of the space to be grouted towards the surface. Provide a suitable grout retainer, packer, or plug at the bottom of the outer casing so that grout will not leak into the bottom of the well. Continuously grout to ensure that the entire annular space is filled in one operation. After grouting is completed, do not resume drilling operations for at least 72 hours to allow proper setting of the grout.

3.2.1.3 Construction of Open borehole below the casing

After the grout has set, drill the borehole below the outer casing at a diameter of not less than four inches, to the required depth, by an approved method.

3.2.2 Well Development

Develop the well within 7 days of completion. Develop the well in accordance with the Well Installation Plan, by approved methods until the water pumped from the well is substantially free from sand, and until the turbidity is less than 5 on the Jackson Turbidity Scale specified in AWWA 10084. Developing equipment must be of an approved type and of sufficient capacity to remove all cutting fluids, sand, rock cuttings, and any other foreign material.

Thoroughly clean the well from top to bottom before beginning the well tests. Perform development using only mechanical surging, intermittent pumping, or jetting, or a combination thereof in accordance with ASTM D5521/D5521M. Include details of the proposed development method in the Well Installation Plan. The well must be free of drawdown or surcharge effects due to pump testing, developing or drilling at another location at the time of development of any well.

3.2.2.1 Site Access and Predevelopment

Maintain the needed access and work area and clearance, necessary to accomplish development at the well site. Furnish, install, or construct the necessary discharge line and troughs to conduct and dispose of the discharge a sufficient distance from the work areas to prevent damage. Conduct development to achieve a stable well of maximum efficiency and continue until a satisfactory sand test, as specified in paragraph SAND TEST, is obtained. Provide an open tube or other approved means for accurately determining the water level in the well under all conditions. If, at any time during the development process it becomes apparent in the opinion of the Contracting Officer that the well may be damaged, immediately terminate development operations. The Contracting Officer may require a change in method if the method selected does not accomplish the desired results. The Contracting Officer may order that wells which continue to produce excessive amounts of fines after development for 6 hours be abandoned, plugged, and backfilled, and may require the Contractor to construct a new well nearby. Remove all materials pulled into the well by the development process prior to performing the pumping

test.

3.2.2.2 Jetting

a. Perform jetting using either a single or double ring jet. If a double ring jet is used the rings should be 2 feet apart.

b. Construct the jetting tool of high-strength material and conservatively designed and proportioned so that it will withstand high pressures.

c. Construct the rings such that the tips of the jets are within 1/2 inch from the surface of the borehole wall.

d. The pump used in conjunction with the jetting tool must be capable of providing pressures up to 250 psi.

e. Prior to commencing jetting, and following each jetting cycle, remove all sand and other materials from inside the screen. Start the jetting process at the bottom of the well and rotate the jetting tool slowly while rotating the pipe 180 degrees for two minutes at each location then raise the pipe 6 inches.

f. Ensure water introduced into the well during this jetting process is free of sand.

g. The Contracting Officer may require other means of developing the well such as intermittent pumping method, variation of the intermittent pumping method, or surge block if it appears that the development of the well is not producing the desired results.

3.2.2.3 Intermittent Pumping

Pump the well at a capacity sufficient to produce a rapid drawdown of approximately 25 feet stopping the pump (backflow through pump will not be permitted) to permit the water surface to rise to its former elevation, and repeat this procedure. Cycle time for this procedure will vary as directed but will not be more than 3 cycles per minute. A pump discharge in excess of 25 gpm is required. Use a deep well turbine pump, or electric submersible pump with check valve, with any attachment necessary to accomplish rapid starting and stopping for intermittent pumping. Set the intake at least 10 feet below the maximum expected drawdown in the well. Prior to commencing intermittent pumping, and periodically during development by this method, remove all sand and other materials from inside the screen. The amount of drawdown may be decreased if, in the opinion of the Contracting Officer, the efficiency of the well might otherwise be impaired.

3.2.2.4 Surging

Surging of the well requires use of a circular block, or multiple blocks, which are approximately 1 inch smaller in diameter than the inside diameter of the well and is constructed of a material which will not damage the well if the block comes in contact with the borehole wall, and a bailer or pump to remove materials drawn into the well. Continue the surging for a period of approximately one hour, or until little or no additional material from the foundation can be pulled through. Move the surge block by a steady motion up and down the full length of the open borehole wall. Prior to commencing surging, and periodically during

development by this method, remove all sand and other materials from the open borehole. Remove all materials pulled into the well by the surging process.

3.2.2.5 Well Development Criteria

Maintain a well development record in accordance with paragraph WELL DEVELOPMENT RECORDS. Development is complete when all of the following criteria are met:

a. Well water is clear to the unaided eye, and turbidity less than or equal to 5 Nephelometric Turbidity Units (NTUs),

b. Sediment thickness in the well is less than 1 percent of the open borehole length,

c. A minimum of three times the standing water volume in the well is removed plus three times the volume of all added water and drilling fluid lost during drilling and installation of the well is removed, and

d. Temperature, specific conductivity, pH, oxidation-reduction potential (ORP), dissolved oxygen (DO), and turbidity readings, measured before, twice during and after development operations, have stabilized. Stabilization is defined as variation of less than 0.2 pH units, variation of plus or minus $\pm$1 degree F, +3 percent change in specific conductance; and less than a $\pm$10mV for ORP; and $\pm$10 percent for DO, and turbidity, measured between three consecutive readings with one casing volume of water removed between each reading. Determine ORP in accordance with AWWA 10084. Conduct temperature, specific conductance, DO, turbidity, and pH readings in accordance with EPA 600/4-79/020. At completion of well development, collect approximately 1 pint of well water in a clear glass jar. Label the jar with project name, well number and date; and digital photograph. The photograph must be a suitably backlit close-up which shows the clarity of the water and any suspended sediment. The photograph and digital copy become a part of the well development record. Water removed during development and testing operations must be discharged to the ground surface at least 20 feet from the well in a down gradient area, without impacting other operations, facilities or structures.

3.2.3 Tests

After the wells have been developed, notify the Government and make the necessary arrangements for conducting the capacity tests. The well must be free of drawdown or surcharge effects caused by pumping tests, well development, or well drilling at another location during capacity testing and the recovery testing after completion of capacity testing. If the capacity test indicates that the required capacity can be obtained, perform the tests for quality of water. If the capacity and quality tests indicate that the required capacity and quality can be obtained, complete the permanent well, as specified, at that depth. Submit Test Reports within 24 hours following the conclusion of each test. Prior to making quality tests, clean drilling equipment, tools and pumps contacting well water with live steam.

3.2.3.1 Capacity Test

a. Provide an approved temporary test pump, with discharge piping of sufficient size and length to conduct the water being pumped to point of discharge, and equipment necessary for measuring the rate of flow and water level in the well.

b. Run a 24 hour constant-rate capacity test with the pumping rate and drawdown at the pump well and observation wells recorded every 1/2 minute during the first 5 minutes after starting the pump; then every 5 minutes for an hour; then every 20 minutes for 2 hours.

c. From this point on, readings taken at hourly intervals, until the water level stabilizes, are sufficient.

d. Begin the test at the rate of 25 gpm and at least that rate maintained throughout the duration of the test.

e. If this capacity cannot be maintained for the test period, terminate the capacity test and drill the test well deeper or relocate as directed.

f. When the pump is shut off, take water level readings during the rebound period for the same intervals of time as the drawdown test until static water level is reached.

g. Submit the record of the test.

3.2.3.2 Test for Plumbness and Alignment

Upon completion of the permanent well, test for plumbness and alignment by lowering into the well, to the total depth of the well, a plumb 40 feet long or a dummy of the same length. The outer diameter of the plumb must not be more than 1/2 inch smaller than the diameter of that part of the hole being tested. If a dummy is used, it must consist of a rigid spindle with three rings, each ring being 12 inches wide. Use cylindrical rings spaced one at each end of the dummy and one in the center. The central member of the dummy must be rigid so that it will maintain the alignment of the axis of the rings. Decontaminate the dummy as specified in paragraph DECONTAMINATION, before use. If the plumb or dummy fail to move freely throughout the length of the casing or well screen for the depth of well or should the well vary from the vertical in excess of two-thirds the inside diameter of that part of the well being tested for each 100 feet of depth, correct the plumbness and alignment of the well. If the faulty alignment and plumbness is not correctable, as determined by the Contracting Officer, abandon the well as specified in paragraph WELL DECOMMISSIONING OR ABANDONMENT and drill a new well at no additional cost to the Government.

3.2.3.3 Water Quality Test

When the capacity test in the test well has been completed, and again after the yield in the permanent well and drawdown test or capacity test have been completed, secure samples of the water in suitable containers, and of sufficient quantity, to have bacterial, physical, and chemical analyses made by a recognized testing laboratory, except that the bacterial analysis may be made by the applicable State Board of Health, if desired. Water Quality Analysis must address each item specified in the Water Quality Analysis Table at the end of this specification. Expenses

incident to these analyses are borne by the Contractor and the results of the analyses submitted to the Contracting Officer. Perform all sampling and analyses using EPA and State approved methods, procedures, and holding times.

3.2.3.4 Sand Test

As part of each capacity test, or at the end of each intermittent pumping, perform a determination of the amount of sand (foundation material) a well is producing. Remove all material from the bottom of the well to starting the sand test. Test the well by pumping at a rate of 25 gpm. After the pump is at the desired pumping rate, divert the flow from the discharge through a Rossum Sand Tester. Development of the well is satisfactory if the amount of sand collected is less than 1 pint per 25,000 gallons of water pumped at the specified rate. Upon completion of the test, determine the amount of sand in the bottom of the well to verify that no material is being deposited in the bottom of the well.

3.3 REQUIREMENTS AFTER TESTING

3.3.1 Installation of Permanent Pump

Install the permanent well pump in the well at a minimum depth of 25 feet below the maximum drawdown groundwater level after the drawdown test has been completed. Secure the pump at the required elevation as recommended by the pump manufacturer. After installation of the pumping units and appurtenances is complete, carry out operating tests to assure that the pumping installation operates properly. Tests must assure that the pumping units and appurtenances have been installed correctly, that there is no objectionable heating, vibration, or noise from any parts, and that all manual and automatic controls function properly.

3.3.2 Disinfecting

a. After completion of tests of well, or installation of permanent pump, or at time of tests for yield and drawdown test, whichever is later, disinfect the wells by adding chlorine, conforming to AWWA B301, or hypochlorite, conforming to AWWA B300, in sufficient quantity so that a concentration of at least 50 ppm of chlorine is obtained in all parts of the well.

b. Prepare chlorine solution and introduce into the well in an approved manner, and leave in the well for period of at least 12 hours but not more than 24 hours. Information on methods for preparing chlorine solution and introducing it into the well can be found in AWWA C654.

c. After the contact period, pump the well until the residual chlorine content is not greater than 1.0 ppm.

d. Pump the well to waste for an additional 15 minutes with less than 1 ppm chlorine residual, after which take two samples not less than 30 minutes apart and test for the presence of coliform bacteria.

e. Disinfect and re-disinfect the well as required until two consecutive samples are free from coliform bacteria.

3.3.3 Pumphouse and Slab

Provide a pumphouse and slab preventing the infiltration of surface water

or precipitation into the well. The slab must be 4 feet square by 6 inches thick and constructed of reinforced concrete. Extend the top of the outer casing 12 inches above the top of the slab. Construct the pumphouse on the slab and thermally insulate.

3.3.4 Site Clean-up

After completion of the work, remove tools, appliances, surplus materials, temporary drainage, rubbish, and debris incidental to work. Backfill and dress excavation and vehicular ruts to conform with the existing landscape. Repair or replace utilities, structures, roads, fences, or any other pre-existing item damaged due to the Contractor's negligence; this must be accomplished prior to completion of this contract.

3.3.5 Drilling Waste Disposal

Dispose of slurry, drill cuttings, rock core; other solid or liquid material bailed, pumped, or otherwise removed from the borehole during drilling, installation, completion, well development procedures and testing; and fluids from material and equipment decontamination activities by one week after final testing on the well.

3.3.6 Surveys

Establish coordinates and elevations for each well or test well. Determine horizontal coordinates to the closest 1.0 foot and referenced to the State Plane Coordinate System, or Universal Transverse Mercator (UTM). If the State Plane Coordinate System or UTM is not readily available, use an existing local grid system. Obtain a ground elevation to the closest 0.1 foot at each well. Use the highest point on the top of the riser pipe as a measurement point. The elevation of the well must reference this point, and be surveyed to the nearest 0.01 foot using the North American Vertical Datum of 1988. If the datum is not readily available, use the existing local vertical datum. Plot the location, identification, coordinates, and elevations of the well and monuments on maps with a scale large enough to show their location with reference to other structures.

3.4 FIELD QUALITY CONTROL

3.4.1 Well Decommissioning or Abandonment

a. Any well disapproved by the Contracting Officer, or any well decommissioned or abandoned by the Contractor for any reason must be decommissioned or abandoned according to the requirements of the State of Florida and the requirements of these specifications.

b. Well decommissioning or abandonment includes the removal of all materials left in the borehole or well, excluding the filter pack, and including backfill materials, casing, screen, and any other material placed into the hole before the decision was made to abandon the borehole or well.

c. Grout test wells decommissioned or abandoned for any reason from the bottom to within one foot feet of the top of the ground surface according to the protocol for grout or bentonite placement established in paragraph GROUT PLACEMENT, using the grout mix specified in paragraph CEMENT AND BENTONITE GROUT. Backfill the top one feet with material similar to the surrounding surface material.

d. Maintain a well decommissioning or abandonment record as specified herein.

e. If encountered before the decision is made for decommissioning or abandonment, measure groundwater levels in all borings prior to backfilling. Include these water levels in the well decommissioning or abandonment records.

f. No well may be decommissioned or abandoned without the approval of the Contracting Officer.

3.4.2 Documentation and Quality Control Reports

Establish and maintain documentation and quality control reports for well construction, development, and testing to record the desired information and to assure compliance with contract requirements, including, but not limited to, the following:

3.4.2.1 Borehole Logs

Complete a borehole log for each boring drilled. Borehole logs must be prepared by the geologist present onsite during all well drilling and installation activities. Use a log scale of 1 inch equals 10 feet. Keep copies of complete well logs current in the field at each well site and make available at all times for inspection by the Contracting Officer. As a minimum, provide the follow information on the logs:

a. Name of the project and site.

b. Boring or well identification number.

c. Location of boring (coordinates, if available).

d. Make and manufacturer's model designation of drilling equipment and name of drilling firm.

e. Date boring was drilled.

f. Reference data for all depth measurements.

g. Name of driller and name and signature of geologist preparing log.

h. Nominal hole diameter and depth at which hole diameter changes.

i. Total depth of boring.

j. Method of drilling, including sampling methods and sample depths, including those attempted with no recovery. Indication of penetration resistance such as drive hammer blows given in blows per 6 inches of driven sample tubes. Information must include hammer weight and drop distance. Record information such as rod size, bit type, and pump type. Include a description of any temporary casing used, drill fluids and fluid additives used, if any, including brand name and amount used, along with the reason for and start (by depth) of its use. If measured, record mud viscosities and weight.

k. Depth of each change of stratum. State if location of strata change is approximate.

l. Description of the material of which each stratum is composed, in accordance with ASTM D2488, or standard rock nomenclature in accordance with CED TR GL-85-3, as necessary. Soil parameters for logging must include, but not be limited to, classification, depositional environment and formation, if known, Unified Soil Classification Symbol, secondary components and estimated percentages, color, plasticity, consistency (cohesive soil), density (non-cohesive soil), moisture content, structure and orientation, and grain angularity. Rock core parameters for logging must include, but not be limited to, rock type, formation, modifier denoting variety (shaly, calcareous, siliceous, etc.), color, hardness, degree of cementation, texture, crystalline structure and orientation, degree of weathering, solution or void conditions, primary and secondary permeability, and lost core. Include the results of any chemical field screening on the boring log. Prepare classification in the field at the time of sampling. Also, duly note and record the results of visual observation of the material encountered, and any unusual odor detected.

m. Depth of any observed fractures, weathered zones, or any abnormalities encountered.

n. Depth and estimated percent of drill fluid loss or lost circulation. Measures taken to regain drill water circulation. Significant color changes in the drilling fluid return.

o. Box or sample number. Record depths and the number of the core boxes and samples at the proper interval.

p. Percent Rock Core Recovery. Show the percent core recovery for the individual drill runs, if rock is cored.

q. Submit five prints of the graphic boring log prepared to scale showing the required details, within 10 working days after completion of the test well. Use this drawing to aid in determining the well design.

3.4.2.2 Installation Diagrams

The well will not be accepted before the geologic logs and installation diagrams are received. Submit As-built installation diagram for each well installed, prepared by the geologist present during well installation operations, within 10 working days of the completion of the well installation procedure. The diagram must illustrate the as-built condition of the well and include, but not be limited to, the following items:

a. Name of the project and site.

b. Well identification number.

c. Name of driller and name and signature of the geologist preparing diagram.

d. Date of well installation.

e. Description of material from which the well is constructed, including well casing or riser pipe and screen material, centralizer composition, if used, diameter and schedule of casing and screen, gradation of filter pack, lithologic description, brand name (if any),

source, and processing method, grout type (cement or high-solids bentonite) and type of protective cover (protective casing or flush-to-ground),if used.

f. Total depth of well.

g. Nominal hole diameter.

h. Depth to top and bottom of well.

i. Depth to top and bottom of any seals installed in the well boring (grout or bentonite).

j. Type of cement and bentonite used, mix ratios of grout, method of placement and quantities used.

k. Elevations, depths, and heights of key features of the well, such as top of well casing or riser pipe, top and bottom of protective casing (if used), ground surface, the depth of maximum frost penetration (frost line), bottom of casing, and top and bottom of grout.

l. Other pertinent construction details.

m. Well location by coordinates. Include a plan sheet showing the coordinate system used and the location of each well. A plan sheet is not required for each well installation diagram; multiple wells may be shown on the same sheet.

n. Static water level upon completion of the well.

o. Special problems and their resolutions; e.g., grout in wells, lost casing, bridging, etc.

p. Description of surface completion.

3.4.2.3 Well Development Records

Prepare a well development record for each well, within 5 working days of the completion of development under the supervision of the geologist present during well installation operations. Include, as a minimum, the following information on the well development record:

a. Date, time, and elevation of water level in the well, before development.

b. Depth to bottom of well, name of project and site, well identification number, and date of development.

c. Method used for development, to include size, type and make of equipment, bailer, and pump used during development.

d. Time spent developing the well by each method, to include typical pumping rate, if pump is used in development.

e. Volume and physical character of water removed, to include changes during development in clarity, color, particulates, and odor.

f. Volume of water added to the well, if any.

g. Volume and physical character of sediment removed, to include changes during development in color, and odor.

h. Source of any water added to the well.

i. Clarity of water before, during, and after development. Nephelometric turbidity unit (NTU) measurements.

j. Total depth of well and the static water level from top of the casing, immediately after pumping or development, and 24 hours after development.

k. Readings of pH, specific conductance, DO, ORP, and temperature taken before, during, and after development.

l. Name and job title of individual developing well.

m. Name and description of the disposal facility or area, for the waters removed during development.

3.4.2.4 Well Decommissioning or Abandonment Records

As a minimum, include the following in the decommissioning or abandonment records:

a. Project name.

b. Well or test well number.

c. Well or boring location, depth and diameter.

d. Date of decommissioning or abandonment.

e. Method of decommissioning or abandonment.

f. All materials used in the decommissioning or abandonment procedure and the interval in which test materials were placed.

g. Casing, and or other items left in hole by depth, description, and composition.

h. Description and total quantity of grout used initially.

i. Description and daily quantities of grout used to compensate for settlement.

j. Water or mud level (specify) prior to grouting and date measured.

k. The reason for decommissioning or abandonment of the well or test well.

3.4.2.5 Tests

Prepare and submit a copy of all testing results from the well installation process. Include results of drawdown, well yield, sand, plumbness or alignment, etc. as well as any other test results in this submittal.

3.4.2.6 Project Photographs

Before, during, and after completion of work, take a minimum of one view of the well installation.

3.4.2.7 WATER QUALITY ANALYSIS

WATER QUALITY ANALYSIS TABLE	
Physical Characteristics	
_____	
Color	
Taste	
Threshold odor number	
Turbidity	
Resistivity in ohms per cubic centimeter and 25 degrees C	
pH value	
Temperature	

WATER QUALITY ANALYSIS TABLE	
Chemical Characteristics (Expressed as mg/L)	
_____	
Arsenic	
Barium	
Cadmium	
Chromium	
Copper	
Lead	
Mercury	
Selenium	
Silver	
Zinc	
Fluoride as F	
Manganese as Mn (dissolved and total)	
Iron as Fe (dissolved and total)	
Suspended Solids	

Total Dissolved Solids	
Calcium as Ca	
Magnesium as Mg	
Sodium and Potassium as Na	
Total Hardness as CaCO(3)	
Endrin	
Lindane	
Methoxychlor	
Toxaphene	
2-4-D	
2, 4, 5 TP Silvex	
Total Organic Halogens	
TOC	
Sulphates as SO(4)	
Chlorides as C1	
Bicarbonates as HCO(3)	
Carbonates as CO(3)	
Nitrates as NO(3)	
Alkalinity (methyl-orange)	
Phenolphthalein as CaCO(3)	
Silica as SiO(2)	
Carbonate Hardness	
Non-Carbonate Hardness	
H2S	
Total Ammonia	
Silt Density Index	
Langelier Saturation Index	

-- End of Section --

SECTION 33 16 15

WATER STORAGE STEEL TANKS
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 WATER WORKS ASSOCIATION (AWWA)

AWWA B300	(2010; Addenda 2011) Hypochlorites
AWWA B301	(2010) Liquid Chlorine
AWWA C104/A21.4	(2016) Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
AWWA C110/A21.10	(2012) Ductile-Iron and Gray-Iron Fittings for Water
AWWA C111/A21.11	(2017) 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 C150/A21.50	(2014) Thickness Design of Ductile-Iron Pipe
AWWA C151/A21.51	(2017) Ductile-Iron Pipe, Centrifugally Cast
AWWA C500	(2009) Metal-Seated Gate Valves for Water Supply Service
AWWA C508	(2017) Swing-Check Valves for Waterworks Service, 2 In. Through 48-In. (50-mm Through 1,200-mm) NPS
AWWA C600	(2017) Installation of Ductile-Iron Mains and Their Appurtenances
AWWA C652	(2011) Disinfection of Water-Storage Facilities
AWWA D100	(2011) Welded Steel Tanks for Water Storage
AWWA D102	(2017) Coating Steel Water-Storage Tanks

ASME INTERNATIONAL (ASME)

ASME B16.3	(2011) Malleable Iron Threaded Fittings,

	Classes 150 and 300
ASME B40.100	(2013) Pressure Gauges and Gauge Attachments

ASTM INTERNATIONAL (ASTM)

ASTM A197/A197M	(2000; R 2015) Standard Specification for Cupola Malleable Iron
ASTM A53/A53M	(2012) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-80	(2013) Bronze Gate, Globe, Angle and Check Valves

NSF INTERNATIONAL (NSF)

NSF/ANSI 61	(2017) Drinking Water System Components - Health Effects

SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC PS 4.04	(1982; E 2004) Four-Coat White or Colored Vinyl Painting System (For Fresh Water, Chemical, and Corrosive Atmospheres)
SSPC Paint 104	(1982; E 2004) White or Tinted Alkyd Paint
SSPC Paint 21	(1982; E 2004) White or Colored Silicone Alkyd Paint (Type I, High Gloss and Type II, Medium Gloss)
SSPC Paint 25	(1997; E 2004) Zinc Oxide, Alkyd, Linseed Oil Primer for Use Over Hand Cleaned Steel, Type I and Type II

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-PRF-23236	(2009; Rev D) Coating Systems for Ship Structures

U.S. FEDERAL AVIATION ADMINISTRATION (FAA)

FAA AC 150/5345-43	(2016; Rev H) Specification for Obstruction Lighting Equipment

1.2 SUBMITTALS

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

accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Tank Installation; G, DO

SD-03 Product Data

System Description

Foundations

Heating System; G, DO

Alarm System; G, DO

SD-06 Test Reports

Tank Installation

Testing of Valves and Piping

SD-07 Certificates

System Description

Foundations

1.3 DELIVERY, STORAGE, AND HANDLING

Deliver paint in unopened containers with unbroken seals and labels showing designated name, specification number, color, directions for use, manufacturer, and date of manufacture, legible and intact at time of use. Handle and store water storage tank systems, components, and parts to prevent distortions and other damage that could affect their structural, mechanical, or electrical integrity. Replace damaged items that cannot be restored to original condition. Store items subject to deterioration by exposure to elements, in a well-drained location, protected from weather, and accessible for inspection and handling.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

Submit certification by an independent third-party organization that all interior coating and materials that come in contact with the potable water comply with NSF/ANSI 61. Submit a certificate signed by a registered professional engineer, providing the following information:

a. Description of the structural design loading conditions used for the design of entire tank including the foundation.

b. Description of the structural design method and codes used in establishing the allowable stresses and safety factors applied in the design.

c. A statement verifying that the structural design has been checked by experienced engineers specializing in hydraulic structures.

d. A statement verifying that the detail drawings have been checked by experienced engineers specializing in hydraulic structures to determine that they agree with the design calculations in member sizes, dimensions, and fabricating process as prescribed by applicable ACI and AWWA standards.

2.1.1 UFC 3-600-01 Specific Requirements

On-site fire protection water storage must comply with NFPA 22, except where specifically modified by UFC 3-600-01. The discharge or suction line(s) from each individual tank or reservoir section must be sized to deliver the maximum required flow.

The total usable supply stored must be equal to 120% of the Facility's maximum required Fire Water Demand for the applicable duration specified in UFC 3-600-01. In calculating the fire protection water storage requirement, a reduction in storage capacity is acceptable if an adequate replenishment source is available. Factors that must be evaluated include the reliability of the makeup supply, its sustained flow capacity, its method of operation (automatic or manual), and flow limitations imposed by the capacity of treatment operations.

The water storage must be capable of being self-replenished to its required volume within 48 hours, during normal domestic and industrial consumption of the supplying utility.

The water level must be remotely monitored in accordance with NFPA 22 and NFPA 72 by the Installation Fire Alarm Reporting System.
In locales subject to freezing, water temperature of aboveground storage tanks must likewise be monitored by the Installation Fire Alarm Reporting System.

2.1.2 Design and Construction Standards

The design, fabrication, and erection of the tank shall be in accordance with the applicable requirements of AWWA D100 or AWWA D103. Submit Design Analyses and Calculations. Tank shall be designed for a peak wind speed as indicated on the structural drawings.

2.1.3 Welding

Qualification of welding procedures, welders, and welding operators shall be in accordance with Section 8.2 of AWWA D100.

2.1.4 Sizing and Design

Sizing and design oftank shall be in accordance with Section 4 of AWWA D100. Submit a certificate signed by a registered professional engineer providing: (1) description of the entire tank and foundation structural design loading conditions, (2) description of structural design methods and codes used in establishing allowable stresses and safety factors, (3) statement that the structural design has been checked by experienced engineers specializing in hydraulic structures to ensure that design calculations for member sizes, dimensions, and fabrication processes are as prescribed by ACI and AWWA standards, and (4) certification that the completed work was inspected in accordance with AWWA D100 or AWWA D103 as applicable.

2.1.5 Tank

The tank must have a net capacity of 40,000 gallons. The net capacity shall be the number of U.S. gallons between the inlet of the overflow and the level of the vortex plate in accordance with NFPA 22. The high-water level of tanks shall be at elevation 223.4' with the top of foundation approximately at elevation 201'. The range between high and low water levels will be approximately 1 foot. Existing grade at proposed location is approximately elevation 200.5'. The tanks shall have such standard shell height and such diameter as will meet the requirements for the selected standard capacity and for the high-water level specified above. The tanks may have supported cone roof, supported toriconical roof, self-supporting umbrella roof, self-supporting dome roof, ellipsoidal roof, or aluminum self-supporting dome roof, as approved. The tanks shall be of welded construction.

2.1.6 Sizing of Tanks

Section 6 of AWWA D100 or Section 4 of AWWA D103.

2.1.7 Coatings Certification

Coating materials for interior applications and all other materials which will be in normal contact with potable water shall conform to NSF/ANSI 61. Certification by an independent third-party organization that all interior coatings and materials, that come in contact with potable water, comply with NSF/ANSI 61 shall be provided.

2.2 MATERIALS

Provide materials conforming to the following requirements:

2.2.1 Steel

Section 2 of AWWA D100 or Section 2 of AWWA D103.

2.2.2 Shop Fabrication

Section 9 of AWWA D100 or Section 7 of AWWA D103.

2.2.3 Ductile-Iron Pipe

Pipe for fluid conductors, except for overflow pipe, shall be ductile-iron pipe and shall be either of the following:

2.2.3.1 Bell-and-Plain End Pipe

AWWA C150/A21.50 and AWWA C151/A21.51, for not less than 150 psi working pressure, unless otherwise shown or specified. Joints shall be push-on or mechanical-joint conforming to AWWA C111/A21.11. Pipe shall be cement mortar lined in accordance with AWWA C104/A21.4. Linings shall be standard thickness.

2.2.3.2 Flanged Pipe

Flanged pipes shall conform to the applicable portions of AWWA C110/A21.10, AWWA C115/A21.15 and AWWA C151/A21.51, for not less than 150 psi working pressure, unless otherwise shown or specified. Pipe shall have flanged

ends in accordance with AWWA C115/A21.15. Pipe shall be cement mortar lined in accordance with AWWA C104/A21.4. Linings shall be standard thickness.

2.2.4 Specials and Fittings (except for overflow pipe)

2.2.4.1 Ductile-Iron with Bell-and-Plain End

AWWA C110/A21.10 and AWWA C151/A21.51 for not less than 150 psi working pressure, unless otherwise shown or specified. Specials and fittings shall be cement mortar lined in accordance with AWWA C104/A21.4. Linings shall be standard thickness.

2.2.4.2 Ductile-Iron with Flanged Ends

AWWA C110/A21.10 and AWWA C151/A21.51 for not less than 150 psi working pressure unless otherwise shown or specified. Fittings shall have flanged ends in accordance with AWWA C110/A21.10. Specials and fittings shall be cement mortar lined in accordance with AWWA C104/A21.4. Linings shall be standard thickness.

2.2.4.3 Fittings for Screw-Joint Pipe

Malleable-iron, galvanized, 150 psi, ASTM A197/A197M, threaded ends, ASME B16.3.

2.2.4.4 Joints Inside Valve Chamber

All joints inside the valve chamber shall be flanged.

2.2.5 Valves

2.2.5.1 Gate Valves

Gate valves shall be opened by turning counterclockwise. Valves 3 inches and larger shall be iron body, brass mounted, conforming to AWWA C500. Valves smaller than 3 inches shall be all bronze and shall conform to MSS SP-80, Type 1, class 150. Valves 3 inches or larger located in valve chambers shall be equipped with hand-operating wheels and shall be flanged.

2.2.5.2 Check Valves

Check valves shall be of the horizontal swing-check type, suitable for the purpose and the operating conditions. The body shall be iron and shall have a removable gate assembly and a cover removable for inspection. The gate, gate seat, shaft, gate studs, and nuts shall be bronze or other suitable alloy. Valves shall conform to AWWA C508.

2.2.5.3 Altitude Valve

The supply to the tanks shall be controlled by a 3 inch combination altitude and backpressure valve set at 50 psi on the upstream side of the valve, automatic in operation and accurately set to prevent overflow of the tanks. The valve shall have flanged ends and a heavy cast iron body, shall be bronze fitted with renewable cups and seats, and shall be designed without metal-to-metal seats. The valve shall be cushioned when opening and closing to prevent water hammer or shock. Valves shall be provided with a travel indicator.

2.2.6 Pressure Gauge

Pressure gauge of the direct-reading type, equipped with a shutoff cock, shall be provided, in the valve chamber, on the tank side and on the discharge side of the check or altitude valve. Gauges shall have 6 inch dials, shall be stem mounted, and shall conform to ASME B40.100. Accuracy of gauges shall be Grade A or better. Gauges shall be calibrated in psi in not more than 2 psi increments from 0 to 50 psi in excess of the normal operating pressure at the tank.

2.3 ASSEMBLIES

2.3.1 Tank Accessories

Section 7 of AWWA D100 or Section 5 of AWWA D103 and as specified. Additional requirements for accessories are as follows:

2.3.1.1 Manholes and Pipe Connections

Section 7 of AWWA D100 and Section 5 of AWWA D103 represent the minimum requirements. Number, type, location, and size of manholes and pipe connections shall be as shown on the drawings. Inlet pipe connections to extend at least 12 inches above tank bottom and shall be provided with deflectors as shown on the drawings. Outlet pipe connections to extend at least 12 inches above tank bottom and shall be provided with vortex breakers as shown on the drawings.

2.3.1.2 Overflow

The overflow for the tank shall consist of an overflow weir and outside drop pipe, adequately supported and capable of discharging at a rate of 25 gpm with 4 inches of head, without the water level exceeding the tangent line of the top of the shell. The top of the weir shall be located as indicated. The overflow pipe shall be steel, ASTM A53/A53M or equal, and shall terminate 1 to 2 feet above grade and shall be fitted with a flapper valve or screen to prevent ingress of animals and insects.

2.3.1.3 Vent

Vent shall be welded to the cover plate of the center manhole on the roof. Vent will be tank manufacturer's standard type mushroom vent with aluminum bird screen. The free area of the vent shall be sized 50 percent in excess of the pump-in rate and pump-out rate. Screening for vent shall conform to Section 5.7.2 of AWWA D100 or Section 5.7.2 of AWWA D103which ensures fail-safe operation in the event that screen frosts over and the bottom of the screen shall be sufficiently elevated for snow consideration in the area.

2.3.1.4 Ladders and Safety Devices

Ladders and safety devices shall be provided in accordance with Sections 7.4 and 7.5 of AWWA D100 or Sections 5.4 and 5.5 of AWWA D103. Location of ladders shall be as shown on the drawings. Sections 7.4 and 7.5 of AWWA D100 and Sections 5.4 and 5.5 of AWWA D103 represent the minimum requirement. In addition, safety cage, rest platforms, roof ladder handrails, and other safety devices shall be provided as required by federal or local laws or regulations.

2.3.1.5 Scaffold Cable Support

Provision shall be made for the attachment of a scaffold cable support at the top of the roof on welded tanks.

2.3.1.6 Coating for Welded Tanks

Provide interior and exterior coating systems conforming to AWWA D102.

2.3.2 Valve Chamber

Valve chamber shall be sufficiently large to house all control valves and fittings. Pipes, valves, and fittings shall be supported on concrete blocks where necessary. The valve chamber shall be constructed to provide not less than 3 feet of cover over the pipes. The valves and fittings shall extend from the tanks connection to a point one length of pipe outside the valve chamber walls on the main or feed line to the tanks; the drain line will be carried to an outlet as indicated on the drawings. The access manhole shall be not less than 30 inches in diameter.

2.3.3 Anchors for Tanks

The following requirements shall be met:

a. An adequate number of anchors designed to prevent overturning of the tanks when empty shall be installed. If anchor bolts are used, the nominal diameter shall not be less than one inch, plus a corrosion allowance of at least 1/4 inch on the diameter. If anchor straps are used, they shall be pre-tensioned before welding to the tank shell.

b. The anchor bolts shall be a right angle bend, hook, or plate washer, while anchor straps shall have only a plate welded to the bottom. The anchors shall be inserted into the foundation to resist the computed uplift.

c. Attachment of anchors to the shell shall not add significant localized stresses to the shell. The method of attachment shall consider the effects of deflection and rotation of the tank shell. Anchors shall not be attached to the tank bottom. Attachment of the anchor bolts to the shell shall be through stiffened chair-type assemblies or anchor rings of adequate size and height.

2.3.4 High and Low Water Level Alarm System

Provide high and low level devices for alarm monitoring and an intermediate device for tank water level status. All three water levels must be indicated by their respective pilot lights; green for high, amber for intermediate and red for low water levels, and a buzzer for low and high water levels. Buzzer and the respective pilot lights at high and low water levels must be energized while the high or low water level pilot device is actuated. Depressing a silencing button must silence the buzzer indicating the water level and must remain in OFF condition. The pilot light must remain energized. Resetting the pilot light must de-energize the pilot light and release the buzzer from its sealed-off condition.

2.3.5 Heating System

Provide tank heating to comply with NFPA 22 and with capacity to maintain 42 degrees F at all times including coldest temperatures and lowest

consumption.

2.4 CONCRETE WORK

Concrete work shall conform to Section 03 30 00 CAST-IN-PLACE CONCRETE.

2.5 CHLORINE

AWWA B300 for hypochlorites or AWWA B301 for liquid chlorine, mixed with water to give the solutions required in AWWA C652.

PART 3 EXECUTION

3.1 FOUNDATIONS

Foundations for the tanks and for the valve chamber shall be constructed of concrete, reinforced where necessary, and designed in accordance with Section 12 of AWWA D100 or Sections 11 and 8.5 of AWWA D103 for earth with a bearing value of 1500 psf, at a finished floor elevation of 200.5, and constructed in conformance with the applicable requirements of Section 03 30 00 CAST-IN-PLACE CONCRETE, except as shown or specified herein. An AWWA D100 Type 1 or an AWWA D103 Type 1 or Type 2 foundation shall be provided for the tanks. Factor of safety on overturning of tanks under design wind load shall be 1.33 minimum. When a footing is required, an inverted truncated pyramid of earth with 2 on 1 side slopes above top of footing may be used in determining overturning stability.

3.2 EXCAVATING, FILLING, AND GRADING

Excavating, filling, and grading shall conform to the applicable requirements of Section 31 00 00 EARTHWORK.

3.3 CATHODIC PROTECTION

Cathodic protection shall be provided, conforming to Section 26 42 15.00 10 CATHODIC PROTECTION SYSTEM (STEEL WATER TANKS).

3.4 OBSTRUCTION LIGHTING

Obstruction lighting shall be provided and installed as shown, and shall conform to Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM or FAA AC 150/5345-43.

3.5 TANK INSTALLATION

Submit detail and erection drawings, before proceeding with any fabrication. Complete drawings with details of steel, pipe, and concrete work, and of the assembling of items required for the total installation. Use standard welding symbols as recommended by the American Welding Society. Details of welded joints referenced on the drawings shall be included. Tank installation shall be in accordance with the following requirements:

3.5.1 Welding

Section 8 of AWWA D100 or Section 6 of AWWA D103.

3.5.2 Erection

Section 10 of AWWA D100 or Section 8 of AWWA D103.

3.5.3 Inspections and Testing

Tank inspection and testing shall be in accordance with Section 11 of AWWA D100 or Section 9 of AWWA D103. Mill and shop inspections are required and shall be performed by an approved commercial inspection agency. Perform the radiographic inspections of the welded tank shell, the hydrostatic test and the vacuum box leak test of the tank bottom. Final hydrostatic and leak tests shall be performed before painting of welded tanks.

3.6 PIPING INSTALLATION (EXCEPT FOR OVERFLOW PIPING)

3.6.1 General Guidelines

Where details of fabrication or installation are not shown on the drawings, installation shall conform to Section 1 and 3 of AWWA C600.

3.6.2 Testing of Valves and Piping

After the tanks has been erected and the valves and piping installed, and before field painting is begun, the valves and piping shall be hydrostatically tested in accordance with Section 4 of AWWA C600. Submit each coating manufacturer's technical data, application instructions, Safety Data Sheets (SDS), and certificate for compliance for VOC content. Submit copies of the following test results:

a. Manufacturer's mill test reports for plate material.

b. Mill and shop inspections by a commercial inspection agency.

c. After acceptance of the structure, the radiographic film and test segments.

d. At the conclusion of the work, a written report covering the hydrostatic test and certifying that the work was inspected in accordance with Section 11.2.1 of AWWA D100.

Replace with sound material any defective material disclosed by the pressure test; the test shall be repeated until the test results are satisfactory.

3.6.3 Underground Ductile-Iron Piping

For ductile iron piping, Fusion Bonded Epoxy (FBE) or 3-Layer Polyethylene (3LPE) is recommended to be used in conjunction with cathodic protection. These coatings should be mill or plant applied, not field applied. Typically around 7mil thickness. NO baggie type wraps are to be used; they can disbond and lead to corrosion due to water ingress and CP shielding. For irregular surfaces, only wraps of profiling mastic type or petrolatum wax tape wrap type should be used. Wrap type systems should only be primarily used for mechanical joints with uncoated bolts and any other uncoated surfaces like service saddles, valve bonnet bolts, etc.".

3.6.4 Plugging Ends

Cap or plug pipe ends left for future connections as directed.

3.7 PAINTING AND COATING OF TANK

Each coating manufacturer's technical data, application instructions, SDS, and certificate for compliance for VOC content must be submitted to the Contracting Officer. Application, curing time, mixing and thinning of the coating materials must be in strict accordance with the manufacturers instructions. The use of thinners must not alter the required minimum dry thickness or adversely affect the VOC content.

3.7.1 Exterior Surfaces (Welded Tanks)

A prime coat, minimum of 2.0 mil thick followed by two coats of alkyd enamel, each a minimum of 1.5 mil thick shall be applied. The prime coat shall be rust inhibitive red iron oxide, zinc oxide, oil and alkyd primer without lead or chromate pigments, in accordance with SSPC Paint 25. The finish coats shall be an alkyd enamel in accordance with Type I of SSPC Paint 104 or gloss alkyd enamel in accordance with SSPC Paint 21. Submit paint color to COR for approval.

3.7.2 Interior Surfaces (Welded Tanks)

A prime coat at least 3.0 mil thick and a final coat at least 5.0 mil thick shall be applied. Each coat shall be a two-component catalyzed epoxy in accordance with MIL-PRF-23236. The primer shall contrast with the color of the finish coat. Four coats, each at least 1.5 mil thick, of VR-3 vinyl resin paint in accordance with SSPC PS 4.04 shall be applied. The second, third, and fourth coats shall be of contrasting colors. Submit paint color to COR for approval.

3.8 DISINFECTION

The tanks and connecting lines thereto shall be disinfected with chlorine before being placed in operation.

3.8.1 Tank

The tanks shall be disinfected in accordance with AWWA C652. After the chlorination procedure is completed and before the storage facility is placed in service, the Contracting Officer will collect samples of water in properly sterilized containers for bacteriological testing from the full facility in accordance with Section 7 of AWWA C652. The tank will not be accepted until satisfactory bacteriological results have been obtained. After coating system has been inspected, approved, and cured, rinse tank with potable water. Disinfect tank and connecting lines in accordance with AWWA C652, Method 1, Method 2, or Method 3.

3.8.2 Piping

The valves and piping shall be disinfected in accordance with Section 33 11 00 WATER UTILITY DISTRIBUTION PIPING.

3.9 INSPECTION AND REPAIR

Prior to tank repair job, perform a detailed inspection of the structure and submit report by a certified inspector.

-- End of Section --

SECTION 33 30 00

SANITARY SEWERAGE
05/18

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C105/A21.5	(2010) Polyethylene Encasement for Ductile-Iron Pipe Systems
AWWA C111/A21.11	(2017) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C600	(2017) Installation of Ductile-Iron Mains and Their Appurtenances

ASTM INTERNATIONAL (ASTM)

ASTM A123/A123M	(2017) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A48/A48M	(2003; R 2012) Standard Specification for Gray Iron Castings
ASTM A536	(1984; R 2014) Standard Specification for Ductile Iron Castings
ASTM C1227	(2013) Standard Specification for Precast Concrete Septic Tanks
ASTM C1244	(2011; R 2017) Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test Prior to Backfill
ASTM C150/C150M	(2018) Standard Specification for Portland Cement
ASTM C1644	(2006; R 2017) Standard Specification for Resilient Connectors Between Reinforced Concrete On-Site Wastewater Tanks and Pipes
ASTM C270	(2014a) Standard Specification for Mortar for Unit Masonry
ASTM C443	(2012; R 2017) Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets

ASTM C478	(2018) Standard Specification for Circular Precast Reinforced Concrete Manhole Sections
ASTM C478M	(2018) Standard Specification for Precast Reinforced Concrete Manhole Sections (Metric)
ASTM C94/C94M	(2017a) Standard Specification for Ready-Mixed Concrete
ASTM C972	(2000; R 2011) Compression-Recovery of Tape Sealant
ASTM C990	(2009; R 2014) Standard Specification for Joints for Concrete Pipe, Manholes and Precast Box Sections Using Preformed Flexible Joint Sealants
ASTM D2321	(2018) Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
ASTM D2412	(2011) Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading
ASTM D3034	(2016) Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
ASTM D3212	(2007; R 2013) Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM D4101	(2017) Standard Classification System and Basis for Specification for Polypropylene Injection and Extrusion Materials
ASTM D412	(2016) Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension
ASTM D624	(2000; R 2012) Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers
ASTM F477	(2014) Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
ASTM F667/F667M	(2016) Standard Specification for 3 through 24 in. Corrugated Polyethylene Pipe and Fittings
ASTM F758	(2014) Smooth-Wall Poly(Vinyl Chloride) (PVC) Plastic Underdrain Systems for Highway, Airport, and Similar Drainage

ASTM F794	(2003; R 2014) Standard Specification for Poly(Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter
ASTM F949	(2015) Poly(Vinyl Chloride) (PVC) Corrugated Sewer Pipe with a Smooth Interior and Fittings

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

29 CFR 1910.27	Scaffolds and Roope Descent Systems

UNI-BELL PVC PIPE ASSOCIATION (UBPPA)

UBPPA UNI-B-6	(1998) Recommended Practice for Low-Pressure Air Testing of Installed Sewer Pipe

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

Contractor's License; G, RO

SD-02 Shop Drawings

Installation Drawings; G, DO

SD-03 Product Data

Precast Concrete Manholes

Frames, Covers, and Gratings

Gravity Pipe

Precast Concrete Septic Tanks; G,DO

SD-06 Test Reports

Precast Concrete Sewer Manhole Test; G, DO

Negative Air Pressure Test; G, DO

Low-Pressure Air Tests; G, DO

Deflection Testing

SD-07 Certificates

Portland Cement

1.3 QUALITY CONTROL

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. Verify installing Contractor's License is current and state certified or state registered.

1.4 DELIVERY, STORAGE, AND HANDLING

1.4.1 Delivery and Storage

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.

1.4.1.1 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 Cement, Aggregate, and Reinforcement

As specified in Section 03 30 00 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. Store solvents, solvent compounds, lubricants, elastomeric gaskets, and any similar materials required to install the plastic pipe in accordance with the manufacturer's recommendation and discard those materials if the storage period exceeds the recommended shelf life. Discard solvents in use when the recommended pot life is exceeded.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

2.1.1 Sanitary Sewer Gravity Pipeline and Drainage Field Dosing Chamber

Provide mains and laterals of no less than 4 inch lines of ductile-iron pipe or polyvinyl chloride (PVC) plastic pipe. Provide building connections 4 inch lines of polyvinyl chloride (PVC) plastic pipe. Provide new and modify existing exterior sanitary gravity sewer piping and appurtenances. Provide each system complete and ready for operation. The exterior sanitary gravity sewer system includes equipment, materials, installation, and workmanship as specified herein more than 5 feet outside of building walls.

2.1.2 Sanitary Sewer Pressure Lines

Provide pressure lines of polyvinyl chloride (PVC) plastic pressure pipe.

2.2 MATERIALS

Provide materials conforming to the respective specifications and other requirements specified below. Submit manufacturer's product specification,standard drawings or catalog cuts.

2.2.1 Gravity Pipe

2.2.1.1 PVC Gravity Sewer Piping

2.2.1.1.1 PVC Gravity Pipe and Fittings

ASTM D3034, SDR 35, or ASTM F949 with ends suitable for elastomeric gasket joints. ASTM F794, Series 46, for ribbed sewer pipe with smooth interior, size 8 inch through 48 inch diameters.

2.2.1.1.2 PVC Gravity Joints and Jointing Material

Provide joints conforming to ASTM D3212. Gaskets are to conform to ASTM F477.

2.2.2 Cement Mortar

Provide cement mortar conforming to ASTM C270, Type M with Type II cement.

2.2.3 Portland Cement

Submit certificates of compliance stating the type of cement used in manufacture of concrete pipe, fittings, septic tanks, and precast manholes. Provide portland cement conforming to ASTM C150/C150M, Type V for concrete used in concrete pipe, concrete pipe fittings, septic tanks, and manholes and type optional for cement used in concrete cradle, concrete encasement, and thrust blocking.

2.2.4 Portland Cement Concrete

Provide portland cement concrete conforming to ASTM C94/C94M, 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 is to have a compressive strength of 2500 psi minimum at 28 days. Protect concrete in place from freezing and moisture loss for 7 days.

2.2.5 Precast Concrete Manholes

Provide precast concrete manholes, risers, base sections, and tops conforming to ASTM C478.

2.2.6 Gaskets and Connectors

Provide gaskets for joints between manhole and wastewater tanks sections conforming to ASTM C443. Resilient connectors for making joints between manhole and wastewater tanks and pipes entering manhole are to conform to ASTM C1644 or ASTM C990.

2.2.7 External Preformed Rubber Joint Seals

An external preformed rubber joint seal is an accepted method of sealing cast iron covers to precast concrete sections to prevent ground water infiltration into sewer systems. All finished and sealed manholes constructed in accordance with paragraph entitled "Manhole Construction" are to be tested for leakage in the same manner as pipelines as described in paragraph entitled "Leakage Tests." The seal is to be multi-section with a neoprene rubber top section and all lower sections made of Ethylene Propylene Diene Monomer (EPDM) rubber with a minimum thickness of 60 mils. Each unit is to consist of a top and bottom section and have mastic on the bottom of the bottom section and mastic on the top and bottom of the top section. The mastic is to be a non-hardening butyl rubber sealant and seal to the cone/top slab of the manhole/catch basin and over the lip of the casting. Extension sections are to cover up to two more adjusting rings. Properties and values are listed in the following table:

Properties, Test Methods and Minimum Values for Rubber used in Preformed Joint Seals

Physical Properties	Test Methods	EPDM	Neoprene	Butyl Mastic
Tensile, psi	ASTM D412	1840	2195	--
Elongation, percent	ASTM D412	553	295	350
Tear Resistance, ppi	ASTM D624 (Die B)	280	160	--
Rebound, percent, 5 minutes	ASTM C972 (mod.)	--	--	11
Rebound, percent, 2 hours	ASTM C972	--	--	12

2.2.8 Precast Concrete Septic Tanks

Provide precast concrete septic tanks risers, base sections, and tops conforming to ASTM C1227 and as approved by the State of Florida Department of Health or other official agencies regarding state approved precast septic tanks; base and first riser are to be monolithic.

2.2.9 Septic Tank Piping

PVC pipe and fittings. Provide NSF/ANSI 46 certified effluent filter on the outlet pipe.

2.2.10 Siphon for Septic Tank

PVC or Polyethylene,of an approved standard design, and prompt and positive in action.

2.2.11 Sewage Absorption Field Materials

Pipe is to be perforated corrugated polyethylene tubing conforming to

ASTM F667/F667M or perforated PVC pipe conforming to ASTM F758. 2.2.12 Frames, Covers, and Gratings for Manholes

Submit certification on the ability of frame and cover to carry the imposed live load. Frame and cover are to be cast gray iron, ASTM A48/A48M, Class 35B, cast ductile iron, ASTM A536, Grade 65-45-12, or reinforced concrete, ASTM C478 ASTM C478M. Frames and covers are to be circular without vent holes. Size are to be as indicated on the plans. Stamp or cast the words "Sanitary Sewer" into covers so that it is plainly visible.

2.2.13 Manhole Steps

Zinc-coated steel conforming to 29 CFR 1910.27. As an option, plastic or rubber coating pressure-molded to the steel may be used. Provide plastic coating conforming to ASTM D4101, copolymer polypropylene. Rubber is to conform to ASTM C443, except shore A durometer hardness is to be 70 plus or minus 5. Aluminum steps or rungs will not be permitted. Steps are not required in manholes less than 4 feet deep.

2.2.14 Manhole Ladders

Provide a steel ladder where the depth of a manhole exceeds 12 feet. The ladder is not to be less than 16 inches in width, with 3/4 inch diameter rungs spaced 12 inches apart. The two stringers are to be a minimum 3/8 inch thick and 2 inches wide. Galvanize ladders and inserts after fabrication in conformance with ASTM A123/A123M.

PART 3 EXECUTION

3.1 PREPARATION

3.1.1 Installation Drawings

Submit Installation Drawings showing complete detail, both plan and side view details with proper layout and elevations.

3.2 INSTALLATION

Backfill after inspection by the Contracting Officer. Before, during, and after installation, protect plastic pipe and fittings from any environment that would result in damage or deterioration to the material. Keep a copy of the manufacturer's instructions available at the construction site at all times and follow these instructions unless directed otherwise by the Contracting Officer.

3.2.1 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.

3.2.2 General Requirements for Installation of Pipelines

These general requirements apply except where specific exception is made in the following paragraphs entitled "Special Requirements."

3.2.2.1 Location

Terminate the work covered by this section at a point approximately 5 feet

from the building, unless otherwise indicated. Install pressure sewer lines beneath water lines only, with the top of the sewer line being at least 2 feet below bottom of water line. When these separation distances can not be met, contact the Contracting Officer for direction.

3.2.2.1.1 Sanitary Sewer Manholes

No water piping shall pass through or come in contact with any part of a sanitary sewer manhole.

3.2.2.2 Earthwork

Perform earthwork operations in accordance with Section 31 00 00 EARTHWORK.

3.2.2.3 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 or groove ends in the upgrade direction. Adjust spigots in bells and tongues in grooves to give a uniform space all around. Blocking or wedging between bells and spigots or tongues and grooves 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. Construct branch connections by use of regular fittings or solvent cemented saddles as approved. Provide saddles for PVC pipe conforming to Table 4 of ASTM D3034.

3.2.3 Special Requirements

3.2.3.1 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.

3.2.3.2 Installation of PVC 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 D2321 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 D2321 for assembly of joints. Make joints to other pipe materials in accordance with the recommendations of the plastic pipe manufacturer.

3.2.4 Concrete Work

Cast-in-place concrete is included in Section 03 30 00 CAST-IN-PLACE CONCRETE. Support the pipe on a concrete cradle, or encased in concrete where indicated or directed.

3.2.5 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. Perform cast-in-place concrete work 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.

3.2.6 Miscellaneous Construction and Installation

3.2.7 Sewage Absorption Trench Construction

Grade trenches uniformly with no slope. 3.2.8 Installations of Wye Branches

Install wye branches in an existing sewer using a method which does not damage the integrity of the existing sewer. Do not cutinto piping for connections except when approved by the Contracting Officer. When the connecting pipe cannot be adequately supported on undisturbed earth or tamped backfill, support on a concrete cradle as directed by the Contracting Officer. Provide and install concrete required because of conditions resulting from faulty construction methods or negligence without any additional cost to the Government. Do not damage the existing sewer when installing wye branches in an existing sewer.

3.3 FIELD QUALITY CONTROL

The Contracting Officer will conduct field inspections and witness field tests specified in this section. Be able to produce evidence, when required, that each item of work has been constructed in accordance with the drawings and specifications.

3.3.1 Tests

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

3.3.1.1 Leakage Tests for Nonpressure Lines

Test lines for leakage by either negative air pressure tests or by low-pressure air tests. 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.

3.3.1.1.1 Negative Air Pressure Test

3.3.1.1.1.1 Precast Concrete Manholes

Test precast concrete sewer manhole test in accordance with ASTM C1244. The allowable vacuum drop is located in ASTM C1244 Make calculations in accordance with the Appendix to ASTM C1244.

3.3.1.1.2 Low-Pressure Air Tests

3.3.1.1.2.1 PVC Pipelines

Test PVC pipe in accordance with UBPPA UNI-B-6. The allowable pressure drop is located in UBPPA UNI-B-6. Make calculations in accordance with the Appendix to UBPPA UNI-B-6.

3.3.1.2 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 D2412. Deflection of pipe in the installed pipeline under external loads is not to 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.

3.3.1.2.1 Pull-Through Device

This device is to be a spherical, spheroidal, or elliptical ball, a cylinder, or circular sections fused to a common shaft. Space circular sections on the shaft so that the distance from external faces of front and back sections will equal or exceed the 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 are to conform to the following:

a. 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.

b. Homogeneous material throughout, is to have a density greater than 1.0

as related to water at 39.2 degrees F, and a surface Brinell hardness of not less than 150.

c. 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.

d. Suitably Back each eye or loop with a flange or heavy washer such that a pull exerted on opposite end of shaft will produce compression throughout remote end.

3.3.1.2.2 Deflection Measuring Device

Sensitive to 1.0 percent of the diameter of the pipe being tested and be accurate to 1.0 percent of the indicated dimension. Prior approval is required for the deflection measuring device.

3.3.1.2.3 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.

3.3.1.2.4 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.

3.3.2 Field Tests for Cast-In-Place Concrete

Field testing requirements are covered in Section 03 30 00 CAST-IN-PLACE CONCRETE

3.3.3 Inspection

Check each straight run of pipeline for gross deficiencies by holding a light in a manhole; the light must show a practically full circle of light through the pipeline when viewed from the adjoining end of line.

-- End of Section --

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SECTION 33 40 00

STORM DRAINAGE UTILITIES
02/10

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 RAILWAY ENGINEERING AND MAINTENANCE-OF-WAY ASSOCIATION (AREMA)

AREMA Eng Man	(2017) Manual for Railway Engineering

ASTM INTERNATIONAL (ASTM)

ASTM A929/A929M	(2018) Standard Specification for Steel Sheet, Metallic-Coated by the Hot-Dip Process for Corrugated Steel Pipe
ASTM C14	(2015) Standard Specification for Concrete Sewer, Storm Drain, and Culvert Pipe
ASTM C32	(2013; R 2017) Standard Specification for Sewer and Manhole Brick (Made from Clay or Shale)
ASTM C55	(2017) Standard Specification for Concrete Building Brick
ASTM C62	(2017) Standard Specification for Building Brick (Solid Masonry Units Made from Clay or Shale)
ASTM C76	(2019) Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
ASTM C139	(2017) Standard Specification for Concrete Masonry Units for Construction of Catch Basins and Manholes
ASTM C231/C231M	(2017a) Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C270	(2019) Standard Specification for Mortar for Unit Masonry
ASTM C425	(2004; R 2013) Standard Specification for Compression Joints for Vitrified Clay Pipe and Fittings

ASTM C443	(2012; R 2017) Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
ASTM C444	(2017) Standard Specification for Perforated Concrete Pipe
ASTM C877	(2008) External Sealing Bands for Concrete Pipe, Manholes, and Precast Box Sections
ASTM C923	(2008; R 2013; E 2016) Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals
ASTM C990	(2009; R 2014) Standard Specification for Joints for Concrete Pipe, Manholes and Precast Box Sections Using Preformed Flexible Joint Sealants
ASTM D1056	(2014) Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber
ASTM D1171	(2016; E 2016) Standard Test Method for Rubber Deterioration - Surface Ozone Cracking Outdoors (Triangular Specimens)
ASTM D1557	(2012; E 2015) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3) (2700 kN-m/m3)
ASTM D1751	(2004; E 2013; R 2013) Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
ASTM D1752	(2018) Standard Specification for Preformed Sponge Rubber, Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction
ASTM D2167	(2015) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D6938	(2017a) Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. . When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submittals with an "S" are for inclusion in the Sustainability eNotebook,

in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-04 Samples

Pipe for Culverts and Storm Drains

SD-07 Certificates

Oil Resistant Gasket
Determination of Density

Post-Installation Inspection Report

SD-08 Manufacturer's Instructions

Placing Pipe

1.3 DELIVERY, STORAGE, AND HANDLING

1.3.1 Delivery and Storage

Materials delivered to site shall be inspected for damage, unloaded, and stored with a minimum of handling. Materials shall not be stored directly on the ground. The inside of pipes and fittings shall be kept free of dirt and debris. Before, during, and after installation, plastic pipe and fittings shall be protected from any environment that would result in damage or deterioration to the material. Keep a copy of the manufacturer's instructions available at the construction site at all times and follow these instructions unless directed otherwise by the Contracting Officer. Solvents, solvent compounds, lubricants, elastomeric gaskets, and any similar materials required to install plastic pipe shall be stored in accordance with the manufacturer's recommendations and shall be discarded if the storage period exceeds the recommended shelf life. Solvents in use shall be discarded when the recommended pot life is exceeded.

1.3.2 Handling

Materials shall be handled in a manner that ensures delivery to the trench in sound, undamaged condition. Pipe shall be carried to the trench, not dragged.

PART 2 PRODUCTS

2.1 PIPE FOR CULVERTS AND STORM DRAINS

Pipe for culverts and storm drains shall be of the sizes indicated and shall conform to the requirements specified.

2.1.1 Concrete Pipe

Manufactured in accordance with and conforming to ASTM C76, Class III .

2.2 PERFORATED PIPING

2.2.1 Concrete Pipe

Manufactured in accordance with and conforming to ASTM C444, and applicable requirements of ASTM C14, Class III.

2.3 DRAINAGE STRUCTURES

2.3.1 Flared End Sections

Sections shall be of a standard design fabricated from zinc coated steel sheets meeting requirements of ASTM A929/A929M.

2.4 MISCELLANEOUS MATERIALS

2.4.1 Concrete

Unless otherwise specified, concrete and reinforced concrete shall conform to the requirements for 4000 psi concrete under Section 03 30 00 CAST-IN-PLACE CONCRETE. The concrete mixture shall have air content by volume of concrete, based on measurements made immediately after discharge from the mixer, of 5 to 7 percent when maximum size of coarse aggregate exceeds 1-1/2 inches. Air content shall be determined in accordance with ASTM C231/C231M. The concrete covering over steel reinforcing shall not be less than 1 inch thick for covers and not less than 1-1/2 inches thick for walls and flooring. Concrete covering deposited directly against the ground shall have a thickness of at least 3 inches between steel and ground. Expansion-joint filler material shall conform to ASTM D1751, or ASTM D1752, or shall be resin-impregnated fiberboard conforming to the physical requirements of ASTM D1752.

2.4.2 Mortar

Mortar for pipe joints, connections to other drainage structures, and brick or block construction shall conform to ASTM C270, Type M, except that the maximum placement time shall be 1 hour. The quantity of water in the mixture shall be sufficient to produce a stiff workable mortar but in no case shall exceed Manufatures recommended gallons of water per sack of cement. Water shall be clean and free of harmful acids, alkalis, and organic impurities. The mortar shall be used within 30 minutes after the ingredients are mixed with water. The inside of the joint shall be wiped clean and finished smooth. The mortar head on the outside shall be protected from air and sun with a proper covering until satisfactorily cured.

2.4.3 Precast Concrete Segmental Blocks

Precast concrete segmental block shall conform to ASTM C139, not more than 8 inches thick, not less than 8 inches long, and of such shape that joints can be sealed effectively and bonded with cement mortar.

2.4.4 Brick

Brick shall conform to ASTM C62, Grade SW; ASTM C55, Grade S-I or S-II; or ASTM C32, Grade MS. Mortar for jointing and plastering shall consist of one part portland cement and two parts fine sand. Lime may be added to the mortar in a quantity not more than 25 percent of the volume of cement. The joints shall be filled completely and shall be smooth and

free from surplus mortar on the inside of the structure. Brick structures shall be plastered with 1/2 inch of mortar over the entire outside surface of the walls. For square or rectangular structures, brick shall be laid in stretcher courses with a header course every sixth course. For round structures, brick shall be laid radially with every sixth course a stretcher course.

2.4.5 Joints

2.4.5.1 Flexible Watertight Joints

a. Flexible watertight joints shall be made with plastic or rubber-type gaskets for concrete pipe and with factory-fabricated resilient materials for clay pipe. The design of joints and the physical requirements for preformed flexible joint sealants shall conform to ASTM C990, and rubber-type gaskets shall conform to ASTM C443. Factory-fabricated resilient joint materials shall conform to ASTM C425. Gaskets shall have not more than one factory-fabricated splice, except that two factory-fabricated splices of the rubber-type gasket are permitted if the nominal diameter of the pipe being gasketed exceeds 54 inches.

b. Rubber gaskets shall comply with the oil resistant gasket requirements of ASTM C443. Certified copies of test results shall be delivered to the Contracting Officer before gaskets or jointing materials are installed. Alternate types of watertight joint may be furnished, if specifically approved.

2.4.5.2 External Sealing Bands

Requirements for external sealing bands shall conform to ASTM C877.

2.4.5.3 Flexible Watertight, Gasketed Joints

a. Gaskets: When infiltration or exfiltration is a concern for pipe lines, the couplings may be required to have gaskets. The closed-cell expanded rubber gaskets shall be a continuous band approximately 7 inches wide and approximately 3/8 inch thick, meeting the requirements of ASTM D1056, Type 2 A1 , and shall have a quality retention rating of not less than 70 percent when tested for weather resistance by ozone chamber exposure, Method B of ASTM D1171. Rubber O-ring gaskets shall be 13/16 inch in diameter for pipe diameters of 36 inches or smaller and 7/8 inch in diameter for larger pipe having 1/2 inch deep end corrugation. Rubber O-ring gaskets shall be 1-3/8 inches in diameter for pipe having 1 inch deep end corrugations. O-rings shall meet the requirements of ASTM C990 or ASTM C443. Preformed flexible joint sealants shall conform to ASTM C990, Type B.

2.5 RESILIENT CONNECTORS

Flexible, watertight connectors used for connecting pipe to manholes and inlets shall conform to ASTM C923.

2.6 EROSION CONTROL RIP RAP

Provide non-erodible rock not exceeding 15 inches in its greatest dimension and choked with sufficient small rocks to provide a dense mass with a minimum thickness of 8 inches .

PART 3 EXECUTION

3.1 INSTALLATION OF PIPE CULVERTS, STORM DRAINS, AND DRAINAGE STRUCTURES

Excavation of trenches, and for appurtenances and backfilling for culverts and storm drains, shall be in accordance with the applicable portions of Section 31 00 00 EARTHWORK, and the requirements specified below.

3.1.1 Trenching

The width of trenches at any point below the top of the pipe shall be not greater than the outside diameter of the pipe plus 18 inches to permit satisfactory jointing and thorough tamping of the bedding material under and around the pipe. Sheeting and bracing, where required, shall be placed within the trench width as specified, without any overexcavation. Where trench widths are exceeded, redesign with a resultant increase in cost of stronger pipe or special installation procedures will be necessary. Cost of this redesign and increased cost of pipe or installation shall be borne by the Contractor without additional cost to the Government.

3.1.2 Removal of Rock

Rock in either ledge or boulder formation shall be replaced with suitable materials to provide a compacted earth cushion having a thickness between unremoved rock and the pipe of at least 8 inches or 1/2 inch for each foot of fill over the top of the pipe, whichever is greater, but not more than three-fourths the nominal diameter of the pipe. Where bell-and-spigot pipe is used, the cushion shall be maintained under the bell as well as under the straight portion of the pipe. Rock excavation shall be as specified and defined in Section 31 00 00 EARTHWORK .

3.1.3 Removal of Unstable Material

Where wet or otherwise unstable soil incapable of properly supporting the pipe, as determined by the Contracting Officer, is unexpectedly encountered in the bottom of a trench, such material shall be removed to the depth required and replaced to the proper grade with select granular material, compacted as provided in paragraph BACKFILLING. When removal of unstable material is due to the fault or neglect of the Contractor while performing shoring and sheeting, water removal, or other specified requirements, such removal and replacement shall be performed at no additional cost to the Government.

3.2 BEDDING

The bedding surface for the pipe shall provide a firm foundation of uniform density throughout the entire length of the pipe.

3.2.1 Concrete Pipe Requirements

When no bedding class is specified or detailed on the drawings, concrete pipe shall be bedded in granular material minimum 4 inch in depth in trenches with soil foundation. Depth of granular bedding in trenches with rock foundation shall be 1/2 inch in depth per foot of depth of fill, minimum depth of bedding shall be 8 inch up to maximum depth of 24 inches. The middle third of the granular bedding shall be loosely placed. Bell holes and depressions for joints shall be removed and formed so entire barrel of pipe is uniformly supported. The bell hole and depressions for

the joints shall be not more than the length, depth, and width required for properly making the particular type of joint.

3.3 PLACING PIPE

Each pipe shall be thoroughly examined before being laid; defective or damaged pipe shall not be used. Pipelines shall be laid to the grades and alignment indicated. Proper facilities shall be provided for lowering sections of pipe into trenches. Lifting lugs in vertically elongated pipe shall be placed in the same vertical plane as the major axis of the pipe. Pipe shall not be laid in water, and pipe shall not be laid when trench conditions or weather are unsuitable for such work. Diversion of drainage or dewatering of trenches during construction shall be provided as necessary.
Note post installation requirements of paragraph DEFLECTION TESTING in PART 3 of this specification for all pipe products including deflection testing requirements for flexible pipe.

3.3.1 Concrete, Clay, PVC, Ribbed PVC, Ductile Iron and Cast-Iron Pipe

Laying shall proceed upgrade with spigot ends of bell-and-spigot pipe and tongue ends of tongue-and-groove pipe pointing in the direction of the flow.

3.3.2 Multiple Culverts

Where multiple lines of pipe are installed, adjacent sides of pipe shall be at least half the nominal pipe diameter or 3 feet apart, whichever is less.

3.3.3 Jacking Pipe Through Fills

Methods of operation and installation for jacking pipe through fills shall conform to requirements specified in Volume 1, Chapter 1, Part 4 of AREMA Eng Man.

3.4 JOINTING

3.4.1 Concrete and Clay Pipe

3.4.1.1 Cement-Mortar Bell-and-Spigot Joint

The first pipe shall be bedded to the established grade line, with the bell end placed upstream. The interior surface of the bell shall be thoroughly cleaned with a wet brush and the lower portion of the bell filled with mortar as required to bring inner surfaces of abutting pipes flush and even. The spigot end of each subsequent pipe shall be cleaned with a wet brush and uniformly matched into a bell so that sections are closely fitted. After each section is laid, the remainder of the joint shall be filled with mortar, and a bead shall be formed around the outside of the joint with sufficient additional mortar. If mortar is not sufficiently stiff to prevent appreciable slump before setting, the outside of the joint shall be wrapped or bandaged with cheesecloth to hold mortar in place.

3.4.1.2 Cement-Mortar Oakum Joint for Bell-and-Spigot Pipe

A closely twisted gasket shall be made of jute or oakum of the diameter required to support the spigot end of the pipe at the proper grade and to

make the joint concentric. Joint packing shall be in one piece of sufficient length to pass around the pipe and lap at top. This gasket shall be thoroughly saturated with neat cement grout. The bell of the pipe shall be thoroughly cleaned with a wet brush, and the gasket shall be laid in the bell for the lower third of the circumference and covered with mortar. The spigot of the pipe shall be thoroughly cleaned with a wet brush, inserted in the bell, and carefully driven home. A small amount of mortar shall be inserted in the annular space for the upper two-thirds of the circumference. The gasket shall be lapped at the top of the pipe and driven home in the annular space with a caulking tool. The remainder of the annular space shall be filled completely with mortar and beveled at an angle of approximately 45 degrees with the outside of the bell. If mortar is not sufficiently stiff to prevent appreciable slump before setting, the outside of the joint thus made shall be wrapped with cheesecloth. Placing of this type of joint shall be kept at least five joints behind laying operations.

3.4.1.3 Cement-Mortar Diaper Joint for Bell-and-Spigot Pipe

The pipe shall be centered so that the annular space is uniform. The annular space shall be caulked with jute or oakum. Before caulking, the inside of the bell and the outside of the spigot shall be cleaned.

a. Diaper Bands: Diaper bands shall consist of heavy cloth fabric to hold grout in place at joints and shall be cut in lengths that extend one-eighth of the circumference of pipe above the spring line on one side of the pipe and up to the spring line on the other side of the pipe. Longitudinal edges of fabric bands shall be rolled and stitched around two pieces of wire. Width of fabric bands shall be such that after fabric has been securely stitched around both edges on wires, the wires will be uniformly spaced not less than 8 inches apart. Wires shall be cut into lengths to pass around pipe with sufficient extra length for the ends to be twisted at top of pipe to hold the band securely in place; bands shall be accurately centered around lower portion of joint.

b. Grout: Grout shall be poured between band and pipe from the high side of band only, until grout rises to the top of band at the spring line of pipe, or as nearly so as possible, on the opposite side of pipe, to ensure a thorough sealing of joint around the portion of pipe covered by the band. Silt, slush, water, or polluted mortar grout forced up on the lower side shall be forced out by pouring, and removed.

c. Remainder of Joint: The remaining unfilled upper portion of the joint shall be filled with mortar and a bead formed around the outside of this upper portion of the joint with a sufficient amount of additional mortar. The diaper shall be left in place. Placing of this type of joint shall be kept at least five joints behind actual laying of pipe. No backfilling around joints shall be done until joints have been fully inspected and approved.

3.4.1.4 Cement-Mortar Tongue-and-Groove Joint

The first pipe shall be bedded carefully to the established grade line with the groove upstream. A shallow excavation shall be made underneath the pipe at the joint and filled with mortar to provide a bed for the pipe. The grooved end of the first pipe shall be thoroughly cleaned with a wet brush, and a layer of soft mortar applied to the lower half of the groove. The tongue of the second pipe shall be cleaned with a wet brush;

while in horizontal position, a layer of soft mortar shall be applied to the upper half of the tongue. The tongue end of the second pipe shall be inserted in the grooved end of the first pipe until mortar is squeezed out on interior and exterior surfaces. Sufficient mortar shall be used to fill the joint completely and to form a bead on the outside.

3.4.1.5 Cement-Mortar Diaper Joint for Tongue-and-Groove Pipe

The joint shall be of the type described for cement-mortar tongue-and-groove joint in this paragraph, except that the shallow excavation directly beneath the joint shall not be filled with mortar until after a gauze or cheesecloth band dipped in cement mortar has been wrapped around the outside of the joint. The cement-mortar bead at the joint shall be at least 1/2 inch, thick and the width of the diaper band shall be at least 8 inches. The diaper shall be left in place. Placing of this type of joint shall be kept at least five joints behind the actual laying of the pipe. Backfilling around the joints shall not be done until the joints have been fully inspected and approved.

3.4.1.6 Plastic Sealing Compound Joints for Tongue-and-Grooved Pipe

Sealing compounds shall follow the recommendation of the particular manufacturer in regard to special installation requirements. Surfaces to receive lubricants, primers, or adhesives shall be dry and clean. Sealing compounds shall be affixed to the pipe not more than 3 hours prior to installation of the pipe, and shall be protected from the sun, blowing dust, and other deleterious agents at all times. Sealing compounds shall be inspected before installation of the pipe, and any loose or improperly affixed sealing compound shall be removed and replaced. The pipe shall be aligned with the previously installed pipe, and the joint pulled together. If, while making the joint with mastic-type sealant, a slight protrusion of the material is not visible along the entire inner and outer circumference of the joint when the joint is pulled up, the pipe shall be removed and the joint remade. After the joint is made, all inner protrusions shall be cut off flush with the inner surface of the pipe. If non-mastic-type sealant material is used, the "Squeeze-Out" requirement above will be waived.

3.4.1.7 Flexible Watertight Joints

Gaskets and jointing materials shall be as recommended by the particular manufacturer in regard to use of lubricants, cements, adhesives, and other special installation requirements. Surfaces to receive lubricants, cements, or adhesives shall be clean and dry. Gaskets and jointing materials shall be affixed to the pipe not more than 24 hours prior to the installation of the pipe, and shall be protected from the sun, blowing dust, and other deleterious agents at all times. Gaskets and jointing materials shall be inspected before installing the pipe; any loose or improperly affixed gaskets and jointing materials shall be removed and replaced. The pipe shall be aligned with the previously installed pipe, and the joint pushed home. If, while the joint is being made the gasket becomes visibly dislocated the pipe shall be removed and the joint remade.

3.4.1.8 External Sealing Band Joint for Noncircular Pipe

Surfaces to receive sealing bands shall be dry and clean. Bands shall be installed in accordance with manufacturer's recommendations.

3.5 DRAINAGE STRUCTURES

3.5.1 Walls and Headwalls

Construction shall be as indicated.

3.6 BACKFILLING

3.6.1 Backfilling Pipe in Trenches

After the pipe has been properly bedded, selected material from excavation or borrow, at a moisture content that will facilitate compaction, shall be placed along both sides of pipe in layers not exceeding 6 inches in compacted depth. The backfill shall be brought up evenly on both sides of pipe for the full length of pipe. The fill shall be thoroughly compacted under the haunches of the pipe. Each layer shall be thoroughly compacted with mechanical tampers or rammers. This method of filling and compacting shall continue until the fill has reached an elevation equal to the midpoint (spring line) of concrete pipe or has reached an elevation of at least 12 inches above the top of the pipe for flexible pipe. The remainder of the trench shall be backfilled and compacted by spreading and rolling or compacted by mechanical rammers or tampers in layers not exceeding 8 inches. Tests for density shall be made as necessary to ensure conformance to the compaction requirements specified below. Where it is necessary, in the opinion of the Contracting Officer, that sheeting or portions of bracing used be left in place, the contract will be adjusted accordingly. Untreated sheeting shall not be left in place beneath structures or pavements.

3.6.2 Backfilling Pipe in Fill Sections

For pipe placed in fill sections, backfill material and the placement and compaction procedures shall be as specified below. The fill material shall be uniformly spread in layers longitudinally on both sides of the pipe, not exceeding 6 inches in compacted depth, and shall be compacted by rolling parallel with pipe or by mechanical tamping or ramming. Prior to commencing normal filling operations, the crown width of the fill at a height of 12 inches above the top of the pipe shall extend a distance of not less than twice the outside pipe diameter on each side of the pipe or 12 feet, whichever is less. After the backfill has reached at least 12 inches above the top of the pipe, the remainder of the fill shall be placed and thoroughly compacted in layers not exceeding 8 inches. Use select granular material for this entire region of backfill for flexible pipe installations.

3.6.3 Movement of Construction Machinery

When compacting by rolling or operating heavy equipment parallel with the pipe, displacement of or injury to the pipe shall be avoided. Movement of construction machinery over a culvert or storm drain at any stage of construction shall be at the Contractor's risk. Any damaged pipe shall be repaired or replaced.

3.6.4 Compaction

3.6.4.1 General Requirements

Cohesionless materials include gravels, gravel-sand mixtures, sands, and gravelly sands. Cohesive materials include clayey and silty gravels,

gravel-silt mixtures, clayey and silty sands, sand-clay mixtures, clays, silts, and very fine sands. When results of compaction tests for moisture-density relations are recorded on graphs, cohesionless soils will show straight lines or reverse-shaped moisture-density curves, and cohesive soils will show normal moisture-density curves.

3.6.4.2 Minimum Density

Backfill over and around the pipe and backfill around and adjacent to drainage structures shall be compacted at the approved moisture content to the following applicable minimum density, which will be determined as specified below.

a. Under airfield and heliport pavements, paved roads, streets, parking areas, and similar-use pavements including adjacent shoulder areas, the density shall be not less than 90 percent of maximum density for cohesive material and 95 percent of maximum density for cohesionless material, up to the elevation where requirements for pavement subgrade materials and compaction shall control.

b. Under unpaved or turfed traffic areas, density shall not be less than 90 percent of maximum density for cohesive material and 95 percent of maximum density for cohesionless material.

c. Under nontraffic areas, density shall be not less than that of the surrounding material.

3.7 FIELD QUALITY CONTROL

3.7.1 Tests

Testing is the responsibility of the Contractor. Perform all testing and retesting at no additional cost to the Government.

3.7.1.1 Determination of Density

Testing shall be performed by an approved commercial testing laboratory or by the Contractor subject to approval. Tests shall be performed in sufficient number to ensure that specified density is being obtained. Laboratory tests for moisture-density relations shall be made in accordance with ASTM D1557 except that mechanical tampers may be used provided the results are correlated with those obtained with the specified hand tamper. Field density tests shall be determined in accordance with ASTM D2167 or ASTM D6938. When ASTM D6938 is used, the calibration curves shall be checked and adjusted, if necessary, using the sand cone method as described in paragraph Calibration of the referenced publications. ASTM D6938 results in a wet unit weight of soil and ASTM D6938 shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall be checked along with density calibration checks as described in ASTM D6938. Test results shall be furnished the Contracting Officer. The calibration checks of both the density and moisture gauges shall be made at the beginning of a job on each different type of material encountered and at intervals as directed.

3.7.2 Inspection

3.7.2.1 Post-Installation Inspection

Visually inspect each segment of concrete pipe for alignment, settlement, joint separations, soil migration through the joint, cracks, buckling, bulging and deflection. An engineer must evaluate all defects to determine if any remediation or repair is required.

3.7.2.1.1 Concrete

Cracks with a width greater than 0.01 inches. An engineer must evaluate all pipes with cracks with a width greater than 0.01 inches but less than 0.10 inches to determine if any remediation or repair is required.

3.7.2.1.2 Post-Installation Inspection Report

The deflection results and final post installation inspection report must include: pipe location identification, equipment used for inspection, inspector name, deviation from design, grade, deviation from line, deflection and deformation of flexible pipe, inspector notes, condition of joints, condition of pipe wall (e.g. distress, cracking, wall damage dents, bulges, creases, tears, holes, etc.).

3.7.3 Repair Of Defects

3.7.3.1 Leakage Test

When leakage exceeds the maximum amount specified, correct source of excess leakage by replacing damaged pipe and gaskets and retest.

3.7.3.2 Deflection Testing

When deflection readings are in excess of the allowable deflection of average inside diameter of pipe are obtained, remove pipe which has excessive deflection and replace with new pipe. Retest 30 days after completing backfill, leakage testing and compaction testing.

3.7.3.3 Inspection

Replace pipe or repair defects indicated in the Post-Installation Inspection Report.

3.7.3.3.1 Concrete

Replace pipes having cracks with a width greater than 0.1 inches.

3.8 PROTECTION

Protect storm drainage piping and adjacent areas from superimposed and external loads during construction.

3.9 WARRANTY PERIOD

Pipe segments found to have defects during the warranty period must be replaced with new pipe and retested.

-- End of Section --

SECTION 33 71 02

UNDERGROUND ELECTRICAL DISTRIBUTION
02/15, CHG 1: 11/19

PART 1 GENERAL

1.1 REFERENCES

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

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 CONCRETE INSTITUTE (ACI)

ACI 318M	(2014; ERTA 2015) Building Code Requirements for Structural Concrete & Commentary

ASTM INTERNATIONAL (ASTM)

ASTM B1	(2013) Standard Specification for Hard-Drawn Copper Wire
ASTM B3	(2013) Standard Specification for Soft or Annealed Copper Wire
ASTM B8	(2011; R 2017) Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
ASTM C32	(2013; R 2017) Standard Specification for Sewer and Manhole Brick (Made from Clay or Shale)
ASTM C139	(2017) Standard Specification for Concrete Masonry Units for Construction of Catch Basins and Manholes
ASTM C309	(2011) Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C478	(2018) Standard Specification for Circular Precast Reinforced Concrete Manhole Sections
ASTM C857	(2016) Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures

ASTM C990	(2009; R 2014) Standard Specification for Joints for Concrete Pipe, Manholes and Precast Box Sections Using Preformed Flexible Joint Sealants
ASTM F512	(2019) Standard Specification for Smooth-Wall Poly (Vinyl Chloride) (PVC) Conduit and Fittings for Underground Installation
ASTM F2160	(2016) Standard Specification for Solid Wall High Density Polyethylene (HDPE) Conduit Based on Controlled Outside Diameter (OD)

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 81	(2012) Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System
IEEE C2	(2017; Errata 1-2 2017; INT 1 2017) National Electrical Safety Code
IEEE Stds Dictionary	(2009) IEEE Standards Dictionary: Glossary of Terms & Definitions

INTERNATIONAL ELECTRICAL TESTING ASSOCIATION (NETA)

NETA ATS	(2017; Errata 2017) Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI C119.1	(2016) Electric Connectors - Sealed Insulated Underground Connector Systems Rated 600 Volts
NEMA C119.4	(2011) Electric Connectors - Connectors for Use Between Aluminum-to-Aluminum or Aluminum-to-Copper Conductors Designed for Normal Operation at or Below 93 Degrees C and Copper-to-Copper Conductors Designed for Normal Operation at or Below 100 Degrees C
NEMA RN 1	(2005; R 2013) Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit
NEMA TC 2	(2020) Standard for Electrical Polyvinyl Chloride (PVC) Conduit
NEMA TC 6 & 8	(2020) Standard for Polyvinyl Chloride (PVC) Plastic Utilities Duct for Underground Installations

NEMA TC 7	(2016) Smooth-Wall Coilable Electrical Polyethylene Conduit
NEMA TC 9	(2020) Standard for Fittings for Polyvinyl Chloride (PVC) Plastic Utilities Duct for Underground Installation

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2020; ERTA 20-1 2020; ERTA 20-2 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4) National Electrical Code

SOCIETY OF CABLE TELECOMMUNICATIONS ENGINEERS (SCTE)

ANSI/SCTE 77	(2013) Specification for Underground Enclosure Integrity

TELECOMMUNICATIONS INDUSTRY ASSOCIATION (TIA)

TIA-758	(2012b) Customer-Owned Outside Plant Telecommunications Infrastructure Standard

U.S. DEPARTMENT OF AGRICULTURE (USDA)

RUS Bull 1751F-644	(2002) Underground Plant Construction

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

CID A-A-60005	(Basic; Notice 2) Frames, Covers, Gratings, Steps, Sump And Catch Basin, Manhole

UNDERWRITERS LABORATORIES (UL)

UL 6	(2007; Reprint Sep 2019) UL Standard for Safety Electrical Rigid Metal Conduit-Steel
UL 44	(2018) UL Standard for Safety Thermoset-Insulated Wires and Cables
UL 83	(2017; Reprint Mar 2020) UL Standard for Safety Thermoplastic-Insulated Wires and Cables
UL 94	(2013; Reprint Jun 2020) UL Standard for Safety Tests for Flammability of Plastic Materials for Parts in Devices and Appliances
UL 467	(2013; Reprint Jun 2017) UL Standard for Safety Grounding and Bonding Equipment
UL 486A-486B	(2018) UL Standard for Safety Wire Connectors
UL 510	(2020) UL Standard for Safety Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape

UL 514A	(2013; Reprint Aug 2017) UL Standard for Safety Metallic Outlet Boxes
UL 514B	(2012; Reprint May 2020) Conduit, Tubing and Cable Fittings
UL 651	(2011; Reprint Mar 2020) UL Standard for Safety Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings
UL 854	(2020) Standard for Service-Entrance Cables
UL 1242	(2006; Reprint Aug 2020) Standard for Electrical Intermediate Metal Conduit -- Steel

1.2 SYSTEM DESCRIPTION

Airmen Leadership School Electrical Distribution including the transformer shall be supplied by Chelco. Service from the transformer to the service entrance shall be the responsibility of the ALS contractor and shall be in accordance with the following CoE specificaitons. The ALS contractor shall make the connections to the transformer. Items provided under this section must be specifically suitable for the following service conditions. .

a. Ambient Temperature 0-130 Fahrenheit degrees F.

bg. Humidity Control

h. Corrosive Areas

1.3 DEFINITIONS

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

b. In the text of this section, the words conduit and duct are used interchangeably and have the same meaning.

c. In the text of this section, "medium voltage cable splices," and "medium voltage cable joints" are used interchangeably and have the same meaning.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. When used, a code following the "G" classification identifies the office that will review the submittal for the Government; RO for Resident Office; DO for Mobile District Office.

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

SD-02 Shop Drawings

SD-03 Product Data

Precast concrete structures; G

Sealing Material

Pulling-In Irons

Manhole frames and covers; G

Handhole frames and covers; G

Composite/fiberglass handholes; G

Cable supports (racks, arms and insulators); G

SD-06 Test Reports

Field Acceptance Checks and Tests; G

Arc-proofing test for cable fireproofing tape; G

Cable Installation Plan and Procedure; G

Six copies of the information described below in 8-1/2 by 11 inch binders having a minimum of three rings from which material may readily be removed and replaced, including a separate section for each cable pull. Separate sections by heavy plastic dividers with tabs, with all data sheets signed and dated by the person supervising the pull.

a. Site layout drawing with cable pulls numerically identified.

b. A list of equipment used, with calibration certifications. The manufacturer and quantity of lubricant used on pull.

c. The cable manufacturer and type of cable.

d. The dates of cable pulls, time of day, and ambient temperature.

e. The length of cable pull and calculated cable pulling tensions.

f. The actual cable pulling tensions encountered during pull.

SD-07 Certificates

Cable Installer Qualifications; G

1.5 QUALITY ASSURANCE

1.5.1 Cable Installer Qualifications

Provide at least one onsite person in a supervisory position with a documentable level of competency and experience to supervise all cable pulling operations. Provide a resume showing the cable installers' experience in the last three years, including a list of references complete with points of contact, addresses and telephone numbers. Cable installer must demonstrate experience with a minimum of three medium voltage cable installations. The Contracting Officer reserves the right to require additional proof of competency or to reject the individual and call for an alternate qualified cable installer.

1.5.2 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "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. Equipment, materials, installation, and workmanship must be in accordance with the mandatory and advisory provisions of IEEE C2 and NFPA 70 unless more stringent requirements are specified or indicated.

1.5.3 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. Products must have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year period must include applications of equipment and materials under similar circumstances and of similar size. The product must have been for 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 must 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 this section.

1.5.3.1 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.

1.5.3.2 Material and Equipment Manufacturing Date

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

PART 2 PRODUCTS

2.1 CONDUIT, DUCTS, AND FITTINGS

2.1.1 Rigid Metal Conduit

UL 6.

2.1.1.1 Rigid Metallic Conduit, PVC Coated

NEMA RN 1, Type A40, except that hardness must be nominal 85 Shore A durometer, dielectric strength must be minimum 400 volts per mil at 60 Hz, and tensile strength must be minimum 3500 psi.

2.1.2 Intermediate Metal Conduit

UL 1242.

2.1.2.1 Intermediate Metal Conduit, PVC Coated

NEMA RN 1, Type A40, except that hardness must be nominal 85 Shore A durometer, dielectric strength must be minimum 400 volts per mil at 60 Hz, and tensile strength must be minimum 3500 psi.

2.1.3 Plastic Conduit for Direct Burial and Riser Applications

UL 651 and NEMA TC 2, EPC-40 as indicated.

2.1.4 Plastic Duct for Concrete Encasement

Provide Type EB-35 per UL 651, ASTM F512, and NEMA TC 6 & 8 or Type EPC-40 per UL 651 and NEMA TC 2 as indicated.

2.1.5 High Density Polyethylene (HDPE) Electrical Conduit for Directional Boring

Smoothwall, approved/listed for directional boring, minimum Schedule 80, ASTM F2160, NEMA TC 7.

2.1.6 Innerduct

Provide corrugated or solid wall polyethylene (PE) or PVC innerducts, or fabric-mesh innerducts, with pullwire. Size as indicated.

2.1.7 Duct Sealant

UL 94, Class HBF. Provide high-expansion urethane foam duct sealant that expands and hardens to form a closed, chemically and water resistant, rigid structure. Sealant must be compatible with common cable and wire jackets and capable of adhering to metals, plastics and concrete. Sealant must be capable of curing in temperature ranges of 35 degrees F to 95 degrees F. Cured sealant must withstand temperature ranges of -20 degrees F to 200 degrees F without loss of function.

2.1.8 Fittings

2.1.8.1 Metal Fittings

UL 514B.

2.1.8.2 PVC Conduit Fittings

UL 514B, UL 651.

2.1.8.3 PVC Duct Fittings

NEMA TC 9.

2.1.8.4 Outlet Boxes for Steel Conduit

Outlet boxes for use with rigid or flexible steel conduit must be cast-metal cadmium or zinc-coated if of ferrous metal with gasketed closures and must conform to UL 514A.

2.2 LOW VOLTAGE INSULATED CONDUCTORS AND CABLES

Insulated conductors must be rated 600 volts and conform to the requirements of NFPA 70, including listing requirements. Wires and cables manufactured more than 12 months prior to date of delivery to the site are not acceptable. Service entrance conductors must conform to UL 854, type USE.

2.2.1 Conductor Types

Cable and duct sizes indicated are for copper conductors and THHN/THWN unless otherwise noted. Conductors No. 10 AWG and smaller must be solid. Conductors No. 8 AWG and larger must be stranded. All conductors must be copper.

2.2.2 Conductor Material

Unless specified or indicated otherwise or required by NFPA 70, wires in conduit, other than service entrance, must be 600-volt, Type THWN/THHN conforming to UL 83 or Type XHHW or RHW conforming to UL 44. Copper conductors must be annealed copper complying with ASTM B3 and ASTM B8.

2.2.3 Jackets

Multiconductor cables must have an overall PVC outer jacket.

2.2.4 Direct Buried

Single-conductor and multi-conductor cables must be of a type identified for direct burial.

2.2.5 In Duct

Cables must be single-conductor cable. Cables in factory-installed, coilable-plastic-duct assemblies must conform to NEMA TC 7.

2.2.6 Cable Marking

Insulated conductors must have the date of manufacture and other identification imprinted on the outer surface of each cable at regular intervals throughout the cable length.

Identify each cable by means of a fiber, laminated plastic, or non-ferrous metal tags in each manhole, handhole, junction box, and each terminal.

Each tag must contain the following information; cable type, conductor size, circuit number, circuit voltage, cable destination and phase identification.

Conductors must be color coded. Provide conductor identification within each enclosure where a tap, splice, or termination is made. Conductor identification must be by color-coded insulated conductors, plastic-coated self-sticking printed markers, colored nylon cable ties and plates, heat shrink type sleeves,or colored electrical tape. Control circuit terminations must be properly identified. Color must be green for grounding conductors and white for neutrals; except where neutrals of more than one system are installed in same raceway or box, other neutrals must be white with a different colored (not green) stripe for each. Color of ungrounded conductors in different voltage systems must be 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

2.3 LOW VOLTAGE WIRE CONNECTORS AND TERMINALS

Must provide a uniform compression over the entire conductor contact surface. Use solderless terminal lugs on stranded conductors.

a. For use with copper conductors: UL 486A-486B.

2.4 LOW VOLTAGE SPLICES

Provide splices in conductors with a compression connector on the conductor and by insulating and waterproofing using one of the following methods which are suitable for continuous submersion in water and comply with ANSI C119.1.

2.4.1 Heat Shrinkable Splice

Provide heat shrinkable splice insulation by means of a thermoplastic adhesive sealant material applied in accordance with the manufacturer's written instructions.

2.4.2 Cold Shrink Rubber Splice

Provide a cold-shrink rubber splice which consists of EPDM rubber tube which has been factory stretched onto a spiraled core which is removed during splice installation. The installation must not require heat or flame, or any additional materials such as covering or adhesive. It must

be designed for use with inline compression type connectors, or indoor, outdoor, direct-burial or submerged locations.

2.5 TELECOMMUNICATIONS CABLING

Provide telecommunications cabling in accordance with Section 33 82 00 TELECOMMUNICATIONS OUTSIDE PLANT (OSP).

2.6 TAPE

2.6.1 Insulating Tape

UL 510, plastic insulating tape, capable of performing in a continuous temperature environment of 80 degrees C.

2.6.2 Buried Warning and Identification Tape

Provide detectable tape in accordance with Section 31 00 00 EARTHWORK

2.6.3 Fireproofing Tape

Provide tape composed of a flexible, conformable, unsupported intumescent elastomer. Tape must be not less than .030 inch thick, noncorrosive to cable sheath, self-extinguishing, noncombustible, adhesive-free, and must not deteriorate when subjected to oil, water, gases, salt water, sewage, and fungus.

2.7 PULL ROPE

Plastic or flat pull line (bull line) having a minimum tensile strength of 200 pounds.

2.8 GROUNDING AND BONDING

2.8.1 Driven Ground Rods

Provide copper-clad steel ground rods conforming to UL 467 or solid copper ground rods conforming to UL 467 not less than 3/4 inch in diameter by 10 feet in length. Sectional type rods may be used for rods 20 feet or longer.

2.8.2 Grounding Conductors

Stranded-bare copper conductors must conform to ASTM B8, Class B, soft-drawn unless otherwise indicated. Solid-bare copper conductors must conform to ASTM B1 for sizes No. 8 and smaller. Insulated conductors must be of the same material as phase conductors and green color-coded, except that conductors must be rated no more than 600 volts. Aluminum is not acceptable.

2.9 CAST-IN-PLACE CONCRETE

Provide concrete in accordance with Section 03 30 00 CAST-IN-PLACE CONCRETE. In addition, provide concrete for encasement of underground ducts with 3000 psi minimum 28-day compressive strength. Concrete associated with electrical work for other than encasement of underground ducts must be 4000 psi minimum 28-day compressive strength unless specified otherwise.

2.10 UNDERGROUND STRUCTURES

Provide precast concrete underground structures or standard type cast-in-place manhole types as indicated, conforming to ASTM C857 and ASTM C478. Top, walls, and bottom must consist of reinforced concrete. Walls and bottom must be of monolithic concrete construction. Locate duct entrances and windows near the corners of structures to facilitate cable racking. Covers must fit the frames without undue play. Form steel and iron to shape and size with sharp lines and angles. Castings must be free from warp and blow holes that may impair strength or appearance. Exposed metal must have a smooth finish and sharp lines and arises. Provide necessary lugs, rabbets, and brackets. Set pulling-in irons and other built-in items in place before depositing concrete. Install a pulling-in iron in the wall opposite each duct line entrance. Cable racks, including rack arms and insulators, must be adequate to accommodate the cable.

2.10.1 Cast-In-Place Concrete Structures

Concrete must conform to Section 03 30 00 CAST-IN-PLACE CONCRETE. Construct walls on a footing of cast-in-place concrete except that precast concrete base sections may be used for precast concrete manhole risers. Concrete block must conform to ASTM C139 and Section 04 20 00, MASONRY.

2.10.2 Precast Concrete Structures, Risers and Tops

Precast concrete underground structures may be provided in lieu of cast-in-place subject to the requirements specified below. Precast units must be the product of a manufacturer regularly engaged in the manufacture of precast concrete products, including precast manholes.

2.10.2.1 General

Precast concrete structures must have the same accessories and facilities as required for cast-in-place structures. Likewise, precast structures must have plan area and clear heights not less than those of cast-in-place structures. Concrete materials and methods of construction must be the same as for cast-in-place concrete construction, as modified herein. Slope in floor may be omitted provided precast sections are poured in reinforced steel forms. Concrete for precast work must have a 28-day compressive strength of not less than 4000 psi. Structures may be precast to the design and details indicated for cast-in-place construction, precast monolithically and placed as a unit, or structures may be assembled sections, designed and produced by the manufacturer in accordance with the requirements specified. Structures must be identified with the manufacturer's name embedded in or otherwise permanently attached to an interior wall face.

2.10.2.2 Design for Precast Structures

ACI 318M. In the absence of detailed on-site soil information, design for the following soil parameters/site conditions:

a. Angle of Internal Friction (phi) = 30 degrees

b. Unit Weight of Soil (Dry) = 110 pcf, (Saturated) = 130 pcf

c. Coefficient of Lateral Earth Pressure (Ka) = 0.33

d. Ground Water Level = 3 feet below ground elevation

e. Vertical design loads must include full dead, superimposed dead, and live loads including a 30 percent magnification factor for impact. Live loads must consider all types and magnitudes of vehicular (automotive, industrial, or aircraft) traffic to be encountered. The minimum design vertical load must be for H20 highway loading per AASHTO HB-17.

f. Horizontal design loads must include full geostatic and hydrostatic pressures for the soil parameters, water table, and depth of installation to be encountered. Also, horizontal loads imposed by adjacent structure foundations, and horizontal load components of vertical design loads, including impact, must be considered, along with a pulling-in iron design load of 6000 pounds.

g. Each structural component must be designed for the load combination and positioning resulting in the maximum shear and moment for that particular component.

h. Design must also consider the live loads induced in the handling, installation, and backfilling of the manholes. Provide lifting devices to ensure structural integrity during handling and installation.

2.10.2.3 Construction

Structure top, bottom, and wall must be of a uniform thickness of not less than 6 inches. Thin-walled knock-out panels for designed or future duct bank entrances are not permitted. Provide quantity, size, and location of duct bank entrance windows as directed, and cast completely open by the precaster. Size of windows must exceed the nominal duct bank envelope dimensions by at least 12 inches vertically and horizontally to preclude in-field window modifications made necessary by duct bank misalignment. However, the sides of precast windows must be a minimum of 6 inches from the inside surface of adjacent walls, floors, or ceilings. Form the perimeter of precast window openings to have a keyed or inward flared surface to provide a positive interlock with the mating duct bank envelope. Provide welded wire fabric reinforcing through window openings for in-field cutting and flaring into duct bank envelopes. Provide additional reinforcing steel comprised of at least two No. 4 bars around window openings. Provide drain sumps a minimum of 12 inches in diameter and 4 inches deep for precast structures.

2.10.2.4 Joints

Provide tongue-and-groove joints on mating edges of precast components. Shiplap joints are not allowed. Design joints to firmly interlock adjoining components and to provide waterproof junctions and adequate shear transfer. Seal joints watertight using preformed plastic strip conforming to ASTM C990. Install sealing material in strict accordance with the sealant manufacturer's printed instructions. Provide waterproofing at conduit/duct entrances into structures, and where access frame meets the top slab, provide continuous grout seal.

2.10.3 Manhole Frames and Covers

Provide cast iron frames and covers for manholes conforming to CID A-A-60005. Cast the words "ELECTRIC" or "TELECOMMUNICATIONS" in the

top face of power and telecommunications manhole covers, respectively.

2.10.4 Handhole Frames and Covers

Frames and covers of steel must be welded by qualified welders in accordance with standard commercial practice. Steel covers must be rolled-steel floor plate having an approved antislip surface. Hinges must be per manufacturer, 5 by 5 inches by approximately 3/16 inch thick, without screw holes, and must be for full surface application by fillet welding. Hinges must have nonremovable pins and five knuckles. The surfaces of plates under hinges must be true after the removal of raised antislip surface, by grinding or other approved method.

2.10.5 Brick for Manhole Collar

Provide sewer and manhole brick conforming to ASTM C32, Grade MS.

2.10.6 Composite/Fiberglass Handholes and Covers

ANSI/SCTE 77. Provide handholes and covers of polymer concrete, reinforced with heavy weave fiberglass with a design load (Tier rating) appropriate for or greater than the intended use. All covers are required to have the Tier level rating embossed on the surface and this rating must not exceed the design load of the box.

2.11 CABLE SUPPORTS (RACKS, ARMS, AND INSULATORS)

The metal portion of racks and arms must be zinc-coated after fabrication.

2.11.1 Cable Rack Stanchions

The wall bracket or stanchion must be 4 inches by approximately 1-1/2 inch by 3/16 inch channel steel, or 4 inches by approximately 1 inch glass-reinforced nylon with recessed bolt mounting holes, 48 inches long (minimum) in manholes. Slots for mounting cable rack arms must be spaced at 8 inch intervals.

2.11.2 Rack Arms

Cable rack arms must be steel or malleable iron or glass reinforced nylon and must be of the removable type. Rack arm length must be a minimum of 8 inches and a maximum of 12 inches.

2.11.3 Insulators

Insulators for metal rack arms must be dry-process glazed porcelain. Insulators are not required for nylon arms.

2.12 CABLE TAGS IN MANHOLES

Provide tags for each power cable located in manholes. The tags must be polyethylene. Do not provide handwritten letters. The first position on the power cable tag must denote the voltage. The second through sixth positions on the tag must identify the circuit. The next to last position must denote the phase of the circuit and include the Greek "phi" symbol. The last position must denote the cable size. As an example, a tag could have the following designation: "11.5 NAS 1-8(Phase A)500," denoting that the tagged cable is on the 11.5kV system circuit number NAS 1-8, underground, Phase A, sized at 500 kcmil.

2.12.1 Polyethylene Cable Tags

Provide tags of polyethylene that have an average tensile strength of 3250 pounds per square inch; and that are 0.08 inch thick (minimum), non-corrosive non-conductive; resistive to acids, alkalis, organic solvents, and salt water; and distortion resistant to 170 degrees F. Provide 0.05 inch (minimum) thick black polyethylene tag holder. Provide a one-piece nylon, self-locking tie at each end of the cable tag. Ties must have a minimum loop tensile strength of 175 pounds. The cable tags must have black block letters, numbers, and symbols one inch high on a yellow background. Letters, numbers, and symbols must not fall off or change positions regardless of the cable tags' orientation.

2.13 LOW VOLTAGE ABOVE GROUND TERMINATION PEDESTAL

Provide copolymer polypropylene, low voltage above ground termination pedestal manufactured through an injection molding process. Pedestals must resist fertilizers, salt air environments and ultra-violet radiation. Pedestal top must be imprinted with a "WARNING" and "ELECTRIC" identification. Pedestal must contain four lay-in six port connectors. Connectors must be NEMA C119.4, Class "A", dual rated for aluminum or copper, and capable of terminating conductors ranging from 10 AWG to 500 kcmil. Protect each connector with a clear, hard lexan (plastic) cover. Pedestal must be provided with rust-free material and stainless steel hardware. Pedestal must be lockable.

2.14 SOURCE QUALITY CONTROL

2.14.1 Arc-Proofing Test for Cable Fireproofing Tape

Manufacturer must test one sample assembly consisting of a straight lead tube 12 inches long with a 2 1/2 inch outside diameter, and a 1/8 inch thick wall, and covered with one-half lap layer of arc and fireproofing tape per manufacturer's instructions. The arc and fireproofing tape must withstand extreme temperature of a high-current fault arc 13,000 degrees K for 70 cycles as determined by using an argon directed plasma jet capable of constantly producing and maintaining an arc temperature of 13,000 degrees K. Temperature (13,000 degrees K) of the ignited arc between the cathode and anode must be obtained from a dc power source of 305 (plus or minus 5) amperes and 20 (plus or minus 1) volts. The arc must be directed toward the sample assembly accurately positioned 5 (plus or minus 1) millimeters downstream in the plasma from the anode orifice by fixed flow rate of argon gas (0.18 g per second). Each sample assembly must be tested at three unrelated points. Start time for tests must be taken from recorded peak current when the specimen is exposed to the full test temperature. Surface heat on the specimen prior to that time must be minimal. The end point is established when the plasma or conductive arc penetrates the protective tape and strikes the lead tube. Submittals for arc-proofing tape must indicate that the test has been performed and passed by the manufacturer.

PART 3 EXECUTION

3.1 INSTALLATION

Install equipment and devices in accordance with the manufacturer's published instructions and with the requirements and recommendations of NFPA 70 and IEEE C2 as applicable. In addition to these requirements,

install telecommunications in accordance with TIA-758 and RUS Bull 1751F-644.

3.2 CABLE INSPECTION

Inspect each cable reel for correct storage positions, signs of physical damage, and broken end seals prior to installation. If end seal is broken, remove moisture from cable prior to installation in accordance with the cable manufacturer's recommendations.

3.3 CABLE INSTALLATION PLAN AND PROCEDURE

Obtain from the manufacturer an installation manual or set of instructions which addresses such aspects as cable construction, insulation type, cable diameter, bending radius, cable temperature limits for installation, lubricants, coefficient of friction, conduit cleaning, storage procedures, moisture seals, testing for and purging moisture, maximum allowable pulling tension, and maximum allowable sidewall bearing pressure. Prepare a checklist of significant requirements and submit along with the manufacturer's instructions in accordance with SUBMITTALS. Install cable strictly in accordance with the cable manufacturer's recommendations and the approved installation plan.

Calculations and pulling plan must include:

a. Site layout drawing with cable pulls identified in numeric order of expected pulling sequence and direction of cable pull.

b. List of cable installation equipment.

c. Lubricant manufacturer's application instructions.

d. Procedure for resealing cable ends to prevent moisture from entering cable.

e. Cable pulling tension calculations of all cable pulls.

f. Cable percentage conduit fill.

g. Cable sidewall bearing pressure.

h. Cable minimum bend radius and minimum diameter of pulling wheels used.

i. Cable jam ratio.

j. Maximum allowable pulling tension on each different type and size of conductor.

k. Maximum allowable pulling tension on pulling device.

3.4 UNDERGROUND FEEDERS SUPPLYING BUILDINGS

Terminate underground feeders supplying building at a point 5 feet outside the building and projections thereof, except that conductors must be continuous to the terminating point indicated. Coordinate connections of the feeders to the service entrance equipment with Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Provide PVC, Type EPC-40 conduit from the supply equipment to a point 5 feet outside the building and projections thereof. Protect ends of underground conduit with plastic plugs until

connections are made.

Encase the underground portion of the conduit in a concrete envelope and bury as specified for underground duct with concrete encasement.

3.5 UNDERGROUND STRUCTURE CONSTRUCTION

Provide standard type cast-in-place construction as specified herein and as indicated, or precast construction as specified herein. Horizontal concrete surfaces of floors must have a smooth trowel finish. Cure concrete by applying two coats of white pigmented membrane forming-curing compound in strict accordance with the manufacturer's printed instructions, except that precast concrete may be steam cured. Curing compound must conform to ASTM C309. Locate duct entrances and windows in the center of end walls (shorter) and near the corners of sidewalls (longer) to facilitate cable racking and splicing. Covers for underground structures must fit the frames without undue play. Steel and iron must be formed to shape and size with sharp lines and angles. Castings must be free from warp and blow holes that may impair strength or appearance. Exposed metal must have a smooth finish and sharp lines and arises. Provide necessary lugs, rabbets, and brackets. Set pulling-in irons and other built-in items in place before depositing concrete. Manhole locations, as indicated, are approximate. Coordinate exact manhole locations with other utilities and finished grading and paving.

3.5.1 Precast Concrete Construction

Set commercial precast structures on 6 inches of level, 90 percent compacted granular fill, 3/4 inch to 1 inch size, extending 12 inches beyond the structure on each side. Compact granular fill by a minimum of four passes with a plate type vibrator. Installation must additionally conform to the manufacturer's instructions.

3.5.2 Pulling-In Irons

Provide steel bars bent as indicated, and cast in the walls and floors. Alternatively, pipe sleeves may be precast into the walls and floors where required to accept U-bolts or other types of pulling-in devices possessing the strengths and clearances stated herein. The final installation of pulling-in devices must be made permanent. Cover and seal exterior projections of thru-wall type pulling-in devices with an appropriate protective coating. In the floor the irons must be a minimum of 6 inches from the edge of the sump, and in the walls the irons must be located within 6 inches of the projected center of the duct bank pattern or precast window in the opposite wall. However, the pulling-in iron must not be located within 6 inches of an adjacent interior surface, or duct or precast window located within the same wall as the iron. If a pulling-in iron cannot be located directly opposite the corresponding duct bank or precast window due to this clearance limitation, locate the iron directly above or below the projected center of the duct bank pattern or precast window the minimum distance required to preserve the 6 inch clearance previously stated. In the case of directly opposing precast windows, pulling-in irons consisting of a 3 foot length of No. 5 reinforcing bar, formed into a hairpin, may be cast-in-place within the precast windows simultaneously with the end of the corresponding duct bank envelope. Irons installed in this manner must be positioned directly in line with, or when not possible, directly above or below the projected center of the duct bank pattern entering the opposite wall, while maintaining a minimum clear distance of 3 inches from any edge of the cast-in-place duct bank

envelope or any individual duct. Pulling-in irons must have a clear projection into the structure of approximately 4 inches and must be designed to withstand a minimum pulling-in load of 6000 pounds. Irons must be hot-dipped galvanized after fabrication.

3.5.3 Cable Racks, Arms and Insulators

Cable racks, arms and insulators must be sufficient to accommodate the cables. Space racks in power manholes not more than 3 feet apart, and provide each manhole wall with a minimum of two racks. Space racks in signal manholes not more than 16 1/2 inches apart with the end rack being no further than 12 inches from the adjacent wall. Methods of anchoring cable racks must be as follows:

a. Provide a 5/8 inch diameter by 5 inch long anchor bolt with 3 inch foot cast in structure wall with 2 inch protrusion of threaded portion of bolt into structure. Provide 5/8 inch steel square head nut on each anchor bolt. Coat threads of anchor bolts with suitable coating immediately prior to installing nuts.

b. Provide concrete channel insert with a minimum load rating of 800 pounds per foot. Insert channel must be steel of the same length as "vertical rack channel;" channel insert must be cast flush in structure wall. Provide 5/8 inch steel nuts in channel insert to receive 5/8 inch diameter by 3 inch long steel, square head anchor bolts.

c. Provide concrete "spot insert" at each anchor bolt location, cast flush in structure wall. Each insert must have minimum 800 pound load rating. Provide 5/8 inch diameter by 3 inch long steel, square head anchor bolt at each anchor point. Coat threads of anchor bolts with suitable coating immediately prior to installing bolts.

3.5.4 Field Painting

Cast-iron frames and covers not buried in concrete or masonry must be cleaned of mortar, rust, grease, dirt and other deleterious materials, and given a coat of bituminous paint.

3.6 UNDERGROUND CONDUIT AND DUCT SYSTEMS

3.6.1 Requirements

Run conduit in straight lines except where a change of direction is necessary. Provide numbers and sizes of ducts as indicated. Provide a 4/0 AWG bare copper grounding conductor with medium-voltage distribution duct banks. Bond bare copper grounding conductor to ground rings (loops) in all manholes and to ground rings (loops) at all equipment slabs (pads). Route grounding conductor into manholes with the duct bank (sleeving is not required). Ducts must have a continuous slope downward toward underground structures and away from buildings, laid with a minimum slope of 3 inches per 100 feet. Depending on the contour of the finished grade, the high-point may be at a terminal, a manhole, a handhole, or between manholes or handholes. Provide ducts with end bells whenever duct lines terminate in structures.

Perform changes in ductbank direction as follows:

a. Short-radius manufactured 90-degree duct bends may be used only for

pole or equipment risers, unless specifically indicated as acceptable.

b. The minimum manufactured bend radius must be 18 inches for ducts of less than 3 inch diameter, and 36 inches for ducts 3 inches or greater in diameter.

c. As an exception to the bend radius required above, provide field manufactured longsweep bends having a minimum radius of 25 feet for a change of direction of more than 5 degrees, either horizontally or vertically, using a combination of curved and straight sections. Maximum manufactured curved sections: 30 degrees.

3.6.2 Treatment

Ducts must be kept clean of concrete, dirt, or foreign substances during construction. Field cuts requiring tapers must be made with proper tools and match factory tapers. A coupling recommended by the duct manufacturer must be used whenever an existing duct is connected to a duct of different material or shape. Ducts must be stored to avoid warping and deterioration with ends sufficiently plugged to prevent entry of any water or solid substances. Ducts must be thoroughly cleaned before being laid. Plastic ducts must be stored on a flat surface and protected from the direct rays of the sun.

3.6.3 Conduit Cleaning

As each conduit run is completed, for conduit sizes 3 inches and larger, draw a flexible testing mandrel approximately 12 inches long with a diameter less than the inside diameter of the conduit through the conduit. After which, draw a stiff bristle brush through until conduit is clear of particles of earth, sand and gravel; then immediately install conduit plugs. For conduit sizes less than 3 inches, draw a stiff bristle brush through until conduit is clear of particles of earth, sand and gravel; then immediately install conduit plugs.

3.6.4 Jacking and Drilling Under Roads and Structures

Conduits to be installed under existing paved areas which are not to be disturbed, and under roads and railroad tracks, must be zinc-coated, rigid steel, jacked into place. Where ducts are jacked under existing pavement, rigid steel conduit must be installed because of its strength. To protect the corrosion-resistant conduit coating, predrilling or installing conduit inside a larger iron pipe sleeve (jack-and-sleeve) is required. For crossings of existing railroads and airfield pavements greater than 50 feet in length, the predrilling method or the jack-and-sleeve method will be used. Separators or spacing blocks must be made of steel, concrete, plastic, or a combination of these materials placed not farther apart than 4 feet on centers. Hydraulic jet method must not be used.

3.6.5 Galvanized Conduit Concrete Penetrations

Galvanized conduits which penetrate concrete (slabs, pavement, and walls) in wet locations must be PVC coated and must extend from at least 2 inches within the concrete to the first coupling or fitting outside the concrete (minimum of 6 inches from penetration).

3.6.6 Multiple Conduits

Separate multiple conduits by a minimum distance of 3 inches, except that

light and power conduits must be separated from control, signal, and telephone conduits by a minimum distance of 12 inches. Stagger the joints of the conduits by rows (horizontally) and layers (vertically) to strengthen the conduit assembly. Provide plastic duct spacers that interlock vertically and horizontally. Spacer assembly must consist of base spacers, intermediate spacers, ties, and locking device on top to provide a completely enclosed and locked-in conduit assembly. Install spacers per manufacturer's instructions, but provide a minimum of two spacer assemblies per 10 feet of conduit assembly.

3.6.7 Conduit Plugs and Pull Rope

New conduit indicated as being unused or empty must be provided with plugs on each end. Plugs must contain a weephole or screen to allow water drainage. Provide a plastic pull rope having 3 feet of slack at each end of unused or empty conduits.

3.6.8 Conduit and Duct Without Concrete Encasement

Depths to top of the conduit must be not less than 36 inches below finished grade. Provide not less than 3 inches clearance from the conduit to each side of the trench. Grade bottom of trench smooth; where rock, soft spots, or sharp-edged materials are encountered, excavate the bottom for an additional 3 inches, fill and tamp level with original bottom with sand or earth free from particles, that would be retained on a 1/4 inch sieve. The first 6 inch layer of backfill cover must be sand compacted as previously specified. The rest of the excavation must be backfilled and compacted in 3 to 6 inch layers. Provide color, type and depth of warning tape as specified in Section 31 00 00 EARTHWORK.

3.6.8.1 Encasement Under Roads and Structures

Under roads, paved areas, and railroad tracks, install conduits in concrete encasement of rectangular cross-section providing a minimum of 3 inch concrete cover around ducts. Concrete encasement must extend at least 5 feet beyond the edges of paved areas and roads, and 12 feet beyond the rails on each side of railroad tracks. Depths to top of the concrete envelope must be not less than 36 inches below finished grade.

3.6.8.2 Directional Boring

HDPE conduits must be installed below the frostline and as specified herein.

For branch circuit wiring less than 600 volts, depths to the top of the conduit must not be less than 24 inches in pavement- or non-pavement-covered areas.

3.6.9 Duct Encased in Concrete

Construct underground duct lines of individual conduits encased in concrete. Depths to top of the concrete envelope must be not less than 24 inches below finished grade, except under roads and pavement, concrete envelope must be not less than 24 inches below finished grade. Do not mix different kinds of conduit in any one duct bank. Concrete encasement surrounding the bank must be rectangular in cross-section and must provide at least 3 inches of concrete cover for ducts. Separate conduits by a minimum concrete thickness of 3 inches. Before pouring concrete, anchor duct bank assemblies to prevent the assemblies from floating during

concrete pouring. Anchoring must be done by driving reinforcing rods adjacent to duct spacer assemblies and attaching the rods to the spacer assembly. Provide steel reinforcing in the concrete envelope as indicated. Provide color, type and depth of warning tape as specified in Section 31 00 00 EARTHWORK.

3.6.9.1 Connections to Manholes

Duct bank envelopes connecting to underground structures must be flared to have enlarged cross-section at the manhole entrance to provide additional shear strength. Dimensions of the flared cross-section must be larger than the corresponding manhole opening dimensions by no less than 12 inches in each direction. Perimeter of the duct bank opening in the underground structure must be flared toward the inside or keyed to provide a positive interlock between the duct bank and the wall of the structure. Use vibrators when this portion of the encasement is poured to assure a seal between the envelope and the wall of the structure.

3.6.9.2 Connections to Existing Underground Structures

For duct bank connections to existing structures, break the structure wall out to the dimensions required and preserve steel in the structure wall. Cut steel and connect to the duct bank envelope. Chip the perimeter surface of the duct bank opening to form a key or flared surface, providing a positive connection with the duct bank envelope.

3.6.9.3 Connections to Existing Concrete Pads

For duct bank connections to concrete pads, break an opening in the pad out to the dimensions required and preserve steel in pad. Cut the steel and connect to the duct bank envelope. Chip out the opening in the pad to form a key for the duct bank envelope.

3.6.9.4 Connections to Existing Ducts

Where connections to existing duct banks are indicated, excavate the banks to the maximum depth necessary. Cut off the banks and remove loose concrete from the conduits before new concrete-encased ducts are installed. Provide a reinforced concrete collar, poured monolithically with the new duct bank, to take the shear at the joint of the duct banks. Remove existing cables which constitute interference with the work.

3.6.9.5 Partially Completed Duct Banks

During construction wherever a construction joint is necessary in a duct bank, prevent debris such as mud, and, and dirt from entering ducts by providing suitable conduit plugs. Fit concrete envelope of a partially completed duct bank with reinforcing steel extending a minimum of 2 feet back into the envelope and a minimum of 2 feet beyond the end of the envelope. Provide one No. 4 bar in each corner, 3 inches from the edge of the envelope. Secure corner bars with two No. 3 ties, spaced approximately one foot apart. Restrain reinforcing assembly from moving during concrete pouring.

3.6.9.6 Removal of Ducts

Where duct lines are removed from existing underground structures, close the openings to waterproof the structure. Chip out the wall opening to provide a key for the new section of wall.

3.6.10 Duct Sealing

Seal all electrical penetrations for radon mitigation, maintaining integrity of the vapor barrier, and to prevent infiltration of air, insects, and vermin.

3.7 CABLE PULLING

Test existing duct lines with a mandrel and thoroughly swab out to remove foreign material before pulling cables. Pull cables down grade with the feed-in point at the manhole or buildings of the highest elevation. Use flexible cable feeds to convey cables through manhole opening and into duct runs. Do not exceed the specified cable bending radii when installing cable under any conditions, including turnups into switches, transformers, switchgear, switchboards, and other enclosures. Cable with shield must have a bending radius not less than 12 times the overall diameter of the completed cable. If basket-grip type cable-pulling devices are used to pull cable in place, cut off the section of cable under the grip before splicing and terminating.

3.7.1 Cable Lubricants

Use lubricants that are specifically recommended by the cable manufacturer for assisting in pulling jacketed cables.

3.8 CABLES IN UNDERGROUND STRUCTURES

Do not install cables utilizing the shortest path between penetrations, but route along those walls providing the longest route and the maximum spare cable lengths. Form cables to closely parallel walls, not to interfere with duct entrances, and support on brackets and cable insulators. Support cable splices in underground structures by racks on each side of the splice. Locate splices to prevent cyclic bending in the spliced sheath. Install cables at middle and bottom of cable racks, leaving top space open for future cables, except as otherwise indicated for existing installations. Provide one spare three-insulator rack arm for each cable rack in each underground structure.

3.8.1 Cable Tag Installation

Install cable tags in each manhole as specified, including each splice. Tag wire and cable provided by this contract. Install cable tags over the fireproofing, if any, and locate the tags so that they are clearly visible without disturbing any cabling or wiring in the manholes.

3.9 CONDUCTORS INSTALLED IN PARALLEL

Conductors must be grouped such that each conduit of a parallel run contains 1 Phase A conductor, 1 Phase B conductor, 1 Phase C conductor, and 1 neutral conductor.

3.10 LOW VOLTAGE CABLE SPLICING AND TERMINATING

Make terminations and splices with materials and methods as indicated or specified herein and as designated by the written instructions of the manufacturer. Do not allow the cables to be moved until after the splicing material has completely set. Make splices in underground distribution systems only in accessible locations such as manholes,

handholes, or aboveground termination pedestals.

3.11 MEDIUM VOLTAGE CABLE TERMINATIONS

Make terminations in accordance with the written instruction of the termination kit manufacturer.

3.12 MEDIUM VOLTAGE CABLE JOINTS

Provide power cable joints (splices) suitable for continuous immersion in water. Make joints only in accessible locations in manholes or handholes by using materials and methods in accordance with the written instructions of the joint kit manufacturer.

3.12.1 Joints in Shielded Cables

Cover the joined area with metallic tape, or material like the original cable shield and connect it to the cable shield on each side of the splice. Provide a bare copper ground connection brought out in a watertight manner and grounded to the manhole grounding loop as part of the splice installation. Ground conductors, connections, and rods must be as specified elsewhere in this section. Wire must be trained to the sides of the enclosure to prevent interference with the working area.

3.12.2 Joints in Armored Cables

Armored cable joints must be enclosed in compound-filled, cast-iron or alloy splice boxes equipped with stuffing boxes and armor clamps of a suitable type and size for the cable being installed.

3.13 CABLE END CAPS

Cable ends must be sealed at all times with coated heat shrinkable end caps. Cables ends must be sealed when the cable is delivered to the job site, while the cable is stored and during installation of the cable. The caps must remain in place until the cable is spliced or terminated. Sealing compounds and tape are not acceptable substitutes for heat shrinkable end caps. Cable which is not sealed in the specified manner at all times will be rejected.

3.14 FIREPROOFING OF CABLES IN UNDERGROUND STRUCTURES

Fireproof (arc proof) wire and cables which will carry current at 2200 volts or more in underground structures.

3.14.1 Fireproofing Tape

Tightly wrap strips of fireproofing tape around each cable spirally in half-lapped wrapping. Install tape in accordance with manufacturer's instructions.

3.14.2 Tape-Wrap

Tape-wrap metallic-sheathed or metallic armored cables without a nonmetallic protective covering over the sheath or armor prior to application of fireproofing. Wrap must be in the form of two tightly applied half-lapped layers of a pressure-sensitive 10 mil thick plastic tape, and must extend not less than one inch into the duct. Even out irregularities of the cable, such as at splices, with insulation putty

before applying tape.

3.15 GROUNDING SYSTEMS

NFPA 70 and IEEE C2, except provide grounding systems with a resistance to solid earth ground not exceeding 25 ohms.

3.15.1 Grounding Electrodes

Provide cone pointed driven ground rods driven full depth plus 6 inches, installed to provide an earth ground of the appropriate value for the particular equipment being grounded.
If the specified ground resistance is not met, an additional ground rod must be provided in accordance with the requirements of NFPA 70 (placed not less than 6 feet from the first rod). Should the resultant (combined) resistance exceed the specified resistance, measured not less than 48 hours after rainfall, notify the Contracting Officer immediately.

3.15.2 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. Tools and dies must be as recommended by the manufacturer. An embossing die code or other standard method must provide visible indication that a connector has been adequately compressed on the ground wire.

3.15.3 Grounding Conductors

Provide bare grounding conductors, except where installed in conduit with associated phase conductors. Ground cable sheaths, cable shields, conduit, and equipment with No. 6 AWG. Ground other noncurrent-carrying metal parts and equipment frames of metal-enclosed equipment. Ground metallic frames and covers of handholes and pull boxes with a braided, copper ground strap with equivalent ampacity of No. 6 AWG. Provide direct connections to the grounding conductor with 600 v insulated, full-size conductor for each grounded neutral of each feeder circuit, which is spliced within the manhole.

3.15.4 Ground Cable Crossing Expansion Joints

Protect ground cables crossing expansion joints or similar separations in structures and pavements by use of approved devices or methods of installation which provide the necessary slack in the cable across the joint to permit movement. Use stranded or other approved flexible copper cable across such separations.

3.15.5 Manhole Grounding

Loop a 4/0 AWG grounding conductor around the interior perimeter, approximately 12 inches above finished floor. Secure the conductor to the

manhole walls at intervals not exceeding 36 inches. Connect the conductor to the manhole grounding electrode with 4/0 AWG conductor. Connect all incoming 4/0 grounding conductors to the ground loop adjacent to the point of entry into the manhole. Bond the ground loop to all cable shields, metal cable racks, and other metal equipment with a minimum 6 AWG conductor.

3.15.6 Fence Grounding

Provide grounding for fences with a ground rod at each fixed gate post and at each corner post. Drive ground rods until the top is 12 inches below grade. Attach a No. 4 AWG copper conductor, by exothermic weld to the ground rods and extend underground to the immediate vicinity of fence post. Lace the conductor vertically into 12 inches of fence mesh and fasten by two approved bronze compression fittings, one to bond wire to post and the other to bond wire to fence. Each gate section must be bonded to its gatepost by a 1/8 by one inch flexible braided copper strap and ground post clamps. Clamps must be of the anti-electrolysis type.

3.15.7 Metal Splice Case Grounding

Metal splice cases for medium-voltage direct-burial cable must be grounded by connection to a driven ground rod located within 2 feet of each splice box using a grounding electrode conductor having a current-carrying capacity of at least 20 percent of the individual phase conductors in the associated splice box, but not less than No. 6 AWG.

3.16 EXCAVATING, BACKFILLING, AND COMPACTING

Provide in accordance with NFPA 70 and Section 31 00 00 EARTHWORK.

3.16.1 Reconditioning of Surfaces

3.16.1.1 Unpaved Surfaces

Restore to their original elevation and condition unpaved surfaces disturbed during installation of duct. Preserve sod and topsoil removed during excavation and reinstall after backfilling is completed. Replace sod that is damaged by sod of quality equal to that removed. When the surface is disturbed in a newly seeded area, re-seed the restored surface with the same quantity and formula of seed as that used in the original seeding, and provide topsoiling, fertilizing, liming, seeding, sodding, sprigging, or mulching. Provide work in accordance with Section 32 92 19 SEEDING.

3.16.1.2 Paving Repairs

Where trenches, pits, or other excavations are made in existing roadways and other areas of pavement where surface treatment of any kind exists , restore such surface treatment or pavement the same thickness and in the same kind as previously existed, except as otherwise specified, and to match and tie into the adjacent and surrounding existing surfaces.

3.17 CAST-IN-PLACE CONCRETE

Provide concrete in accordance with Section 03 30 00 CAST-IN-PLACE CONCRETE.

3.17.1 Concrete Slabs (Pads) for Equipment

Unless otherwise indicated, the slab must be at least 8 inches thick, reinforced with a 6 by 6 - W2.9 by W2.9 mesh, placed uniformly 4 inches from the top of the slab. Slab must be placed on a 6 inch thick, well-compacted gravel base. Top of concrete slab must be approximately 4 inches above finished grade with gradual slope for drainage. Edges above grade must have 1/2 inch chamfer. Slab must be of adequate size to project at least 8 inches beyond the equipment.

Stub up conduits, with bushings, 2 inches into cable wells in the concrete pad. Coordinate dimensions of cable wells with transformer cable training areas.

3.17.2 Sealing

When the installation is complete, seal all conduit and other entries into the equipment enclosure with an approved sealing compound. Seals must be of sufficient strength and durability to protect all energized live parts of the equipment from rodents, insects, or other foreign matter.

3.18 FIELD QUALITY CONTROL

3.18.1 Performance of Field Acceptance Checks and Tests

Perform in accordance with the manufacturer's recommendations, and include the following visual and mechanical inspections and electrical tests, performed in accordance with NETA ATS.

3.18.1.1 Low Voltage Cables, 600-Volt

Perform tests after installation of cable, splices and terminations and before terminating to equipment or splicing to existing circuits.

a. Visual and Mechanical Inspection

(1) Inspect exposed cable sections for physical damage.

(2) Verify that cable is supplied and connected in accordance with contract plans and specifications.

(3) Verify tightness of accessible bolted electrical connections.

(4) Inspect compression-applied connectors for correct cable match and indentation.

(5) Visually inspect jacket and insulation condition.

(6) Inspect for proper phase identification and arrangement.

b. Electrical Tests

(1) Perform insulation resistance tests on wiring No. 6 AWG and larger diameter using instrument which applies voltage of approximately 1000 volts dc for one minute.

(2) Perform continuity tests to insure correct cable connection.

3.18.1.2 Grounding System

a. Visual and mechanical inspection

Inspect ground system for compliance with contract plans and specifications.

b. Electrical tests

Perform ground-impedance measurements utilizing the fall-of-potential method in accordance with IEEE 81. On systems consisting of interconnected ground rods, perform tests after interconnections are complete. On systems consisting of a single ground rod perform tests before any wire is connected. Take measurements in normally dry weather, not less than 48 hours after rainfall. Use a portable ground resistance tester in accordance with manufacturer's instructions to test each ground or group of grounds. The instrument must be equipped with a meter reading directly in ohms or fractions thereof to indicate the ground value of the ground rod or grounding systems under test. Provide site diagram indicating location of test probes with associated distances, and provide a plot of resistance vs. distance.

3.18.2 Follow-Up Verification

Upon completion of acceptance checks and tests, show by demonstration in service that circuits and devices are in good operating condition and properly performing the intended function. As an exception to requirements stated elsewhere in the contract, the Contracting Officer must be given 5 working days advance notice of the dates and times of checking and testing.

.... -- End of Section --

SECTION 33 82 00

TELECOMMUNICATIONS OUTSIDE PLANT (OSP)
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 in the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM B1	(2013) Standard Specification for Hard-Drawn Copper Wire
ASTM B8	(2011; R 2017) Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
ASTM D709	(2017) Standard Specification for Laminated Thermosetting Materials
ASTM D1557	(2012; E 2015) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3) (2700 kN-m/m3)

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 100	(2000; Archived) The Authoritative Dictionary of IEEE Standards Terms
IEEE C2	(2017; Errata 1-2 2017; INT 1 2017) National Electrical Safety Code

INSULATED CABLE ENGINEERS ASSOCIATION (ICEA)

ICEA S-87-640	(2016) Optical Fiber Outside Plant Communications Cable; 4th Edition
ICEA S-98-688	(2012) Broadband Twisted Pair Telecommunication Cable, Aircore, Polyolefin Insulated, Copper Conductors Technical Requirements
ICEA S-99-689	(2012) Broadband Twisted Pair Telecommunication Cable Filled, Polyolefin Insulated, Copper Conductors Technical Requirements

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2020; ERTA 20-1 2020; ERTA 20-2 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4) National Electrical Code

TELECOMMUNICATIONS INDUSTRY ASSOCIATION (TIA)

TIA-455-78-B	(2002) FOTP-78 Optical Fibres - Part 1-40: Measurement Methods and Test Procedures - Attenuation
TIA-455-107	(1999a) FOTP-107 Determination of Component Reflectance or Link/System Return Loss using a Loss Test Set
TIA-472D000	(2007b) Fiber Optic Communications Cable for Outside Plant Use
TIA-492CAAA	(1998; R 2002) Detail Specification for Class IVa Dispersion-Unshifted Single-Mode Optical Fibers
TIA-526-7	(2015a) OFSTP-7 Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant
TIA-526-14	(2015c) OFSTP-14A Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant
TIA-568-C.1	(2009; Add 2 2011; Add 1 2012) Commercial Building Telecommunications Cabling Standard
TIA-568-C.2	(2009; Errata 2010; Add 2 2014; Add 1 2016) Balanced Twisted-Pair Telecommunications Cabling and Components Standards
TIA-568-C.3	(2008; Add 1 2011) Optical Fiber Cabling Components Standard
TIA-569	(2015d) Commercial Building Standard for Telecommunications Pathways and Spaces
TIA-590	(1997a) Standard for Physical Location and Protection of Below Ground Fiber Optic Cable Plant
TIA-606	(2017c) Administration Standard for the Telecommunications Infrastructure
TIA-607	(2015c; Addendum 1 2017) Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises
TIA-758	(2012b) Customer-Owned Outside Plant Telecommunications Infrastructure Standard
TIA/EIA-455	(1998b) Standard Test Procedure for Fiber Optic Fibers, Cables, Transducers, Sensors, Connecting and Terminating Devices, and Other Fiber Optic Components

TIA/EIA-455-204	(2000) Standard for Measurement of Bandwidth on Multimode Fiber
TIA/EIA-598	(2014D; Add 2 2018) Optical Fiber Cable Color Coding

UNITED FACILITIES CRITERIA (UFC)

UFC 3-580-01	(2016, June 1) Telecommunications Interior Infrastructure Planning and Design, Change 1

U.S. DEPARTMENT OF AGRICULTURE (USDA)

RUS 1755	Telecommunications Standards and Specifications for Materials, Equipment and Construction
RUS Bull 345-65	(1985) Shield Bonding Connectors (PE-65)
RUS Bull 1751F-630	(1996) Design of Aerial Plant
RUS Bull 1751F-640	(1995) Design of Buried Plant, Physical Considerations
RUS Bull 1751F-643	(2002) Underground Plant Design
RUS Bull 1751F-815	(1979) Electrical Protection of Outside Plant
RUS Bull 1753F-201	(1997) Acceptance Tests of Telecommunications Plant (PC-4)

UNDERWRITERS LABORATORIES (UL)

UL 83	(2017; Reprint Mar 2020) UL Standard for Safety Thermoplastic-Insulated Wires and Cables
UL 510	(2020) UL Standard for Safety Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape

1.2 RELATED REQUIREMENTS

Section 27 10 00, BUILDING TELECOMMUNICATIONS CABLING SYSTEM, Section 33 71 02, UNDERGROUND ELECTRICAL DISTRIBUTION and UFC 3-580-01 apply to this section with additions and modifications specified herein.

1.3 DEFINITIONS

Unless otherwise specified or indicated, electrical and electronics terms used in this specification shall be as defined in TIA-568-C.1, TIA-568-C.2, TIA-568-C.3, TIA-569, TIA-606, and IEEE 100 and herein.

1.3.1 Campus Distributor (CD)

A distributor from which the campus backbone cabling emanates.

(International expression for main cross-connect - (MC).)

1.3.2 Entrance Facility (EF) (Telecommunications)

An entrance to the building for both private and public network service cables (including antennae) including the entrance point at the building wall and continuing to the entrance room or space.

1.3.3 Entrance Room (ER) (Telecommunications)

A centralized space for telecommunications equipment that serves the occupants of a building. Equipment housed therein is considered distinct from a telecommunications room because of the nature of its complexity.

1.3.4 Building Distributor (BD)

A distributor in which the building backbone cables terminate and at which connections to the campus backbone cables may be made. (International expression for intermediate cross-connect - (IC).)

1.3.5 Pathway

A physical infrastructure utilized for the placement and routing of telecommunications cable.

1.4 SYSTEM DESCRIPTION

Contractor provides 24 single mode fiber optic cable from Building 880 to Airmen Leadership School as shown on the plans. Contractor provides 2 - 4" conduits from Airmen Leadership School to manhole MH-10G as shown on the plans. Contractor installs 4 - 4" conduits from manhole MH-10G to MH-10E as shown on the plans. The telecommunications outside plant consists of cable, conduit, manholes, poles, etc. required to provide signal paths from the closest point of presence to the new facility, including free standing frames or backboards, interconnecting hardware, terminating cables, lightning and surge protection modules at the entrance facility. The work consists of providing, testing and making operational cabling, interconnecting hardware and lightning and surge protection necessary to form a complete outside plant telecommunications system for continuous use.

1.5 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. When used, a code following the "G" classification identifies the office that will review the submittal for the Government. "RO" indicates Resident Office, and "DO" indicates District Office. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Telecommunications Outside Plant; G, RO

Telecommunications Entrance Facility Drawings; G, RO

In addition to Section 01 33 00 SUBMITTAL PROCEDURES, provide shop drawings in accordance with paragraph SHOP DRAWINGS.

SD-03 Product Data

Wire and cable; G, RO

Cable splices, and connectors; G, RO

Closures; G, RO

Spare Parts; G

Submittals shall include the manufacturer's name, trade name, place of manufacture, and catalog model or number. Submittals shall also include applicable federal, military, industry, and technical society publication references. Should manufacturer's data require supplemental information for clarification, the supplemental information shall be submitted as specified in paragraph REGULATORY REQUIREMENTS and as required for certificates in Section 01 33 00 SUBMITTAL PROCEDURES.

SD-06 Test Reports

Pre-installation tests; G

Acceptance tests; G

Outside Plant Test Plan; G, RO

SD-07 Certificates

Telecommunications Contractor Qualifications; G

Key Personnel Qualifications; G

Minimum Manufacturer's Qualifications; G

SD-08 Manufacturer's Instructions

Cable tensions; G

Fiber Optic Splices; G

Submit instructions prior to installation.

SD-09 Manufacturer's Field Reports

Factory Reel Test Data; G

SD-10 Operation and Maintenance Data

Telecommunications outside plant (OSP), Data Package 5; G,RO

Commercial off-the-shelf manuals shall be provided for operation, installation, configuration, and maintenance of products provided as a part of the telecommunications outside plant (OSP). Submit

operations and maintenance data in accordance with Section 01 78 23, OPERATION AND MAINTENANCE DATA and as specified herein not later than 2 months prior to the date of beneficial occupancy. In addition to requirements of Data package 5, include the requirements of paragraphs TELECOMMUNICATIONS OUTSIDE PLANT SHOP DRAWINGS and TELECOMMUNICATIONS ENTRANCE FACILITY DRAWINGS.

SD-11 Closeout Submittals

Record Documentation; G, RO

In addition to other requirements, provide in accordance with paragraph RECORD DOCUMENTATION.

1.6 QUALITY ASSURANCE

1.6.1 Shop Drawings

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. Submittals shall include the nameplate data, size, and capacity. Submittals shall also include applicable federal, military, industry, and technical society publication references.

1.6.1.1 Telecommunications Outside Plant Shop Drawings

Provide Outside Plant Design in accordance with TIA-758, RUS Bull 1751F-630 for aerial system design, and RUS Bull 1751F-643 for underground system design. Provide T0 shop drawings that show the physical and logical connections from the perspective of an entire campus, such as actual building locations, exterior pathways and campus backbone cabling on plan view drawings, major system nodes, and related connections on the logical system drawings in accordance with TIA-606. Drawings shall include wiring and schematic diagrams for fiber optic and copper cabling and splices, copper conductor gauge and pair count, fiber pair count and type, pathway duct and innerduct arrangement, associated construction materials, and any details required to demonstrate that cable system has been coordinated and will properly support the switching and transmission system identified in specification and drawings. Provide Registered Communications Distribution Designer (RCDD) approved drawings of the telecommunications outside plant. Update existing telecommunication Outside Plant T0 drawings to include information modified, deleted or added as a result of this installation in accordance with TIA-606. The telecommunications outside plant (OSP) shop drawings shall be included in the operation and maintenance manuals.

1.6.1.2 Telecommunications Entrance Facility Drawings

Provide T3 drawings for EF Telecommunications in accordance with TIA-606 and I3A Technical Criteria that include telecommunications entrance facility plan views, pathway layout (cable tray, racks, ladder-racks, etc.), mechanical/electrical layout, and rack, backboard and wall elevations. Drawings shall show layout of applicable equipment including incoming cable stub or connector blocks, building protector assembly,

outgoing cable connector blocks, patch panels and equipment spaces and cabinet/racks. Drawings shall include a complete list of equipment and material, equipment rack details, proposed layout and anchorage of equipment and appurtenances, and equipment relationship to other parts of the work including clearance for maintenance and operation. Drawings may also be an enlargement of a congested area of T1 or T2 drawings. Provide T3 drawings for EF Telecommunications as specified in the paragraph TELECOMMUNICATIONS SPACE DRAWINGS of Section 27 10 00 BUILDING TELECOMMUNICATIONS CABLING SYSTEMS. The telecommunications entrance facility shop drawings shall be included in the operation and maintenance manuals.

1.6.2 Telecommunications Qualifications

Work under this section shall be performed by and the equipment shall be provided by the approved telecommunications contractor and key personnel. Qualifications shall be provided for: the telecommunications system contractor, the telecommunications system installer, the supervisor (if different from the installer), and the cable splicing and terminating personnel. A minimum of 30 days prior to installation, submit documentation of the experience of the telecommunications contractor and of the key personnel.

1.6.2.1 Telecommunications Contractor Qualifications

The telecommunications contractor shall be a firm which is regularly and professionally engaged in the business of the applications, installation, and testing of the specified telecommunications systems and equipment. The telecommunications contractor shall demonstrate experience in providing successful telecommunications systems that include outside plant and broadband cabling within the past 3 years. Submit documentation for a minimum of three and a maximum of five successful telecommunication system installations for the telecommunications contractor. Each of the key personnel shall demonstrate experience in providing successful telecommunications systems in accordance with TIA-758 within the past 3 years.

1.6.2.2 Key Personnel Qualifications

Provide key personnel who are regularly and professionally engaged in the business of the application, installation and testing of the specified telecommunications systems and equipment. There may be one key person or more key persons proposed for this solicitation depending upon how many of the key roles each has successfully provided. Each of the key personnel shall demonstrate experience in providing successful telecommunications systems within the past 3 years.

Cable splicing and terminating personnel assigned to the installation of this system or any of its components shall have training in the proper techniques and have a minimum of 3 years experience in splicing and terminating the specified cables. Modular splices shall be performed by factory certified personnel or under direct supervision of factory trained personnel for products used.

Supervisors and installers assigned to the installation of this system or any of its components shall have factory or factory approved certification from each equipment manufacturer indicating that they are qualified to install and test the provided products.

Submit documentation for a minimum of three and a maximum of five successful telecommunication system installations for each of the key personnel. Documentation for each key person shall include at least two successful system installations provided that are equivalent in system size and in construction complexity to the telecommunications system proposed for this solicitation. Include specific experience in installing and testing telecommunications outside plant systems, including broadband cabling, and provide the names and locations of at least two project installations successfully completed using optical fiber telecommunications cabling systems. All of the existing telecommunications system installations offered by the key persons as successful experience shall have been in successful full-time service for at least 18 months prior to the issuance date for this solicitation. Provide the name and role of the key person, the title, location, and completed installation date of the referenced project, the referenced project owner point of contact information including name, organization, title, and telephone number, and generally, the referenced project description including system size and construction complexity.

Indicate that all key persons are currently employed by the telecommunications contractor, or have a commitment to the telecommunications contractor to work on this project. All key persons shall be employed by the telecommunications contractor at the date of issuance of this solicitation, or if not, have a commitment to the telecommunications contractor to work on this project by the date that the bid was due to the Contracting Officer.

Note that only the key personnel approved by the Contracting Officer in the successful proposal shall do work on this solicitation's telecommunications system. Key personnel shall function in the same roles in this contract, as they functioned in the offered successful experience. Any substitutions for the telecommunications contractor's key personnel requires approval from The Contracting Officer.

1.6.2.3 Minimum Manufacturer's Qualifications

Cabling, equipment and hardware manufacturers shall have a minimum of 3 years experience in the manufacturing, assembly, and factory testing of components which comply with, TIA-568-C.1, TIA-568-C.2 and TIA-568-C.3. In addition, cabling manufacturers shall have a minimum of 3 years experience in the manufacturing and factory testing of cabling which comply with ICEA S-87-640, ICEA S-98-688, and ICEA S-99-689.

1.6.3 Outside Plant Test Plan

Prepare and provide a complete and detailed test plan for field tests of the outside plant including a complete list of test equipment for the optical fiber cables, components, and accessories for approval by the Contracting Officer. Include a cut-over plan with procedures and schedules for relocation of facility station numbers without interrupting service to any active location. Submit the plan at least 30 days prior to tests for Contracting Officer approval. Provide outside plant testing and performance measurement criteria in accordance with TIA-568-C.1 and RUS Bull 1753F-201. Include procedures for certification, validation, and testing that includes fiber optic link performance criteria.

1.6.4 Standard Products

Provide materials and equipment that are standard products of

manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship and shall be the manufacturer's latest standard design that has been in satisfactory commercial or industrial use for at least 1 year prior to bid opening. The 1-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 1-year period. Products supplied shall be specifically designed and manufactured for use with outside plant telecommunications systems. 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 this section.

1.6.4.1 Alternative Qualifications

Products having less than a 1-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 provided.

1.6.4.2 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.

1.6.5 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 unless more stringent requirements are specified or indicated.

1.6.5.1 Independent Testing Organization Certificate

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

1.7 DELIVERY, STORAGE, AND HANDLING

Ship cable on reels in 500 feet length with a minimum overage of 10 percent. Radius of the reel drum shall not be smaller than the minimum bend radius of the cable. Wind cable on the reel so that unwinding can be done without kinking the cable. Two meters of cable at both ends of the cable shall be accessible for testing. Attach permanent label on each reel showing length, cable identification number, cable size, cable type, and date of manufacture. Provide water resistant label and the indelible writing on the labels. Apply end seals to each end of the cables to prevent moisture from entering the cable. Reels with cable shall be suitable for outside storage conditions when temperature ranges from minus 40 degrees C to plus 65 degrees C, with relative humidity from 0 to 100

percent. Equipment, other than cable, delivered and placed in storage shall be stored with protection from weather, humidity and temperature variation, dirt and dust, or other contaminants in accordance with manufacturer's requirements.

1.8 MAINTENANCE

1.8.1 Record Documentation

Provide the activity responsible for telecommunications system maintenance and administration a single complete and accurate set of record documentation for the entire telecommunications system with respect to this project.

Provide T5 drawings including documentation on cables and termination hardware in accordance with TIA-606. T5 drawings shall include schedules to show information for cut-overs and cable plant management, patch panel layouts, cross-connect information and connecting terminal layout as a minimum. T5 drawings shall be provided on electronic media using Windows based computer cable management software. A licensed copy of the cable management software including documentation, shall be provided. Update existing record documentation to reflect campus distribution T0 drawings and T3 drawing schedule information modified, deleted or added as a result of this installation. Provide the following T5 drawing documentation as a minimum:

a. Cables - A record of installed cable shall be provided in accordance with TIA-606. The cable records shall include the required data fields for each cable and complete end-to-end circuit report for each complete circuit from the assigned outlet to the entry facility in accordance with TIA-606. Include manufacture date of cable with submittal.

b. Termination Hardware - Provide a record of installed patch panels, cross-connect points, campus distributor and terminating block arrangements and type in accordance with TIA-606. Documentation shall include the required data fields in accordance with TIA-606.

Provide record documentation as specified in Section 27 10 00 BUILDING TELECOMMUNICATIONS CABLING SYSTEM.

1.8.2 Spare Parts

In addition to the requirements of Section 01 78 23 OPERATION AND MAINTENANCE DATA, provide a complete list of parts and supplies, with current unit prices and source of supply, and a list of spare parts recommended for stocking. Spare parts shall be provided no later than the start of field testing.

1.9 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.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

Products supplied shall be specifically designed and manufactured for use with outside plant telecommunications systems.

2.2 TELECOMMUNICATIONS ENTRANCE FACILITY

2.2.1 Fiber Optic Terminations

Provide fiber optic cable terminations as specified in 27 10 00 BUILDING TELECOMMUNICATIONS CABLING SYSTEM.

2.3 CLOSURES

2.3.1 Fiber Optic Closures

2.3.1.1 Direct Burial

Provide buried closure suitable to house splice organizer in protective housing into which can be poured an encapsulating compound. Closure shall have adequate strength to protect the splice and maintain cable shield electrical continuity, when metallic, in buried environment. Encapsulating compound shall be reenterable and shall not alter chemical stability of the closure.

2.3.1.2 In Vault or Manhole

Provide underground closure suitable to house splice organizer in a protective housing into which can be poured an encapsulating compound. Closure shall be of thermoplastic, thermoset, or stainless steel material supplying structural strength necessary to pass the mechanical and electrical requirements in a vault or manhole environment. Encapsulating compound shall be reenterable and shall not alter the chemical stability of the closure.

2.4 CABLE SPLICES, AND CONNECTORS

2.4.1 Fiber Optic Cable Splices

Provide fiber optic cable splices and splicing materials for fusion mechanical methods at locations shown on the construction drawings. The splice insertion loss shall be 0.3 dB maximum when measured in accordance with TIA-455-78-B using an Optical Time Domain Reflectometer (OTDR). Splices shall be designed for a return loss of 40.0 db max for single mode fiber when tested in accordance with TIA-455-107. Physically protect each fiber optic splice by a splice kit specially designed for the splice.

2.4.2 Fiber Optic Splice Organizer

Provide splice organizer suitable for housing fiber optic splices in a neat and orderly fashion. Splice organizer shall allow for a minimum of 3 feet of fiber for each fiber within the cable to be neatly stored without kinks or twists. Splice organizer shall accommodate individual strain relief for each splice and allow for future maintenance or modification, without damage to the cable or splices. Provide splice organizer hardware, such as splice trays, protective glass shelves, and shield bond connectors in a splice organizer kit.

2.4.3 Shield Connectors

Provide connectors with a stable, low-impedance electrical connection between the cable shield and the bonding conductor in accordance with RUS Bull 345-65.

2.5 CONDUIT

Provide conduit as specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION.

2.6 PLASTIC INSULATING TAPE

UL 510.

2.7 WIRE AND CABLE

2.7.1 Fiber Optic Cable

Provide single-mode, 8/125-um, 0.10 aperture 1310 nm fiber optic cable in accordance with TIA-492CAAA, TIA-472D000, and ICEA S-87-640 including any special requirements made necessary by a specialized design. Provide optical fibers as indicated on the drawings. Fiber optic cable shall be specifically designed for outside use with loose buffer construction. Provide fiber optic color code in accordance with TIA/EIA-598

2.7.1.1 Strength Members

Provide central non-metallic strength members with sufficient tensile strength for installation and residual rated loads to meet the applicable performance requirements in accordance with ICEA S-87-640. The strength member is included to serve as a cable core foundation to reduce strain on the fibers, and shall not serve as a pulling strength member.

2.7.1.2 Shielding or Other Metallic Covering

Provide bare aluminum or coated aluminum tape covering or shield in accordance with ICEA S-87-640.

2.7.1.3 Performance Requirements

Provide fiber optic cable with optical and mechanical performance requirements in accordance with ICEA S-87-640.

2.7.2 Grounding and Bonding Conductors

Provide grounding and bonding conductors in accordance with RUS 1755.200, TIA-607, IEEE C2, I3A Technical Criteria, and NFPA 70. Solid bare copper wire meeting the requirements of ASTM B1 for sizes No. 8 AWG and smaller and stranded bare copper wire meeting the requirements of ASTM B8, for sizes No. 6 AWG and larger. Insulated conductors shall have 600-volt, Type TW insulation meeting the requirements of UL 83.

2.8 CABLE TAGS IN MANHOLES, HANDHOLES, AND VAULTS

Provide tags for each telecommunications cable or wire located in manholes, handholes, and vaults. Cable tags shall be polyethylene and labeled in accordance with TIA-606. Handwritten labeling is unacceptable.

2.8.1 Polyethylene Cable Tags

Provide tags of polyethylene that have an average tensile strength of 3250 pounds per square inch; and that are 0.08 inch thick (minimum), non-corrosive non-conductive; resistive to acids, alkalis, organic solvents, and salt water; and distortion resistant to 170 degrees F. Provide 0.05 inch (minimum) thick black polyethylene tag holder. Provide a one-piece nylon, self-locking tie at each end of the cable tag. Ties shall have a minimum loop tensile strength of 175 pounds. The cable tags shall have black block letters, numbers, and symbols one inch high on a yellow background. Letters, numbers, and symbols shall not fall off or change positions regardless of the cable tags' orientation.

2.9 BURIED WARNING AND IDENTIFICATION TAPE

Provide fiber optic media marking and protection in accordance with TIA-590. Provide color, type and depth of tape as specified in paragraph BURIED WARNING AND IDENTIFICATION TAPE in Section 31 00 00, EARTHWORK.

2.10 GROUNDING BRAID

Provide grounding braid that provides low electrical impedance connections for dependable shield bonding in accordance with RUS 1755.200. Braid shall be made from flat tin-plated copper.

2.11 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.

2.12 FIELD FABRICATED NAMEPLATES

Provide laminated plastic nameplates in accordance with ASTM D709 for each patch panel, protector assembly, rack, cabinet and other equipment 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.

2.13 TESTS, INSPECTIONS, AND VERIFICATIONS

2.13.1 Factory Reel Test Data

Test 100 percent OTDR test of FO media at the factory in accordance with TIA-568-C.1 and TIA-568-C.3. Use TIA-526-7 for single mode fiber and TIA-526-14 Method B for multi mode fiber measurements. Calibrate OTDR to show anomalies of 0.2 dB minimum. Enhanced performance filled OSP copper cables, referred to as Broadband Outside Plant (BBOSP), shall meet the requirements of ICEA S-99-689. Enhanced performance air core OSP copper cables shall meet the requirements of ICEA S-98-688. Submit test reports, including manufacture date for each cable reel and receive approval before delivery of cable to the project site.

PART 3 EXECUTION

3.1 INSTALLATION

Install all system components and appurtenances in accordance with manufacturer's instructions IEEE C2, NFPA 70, and as indicated. Provide all necessary interconnections, services, and adjustments required for a complete and operable telecommunications system.

3.1.1 Contractor Damage

Promptly repair indicated utility lines or systems damaged during site preparation and construction. Damages to lines or systems not indicated, which are caused by Contractor operations, shall be treated as "Changes" under the terms of the Contract Clauses. When Contractor is advised in writing of the location of a nonindicated line or system, such notice shall provide that portion of the line or system with "indicated" status in determining liability for damages. In every event, immediately notify the Contracting Officer of damage.

3.1.2 Cable Inspection and Repair

Handle cable and wire provided in the construction of this project with care. Inspect cable reels for cuts, nicks or other damage. Damaged cable shall be replaced or repaired to the satisfaction of the Contracting Officer. Reel wraps shall remain intact on the reel until the cable is ready for placement.

3.1.3 Direct Burial System

Installation shall be in accordance with RUS Bull 1751F-640. Under railroad tracks, paved areas, and roadways install cable in conduit encased in concrete. Slope ducts to drain. Excavate trenches by hand or mechanical trenching equipment. Provide a minimum cable cover of 24 inches below finished grade. Trenches shall be not less than 6 inches wide and in straight lines between cable markers. Do not use cable plows. Bends in trenches shall have a radius of not less than 36 inches. Where two or more cables are laid parallel in the same trench, space laterally at least 3 inches apart. When rock is encountered, remove it to a depth of at least 3 inches below the cable and fill the space with sand or clean earth free from particles larger than 1/4 inch. Do not unreel and pull cables into the trench from one end. Cable may be unreeled on grade and lifted into position. Provide color, type and depth of warning tape as specified in paragraph BURIED WARNING AND IDENTIFICATION TAPE in Section 31 00 00 EARTHWORK.

3.1.3.1 Cable Placement

a. Separate cables crossing other cables or metal piping from the other cables or pipe by not less than 3 inches of well tamped earth. Do not install circuits for communications under or above traffic signal loops.

b. Cables shall be in one piece without splices between connections except where the distance exceeds the lengths in which the cable is furnished.

c. Avoid bends in cables of small radii and twists that might cause damage. Do not bend cable and wire in a radius less than 10 times the

outside diameter of the cable or wire.

d. Leave a horizontal slack of approximately 3 feet in the ground on each end of cable runs, on each side of connection boxes, and at points where connections are brought aboveground. Where cable is brought aboveground, leave additional slack to make necessary connections.

3.1.3.2 Identification Markers

Provide a marker at each change of direction of the cable, over the ends of ducts or conduits which are installed under paved areas and roadways and over each splice. Identification markers shall be of concrete, approximately 20 inches square by 6 inches thick.

3.1.3.3 Backfill for Rocky Soil

When placing cable in a trench in rocky soil, the cable shall be cushioned by a fill of sand or selected soil at least 2 inches thick on the floor of the trench before placing the cable or wire. The backfill for at least 4 inches above the wire or cable shall be free from stones, rocks, or other hard or sharp materials which might damage the cable or wire. .

3.1.4 Cable Protection

Provide direct burial cable protection in accordance with NFPA 70 and as specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION. Galvanized conduits which penetrate concrete (slabs, pavement, and walls) shall be PVC coated and shall extend from the first coupling or fitting outside either side of the concrete minimum of 6 inches per 12 inches burial depth beyond the edge of the surface where cable protection is required; all conduits shall be sealed on each end. Where additional protection is required, cable may be placed in galvanized iron pipe (GIP) sized on a maximum fill of 40 percent of cross-sectional area, or in concrete encased 4 inches PVC pipe. Conduit may be installed by jacking or trenching. Trenches shall be backfilled with earth and mechanically tamped at 6 inches lift so that the earth is restored to the same density, grade and vegetation as adjacent undisturbed material.

3.1.4.1 Cable End Caps

Cable ends shall be sealed at all times with coated heat shrinkable end caps. Cables ends shall be sealed when the cable is delivered to the job site, while the cable is stored and during installation of the cable. The caps shall remain in place until the cable is spliced or terminated. Sealing compounds and tape are not acceptable substitutes for heat shrinkable end caps. Cable which is not sealed in the specified manner at all times will be rejected.

3.1.5 Underground Duct

Provide underground duct and connections to existing manholes, and existing ducts as specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION with any additional requirements as specified herein.

3.1.6 Reconditioning of Surfaces

Provide reconditioning of surfaces as specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION.

3.1.7 Penetrations

Caulk and seal cable access penetrations in walls, ceilings and other parts of the building. Seal openings around electrical penetrations through fire resistance-rated wall, partitions, floors, or ceilings in accordance with Section 07 84 00 FIRESTOPPING.

3.1.8 Cable Pulling

Test duct lines with a mandrel and swab out to remove foreign material before the pulling of cables. Avoid damage to cables in setting up pulling apparatus or in placing tools or hardware. Do not step on cables when entering or leaving the manhole. Do not place cables in ducts other than those shown without prior written approval of the Contracting Officer. Roll cable reels in the direction indicated by the arrows painted on the reel flanges. Set up cable reels on the same side of the manhole as the conduit section in which the cable is to be placed. Level the reel and bring into proper alignment with the conduit section so that the cable pays off from the top of the reel in a long smooth bend into the duct without twisting. Under no circumstances shall the cable be paid off from the bottom of a reel. Check the equipment set up prior to beginning the cable pulling to avoid an interruption once pulling has started. Use a cable feeder guide of suitable dimensions between cable reel and face of duct to protect cable and guide cable into the duct as it is paid off the reel. As cable is paid off the reel, lubricate and inspect cable for sheath defects. When defects are noticed, stop pulling operations and notify the Contracting Officer to determine required corrective action. Cable pulling shall also be stopped when reel binds or does not pay off freely. Rectify cause of binding before resuming pulling operations. Provide cable lubricants recommended by the cable manufacturer. Avoid bends in cables of small radii and twists that might cause damage. Do not bend cable and wire in a radius less than 10 times the outside diameter of the cable or wire.

3.1.8.1 Cable Tensions

Obtain from the cable manufacturer and provide to the Contracting Officer, the maximum allowable pulling tension. This tension shall not be exceeded.

3.1.8.2 Pulling Eyes

Equip cables 1.25 inches in diameter and larger with cable manufacturer's factory installed pulling-in eyes. Provide cables with diameter smaller than 1.25 inches with heat shrinkable type end caps or seals on cable ends when using cable pulling grips. Rings to prevent grip from slipping shall not be beaten into the cable sheath. Use a swivel of 3/4 inch links between pulling-in eyes or grips and pulling strand.

3.1.8.3 Installation of Cables in Manholes, Handholes, and Vaults

Do not install cables utilizing the shortest route, but route along those walls providing the longest route and the maximum spare cable lengths. Form cables to closely parallel walls, not to interfere with duct entrances, and support cables on brackets and cable insulators at a maximum of 4 feet. In existing manholes, handholes, and vaults where new ducts are to be terminated, or where new cables are to be installed, modify the existing installation of cables, cable supports, and grounding as required with cables arranged and supported as specified for new cables. Identify each cable with corrosion-resistant embossed metal tags.

3.1.9 Cable Splicing

3.1.9.1 Fiber Optic Splices

Fiber optic splicing shall be in accordance with manufacturer's recommendation and shall exhibit an insertion loss not greater than 0.2 dB for fusion splices and not greater than 0.4 db for mechanical splices.

3.1.10 Surge Protection

All cables and conductors, except fiber optic cable, which serve as communication lines through off-premise lines, shall have surge protection installed at each end which meet the requirements of RUS Bull 1751F-815.

3.1.11 Grounding

Provide grounding and bonding in accordance with RUS 1755.200, TIA-607, IEEE C2, and NFPA 70. Ground exposed noncurrent carrying metallic parts of telephone equipment, cable sheaths, cable splices, and terminals.

3.1.11.1 Telecommunications Primary Bus Bar (TPBB)

The TPBB is the hub of the basic telecommunications grounding system providing a common point of connection for ground from outside cable, CD, and equipment. Establish a TPBB for connection point for cable stub shields to connector blocks and CD protector assemblies as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

3.1.11.2 Incoming Cable Shields

Shields shall not be bonded across the splice to the cable stubs. Ground shields of incoming cables in the EF Telecommunications to the TMGB.

3.1.11.3 Campus Distributor Grounding

a. Protection assemblies: Mount CD protector assemblies directly in the telecommunications rack. Connect assemblies mounted on each vertical frame with No. 6 AWG copper conductor to provide a low resistance path to TMGB.

b. TMGB connection: Connect TPBB to TGB with copper conductor with a total resistance of less than 0.01 ohms.

3.1.12 Cut-Over

All necessary transfers and cut-overs, shall be accomplished by the telecommunications contractor.

3.2 LABELING

3.2.1 Labels

Provide labeling for new cabling and termination hardware located within the facility in accordance with TIA-606. Handwritten labeling is unacceptable. Stenciled lettering for cable and termination hardware shall be provided using thermal ink transfer process.

3.2.2 Cable Tag Installation

Install cable tags for each telecommunications cable or wire located in manholes, handholes, and vaults including each splice. Tag new wire and cable provided under this contract and existing wire and cable which are indicated to have splices and terminations provided by this contract. The labeling of telecommunications cable tag identifiers shall be in accordance with TIA-606 Do not provide handwritten letters. Install cable tags so that they are clearly visible without disturbing any cabling or wiring in the manholes, handholes, and vaults.

3.2.3 Termination Hardware

Label patch panels, distribution panels, connector blocks and protection modules using color coded labels with identifiers in accordance with TIA-606.

3.3 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.

3.4 FIELD QUALITY CONTROL

Provide the Contracting Officer 10 working days notice prior to each test. Provide labor, equipment, and incidentals required for testing. Correct defective material and workmanship disclosed as the results of the tests. Furnish a signed copy of the test results to the Contracting Officer within 3 working days after the tests for each segment of construction are completed. Perform testing as construction progresses and do not wait until all construction is complete before starting field tests.

3.4.1 Pre-Installation Tests

Perform the following tests on cable at the job site before it is removed from the cable reel. For cables with factory installed pulling eyes, these tests shall be performed at the factory and certified test results shall accompany the cable.

3.4.1.1 Cable Capacitance

Perform capacitance tests on at least 10 percent of the pairs within a cable to determine if cable capacitance is within the limits specified.

3.4.1.2 Loop Resistance

Perform DC-loop resistance on at least 10 percent of the pairs within a cable to determine if DC-loop resistance is within the manufacturer's calculated resistance.

3.4.1.3 Pre-Installation Test Results

Provide results of pre-installation tests to the Contracting Officer at least 5 working days before installation is to start. Results shall indicate reel number of the cable, manufacturer, size of cable, pairs tested, and recorded readings. When pre-installation tests indicate that cable does not meet specifications, remove cable from the job site.

3.4.2 Acceptance Tests

Perform acceptance testing in accordance with I3A Technical Criteria, RUS Bull 1753F-201 and as further specified in this section. Provide personnel, equipment, instrumentation, and supplies necessary to perform required testing. Notification of any planned testing shall be given to the Contracting Officer at least 14 days prior to any test unless specified otherwise. Testing shall not proceed until after the Contractor has received written Contracting Officer's approval of the test plans as specified. Test plans shall define the tests required to ensure that the system meets technical, operational, and performance specifications. The test plans shall define milestones for the tests, equipment, personnel, facilities, and supplies required. The test plans shall identify the capabilities and functions to be tested. Provide test reports in booklet form showing all field tests performed, upon completion and testing of the installed system. Measurements shall be tabulated on a pair by pair or strand by strand basis.

3.4.2.1 Copper Conductor Cable

Perform the following acceptance tests in accordance with TIA-758:

a. Wire map (pin to pin continuity)

b. Continuity to remote end

c. Crossed pairs

d. Reversed pairs

e. Split pairs

f. Shorts between two or more conductors

3.4.2.2 Fiber Optic Cable

Test fiber optic cable in accordance with TIA/EIA-455 and as further specified in this section. Two optical tests shall be performed on all optical fibers: Optical Time Domain Reflectometry (OTDR) Test, and Attenuation Test. In addition, a Bandwidth Test shall be performed on all multimode optical fibers. These tests shall be performed on the completed end-to-end spans which include the near-end pre-connectorized single fiber cable assembly, outside plant as specified, and the far-end pre-connectorized single fiber cable assembly.

a. OTDR Test: The OTDR test shall be used to determine the adequacy of the cable installations by showing any irregularities, such as discontinuities, micro-bendings or improper splices for the cable span under test. Hard copy fiber signature records shall be obtained from the OTDR for each fiber in each span and shall be included in the test results. The OTDR test shall be measured in both directions. A reference length of fiber, 66 feet minimum, used as the delay line shall be placed before the new end connector and after the far end patch panel connectors for inspection of connector signature. Conduct OTDR test and provide calculation or interpretation of results in accordance with TIA-526-7 for single-mode fiber and TIA-526-14 for multimode fiber. Splice losses shall not exceed 0.3 db.

b. Attenuation Test: End-to-end attenuation measurements shall be made on all fibers, in both directions, using a 1310 nanometer light source at one end and the optical power meter on the other end to verify that the cable system attenuation requirements are met in accordance with TIA-526-7 for single-mode fiber optic cables. The measurement method shall be in accordance with TIA-455-78-B. Attenuation losses shall not exceed 0.5 db/km at 1310 nm and 1550 nm for single-mode fiber. Attenuation losses shall not exceed 5.0 db/km at 850 nm and 1.5 db/km at 1300 nm for multimode fiber.

c. Bandwidth Test: The end-to-end bandwidth of all multimode fiber span links shall be measured by the frequency domain method. The bandwidth shall be measured in both directions on all fibers. The bandwidth measurements shall be in accordance with TIA/EIA-455-204.

3.4.3 Soil Density Tests

a. Determine soil-density relationships for compaction of backfill material in accordance with ASTM D1557, Method D.

-- End of Section --

APPENDIX A

GEOTECHNICAL REPORT (BORING LOG)

APPENDIX 'A' - LOGS OF BORINGS AND TEST DATA

GENERAL NOTES:

1. GROUNDWATER DEPTHS OR ELEVATIONS SHOWN ON THE BORING LOGS REPRESENT GROUNDWATER ENCOUNTERED ON THE DATES SHOWN. ABSENCE OF GROUNDWATER DATA ON CERTAIN BORINGS IMPLIES THAT NO DATA IS AVAILABLE, BUT DOES NOT NECESSARILY MEAN THAT GROUNDWATER WILL NOT BE ENCOUNTERED AT THE LOCATIONS. GROUNDWATER ELEVATIONS VARY AND SEEPAGE ABOVE THE DEPTHS OR ELEVATIONS SHOWN CAN BE EXPECTED AT ANY TIME.

2. WHILE THE BORINGS ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT THEIR RESPECTIVE LOCATIONS AND FOR THEIR RESPECTIVE VERTICAL REACHES, LOCAL MINOR VARIATIONS IN CHARACTERISTICS OF THE SUBSURFACE MATERIALS ARE ANTICIPATED AND, IF ENCOUNTERED, SUCH VARIATIONS WILL NOT BE CONSIDERED AS DIFFERING MATERIALLY FROM THE DESCRIPTION SHOWN WITH THE LOGS OR PROFILES.

3. SOILS ARE CLASSIFIED IN ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM, ASTM-D-2487, CLASSIFICATION OF SOILS FOR ENGINEERING PURPOSES.

4. DRIVING RESISTANCES (BLOW COUNTS OR N VALUES) ARE DETERMINED WITH A STANDARD SPLIT SPOON SAMPLER (1-3/8" I.D.) AND A 140-LB DRIVING HAMMER WITH A 30" DROP UNLESS OTHERWISE NOTED ON THE BORING LOGS. N VALUES SHOWN NUMERICALLY ON THE LOGS ARE THE SUM OF BLOWS FOR THE LOWER TWO OF THREE 0.5-FOOT DRIVES THAT MAKE UP THE 1.5-FOOT STANDARD PENETRATION TEST, EXCEPT WHEN REFUSAL OCCURS. REFUSAL OF THE SPLITSPOON IS DEFINED AS 50 BLOWS IN LESS THAN A 0.5-FOOT DRIVE. REFUSAL IS SHOWN ON THE LOGS AS INDICATED IN THE FOLLOWING EXAMPLES:

50/0.3' - INDICATES 50 BLOWS (REFUSAL) AFTER 0.3' PENETRATION IN THE FIRST DRIVE.

20, 50/0.2' - INDICATES 20 BLOWS IN THE FIRST DRIVE AND REFUSAL AFTER 0.2' PENETRATION IN THE SECOND DRIVE.

20, 85/0.8' - INDICATES 20 BLOWS IN THE FIRST DRIVE, 35 BLOWS IN THE SECOND DRIVE AND REFUSAL (50 BLOWS) AFTER 0.3' PENETRATION IN THE THIRD DRIVE.

5. "MAX SIZE" OF GRAVEL OR ROCK FRAGMENTS SHOWN ON THE BORING LOGS REPRESENTS THE MAXIMUM SIZE OF MATERIAL RECOVERED IN THE DRIVE SAMPLER AND/OR CORE BARREL OR OBSERVED FROM AUGERING UNLESS OTHERWISE NOTED. NOTE THAT THE MAXIMUM LOGGED SIZE OF GRAVEL OR ROCK FRAGMENTS IS LIKELY TO BE SMALLER THAN THE MAXIMUM SIZE OF THE IN-PLACE MATERIAL, ESPECIALLY WHEN THE MAXIMUM LOGGED SIZE IS MORE THAN APPROXIMATELY ONE-HALF THE DIAMETER OF THE DRIVE SAMPLER OR CORE BARREL, OR MORE THAN ONE-THIRD THE DIAMETER OF THE AUGER.

6. CLASSIFICATIONS SHOWN IN COLUMN D OF THE BORING LOG FORM ARE THE DRILLING INSPECTOR'S FIELD VISUAL CLASSIFICATION OF SAMPLES UNLESS OTHERWISE INDICATED ON THE LOG. WHEN AVAILABLE, LABORATORY CLASSIFICATIONS OF SAMPLES ARE SHOWN IN COLUMN G (REMARKS COLUMN) UNLESS OTHERWISE INDICATED.

SOIL CLASSIFICATION LEGEND

COARSE-GRAINED SOILS - MORE THAN HALF OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE

GW		WELL GRADED GRAVELS OR GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
GP		POORLY GRADED GRAVELS OR GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
GM		SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
GC		CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES
SW		WELL GRADED SANDS OR GRAVELLY SANDS, LITTLE OR NO FINES
SP		POORLY GRADED SANDS OR GRAVELLY SANDS, LITTLE OR NO FINES
SM		SILTY SANDS, SAND-SILT MIXTURES
SM-H		SAME AS ABOVE WITH HIGH LIQUID LIMIT
SC		CLAYEY SANDS, SAND-CLAY MIXTURES
SC-H		SAME AS ABOVE WITH HIGH LIQUID LIMIT

NOTE: DUAL CLASSIFICATIONS, E.G. SP-SM, GP-GM, ML-CL AND SM-SC, ARE SHOWN BY PLACING BOTH SYMBOLS SIDE BY SIDE.

FINE-GRAINED SOILS - MORE THAN HALF OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE

ML		INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SANDY SILTS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
MH		INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDS OR SILTY SOIL, PLASTIC SILTS
OL		ORGANIC SILTS AND ORGANIC SILT-CLAYS OF LOW PLASTICITY
OH		ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
CL		INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
CH		INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
PT		PEAT AND OTHER HIGHLY ORGANIC SOILS
		BITUMEN, ASPHALT, OR ASPHALTIC CONCRETE
		CONCRETE

ROCK CLASSIFICATION LEGEND


SANDSTONE


RHYOLITE


SILTSTONE OR CLAYSTONE


BASALT


SHALE


GRANITE


CEMENTED SHALE


GNEISS


LIMESTONE


CONGLOMERATE


DOLOMITE


CHERT


SCHIST


COAL


PHYLLITE


SHELL, SHELL FRAGMENTS,
OR SHELL-SOIL MIXTURE
CONSISTING MOSTLY OF SHELL


QUARTZITE


WOOD


NOT SAMPLED OR
SAMPLE NOT RECOVERED


VOID (CAVITY,
OPEN JOINT, ETC.)

ABBREVIATIONS

@	AT
ACCUM	ACCUMULATED
ALT	ALTERNATING
ANG	ANGULAR
APPROX.	APPROXIMATE (LY)
ARGIL	ARGILLACEOUS
AUG	AUGER
AVG	AVERAGE
B.A.	BASE OF ALLUVIUM
B.I.	BREAKAGE INTERVAL
B.O.H.	BOTTOM OF HOLE
BBL	BARREL
BDD	BED (ED) (DING)
BDR	BEDROCK
BENT.	BENTONITIC
BGE	BEIGE
BKY	BLOCKY
BL	BLACK (ISH)
BLD	BOULDER
BR	BROWN (ISH)
BREC.	BRECCIATED
BRK	BROKEN. BREAKAGE
C.D.	CORRECTED DEPTH
CAL	CALCITE. CALCAREOUS
CARB	CARBONACEOUS
CAV	CAVITY
CBL	COBBLE
CEM	CEMENT
CHT	CHERT
CIRCLE.	CIRCULATION
CLY	CLAYEY
CMT'D	CEMENTED
CNTR (S)	CONCENTRATION (S)
COMP	COMPACT
CONC	CONCRETE
CONCR	CONCRETIONS
CONGL	CONGLOMERATE
CONT.	CONTINUED
CR'D	CRUSHED
CRM	CRUMBLY
CSE	COARSE
CTD	COATED
D.	DENSE
d.	DEPTH
D.A.	DRILL ACTION
D.T.	DRILL TIME
D.W.L.	DRILL WATER LOSS
D.W.R.	DRILL WATER RETURN
DECOM	DECOMPOSED
DIAG	DIAGONAL
DIS.	DISSEMINATED
DK	DARK
DOL.	DOLOMITE. DOLOMITIC
DRL	DRILLING
DSTG	DISINTEGRATE (D)
EL	ELEVATION
ENC	ENCOUNTERED
EST	ESTIMATE (D)
EXCL	EXCLUDING
EXTR	EXTREMELY
F.	FINE (LY)
F.R.	FLUID RETURN
F/T	FISHTAILED
FE	IRON
FERR	FERRUGINOUS
FIS	FISSILE
FLD	FILLED
FM	FORMATION

ABBREVIATIONS

FOLIA.	FOLIATION
FOS	FOSSIL (IFEROUS)
FRAC	FRACTURE
FRAG	FRAGMENT (S)
G.W.	GROUNDWATER
GEN.	GENERALLY
GLAU	GLAUCONITE (ITIC)
GR	GRAY (ISH)
GRA	GRAIN (ED)
GRAD	GRADATIONAL
GRN	GREEN (ISH)
GRT	GROUT
GVL	GRAVEL (LY)
GYP	GYPSUM
H/A	HIGH ANGLE
H/B	HAMMER BREAK
HD	HARD
HI	HIGH (LY)
HLD	HEALED
HMR	HAMMER
HOR	HORIZONTAL
HYD	HYDRAULIC
INCL	INCLUDING (ED)
INDT	INDURATED
INIT	INITIAL (LY)
INTBDD	INTERBED (DED)
INTLAM	INTERLAMINATED
IRR	IRREGULAR (LY)
JT'S	JOINT'S
JTD	JOINTED
L.C.	LOSE CORE
L.D.W.	LOST DRILL WATER
L/A	LOW ANGLE
LAB.	LABOR
LAM	LAMINATED. LAMINA (NAE)
LAY.	LAYER
LEA	LEACHED
LGE	LARGE
LIG	LIGNITIC
LIT	LITTLE
LL	LIQUID LIMIT
LN. (S)	LENSE (S)
LO	LOOSE
LS	LIMESTONE
LT	LIGHT
MAS	MASSIVE
MAX	MAXIMUM
MECH	MECHANICAL
MED	MEDIUM
MIC	MICACEOUS
MIN	MINIMUM
MINR	MINERALIZED (IZATION)
MIX.	MIXTURE
MOD	MODERATE (D)
MOT	MOTTLED (ING)
MST	MOIST
MTL	MATERIAL
MTX	MATRIX
N/A	NOT APPLICABLE
N/E	NOT ENCOUNTERED
N/R	NO RECOVERY
NOD.	NODULE
NUM	NUMEROUS
OB	OVERBURDEN (UNCLASSIFIED)
OBS	OBSERVED
OCC	OCCASIONAL (LY)
OOL	OOLITE. OOLITIC
OP	OPEN (ED)
OR	ORANGE

ABBREVIATIONS

ORG	ORGANIC
P.S.I.	POUNDS/SQ. IN.
P.T.	PRESSURE TEST
PART.	PARTIALLY
PCS	PIECES
PERTRO	PETROLEUM, PETROLIFEROUS
PHOS	PHOSPHATE (PHOROUS)
PI	PLASTICITY INDEX
PIT	PIT (TED) (TING)
PKT (S)	POCKET (S)
PL	PLASTIC LIMIT
PLA	PLATY
PLAS	PLASTIC
PLN	PLANE
PNK	PINK
PR	POORLY
PRED	PREDOMINATED
PRESS	PRESSURE
PROB	PROBABLE (ABILITY)
PTC	PARTICLES
PTG	PARTING
PUR	PURPLE
QTZ	QUARTZ
QTZE	QUARTZITE
R.Q.D.	ROCK QUALITY DESIGNATION
RBL	RUBBLE
RD	RED (DISH)
REC	RECOVERY
RECEM	RECEMENTED
RND	ROUND (ED)
RTS	ROOTS
S/S	SPLIT
SAP	SAPROLITE
SAT	SATURATED
SCAT.	SCATTEREDLY
SCH (S)	SCHIST (OS)
SD	SAND
SDY	SANDY
SH	SHALE
SI	SILT
SIS	SILTSTONE
SIY	SILTY
SL	SLIGHT (LY)
SLCES	SILICEOUS
SLICK.	SLICKENSIDE
SML	SMALL
SO	SOFT
SOL	SOLUTION (ED) (ING)
SPG	SPECIFIC GRAVITY
SPT	STANDARD PENETRATION TEST
SPT	STANDARD SPLITSPOON
SS	SANDSTONE
ST	STRAIN (ED) (ING)
STF	STIFF
STR	STRUCTURE
STRG	STRINGER
STYL	STYLOLITE (OLITIC)
SUR	SURFACED
T.F.R.	TOP OF FIRM ROCK
T.O.R.	TOP OF ROCK
T.S.R.	TOP OF SOUND ROCK
TEXT.	TEXTURE
THK	THICK
THN	THIN
TI	TIGHT
TN	TAN (NISH)
TR	TRACE
TRP	TRIPOLI

ABBREVIATIONS

UD	UNDISTUBED
UL	UNACCOUNTABLE LOSS
UNACC	UNACCOUNTABLE
UNWEA	UNWEATHERED
V/	VERY
VERT	VERTICAL
VGY	VUGGY
W.C.	WATER CONTENT
W.L.	WATER LEVEL
W/	WITH
W/H	WEIGHT OF HAMMER
W/R	WEIGHT OF ROD
WD	WOOD
WEA	WEATHERED
WG	WEIGH
WHT	WHITE
X-BDD	CROSS-BEDDED
XL	CRYSTAL
XLN	CYRSTALLINE
YEL	YELLOW

US Army Corps of Engineers®

MARK	DESCRIPTION	DATE

DESIGNED BY: J. DESIGNER
DRAWN BY: J. DRAWER
CHECKED BY: J. CHECKER
SUBMITTED BY: J. REVIEWER
SIZE:
ISSUE DATE:
SOLICITATION NO.:
CONTRACT NO.:
USACE Civil 3D 2016 Template v3.0.dwt

U.S. ARMY CORPS OF ENGINEERS

WRECC FACILITY
CHARETTE PRELIMINARY SITE PLAN
OPTION A

SHEET ID
CS001

Boring Designation WRF-01-20

DRILLING LOG	DIVISION	INSTALLATION	SHEET 1 OF 2 SHEETS
	South Atlantic	Mobile District	

1. PROJECT: Eglin AFB WRECC		9. SIZE AND TYPE OF BIT: See Remarks	
		10. COORDINATE SYSTEM/DATUM	HORIZONTAL: NAD83 / VERTICAL: NAVD88
2. BORING DESIGNATION: WRF-01-20	LOCATION COORDINATES: X = 609,619 Y = 1,373,267	11. MANUFACTURER'S DESIGNATION OF DRILL: CME-850	☒ AUTO HAMMER ☐ MANUAL HAMMER
3. DRILLING AGENCY: Corps of Engineers - CESAM	CONTRACTOR FILE NO.	12. TOTAL SAMPLES	DISTURBED: 20 / UNDISTURBED (UD): 0
4. NAME OF DRILLER: Eddie Woods		13. TOTAL NUMBER CORE BOXES: 0	
5. DIRECTION OF BORING: ☒ VERTICAL ☐ INCLINED	DEG. FROM VERTICAL	BEARING	14. ELEVATION GROUND WATER: Not Encountered
		15. DATE BORING	STARTED: 09-30-20 / COMPLETED: 09-30-20
6. THICKNESS OF OVERBURDEN: N/A		16. ELEVATION TOP OF BORING: 201.0 Ft.	
7. DEPTH DRILLED INTO ROCK: N/A		17. TOTAL RECOVERY FOR BORING: 100 %	
8. TOTAL DEPTH OF BORING: 30.0 Ft.		18. NAME AND TITLE OF INSPECTOR: Wes Stringfellow, Geotechnical Engineer	

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% REC.	BOX OR SAMPLE	RQD OR UD	REMARKS	BLOWS/0.5 FT.	N-VALUE
201.0	0.0						201.0		
			(SP-SM) SAND, poorly-graded with silt, very loose, mostly fine-grained sand-sized quartz, trace roots, trace silt, dry, light brown	100	1		SPT Sampler	WH 1 1	2
199.5							199.5		
				100	2		SPT Sampler	1 2 2	4
198.0	3.0						198.0		
			(SP) SAND, poorly-graded, very loose, mostly fine-grained sand-sized quartz, dry	100	3		SPT Sampler	1 1 2	3
196.5							196.5		
				100	4		SPT Sampler	1 1 1	2
195.0							195.0		
				100	5		SPT Sampler	1 1 1	2
193.5	7.5						193.5		
			(SP-SC) SAND, poorly-graded with clay, loose, mostly fine-grained sand-sized quartz, trace clay, moist, light brown and orange	100	6		SPT Sampler	1 2 2	4
192.0							192.0		
				100	7		SPT Sampler	2 2 3	5
190.5	10.5						190.5		
			(SP) SAND, poorly-graded, loose, mostly fine-grained sand-sized quartz, dry, orange and light brown	100	8		SPT Sampler	2 2 4	6
189.0	12.0						189.0		
			(SP-SC) SAND, poorly-graded with clay, loose, mostly fine-grained sand-sized quartz, trace clay, moist, orange	100	9		SPT Sampler	2 3 4	7
187.5							187.5		
				100	10		SPT Sampler	3 4 4	8
186.0							186.0		

(Continued)

Boring Designation WRF-01-20

DRILLING LOG (Cont. Sheet)	INSTALLATION	SHEET 2 OF 2 SHEETS
	Mobile District	

PROJECT	COORDINATE SYSTEM/DATUM	HORIZONTAL	VERTICAL
Eglin AFB		NAD83	NAVD88

LOCATION COORDINATES	ELEVATION TOP OF BORING
X = 609,619 Y = 1,373,267	201.0 Ft.

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% REC.	BOX OR SAMPLE	RQD OR UD	REMARKS	BLOWS/ 0.5 FT.	N-VALUE
				100	11		SPT Sampler	4 / 6 / 6	12
							184.5		
				100	12		SPT Sampler	5 / 5 / 6	11
							183.0		
			At El. 183.0 Ft., medium, light brown, orange, and white	100	13		SPT Sampler	7 / 8 / 9	17
181.5	19.5						181.5		
			(SP) SAND, poorly-graded, medium, mostly fine-grained sand-sized quartz, dry, orange and whtie	100	14		SPT Sampler	7 / 7 / 9	16
							180.0		
				100	15		SPT Sampler	5 / 8 / 9	17
							178.5		
				100	16		SPT Sampler	6 / 10 / 11	21
							177.0		
				100	17		SPT Sampler	7 / 8 / 10	18
							175.5		
				100	18		SPT Sampler	6 / 7 / 11	18
							174.0		
				100	19		SPT Sampler	9 / 10 / 13	23
							172.5		
				100	20		SPT Sampler	9 / 11 / 12	23
171.0	30.0						171.0		

NOTES:

1. Soils are field visually classified in accordance with the Unified Soils Classification System.

2. Borehole tremie grouted

140# hammer w/30" drop used with 2.0' split spoon (1-3/8" I.D. x 2" O.D.).

Boring Designation WRF-02-20

DRILLING LOG	DIVISION	INSTALLATION	SHEET 1 OF 2 SHEETS
	South Atlantic	Mobile District	

1. PROJECT	Eglin AFB WRECC	9. SIZE AND TYPE OF BIT	See Remarks
		10. COORDINATE SYSTEM/DATUM	HORIZONTAL: NAD83 / VERTICAL: NAVD88
2. BORING DESIGNATION	WRF-02-20	LOCATION COORDINATES	X = 609,630 Y = 1,373,322
11. MANUFACTURER'S DESIGNATION OF DRILL	CME-850	☒ AUTO HAMMER ☐ MANUAL HAMMER	
3. DRILLING AGENCY	Corps of Engineers - CESAM	CONTRACTOR FILE NO.	
12. TOTAL SAMPLES	DISTURBED: 20	UNDISTURBED (UD): 0	
4. NAME OF DRILLER	Eddie Woods	13. TOTAL NUMBER CORE BOXES	0
5. DIRECTION OF BORING ☒ VERTICAL ☐ INCLINED	DEG. FROM VERTICAL	BEARING	
14. ELEVATION GROUND WATER	Not Encountered		
15. DATE BORING	STARTED: 09-30-20	COMPLETED: 09-30-20	
6. THICKNESS OF OVERBURDEN	N/A	16. ELEVATION TOP OF BORING	203.0 Ft.
7. DEPTH DRILLED INTO ROCK	N/A	17. TOTAL RECOVERY FOR BORING	100 %
8. TOTAL DEPTH OF BORING	30.0 Ft.	18. NAME AND TITLE OF INSPECTOR	Wes Stringfellow, Geotechnical Engineer

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% REC.	BOX OR SAMPLE	RQD OR UD	REMARKS	BLOWS/0.5 FT.	N-VALUE
203.0	0.0						203.0		
			(SP) SAND, poorly-graded, very loose, mostly fine-grained sand-sized quartz, trace roots, dry, brown	100	1		SPT Sampler	WH 1 2	3
			At El. 201.5 Ft., light brown				201.5		
				100	2		SPT Sampler	1 1 1	2
			At El. 200.0 Ft., discontinue organics/roots				200.0		
				100	3		SPT Sampler	1 1 2	3
							198.5		
				100	4		SPT Sampler	1 1 2	3
							197.0		
				100	5		SPT Sampler	1 1 2	3
							195.5		
				100	6		SPT Sampler	3 3 4	7
194.0	9.0						194.0		
			(SP-SC) SAND, poorly-graded with clay, loose, mostly quartz, trace clay, moist, orange and light brown	100	7		SPT Sampler	2 3 3	6
							192.5		
				100	8		SPT Sampler	2 2 2	4
							191.0		
				100	9		SPT Sampler	2 3 3	6
			At El. 189.5 Ft., little clay				189.5		
				100	10		SPT Sampler	5 5 6	11
							188.0		

(Continued)

Boring Designation WRF-02-20

DRILLING LOG (Cont. Sheet)	INSTALLATION	SHEET 2 OF 2 SHEETS
	Mobile District	

PROJECT	COORDINATE SYSTEM/DATUM	HORIZONTAL	VERTICAL
Eglin AFB		NAD83	NAVD88

LOCATION COORDINATES	ELEVATION TOP OF BORING
X = 609,630 Y = 1,373,322	203.0 Ft.

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% REC.	BOX OR SAMPLE	RQD OR UD	REMARKS	BLOWS/ 0.5 FT.	N-VALUE
				100	11		SPT Sampler 186.5	7 7 8	15
				100	12		SPT Sampler 185.0	7 10 11	21
185.0	18.0		(SP) SAND, poorly-graded, medium, mostly fine-grained sand-sized quartz, dry, orange and light brown	100	13		SPT Sampler 183.5	9 10 11	21
183.5	19.5		(SP-SC) SAND, poorly-graded with clay, medium, mostly fine-grained sand-sized quartz, trace clay, moist	100	14		SPT Sampler 182.0	8 9 9	18
182.0	21.0		(SP) SAND, poorly-graded, medium, mostly fine-grained sand-sized quartz, orange, light brown, and white	100	15		SPT Sampler 180.5	4 6 8	14
				100	16		SPT Sampler 179.0	6 8 9	17
				100	17		SPT Sampler 177.5	5 8 9	17
				100	18		SPT Sampler 176.0	8 10 11	21
			At El. 176.0 Ft., light brown and white	100	19		SPT Sampler 174.5	7 11 13	24
				100	20		SPT Sampler 173.0	8 10 11	21
173.0	30.0								

NOTES:

1. Soils are field visually classified in accordance with the Unified Soils Classification System.

2. Borehole tremie grouted

140# hammer w/30" drop used with 2.0' split spoon (1-3/8" I.D. x 2" O.D.).

Boring Designation WRF-03-20

DRILLING LOG	DIVISION	INSTALLATION	SHEET 1 OF 2 SHEETS
	South Atlantic	Mobile District	

1. PROJECT	Eglin AFB WRECC	9. SIZE AND TYPE OF BIT	See Remarks
		10. COORDINATE SYSTEM/DATUM	HORIZONTAL: NAD83 / VERTICAL: NAVD88
2. BORING DESIGNATION	WRF-03-20	LOCATION COORDINATES	X = 609,644 Y = 1,373,371
11. MANUFACTURER'S DESIGNATION OF DRILL	CME-850	☒ AUTO HAMMER ☐ MANUAL HAMMER	
3. DRILLING AGENCY	Corps of Engineers - CESAM	CONTRACTOR FILE NO.	
12. TOTAL SAMPLES	DISTURBED: 20	UNDISTURBED (UD): 0	
4. NAME OF DRILLER	Eddie Woods	13. TOTAL NUMBER CORE BOXES	0
5. DIRECTION OF BORING ☒ VERTICAL ☐ INCLINED	DEG. FROM VERTICAL	BEARING	
14. ELEVATION GROUND WATER	Not Encountered		
15. DATE BORING	STARTED: 09-30-20	COMPLETED: 09-30-20	
6. THICKNESS OF OVERBURDEN	N/A	16. ELEVATION TOP OF BORING	203.0 Ft.
7. DEPTH DRILLED INTO ROCK	N/A	17. TOTAL RECOVERY FOR BORING	100 %
8. TOTAL DEPTH OF BORING	30.0 Ft.	18. NAME AND TITLE OF INSPECTOR	Wes Stringfellow, Geotechnical Engineer

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% REC.	BOX OR SAMPLE	RQD OR UD	REMARKS	BLOWS/0.5 FT.	N-VALUE
203.0	0.0						203.0		
			(SP) SAND, poorly-graded, very loose, mostly fine-grained sand-sized quartz, trace roots, dry, light brown	100	1		SPT Sampler	WH WH 1	1
			At El. 201.5 Ft., discontinue roots				201.5		
				100	2		SPT Sampler	WH 1 1	2
							200.0		
				100	3		SPT Sampler	WH 1 1	2
							198.5		
				100	4		SPT Sampler	1 2 2	4
			At El. 197.0 Ft., loose, dry, light brown and orange				197.0		
				100	5		SPT Sampler	2 2 2	4
195.5	7.5						195.5		
			(SP-SC) SAND, poorly-graded with clay, loose, mostly fine-grained sand-sized quartz, trace clay, moist, light brown and orange	100	6		SPT Sampler	2 3 2	5
							194.0		
				100	7		SPT Sampler	3 2 2	4
			At El. 192.5 Ft., orange				192.5		
				100	8		SPT Sampler	2 2 3	5
							191.0		
				100	9		SPT Sampler	3 3 4	7
							189.5		
				100	10		SPT Sampler	3 5 7	12
							188.0		

0 5 10 15

(Continued)

Boring Designation WRF-03-20

DRILLING LOG (Cont. Sheet)	INSTALLATION	SHEET 2 OF 2 SHEETS
	Mobile District	

PROJECT	COORDINATE SYSTEM/DATUM	HORIZONTAL	VERTICAL
Eglin AFB		NAD83	NAVD88

LOCATION COORDINATES	ELEVATION TOP OF BORING
X = 609,644 Y = 1,373,371	203.0 Ft.

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% REC.	BOX OR SAMPLE	RQD OR UD	REMARKS	BLOWS/ 0.5 FT.	N-VALUE
				100	11		SPT Sampler	7 7 7	14
							186.5		
				100	12		SPT Sampler	3 5 4	9
							185.0		
				100	13		SPT Sampler	5 5 5	10
							183.5		
				100	14		SPT Sampler	4 6 8	14
							182.0		
				100	15		SPT Sampler	8 8 8	16
180.5	22.5						180.5		
			(SP) SAND, poorly-graded, medium, mostly fine-grained sand-sized quartz, dry, light brown, orange, and white	100	16		SPT Sampler	7 8 9	17
							179.0		
				100	17		SPT Sampler	6 7 11	18
							177.5		
				100	18		SPT Sampler	8 8 10	18
							176.0		
				100	19		SPT Sampler	6 8 11	19
							174.5		
				100	20		SPT Sampler	5 9 10	19
173.0	30.0						173.0		
			NOTES: 1. Soils are field visually classified in accordance with the Unified Soils Classification System. 2. Borehole tremie grouted				140# hammer w/30" drop used with 2.0' split spoon (1-3/8" I.D. x 2" O.D.).		

SAJ FORM 1836-A
JUN 02

Boring Designation WRF-04-20

DRILLING LOG	DIVISION	INSTALLATION	SHEET 1 OF 2 SHEETS
	South Atlantic	Mobile District	

1. PROJECT	Eglin AFB WRECC	9. SIZE AND TYPE OF BIT	See Remarks
		10. COORDINATE SYSTEM/DATUM	HORIZONTAL: NAD83 / VERTICAL: NAVD88
2. BORING DESIGNATION	WRF-04-20	LOCATION COORDINATES	X = 609,439 Y = 1,373,527
11. MANUFACTURER'S DESIGNATION OF DRILL	CME-850	☒ AUTO HAMMER ☐ MANUAL HAMMER	
3. DRILLING AGENCY	Corps of Engineers - CESAM	CONTRACTOR FILE NO.	
12. TOTAL SAMPLES	DISTURBED: 14	UNDISTURBED (UD): 0	
4. NAME OF DRILLER	Eddie Woods	13. TOTAL NUMBER CORE BOXES	0
5. DIRECTION OF BORING ☒ VERTICAL ☐ INCLINED	DEG. FROM VERTICAL	BEARING	
14. ELEVATION GROUND WATER	Not Encountered		
15. DATE BORING	STARTED: 10-01-20	COMPLETED: 10-01-20	
6. THICKNESS OF OVERBURDEN	N/A	16. ELEVATION TOP OF BORING	207.0 Ft.
7. DEPTH DRILLED INTO ROCK	N/A	17. TOTAL RECOVERY FOR BORING	100 %
8. TOTAL DEPTH OF BORING	21.0 Ft.	18. NAME AND TITLE OF INSPECTOR	Wes Stringfellow, Geotechnical Engineer

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% REC.	BOX OR SAMPLE	RQD OR UD	REMARKS	BLOWS/0.5 FT.	N-VALUE
207.0	0.0						207.0		
			(SP) SAND, poorly-graded, very loose, mostly fine-grained sand-sized quartz, trace roots, dry, light brown	100	1		SPT Sampler	WH 1 2	3
			At El. 205.5 Ft., discontinue roots				205.5		
				100	2		SPT Sampler	1 1 2	3
							204.0		
				100	3		SPT Sampler	1 1 1	2
							202.5		
				100	4		SPT Sampler	1 2 2	4
							201.0		
				100	5		SPT Sampler	2 2 3	5
							199.5		
				100	6		SPT Sampler	2 3 3	6
198.0	9.0						198.0		
			(SP-SC) SAND, poorly-graded with clay, loose, mostly quartz, trace clay, moist, light brown and orange	100	7		SPT Sampler	2 3 3	6
							196.5		
				100	8		SPT Sampler	2 3 3	6
							195.0		
				100	9		SPT Sampler	3 3 3	6
							193.5		
				100	10		SPT Sampler	2 3 4	7
192.0	15.0						192.0		

0 5 10 15

(Continued)

Boring Designation WRF-04-20

DRILLING LOG (Cont. Sheet)	INSTALLATION: Mobile District	SHEET 2 OF 2 SHEETS
PROJECT: Eglin AFB	COORDINATE SYSTEM/DATUM: HORIZONTAL NAD83 / VERTICAL NAVD88	
LOCATION COORDINATES: X = 609,439 Y = 1,373,527	ELEVATION TOP OF BORING: 207.0 Ft.	

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% REC.	BOX OR SAMPLE	RQD OR UD	REMARKS	BLOWS/ 0.5 FT.	N-VALUE
			(SP) SAND, poorly-graded, medium, mostly fine-grained sand-sized quartz, dry, light brown, orange, and white	100	11		SPT Sampler	5 5 6	11
							190.5		
				100	12		SPT Sampler	4 7 8	15
							189.0		
				100	13		SPT Sampler	4 7 9	16
							187.5		
				100	14		SPT Sampler	6 7 8	15
186.0	21.0						186.0		
			NOTES: 1. Soils are field visually classified in accordance with the Unified Soils Classification System. 2. Borehole tremie grouted				140# hammer w/30" drop used with 2.0' split spoon (1-3/8" I.D. x 2" O.D.).		

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SAJ FORM 1836-A
JUN 02

Boring Designation WRF-05-20

DRILLING LOG	DIVISION	INSTALLATION	SHEET 1 OF 2 SHEETS
	South Atlantic	Mobile District	

1. PROJECT	Eglin AFB WRECC	9. SIZE AND TYPE OF BIT	See Remarks
		10. COORDINATE SYSTEM/DATUM	HORIZONTAL: NAD83 / VERTICAL: NAVD88
2. BORING DESIGNATION	WRF-05-20	LOCATION COORDINATES	X = 609,618 Y = 1,373,551
11. MANUFACTURER'S DESIGNATION OF DRILL	CME-850	☒ AUTO HAMMER ☐ MANUAL HAMMER	
3. DRILLING AGENCY	Corps of Engineers - CESAM	CONTRACTOR FILE NO.	
12. TOTAL SAMPLES	DISTURBED: 14	UNDISTURBED (UD): 0	
4. NAME OF DRILLER	Eddie Woods	13. TOTAL NUMBER CORE BOXES	0
5. DIRECTION OF BORING ☒ VERTICAL ☐ INCLINED	DEG. FROM VERTICAL	BEARING	
14. ELEVATION GROUND WATER	Not Encountered		
15. DATE BORING	STARTED: 10-02-20	COMPLETED: 10-02-20	
6. THICKNESS OF OVERBURDEN	N/A	16. ELEVATION TOP OF BORING	205.0 Ft.
7. DEPTH DRILLED INTO ROCK	N/A	17. TOTAL RECOVERY FOR BORING	100 %
8. TOTAL DEPTH OF BORING	21.0 Ft.	18. NAME AND TITLE OF INSPECTOR	Wes Stringfellow, Geotechnical Engineer

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% REC.	BOX OR SAMPLE	RQD OR UD	REMARKS	BLOWS/0.5 FT.	N-VALUE
205.0	0.0						205.0		
			(SP) SAND, poorly-graded, very loose, mostly fine-grained sand-sized quartz, trace roots, dry, light brown	100	1		SPT Sampler	1 1 1	2
			At El. 203.5 Ft., discontinue roots				203.5		
				100	2		SPT Sampler	1 1 1	2
							202.0		
				100	3		SPT Sampler	1 1 2	3
							200.5		
				100	4		SPT Sampler	2 2 2	4
			At El. 199.0 Ft., light brown and orange				199.0		
				100	5		SPT Sampler	3 4 4	8
197.5	7.5						197.5		
			(SP-SC) SAND, poorly-graded with clay, loose, mostly fine-grained sand-sized quartz, trace clay, moist, orange	100	6		SPT Sampler	3 3 3	6
							196.0		
				100	7		SPT Sampler	2 3 3	6
							194.5		
				100	8		SPT Sampler	4 6 5	11
							193.0		
				100	9		SPT Sampler	4 4 7	11
191.5	13.5						191.5		
			(SP) SAND, poorly-graded, medium, mostly fine-grained sand-sized quartz, dry, light brown and orange	100	10		SPT Sampler	4 4 7	11
							190.0		

(Continued)

Boring Designation WRF-05-20

DRILLING LOG (Cont. Sheet)	INSTALLATION	SHEET 2 OF 2 SHEETS
	Mobile District	

PROJECT	COORDINATE SYSTEM/DATUM	HORIZONTAL	VERTICAL
Eglin AFB		NAD83	NAVD88

LOCATION COORDINATES	ELEVATION TOP OF BORING
X = 609,618 Y = 1,373,551	205.0 Ft.

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% REC.	BOX OR SAMPLE	RQD OR UD	REMARKS	BLOWS/ 0.5 FT.	N-VALUE
				100	11		SPT Sampler	7 9 10	19
							188.5		
				100	12		SPT Sampler	8 9 10	19
							187.0		
				100	13		SPT Sampler	6 8 8	16
							185.5		
				100	14		SPT Sampler	6 8 9	17
184.0	21.0						184.0		
			NOTES: 1. Soils are field visually classified in accordance with the Unified Soils Classification System. 2. Borehole tremie grouted				140# hammer w/30" drop used with 2.0' split spoon (1-3/8" I.D. x 2" O.D.).		

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SAJ FORM 1836-A
JUN 02

Boring Designation WRF-06-20

DRILLING LOG	DIVISION: South Atlantic	INSTALLATION: Mobile District	SHEET 1 OF 2 SHEETS

1. PROJECT: Eglin AFB WRECC		9. SIZE AND TYPE OF BIT: See Remarks	
		10. COORDINATE SYSTEM/DATUM: HORIZONTAL: NAD83	VERTICAL: NAVD88
2. BORING DESIGNATION: WRF-06-20	LOCATION COORDINATES: X = 609,810 Y = 1,373,355	11. MANUFACTURER'S DESIGNATION OF DRILL: CME-850	☒ AUTO HAMMER ☐ MANUAL HAMMER
3. DRILLING AGENCY: Corps of Engineers - CESAM	CONTRACTOR FILE NO.	12. TOTAL SAMPLES: DISTURBED: 14	UNDISTURBED (UD): 0
4. NAME OF DRILLER: Eddie Woods		13. TOTAL NUMBER CORE BOXES: 0	
5. DIRECTION OF BORING: ☒ VERTICAL ☐ INCLINED	DEG. FROM VERTICAL	BEARING	14. ELEVATION GROUND WATER: Not Encountered
		15. DATE BORING: STARTED: 10-02-20	COMPLETED: 10-02-20
6. THICKNESS OF OVERBURDEN: N/A		16. ELEVATION TOP OF BORING: 201.0 Ft.	
7. DEPTH DRILLED INTO ROCK: N/A		17. TOTAL RECOVERY FOR BORING: 100 %	
8. TOTAL DEPTH OF BORING: 21.0 Ft.		18. NAME AND TITLE OF INSPECTOR: Wes Stringfellow, Geotechnical Engineer	

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% REC.	BOX OR SAMPLE	RQD OR UD	REMARKS	BLOWS/0.5 FT.	N-VALUE
201.0	0.0						201.0		
			(SP) SAND, poorly-graded, very loose, mostly fine-grained sand-sized quartz, trace roots, dry, light brown	100	1		SPT Sampler	WH WH 1	1
							199.5		
			At El. 199.5 Ft., discontinue roots	100	2		SPT Sampler	1 1 1	2
							198.0		
				100	3		SPT Sampler	1 1 1	2
							196.5		
				100	4		SPT Sampler	1 1 1	2
							195.0		
				100	5		SPT Sampler	1 2 2	4
							193.5		
				100	6		SPT Sampler	2 3 3	6
192.0	9.0						192.0		
			(SP-SC) SAND, poorly-graded with clay, loose, mostly fine-grained sand-sized quartz, trace clay, moist, orange and light brown	100	7		SPT Sampler	2 3 3	6
190.5	10.5						190.5		
			(SP) SAND, poorly-graded, loose, mostly fine-grained sand-sized quartz, dry, light brown and orange	100	8		SPT Sampler	3 4 4	8
							189.0		
				100	9		SPT Sampler	3 3 3	6
							187.5		
				100	10		SPT Sampler	3 4 4	8
							186.0		

(Continued)

Boring Designation WRF-06-20

DRILLING LOG (Cont. Sheet)	INSTALLATION: Mobile District	SHEET 2 OF 2 SHEETS
PROJECT: Eglin AFB	COORDINATE SYSTEM/DATUM: HORIZONTAL NAD83 / VERTICAL NAVD88	
LOCATION COORDINATES: X = 609,810 Y = 1,373,355	ELEVATION TOP OF BORING: 201.0 Ft.	

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% REC.	BOX OR SAMPLE	RQD OR UD	REMARKS	BLOWS/ 0.5 FT.	N-VALUE
				100	11		SPT Sampler	5 5 7	12
							184.5		
				100	12		SPT Sampler	5 6 8	14
							183.0		
				100	13		SPT Sampler	6 8 8	16
							181.5		
				100	14		SPT Sampler	7 8 11	19
180.0	21.0						180.0		

NOTES:

1. Soils are field visually classified in accordance with the Unified Soils Classification System.

2. Borehole tremie grouted

140# hammer w/30" drop used with 2.0' split spoon (1-3/8" I.D. x 2" O.D.).

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Boring Designation WRF-07-20

DRILLING LOG	DIVISION	INSTALLATION	SHEET 1 OF 2 SHEETS
	South Atlantic	Mobile District	

1. PROJECT	Eglin AFB WRECC	9. SIZE AND TYPE OF BIT	See Remarks
		10. COORDINATE SYSTEM/DATUM	HORIZONTAL: NAD83 / VERTICAL: NAVD88
2. BORING DESIGNATION	WRF-07-20	LOCATION COORDINATES	X = 609,377 Y = 1,373,329
11. MANUFACTURER'S DESIGNATION OF DRILL	CME-850	☒ AUTO HAMMER ☐ MANUAL HAMMER	
3. DRILLING AGENCY	Corps of Engineers - CESAM	CONTRACTOR FILE NO.	
12. TOTAL SAMPLES	DISTURBED: 10	UNDISTURBED (UD): 0	
4. NAME OF DRILLER	Eddie Woods	13. TOTAL NUMBER CORE BOXES	0
5. DIRECTION OF BORING ☒ VERTICAL ☐ INCLINED	DEG. FROM VERTICAL	BEARING	
14. ELEVATION GROUND WATER	Not Encountered		
15. DATE BORING	STARTED: 10-01-20	COMPLETED: 10-01-20	
6. THICKNESS OF OVERBURDEN	N/A	16. ELEVATION TOP OF BORING	204.0 Ft.
7. DEPTH DRILLED INTO ROCK	N/A	17. TOTAL RECOVERY FOR BORING	100 %
8. TOTAL DEPTH OF BORING	15.0 Ft.	18. NAME AND TITLE OF INSPECTOR	Wes Stringfellow, Geotechnical Engineer

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% REC.	BOX OR SAMPLE	RQD OR UD	REMARKS	BLOWS/0.5 FT.	N-VALUE
204.0	0.0						204.0		
			(SP-SM) SAND, poorly-graded with silt, very loose, mostly fine-grained sand-sized quartz, trace roots, trace silt, dry, light brown	100	1		SPT Sampler	WH WH 1	1
							202.5		
			At El. 202.5 Ft., discontinue roots	100	2		SPT Sampler	WH 1 1	2
							201.0		
				100	3		SPT Sampler	1 1 1	2
199.5	4.5						199.5		
			(SP) SAND, poorly-graded, very loose, mostly fine-grained sand-sized quartz, light brown	100	4		SPT Sampler	1 1 1	2
							198.0		
				100	5		SPT Sampler	1 3 2	5
196.5	7.5						196.5		
			(SP-SC) SAND, poorly-graded with clay, loose, mostly fine-grained sand-sized quartz, trace clay, moist, light brown and orange	100	6		SPT Sampler	3 2 3	5
							195.0		
				100	7		SPT Sampler	2 3 3	6
							193.5		
				100	8		SPT Sampler	3 4 3	7
							192.0		
				100	9		SPT Sampler	2 3 4	7
			At El. 190.5 Ft., medium				190.5		
				100	10		SPT Sampler	3 6 7	13
189.0	15.0						189.0		

(Continued)

Boring Designation WRF-07-20

DRILLING LOG (Cont. Sheet)	INSTALLATION: Mobile District	SHEET 2 OF 2 SHEETS
PROJECT: Eglin AFB	COORDINATE SYSTEM/DATUM: HORIZONTAL: NAD83	VERTICAL: NAVD88
LOCATION COORDINATES: X = 609,377 Y = 1,373,329	ELEVATION TOP OF BORING: 204.0 Ft.	

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% REC.	BOX OR SAMPLE	RQD OR UD	REMARKS	BLOWS/ 0.5 FT.	N-VALUE
			NOTES: 1. Soils are field visually classified in accordance with the Unified Soils Classification System. 2. Borehole tremie grouted				140# hammer w/30" drop used with 2.0' split spoon (1-3/8" I.D. x 2" O.D.).		

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SAJ FORM 1836-A
JUN 02

Boring Designation WRF-08-20

DRILLING LOG	DIVISION	INSTALLATION	SHEET 1 OF 2 SHEETS
	South Atlantic	Mobile District	

1. PROJECT	Eglin AFB WRECC	9. SIZE AND TYPE OF BIT	See Remarks
		10. COORDINATE SYSTEM/DATUM	HORIZONTAL: NAD83 / VERTICAL: NAVD88
2. BORING DESIGNATION	WRF-08-20	LOCATION COORDINATES	X = 609,352 Y = 1,373,353
11. MANUFACTURER'S DESIGNATION OF DRILL	CME-850	☒ AUTO HAMMER ☐ MANUAL HAMMER	
3. DRILLING AGENCY	Corps of Engineers - CESAM	CONTRACTOR FILE NO.	
12. TOTAL SAMPLES	DISTURBED: 10	UNDISTURBED (UD): 0	
4. NAME OF DRILLER	Eddie Woods	13. TOTAL NUMBER CORE BOXES	0
5. DIRECTION OF BORING ☒ VERTICAL ☐ INCLINED	DEG. FROM VERTICAL	BEARING	
14. ELEVATION GROUND WATER	Not Encountered		
15. DATE BORING	STARTED: 10-01-20	COMPLETED: 10-01-20	
6. THICKNESS OF OVERBURDEN	N/A	16. ELEVATION TOP OF BORING	205.0 Ft.
7. DEPTH DRILLED INTO ROCK	N/A	17. TOTAL RECOVERY FOR BORING	100 %
8. TOTAL DEPTH OF BORING	15.0 Ft.	18. NAME AND TITLE OF INSPECTOR	Wes Stringfellow, Geotechnical Engineer

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% REC.	BOX OR SAMPLE	RQD OR UD	REMARKS	BLOWS/0.5 FT.	N-VALUE
205.0	0.0						205.0		
			(SP-SM) SAND, poorly-graded with silt, very loose, mostly fine-grained sand-sized quartz, trace roots, trace silt, dry, light brown	100	1		SPT Sampler	WH 1 1	2
203.5	1.5						203.5		
			(SP) SAND, poorly-graded, very loose, mostly fine-grained sand-sized quartz, dry, light brown	100	2		SPT Sampler	1 1 1	2
							202.0		
				100	3		SPT Sampler	1 1 1	2
							200.5		
				100	4		SPT Sampler	2 2 2	4
							199.0		
			At El. 199.0 Ft., light brown and orange	100	5		SPT Sampler	2 2 2	4
197.5	7.5						197.5		
			(SP-SC) SAND, poorly-graded with clay, loose, mostly fine-grained sand-sized quartz, trace clay, moist, light brown and orange	100	6		SPT Sampler	3 3 3	6
							196.0		
				100	7		SPT Sampler	3 3 3	6
							194.5		
				100	8		SPT Sampler	3 3 3	6
							193.0		
			At El. 193.0 Ft., medium	100	9		SPT Sampler	3 4 6	10
							191.5		
				100	10		SPT Sampler	6 8 8	16
190.0	15.0						190.0		

(Continued)

Boring Designation WRF-08-20

DRILLING LOG (Cont. Sheet)	INSTALLATION	SHEET 2 OF 2 SHEETS
	Mobile District	

PROJECT	COORDINATE SYSTEM/DATUM	HORIZONTAL	VERTICAL
Eglin AFB		NAD83	NAVD88

LOCATION COORDINATES	ELEVATION TOP OF BORING
X = 609,352 Y = 1,373,353	205.0 Ft.

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% REC.	BOX OR SAMPLE	RQD OR UD	REMARKS	BLOWS/ 0.5 FT.	N-VALUE
			NOTES: 1. Soils are field visually classified in accordance with the Unified Soils Classification System. 2. Borehole tremie grouted				140# hammer w/30" drop used with 2.0' split spoon (1-3/8" I.D. x 2" O.D.).		

15
20
25
30
35

SAJ FORM 1836-A
JUN 02

Boring Designation WRF-09-20

DRILLING LOG	DIVISION	INSTALLATION	SHEET / OF
	South Atlantic	Mobile District	SHEET 1 OF 1 SHEETS

1. PROJECT: Eglin AFB WRECC		9. SIZE AND TYPE OF BIT: See Remarks	
		10. COORDINATE SYSTEM/DATUM	HORIZONTAL: NAD83 / VERTICAL: NAVD88
2. BORING DESIGNATION: WRF-09-20	LOCATION COORDINATES: X = 609,106 Y = 1,373,621	11. MANUFACTURER'S DESIGNATION OF DRILL: CME-850	☒ AUTO HAMMER ☐ MANUAL HAMMER
3. DRILLING AGENCY: Corps of Engineers - CESAM	CONTRACTOR FILE NO.	12. TOTAL SAMPLES	DISTURBED: 6 / UNDISTURBED (UD): 0
4. NAME OF DRILLER: Eddie Woods		13. TOTAL NUMBER CORE BOXES: 0	
5. DIRECTION OF BORING: ☒ VERTICAL ☐ INCLINED	DEG. FROM VERTICAL	BEARING	14. ELEVATION GROUND WATER: Not Encountered
		15. DATE BORING	STARTED: 10-03-20 / COMPLETED: 10-03-20
6. THICKNESS OF OVERBURDEN: N/A		16. ELEVATION TOP OF BORING: 208.0 Ft.	
7. DEPTH DRILLED INTO ROCK: N/A		17. TOTAL RECOVERY FOR BORING: 94 %	
8. TOTAL DEPTH OF BORING: 9.0 Ft.		18. NAME AND TITLE OF INSPECTOR: Wes Stringfellow, Geotechnical Engineer	

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% REC.	BOX OR SAMPLE	RQD OR UD	REMARKS	BLOWS/0.5 FT.	N-VALUE
208.0	0.0						208.0		
			(SP) SAND, poorly-graded, very loose, mostly fine-grained sand-sized quartz, trace roots, dry, brown	100	1		SPT Sampler	WH / WH / 1	1
			At El. 206.5 Ft., discontinue roots, light brown				206.5		
				67	2		SPT Sampler	WH / WH / 1	1
							205.0		
				100	3		SPT Sampler	WH / 1 / 1	2
			At El. 203.5 Ft., trace silt				203.5		
				100	4		SPT Sampler	1 / 1 / 2	3
			At El. 202.0 Ft., loose				202.0		
				100	5		SPT Sampler	2 / 2 / 3	5
			At El. 200.5 Ft., reddish brown				200.5		
				100	5		SPT Sampler	2 / 2 / 3	5
199.0	9.0						199.0		

NOTES:

1. Soils are field visually classified in accordance with the Unified Soils Classification System.

2. Borehole tremie grouted

140# hammer w/30" drop used with 2.0' split spoon (1-3/8" I.D. x 2" O.D.).

0 5 10 15

SAJ FORM 1836
JUN 02

Boring Designation WRF-10-20

DRILLING LOG	DIVISION	INSTALLATION	SHEET 1 OF 1 SHEETS
	South Atlantic	Mobile District	

1. PROJECT: Eglin AFB WRECC		9. SIZE AND TYPE OF BIT: See Remarks	
		10. COORDINATE SYSTEM/DATUM	HORIZONTAL: NAD83 / VERTICAL: NAVD88
2. BORING DESIGNATION: WRF-10-20	LOCATION COORDINATES: X = 609,247 Y = 1,373,508	11. MANUFACTURER'S DESIGNATION OF DRILL: CME-850	☒ AUTO HAMMER ☐ MANUAL HAMMER
3. DRILLING AGENCY: Corps of Engineers - CESAM	CONTRACTOR FILE NO.	12. TOTAL SAMPLES	DISTURBED: 6 / UNDISTURBED (UD): 0
4. NAME OF DRILLER: Eddie Woods		13. TOTAL NUMBER CORE BOXES: 0	
5. DIRECTION OF BORING: ☒ VERTICAL ☐ INCLINED	DEG. FROM VERTICAL	BEARING	14. ELEVATION GROUND WATER: Not Encountered
		15. DATE BORING	STARTED: 10-02-20 / COMPLETED: 10-02-20
6. THICKNESS OF OVERBURDEN: N/A		16. ELEVATION TOP OF BORING: 208.0 Ft.	
7. DEPTH DRILLED INTO ROCK: N/A		17. TOTAL RECOVERY FOR BORING: 100 %	
8. TOTAL DEPTH OF BORING: 9.0 Ft.		18. NAME AND TITLE OF INSPECTOR: Wes Stringfellow, Geotechnical Engineer	

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% REC.	BOX OR SAMPLE	RQD OR UD	REMARKS	BLOWS/0.5 FT.	N-VALUE
208.0	0.0						208.0		
			(SP) SAND, poorly-graded, loose, mostly fine-grained sand-sized quartz, trace roots, trace gravel, dry, light brown	100	1		SPT Sampler	WH 2 3	5
			At El. 206.5 Ft., discontinue gravel, discontinue roots				206.5		
				100	2		SPT Sampler	3 6 5	11
							205.0		
				100	3		SPT Sampler	3 3 3	6
							203.5		
				100	4		SPT Sampler	2 2 2	4
							202.0		
				100	5		SPT Sampler	2 3 3	6
200.5	7.5						200.5		
			(SP-SC) SAND, poorly-graded with clay, loose, mostly fine-grained sand-sized quartz, trace clay, dry, orange and light brown	100	6		SPT Sampler	1 2 3	5
199.0	9.0						199.0		
			NOTES: 1. Soils are field visually classified in accordance with the Unified Soils Classification System. 2. Borehole backfilled with cuttings				140# hammer w/30" drop used with 2.0' split spoon (1-3/8" I.D. x 2" O.D.).		

0 5 10 15

SAJ FORM 1836
JUN 02

Boring Designation WRF-11-20

DRILLING LOG	DIVISION	INSTALLATION	SHEET 1 OF 1 SHEETS
	South Atlantic	Mobile District	

1. PROJECT: Eglin AFB WRECC		9. SIZE AND TYPE OF BIT: See Remarks	
		10. COORDINATE SYSTEM/DATUM	HORIZONTAL: NAD83 / VERTICAL: NAVD88
2. BORING DESIGNATION: WRF-11-20	LOCATION COORDINATES: X = 609,404 Y = 1,373,381	11. MANUFACTURER'S DESIGNATION OF DRILL: CME-850	☒ AUTO HAMMER ☐ MANUAL HAMMER
3. DRILLING AGENCY: Corps of Engineers - CESAM	CONTRACTOR FILE NO.	12. TOTAL SAMPLES	DISTURBED: 6 / UNDISTURBED (UD): 0
4. NAME OF DRILLER: Eddie Woods		13. TOTAL NUMBER CORE BOXES: 0	
5. DIRECTION OF BORING: ☒ VERTICAL ☐ INCLINED	DEG. FROM VERTICAL	BEARING	14. ELEVATION GROUND WATER: Not Encountered
		15. DATE BORING	STARTED: 10-01-20 / COMPLETED: 10-01-20
6. THICKNESS OF OVERBURDEN: N/A		16. ELEVATION TOP OF BORING: 205.0 Ft.	
7. DEPTH DRILLED INTO ROCK: N/A		17. TOTAL RECOVERY FOR BORING: 100 %	
8. TOTAL DEPTH OF BORING: 9.0 Ft.		18. NAME AND TITLE OF INSPECTOR: Wes Stringfellow, Geotechnical Engineer	

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% REC.	BOX OR SAMPLE	RQD OR UD	REMARKS	BLOWS/0.5 FT.	N-VALUE
205.0	0.0						205.0		
			(SP) SAND, poorly-graded, very loose, mostly fine-grained sand-sized quartz, trace roots, dry, light brown	100	1		SPT Sampler	WH 1 1	2
			At El. 203.5 Ft., discontinue roots				203.5		
				100	2		SPT Sampler	1 1 1	2
							202.0		
				100	3		SPT Sampler	WH 1 1	2
							200.5		
				100	4		SPT Sampler	1 1 1	2
			At El. 199.0 Ft., orange and light brown				199.0		
				100	5		SPT Sampler	2 3 3	6
197.5	7.5						197.5		
			(SP-SC) SAND, poorly-graded with clay, loose, mostly fine-grained sand-sized quartz, trace clay, moist, orange	100	6		SPT Sampler	2 3 3	6
196.0	9.0						196.0		

NOTES:

1. Soils are field visually classified in accordance with the Unified Soils Classification System.

2. Borehole backfilled with cuttings

140# hammer w/30" drop used with 2.0' split spoon (1-3/8" I.D. x 2" O.D.).

0 5 10 15

SAJ FORM 1836
JUN 02

Boring Designation WRF-12-20

DRILLING LOG	DIVISION	INSTALLATION	SHEET 1 OF 1 SHEETS
	South Atlantic	Mobile District	

1. PROJECT: Eglin AFB WRECC		9. SIZE AND TYPE OF BIT: See Remarks	
		10. COORDINATE SYSTEM/DATUM	HORIZONTAL: NAD83 / VERTICAL: NAVD88
2. BORING DESIGNATION: WRF-12-20	LOCATION COORDINATES: X = 609,515 Y = 1,373,476	11. MANUFACTURER'S DESIGNATION OF DRILL: CME-850	☒ AUTO HAMMER ☐ MANUAL HAMMER
3. DRILLING AGENCY: Corps of Engineers - CESAM	CONTRACTOR FILE NO.	12. TOTAL SAMPLES	DISTURBED: 6 / UNDISTURBED (UD): 0
4. NAME OF DRILLER: Eddie Woods		13. TOTAL NUMBER CORE BOXES: 0	
5. DIRECTION OF BORING: ☒ VERTICAL ☐ INCLINED	DEG. FROM VERTICAL	BEARING	14. ELEVATION GROUND WATER: Not Encountered
		15. DATE BORING	STARTED: 10-02-20 / COMPLETED: 10-02-20
6. THICKNESS OF OVERBURDEN: N/A		16. ELEVATION TOP OF BORING: 205.0 Ft.	
7. DEPTH DRILLED INTO ROCK: N/A		17. TOTAL RECOVERY FOR BORING: 100 %	
8. TOTAL DEPTH OF BORING: 9.0 Ft.		18. NAME AND TITLE OF INSPECTOR: Wes Stringfellow, Geotechnical Engineer	

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% REC.	BOX OR SAMPLE	RQD OR UD	REMARKS	BLOWS/0.5 FT.	N-VALUE
205.0	0.0						205.0		
			(SP) SAND, poorly-graded, very loose, mostly fine-grained sand-sized quartz, trace roots, dry, light brown	100	1		SPT Sampler	WH 1 1	2
			At El. 203.5 Ft., discontinue roots				203.5		
				100	2		SPT Sampler	1 1 1	2
							202.0		
				100	3		SPT Sampler	1 1 1	2
							200.5		
				100	4		SPT Sampler	1 1 2	3
			At El. 199.0 Ft., loose, trace gravel				199.0		
				100	5		SPT Sampler	2 2 3	5
							197.5		
				100	6		SPT Sampler	3 4 4	8
196.0	9.0						196.0		

NOTES:

1. Soils are field visually classified in accordance with the Unified Soils Classification System.

2. Borehole backfilled with cuttings

140# hammer w/30" drop used with 2.0' split spoon (1-3/8" I.D. x 2" O.D.).

0 5 10 15

SAJ FORM 1836
JUN 02

Boring Designation WRF-13-20

DRILLING LOG	DIVISION: South Atlantic	INSTALLATION: Mobile District	SHEET 1 OF 1 SHEETS

1. PROJECT: Eglin AFB WRECC		9. SIZE AND TYPE OF BIT: See Remarks	
		10. COORDINATE SYSTEM/DATUM:	HORIZONTAL: NAD83 / VERTICAL: NAVD88
2. BORING DESIGNATION: WRF-13-20	LOCATION COORDINATES: X = 609,553 Y = 1,373,352	11. MANUFACTURER'S DESIGNATION OF DRILL: CME-850	☒ AUTO HAMMER ☐ MANUAL HAMMER
3. DRILLING AGENCY: Corps of Engineers - CESAM	CONTRACTOR FILE NO.	12. TOTAL SAMPLES	DISTURBED: 6 / UNDISTURBED (UD): 0
4. NAME OF DRILLER: Eddie Woods		13. TOTAL NUMBER CORE BOXES: 0	
5. DIRECTION OF BORING: ☒ VERTICAL ☐ INCLINED	DEG. FROM VERTICAL	BEARING	14. ELEVATION GROUND WATER: Not Encountered
		15. DATE BORING	STARTED: 10-01-20 / COMPLETED: 10-01-20
6. THICKNESS OF OVERBURDEN: N/A		16. ELEVATION TOP OF BORING: 203.0 Ft.	
7. DEPTH DRILLED INTO ROCK: N/A		17. TOTAL RECOVERY FOR BORING: 100 %	
8. TOTAL DEPTH OF BORING: 9.0 Ft.		18. NAME AND TITLE OF INSPECTOR: Wes Stringfellow, Geotechnical Engineer	

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% REC.	BOX OR SAMPLE	RQD OR UD	REMARKS	BLOWS/0.5 FT.	N-VALUE
203.0	0.0						203.0		
			(SP) SAND, poorly-graded, very loose, mostly fine-grained sand-sized quartz, trace roots, dry, light brown	100	1		SPT Sampler	WH / WH / 1	1
							201.5		
			At El. 201.5 Ft., discontinue roots	100	2		SPT Sampler	WH / 1 / 1	2
							200.0		
				100	3		SPT Sampler	WH / 1 / 1	2
							198.5		
				100	4		SPT Sampler	1 / 1 / 2	3
							197.0		
			At El. 197.0 Ft., loose	100	5		SPT Sampler	2 / 3 / 3	6
							195.5		
			At El. 195.5 Ft., light brown and orange	100	6		SPT Sampler	2 / 2 / 3	5
194.0	9.0						194.0		

NOTES:

1. Soils are field visually classified in accordance with the Unified Soils Classification System.

2. Borehole backfilled with cuttings

140# hammer w/30" drop used with 2.0' split spoon (1-3/8" I.D. x 2" O.D.).

0 5 10 15

SAJ FORM 1836
JUN 02

Boring Designation WRF-14-20

DRILLING LOG

DIVISION	South Atlantic
INSTALLATION	Mobile District
SHEET	1 OF 1 SHEETS

1. PROJECT	Eglin AFB WRECC
2. BORING DESIGNATION	WRF-14-20
LOCATION COORDINATES	X = 609,684 Y = 1,373,247
3. DRILLING AGENCY	Corps of Engineers - CESAM
CONTRACTOR FILE NO.	
4. NAME OF DRILLER	Eddie Woods
5. DIRECTION OF BORING	☒ VERTICAL ☐ INCLINED
DEG. FROM VERTICAL	
BEARING	
6. THICKNESS OF OVERBURDEN	N/A
7. DEPTH DRILLED INTO ROCK	N/A
8. TOTAL DEPTH OF BORING	9.0 Ft.
9. SIZE AND TYPE OF BIT	See Remarks
10. COORDINATE SYSTEM/DATUM	HORIZONTAL: NAD83 VERTICAL: NAVD88
11. MANUFACTURER'S DESIGNATION OF DRILL	CME-850
	☒ AUTO HAMMER ☐ MANUAL HAMMER
12. TOTAL SAMPLES	DISTURBED: 6 UNDISTURBED (UD): 0
13. TOTAL NUMBER CORE BOXES	0
14. ELEVATION GROUND WATER	Not Encountered
15. DATE BORING	STARTED: 10-02-20 COMPLETED: 10-02-20
16. ELEVATION TOP OF BORING	201.0 Ft.
17. TOTAL RECOVERY FOR BORING	100 %
18. NAME AND TITLE OF INSPECTOR	Wes Stringfellow, Geotechnical Engineer

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% REC.	BOX OR SAMPLE	RQD OR UD	REMARKS	BLOWS/0.5 FT.	N-VALUE
201.0	0.0						201.0		
			(SP) SAND, poorly-graded, very loose, mostly fine-grained sand-sized quartz, trace roots, dry, light brown	100	1		SPT Sampler	WH 1 2	3
							199.5		
			At El. 199.5 Ft., discontinue roots	100	2		SPT Sampler	1 1 2	3
							198.0		
				100	3		SPT Sampler	1 1 1	2
			At El. 197.0 Ft., loose				196.5		
				100	4		SPT Sampler	1 2 2	4
							195.0		
				100	5		SPT Sampler	2 2 3	5
							193.5		
				100	6		SPT Sampler	2 3 3	6
192.0	9.0						192.0		

NOTES:

1. Soils are field visually classified in accordance with the Unified Soils Classification System.

2. Borehole backfilled with cuttings

140# hammer w/30" drop used with 2.0' split spoon (1-3/8" I.D. x 2" O.D.).

0 5 10 15

SAJ FORM 1836
JUN 02

Boring Location	Depth (feet)	USCS CLASS	Water Content (%)	-40 Materials		Percent Passing U.S. Standard Sieve							Permeability (cm/sec)	Resitivity (ohms)	Cohesive strength (tsf)	Effective Cohesive strength (tsf)
				LL	PI	#4	#10	#20	#40	#60	#140	#200				
WRF-1	9.0	SM	12	NP	NP		100.0	99.0	79.4	37.3	16.5	15.1				
WRF-1	16.5		9				100.0	98.9	66.5	24.5	12.4	11.5				
WRF-2	18.0		8			100.0						8.4				
WRF-3	13.5	SM	12	NP	NP	100.0						16.7				
WRF-3	24.0	SP	5			100.0						3.9				
WRF-5	9.0	SM	12	NP	NP	100.0						18.0				
WRF-6	1.0		5			100.0						7.4				
WRF-7	10.5	SM	11	NP	NP	100.0						15.0				
WRF-8	4.5		5			100.0						5.5				
WRF-11	1.5		5				100.0	99.5	79.0	31.9	8.2	7.1	8.086e-03			
WRF-13	4.5		6				100.0	98.9	78.2	33.5	8.1	7.0	8.718e-03			

GEOTECHNICAL ENGINEERING TESTING, INC.

REPORT OF LABORATORY TEST DATA

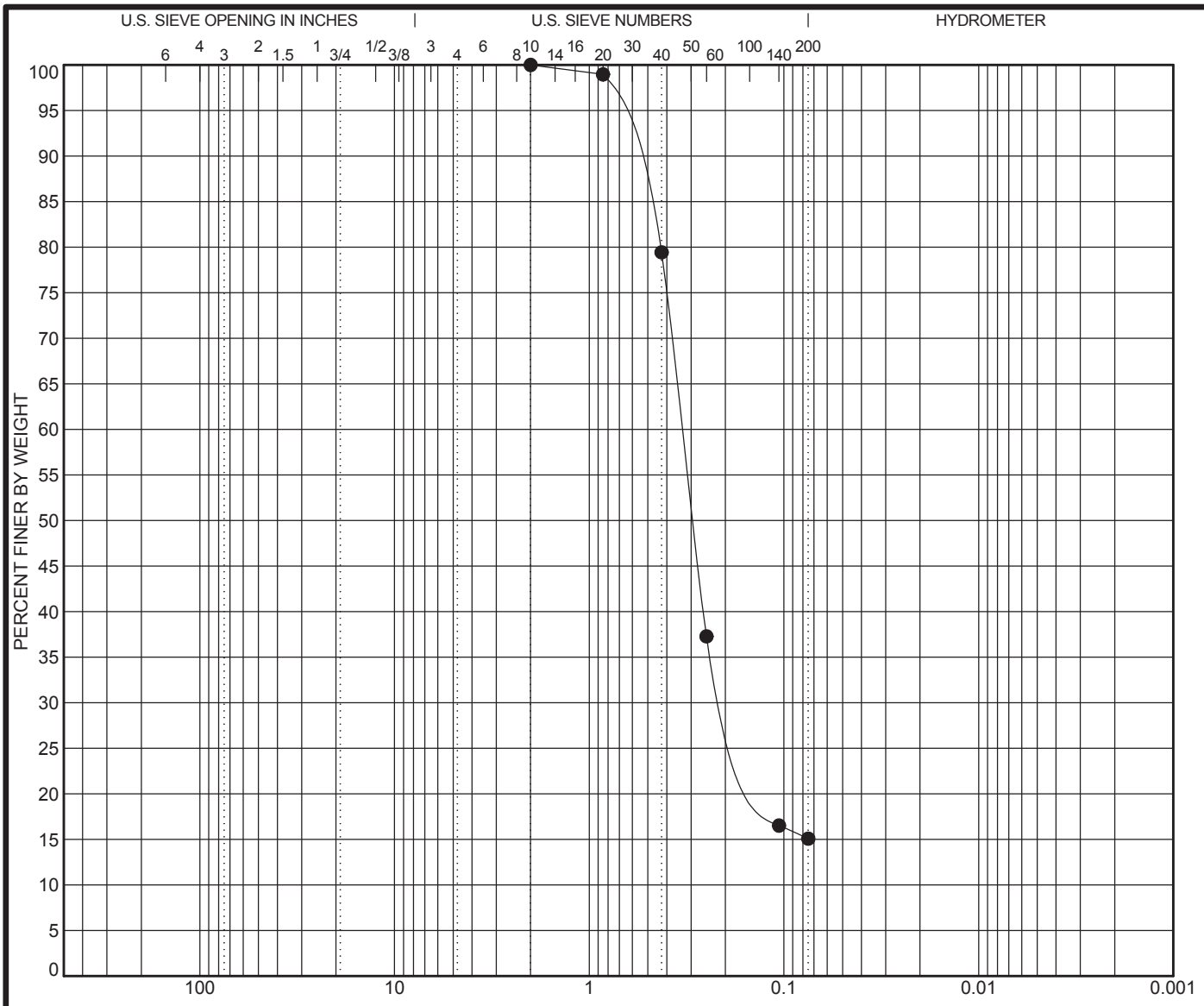
PROJECT NAME: EGLIN A.F.B. - W.R.E.C.C.
G.E.T. PROJ. NUMBER: 20-205
PROJECT LOCATION: EGLIN AFB, FLORIDA

Borehole	Depth	Liquid Limit	Plastic Limit	Plasticity Index	Specific Gravity	%<#200 Sieve	Class-ification	Water Content (%)	Cohesion (tsf)	Dry Density (pcf)	Satur-ation (%)	Void Ratio
WRF-1	9.0	NP	NP	NP		15.1	SM	12				
WRF-1	16.5					11.5		9				
WRF-2	18.0					8.4		8				
WRF-3	13.5	NP	NP	NP		16.7	SM	12				
WRF-3	24.0					3.9	SP	5				
WRF-5	9.0	NP	NP	NP		18.0	SM	12				
WRF-6	1.0					7.4		5				
WRF-7	10.5	NP	NP	NP		15.0	SM	11				
WRF-8	4.5					5.5		5				
WRF-11	1.5					7.1		5		101.4		
WRF-13	4.5					7.0		6		101.0		

GEOTECHNICAL ENGINEERING TESTING, INC.

Summary of Laboratory Results

PROJECT NAME: EGLIN A.F.B. - W.R.E.C.C.
G.E.T. PROJ. NUMBER: 20-205
PROJECT LOCATION: EGLIN AFB, FLORIDA



Test Method: _____

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification	Classification	LL	PL	PI	Cc	Cu
● **WRF-1 S-S-7;9.0 ft.**	**YELLOWISH RED CLAYEY COARSE SAND (SM)**	**NP**	**NP**	**NP**		

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
WRF-01 9.0 ft.	**2**	**0.333**	**0.185**		**0.0**	**84.9**	**15.1**	

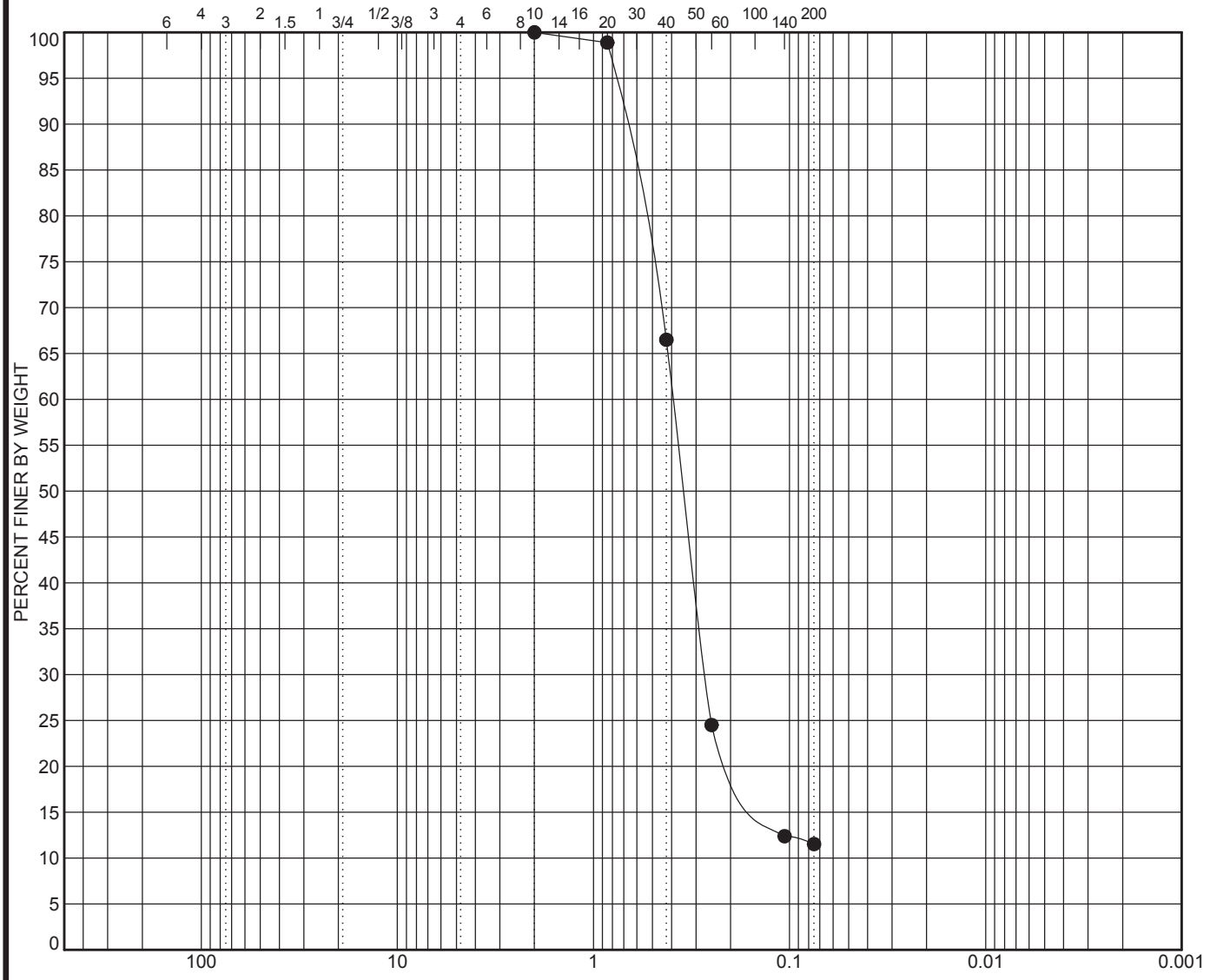
REMARKS:

GEOTECHNICAL ENGINEERING TESTING, INC.

GRAIN SIZE DISTRIBUTION

PROJECT NAME: EGLIN A.F.B. - W.R.E.C.C.
G.E.T. PROJ. NUMBER: 20-205
PROJECT LOCATION: EGLIN AFB, FLORIDA

GET GRAINSIZE 20-205 EGLIN AFB - WRECC.GPJ GETI AL.GDT 6/12/20



Test Method: _____

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification	Classification	LL	PL	PI	Cc	Cu
●	**WRF-1S-S-12;16.5 ft.**	**REDDISH YELLOW SILTY CLAYEY SAND**				**4.51**	**9.63**

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
WRF-01 16.5 ft.	**2**	**0.391**	**0.268**		**0.0**	**88.5**	**11.5**	

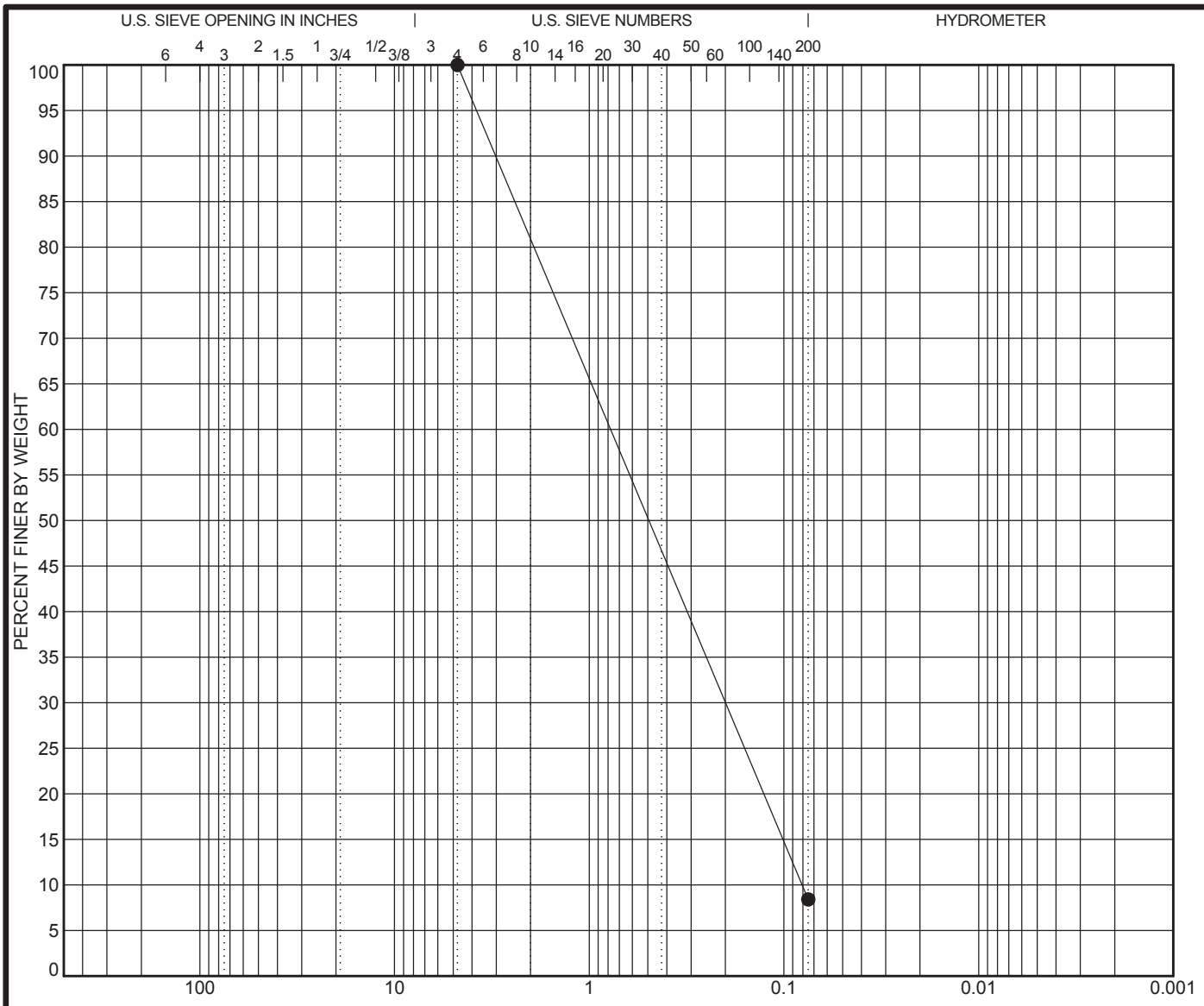
REMARKS:

GEOTECHNICAL ENGINEERING TESTING, INC.

GRAIN SIZE DISTRIBUTION

PROJECT NAME: EGLIN A.F.B. - W.R.E.C.C.
G.E.T. PROJ. NUMBER: 20-205
PROJECT LOCATION: EGLIN AFB, FLORIDA

GET GRAINSIZE 20-205 EGLIN AFB - WRECC.GPJ GETI AL.GDT 6/12/20



Test Method: _____

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification	Classification	LL	PL	PI	Cc	Cu
● **WRF-2S-S-13;18.0 ft.**	**YELLOWISH RED trace PALE YELLOW SAND**				**0.64**	**9.63**

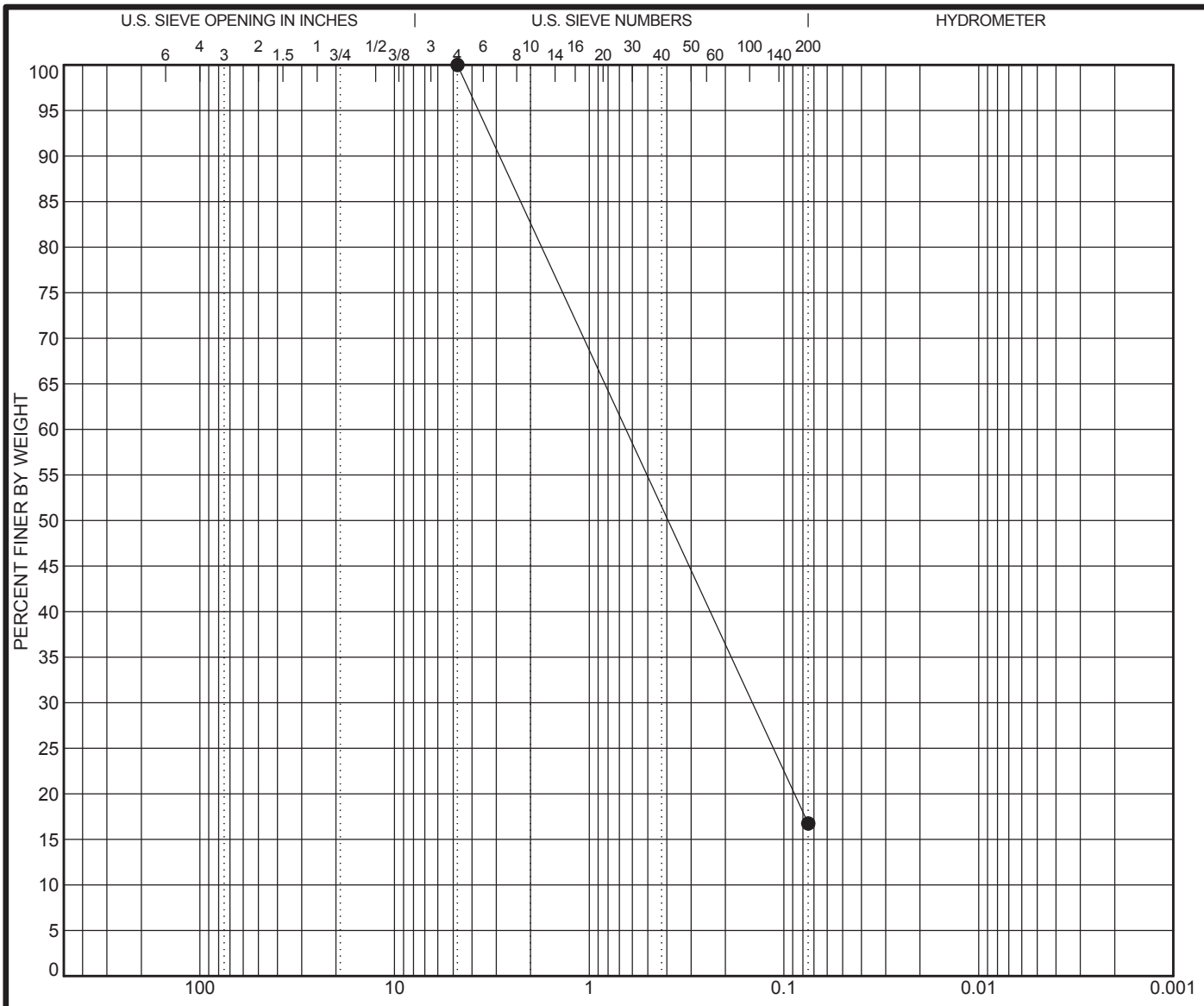
Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
WRF-02 18.0 ft.	**4.75**	**0.776**	**0.199**	**0.081**	**0.0**	**91.6**	**8.4**	

REMARKS:

GEOTECHNICAL ENGINEERING TESTING, INC.

GRAIN SIZE DISTRIBUTION

PROJECT NAME: EGLIN A.F.B. - W.R.E.C.C.
G.E.T. PROJ. NUMBER: 20-205
PROJECT LOCATION: EGLIN AFB, FLORIDA



Test Method: _____

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification	Classification	LL	PL	PI	Cc	Cu
● **WRF-3S-S-10;13.5 ft.**	**YELLOWISH RED CLAYEY SAND (SM)**	**NP**	**NP**	**NP**		

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
WRF-03 13.5 ft.	**4.75**	**0.647**	**0.145**		**0.0**	**83.3**	**16.7**	

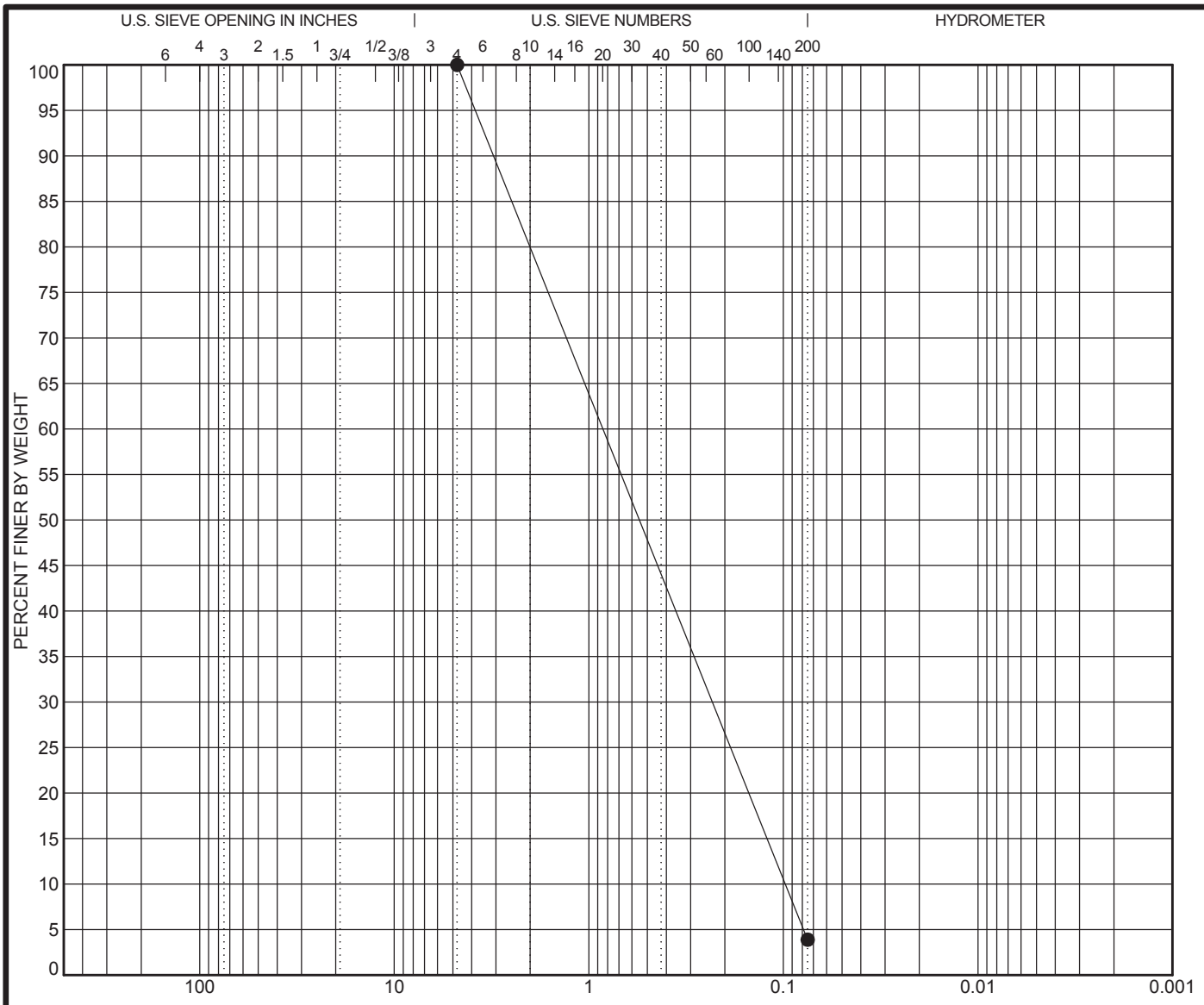
REMARKS:

GEOTECHNICAL ENGINEERING TESTING, INC.

GRAIN SIZE DISTRIBUTION

PROJECT NAME: EGLIN A.F.B. - W.R.E.C.C.
G.E.T. PROJ. NUMBER: 20-205
PROJECT LOCATION: EGLIN AFB, FLORIDA

GET GRAINSIZE 20-205 EGLIN AFB - WRECC.GPJ GETI AL.GDT 6/12/20



Test Method: _____

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification	Classification	LL	PL	PI	Cc	Cu
●	**WRF-3S-S-17;24.0 ft.**	**WHITE with LIGHT REDDISH YELLOW SAND (SP)**				**0.65**	**8.65**

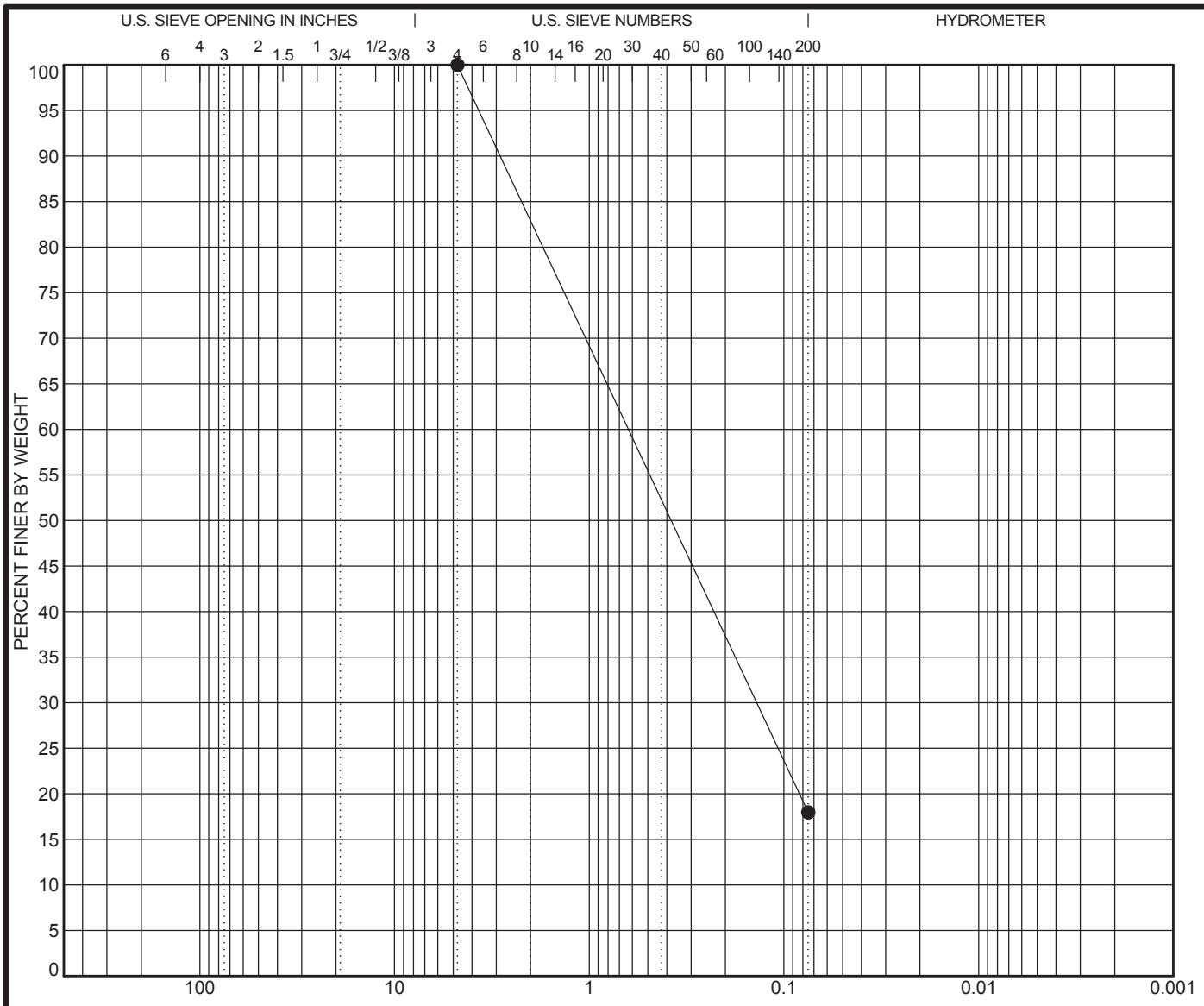
Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
WRF-03 24.0 ft.	**4.75**	**0.845**	**0.232**	**0.098**	**0.0**	**96.1**	**3.9**	

REMARKS:

GEOTECHNICAL ENGINEERING TESTING, INC.

GRAIN SIZE DISTRIBUTION

PROJECT NAME: EGLIN A.F.B. - W.R.E.C.C.
G.E.T. PROJ. NUMBER: 20-205
PROJECT LOCATION: EGLIN AFB, FLORIDA



Test Method: _____

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification	Classification	LL	PL	PI	Cc	Cu
● **WRF-5 S-S-7;9.0 ft.**	**LIGHT REDDISH YELLOW SAND (SM)**	**NP**	**NP**	**NP**		

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
WRF-05 9.0 ft.	**4.75**	**0.628**	**0.138**		**0.0**	**82.0**	**18.0**	

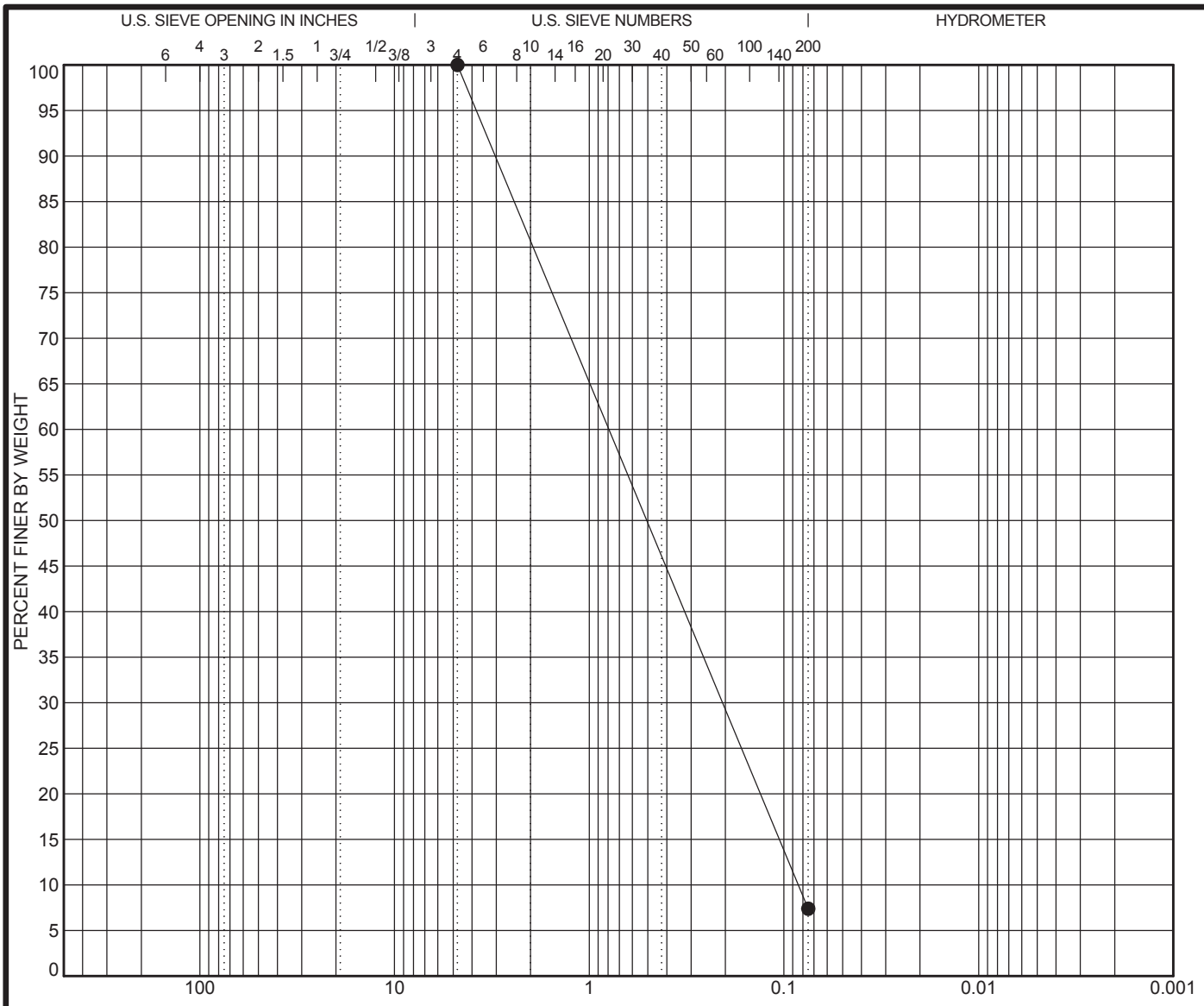
REMARKS:

GEOTECHNICAL ENGINEERING TESTING, INC.

GRAIN SIZE DISTRIBUTION

PROJECT NAME: EGLIN A.F.B. - W.R.E.C.C.
G.E.T. PROJ. NUMBER: 20-205
PROJECT LOCATION: EGLIN AFB, FLORIDA

GET GRAINSIZE 20-205 EGLIN AFB - WRECC.GPJ GETI AL.GDT 6/12/20



Test Method: _____

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification	Classification	LL	PL	PI	Cc	Cu
● **WRF-06 GRAB BULK;1.0 ft.**	**BROWNISH YELLOW SAND**				**0.64**	**9.39**

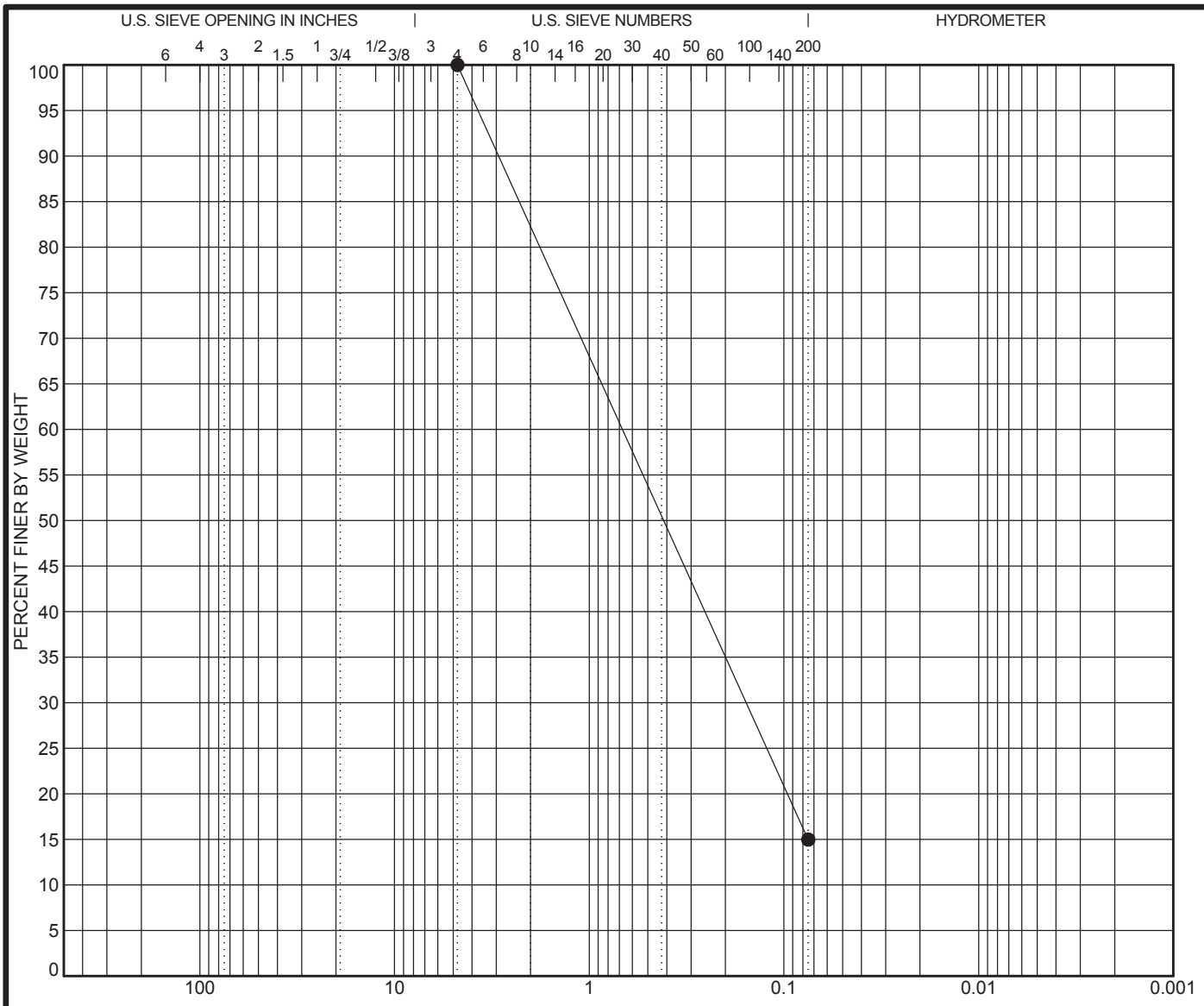
Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
WRF-06 1.0 ft.	**4.75**	**0.792**	**0.206**	**0.084**	**0.0**	**92.6**	**7.4**	

REMARKS:

GEOTECHNICAL ENGINEERING TESTING, INC.

GRAIN SIZE DISTRIBUTION

PROJECT NAME: EGLIN A.F.B. - W.R.E.C.C.
G.E.T. PROJ. NUMBER: 20-205
PROJECT LOCATION: EGLIN AFB, FLORIDA



Test Method: _____

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification	Classification	LL	PL	PI	Cc	Cu
● **WRF-7 S-S-8;10.5 ft.**	**LIGHT REDDISH YELLOW SAND (SM)**	**NP**	**NP**	**NP**		

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
WRF-07 10.5 ft.	**4.75**	**0.675**	**0.156**		**0.0**	**85.0**	**15.0**	

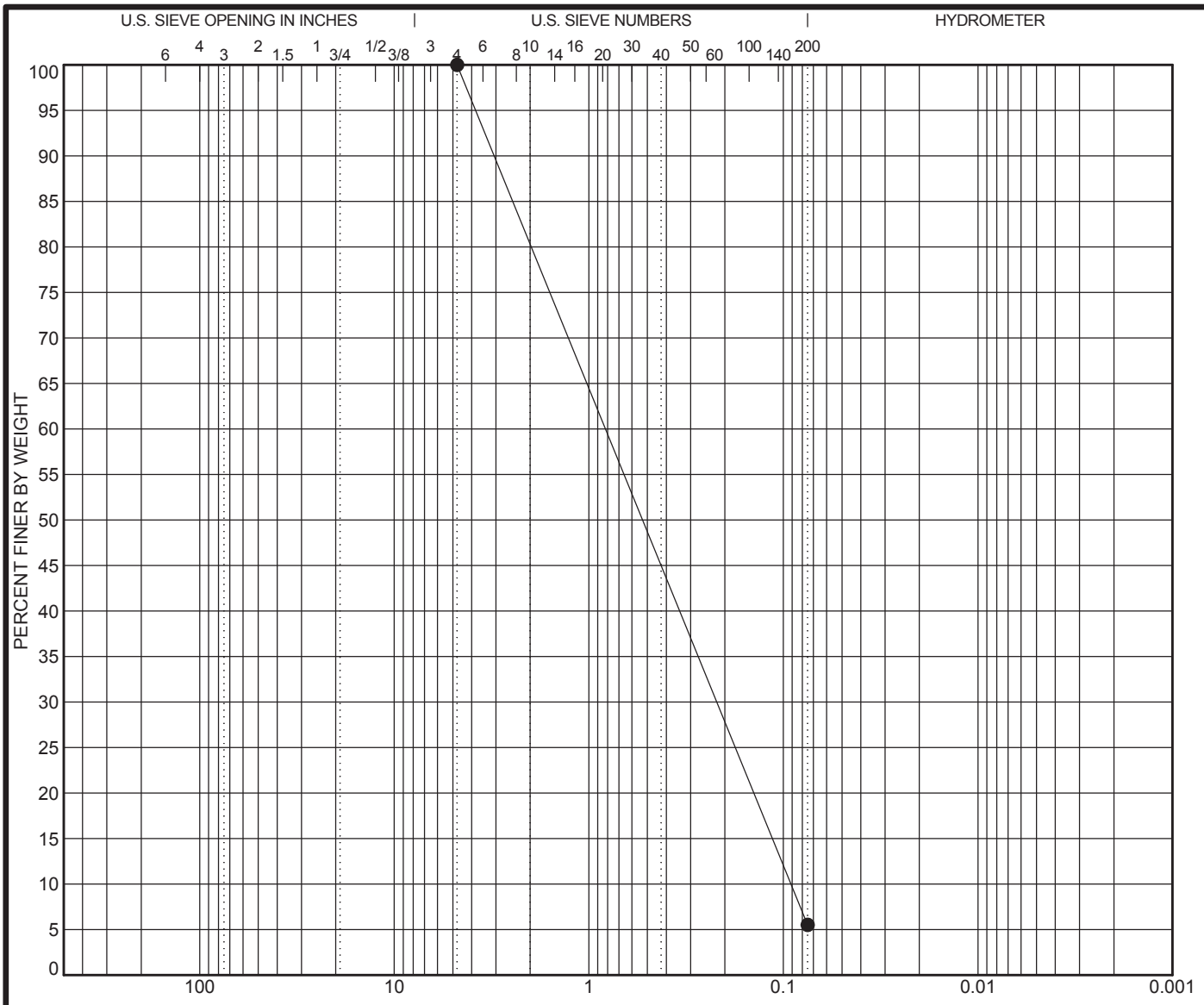
REMARKS:

GEOTECHNICAL ENGINEERING TESTING, INC.

GRAIN SIZE DISTRIBUTION

PROJECT NAME: EGLIN A.F.B. - W.R.E.C.C.
G.E.T. PROJ. NUMBER: 20-205
PROJECT LOCATION: EGLIN AFB, FLORIDA

GET GRAINSIZE 20-205 EGLIN AFB - WRECC.GPJ GETI AL.GDT 6/12/20



Test Method: _____

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification	Classification	LL	PL	PI	Cc	Cu
● **WRF-8 S-S-4;4.5 ft.**	**LIGHT YELLOWISH BROWN SAND**				**0.64**	**8.98**

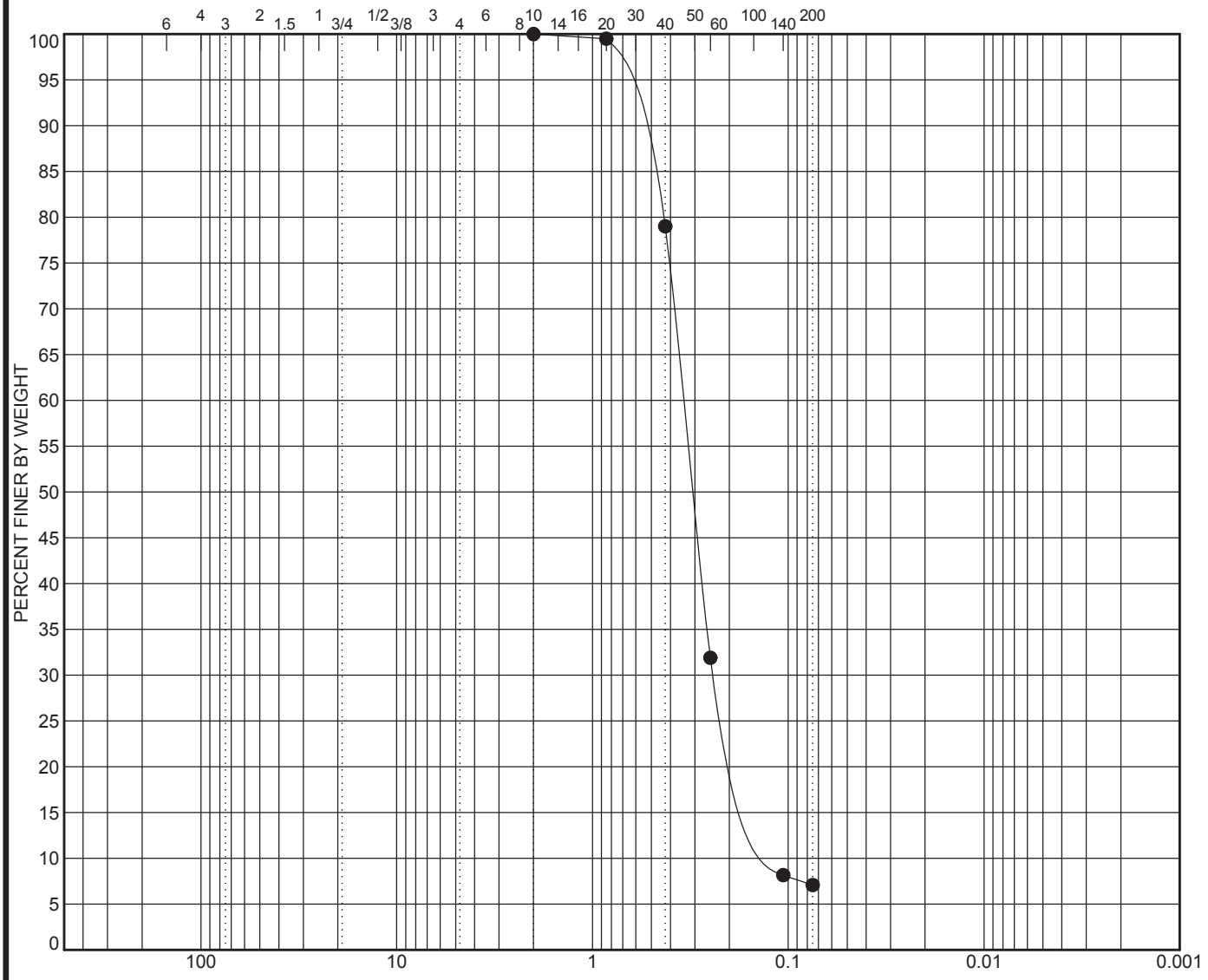
Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
WRF-08 4.5 ft.	**4.75**	**0.82**	**0.22**	**0.091**	**0.0**	**94.5**	**5.5**	

REMARKS:

GEOTECHNICAL ENGINEERING TESTING, INC.

GRAIN SIZE DISTRIBUTION

PROJECT NAME: EGLIN A.F.B. - W.R.E.C.C.
G.E.T. PROJ. NUMBER: 20-205
PROJECT LOCATION: EGLIN AFB, FLORIDA



Test Method: _____

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification	Classification	LL	PL	PI	Cc	Cu
●	**WRF-11S-(234);1.5 ft.**	**YELLOWISH BROWN & LIGHT YELLOWISH BROWN SAND**				**1.40**	**3.03**

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
WRF-11	**1.5 ft.**	**2**	**0.343**	**0.233**	**0.113**	**0.0**	**92.9**	**7.1**	

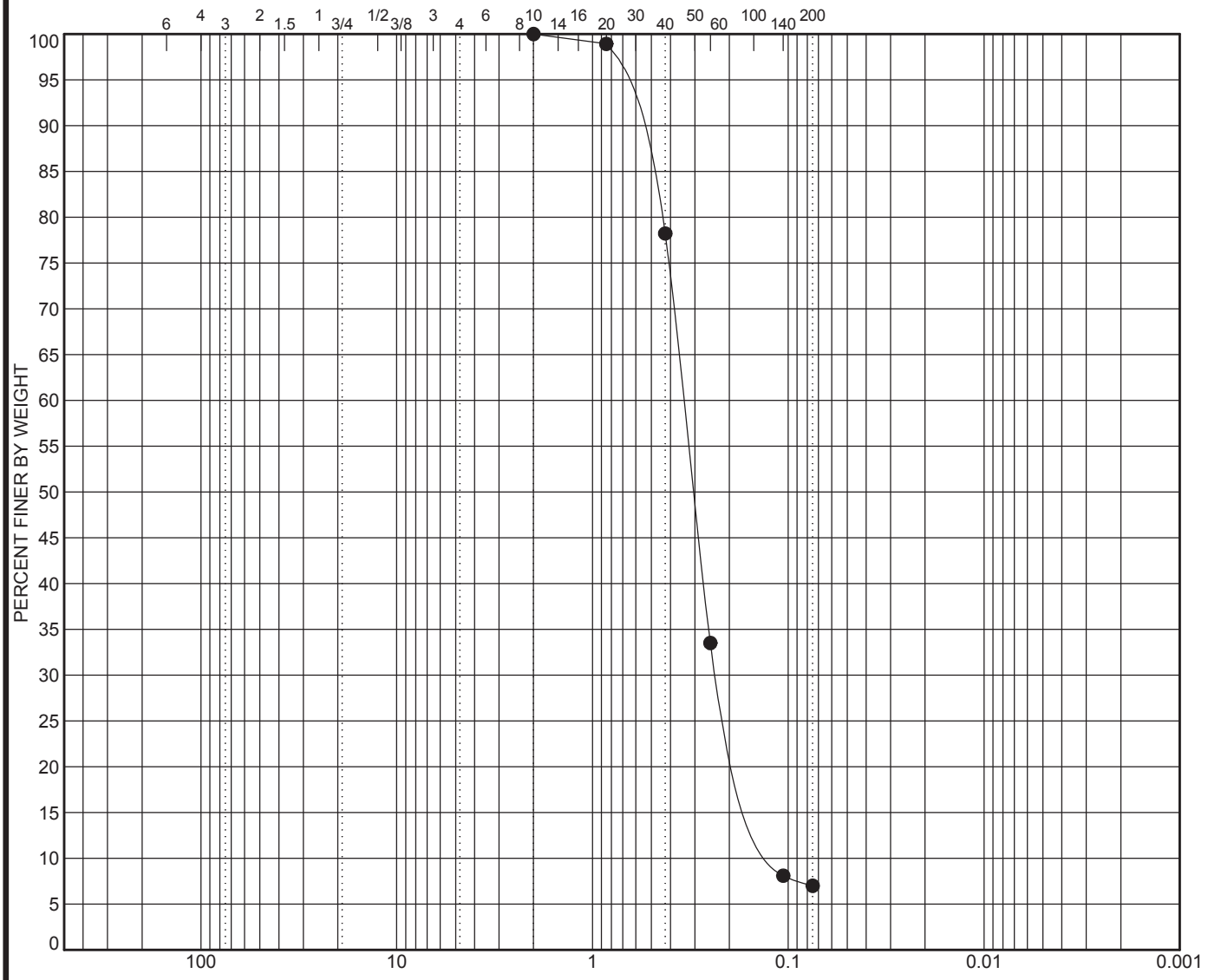
REMARKS: **k20 = 8.086e-03 cm/sec**

GEOTECHNICAL ENGINEERING TESTING, INC.

GRAIN SIZE DISTRIBUTION

PROJECT NAME: EGLIN A.F.B. - W.R.E.C.C.
G.E.T. PROJ. NUMBER: 20-205
PROJECT LOCATION: EGLIN AFB, FLORIDA

GET GRAINSIZE 20-205 EGLIN AFB - WRECC.GPJ GETI AL.GDT 6/12/20



Test Method: _____

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification	Classification	LL	PL	PI	Cc	Cu
● **WRF-13 4.5 ft.**	**LIGHT YELLOWISH BROWN with LIGHT REDDISH YELLOW SAND**				**1.27**	**3.03**

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
WRF-13 4.5 ft.	**2**	**0.342**	**0.222**	**0.113**	**0.0**	**93.0**	**7.0**	

REMARKS: **k20 = 8.718e-03 cm/sec**

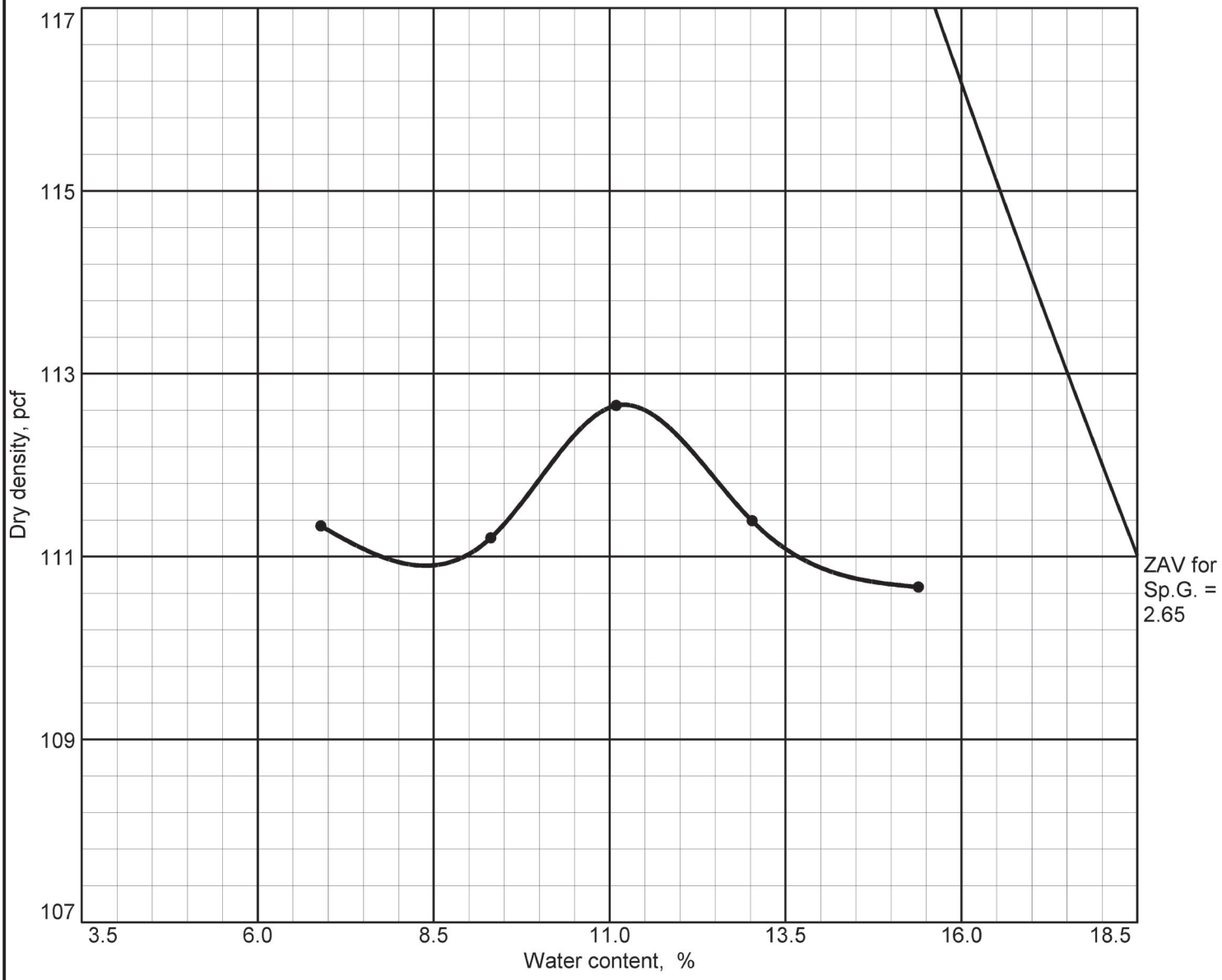
GEOTECHNICAL ENGINEERING TESTING, INC.

GRAIN SIZE DISTRIBUTION

PROJECT NAME: EGLIN A.F.B. - W.R.E.C.C.
G.E.T. PROJ. NUMBER: 20-205
PROJECT LOCATION: EGLIN AFB, FLORIDA

GET GRAINSIZE 20-205 EGLIN AFB - WRECC.GPJ GETI AL.GDT 6/12/20

COMPACTION TEST REPORT



Test specification: ASTM D 1557-00 Method A Modified

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No.4	% < No.200
	USCS	AASHTO						
1.0' - 4.0'	SP-SM				NP	NP	0.0	

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 112.7 pcf Optimum moisture = 11.2 %	Brown Silty Sand

Project No. 20-205 **Client:**

Project: EGLIN A.F.B. - WRECC

● **Source:** **Sample No.:** WRF-05- **Elev./Depth:** 1.0' - 4.0'

Remarks:

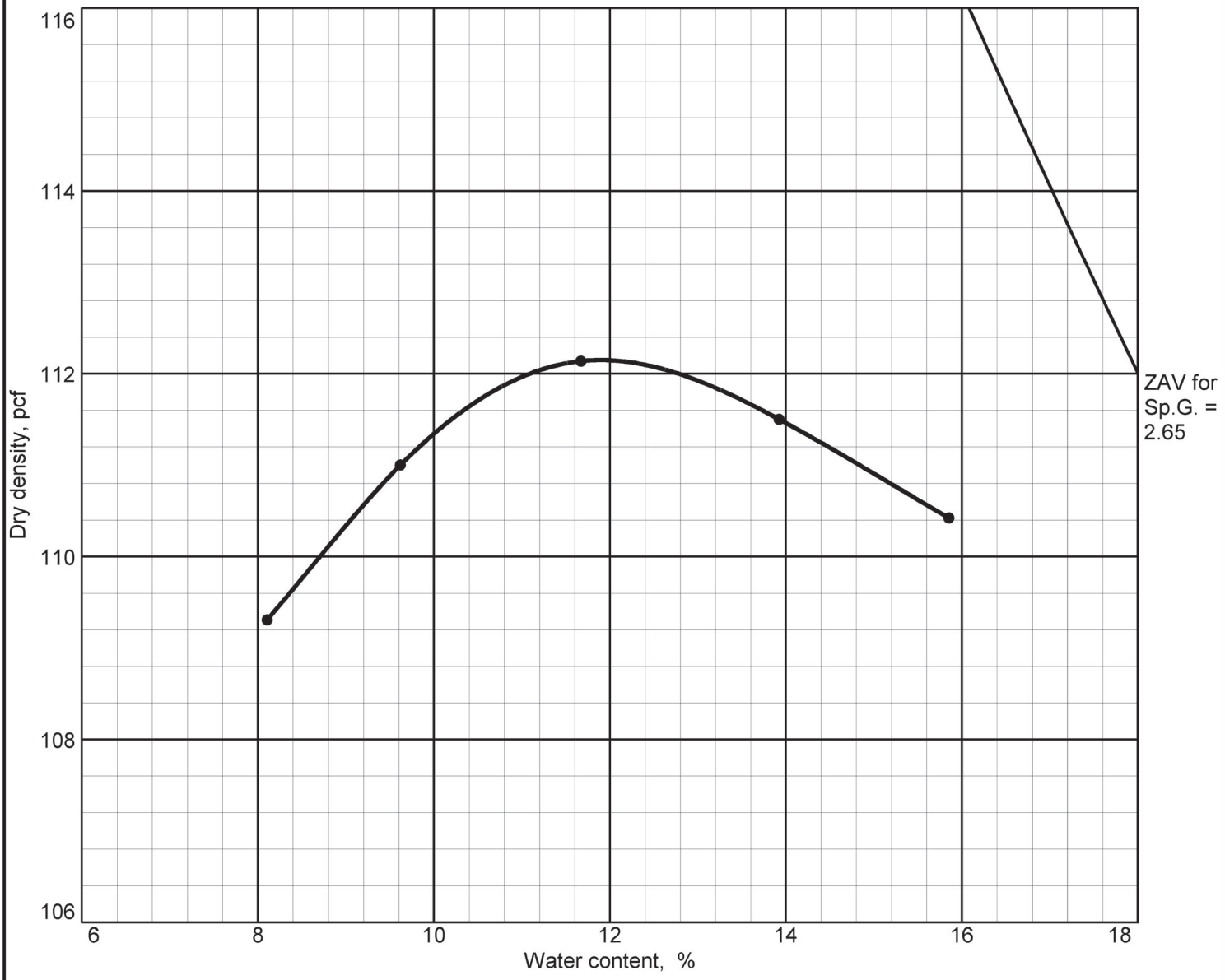
11-24-2020

Geotechnical Engineering-Testing, Inc.

Mobile, AL

Figure

COMPACTION TEST REPORT



Test specification: AASHTO T 180 Method A Modified

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No.4	% < No.200
	USCS	AASHTO						
1.0' - 4.0'	SP-SM		5		NP	NP	0.0	7.4

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 112.2 pcf Optimum moisture = 11.9 %	Brownish Yellow Silty Sand

Project No. 20-205 **Client:**

Project: EGLIN A.F.B. - WRECC

● **Source:** **Sample No.:** WRF-06- **Elev./Depth:** 1.0' - 4.0'

Remarks:

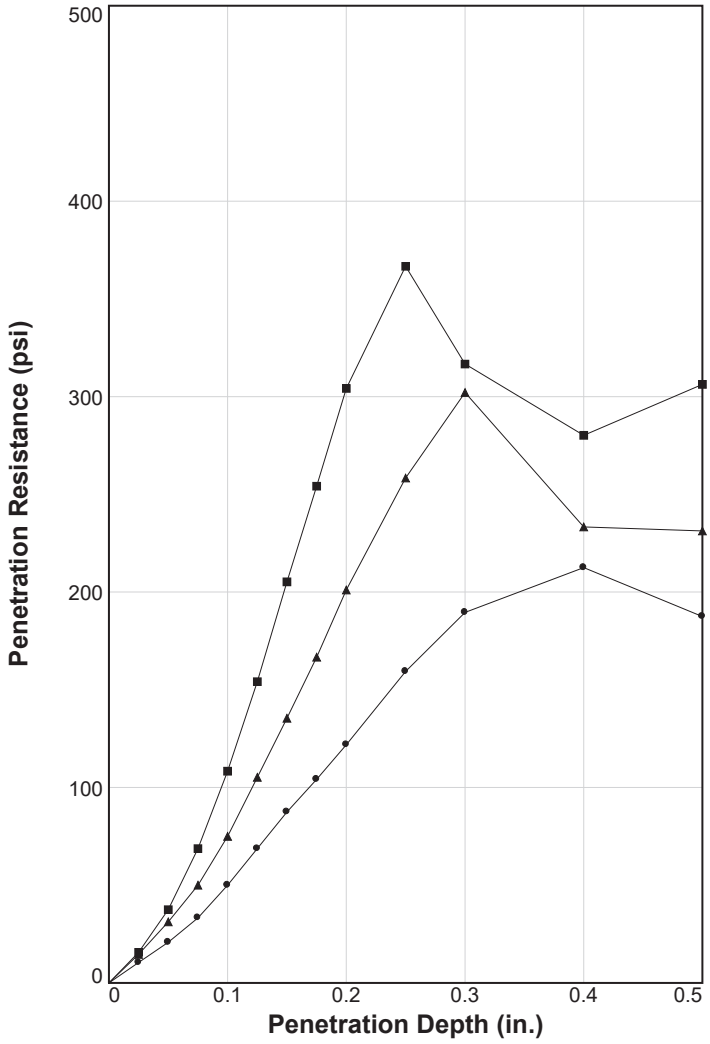
11-24-2020

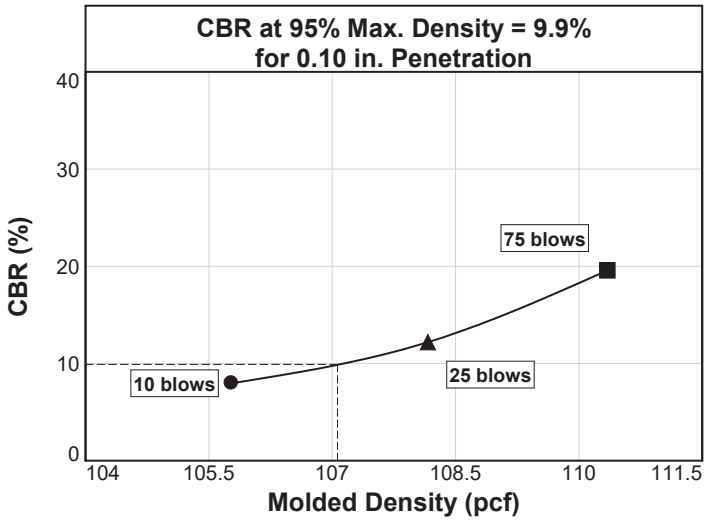
Geotechnical Engineering-Testing, Inc.

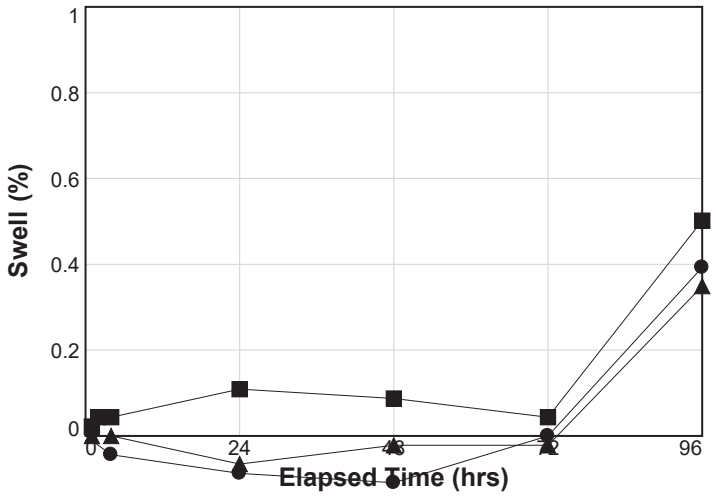
Mobile, AL

Figure

BEARING RATIO TEST REPORT
ASTM D 1883-05







	Molded			Soaked			CBR (%)		Linearity Correction (in.)	Surcharge (lbs.)	Max. Swell (%)
	Density (pcf)	Percent of Max. Dens.	Moisture (%)	Density (pcf)	Percent of Max. Dens.	Moisture (%)	0.10 in.	0.20 in.			
1 ○	105.8	93.9	11.1	105.4	93.5	11.7	8.0	10.1	0.039	10	0.4
2 △	108.2	96	11.3	107.8	95.6	11.1	12.2	16.4	0.039	10	0.3
3 □	110.3	97.9	11.3	109.8	97.4	11.2	19.6	24.1	0.045	10	0.5

Material Description	USCS	Max. Dens. (pcf)	Optimum Moisture (%)	LL	PI
Brown Silty Sand	SP-SM	112.7	11.2	NP	NP

Project No: 20-205

Project: EGLIN A.F.B. - WRECC

Sample Number: WRF-05-20 BULK **Depth:** 1.0' - 4.0'

Date: 11-30-2020

BEARING RATIO TEST REPORT

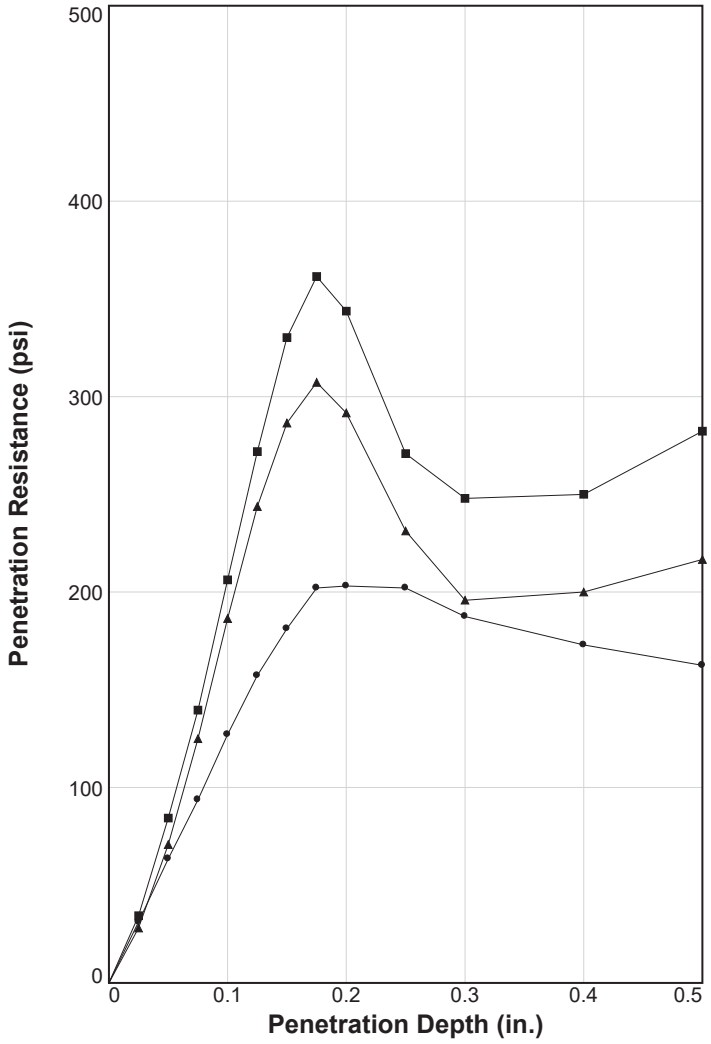
Geotechnical Engineering-Testing, Inc.

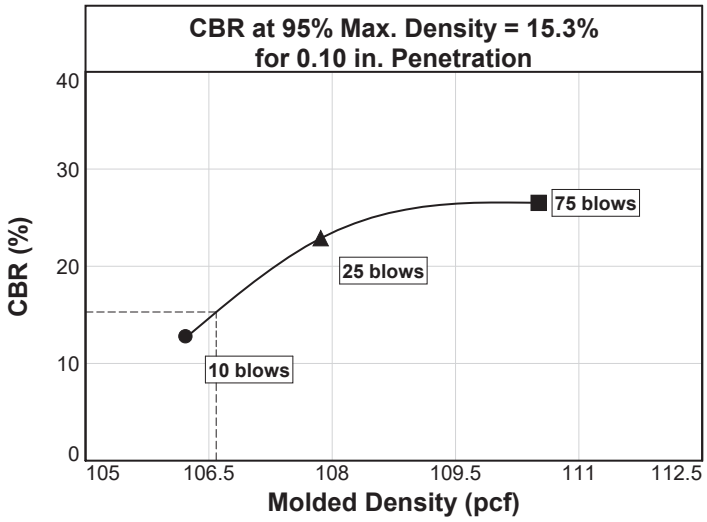
Test Description/Remarks:

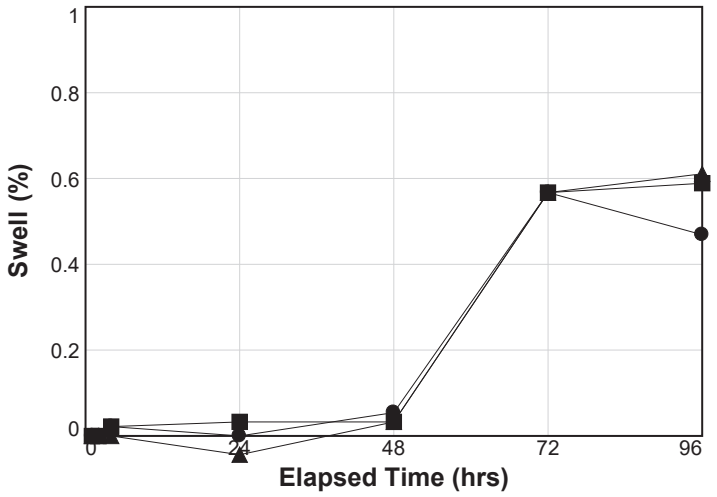
ASTM D1557
3 TRIALS AT 4" OPT MC
10/25/75 B/L

Figure _____

BEARING RATIO TEST REPORT
ASTM D 1883-05







	Molded			Soaked			CBR (%)		Linearity Correction (in.)	Surcharge (lbs.)	Max. Swell (%)
	Density (pcf)	Percent of Max. Dens.	Moisture (%)	Density (pcf)	Percent of Max. Dens.	Moisture (%)	0.10 in.	0.20 in.			
1 ○	106.2	94.7	11.8	105.6	94.1	14.2	12.7	13.5	0.000	10	0.6
2 △	107.9	96.2	11.9	107.2	95.5	13.6	22.9	18.0	0.018	10	0.6
3 □	110.5	98.5	11.9	109.9	97.9	13.6	26.5	20.7	0.022	10	0.6

Material Description	USCS	Max. Dens. (pcf)	Optimum Moisture (%)	LL	PI
Brownish Yellow Silty Sand	SP-SM	112.2	11.9	NP	NP

Project No: 20-205

Project: EGLIN A.F.B. - WRECC

Sample Number: WRF-06-20 BULK **Depth:** 1.0' - 4.0'

Date: 12-1-2020

BEARING RATIO TEST REPORT

Geotechnical Engineering-Testing, Inc.

Test Description/Remarks:

ASTM D1557
3 TRIALS AT 4" OPT MC
10/25/75 B/L

Figure _____

APPENDIX B

NOT USED

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APPENDIX C

AIR FORCE SUSTAINABILITY REQUIREMENTS SCORESHEET

Air Force Sustainability Requirements Scoresheet

HPSB COMPLIANCE (Updated Jan 2017)

* required entry

General Information		
	INCOMPLETE	
MHF20007	Project ID (e.g. ABCD12345)	
	Real Property Unique ID (RPUID)	*
TBD	Facility Number	
Weapons Research Experimentation Control Cente (WRECC)	Building Name	
Eglin AFB	Installation	
Valpariso	City	
FL	State	
Yes	CONUS	
AFMC	MAJCOM	
USACE	Construction Agent	
TBD	AFCEC DM/CM (Last Name, First Name)	
$5,690,000.00	PA	
6,600	Building Size (SF)	
2022	Program Year (FY####)	
Design Complete	Project Phase	
04/23/20	Design Started (MM/DD/YY)	
09/30/23	BOD (MM/DD/YY)	
Not Certifying	Guiding Principles Compliance Certification Method	
	Date Project Registered (MM/DD/YY)	
	Date Project Certified (MM/DD/YY)	
96%	HPSB Compliant	
44%	Energy Efficiency Achieved (% below ANSI/ASHRAE/IESNA Standard 90.1-2013)	
2017V1	Scoresheet version	

Please complete NA justifications

Federal Requirements Complete

Air Force Sustainability Requirements Scoresheet

HPSB COMPLIANCE (Updated Jan 2017)

* required entry

Color Coding: See Instructions Tab for more detail	
Drop-Down Box	Yes or N/A
No Entry Required	No
Custom Entry	Recommended not Required

90.1-2013

HPSB I: Employ Integrated Design Principles (UFC 1-200-02 para 2-2)

Total Points: 2 — Possible Points: 2

Yes	HPSB I.1	**Integrated Design**	1
Yes	HPSB I.2	**Commissioning**	1

HPSB II: Optimize Energy Performance (UFC 1-200-02 para 2-3)

Total Points: 5 — Possible Points: 5

Yes	HPSB II.1	**Energy Efficiency**		1
		Yes	Reduce energy use 30% below ANSI/ASHRAE/IESNA Standard 90.1-2013 or IECC, or if not - achieve maximum energy efficiency that is lifecycle cost effective	
		44.3%	Insert percentage below ANSI/ASHRAE/IESNA Standard 90.1-2013 or IECC, in terms of energy use (e.g. 32)	
		46.152	Insert building energy intensity (kBtu/yr-sqft) calculated IAW 10 CFR 433	
		No	Roof Attributes (Recommended)	
			Select roof types (Check below)	
			☐ Cool roof ☐ Solar electric ☐ Solar Passive ☐ Green roof ☐ Solar thermal	
		Energy Efficient Products		1
		Yes		
Yes	HPSB II.2	**On-site Renewable Energy**		1
		Yes	Installed renewable energy elements or projects were not lifecycle cost effective	
		1	Renewable energy types (check below)	
			☐ Solar PV ☐ Geothermal ☐ Hydro ☐ Waste to Energy ☐ Solar CP ☐ GSHP ☐ Wind ☑ Renewables were not lifecycle cost effective ☐ Solar Thermal Electric	
			Insert generation capacity (kW)	*
			Insert percentage of total building	*
Yes	HPSB II.3	**On-site Renewable Energy - Solar Hot Water Heater System**		1
		Yes	Installed solar hot water heater system or found installation not lifecycle cost effective	
			Insert generation capacity (MMBtu/yr)	*
			Insert percentage of demand	*
Yes	HPSB II.4	**Metering**		1
		Yes	Electric Metering: Select N/A if no service	
		N/A	Natural Gas Metering: Select N/A if no service	
		N/A	Steam Metering: Select N/A if no service	

HPSB III: Protect and Conserve Water (UFC 1-200-02 para 2-4)

Total Points: 6 — Possible Points: 6

Yes	HPSB III.1	**Indoor Water**		1
Yes		**Indoor Water Metering**		1
N/A	HPSB III.2	**Outdoor Water**		1
N/A		**Outdoor Water Metering**		1
N/A	HPSB III.3	**Alternative Water**		1
Yes	HPSB III.4	**Stormwater Management (LID Documentation per UFC 3-210-10)**		1
		90605.0	Change in Impervious Area (SF)	
			Pre-Award Cost Estimate ($)	*
		Yes	Project addressed EISA 438	
		3	EISA Technical Constraints	
			☐ Retaining stormwater impact receving water flow ☐ Shallow bedrock, contaminated soil, high ground water table, underground utilities ☐ Soil infiltration capacity limited ☐ Site too small to infiltrate significant volume ☐ Non-potable water demand to small ☐ Structural, plumbing, and other mods not feasible ☑ State or local restrict water ☑ State or local restrict use of green ☑ Other	
		55.0%	Percent Increase in Stormwater Runoff for 95 Percentile Storm (%) - or- Percent Increase in Stormwater Runoff from continuous simulation model, published data, studies, or other established tools (Reference UFC 3-210-10 Figure 2-1 Implementation of EISA Section 438)	
		On-Site	LID Features Locations	
		1	Integrated Management Practices Employed	

Air Force Sustainability Requirements Scoresheet

HPSB COMPLIANCE (Updated Jan 2017)

* required entry

☐ Bio-Retention	☐ Dry Wells	☐ Filter Strips	☐ Grassed Swells		
☐ Infiltration Trench	☐ Inlet Pollution Removal Device	☐ Permeable Pavement/Pavers	☐ Rain Barrels/Cisterns		
☐ Soil Amendments	☐ Tree Box Filters	☐ Vegetated Buffers	☐ Vegetate		
☑ Other					

	Final LID Construction Cost ($)
Phillip Erdman	Post Construction Analysis (Name of DOR)

HPSB IV: Enhance Indoor Environmental Quality (UFC 1-200-02 para 2-5)				
Total Points	**8**		Possible Points	8
Yes	HPSB IV.1	**Thermal Comfort**		1
Yes	HPSB IV.2	**Ventilation**		1
Yes	HPSB IV.3	**Daylighting**		1
Yes	HPSB IV.4	**Moisture Control**		1
Yes	HPSB IV.5	**Low Emitting Materials**		1
Yes	HPSB IV.6	**Protect Indoor Air Quality during Construction**		1
Yes	HPSB IV.7	**Environmental Tobacco Smoke Control**		1
Yes	HPSB IV.8	**Occupant Health and Wellness**		1
HPSB V: Reduce Environmental Impact of Materials (UFC 1-200-02 para 2-6)				
Total Points	**5**		Possible Points	5
Yes	HPSB V.1	**Recycled Content**		1
Yes	HPSB V.2	**Biologically-based Products**		1
Yes	HPSB V.3	**Ozone Depleting Substances**		1
Yes	HPSB V.4	**Waste and Materials Management - Recycling**		1
Yes	HPSB V.5	**Waste and Materials Management - Divert 60% from Disposal**		1
		Yes	60% or greater diverted	
		60.0%	Insert percentage diverted from landfill	
HPSB VI: Address Climate Change Risk (UFC 1-200-02 para 2-7)				
Total Points	**0**		Possible Points	1
No	HPSB VI.1	**Address Climate Change Risk**		1
			Possible Points	**27**
26	**Federal Requirements - Yes or N/A**			
1	**Federal Requirements - No**			
96%	**Percentage of Federal Requirements Met**			

APPENDIX D

96 CS CYBER INFRASTRUCTURE STANDARDS AND INSTALLATION SPECIFICATIONS JAN 2024

96th Communications Squadron Cyber Infrastructure Standards and Installation Specifications

January 2024

AUTHORITY:

DAVID C. COTÉ, Lt Col, USAF
Commander, 96th Communications Squadron

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ATTACHMENT C—FIBER DESIGN REQUIREMENTS
ATTACHMENT D—RACK ELEVATION STANDARDS NIPR/SIPR/DATA/VOIP
ATTACHMENT E—CABLE MANAGEMENT ACCESSORIES
ATTACHMENT F—SECURITY TECHNICAL IMPLEMENTATION GUIDE
ATTACHMENT G—APPLICABLE PUBLICATION
ATTACHMENT H—STANDARD INSTALLATION DRAWINGS

Chapter 1

INTRODUCTION

1.1. Purpose: The 96th Communications Squadron Cyber Infrastructure Standards and Installation Specifications provides the compliance requirements for Eglin Air Force Base Command, Control, Communications and Computer (C4) requirements. This Cyber Infrastructure typically includes telecommunications spaces, pathways, inside and outside plant cabling and interconnecting Base Area Network (BAN) equipment and Air Force Network (AFNET) components. Therefore, the design of interior and exterior telecommunications infrastructure shall be designed by a Registered Communications Distribution Designer (RCDD) using current Department of Defense, Air Force, and industry standards. Moreover, the 96th Communications Squadron Cyber Infrastructure Standards and Installation Specifications provides compliance specifications to those employed or tasked with implementing existing and emerging interior and exterior BAN telecommunications Cyber infrastructure task orders, work orders, contracts, customer information technology and Simplified Acquisition of Base Engineering Requirements (SABER). Furthermore, these specifications shall be used and included as a whole when implementing, engineering, and designing communications requirements in order to meet mission operating and maintenance standards for protecting 96 TW Cyber Space domain.

1.2. Scope: These mandatory specification and technical requirements, parts, materials register, and referenced applicable publications contained within this document, shall be adhered to, and incorporated within all project designs, contracts and SABER renovations for implementation on the Cyber Infrastructure. Deviation from this guide requires Communications Squadron (CS) approval. The telecommunications contractor(s) herein must coordinate with the 96th Communications Squadron concerning layout and configuration of the BAN. Outside Plant (OSP) is defined as network transportation (copper and fiber) outside a building (e.g., underground or buried) and Inside Plant (ISP) is defined as network transport (copper and fiber) within a building supporting the cyber infrastructure.

1.3. Communications and Information Systems Officer: The 96th Communications Squadron, Commander is designated by Technical Order (TO) 00-33A-1001 as the Communications and Information Systems Officer (CSO) for the base. The 96 CS Commander is the operational and maintaining authority for Cyber Infrastructure that supports the base and tenant units and has final approval over all Cyber Infrastructure C4 processes, procedures, requirements, and installations.

> **NOTE:** The term approved is defined in this document and other standards as acceptable to the authority having jurisdiction.

Chapter 2

TECHNICAL REQUIREMENTS

2. The following standards and installation specification criteria provides additional installation specification requirements for 96th Test Wing, Eglin AFB. These compliance specific requirements shall be executed IAW Department of Defense, Air Force, industry standards, applicable publications and documents referenced within attachment G of this document. In the case of conflicting guidance, defer to the most stringent communications applicable standard.

Contractor and subcontractor(s) are recommended to read and understand the Cyber Infrastructure Standards and Installation Specifications prior to working on or changing the BAN Cyber Infrastructure and should pose any questions to the 96 CS/SCXP, in a formal Request for Interpretation or Information (RFI), for Telecommunications design, product submittals, test results and other communications related issues that may need clarification for a complete understanding.

All coordination shall exist in writing, preferably electronic format using industry standard compatible documentation software available to all parties. i.e., Word or Outlook.

2.1. Land Mobile Radio (LMR) Equipment

2.1.1. Construction and Renovation: For new construction and renovation of existing buildings, coordinate with 96 CS/SCXP, Projects and Requirements work center regarding the installation, relocation or removal of any land mobile radio equipment and air-to-ground radio equipment. A Project Manager will provide guidance on the purchase and installation of new equipment, removal and disposition of installed equipment and removal and re-installation of equipment being moved.

2.1.2. Planning: For planning purposes, the Eglin LMR infrastructure is currently version 2022HS. All Eglin LMR equipment is tied to the United States Space Force's LMR zone core at Peterson AFB, CO. All changes to the LMR infrastructure will require coordination with AF Installation and Mission Support Center (AFIMSC).

2.1.3. Subscriber Equipment: All subscriber equipment intended to operate on the Eglin LMR infrastructure will be compatible and interoperable with the Motorola system. Subscriber equipment will have the required feature set and capabilities required to operate on the Eglin system. Subscriber programming will be completed by the 96 CS.

2.1.4. Antenna Systems and Cabling: All radio frequency antenna systems and cabling shall be installed, terminated, protected, and tested based on industry standards, manufacturer instructions and design technical specifications.

2.2. Telecommunication Spaces

2.2.1. Floor Mount Equipment Cabinet: All 72-inch or taller cabinet enclosures shall be 4-Post and blend seamlessly into existing or new fixed ladder rack assemblies. In order to support, internal to the cabinet, copper and fiber cable installation; all 4-Post cabinet enclosures shall be outfitted with all necessary cable management accessories IAW Attachment E. All 4-Post cabinet enclosures shall be Great Lakes model GL790ES-2442MS or equal with two sidecars and end panels (P/N

SC67942 and P/N SCP7942) cable managers or equal, however customer requirements may dictate the size. All 4-Post cabinet enclosures shall follow the rack elevation layout in Attachment D. All 4-Post cabinet enclosures shall be lockable with unique lock cylinders and corresponding keys turned over to 96 CS that are compliant and only accessible by 96 CS technicians in accordance with Attachment F. Dedicated circuits with electrical receptacles depicted in the rack elevations shall be supplied by onsite contractor and shall be placed in accordance with Attachment D. Exact electrical receptacles shall be identified in all iterations of the design drawings based on customer requirements and any future changes.

Any cabinet requiring fiber patch cables in excess of 6-foot fiber patch cords to access switches shall require horizontal cable management accessories. All Surge Arrestors shall always be 1U higher than the top mounted UPS. In narrow or crowded telecommunication rooms, equipment cabinets shall be floor-mounted adjacent to a wall but shall provide a minimum 36-inches of space both in front of and behind the cabinet and behind any installed equipment. A minimum side clearance of 24-inches shall be provided on end cabinets. Provide 100 percent spare cabinet capacity based on the amount of cabinet capacity utilized by the patch panels provided. Spare cabinets shall be provided for the mounting of Government-purchased/installed LAN equipment, if required. Only 96 CS network equipment shall reside within the confines of 96 CS lockable enclosures in accordance with Attachment F. Wall-mounted cabinets may be utilized in small buildings or smaller areas not conducive for floor mount cabinet enclosures.

2.2.2. Wall Mount Equipment Cabinet: All wall mount lockable enclosures shall be Great Lakes, Model: GL48WDXM-B-SH-AF, GL36WDXM-B-SH-AF, or GL24WMCMS-B-SH-AF or equal based on customer requirements mounted to fire rated backboard and grounded IAW para 2.2.11. All wall-mount lockable enclosures shall follow elevation layout IAW Attachment D. Dedicated circuits with electrical receptacles depicted in the rack elevation shall be supplied by onsite contractor and shall be placed IAW rack elevation drawings in Attachment D. Exact electrical receptacles shall be identified in all iterations of the design drawings based on customer requirements and any future changes.

2.2.3. Information Processing System (IPS) Container: A SIPR switch not located in an approved classified storage safe, vault, approved open storage area (AKA: secure room), or in a SCIF shall be secured in an IPS container. All IPS containers shall follow elevation layout IAW Attachment D. All IPS containers shall be Hamilton Class 5 Single Door Model 23-36-19 or equal based on customer requirements. Dedicated circuits with electrical receptacles depicted in the rack elevation shall be supplied by onsite contractor and shall be placed in the nearest wall next to the IPS container. Exact electrical receptacles shall be identified in all iterations of the design drawings based on customer requirements and any future changes. End user encryption equipment shall reside outsider the IPS container IAW DISA STIG V-245788 under Traditional Security or most current applicable STIG.

2.2.4. Network Switches: All network switches and or network design solutions providing LAN connectivity for NIPR and SIPR shall be specified by 96 CS and funded by the occupying customer.

2.2.5. Temporary Network Switches: Temporary switches shall meet all aspects of this Cyber Infrastructure Standards and Installation Specification. Temporary switches shall only remain active for a period of 120 days at which a permanent solution shall be implemented and funded by the occupying customer.

2.2.6. Voice Networking Services: All voice networking services will be provided utilizing Voice over Internet Protocol (VoIP). All VoIP devices and equipment to provide voice service shall be specified by 96 CS and funded by the occupying customer.

2.2.7. Intrusion Detection System (IDS) Services: All IDS services will be coordinated through the 96 SFS prior to request for installation. SF's IDS provider will engineer a solution based on customer's requirements. Any variation to a fiber solution shall be approved through 96 CS/Authority Having Jurisdiction (AHJ). Customer may be required to purchase IDS Network Switches. Telecommunications design engineer or supporting contractor shall be responsible for incorporating an appropriately sized conduit from IDS provider security panel to the nearest supporting 96 CS communications room. Appropriate CAT-6 plenum-rated cable or fiber optic cable shall be installed inside the IDS supporting conduit to ensure the IDS controller and the supporting IDS switch are interconnected to complete the IDS path. 96 CS personnel will interconnect the cable/fiber in the 96 CS communications room to establish the remainder of the IDS path to the Base Defense Operations Center (BDOC).

2.2.8. Copper Patch Panels: Modular patch panels shall consist of a metal panel that accepts all Panduit Mini-Com® Modules to mix and match media types in the same panel. Patch panels shall accept all modules for UTP and ScTP applications and shall mount to standard 19" racks. A 1RU cable management panel shall be installed between all equipment and patch panels as necessary. For existing patch panels, see Note 4.11

> **NOTE:** Users must provide and install factory-produced patch cords for work area outlet locations. Patch cables must be CAT-6 and cable jacket must match the horizontal cabling 1-GBASE-T connections.
> **Cable jacket colors:** GREEN - NIPR/VOIP, RED - SIPR, BLUE - Wireless, YELLOW – SCI, VIOLET – DDC.
> **NOTE:** 7 SFG (A) jacket colors: BLUE – Air Force NIPR/VOIP, GREEN – Army NIPR/VOIP, RED – SIPR, VIOLET - DDC

2.2.9. Fiber Optic Distribution Panels: Shall be populated for maximum density utilizing LC type connectors. Optical fiber termination shall use fusion splices with factory produced pigtails for all backbone and premise cabling with a 3-foot slack loop, strain relieve cables at panel and other termination points included with each panel in the Communications Equipment Room (CER).

2.2.10. Distribution Pathway: All pathways shall be installed IAW all applicable industry standards. Cable tray shall consist of a welded wire cable tray with flat solid bottom or plenum rated tray insert in the telecommunication spaces to provide distribution between the plywood backboard, equipment racks, backbone conduits, and the pathway cable tray to alleviate micro/macro bends on cabling. When multiple distributor rooms are located on the same floor, they should be interconnected by a minimum of (2-each 4-inch) conduit or equivalent pathway. The CER distributors shall be dedicated to the telecommunications function and related communications support facilities. These CERs shall not be shared with electrical installations other than those supporting telecommunications or associated equipment. Equipment not related to the support of the distributor room (e.g., piping, ductwork, pneumatic tubing) shall not be installed in, pass through, or enter the space.

Cable Installation Clearances:

1. Cables shall not rest upon any other structure not intended for the direct support of the cable(s).

2. Provide minimum clearance of 6-inches from any electromagnetic interference EMI/radio frequency interference RFI sources.
3. Provide minimum clearance of 4-feet from any motor or transformer.
4. Provide minimum clearance of 12-inches from HVAC ducts, flue, hot water, steam line or other heat-producing source.
5. Copper and Fiber cable separation of any classification shall be 3-inches or as designed.

Cable jacket colors: GREEN - NIPR/VOIP, RED - SIPR, BLUE – Wireless Access Points, YELLOW – SCI, VIOLET – DDC.

NOTE: 7 SFG (A) jacket colors: BLUE – Air Force NIPR/VOIP, GREEN – Army NIPR/VOIP, RED – SIPR, VIOLET - DDC

Commercial Communications: Commercial ISP services shall be installed and terminated in customer owned spaces only. Commercial OSP/ISP services shall not be housed or routed through any 96 CS CERs, spaces, or communication equipment locations (CEL's). The 96 CS CERs shall not contain any user system equipment or cabling such as ACS, A/V, CCTV, CATV, and similar type systems or networks. Facilities acting as distribution facilities for IDS services supporting IDS connectivity to other outlying facilities shall house the IDS network switch only in the 96 CS CERs. For larger facilities with multiple floors acting as an access or distribution facility, the IDS network switch shall be housed in the 96 CS CERs. IDS network switch(s) shall not be installed in 96 CS communication equipment racks. The IDS controller and supporting IDS panel(s) shall always be housed in end user security or IT room. The 96 CS Comm Rooms will only contain equipment relevant to AFNET maintained systems.

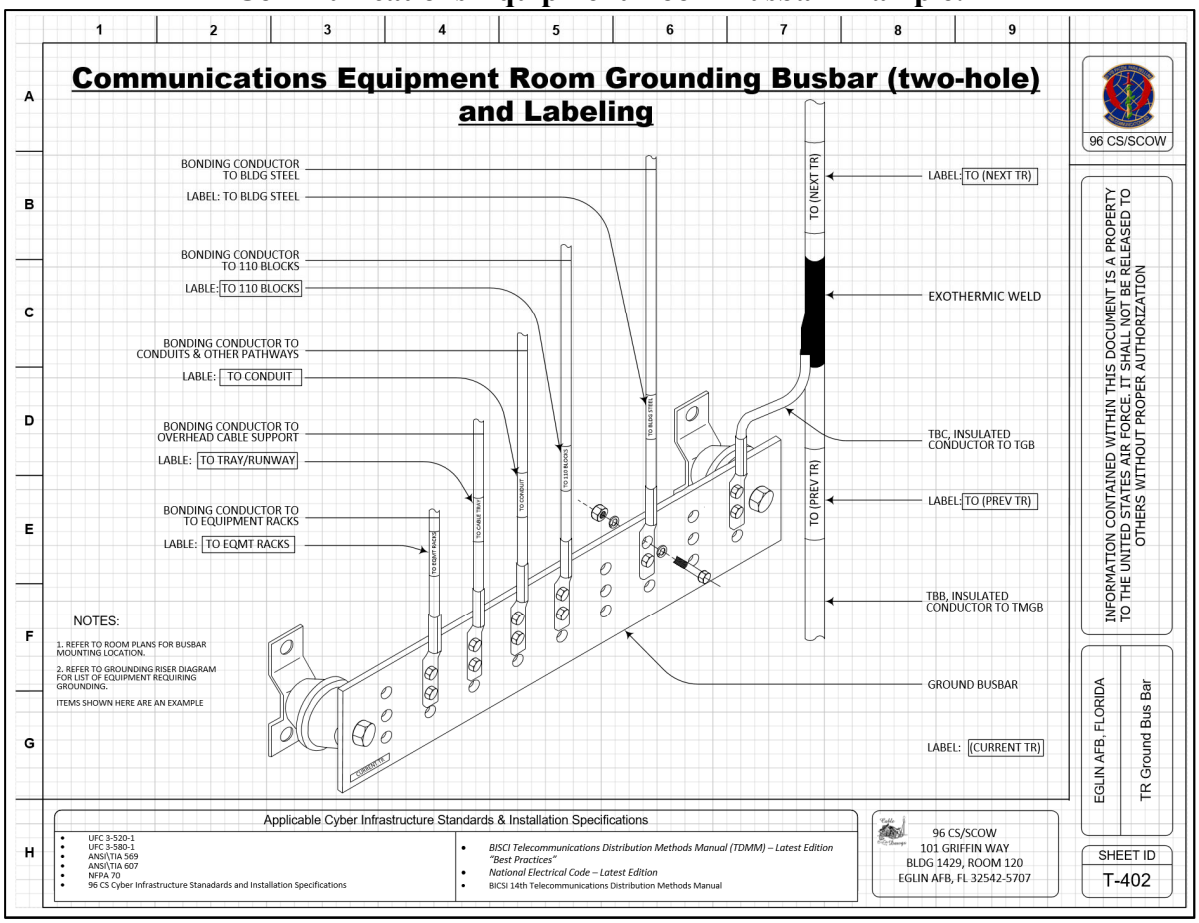
NOTE: Hook and loop straps shall be used to secure/bundle both fiber/copper cables within cable trays, ladders and racks throughout pathway. The hook and loop straps should be evenly spaced (4-feet on center) throughout the dressed length end-to-end. Hook and loop straps shall be used to prevent a change in the physical geometry of the cable that typically results from use of nylon tie wraps. Vinyl tape will not be accepted - Reference drawing T-305:

2.2.11. Grounding, Bonding, Shielding, and Labeling: All grounding shall be performed IAW ANSI/TIA-607-D, 606-D, and Rural Utility Services standards. Cyber infrastructure antenna systems, network equipment, OSP/ISP components, cabinets, racks and lockable enclosures shall be grounded to applicable standards.

Additional specifications for Class 2 Facilities on Eglin

1. On Primary Bonding Busbar (PBB) Label per 606-D, 5.1.12, add Grounding Service Tags
2. On Secondary Bonding Busbar (SBB) Label per 606-D, 5.1.13, add Grounding Service Tags
3. On Telecommunications Bonding Backbone (TBB) Label per 606-D, 5.1.17, add Grounding Service Tags
4. On conductors leaving the Primary Bonding Bar (PBB) Label per 606-D, 5.1.19, add Grounding Service Tags
5. On conductors leaving a Secondary Bonding Bar (SBB) Label per 606-D, 5.1.20, add Grounding Service Tags
6. On Backbone Bonding Conductors (BBC) Label per 606-D, 5.1.18, add Grounding Service Tags
7. On Telecommunications Equipment Bonding Conductor (TEBC), add Grounding Service Tags
8. On Metallic pathways (cable tray sections, conduits), add Grounding Service Tags

Communications Equipment Room Busbar Example:



2.2.12. Work Area Outlets: All recessed gang boxes and surface mount deep device boxes shall be a minimum of 2.5 inches in depth. All faceplates shall be four-port compatible minimum (2-active/2-blanks) fed by a 1-inch EMT conduit stubbed-up to cable pathway above ceiling. Panduit Mini-Com® Classic series single gang downward sloped faceplate that accepts four modular jacks, color shall match cabling jacket. Contractor shall provide fiber and copper cable slack for maintenance within the horizontal cabling system configuration as follows in: CER - cable ladder - UTP/ScTP 10-feet and SM/MM 10-feet, work area outlet - UTP/ScTP 1-foot and SM/MM 3.5-Feet above ceiling. Do not put slack or service loops in communications equipment cabinets or racks. (See attachment G - Applicable Publications)

2.2.13. Cable Specifications: All premise wiring supporting NIPR/VoIP/POTS work area outlets shall be GREEN - NIPR/VOIP, RED - SIPR, BLUE - Wireless Access Points, YELLOW - SCI, VIOLET - DDC.

NOTE: 7 SFG (A) jacket colors: BLUE - Air Force NIPR/VOIP, GREEN - Army NIPR/VOIP, RED - SIPR, YELLOW - SCI, VIOLET - DDC.
Specific color types to support users' classification shall differ from above.

2.2.13.1 All cable subsystems labels shall use a permanent identifier that can be easily traced using methods in Attachment B and ANSI/TIA 606 for other system labeling requirements as described below.

2.2.14. Existing Legacy: CAT-3, 5 & 5e cabling shall not be reutilized, relocated, moved or re-terminated for design planning, construction, or renovation. i.e., modular and cubical furniture. Ensure the Designer of Record (DOR) and Customers are aware of cost/detail requirements prior to Planning, Programming and Budgeting. All Legacy (CAT-3, 5 & 5e) / (OM1) cabling shall be brought to CAT-6/OM3/OM4 or current industry standards and codes during renovations, MILCONs, SABER projects or planned facility upgrades. (See attachment G - Applicable Publications)

2.2.15. New Systems: All cabling shall be CAT-6/OM3/OM4/OS2 for all new installations. Ensure the Designer of Record (DOR) and Customers are aware of cost/detail requirements prior to Planning, Programming and Budgeting. (See attachment G - Applicable Publications)

2.2.16. Abandoned ISP Cables: The accessible portion of all ISP abandoned communications cables shall be removed end-to-end after cut-over and before final inspection. Where cables are identified for future use with a tag, the tag shall be of sufficient durability to withstand the environment involved.

2.2.17. Labeling Standard: Label all ISP/OSP telecommunications infrastructure IAW ANSI/TIA 606-D. Cable tags shall be polyethylene. Handwritten labeling will not be accepted. Stenciled lettering for cable and termination hardware shall be provided using thermal ink transfer process. Existing OSP cable(s) that have been spliced shall be relabeled/retagged back to the origination demark. Label each ISP cable at both ends (patch panels/work area outlets) within 6-inches of each termination.

2.2.17.1. Use the examples in Attachment B to assist with labeling the cable subsystem on (patch panel to equipment outlet) outlets, and patch panels. From left to right the label reads, Telecomm space feeding outlet. Row letter (if there's one row then it's not needed) rack number, Patch panel elevation letter, Port number on patch panel in sequential order.

2.2.17.2. Contractor shall use a period between information to save space.

2.2.17.3. Contractor shall use elevation letter over RU's because older racks aren't marked. (Request deviation approval from 96 CS/SCOW)

2.2.17.4. A "/" is authorized between port numbers if all the previous information is the same in the outlet labeling window. i.e., 129.A1.B.47/48.

2.2.17.5. Each cable, conduit, sleeve, and pathway within the ISP shall be labeled showing TO & FROM information.

2.2.17.6. All labels shall meet requirements for legibility, defacement, and adhesion, specified in UL 969.

2.2.17.7. All outlet jacks, connectors, patch panels, and block hardware shall be labeled.

2.2.17.8. All labels must match design and permanent record as-built documentation.

Example:	RM # 129.	Row # A /Rack# 1.		PP# B.		Port# 44	
	129.		A1.		B.		44

NOTE: All ISP/OSP requirements stated shall be used unless otherwise specified and approved during design by maintaining organization. ISP/OSP terminations shall be installed IAW all applicable local standards, industry standards and/or manufacturer specifications with the more stringent applying. (See attachment G - Applicable Publications)

2.2.18. Voice Communications: Work area outlets shall be installed in all telecommunication rooms, break rooms, mechanical rooms, and entryways that are secured vestibules to support

phone installation for safety, courtesy, and convenience purposes. Each CER shall have one wall-outlet installed at or near the entry door for emergency and voice communications.

2.3. OUTSIDE PLANT (OSP)

*SEE ATTACHMENT C: FIBER DESIGN NOTES

2.3.1. Fiber Optic Cables (FOCA): All OSP cables installed shall be loose tube design with either water block tape or gel filled. All fiber optic cable installed shall be all dielectric with no metallic content. A minimum 24-strand single-mode fiber shall be installed to support core service for all fiber optic installations. FOCA shall be installed for long distances using a figure-8 to prevent twisting and protect the cable when pulling as one piece (home run) without splices between connections except where the distance exceeds the lengths in which cables are manufactured. Fiber cables may be installed by jetting or blown applications using special installed ducts with compressed air. Where splices are required, install splices only in 96 CS approved lockable maintenance communications holes to maximum extent possible. Avoid all unnecessary splicing to prevent excess attenuation and reflection. Follow manufacturer's instructions and pulling tensions. Ensure fibers are installed using strength members "aramid yarn" during installation. Fiber and Copper cables shall not reside together in a 4-inch conduit/duct within the infrastructure, nor shall fiber and copper cabling be installed or exist within the same innerduct/GEO-textile mesh/Micro-duct. To maximize comm pathway availability and spacing ensure 4-inch conduit and duct systems are populated with innerduct/GEO-textile mesh/Micro-ducts before installing any cables. (Reference NECA 301-16)

2.3.2. Fiber Optic Distribution Panels (FODP) for OSP Termination: Shall be populated for maximum density utilizing LC type connectors. All new FODP's installed in an Information Transfer Building, Main Access Node, and Critical Edge Buildings will be capable of housing 288-strand terminations (Corning CCH-04U Housing with CCH-CS24-A9-P00RE Cassettes) regardless of cable size being installed. Utilize existing 4RU FODP if space is available. All terminations shall be fusion spliced to pre-manufactured cassettes with factory pigtails unless otherwise approved by the maintaining organization. No mechanical terminations shall be used to terminate OSP FOCA.

2.3.3. Fiber Optic Splice Enclosures: All fiber optic OSP underground splices shall be encased in a dome type enclosure with a 50-foot service loop for the main cable and 50-foot for each cable serviced by the splice case. Provide an additional 10-foot for racking of cables and splice case. Additionally, every other maintenance hole starting from the entrance MH shall have a 25-foot service loop installed. (TYCO 450 Fiber Optic Splice Enclosure). Direct buried fiber splices shall NOT be allowed for any permanent or temporary communications requirements or fix actions.

2.3.4. Copper Cables: OSP copper core cables shall be PE-89 OSP Telephone Cable with an expanded polyethylene (Foam Skin) and external layer of solid, high-density polyethylene. Fiber and copper cabling shall not be installed within the same duct, pathway or mesh/inner ducts at any point. Copper design intra-building and cross-connects terminals from the Point-of-Presence (POP) or DMARC campus backbone for house cabling terminals shall utilize CAT 6 plenum rated UTP for connection/terminations. CAT-3, CAT-5, and CAT-5e cabling solution(s) will not be accepted.

NOTE: An entrance transition point shall be required for unlisted OSP cable when the termination point is greater than (50 feet) from the point of entrance, and the cable cannot be installed in a properly rated conduit (e.g., rigid metal conduit or intermediate metal conduit) or as directed by the authority having jurisdiction. This provision does not apply to a listed indoor/outdoor fire-rated optical fiber cable. The OSP cable can be spliced to a building backbone cable to meet local codes for fire-rated cables.

2.3.5. Copper Cable Terminations: OSP copper cable shall be terminated on a Protected Entrance Terminal (PET) 110 type/710 splice connectors or 388 central office connectors with primary protector blocks equipped with 5-pin solid state or gas protector module accessories installed.

2.3.6. Copper Cable Splice Enclosures: All copper cable OSP underground splices shall be encased in an appropriate size and type enclosure and installed IAW manufacturer installation guidelines (Preformed Line Armadillo Stainless Steel Splice Enclosure or equivalent). For Copper OSP no service loop/slack shall be allowed at the terminal or within MHDS. Direct buried cables shall be spliced above ground only in a buried distribution terminal or cabinet for ease of maintenance. Note: Fiber and Copper splices shall be installed in Pre-cast concrete maintenance holes to accommodate the splice case(s) and required splicing service, copper racking and fiber service loop materials.

NOTE: Some splice enclosures may require re-enterable encapsulation compound and shall be determined by the maintaining organization.

2.3.7. Backboards: Fire rated Backboards shall be provided on a minimum of two adjacent walls in the telecommunication spaces near cable entry ports. (Backboards) Provide void-free, interior grade A-C plywood 3/4-inch thick 4-feet by 8-feet. Backboards shall be fire rated by manufacturing process. Painting the backboard is optional however, if paint is applied over fire retardant backboard it shall be UL 723 fire retardant paint. Provide fire retardant paint information via product submittal. When painted, Fire Stamp shall be clearly visible. Permanently mount backboards vertically to the wall by means of a countersunk stainless steel flat head bolt and washer providing a finished flush surface. Drywall screws or any other screw types shall not be acceptable.

2.3.8. Maintenance Holes (MH)**:** The preferred term for communications underground closures or holes on Eglin AFB shall be “Maintenance Hole or Maintenance Vault”, as Manhole or hand hole will not be used. All Maintenance Holes and vaults shall be pre-cast reinforced concrete, multi-directional type with cast-in single or multiple plastic terminators to accept the conduits. Thin concrete knockout sections may be provided for terminating multiple-bore conduits. New MHs shall be placed to support the locations of junction points, offsets, load points, and curvature in the duct line. The contractor shall form and install a 1-foot-wide x 8-inch-deep concrete perimeter around new maintenance holes being installed. The contractor shall ensure the appropriate MHs number is permanently stenciled by the application of paint with 3.5-inch lettering, on the inside top interior within the first 12-inches with a number designated by the 96 CS Authority Having Jurisdiction. All new ducts shall be permanently stenciled by the application of paint with 2-inch lettering on the wall above each duct back and in each building and maintenance hole indicating the connecting building/maintenance hole at the other end of the duct (for example, “To MH-200”). All MHs shall be installed IAW all applicable industry standards.

2.3.8.1. Cast-in-place (site-poured) MHs may be required when overbuilding on existing infrastructure, rebuilding, or enlarging existing MHs that are congested, oddly configured, or contain excessive cables that are improperly routed through the MH.

2.3.8.2. All MHs shall be installed on a leveled, crushed, washed, gravel base of sufficient depth, a minimum thickness of 6-inches under the entire structure and extending past foundation or all outer edges by 6-inches or more, to allow for drainage and stability. In cantonment areas that have or will potentially have multiple cables, they shall not be spaced more than 600-feet apart using the ground plane view. In sparsely populated areas (i.e., range test area) containing only fiber cables, they may be spaced up to 800-feet apart using the ground plain view, providing spacing does not exceed the manufacture's recommended pulling tension for the cables being installed. The above distances (600-feet and 800-feet) may be modified with the approval of the 96 CS. Every effort should be made to implement Jetted or blown fiber optic cabling system designs IAW industry standards to reduce the underground cyber infrastructure and Base Civil Engineering real property footprint towards OSP pathways and maintenance hole requirements. MHs may be placed closer together to accommodate distribution designs when needed. Placed IAW ASTM C891-11 and all other applicable industry and local standards. Accessories shall be designed and provided for use IAW RUS Bulletin 1751F-643, and RUS Bulletin 1753F-151 to support the weight of the cable(s) and splice case(s).

NOTE: Precast polymer concrete or combination of polymers supporting communications cyber infrastructure shall not be utilized on Eglin AFB.

2.3.8.3. New construction shall have a maintenance hole installed within 50-feet of facility telecommunication entrance, CER demarcation point. Furthermore, existing or new conduit feeding a MH or located beyond 50-feet and servicing an Information Transfer Building or Critical Edge Building shall be concrete encased. Additionally, a concrete cap is required when infrastructure backbone cables enter the facility within 40-feet of each other to truly support backbone diversity and protection.

2.3.8.4. In projects where explosive materials may be used or maintained, (such as munition facilities), ensure the last 50-feet of conduit is steel going into the facility to meet building codes.

2.3.9. Maintenance Hole Grounding: MH shall be grounded in accordance with RUS 1751F 802 and NEC, Article 25, the resistance for OSP grounding shall be nominally 25 ohms. All new MHs installed shall include ground rods and bonding ribbon. The surface mounted bonding ribbon may only be omitted when the following conditions apply:

2.3.9.1. MHs are designed and constructed with an integral ground system with all ironwork bonded together.

2.3.9.2. MHs are identified as containing an integral ground system with a manufacturer's label.

2.3.10. Main Distribution Maintenance Holes: The preferred main distribution maintenance holes system interior size is 12-feet (length) x 6-feet (width) x 7-feet. (height) and shall have a load rating of HS-20 for heavy vehicular traffic. (Deviations from this size must be pre-approved by the 96 CS)

2.3.11. Sub-Distribution Maintenance Holes: Other size approved for sub-distribution systems depending on location and project design are pre-cast reinforced concrete interior size 3-feet (width)

x 5-feet (length) x 4-feet (height) and shall have a load rating of HS-20 for heavy vehicular traffic. (Deviations from this size must be pre-approved by the 96 CS)

Maintenance holes shall be equipped with all accessories to provide complete system:

2.3.11.1. Torsion assisted rectangular diamond plate covers
2.3.11.2. Self-latching stainless steel slam locks
2.3.11.3. 1/8" raised letters stating "COMMUNICATIONS"
2.3.11.4. A sump pan with insert for drainage, and a grounding/bonding system
2.3.11.5. Corrosion resistant cable racks
2.3.11.6. Pulling irons

2.3.12. Concrete Encasement: In new construction, the duct system shall be concrete encased in all government areas as follows: At a minimum, the duct system shall be encased under all traffic areas; where any bend/sweep exceeds 10 degrees in any direction; in any stream/drainage area subject to washing out; and in major construction zones. Concrete encasement of the ducts for a "core path" shall be required where no alternate paths are present. Concrete encased duct, galvanized RSC, pipe casings, or HDPE duct placed by horizontal directional drilling (HDD) shall also be placed under all paved road surfaces and certain heavy traffic non-surfaced roads as documented in the design package. Concrete forms shall be utilized when encasing ducts into a maintenance hole to limit blockage of empty duct knockouts or windows in the maintenance hole. The encasement/pipe shall be extended a minimum of 6-feet beyond the roadbed for all road crossings. The installer shall use only one brand of Portland cement that conforms to American Society for Testing and Materials (ASTM) C 150. The concrete shall be a wet-type mix and shall be placed in such a manner as to ensure the concrete completely surrounds all ducts and that no air or voids are trapped in the mix. (A dry bag of ready-mix type cement that has not been mixed with water but has been dumped in the trench is not acceptable.) Prior to pouring any concrete over the duct, the installer shall obtain the signature of the on-site U.S. Government AHJ representative to signify the acceptability of the duct placement and spacing. Concrete used to encase conduits shall be a minimum compressive strength of 20,700 kPa (3,000 PSI).

NOTE - Concrete encasement of conduits should be considered for the following conditions:
a. Road or street crossings having earth covers that are equal to or less than 30-inches.
b. Railroad crossings
c. Earth covers parallel to and within street, highway, or road travel areas that are less than 30-inches.
d. Stream crossings, storm canals, ditches, ponds, parking lots and heavy vehicle traffic areas.
e. Bend angles of 20-degress or greater in conduit lengths equal to or greater than 550-feet

2.3.13. Duct Placement: New ducts shall be swept down and installed in the lowest available duct positions within the lowest available duct window in the MH. Duct placement shall not prevent placement of future ducts in the upper duct positions. Conduits shall terminate in bell ends or duct terminators at the point of entrance into the MHs and buildings. Main conduits entering poured-in-place or precast MHs shall be located in the lower portion of the end wall and centered between end walls. Conduits entering sidewalls shall be located a minimum of 4-inches from the end walls that are located farthest from the central office or serving node. Clearances of 12-inches should be maintained between main conduit formations and the roofs or floors of MHs unless the construction drawings indicate otherwise, wall recesses shall be provided at conduit entrances.

Subsidiary conduits entering MHs shall be located to provide clearances of 4-inches from roofs and adjacent walls.

2.3.14. Four Inch Duct Fill: A minimum of one 4-inch or larger conduit/duct installed in any given duct bank/system shall be populated with three each, 3-inch, three cell geotextile or Micro-Ducts for maximum cable placement. Determination will be conducted during design reviews. (Other sizes/options may be used only with 96 CS pre-approval.) When installing conduits near other ducts or electrical, installers shall provide a minimum concrete separation of 3-inches or dirt separation of 12-inches. When installing conduits/ducts parallel other utilities, provide separation of 6 and 12-inches respectively. Other direct buried or underground utilities systems shall not be installed above or over-the-top any communications cables.

2.3.15. Rerouting of Existing Ducts: Existing ducts shall be joined to new MHs (pre- cast or cast-in-place) by rerouting the designated ducts from the demolished or abandoned MH to the new MH. Rerouting shall begin 30-feet from the old MH, to allow for standard bending radius and pulling tension. Continuity of operations on the affected cables shall be maintained during the duct rerouting actions.

2.3.16. Pull String, Rope, and Tape: A pull string, pull rope, or pull tape rated at not less than 600-lbs (2700-newtons (N)) tensile strength shall be installed in each new individual conduit, duct, and/or sub-duct. A minimum of 5-feet shall be provided at each end of the conduit. The string/rope/tape shall be coiled and secured to the closest maintenance hole rack or pulling eye in such a manner as to prevent it from being accidentally pulled back into the duct.

2.3.17. Plugs: All ducts, sub-ducts, HDPE roll pipes and innerducts, whether main or subsidiary runs, shall be plugged using universal duct plugs or removable putty sealants in all MHs, vaults and building entrances. Foam sealant is **not** acceptable in a building. Outdoor-rated ducts (sub-ducts, etc.) entering a building will be fire-stopped IAW the National Electrical Code, local codes, and per manufacturer's instructions.

2.3.18. Duct and Acoustical Sealants: The area between the entrance conduits and the penetrated floors and/or walls of a building or MH shall be sealed to be waterproof or shall be fire-stopped as appropriate. Use of hydraulic cement between the duct and wall is acceptable for waterproofing the duct entry point.

2.3.19. Duct Tie-Downs: Duct systems to be concrete-encased shall be tied down to eliminate movement of the duct system during the placement of concrete. All sections of conduit systems to be concrete-encased shall be tied down using an industry recognized method such as metal rods (four stakes) and metal strapping (for securing the duct system). The metal strapping shall be wrapped completely around the conduit structure and securely attached to the metal rods. The metal rods shall be a minimum of ¼-inch thick. Rods will be driven into the ground a minimum depth of 12-inches and the ducts shall be tied down every 10-feet or closer.

2.3.20. Conduit Spacers: Spacers shall be installed at minimum of one spacer every 5-feet on center. The duct shall not be damaged, cracked, or crushed prior to or during installation:

2.3.20.1. Ensure the integrity of the orientation of the duct bank between MHs. Do not allow the ducts to twist or tangle between MHs.

2.3.20.2. Ducts that are classified as stub-outs shall be plugged inside the MH or building; tagged, identifying them as stub-outs; and capped on the far end to prevent soil and water from entering the duct. An orange communications locator ball shall be placed at the stub-out end location to facilitate future locating of the stub-out.

2.3.21. Joints and Connectors: Ducts shall be joined using manufacturer specific requirements and industry standard such as RUS/ANSI/TIA, to ensure complete end-to-end watertight system and connections. Joints shall not be damaged when pulled past the joint. Joints between dissimilar types of ducts (PVC, HDPE, galvanized steel pipe (GSP), EB, DB, etc.) shall use the appropriate connectors designed for the purpose of providing a seal between the ducts and preventing damage to cables pulled through these joints. All joint surfaces shall be prepared IAW the manufacturer's instructions, and, at a minimum, the mating surfaces shall be wiped clean before they are joined. Locating marker balls shall be placed at all HDPE splice points or duct system repairs.

2.3.22. Bends and Sweeps: Accomplish changes in the direction of runs exceeding a total of 10-degrees, either vertically or horizontally, by long sweeping bends having a minimum radius of 20-feet. Long sweeps may be made up of one or more curved or straight sections and/or combinations thereof. Bends made manually shall not reduce the internal diameter of the conduit. There shall be no more than the equivalent of two 90-degree bends (180-degrees total) between pull points, including offsets and kicks with a curvature radius of less than 10-feet. Back-to-back 90-degree bends shall not be utilized. NOTE: Use a large sweep bend that does not abruptly turn the corner. A sweep bends should have a much larger radius then a standard elbow, this allows for improved cable installation.

NOTE: All bends, sweeps, couplers, bend radius/angles, bell ends, adapters, and connection points shall be inspected during construction and prior to burial, concrete encasement or back-filling operations by 96 CS representative to signify the acceptability of installation, placement, and spacing requirements. Follow Rural Utility Services Underground Plant Design, Underground Plant Construction, Construction of Buried Plant, and ANSI/TIA-758-B Customer-Owned Outside Plant for reference.

The following definitions apply:

2.3.22.1. 90-degree bend: Any radius bends in a piece of pipe that changes the direction of the pipe by 90 degrees.

2.3.22.2. Kick: A bend in a piece of pipe, usually less than 45-degrees, made to change the direction of the pipe.

2.3.22.3. Offset: Two bends usually having the same degree of bend, made to avoid and obstruction blocking the run of the pipe.

2.3.22.4. 90-degree sweep: A bend that exceeds the manufacturer's standard size 90-degree bend (e.g., 24-inches is standard for 4-inch conduit).

2.3.22.5. Back-to-back 90-degree bend: Any two 90-degree bends placed closer together than 10 feet in a conduit run. Utilize radius-manufactured bends to the maximum extent possible. Manufactured bends may be used on subsidiary/lateral conduits at the riser pole or building entrance. Manufactured bends shall have a minimum radius of 10-times the internal diameter of the conduit IAW Chapter 9 of the National Electrical Code and the ANSI/TIA-758 standard. Bends

and sweeps shall be concrete encased to protect the duct from the pressures developed while pulling cables. Where a duct enters a building and sweeps up through a floor slab, galvanized RSC shall be used. For ducts transitioning from the lower duct window of a maintenance hole to the nominal trench depth, the transition shall be accomplished in no less than 30-linear feet from the maintenance hole in order to reduce the radius of the bends. The duct shall be concrete encased in the transition area.

2.3.23. **Section Lengths:** Without prior U.S. Government AHJ approval, the section length of conduit shall not exceed 600-feet between pulling points in main conduit runs. The section length of duct is limited mainly by the size of the cable to be pulled into it and by the number of bends it shall contain.

2.3.24. Minimum Duct Bank Sizing: Duct bank sizing shall be a minimum of 4-inches for each design, build, construction, and renovation application:

2.3.24.1. The minimum sizing for new duct banks is listed below. The total number of conduits required shall be determined, including existing conduits, conduits installed by this effort, and known future requirements, along with 50-percent of this total for spares.

2.3.24.2. Ducts between the cable vault and the first maintenance hole shall be based upon the size of the switch, the number of outside cable pairs served from the switch location, the FO requirements, and future growth.

2.3.24.3. A main duct run includes the maintenance holes and ducts from a DCO or node and provides the pathways for large feeder cables and/or core FOCs. New main duct runs shall consist of a minimum of 6-way, 4-inch duct banks.

2.3.24.4. A lateral duct run is defined as a minor branch run from the main duct run between maintenance holes. New lateral duct runs shall be a minimum of four-way, 4-inch duct banks.

2.3.24.5. Entrance ducts are defined as ducts from a maintenance hole or hand hole to an Edge-Building (EB). New EB entrance ducts shall be a minimum of two-way, 4-inch duct bank.

2.3.24.6. Entrance conduits in minor buildings, as listed in the design package, shall be a minimum of two-way, 4-inch ducts if the entrance cables are less than one-inch in diameter and if less than 40-percent of the duct area shall be used.

2.3.24.7. In accordance with the National Electrical Code, cables entering a building from the outside and not rated for inside plant use may not extend beyond 50-feet from the cable's point of entry into the building. The point of entry is defined as the point at which the cable penetrates the exterior wall or floor. The point of entry for metallic cables may be extended beyond the 50-foot limitation by using either rigid metal conduit (RMC) or IMC, both of which shall be grounded. Electrical metallic tubing shall not be used for extending the point of entry of metallic cables (transmission media, shields, or strength members). The point of entry for non-metallic cables may be extended using EMT or PVC. Refer to the National Electrical Code, Sections 770.50 and 800.50.

2.3.25. Depth of Cover: At least 36-inches of cover are required above the top of the duct bank. At least 24-inches of cover are required under roads or sidewalks (if duct is concrete-encased). For

ducts installed in solid rock, the cover shall consist of at least 6-inches of concrete. If rock is encountered below grade, the minimum cover above the concrete-encased duct shall be 12-inches.

2.3.26. **Trench Width:** The installer shall engineer the trench width to the minimum width required to support the size of the duct bank being installed. When installing ducts, the trench width depends on the number of ducts, size of ducts, arrangement of ducts, and space around ducts (at least 2-inches). Additional width may be required to work in deep trenches or with large-count duct banks. Shoring of walls or sloping shall be performed as required by the OSHA and/or local requirements. The trench width for direct buried conduit shall be of sufficient width to permit tamping of dirt on the sides of the conduit formation. (See attachment H - Standard Installation Specification Drawings)

2.3.27. Split Duct: Pre-manufactured split ducts shall be of adequate material and approved by the AHJ. Installation shall be done IAW all manufacturer and industry standards.

2.3.28. Existing Ducts: Existing vacant ducts that are to be used in new cable installations, as defined in the design package, shall be cleaned and tested with a test mandrel to detect any obstructions, collapsed ducts, or duct inconsistencies. The installer may need to repair damaged ducts by installing new ducts with couplers, split ducts or cured in place pipe lining solutions

2.3.29. Marking/Warning Tape: The tape shall be a minimum of three inches wide and orange in color with the appropriate warning message and shall not be utilized as the sole tracing capability. Locating tape/wire shall be installed 18-inches above any communications cable or duct system. Copper wire installed in self-supporting duct shall be minimum 14-gauge and shall not be utilized as the sole tracing capability. Shall be installed IAW all applicable standards.

2.3.30. Trace-Safe: Install 24-inches below finished grade directly over the duct banks and 12-inches below the “marking/warning tape”. All new Trace-Safe systems installed shall use an approved splice, termination end, connectors, etc.… where needed and an approved label installed at all wire ends. Each wire end shall be secured to the MHs walls at around 8-inches within the top of the MHs *(rationale: the new clamshell MHs have concrete cap of around 8-inches thick, therefore it is recommended to mount the Trace-Safe below the cap/MH joint (and in the actual MH) to ensure the Trace-Safe will not be damaged in the event of the MH cap moving)*, accessible without having to enter the hole and not connected to grounds. The tracer will be secured to the MHs wall and tagged with a label indicating it as a "Tracer Wire to xxx - Do Not Remove” (where xxx is the other end of the wire). Do not connect to grounding/bonding system.

2.3.31. Marker Poles: Marker Poles: Two route markers shall be installed at every maintenance hole at a height of 4-feet above finished grade. Additional markers are required along all communications pathways at a maximum of 500-feet, line- of-sight or less; whichever is shorter and/or at each change in route direction, on both sides of street crossings at a height of 4-feet above finished grade *(to standardize Height).* Stenciled at the top section of each marker pole:

“*CONTACT EGLIN BASE COMMUNICATIONS PRIOR TO EXCAVATION AT 882.2581”*

2.3.32. Duct and Conduit Mandrelling Requirements

2.3.32.1. Mandrel inspections are a requirement under industry standards for quality control. Prime/Contractor of record shall provide reports on all mandrel tests accomplished for record to ensure compliance with industry standards noted herein.

2.3.32.2. New ducts in main and subsidiary duct runs shall be mandrelled before pulling anything into the duct system with a mandrel that is ¼-inch less than inside diameter of duct. If a design will require installing new cable in existing, empty duct, the OSP designer should consider requiring a mandrel test of the existing duct before installing the cable to verify that the duct is usable.

2.3.32.3. Prior to pouring concrete over the duct, the installer shall obtain the signature of the on-site 96 CS representative to signify the acceptability of the conduit mandrelling, placement and spacing.

2.3.32.4. Duct Cleaning: Duct shall be cleaned with an assembly that consists of a flexible mandrel (manufacturers standard product in lengths recommended for the specific size and type of duct) that is ¼-inch less than inside diameter of duct, 2 wire brushes, and a rag. The cleaning assembly shall be pulled through conduit a minimum of two times or until less than a volume of 8 cubic inches of debris is expelled from the duct. Do not install cables in ducts without an approved witness test and written approval of the 96 CS. (See attachment G - Applicable Publications)

Chapter 3

3. DELIVERABLES

The Contractor shall submit all applicable deliverables and test reports and as-built for review 15-duty days prior to final test and acceptance inspection to the 96 CS/SCXP, Projects and Requirements work center.

3.1. Fiber and Copper Verification Tests

3.1.1. Factory Reel Test/Inspection: The contractor/installer shall provide a copy of the reel tests/physical inspection reports of factory delivered cable(s) verifying good condition upon delivery.

> **NOTE:** 96 CS review/approval of reel tests/physical inspection reports of factory delivered cable(s) is not required.

3.1.2. Pre-Installation Tests: Contractor/installer shall test all existing ISP/OSP cable(s) that will be moved, re-terminated, or spliced before any modification. This testing phase is the sole responsibility of the contractor/installer and should be performed prior to the installation of any ISP/OSP cable(s) as to provide a baseline of the fiber/copper quality. If pre-installation tests show any failures contractor shall provide the test reports to 96CS for corrective actions.

3.1.3. Post-Installation Test: The contractor/installer shall perform final configuration post-installation test and provide all tests results to 96 CS 15-days prior to final QA inspection of all installed ISP/OSP cabling.

> **NOTE:** Optical fibers or copper cable(s) found with damage or defective strands or pairs, shall be replaced (from end to end) and will not be accepted by 96 CS Authority Having Jurisdiction (AHJ).

3.1.4. Copper Testing: End-to-end testing for Unshielded Twisted Pair/Screened Twisted Pair (UTP/ScTP) copper shall be conducted for 100-percent of pairs and shall identify any discrepancies. All new UTP/ScTP copper installations shall be free from any and all cable faults or splicer's errors to allow for 100-percent cable usage. Cat-6 network ISP wiring will require a test report showing DB loss, head room, wire map, length, delay skew, and attenuation. The test results shall be documented, corrections implemented, and retesting conducted and documented as required. In addition, documentation shall be presented to show the length of the cable between the telecommunications room and the work area. Testing shall be per industry standards. Copper cabling shall be tested 100-percent (All Pairs) for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors, and between conductors and shield, if cable has overall shield. Test operation of shorting bars in connection blocks. Test cables after termination but prior to being cross connected (See attachment G - Applicable Publications)

> **NOTE:** Test report results shall reflect the wiring scheme that was selected during design/installation (i.e. 568A or 568B). Fiber and Copper test equipment **must be** calibrated within one year of test date. Test results shall be test equipment exported products from

calibrated device only, fiber links will illustrate bi-directional results. No handwritten or typed out results will be accepted. All test cables shall be factory made.

3.1.5. Fiber Testing: All testing shall be accomplished IAW all applicable industry standards. Attenuation testing for optical fiber shall be performed and documented 1) from manufacturer, 2) upon delivery acceptance/prior to installation, 3) after cable placement/post installation and 4) after all splicing/end terminations have been completed. Any errors or above allowable loss readings will be repaired to bring the faulted fibers to within acceptable parameters. No additional splicing will be allowed in lieu of fiber end-to-end replacement due to manufacturer or installation damage. All strands are to be usable and free of errors providing 100-percent cable usage. Test Results: Certification of the cable(s) being tested is required to ensure it meets/exceeds requirements.

3.1.5.1. Perform 100-percent verification acceptance test for single-mode and multi-mode optical fibers, (all strands) end-to-end attenuation tests IAW OFSTP-14, OFSTP-7, TIA-568-C.3 and TIA-526-7.

3.1.5.2. Installer shall use Tier One Testing using an Optical Power Meter and Light Source for all Inside Plant (ISP) and Outside Plant (OSP) single-mode and multi-mode optical fibers in a bi-directional manner. Fiber test equipment must be calibrated within one year of installation.

3.1.5.3. Installer shall use Tier Two Testing using an Optical Time Domain Reflectometer (OTDR) and Optical Power Meter and Light Source for all Outside Plant (OSP) single-mode and multi-mode optical fiber in a bi-directional manner. Fiber test equipment must be calibrated within one year of installation. All launch and test cables shall be factory made with lengths for OTDR 150-meters (SM/MM) and light source/power meter 7-feet (SM/MM).

NOTE: Optical fibers or copper cable(s) found with damage or defective strands, or pairs will not be accepted by 96 CS Authority Having Jurisdiction (AHJ) and shall be replaced (from end to end).

3.2. As-Built Documentation: The installer shall provide accurate As-Built documentation of the entire OSP and ISP install system to include schedule T-5 documentation (i.e., rack elevations, cable route drawings "T-Sheets"). The Telecommunications Contractor(s) of Record shall maintain "red-lined" drawings at the job site under direct control of the Site POC. The red lines shall represent changes made.

As a minimum, the following information will be on each drawing for OSP/ISP requirements:

3.2.1. Accurate, reasonable facsimile of the OSP/ISP cable pathways and maintenance hole duct/cable tray system as installed
3.2.2. Accurate, reasonable facsimile of the building floor plan
3.2.3. Room and area numbers assigned for identification purposes
3.2.4. Location and designation of all CERs
3.2.5. Telecommunication Room Layout diagram for all CERs
3.2.6. Location and designation of all work area outlets installed
3.2.7. Rack elevations
3.2.8. Location of all vertical/horizontal penetrations
3.2.9. Routes for all cables, including horizontal, tie, and backbone
3.2.10. Location of vertical/horizontal penetrations through firewalls/floors

3.2.11. Geospatial data of new outside plant distribution system with accuracy of the GNSS points no more than 6-12-inches after differential correction/post-processing
3.2.12. Drawing Reference Details (ANSI/TIA 606)

T-1 - Layout of complete building per floor showing: Building area/serving zone boundaries, backbone systems, and horizontal pathways.
T-2 - Serving zone/building area: Drop locations and cable identification.
T-4 - Typical Details: Faceplate labeling, fire stopping, symbols, installation procedures, detail racking and raceways data.
T-5 Schedule: Documentation on cables showing cut overs and cable management, patch panel layouts, faceplate assignments, cross-connects information, and terminal layout as a minimum.

3.3. Shape Files: The installer shall provide Global Navigation Satellite System (GNSS) collected OSP infrastructure features and communications pathways attribute, metadata, and location information shall be converted to, stored, and submitted in an Environmental Systems Research Institute (ESRI) Shape File format. The shape files must be compatible with the Cyberspace Infrastructure Planning System (CIPS) Visualization Component (CVC) web-based application. The shape files shall have a geospatial reference (.prj, .dbf, .shp, .shx and .cor) files included that specifies the parameters of the coordinate system. (See Attachment A for more information)

NOTE: Installer(s) shall coordinate with the 96 CS/SCXP office through a Request for Information (RFI) to ensure they have the latest data dictionary before accomplishing any project GIS actions. The accuracy of the GNSS points shall be no more than 6-12-inches after differential correction/post-processing.:

Coordinate system: UTM
Zone: 16 North
Datum: NAD 1983(conus)
Coordinate units: Meters
Altitude units: Meters
Altitude Reference: HAE

3.4. Test and Acceptance Documentation (AFTO 747): The Contractor shall submit all test reports and as-built deliverables for review 15-duty days prior to final test and acceptance inspection. The test reports shall show the tests performed to verify compliance with the specified performance criteria. Test reports shall include record of the physical parameters verified during testing. As-builts shall show all communications pathways, cabling with correct labeling as installed. The contractor shall correct any errors or performance deficiencies detected by testing. The assigned 96 CS/SCXP Project Manager will sign an AFTO Form 747 in Block 11A upon government QA acceptance of contractor's final test results. The 96 CS reserves the right to refuse final acceptance until all discrepancies have been resolved to the satisfaction of the Authority Having Jurisdiction.

3.5. Projects, Designs, USACE, SABER Requirement Support Timelines:

3.5.1. Task Timelines: Once accepted by SCX and SCO production work center(s).
3.5.1.1. Survey Inputs: 96 CS 5 full duty days (internal use only SCX 1/SCO 4)
3.5.1.2. Project/Design Reviews: 96 CS 12 full duty days (internal use only SCX 2 /SCO 10)
3.5.1.3. Comm path segment verifications: 96 CS 13 full duty days (internal use only SCX 1 / SCO 12)

3.5.1.4. Product submittals: 96 CS 6 full duty days (internal use only SCX 1/SCO 5)
3.5.1.5. Official Request for Interpretation (RFI): 96 CS 5 full duty days (internal use only SCX 1/SCO 4)
3.5.1.6. Request for Escort: 96 CS 5 full duty days (internal use only SCX 1/SCO 4)
3.5.1.7. Deliverables documentation reviews (Shape files, As-built, final test results, reviews: 96 CS 17 full duty days prior to final inspection (internal use only SCX 2/SCO 15)
3.5.1.8. Fiber and copper in-progress test result: 96 CS 9 full duty days (internal use only SCX 1 / SCO 8)
3.5.1.9. Request for in-progress checks or final inspections: 96 CS 6 full duty days (internal use only SCX 1/SCO 5)
3.5.1.10. Rough Order Magnitude (ROM): 96 CS 23 full duty days (internal use only SCX 3/SCO 20)

NOTE: It is imperative on each requirement the 96 CEG, USACE, etc. project manager(s) notifies the required 96 CS discipline in a timely manner.

Chapter 4

4. PARTS AND MATERIALS REGISTER

The salient physical, functional, and performance characteristics of the following telecommunication parts and materials specified shall be adhered to for all installations or like items. Replacement parts shall be standard and readily available through commercial means. Discontinued products will not be accepted unless approved by the Contracting Officer and 96 CS Authority Having Jurisdiction:

NOTE: The term approved is defined in this document as acceptable to the authority having jurisdiction.

4.1. Data Jack: Category 6, RJ45, 8-position, 8-wire UTP Mini-Com® universal jack module has TG-style termination. Color shall match cable jacket.

4.2. Blank Inserts: Mini-Com® 1-port blank module, reserves space for future use, Off-White/International White.

4.3. Surface Mount Raceway System: Tamper resistant two-piece latching surface raceway. Supplied with pre-punched mounting holes. Available in 6', 8', and 10' lengths, Off-White/International White. Compatible with surface mount outlet box. All surface mounted raceway systems shall be screwed to the wall to prevent detachment from the mounted surface.

4.4. Riser CAT-6: CAT-6 (600MHz), 4-Pair, U/UTP-Unshielded, Riser-CMR, Premise Horizontal Cable, 23 AWG Solid Bare Copper Conductors, Polyolefin Insulation, X Spline, Ripcord, PVC Jacket.

4.5. Plenum CAT-6: Copper Cable, Giga SPEED XL 2071E, 23 AWG, 4 Pair, Unshielded,UTP, Solid Bare Copper Conductor, FEP/PVC, CMP. Plenum CAT-6: Copper Cable, Giga SPEED XL 2071, 23 AWG, 4 Pair, Shielded, ScTP, Solid Bare Copper Conductor, FEP/PVC, CMP, (RED).

4.6. Intra-Building Distribution Cables: Used after 15m (50ft) of “exposed” outside plant copper cable enters building. “Fold back” splicing method preferred.

4.7. 25-pair – 3600-pair: CMR rated. Pair count varies. Use applicable count determined by the pair count from the outside plant cable.

4.8. Splice Enclosure: An intra-building splice closure is a strong, lightweight, fire-retardant covering that protects non-pressurized splices. The closure shields the splice against humidity and moisture and may even resist temporary immersion in water. When you install the closure, properly support it, ground it and test it for air leaks according to manufacturer's recommendations. Affix labels to all cables entering the splice, indicating cable number and pair counts. Clearly designate the "In" and "Out" for the spliced cables.

4.9. Building Station Terminal Blocks (110-Type): Terminates intra-building cables and horizontal cables. Must clearly label intra-building cable using stencils above 110 type (IDC) block with applicable information during pre-installation survey.

4.10. Building Entrance Terminal Blocks (110-Type): 16 AWG steel building entrance terminals feature an industry standard 110 - style connector for both the input and output terminals. Also included are multiple external and internal ground lugs. UL approved standard on all terminals and standard 5-pin protection modules.

4.11. Cat-6 Connector Block 24/48 Port (Patch Panel): Constructed for maximum strength and durability. Rack-mount modular panels shall include an integrated cable management requirement for cable routing and strain relieve cables at patch panel and other termination points. Provide a complete modular system from patch panel to work area outlet. **NOTE:** When terminating new Twisted Pair cabling onto existing Cat-6 rated patch panel(s), strain relief requirements will be adhered to as referenced in section 4.12 Strain Relief Requirements.

4.12. Strain Relief Requirements: All Strain relief bars shall consist of a metal bar that mounts to the rear of a standard EIA 19-inch rack to support a minimum of 24 cables exiting from the back of a patch panel with a 2-inch to 5-inch inward mounted offset. Cables shall be secured with integrated adjustable clips, hook and loop strips or cable ties. Optional quick release brackets shall provide an easy way to remove the strain relief bar without the use of tools.

NOTE: Vinyl tape will not be accepted

4.13. Fiber Optic Cabling for Inside Structure Installation: Inside plant single-mode fiber will have a (YELLOW) Polyvinyl Difluoride jacket and multi-mode will have a (ORANGE) Polyvinyl Difluoride jacket for quick identification unless otherwise noted for specified network.) Cable medium and strand count shall be determined by 96 CS Authority Having Jurisdiction and customer requirement(s).

4.14. Fiber Optic Connectors: All new installations requiring the installation of a fiber optic distribution panel will use the connector style below:

4.14.1. **Fiber Optic Connector — LC, SM:** Splice Cassette, 24 fiber strands, LC, UPC, Duplex, Single- Mode (OS2), Single-Fiber (250 µm).

4.14.2. Fiber Optic Connector — LC, MM: Splice Cassette, 24 fiber strands, LC, UPC, Duplex, 50 µm (OM 3 and 4).

4.15. Fiber Optic Patch Panel: All fiber optic housing units shall be compatible to support fiber splice cassettes mentioned in 4.14.

4.16. Fiber Optic Core Cables: Non-Armored ALTOS® / MiniXtend® Fiber (or equivalent) is to be used for new installations. Due to damages caused by lightning, all fiber optic cables will contain zero conductive materials.

4.17. ALTOS® / MiniXtend® Fiber Single-Mode Cable (or equivalent): Minimum 24 strand count to be installed unless otherwise approved by 96 CS.

4.18. Maintenance-Holes: Shall be equipped with all accessories to provide a complete system as or like Oldcastle Precast concreted MH design and meet applicable ASTM standards specification.

4.18.1. Main distribution MH system interior size is 12-feet (length) x 6-feet (width) x 7-feet (height) and shall have a load rating of HS-20 for heavy vehicular traffic.

4.18.2. Sub-distribution MH systems depending on location and project design are pre-cast reinforced concrete interior size 3-feet (width) x 5-feet (length) x 4-feet (height) and shall have a load rating of HS-20 for heavy vehicular traffic.

4.19. Underground Plant Conduit HDPE: UL Listed HDPE is a flexible, non-metallic raceway used to protect underground cables. It has superior crush resistance, low coefficient of friction, and high tensile strength. Size, length and type will be determined during design. Smooth wall, approved/listed for directional boring, minimum Schedule 80 HDPE SLR 11.5, ASTM F2160, NEMA TC 7.

4.20. Underground Plant Conduit Schedule 40/80: Non-metallic conduits shall be encased in concrete of minimum 3,000 lb/in2 (20,700kPa) compressive strength where vehicular traffic (i.e. automotive, railway) is above the pathway or where a bend or sweep is placed.

Chapter 5

5. EMERGENCY REPAIR PROCEDURES

5.1. ISP/OSP Telecommunication Infrastructure Copper/Fiber Repair Guidelines: Contractor shall notify Eglin's 96 CS Communications Focal Point (CFP) at 850-882-2666 or immediately upon discovery of any damaged Eglin communications cyber infrastructure. Extent of repairs required will be assessed and determined by 96 CS/CC or designated Authority Having Jurisdiction (AHJ).

> **NOTE**: All temporary and/or permanent repairs shall be made at no additional cost to the government. Repairs shall be IAW all applicable industry and local standards.

5.2. Temporary Repair Actions: Temporary repairs shall be initiated within 12-hours of reported/identified damage and must restore all circuits (pairs, strands, etc...) to full mission capability within 24-hours unless otherwise approved by AHJ. Contractor shall provide 24 hour/7 day a week on-call maintenance service for temporary repairs until all permanent repairs have been completed and accepted by the AHJ.

5.3. Permanent Repair Actions: All fiber optic and copper communications cyber infrastructure shall be restored to its original state or better prior to damage for all permanent repairs. All damaged communications cyber infrastructure shall be replaced, at a minimum, to the closest, pre-existing, splice/terminal locations regardless of distance and/or cost incurred. New or additional splices shall not be allowed for permanent repairs without written approval from the designated AHJ.

5.3.1. Contractors shall provide a Statement of Work (SOW), test plan and product submittals for all proposed permanent repair solutions within 5 business days from date of reported damage to 96 CS/CFP and AHJ for written approval prior to beginning any permanent repairs.

Chapter 6

TELECOMMUNICATIONS CONTRACTOR(S) QUALIFICATIONS

6.1. Telecommunications Contractor(s) Qualifications Requirements:

6.1.1. Work under communications requirements shall be performed by and the equipment shall be provided by the approved telecommunications contractor and key personnel. Qualifications shall be provided for: The Telecommunications System Contractor, the telecommunications system installer, and the supervisor (if different from the installer). A minimum of 30 days prior to installation, submit documentation of the experience of the Telecommunications Contractor and of the key personnel.

6.1.2. Telecommunications Contractor shall be a firm which is regularly and professionally engaged in the business of the applications, installation, and testing of the specified telecommunications fiber optic and copper OSP/ISP systems and equipment. The Telecommunications Contractor shall demonstrate experience in providing successful telecommunications systems within the past 3 years of similar scope and size. Submit documentation for a minimum of three and a maximum of five successful telecommunication system installations for the Telecommunications Contractor.

6.1.3. Provide key personnel who are regularly and professionally engaged in the business of the application, installation and testing of the specified telecommunications fiber optic and copper OSP/ISP systems and equipment. There may be one key person or more key persons proposed for this solicitation depending upon how many of the key roles each has successfully provided. Each of the key personnel shall demonstrate experience in providing successful telecommunications systems within the past 3 years.

6.1.4. Supervisors and installers assigned to the installation of this system or any of its components shall be Building Industry Consulting Services International (BICSI) Registered Cabling Installers, Technician Level. Submit documentation of current BICSI certification for each of the key personnel. In lieu of BICSI certification, supervisors and installers assigned to the installation of this system or any of its components shall have a minimum of 3-years' experience in the installation of the specified copper and fiber optic cable and components. They shall have factory or factory approved certification from each equipment manufacturer indicating that they are qualified to install and test the provided products. Submit documentation for a minimum of three and a maximum of five successful telecommunication system installations for each of the key personnel. Documentation for each key person shall include at least two successful system installations provided that are equivalent in system size and in construction complexity to the telecommunications system proposed for this solicitation. Include specific experience in installing and testing telecommunications systems and provide the names and locations of at least two project installations successfully completed using optical fiber and copper telecommunications.

6.1.5. Indicate that all key persons are currently employed by the Telecommunications Contractor or have a commitment to the Telecommunications Contractor to work on this Project. All key persons shall be employed by the Telecommunications Contractor at the date of issuance of this solicitation, or if not, have a commitment to the Telecommunications Contractor to work on this Project by the date that the bid was due to the Contracting Officer.

NOTE: Only the key personnel approved by the Contracting Officer in the successful proposal shall do work on this solicitation's telecommunications system. Key personnel shall function in the same roles in this Contract, as they functioned in the offered successful experience. Any substitutions for the Telecommunications Contractor's key personnel requires approval from the Contracting Officer.

NOTE: The term approved is defined in this document and other standards as acceptable to the authority having jurisdiction.

Chapter 7

CRITICAL EDGE BUILDING

7.1. Classification and Criteria

7.1.1. Specific criteria shall be met in order for a facility to be classified as a critical edge building (CEB) on Eglin AFB. Discussions to classify a facility as a CEB will take place during the design kickoff, charrette, or SATAF meetings. If the organization wishes to seek the CEB classification, customer shall complete the Critical Edge Building Classification and Criteria template coordinated by 96 CS/SCOI. Responses to the specified criteria will dictate an approved/disapproved CEB classification. In accordance with current Air Force Base Area Network Specifications (AFBAN) policy, a facility shall be classified as a CEB prior to implementing redundant links to two different Information Transfer Buildings (ITBs) or Core Nodes. If the mission set changes throughout the lifecycle of the facility, customers shall reassess their responses to the criteria to ensure the justification for being a CEB is still warranted. Additionally, if a facility meets compliance to be classified as a CEB, the alternate fiber path shall be physically diverse. If all means necessary have been exhausted to ensure physically diverse fiber paths have been implemented, but physical diversity is still unachievable, logically diverse cable paths are an exception, but are not guaranteed. Physically diverse fiber paths shall be classified as the following: Fiber Point of Entry to the facility for alternate route should be different from primary point of entry, but same point of entry is also authorized up to 50-feet maximum. Then both FOCA's are required to be in separate ducts using different communication pathways in different geographical directions. See current AFBAN for additional pathway information.

7.1.2. Once approval for the classification and criteria document has been completed, the 96 CS network engineers will conduct extensive network assessments to determine the most viable core node infrastructure capable of supporting the customer’s new CEB requirement. Following network assessment completion for each core node where logical path and ITB has been determined, the physical path and duct assessment will be conducted by the 96 CS Cyber Infrastructure personnel.

Chapter 8

COMMUNICATIONS EQUIPMENT LOCATION (CEL)

8.1. Eglin AFB CEL Requirements:

8.1.1. CEL's must be locked and secured IAW DoD 5200.08-R, paragraph C6.2.4.

8.1.2. CEL's must be clean and in good order IAW AFMAN 91-203, paragraph 30.1.

8.1.3. CEL's cannot be used as a storage room and must only contain 96 CS information technology equipment IAW UFC 3-580-01, paragraph 2-4.2.1.

8.2. 96 CS managed CEL's house installation network equipment and shall be protected IAW Defense Information Systems Agency (DISA) Traditional Security Guidance.

8.3. Access to CEL's or cohabiting space within a CEL shall only be provided as a last resort.

8.3.1. Cohabiting space within a CEL should only be requested if there is absolutely no other suitable space within the facility to house non-core networking equipment. Valid justification is required and must be accompanied by documentation preventing units from installing non-core equipment elsewhere within the facility.

8.3.2. If a CEL shall be deemed a cohabiting space, specific criteria must be met to retrofit an existing CEL:

- If existing keying mechanism is standard Z5 key lock, then entire door handle and lock mechanism shall be replaced to support cipher lock and Z5 lock keying mechanisms. Cohabiting unit shall use cipher lock for entry and 96 CS will use standard Z5 lock keying mechanism.
- A survey shall be conducted by 796 CES in coordination with 96 CS to assess electrical loads and heating/ventilation air conditioning (HVAC) requirements for proposed unit equipment.
- The requesting unit shall submit a request to 796 CES when current or existing electrical loads and or HVAC loads will be exceeded or limitations to existing provisions will not support user's requirement.
- The requesting unit shall fund for any expansions to electrical, HVAC, door handle retrofits, etc. to satisfy unit's requirement.

8.4. Units requesting space for equipment installation in a CEL shall adhere to all DoD policies and regulations, to include but not limited to:

Air Force Base Area Network Functional Specifications (AFBAN)
DISA Security Technical Implementation Guides (STIGs)
Unified Facilities Criteria (UFC) 3-580-01, Telecommunications Interior Infrastructure Planning and Design
DoD 5200.08.R, Physical Security Program
AFMAN 91-203, Air Force Occupational Safety, Fire, and Health Standards

T.O. 00-33A-1001, General Cyberspace Support Activities Management Procedures and Practice Requirements
AFI 33-200, Air Force Cybersecurity Program Management

8.5. All 96 CS core network equipment shall reside in its own separate lockable enclosure. All non-core network equipment shall reside in a separate enclosure from 96 CS network equipment.

8.5.1. Core network equipment includes: all NIPRNet, SIPRNet, VoIP, and SONET-Transport equipment managed by the 96 CS.

8.5.2. A lockable enclosure is defined as either a lockable equipment rack or lockable wall mount cabinet that is controlled and accessed by 96 CS authorized personnel only. 96 CS lockable enclosures are outlined in Attachment D.

8.6. All network connections must be secured within a locked communications closet or secured within a CEL if room is accessed by non-network personnel.

8.7. Outside Plant cabling infrastructure shall only reside in designated 96 CS lockable enclosures.

8.8. 96 CS managed patch panels and premise wiring shall not be cross utilized with other unit services.

8.9. The final approver for 96 CS CEL usage or cohabiting space within a CEL is the 96 CS/CC.

8.9.1. CEL access requests shall use the 96 CS Communications Focal Point (CFP) Remedy process.

8.9.2. 96 CS personnel shall change the cipher lock code when personnel on the access roster change or when CEL access privileges have been revoked.

8.10. 96 CS shall provide a tech solution in collaboration with 796 CES for all CEL usage requests. CEL usage is not guaranteed and is subject to 96 CS/CC approval.

8.11. CEL building manager shall submit names of personnel requiring CEL access to their unit's security manager for vetting. Unescorted access shall only be granted to personnel with a minimally favorable adjudicated National Agency Check (NAC), appropriate security clearance, and a need-to-know IAW the DISA Traditional Security STIG. Vetted access lists names shall be approved and signed by the submitting unit's commander or appointed representative.

8.11.1. Approved access list personnel shall be provided cipher lock codes for CEL access, but codes may not be shared with other unit members.

8.11.2. When unit member access for cohabiting space is no longer required or personnel no longer require access to the shared space, units shall remove names from the access list and submit updates to the 96 CS.

8.11.3. Units shall audit their access lists every six months IAW the DISA Traditional Security STIG. The unit security managers, facility managers, and work center SMEs shall revalidate each unit's access list.

8.11.4. CEL Inspection

8.11.4.1. 96 CS Policy and Evaluation (96 CS/SCQ) are the lead inspectors for 96 CS managed CELs.

8.11.4.2. Inspection results shall be sent to the associated units for further actions.

8.11.4.3. Any unit in breach of the CEL guidance shall be considered for removal from the 96 CS CEL

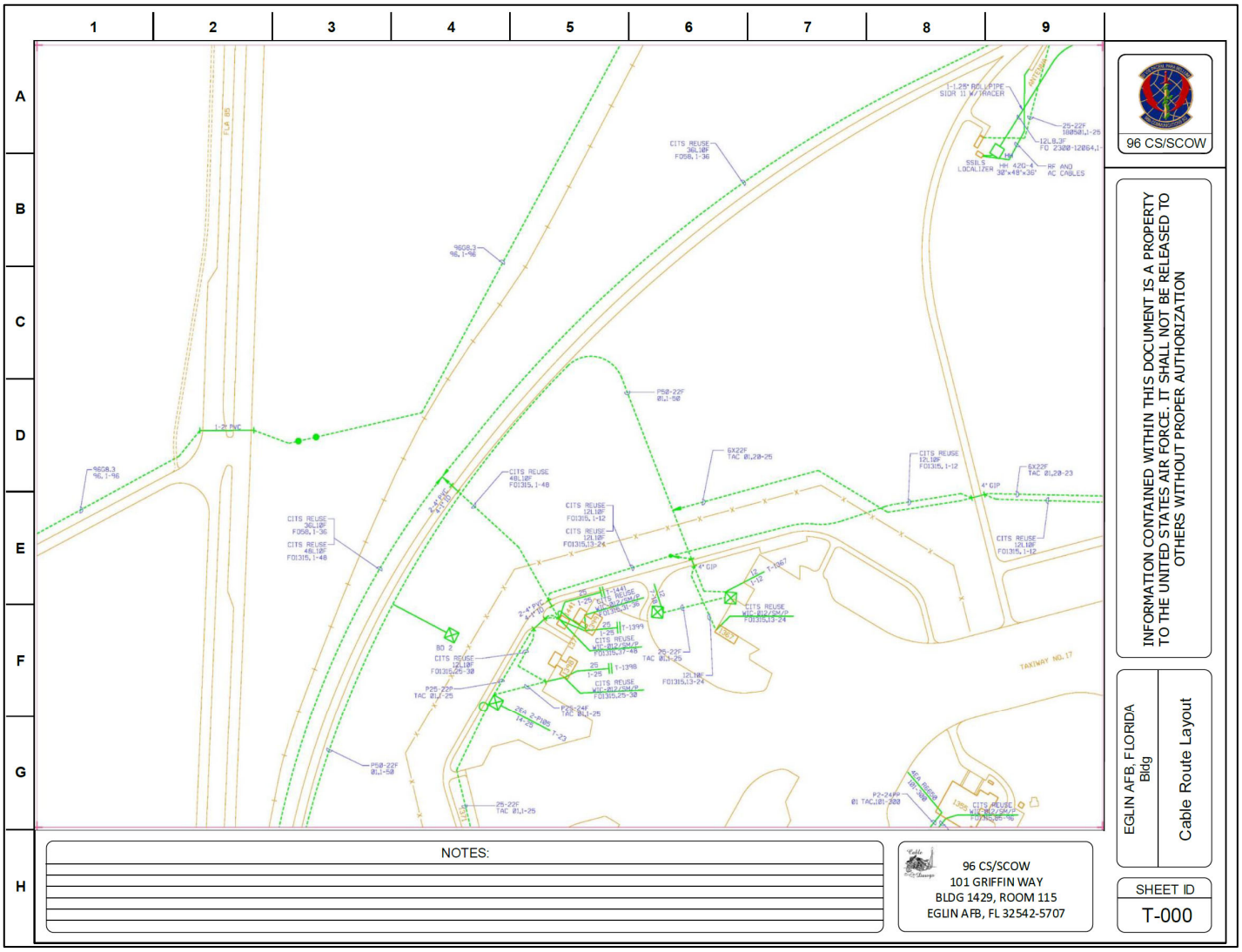
8.12. Any new building projects or facility renovations shall adhere to this guidance and be incorporated into the standard architecture.

Attachment A

6. DRAWING SPECIFICATIONS

A.1. Cable Route: The outside plant communications cable shall be depicted as installed, showing street/road locations and names, building 'footprints' accurately oriented as actually located. Maintenance Holes shall be depicted accurately oriented as located in reference to buildings and streets/roads. Extraneous information of other utility disciplines shall NOT be accepted on the as-built drawings. The information on the as-built drawings shall pertain to COMM specific.

A.2.

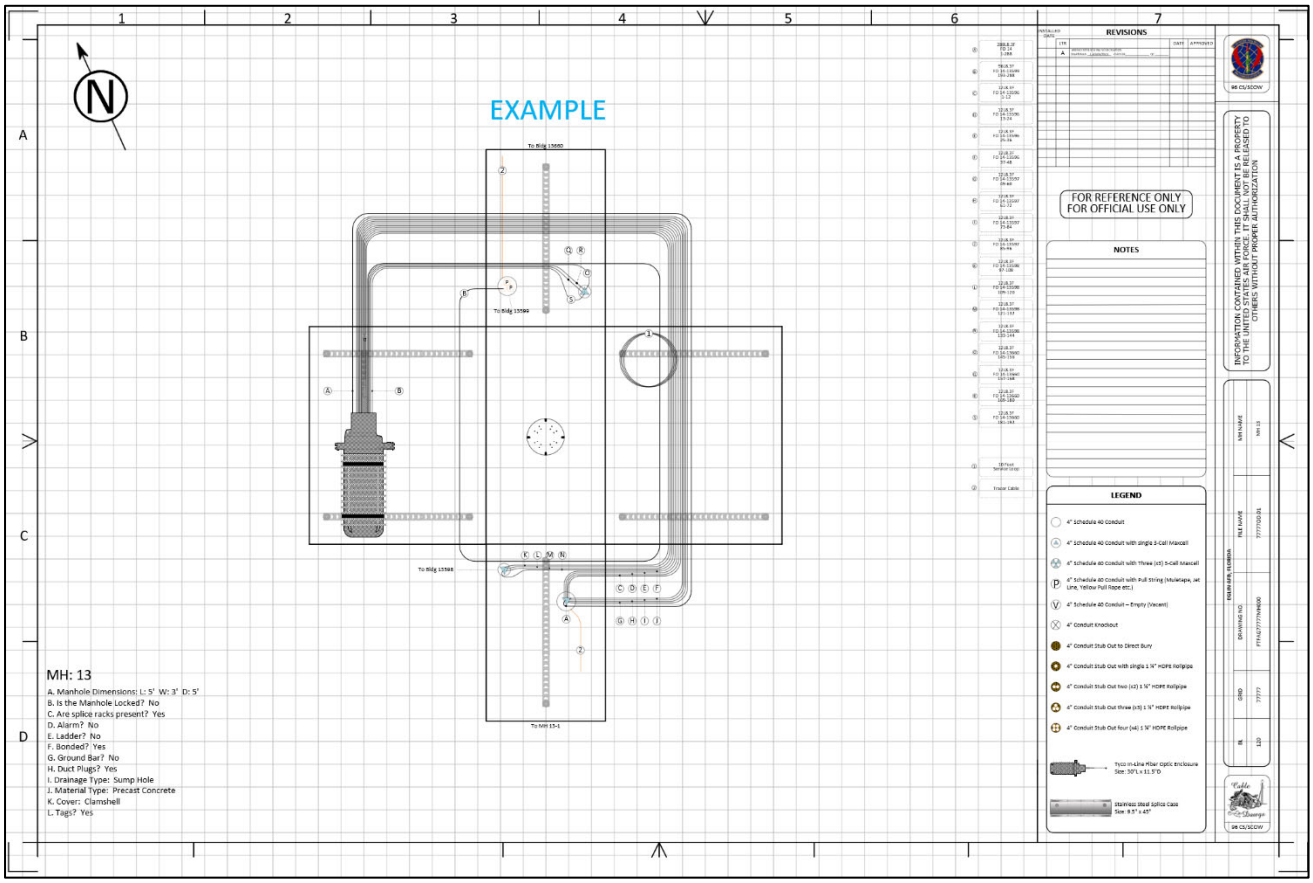


Sample Cable Route Drawing

A.3. Butterfly: Drawing of the interior of individual Maintenance Holes that were installed, passed through, or modified in any way. Reference drawing below.

A.4. The Installer shall augment the GNSS survey by using conventional land surveying equipment and electronic cable locating (underground utility toning) equipment to meet requirements. The Installer shall ensure collected/provided data is compatible with the CVC. The accuracy of the GNSS points shall be no more than 6-12-inches after differential correction/post-processing.

A.5.



Example: Maintenance Hole Butterfly with GIS Metadata

A.6. Geographic Information Systems (GIS) data: Provide technical/field services necessary to locate and perform Geographic Information System (GIS) data collection of Outside Plant (OSP) cable infrastructure and communications pathways for government entry into the Cyberspace Infrastructure Planning System (CIPS) Visualization Component (CVC). Additionally, the Contractor shall enter into all communication "containers" to include communication Maintenance Vaults, Maintenance-Holes (MH), and Pedestals in order to record/document detailed container information by means of field drawings. Outside plant features/containers include vaults, maintenance-holes, pedestals, underground cables, direct buried splices, terminals, etc. The communications pathways include duct routes, aerial and direct-buried cable, trench routes, communication pathway entry points on building exterior walls that lead to interior building entry terminals, etc. The Installer shall augment the GPS survey by using conventional land surveying equipment and electronic cable locating (underground utility toning) equipment to meet requirements. The Installer shall ensure collected/provided data is compatible with

the CVC. The accuracy of the GPS points shall be no more than 6-12-inches after differential correction/post-processing.

> **NOTE: Contractor/**Installer(s) shall coordinate with the AHJ through a Request for Information (RFI) to ensure they have the latest data dictionary before accomplishing any project GIS actions.

Shapefile filename extensions:
.prj. = projection description, using a well-known text representation of coordinate reference systems
.dbf = attribute format; columnar attributes for each shape, in dBase IV format
.shp = shape format; the feature geometry itself
.shx = shape index format; a positional index of the feature geometry to allow seeking forwards and backwards quickly
.cor = COR files generated by GPS Pathfinder Office after post processing the positions captured by GPS devices

A.7. GPS_MAINTENANCE HOLE

A.7.1. Definition: An enclosed structure MHs. A butterfly layout is used that shows the floor and walls flattened out so that duct openings can be drawn on the walls. This must be represented as one polygon (one row in the table). The point is used to show the center of the MHs cover.

A.7.2. Geometry type: Site (Point).

A.7.3. Attributes:

Column Name	SDSFIE Common Name	Description	Data Type	Use	Domain Table
MH_NAME	Identifier Name	The standard identifier name (e.g., MH-19)	Char (60)	Required	
MATERIAL		Used to describe the material composition of the maintenance hole	Menu	Required	PreCast Concrete Fiberglass Quazite Unknown Other
SIZE	Dimension of the structure	The width, length, and height (or depth) of the structure measured from the inside	Char (30)	Required	

Column Name	SDSFIE Common Name	Description	Data Type	Use	Domain Table
LID		Shape of the structure lid	Menu	Required	Round Clamshell Rectangle Other
DRAINAGE_TYPE			Menu	Required	Sump Hole Seepage Pit Other None
SPLICE_RACK		Support braces on the side of the structure	Menu	Required	Yes No
LOCK_PRESENT		Is the structure able to be locked	Menu	Required	Yes No
SPLICE_PRESENT		Type of splice case is in the structure	Menu	Required	Copper Fiber Optics Both None
BONDED			Menu		Yes No
GROUND BAR			Menu		Yes No
ARE DUCTS PLUGGED			Menu		All Some None

A.8. COMM_PATH_SEGMENT

A.8.1. Definition: Link that represents an enclosure path of comm, items outside of a building, maintenance hole, General Container, or other enclosed structure. For duct banks, comm-path segment can represent the virtual path, duct bank, duct, and innerducts. For ducts, comm-path segment can represent the virtual path, duct, and innerducts. For direct-buried cables at road-crossings, comm- path segment can represent the virtual path, road-crossing duct, and direct-buried cables. It can also represent the path of aerial cable, cable-bridges, and cable-troughs.

A.8.2. Geometry type: Polyline

A.8.3. Attributes

Column Name	SDSFIE Common Name	Description	Data Type	Use	Domain Table
FROM		Origination	Char (60)	Required	
TO		Destination	Char (60)	Required	
CABLE_ID		A field that describes the originating and end structure this segment is representing	Char (60)	Required	
INSTALL_TYPE		Type of path	Menu	Required	Duct Duct Bank Direct Buried
NUMBER_OF_DUCTS		Condition, Install Type = Duct Bank	Numeric Min=1 Max=20 Default=1		
DUCT_SIZE		Dimension of the duct measured in inches	Numeric Min=1 Max=12 Default=4	Required	
MATERIAL		Composition of the Duct		Required	Schedule 40 PVC Schedule 80 PVC HDPE Micr-Duct
DEPTH		The minimum depth of this part of the path from grade, in inches	Numeric	Required	
COMMENTS					

A.9. PEDESTAL

A.9.1. Definition: An above ground container used as a splice point, testing point, ortermination.

A.9.2. Geometry type: Site (Point).

A.9.3. Attributes:

Column Name	Description	Data Type	Use	Domain Table
TERMINAL_ID	A unique container identifier	Char (60)	Required	
SIZE	Dimensions of the container	Menu	Required	BD1 = 2”x2” BD2 = 4”x4” BD3 = 6”x6” BD4 = 8”x8” BD5 = 10”x10” BD7 = Cabinet – 23”x12” BD8 = Cabinet – 32”x18”
GROUNDED/BONDED		Menu	Required	Yes No
BONDING_SECURED		Menu	Required	Yes No Some
TERMINAL		Menu	Required	Yes No
MATERIAL		Menu	Required	Metal Fiberglass
CABLE TAGS PRESENT		Menu	Required	Yes No Some
COMMENTS		Char (230)		

A.9. MARKER POLE

A.9.1. Definition: An above ground marker used to identify MH or Cable Route.

A.9.2. Geometry type: Site (Point).

A.9.3. Attributes:

Column Name	Description	Data Type	Use	Domain Table
LOCATION		Char (60)	Required	
TYPE	What the marker is used for	Menu	Required	MH/HH Marker Cable Route

A.10. MARKER BALL

A.10.1. Definition: A below ground marker used to identify entrances, road crossings, routes, stub out locations.

A.10.2. Geometry type: Site (Point).

A.10.3. Attributes:

Column Name	Description	Data Type	Use	Domain Table
TYPE	What the marker is used for	Char (60)	Required	Ball Disk
MARKER PURPOSE		Menu	Required	Splice Bldg Entrance Road Crossing Cable/Duct Route MH Stub out
MANUFACTURER		Char (60)	Required	

A.11. SPLICE

A.11.1. Definition: A below ground splice used to connect cables or tracing wire.

A.11.2. Geometry type: Site (Point).

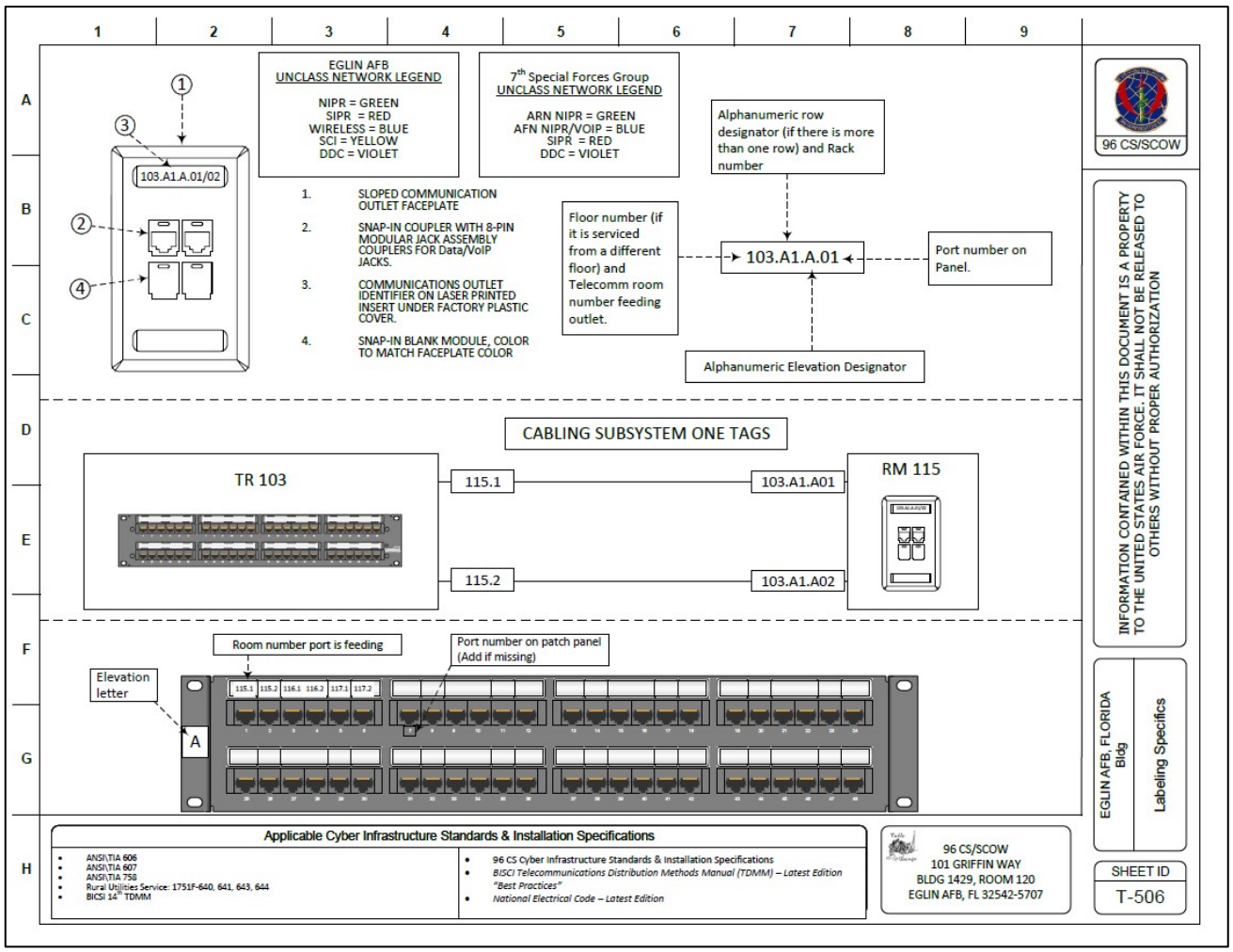
A.11.3. Attributes:

Column Name	Description	Data Type	Use	Domain Table
LOCACTION	Where the splice is	Char (200)	Required	
TYPE	What type of splice	Menu	Required	Auto-Wire Trace Safe Copper Fiber Optic

Attachment B

LABELING SPECIFICATIONS

B.1. LABELING SPECIFICATIONS



Attachment C

FIBER DESIGN REQUIREMENTS

C.1. FIBER DESIGN NOTES

Eglin AFB Core Fiber Optic Baseline

References: (a) AF Base Area Network Functional Specification (AFBAN), dated February 2021

C.1.1. Per the AF Base Area Network Functional Specification (AFBAN), dated February 2021, section 4.1.3.

- New ITB construction shall contain a minimum of 72 single-mode (OS1 and OS2) fiber strand cables, one each Home Run to separate existing (or new) ITBs. Higher strand counts may be used based on known and future requirements.
- Existing ITB-to-ITB cable with less than 18 available strands is a candidate for additional fiber cables between the ITBs.
- Additional fiber cables installed between existing ITBs shall contain a minimum of 48 single-mode (OS1 and OS2) fiber strands. Higher strand counts may be used based on known and future requirements.
- New EB construction shall contain a minimum of 12 single-mode fiber strands dedicated between that EB and its ITB. Higher strand counts may be used based on known and future requirements.
- Existing EB-to-ITB cables with 4 or less available strands is a candidate for additional fiber between the EB and the ITB.
- Additional fiber cables installed between existing EBs and ITBs shall contain a minimum of 12 single-mode (OS1 or OS2) fiber strands. Higher strand counts may be used based on known and future requirements.
- With any cable installation, 10% of the total fiber strands (rounded to the nearest pair of fibers) should be unused to provide emergency routing should the need arise.

Home Run cable design is the recommended method of fiber distribution when adequate OSP pathway is available. In order to conserve preinstalled available pathways, fiber optic trunk design should be considered if ITB to EB fiber routes must traverse existing available pathway routes that are near capacity.

The above standards cover minimum OSP fiber optic requirements needed to provide minimal connectivity and required spare fiber for maintenance purposes only.

C.1.2. The organizational requirements supporting advanced warfighter missions and the demand for increased fiber optic capabilities to support “gray” or “other” networks, Intrusion Detection Systems (IDS), high resolution video graphics imaging and global environmental management control systems has increased. To ensure these requirements and all core services are satisfied and IAW the AFENT architecture specifications and Assured Services LAN (ASLAN), Eglin’s minimum fiber requirements have been determined to be the following:

a) Information Transfer Building to Edge Building = 24 Single Mode fiber optic strands

b) Edge Building main telecommunication room to other downstream communication equipment locations within the same building = 24 Single Mode fiber optic strands

c) Fiber Optic strands 1-18 shall be recorded in the circuit actions installation reporting system as reserved for 96 CS management/use to support and maintain base core services only.

d) Fiber optic strands 19-24 will be available to satisfy design requirements like Intrusion Detection System (IDS) "Alarms" and/or other temporary mission support requirements. All additional fiber optic strand requirements for customer specific use that will deplete or diminish the core service reservations shall be in addition to the baseline 24 strands to include additional maintenance spare fiber optic strands. Final fiber optic cable sizing shall be determined by 96 CS during network design and project requirement reviews.

C.1.3. Cable replacement will be the first design consideration for installation requirements of new cable to existing EBs or through legacy underground plant infrastructure with limited duct availability.

C.1.4. All network designs will be IAW the most current AFBAN, applicable Unified Facilities Criteria, applicable industry standards, and local specifications. (See attachment G - Applicable Publications)

Attachment D

RACK ELEVATION STANDARDS FOR NIPR/SIPR/DATA/VOIP

D.1. FLOOR-MOUNT LOCKABLE NETWORK ENCLOSURE

Standard AF Data/VoIP Rack Elevation for all NIPR TRs

Current as of: 20 Nov 23

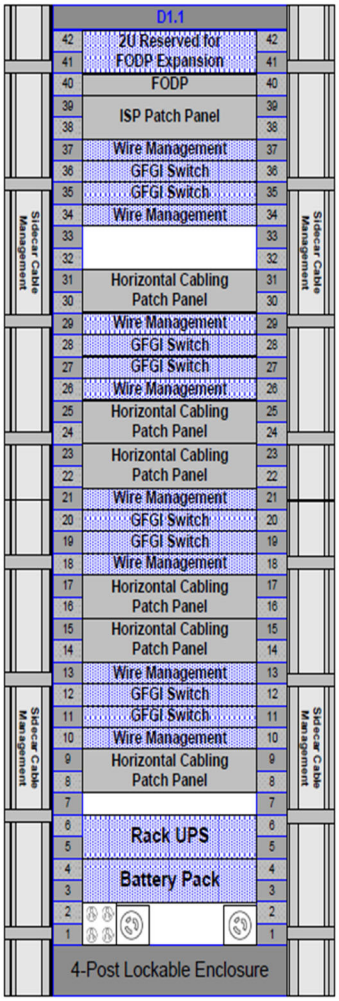


Figure D1.1
AF DN RACK

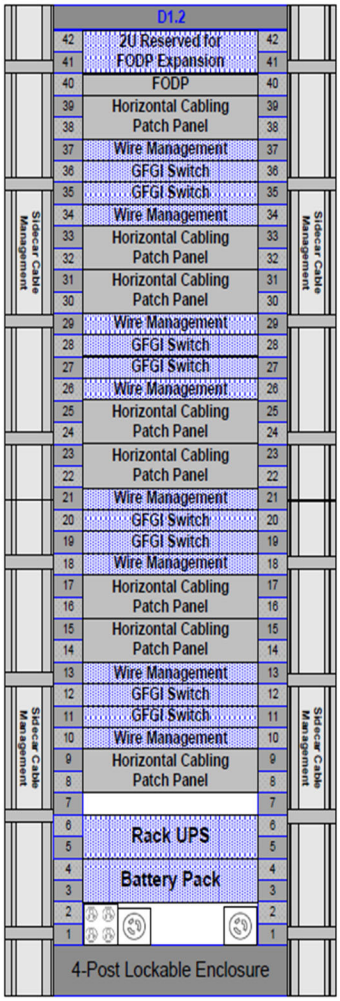


Figure D1.2
AF AN RACK

Notes:

1. All 4-post lockable enclosures shall be specified by 96CS to ensure proper rack specifications based on customer provided requirements. Racks shall be lockable enclosures with part number GL790ES-2442MS or equivalent.

2. All 72" TR racks shall be 4-post lockable enclosures with vertical sidecar cable management to support wiring on either side. If using the model specified in Note 1, the vertical sidecars include part numbers SC67942, SCP7942, VCT-79, and VTC-79C.

3. Ensure rack's front rails are set back a minimum of 6" from the front of the rack. This ensures all cabling will be unaffected by the door when closing.

4. All 72" TR racks shall follow this elevation layout to comply with Eglin rack elevation standards.

5. Dedicated circuits with power receptacles indicated below and depicted in the rack elevation shall be supplied by onsite contractor. Exact power receptacle shall be identified in the 100% design drawings based on the requirements.

6. A dedicated junction box shall be placed no greater than 2-feet from the 96CS lockable enclosure and appropriate electrical wiring shall be homerun from supporting electrical panel to junction box. A pigtail splice with compatible size wiring shall be run from the 96CS electrical outlet(s) to the junction box and interconnected with dedicated homerun wiring using appropriate wire nuts.

7. No other circuits shall reside in this junction box to ensure survivability of the 96CS dedicated circuits are not interrupted or impacted.

8. Each rack shall require minimum 1-foot patch cables routed from each patch panel port to its corresponding network switch port. All network equipment to provide LAN connectivity is specified by 96CS and funded by the contractor or the occupying customer.

120V / 20A dedicated circuit w/Quad receptacle mounted at base of rack w/receptacles facing towards center of rack

120V / 30A dedicated circuit w/NEMA L5-30R w/ Duplex receptacle mounted at base of rack w/receptacle facing towards center of rack

D.2. WALL-MOUNT LOCKABLE NETWORK ENCLOSURE (VERTICAL EQUIPMENT MOUNT)

Standard AF Data Wall-Mount Lockable Enclosure (WMLE) Elevations for all 96CS TRs

Current as of: 20 Nov 23

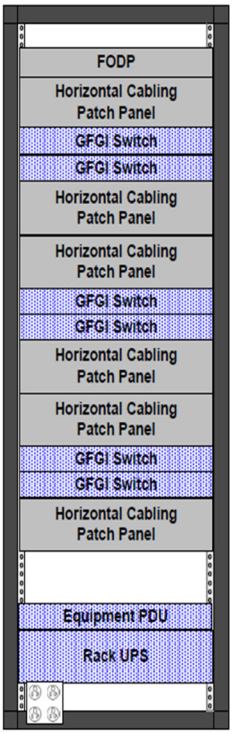


Figure D2.1
GL48WDXM-B-SH-AF
48" x 24" x 32"
350 lbs Weight Capacity
or equivalent

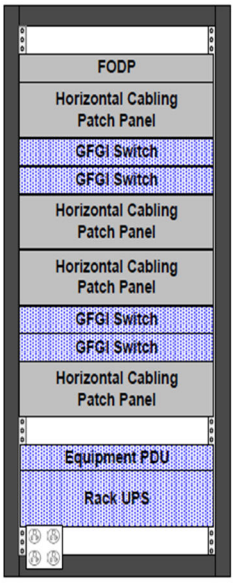


Figure D2.2
GL36WDXM-B-SH-AF
36" x 24" x 32"
300 lbs Weight Capacity
or equivalent

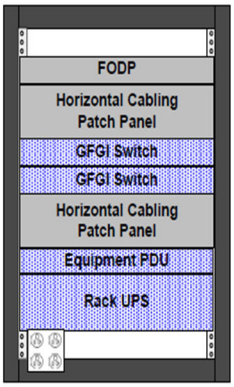


Figure D2.3
GL24WDXM-B-SH-AF
24" x 24" x 32"
250 lbs Weight Capacity
or equivalent

Notes:

1. WMLE shall be mounted on backer board in TR. All AF network equipment shall be mounted in WMLE.

2. A 120V / 20A dedicated circuit shall be mounted inside WMLE toward the bottom facing the front. Preferably on either side inside the WMLE.

3. Rack elevation shown here is front-view depiction. If UPS is required, it will be placed at the bottom of the WMLE above the electrical receptacle , but 1U below the surge arrestor.

4. A dedicated junction box shall be placed no greater than 2-feet from the 96CS lockable enclosure and appropriate electrical wiring shall be homerun from supporting electrical panel to junction box. A pigtail splice with compatible size wiring shall be run from the 96CS electrical outlet(s) to the junction box and interconnected with dedicated homerun wiring using appropriate wire nuts.

5. No other circuits shall reside in this junction box to ensure survivability of the 96CS dedicated circuits are not interrupted or impacted.

6. Each rack shall require 1-foot patch cables routed from each patch panel port to its corresponding network switch port. All network equipment to provide LAN connectivity is specified by 96CS and funded by the contractor or the occupying customer.

7. All 96CS fiber optic PPs and TP PPs shall also be terminated inside the WMLE.

8. All WMLE's shall be double-hinged with a solid metal front door.

9. All keys to WMLE's shall be turned over to the 96CS upon installation.

10. All WMLE's shall be sized to support 20% growth.

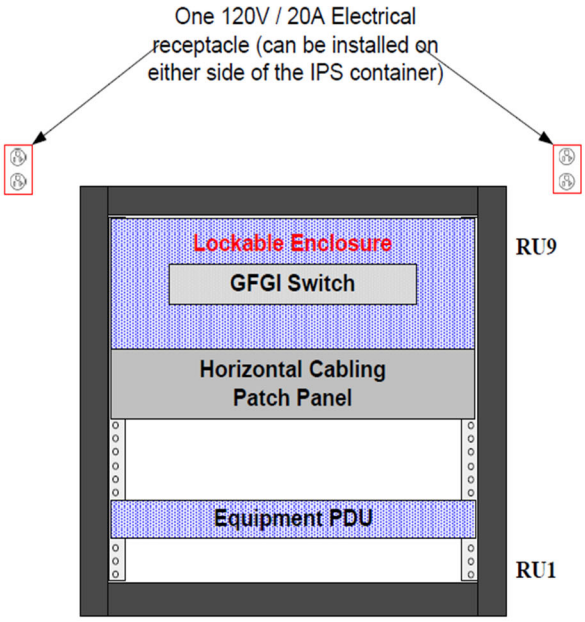
11. All WMLE's shall be grounded IAW UFC 3-580-01.

120V / 20A dedicated circuit w/Quad receptacle mounted at base of rack w/receptacles facing towards front of rack

D.3. IPS CONTAINER

Standard Rack Elevation for 96CS IPS Container

Current as of: 20 Nov 23



Hamilton Class 5 Single Door Model 23-36-19 (or Equivalent)

Notes:

1. IPS container shall be installed in End-User-Area and not in 96CS TR.

2. All 96CS network equipment shall be mounted IAW the diagram to the left.

3. 96CS Network switch shall be housed in IPS container inside a lockable enclosure (such as the Mier Box BW-235) and placed at RU 7-9.

4. A 120V / 20A dedicated circuit shall be mounted outside located at the top left or right of the IPS container, but no further than 1-foot away.

5. Rack elevation shown here is front-view depiction.

6. All network equipment to provide LAN connectivity is specified by 96CS and funded by the occupying customer.

7. All IPS containers shall be Class 5 with single door.

8. All IPS containers shall meet proper clearances from the wall in order to circulate room air through the cabinet for electronic equipment cooling.

9. End User encryption devices will not be housed within IPS container, where feasible, to minimize required access to the container.

120V / 20A dedicated circuit w/duplex receptacle mounted inside enclosure.

Attachment E

CABLE MANAGEMENT ACCESSORIES

E.1. Cable Management.

BGS-79 – Brush grommet to cover rear vertical cable pass through
ESC-K12 – Cable management rail kit for front or rear rails; includes 12 sections of "fingers" (each section 7 RMU); rails will need to be recessed 4.5"
GL790ES-2242MS - Great Lakes 79" x 24" x 42" D Complete Rack Mount Enclosure, Black
SC67942 - Great Lakes External Cable Manager/Sidecar
SCP7942 Great Lakes Side Car End Panel
VCT-79 – Vertical cable trough
VCT-79C – Cover for VCT-79
VCB-7936 – Vertical cable bar kit (includes 1 vertical cable bar, 2 horizontal bars and 6-inch straps); use with optional ¼ turn "D" rings
CM-26 – Kit of 10, ¼ turn "D" rings, 3.5"x 5"

E.2. Other Accessories.

HDW-105-50 **–** Package of 50 M6 cage nuts with screws (12mm screw length)

Attachment F

SECURITY TECHNICAL IMPLEMENTATION GUIDE

F.1. PHYSICAL SECURITY

Based on the AFI 31-101 section 2.7.1.3 all locations where active communications equipment is used are designed as Protection Level 4 (PL) and have to be secured as such.

Every data switch in the network shall reside in a physically locked CEL closet, data center, or a lockable enclosure. Controlled areas are legally defined areas containing PL4 resources. Only authorized personnel, designated by a unit commander, have access to controlled areas.

The designation "controlled area" carries the same legal and moral restrictions as a physical barrier. Unless physical barriers are specifically required, the actual effectiveness of a controlled area may depend entirely on the security awareness of the people working in it. Installation commanders must designate areas containing the resources identified below.

APPLICABLE AFI REFERENCES

AFI 31-101, Section 2.7.1.3. - Mission essential communications facilities and computer centers, RAPCONs to include off installation navigational aids and related resources, control towers, power plants, and environmental control systems critical to operational capability.

The protection implemented shall be sufficient to protect the network from unauthorized personnel. The keys to the locked cabinets and dedicated communications rooms shall be controlled and only provided to authorized individuals appointed by 96 CS leadership.

APPLICABLE STIG REFERENCES

CAT III: NET0140 - The IAO/NSO will ensure the connection between the CSU/DSU and the local exchange carriers (LEC) data service jack (i.e., demarc) is in a secured environment.
CAT II: NET0210 - The IAO/NSO will ensure that all network devices (i.e., IDS, routers, RAS, NAS, firewalls, etc.) are located in a secure room with limited access.
CAT II: NET1730 - The IAO/NSO will ensure that the management workstation (NMS) is located in a secure environment.
CAT II: NET1832 - The ISSM will ensure the VPN tunnel demarcation is located in facilities authorized to process classified US government information, classified at the Secret Level (for SIPRNet).
CAT II: NET-VLAN-001 - The IAO/NSO will ensure that all switches and associated cross-connects hardware are kept in a secured IDF or an enclosed cabinet that is kept locked.

Attachment G

APPLICABLE PUBLICATIONS

Publications current time of contract or design build award or latest editions of the following publications shall apply and be utilized as applicable for engineering, installations, progress checks, quality controls, and final acceptance quality assurance inspections.

- Air Force Systems Security Instruction 7700, Emission Security
- Air Force Systems Security Instruction 7702, Emission Security Countermeasures Reviews
- Air Force Systems Security Instruction 7703, Communications Security: Protected Distribution Systems (PDS)
- ANSI C2-1997, National Electric Safety Code (NESC)
- ANSI/NEMA WC 66, Performance Standard for Category 6 and Category 7 100 Ohm Shielded and Unshielded Twisted Pairs
- ANSI/TIA-526-7, OFSTP-7 Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant
- ANSI/TIA-568-E.0, Generic Telecommunications Cabling for Customer Premises
- ANSI/TIA-568-E.1, Commercial Building Telecommunications Cabling Standard
- ANSI/TIA-568-E.2, Balanced Twisted-Pair Telecommunications Cabling and Components Standards
- ANSI/TIA-568-E.3, Optical Fiber Cabling Components Standard
- ANSI/TIA-568-E, Commercial Building Telecommunications Cabling Standard
- ANSI/TIA-569-E, Commercial Building Standard for Telecom Pathways & Spaces Wiring
- ANSI/TIA-570-D, Residential Telecommunications Cabling Standard
- ANSI/TIA-598, Optical Fiber Cable Color Coding
- ANSI/TIA-604-10, FOCIS 10 Fiber Optic Connector Intermateability Standard - Type LC
- ANSI/TIA-606-D, Administration Standard for the Telecommunications Infrastructure
- ANSI/TIA-607-D, Commercial Building Grounding and Bonding Requirements for Telecommunications
- ANSI/TIA-758, Customer-Owned Outside Plant Telecommunications Cabling Standard
- ANSI/TIA-1152, Requirements for Field Test
- ANSI/TIA 942 B DATA CENTER INFRASTRUCTURE
- ASTM C 478, Standard Specification for Precast Reinforced Concrete Maintenance Hole Sections
- ASTM D 709, Laminated Thermosetting Materials
- ASTM C 789, Standard Specification for Precast Reinforced Concrete Box Sections for Culverts, Storm Drains, and Sewers

- ASTM C 850, Standard Specification for Precast Reinforced Concrete Box Sections for Culverts, Storm Drains, and Sewers with Less Than 2 Ft of Cover Subjected to Highway Loadings
- ASTM C 857, Standard Practice for Minimum Structural Design Loading for Underground Precast Utility Structures
- ASTM C 858, Standard Specification for Underground Precast Concrete Utility Structures
- ASTM C 890, Standard Practice for Minimum Structural Design Loading for Monolithic or Sectional Precast Concrete Water and Wastewater Structures
- ASTM C 891, Standard Practice for Installation of Underground Precast Concrete Utility Structures
- ASTM C 891.11, Standard Practice for Installation of Underground Precast Concrete Utility Structures
- ASTM C 913, Standard Specification for Precast Concrete Water and Wastewater Structures
- ASTM C 1037, Standard Practice for Inspection of Underground Precast Concrete Utility Structures
- CFR Title 47, Parts 68, Telecommunications, Federal Communications Commission Connection of terminal equipment to the telephone network
- DODI 5000.2, Part 6, System Safety, Health Hazards, and Environmental Impact
- ECA EIA/ECA 310, Cabinets, Racks, Panels, and Associated Equipment
- EPA CFR 40, Parts 1500-1508, Protection of Environment, Council on Environment Quality
- EPA CFR 40, Parts 260, 261, 262, 263, 264, 265, Hazardous Waste Generation and Transportation
- EPS-98-38EITS-001, Equipment Performance Specification for Maintenance and Operations Services for Base Telecommunications System
- FCC Part 68, Connection of Terminal Equipment to the Telephone Network (47 CFR 68)
- ICEA S-83-596, Indoor Optical Fiber Cables
- IEEE 100, The Authoritative Dictionary of IEEE Standards Terms
- MIL-STD-188-124B, Grounding, Bonding, and Shielding for Common/ Long Haul/ Tactical Systems Including Ground Based Communications-Electronics Facilities and Equipment

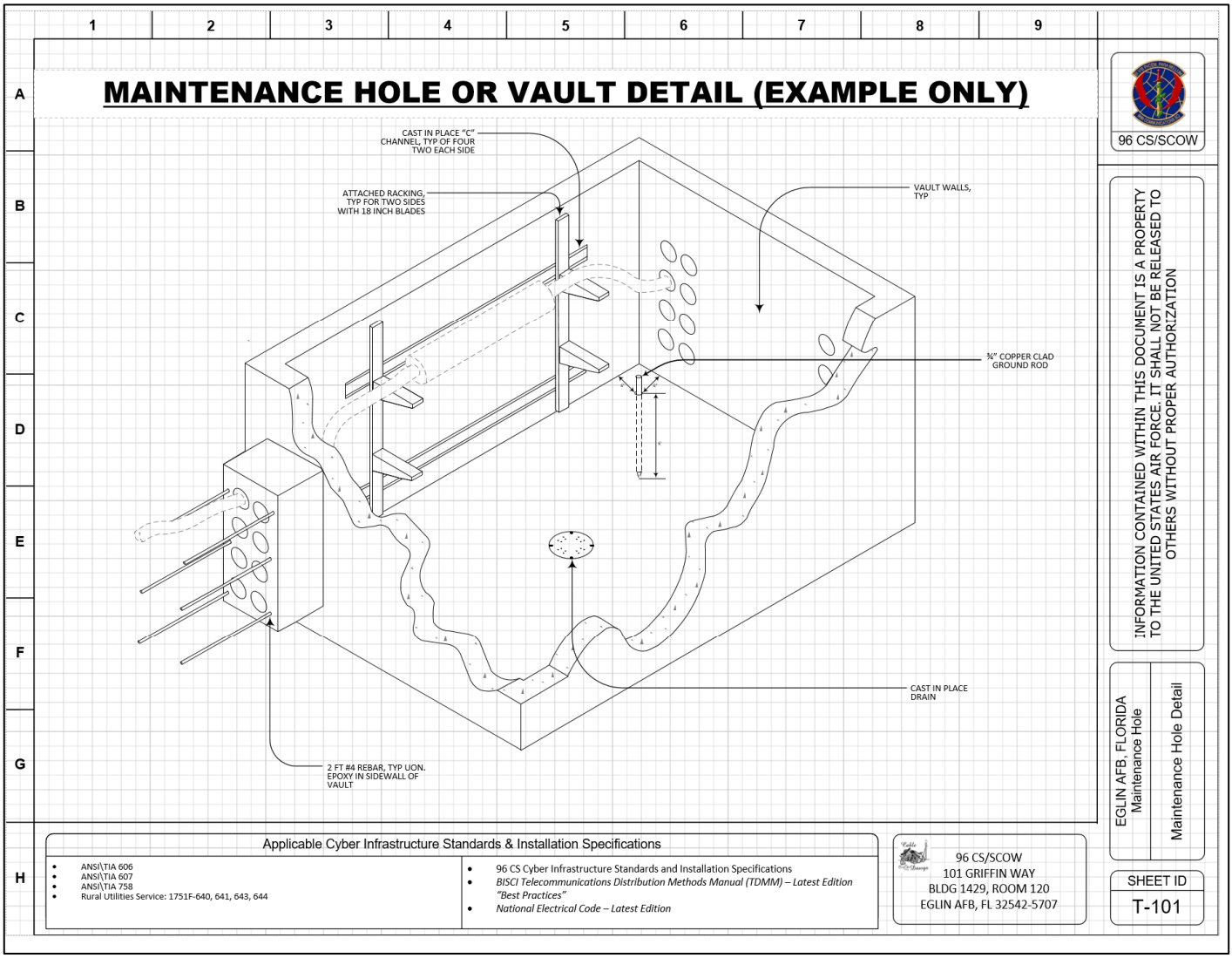
- MIL-STD-882-D, System Safety Program
- NECA/FOA 301-2016 Standard for Installing and Testing Fiber Optics
- NECA/NEMA 605-201X Standard for Installing Underground Nonmetallic Utility Duct
- NEMA Standards Publication TC-7
- NEMA Standards Publication TC-2
- NFPA 70, National Electrical Code
- NFPA 70-2002, National Electrical Code (NEC)
- OSHA CFR 29, Asbestos
- OSHA CFR 29, Excavation
- OSHA CFR 29, Hazardous Waste Operation and Emergency Response
- OSHA CFR 29, Occupational Safety and Health Standards

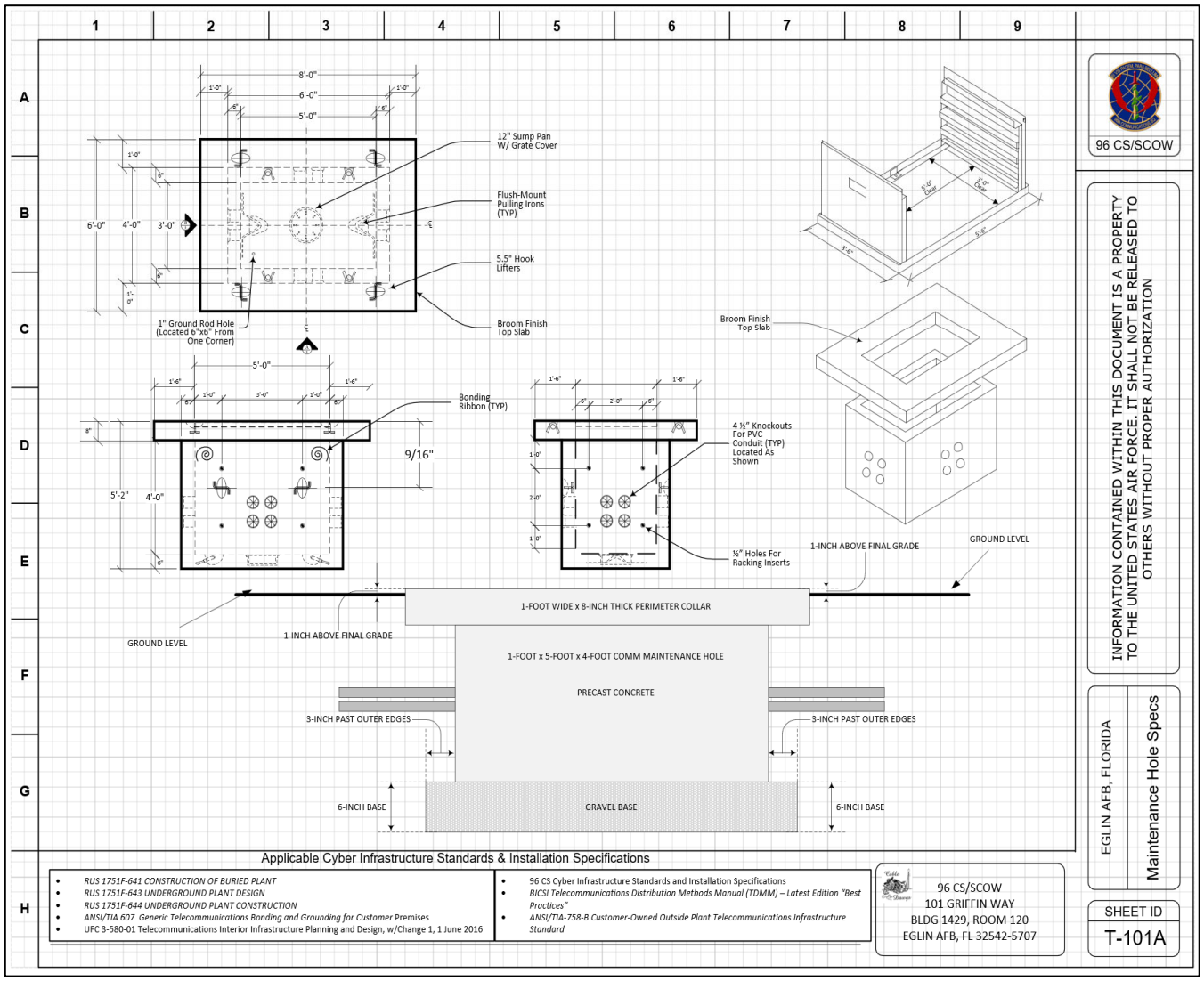
- OSHA CFR 29, Part 1910.1200, Hazard Communications
- OSHA CFR 29, Part 1910.147, The Control of Hazardous energy (Lockout/Tagout)
- OSHA CFR 29, Permit-required Confined Spaces
- OSHA CFR 29, Telecommunications
- REA Standard PC-5A, Bulletin 345-52, REA Standard for Service Entrance
- REA TE & CM Section 451.2, Shield Continuity
- REA TE & CM Section 644, Design and Construction of Underground Cable (Physical Plant)
- REA TE & CM Section 823, Electrical Protection by Use of Gas Tube Arresters
- REA TE & CM, Section 643, Underground Conduit and Maintenance hole Design and Construction
- REA TE & CM, Section 810, Electrical Protection of Electronic Analog Section Digital Central Office Equipment
- REA TE & CM, Section 825, Situations Requiring Special Protection
- Unified Facilities Criteria (UFC) 3-520-1 Interior Electrical Systems
- Unified Facilities Criteria (UFC) 3-580-1, Telecommunications Interior Infrastructure Planning and Design

- Unified Facilities Criteria (UFC) 4-010-05 - Sensitive Compartmented Information Facilities Planning, Design, and Construction
- Unified Facilities Criteria (UFC) 4-010-06 Cybersecurity of Facility
- Unified Facilities Criteria (UFC) Facilities Criteria (UFC) 4-510-01 Design: Military Medical Facilities
- Unified Facilities Criteria (UFC) 4-711-01 Family Housing
- UL 1286, Office Furnishings
- UL 1863, Communication Circuit Accessories
- UL 444, Communications Cables
- UL 467, Grounding and Bonding Equipment
- UL 50, Enclosures for Electrical
- UL 514C, Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers
- UL 723, Test for Surface Burning Characteristics of Building Materials
- UL 969, Standard for Marking and Labeling Systems

Attachment H

STANDARD INSTALLATION DRAWINGS




12" Sump Pan W/ Grate Cover
Flush-Mount Pulling Irons (TYP)
5.5" Hook Lifters
Broom Finish Top Slab
1" Ground Rod Hole (Located 6"±6" from One Corner)
Bonding Ribbon (TYP)
9/16"
4 ½" Knockouts For PVC Conduit (TYP) Located As Shown
½" Holes For Racking Inserts
1-INCH ABOVE FINAL GRADE
GROUND LEVEL
1-FOOT WIDE x 8-INCH THICK PERIMETER COLLAR
1-FOOT x 5-FOOT x 4-FOOT COMM MAINTENANCE HOLE
PRECAST CONCRETE
3-INCH PAST OUTER EDGES
6-INCH BASE
GRAVEL BASE
96 CS/SCOW
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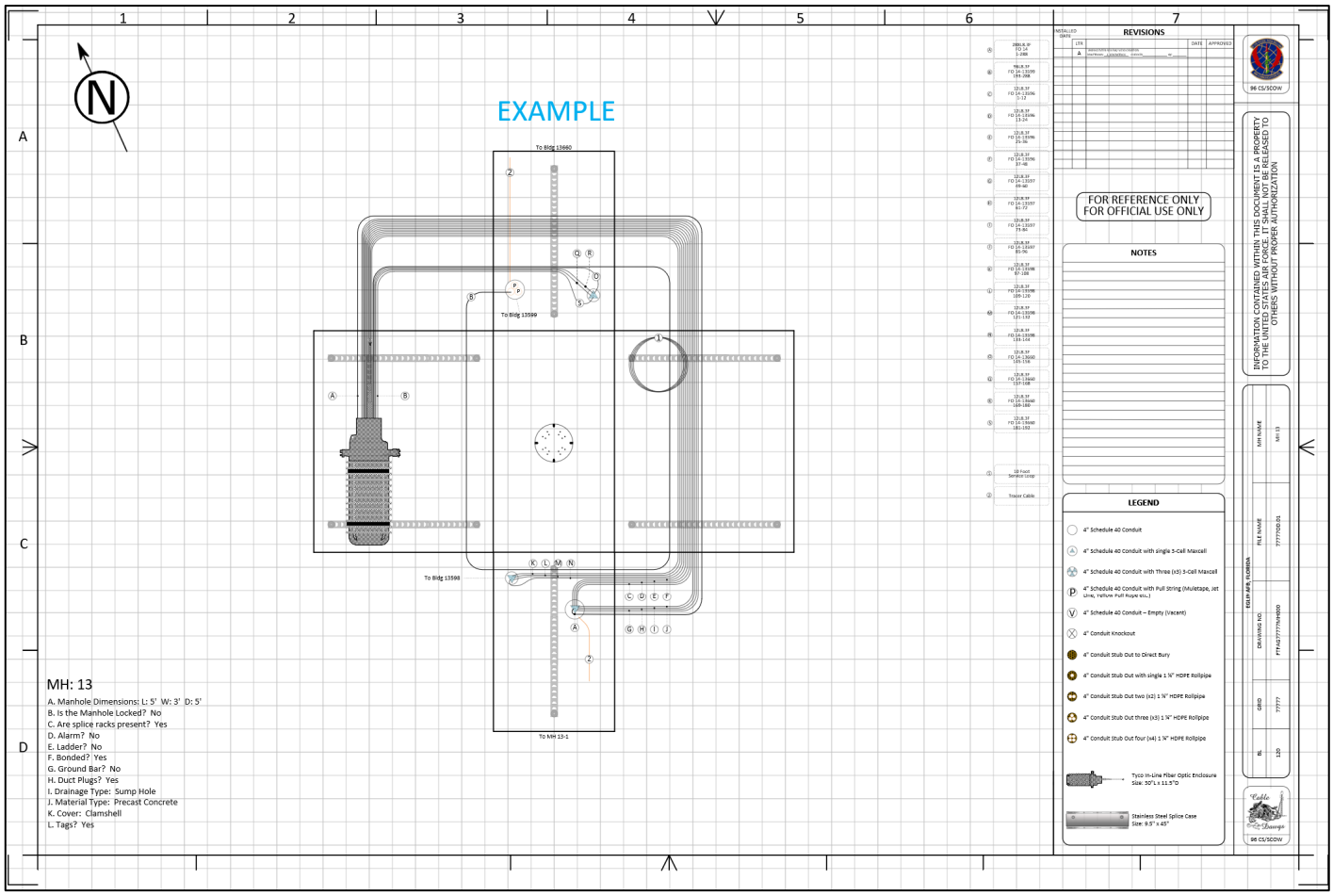
EGLIN AFB, FLORIDA
Maintenance Hole Specs
Applicable Cyber Infrastructure Standards & Installation Specifications
RUS 1751F-641 CONSTRUCTION OF BURIED PLANT
RUS 1751F-643 UNDERGROUND PLANT DESIGN
RUS 1751F-644 UNDERGROUND PLANT CONSTRUCTION
ANSI/TIA 607 Generic Telecommunications Bonding and Grounding for Customer Premises
UFC 3-580-01 Telecommunications Interior Infrastructure Planning and Design, w/Change 1, 1 June 2016
96 CS Cyber Infrastructure Standards and Installation Specifications
BICSI Telecommunications Distribution Methods Manual (TDMM) – Latest Edition "Best Practices"
ANSI/TIA-758-B Customer-Owned Outside Plant Telecommunications Infrastructure Standard
96 CS/SCOW
101 GRIFFIN WAY
BLDG 1429, ROOM 120
EGLIN AFB, FL 32542-5707
SHEET ID
T-101A


EXAMPLE
MH: 13
A. Manhole Dimensions: L: 5' W: 3' D: 5'
B. Is the Manhole Locked? No
C. Are splice racks present? Yes
D. Alarm? No
E. Ladder? No
F. Bonded? Yes
G. Ground Bar? No
H. Duct Plugs? Yes
I. Drainage Type: Sump Hole
J. Material Type: Precast Concrete
K. Cover: Clamshell
L. Tags? Yes
REVISIONS
FOR REFERENCE ONLY
FOR OFFICIAL USE ONLY
NOTES
LEGEND
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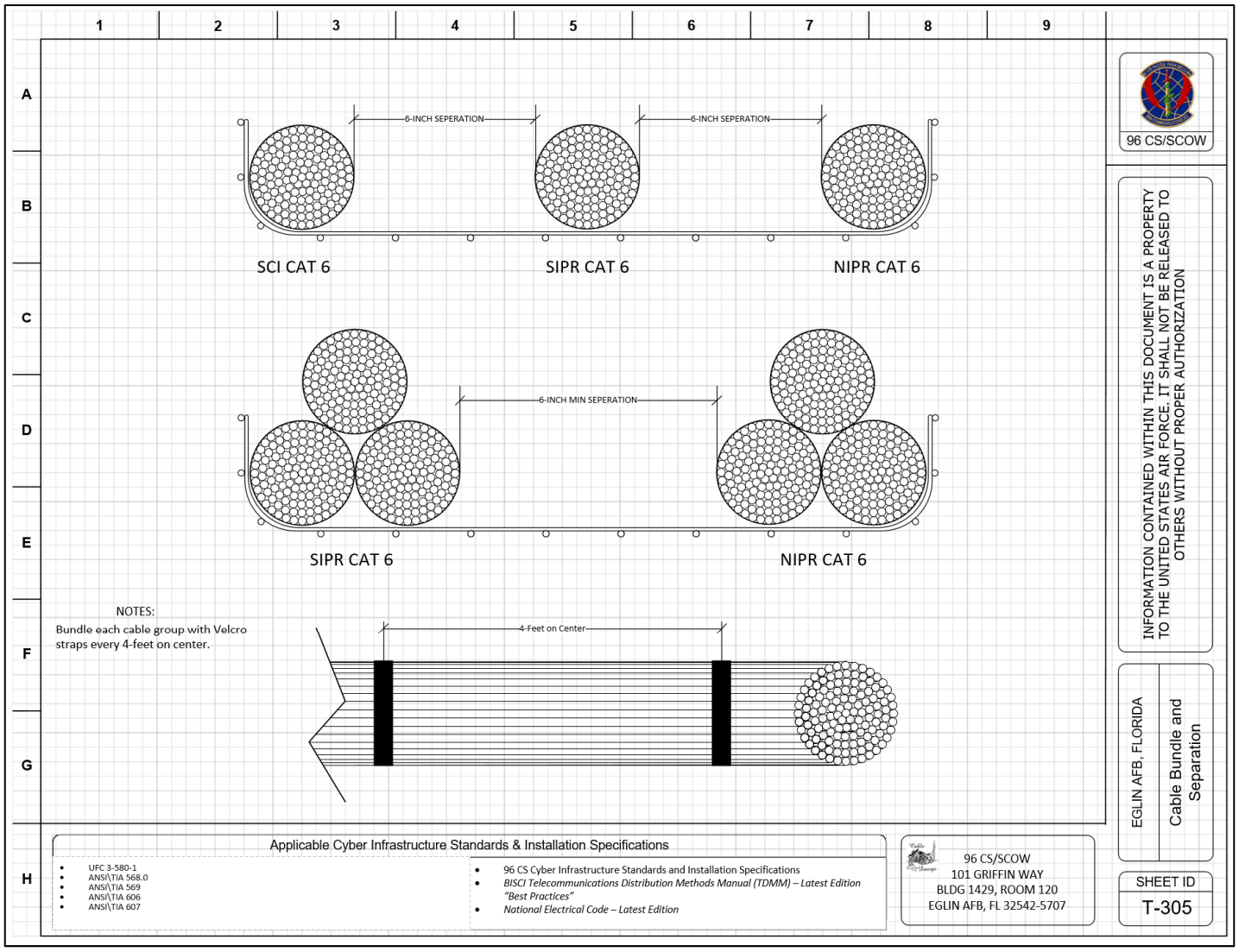
6-INCH SEPERATION
6-INCH SEPERATION
SCI CAT 6
SIPR CAT 6
NIPR CAT 6
6-INCH MIN SEPERATION
SIPR CAT 6
NIPR CAT 6
NOTES:
Bundle each cable group with Velcro straps every 4-feet on center.
4-Feet on Center
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Cable Bundle and Separation
Applicable Cyber Infrastructure Standards & Installation Specifications
UFC 3-580-1
ANSI\TIA 568.0
ANSI\TIA 569
ANSI\TIA 606
ANSI\TIA 607
96 CS Cyber Infrastructure Standards and Installation Specifications
BISCI Telecommunications Distribution Methods Manual (TDMM) – Latest Edition
"Best Practices"
National Electrical Code – Latest Edition
96 CS/SCOW
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BLDG 1429, ROOM 120
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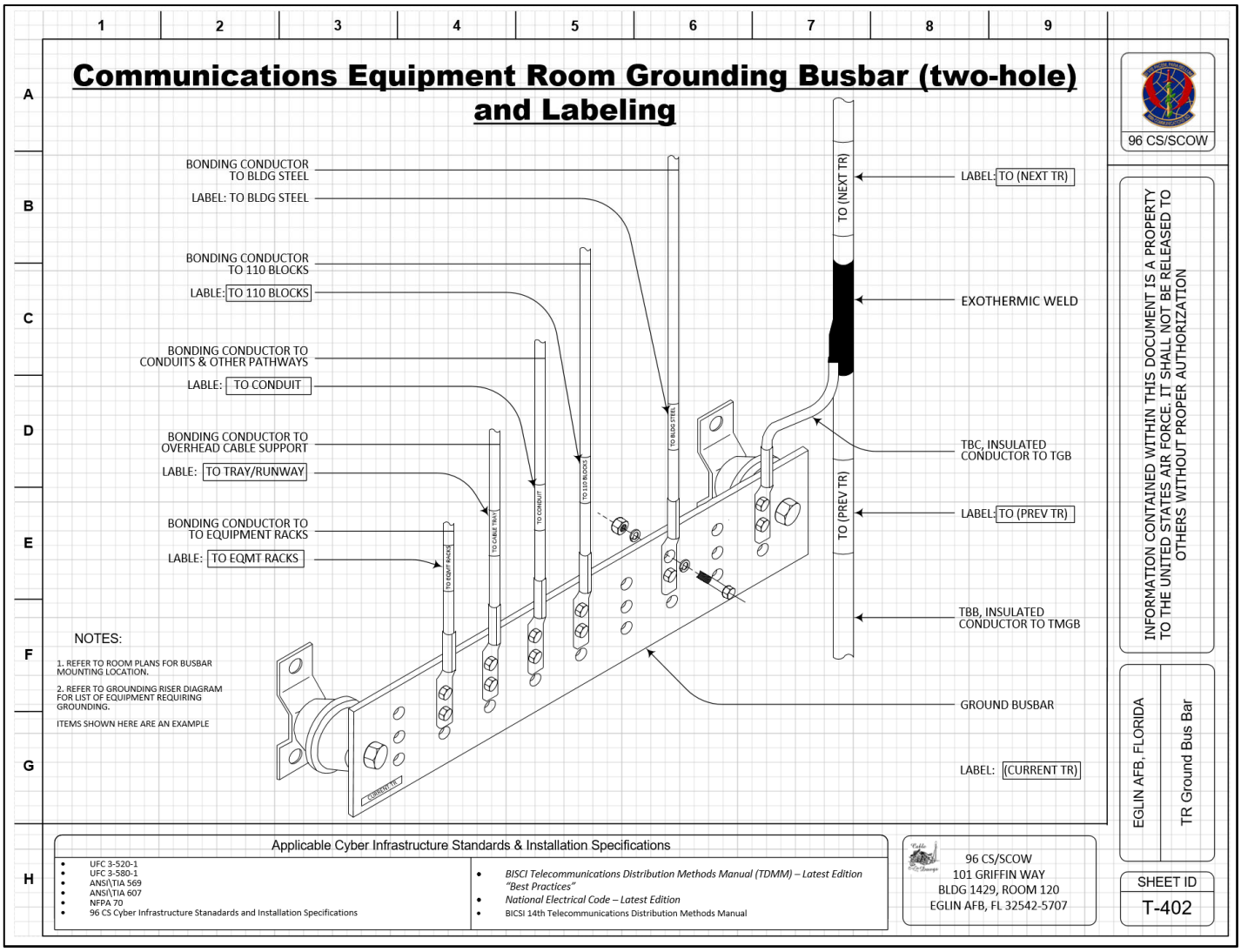
SHEET ID
T-305


Communications Equipment Room Grounding Busbar (two-hole) and Labeling
BONDING CONDUCTOR TO BLDG STEEL
LABEL: TO BLDG STEEL
BONDING CONDUCTOR TO 110 BLOCKS
LABLE: TO 110 BLOCKS
BONDING CONDUCTOR TO CONDUITS & OTHER PATHWAYS
LABLE: TO CONDUIT
BONDING CONDUCTOR TO OVERHEAD CABLE SUPPORT
LABLE: TO TRAY/RUNWAY
BONDING CONDUCTOR TO TO EQUIPMENT RACKS
LABLE: TO EQMT RACKS
TO (NEXT TR)
TO (PREV TR)
LABEL: TO (NEXT TR)
EXOTHERMIC WELD
TBC, INSULATED CONDUCTOR TO TGB
LABEL: TO (PREV TR)
TBB, INSULATED CONDUCTOR TO TMGB
GROUND BUSBAR
LABEL: (CURRENT TR)
NOTES:
1. REFER TO ROOM PLANS FOR BUSBAR MOUNTING LOCATION.
2. REFER TO GROUNDING RISER DIAGRAM FOR LIST OF EQUIPMENT REQUIRING GROUNDING.
ITEMS SHOWN HERE ARE AN EXAMPLE
Applicable Cyber Infrastructure Standards & Installation Specifications
UFC 3-520-1
UFC 3-580-1
ANSI\TIA 569
ANSI\TIA 607
NFPA 70
96 CS Cyber Infrastructure Stanadards and Installation Specifications
BISCI Telecommunications Distribution Methods Manual (TDMM) – Latest Edition "Best Practices"
National Electrical Code – Latest Edition
BICSI 14th Telecommunications Distribution Methods Manual
96 CS/SCOW
101 GRIFFIN WAY
BLDG 1429, ROOM 120
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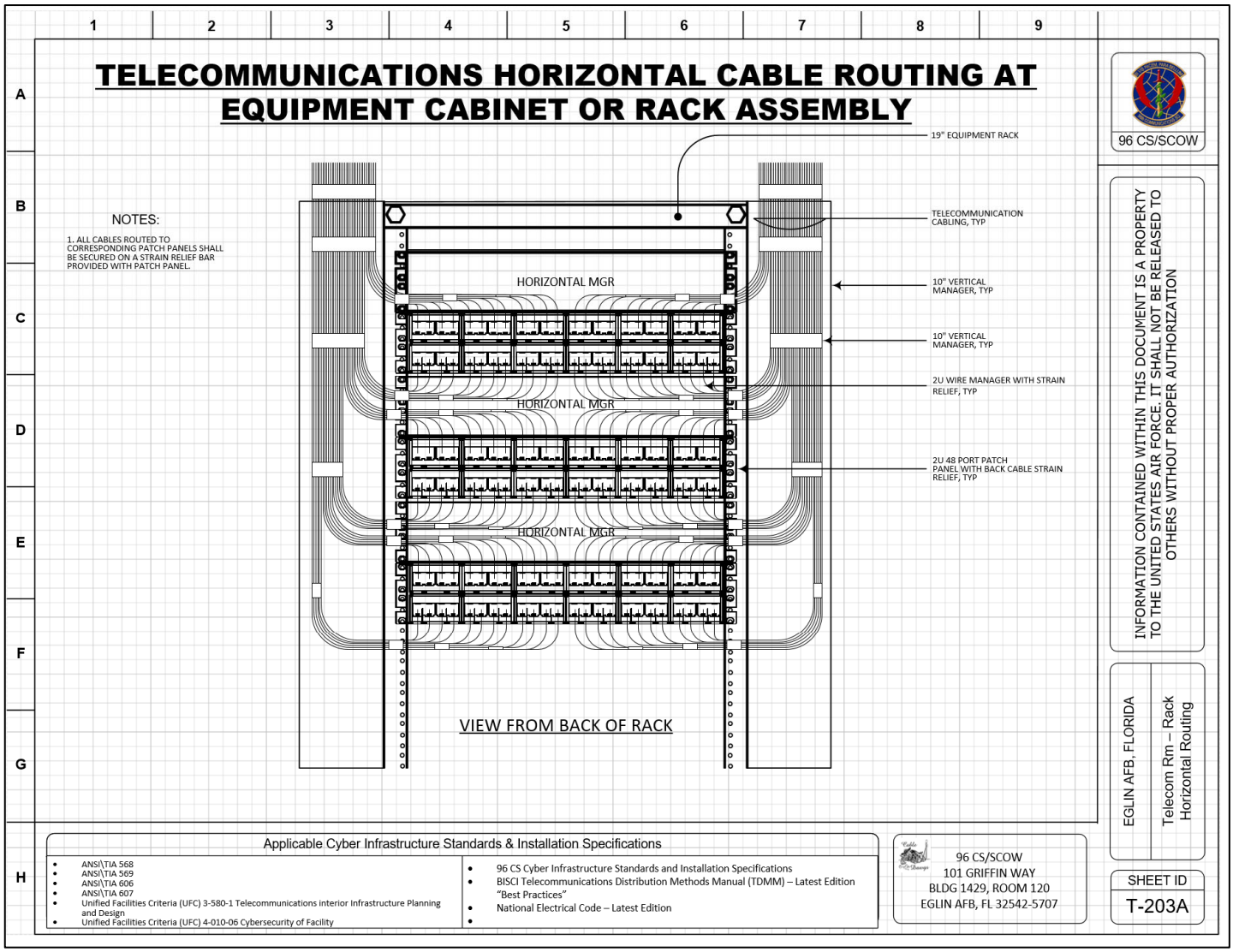
EGLIN AFB, FLORIDA
TR Ground Bus Bar
SHEET ID
T-402


TELECOMMUNICATIONS HORIZONTAL CABLE ROUTING AT EQUIPMENT CABINET OR RACK ASSEMBLY
NOTES:
1. ALL CABLES ROUTED TO CORRESPONDING PATCH PANELS SHALL BE SECURED ON A STRAIN RELIEF BAR PROVIDED WITH PATCH PANEL.
19" EQUIPMENT RACK
TELECOMMUNICATION CABLING, TYP
10" VERTICAL MANAGER, TYP
10" VERTICAL MANAGER, TYP
2U WIRE MANAGER WITH STRAIN RELIEF, TYP
2U 48 PORT PATCH PANEL WITH BACK CABLE STRAIN RELIEF, TYP
HORIZONTAL MGR
HORIZONTAL MGR
HORIZONTAL MGR
VIEW FROM BACK OF RACK
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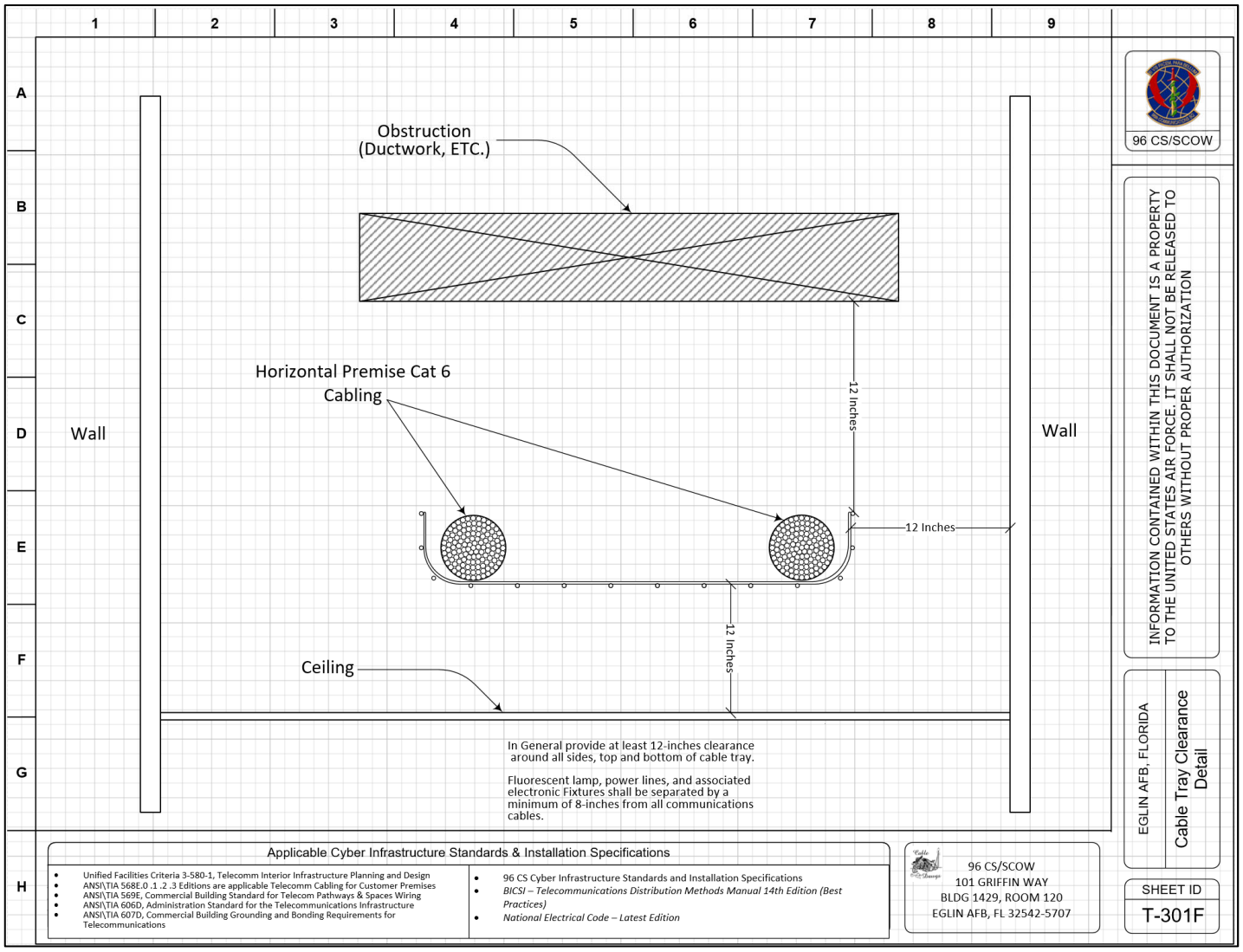
Telecom Rm – Rack Horizontal Routing
SHEET ID
T-203A
Applicable Cyber Infrastructure Standards & Installation Specifications
ANSI\TIA 568
ANSI\TIA 569
ANSI\TIA 606
ANSI\TIA 607
Unified Facilities Criteria (UFC) 3-580-1 Telecommunications interior Infrastructure Planning and Design
Unified Facilities Criteria (UFC) 4-010-06 Cybersecurity of Facility
96 CS Cyber Infrastructure Standards and Installation Specifications
BISCI Telecommunications Distribution Methods Manual (TDMM) – Latest Edition "Best Practices"
National Electrical Code – Latest Edition
96 CS/SCOW
101 GRIFFIN WAY
BLDG 1429, ROOM 120
EGLIN AFB, FL 32542-5707


Obstruction
(Ductwork, ETC.)
Horizontal Premise Cat 6
Cabling
Wall
Wall
12 Inches
12 Inches
12 Inches
Ceiling
In General provide at least 12-inches clearance around all sides, top and bottom of cable tray.
Fluorescent lamp, power lines, and associated electronic Fixtures shall be separated by a minimum of 8-inches from all communications cables.
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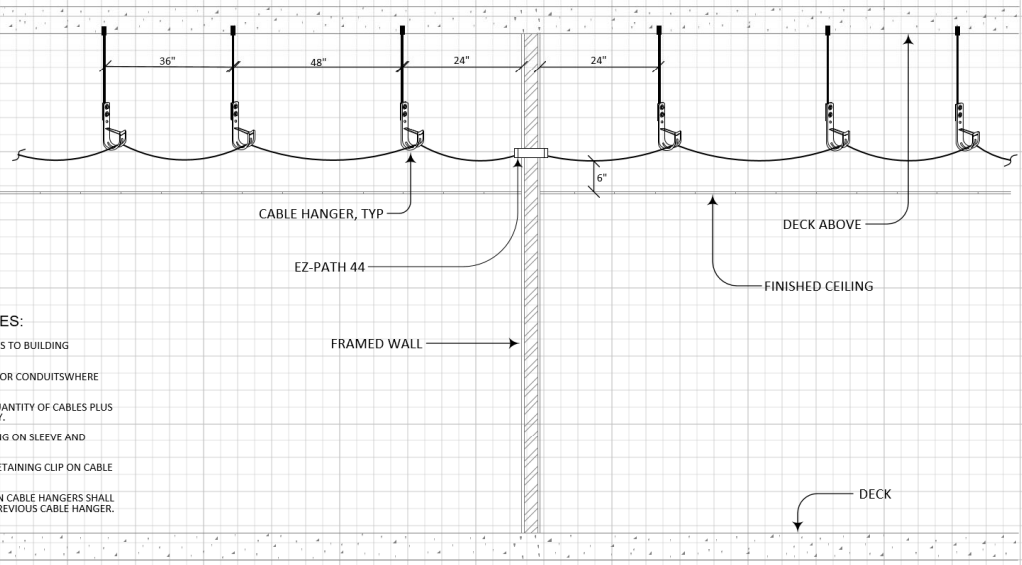
EGLIN AFB, FLORIDA
Cable Tray Clearance Detail
Applicable Cyber Infrastructure Standards & Installation Specifications
Unified Facilities Criteria 3-580-1, Telecomm Interior Infrastructure Planning and Design
ANSI\TIA 568E.0 .1 .2 .3 Editions are applicable Telecomm Cabling for Customer Premises
ANSI\TIA 569E, Commercial Building Standard for Telecom Pathways & Spaces Wiring
ANSI\TIA 606D, Administration Standard for the Telecommunications Infrastructure
ANSI\TIA 607D, Commercial Building Grounding and Bonding Requirements for Telecommunications
96 CS Cyber Infrastructure Standards and Installation Specifications
BICSI – Telecommunications Distribution Methods Manual 14th Edition (Best Practices)
National Electrical Code – Latest Edition
96 CS/SCOW
101 GRIFFIN WAY
BLDG 1429, ROOM 120
EGLIN AFB, FL 32542-5707
SHEET ID
T-301F

TELECOMMUNICATIONS CABLE ROUTING DETAIL USING J-HOOKS SUPPORT THROUGH FULL HEIGHT PARTITIONS



NOTES:

1. DO NOT TIE CABLES TO BUILDING STRUCTURES.
2. PROVIDE SLEEVES OR CONDUITSWHERE REQUIRED.
3. SIZE BASED ON QUANTITY OF CABLES PLUS 40% SPARE CAPACITY.
4. PROOVIDE BUSHING ON SLEEVE AND COONDUIT ENDS.
5. PROVIDE CABLE RETAINING CLIP ON CABLE HANGERS.
6. SPACING BETWEEN CABLE HANGERS SHALL NOT BE EQUAL TO PREVIOUS CABLE HANGER.

96 CS/SCOW

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Cable Routing – Full Height Wall

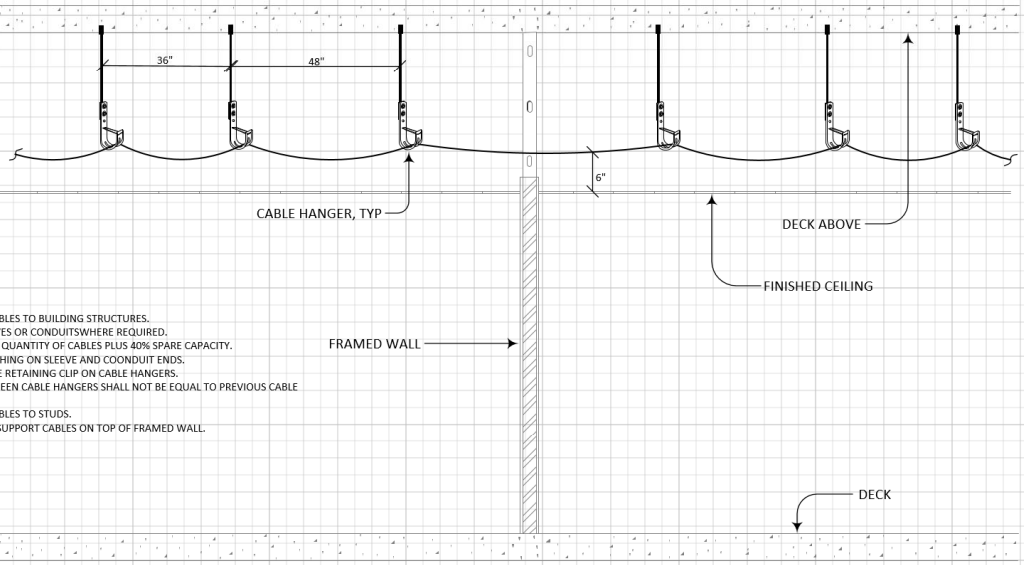
Applicable Cyber Infrastructure Standards & Installation Specifications

- Unified Facilities Criteria 3-580-1, Telecomm Interior Infrastructure Planning and Design
- ANSI\TIA 568E.0 .1 .2 .3 Editions are applicable Telecomm Cabling for Customer Premises
- ANSI\TIA 569E, Commercial Building Standard for Telecom Pathways & Spaces Wiring
- ANSI\TIA 606D, Administration Standard for the Telecommunications Infrastructure
- ANSI\TIA 607D, Commercial Building Grounding and Bonding Requirements for Telecommunications
- 96 CS Cyber Infrastructure Standards and Installation Specifications
- BICSI – Telecommunications Distribution Methods Manual 14th Edition (Best Practices)
- National Electrical Code – Latest Edition

96 CS/SCOW
101 GRIFFIN WAY
BLDG 1429, ROOM 120
EGLIN AFB, FL 32542-5707

SHEET ID
T-302

TELECOMMUNICATIONS CABLE ROUTING DETAIL USING J-HOOKS SUPPORT FOR LOW PROFILE PARTITIONS



NOTES:

1. DO NOT TIE CABLES TO BUILDING STRUCTURES.
2. PROVIDE SLEEVES OR CONDUITSWHERE REQUIRED.
3. SIZE BASED ON QUANTITY OF CABLES PLUS 40% SPARE CAPACITY.
4. PROOVIDE BUSHING ON SLEEVE AND COONDUIT ENDS.
5. PROVIDE CABLE RETAINING CLIP ON CABLE HANGERS.
6. SPACING BETWEEN CABLE HANGERS SHALL NOT BE EQUAL TO PREVIOUS CABLE HANGER.
7. DO NOT TIE CABLES TO STUDS.
8. DO NOT REST/SUPPORT CABLES ON TOP OF FRAMED WALL.

96 CS/SCOW

EGLIN AFB, FLORIDA

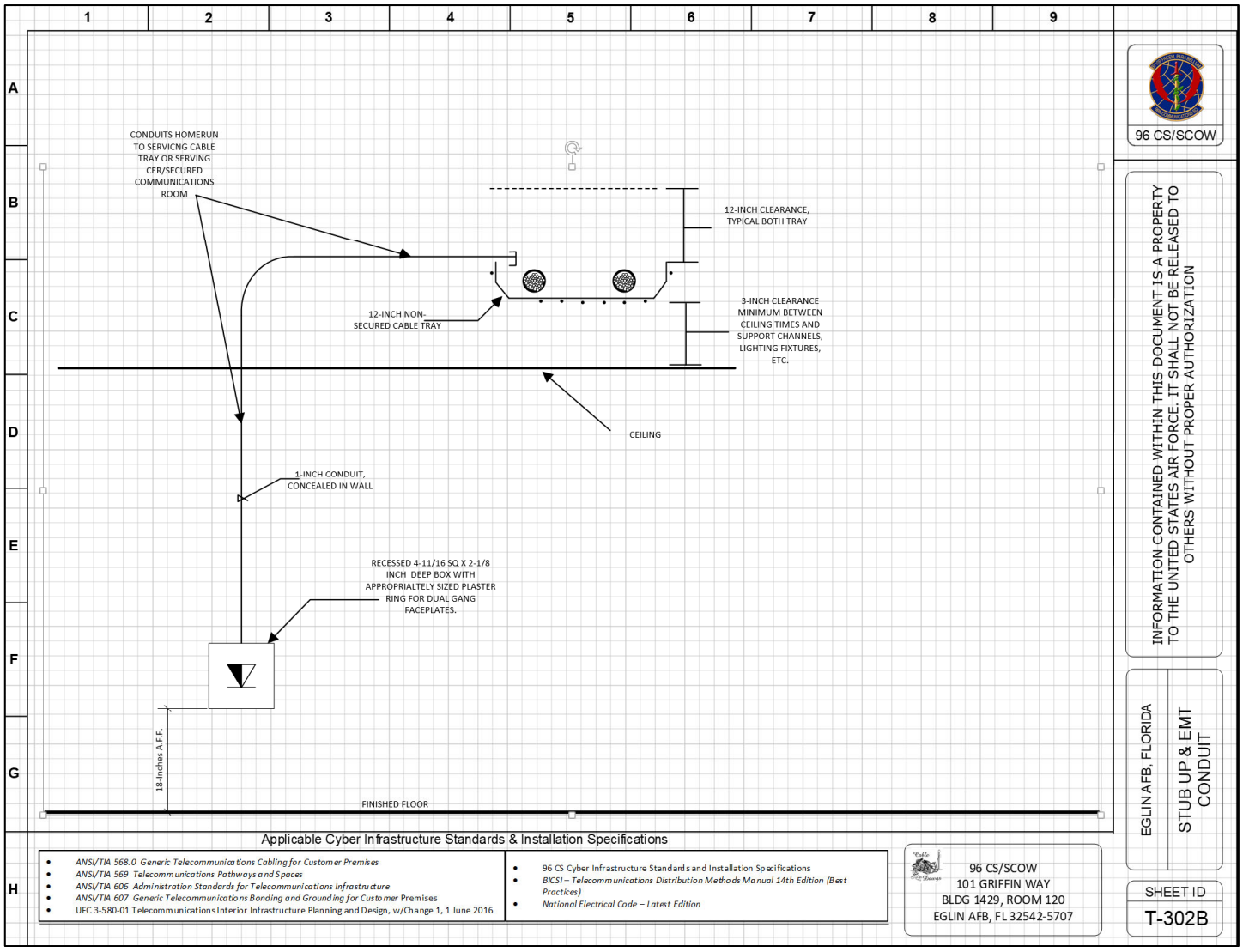
Cable Routing – Partition Wall

SHEET ID T-302A

Applicable Cyber Infrastructure Standards & Installation Specifications

- Unified Facilities Criteria 3-580-1, Telecomm Interior Infrastructure Planning and Design
- ANSI\TIA 568E.0 .1 .2 .3 Editions are applicable Telecomm Cabling for Customer Premises
- ANSI\TIA 569E, Commercial Building Standard for Telecom Pathways & Spaces Wiring
- ANSI\TIA 606D, Administration Standard for the Telecommunications Infrastructure
- ANSI\TIA 607D, Commercial Building Grounding and Bonding Requirements for Telecommunications
- 96 CS Cyber Infrastructure Standards and Installation Specifications
- BICSI – Telecommunications Distribution Methods Manual 14th Edition (Best Practices)
- National Electrical Code – Latest Edition

96 CS/SCOW
101 GRIFFIN WAY
BLDG 1429, ROOM 120
EGLIN AFB, FL 32542-5707


CONDUITS HOMERUN TO SERVICNG CABLE TRAY OR SERVING CER/SECURED COMMUNICATIONS ROOM
12-INCH CLEARANCE, TYPICAL BOTH TRAY
12-INCH NON-SECURED CABLE TRAY
3-INCH CLEARANCE MINIMUM BETWEEN CEILING TIMES AND SUPPORT CHANNELS, LIGHTING FIXTURES, ETC.
CEILING
1-INCH CONDUIT, CONCEALED IN WALL
RECESSED 4-11/16 SQ X 2-1/8 INCH DEEP BOX WITH APPROPRIALTELY SIZED PLASTER RING FOR DUAL GANG FACEPLATES.
18-Inches A.F.F.
FINISHED FLOOR
Applicable Cyber Infrastructure Standards & Installation Specifications
ANSI/TIA 568.0 Generic Telecommunications Cabling for Customer Premises
ANSI/TIA 569 Telecommunications Pathways and Spaces
ANSI/TIA 606 Administration Standards for Telecommunications Infrastructure
ANSI/TIA 607 Generic Telecommunications Bonding and Grounding for Customer Premises
UFC 3-580-01 Telecommunications Interior Infrastructure Planning and Design, w/Change 1, 1 June 2016
96 CS Cyber Infrastructure Standards and Installation Specifications
BICSI – Telecommunications Distribution Methods Manual 14th Edition (Best Practices)
National Electrical Code – Latest Edition
96 CS/SCOW
101 GRIFFIN WAY
BLDG 1429, ROOM 120
EGLIN AFB, FL 32542-5707
96 CS/SCOW
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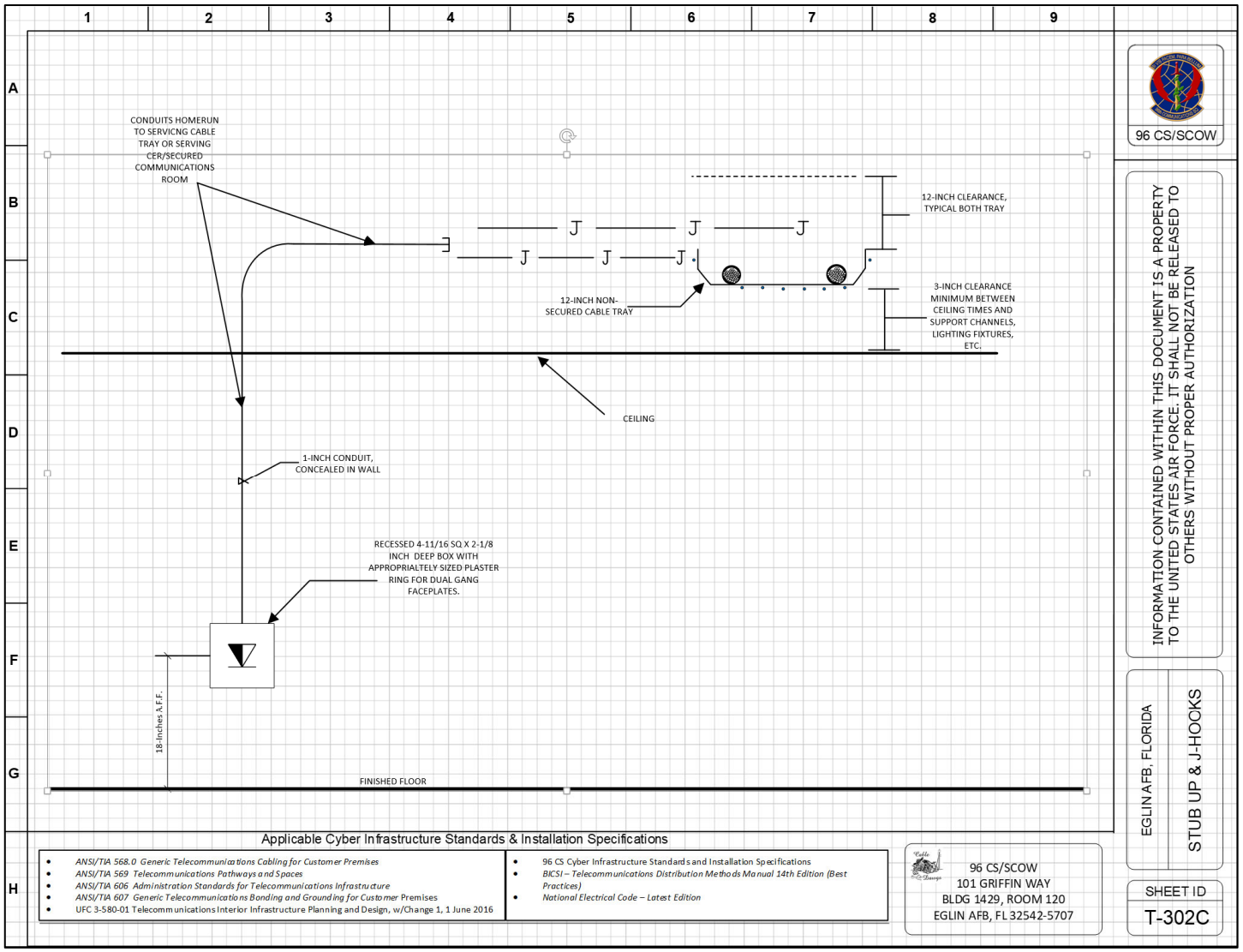
STUB UP & EMT CONDUIT
SHEET ID
T-302B


CONDUITS HOMERUN TO SERVICNG CABLE TRAY OR SERVING CER/SECURED COMMUNICATIONS ROOM
12-INCH CLEARANCE, TYPICAL BOTH TRAY
12-INCH NON-SECURED CABLE TRAY
3-INCH CLEARANCE MINIMUM BETWEEN CEILING TIMES AND SUPPORT CHANNELS, LIGHTING FIXTURES, ETC.
CEILING
1-INCH CONDUIT, CONCEALED IN WALL
RECESSED 4-11/16 SQ X 2-1/8 INCH DEEP BOX WITH APPROPRIALTELY SIZED PLASTER RING FOR DUAL GANG FACEPLATES.
18 Inches A.F.F.
FINISHED FLOOR
96 CS/SCOW
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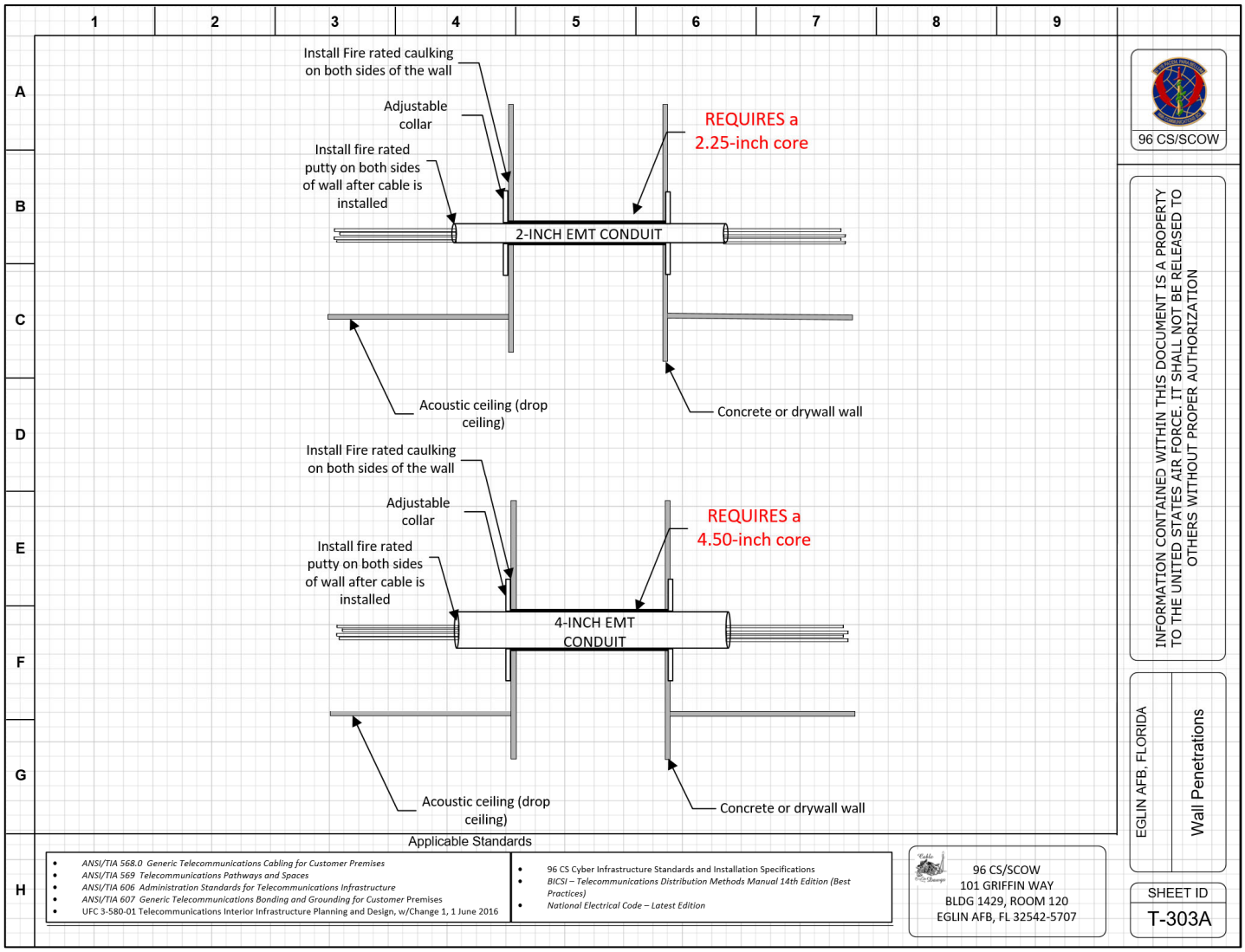
EGLIN AFB, FLORIDA
STUB UP & J-HOOKS
Applicable Cyber Infrastructure Standards & Installation Specifications
ANSI/TIA 568.0 Generic Telecommunications Cabling for Customer Premises
ANSI/TIA 569 Telecommunications Pathways and Spaces
ANSI/TIA 606 Administration Standards for Telecommunications Infrastructure
ANSI/TIA 607 Generic Telecommunications Bonding and Grounding for Customer Premises
UFC 3-580-01 Telecommunications Interior Infrastructure Planning and Design, w/Change 1, 1 June 2016
96 CS Cyber Infrastructure Standards and Installation Specifications
BICSI – Telecommunications Distribution Methods Manual 14th Edition (Best Practices)
National Electrical Code – Latest Edition
96 CS/SCOW
101 GRIFFIN WAY
BLDG 1429, ROOM 120
EGLIN AFB, FL 32542-5707
SHEET ID
T-302C


Install Fire rated caulking on both sides of the wall
Adjustable collar
Install fire rated putty on both sides of wall after cable is installed
REQUIRES a 2.25-inch core
2-INCH EMT CONDUIT
Acoustic ceiling (drop ceiling)
Concrete or drywall wall
Install Fire rated caulking on both sides of the wall
Adjustable collar
Install fire rated putty on both sides of wall after cable is installed
REQUIRES a 4.50-inch core
4-INCH EMT CONDUIT
Acoustic ceiling (drop ceiling)
Concrete or drywall wall
Applicable Standards
ANSI/TIA 568.0 Generic Telecommunications Cabling for Customer Premises
ANSI/TIA 569 Telecommunications Pathways and Spaces
ANSI/TIA 606 Administration Standards for Telecommunications Infrastructure
ANSI/TIA 607 Generic Telecommunications Bonding and Grounding for Customer Premises
UFC 3-580-01 Telecommunications Interior Infrastructure Planning and Design, w/Change 1, 1 June 2016
96 CS Cyber Infrastructure Standards and Installation Specifications
BICSI – Telecommunications Distribution Methods Manual 14th Edition (Best Practices)
National Electrical Code – Latest Edition
96 CS/SCOW
101 GRIFFIN WAY
BLDG 1429, ROOM 120
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96 CS/SCOW
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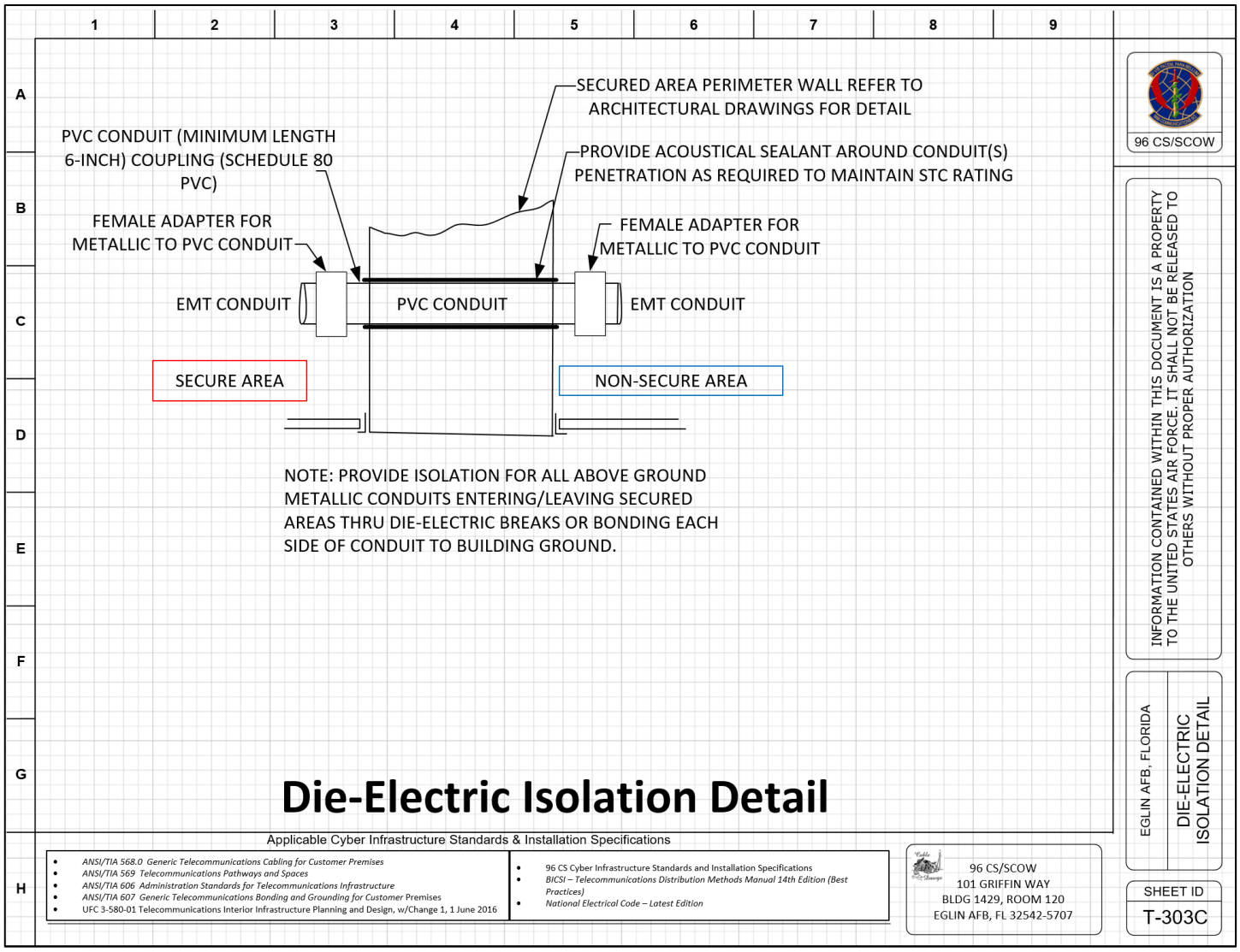
EGLIN AFB, FLORIDA
Wall Penetrations
SHEET ID
T-303A


SECURED AREA PERIMETER WALL REFER TO ARCHITECTURAL DRAWINGS FOR DETAIL
PVC CONDUIT (MINIMUM LENGTH 6-INCH) COUPLING (SCHEDULE 80 PVC)
PROVIDE ACOUSTICAL SEALANT AROUND CONDUIT(S) PENETRATION AS REQUIRED TO MAINTAIN STC RATING
FEMALE ADAPTER FOR METALLIC TO PVC CONDUIT
FEMALE ADAPTER FOR METALLIC TO PVC CONDUIT
EMT CONDUIT
PVC CONDUIT
EMT CONDUIT
SECURE AREA
NON-SECURE AREA
NOTE: PROVIDE ISOLATION FOR ALL ABOVE GROUND METALLIC CONDUITS ENTERING/LEAVING SECURED AREAS THRU DIE-ELECTRIC BREAKS OR BONDING EACH SIDE OF CONDUIT TO BUILDING GROUND.
96 CS/SCOW
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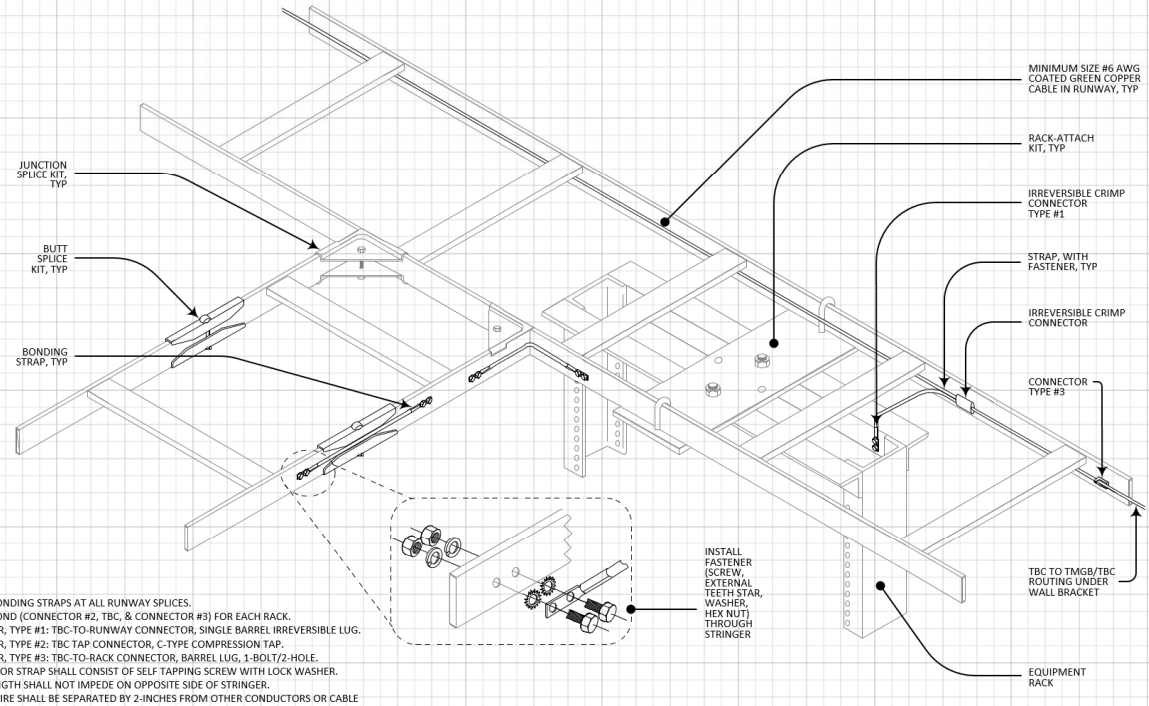
DIE-ELECTRIC ISOLATION DETAIL
Die-Electric Isolation Detail
Applicable Cyber Infrastructure Standards & Installation Specifications
ANSI/TIA 568.0 Generic Telecommunications Cabling for Customer Premises
ANSI/TIA 569 Telecommunications Pathways and Spaces
ANSI/TIA 606 Administration Standards for Telecommunications Infrastructure
ANSI/TIA 607 Generic Telecommunications Bonding and Grounding for Customer Premises
UFC 3-580-01 Telecommunications Interior Infrastructure Planning and Design, w/Change 1, 1 June 2016
96 CS Cyber Infrastructure Standards and Installation Specifications
BICSI – Telecommunications Distribution Methods Manual 14th Edition (Best Practices)
National Electrical Code – Latest Edition
96 CS/SCOW
101 GRIFFIN WAY
BLDG 1429, ROOM 120
EGLIN AFB, FL 32542-5707
SHEET ID
T-303C

TELECOMMUNICATIONS CABLE RUNWAY BONDING



NOTES:
1. PROVIDE BONDING STRAPS AT ALL RUNWAY SPLICES.
2. PROVIDE BOND (CONNECTOR #2, TBC, & CONNECTOR #3) FOR EACH RACK.
3. CONNECTOR, TYPE #1: TBC-TO-RUNWAY CONNECTOR, SINGLE BARREL IRREVERSIBLE LUG.
4. CONNECTOR, TYPE #2: TBC TAP CONNECTOR, C-TYPE COMPRESSION TAP.
5. CONNECTOR, TYPE #3: TBC-TO-RACK CONNECTOR, BARREL LUG, 1-BOLT/2-HOLE.
6. FASTENER FOR STRAP SHALL CONSIST OF SELF TAPPING SCREW WITH LOCK WASHER. FASTENER LENGTH SHALL NOT IMPEDE ON OPPOSITE SIDE OF STRINGER.
7. GROUND WIRE SHALL BE SEPARATED BY 2-INCHES FROM OTHER CONDUCTORS OR CABLE GROUPS OR INSTALLED UNDER OR OFF THE SIDE OF THE CABLE TRAY.
8. TAG OR LABEL ALL GROUND CONNECTIONS IW ANSI/TIA 606 AND ANSI/TIA 607

Applicable Cyber Infrastructure Standards & Installation Specifications

- Unified Facilities Criteria 3-580-1, Telecomm Interior Infrastructure Planning and Design
- Unified Facilities Criteria 3-520-1, Interior Electrical Systems
- ANSI\TIA 569E, Commercial Building Standard for Telecom Pathways & Spaces Wiring
- ANSI\TIA 606D, Administration Standard for the Telecommunications Infrastructure
- ANSI\TIA 607D, Commercial Building Grounding and Bonding Requirements for Telecommunications
- 96 CS Cyber Infrastructure Standards and Installation Specifications
- BICSI – Telecommunications Distribution Methods Manual 14th Edition (Best Practices)
- National Electrical Code – Latest Edition

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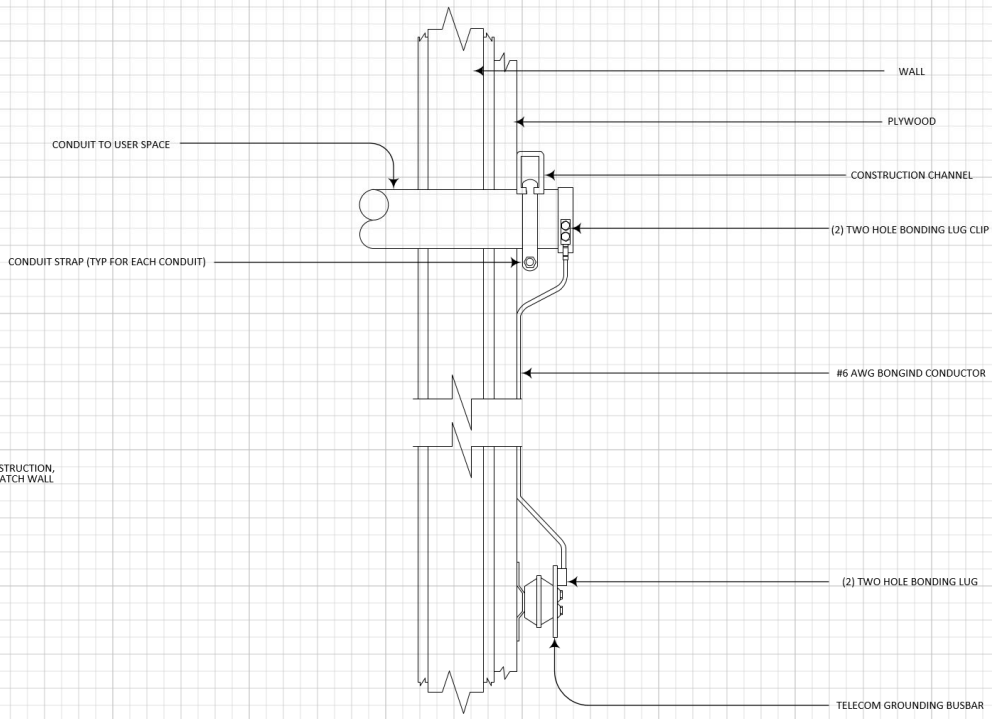
EGLIN AFB, FLORIDA

Cable Runway Section Bonding

SHEET ID
T-405

TELECOMMUNICATIONS CONDUIT BONDING



NOTES:

1. FOR FIRE RATED WALL CONSTRUCTION, PROVIDE FIRESTOPPING TO MATCH WALL RATING.

96 CS/SCOW

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EGLIN AFB, FLORIDA

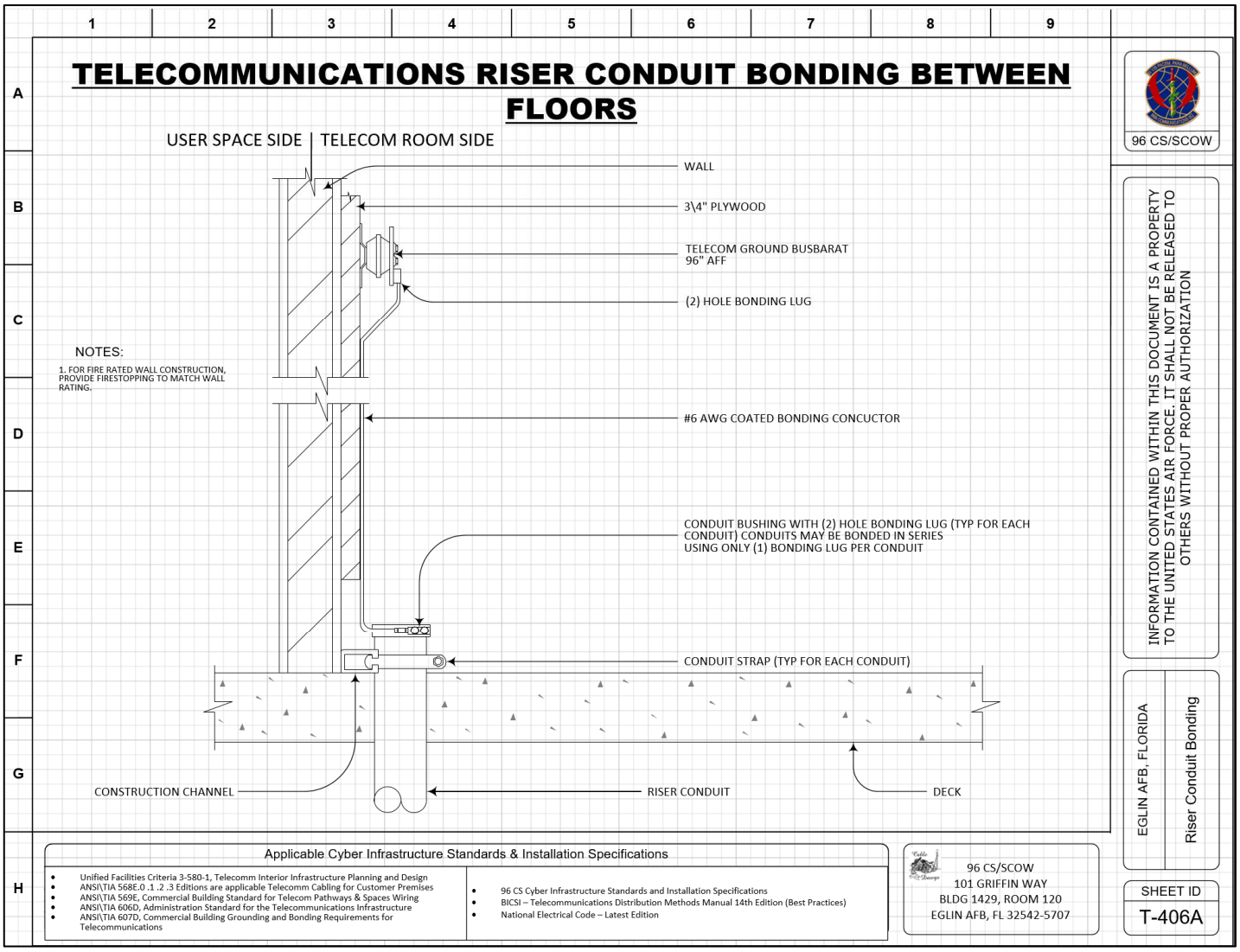
Conduit Bonding

Applicable Cyber Infrastructure Standards & Installation Specifications

- Unified Facilities Criteria 3-580-1, Telecomm Interior Infrastructure Planning and Design
- ANSI\TIA 569E, Commercial Building Standard for Telecom Pathways & Spaces Wiring
- ANSI\TIA 606D, Administration Standard for the Telecommunications Infrastructure
- ANSI\TIA 607D, Commercial Building Grounding and Bonding Requirements for Telecommunications
- 96 CS Cyber Infrastructure Standards and Installation Specifications
- BICSI – Telecommunications Distribution Methods Manual 14th Edition (Best Practices)
- National Electrical Code – Latest Edition

96 CS/SCOW
101 GRIFFIN WAY
BLDG 1429, ROOM 120
EGLIN AFB, FL 32542-5707

SHEET ID
T-406


TELECOMMUNICATIONS RISER CONDUIT BONDING BETWEEN FLOORS
USER SPACE SIDE
TELECOM ROOM SIDE
WALL
3\4" PLYWOOD
TELECOM GROUND BUSBARAT 96" AFF
(2) HOLE BONDING LUG
NOTES:
1. FOR FIRE RATED WALL CONSTRUCTION, PROVIDE FIRESTOPPING TO MATCH WALL RATING.
#6 AWG COATED BONDING CONCUCTOR
CONDUIT BUSHING WITH (2) HOLE BONDING LUG (TYP FOR EACH CONDUIT) CONDUITS MAY BE BONDED IN SERIES USING ONLY (1) BONDING LUG PER CONDUIT
CONDUIT STRAP (TYP FOR EACH CONDUIT)
CONSTRUCTION CHANNEL
RISER CONDUIT
DECK
96 CS/SCOW
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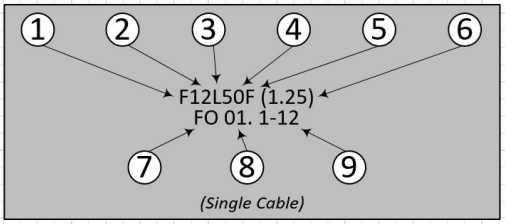
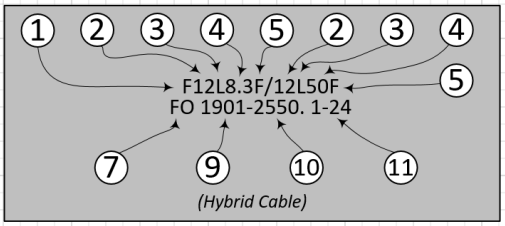
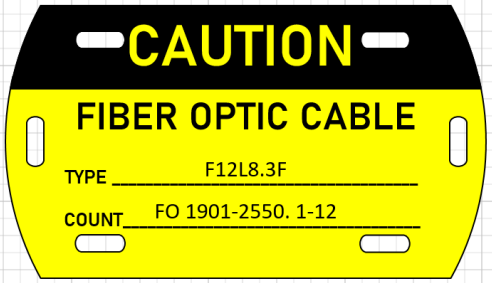
EGLIN AFB, FLORIDA
Riser Conduit Bonding
Applicable Cyber Infrastructure Standards & Installation Specifications
Unified Facilities Criteria 3-580-1, Telecomm Interior Infrastructure Planning and Design
ANSI\TIA 568E.0 .1 .2 .3 Editions are applicable Telecomm Cabling for Customer Premises
ANSI\TIA 569E, Commercial Building Standard for Telecom Pathways & Spaces Wiring
ANSI\TIA 606D, Administration Standard for the Telecommunications Infrastructure
ANSI\TIA 607D, Commercial Building Grounding and Bonding Requirements for Telecommunications
96 CS Cyber Infrastructure Standards and Installation Specifications
BICSI – Telecommunications Distribution Methods Manual 14th Edition (Best Practices)
National Electrical Code – Latest Edition
96 CS/SCOW
101 GRIFFIN WAY
BLDG 1429, ROOM 120
EGLIN AFB, FL 32542-5707
SHEET ID
T-406A

FIBER CABLE TAG INFORMATION







Fiber Optic Cable

1	-	P = Plenum (Else Leave Blank) R = Riser Rated (Else Leave Blank) F = Indoor/Outdoor
2	-	12 = 12 Strand Fiber Cable (Range is 1-288)
3	-	L = Loose Tube Buffer T = Tight Tube Buffer
4	-	Core Size in Microns Multimode = 50 and 62.5 (UNKNOWN = MM) Singlemode = 8.3, 9.2 or 10 (UNKNOWN = SM) (Cladding is assumed to be 125um, If different include after core size, separated with slash "/")
5	-	F = Filled Core (leave blank for Air Core)
6	-	(1.25) = Cable installed in 1.25" I.D. innerduct 1 = Cable installed in 1" I.D. innerduct Blank = No innerduct
7	-	FO – Fiber Optic Cable
8	-	##### - Cable Number (Range is 01 – 99999)
9	-	#### - Source Building Number
10	-	#### - Destination Building Number
11	-	1 – 12 = Conductor Count

CABLE NUMBERS WILL EITHER USE A SEQUENTIAL NUMBERING PATTERN OR SOURCE AND DESTINATION BUILDING NUMBERS

IF THE BUILDING NUMBER METHOD IS USED, THE SOURCE BUILDING WILL BE THE ITN AND DESTINATION WILL BE THE EBN (BACKBONE CABLES MAY USE EITHER ITN AS THE SOURCE BUILDING)

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EGLIN AFB, FLORIDA

Fiber Cable Tag Information

Applicable Cyber Infrastructure Standards & Installation Specifications

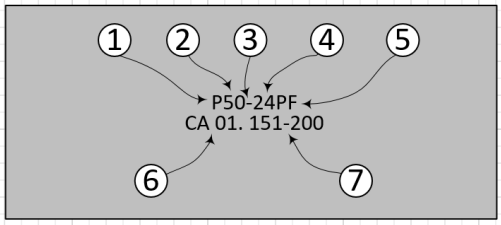
- Unified Facilities Criteria 3-580-1, Telecomm Interior Infrastructure Planning and Design
- ANSI\TIA 606D, Administration Standard for the Telecommunications Infrastructure
- 96 CS Cyber Infrastructure Standards and Installation Specifications
- BICSI – Telecommunications Distribution Methods Manual 14th Edition (Best Practices)
- National Electrical Code – Latest Edition

- Cables shall be label/tagged at ducts, Conduits, service loops and transition entrance and exit points throughout the cable pathway to clearly identify ISP/OSP circuits.

96 CS/SCOW
101 GRIFFIN WAY
BLDG 1429, ROOM 120
EGLIN AFB, FL 32542-5707

SHEET ID
T-501B

COPPER CABLE TAG INFORMATION



Central Office Copper Cable

1	-	Cable Outer Protection P = Plastic Sheath Cable PP = Double Layer Plastic Sheath Core Blank = Lead Sheath Cable A = ABAM Cable WA = Wire Armored Cable JP = Jute Protected Cable TA = Tape Armored Cable DTA = Double Tape Armored Cable
2	-	(Size) Number of Cable Pairs in Sheath (For Greater than 100 pairs Exclued "00"s when labeling cables)
3	-	"X" = 24 Pair (or less) Cables "-" = 25 pair (or greater) cables
4	-	Wire Gauge Size (19, 22, 24, or 26)
5	-	Conductor Protection PF = Plastic Insulated Filled Core Cable FF = Foam Insulated Filled Core Cable P = Plastic Insulated Air Core Cable
6	-	Cable Number (Two Numeric Digits) "CA" Optional
7	-	Inclusive Cable Count(s) (If pairs are Dead/Dead Ended/Abandoned they are on a separate line below and denoted with a plus sign "+" followed by an Alpha Character (Sequential if Multiples) a comma "," and the Inclusive pair count)

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EGLIN AFB, FLORIDA

Copper Cable Tag Information

Applicable Cyber Infrastructure Standards & Installation Specifications

- Unified Facilities Criteria 3-580-1, Telecomm Interior Infrastructure Planning and Design
- ANSI\TIA 606D, Administration Standard for the Telecommunications Infrastructure
- 96 CS Cyber Infrastructure Standards and Installation Specifications
- BICSI – Telecommunications Distribution Methods Manual 14th Edition (Best Practices)
- National Electrical Code – Latest Edition

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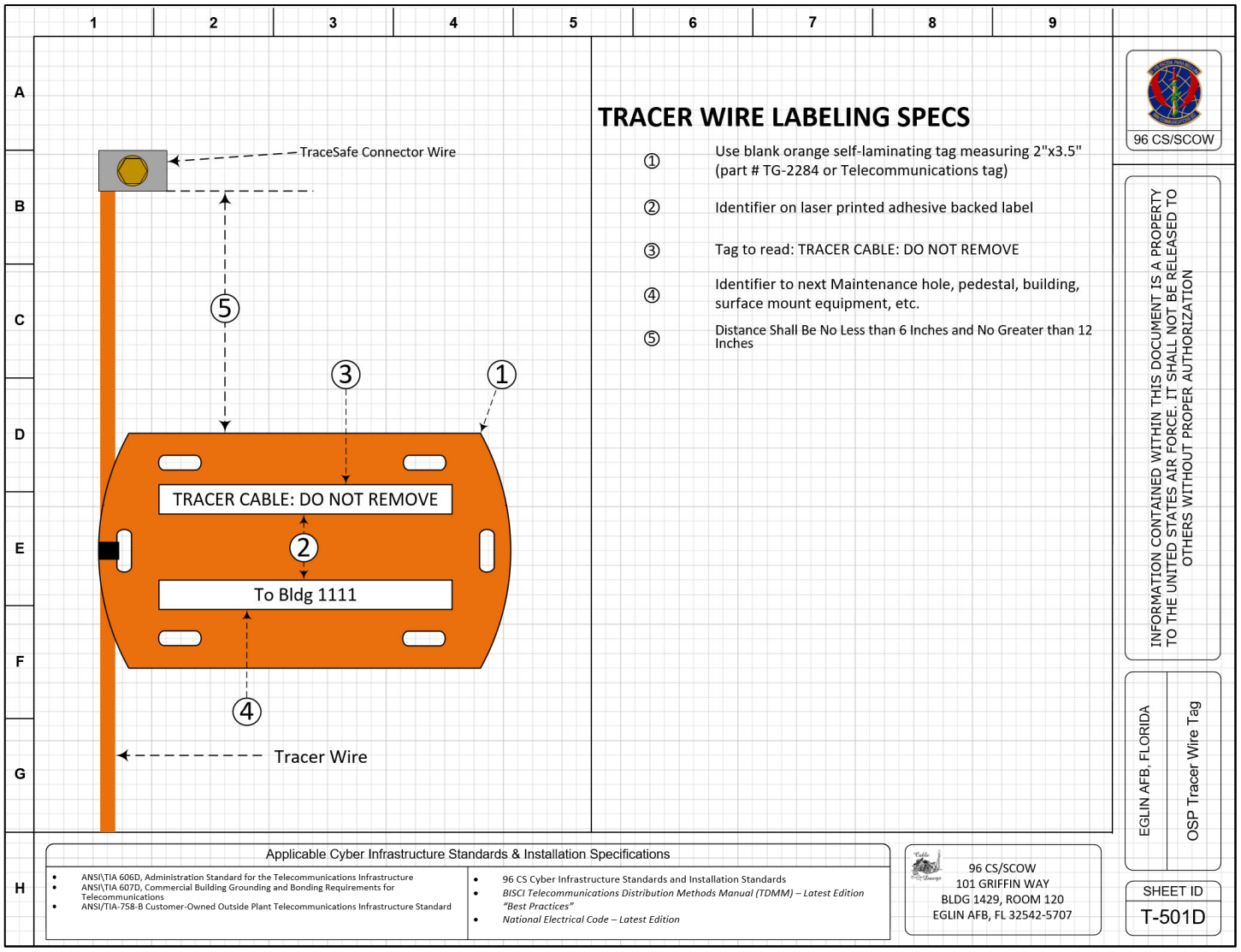
96 CS/SCOW
101 GRIFFIN WAY
BLDG 1429, ROOM 120
EGLIN AFB, FL 32542-5707

SHEET ID
T-501C



TRACER WIRE LABELING SPECS

① Use blank orange self-laminating tag measuring 2"x3.5" (part # TG-2284 or Telecommunications tag)

② Identifier on laser printed adhesive backed label

③ Tag to read: TRACER CABLE: DO NOT REMOVE

④ Identifier to next Maintenance hole, pedestal, building, surface mount equipment, etc.

⑤ Distance Shall Be No Less than 6 Inches and No Greater than 12 Inches

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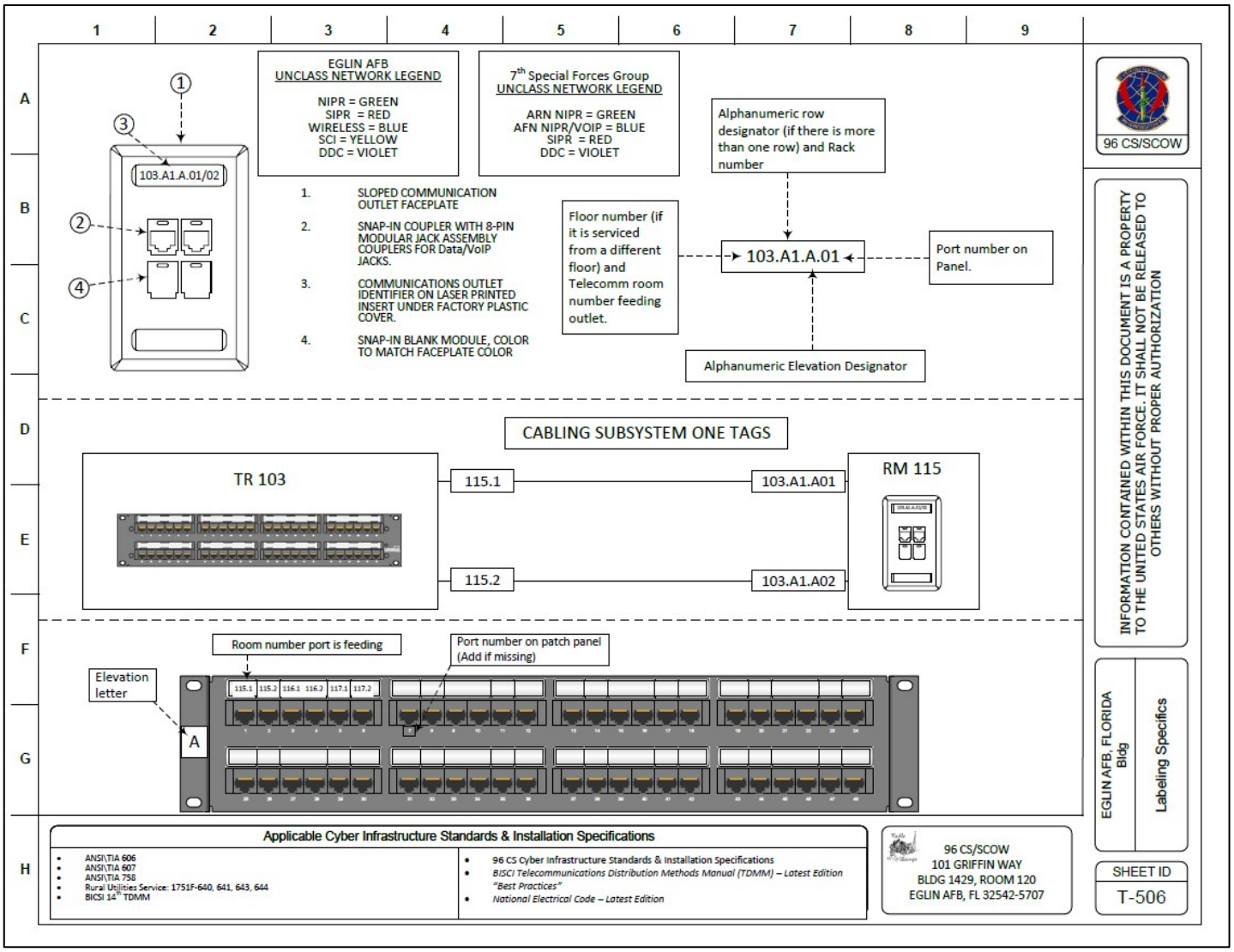
OSP Tracer Wire Tag

Applicable Cyber Infrastructure Standards & Installation Specifications

- ANSI\TIA 606D, Administration Standard for the Telecommunications Infrastructure
- ANSI\TIA 607D, Commercial Building Grounding and Bonding Requirements for Telecommunications
- ANSI/TIA-758-B Customer-Owned Outside Plant Telecommunications Infrastructure Standard
- 96 CS Cyber Infrastructure Standards and Installation Standards
- *BISCI Telecommunications Distribution Methods Manual (TDMM) – Latest Edition "Best Practices"*
- *National Electrical Code – Latest Edition*

96 CS/SCOW
101 GRIFFIN WAY
BLDG 1429, ROOM 120
EGLIN AFB, FL 32542-5707

SHEET ID
T-501D


EGLIN AFB
UNCLASS NETWORK LEGEND
NIPR = GREEN
SIPR = RED
WIRELESS = BLUE
SCI = YELLOW
DDC = VIOLET
7th Special Forces Group
UNCLASS NETWORK LEGEND
ARN NIPR = GREEN
AFN NIPR/VOIP = BLUE
SIPR = RED
DDC = VIOLET
103.A1.A.01/02
1. SLOPED COMMUNICATION OUTLET FACEPLATE
2. SNAP-IN COUPLER WITH 8-PIN MODULAR JACK ASSEMBLY COUPLERS FOR Data/VoIP JACKS.
3. COMMUNICATIONS OUTLET IDENTIFIER ON LASER PRINTED INSERT UNDER FACTORY PLASTIC COVER.
4. SNAP-IN BLANK MODULE, COLOR TO MATCH FACEPLATE COLOR
Alphanumeric row designator (if there is more than one row) and Rack number
Floor number (if it is serviced from a different floor) and Telecomm room number feeding outlet.
103.A1.A.01
Port number on Panel.
Alphanumeric Elevation Designator
CABLING SUBSYSTEM ONE TAGS
TR 103
115.1
115.2
103.A1.A01
103.A1.A02
RM 115
Room number port is feeding
Port number on patch panel (Add if missing)
Elevation letter
A
Applicable Cyber Infrastructure Standards & Installation Specifications
ANSI\TIA 606
ANSI\TIA 607
ANSI\TIA 758
Rural Utilities Service: 1751F-640, 641, 643, 644
BICSI 14th TDMM
96 CS Cyber Infrastructure Standards & Installation Specifications
BISCI Telecommunications Distribution Methods Manual (TDMM) – Latest Edition "Best Practices"
National Electrical Code – Latest Edition
96 CS/SCOW
101 GRIFFIN WAY
BLDG 1429, ROOM 120
EGLIN AFB, FL 32542-5707
96 CS/SCOW
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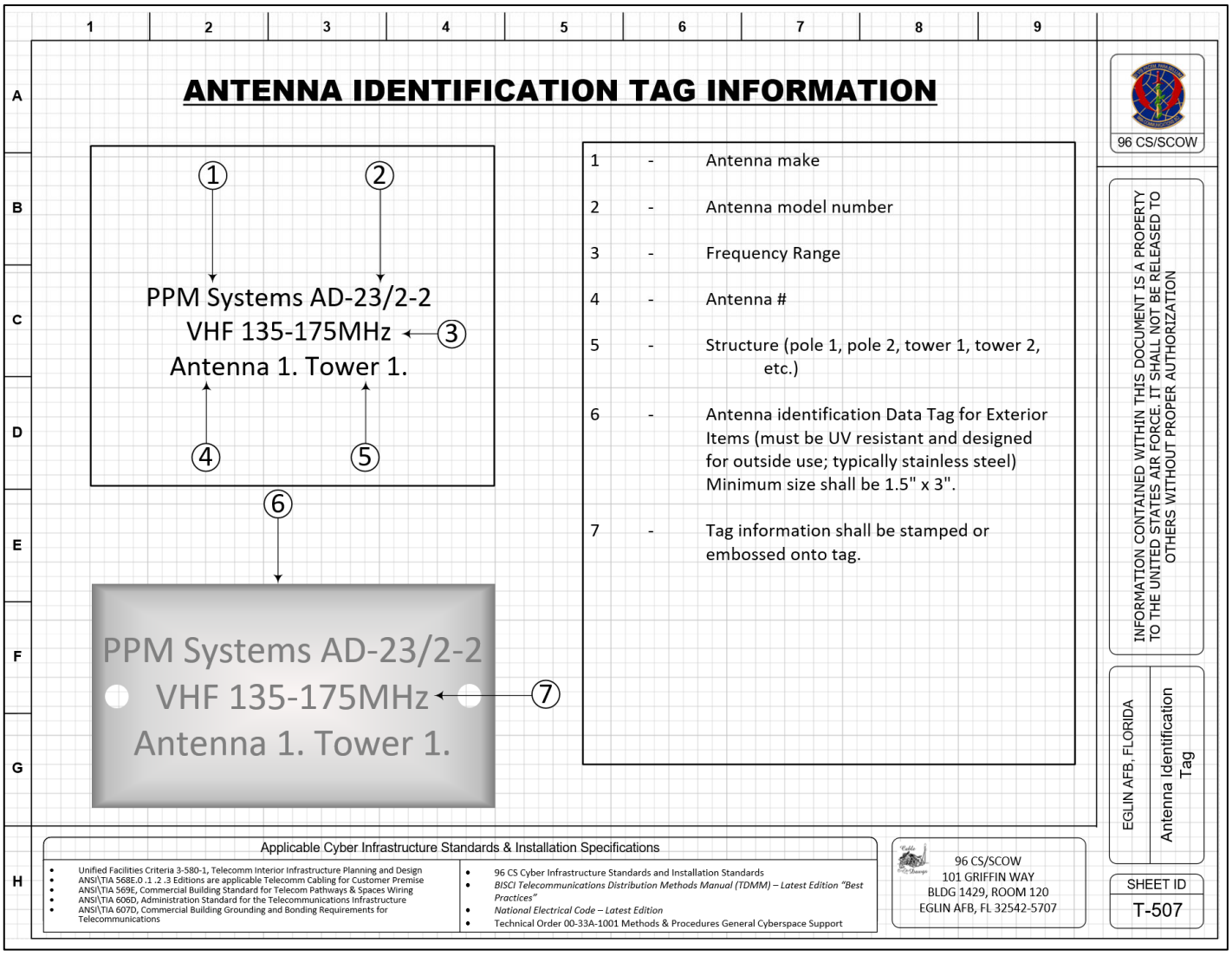
EGLIN AFB, FLORIDA Bldg
Labeling Specifics
SHEET ID
T-506


ANTENNA IDENTIFICATION TAG INFORMATION
1
2
PPM Systems AD-23/2-2
VHF 135-175MHz
3
Antenna 1. Tower 1.
4
5
6
PPM Systems AD-23/2-2
VHF 135-175MHz
7
Antenna 1. Tower 1.
1 - Antenna make
2 - Antenna model number
3 - Frequency Range
4 - Antenna #
5 - Structure (pole 1, pole 2, tower 1, tower 2, etc.)
6 - Antenna identification Data Tag for Exterior Items (must be UV resistant and designed for outside use; typically stainless steel) Minimum size shall be 1.5" x 3".
7 - Tag information shall be stamped or embossed onto tag.
96 CS/SCOW
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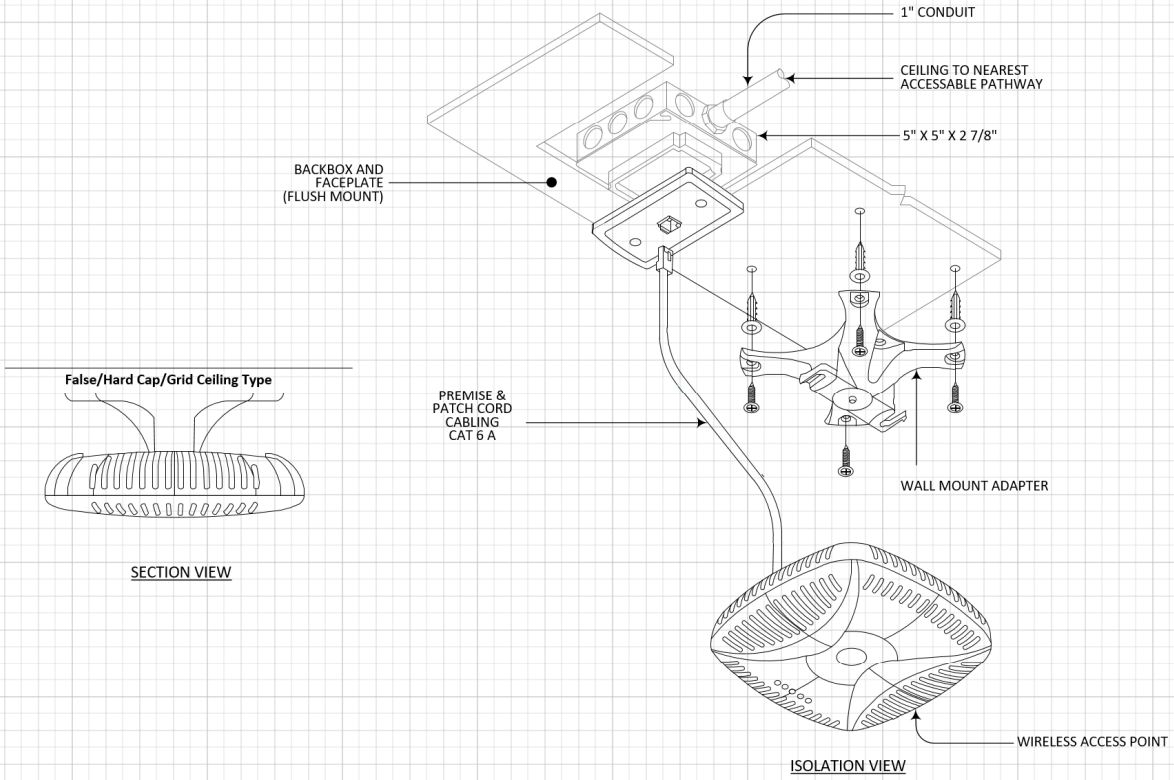
EGLIN AFB, FLORIDA
Antenna Identification Tag
SHEET ID
T-507
Applicable Cyber Infrastructure Standards & Installation Specifications
Unified Facilities Criteria 3-580-1, Telecomm Interior Infrastructure Planning and Design
ANSI\TIA 568E.0 .1 .2 .3 Editions are applicable Telecomm Cabling for Customer Premise
ANSI\TIA 569E, Commercial Building Standard for Telecom Pathways & Spaces Wiring
ANSI\TIA 606D, Administration Standard for the Telecommunications Infrastructure
ANSI\TIA 607D, Commercial Building Grounding and Bonding Requirements for Telecommunications
96 CS Cyber Infrastructure Standards and Installation Standards
BISCI Telecommunications Distribution Methods Manual (TDMM) – Latest Edition "Best Practices"
National Electrical Code – Latest Edition
Technical Order 00-33A-1001 Methods & Procedures General Cyberspace Support
96 CS/SCOW
101 GRIFFIN WAY
BLDG 1429, ROOM 120
EGLIN AFB, FL 32542-5707

WIRELESS ACCESS POINT MOUNTED IN CEILING



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EGLIN AFB, FLORIDA

Wireless Access Point

Applicable Cyber Infrastructure Standards & Installation Specifications

- Unified Facilities Criteria 3-580-1, Telecomm Interior Infrastructure Planning and Design
- ANSI\TIA 568E.0 .1 .2 .3 Editions are applicable Telecomm Cabling for Customer Premises
- ANSI\TIA 569E, Commercial Building Standard for Telecom Pathways & Spaces Wiring
- ANSI\TIA 606D, Administration Standard for the Telecommunications Infrastructure
- ANSI\TIA 607D, Commercial Building Grounding and Bonding Requirements for Telecommunications
- 96 CS Cyber Infrastructure Standards and Installation Specifications
- BICSI – Telecommunications Distribution Methods Manual 14th Edition (Best Practices)
- National Electrical Code – Latest Edition

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BLDG 1429, ROOM 120
EGLIN AFB, FL 32542-5707

SHEET ID
T-603

APPENDIX E

EGLIN DIRECT DIGITAL CONTROL (DDC) SYSTEM & CYBERSECURITY REQUIREMENTS FOR NEW FACILTITIES MAY 2023

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS 96TH TEST WING (AFMC)
EGLIN AIR FORCE BASE FLORIDA

02 May 2023

Energy Management Control System (**EMCS) and/or Direct Digital Control (DDC) System Requirements for New Facilities**

1. Provide building level supervisory controllers based on Eglin's existing Niagara 4.0 version 4.8 Framework or later. The building level supervisory controllers shall include point-2-point (P2P), Secure Socket Layer SSL, Web server and embedded WorkBench (WB). All control devices shall be programmable directly from The Niagara 4 Workbench embedded toolset. The use of configurable or programmable controllers that require additional software tools or tools that require a specific Niagara 4 license brand to operate for post-installation maintenance shall not be acceptable. The building level supervisory controllers shall contain all building logic, graphics and local controller backups. JACE's shall be installed in the mechanical room.
2. All graphics and points shall be duplicated in the existing Niagara 4.0 version 4.8 Framework ENS (Enterprise Network Server) using existing workbench software located in building 696, which shall serve as the Web Server for the system. All trended points shall be transferred via P2P to the server for history trending of points.
3. Provide one laptop computer that meets/exceeds technical specifications required for current Windows operating system. The device should have an internal or external CD ROM writer. Provide software and USB adapters for each type of DDC field controllers, to include factory installed DDC controllers. This laptop will be used/verified during the training. Laptop will need to be submitted to 96 CEG IT to facilitate required device security scans and uploading of Air Force Network (AFNET) standard desktop configuration (SDC) PRIOR to the contractor uploading any specialty (DDC) software. A minimum of 7 days should be allotted to accomplish this. Once complete, the device will be returned to the contractor for DDC software installation and perform training.
4. The system shall allow Civil Engineer (CE) technicians to connect to all controllers with all available software in all modes available by the manufacturer from building 696 via the local area network (LAN) to program, backup, download, configure and perform all functions necessary to maintain the system as if onsite and direct connected to the device.
5. All hardware and software administrator level passwords shall be provided to the government to access all levels of all controllers including the new Niagara Framework controllers as well as copies of the system's topology, hardware/software inventory, and configuration. The password shall allow complete access to everything the manufacturer has access to. Leave the default factory Platform User name and Password.
6. All field controllers shall use Building Automation and Control network (BACnet) **IP** protocol. Put Field Controller backups in the JACE.
7. Provide a LAN drop within three feet of each building level supervisory controller and provide a patch cable between the LAN drop and the building level supervisory controller.
8. When the BACnet communication buss leaves and enters a building, use fiber optic cable and provide media converter pairs (i.e. between buildings or out to chillers) and provide DB testing results.
9. The BACnet communication buss shall be daisy chained to the JACE. No additional switches or routers shall be used.

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS 96TH TEST WING (AFMC)
EGLIN AIR FORCE BASE FLORIDA

15 Nov 2021

Energy Management Control System (**EMCS) and/or Direct Digital Control (DDC) System Requirements for Existing Facility Remodels**

1. Modifications to an existing facility's Control System (CS) **must** be compatible with the current CS in that facility if the new controls are connecting to existing JACE. Whenever possible, the same brand controls should be used. If a new JACE is to be installed, the requirements for New Facilities will apply.
2. All graphics (including floor plans) must be updated in the existing ENS (Enterprise Network Server) located in building 696 which shall serve as the Web Server for the system, as well as in the JACE.
3. The system shall allow Civil Engineer (CE) technicians to connect to all controllers with all available software in all modes available by the manufacturer from building 696 via the local area network (LAN) to program, backup, download, configure and perform all functions necessary to maintain the system as if onsite and direct connected to the device.
4. Provide all Controls software necessary for project; to be loaded onto an AF provided Laptop with current SDC. Provide latest software and USB adapters for each type of DDC field controllers, to include factory installed DDC controllers. (This laptop will be used/verified during the training).
5. All hardware and software administrator level passwords shall be provided to the government to access all levels of all controllers including the new Niagara Framework controllers as well as copies of the system's topology, hardware/software inventory, and configuration. The password shall allow complete access to everything the manufacturer has access to.
6. All field controllers shall use Building Automation and Control network (BACnet) **IP** protocol.
7. The BACnet communication buss shall be daisy chained to the JACE. No additional switches or routers shall be used. Ensure not to damage/cut existing Buss Line for the remainder of the facility.

Energy Management Control System (EMCS) and/or Direct Digital Control (DDC) System Graphics Requirements

1. Graphics shall be in the existing ENS (Enterprise Network Server) located in building 696 which shall serve as the Web Server for the system, as well as in the JAC
2. Include date and time on all graphic screens.

3. **Main Map Graphic**- This screen will have a list and link to all of the buildings on the entire Eglin AFB complex.

4. **Building Graphic**- This screen will have a third graphic of the front of the building and a building number. The following links are required on this page: Back to Main Map, Floor Plans, Alarms, Reports, Schedules, History, and User Service.

5. **Floor Plan Graphic**The floor plan will be 3D with color coded zones, room numbers, and as-built sensor and equipment locations.The following points are required on this page: room temp, room humidity, occupancy status
The following links are required on this page: Back to Building Graphic, All Eequipment (Click on sensor or equipment shown on the floor plan and the link will go to the corresponding equipment).

6. **Typical VAV Table Graphic**
The VAV table should include the following info:
Box #, Zone Temp, Set Points (Heat & Cool), SP Source, Flow SP, Flow, Damper position, Heating %, SAT

7. **Typical Equipment Graphic**
Include a header with equipment type and number, room numbers and area(s) served.
Include all points on the equipment graphic.
The following points will be animated: fans, dampers, coils, pumps, boilers.

All set points will have the capability of being changed from the graphic.
The following links are required on this page: Back to Floor Plan, provide a hidden link over each point to show an hourly third day trend, provide a hidden link over each point to override all outputs. Provide a link to a spreadsheet with manufacturer and part numbers and warranty dates for all parts on the equipment graphic.

8. **Communication Bus Graphic**
Include an as-built wiring diagram of the communication buss between all controllers.

9. Provide a printed copy of the graphics prior to project training.

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS 96TH TEST WING (AFMC)
EGLIN AIR FORCE BASE FLORIDA

Energy Management Control System (EMCS) Network Requirements for New Facilities

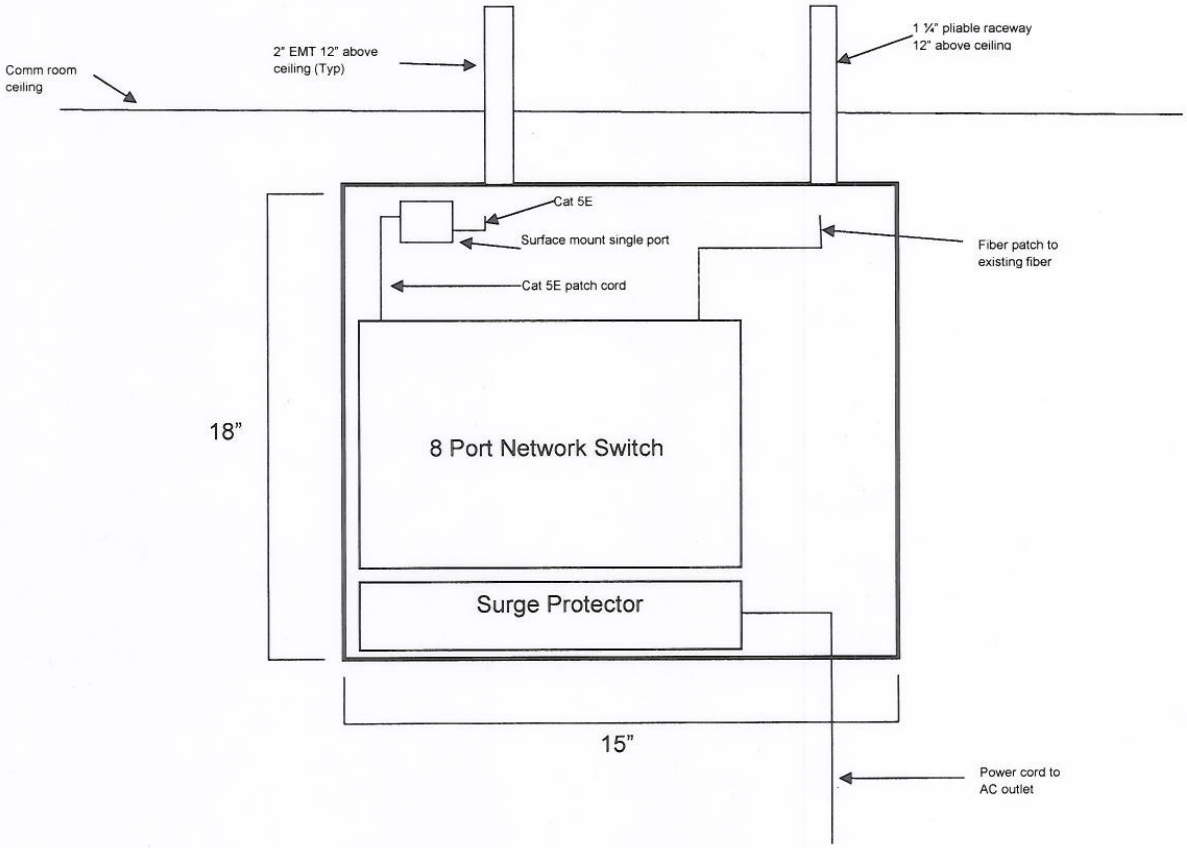
1. Comm Squadron shall Install/Identify 2 fiber strands dedicated for DDC connectivity.
2. Contractor installs a wall mounted lockable network enclosure (LNE) with surge protector [for an 8 port switch--**provided by AF** (see attached LNE Detail)] in the **main Communications room** mounted on the fire rated backer board.
3. Contractor installs a 20A/125V duplex receptacle within 3' of the LNE for connection of the surge protector. This receptacle shall be connected to the emergency power panel if the building is, or will be, equipped with an emergency generator.
4. Contractor installs a single port LAN connection inside the LNE and inside each building level supervisory controller.
5. Contractor installs a 2" EMT conduit from the LNE to each building level supervisory controller in the building.
6. Contractor installs a 1 ¼" pliable raceway, w/pull string, from the LNE to a height approximately 12" above the Communications room rack. [DDC shop personnel shall install a fiber jumper from the LNE to the installed fiber patch panel].
7. Contractor installs purple Cat 5E cable from the LNE to each building level supervisory controller. **Note**: If the distance exceeds 100 meters between the LNE and the building level supervisory controller, the building level supervisory controller shall be moved or fiber w/media converters must be used.

Preferred DDC Manufacturers installed on Eglin

Trane
Johnson
Automated Logic
Siemens
Schneider

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS 96TH TEST WING (AFMC)
EGLIN AIR FORCE BASE FLORIDA

Typical Drawing of Lockable Network Enclosures



APPENDIX F

EGLIN AFB FIRE ALARM AND SUPPRESSION SPECIFIC REQUIREMENTS FOR NEW INSTALLATION – OCTOBER 2023

EGLIN AFB FIRE ALARM AND SUPPRESSION
SPECIFIC REQUIREMENTS FOR NEW INSTALATION

1.0 FIRE ALARM / SUPPRESSION SYSTEMS

1.1 Electronic Fire Alarm and Suppression Section

1.1.1 The 796CEOFA section of Civil Engineers are technical support to the Authority Having Jurisdiction (AHJ) only. They are here to review, inspect, observe tests, and will not take part in the execution of any section of an awarded project on this installation (Examples; disable, safe, or shut down a complete system or a part of one; bring systems back online, etc.).

1.2 Fire Alarm Transceivers

1.2.1 All Fire Alarm transceivers shall be standalone units (BT-XFs) and completely compatible with the existing Monaco Enterprises Model D-21-M central station system.

1.2.2 Transceivers shall have the appropriate number of zones to interface with the Fire Alarm Control Unit and transmit by device type/floor. The authority having jurisdiction shall approve the fire alarm zones. Transceivers shall operate on a frequency of 141.3625 MHZ. Transceivers shall not be mounted higher than 60 inches from floor level.

1.2.2.1 Monaco Audio Board and Relay Board (BT-XMs) are not required and shall not be installed.

1.2.3 Before any Technician will program the fire alarm transceiver for any project, the Electronic/Alarm Section require the following items to be in their possession:

1.2.3.1 QFPE stamped shop drawings.

1.2.3.2 Copy of megger test results.

1.2.4 The installer is responsible to determine the proper location and type of antenna to be utilized:

1.2.4.1 When it is determined that the use of a directional (YAGI) antenna is required it shall be mounted on 1-inch heavy wall galvanized rigid conduit, utilizing positive means to prevent the antenna and/or mast from twisting by wind.

1.2.4.2 In cases where it is determined that an “Omni” antenna will be sufficient, the antenna may be mounted on ¾ inch rigid electrical conduit or a mast of proved equal strength.

1..2.5 The installer shall demonstrate the forward and the reflected power of installed antenna systems prior to acceptance in accordance with manufacturer’s specifications.

1.3 Fire Alarm and Mass Notification Systems

1.3.1 Batteries shall not be larger than 55 amp-hour. If a larger capacity is figured, parallel sets of batteries, 55 A/H and smaller together. The handling of larger batteries has produced an inherent safety hazard.

1.3.2 All batteries shall be labeled with the date of installation.

1.3.3 All notification appliance circuits (NAC) shall be Class A.

1.3.4 IAW UFC 4-021-01, 4-3.4.2.2 textual signs are optional and at the discretion of the DOD installation for Army and Air Force installations. Textual signs shall not be installed on Eglin AFB.

1.3.4.1 USACE ECB 2018-17 shall be applied on USACE projects. Fixed textual signs displaying “evacuate/announcement” shall be used.

EGLIN AFB FIRE ALARM AND SUPPRESSION
SPECIFIC REQUIREMENTS FOR NEW INSTALATION

2.0 CONSTRUCTION

2.1 General Requirements

2.1.1 Before any work is conducted in an existing facility that might affect the fire alarm, mass notification, or fire suppression systems, either directly or indirectly, a test of the existing systems shall be conducted by qualified persons IAW UFC 3-601-02 and witnessed by personal from 796 CEOFA. All paperwork must be submitted for review and record.

2.1.2 Ceiling Tile Bridge Plates should be installed instead of T-Bar Hangers for mounting equipment in ceiling tiles (detectors, NAC's, speakers, etc.).

2.1.3 Alarm valves shall be installed in a dedicated riser room or unoccupied area, be readily accessible, and located 30" – 60" above the finished floor.

2.1.4 Sprinkler system piping shall be Schedule 40 black iron steel.

2.1.5 Concrete splash blocks large enough to prevent ground erosion shall be placed to displace discharge from all inspector's test, auxiliary drains, and main drain outlets.

2.1.6 Hydraulic gongs and alarm check valves shall be installed on all sprinkler systems.

2.1.7 All mechanical joints shall be tightened with a calibrated torque wrench to manufacture's specifications.

2.1.8 All-thread shall not be used in floor-based pipe stands

2.1.9 A general information sign encompassing applicable current NFPA requirements, and location of Inspectors Test Valve shall be permanently etched/engraved on weatherproof metal, secured with corrosion-resistant wire, chain, or other acceptable means to the riser.

2.2 Valves

2.2.1 All check valves over 2" shall have a cover plate for maintenance without removing the check valve assembly from the piping system.

2.2.2 A minimum of one air relief valve shall be installed at the systems highest point.

2.2.3 Test and Drain Valves

2.2.3.1 A test and drain valve shall meet the following requirements:

2.2.3.2 Be installed at the riser.

2.2.3.3 Be equipped with sight glass and 175 PSI rated pressure relief valve.

2.2.3.4 drain to the exterior of the facility.

2.2.4. An auxiliary drain shall be installed at the systems most remote point and piped to the exterior of the facility.

2.3 Electronic Supervision

2.3.1 PIVs shall not be electronically supervised and be secured by frangible lock provided by 796 CES/CEOFA after completion of acceptance testing.

2.3.2 Valves requiring electronic supervision shall utilize rope type tampers.

2.3.3 An electronically supervised isolation valve shall be installed on pre-existing systems to separate new work of more than (20) heads.

2.4 Backflow Prevention Assemblies (BPA)

2.4.1 Install only University of Southern California (USC) approved double check valve assemblies.

2.4.2 BPA shall be installed downstream of the post indicator valve (PIV)

2.4.3 BPA shall be installed upstream of the fire pump.

2.4.4 BPAs shall include indicating type valves.

2.4.5 Water meters/detector check assemblies shall not be installed on BPAs installed on fire suppression systems.

2.5 Fire/Jockey Pump and Controller
- 2.5.1 Premanufactured fire pump houses shall have the entire floor area between the beams filled solid with concrete and fire pump frame must be grouted in.
- 2.5.2 Jockey pump/jockey pump controllers shall be variable frequency drive.
- 2.5.3 Both fire/jockey pumps and controllers shall be connected to emergency power when available.

2.6 Fire Water Storage Tanks
- 2.6.1 Fire water storage tanks shall be constructed of steel with welded joints.
- 2.6.2 Fire water storage tanks shall use an approved air gap as backflow prevention.
- 2.6.3 Fire water storage tank inlet control valves shall utilize slow closing solenoid valves or controlled by solenoid valves only.
- 2.6.4 Fire water storage tank inlet control valves shall have a means of manual operation.
- 2.6.5 Fire water storage tank fill valves that use electrical means to operate a control valve shall use separate sensors from the high and low water level alarms to operate the level control valve within the high- and low-level alarms.
- 2.6.6 The water level sensors that control the fire water storage inlet fill valve shall be the probe type and have the following functions.
- 2.6.7 The valve shall tell the inlet fill valve to open before the low water level supervisory signal activates.
- 2.6.8 The fill valve shall shut off before the high-water level supervisory signal activates.
- 2.6.9 Additional NFPA/UFC requirements
- 2.6.10 All other types of water level sensors are prohibited on Eglin AFB.
- 2.6.11 City water bypass loops shall be omitted on fire pumps supplied by a non-elevated fire water storage tank.

2.7 Fire Hydrants
- 2.7.1 Fire hydrants shall be painted IAW UFC 3-600-01 and NFPA 291. The paint will be enamel and color matched as follows:
  - 2.7.1.1 Fire Hydrant Red #MD-43827
  - 2.7.1.2 Safety Yellow #MD-43828
  - 2.7.1.3 Safety Orange #MD-43829
  - 2.7.1.4 Safety Blue #MD-43830
  - 2.7.1.5 Green #MD-43831

2.8 Signage
- 2.8.1 All signage shall be etched/engraved on weatherproof metal.
- 2.8.2 A general information sign providing the location of any type of valves not installed at the risers, shall be secured to the riser or posted above or below the headbox.

3.0 FINAL INSPECTIONS AND PROJECT COMPLETION

3.1 At the final inspection, a factory-trained representative of the manufacturer of the major equipment shall demonstrate that the system functions properly in every respect, including connection to with the technician interface tool (laptop), if required. Also, provide a box of spare components (smoke detectors, pull stations, etc.), at least two of each device installed on the system. This does not include spare panels, NAC power supplies, or transceivers.
- 3.1.1 Note: At least (2) representatives shall be on site for the final inspections.

3.2 Instruction shall be provided as required for operating the system. Hands-on demonstrations of the operation of all system components and the entire system including program changes and functions shall be provided.

3.3 The contractor and/or the systems manufacturer's representatives shall provide the following items at the final inspection:

3.3.1 NFPA Record of Completion and Inspection, Testing, and Maintenance Report on CDROM

3.3.2 As-built drawings in true half size (12x18) to include a riser diagram, equipment technical data sheets, and battery and voltage drop calculations.

3.3.3 (2) or 10% of each initiating and notification devices installed

3.3.4 Laptop, connecting cables required to interface with installed devices, and CDROM drive.

3.4 Provide the manufacturer’s recommended/required level of factory training on all the installed equipment and software, regarding installation, operation, maintenance, testing, future expansion, and programming of the fire alarm system for two (2) personnel. This training shall meet or exceed NFPA 72 National F/A and Signaling Code for System Installers, Inspection, Testing and Maintenance Personnel as well as the manufacturer’s required level of training and shall guarantee the unconditional operation and future purchase of additional and/or replacement equipment. The training shall take place at one of the locations normally used by the manufacturer and/or distributor to conduct factory training for their in-house employees. This goes for all systems being installed, to include, but not limited to the main fire alarm system, subordinate releasing panels, VESDA systems, mass notification, textual sign systems, electrical/electronic fire pump controller, and clean agent systems. Upon successful completion of all curriculum requirements, the government personnel shall be awarded full access to all available technical support resources, to include at a minimum, on-line and telephone support provided to manufacture and/or distributer personnel.

4.0 OTHER SUPPRESSION SYSTEMS

4.1 Clean Agent

4.1.1 Clean agent fire suppression systems shall use non-hydrofluorocarbon gaseous fire suppressant.

4.1.2 Clean agent systems must be hard piped from agent container to nozzle.

4.2 Antifreeze fire suppression systems

4.2.1 Antifreeze fire suppression systems shall not be installed.

5.0 DEFINITIONS

5.1 Readily accessible is defined as the following:

5.1.1 Accessible without the use of a ladder, work platform, or special tools

5.1.2 Accessible outside of areas requiring additional security requirements within the facility, i.e., secured/special access areas within the facility.

5.1.3 Below finished ceiling.

5.1.4 Not installed higher than 72” from the finished floor

EGLIN AFB FIRE ALARM AND SUPPRESSION SPECIFIC REQUIREMENTS FOR NEW INSTALATION

DEPARTMENT OF THE AIR FORCE
AIR FORCE CIVIL ENGINEER CENTER
TYNDALL AIR FORCE BASE FLORIDA

5 Jan 2023

MEMORANDUM FOR RECORD

FROM: AFCEC/CO
139 Barnes Drive, STE 1
Tyndall AFB, FL 32403-5319

SUBJECT: Fire Alarm Panel Standardization, Up to 3 Manufacturer Brands can be selected

1. This memorandum serves as AFCEC/CO's official communication approving the selection of 2 manufacturers for Fire Alarm Panels respective to the following installation:

Installation:	**Unit:**	**Manufacturers:**
Eglin AFB	796 CES	Notifier Onyx, Firelite

2. The comprehensive inventory analysis is to be repeated after five years from the date of this memorandum. The purpose of this secondary analysis is to document the installation's progress in standardizing fire alarm panels, consider any changes in the decision facts, and confirm no external factors exist that may drive a reconsideration of the approved single manufacturer. Should the BCE determine that a change in the approved manufacturers is required, a new Memorandum of Request (MOR) and analysis will be accomplished.

3. Please direct any questions and/or concerns regarding implementation of this guidance to my POC, Mr. Efrem Rivers, DSN 523-6764, efrem.rivers.1@us.af.mil or to the AFCEC Reachback Center at AFCEC.RBC@us.af.mil.

KLEIN.JEFFREY.ROBERT.1266032575 Digitally signed by KLEIN.JEFFREY.ROBERT.1266032575 Date: 2023.01.06 08:34:00 -06'00'

JEFFREY R. KLEIN, Lt Col, USAF
Deputy Director, Operations Directorate

INTERIOR MASS NOTIFICATION MESSAGES - EGLIN AFB

Department of Defense, Unified Facilities Criteria 4-021-01

Sept 2017

Authorization for MNS to temporarily override Fire Alarm audible messages and visual signals for providing intelligible voice commands during simultaneous fire and terrorist events (Priority is electronic override of above message – example: 1, 2, & 3 will override 4)

Priority	Type	Pre-Tone	Message Script (Tones and Messages Repeat a Minimum of Three Times)
1	Local Live Voice	None	**LOCAL, IN-BUILDING P.A.: Special Announcement for All or Zones in Facility.**
2	Bomb Threat	Continuous	**May I have your attention please! A bomb threat has been reported in or around this Building 0000. Please follow the pre-plan and await further instructions.**
3	Intruder	Continuous	**May I have your attention please! An intruder or hostile person has been sighted within or around this Building 0000. Please follow the pre-plan and await further instructions.**
4	Alternate Exit	Continuous	**May I have your attention please! Please evacuate Building 0000 – using pre-designated Alternate Exits.**
5	FIRE	Code 3	**May I have your attention please! A FIRE emergency has been reported in this Building 0000. Please depart to your nearest Exit and report to your designated Assembly Area.**
6	Shelter In-Place	Continuous	**May I have your attention please! Please shelter in-place and await further instructions.**
7	Weather	None	**May I have your attention please! The National Weather Service has issued a severe weather warning for our area. Please await further instructions.**
8	All Clear	None	**May I have your attention please! This Building emergency has ended. An "All Clear" has been given. Please resume normal activities.**
9	TEST	None	**May I have your attention please! This is a TEST of the Mass Notification System. This is only a TEST.**

1 ***Emergency Notification System ONLY; NOT to be utilized for Non-Emergency Messaging Traffic.***

2 ***Mass Notification System is a Life Safety application authorized only for real-time intelligible voice communications of an actual emergency situation with instructions to personnel for response and action.***

3 ***Relay #4, linked to priority #6, FIRE, shall not be activated remotely.***

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APPENDIX G

EGLIN AS-BUILT STANDARDS – MAY 2023

Eglin AFB As-built Standards

Current as of 13 April 2016

Updated 11 May 2023

General:

- As-built drawings shall be submitted in a version of AutoCAD that is coordinated with 96 CEG drafting section at time of submission.

- The as-built DWG files shall have no reference files attached as all shall be bound into the file to make one AutoCAD DWG file, which also shall be purged and created with standard AutoCAD pen table.

- Scaled drawings should provide a bar scale and shall be in feet not meters. Contractor shall provide ~~1 hard copy of as-built on Mylar on an Arch D sheet size and~~ 2 CD's in AutoCAD and PDF.

- Final As-builts shall include the assigned building number in the title block and Air Force FTFA number.

Other Requirements:

1. AutoCAD drawings shall have correct geometry:

    a. Segmented lines and arcs are to be made continuous and free of self-overlapping sections, thus decreasing files size and increasing efficiency within the AutoCAD platform.

    b. All AutoCAD data shall be free of topological errors such as slivers, undershoots, overshoots dangles, overlaps, intersections, etc.

    c. Area features such as building footprints, parking lots, roadways, and airfield pavements shall be true polyline polygons. Adjacent polygons shall not have gaps or overlaps.

2. AutoCAD drawings shall be checked for correct spatial projection to one of the following:

    a. North American Datum 1983 Florida State Plane North FIPS 0903 Feet (AutoCAD Code FL83-NF)

    b. Universal Transverse Mercator 1984, Zone 16 North (AutoCAD Code UTM84-16N)

3. Any Building Information Models (BIM) developed for a project shall be supplied in a Model Archive as part of the final as-built submittal consisting of two sets of files:

    a. The first set shall be a collection of individual Models as received from the Model Element Author(s).

    b. The second set of files shall consist of the aggregate of those individual Models in a format suitable for archiving and viewing. The aggregate model shall also be submitted in a DWG file format.

POC for clarifications is Mr. Mike Miller or Ms. Glenda Sweet

4. Drawings submitted for approval as as-builts shall have all changes incorporated into the final drawings.

a. Drawings shall be free of revision clouds, hand-written notes, scanned in change orders, etc.

b. Revision symbols shall be accompanied with an entry in the sheet's revision block. Revision block entries shall consist of a brief description of the change along with the change order number.

c. Each sheet shall be annotated in bold letters near the title block with the date the as-builts were accepted (i.e. AS-BUILT DRAWING 12 APR 2012).

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APPENDIX H

WRECC FFE BID OPTION

WEAPONS RESEARCH EXPERIMENTATION CONTROL CENTER

EGLIN AFB

100% FFE BID OPTION

LINDA CASHMAN, IIDA
INTERIOR DESIGNER
US ARMY CORPS OF ENGINEERS
MOBILE DISTRICT

MANUFACTUER'S LIST

NOTE: ALL MANUFACTURERS ARE THE BASIS OF DESIGN—EQUIVALENT PRODUCTS WILL BE CONSIDERED

AVANTCO REFRIGERATION
www.avantco.com

BUNN
www.webstaurantstore.com

CROWN MATTING TECHNOLOGIES
800-MATT-LINE
www.CrownMats.com

EPSON PROJECTORS
www.epson.com

HAWORTH
201 St. Joseph St.
Mobile, AL 36602
251-433-2730
www.haworth.com

KEURIG
www.keurig.com

KITCHENAID
www.kitchenaid.com

KNOLL
1235 Water Street
East Greenville, PA 18041
1-800-343-5665
www.knoll.com

PREMIUM REFRIGERATION
www.webstaurantstore.com

QUARTET
1-844-715-3694
www.quartet.com

RUBBERMAID
800-347-9800
www.rubbermaid.com

SAFECO
www.safecoproducts.com

SAMSUNG
1-800-726-7864
www.samsung.com

SANUS
6436 City West Pkwy Eden
Prairie, MN 5344
800-359-5520
www.sanus.com

SHARP
800-472-4643
www.grainger.com

STEWART PROJECTION SCREENS
www.stewartfilmscreen.com

VERSTEEL
2332 Cathy Lane
Jasper, IN 47546
800-876-2120
www.versteel.com

WHIRLPOOL
Whirlpool Distribution Center
7301 Whirlpool Drive
Tulsa, OK 74117
918-274-7941
www.whirlpool.com

ITEM CODE:	**CH1 TASK AND CONFERENCE ROOM CHAIR**
TOTAL QUANTITY:	50
MANUFACTURER:	KNOLL (basis of design)
DESCRIPTION:	Adjustable task chair w/ faux leather seat, web back
MODEL NO.	K.TASK
DIMENSIONS:	27”Wx 27’Dx 37.9”-43.2”H
FINISHES:	Black frame, 01 Black Mesh Back, FLB Black Faux Leather Seat
ROOM NO. LOCATION:	101 (18), 102 (1), 103 (1), 104 (1), 111 (3), 120(3), 121(22), 122(1)
CATALOG SHEET:	ATTACHED

CH1 TASK AND CONFERENCE CHAIRS

Generation by Knoll®

Formway Design 2009

Responding to ergonomic research that challenges the idea that we only sit in a single forward-facing position, Generation is designed to support the range of postures and workstyles typical of today's workplace, allowing you to sit how you want.

Generation by Knoll®

Arm Option:Height Adjustable

Height Adjustable

High Performance
Base:Plastic

Plastic

Polished Aluminum
Casters:Hard Wheel

Hard Wheel

Soft Wheel
Frame:Dark

Flex Back Net Color:Onyx

FEATURES

Frameless Flex Back fuses two elements: high performance elastomeric Flex Back Net cradles your back, providing integral lumbar support, and figure 8 structure enables multidimensional movement
Flex Seat offers 270 degrees of unobstructed seat edge flex with a buoyant two-piece cushion and nest structure
Continuous Lumbar carries the lumbar support from the back into the arms to support side sitting
The Dynamic Suspension™ offers weight-compensated, synchronized recline for a smooth,
effortless ride
Flex Top folds over as armrest for side sitting
Tilt Preference Selector offers three ranges of recline movement
This chair has been tested and is approved for use by individuals weighing up to 300 pounds
This chair is warranted for 12 years, 24-hour, 7 days a week, multi shift use. See Knoll Selling Policy for further details, conditions and exclusions

SUSTAINABLE DESIGN AND ENVIRONMENTAL CERTIFICATION

Rated SMaRT© Sustainable Platinum
BIFMA level® 3 certified
GREENGUARD and GREENGUARD Gold Certified
Can contribute to achieving 4 LEED® credits

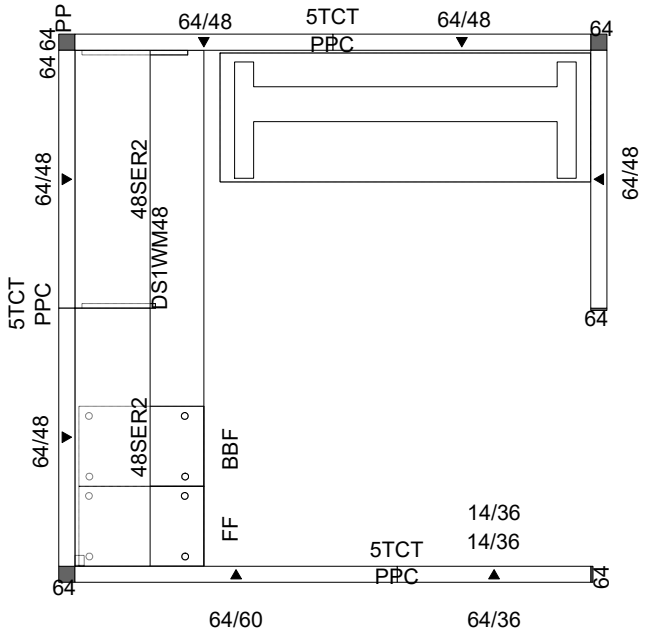
ITEM CODE:	**WS1 AND WS2 WORKSTATIONS**
QUANTITY:	WS1 26 WS2 3 (only 1 panel wall)
MANUFACTURER:	KNOLL (BASIS OF DESIGN)
DESCRIPTION:	26 Adjustable height desk w/return, 1 box/box/file pedestal and one panel end, steel w/ laminate top and sides. Overhead storage unit w/lock, task light and tack board. 3 non-adjustable height desks.
MODEL NO.	DIVIDENDS HORIZON
DIMENSIONS:	72”Wx30"D"w/48"Wx30"D return, 64"H panel height
FINISHES:	Beige Mist Metallic w/Micro Gray 121 Laminate
ROOM NO. LOCATION:	WS1: 111(3), 120(3), 121(20) WS2: 103(1), 104(1),122(1)

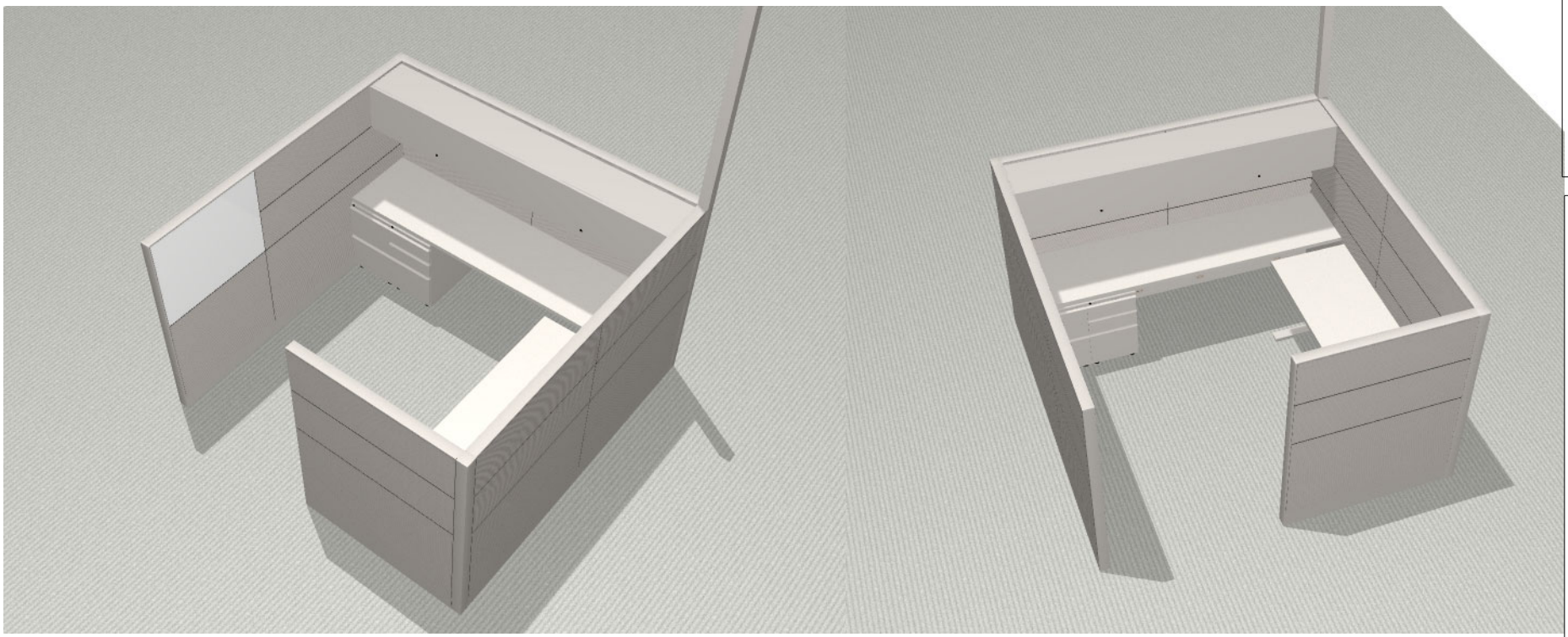
ADJUSTABLE HEIGHT WORKSTATION

QTY: 20

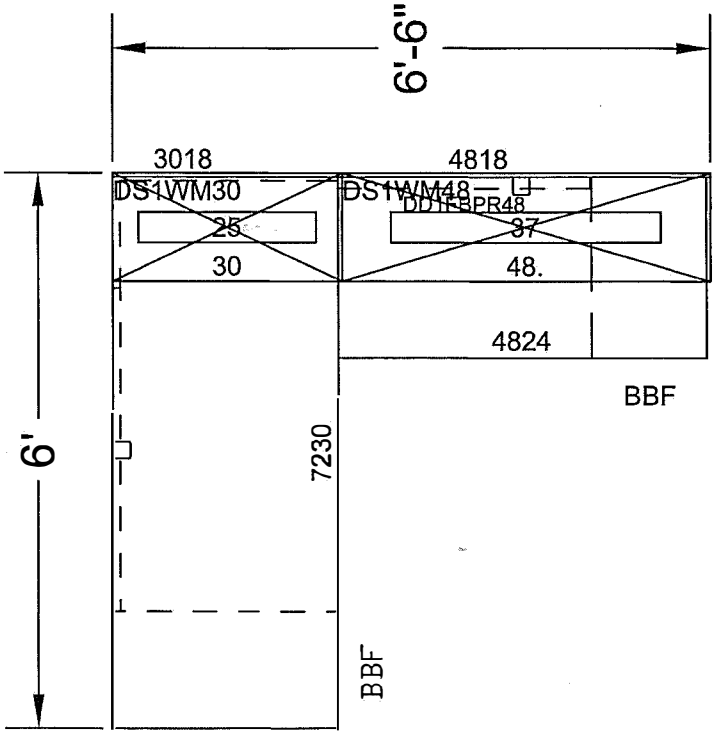
72"Wx30"Dx64"H,w/72"Wx30"Dx64"H return

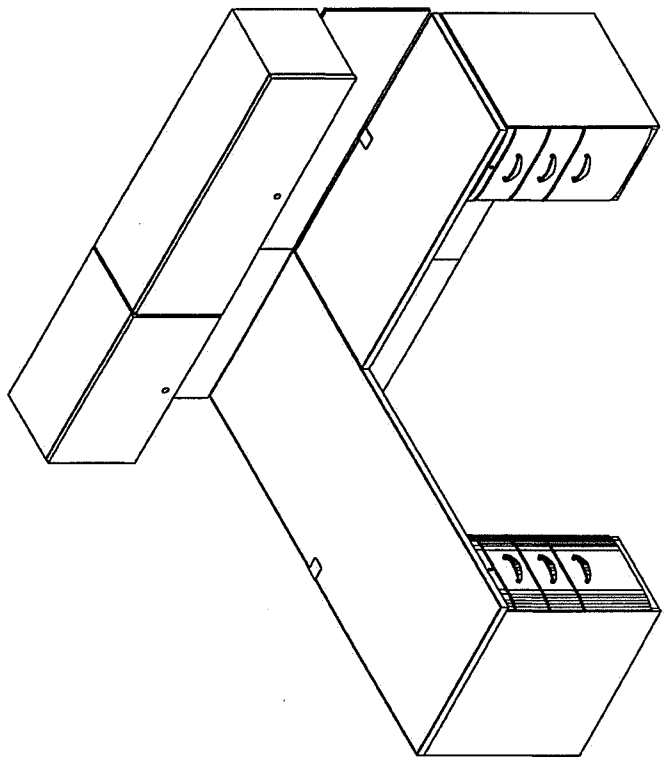
KNOLL DIVIDENDS HORIZON (basis of Design)





WS2 PRIVATE OFFICE WORKSTATION THAT IS NOT HEIGHT ADJUSTABLE QTY: 3

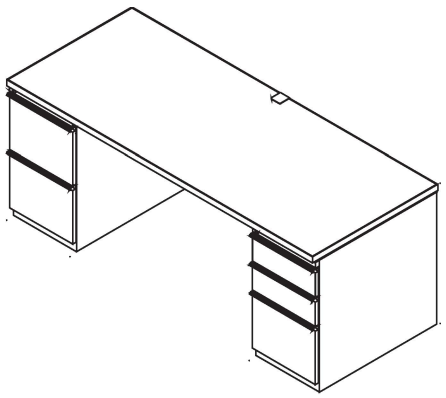




KNOLL (basis of design)

ITEM CODE:	D1 RECEPTION TRANSACTION DESK
TOTAL QTY:	1
MANUFACTURER:	KNOLL (Basis of Design)
DESCRIPTION:	Single wide transaction top administrative desk w/lower work surface, flush infill panel, full return, gamble support, 2 box/box/file drawer units, laminate
MODEL:	REFF PROFILES Laminate Transaction Top 114
DIMENSIONS:	72”Wx30”D, w/48”Wx24D” extension, 42”H transaction counter
FINISHES:	Beige Mist Metallic w/Micro Grey laminate worksurface
ROOM NO. LOCATION:	102 Range Entry
CATALOG SHEET:	ATTACHED

ITEM CODE:	**D2 DOUBLE PEDESTAL DESK**
TOTAL QUANTITY:	2
MANUFACTURER:	KNOLL (BASIS OF DESIGN)
DESCRIPTION:	Double Pedestal Desk w/ 2 BOX/BOX/FILE Drawer Units Laminate Top
MODEL NO.	DIVIDENDS HORIZON
DIMENSIONS:	72"Wx30"D
FINISHES:	Beige Mist Metallic w/Micro Gray Laminate work surface
ROOM NO. LOCATION:	120 (2)
CATALOG SHEET:	ATTACHED



ITEM CODE:	**CH 2 GUEST CHAIR**
TOTAL QUANTITY:	22
MANUFACTURER:	KNOLL {BASIS OF DESIGN)
DESCRIPTION:	HARDWOOD SIDE CHAIR WITH ARMS, UPHOLSTERED SEAT, WITH DOWEL AND MORTISE AND TENON CONSTRUCTION, STEAM BENT TOP RAIL, SEAT CUSHION USES HIGH DENSITY POLYURETHANE FOAM AND ELASTIC SEAT BELT SUSPENSION, NYLON GLIDES.
MODEL NO.:	KRUSIN
DIMENSIONS:	23.5”Wx21.75”Dx30.5”H (arm height 24.5”)
FINISH:	WALNUT
FABRIC:	MOMENTUM PATTERN ANGLE, COLOR BALTIC
ROOM LOCATION:	101(14), 102(2), 103(2), 104(2), 122(2)
CATALOG SHEET:	ATTACHED

CH2 OFFICE GUEST CHAIRS WITH CASTERS

Arm Option: with Arms

Frame Finish: American Walnut

Seat Fabric: Black faux leather

Seat cushion in BLACK faux leather

low gloss natural wood finishes in American Walnut

CONSTRUCTION AND DETAILS

Frame is select American and European hardwood using dowel and mortise + tenon construction with steam-bent top rail

Upholstered seat cushion uses high-density polyurethane foam and elastic seat belt suspension

Casters included

SUSTAINABLE DESIGN AND ENVIRONMENTAL CERTIFICATION

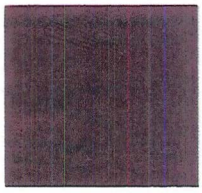
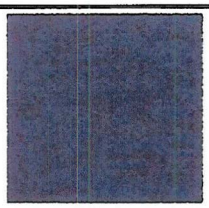
GREENGUARD Indoor Air Quality Certified® for low-emitting products

MISC EQUIPMENT DATA / ILLUSTRATION AND ORDER SHEET

Guest Chair

Mfg. Contact:	Knoll, Inc	**Photo:** 

ITEM / NOMENCLATURE:	**Guest Chair**		
Manufacturer:	Knoll, Inc		**Remarks:**
Product Name:	Krusin side chair with arms		**Krusin side chair used as the "Basis of Design"**
Model Number:	MK01A		
Dimensions (W x D x H):	23.5 x 21.75 x 30.5"	(in inches unless noted otherwise)	
Weight:	20 lbs		
Detailed Description:	Hardwood side chair with arms, upholstered seat, with dowel and mortise and tenon construction, steam bent top rail, seat cushion uses high density polyurethane foam and elastic seat belt suspension, nylon glides. Note: (arm height is 24.5").		
LEED:			
Product Finishes:	American Walnut - AW, Momentum, pattern is Bangle, color is Baltic		
Other:			

		
Wood finish	Upholstery - Momentum , Bangle, Baltic	

ITEM CODE:	**S1 LATERAL FILE CABINET**
QTY:	
MANUFACTURER:	KNOLL (basis of design
DESCRIPTION:	File cabinet with 2 sliding doors, 3 horizontal drawers w/ hanging rails, adjustable for letter, legal and other paper sizes, locking
MODEL:	CALIBRE
DIMENSIONS:	36”Wx18”Dx53”H
FINISH::	BEIGE MIST METALLIC
ROOM LOCATION:	
CATALOG SHEET:	ATTACHED

Knoll Storage: Designed to Deliver

In today's office landscape, change is constant and available workspace is slowly disappearing. Knoll filing and storage products — featuring Calibre® lateral files, mobile pedestals and architectural towers in a vast array of sizes, configurations and colors — maximize your organizational options without compromising valuable workspace.

Calibre solutions for every need

From documents and binders to coats and office supplies — whatever needs organizing — Calibre has the storage solutions that support your real-world needs. Lateral files offer a vast array of drawer and case height options, including add-on modules, with locking mechanisms, that enable you to customize and personalize your storage.

Calibre towers, available in four heights — 42", 50", 57" and 64" — and three widths — 15", 24", and 30" — enhance your ability to store and organize the things you need throughout your day.

Back row, from left: 63"-high Calibre hybrid cabinet with lateral files and cabinet for office supplies and binders; 64.5"-high Calibre lateral file with posting shelf and four 12" drawers and 12" receding door with fixed shelf; 63"-high wardrobe; 24"-wide x 64"-high tower with wardrobe, cupboard, two box and one file drawer.

Front row, from left: 36"-wide x 39"-high Calibre lateral file; 51"-high x 18"-deep Calibre cabinet (versus a 15"-deep bookshelf); Calibre mobile pedestal.

ITEM CODE:	**CH3 BREAK ROOM CHAIRS**
TOTAL QUANTITY:	8
MANUFACTURER:	KNOLL (basis of design)
DESCRIPTION:	Steel powder coated frame,, molded seat, glides
MODEL:	Bertoia
DIMENSIONS:	22"Wx21.75"Dx30.5"H
FINISH:	Black powder coated frame,blue molded seat & back
ROOM NO.:	119 Break Room
CATALOG SHEET:	Attached

Bertoia Molded Shell Side Chair | Knoll

Bertoia Molded Shell Side Chair

Harry Bertoia 1960

The Bertoia Molded Shell Side Chair is a reintroduction of a design originally debuted 1960. Merging the sublime grace of the wire-form Side Chair with a touch of color and natural flex, the reinvigorated classic is ready to add colorful accents to any room. Mix and match the chairs or keep a singular color palette, the Bertoia Shell Chair offers an iconic design with a playful tone.

1.Select Style: **Indoor**

INDOOR

2.Select Plastic Seat: **Blue**

3.Select Frame Finish: **Black**

Bertoia Side Chairs & Stools

Details

Construction and Details

- Seat is glass fiber reinforced nylon
- Base is constructed of welded steel rods with polished chrome finish or white or black powder coat
- Plastic glides included on sled base to protect floors
- Knoll logo stamped into the back of the base

Sustainable Design and Environmental Certification

- Certified Clean Air GOLD

ITEM CODE:	**TB3 BREAK ROOM TABLES**
TOTAL QUANTITY:	2
MANUFACTURER:	KNOLL (basis of design)
DESCRIPTION:	Table w/center pedestal
MODEL NO.:	ARENA
DIMENSIONS:	42""DIAMETER
FINISHES:	White laminate top w/natural birch edge Steel column w/round laser cut footplate
ROOM NUMBER LOCATION:	119 BREAK ROOM
CATALOG SHEET:	ATTACHED

Arena Tables
Piiroinen

KnollStudio

Arena Table

Pasi Pänkäläinen 2003

Finnish designer Pasi Pänkäläinen offers a new take on the traditional café table with the versatile Arena Collection. The Arena tables are available in both round and square shapes, in dining- and bar-

heights and a broad range of sizes. Tables feature a white laminate top with a natural birch edge, a steel column and round laser-cut footplate. The Arena tables are the ideal complement to the spirited CHIP chairs and barstools, and are suitable for corporate café and breakout areas as well as hospitality and residential applications.

Downloads

General Info

Planning Tools

- Arena Table Round 2D AutoCAD Symbol (0.05 MB)
- Arena Table Square 2D AutoCAD Symbol (0.05 MB)
- Arena Table Round 3D AutoCAD Symbol (0.1 MB)
- Arena Table Square 3D AutoCAD Symbol (0.1 MB)
- Arena Table Round Revit Symbols (0.22 MB)
- Arena Table Square Revit Symbols (0.23 MB)

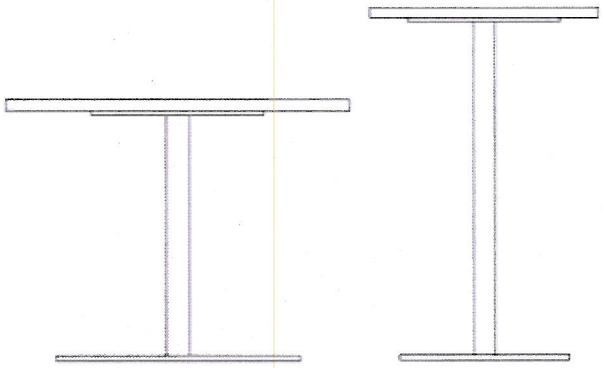
Finishes

Base is always painted silver grey, even if column is finished in chrome. Top is birch plywood with white laminate and natural birch edge.

Top
Column
Base

White

Dimensions



	w
23TR Round Cafe Table	24 / 27 / 36 / 42"
23TRH Round Bar-height Table	24 / 27"

ITEM CODE:	**TB1 CONFERENCE TABLE TO SEAT 16**
QTY:	**1**
MANUFACTURER:	KNOLL (basis of design)
DESCRIPTION:	Modular design w/wire & data management, rectangular w/radius ends
MODEL:	PROPELLER
FINISHES:	Walnut Laminate
DIMENSIONS:	3 sections, each measuring 72"Lx42"Wx29"H
ROOM NO.:	101
CATALOG SHEET:	ATTACHED


Propeller
Innovative,
flexible tables.
Knoll

Sophisticated Tables for Conferencing, Meeting and Training

In today's modern office, flexibility is key. Spaces must support a variety of collaborative and individual work, all while staying connected to technology.

Propeller® offers a multi-purpose portfolio of training and conference tables for the evolving office landscape. Characterized by intelligent design, a sophisticated aesthetic and ease of reconfiguration, Propeller is the solution to the multi-tasking workplace.

Emanuela Frattini Magnusson is a Milan-born architect and designer based in New York. Her work spans architecture, interiors, and product design.

Refined, Modular Design

Propeller Conferencing is designed for beauty and performance throughout the workplace. With a modular design that's offered in a variety of bases, it accommodates a group as small as four to a large boardroom. Paired with a multitude of storage solutions, Propeller Conferencing adds grace and sophistication to the modern office.

Advanced solutions for wire management

+ With enhanced space in the base for vertical wire management and the ability to conceal floor monuments, Peanut and Drum are ideal solutions. Panels on the base can be easily removed without tools for easy access.

+ Large conference tables, top right, incorporate a structural frame which also serves as a horizontal wire management channel.

Finishes and Options

Table options

Conference Table, Square Drum Base

Conference Table, Peanut Base

Conference Table, Drum Base

Conference Table, Rectangular Base

Column Leg Table

Storage options

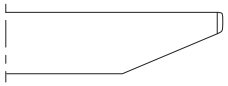
Credenza

Sideboard

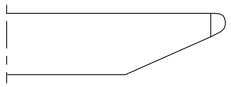
Edge options

Flat Edgeband

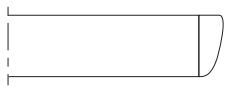
Molded Edgeband



AutoStrada Edge Profile



Saarinen Edge Profile



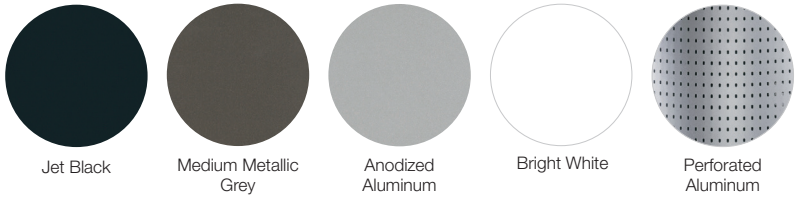
Propeller Edge Profile

Woodgrain Laminate Top

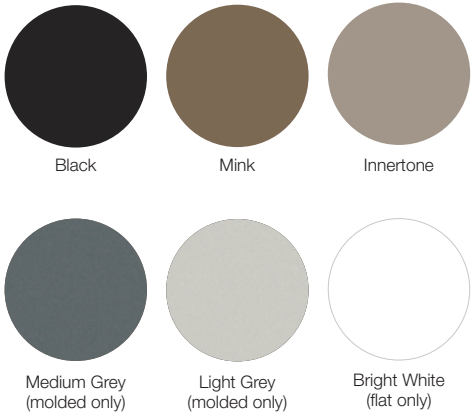
Veneer Top | Solid Wood Edgeband

Solid Laminate Top

Leg and Grommet

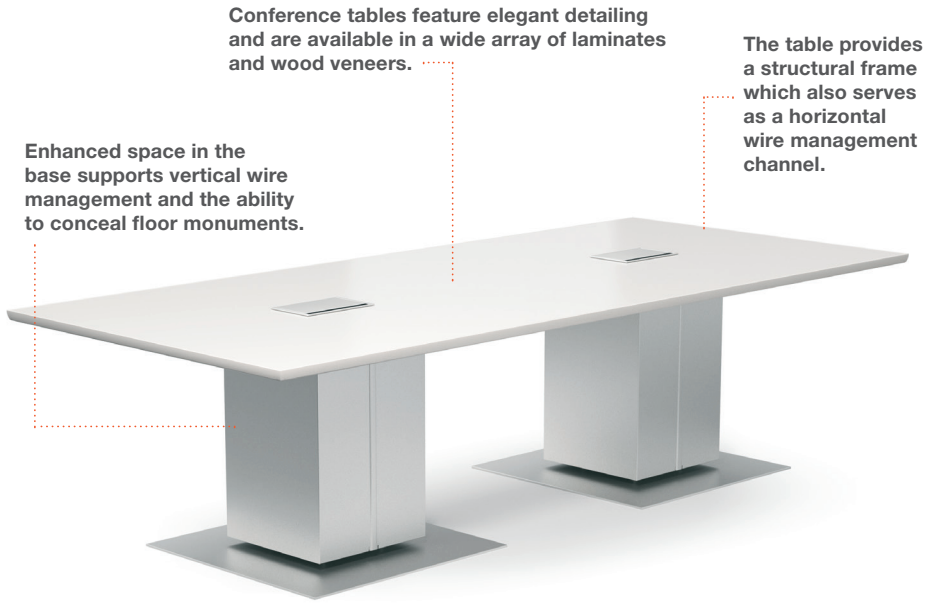


Flat or Molded Edgeband



Propeller

The Propeller® Collection delivers a series of training and conference tables that integrate across the office or learning environment. Combining a range of base options with a sophisticated aesthetic, Propeller has an intuitive design that ensures ease of use throughout each workspace.



Conference Tables

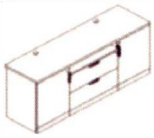
Knoll®

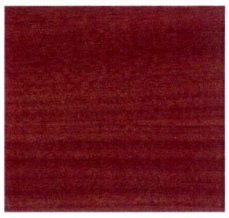
ITEM CODE:	**S3 CREDENZA**
TOTAL QTY:	1
MANUFACTURER:	KNOLL (BASIS OF DESIGN)
DESCRIPTION:	84”Wx24”Dx34 3/8”H, LAMINATE TOP, SIDES AND EDGE
MODEL:	REFF
DIMENSIONS:	84”Wx24”Dx34 3/8”H
FINISH:	127 WALNUT LAMINATE
ROOM NUMBER LOCATIONS:	101 LARGE CONFERENCE ROOM
CATALOG SHEET/SPECS:	ATTACHED

MISC EQUIPMENT DATA / ILLUSTRATION AND ORDER SHEET

Conf room Credenza

Mfg. Contact:	Knoll, Inc. **(Basis of Design)**	**Photo:**
Telephone:		
Fax:		
Order Name & Address:		
POC:		
Telephone:		
Fax:		
E-mail:		
GSA Contract No/SIN:		
GSA Contract Period:		
FSC Group/ Part/Sect:		
M.O.L.:		

ITEM / NOMENCLATURE:	**Conference Room Credenza**	
Manufacturer:	Knoll, Inc.	**Remarks:**
Product Name:	Reff Classic Credenza	**Knoll Reff, used as the "Basis of Design"**
Model Number:	RCSHHBH22	
Dimensions (W x D x H):	84 x 24 x 34-3/8" (in inches unless noted otherwise)	
Weight:	weight in lbs.	
Detailed Description:	Credenza for conference rooms. 	
LEED:		
Product Finishes:	Laminate in Walnut, 127 - top , sides and edge	
Other:		



Laminate

LOCATION(S):

Rm. No:	Rm. Name:	Qty:	Section:

Unit Cost and Total Qty.:

ITEM CODE:	CH5 UPHOLSTERED TABLET ARM CHAIR
MANUFACTURER:	INTEGRA (BASIS OF DESIGN)
QTY:	1
DIMENSIONS:	33”W x 32”D x 33”H
DESCRIPTION:	300 LB. CAPACITY HEAVY DUTY CASTERS LAMINATE TABLET ARM CUP HOLDER HIGHER BACK (18”) MOISTURE/FIRE BARRIER PERMA COAT WOOD LEG PROTECTOR LAMINATE ARM CAPS LIFETIME WARRANTY
MODEL:	RENDEZVOUS
FABRIC/FINISHES:	FABRIC: MOMENTUM “FELTED CIRCLES” LAMINATE: WALNUT
ROOM LOCATIONS:	MOTHER’S ROOM
CATALOG SPECS:	ATTACHED

Rendezvous Lounge Seating

Chair
w 33 d 32 h 33 sw 21 sd 20 sh 19.5

Power Port Options


All Black


All White


Silver/White

Power Port Option with Plug-in Cord
Rendezvous shown with optional Brushed Aluminum Nave Legs

Oversize Chair
w 38 d 32 h 35 sw 26 sd 20 sh 19.5

Tablet Arm Option
has a 300 lb Capacity. Chair shown with optional heavy duty casters, recessed pull, cup holder, and shelf

Settee
w 54 d 32 h 33 sw 42 sd 20 sh 19.5
Oversize Settee
w 64 d 32 h 35 sw 52 sd 20 sh 19.5

Wood Cap & Wood Base Options
Available on all Rendezvous Seating
2"H Wood Base lowers seat/overall height by 1"

Hide & Go Mobility Option
Beautifully Concealed Mobility

Sofa
w 75 d 32 h 33 sw 63 sd 20 sh 19.5
Oversize Sofa
w 90 d 32 h 35 sw 78 sd 20 sh 19.5

Ottomans
w 26 d 22 h 19.5
w 48 d 22 h 19.5
w 36 d 36 h 19.5

Rendezvous Lounge Seating Features
Lifetime Warranty
Superior Strength: All Rendezvous Chairs pass 1200 lb drop test & 2000 lb capacity
Replaceable & Recoverable Components
Steel Inner Construction
Solid Hard Wood Legs (3"H)
Dymetrol Suspension

Options
Tablet Arm with 300 lb Capacity
Cup Holder (used with Tablet)
Wood or Kydex® Arm Caps
Solid Wood Base (2"H)
Brushed Aluminum Nave Legs
Hide & Go Mobility
Heavy Duty Casters
Recessed Pull (used with mobile options)
Power Port with Plug-in Cord
Shelf (not avail. with power option)
Higher Back (18"H)
Perma-Coat Wood Leg Protector
Weighted
Tamper Resistant Fasteners
Combination Fabrics
Moisture Barrier and Fire Barrier

Integra®
PO Box M Walworth, WI 53184 800.235.0234 fax 262.275.3614 integraseating.com

Tablet Arms

Standard Tablets

Features:

- Integra's Tablet Arm has been engineered and tested to hold up to 300 lbs. of weight.
- The Tablet has a 180° smooth swivel mechanism that allows for optimal positioning.
- Allows for addition of optional cup holder (which will limit tablet swivel to 90°)

Key for Specifying Tablet Option:

1. CHOOSE POSITION

(4) (5)

4 - Tablet on right as seated
5 - Tablet on left as seated

2. CHOOSE MATERIAL

MT - Maple Tablet (Specify finish)
OT - Oak Tablet (Specify finish)
DT - 3D Solid Color Laminate Tablet - (B) Black or (G) Ginger
OR
3D Woodgrain Laminate Tablet - contact Customer Service for available options
LT - Laminate Tablet (Specify finish & laminate)
(Laminate tablets have a solid wood edge. Please specify finish.)

Solid surface tablets are available.
Contact Customer Service for pricing.

3. CHOOSE SIZE

Standard **(1)**
17 1/4"
12"

Kids **(3)**
14 1/4"
10 3/4"

Oversize **(2)**
19 1/4"
12"

Bay (https://integraseating.com/product/bay-22)

Marina Upholstered Arm (https://integraseating.com/product/marina-uph-arm-22)

Reef Upholstered Arm (https://integraseating.com/product/reef-upholstered-arm-chair-24sw)

Coffee House (https://integraseating.com/product/coffee-house-straight-22)
Tria (https://integraseating.com/product/tria-upholstered-arm-chair)

X Rendezvous (https://integraseating.com/product/rendezvous-upholstered-arm-chair)

Rendezvous Squared (https://integraseating.com/product/rendezvous-squared-upholstered-arm-chair)

Soirée (https://integraseating.com/product/soiree-chair)

Flair (https://integraseating.com/product/l chair)

Alpine Tablets

Features:

- Integra's Alpine Tablet Arm has been engineered and tested to hold 300+ lbs. of weight.
- This tablet has a 105° smooth swivel mechanism that allows for optimal positioning.
- Allows for addition of optional cup holder (which will be inset into the tablet, as shown below)

ITEM CODE:	**AV2 ULTRA SHORT THROW PROJECTOR**
QUANTITY:	**1**
MANUFACTURER:	EPSON (basis of design)
DESCRIPTION:	Ultra Short Throw Projector, 3LCD, 3500 Lumens white, 3500 Lumens color, wall mounted. SEE ATTACHED TECHNICAL SPECIFICATIONS.
MODEL NO.:	V11H740522/CDW Part: 441982/UNSPSC: 45111614
DIMENSIONS:	14.5”Wx14.8”Dx6.1”H
FINISH:	White
ROOM NO. LOCATION:	101
CATALOG SHEET:	ATTACHED

MFR # V11H599022

EPSON BRIGHTLINK 595WI INTERACTIVE PROJECTOR

PRODUCT SPECIFICATIONS

MANUFACTURER	Epson Corporation
MANUFACTURER PART NUMBER	V11H599022
MANUFACTURER WEBSITE ADDRESS	http://www.epson.com
BRAND NAME	Epson
PRODUCT TYPE	LCD Projector
PLATFORM SUPPORTED	PC
PLATFORM SUPPORTED	Mac
NUMBER OF LAMPS	1
LAMP TYPE	UHE
STANDARD MODE BRIGHTNESS	3300 lm
VIDEO SIGNAL STANDARD	HDTV
COMPOSITE VIDEO	Yes

OVERVIEW

Epson Brightlink 595wi Interactive Projector

BrightLink 595Wi Interactive WXGA 3LCD Projector

The ultra-short-throw BrightLink 595Wi is the world's first 3LCD, touch-enabled interactive projector. Offering 3x Brighter Colors than competitive models, Epson 3LCD projectors ensure bright, vivid lessons. With 3300 lumens of color brightness1 and 3300 lumens of white brightness1, the 595Wi delivers truly dynamic images. And, it takes kinesthetic learning to new heights. With touch- and pen-based interactivity, the 595Wi makes it easy to draw and collaborate using any wall and familiar, intuitive gestures. Teachers can use the Moderator software2 to simultaneously share students' work from multiple devices3. Plus, it's compatible with top curriculum software and can display images up to 100in from just 12in away.

BRIGHTLINK 595WI INTERACTIVE PROJECTOR

Manufacturer	Epson Corporation
Manufacturer Part Number	V11H599022
Manufacturer Website Address	http://www.epson.com
Brand Name	Epson
Product Line	BrightLink
Product Model	595Wi
Product Name	BrightLink 595Wi Interactive WXGA 3LCD Projector
Marketing Information	**Touch brilliance - the world\'s first 3LCD, touch-enabled interactive projector** The ultra-short-throw BrightLink 595Wi is the world\'s first 3LCD, touch-enabled interactive projector. Offering 3x Brighter Colors than competitive models, Epson 3LCD projectors ensure bright, vivid lessons. With 3300 lumens of color brightness and 3300 lumens of white brightness, the 595Wi delivers truly dynamic images. And, it takes kinesthetic learning to new heights. With touch- and pen-based interactivity, the 595Wi makes it easy to draw and collaborate using any wall and familiar, intuitive gestures. Teachers can use the Moderator software to simultaneously share students\' work from multiple devices. Plus, it\'s compatible with top curriculum software and can display images up to 100\" from just 12\" away.
Product Type	LCD Projector
Projection Method	Front

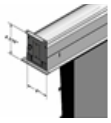
Projection Method	Rear
Platform Supported	PC
Platform Supported	Mac
Interactive	Yes
Minimum Diagonal Image Size	60\"
Maximum Diagonal Image Size	100\"
Number of Lamps	1
Lamp Type	UHE
Lamp Power	245 W
Economy Mode Lamp Life	6000 Hour
Standard Mode Brightness	3300 lm
Native Resolution	1280 x 800
Graphic Mode	WXGA
Native Aspect Ratio	16:10

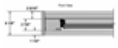
Compatible Aspect Ratio	4:3
Compatible Aspect Ratio	16:9
Throw Ratio	0.27 to 0.37
Video Signal Standard	HDTV
Input Scan Format	1080i
Output Scan Format	720p
Number of Speakers	1
Speaker Output Power	16 W
Speaker Output Mode	Mono
HDMI	Yes
Number of HDMI Ports	2
USB	Yes
Composite Video	Yes
Network (RJ-45)	Yes

S-Video	Yes
VGA In	Yes
VGA Out	Yes
Number Of Audio Inputs	3
Audio Line In	Yes
Number Of Audio Outputs	1
Audio Line Out	Yes
Color	White
Form Factor	Wall Mountable
Height	6.1\"
Width	14.5\"
Depth	14.8\"
Weight (Approximate)	12.10 lb
Application/Usage	Business
Application/Usage	Education
Package Contents	• BrightLink 595Wi Interactive WXGA 3LCD Projector

	• Wall Mount
Limited Warranty	2 Year
Parts Warranty/Labor	3 Month - Lamp

ITEM CODE:	**AV1 MOTORIZED PROJECTION SCREEN**
MANUFACTURER:	STEWART (basis of design)
QTY:	1
DESCRIPTION:	RETRACTABLE ABOVE CEILING SCREEN SYSTEM with Trapdoor.
MODEL:	01201-5100H, STEALTH, FIREHAWK G5 STUDIOTEK 130
DIMENSIONS:	100”Wx49”H
FINISH:	GRAY CASE: WHITE
LOCATIONS:	101
CATALOG SHEET:	ATTACHED





STEWART 01201-6100H STEALTH FIREHAWK CEILING RECESSED SCREEN - 100"

Item #: Stewart-01201-6100H

Manufacturer Part #: 01201-6100H

Special Features:	Ambient Light Rejection, Tensioned
Supported Resolution:	4K, 8K, 16K
Surface Color:	Gray
Screen Type:	Electric
Mount Type:	Ceiling
Format:	HDTV [16:9]
Brand:	Stewart Filmscreen
Viewable Diagonal in.:	100
Viewable Width in.:	87
Viewable Height in.:	49
Product Status:	Leaves Warehouse within 5-6 Weeks
Gain:	1.1
Case Color:	White

"Next Projection is a trusted partner to Stewart Filmscreen. The ability to demystify two-piece projection and highlight what is really the "Big Screen Experience" is important in the consumer education process. There is something to be said in watching movies and other content in sizes not available in today's televisions and the team at Next Projection (ProjectorScreen.com, 4KProjectors.com & BuyAV) is a phenomenal resource to consumers looking to "go big."

Robert Keeler
Vice President, Stewart Filmscreen

Stealth

Retractable, Above Ceiling Screen System with Trapdoor, and Optional Camera Deployment

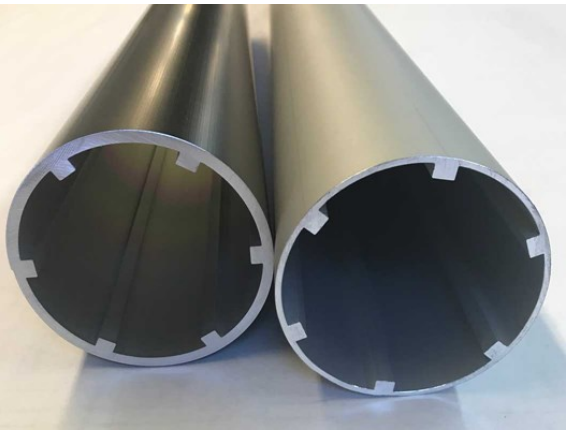
When a high-quality fit and finish is every bit as important as a high-quality image

Stealth is a beautiful, small format retractable screen system with a trapdoor closure, allowing the screen to be completely hidden from view until deployment. Stealth offers exceptional reliability and features quiet operation, along with a choice of several electronic control options. Always seamless, Stealth is available in any of Stewart's front or rear 16K+ projection fabrics with image widths up to 13 feet. Stealth can also be equipped with optional camera deployment for video conferencing. Optional vertical or horizontal masking is also available.

This screen is used most commonly in:

Stealth is discrete

No one knows there is a projection screen in the room until deployment. Hit the start button and a quiet, powerful motor activates the screen. Already, people are paying attention.

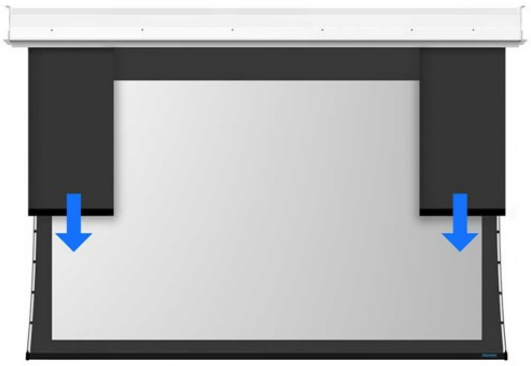


Two custom roller tubes are offered

Our roller tubes are the best in the business and we engineer each one for perfect optimization. With Stealth we offer our 3 inch mill finish tube or our beefier, 3 inch Mamba Tube. The MT3 will allow you to achieve a little bigger image before jumping up in price to the next size.

Optional masking available

Dual aspect ratios can be achieved by adding either vertical (as shown) or horizontal masking to this screen system. A common choice for vertical masking is a constant height, native Scope aspect ratio of 2.39 or 2.35 which can then be masked down to 1.85 Academy Flat or 1.78 HD. With horizontal masking, you can start with a native aspect ratio of 4:3 and mask down to nearly every other aspect ratio. Additionally, we use a wide range



of acoustically transparent, masking fabrics. Each fabric is balanced for optimal sonic and visual performance.

Optional camera deployment

ETL approved, the Stealth Video Conference Screen (VCS) is engineered with super build quality and robust gear that will always deliver as specified. This screen system is beautifully concealed behind a well-engineered trapdoor closure. Precise arms carry your choice of camera systems, reliably and safely. The flexible control system allows deployment of independent elements when the camera is not in use.

Finished with a beautifully detailed trapdoor closure

We offer trapdoors on Stealth to finish the ceiling professionally when a soffit or proscenium to conceal the screen system is not in the offing. With Stealth, form follows function with only the elegant essentials remaining. No one will know the screen is in the room until deployment.

Perfect in-ceiling concealment

With a press of a button, your screen will retract into the ceiling keeping it clean and safe until your next viewing experience. Stealth gives you high functionality and allows you to free up valuable wall space so your room can express other ideas besides a place to watch TV.

Owner's Manual

Firehawk G5

FireHawk, in its fifth generation, is a flexible, front projection, screen surface engineered for use with today's high-powered projection technology in applications involving the presence of ambient light.

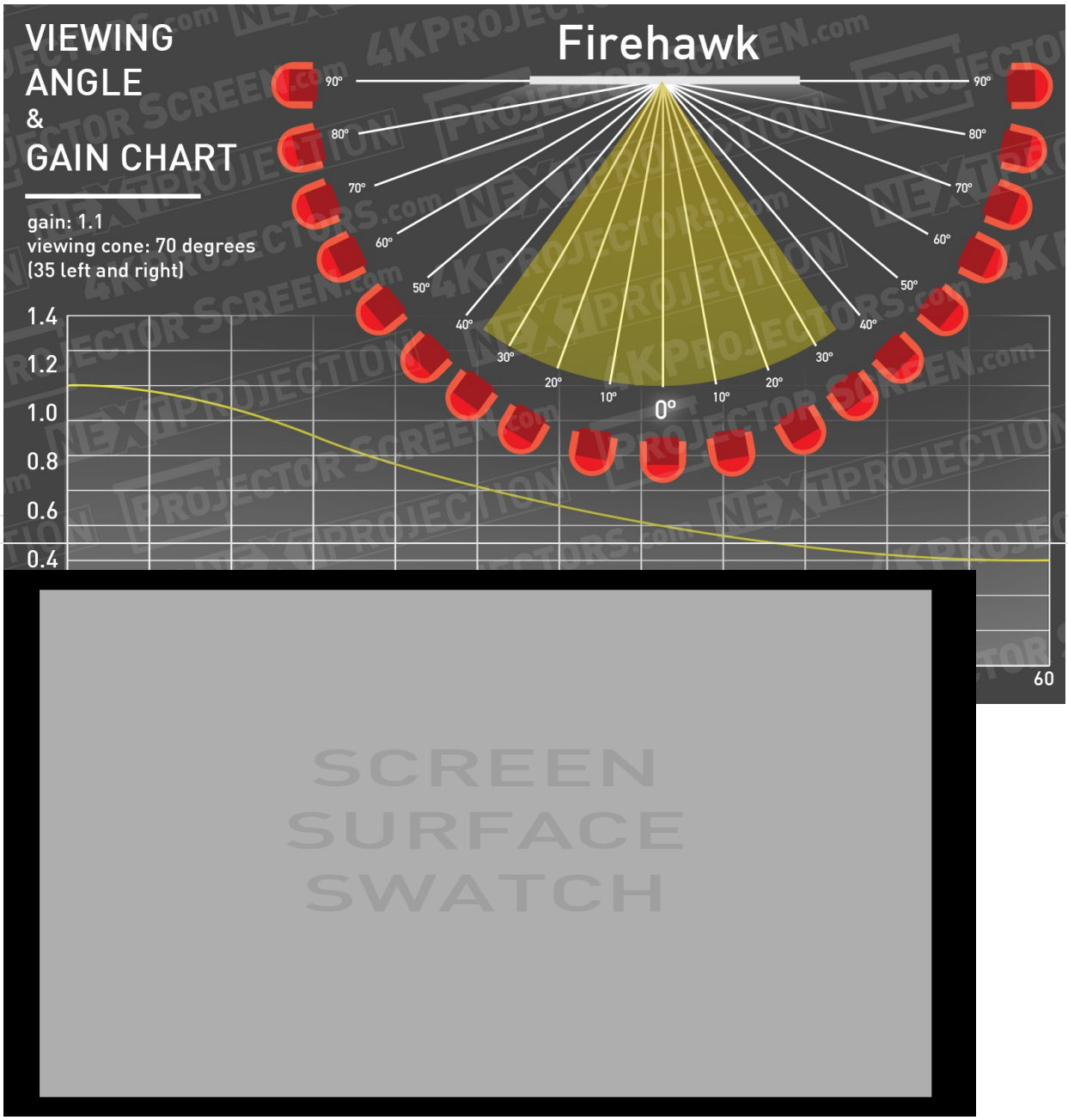
Ambient light is the enemy of two-piece projection. Screens designed to reject ambient light can be effective at furnishing an image in even the brightest of rooms, but the trade-off is the presence of unwanted artifacts such as color-shift, hot-spotting, and poor off-axis viewing. Stewart Filmscreen is in the business of image fidelity, and FireHawk was designed to provide the best possible trade-off between image fidelity and ambient light resistance. With improvements to uniformity and off-axis viewing, FireHawk G4 is even closer to the reference quality and image fidelity that have long been synonymous with Stewart Filmscreen. Click to download spec sheet. (https://www.stewartfilmscreen.com/Files/files/Support%20Material/Material%20Data%20Sheets/FireHawk%20G5.1.pdf)

Surface Characteristics

- Reformulated optical coating allows for enhanced focusing capabilities
- Superior performance in environments with ambient light
- Offers superb black levels, shadow detailing, and overall color saturation
- Increased image contrast and resolution
- Certified by THX
- Certified by the Imaging Science Foundation (ISF)

Surface Material Properties

Peak Gain	1.1
Half Gain	35 Degrees
Ambient Light Rejection Value	73%
Ambient Light Resistance	Very Good
Minimum Throw Distance	1.6 x Image Width
Edge Blending Properties	N/A
Passive 3D use	No
Lay Flat Quality	Excellent
Flame Resistance	Yes


VIEWING
ANGLE
&
GAIN CHART
gain: 1.1
viewing cone: 70 degrees
(35 left and right)
Firehawk
90°
80°
70°
60°
50°
40°
30°
20°
10°
0°
1.4
1.2
1.0
0.8
0.6
0.4
60

SCREEN
SURFACE
SWATCH

Item Number	Price	Viewable Diagonal in.	Viewable Height in.	Viewable Width in.	Projection Surface	
Search	Search	Search	Search	Search	Search	
Stewart-01201-5094D (/stewart-stealth-01201-5094d-ceiling-recessed-screen-94-50x80-16-10-1-3-gain-studiotek-130.html)		94	50	80	StudioTek 130	
Stewart-01201-5100H (/stewart-stealth-01201-5100h-ceiling-recessed-screen-100-49x87-16-9-1-3-gain-studiotek-130.html)		100	49	87	StudioTek 130	
Stewart-01201-5100H-Perf (/stewart-01201-5100h-perf-stealth-studiotek-130-perf-ceiling-recessed-screen-100-49x87-16-9-1-3.html)		100	49	87	StudioTek 130 Perf	
Stewart-01201-5100H-PHALR (/stewart-01201-5100h-phalr-stealth-phantom-ceiling-recessed-screen-100-49x87-16-9-1-0-gain.html)		100	49	87	Phantom HALR	
Stewart-01201-5100H-PHALR-Perf (/stewart-01201-5100h-phalr-perf-stealth-phantom-perf-ceiling-recessed-screen-100-49x87-16-9-1-0.html)		100	49	87	Phantom HALR Perf	
Stewart-01201-5100H-ST100 (/stewart-01201-5100h-st100-stealth-studiotek-100-ceiling-recessed-screen-100-49x87-16-9-1-0.html)		100	49	87	StudioTek 100	

Item Number	Price	Viewable Diagonal in.	Viewable Height in.	Viewable Width in.	Projection Surface
Search	Search	Search	Search	Search	Search
Stewart-01201-5100H-ST100-Perf (/stewart-01201-5100h-st100-perf-stealth-studiotek-100-perf-recessed-screen-100-49x87-16-9-1-0.html)		100	49	87	StudioTek 100 Perf
Stewart-01201-5109D (/stewart-stealth-01201-5109d-ceiling-recessed-screen-109-57-5x92-16-10-1-3-gain-studiotek-130.html)		109	57.5	92	StudioTek 130
Stewart-01201-5110H (/stewart-stealth-01201-5110h-ceiling-recessed-screen-110-54x96-16-9-1-3-gain-studiotek-130.html)		110	54	96	StudioTek 130
Stewart-01201-5110H-Perf (/stewart-01201-5110h-perf-stealth-studiotek-130-perf-ceiling-recessed-screen-110-54x96-16-9-1-3.html)		110	54	96	StudioTek 130 Perf
Stewart-01201-5110H-PHALR (/stewart-01201-5110h-phalr-stealth-phantom-ceiling-recessed-screen-110-54x96-16-9-1-0-gain.html)		110	54	96	Phantom HALR
Stewart-01201-5110H-PHALR-Perf (/stewart-01201-5110h-phalr-perf-stealth-phantom-perf-ceiling-recessed-screen-110-54x96-16-9-1-0.html)		110	54	96	Phantom HALR Perf

Item Number	Price	Viewable Diagonal in.	Viewable Height in.	Viewable Width in.	Projection Surface
Search	Search	Search	Search	Search	Search
Stewart-01201-5110H-ST100 (/stewart-01201-5110h-st100-stealth-studiotek-100-ceiling-recessed-screen-110-54x96-16-9-1-0.html)		110	54	96	StudioTek 100
Stewart-01201-5110H-ST100-Perf (/stewart-01201-5110h-st100-perf-stealth-studiotek-100-perf-recessed-screen-110-54x96-16-9-1-0.html)		110	54	96	StudioTek 100 Perf
Stewart-01201-5123D (/stewart-stealth-01201-5123d-ceiling-recessed-screen-123-65x104-16-10-1-3-gain-studiotek-130.html)		123	65	104	StudioTek 130
Stewart-01201-5123H (/stewart-stealth-01201-5123h-ceiling-recessed-screen-123-60x107-16-9-1-3-gain-studiotek-130.html)		123	60	107	StudioTek 130
Stewart-01201-5123H-Perf (/stewart-01201-5123h-perf-stealth-studiotek-130-perf-ceiling-recessed-screen-123-60x107-16-9-1-3.html)		123	60	107	StudioTek 130 Perf

Item Number	Price	Viewable Diagonal in.	Viewable Height in.	Viewable Width in.	Projection Surface
Search	Search	Search	Search	Search	Search
Stewart-01201-5123H-PHALR (/stewart-01201-5123h-phalr-stealth-phantom-ceiling-recessed-screen-123-60x107-16-9-1-0-gain.html)		123	60	107	Phantom HALR
Stewart-01201-5123H-PHALR-Perf (/stewart-01201-5123h-phalr-perf-stealth-phantom-perf-ceiling-recessed-screen-123-60x107-16-9-1-0.html)		123	60	107	Phantom HALR Perf
Stewart-01201-5123H-ST100 (/stewart-01201-5123h-st100-stealth-studiotek-100-ceiling-recessed-screen-123-60x107-16-9-1-0.html)		123	60	107	StudioTek 100
Stewart-01201-5123H-ST100-Perf (/stewart-01201-5123h-st100-perf-stealth-studiotek-100-perf-recessed-screen-123-60x107-16-9-1-0.html)		123	60	107	StudioTek 100 Perf
Stewart-01201-5130D (/stewart-stealth-01201-5130d-ceiling-recessed-screen-130-69x110-16-10-1-3-gain-studiotek-130.html)		130	69	110	StudioTek 130

Item Number	Price	Viewable Diagonal in.	Viewable Height in.	Viewable Width in.	Projection Surface	
Search	Search	Search	Search	Search	Search	
Stewart-01201-5135H (/stewart-stealth-01201-5135h-ceiling-recessed-screen-135-66x118-16-9-1-3-gain-studiotek-130.html)		135	66	118	StudioTek 130	
Stewart-01201-5135H-Perf (/stewart-01201-5135h-perf-stealth-studiotek-130-perf-ceiling-recessed-screen-135-66x118-16-9-1-3.html)		135	66	118	StudioTek 130 Perf	
Stewart-01201-5135H-PHALR (/stewart-01201-5135h-phalr-stealth-phantom-ceiling-recessed-screen-135-66x118-16-9-1-0-gain.html)		135	66	118	Phantom HALR	

Projector Screens

Electric Screens (/projector-screens/screen-type/electric)

Fixed Frame Screens (/projector-screens/fixed-frame-screens)

Folding Frame Screens (/projector-screens/folding-frame-screens)

Manual Screens (/projector-screens/screen-type/manual)

Ceiling Screens (/projector-screens/mount-type/ceiling)

Screens by Size (/projector-screens/viewable-diagonal)

see all screens... (/projector-screens)

Popular Screen Brands

Da-Lite (/da-lite)

Draper (/draper)

Elite Screens (/elite-screens)

Screen Innovations (/screen-innovations)

Stewart Filmscreen (/stewart-filmscreen)

see all brands... (/shop-by-brand)

Popular Links

4K Projection Explained (https://www.projectorscreen.com/blog/4K-Projection-Surfaces-Explained)

UST Projectors & Screens (/ultra-short-throw-ust)

4K Projectors (/4k-projectors)

Samsung LSP9T (/samsung-lsp9t-4k-ultra-short-throw-laser-projector.html)

Samsung LSP7T (/samsung-lsp7t-4k-ultra-short-throw-laser-projector.html)

Epson 5050 Projector (/epson-powerlite-home-cinema-5050ub-lcd-projector-with-2600-lumens.html)

Epson 6050 Projector (/epson-powerlite-pro-cinema-6050ub-projector-bundle-with-2600-lumens.html)

Optoma CinemaX P2 (/optoma-p2-cinemax-4k-uhd-3000-lumen-ultra-short-throw-home-cinema-laser-projector-with-soundbar.html)

Optoma UHZ65LV Projector (/optoma-uhz65lv-native-4k-uhd-5000-lumen-home-cinema-laser-projector.html)

JVC NX5 Projector (/jvc-dla-nx5-d-ila-4k-projector-with-1800-lumens-and-hdr10.html)

JVC NX7 Projector (/jvc-dla-nx7-d-ila-4k-projector-with-1900-

Information

Return & Pricing Policies (/store/pg/46-Return-and-Pricing-Policies-ProjectorScreen-com.html)

Contact Us (/contact-us)

Education (/edu)

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Government (/gov)

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Projector Buying Guide (/blog/projector-buying-guide)

Projector Screen Buying Guide (/projector-screen-guide)

Accessibility Statement (/projectorscreen-com-accessibility-statement.html)

Contact Us

(866) 329-8987

www.projectorscreen.com (/)

200 Wanaque Ave #200

Pompton Lakes NJ 07442

ITEM ID:	**AP3 UNDERCABINET REFRIGERATOR**
QTY:	1
MANUFACTURER :	WHIRLPOOL (BASIS OF DESIGN)
DESCRIPTION:	5.1 cu.ft., temp from 41 to 64 degrees F, spill proof glass shelves, reversible stainless steel door, LED interior light, temperature sensor alert.
DIMENSIONS:	24”Wx34 ½”Hx24”D
MODEL NO.:	WUR50X24HZ
FINISH:	FiNGERPRINT RESISTANT STAINLESS STEEL
ROOM. LOCATION:	MOTHER'S ROOM
CATALOG PAGES:	ATTACHED

MOTHER'S ROOM UNDER COUNTER REFRIGERATOR

QTY: 1

Whirlpool® (basis of design)

24-inch Wide Undercounter Refrigerator - 5.1 cu. ft.

WUR50X24HZ

Color: Fingerprint Resistant Stainless Steel

Stay organized with purposeful spaces for any item. This undercounter 5.1 cu. ft. refrigerator features fingerprint-resistant stainless steel that makes it easy to clean. LED interior lighting keeps food looking as good as it tastes, and this undercounter fridge has a temperature sensor alert to makes sure drinks stay cold.

Features

LED Interior Lighting

Keep food looking as good as it tastes. Light is cast inside the refrigerator so food looks like it's supposed to.

Reversible Stainless Steel Door

Install the stainless steel door on either side to accommodate unique spaces.

Spillproof Glass Shelves

Additional Features

Single-Temperature Controlled Zone

Store food and beverages the way you like them with customized temperature selection ranging anywhere from 41 to 64°F.

Temperature Sensor Alert

Keep items at their ideal temperature with an alert that lets you know if the temperature is rising or cold air is escaping through an open door.

ITEM CODE:	**AP1 REFRIGERATOR**
TOTAL QUANTITY:	2
MANUFACTURER:	WHIRLPOOL (BASIS OF DESIGN)
DESCRIPTION:	20 cu. Ft. Counter Depth French Door Refrigerator
MODEL NO.:	WRF540CWBM
DIMENSIONS:	36”W
FINISHES:	STAINLESS STEEL
ROOM NUMBER LOCATION:	119 BREAK ROOM
CATALOG SHEET:	ATTACHED

Whirlpool 25.2-cu ft French Door Refrigerator with Single Ice Maker (Stainless Steel) ENERGY STAR (basis of design)

Item # 509262 **Model #** WRF535SMBM

QTY: 2 BREAK ROOM

Manufacturer Color/Finish

Stainless Steel

Refrigerator Type
French Door
Refrigerator Capacity Cu. Ft.
14.38
Freezer Capacity Cu. Ft.
5.62
Energy Star® Qualified
ENERGY STAR® Qualified
ADA Compliant
No
Star K Compliant
No

Depth
29 3/8
Height
70 1/8
Width
35 5/8
Cutout Height
69
Cutout Width
36
Height To Top Of Cabinet
68 13/16
Depth With Door Open 90 Degree
43 1/16
Depth Excluding Doors
24 1/8
Depth Closed Excluding Handles
28
Width of Cabinet Only
35 5/8
Refrigerator Capacity
20.00
Number of Interior Shelves
5
Spill-Proof Glass Shelves
No
Conventional Shelves
4 Adjustable Full-Width Glass
Temperature-Controlled Drawers
1 Full Width Pantry
Humidity-Controlled Drawers

2 Half-Width

Non Climate-Control Drawers

No

Door Bins

2 Adjustable Gallon, 4 Adjustable Half-Width

Number of Freezer Shelves

0

Interior Shelves

No

Freezer Drawer/Basket

1 Full Width Lower Wire, 1 Full Width Upper Wire

Door Bins

No

Dispenser Type

Interior Water Only

Dispenser Options

Filtered Water

Ice Maker

Factory Installed

Door Style

Contour

LCD Touch Screen

No

Specifications

Appliance Color/Finish	Stainless steel
Overall Capacity (Cu. Feet)	25.2
Refrigerator Capacity (Cu. Feet)	17.8
Freezer Capacity (Cu. Feet)	7.4
Door Texture	Smooth
Door Style	Contoured
Hidden Hinge	
Handle Type	Standard
Water Filtration	
Dispenser Options	N/A
Child Safety Locks	
Water Filter Indicator	
Door Alarm	
Dispenser Light	
Ice Maker	Single
Space-Saving In-Door Ice	
Air Filtration	
Dual Evaporator Cooling System	
	LED

Height to Top of Case (Inches)	68.8125
Height to Top of Door Hinge (Inches)	70.125
Width (Inches)	35.625
Depth (Including Handles) (Inches)	35.4375
Depth (Excluding Handles) (Inches)	32.9375
Depth (Less Door) (Inches)	29.125
Depth with Door Open (Inches)	48.0625
Manufacturer Color/Finish	Stainless steel
Cabinet Color	Gray
Door Handle(s) Color	Stainless steel
Toe Grille Color	Gray
Custom Door Kit Compatible	
Manufacturer's Warranty (Labor)	1-year limited
Manufacturer's Warranty (Parts)	1-year limited
Lowe's Exclusive Color/Finish Family	Stainless steel

AP 10 BREAK ROOM DOUBLE GLASS DOOR COOLER

QTY: 1

PREMIUM (basis of design) 18 cu.ft. GLASS FRONT REFRIGERATOR.

Specifications

Key Specs

Product Height	73 inches
Product Width	34 7/16 inches
Height To Top Of Door Hinge	77 13/32 inches
Total Capacity	16 cubic feet
Refrigerator Style	No Freezer
Lighting Type	LED
Ice Maker	No
App Compatible	No

General

Product Name	16 FT³ VERTICAL REFRIGERATOR DISPLAY
Brand	Premium Levella
Model Number	PRN165DX
Color	Silver
Color Category	Silver
Side Panel Color	Gray

Dimension

Product Height	73 inches
Product Width	34 7/16 inches
Product Depth	22 7/8 inches
Height To Top Of Door Hinge	77 13/32 inches
Standardized Width	35 inches
Counter Depth	No

Capacity

Total Capacity	16 cubic feet
Refrigerator Capacity	16.5 cubic feet

Features

Configuration	Freestanding
Refrigerator Style	No Freezer
Defrost Type	Frost free
Reversible Door Hinge	No

ITEM NO.	**MB1 MARKERBOARD, GLASS**
MANUFACTURER:	QUARTET (basis of design)
QTY:	4
DESCRIPTION:	FRAMED MAGNETIC TEMPERED GLASS MAGNETIC DRY ERASE BOARD, smooth glass surface, hidden mounting hardware, thin aluminum frame, marker tray.
MODEL:	ELEMENT
DIMENSIONS:	74”X42”
FINISH:	FRAME: SILVER ALUMINUM SURFACE: WHITE
ROOM LOCATIONS:	101 LARGE CONFERENCE ROOM (4)
CATALOG SHEET:	ATTACHED

Quartet Element Framed Magnetic Glass Dry-Erase Board, 74" x 42", Aluminum Frame

Minimalist Frame

A thin, silver aluminum frame boarders this glass dry-erase board, creating a clean and modern look. The minimalist design adds an elegant touch to any room and gives you more space to capture all of your thoughts.

Clean Erase

Clearly communicate ideas, announcements and more without the distraction of leftover streaks. Our easy-to-erase glass will not stain or ghost, which lets you write, erase and rewrite on a clean surface, every time.

Tempered Glass

Designed for long-term performance, this board is built-to-last. The durable glass surface resists scratches and dents and is great for heavy use in the office or at home. Comes with a 25 year limited warranty.

Featuring a white glass surface, the Quartet Element Dry-Erase Board meets the needs of a contemporary office. The precisely crafted silver aluminum frame updates the design and ambiance of any corporate environment with a modern vibe.

- Precision engineered silver aluminum frame adds a contemporary edge to enhance the design and ambiance of any office environment
- Tempered glass board is stain and ghost resistant, making it excellent for a heavy use environment that demands superior erasability
- Steel-backed magnetic glass allows secure hanging of papers with high powered glass board magnets
- Wide format, 74” x 42” board size. The 16:9 aspect ratio maximizes the usable space on the glass surface.
- Mounting hardware with template makes it easy to accurately hang board
- Marker tray keeps accessories handy. 1 dry-erase marker and 2 rare earth magnets are included.
- Limited 25 year warranty

Product Specifications

- Magnetic

  Yes

- Frame Finish

  Silver Aluminum

- Surface Type

Glass

- Accessory Tray

  Yes

- Color

  White

- Hardware Included

  Yes

- Orientation

  Horizontal

- Pack Quantity

  1

- Warranty

  25 years

- Size

  74" x 42"

- Surface Color

  White

- Usage

  Public Space - High traffic

- Use Frequency

  Heavy

- Weight

  79 lbs

- Placement

  Wall

MB2 DRY ERASE MARKERBOARDS FOR ALL OFFICE SPACES

QTY: 32

Quartet Classic **(basis of design)**

DuraMax Porcelain
Magnetic
Whiteboard,
24"x36" (3' x 2'), Silver
Aluminum Frame

ITEM CODE:	**AP2 MICROWAVE OVEN**
TOTAL QTY:	2
MANUFACTURER:	SHARP (basis of design)
DESCRIPTION:	Professional Microwave Oven 120V@60Hz Output Watts 1000 .95 cu. Ft. Commercial UL LISTED E44459, FCC, DHHS and NSF 1 touch cooking, compact design, 10 memory presets, dial timer Weight: 44.5 lbs.
MODEL NO.:	#R21LCF
DIMENSIONS:	20 ½”Wx16”Dx12 1/8”H
FINISH:	Stainless Steel
ROOM NUMBER LOCATION:	119 BREAK ROOM (2)
CATALOG SHEET:	ATTACHED

SHARP

Microwave, Commercial, Digital Timer

Mfr. Model # **R21LCF**

Shipping Weight **44.5 lbs.**

Product Details

Compact design with automatic cook options allow 1-touch cooking and has up to 10 memory presets. Suitable for high-volume use.

Technical Specs

Item	**Professional Microwave Oven**
Voltage	**120V @ 60 Hz**
Output Watts	**1000**
Color	**Stainless Steel**
Oven Capacity	**0.95 cu. ft.**

Outside Width	**20-1/2"**
Outside Depth	**16"**
Outside Height	**12-1/8"**
Standards	**Commercial UL Listed E44459, FCC, DHHS and NSF**
Features	**1-touch cooking, compact design, 10 memory presets, Dial Timer**

ITEM CODE:	**TC4 3 BIN RECYCLING CENTER**
QTY:	1
MANUFACTURER:	SAFECO (BASIS OF DESIGN)
DESCRIPTION:	3 receptacles, impact resistant,28 gal capacity each bin, joined together, large diameter openings w/decals
DIMENSIONS:	46”Wx16”Dx33”H
MODEL NO.:	9798BL
FINISH:	Black/Gray Plastic
ROOM LOCATIONS:	121 (1)
CATALOG SHEET:	Attached

TC4 3 BIN RECYCLING CENTER FOR BREAK ROOM

Safco® 3-In-1 Disposable Recycling Center 9798BL - Corrugated Plastic

(basis of design)

3-IN-1 DISPOSABLE RECYCLING CENTER
Ideal For Temporary Recycling Applications Including Trade Shows, Concerts & Sporting Events.

Recycling center includes 3 receptacles made of 100% recyclable polyethylene that is impact and moisture resistant. Receptacles offer 28 gallon capacity each and are joined together using a corrugated plastic base and lid. Lid includes large diameter openings with decals for quick identification. Measures 46"W x 16"D x 33"H overall. Easy assembly.

Product Specifications

WIDTH INCHES	46
DEPTH INCHES	16
HEIGHT INCHES	33
COLOR FINISH	Black/Gray
ASSEMBLY	Unassembled
CONSTRUCTION	Corrugated Plastic
MANUFACTURERS PART NUMBER	9798BL
TYPE	Triple Unit
GALLONS PER LINER	28
BRAND	Safco®
CAPACITY GALLONS	84
DESCRIPTION	Disposable Recycling Center

TC1 TRASH RECEPTACLE FOR BREAK ROOM, RESTROOMS AND MOTHER'S ROOM
QTY: 6 (ROOMS 105,106,107,108,120,121)

(BASIS OF DESIGN)

ADA

ECLIPSE OPEN TOP 29 GAL METAL REFUSE STAINLESS STEEL

SKU: FGR2030SSPL

Combining contemporary appearance with lasting durability, the Rubbermaid Eclipse R2030E black waste receptacle offers fresh, functional design.

- Heavy-gauge, fire-safe, powder-coated stainless steel
- Sanitary, hands-free operation
- Leak-proof rigid plastic liner

Color:

SPECIFICATIONS

	U.S.	Metric
Product Packaging Length		50.80 cm
Product Packaging Width		50.80 cm
Product Packaging Height		85.09 cm
UPC	00097591121856	
Case Pack Length	21.00 in	53.34 cm
Case Pack Width	21.00 in	53.34 cm
Case Pack Height	36.00 in	91.44 cm
Case Pack Weight	42.40 lb	19.23 kg
UCC	00097591121856	
Case Pack Quantity	1	
Capacity	29.00 gal	
Color	Stainless Steel	
Material Type	Metal	
Country of Origin	China	

TC2 DESKSIDE WASTEBASKET
CONFERENCE ROOMS,WORKSTATIONS,DESKS, COPY AREA

Rubbermaid® (basis of design) Deskside Wastebasket, 10 Gallon, Black, 20"H x 11"W x 15"D **Model:** FG295700BLA

QTY: 30

Product Details

- All-plastic construction won’t chip, rust or dent
- Rolled rims add strength, and are easy to clean
- Fits under standard desk height even when swing top is fully extended

TC3 RUBBERMAID (basis of design)

DESKSIDE RECYCLING BIN QTY: 30

CONFERENCE ROOMS, WORKSTATIONS, DESKS, COPY AREA

Item: 756076 **Model:** FG295773BLUE

Product Details

- Dark blue
- Capacity: 10.3gal
- Dimension: 19 7/8"H X 11"W X 15 1/4"L

Product Details

Rubbermaid Recycling bin in blue color comes in seamless construction that offers leak resistance. Bin measuring 20" X 11" X 15 1/4" with printed recycling symbol allows fast, easy/efficient recycling collection and is ideal for office usage.

- Dark blue
- Capacity: 10.3gal
- Dimension: 19 7/8"H X 11"W X 15 1/4"L
- 41 1/4 qt
- Type: Utility
- Function: Recycling
- Go green: Eco friendly
- Outside diameter: 19.9"
- Shape: Rectangular
- Designed to be used with existing office containers and accessories
- Promote fast, easy and efficient recycling collection
- All plastic construction will not rust, chip or peel and easy and effective way to collect waste paper
- Contains post consumer recycled resin (PCR) exceeding EPA guidelines
- Recycling symbol imprinted on the containers with variety of shapes and capacities to suit your workspace

Specifications

Trash Can & Recycling Bin Capacity (gal.)	10
Trash Can & Recycling Bin Type	Recycling Bins
Width (in.)	15.25
Usage Area	Indoor
Lid Lock	No
Color Family	Blue
Material	Plastic
Depth (in.)	11
Height (in.)	19.8
Handle	No
Bin Lid Type	No Lid

AP8 KEURIG POD COFFEE BREWER

FOR BREAK ROOM

QTY: 2

KEURIG COMMERCIAL

Keurig K155 OfficePRO Premier Brewing System

(Basis of Design)

The Keurig® OfficePRO® Premier Brewing System brews a perfect cup of coffee, tea, hot cocoa or iced beverage in under one minute at the touch of a button. Now everyone you work with can brew what they love. This fully programmable brewer has an interactive touchscreen that allows you to program the brew temperature, Auto On/Off and set your language preference to English, Spanish or French.

The OfficePRO® Premier brewer has a choice of four cup sizes, offers a removable drip tray to accommodate travel mugs and a drainable internal hot water tank for transport or storage. Includes a Bonus 12 Count K-Cup® variety box.

Choose from more than 500 varieties of coffee, tea, specialty beverages, and even iced beverages — from over 75 brands you know and love. Just look for the Keurig logo on your favorite varieties of K-Cup® pods.

Note: The My K-Cup® is not compatible with the Keurig® OfficePRO® Premier Brewing System. In addition, this brewer cannot be plumbed to a water line.

Key Features:
• Full color LCD touchscreen
• Adjustable brew temperature
• Programmable features such as language and clock time
• Auto On/Off feature
• Quiet Brew® Technology
• Extra large 90oz. Water Reservoir
• Easily drains for transport and storage

Product Highlights

- OFFICE COFFEE MAKER
- 4 CUP SIZES: 4, 6, 8 AND 10OZ.
- 90 OZ RESERVOIR
- < 1 MINUTE BREW TIME
- 13.9”H x 10.4”W x 14.0”D

AP9 BREAK ROOM UNDERCOUNTER ICEMAKER

QTY: 1

KitchenAid® 18'' Automatic Ice Maker with PrintShield™ Finish

MODEL KUID308HPS (basis of design)

Dimensions

CABINET WIDTH
17-7/8 in
CUTOUT DEPTH
25.0 in
CUTOUT HEIGHT
34-1/2 in
CUTOUT WIDTH
18.0 in
DEPTH CLOSED EXCLUDING HANDLES
23-1/8 in
DEPTH CLOSED INCLUDING HANDLES
25-5/8 in
DEPTH EXCLUDING DOORS

21-1/2 in
DEPTH WITH DOOR OPEN 90 DEGREE
44-1/8 in
HEIGHT TO TOP OF CABINET
34-3/8 in
HEIGHT TO TOP OF DOOR HINGE
34-3/8 in
Appearance
CABINET FINISH
Textured
HANDLE LOCATION
Horizontal
HANDLE MATERIAL
Metal
REVERSIBLE DOOR
No
DEFROST TYPE
Automatic Defrost
ICE MAKER ON/OFF
Yes
LOCATION OF CONTROLS
Interior Up Front
Filter Details
WATER FILTER INDICATOR/RESET
Yes
WATER FILTER LOCATION
Interior
Details
AMBIENT TEMPERATURE RANGE
55F to 110F
DRAIN CONNECTION
Rear Access 5/8"" OD
DRAIN PUMP
No, Gravity Drain
INTERIOR LIGHT
LED
SELECTIONS
Clear Ice Technology, Easy Access Filter Install, True Flush Installable, Max Ice, Ice Scoop

ITEM CODE:	**S2 TALL INDUSTRIAL SHELVING**
QTY:	3
MANUFACTURER:	LYON (basis of design)
DESCRIPTION:	20 guage heavy duty shelves, 900 lb. capacity, 6 shelves
DIMENSIONS:	36" Wx24”Dx84”H
MODEL No.:	8042SH 8000 SERIES OPEN SHELVING
FINISH:	STEEL
ROOM NO. LOCATIONS:	STORAGE ROOM
CATALOG SHEET:	ATTACHED

Lyon, LLC
P.O. Box 671
Aurora, IL 60507-0671
Phone: 630-892-8941 • **Fax:** 630-892-8966

Cat. No. 8042SH, 8000 Series Open Shelving Sections

20-Gauge Heavy Duty, Box "W" Shelves provide 900 lb. capacity to hold grinders, wheels, gears, sprockets, and other similar articles.

Application

All-purpose standard and heavy-duty storage.

Specifications | Details

Gauge	20
Component Type	Starter
Duty Classification	Heavy Duty
No. of Shelves	6
Add-Ons	8042H
Dimensions	36"w x 24"d x 84"h
Width	36 in
Depth	24 in
Shelf Type	20-Gauge Heavy Duty, Box "W" (900 lbs)

Shelving Uprights	 T-Post Upright
Shelving Section	Open
Height	84 in
Max. Capacity per shelf[1]	900 lb
Application	Industrial
Color	BB - Wedgewood Blue DD - Dove Gray (In Stock) PP - Putty (In Stock)

Details −

- **Shelf Construction**
18, 20, 22 ga. box, 18 ga. flanged, lapped and welded.
- **Upright Construction**
T-Post, B.P., O.A., 16 ga. cold rolled, formed steel. Double thick.
- **Adjustability**
1 1/2" centers
- **Stock Colors**
Dove Gray, Putty, Wedgewood Blue

[1] Capacities are based on evenly distributed load. Maximum load capacity: 8000 lbs. per section.

RU9000 TV

AV 3 65" FLAT PANEL TV

QTY: 4

PRODUCT HIGHLIGHTS

- Dynamic Crystal Color
- Crystal Processor 4K
- Smart TV Powered by Tizen
- HDR
- Real Game Enhancer

SIZE CLASS

65"

ROOM 101 (4)

4K ULTRA HD CONNECTED

Warm and cool LED backlighting enlivens your content with deeper blacks and brighter whites, while millions of shades fill the screen with energy.

KEY FEATURES

Picture
- Crystal Processor 4K
- Dynamic Crystal Display
- HDR
- Dynamic Crystal Color
- Real Game Enhancer
- Motion Rate 240

Design
- Boundless Design
- Titan Gray Flat Foot Stand

Smart Features
- Smart TV Powered by Tizen
- Universal Guide
- Bixby built-in
- TV Plus
- Samsung OneRemote

Connections
- 4 HDMI Connections[1]
- 2 USB Connections
- LAN Port
- 802.11AC built-in Wi-Fi
- Bluetooth®
- RS232 Control (EX-Link)
- IP Control Support[2]
- Optical Audio Output Port

Audio
- Dolby® Digital Plus
- 20 Watt 2 Channel

Included Accessories
- Samsung OneRemote

Industry Certifications
- CTA 4K Ultra HD Connected

[1]HDMI—CEC (Consumer Electronics Control) facilitates convenient control functions with compatible devices.
[2]Requires third-party control system installation. See www.samsung.com/us/business/custominstall.

SAMSUNG

SEE BACK FOR DETAILS

RU9000 TV

KEY FEATURES (page 1 of 2)

PICTURE

Crystal Processor 4K
This ultrafast processor transforms everything you watch into stunning 4K.

Dynamic Crystal Display
Crystal-shaped nanostructured particles reveal millions of colors, producing a true-to-life picture that HDTVs can't display.

HDR
Unveils shades of color and detail you can't find on HDTV.

Dynamic Crystal Color
Millions of additional shades of color reveal a vibrant, lifelike picture that HDTVs can't display.

Real Game Enhancer
Helps prevent tearing and stuttering, giving you smooth, lifelike visuals along with cinematic sound.

Motion Rate 240
Minimizes motion blur on screen, so actioned-packed movies and sports stay smooth and crisp.

HDR Formats Supported
HDR10 (Static MetaData), HDR10+ (Dynamic MetaData), HLG (Hybrid Log Gamma). All Samsung 4K UHD TVs also meet the CTA HDR-Compatible Definition.

DESIGN

Boundless Design
An ultra-thin bezel on all sides for a stunningly clean look.

SMART FEATURES

Smart TV Powered by Tizen
Go beyond smart TV with next-gen apps, super-easy control and a host of enhancements that elevate the TV-watching experience.

Universal Guide
One simple on-screen guide organizes your streaming and live TV content, while also making recommendations.

TV Plus
Enjoy your favorite content through virtual channels.

Samsung OneRemote
The sleek and slim OneRemote automatically detects and controls all compatible connected devices and content.

SAMSUNG

RU9000 TV

KEY FEATURES (page 2 of 2)

CONNECTIONS

HDMI
Enjoy higher-quality audio and video with an HDMI connection that transmits both signals over a single cable. Compatible with next-generation Ultra HD Blu-ray™ players and HDR content decoding. Includes 1 Audio Return Channel (ARC).

Wi-Fi
Enjoy your favorite on-demand content seamlessly through your existing network with built-in Wi-Fi (802.11AC).

AUDIO

Dolby® Digital Plus
Enjoy the ultimate digital sound quality on all of your favorite movies, TV shows and streaming content. Dolby Digital Plus optimizes your entertainment experience with enhanced sound richness and clarity.

INCLUDED ACCESSORIES

Samsung OneRemote

INDUSTRY CERTIFICATIONS

4K Ultra HD Connected
All Samsung 2020 4K UHD and QLED televisions comply with the CTA 4K Ultra High-Definition Connected definition requirements. The trade organization known as the Consumer Technology Association (CTA™) is considered an industry authority on engineering standards for consumer electronics in the United States. Visit www.cta.tech for more information.

SAMSUNG

RU9000 TV

MODELS

MODEL: UN82RU9000
ORDER CODE: UN82RU9000FXZA

SCREEN SIZE CLASS: 82"

SCREEN DIAGONAL MEASUREMENT: 81.5"

UPC CODE: 887276414218

COUNTRY OF ORIGIN: Mexico

DIMENSIONS (INCHES W x H x D):
- **TV WITHOUT STAND:** 72.4 x 41.4 x 2.4
- **TV WITH STAND:** 72.4 x 43.9 x 15.1
- **SHIPPING:** 80.3 x 48.2 x 10.2
- **STAND FOOTPRINT:** 1 x 10.1 x 15.1

WEIGHT (LB):
- **TV WITHOUT STAND:** 103.8
- **TV WITH STAND:** 105.8
- **SHIPPING:** 135.6

VESA SUPPORT: Yes (600 x 400)

ACCESSORIES INCLUDED IN BOX:
- **REMOTE MODEL:** TM2050A (Black)

MODEL: UN75RU9000
ORDER CODE: UN75RU9000FXZA

SCREEN SIZE CLASS: 75"

SCREEN DIAGONAL MEASUREMENT: 74.5"

UPC CODE: 887276414188

COUNTRY OF ORIGIN: Mexico

DIMENSIONS (INCHES W x H x D):
- **TV WITHOUT STAND:** 66.3 x 38 x 2.4
- **TV WITH STAND:** 66.3 x 40.5 x 14.9
- **SHIPPING:** 73.7 x 44.4 x 8.8
- **STAND FOOTPRINT:** 1.1 x 7.6 x 14.9

WEIGHT (LB):
- **TV WITHOUT STAND:** 86.2
- **TV WITH STAND:** 87.7
- **SHIPPING:** 111.8

VESA SUPPORT: Yes (400 x 400)

ACCESSORIES INCLUDED IN BOX:
- **REMOTE MODEL:** TM2050A (Black)

SAMSUNG

RU9000 TV

MODEL

MODEL: UN65RU9000
ORDER CODE: UN65RU9000FXZA

SCREEN SIZE CLASS: 65"

SCREEN DIAGONAL MEASUREMENT: 64.5"

UPC CODE: 887276414171

COUNTRY OF ORIGIN: Mexico

DIMENSIONS (INCHES W x H x D):

- **TV WITHOUT STAND:** 57.3 x 32.9 x 2.3
- **TV WITH STAND:** 57.3 x 35.4 x 13.1
- **SHIPPING:** 63.4 x 38.4 x 7
- **STAND FOOTPRINT:** 1 x 7.4 x 13.1

WEIGHT (LB):

- **TV WITHOUT STAND:** 56.4
- **TV WITH STAND:** 57.5
- **SHIPPING:** 74.5

VESA SUPPORT: Yes (400 x 400)

ACCESSORIES INCLUDED IN BOX:

- **REMOTE MODEL:** TM2050A (Black)

SAMSUNG

AV4 32" FLAT PANEL TV QTY: 2

Q50R TV

PRODUCT HIGHLIGHTS

- 100% Color Volume[1] with Quantum Dot
- 4K UHD Processor
- HDR
- Game Mode

SIZE CLASS

32"

32Q50R

ROOM 120 (1)
ROOM 111 (1)

4K ULTRA HD CONNECTED

Step up to a whole new world of color. Quantum Dot technology lets you experience images bursting with a dazzling range of over one billion colors, each upscaled to incredible clarity in a revolutionary new way thanks to our intelligent UHD processor.

KEY FEATURES

Product Type

- QLED

Picture

- 100% Color Volume[1] with Quantum Dot
- HDR
- Ultra Slim Array
- 4K UHD Processor
- 4K UHD
- Game Mode

Style

- Wide Viewing Angle
- 360° Design
- Bezel Color: Charcoal Black
- Stand Color: Charcoal Black
- Bezel-free Design

Smart

- Smart TV with Universal Guide
- Bixby
- Apple TV
- SmartThings Compatible

Connections

- 3 HDMI Connections[2]
- 2 USB Connections
- 1 Shared A/V & Component Input
- 802.11AC built-in Wi-Fi
- Bluetooth®
- RS232 Control (requires adaptor)[3]
- IP Control Support[4]
- Optical Audio Output Port

Audio

- Dolby® Digital Plus
- 20 Watt 2 Channel

Included Accessories

- Standard Remote

Industry Certifications

- CTA 4K Ultra HD Connected

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[1]QLED televisions can produce 100% Color Volume in the DCI-P3 color space, the format for most cinema screens and HDR movies for television.
[2]HDMI–CEC (Consumer Electronics Control) facilitates convenient control functions with compatible devices.
[3]Serial control requires USB adaptor provided by participating dealers and distributors.
[4]Requires third-party control system installation. See www.samsung.com/us/business/custominstall. SEE BACK FOR DETAILS

AV5 50" FLAT PANEL TV QTY: 8

PRODUCT HIGHLIGHTS

- Direct Full Array 12X[1]
- Quantum HDR 12X[2]
- Quantum Processor 4K
- Object Tracking Sound™[3]
- 100% Color Volume with Quantum Dot[4]

SIZE CLASS

Room 102 (2)
Room 103 (1)
Room112 (4)
Room 119 (1)

As intelligent as it is beautiful. A smart TV interface learns the content you like and makes suggestions based on what you watch. Concentrated zones of LED backlighting deliver heightened contrast and impeccable detail. And with Object Tracking Sound, you won't just see the action, you'll feel it in your bones.

KEY FEATURES

Picture

- Direct Full Array 12X
- Quantum HDR 12X
- Quantum Processor 4K
- 100% Color Volume with Quantum Dot
- 4K UHD
- Real Game Enhancer+™[5]
- Motion Rate 240[6]
- Ultra Viewing Angle[7]
- Adaptive Picture™

Design

- Boundless Design
- Titan Black Floating Plate Stand

Smart Features

- Smart TV Powered by Tizen
- Universal Guide
- Ambient Mode+™[8]
- Multiple Voice Assistants[9]
- TV Plus
- Mobile View
- Samsung OneRemote
- SmartThings Compatible

Connections

- 4 HDMI Connections[10]
- HDMI 2.1 Port 4
- eArc Port 3
- 2 USB Connections
- LAN Port
- 802.11AC built-in Wi-Fi
- Bluetooth®
- RS232 Control (Ex-Link)
- IP Control Support[11]
- Optical Audio Output Port

Audio

- Object Tracking Sound™
- Q-Symphony
- Active Voice Amplifier
- Dolby® Digital Plus
- 60 Watt 2.2 Channel[12]

Included Accessories

- Samsung OneRemote

Industry Certifications

- 4K Ultra HD Connected
- HDR10+

[1]Direct Full Array Numerical Index based on backlighting, antire ection and contrast enhancement technologies. Direct Full Array 8X for 49"/50" model. [2]Quantum HDR 8X on 49"/50" model. [3]OTS not supported on 49"/50" model. [4]QLED televisions can produce 100% Color Volume in the DCI-P3 color space, the format for most cinema screens and HDR movies for television. [5]Excludes FreeSync on 49"/50" model. [6]Motion Rate 120 for 49"/50" model. [7]Ultra Viewing Angle not supported on 49"/50" model. [8]Background feature accuracy may vary based on TV location and is dependent on wall designs, patterns and/or colors. SmartThings app on a mobile device (Android, iOS) is required for some functionality. App features may be limited at launch; please continue to check for updates. [9]The Google Assistant service may not yet be available at the time of purchase of this product; please continue to check for app updates. [10]HDMI—CEC (Consumer Electronics Control) facilitates convenient control functions with compatible devices. [11]Requires third-party control system installation. See www.samsung.com/us/business/custominstall. [12]40W 2.2 Channel for 49"/50" model.

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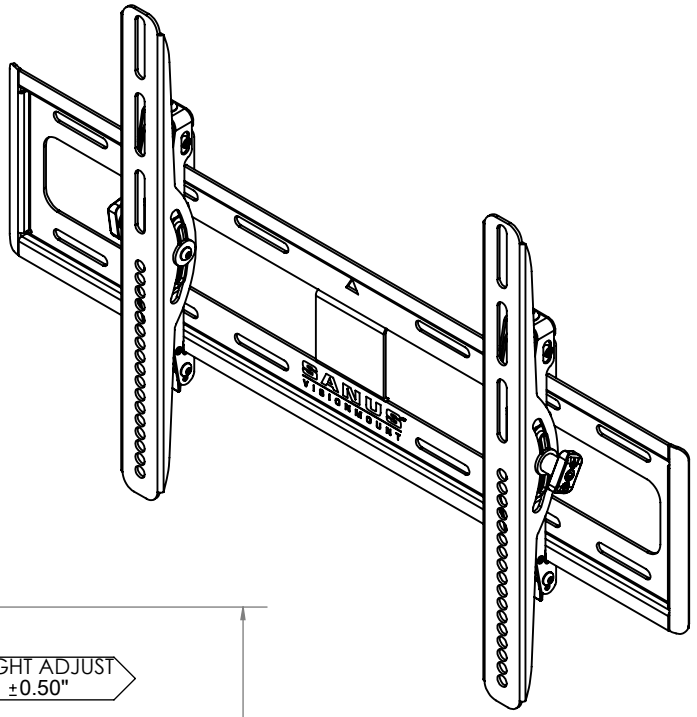
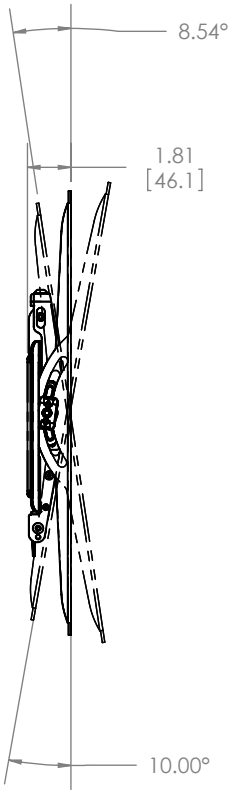
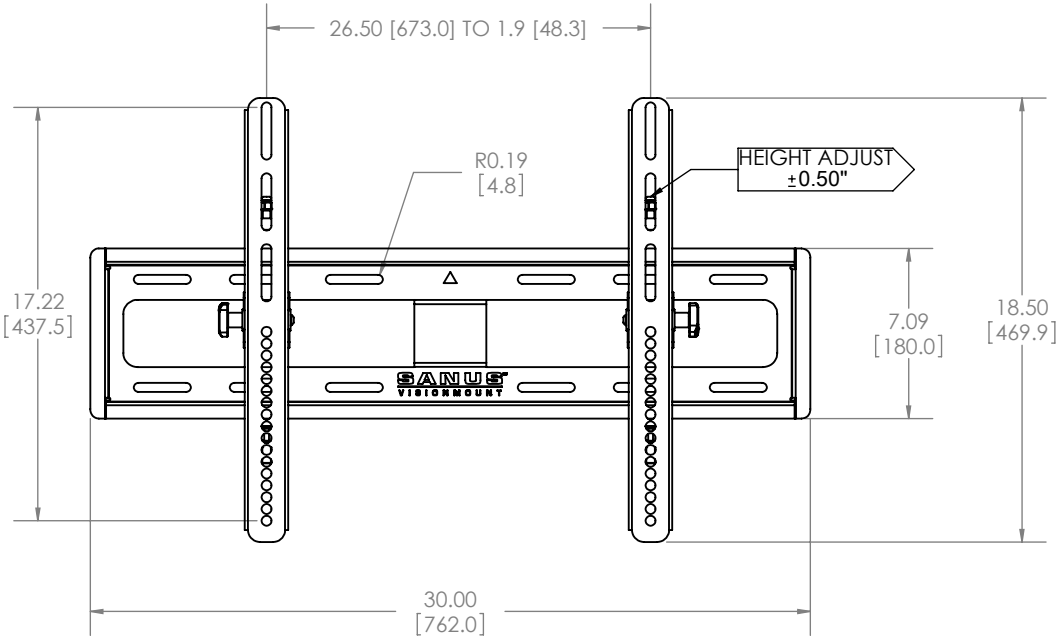
SEE BACK FOR DETAILS

SANUS WALL MOUNT FOR FLAT PANEL TVs (BASIS OF DESIGN)
QTY: 14







	NAME 姓名	DATE 日期
ENGINEER工程师	STR	4/21/2010
DESIGNER设计师	STR	4/24/2010
APPROVED批准	STR	4/21/2010

NOTES注释：

TEMPLATE REV 模板修订版： 06

SHEET 1 OF第 1

SANUS™ VISIONMOUNT

DESCRIPTION 描述：

Large Tilt, VMPL50A

5 4 3 2 1

VIDEO TELECONFERENCING CAMERA FOR CONFERENCE ROOMS

QTY: 2

Logitech (basis of design) Rally Bar

Videoconferencing Device - 4K PTZ Camera - White

Set up your office meeting room with this white Logitech Rally Bar videoconferencing device for quality video calls. The six built-in beamforming microphones clearly pick up sound within a 15-foot range, letting you share ideas seamlessly.

Set up your office meeting room with this white Logitech Rally Bar videoconferencing device for quality video calls. The six built-in beamforming microphones clearly pick up sound within a 15-foot range, letting you share ideas seamlessly.

Bring work associates into the loop while making key decisions with this Logitech Rally Bar videoconferencing device. A 4K motorized PTZ camera offers wide coverage to ensure nobody feels left out, while the high-performance speakers and an anti-vibration enclosure deliver room-filling sound for a realistic experience. The compact all-in-one design and a cable management system help declutter your conference room, and the included remote control allows easy operation.

Compatibility with macOS and Windows 7 or later enables use on a variety of devices, and wireless connectivity through Bluetooth allows smooth video and audio streaming. The plug-and-play design offers an easy, quick setup, while the 7-foot USB Type-C to Type-A cable offers flexible placement. This white Logitech Rally Bar videoconferencing device features AES encryption to enhance security and create reliable connections to compatible devices to prevent hackers from spying on your conversations.

- All-in-one video bar features an advanced microphone array, room-filling speakers, and a real PTZ camera in a sleek, easy-to-install form factor.
- Simple to set up with a dedicated PC, laptop, or in appliance mode for a computer-free deployment option.
- Thoughtful cable management lets you route cables from above or below to minimize visible cabling and prevent accidental disconnections.
- Multiple mounting options, including available Wall and TV Mounts, provide a finished look and no-drill options for both meeting rooms and mobile carts.

- Motorized PTZ lens delivers expansive room coverage, outstanding color, and exceptional accuracy at resolutions up to 4K.
- Always-on AI Viewfinder provides persistent awareness for RightSight auto-framing and room utilization metrics like people count.
- High-performance speakers, adaptive beamforming mics, and a patented anti-vibration suspension system combine room-filling sound with exquisite sensitivity.
- Manage Rally Bar together with other meeting room devices in Logitech Sync to resolve issues and identify under-used and over-crowded rooms.

Tech Specs

Quick Specs

- Device Type
- Video conferencing device
- Dimensions (WxDxH)
- 35.8 in x 6.5 in x 5.1 in
- Weight
- 15.61 lbs
- Video Input
- Digital video camera - SuperSpeed USB 3.0
- Audio Input
- 6-microphone array - beamforming
- Audio Output
- Speaker(s)
- Input Device
- Remote control (wireless)
- Networking
- Bluetooth, IEEE 802.11b, IEEE 802.11a, IEEE 802.11g, IEEE 802.11n, IEEE 802.11ac
- Power
- AC 120/230 V
- Software Certification
- Zoom Certified, Certified for Microsoft Teams
- System Requirements
- Apple MacOS, Microsoft Windows 7 / 8 / 8.1 / 10 or later
- Manufacturer Warranty
- 2-year warranty
- Device Type
- Video conferencing device
- Dimensions (WxDxH)
- 35.8 in x 6.5 in x 5.1 in
- Weight
- 15.61 lbs
- Video Input
- Digital video camera - SuperSpeed USB 3.0
- Audio Input
- 6-microphone array - beamforming
- Audio Output
- Speaker(s)
- Input Device
- Remote control (wireless)
- Networking
- Bluetooth, IEEE 802.11b, IEEE 802.11a, IEEE 802.11g, IEEE 802.11n, IEEE 802.11ac

- Power
- AC 120/230 V
- Software Certification
- Zoom Certified, Certified for Microsoft Teams
- System Requirements
- Apple MacOS, Microsoft Windows 7 / 8 / 8.1 / 10 or later
- Manufacturer Warranty

- *General*
- ---
- Device Type
- Video conferencing device
- Width
- 35.8 in
- Depth
- 6.5 in
- Height
- 5.1 in
- Weight
- 15.61 lbs
- Enclosure Color
- White

- *Video Input*
- ---
- Type
- Digital video camera (color) - desktop
- Interface Type
- SuperSpeed USB 3.0
- Digital Video Capture Resolution
- 3840 x 2160
- Video Modes
- 480p, 720p, 1080p, 4K, 1440p, 900p
- Optical Zoom
- 5
- Digital Zoom
- 3
- Camera Mechanical Design
- Pan / tilt / zoom
- Features
- RightLight technology, RightSound technology, Wide Dynamic Range (WDR), Artificial Intelligence, Acoustic Echo Cancellation (AEC), 30 fps, microphone noise suppression technology, 52.2° field of view (vertical), 82.1° field of view (horizontal), 90° diagonal field of view, RightSight technology, Voice Activity Detector (VAD), -25° / +25° pan, -15° / +15° tilt
- 2-year warranty

- *General*
- ---
- Device Type
- Video conferencing device
- Width
- 35.8 in
- Depth
- 6.5 in
- Height
- 5.1 in
- Weight
- 15.61 lbs
- Enclosure Color
- White

- *Video Input*
- ---
- Type
- Digital video camera (color) - desktop
- Interface Type
- SuperSpeed USB 3.0
- Digital Video Capture Resolution
- 3840 x 2160
- Video Modes
- 480p, 720p, 1080p, 4K, 1440p, 900p
- Optical Zoom
- 5
- Digital Zoom
- 3
- Camera Mechanical Design
- Pan / tilt / zoom
- Features
- RightLight technology, RightSound technology, Wide Dynamic Range (WDR), Artificial Intelligence, Acoustic Echo Cancellation (AEC), 30 fps, microphone noise suppression technology, 52.2° field of view (vertical), 82.1° field of view (horizontal), 90° diagonal field of view, RightSight technology, Voice Activity Detector (VAD), -25° / +25° pan, -15° / +15° tilt

- *Audio Input*
- ---
- Type
- 6-microphone array - integrated
- Microphone Operation Mode
- Beamforming
- Frequency Response
- 90 - 16000 Hz
-
-

- *Audio Output*
- ---
- Type
- Speaker(s)
-
-

- *Input Device*
- ---
- Type
- Remote control
- Connectivity Technology
- Wireless

- *Networking*
- ---
- Connectivity Technology
- Wireless, wired
- Data Link Protocol
- Bluetooth, IEEE 802.11b, IEEE 802.11a, IEEE 802.11g, IEEE 802.11n, IEEE 802.11ac

Features
AES encryption

Expansion / Connectivity

Interfaces

- 1 x network - Ethernet 10Base-T/100Base-TX/1000Base-T - RJ-45
- 2 x display / video - HDMI output
- 3 x SuperSpeed USB 3.0 - 9 pin USB Type A
- 1 x USB-C 3.0 - 24 pin USB-C
- 1 x display / video - HDMI input

Miscellaneous

Cables Included

- 1 x USB 3.0 Type C to Type A cable - 7 ft
- 1 x HDMI cable - 6.6 ft

Included Accessories
Remote control

Software Certification
Zoom Certified, Certified for Microsoft Teams
Compliant Standards

Power

Power Device
Power adapter - external
Voltage Required
AC 120/230 V

Software / System Requirements

OS Required
Apple MacOS, Microsoft Windows 7 / 8 / 8.1 / 10 or later

Manufacturer Warranty

Service & Support
Limited warranty - 2 years

Environmental Parameters

Min Operating Temperature
32 °F
Max Operating Temperature
104 °F

Humidity Range Operating
10 - 95%

Plug and Play

WINDOW BLINDS AS REQUIRED-CONTRACTOR RESPONSIBLE FOR MEASUREMENTS

LEVOLOR **(BASIS OF DESIGN)**
COLOR: ALABASTER

Guide Specifications

Riviera Contract 1 Inch Blind

Model #RIV1C

Competitively positioned 1 inch horizontal aluminum window covering for commercial applications.

Part I - General

1.01 Scope

A. Furnish and install LEVOLOR blinds, provided by LEVOLOR, 1400 Lavon Dr., McKinney, TX 75069 , in accordance with specifications, drawings, and contract documents.

B. Related work specified elsewhere.

1.02 Quality Assurance

A. Installer's qualifications:

1. The installer shall be a firm approved by LEVOLOR Commercial.

2. The installer shall be qualified to install the product specified, as demonstrated by prior experience.

1.03 Submittals

A. Product information: Submit Levolor's product literature and installation instructions.

B. Shop drawings: Indicate field-measured dimensions of opening which are to receive blinds, details on mounting surface and sill conditions, and details of corners and conditions between adjacent blinds.

C. Color samples: Submit a sample of each type and color of material specified.

1.04 Delivery, Storage, and Handling

A. Packing and Shipping

1. Materials shall be delivered to the project in Levolor's original unopened packaging with labels intact.

2. Stacks shall be covered with tarpaulins or plastic so that ventalition is provided for, and so that contaminants are prevented from contacting surfaces.

B. Storage

1. Materials shall be stored in a clean area which is free of corrosive fumes, dust, and away from construction activities.

2. Materials shall be stacked horizontally using plastic or wood shims so that drainage and ventilation are provided for, and so that water cannot accumulate in, about or upon the containers.

1.05 Project/Site Conditions

(Before Product Installation Begins)

A. Roof must be tight, windows and frames installed and glazed, and interior doors hung.

B. Wet work including concrete, masonry, plaster, stucco, terrazzo, sheet-rock, spackling, and taping (including sanding) shall be complete and dry.

C. Ceilings, window pockets, electrical, and mechanical work above the product shall be complete.

D. Electrical power (110 volt AC) shall be available for installer's tools within 500 ft. of product installation areas.

1.06 Warranty

A. Limited Lifetime Warranty: LEVOLOR Commercial shall repair or replace for the life of the blind, at its option, without charge, any part found defective in workmanship or material as long as the blind remains in the same window for which it was purchased.

Part II - Products

2.01 Manufacturer and Product Description

A. Acceptable product: Riviera Contract 1 Inch Blind manufactured by Levolor (model #RIV1C).

B. Materials:

1. Headrail shall be of .025 inch thick painted, steel, "U" shaped, 1 inch high x 1 9/16 inches wide with flanged edges at top, and coated with baked on finish. All hardware shall be enclosed in the metal headrail.

2. Guardian Tilter mechanism shall be of a not less than .042 inch thick Tomized steel housing with a self-lubricating nylon, automatically disengaging worm and gear mechanism to provide maximum closure, eliminate overdrive, and prevent strain or damage to blind.

3. Tilt Wand shall be transparent with a hexagonal cross section 5/16 inches across flats.

4. Cord Lock shall be .042 inches thick Tomized steel and shall be securely attached to headrail. It shall be a crash-proof type with sufficient sensitivity to lock slats at desired height upon release of cords.

5. Drum and cradle shall be provided for each ladder.

a. Drums shall be of .031 inch thick Tomized steel providing secure attachment for both ladder ends.

b. Cradles shall be of .042 inch thick Tomized steel having two holes with rolled edges to guide cords through bottom of headrail without abrasion. They shall provide bearing support for the tilt rod, thus preventing the weight of the blind from being transferred to the tilter. Cradles shall center drums over ladder openings.

6. Tilt rod shall be solid D-shaped with an average cross section of .28 inches designed to achieve minimum torsional deflection.

7. End Braces shall be of .037 inch thick Tomized steel with reinforcing ribs and field adjustable tabs. End braces shall incorporate a field adjustable tab to ensure secure installation, center blind in window, and prevent lateral movement.

8. Installation Brackets shall be of at least .048 inch thick painted steel with baked-on finish to match headrail. The brackets shall incorporate a rivet-hinged safety locking front cover to permit removal of headrail without lateral movement. Mounting holes shall be located to accommodate overhead, side, or face mounting.

9. Intermediate brackets shall be of .050 inch thick Tomized steel and shall be installed with blinds over 60 inches wide and under 80 inches long, or over 55 inches wide and over 80 inches long.
Brackets shall be supplied as required.

10. Ladders (slat supports) shall be braided polyester yarn dyed to Levolor color standards. The two vertical components shall be .076 inches x .038 inches designed for maximum flexibility combined with minimum stretch and tensile strength of not less than 50 lbs. per cable. Horizontal components (rungs) shall consist of not less than two cables inter-braided with the vertical components. Ladder shall support the slats without visible distortion. Distance between slats shall not exceed 21.5mm. Distance between ladders shall not exceed 23 inches for blinds up to 80 inches long. For blinds over 80 inches long, distance between ladders shall not be greater than 22 inches. Distance between end ladder and end of slat shall not be exceed 7 inches.

11. Slats shall be of 5000 series magnesium aluminum alloy to optimize tensile and yield strength for superior slat strength, resiliency, and corrosion resistance. Slats shall be nominally 1 inch wide and the thickness of the slats shall be nominally .006 inches. Slats shall have a coating thickness of .8 mil to 1.5 mil. Unperforated slats shall perform for 500 hours of 100% relative humidity testing, 300 hours of 5% salt spray solution at 95 degrees F testing, and 250 hours of accelerated weathering testing without blistering, fading, corroding, or adhesive failure. Slat thickness and ladder support distances shall prevent visible sag or bow after continued use indoors.

DustGuard® feature is a permanent, patented paint process that disrupts the natural static attraction of airborne dust particles.

12. Bottomrail shall be of .023 inch thick painted steel formed after coating and shall be provided with color compatible molded plastic ladder and clear end caps having integral protrusions designed to prevent bottom bar from marring window sill and/or mullions.

13. Lift Cord shall be braided of high strength, 1.4mm dia. Polyester fiber, 34 picks per inch, 16 carrier smooth braids, and shall be flexible, have minimum stretch, maximum abrasion resistance characteristics, and a minimum breaking strength of 130 lbs. Cord shall be of sufficient length equalized to properly control raising and lowering of blind and spaced not over 46 inches between cords.

14. Options shall include:
- **a.** Cutouts
- **b.** Extension Brackets
- **c.** Hold-down Brackets
- **d.** Multi-Colored Striping
- **e.** Multiple Blinds on One Headrail
- **f.** Pivot Plate
- **g.** Projection Brackets
- **h.** Restrictive Cam Tilter
- **i.** Ring Pull
- **j.** Telescopic or Non-Telescopic Tilter Pole
- **k.** Top Lok Cord Lock
- **l.** Universal Ring Tilter
- **m.** 2 Slat Framed Vogue Valance

Part III - Execution

3.01 Inspection

A. Window treatment subcontractor shall be responsible for inspection of site, field measurements, and approval of mounting surfaces and installation conditions.

B. Subcontractor shall verify that site is free of conditions that interfere with blind installation and operation, and shall begin installation only when any unsatisfactory conditions have been rectified.

3.02 Installation

A. Installation shall comply with Levolor specifications, standards, and procedures.

B. Provide support brackets as per Levolor's installation instructions.

C. See installation instructions packaged with blinds for more installation details.

D. Provide adequate clearance to permit unencumbered operation of blind and hardware.

E. Demonstrate blinds to be in uniform and smooth working order.

3.03 Cleaning

A. Clean soiled blinds with a mild soap solution only. Do not use cleaning methods involving heat, bleach, abrasives, or solvents. Do not use window cleaner or cloths with paper content.

B. Ensure proper drying following cleaning by providing adequate ventilation.

LEVOLOR

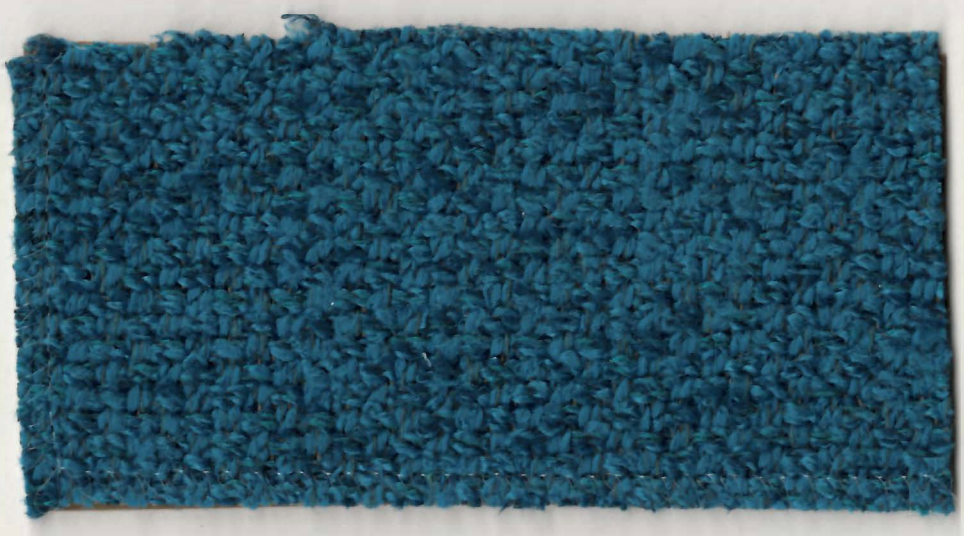
1400 Lavon Dr., McKinney, TX 75069 USA
Phone: 1.800.826.8021 · LEVOLOR.com/commercial

CH 2 **GUEST CHAIR WOOD FINISH**

MANUFACTURER: KNOLL

COLOR: WALNUT

LOCATION: GUEST CHAIR WOOD FRAMES



CH 2 **GUEST CHAIR UPHOLSTERY**

MANUFACTURER: MOMENTUM FOR KNOLL

PATTERN/COLOR: BANGLE/BALTIC

LOCATION: GUEST CHAIR SEATS

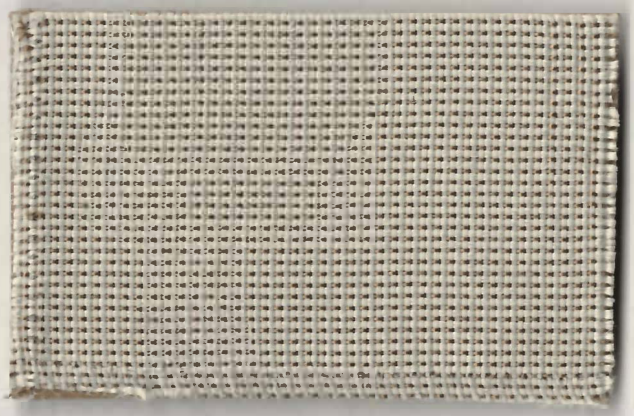
WS 1&2,D1 **WORKSTATION PAINT**

MANUFACTURER: KNOLL

COLOR: BEIGE MIST METALLIC 611

FINISH: SMOOTH

LOCATION: WORKSTATIONS



WS 1&2 **WORKSTATION PANEL FABRIC**

MANUFACTURER: KNOLL TEXTILES

PATTERN/COLOR: BROADCLOTH II, TAUPE

LOCATION: WORKSTATION PANELS

PL 3 **WORKSTATION SURFACE LAMINATE**

MANUFACTURER: KNOLL

COLOR: MICRO GREY 121

LOCATION: WORKSTATIONS 1&2,D1 WORK SURFACES

CH 1 **TASK/CONFERENCE CHAIR BACK FABRIC**

MANUFACTURER: KNOLL TEXTILES

PATTERN/COLOR: BL BLACK MESH

LOCATION: CHAIR BACKS

CH 1 **TASK/CONFERENCE CHAIR SEAT FABRIC**

MANUFACTURER: KNOLL TEXTILES

PATTERN/COLOR: FLB FAUX LEATHER BLACK

LOCATION: CHAIR SEATS

CH 4: BREAK ROOM LOUNGE AND MOTHER'S ROOM CHAIR FABRIC
MANUFACTURER: MOMENTUM
PATTERN: FELTED CIRCLES
COLOR: CADET

PL-1 BREAK ROOM TABLETOPS
MANUFACTURER: KNOLL
COLOR: WHITE

PL-2 BREAK ROOM CABINETS (SID)
MANUFACTURER: WILSONART
COLOR: PHANTOM PEARL 8211K-28

SS-1: BREAK ROOM COUNTERTOPS (SID)
MANUFACTURER: CORIAN
COLOR: RAIN CLOUD

CH 5 TRAINING CHAIRS POLYSHELL

MANUFACTURER: VERSTEEL

COLOR: NEAR BLACK

LOCATION: TRAINING AREA

TB 3 TRAINING TABLE FRAMES

MANUFACTURER: VERSTEEL

COLOR: SO STONE

LOCATION: TRAINING AREA

TB 3 TRAINING TABLE PVC EDGE

MANUFACTURER: VERSTEEL

COLOR: SO STONE

LOCATION: TRAINING AREA

PL 3 TRAINING TABLE PLASTIC LAMINATE

MANUFACTURER: WILSONART

COLOR: SIERRA CASCADE 5005-38

VELVET FINISH

LOCATION: TRAINING AREA

APPENDIX I

JUSTIFICATION AND APPROVAL (J&A) FOR HVAC EQUIPMENT

JUSTIFICATION REVIEW DOCUMENT
OTHER THAN FULL AND OPEN COMPETITION

PROJECT: Class Justification and Approval (J&A) to support the use of brand name Heating, Ventilation, and Air Conditioning (HVAC) equipment in new construction and sustainment, restoration, and modernization projects executed by the US Army Corps of Engineers (USACE) on behalf of the US Air Force. In accordance with the agency's standardization program, the US Air Force has determined that only specified makes and models of HVAC will satisfy the agency's needs for additional units or replacement items.

CONTROL NO: LRL-FY23-30

AUTHORITY: 10 U.S.C § 3204(a)(1), *amended by* Pub. L. No. 117-81, 135 Stat. 154); FAR 6.302-1(a)(2)

AMOUNT: $145,000,000

PREPARED BY / CONTRACTING OFFICER	NAME: Emily A. Moore PHONE: 502-315-6181	Emily Moore MOORE.EMILY A[redacted] 2023 04.20 12:58:09 -04'00'
LRL COUNSEL	NAME: Tarrah Beavin PHONE: 502-315-6651	BEAVIN.TARRAH.M[redacted] Digitally signed by BEAVIN.TARRAH.M[redacted] Date: 2023.04.20 13:02:54 -04'00'

SIGNATURES ARE REQUIRED BELOW:

I have reviewed this J&A and find the justification adequate to support other than full and open competition.

SCO ATLANTA - COUNSEL	NAME: Alexandria Tramel PHONE: 817-229-0971	TRAMEL.ALEXANDRIA.POLK[redacted] Digitally signed by TRAMEL.ALEXANDRIA.POLK[redacted] Date: 2023.04.20 13:39:03 -05'00'
SCO-ATLANTA/ ALTERNATE ADVOCATE FOR COMPETITION	NAME: Laura Eichhorn PHONE: 404-562-5051	Laura Eichhorn Digitally signed by EICHHORN.LAURA.J[redacted] Date: 2023.04.20 14:54:50 -04'00'
USACE HEAD OF CONTRACTING AGENCY	NAME: Jason K Jefferis COL, USA PHONE: 202-761-4707	

FAR Part 6 Justification and Approval for Other than Full and Open Competition

1. Contracting Activity: U.S. Army Corps of Engineers (USACE), Louisville District, 600 Martin Luther King, Jr., Place, Room 821, Louisville, KY 40201. Louisville District has prepared this document in support of construction contracts across the entire USACE Enterprise.

2. Description of Action: USACE requests approval of a Class Justification and Approval (J&A) for Other than Full and Open competition to allow Contracting Officers to issue solicitations that specify the use of brand name Heating, Ventilation, and Air Conditioning (HVAC) equipment in the construction of new facilities, as well as equipment for sustainment, restoration, and modernization (SRM) projects for existing facilities, that are executed by USACE on behalf of the Air Force.

During Fiscal Years (FY) 2023 through 2027, USACE will award numerous Firm-Fixed-Price, Design-Build and Design-Bid-Build construction contracts utilizing Military Construction (MILCON), Operations and Maintenance (O&M), and SRM funding. Therefore, this J&A is applicable to various types of facilities due to the numerous projects within the USACE Military and Air Force Reserve Area of Responsibility (AOR). In accordance with mandatory standardization decisions made by the Air Force in accordance with their Category Management (CM) Program, HVAC equipment is being standardized throughout the Air Force on an installation-by-installation basis. The Government will not purchase the equipment directly, but will specify the requirement for offerors to utilize specific brands of HVAC equipment in competitive solicitations that will lead to new construction and SRM contracts for various Air Force renovation and construction projects. The contracts will cover new construction and SRM projects at Contiguous United States (CONUS) and outside the Contiguous United States (OCONUS) locations. The estimated dollar value of HVAC equipment in new construction projects is $60M and the estimated dollar value of HVAC equipment in renovation projects is $85M, for a total estimated value of $145M in HVAC equipment that is anticipated to be required during FY 2023 through 2027.

3. Description of the Supplies/Service: USACE executes MILCON and SRM construction projects on behalf of the Air Force and Air Force Reserve. The anticipated requirements to design/construct facilities, or perform SRM requirements, on Air Force installations for FY 2023 through 2027 is approximately $145M. The type of facilities will include, but are not limited to, hangars, training ranges, barracks, reserve training centers, maintenance complexes, headquarters complexes, fire stations, and all supporting infrastructure (gates, utilities, roads, drainage) across USACE AOR. As part of the design/construction or SRM efforts, new HVAC chillers will be installed in these facilities. To support the Air Force initiative of achieving economy and efficiency, this J&A supports the specification of brand name HVAC units to be incorporated into construction and SRM contracts from the approval date of this J&A through FY 2027. Periods of performance will be specified in each individual contract. In the performance of these contracts, awardees will be required to provide and install

HVAC equipment from the specified manufacturer. In support of these requirements, USACE obtained properly approved standardization memos from the Air Force to support the designated brand name of HVAC manufacturers that is required at each Air Force installation, as shown in the below table.

HVAC Chiller System Standardization, Single Manufacturer Selection	
Installation	**Manufacturer**
Al Udeid Air Base	Carrier Corp.
Altus AFB	Trane Inc.
Anderson AFB	Dunham Bush
Arnold AFB	Carrier Corp.
Aviano AB	Swegon Group (Blue Box Inc.)
Barksdale AFB	Trane Inc.
Beale AFB	Trane Inc.
Buckley AFB	Ingersoll Rand (Trane Inc)
Beale AFB	Trane Inc.
Cannon AFB	Ingersoll Rand (Trane Inc., American Standard)
Cape Canaveral AFS	Trane Inc.
Cape Cod AFS	Carrier Corp
Carswell ARS	Carrier
Cavalier AFS	Trane Inc.
Cheyenne Mountain	Trane Inc.
Columbus AFB	Daikin Industries, Ltd. (McQuay International)
Creech AFB	Trane Inc.
Creech AFB	Trane Inc.
Dahlgren AS	Trane Inc.
Davis-Monthan AFB	Trane Inc.
Davis-Monthan AFB	Trane Inc.
Dobbins AFB	Carrier Corp.
Dover AFB	Trane Inc.
Dyess AFB	Trane Inc.
Eareckson AFS	Carrier Corp.
Edwards AFB	Trane Inc.
Eglin AFB	Trane Inc.
Eielson AB	Trane Inc.
Ellsworth AFB	Carrier Corp.
F.E. Warren AFB	Trane Inc.
Fairchild AFB	Trane Inc.
Goodfellow AFB	Trane Inc.
Grand Forks AFB	Trane Inc.
Grand Forks AFB	Trane Inc.
Grissom AFB	Trane Inc.
Hanscom AFB	Trane Inc.
Hill AFB	Trane Inc.
Holloman AFB	Carrier Corp.

Homestead ARS	Carrier
Hurlburt Field	Trane Inc.
Incirlik AB	Carrier Corp. / Clivet (FORM, Midea Group)
JB Andrews	Trane Inc.
JB Charleston	Trane Inc.
JB Elmendorf-Richardson	Trane Inc.
JB Langley-Eustis	Trane Inc.
JB Langley-Eustis	Trane Inc.
JB McGuire-Dix-Lakehurst	Trane Inc.
JB San Antonio	Trane
Kadena AB	Carrier Corp.
Keesler AFB	Trane
Kirtland AFB	Johnson Controls Inc. (York, Quantech)
Kunsan AB	LG
Lajes Field (Azores)	Carrier Corp.
Laughlin AFB	Trane Inc.
Little Rock AFB	Trane Inc.
Los Angeles AFS	Carrier Corp.
Luke AFB	Carrier Corp.
MacDill AFB	Carrier Corp.
Malmstrom AFB	Trane Inc.
Maxwell AFB	Trane Inc.
McConnell AFB	Daikin Industries, Ltd. (McQuay International)
Minneapolis-St. Paul ARS	Trane
Minot AFB	Johnson Controls Inc. (York, Quantech)
Misawa AB	Mitsubishi
Moody AFB	Trane Inc.
Moody AFB	Trane Inc.
Moron AB	Carrier Corp.
Mountain Home AFB	Trane Inc.
Mountain Home AFB	Trane Inc.
Nellis AFB	Carrier Corp.
Nellis AFB	Carrier Corp.
Niagara Falls ARS	Johnson Controls Inc. (York)
Offutt AFB	Daikin Industries, Ltd. (McQuay International)
Offutt AFB	Daikin Industries, Ltd. (McQuay International)
Osan AB	AERMEC
Patrick AFB	Trane Inc.
Peterson AFB	Trane Inc
Pittsburgh ARS	Carrier
RAF Alconbury/Molesworth	Uniflair Limited
RAF Croughton	Carrier Corp.
RAF Lakenheath	Carrier Corp.
RAF Mildenhall	Carrier Corp.

Ramstein AB	Trane Inc
Robins AFB	Carrier Corp.
Schriever AFB	Carrier Corp.
Scott AFB	Trane Inc.
Seymour Johnson AFB	Trane Inc.
Seymour Johnson AFB	Trane Inc.
Shaw AFB	Trane Inc.
Shaw AFB	Trane Inc.
Sheppard AFB	Trane Inc.
Spangdahlem AB	United Technologies Corp. - UTC (CIAT)
Thule AB	Exhausto/ Novenco
Tinker AFB	Trane
Travis AFB	Carrier Corp.
Tyndall AFB	Trane Inc.
Tyndall AFB	Trane Inc.
US Air Force Academy	Trane Inc.
Vance AFB	Carrier
Vandenberg AFB	Trane Inc.
Westover AFB	Carrier Corp.
Wheeler AFS	Carrier Corp.
Whiteman AFB	Trane Inc.
Wright-Patterson AFB	Trane Inc.
Yokota AB	Carrier Corp. (Toshiba-Carrier)
Youngstown ARS	Trane

4. Authority Cited: 10 U.S.C § 3204(a)(1), as implemented by FAR 6.302-1(a)(2), “Only One Responsible Source and No Other Supplies or Services Will Satisfy Agency Requirements.”

5. Reason for Authority Cited: As described at FAR 6.302-1(a)(2), when the supplies or services required by the agency are available only from one responsible source and no other types of supplies or services will satisfy agency requirements, full and open competition need not be provided for. This J&A applies the Only One Responsible Source authority using the application of FAR 6.302-1(b)(4), which indicates that the use of FAR 6.302-1 is appropriate “When the agency head has determined in accordance with the agency’s standardization program that only specified makes and models of technical equipment and parts will satisfy the agency’s needs for additional units or replacement items, and only one source is available.”

a. Background:

(1) USACE is the servicing agency for USAF MILCON (MCAF), Minor MILCON (MMAF), Air Force Reserve MILCON (MAFR), Base Realignment and Closure (BCF), Air Force Family Housing MILCON/Investment (FHAF) projects executed in accordance with 10 USC 2851, “Supervision of Military Construction Projects”, and DoD

Directive 4270.5, “Military Construction”.

(2) In 2019, the Air Force established standardization requirements for the replacement of HVAC equipment across all Air Force installations. The Air Force Senior Procurement Executive approved a Class J&A on 7 August 2019, that requires Air Force procurements to utilize specific makes of HVAC equipment in their requirements. The J&A includes a spreadsheet that identifies the HVAC equipment manufacturers specified for each of the 107 Air Force installations. The Air Force Class J&A is valued at $370M and states that “[t]he Air Force is required to use the brand name exception to the Competition in Contracting Act (CICA) because the nature of the acquisition as a strategic vehicle for Category Management requires a pre-planned brand name approach to acquiring HVAC chillers.” The J&A speaks to significant estimated cost savings in training expenses and efficiency improvements in mission performance that are projected to be achieved through HVAC standardization.

(3) FAR 17.503(d)(1) states that if a J&A or a Determination and Findings (D&F) is required by law or regulation, the servicing agency shall execute and issue the J&A or D&F, though the requesting agency shall furnish the servicing agency any information needed to make the J&A or D&F. Therefore, USACE, as the servicing agency, concluded that J&As in support of Air Force projects procured by USACE must be executed by the Army.

b. Justification:

(1) FAR 6.302-1(b)(4) permits use of the Only One Responsible Source authority when the agency head has determined in accordance with the agency's standardization program that only specified makes and models of technical equipment and parts will satisfy the agency's needs for additional units or replacement items, and only one source is available.

(2) In a memorandum signed on 22 June 2017, the Under Secretary of the Air Force appointed the Deputy Under Secretary of the Air Force, Management and Deputy Chief Management Officer as the Air Force Category Management Accountable Official. On 14 July 2017, the Deputy Under Secretary of the Air Force, Management and Deputy Chief Management Officer, appointed the Civil Engineer Center Director (AFCEC/CL) as the Air Force Category Manager for the Facilities and Construction Category. On 16 May 2019, the AFCEC/CL directed the mandatory standardization of HVAC chiller systems and delegated manufacturer selection to the AFCEC Operations Director (AFCEC/CO).

(3) On 3 May 2019, the AFCEC/CO executed a Memorandum, Subject: HVAC Chiller System Standardization, Single Manufacturer Selection, which set forth the AFCEC/CL intent to standardize HVAC chiller systems to a single manufacturer at the installation level. The memorandum

explained that standardization of all HVAC chiller systems allows the Air Force to significantly reduce the total cost of ownership which includes the initial procurement, subsequent maintenance, and associated training costs to operate the system over its lifecycle. The memorandum went on to provide guidance for the evaluation, recommendation, and subsequent approval of a single manufacturer for HVAC chiller systems at each installation and stated that Base Civil Engineers (BCEs) were to request and provide justification for the recommended single HVAC chiller manufacturer. The memorandum concluded with a requirement to repeat the analysis after five years from the date of AFCEC/CO approval for a single manufacturer. The purpose of this secondary analysis is to document the installation's progress in standardizing HVAC chiller systems, consider any changes in the decision facts, and confirm no external factors exist that may drive a reconsideration of the approved single manufacturer.

(4) On 16 May 2019, the AFCEC/CL signed a Memorandum, Subject: Mandatory Standardization of HVAC Chiller Systems. The memorandum directed the mandatory standardization of HVAC chiller systems to a single manufacturer at the installation level and reiterated the process laid out in the above referenced 3 May 2019 guidance. The memorandum also delegated the AFCEC/CL's approval authority to the AFCEC/CO for the selection of a single manufacturer for HVAC chiller systems.

(5) In a Memorandum dated 10 September 2019, Subject: HVAC Chiller System Standardization, Single Manufacturer Selection, the AFCEC/CO approved the selection of specific brands as the single manufacturer for bases that fall in the USACE AOR. This selection, supported by the other memorandums summarized above, satisfies the FAR 6.302-1(b)(4) application of the Only One Responsible Source authority, as the Agency Head (delegee) has determined, in accordance with the agency's standardization program, that only specified makes and models of technical equipment and parts will satisfy the agency's needs for additional units or replacement items, and only one source is available.

c. Alternatives: The standardization determination executed by the Air Force compels USACE to include the base specific requirement in solicitations for the USACE. There is no alternative product that meets the Air Force's need to standardize this equipment. The only alternative considered that would differ from the terms of this J&A was to purchase the HVAC equipment separately and provide it to the construction contractor as Government furnished equipment (GFE). This alternative would still involve the purchase of a specific brand name/manufacturer's equipment on a sole source basis. Further, the effort associated with purchasing, storing, equipment warranty, conveying and managing the GFE was determined to both be inefficient and uneconomical. No other feasible alternative was identified.

d. Impact: If this J&A is not approved, USACE's Air Force construction contracts will not be executed in accordance with the Air Force CM program. USACE will be unable to implement the Air Force's standardization program. If the HVAC equipment is not standardized, the Air Force will not be able to realize the efficiencies and reduction of costs that have been targeted in the category management analysis. Anticipated advantages include reduced training costs for Air Force maintenance personnel, efficiencies in obtaining and storing spare parts, and decreased disruption to mission by rapid resolution of any HVAC system failures. This Class J&A alleviates the need for preparation and approval of multiple individual J&As.

6. Efforts to Obtain Competition: The Contracting Officer will publish the notices required by FAR 5.201, Publicizing Contract Actions, as described below, and any bids or proposals received shall be considered.

a. To the fullest extent practicable, solicitations for construction projects will be issued competitively. Though the brand name requirement for HVAC equipment will be stipulated in the solicitations, the HVAC equipment is a small component of the overall large construction project. Where required, Acquisition Plans shall be prepared to ensure the most effective approach to fulfill each requirement. Effective competition will be achieved in multiple ways, including but not limited to full and open competition, small business set asides, and fair opportunity for task orders placed under multiple award task order contracts. This J&A will be posted with each solicitation that relies upon it. Through industry outreach events and initiatives, potential contractors will be made aware of the Air Force standardization decisions and the intent to issue solicitations that specify brand name HVAC equipment for each Air Force installation. This coordination will alert them to engage subcontractors that are certified installers. Approval of this J&A will have no specific impact on small businesses and will not preclude small businesses from any business opportunities for construction and SRM projects in support of the Air Force.

b. Though the use of specified items cannot be considered competitive regardless of the number of suppliers available, it is anticipated that multiple vendors will be available to provide, install and maintain the Air Force installation identified HVAC systems at the subcontracting level and this sole source will not affect the overall competition for the construction requirement.

7. Actions to Increase Competition: In accordance with FAR subpart 5.2, Synopses of Proposed Contract Action, a Notice of Intent (NOI) under North American Industry Classification System (NAICS) 236220, Commercial and Institutional Building Construction, to include the brand name for HVAC Standardization, was posted to SAM.gov on 05 May 2021 and requested responses by 20 May 2021. Reference section 9 for Market Survey responses. The Air Force requirement to use one type of HVAC chiller at each installation means that only the identified standard chillers will be required. Due to this standardization requirement, there are no planned actions to increase competition for the requirement.

On 27 April 2022, a second NOI under NAICS 236220, Commercial and Institutional Building Construction, to include the brand name for HVAC Standardization, was posted to SAM.gov with requested responses by 12 May 2022. No submissions were received in response to this NOI.

8. **Market Research:** Market research indicated that competition among authorized suppliers for the brand name products will exist since the products are readily available in the commercial marketplace and there are multiple companies that are licensed to sell the products. Because there are multiple sources, it is reasonable to expect that a fair and reasonable price will result from adequate competition at the subcontracting level.

   A NOI was posted to SAM.gov on 05 May 2021, and again on SAM.gov 27 April 2022, with a 15-calendar day response period for interested contractors. The government did not receive any objections to the intent to standardize HVAC chillers in accordance with the Air Force CM for the Facilities and Construction Category Program. A description of the requirement was provided in the SAM notices and advised any contractor that can provide the required were invited to submit a written response indicating ability to meet the requirement. Two sources expressed interest to the published notice dated 05 May 2021. The responses indicate that there are providers that can provide, install, and maintain the required items and no alternative sources were identified for the HVAC equipment that would meet the Government's requirements. No sources expressed interest in response to the published notice dated 27 April 2022.

9. **Interested Sources:** To date, two responses have been received; Carrier and GCM. The first response was received on 12 May 2021, from Carrier who stated that they "…were selected as a sole-source chiller supplier for a number of USAF bases." The response stated they were happy to provide documentation requested but asked for additional clarification. USACE reached out providing clarification, however a subsequent response was not received from Carrier. The second response was received on 17 May 2021, from GCM. GCM provided a capability statement which indicated vast experience with chillers from 14 manufacturers. The 14 manufacturers identified represents the ability to provide, install and maintain 93% of the Air Force installations identified in the Air Force HVAC Standardization. The J&A will be posted with the issuance of each applicable forthcoming solicitation in accordance with FAR 5.102(a)(6).

10. **Other Facts:** Reasonable efforts were made to retrieve other facts from computer records, contract files, and other sources to support the use of other than full and open competition as follows:

    a. Prior to the recent standardization efforts launched by the Air Force, there is no known history of sole source procurement of HVAC equipment on an Air Force installation-wide basis.

b. As previously stated, the Air Force Senior Procurement Executive approved a Class J&A on 7 August 2019 that requires use of brand name HVAC equipment in all requirements procured directly by the Air Force through 2024. The J&A encompassed all Air Force installations and specified a particular brand name as the designated single manufacturers for installations. The Air Force followed up with a formal HVAC Chiller System Standardization, Single Manufacturer Selection determination on 10 September 2019. This Class J&A implements the Air Force standardization determination for all construction projects executed by USACE through 2024.

Attachments:
Tab 1 – Justification and Approval for Air Force HVAC Standardization
Tab 2 – Category Management 4 - HVAC Installation Standardization Memorandums
Tab 3 – Notice of Intent dated 05 May 2021
Tab 4 – Notice of Intent dated 27 April 2022
Tab 5 – AF install estimate FY23-27
Tab 6 – AF SRM estimate FY23-27

11. Technical Certification: I certify that the supporting data under my cognizance, which are included in the Justification and Approval, are accurate and complete to the best of my knowledge and belief.

Ian F. Mitchell
2023.04.20 12:56:01 -04'00' DATE 4/20/23

Ian F. Mitchell, P.E., LEED AP BD+C
Engineering Division

12. Small Business Certification: I certify supporting data under my cognizance which are included in the Justification and Approval is accurate and complete to the best of my knowledge and belief.

Crystal Harbin Digitally signed by Crystal Harbin
Date: 2023.04.20 11:53:31 -04'00' DATE 4/20/23

Crystal Harbin
Louisville District, Deputy for Small Business

13. Requirements Certification: I certify that the supporting data under my cognizance, which are included in the Justification and Approval, are accurate and complete to the best of my knowledge and belief.

MITCHELL.CRISTIE.L[redacted] Digitally signed by MITCHELL.CRISTIE.L[redacted]
Date: 2023.04.20 12:04:52 -04'00' DATE 4/20/23

Cristie Mitchell, P.E., PMP
Project Management Division

14. Legal Review and Concurrence: I hereby determine that the information herein is legally sufficient, and I concur with the sole source procurement.

BEAVIN.TARRAH.M[redacted] Digitally signed by BEAVIN.TARRAH.M[redacted]
Date: 2023.04.20 13:03:43 -04'00' DATE 4/20/23

Tarrah Beavin
Assistance District Counsel

15. Contracting Officer Certification: I certify that this justification is accurate and complete to the best of my knowledge and belief. A determination of fair and reasonable price will be made for each individual contract executed under the authority provided by this Class J&A.

Emily Moore MOORE.EMILY.A[redacted]
2023.04.20 12:59:03 -04'00' DATE 4/20/23

Emily A. Moore
Contracting Officer

Approval

Based on the foregoing justification, I hereby approve a class justification for the standardization of Heating, Ventilation and Air Conditioning (HVAC) equipment for Air Force construction projects on an Other than Full and Open Competition basis pursuant to the authority of Title 10 United States Code, Section 3204(a)(1), as implemented by Federal Acquisition Regulation 6.302-1(a)(2), "Only One Responsible Source and No Other Supplies or Services Will Satisfy Agency Requirements." The estimated period of award is from Fiscal Years 2023 through 2027. The total estimated value is $145,000,000. The approval is subject to the availability of funds and provided that the services and supplies herein described have otherwise been authorized for this acquisition.

7/17/2023
Date

Douglas R. Bush
Senior Procurement Executive

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