

AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT				1. CONTRACT ID CODE J		PAGE OF PAGES 1 3	
2. AMENDMENT/MODIFICATION NO. 0002		3. EFFECTIVE DATE 16 -APR-2021		4. REQUISITION/PURCHASE REQ. NO.		5. PROJECT NO.(If applicable)	
6. ISSUED BY CODE US ARMY ENGINEER DISTRICT, FORT WORTH ATTN: CESWF-CT 819 TAYLOR ST, ROOM 2A19 P.O. BOX 17300 FORT WORTH TX 76102-0300		7. ADMINISTERED BY (If other than item 6) CODE See Item 6		7. ADMINISTERED BY (If other than item 6) CODE			
8. NAME AND ADDRESS OF CONTRACTOR (No., Street, County, State and Zip Code)				☒ 9A. AMENDMENT OF SOLICITATION NO. W912621R0051			
				☒ 9B. DATED (SEE ITEM 11) 23-MAR-2021			
				10A. MOD. OF CONTRACT/ORDER NO.			
				10B. DATED (SEE ITEM 13)			
CODE		FACILITY CODE					
11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS							
☒ The above numbered solicitation is amended as set forth in Item 14. The hour and date specified for receipt of Offer ☒ is extended, ☐ is not extended. Offer must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended by one of the following methods: (a) By completing Items 8 and 15, and returning <u>1</u> copies of the amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGMENT TO BE RECEIVED AT THE PLACE DESIGNATED FOR THE RECEIPT OF OFFERS PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If by virtue of this amendment you desire to change an offer already submitted, such change may be made by telegram or letter, provided each telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.							
12. ACCOUNTING AND APPROPRIATION DATA (If required)							
13. THIS ITEM APPLIES ONLY TO MODIFICATIONS OF CONTRACTS/ORDERS. IT MODIFIES THE CONTRACT/ORDER NO. AS DESCRIBED IN ITEM 14.							
A. THIS CHANGE ORDER IS ISSUED PURSUANT TO: (Specify authority) THE CHANGES SET FORTH IN ITEM 14 ARE MADE IN THE CONTRACT ORDER NO. IN ITEM 10A.							
B. THE ABOVE NUMBERED CONTRACT/ORDER IS MODIFIED TO REFLECT THE ADMINISTRATIVE CHANGES (such as changes in paying office, appropriation date, etc.) SET FORTH IN ITEM 14, PURSUANT TO THE AUTHORITY OF FAR 43.103(B).							
C. THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF:							
D. OTHER (Specify type of modification and authority)							
E. IMPORTANT: Contractor ☐ is not, ☐ is required to sign this document and return _____ copies to the issuing office.							
14. DESCRIPTION OF AMENDMENT/MODIFICATION (Organized by UCF section headings, including solicitation/contract subject matter where feasible.) The Solicitation for Lackland Aquatics Tanks; Lackland AFB, Texas is amended as follows. See SF30 Continuation Sheet(s) NOTE: Proposal Receipt date has been changed to 6 May 2021; at 2:00 p.m.,CT.							
Except as provided herein, all terms and conditions of the document referenced in Item 9A or 10A, as heretofore changed, remains unchanged and in full force and effect.							
15A. NAME AND TITLE OF SIGNER (Type or print)				16A. NAME AND TITLE OF CONTRACTING OFFICER (Type or print)			
				TEL: EMAIL:			
15B. CONTRACTOR/OFFEROR		15C. DATE SIGNED		16B. UNITED STATES OF AMERICA		16C. DATE SIGNED	
(Signature of person authorized to sign)				BY (Signature of Contracting Officer)			

SECTION SF 30 BLOCK 14 CONTINUATION PAGE

SUMMARY OF CHANGES**CHANGES TO SOLICITATION W9126G21R0051****CHANGES TO PROPOSAL RECEIPT DATE**

1. Proposal Receipt Date: The proposal receipt date has been changed from "22 April 2021, 2:00 p.m. local time" to "6 May 2021, 2:00 p.m. local time".

CHANGES TO CLIN SCHEDULE

2. CLIN Schedule: Replace the CLIN Schedule with the accompanying new CLIN Schedule, bearing the notation W9126G21R0051, AMENDMENT 0002.

CHANGES TO THE SPECIFICATIONS

3. Revised Section: Replace the sections listed below with the attached revised sections of the same number, bearing the notation W9126G21R0051, AMENDMENT 0002.

05 30 00	STEEL DECKS
05 52 00	METAL RAILINGS
09 06 00	SCHEDULES FOR FINISHES
09 24 23	CEMENT STUCCO
09 51 00	ACOUSTICAL CEILINGS
13 11 00	SWIMMING POOLS
13 11 01	SWIMMING POOL CAST-IN-PLACE CONCRETE
13 11 03	SWIMMING POOL TILE
13 11 04	SWIMMING POOL CEMENTITIOUS FINISH
13 11 06	SWIMMING POOL TIMING SYSTEM
14 21 23	ELECTRIC TRACTION PASSENGER ELEVATORS
25 08 10	UTILITY MONITORING & CONTROL SYSTEM (UMCS) TESTING
26 27 13.10 30	ELECTRIC METERS
31 00 00	EARTHWORK
32 31 13.53	HIGH-SECURITY FINCES (CHAIN LINK & ORNAMENTAL) AND GATES
32 92 23	SODDING
33 82 00	TELECOMMUNICATIONS OUTSIDE PLANT (OSP)

4. Revised Section (American Water): Replace the section below with the attached revised section of the same number, bearing the notation W9126G21R0051, AMENDMENT 0002.

33 11 00.11	POLYVINYL CHLORIDE (PVC) PIPE

CHANGES TO THE DRAWINGS

5. Revised Drawings: Replace the drawings listed below with the attached revised drawings of the same numbers, bearing the notation W9126G21R0051, AMENDMENT 0002.

C-502	CIVIL DETAILS
C-509	CIVIL DETAILS
C-512	CIVIL DETAILS
C-513	CIVIL DETAILS
C-515	CIVIL DETAILS

L-401	LANDSCAPE PLAN
S-309	SECTIONS ROOF AREA 1 & 3
S-506	STANDARD DETAILS – STRUCTURAL STEEL
A-201	EXTERIOR ELEVATIONS
A-202	EXTERIOR ELEVATIONS
I-110	LEVEL 1 (LOWER LEVEL) - COMPOSITE FINISHES
I-112	LEVEL 1 (LOWER LEVEL) – AREA 2 FINISHES
I-120	LEVEL 2 (MEZZANINE) – COMPOSITE FINISHES
I-122	LEVEL 2 (MEZZANINE) – AREA 2 FINISHES
I-601	FINISH LEGENDS & SCHEDULES
I-602	SIGNAGE SCHEDULE & TYPICALS
P-001	LEGEND, NOTES & ABBREVIATIONS
P-501	PLUMBING DETAILS
P-601	PLUMBING SCHEDULES
M-001	MECHANICAL LEGEND & ABBREVIATIONS
M-002	MECHANICAL BASIS OF DESIGN & GENERAL NOTES
M-003	OUTSIDE AIR CALCULATIONS
M-100	PLAN – LEVEL 0 (CRAWL SPACE) – HVAC
M-110	PLAN – LEVEL 1 (LOWER LEVEL) – HVAC
M-120	PLAN – LEVEL 2 (MEZZANINE) – HVAC
M-130	PLAN – LEVEL 3 (MECH PLATFORM) – HVAC
M-200	PLAN – LEVEL 0 (CRAWL SPACE) – ZONING
M-210	PLAN – LEVEL 1 (LOWER LEVEL) – ZONING
M-220	PLAN – LEVEL 2 (MEZZANINE) – ZONING
M-230	PLAN – LEVEL 3 (MECH PLATFORM) – ZONING
M-301	SECTIONS
M-501	MECHANICAL DETAILS
M-502	MECHANICAL DETAILS
M-503	MECHANICAL DETAILS
M-601	MECHANICAL SCHEDULES
M-602	MECHANICAL SCHEDULES
M-701	CONTROLS – SCHEMATICS
M-702	CONTROLS – SCHEMATICS
M-703	CONTROLS – SCHEMATICS
M-704	CONTROLS – SCHEMATICS
M-705	CONTROLS – SCHEDULES
M-706	CONTROLS – SCHEDULES
E-001	LEGEND, ABBREVIATIONS & NOTES
E-501	ELECTRICAL DETAILS
E-502	ELECTRICAL DETAILS
E-503	ELECTRICAL DETAILS
E-504	ELECTRICAL DETAILS
E-601	ELECTRICAL DIAGRAMS
T-101	TELECOMMUNICATIONS SITE PLAN
XP504	TANK MECHANICAL DETAILS
XP601	TANK SCHEDULES

End of Summary of Changes

Design-Bid-Build
Request for Proposal
AQUATICS TANK
JBSA, Lackland AFB, Texas

CONTRACT LINE ITEM SCHEDULE

Item No.	Description	Quantity	Unit	Price	Line Item Amount
BASE OFFER: All work required by the plans and specifications.					
0001	All work required to Construct New Aquatics Tank within the 5' demarcation line.	1	JOB	\$ ***	\$ _____
0002	Type I (24") Concrete ~~<AM#0002>~~ ~~Piles Piers~~ ~~</AM#0002>~~ for Aquatics Tank Building.	5,112	VLF	\$ ***	\$ _____
0003	Type I (36") Concrete ~~<AM#0002>~~ ~~Piles Piers~~ ~~</AM#0002>~~ for Aquatics Tank Building.	4,950	VLF	\$ ***	\$ _____
0004	All work to Complete Site Improvements outside the 5' demarcation line.	1	JOB	\$ ***	\$ _____
TOTAL BASE OFFER					\$ _____

Contract Duration in Calendar Days After the Notice to Proceed is received.*

_____ DAYS

*Note: Contract duration for all work shall NOT exceed the duration specified in Section 01 00 00.00 44 CONSTRUCTION SCHEDULE. See Note No. 9.

SECTION 05 30 00

STEEL DECKS

<AMENDMENT NO. 0002>

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI D100 (1991; R 2008) Cold-Formed Steel Design Manual

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M (2015; Errata 1 2015; Errata 2 2016) Structural Welding Code - Steel

AWS D1.3/D1.3M (2018) Structural Welding Code - Sheet Steel

ASTM INTERNATIONAL (ASTM)

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

ASTM A123/A123M (2017) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A653/A653M (2018) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

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

ASTM A792/A792M (2010) Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process

ASTM A1008/A1008M (2016) Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable

ASTM C423 (2009a) Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method

ASTM D746	(2014) Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact
ASTM D1056	(2014) Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber
ASTM D1149	(2007; R 2012) Standard Test Method for Rubber Deterioration - Surface Ozone Cracking in a Chamber
ASTM E84	(2018a) Standard Test Method for Surface Burning Characteristics of Building Materials
FM GLOBAL (FM)	
FM APP GUIDE	(updated on-line) Approval Guide http://www.approvalguide.com/
FM DS 1-28R	(1998) Data Sheet: Roof Systems
SOCIETY FOR PROTECTIVE COATINGS (SSPC)	
SSPC Paint 20	(2002; E 2004) Zinc-Rich Primers (Type I, Inorganic, and Type II, Organic)
STEEL DECK INSTITUTE (SDI)	
ANSI/SDI C	(2017) Standard for Composite Steel Floor Deck - Slabs
ANSI/SDI NC	(2017) Standard for Non-Composite Steel Floor Deck
ANSI/SDI RD	(2017) Standard for Steel Roof Deck
SDI DDM04	(2015; Errata 1-3 2016; Add 1 2015; Add 2 20162006) Diaphragm Design Manual; 4th Edition
SDI DDP	(1987; R 2000) Deck Damage and Penetrations
SDI MOC3	(2016) Manual of Construction with Steel Deck (3rd Edition)
U.S. DEPARTMENT OF DEFENSE (DOD)	
UFC 3-301-01	(2013; with Change 4, 2018) Structural Engineering
U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)	
29 CFR 1926	Safety and Health Regulations for Construction

UNDERWRITERS LABORATORIES (UL)

UL 580 (2006; Reprint Nov 2018Mar 2019) UL
Standard for Safety Tests for Uplift
Resistance of Roof Assemblies

UL Fire Resistance (2014) Fire Resistance Directory

1.2 SUBMITTALS

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

Fabrication Drawings; G
Natatorium Deck Attachment Signed And Sealed Calculations; G

SD-03 Product Data

Accessories
Deck Units
Galvanizing Repair Paint
Mechanical Fasteners
Touch-Up Paint
Sound Absorbing Materials
Welding Equipment
Welding Rods and Accessories
Recycled Content of Steel Products; S

SD-04 Samples

Metal Roof Deck Units

Flexible Closure Strips
Acoustical Material

SD-05 Design Data

Deck Units; G

SD-07 Certificates

Powder-Actuated Tool Operator
Welder Qualifications
Welding Procedures
Fire Safety
Wind Storm Resistance
Manufacturer's Certificate

1.3 QUALITY ASSURANCE

1.3.1 Deck Units

Furnish deck units and accessory products from a manufacturer regularly engaged in manufacture of steel decking. Provide [manufacturer's certificate](#) s attesting that the decking material meets the specified requirements.

1.3.2 Certification of [Powder-Actuated Tool Operator](#)

Provide manufacturer's certificate attesting that the operators are authorized to use the low velocity powder-actuated tool.

1.3.3 Qualifications for Welding Work

Follow [Welding Procedures](#) of [AWS D1.3/D1.3M](#) for sheet steel and [AWS D1.1/D1.1M](#) for stud welding. Submit qualified [Welder Qualifications](#) in accordance with [AWS D1.3/D1.3M](#) for sheet steel and [AWS D1.1/D1.1M](#) for stud welding, or under an equivalent approved qualification test. Perform tests on test pieces in positions and with clearances equivalent to those actually encountered. If a test weld fails to meet requirements, perform an immediate retest of two test welds until each test weld passes. Failure in the immediate retest will require the welder be retested after further practice or training, performing a complete set of test welds.

Submit manufacturer's catalog data for [Welding Equipment](#) and [Welding Rods and Accessories](#).

1.3.4 Regulatory Requirements

1.3.4.1 [Fire Safety](#)

Test roof deck as a part of a roof deck construction assembly of the type used for this project, listing as fire classified in the [UL Fire Resistance](#), or listing as Class I construction in the [FM APP GUIDE](#), and so labeled.

1.3.4.2 [Wind Storm Resistance](#)

Provide roof construction assembly capable of withstanding a nominal uplift pressure of [60 pounds per square foot](#) when tested in accordance with the uplift pressure test described in the [FM DS 1-28R](#) or as described in [UL 580](#) and in general compliance with [UFC 3-301-01](#).

1.3.5 [Fabrication Drawings](#)

Show type and location of units, location and sequence of connections, bearing on supports, methods of anchoring, attachment of accessories, adjusting plate details, cant strips, ridge and valley plates, metal closure strips, size and location of holes to be cut and reinforcement to be provided, the manufacturer's erection instructions and other pertinent details.

1.4 DELIVERY, STORAGE, AND HANDLING

Deliver deck units to the site in a dry and undamaged condition. Store and handle steel deck in a manner to protect it from corrosion, deformation, and other types of damage. Do not use decking for storage or as working platform until units have been fastened into position. Exercise care not

to damage material or overload decking during construction. The maximum uniform distributed storage load must not exceed the design live load. Stack decking on platforms or pallets and cover with weathertight ventilated covering. Elevate one end during storage to provide drainage. Maintain deck finish at all times to prevent formation of rust. Repair deck finish using touch-up paint. Replace damaged material.

1.5 DESIGN REQUIREMENTS FOR ROOF DECKS

1.5.1 Properties of Sections

Properties of metal roof deck sections must comply with engineering design width as limited by the provisions of [AISI D100](#).

1.5.2 Allowable Loads

Deck supplier to, indicate total uniform dead and live load for detailing purposes.

PART 2 PRODUCTS

2.1 DECK UNITS

Submit manufacturer's design calculations, or applicable published literature for the structural properties of the proposed deck units.

Provide products with an average [recycled content of steel products](#) so postconsumer recycled content plus one half of preconsumer recycled content not less than 25 percent.

2.1.1 Roof Deck

Conform to [ASTM A792/A792M](#) or [ASTM A1008/A1008M](#) for deck used in conjunction with insulation and built-up roofing. Fabricate roof deck units of [0.0295 inch](#) design thickness or thicker steel the steel design thickness required by the design drawings and galvanized and painted with an epoxy coating. Furnish sample of [Metal Roof Deck Units](#) used to illustrate actual cross section dimensions and configurations.

2.1.2 Acoustical 9" Natatorium Roof Deck

Natatorium acoustical roof deck shall be nominally nine inches deep by modular width of sixteen inches. The acoustical roof deck shall be cold-formed from steel coils conforming to ASTM A653, structural quality, with a minimum yield strength of 40 ksi. Before forming, the steel coils shall have received a hot-dip protective coating of zinc conforming to ASTM A924, Class G90, as defined in ASTM A653. The minimum uncoated thickness of the steel furnished shall not be less than 95% of the design thickness. provide [natatorium deck attachment signed and sealed calculations for review and approval](#).

Natatorium acoustical roof deck shall be cold-formed by the continuous roll forming process and resistance-welded together to form an integral cellular unit.

1. Natatorium acoustical roof deck shall have interlocking sidelaps suitable for screw or weld fastening.

2. Natatorium acoustical roof deck shall have roll-formed embossments located between the longitudinal stiffening ribs in the top flanges and horizontal stiffening ribs along the vertical webs to enhance the structural performance.

3. Shallow stiffening ribs shall be roll-formed into the bottom plates of natatorium acoustical roof deck. The ribs shall be located in the area between the webs to enhance flatness of the bottom plate.

4. Natatorium acoustical roof deck shall have bottom plates in the area located between the webs perforated for enhanced acoustic performance with uniform rows of holes. Acoustic elements shall be factory installed and restrained in deck cavity. A minimum NRC value of 0.95 shall be provided, the value shall be established by sound absorption tests without the use of fiberglass insulation above the panels. Acoustical elements shall be factory encapsulated to protect elements from moisture. Elements shall be held off bottom of deck cavity by non-corrosive / non-metallic separators.

5. Before fabrication of the panel, all surfaces of the galvanized sheet steel shall be processed through a continuous coil coating line, designed to degrease and clean the metal, followed by a chemical conversion coating to etch the surface for proper bond characteristics. A Stage-One zinc-rich primer compatible with the Stage-Two anti-corrosion natatorium primer shall be applied immediately after the chemical conversion process.

Metallic components shall then be roll-formed (no brake-forming components allowed) and robotically factory welded together. After welding, all exposed welds shall be touch-up painted at the factory to ensure that all exposed welds are coated.

After assembly of the panel, the exposed surface shall receive the Stage-Two factory applied natatorium epoxy primer using robotic paint line to assure edges of all acoustical perforations are painted, and thereafter oven-cured to enhance adhesion and durability characteristics. Application of Stage-Two coating by manual or hand means shall not be permitted.

Accelerated corrosion test reports from a recognized laboratory shall have been conducted for a minimum of 4000 hours on the Stage-One primer and Stage-Two natatorium primer system via a controlled humidity chamber at 100° F infused with approximately 5 times the chlorine or bromine concentration found in a typical indoor pool environment. The final report must indicate that corrosion on the panel surface be less than 20% and blistering of the paint finish to be 0%.

A field applied 3 mil (DFT min) top coat of Tnemec #113 shall be field applied by the painting contractor after panel erection. Any substitution of the field applied coating must be compatible with the factory applied natatorium Stage-Two primer and suitable for the intended environment. Compatibility of the field applied finish paint with the factory applied prime paint shall be the responsibility of the painting contractor. Refer to section 09 96 00 & 09 90 00

Provide a Noise Reduction Coefficient (NRC) rating of not less than 0.95 , when tested in accordance with ASTM C423. Provide sound absorbing materials with either glass fiber in roll or premolded form for acoustical steel deck (noncellular) and or glass fiber rigid strip for acoustical steel deck (cellular) in accordance with manufacturer's standards.

2.1.3 Form Deck

Conform to [ASTM A653/A653M](#) or [ASTM A1008/A1008M](#) for deck used as formwork for concrete. Fabricate form deck of [0.015 inch](#) design thickness or thicker steel. the steel design thickness required by the design drawings. Paint with one coat of manufacture's standard paint. Zinc-coat in conformance with [ASTM A653/A653M](#), Z275 G90 coating class.

2.1.4 Length of Deck Units

Provide deck units of sufficient length to span three or more spacings where possible.

2.1.5 Shop Priming

Shop prime accessories and underside of deck at the factory after coating. Clean surfaces in accordance with the manufacturer's standard procedure followed by a spray, dip or roller coat of rust-inhibitive primer, oven cured.

2.1.6 Touch-Up Paint

Provide a high zinc-dust content paint for regalvanizing welds in galvanized steel conforming to [ASTM A780/A780M](#).

Provide touch-up paint for shop-painted units of the same type used for the shop painting , and touch-up paint for zinc-coated units of an approved [galvanizing repair paint](#) with a high-zinc dust content . Touch-up welds with paint conforming to [SSPC Paint 20](#) in accordance with [ASTM A780/A780M](#). Maintain finish of deck units and accessories by using touch-up paint whenever necessary to prevent the formation of rust.

2.2 ACCESSORIES

Provide accessories of same material as deck, unless specified otherwise. Provide manufacturer's standard type accessories, as specified.

2.2.1 Adjusting Plates

Provide adjusting plates, or segments of deck units, of same thickness and configuration as deck units in locations too narrow to accommodate full size units. Provide factory cut plates of predetermined size where possible.

2.2.2 End Closures

Fabricated of sheet metal by the deck manufacturer. Provide end closures minimum [0.0295 inch](#) thick to close open ends at exposed edges of floors, eaves, openings through deck.

2.2.3 Partition Closures

Provide closures for closing voids above interior walls and partitions that are perpendicular to the direction of the configurations.

2.2.4 Flexible Closure Strips for Roof Decks

Provide strips made of vulcanized, closed-cell, synthetic rubber material

specified and premolded to the configuration required to provide tight-fitting closures at open ends and sides of steel roof decking.

Conforming to [ASTM D1056](#), Grade 2A1, with the following additional properties:

Brittleness temperature of [minus 40 degrees F](#) when tested in accordance with [ASTM D746](#).

Flammability resistance with a flame spread rating of less than 25 when tested in accordance with [ASTM E84](#).

Resistance to ozone must be "no cracks" after exposure of a sample kept under a surface tensile strain of 25 percent to an ozone concentration of 100 parts per million of air by volume in air for 100 hours at [104 degrees F](#) and tested in accordance with [ASTM D1149](#).

Provide a elastomeric type adhesive as recommended by the manufacturer of the flexible closure strips.

2.2.5 Sheet Metal Collar

Where deck is cut for passage of pipes, ducts, columns, etc., and deck is to remain exposed, provide a neatly cut sheet metal collar to cover edges of deck. Do not cut deck until after installation of supplemental supports.

2.2.6 Cover Plates

Sheet metal to close panel edge and end conditions, and where panels change direction or butt. Polyethylene-coated, self-adhesive, [2 inch](#) wide joint tape may be provided in lieu of cover plates on flat-surfaced decking butt joints.

Fabricate cover plates for abutting floor deck units from the specified structural-quality steel sheets not less than nominal [18 gage](#) thick before galvanizing. Provide [6 inch](#) wide cover plates and form to match the contour of the floor deck units.

2.2.7 Roof Sump Pans

Sump pans must be provided for roof drains and must be minimum [0.075 inch](#) thick steel, recessed type. Shape sump pans to meet roof slope by the supplier or by a sheet metal specialist. Provide bearing flanges of sump pans to overlap steel deck a minimum of [3 inch](#). Shape, size, and reinforce the opening in bottom of the sump pan to receive roof drain.

2.2.8 Access Hole Covers

Sheet metal, minimum [0.0474 inch](#) thick.

2.2.9 Cant Strips for Roof Decks

Fabricate cant strips from the specified commercial-quality steel sheets not less than nominal [0.0358 inch](#) thick before galvanizing. Bend strips to form a 45-degree cant not less than [5 inch](#) wide, with top and bottom flanges a minimum [3 inch](#) wide. Length of strips [10 feet](#).

2.2.10 Ridge and Valley Plates for Roof Decks

Fabricate plates from the specified structural-quality steel sheets, not less than nominal 0.0358 inch thick before galvanizing. Provide plates of minimum 4-1/2 inch wide and bent to provide tight fitting closures at ridges and valleys. Provide a minimum length of ridge and valley plates of 10 feet.

2.2.11 Metal Closure Strips for Roof Decks

Fabricate strips from the specified commercial-quality steel sheets not less than nominal 0.0358 inch thick before galvanizing. Provide strips from the configuration required to provide tight-fitting closures at open ends and sides of steel roof decking.

2.2.12 Galvanized Steel Angles for Roof Decks

Provide hot-rolled carbon steel angles conforming to ASTM A36/A36M, and hot-dip galvanized in accordance with ASTM A123/A123M.

2.2.13 Sound Absorbing Material

Provide glass fiber in roll or premolded form for acoustical noncellular steel roof deck and glass fiber rigid strip for acoustical cellular steel deck in accordance with the manufacturer's standards. Provide a sample of acoustical material to be used.

2.2.14 Mechanical Fasteners

Provide mechanical fasteners, such as powder actuated fasteners, pneumatically driven fasteners or self-drilling screws, for anchoring the deck to structural supports and adjoining units that are designed to meet the loads indicated.

2.2.15 Miscellaneous Accessories

Furnish the manufacturer's standard accessories to complete the deck installation. Furnish metal accessories of the same material as the deck and with the minimum design thickness as follows: saddles, 0.0474 inch welding washers, 0.0598 inch other metal accessories, 0.0358 inch unless otherwise indicated.

PART 3 EXECUTION

3.1 EXAMINATION

Prior to installation of decking units and accessories, examine worksite to verify that as-built structure will permit installation of decking system without modification.

3.2 INSTALLATION

Install steel deck units in accordance with 29 CFR 1926, Subpart R - Steel Erection, SDI DDM04 and approved shop drawings. Place units on structural supports, properly adjusted, leveled, and aligned at right angles to supports before permanently securing in place. Damaged deck and accessories including material which is permanently stained or contaminated, deformed, or with burned holes shall not be installed. Extend deck units over three or more supports unless absolutely impractical. Report inaccuracies in alignment or leveling to the

Contracting Officer and make necessary corrections before permanently anchoring deck units. Locate deck ends over supports only. Butted deck ends. Do not use unanchored deck units as a work or storage platform. Permanently anchor units placed by the end of each working day. Do not support suspended ceilings, light fixtures, ducts, utilities, or other loads by steel deck unless indicated. Distribute loads by appropriate means to prevent damage.

3.2.1 NATATORIUM DECK INSTALLATION

Before being permanently fastened, natatorium acoustical roof deck shall be placed on the supporting frame and adjusted to final position with ends accurately aligned and adequately bearing on the supporting frame. Consistent coverage shall be maintained so that panels located in adjacent bays will be properly aligned.

Cutting of the natatorium acoustical roof deck to suit jobsite conditions shall be performed in a neat and professional manner. Only those openings indicated on the structural drawings shall be cut. Other openings shall be cut and reinforced by those requiring the openings as approved by the structural engineer.

(AM#0002)>

The natatorium acoustical roof deck shall be fastened to all supporting members with four (4) pinned powder-actuated fasteners per 16" wide panel or as indicated on the manufacturer's erection drawings.

~~The natatorium acoustical roof deck shall be fastened to all supporting members with four (4) pinned (powder actuated fasteners equivalent to Hilti X ENP 19 L15) per 16" wide panel or as indicated on the manufacturer's erection drawings.~~

<(AM#0002)

The sides of natatorium acoustical roof deck located at the perimeter of the building shall be fastened to supporting members with pinned (powder-actuated fasteners) at a maximum spacing of 36" on center or less as indicated on the manufacturer's erection drawings.

The sidelaps of natatorium acoustical roof deck shall be fastened together with min #12 x ¾" sidelap fasteners on four inch (4") centers. as indicated on the manufacturer's erection drawings.

Construction loads shall not be applied to natatorium acoustical roof deck until after the panels are permanently fastened to supporting members, and sidelaps are attached. The construction loads shall not exceed the capacity of the panels.

Item such as ceilings, light fixtures, conduit, pipe and ductwork shall not be suspended from natatorium acoustical roof deck without specific approval of the structural engineer.

Sump pans, ridge plates, valley plates, transition plates, eave plates, and supplied reinforcement for small openings shall be fastened as indicated on the manufacturer's erection drawings.

3.2.2 Attachment

Immediately after placement and alignment, and after correcting inaccuracies, permanently fasten steel deck units to structural supports and to adjacent deck units by welding with normal 5/8 inch diameter puddle

welds, fastened with screws, powder-actuated fasteners, or pneumatically driven fasteners as indicated on the design drawings and in accordance with manufacturer's recommended procedure and ANSI/SDI C, ANSI/SDI NC or ANSI/SDI RD. Clamp or weight deck units to provide firm contact between deck units and structural supports while performing welding or fastening. Attachment of adjacent deck units by button-punching is prohibited.

3.2.2.1 Welding

Perform welding in accordance with AWS D1.3/D1.3M using methods and electrodes recommended by the manufacturers of the base metal alloys being used. Ensure only operators previously qualified by tests prescribed in AWS D1.3/D1.3M make welds. Immediately recertify, or replace qualified welders, that are producing unsatisfactory welding. Conform to the recommendations of the Steel Deck Institute and the steel deck manufacturer for location, size, and spacing of fastening. Do not use welding washers at the connections of the deck to supports. Do not use welding washers at sidelaps. Holes and similar defects will not be acceptable. Attach all partial or segments of deck units to structural supports in accordance with Section 2.5 of SDI DDM04. . Immediately clean welds by chipping and wire brushing. Heavily coat welds, cut edges and damaged portions of coated finish with zinc-dust paint conforming to ASTM A780/A780M.

3.2.2.2 Mechanical Fastening

Anchor deck to structural supports and adjoining units with mechanical fasteners. Drive the powder-actuated fasteners with a low-velocity piston tool by an operator authorized by the manufacturer of the powder-actuated tool. Drive pneumatically fasteners with a low-velocity fastening tool and comply with the manufacturer's recommendations. Drive screws to properly clamp desk to supporting steel.

3.2.2.3 Sidelap Fastening

Lock sidelaps between adjacent floor deck units together by welding or screws as indicated.

3.2.3 Openings

Cut or drill all holes and openings required and be coordinated with the drawings, specifications, and other trades. Frame and reinforce openings through the deck in conformance with SDI DDP. Reinforce holes and openings 6 to 12 inch across by 0.0474 inch thick steel sheet at least 12 inch wider and longer than the opening and be fastened to the steel deck at each corner of the sheet and at a maximum of 6 inch on center. Reinforce holes and openings larger than 12 inch by steel channels or angles installed perpendicular to the steel joists and supported by the adjacent steel joists. Install steel channels or angles perpendicular to the deck ribs and fasten to the channels or angles perpendicular to the steel joists. Deck manufacturer shall approve holes or openings larger than 6 inch in diameter prior to drilling or cutting. Openings must not interfere with seismic members such as chords and drag struts.

3.2.4 Deck Damage

SDI MOC3, for repair of deck damage.

3.2.5 Touch-Up Paint

3.2.5.1 Roof Deck

After roof decking installation, wire brush, clean, and touchup paint the scarred areas on top and bottom surfaces of metal roof decking. The scarred areas include welds, weld scars, bruises, and rust spots. Touchup galvanized surfaces with galvanizing repair paint. Touchup painted surfaces with repair paint of painted surfaces.

3.2.6 Accessory Installation

3.2.6.1 Adjusting Plates

Provide in locations too narrow to accommodate full-size deck units and install as shown on shop drawings.

3.2.6.2 End Closures

Provide end closure to close open ends of cells at columns, walls, and openings in deck.

3.2.6.3 Closures Above Partitions

Provide for closing voids between cells over partitions that are perpendicular to direction of cells. Provide a one-piece closure strip for partitions 4 inch nominal or less in thickness and two-piece closure strips for wider partitions. Provide sheet metal closures above fire-rated partitions at both sides of partition with space between filled with fiberglass insulation. Provide flexible rubber closures above acoustic-rated partitions at both sides of partition with space between filled with blanket insulation.

3.2.6.4 Cover Plates

Provide metal cover plates, or joint tape, at joints between cellular decking sheets to be used as electrical raceways.

3.2.6.5 Access Hole Covers

Provide access whole covers to seal holes cut in decking to facilitate welding of the deck to structural supports.

3.2.6.6 Hangers

Provide as indicated to support utility system . Space devices as indicated.

3.2.7 Sound Absorbing Material

Install sound absorbing glass fiber roll or premolded form, neatly in voids between perforated webs of acoustical noncellular steel deck and glass fiber rigid strip, in cells of acoustical cellular steel deck. Keep sound absorbing material dry before, during and after installation.

3.3 ROOF SUMP PANS

Place sump pans over openings in roof decking and fusion welded to top surface of roof decking. Do not exceed spacing of welds of 12 inch with

not less than one weld at each corner. Field cut opening in the bottom of each roof sump pan to receive the roof drain as part of the work of this section.

3.4 CANT STRIPS FOR ROOF DECKS

Provide strips to be fusion welded to surface of roof decking, secured to wood nailers by galvanized screws or to steel framing by galvanized self-tapping screws or welds. Do not exceed spacing of welds and fasteners of 12 inch. Lap end joints a minimum 3 inch and secure with galvanized sheet metal screws spaced a maximum 4 inch on center.

3.5 RIDGE AND VALLEY PLATES FOR ROOF DECKS

Provide plates to be fusion welded to top surface of roof decking. Lap end joints a minimum 3 inch. For valley plates, provide endlaps to be in the direction of water flow.

3.6 CLOSURE STRIPS FOR ROOF DECKS

Provide closure strips at open, uncovered ends and edges of the roof decking and in voids between roof decking and top of walls and partitions where indicated. Install closure strips in position in a manner to provide a weathertight installation.

3.7 ROOF INSULATION SUPPORT FOR ROOF DECKS

Provide metal closure strips for support of roof insulation where rib openings in top surface of metal roof decking occur adjacent to edges and openings. Weld metal closure strips in position.

3.8 CLEANING AND PROTECTION FOR ROOF DECKS

Upon completion of the deck, sweep surfaces clean and prepare for installation of the roofing.

3.9 FIELD QUALITY CONTROL

3.9.1 Deck Weld Inspection

Visual inspect welds in accordance with AWS D1.3/D1.3M.

3.9.2 Decks Not Receiving Concrete

Inspect the decking top surface for distortion after installation. For roof decks not receiving concrete, verify distortion by placing a straight edge across three adjacent top flanges. The maximum allowable gap between the straight edge and the top flanges should not exceed manufacturing and construction tolerances of supporting members. When gap is more than the allowable, provide corrective measures or replacement. Reinspect decking after performing corrective measures or replacement.

-- End of Section --

SECTION 05 52 00

METAL RAILINGS

<AMENDMENT NO. 0002>

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M (2015; Errata 1 2015; Errata 2 2016)
Structural Welding Code - Steel

ASTM INTERNATIONAL (ASTM)

ASTM A27/A27M (2017) Standard Specification for Steel Castings, Carbon, for General Application

ASTM A47/A47M (1999; R 2018; E 2018) Standard Specification for Ferritic Malleable Iron Castings

ASTM A123/A123M (2017) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

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

ASTM C1048 (2018) Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass

1.2 ADMINISTRATIVE REQUIREMENTS

1.2.1 Preinstallation Meetings

Within 30 days of contract award, submit fabrication drawings to the Contracting Officer for the following items:

a. Anchorage and fastening systems

Submit manufacturer's catalog data, including two copies of manufacturers specifications, load tables, dimension diagrams, and anchor details for the following items:

b. Concrete inserts

c. Masonry anchorage devices

d. Steel railings and handrails

- e. Stainless steel railings and handrails
- f. Anchorage and fastening systems

1.3 SUBMITTALS

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

SD-02 Shop Drawings

Fabrication Drawings;

Delegated-Design Submittal: G, AE

Glazed Decorative Metal Railings: G, AE

SD-03 Product Data

Concrete Inserts; G

Protective Coating; G

Steel Railings and Handrails; G

Stainless Steel Railings and Handrails; G

Anchorage and Fastening Systems; GSD-07 CertificatesWelding Procedures; G

SD-08 Manufacturer's Instructions

Installation Instructions

1.4 QUALITY CONTROL

1.4.1 Welding Procedures

Submit results of welding procedures testing in accordance with AWS D1.1/D1.1M and AWS D1.6/D1.6M made in the presence of the Contracting Officer and by an approved testing laboratory at the Contractor's expense.

PART 2 PRODUCTS

2.1 FABRICATION

Preassemble items in the shop to the greatest extent possible. Disassemble units only to the extent necessary for shipping and handling. Clearly mark units for reassembly and coordinated installation.

For the fabrication of work exposed to view, use only materials that are smooth and free of surface blemishes, including pitting, seam marks, roller marks, rolled trade names, and roughness. Remove blemishes by grinding, or by welding and grinding, before cleaning, treating, and applying surface finishes, including zinc coatings.

Provide railing and handrail detail plans and elevations at not less than 1 inch to 1 foot. Provide details of sections and connections at not less than 3 inches to 1 foot. Also detail setting drawings, diagrams, templates for installation of anchorages, including concrete inserts, anchor bolts, and miscellaneous metal items having integral anchors.

Use materials of size and thicknesses indicated or, if not indicated, of the size and thickness necessary to produce adequate strength and durability in the finished product for its intended use. Work the materials to the dimensions indicated on approved detail drawings, using proven details of fabrication and support. Use the type of materials indicated or specified for the various components of work.

Form exposed work true to line and level, with accurate angles and surfaces and straight sharp edges. Ensure that all exposed edges are eased to a radius of approximately 1/32 inch. Bend metal corners to the smallest radius possible without causing grain separation or otherwise impairing the work.

Weld corners and seams continuously and in accordance with the recommendations of AWS D1.1/D1.1M for steel handrails and AWS D1.6/D1.6M for stainless steel handrails. Grind exposed welds smooth and flush to match and blend with adjoining surfaces.

Form the exposed connections with hairline joints that are flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of the type indicated or, if not indicated, use countersunk Phillips flathead screws or bolts.

Provide anchorage of the type indicated and coordinated with the supporting structure. Fabricate anchoring devices and space as indicated and as required to provide adequate support for the intended use of the work.

2.1.1 Steel and Stainless Steel Handrails

Fabricate joint posts, rail, and corners by one of the following methods:

- b. Mitered and welded joints made by fitting post to top rail and intermediate rail to post, mitering corners, groove-welding joints, and grinding smooth. Butt railing splices and reinforce them by a tight-fitting interior sleeve not less than 6 inches long.
- c. Railings may be bent at corners in lieu of jointing, provided that bends are made in suitable jigs and the pipe is not crushed.

Provide removable sections as indicated.

2.1.2 Protective Coating

Shop-prime the steelwork (except for stainless steel) as indicated in accordance with Section 09 90 00 PAINTS AND COATINGS except the following:

- a. steel surfaces encased in concrete
- b. steel surfaces for welding
- c. high-strength bolt-connected contact surfaces

d. crane rail surfaces

Provide hot-dipped galvanized steelwork (except for stainless steel) as indicated in accordance with ASTM A123/A123M. Touch up abraded surfaces and cut ends of galvanized members with zinc-dust, zinc-oxide primer, or an approved galvanizing repair compound.

2.2 COMPONENTS

2.2.1 Concrete Inserts

Provide threaded-type concrete inserts consisting of galvanized ferrous castings, internally threaded to receive 3/4 inch diameter machine bolts; either malleable iron conforming to ASTM A47/A47M or cast steel conforming to ASTM A27/A27M, hot-dip galvanized in accordance with ASTM A153/A153M.

2.2.2 Aluminum Railings And Handrails

Provide railings and handrails consisting of 1 1/2 inch nominal schedule 40 pipe. Provide clear anodized aluminum railings. Ensure that all fasteners are Series 300 stainless steel.

2.2.3 Glazed Decorative Metal Railings

Provide glass supported railings with glass infill as indicated on drawings. Support each section of top rail by a minimum of three glass panels or by other means so top rail will remain in place if any one panel fails. Provide cast-stainless steel wall brackets with flange tapped for concealed anchorage with vertical and horizontal adjustment capability.

2.2.3.1 Hanrails and Infill of Glazed Guards:

- a. Uniform load of 50 lbf/ft. applied in any direction.
- b. Concentrated load of 200 lbf applied in any direction.
- c. Uniform and concentrated loads need not be assumed to act concurrently.
- d. Concetrated load at infill of guards: 50 lbf applied horizontally on an area of 1 square foot.
- e. Temperature Change: 120 degrees F. ambient; 180 degrees F. material surfaces.
- f. Laminated-tempered Glass: Glazing shall be laminated glass, consisting of tempered layers laminated together with an interlayer of polyvinyl butyral, ethylene-vinyl acetate, or thermoplastic polyurethane. Tempered glass layers shall be ASTM C1048, Kind FT (fully tempered), Condition A (uncoated), Type 1 (transparent flat glass), Quality-Q3. Provide products that have been tested for surface and edge compression according to ASTM C 1048 and for impact strength according to 16 CFR 1201 for Category II materials. Provide clear glass infill panels with an overall thickness of 0.5 inches.
- g. Installing Glass-supported Railings: Install assembly to comply with railing manufacturer's written instructions.

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~~h. Basis of Design Product: VIVA Railings, LLC, SHOE or a comparable product subject to compliance with requirements. <(AM#0002)>~~

PART 3 EXECUTION

3.1 PREPARATION

Adjust stair railings and handrails before securing in place in order to ensure proper matching at butting joints and correct alignment throughout their length. Space posts not more than 6 feet on center. Plumb posts in each direction. Secure posts and rail ends to building construction as follows:

- a. Anchor posts to steel with oval steel flanges, angle type or floor type as required by conditions, welded to posts and bolted to the steel supporting members.

Secure handrails to walls by means of wall brackets and wall return fitting at handrail ends. Provide brackets of malleable iron castings, with not less than 3 inch projection from the finished wall surface to the center of the pipe, drilled to receive one 3/8 inch bolt. Locate brackets not more than 60 inches on center. Provide wall return fittings of cast iron castings, flush type, with the same projection as that specified for wall brackets. Secure wall brackets and wall return fittings to building construction as follows:

- a. For concrete and solid masonry anchorage, use bolt anchor expansion shields and lag bolts.
- b. For hollow masonry and stud partition anchorage, use toggle bolts having square heads.

Install toe boards and brackets where indicated. Make splices, where required, at expansion joints. Install removable sections as indicated.

3.2 INSTALLATION

Submit manufacturer's installation instructions for the following products to be used in the fabrication of stair railing and hand rail work:

- a. Aluminum railings and handrails
- b. Anchorage and fastening systems

Provide complete, detailed fabrication and installation drawings used in accordance with the design specifications cited in this section.

3.2.1 Aluminum Handrail

Affix to base structure by flanges anchored to concrete or other existing masonry by expansion shields. Provide Series 300 stainless-steel bolts to anchor aluminum alloy flanges, of a size appropriate to the standard product of the manufacturer. Where aluminum or alloy fittings or extrusions are to be in contact with dissimilar metals or concrete, coat the contact surface with a heavy coating of bituminous paint.

3.2.2 Touchup Painting

Immediately after installation, clean field welds, bolted connections, abraded areas of the shop paint, and exposed areas painted with the paint used for shop painting. Apply paint by brush or spray to provide a minimum dry-film thickness of 2 mils.

3.3 FIELD QUALITY CONTROL

3.3.1 Field Welding

Ensure that procedures of manual shielded metal arc welding, appearance and quality of welds made, and methods used in correcting welding work comply with AWS D1.1/D1.1M.

-- End of Section --

SECTION 09 06 00

SCHEDULES FOR FINISHES
<AMENDMENT NO. 0002>

PART 1 GENERAL

1.1 SUMMARY

This section covers only the color of exterior and interior materials and products that are exposed to view in the finished construction. The word "color", as used herein, includes surface color and pattern. Requirements for quality, product specifications, and method of installation are covered in other appropriate sections of the specifications. Specific locations where the various materials are required are shown on the drawings if not identified in this specification. Items not designated for color in this section may be specified in other sections. When color is not designated for items, propose a color for approval.

PART 2 PRODUCTS

2.1 COLOR SCHEDULE

The color schedule information provided in the following paragraphs lists the colors, patterns and textures required for exterior and interior finishes, including both factory applied and field applied colors. Where color is shown as being specific to one manufacturer, an equivalent color by another manufacturer may be submitted for approval. Manufacturers and materials specified are not intended to limit the selection of equal colors from other manufacturers. In the case of difference between the drawings and specifications, colors identified in this specification govern.

2.2 EXTERIOR FINISHES

2.2.1 Exterior Walls

Exterior wall colors apply to exterior wall surfaces including recesses at entrances and projecting vestibules. When applicable, paint conduit to closely match the adjacent surface color. Provide wall colors to match the colors listed below.

2.2.1.1 Brick

Brick Type 1 Meridian Brick, Bessemer Collection, Color Pebble
Brick Type 2 Meridian Brick, Bessemer Collection, Color Manhattan

2.2.1.2 Mortar

i.design Flamingo Brixment, Color Speed Type N

2.2.1.3 Metal Wall Panels, Hardware, and Associated Trim

IWP A Kingspan, Benchmark Designwall 1000, Color Embossed
Taupestone
IWP B Kingspan, Benchmark Designwall 1000, Color Non-Embossed

Bright Silver
 IWP C Kingspan, Benchmark Designwall 1000, Color Shadowline Tahoe Blue
 IWP D Kingspan, Benchmark Designwall 1000, Color Non-Embossed Weathered Zinc

2.2.1.4 Precast Concrete

Concrete Pilaster Triad Associates Inc, Color Exposed Aggregate Large Driftwood with Blue Glass Blend

2.2.1.5 Glass and Glazing

Clear Insulated Laminated Glass.

2.2.2 Exterior Trim

Provide exterior trim to match the colors listed below.

2.2.2.1 Steel Doors and Door Frames

EPNT-5 Sherwin Williams SW 7069 Iron Ore.

2.2.2.2 Aluminum Doors and Door Frames

Kawneer Aluminum, Prefinished Permafluor Coating, Color Bone White

2.2.2.3 Aluminum Windows (mullion, muntin, sash, trim, and sill)

Kalwall Aluminum, Standard Grid, Color Prefinised KCRF White 00

2.2.2.4 Fascia

Fabricated Prefinished Aluminum, Color to Match Roof System 1 Dark Bronze

2.2.2.5 Soffits and Ceilings

IWP A Kingspan, Benchmark Designwall 1000, Color Embossed Taupestone
 IWP B Kingspan, Benchmark Designwall 1000, Color Non-Embossed Bright Silver

2.2.2.6 Downspouts and Gutters

Fabricated Prefinished Aluminum, Color to Match Roof System 1 Dark Bronze

2.2.2.7 Flashings

Match adjacent material in color.

2.2.2.8 Coping

Fabricated Prefinished Aluminum, Color to Match Roof System 1 Dark Bronze

2.2.2.9 Precast Concrete Sills

Precast Sill Advanced Architectural Stone, Color Custom Buff

2.2.2.10 Handrails

Stainless Steel.

2.2.2.11 Guardrails

Stainless Steel.

2.2.2.12 Caulking and Sealants

Match adjacent material in color.

2.2.2.13 Bollards

Safety Yellow

2.2.2.14 Signage

Stainless Steel.

2.2.2.15 Sun Shades

Ametco Manufacturing, Canopy Body, Galvanized Steel Coating System, Color Bone White

Ametco Manufacturing, Perimeter C-Channel, Galvanized Steel Coating System, Color SW 6907 Forsythia

2.2.2.16 Control Joints

Match adjacent material in color.

2.2.2.17 Expansion Joint and/or Covers

Match adjacent material in color.

2.2.3 Exterior Roof

Apply roof color to exterior roof surfaces including sheet metal flashings and copings, snow guards, mechanical units, mechanical penthouses, roof trim, pipes, conduits, electrical appurtenances, and similar items. Provide roof color to match the colors listed below.

2.2.3.1 EPDM

Roof System 1 Sika Sarnafil Systems, Adhered Membrane with Extruded Batten Profile, Color Dark Bronze

Roof System 2 Sika Sarnafil Systems, Adhered Membrane, Color White

2.2.3.2 Penetrations

Match roof in color.

2.3 INTERIOR FINISHES

2.3.1 Interior Floor Finishes

Provide flooring materials to match the colors listed below.

2.3.1.1 Carpet Tile

CPT-1 J&J Carpet, Incognito 24 by 24 inch modular walk off carpet, Color 1838 Espionage

2.3.1.2 Stair Flooring

Sealed Concrete Fill
TZ-1 Terrazzco Series 1.1 Semi Exotic #1176

2.3.1.3 Stair Landings

Sealed Concrete Fill
TZ-1 Terrazzco Series 1.1 Semi Exotic #1176

2.3.1.4 Ceramic Tile

PT-1 Daltile, Keystones Mosaics, 1 by 1 inch straight joint pattern on 12 by 24 sheet, Black D311

2.3.1.5 Concrete (StainIntegrally Colored)

STC-1 Butterfield Color Uni-Mix Integral Concrete, Color U29 Soapstone
STC-2 Sherwin Williams Infusion Water Based Semi-Transparent Decorative Stain, Color Tumbled Stone 45.111034-16

2.3.1.6 Industrial Floor Coating

EPX-1 Dur-A-Flex Hybri-Flex EC Floor System: Poly Crete SL Body with chip broadcast, (1) Dur-A-Glaze #4 Topcoat, Armor Top gloss with grit, Color: Ocean Microchip

2.3.2 Interior Base Finishes

Provide base materials to match the colors listed below.

2.3.2.1 Resilient Base and Moldings

RB-1 Roppe 700 Series 4" Cove base, Color 150 Dark Gray

2.3.2.2 Integral Cove Base

EPXB Dur-A-Flex Hybri-Flex EC Floor System: Poly Crete SL Body with chip broadcast, (1) Dur-A-Glaze #4 Topcoat, Armor Top gloss with grit, Color: Ocean Microchip

2.3.3 Interior Wall Finishes

Apply interior wall color to the entire wall surface, including reveals, vertical furred spaces and columns, grilles, diffusers, electrical and access panels, and piping and conduit adjacent to wall surfaces unless otherwise specified. Paint items not specified in other paragraphs to

match adjacent wall surface. Provide wall materials to match the colors listed below.

2.3.3.1 Paint

EPNT-1 Sherwin Williams SW 7668 March Wind.
EPNT-2 Sherwin Williams SW 7673 Pewter Cast.
EPNT-3 Sherwin Williams SW 6524 Commodore.

2.3.3.2 Vinyl Wall Covering

WC-1 MDC Studio DIGIPSV Digital Pressure Sensitive 3M Envision Film, 48" wide print, 2 mil. thick, pressure activated adhesive backing, custom image graphic.
WC-2 MDC Studio DIGIPSV Digital Pressure Sensitive 3M Envision Film, 48" wide print, 2 mil. thick, pressure activated adhesive backing, custom image graphic.

2.3.3.3 Ceramic Tile

(AM#0002)> PT-1 Daltile, Keystones Mosaics, 1 by 1 inch straight joint pattern on 12 by 24 sheet, Black D311 <(AM#0002).

PT-2 Daltile, Keystones Mosaics, 2 by 2 inch straight joint pattern on 12 by 24 inch sheet, Beach Blend DK04: 33% D200 Desert Grey Speckle, 33% D209 Navy Speckly, 33% D023 Galaxy

2.3.3.4 Grout

GR-1 Custom Building Products #335 Winter Gray, polyblended sanded 1/8" joint.

2.3.3.5 Glazed CMU Block

CMU-1 Echelon Astra-Glaze, 8 by 16 inch nominal plain pre-faced block, satin finish, stacked bond installation, Silver Gray
CMU-2 Echelon Astra-Glaze, 8 by 16 inch nominal plain pre-faced block, satin finish, stacked bond installation, Earl Grey
CMU-3 Echelon Astra-Glaze, 8 by 16 inch nominal plain pre-faced block, satin finish, stacked bond installation, Cosmic Blue
CMU-4 Echelon Acousta-Wall, 8 by 16 inch nominal plain pre-faced block, single sided color, satin finish, stacked bond installation, color to match SW 7668 March Wind

2.3.3.6 Mortar

i.design Flamingo Brixment, Color X-25 Charcoal

2.3.3.7 Exposed Structural Columns

EPNT-5 Sherwin Williams SW 7069 Iron Ore.

2.3.4 Interior Ceiling Finishes

Apply ceiling colors to ceiling surfaces including soffits, furred down areas, grilles, diffusers, registers, and access panels. In addition, apply ceiling color to joists, underside of roof deck, and conduit and piping where joists and deck are exposed and required to be painted. Provide ceiling materials to match the colors listed below.

2.3.4.1 Acoustical Tile and Grid

ACT-1 Armstrong, Lyra Plant Based 8360PB, 24 by 24 by 1 inch square tegular lay in tile, Color Black; paired with 15/16" tee-grid, Color Black.
ACT-2 Armstrong, MetalWorks Blades 8155M1, 4 by 22.5 by 1 inch, Color Silverlume

2.3.4.2 Paint (Ceilings)

EPNT-4 Sherwin Williams High Reflective White.

2.3.4.3 Paint (Soffits)

EPNT-4 Sherwin Williams High Reflective White.

2.3.4.4 Metal Deck

EPNT-6 Sherwin Williams SW 7047 Porpoise.
EPNT-7 Sherwin Williams SW 6238 Icicle.

2.3.4.5 Structural Framing

EPNT-7 Sherwin Williams SW 6238 Icicle.
EPNT-8 Sherwin Williams SW 6907 Forsythia.

2.3.5 Interior Trim

Provide interior trim to match the colors listed below.

2.3.5.1 Steel Doors

EPNT-5 Sherwin Williams SW 7069 Iron Ore.

2.3.5.2 Aluminum Doors and Door Frames

Factory finish organic coating, color matching Sherwin Williams SW 7069 Iron Ore.

2.3.5.3 Aluminum Windows (mullion, muntin, sash, trim, and stool)

Clear Anodized Aluminum.

2.3.5.4 Fire Extinguisher Cabinets

Manufacturer's standard color.

2.3.5.5 Handrails

Stainless steel.

2.3.5.6 Guardrails

Stainless steel.

2.3.5.7 Ladders

EPNT-5 Sherwin Williams SW 7069 Iron Ore.

- 2.3.5.8 Metal Stairs; includes risers only
EPNT-5 Sherwin Williams SW 7069 Iron Ore.
- 2.3.5.9 Exposed Ductwork

Corrosion Resistant Aluminum with Bright Finish

2.3.6 Interior Miscellaneous

Provide miscellaneous items to match the colors listed below.

2.3.6.1 Toilet Partitions and Urinal Screens

TP-1 Bradley Corporation, Series 600, Stainless Steel.

2.3.6.2 Plastic Laminate

PL-1 Chemetal #917 Brushed Black Aluminum.
PL-2 Wilsonart #6281 Satin Brushed Smoke Aluminum.
PL-3 Wilsonart Indigo D379-60, linear finish.
PL-4 Wilsonart Walnut Heights 7965K-12, soft grain finish.

2.3.6.3 Solid Surfacing Material

QZ-1 Hanstone Quartz, Silhouette MV628
SS-1 LivingStone Solid Surface, L714 Rain Dance
SS-2 LivingStone Solid Surface, L715 Eclipse.

2.3.6.4 Operable Partitions

Skyfold Classic Series with Guilford of Maine fabric, Color 1215 Raven.

2.3.6.5 Acoustical Wall Panels

AP-3 3Form, 24 by 24 inch square hush block, Admiral Sola Felt.
AP-4 3Form, 12 by 24 inch rectangle hush block, Admiral Sola Felt
AP-5 3Form, 24 by 24 inch triangle hush block, Admiral Sola Felt
AP-6 3Form, 24 by 24 inch square hush block, Mineral Sola Felt
AP-7 3Form, 12 by 24 inch rectangle hush block, Mineral Sola Felt
AP-8 3Form, 24 by 24 inch triangle hush block, Mineral Sola Felt
AP-9 3Form, 24 by 24 inch square hush block, Nickel Sola Felt
AP-10 3Form, 12 by 24 inch rectangle hush block, Nickel Sola Felt
AP-11 3Form, 24 by 24 inch triangle hush block, Nickel Sola Felt

2.3.6.6 Signage Message Color

SPL-4 Formica Black 909, solid.

2.3.6.7 Signage Background Color

SPL-1 Formica Citadel 1097, microdot face.
SPL-2 Formica Black 909, microdot backer.
SPL-3 Formica Deco Metal, polished aluminum M610.

2.3.6.8 Wall Switch Handles and Standard Receptacle Bodies

White.

2.3.6.9 Electrical Device Cover Plates

White.

2.3.6.10 Electrical Panels

Manufacturers standard color.

2.3.6.11 Shower Curtain

Manufacturers standard color.

(AM#0002)>

2.3.6.12 Elevator Cab

ELEV-1: ThyssenKrupp Elevator cab walls, powder coated steel,
color Smoke Silver

ELEV-2: ThyssenKrupp Elevator cab base, powder coated steel, color
Chalkboard

ELEV-3: ThyssenKrupp Elevator cab ceiling, powder coated steel,
color Smoke Silver

<(AM#0002)

PART 3 EXECUTION

Not Used

-- End of Section --

SECTION 09 24 23

CEMENT STUCCO
<AMENDMENT NO. 0002>

PART 1 GENERAL

1.1 REFERENCES

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

ASTM INTERNATIONAL (ASTM)

ASTM A1064/A1064M	(2017) Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
ASTM C1032	(2014) Standard Specification for Woven Wire Plaster Base
ASTM C1063	(2019a) Standard Specification for Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement-Based Plaster
ASTM C150/C150M	(2018) Standard Specification for Portland Cement
ASTM C206	(2014) Standard Specification for Finishing Hydrated Lime
ASTM C841	(2003; R 2013) Installation of Interior Lathing and Furring
ASTM C847	(2014a) Standard Specification for Metal Lath
ASTM C897	(2015) Aggregate for Job-Mixed Portland Cement-Based Plasters
ASTM C926	(2018b) Standard Specification for Application of Portland Cement-Based Plaster
ASTM C933	(2014) Welded Wire Lath

1.2 SUBMITTALS

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

SD-02 Shop Drawings

Lath

SD-03 Product Data

Proportions and Mixing

SD-04 Samples

Colored Finish Coat

Sample Panel; G

Recycled Content for metal lath; S

1.3 QUALITY ASSURANCE

Submit a **SAMPLE PANEL** as follows: A sample panel of stucco, with special finish ArcusStonecoat constructed at the jobsite, and located as directed, to demonstrate installation procedures, texture and color, prior to proceeding with any stucco work; panel size must be a minimum of **4 feet wide x 8 feet** high; containing each type accessory proposed for use and constructed in the vertical position. Sample panel must have exposed reinforcement at the edges. Each phase of installation such as framing, scratch coat, brown coat, finish coat and curing procedures must be demonstrated in the construction of the panel. Submit one **12 inch** square of reinforcement and one **12 inch** length of each accessory proposed for use, prior to constructing the sample panel.

1.4 DELIVERY, STORAGE, AND HANDLING

Deliver packaged materials to the site in the original packages and containers with labels intact and seals unbroken. Keep cementitious materials dry and stored off the ground, under cover and away from damp surfaces until ready to be used. Aggregate must be covered to prevent the absorption or loss of moisture.

1.5 ENVIRONMENTAL REQUIREMENTS

Do not apply stucco when the ambient temperature is **40 degrees F** or lower, or when a drop in temperature below **40 degrees F** is expected within 48 hours after application.

PART 2 PRODUCTS

2.1 PORTLAND CEMENT

Portland cement must conform to **ASTM C150/C150M**, white Portland cement, Type I.

2.2 COLORED FINISH COAT

Colored ArcusStonecoat finish coat must be a mill mixed product using white Portland cement and requiring only the addition of and mixing with water for application.

2.3 LIME

Lime must conform to **ASTM C206**, Type S.

2.4 SAND

Sand aggregate for job-mixed base coat and job-mixed finish coat stucco must conform to [ASTM C897](#).

2.5 ACCESSORIES

Accessories must be roll formed galvanized steel , except that cornerite and striplath must be formed from steel sheets with manufacturer's standard galvanized coating. Welded wire corner reinforcements must be zinc coated, galvanized [17 gauge](#) steel wire conforming to [ASTM A1064/A1064M](#). Furring must include hangers, bolts, inserts, clips, fastenings, and attachments of number, size, and design to develop the full strength of the members.

2.6 METAL LATH

Metal lath must conform to [ASTM C847](#), types and weights in accordance with the various spacing shown in [ASTM C841](#). Lath for vertical application on steel and wood framing supports must be expanded metal or welded or woven wire and must have paper backing with a minimum vapor permeance of [5 perms](#). Woven wire lath must be a maximum [1-1/2 x 1-1/2 inch](#) mesh wire of not less than [0.0540 inch](#) nominal diameter and must conform to [ASTM C1032](#). Welded wire lath must conform to [ASTM C933](#), with openings not to exceed [2 x 2 inches](#). Expanded metal or wire lath must be fabricated in a manner to provide not less than [1/4 inch](#) keying between wire and paper backing and keying must be obtained by a uniform series of slots in a perforated face paper woven between the wires. Provide Metal Lath containing a minimum of 20 percent recycled content, as calculated by the sum of the percentage of post-consumer and ½ the percentage of pre-consumer recycled steel content. Provide data identifying percentage of [recycled content for metal lath](#).

2.7 WATER

Provide clean, fresh, potable water, free from amounts of oils, acids, alkalis and organic matter that would be injurious to the stucco.

PART 3 EXECUTION

3.1 INSTALLATION

Do not install building construction materials that show visual evidence of biological growth.

3.2 FRAMING

Framing must be installed as indicated.

3.3 CONTROL JOINTS

Locate control joints as indicated on the drawings Install prefabricated control joint members prior to the application of the stucco. Clear control joints of all stucco within the control area after stucco application and prior to final stucco set.

3.4 LATH

Install lath in accordance with [ASTM C841](#) or [ASTM C1063](#) except as otherwise specified. Metal and wire lath must be applied straight, without buckles and with joints staggered. End laps of metal lath must be not less than [1](#)

inch. When paper-backed lath is used, the paper must be split from the lath at all lap areas to provide a paper to paper and lath to lath lap. Horizontal joints must be shiplapped. Lath must be interrupted at all control joints. Submit drawings showing details of construction for reinforcement, furring, and grounds; including manufacturer's installation instructions for stucco materials, and locations where each mix and coating thickness will be used.

3.4.1 On Concrete and Masonry

Fasten lath every 8 inches vertically and every 16 inches horizontally. Where wood supports adjoin masonry or concrete in the same direction, provide casing bead, control joints, or reinforcement as indicated.

3.4.2 Special Shapes, Profiles, and Contours

Special shapes, profiles, and contours must be formed with wood, metal or aluminum furring and reinforcing.

3.5 FURRING

Furring must be installed to true lines and surfaces and must be rigidly supported and secured in place.

3.6 PREPARATION OF SURFACES

Preparation of surfaces for application of stucco to solid bases such as stone, masonry or concrete must conform to the applicable requirements of ASTM C926.

3.7 PROPORTIONS AND MIXING

Proportions and mixing for job-mixed base coat and finish coat must conform to the applicable requirements of ASTM C926. Mixing of mill-mixed finish coat must be in accordance with the manufacturer's directions. Submit detailed description of the proposed job-mix proportions for base and finish coats; including identification of thickness of coats.

3.8 APPLICATION

Stucco must be applied in three coats to a thickness of not less than 1 inch as measured from the back plane of metal reinforcement, exclusive of ribs or dimples or from the face of solid backing or support, with or without metal reinforcement, to the finished stucco surface, including moderate texture variations. Stucco application must conform to the applicable requirements of ASTM C926 and the following:

3.8.1 Workmanship

Items or features of the work in connection with or adjoining the stucco must be in place, plumb, straight, and true prior to beginning the stucco work. Metal and wire lath, where required, must be in place and positioned to provide a good key at back of lath. Where lath is applied over copper, the copper must be given a heavy coat of bituminous paint. Masonry surfaces to receive stucco must be evenly dampened immediately prior to application of stucco. Each stucco coat must be applied continuously in one general direction, without allowing mortar to dry at edges. Where it is impossible to work the full dimension of a wall surface in a continuous operation, jointing must be made at a break, opening, or other natural

division of the surface. Edges to be joined must be dampened slightly to produce a smooth confluence. Exterior corners of stucco must be slightly rounded. Stucco on soffit surfaces must be pitched forward to form a drip.

3.8.2 Scratch Coat

Apply scratch coat not less than 3/8 inch thick under sufficient pressure to form good keys and to completely embed the reinforcement. Before the scratch coat has set, it must be lightly scratched in one direction and vertical surfaces must be scratched in the horizontal direction only. The scratch coat must be fog cured for a minimum of 72 hours.

3.8.3 Brown Coat

Evenly dampen the scratch coat to obtain uniform suction before the brown coat is applied. There must be no visible water on the surface when the brown coat is applied. The brown coat must be applied to the scratch coat with sufficient pressure to force the stucco into the scratches and must be brought to a plumb, true, even plane with rod or straightedge. When set sufficiently, the brown coat must be uniformly floated with a dry float to promote densification of the coat and to provide a surface receptive to bonding of the finish coat. Brown coat must be fog cured for a minimum of 72 hours.

3.8.4 Finish Coat

Dampen surfaces of the brown coat not more than 1 hour before the finish coat is to be applied to a uniform wetness with no free-standing water on the surface. The finish coat must have a smooth trowel finish and must conform to the approved sample. Fog cure the finish coat for a minimum of 48 hours. Take care to prevent staining.

Provide special finish coat with a dry mix of crushed limestone, white Portland cement, sand, and various polymers, integrally colored using powdered mineral oxide pigments. Standard color as selected by Architect.

~~(AM#0002) > Basis of Design finish coat product: ArcusStonecoat by ArcusStone. < (AM#0002)~~

Minimum 28 day compressive strength of finish coat plaster must be 5805 psi.

Apply finish coat as a two-component system. Minimum thickness must be as recommended by the manufacturer, but must in no case be less than 3/16 inch for base coat and 3/16 inch for finish coat of a two-component finish system with a total of 3/8 inch thickness.

Provide 10 year special extended warranty.

3.8.5 Surface Tolerance

When a 10 foot straightedge is placed at any location on the finished surface of the stucco, excluding rough-textured finish, the surface must not vary more than 1/8 inch from the straightedge.

3.9 CURING AND PROTECTION

Perform fog curing by applying a fine mist of water to the stucco. Exercise care during fog curing to avoid erosion damage of the stucco

surfaces. Do not use a solid stream of water. Fog not less than three times daily. Protect the stucco from the direct rays of the sun during severe drying conditions using canvas, cloth or other approved sheet material.

3.10 PATCHING AND POINTING

Replace or patch loose, cracked, damaged or defective work as directed. Patching must match existing work in texture and color and must be finished flush.

-- End of Section --

SECTION 09 51 00

ACOUSTICAL CEILINGS
<AMENDMENT NO. 0002>

PART 1 GENERAL

1.1 REFERENCES

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

ASTM INTERNATIONAL (ASTM)

ASTM A641/A641M (2019) Standard Specification for
Zinc-Coated (Galvanized) Carbon Steel Wire

ASTM C635/C635M (2017) Standard Specification for
Manufacture, Performance, and Testing of
Metal Suspension Systems for Acoustical
Tile and Lay-In Panel Ceilings

ASTM C636/C636M (2013) Standard Practice for Installation
of Metal Ceiling Suspension Systems for
Acoustical Tile and Lay-In Panels

ASTM C834 (2017) Standard Specification for Latex
Sealants

ASTM E795 (2016) Standard Practices for Mounting
Test Specimens During Sound Absorption
Tests

ASTM E1264 (2019) Acoustical Ceiling Products

ASTM E1414/E1414M (2011a; E 2014) Airborne Sound Attenuation
Between Rooms Sharing a Common Ceiling
Plenum

ASTM E1477 (1998a; R 2017; E 2018) Standard Test
Method for Luminous Reflectance Factor of
Acoustical Materials by Use of
Integrating-Sphere Reflectometers

SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS SCS Global Services (SCS) Indoor Advantage

UNDERWRITERS LABORATORIES (UL)

UL 2818 (2013) GREENGUARD Certification Program
For Chemical Emissions For Building
Materials, Finishes And Furnishings

1.2 SUBMITTALS

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

SD-02 Shop Drawings

Approved Detail Drawings; G

SD-03 Product Data

Acoustical Ceiling Systems; G,
Recycled Content for Suspension Systems; S

SD-04 Samples

Acoustical Units; G
Acoustical Ceiling Tiles; G

SD-06 Test Reports

Ceiling Attenuation Class and Test; G

SD-07 Certificates

Indoor Air Quality for Ceiling Tiles; S

1.3 CERTIFICATIONS

1.3.1 Indoor Air Quality Certifications

1.3.1.1 Ceiling Tiles

Provide products certified to meet indoor air quality requirements by UL 2818 (Greenguard) Gold, SCS Global Services Indoor Advantage Gold or provide certification by other third-party programs. Provide current product certification documentation from certification body.

1.4 DELIVERY, STORAGE. AND HANDLING

Deliver materials to the site in the manufacturer's original unopened containers with brand name and type clearly marked. Carefully handle and store materials in dry, watertight enclosures. Immediately before installation, store acoustical units for not less than 24 hours at the same temperature and relative humidity as the space where they will be installed in order to assure proper temperature and moisture acclimation.

1.5 ENVIRONMENTAL REQUIREMENTS

Maintain a uniform temperature of not less than 60 degrees F nor more than 85 degrees F and a relative humidity of not more than 70 percent for 24 hours before, during, and 24 hours after installation of the acoustical ceiling systems.

1.6 SCHEDULING

Complete and dry interior finish work such as plastering, concrete and terrazzo work before ceiling installation. Complete mechanical, electrical, and other work above the ceiling line; install and start operating heating, ventilating, and air conditioning systems in order to maintain temperature and humidity requirements.

1.7 WARRANTY

Provide manufacturer's standard performance guarantees or warranties that extend beyond a one year period. Include an agreement to repair or replace acoustical panels that fail within the warranty period in the standard performance guarantee or warranty. Failures include, but are not limited to, sagging and warping of panels; rusting and manufacturers defects of grid system.

1.8 EXTRA MATERIALS

Furnish spare tiles, from the same lot as those installed, of each color at the rate of 5 tiles for each 1000 tiles installed.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

Provide sound controlling units mechanically mounted on a ceiling suspension system for acoustical treatment. The unit size, texture, finish, and color must be as specified. The Contractor has the option to substitute inch-pound (I-P) Recessed Light Fixtures (RLF) for metric RLF. If the Contractor opts to furnish I-P RLF, other ceiling elements like acoustical ceiling tiles, air diffusers, air registers and grills, must also be I-P products. Coordinate the whole ceiling system with other details, like the location of access panels and ceiling penetrations, etc., shown on the drawings. The Contractor is responsible for all associated labor and materials and for the final assembly and performance of the specified work and products if I-P products are used. The location and extent of acoustical treatment must be as shown on the [approved detail drawings](#). Submit drawings showing suspension system, method of anchoring and fastening, details, and reflected ceiling plan. Coordinate with paragraph RECLAMATION PROCEDURES for reclamation of mineral fiber acoustical ceiling panels to be removed from the job site.

2.1.1 [Ceiling Attenuation Class and Test](#)

Provide a ceiling system with an attenuation class (CAC) of not less than 35 for when determined in accordance with [ASTM E1414/E1414M](#). Provide fixture attenuators over light fixtures and other ceiling penetrations, and provide acoustical blanket insulation adjacent to partitions, as required to achieve the specified CAC. Provide test ceiling continuous at the partition and assembled in the suspension system in the same manner that the ceiling will be installed on the project.

2.1.2 Ceiling Sound Absorption

Determine the Noise Reduction Coefficient (NRC) in accordance with ASTM C423 Test Method.

2.1.3 Light Reflectance

Determine light reflectance factor in accordance with ASTM E1477 Test Method.

2.2 ACOUSTICAL CEILING TILES

Submit two samples of each type of acoustical unit and each type of suspension grid tee section showing texture, finish, and color. Conform acoustical units to ASTM E1264, Class A, and the following requirements:

2.2.1 Units for Exposed-Grid System

2.2.1.1 Type

Provide data identifying percentage of recycled content for ceiling tiles. Provide certification of indoor air quality for ceiling tiles.

2.2.2 Units for Exposed-Grid system - Type I

(AM#0002>)

- a. Type: I (cellulose composition) ~~Basis of Design: Ultima-Tegular, No. 1911 HRC, Manuf.: Armstrong.~~ (AM#0002>)
- b. Flame Spread: Class A, 25 or less
- c. Minimum NRC: 0.70 when tested on mounting Type E-400 of ASTM E795.
- d. Minimum Light Reflectance Coefficient: LR-1, 0.90 or greater.
- e. Nominal size: 24 by 24 inch.
- f. Edge detail: Beveled Tegular.
- g. Color/ Finish: White, Factory-applied standard finish.
- h. Minimum CAC: 35.
- i. suspension system: 9/16 inch Tegular Suprafine.

2.3 SUSPENSION SYSTEM

Provide exposed-grid standard width flange suspension system conforming to ASTM C635/C635M for heavy-duty systems. Provide surfaces exposed to view of aluminum or steel with a factory-applied black baked-enamel finish. Provide wall molding having a flange of not less than 15/16 inch. Provide standard corners. Suspended ceiling framing system must have the capability to support the finished ceiling, light fixtures, air diffusers, and accessories, as shown. Provide a suspension system with a maximum deflection of 1/360 of the span length. Conform seismic details to the contract drawings.

Provide Suspension System containing a minimum of 15 percent recycled content. Provide data identifying percentage of recycled content for suspension systems.

2.4 HANGERS

Provide hangers and attachment capable of supporting a minimum 300 pound ultimate vertical load without failure of supporting material or attachment.

2.4.1 Wires

Conform wires to [ASTM A641/A641M](#), Class 1, [0.11 inch](#) in diameter.

2.5 FINISHES

Use manufacturer's standard textures, patterns and finishes as specified for acoustical units and suspension system members. Treat ceiling suspension system components to inhibit corrosion.

2.6 COLORS AND PATTERNS

Use colors and patterns for acoustical units and suspension system components as specified.

2.7 ACOUSTICAL SEALANT

Conform acoustical sealant to [ASTM C834](#), nonstaining.

PART 3 EXECUTION

3.1 INSTALLATION

Do not install building construction materials that show visual evidence of biological growth.

Provide acoustical work complete with necessary fastenings, clips, and other accessories required for a complete installation. Do not expose mechanical fastenings in the finished work. Lay out hangers for each individual room or space. Provide hangers to support framing around beams, ducts, columns, grilles, and other penetrations through ceilings. Keep main runners and carrying channels clear of abutting walls and partitions. Provide at least two main runners for each ceiling span. Wherever required to bypass an object with the hanger wires, install a subsuspension system so that all hanger wires will be plumb.

3.1.1 Suspension System

Install suspension system in accordance with [ASTM C636/C636M](#) and as specified herein. Do not suspend hanger wires or other loads from underside of steel decking.

3.1.1.1 Plumb Hangers

Install hangers plumb and not pressing against insulation covering ducts and pipes. Where lighting fixtures are supported from the suspended ceiling system, provide hangers at a minimum of four hangers per fixture and located not more than [6 inch](#) from each corner of each fixture.

3.1.1.2 Splayed Hangers

Where hangers must be splayed (sloped or slanted) around obstructions, offset the resulting horizontal force by bracing, countersplaying, or other acceptable means.

3.1.2 Wall Molding

Provide wall molding where ceilings abut vertical surfaces. Miter corners

where wall moldings intersect or install corner caps. Secure wall molding not more than 3 inch from ends of each length and not more than 16 inch on centers between end fastenings. Provide wall molding springs at each acoustical unit in semi-exposed or concealed systems.

3.1.3 Acoustical Units

Install acoustical units in accordance with the approved installation instructions of the manufacturer. Ensure that edges of acoustical units are in close contact with metal supports, with each other, and in true alignment. Arrange acoustical units so that units less than one-half width are minimized. Hold units in exposed-grid system in place with manufacturer's standard hold-down clips, if units weigh less than 1 psf or if required for fire resistance rating.

3.1.4 Caulking

Seal all joints around pipes, ducts or electrical outlets penetrating the ceiling. Apply a continuous ribbon of acoustical sealant on vertical web of wall or edge moldings.

3.2 CEILING ACCESS PANELS

Locate ceiling access panels directly under the items which require access.

3.3 CLEANING

Following installation, clean dirty or discolored surfaces of acoustical units and leave them free from defects. Remove units that are damaged or improperly installed and provide new units as directed.

-- End of Section --

SECTION 13 11 00

SWIMMING POOLS

<AMENDMENT NO. 0002>

PART 1 GENERAL

1.1 RELATED DOCUMENTS

The BIDDING REQUIREMENTS, CONTRACT FORMS, AND CONDITIONS OF THE CONTRACT and applicable parts of DIVISION 1 - GENERAL REQUIREMENTS, as listed in the Table of Contents, shall be included in and made a part of this Section.

1.2 REFERENCES

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

ASTM INTERNATIONAL (ASTM)

ASTM A554	(2016) Standard Specification for Welded Stainless Steel Mechanical Tubing
ASTM A653/A653M	(2019) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A967-99	(2015) Standard Specification for Chemical Passivation Treatments for Stainless Steel Parts
ASTM A1011/A1011M	(2018a) Standard Specification for Steel Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
ASTM B179	(2017) Standard Specification for Aluminum Alloys in Ingot and Molten Forms for Castings from All Casting Processes
ASTM B633	(2019) Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel
ASTM C1028	(2014) Standard Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Other like Surfaces by the Horizontal Dynamometer Pull-Meter Method
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 D2240	(2015; E 2017) Standard Test Method for Rubber Property - Durometer Hardness
ASTM D2774	(2012) Underground Installation of Thermoplastic Pressure Piping

1.3 SUMMARY OF WORK (for general guidance-not all inclusive)

A. Introduction

1. Provide all labor, materials, equipment and services necessary to construct the following: (2) aquatic training tanks (swimming pools). This work shall include the structure(s) and installation of pool finishes as well as all products listed in Part 2 of Section 131100.

B. Work Included in This Section

1. It is the intent of this section to place the entire responsibility for the construction of the pool(s) (including the construction of the pool shell(s)) under one vested CONTRACTOR. Under this section the Swimming Pool Contractor will provide but is not necessarily limited to the following:
 - a. Provide all equipment and services required for erection and delivery onto the premises of any equipment or apparatus provided. Remove equipment from premises when no longer required.
 - b. Layout, excavate, remove from the construction site, replace and grade materials as required beyond the limits of excavation of the pool shell(s) to complete the work described in this section. Reference Division 31 - Earthwork.
 - c. Grade and replace load bearing or high plasticity index soil, pump and dewater as necessary to keep excavations free from water during construction and provide sub-surface drainage as needed or required in the project geotechnical report. Reference Division 31 - Earthwork.
 - d. Provide and maintain proper shoring and bracing for existing utilities, sewers and building foundations where required for related excavations. Reference Division 31 - Earthwork.
 - e. Provide all electrical conduit, wiring, junction boxes etc. to all low voltage pool equipment within pool filter/chemical rooms per Division 26 - Electrical. (Low voltage is considered less than 110 V.)
 - f. Coordinate for all required bonding and grounding of the pool shell, fittings, and equipment.
 - g. Provide all necessary piping and valving as shown on the drawings and specified herein.
 - h. Provide individually sized housekeeping pads for each pool pump.

Provide housekeeping pads for pool equipment as required in the drawings.

- i. Construct the cast in place concrete pool shell(s) and cast in place surge tank(s) as described in these specifications and detailed on the drawings, including reinforcement steel, inserts, fittings, main drain sumps and all embedded items (piping, anchors, etc.) for the pool(s). Reference Division 3 - Concrete and Structural. Before commencing the placement of concrete, verify electrical bonding of the pool embedded items and reinforcing steel. Also, coordinate and arrange any required electrical, plumbing and or building inspections. Provide any structure drainage around the pool as shown on the drawings. Backfill and compact fill around the pool structure, piping trenches and excavations required by this work. Reference Division 31 - Earthwork.
- j. Provide a proprietary aggregate cementitious finish in the pool(s) with a slip resistant surface with a vertical tile band. Provide specialty tile for the wall targets, floor lane markings, depth markings and warning signs, construction joint installation bands and all other tile installation within the pool structures. Reference Section 131103 - Swimming Pool Tile - including the tolerance requirements for the concrete substrate.
- k. Assemble and install the cleaning and maintenance equipment for the pool(s) as specified herein.
- l. Provide for the storage of all pool related equipment, materials and systems. All items are the responsibility of the CONTRACTOR until accepted by owner.
- m. Obtain final acceptance by jurisdictional health department(s).
- n. Start, test, calibrate and adjust all mechanical equipment, electrical equipment, recirculation, chemical, and other supplied systems including deck, loose, maintenance, and safety equipment. Instruct the Owner's representative in the systems operation and maintenance as described herein.
- o. Provide a one-year license and basic startup training for aquatic facility management application.
- p. Provide the heating system for the pool(s). Include all piping, heaters, heat exchangers, booster pumps, controls, gauges, thermostats, control valves and wiring required to draw water from the recirculation line, heat the water and return it back to the recirculation line and interlock with pool recirculation pumps.

C. Related Work Specified in Other Sections

1. Section 13 11 03 - Swimming Pool Tile
2. Section 13 11 04 - Swimming Pool Cementitious Finish
3. Section 25 05 11 - Cybersecurity for Water Chemistry Controller
4. The following work related to swimming pools shall be completed by other trades.

- a. Provide, erect and maintain all necessary barricades, signs, lights and flares for pool construction to protect workers and the public.
 - b. Provide and maintain proper shoring and bracing for existing utilities, sewers and building foundations where required for swimming pool related excavations. Reference Division 31 - Earthwork.
 - c. Construct pump pit and backwash pit including reinforcement, inserts, wall sleeves, anchors, access hatches, and fittings. Reference Division 3 - Concrete.
 - d. Layout, excavate, remove from the construction site, replace and grade materials as required beyond the limits of excavation of the pool shell(s) to complete the work described in this section. Reference Division 31 - Earthwork.
 - e. Prior to concrete pours, verify electrical bonding of the pool embedded items. Coordinate and arrange any required electrical, plumbing and or building inspections to be performed on embedded items. Reference Division 26 - Electrical.
 - f. Provide sanitary sewer and storm drain connections. Reference Division 22 - Plumbing.
 - g. Provide deck finish beyond perimeter tile band. Reference Division 32 - Exterior Improvements.
 - h. Provide rules and regulations signage as required by code. Reference Division 1 - General Requirements.
 - i. Provide chlorine resistant caulking (sealant) and backer rod on pool decks. Reference Division 7 - Thermal and Moisture Protection.
- D. Related work specified in Plumbing Section. Reference Division 22 - Plumbing.
- 1. Provide trench drains and area drains on pool deck.
 - 2. Provide sanitary sewer piping from the filter room including floor drains, sumps, and sump pump.
 - 3. Provide water service to all hose bibbs, flush hydrant boxes and auto-fill bypass to air gap above fill funnel(s). Install the slow closing solenoid valve(s) in the bypass auto-fill piping.
 - 4. Install Plumbing Contractor supplied water meter on the fresh water supply line upstream of the manual fill valve and the slow closing solenoid valve.
- E. Related work specified in Mechanical Section. Reference Division 23 - HVAC.
- 1. Provide any related systems for supplemental pool water heating.
 - 2. Provide air recirculation systems for pool related spaces.

F. Related work specified in Electrical Sections. REference Division 26 - Electrical.

1. Provide power to the exhaust fans for the chemical rooms.
2. Provide power conductors, auxiliary contacts, magnetic relays and other electrical control devices necessary for the complete operation of the pool systems. Install power to Variable Frequency Drive pool pump starters and power from VFD to the pool pump motor.
3. Ground and bond all pool structures, fittings and equipment in accordance with Article 680 of the N.E.C. Test and verify that the system electrical ground is true and solid. Provide certification to this effort.
4. Obtain permits, inspections, and approvals of all wiring including grounding and bonding of all metal components associated with the pool in accordance with Local, State and National Electrical Codes.
5. Install power, conduits, electrical boxes, and wiring for the Contractor/Owner furnished electronic timing and scoreboard system with multi-sport capability for race swimming.
6. Install power, conduits, electrical boxes, and wiring for the Contractor furnished underwater lights and junction boxes.
7. Confirm all electrical conduits that penetrate the pool shell are watertight and installed per N.E.C. Article 680.

1.4 QUALITY ASSURANCE

A. The specifications and drawings illustrate and detail two (2) swimming pool systems that shall be utilized for competitive / training use. Certain technical aspects of the design are common only to pool systems planned for public use. Understanding these aspects, their functions and interaction through experience is vital to completing a successful operating system. It is a mandatory requirement that all bidders will have achieved such experience as a prerequisite for bidding this project.

1. CONTRACTOR to refer to Section 00 21 13 - INSTRUCTIONS TO BIDDERS for bonding requirements.
2. If the Contractor has not received prior written approval for this project or has not been included in the pre-approved list of Contractors, they must submit a list of projects meeting the aforementioned qualifications, including contact information of the General Contractor shall be submitted for review and approval at least 10 days prior to bidding of the project. The Contractor must have completed at least five (5) public-use competition pools with individual water surface areas in excess of 14,200 square feet and a depth of 12'-6" or more within the past 10 years.
3. The Contractor must submit prior to the start of construction the name of the on-site Project Superintendent including their relevant experience. The Contractor's on-site Project Superintendent must have completed at least five (5) public-use competition pools with individual water surface areas in excess of 14,200 square feet and a depth of 12'-6" or more within the past 10 years. A list of projects meeting the aforementioned qualifications, including contact

information of the General Contractor as well as Owner shall be included with the experience submittal. Project Superintendent must not change on the project unless written authorization has been provided by the Contracting Officer.

4. The Owner reserves the right to reject any bid if the evidence submitted by, or investigation of, such bidder fails to satisfy the Owner that such bidder is properly qualified to carry out the obligation of the contract and to complete the work described or if the bidder does not have the qualifications stated herein. Subject to compliance with item 2 above on this specification.
5. The following bidders have been pre-approved. All bidders shall meet the requirements listed above.

Acapulco Pools Bernie Gall 1550 Victoria St. N. Kitchener, Ontario N2B3EZ p: 519-743-6357 f: 519-734-9698 e: bernie@acapulcopool.com	Atlantis Aquatic Group Terry Smith, Dennis Watson 7700 Hwy. 71 West Austin, TX 78735 p: 512-243-6877 f: 210-579-7308 e: terry@atlantisaquaticgroup.com
Progressive Commercial Pools Tim Phelps, Steve Davis 2510 Farrell Road Houston, TX 77073 p: 512-846-4677 f: 281-443-1524 e: tphelps4@austin.rr.com	Sunbelt Pools Rob Morgan, Jon Collins 10555 Plano Road Dallas, TX 75238-1305 p: 241-343-1133 f: 214-434-1201 e: robm@sunbelt pools.com
Weller Pool Constructors, Inc. Nils Erickson, Jack Oren 1821 South Orange Blossom Trail P.O. Box 16008 Apopka, FL 32703 p: 407-880-8800 f: 427-884-7306	The Pool Company, Inc. Dwight Love 3077 20th St. E Suite D Tacoma, WA 96424 p: 253-936-6875 f: 253-926-0590 e: dlove@the poolcompanyinc.com
Paddock Southwest Curtis Morgan P.O. Box 1616 Pasadena, TX 77501 p: 713-477-3896 e: curtis@paddocksw.com	CEM Aquatics Matt Ruzicka 5801 Soundview Dr., Suite 204 Gig Harbor, WA 98335 p: 253-649-0183 e: mattr@cemaquatics.com

1.5 REGULATOR AGENCY REQUIREMENTS AND ENGINEERING SERVICES

- A. The system shall comply with all necessary pre-construction approvals obtained by the Owner and Owner's Consultants from local regulatory agencies governing the design and construction of public swimming pools.
- B. The Contractor shall give all necessary notices, obtain all [permits](#),

receipts and test reports and pay all government fees, and other costs in connection with his work, including the filing of all necessary as-built drawings, prepare all documents and obtain all necessary approvals of governmental departments having jurisdiction over their work. The Contractor shall also be responsible for obtaining all required certificates of inspection for his work and deliver same to the Owner and Owner's Consultants before requesting acceptance and final payment for the work.

C. The Contractor shall include in the work, without extra cost to the Owner, any labor, materials, services, apparatus or drawings in order to comply with all applicable laws, ordinances, rules and regulations, whether or not shown on drawings and/or specified.

1.6 COORDINATION AND CLARIFICATION

A. Coordinate with other contractors or subcontractors all work relating to this section.

B. The Contractor must establish with other contractors or subcontractors, having related work in this section, that all work necessary to complete the pool(s) as shown on the drawings and in the specifications is included in the base bid and alternates to the Contracting Officer.

C. If in doubt regarding the responsibility for work covered in this section and/or discovery of errors or omissions in the bidding documents, the Contractor shall notify the Contracting Officer through channels established by the specifications and request a clarification ten (10) days prior to the bid date.

1.7 ALTERNATES

A. Review the description of the alternates in Division 1 and on the drawings for possible effect upon work in this section. Alternates related to the work in this section are described in this division and on the bid proposal form.

B. Pool Alternates

1. Alternate #1: NONE

1.8 CONTRACTOR'S ALTERNATE PROPOSAL

A. Contractor shall submit his bid to the owner based on materials, equipment and methods as specified in this Section. No substitutions of material will be allowed.

B. It is the intent of the contract documents to encourage competition. The base proposal must be on providing the construction methods and equipment as specified and detailed. Any proposed system substitution must have prior written approval by the Contracting Officer.

C. If there is any deviation from the basis of design equipment it is the responsibility of the contractor to confirm that all engineering criteria are appropriate for the substituted equipment.

D. All proposed substitutions of specified construction methods and equipment shall include a complete submittal as required by these

specifications and drawings of appropriate scale incorporating all required changes. The Contractor shall provide a list of at least ten (10) satisfactory installations comparable to this project that have been manufactured and installed under the manufacturer's current legal name. Submit a list of such projects with the name, address and current telephone number of the Owner's Operator and Architect of Record to the Architect on the bid date.

E. Any changes or modifications to the Contract Documents that are not authorized by the Contracting Officer shall be the sole responsibility of the Contractor.

1.9 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-02 Shop Drawings

- Overflow System; G
- Pumping Equipment; G
- Filtration Equipment; G
- Recirculation Fittings; G
- Piping Systems; G
- Chemical Treatment Systems; G
- Chemistry Monitoring and Control Systems; G
- Flow Meters; G
- Water Level Controllers; G
- Inserts and Anchor Sockets; G
- Deck Equipment; G
- Loose Equipment; G
- Maintenance Equipment; G
- Safety Equipment; G
- Termometers; G
- Swimming Pool Finishes; G
- Waterproofing; G
- Sealants; G

Aquatic Facility Management Application; G

Underwater Lights; G

Movable Bulkhead; G

Pool Heaters; G

Underwater Speakers; G

Underwater Cameras; G

SD-04 Samples

sample format for each test report; G

SD-05 Design Data

Pool Structure; G

Pool Piping; G

SD-06 Test Reports

Permits, Receipts and Test Reports; G

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals; G

A. All submittals shall be made in accordance with the requirements of Division 1 - General Requirements and in strict compliance with the following procedures and guidelines.

B. One (1) set of shop drawings and engineering data shall be tabbed, indexed, and referenced to the specifications, compiled into an electronic submittal, and submitted in two stages. The first stage shall include all items for the pool shell(s), reference swimming pool structural specifications. The second stage shall be for all remaining items. Each section of items shall be prefaced by a cover sheet listing the items submitted within the section. All electronic submittals shall be organized, numbered, and submitted in the same format and order as the project specifications. Only complete sets will be reviewed.

1. Engineering data covering all systems, equipment, structures and fabricated materials, which will become a permanent part of the work under this contract, shall be submitted for review. This data shall include drawings and descriptive information in sufficient detail and scale to show the kind, size, arrangement, and operation of component materials and devices; the external connections, anchorage and supports required; performance characteristics; fabrication and dimensions needed for installation and correlation with other materials and equipment. A certification, in writing, shall be provided indicating that all equipment will fit in the space allotted and as shown on the drawings.
2. All submittals regardless of origin shall be stamped with the approval of the CONTRACTOR and identified with the name and number of this

contract, CONTRACTOR'S name, and references to applicable specification paragraphs and contract drawings. Each submittal shall indicate the intended use of the item in the work. When catalog pages are submitted, applicable items shall be clearly identified. The current revision, issue number, and date shall be indicated on all drawings and other descriptive data.

3. The submittals will not be accepted from anyone but the CONTRACTOR. Submittals shall be consecutively numbered in direct sequence of submittal and without division by subcontracts or trades.
4. The CONTRACTOR'S stamp of approval is a representation that the CONTRACTOR accepts full responsibility for determining and verifying all quantities, dimensions, field construction criteria, materials, catalog numbers and similar data, and that he has reviewed or coordinated each submittal with the requirements of the work and the contract documents.
5. Each submittal shall include a statement prepared by the originator of the drawings and data, certifying compliance with the contract documents except for deviations, which are specifically identified.
6. All deviations from the contract documents shall be identified on each submittal and shall be tabulated in the CONTRACTOR'S letter of transmittal. Such submittals shall, as pertinent to the deviation, indicate essential details of all changes proposed by the CONTRACTOR (including modifications to other facilities that may be a result of the deviation) and all required piping and wiring diagrams.
7. The CONTRACTOR shall accept full responsibility for the completeness of each submission, and, in the case of a resubmission, shall verify that all exceptions previously noted have been taken into account. In the event that more than one resubmission is required because of failure of CONTRACTOR to respond to exceptions and rejections previously noted, CONTRACTOR shall make all further resubmissions in person at the consultant's office.
8. Any need for more than one resubmission, or any other delay in obtaining review of submittals, will not entitle the CONTRACTOR to an extension of the contract time unless delay of the work is directly caused by a change in the work authorized by a change order.
9. Review of drawings and data submitted by CONTRACTOR will cover only general conformity to the drawings and specifications, external connections and dimensions that affect the layout. Review does not indicate a thorough review of all dimensions, quantities, and details of the material, equipment, device or item shown. Review of submittals shall not relieve CONTRACTOR from responsibility for errors, omissions, or deviations, or responsibility for compliance with the contract documents.
10. When the drawings and data are returned marked REJECTED, REVISE AND RESUBMIT or SUBMIT SPECIFIED ITEM, the corrections shall be made as noted thereon and as instructed and six corrected copies (or one copy and one corrected reproducible copy) resubmitted.
11. Resubmittals shall bear the number of the first submittal followed by a letter (A, B, etc.) to indicate the sequence of the resubmittal. All resubmittals shall be indexed, tabbed, referenced to the specifications

and bound in a three-ring binder and submitted at one time.

12. When corrected copies are resubmitted, the CONTRACTOR shall, in writing, direct specific attention to all revisions and shall list separately any revisions made other than those called for on previous submissions.
13. When the drawings and data are returned marked NO EXCEPTIONS TAKEN or MAKE CORRECTIONS NOTED, no additional copies need to be furnished unless specifically requested to do so for record.

C. [Permits, Receipts and Test Reports](#)

1. Provide the Contracting Officer with copies of all permits and receipts for fee payments.
2. Submit a [sample format for each test report](#) intended for use. Submit test reports required herein only on approved forms.

D. Include complete product data indexed, tabbed, and referenced to specifications with 8 1/2" x 11" cover sheet covering:

1. Paragraph 2.01 - [Overflow System](#)
2. Paragraph 2.02 - [Pumping Equipment](#)
3. Paragraph 2.03 - [Filtration Equipment](#)
4. Paragraph 2.04 - [Recirculation Fittings](#)
5. Paragraph 2.05 - [Piping Systems](#)
6. Paragraph 2.06 - [Chemical Treatment Systems](#)
7. Paragraph 2.07 - [Chemistry Monitoring and Control Systems](#)
8. Paragraph 2.08 - [Flow Meters](#)
9. Paragraph 2.09 - [Water Level Controllers](#)
10. Paragraph 2.10 - [Inserts and Anchor Sockets](#)
11. Paragraph 2.11 - [Deck Equipment](#)
12. Paragraph 2.12 - [Loose Equipment](#)
13. Paragraph 2.13 - [Maintenance Equipment](#)
14. Paragraph 2.14 - [Safety Equipment](#)
15. Paragraph 2.15 - [Thermometers](#)
16. Paragraph 2.16 - [Swimming Pool Finishes](#)
17. Paragraph 2.17 - [Waterproofing](#)
18. Paragraph 2.18 - [Sealants](#)
19. Paragraph 2.19 - [Aquatic Facility Management Application](#)
20. Paragraph 2.20 - [Underwater Lights](#)
21. Paragraph 2.21 - [Movable Bulkhead](#)
22. Paragraph 2.22 - [Pool Heaters](#)
22. Paragraph 2.22 - [Underwater Speakers](#)
22. Paragraph 2.22 - [Underwater Cameras](#)

E. Include engineering/construction drawings for the [pool structure](#).

1. Reference Division 3 - Concrete.

F. Include engineering construction drawings for all [pool piping](#).

G. Reference Section 13 11 03 - Swimming Pool Tile

H. Reference Section 13 11 04 - Swimming Pool Cementitious Finish

I. Reference Section 13 11 06 - Swimming Pool Timing System

1.10 OPERATION AND MAINTENANCE MANUALS AND CLOSE-OUT SUBMITTALS

- A. Detailed operation and maintenance information shall be supplied for all equipment requiring maintenance or other attention. The equipment supplier and/or CONTRACTOR shall prepare an operation and maintenance manual for all equipment. Parts lists and operating and maintenance instructions shall be provided.
- B. Each operation and maintenance manual shall include the following:
1. Equipment function and calibration, normal operating characteristics, and limiting conditions.
 2. Assembly, installation, alignment, adjustment and checking instructions.
 3. Operating instructions for startup, routine and normal operation, regulation and control, shut down and emergency conditions.
 4. One (1) copy of all instructional videos.
 5. Operating cycles shall be specifically described in outline format and in referenced detail. A wall-mounted color-coded piping flow diagram shall be provided in the pool equipment room. The diagram shall be engraved on laminated plastic with color-coded piping to match color of coding on piping, and including valves identified with number on tags. The minimum size shall be 11-inch x 17 inch.
 6. Include manufacturer recommended maintenance schedule, parts lists, piping diagram (to agree with wall mounted diagram) and trouble-shooting information for all pool mechanical equipment.
 7. Using reference to keyed valves and wall diagram, include specific written instructions for procedures to be followed for the following:
 - a. Emptying and refilling the pool(s) including de-watering during the period that the pool(s) will be empty;
 - b. Water level control adjustment and chemical control operation;
 - c. Normal surge tank operation and balancing;
 - d. Filter operation and backwashing; and
 - e. Super chlorination.
 8. Lubrication and maintenance instructions.
 9. Guide to "trouble-shooting".
 10. Parts list and predicted life of parts subject to wear.
 11. Outline, cross section, and assembly drawings; engineering data and wiring diagrams.
 12. Test data and performance curves, where applicable.
 13. Specific written instructions for procedure for emptying and refilling the pool(s) including de-watering during any period that the

pool will be empty. Include furnishing and installing a yellow warning sign 8-1/2 in. x 11 in., to be mounted in the filter room, that reads:

WARNING

Prior to emptying Pool

Consult O&M Manuals for Procedures

POOL WATER SHALL BE DECHLORINATED PRIOR TO DISCHARGE TO STORM SEWER

Add another sign shall read:

Keep all Caps, Plugs and Tops Tight Fitting to PRevent Escape of Fumes

14. One set of applicable submittals shall be included in each manual.

C. The operation and maintenance manuals shall be in addition to any instructions or parts lists packed with or attached to the equipment when delivered, or which may be required by the CONTRACTOR.

D. Manuals and other data shall be printed on heavy, first quality paper, 8-1/2 x 11-inch size with standard 3-hole punching and inserted in plastic covers. Drawings and diagrams shall be reduced to 8-1/2 x 11 inches or 11 x 17 inches. Where reduction is not practical, larger drawings shall be folded separately and placed in envelopes that are bound into the manuals. Each envelope shall bear suitable identification on the outside.

E. Six (6) bound volumes of each manual shall be submitted. All parts lists and information shall be assembled in substantial manuals and permanent, three-ring or three-post binders. Material shall be assembled and bound in the same order as specified, and each volume shall have a table of contents and suitable index tabs.

F. All material shall be marked with project identification. Non-applicable information shall be marked out or deleted.

G. Shipment of equipment will not be considered complete until all required manuals and data have been received.

1.11 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver material in manufacturer's original, unopened containers and crates with all labels intact and legible.

B. Deliver materials in sufficient time and quantity to allow continuity of work and compliance with approved construction schedule.

C. Handle materials in a manner to prevent damage.

D. Store all materials on clean raised platforms with weather protective coverings. Provide continuous protection of materials against damage or deterioration.

E. Remove damaged materials from site.

1.12 WARRANTIES

A. The CONTRACTOR warrants to the government that materials and equipment provided under the contract will be of good quality and new unless otherwise required or permitted by the contract documents, that the work will be free from defects not inherent in the quality required or

permitted, and that the work will conform with the requirements of the contract documents. Work not conforming to these requirements, including substitutions not properly approved and authorized will be considered defective. The CONTRACTOR'S warranty will exclude remedies for damage or defect caused by abuse, improper or insufficient maintenance, improper operations, modifications not executed by the CONTRACTOR or improper wear and tear under normal use. If required by the Contracting Officer, the CONTRACTOR shall furnish satisfactory evidence as to the kind and quality of materials and equipment. All warranties shall be for a period of one year from the date of substantial completion or the owner begins using the pool unless otherwise specified.

B. The CONTRACTOR shall agree to repair or replace any defective or non-complying work at no cost to the Owner upon written notification from the Owner within the warranty period. Pro-rated warranties are not acceptable.

C. Submit all warranties covering, but not limited to the following:

1. All pool deck equipment and accessories against defects in material, manufacturer and installation for a period of one (1) year.
2. Defects in material, manufacture or installation of the recirculating overflow system and interior coating of the trench for a period of one (1) year.
3. Defects in material, manufacture and installation of the filtration, backwash, chlorination, pH adjustments and cleaning systems, including controls for a period of one (1) year.
4. Defects in material or workmanship of the pool structure causing a loss of water for a period of three (3) years.
5. Defects in material, workmanship, and installation of the pool piping system for a period of three (3) years.
6. Defects in material, workmanship, and installation of the pool pumps for a period of one (1) year.
7. Manufacturer's minimum five (5) year warranty against defective materials, components and workmanship in the pool chemical controller. ORP, pH, flow and temperature sensors shall be covered by a standard two (2) year warranty. All other sensors and flow cell components shall be covered by a standard one (1) year warranty.
8. Manufacturer's minimum eighteen (18) month warranty against defective materials, components and workmanship in the Variable Frequency Drive system effective the date of supply
9. Defects in material, workmanship, and installation of the pool cementitious finish against cracking and delamination for a period of three (3) years.
10. Defects in material, workmanship, and installation of the tile finish against cracking and delamination for a period of five (5) years.
11. Manufacturer's minimum fifteen (15) year warranty on the filter tank and lining against defective materials or workmanship of the tank and components. (Additional warranty time may be purchased from the

manufacturer.) Prorated warranties are not acceptable. Flexsol 3000 lined vessels shall carry a fifteen (15) year limited non-prorated warranty. The filter manufacturer shall bear the responsibility for suitability of lining and shall be the sole source for the specified warranty. Internal tube elements shall carry a fully rated 10-year warranty. Valve bodies and the RMF controller shall carry a 5 year fully rated warranty. Valve operators and system accessories including the bump tire, quick exhaust valve and solenoid valve shall carry one-year warranty as provided by the product manufacturer. Unless otherwise specified, workmanship is to be guaranteed first class and carry a one (1) year warranty.

12. Manufacturer's minimum one (1) year warranty against defective materials, components and workmanship in the sanitizing feed system.
13. Manufacturer's minimum one (1) year warranty against defective materials, components and workmanship in the pH buffer feed system.
14. Manufacturer's minimum three (3) year warranty against defective materials, components and workmanship in the movable bulkhead. The entire bulkhead shall be guaranteed against delamination or structural defect for a period of twenty-five (25) years.
15. Manufacturer's minimum fifteen (15) year systems warranty against defective materials, components and workmanship in the pool tile setting materials.
16. Manufacturer's minimum five (5) year warranty against defective materials, components and workmanship in the pool cover system and reels.
17. Manufacturer's minimum five (5) year warranty on the complete heat exchanger assembly.
18. Manufacturer's minimum one (1) year warranty against defective materials, components and workmanship in the ultraviolet sanitizing system (excluding the UV arc tube). UV arc tubes are warranted to operate for 4000 hours when operated continuously. A continuously operated UV arc tube that fails prior to 4000 hours of operation shall be replaced free of charge. Intermittently operated UV arc tubes (>1 on/off cycle per day) will be replaced free of charge if failure occur prior to 2000 hours and prorated between 2000 and 4000 hours.

1.13 SYSTEM TRAINING

- A. A qualified representative of the CONTRACTOR performing work under this section shall put the equipment into operation and instruct the Owner's representatives in the operation of this equipment to the Owner's satisfaction immediately after project's substantial completion.
- B. The CONTRACTOR'S training representative shall have completed the equipment/system's manufacturer's training requirements and be certified, by the manufacturer, to provide and teach system training.
- C. The representative from the CONTRACTOR shall be either a CPO (Certified Pool Operator) or have an AFO (Aquatic Facility Operator) certification.
- D. Training periods shall consist of 32 hours of on-site training and

scheduled as follows:

1. 16 hours of initial training on the complete swimming pool system. The 16 hours of initial training is to be comprised of at least 4 hours of training on water chemistry analysis and adjustment. The water chemistry training will include in depth review of the use of the Langlier index and its computation.
2. The initial 16 hours of training shall include information on the care, operation, adjustment, and maintenance of all items provided by the CONTRACTOR under the "Part 2 - Products" section of this specification.
3. 16 hours of training after the Owner's staff has had experience operating the system. This time may be requested any time after the pool has been placed in operation within a period of one (1) year from the time the pool was accepted by the Owner. The additional training shall contain at least 2 hours of review of water chemistry.
4. The CONTRACTOR shall provide a project specific video recording instruction manual in addition to the training sessions. The video instructions shall be project specific and shall include information on the care, operation, adjustment, and maintenance of all items provided by the CONTRACTOR under the "Part 2 - Products" section of this specification. This video recording shall be done separate from the Owner training.
5. The CONTRACTOR shall include one (1) copy of all video recording instructions in each Operations and Maintenance Manual.

1.14 POOL FILL WATER QUALITY

A. The Owner shall bear the cost of the water required for two (2) complete fillings of the pool (the initial water tightness test and the final filling). Removal of iron or copper (if in excess of .3 ppm) will be required for the final fill to avoid staining of the pool finish. Any subsequent fillings or partial fillings (more than 25%) of the pool shall be by the CONTRACTOR, at its own expense.

B. The CONTRACTOR shall provide the necessary plant equipment so that the temperature of fill water will be within plus or minus 10 degrees of the ambient air and/or the pool structure at the time of filling. Extreme caution is urged if the temperature variance is greater than 10-degree F.

C. The CONTRACTOR shall provide the necessary chemicals and to adjust and balance the water chemistry in the pools to the following levels:

pH	7.4 - 7.6
Calcium Hardness	200 - 400 PPM
Total Alkalinity (Calcium Hypochlorite)	60 - 80 PPM
Total Alkalinity (Sodium Hypochlorite)	80 - 120 PPM
Langelier Saturation Index	-0.3 - +0.3

pH	7.4 - 7.6
Total Dissolved Solids (TDS)	not to exceed 1,500 PPM

1.15 START-UP CHEMICALS

A. The CONTRACTOR shall maintain the chemical balance of the pool water (including the cost of all chemicals required) until the pool and mechanical system(s) are fully operational and accepted by the Contracting Officer.

B. Provide the Owner with sufficient quantities of the necessary chemicals to maintain the pool operation for a minimum of thirty (30) days from substantial completion or the owner begins using the pool.

C. Chemicals to be provided to the Owner shall include those required by the chemical feed systems installed.

1.16 RECORD DRAWINGS

A. Provide a complete set of record drawings of the entire pool system(s) including all sub-systems. All record drawings shall be prepared in accordance with the requirements of Section 017839 and shall be a complete, stand-alone set. The CONTRACTOR shall be permitted to obtain original documents and copy them for this purpose only. Provide the record set on compact disk (AutoCAD Release 2010 or compatible software).

PART 2 PRODUCTS

2.1 OVERFLOW SYSTEM

A. It is the intent of the specifications that the perimeter overflow system and surface cleaning be maintained under all conditions of normal operation and that no water be discharged to waste except when cleaning the filters or emptying the pool.

B. Concrete Perimeter Overflow System

1. A perimeter overflow system consisting of a continuous concrete and tile overflow channel as detailed and shown on the drawings shall be installed on the pool(s). The bottom of the trough shall be level throughout.
2. The complete gutter trough interior, , shall be coated with epoxy paint. Refer to section 2.16. Areas not meeting the manufacturer's recommended thickness will be recoated without additional cost to the Owner.
3. All grating corner installations shall be prefabricated thermo-welded corner sections provided by the grating manufacturer and installed with adequate support per manufacturer recommendations. Butting grating sections together at corners shall not be permitted.
4. The grating shall be a high-density stabilized polymer grating. The grating openings shall run perpendicular to the pool wall. The open area of the grating shall be no less than 35%. The grating shall be machined from a solid block of material; no fasteners, adhesives,

joining or other assembly methods shall be used to fabricate or assemble the grating sections. The grating shall be colorfast and easy to clean with a permanent slip-resistant surface, providing no greater than .315-inch (8-mm) opening and shall have a minimum cross-sectional thickness of 1-in. (25.4-mm). The grating must be guaranteed not to crack, flake, separate, rot, swell, splinter, discolor or delaminate, regardless of pool water chemistry. Repeated blows from a heavy hammer shall not cause the grating to crack, chip or shatter. Grating shall be made entirely from FDA and USDA approved materials. Grating color shall be white. Provide a ten (10) year warranty for workmanship and performance with a fifteen (15) year warranty against cracking or breaking. The top surface of the grating shall be a permanent bi-directional slip-resistant surface consisting of integrally machined grooves and shall have cross grooves running perpendicular. The grating shall be certified as slip-resistant, non-hazardous walk surface under ASTM C1028 and shall have the capacity to sustain a uniform load of 100 pounds per square foot. The grating shall have an integral handgrip at the interior pool side with a profile matching that of the plans.

(AM#0002) >

~~a. Basis of Design: Grating shall be GPM Grating manufactured by Natara Corporation or approved equal. < (AM#0002)~~

5. All materials, anchors and fasteners shall be 316L stainless steel.

2.2 PUMPING EQUIPMENT

A. Any proposed substitutions shall include a mechanical drawing incorporating all required changes in layout, piping and valves. The cost of such changes shall be included in the price of the substitute. CONTRACTOR to confirm voltage prior to ordering pump. All motors shall be capable of continuously running without overloading at any point on the characteristic curve of the pump without overload or harm. CONTRACTOR shall confirm by 1/4-inch scale shop drawing that the pumps and filters to be provided will fit in the available space and can be removed for servicing.

1. Pumps shall be certified by the National Sanitation Foundation (NSF) and bear the certification mark.
2. Pump casing shall be cast iron fitted with a replaceable bronze case wear ring. Mechanical seals shall be provided specific for a clear, mildly chlorinated water application. Pump impeller shall be enclosed type of cast bronze, statically and dynamically balanced, and trimmed for the specified design conditions. If a VFD is to be used in conjunction with a pump, the impeller shall be trimmed to the maximum diameter based on the rated motor horse power. All bronze materials shall be suitable for use in a chlorinated environment. Suction and discharge flanges shall be provided and tapped for gauge connections. Provide steel or cast-iron bases.
3. If the pump is powered with a VFD, the impeller to be trimmed to a maximum diameter based on the most limiting condition of either the diameter of the maximum non-overloading rated motor horse power at the design point or a diameter resulting in 10% greater head than the specified head.
4. Pump motor shall be totally enclosed, fan cooled (TEFC) and premium efficiency of the horsepower and speed specified. A pump requiring

larger horsepower shall not be acceptable.

5. Provide a hair and lint strainer, for each pump, of fiberglass or epoxy coated stainless steel construction with a clear observation top in the sizes (or pipe sizes) indicated on the drawings. Verify and coordinate pipe and pump suction sizes in the field. Provide a stainless-steel basket with at least 4 times the free open area as the inlet pipe, and one spare basket with each strainer. Strainer to be a straight non-reducing type with an approved tapered eccentric reducer at the front of the pump at recirculation pump PP1-PP6.

(AM#0002) >

~~a. Basis of Design: As manufactured by MerMade Filter Inc., or Neptune/Benson Inc., or Fluidtrol Process Technologies, Inc.~~

< (AM#0002)

6. Provide a fusion-bonded epoxy coating on all wetted parts to protect pump internals from corrosion, including pump volute interior and complete pump impeller. Sandblast to bare, white metal. Thickness shall be 8 to 12 mils (heavy film). Verify thickness by non-destructive testing. Coat parts as recommended by manufacturer, including preheating parts to 400 degrees and electrostatic deposition or fluidized bed technique. Provide primers if required to resist chlorinated water <10 ppm. ~~(AM#0002) > Coating shall be Scotchkote 134 manufactured by Fusesote or approved equal. < (AM#0002)~~
7. Entire pumping unit shall be mounted on a base using cap screws to preserve the back-pull-out feature of the pump. Pumps shall not be secured with floor studs. The pump base shall be coated with the same epoxy coating as the pump. An OSHA approved guard shall protect coupling and exposed rotating components of the pump and motor where required.

8. Recirculating Pumps and Motors

a. Competition Pool B (PP1, PP2 & PP3)

1) Provide three (3) horizontally mounted centrifugal pump, as shown on the drawings and described in these specifications. Each pump is to be of a straight centrifugal, end suction, bronze fitted, close coupled type, capable of pumping 1,750 GPM against 88 ft. TDH with an efficiency of no less than 85% and a required net positive suction head (NPSHr) no greater than 15 ft. It shall be provided with a 50 HP, 1780 RPM, 460 VAC, 3 phase, 60 cycle electrically driven motor meeting these specifications.

(AM#0002) >

~~a) Basis of Design: The system design is based upon Paco. Pumps manufactured by Paco, ITT Marlow, Griswold, or Aurora shall all be considered, provided they meet the requirements. < (AM#0002)~~

b. Competition Pool A (PP4, PP5 & PP6)

1) Provide three (3) horizontally mounted centrifugal pump, as shown on the drawings and described in these specifications. Each pump is to be of a straight centrifugal, end suction, bronze fitted, close coupled type, capable of pumping 1,600 GPM against 88 ft. TDH with an efficiency of no less than 84% and a required net positive suction head (NPSHr) no greater than 15 ft. It shall

be provided with a 50 HP, 1780 RPM, 460 VAC, 3 phase, 60 cycle electrically driven motor meeting these specifications.

~~(AM#0002) >~~

~~a) Basis of Design: The system design is based upon Paco. Pumps manufactured by Paco, ITT Marlow, Griswold, or Aurora shall all be considered, provided they meet the requirements. < (AM#0002)~~

- c. All recirculation pumps shall be provided by the same manufacturer. Confirm voltages prior to ordering pumps.

9. Other System Pumps and Motors

- a. Provide one (1) portable utility pump(s). The pump(s) shall be a 1 HP, 3600 RPM, 115 volt, 1 phase, 60 cycle unit capable of 60 GPM at 25 ft. TDH.

~~(AM#0002) >~~

~~1) Basis of Design: Pump to be a Godwin GSP10 or approved equal. < (AM#0002)~~

- b. Drain Down Tank Pumps (PP7 & PP8)

1) Provide one (1) horizontally mounted centrifugal pump, as shown on the drawings and described in these specifications. The pump is to be of a straight centrifugal, end suction, Norel filled plastic construction, closed coupled type, with integral hair and lint strainer, capable of pumping 180 GPM against 40 ft. TDH with an efficiency of no less than 75% and require an NPSH of no more than 15 ft. It shall be provided with a 5 HP, 3500 RPM, 460 VAC, 3 phase, 60 cycle electrically driven motor meeting these specifications.

~~(AM#0002) >~~

~~a) Basis of Design: Pump to be Pentair Whisperflo XF VS. < (AM#0002)~~

B. Variable Frequency Drive Starters

1. Provide VFD starters for all pool pumps. ~~(AM#0002) > VFDs shall be a product of H2Flow Controls, Pentair AcuDrive, Neptune Benson, or approved equal.~~

~~a. Basis of Design: Eco Flo C by H2 Flow Controls. < (AM#0002)~~

2. It is the contractor's responsibility to ensure that all equipment is provided with the correct operating voltage and that all interconnected electrical and electronic equipment shall adequately communicate and operate the specified pumping equipment. All equipment installations shall meet or exceed the requirements of the National Electric Code and all other local and state regulations.
3. Specified equipment in this section shall be mounted in accordance with manufacturer's requirements and in a suitable location where indicated on the plans or approved by the Contracting Officer. All electronic equipment installed where a corrosive atmosphere may exist shall be enclosed in NEMA 4 stainless steel or NEMA 4X nonmetallic enclosures. In other locations NEMA 12 enclosures are acceptable. The programmable and display features of all electronic equipment shall be

accomplished via NEMA 4X enclosed key pads and operator backlit LCD Graphical/Alpha/Numerical Displays. VFD's installed within a supplementary panel shall not be vented or cooled from ambient external air. With the exception of the VFD's heatsink and water-resistant heatsink fan, the VFD's electronics shall be fully sealed within the NEMA 12 or higher enclosure. So called 'NEMA 12 or NEMA 4 Vented' enclosures are not permitted.

4. The VFD shall convert incoming fixed frequency three phase AC power into a variable voltage and variable frequency three phase output utilizing pulse width modulation. Advanced Space Vector Control will be utilized to reduce motor heating and provide precise control of the AC motor.
5. The VFD shall be capable of adjusting the pump motor speed based upon specific flow requirements. A 4-20 milliamp output signal from a Programmable Aquatic Controller, PLC, electronic flow meter transmitter or other electronic device shall supply the required flow information to the VFD to regulate motor speed. The VFD shall be capable of interfacing to this analog output signal be commissioned to achieve a 'constant flow' condition. The VFD shall also be provided with a manually operated potentiometer to adjust the pump speed in the case of an electronic communication failure.
6. Electronic equipment shall be supplied with a phase rotational check capability. The contractor shall also be required to assure that a phase rotational check is accomplished with the bypass switch, herein specified, in the across the line position to assure correct rotation when connected to all motor power sources.
7. The VFD shall include a built-in Line Filter to mitigate harmonic distortions being transmitted back through the supply lines.
8. The VFD shall utilize DC link reactors to filter out bus ripple and provide smooth DC power to the transistor section.
9. The VFD shall utilize IGBT transistors to produce a pulse width modulated output. SCR output stages are not acceptable.
10. The VFD shall have a full load amp rating which exceeds or meets NEC Table 430-150. The VFD shall be able to provide full rated output current continuously and shall be able to provide 110% of its variable torque rating and 150% of its constant torque rating for one minute.
11. The VFD shall utilize space vector control to reduce motor harmonics and torque ripple.
12. The VFD shall include the ability to reliably protect the pump from any of the following abnormal pump conditions: Run Dry/Loss of Prime; Cavitation; Dead head/Closed Valve; Worn impeller; Blocked Filter; Bearing Failure/Wear Detection. Protection using measured current (Amps), as a method for these protective features shall not be acceptable.
13. The VFD shall provide a display with selectable readout of parameters, including: Speed; Torque; Electrical Power; Current; Output Voltage; Frequency; Heatsink Temperature; Motor Temperature; Run Time; Energy Consumed; Mains Time.

14. The VFD shall include the capability for copying of settings when multiple similar pumps are involved. Settings established in one VFD shall be transferred to the others via a removable keypad.
15. All VFDs shall be provided with a bypass function to allow for pump motor operation by bypassing the variable frequency drive. Bypass mechanism may be internal to the VFD cabinet or provided in a separate enclosure with NEMA rating equivalent to the specified drive enclosure. NEMA 12 'vented' panels are not acceptable. The bypass shall be UL listed as a motor disconnect device.
16. Three Motor Contactors shall be included. Contactor A is required to be in series with the Line Power supply and the VFD, Contactor C is required to be in series with the VFD and the motor and Contactor B is required to bypass the VFD. In 'VFD' operation, contactors A and C are engaged, and contactor B is open. When in 'Bypass' mode, contactors A and C are open and contactor B is engaged.
 - a. All contactors shall be appropriately rated for the supply voltage and pump motor specified and shall be in accordance with NEC standards.
 - b. Contactor B shall include an appropriately rated Motor Overload.
 - c. Resettable pump motor overload protection shall be provided for both the VFD and across the line sources of power to all motors.
17. A Control Power Transformer shall be included so as to provide the necessary control voltage required to operate the Motor Contactors. The VFD panel or separate Bypass panel, shall include a door mounted 3-position lockable selector switch. The switch shall be labeled: VFD-OFF-BYPASS. The switch is to require a key to move from one position to another. Two keys shall be provided to the customer. The Bypass panel shall be manufactured in accordance with and approved to UL508.
18. All applications shall require the inclusion of an appropriately rated Line Reactor to reduce harmonic distortion. The Line Reactor shall be housed in an enclosure according to the manufacturer's instructions, taking careful note of the device radiated heat and the chemical environment in which it may be installed. Pentair Acu-Drive includes as standard a built in DC Link Reactor (equivalent to 5% Line Reactor). Where this is insufficient, a separate larger Line Reactor shall be provided.
19. All applications that will have a cable length between the VFD and the Pump Motor which exceeds 300 feet shall require the inclusion of an appropriately rated Motor Protection Filter (dV/dt filter). When included, the Motor Protection Filter shall be housed in an enclosure according to the manufacturer's instructions, taking careful note of the device radiated heat and the chemical environment in which it may be installed.
20. Installations in locations where a Power Disconnect is not within 'line of sight' of the VFD Control Panel, or where deemed necessary by local electrical codes, shall require the installer to provide a suitably rated Circuit Breaker Disconnect.
21. The VFD shall be UL listed to accept a supply voltage of -15% / + 10%

of its stated supply rating.

22. The VFD shall be electronically lockable in order to prevent unauthorized or unintended program changes.
23. Motors to which the VFD is to be installed shall have a minimum insulation of "Class F".
24. Parallel operation of recirculation pumps: When specified in the project's scope, the VFD will be required to operate two identically sized pumps simultaneously. In this configuration, the VFD must be rated to simultaneously operate all pumps at full load. Bypass Control must be included. Bypass Control must include an Overload Relay for each pump motor and the Overloads must be configured in such a way as to protect their respective motor when in either VFD control or Bypass control. Under no circumstances should the VFD's motor overload protection be used to protect multiple motors. If 'constant flow' via analog flow transducer signal is enabled for multiple pumps, it must be disabled when one of the pumps is taken out of service.
25. User Interface for initial programming and day to day operation.
 - a. The VFD shall include a programmable Controller with an operator backlit LCD Graphical / Alpha / Numerical Display. The Controller shall comprise the following features:
 - b. Real Time Clock
 - c. Password protection
 - d. Hard-wired tamper protection feature
 - e. Custom software to control the VFD via a Modbus communication network.
 - f. Automatic Flow Control. The Controller and VFD are to automatically adjust the pump's speed in order to compensate for a filter becoming dirty. The system is to maintain a minimum flow (GPM) required to meet State mandated turnover rates.
 - g. Programmable speeds for daytime and nighttime turnover rates.
 - h. Non-volatile memory. All programmed parameters as well as the real time clock settings shall be maintained in the event of a power outage.
 - i. The Controller shall be capable of interfacing to an analog output signal from a Flow Transducer and displaying measured flow in GPM
 - j. Automatic reset of alarms caused by power brown outs/power loss
 - k. External input for seasonal/unoccupied speed
26. Equipment specified in this section shall be programmed and tested under power after connection to the required motor by a factory trained technician. All low voltage control wiring connections to the respective pool systems shall be provided by the Swimming Pool Contractor. Line voltage and/or high voltage connections and

interlocks shall be provided by the Electrical Contractor.

C. Pump Gauges

1. Pressure gauges shall be installed on the discharge of the pumps.
2. Compound gauges shall be provided at the intake port of the pumps, after the hair and lint strainer.
3. Gauges shall be liquid filled, 316L stainless steel bourdon tube type with a minimum 2-1/2-inch diameter dial, high impact polypropylene or stainless-steel case, corrosion resistant white scale with black divisions and numerals, 300 Series stainless steel heavy duty rotary bushed movement, black enameled balanced Micrometer pointer.

(AM#0002) >

~~a. Basis of Design: Gauges shall be as manufactured by Weksler Instrument Corporation or approved equal.~~ < (AM#0002)

4. Scale ranges shall be selected to indicate the normal system operating pressure of each system or location within the system. Pressure ranges shall be calibrated in psig (0-60 psi) and compound gauge shall be calibrated in inches of mercury (0-30 in Hg / 0-60 psi).
5. A stainless-steel filter type pressure snubber shall be provided for each pressure gauge installed consisting of a 3/8-inch diameter by 1/8-inch-thick micro metallic stainless-steel filter and placed in the line just before the pressure gauge. Provide isolation brass valves or brass gauge cocks at each gauge for easy replacement and maintenance.

D. Provide link seals for all pipe penetrations as indicated on the drawings. Locations will include the pump pit, foundation wall penetrations (if expansive soils are present) and other locations as noted. Link seals shall be provided in the sizes and quantities shown on the drawings and installed to provide a flexible watertight penetration. Metal parts shall be made of 316L stainless steel. Links shall form a continuous rubber seal that is tightened with a series of stainless-steel bolts to form a watertight seal. (AM#0002) >~~Link seals shall be manufactured by Thunderline Corporation, Calpico Inc. or approved equal.~~ < (AM#0002) Xypex Patch'n Plug or approved equal shall be used to seal pipe penetration. The CONTRACTOR is to provide factory plastic wall sleeves of the appropriate sizes designed for the specific application and seal size and type. Each sleeve is to have an integrated water stop.

E. Pump Hoist Beam Trolley: Provide CM Series 632 close radius trolley by CM Industrial to be mounted on hoist I-beam at pool pump pit (refer to structural). Trolley shall be sized adequately to provide hoist capabilities for all pump/motor combinations located in the pump pit. Provide with double row ball bearing wheel design, bearings pre-packed with lifetime lubricant. Confirm trolley size is compatible with beam configuration. Minimum rated capacity of 2 tons.

2.3 FILTRATION EQUIPMENT

A. The filter system shall consist of high rate pressure sand filter tanks as shown on the drawings. Every aspect and component of the filter system must be certified by the National Sanitation Foundation (NSF) and bear the certification mark. The filter must have an engraved metal data plate permanently affixed on the face of the system that describes

operational data and instructions and indicates startup date.

B. It is the intent of these specifications to describe a filtration system complete in every respect with all accessory items and supplied and warranted by one manufacturer.

C. Filter Size

1. Filters have been sized based on a maximum allowable filtration rate of 1.3 GPM/SF:

	Units	Tank B	Tank A
Volume	Gallons	1,030,861	874,994
flow Rate	GPM	3,500	3,200
Filter Model	Regenerative	(AM#0002) > (2) ~~SP-55-48-2076~~	(2) ~~SP-55-48-2076~~ < (AM#0002)
Filter Size	Sq. Ft.	1,625	1,625
Turnover Rage	Hours	4.86	4.56
Filtration Rate	GPM/Sq.Ft.	1.08	0.98

D. Regenerative Media Filters with Pre-Coat in a Closed Loop

1. Filter System

(AM#0002) >

- a. ~~Basis of Design: The filter system under this section shall be a Defender Model SP-55-48-2076, or approved equal, as detailed on the drawings.~~ < (AM#0002)

- b. It is the intent of these specifications to describe a filter system complete with all accessory items supplied and warranted by one manufacturer.
- c. The primary components of the system consist of the main filter tank, flex tube filter elements, element assembly, bump mechanism, vacuum transfer system, sight glass, pressure gauge panel, inspection (viewing) window, valves and automatic filter controller.
- d. All components and related subassemblies shall be factory assembled and tested prior to shipment.

2. Filter System Capacity

- a. The filter system shall have a capacity of filtering at Tank B 1,020,861 gallons in 4.86 hours at a rate of 3,500 gallons per minute and at Tank A 874,994 gallons in 4.56 hours at a rate of 3,200 gallons per minute.
- b. The filtration system shall consist of two (2) filter tanks for Tank B with a total designed effective filter surface area of 2,692.3 square feet and operate at a rate of 1.3 gallons per

minute per square foot of filter area and Tank A with a total designed effective filter surface area of 2,461.5 square feet and operate at a rate of 1.3 gallons per minute per square foot of filter area.

3. Filter Tanks

- a. The filter tanks shall not be less than 55" in diameter with a 60" side shell, suitable for 50 psi working pressure and hydrostatically tested to 75 psi. Tank shell shall be not less than $\frac{1}{4}$ " thick. Bottom dished head shall be not less than $\frac{1}{4}$ " thick. Top flat head shall be not less than 1 $\frac{1}{2}$ " thick. All material to be Type A-36 carbon steel.
- b. All welding shall be performed by qualified operators. Joints shall be butt or fillet welded inside and out by manual or automatic process. Welded joints shall have complete penetration and fusion with little or no reduction of the thickness of the base metal. Welds shall be free of coarse ripples, grooves, overlaps, abrupt ridges or valleys. All welded surfaces shall be chipped and brushed clean, when necessary, leaving no slag or splatter.
- c. Tank legs shall be constructed of 6" x 2 $\frac{1}{2}$ " channel legs $\frac{1}{4}$ " thick. 24", 27" and 33' filters shall have (3) legs. 41", 49" and 55" filters shall have (4) legs. The material shall be Type A-36 carbon steel. Bearing plates shall be 10" x 5" x $\frac{1}{4}$ " type 304L stainless steel. Each bearing plate shall have (2) $\frac{5}{8}$ " drilled holes to secure to the floor with the $\frac{1}{2}$ " x 4 $\frac{1}{2}$ " stainless steel concrete anchors provided. The legs shall be designed with bolted connections to minimize overall tank height for shipping and access into the mechanical room.
- d. The tank heads shall be bolted to the shell with $\frac{7}{8}$ " diameter T304 stainless steel threaded rods and nuts, 9" on center around the tank perimeter.
- e. Tanks shall be equipped with a UL listed grounding lug.
- f. Tanks shall incorporate connections for filter influent, effluent, drain; 1-1/2" vacuum transfer piping, 4" viewing window, and lift shaft gland. Refer to the drawings for pipe and connection sizes.
- g. Tanks shall include brackets for mounting of automatic controller, gauge panel, filter / regulator, vacuum transfer blower and vacuum hose rack.
- h. The competition pool filter tank shall include an integrally mounted hydraulic lifting device (davit). The davit assembly shall be designed to lift the filter head and include a pivot mechanism allowing the head to rotate 180°, for access to the tube sheet.

4. Flexol 3000 Interior Lining

- a. All interior surfaces shall be grit blasted to white metal condition with a 2-3 mil profile. Blasted surfaces shall be cleaned of all dust or blast residue and primed as soon as is

practical on the same day blasting is done.

- b. When priming has dried the lining process will begin. If prime coat has cured for over twenty-four hours, a refresher coat will be applied.
- c. Flexsol 3000 shall be an elastomeric polyurethane, 100% solid plural component lining. Hardness shall be 70 durometer on the shore D scale. Break tensile strength shall be 2460 psi with elongation of 25-30%.
- d. Application of Flexsol 3000 lining shall be done by experienced applicators using a high pressure, high temperature plural component system. All wetted surfaces including flange faces, manway rings and manway covers shall be lined to 120 mils +/- 5 mils DFT.
- e. Hardness shall be verified after curing to ASTM D2240 standard.
- f. Flexsol 3000 lining shall meet the NSF toxicity standard unconditionally and shall be approved for use with the NSF approved filter.

5. Exterior Coatings

- a. All exterior surfaces shall be grit blasted to white metal condition with a 2-3 mil profile. Blasted surfaces shall be cleaned of all dust or blast residue and primed as soon as is practical on the same day blasting is done.
- b. When priming has dried the coating process will begin. If prime has sat for over twenty-four hours, a refresher coat will be applied.
- c. Two coats of high solids enamel shall be applied for a total developed film thickness of 5-8 mils.
- d. Manufacturer is to supply min.16 oz of high solids enamel touch-up paint.

6. Internal Components

- a. The filters shall consist of flex tube elements, filter tube sheet, stainless steel lift shaft and internal flow diversion assembly.
- b. The filter elements shall be flexible tubes that provide the support structure for the media. The outer wall of each element shall be fabricated of multi-filament high strength polyester braid. Each element shall have an internal T304 stainless steel spring, which acts a support structure for the braided filament.
- c. The filter element tube sheet shall be fabricated of T304 stainless steel and provide both support for the top of the element assembly as well as water tight seal to prevent media from escaping the filter tank.
- d. The lifts shaft shall be fabricated from T304 stainless steel and provide the internal connection between the filter element tube

sheet and the external bump mechanism.

- e. The filter influent connections shall be fitted with a T316 stainless steel flow diversion assembly to eliminate disturbance to the filter elements during operation.
- f. All stainless-steel wetted fasteners shall be Type 304.

7. Bump Mechanism

- a. The bump mechanisms shall include a pneumatically operated tire mounted externally on the filter tank heads. The tire is alternately pressurized then depressurized causing the connected filter element assembly to move in an upward then downward fashion. This movement shall provide the means of dislodging the media and accumulated solids, which then recoat the filter element.

8. Vacuum Transfer System

- a. The vacuum transfer systems shall be provided to allow the recharging of media into the filter for either bag or bulk media.
- b. The vacuum blowers shall include a 1.5 HP TEFC 115/230v single phase motor 50/60 Hz.
- c. In-line filters with dual connections shall be provided to prevent dust and media from being drawn into the blowers.
- d. Provide three (3) 1-1/2" SCH 80 PVC ball valves: for the vacuum drain line, the blower inlet and the vacuum hose.
- e. Provide 10 feet of 1-1/2" vacuum hose with required fittings.

9. Automatic Controller

- a. The automatic controllers shall provide total control of the system's filtration and regeneration cycles and provide all necessary equipment interlocks and timing mechanisms to execute the filter program.
- b. The controllers shall include an adjustable pressure switch, factory set to 50 psi. The switch shall stop the recirculating pump and close the pneumatic valves if air pressure falls to 50 psi.
- c. The controllers shall contain a microprocessor that will activate the following functions of the system:
 - 1) Bump cycle / manual or automatic
 - 2) Pre-coating of the filter elements
 - 3) Stopping and starting of the main recirculating pumps
 - 4) Opening and closing of pneumatically operated valving
 - 5) Vacuum transfer system
 - 6) Heater cool down delay
 - 7) Auxiliary contacts to interlock chemical control or other equipment
 - 8) Keyed switch to activate continuous, intermittent bump cycle for flex tube cleaning.

- d. The controller panel shall display the following functions:
 - 1) Filter status
 - 2) Pre-coat status
 - 3) Recirculating pump status
 - 4) Vacuum transfer pump status
 - 5) System power
 - e. The controller enclosure shall be NEMA 12.
 - f. The RMF automatic controller will provide signal power to the main recirculating pump motor starters. The unit is required to be a device or variable frequency drive (VFD) and is to be installed with control wiring by the electrical contractor.
 - g. The RMF shall be 120V, 1 phase, 30 amp rated and shall be UL labeled.
10. Flow Meter
- a. A digital flow meter shall be included with a 4-20mA 0-10 VDC analog output.
 - b. The flow meters shall be wired into the VFDs to provide automatic speed control of the filter pump motors.
 - c. The VFDs shall compensate for varying filter head losses by maintaining the specified flow rate with the 4-20mA output signal of the flow meters.
11. Filter / Regulator
- a. One water separator with automatic drain shall be included for each air compressor supplied. 1/2" F.P.T. connections shall be provided for field installation of air lines.
13. Air Compressor
- a. The filtration systems will require (1) air compressor per mechanical room. The following is the minimum requirement: 20-gallon tank, 2 HP 120 V, 1 phase, 15-amp, 5.2 CFM @ 90 psi, air pressure gauge, pressure relief valve, belt guard, pressure switch, air filter.
14. Pneumatic Actuators
- a. Each filter shall include pneumatic actuators for one (1) influent valve, one (1) effluent valve and one (1) precoat valve.
 - b. The actuators shall be double acting with valve mounted drilling to ISO 5211.
 - c. The actuators shall include two (2) 1/4" FPT ports for open / close connections. Flow control valves with quick connect fittings shall be provided at each port to allow speed control adjustment for the open / close function of the actuators.
 - d. Materials of Construction

- 1) Body: aluminum alloy, extruded acc. to ASTM 6063, anodized acc. To UNI 4522
 - 2) Ends: Die-cast in aluminum alloy acc. To ASTM B179, epoxy-polyester coated
 - 3) Pistons: Die-cast in aluminum alloy acc. To ASTM B179
 - 4) Pinion: Nickel-plated steel
 - 5) Slideways: Acetal resin (LAT LUB 731320T)
 - 6) Fasteners: AISI 304 Stainless steel
 - 7) Springs: Epoxy coated steel, pre-compressed
 - 8) Seals: NBR Nitrile rubber
 - 9) Lubricant: MoS2
- e. The actuators shall be factory lubricated to allow for 1,000,000 maneuvers.
- f. The actuators shall have adjustable travel stops for both directions.
- g. Working temperature limits: 4°F to 186°F.
15. Fiberglass Eccentric Reducing Flanged Precoat Tees
- a. Eccentric reducing precoat tees shall be constructed of fiberglass with flanged connections. The tee shall be equipped with influent, effluent connections as well as a precoat line branch connection sized in accordance with the drawings.
 - b. Flanged connections shall be ANSI 125# dimensions.
 - c. Reducing tees shall include a 4" F.P.T. gauge connection.
 - d. Reducing tees shall be designed for 50 psi operating pressure _ (AM#0002) ~~>as manufactured by Neptune Benson.<~~ (AM#0002)
16. Solenoid Valves
- a. Each filter shall include four-(4) single solenoid, 4-way valves mounted on a multi-station manifold for operation of the pneumatic actuators and bump mechanism.
 - b. The solenoids valves shall include lighted DIN connectors.
 - c. The solenoid valves shall be factory lubricated and shall not require any field lubrication.
 - d. The solenoid valves with multi-station manifold shall be located on the bottom of the automatic controller, factory wired and include quick connect fittings for attachment to the pneumatic actuators and bump mechanism.
- (AM#0002) ~~e. The solenoid valves shall be SMC Series SY 7000.<~~ (AM#0002)
17. Valves
- a. All valves 3" - 12" shall be constructed with cast aluminum ASTM S12A housing and fully coated with Rilsan on all interior and exterior surfaces. Internal components include EPDM resilient lining, Rilsan coated ductile iron disc and T304 stainless steel

shaft. Valves 14" and larger shall be constructed with cast iron housing fully coated with nylon and with nylon coated ductile iron disc.

- b. Valves shall be butterfly valves and shall be provided for the influent, effluent and precoat lines.

18. Drain Requirements (By Others)

- a. A sump pit or stand pipe is required for dumping spent media and rinsing tube elements.
- b. To prevent overflow the sump or stand pipe drain piping shall be sized for 300 GPM capacity.
- c. If drain piping cannot be sized for 300 GPM, or if the sewer is at an elevation higher than the filter tank drain, use the following minimum sump sizes:

(AM#0002) >

- 1) ~~Model SP-55:-~~ 850 gallons < (AM#0002)

- d. Use a sump pump to transfer waste to sewer.

19. Packaging

- a. For loading and unloading, filter tank diameters 24" - 41" shall be bolted to individual wooden pallets. All tanks shall be shrink wrapped to prevent damage during transport.
- b. The components shall be carefully packaged in a totally enclosed wooden crate to prevent damage during transport.

20. Media

- a. Media shall be expanded perlite with a median particle size of 37 microns. Percentage retained on a +150 Tyler Mesh shall not be less than 8% or more than 25%. Darcy permeability shall be at least 1.7 and have a maximum float of 5%.
- b. The media shall contain no more than 1 tenth of one percent (.001) of crystalline silicate.
- c. The media shall be certified by the manufacturer for use in the filter. The media shall be NSF listed in Standard 61 and Standard 50.

(AM#0002) >

- ~~d. The media shall be Harborlite Aquaperl as supplied by World Minerals, Techflo 2000x, or approved equal.~~ < (AM#0002)

- e. Each Defender filter shall be provided with six (6) charges of perlite media.

21. Quality Assurance

- a. The Contractor shall have documented at least three (3) completed installations of the proposed filtration system or a qualified manufacturer's representative shall be required for on-site installation supervision.

2.4 RECIRCULATION FITTINGS

A. Main outlets (main drains) shall be concrete sumps with 12-gauge PVC frame and PVC grating or prefabricated fiberglass sump with PVC grating and sized as shown on the plan. Grate openings shall not exceed 11/32 inch in width, providing an open flow area to allow water velocity not to exceed 1.5 fps. The grate shall be PVC and fit closely and flush with top surface of frame and secured to frame with vandal proof fasteners. All exposed edges of main outlets shall be rounded and smooth, free of burrs and sharp edges. All main drain covers shall comply with the Virginia Graeme Baker Act and ANSI/APSP-16 2011.

B. Concrete drop out boxes (converters) shall be concrete sumps with 12-gauge 316L stainless steel frame and PVC grating and sized as shown on the plans. Grate openings shall not exceed 11/32 inch in width, providing an open flow area to allow water velocity not to exceed 1.0 fps. The grate shall be PVC and fit closely and flush with top surface of frame and secured to frame with vandal proof fasteners. Provide no-leak seal flange at the midpoint of the boxes.

C. Adjustable floor inlet fittings shall be provided each consisting of an ABS plastic body and adjusting top plate with a positive locking device. A spanner wrench shall be provided to facilitate flow adjustment. The inlet body shall be provided with a 2-inch cycloc solvent weld connection and internal NPT threads to facilitate line pressure testing. Floor inlet fittings shall be (AM#0002) ~~>Sta Rite No. 8417-0000 White/ Sta Rite No. 8417-0200 Black or approved equal.~~ < (AM#0002)

D. Sight sump frame(s) and cover(s) shall be size appropriately to provide access to the vertical sight sump standpipe as indicated in the plans. Frame and cover shall be (AM#0002) ~~>Zurn model #ZANB-1461-14 VP, nickel bronze with polished scored top, vandal proof screws or approved equal.~~ < (AM#0002)

E. Anti-vortex plates shall be provided at the suction points of the main recirculation pump(s) in the surge tank(s). Each plate shall be connected to the suction pipe via a PVC flange and shall be ½ in. thick with minimum dimension of at least 2.5 times the connecting pipe diameter. The plate shall be located 4 inches above the finished floor of the surge tank. Four (4) ¾ in. stainless steel threaded rods, nuts, anchor bolts and washers shall be used to fix the offset distance and provide a secure base for the suction pipe. Manufactured fiberglass or PVC anti-vortex plates (AM#0002) ~~> by Daldorado, Neptune Benson, or approved equal, shall also be acceptable.~~ < (AM#0002)

2.5 PIPING SYSTEMS

A. General

1. Provide all recirculating piping between the pool(s) and the filter room, fill receptor and all interconnecting piping to and from the chemical feed systems and chemical controller.
2. Provide all necessary pipe supports and support systems required to support all associated piping and valves.
3. Provide all other tubing, conduit, or piping associated with equipment specified herein. Coordinate with other trades.

B. Pipes

1. Pipe routing as shown and detailed on the contract drawings is diagrammatic only and is not intended to show minor details or exact locations of piping systems. Installation is required to be adjusted to accommodate interference and adjustments anticipated and encountered. Pipe sizes on plans refer to nominal inside diameter of the pipe.
2. All PVC swimming pool piping shall be NSF approved and conform to the requirements of ASTM D1785.
3. All PVC pipes shall be the product of one manufacturer. ~~(AM#0002) > Approved manufacturers of PVC piping are Eslon, Harvel, and Chemtrol or approved equal. < (AM#0002)~~
4. Swimming pool piping above the floor or deck in the filter room shall be Schedule 80 PVC.
5. Swimming pool piping below the filter room floor or deck shall be NSF approved, Schedule 80 PVC.
6. All swimming pool piping under the pool floor shall be NSF approved, Schedule 40 PVC and concrete encased. All transitions between Schedule 40 and Schedule 80 shall be encased in concrete.
7. Flexible couplings: all piping transitions from concrete encased to non-encased shall be installed with a flexible coupling sized to match the equivalent pipe I.D. Flexible couplings shall be approved for direct burial installation and for use with chlorinated swimming pool water systems. ~~(AM#0002) > Flexible couplings shall be FLEX TEND as manufactured by EBAA Iron, INC. Eastland, TX., U.S.A., or approved equal. < (AM#0002)~~
 - a. Flexible couplings shall be manufactured of ductile iron conforming to the material requirements of ASTM A536 and ANSI/AWWA C153/A21.53. Foundry certification of material shall be readily available upon request.
 - b. Each flexible expansion joint shall be pressure tested prior to shipment against its own restraint to a minimum of 350 psi (250 psi for flexible expansion joints 2 inch and 30 inch diameter and larger.) A minimum 2:1 safety factor, determined from the published pressure rating, shall apply.
 - c. Each flexible expansion joint shall consist of an expansion joint designed and cast as an integral part of a ball and socket type flexible joint, having a minimum per ball deflection of: 20°, 2" - 12"; 15°, 14" - 36"; 12°, 42"-48" and 4-inches minimum expansion. Additional expansion sleeves shall be available and easily added or removed at the factory or in the field. Both standardized mechanical joint and flange end connections shall be available.
 - d. All internal surfaces (wetted parts) shall be lined with a minimum of 15 mils of fusion bonded epoxy conforming to the applicable requirements of ANSI/AWWA C213. Sealing gaskets shall be constructed of EPDM. The coating shall meet ANSI/NSF-61.

- e. Exterior surfaces shall be coated with a minimum of 6 mils of fusion bonded epoxy conforming to the applicable requirements of ANSI/AWWA C116/A21.16.
- 6.f. Appropriately sized polyethylene sleeves, meeting ANSI/AWWA C105/A21.5, shall be included for direct buried applications.
8. The influent and effluent lines to the heat exchanger unit shall be CPVC. Connections between metallic piping and/or equipment and PVC shall be flanged.
9. All PVC and CPVC fittings shall be the product of one manufacturer. Molded fittings (AM#0002) ~~>shall be as manufactured by Asahi, Eslon, Chemtrol, Harvel, Spear, Lasco or acceptable substitute.~~ or fabricated fittings shall be as manufactured by Harrison Machine, Plastinetics, or acceptable substitute. <(AM#0002)
10. Vertical sight sump piping shall be NSF approved, Schedule 40 PVC. Horizontal sight sump piping shall be NSF approved, Schedule 40 PVC that is perforated and wrapped with fabric and have 3/8" diameter holes located top and bottom on 4 ft centers. Horizontal sight sump piping shall extend 1 ft minimum beyond the main drain.
11. Chemical feed lines from chemical feeders to recirculation piping shall be Schedule 80 PVC piping. Piping shall be hard piped into the recirculation plumbing. All required valves shall be of all PVC construction.
12. Splash collar(s) for the fill funnel(s) shall be clear Schedule 80 PVC and manufactured from a Type I, Grade I PVC compound with a Cell Classification of 12454 per ASTM D1784. The pipe shall be manufactured in compliance to ASTM D1785.
13. All flanged plumbing connection hardware shall be stainless steel.
14. All materials shall be installed by workmen thoroughly skilled in their trades and all work shall present a neat and mechanical appearance when complete. The CONTRACTOR, at no additional expense to the Owner, shall replace or correct any work not judged acceptable by the government's testing agency, or their consultants.
15. All support hardware, brackets, fasteners, hangers, etc. installed in the surge tank shall be 316L stainless steel.
16. No installation shall be made that will provide a cross-connection or interconnection between a distributing supply for drinking purposes and the swimming pool, or between the pool and a sanitary or storm water sewer system that will permit a backflow of water into the pool water system.
17. All piping shall be hydrostatically (water) pressure tested for leaks before and after backfilling to guarantee water tightness. Pneumatic (air) pressure test not allowed.
18. The CONTRACTOR shall provide 1/4" PVC water stops for this work for watertight penetration of concrete walls. Water stops shall be round and the O.D. shall be sized to 150% of the O.D. of the pipe. The water stops shall be thermo-welded to the pipe from both sides and shall be

located at the centerline of the wall being penetrated prior to placing the concrete to assure a watertight seal. — ~~(AM#0002) >Manufactured fiberglass and PVC water stop fittings by Dalderado, A.S.A. Manufacturing, or approved equal shall also be acceptable. < (AM#0002)~~

19. CONTRACTOR must adhere to all the applicable provisions in Division 22 - Plumbing, "General Provisions" and "Basic Materials and Methods" for installation of piping system.
20. All mechanical equipment to be connected into the recirculation piping system shall be done so using flanged or union connections.
21. Provisions shall be made to purge all pipes in the system.
22. Concentric reducers shall be fiberglass ~~(AM#0002) >by MerMade Filter, Inc., or equivalent reducers of schedule 80 PVC construction. < (AM#0002)~~

C. Pipe Hangers and Supports

1. Manufacturer

- a. Subject to compliance with these specifications, pipe hanger and support systems ~~(AM#0002) >shall be manufactured by Cooper B line (basis of design), Inc, TOLCO, and Anvil International or approved equal. < (AM#0002)~~

2. Hangers

a. Pipes 2 inches and smaller

- 1) Adjustable steel clevis hanger ~~(AM#0002) >, B-Line models B3100 or B3104. < (AM#0002)~~
- 2) Adjustable steel swivel ring (band type) hanger ~~(AM#0002) >, B-Line model B3170. < (AM#0002)~~

b. Pipes 2-1/2 inches and larger

- 1) Adjustable steel clevis hanger ~~(AM#0002) >, B-Line model B3100. < (AM#0002)~~
- 2) Adjustable steel yoke pipe roll ~~(AM#0002) >, B-Line model B3114. < (AM#0002)~~

3. Multiple or Trapeze Hangers

- a. Trapeze hangers shall be constructed from 12-gauge roll formed ~~ASTM A1011/A1011M~~ SS, Grade 33 structural steel channel, 1-5/8 by 1-5/8-inch minimum, ~~(AM#0002) >B-Line B22 < (AM#0002)~~ strut or stronger as required.
- b. Mount pipes to trapeze with 2-piece pipe straps sized for outside diameter of pipe ~~(AM#0002) >, B-Line B-2000 series. < (AM#0002)~~

4. Wall Supports

a. Pipes 2-1/2 inches and smaller

- 1) Steel offset "J" hook hanger ~~(AM#0002) >, B-Line model B3600. < (AM#0002)~~

- b. Pipes 3 inches and larger

(AM#0002) >

~~1) Welded strut bracket and pipe straps, B-Line models B3064 and B2000 series. < (AM#0002)~~

2) Welded steel bracket (AM#0002) > ~~B-Line model B3066 or B3067~~ < (AM#0002) with roller chair or adjustable steel yoke pipe roll. (AM#0002) > ~~B-Line model B3120 or B3110. < (AM#0002)~~

5. Floor Supports

- a. Electroplated carbon steel adjustable pipe saddle and nipple attached to steel base stand sized for pipe elevation. (AM#0002) > ~~B-Line model B3093 and B3088T or B3090 and B3088. < (AM#0002)~~ Pipe saddle shall be screwed or welded to appropriate base stand.

6. Vertical Supports

- a. Steel riser clamp sized to outside diameter of pipe (AM#0002) > ~~B-Line model B3373. < (AM#0002)~~

7. Plastic Pipe Supports

- a. V-Bottom clevis hangers with galvanized 18-gauge continuous support channel (AM#0002) > ~~B-Line models B3106 and B3106V, < (AM#0002)~~ to form a continuous support system for all plastic pipes smaller than 1 inch or flexible tubing.
- b. A vented and sloped continuous PVC Schedule 40 pipe no smaller than 1-1/2 inch outside diameter will be used to route flexible tubing with the appropriate pipe supports.

8. Supplementary Structural Supports - Design and fabricate supports using structural quality steel bolted framing materials. Channels shall be roll formed, 12-gauge ASTM A1011/A1011M SS Grade 33 steel, 1-5/8 inch or greater as required by loading conditions. Submit design for pipe tunnels, pipe galleries etc. for approval. Use clamps and fittings designed for use with the strut system.

D. Hanger Attachments

1. Upper Attachments

a. Beam Clamps

1) Beam clamps shall be used where piping is to be suspended from building steel. Clamp type shall be selected on the basis of load to be supported, and load configuration.

2) C-Clamps shall be locknuts and cup point set screws (AM#0002) > ~~similar to B-Line model B351L or B3036L. < (AM#0002)~~ Top flange c-clamps shall be used when attaching a hanger rod to the flange of structural steel (AM#0002) > ~~B-Line model B3034 or B3033 or approved equal. < (AM#0002)~~ Refer to manufacturers recommendations for set screw torque. Retaining straps (AM#0002) > shall be used to maintain the clamp position on the beam where required.

3) Center load beam clamps shall be used where specified. Steel clamps (AM#0002) ~~>shall be B Line models B3050 or B3055.~~
~~<(AM#0002) Forged steel beam clamps with cross bolt (AM#0002)>~~
~~shall be B Line B3291 B3297 series or approved equal~~ <(AM#0002) as required to fit beams.

b. Concrete Inserts

1) Cast in place spot concrete inserts shall be used applicable, either steel or malleable iron body (AM#0002) ~~>, B line B2500 or B3014 or approved equal.~~ <(AM#0002) Spot inserts shall allow for lateral adjustment and have means for attachment to forms. Select inserts to suit threaded hanger rods sizes (AM#0002) ~~>, B line models N2500 or B3014N series.~~ <(AM#0002)

2) Continuous concrete inserts shall be used where applicable. Channels shall be 12 gauge, ASTM A1011/A1011M Grade 33 structural quality carbon steel, complete with styrofoam inserts and end caps with nail holes for attachment to forms. The continuous concrete insert shall have a load rating of 2,000 lbs/ft. in concrete (AM#0002) ~~>, B Line models B22I, 32I, or 52I or approved equal.~~ <(AM#0002) Select channel nuts suitable for strut and rod sizes.

E. Hanger Accessories

1. Hanger rods shall be threaded on both ends or continuously threaded rods of circular cross section. Use adjustable lock nuts at upper attachments and hangers. No wire, chain, or perforated straps are allowed.

F. Hanger Finish

1. Indoor Finishes
 - a. Hangers shall be zinc plated in accordance with ASTM B633 OR shall have an electro-deposited green epoxy finish.
 - b. Strut channels shall be pre-galvanized in accordance with ASTM A653/A653M SS Grade 33 G90 OR shall have an electro-deposited green epoxy finish.
 - c. Zinc Plated hardware is not acceptable for use in chemical rooms.

G. Valves

1. Valves 3 inches and larger shall be butterfly type valves, with PVC body, 150# SWP with stainless steel shaft, polypropylene disc and replaceable resilient seat bonded to a rigid shaft and guaranteed for bubble tight shutoff from 27-inch vacuum to 150 PSI. Extended neck 2 inch beyond flanges for any insulated piping shall be provided with handle for manual operation. All valve components shall be suitable for swimming pool chlorinated water service. (AM#0002) ~~>Butterfly valves shall be Georg Fischer Type 563, Asahi/America Type SP Pool Pro, Chemtrol Model B, Simtech VP series, Colonial Valve 411 Series, or approved equal.~~ <(AM#0002)
2. Valves smaller than 3 inches shall be PVC true union ball valves, full port, three-piece construction, blowout-proof stem, Viton seal

with socket end connectors.

3. Check valves shall be a quick closing non-slam type, either self-aligning wafer or flanged type, of corrosion resistant materials suitable for use in a swimming pool environment. Install check valves in accordance with the manufacturer's recommendations. Locate check valves at least 5 pipe diameters from pumps and fittings. Provide check valves as indicated, where two pumps are used in parallel. Check valves shall ~~(AM#0002) >be either by Technocheck Corp., model 5050, with~~ have <(AM#0002) epoxy coated cast iron body and bronze swing plates on a stainless-steel spring (AM#0002) >; or approved equal, <(AM#0002) for installation between 150 lb. flanges.
4. Modulating float valve in the surge tank(s) shall have PVC body and stainless-steel wafer disc. All hardware shall be non-corrodible. The float-operated valves shall be provided horizontally on the main drain lines in the surge tank(s). Valve shall consist of all non-corrosion components including shaft, float arm, pins and floats. Valve shall be suitable for mounting on a 125E class standard PVC flange. The float arm leverage weight and pivot lengths shall be adjustable to obtain desired ratio of surge tank level change to pool gutter overflow level change. Two floats and stabilizer required. ~~(AM#0002) >Valve shall be Model FV D XWB (Extra Weight Ball) as manufactured by MerMade Filter, Inc. or approved equal manufactured by EPD, or Fluidtrol Process Technologies, Inc. <(AM#0002)~~
5. Submerged valves up to 3 inches shall be PVC true union ball valves. Submerged valves over 3 inches shall be PVC bodied, wafer type, butterfly valves with stainless steel handle extensions as required. ~~(AM#0002) >Valves shall be by approved manufacturers listed above. <(AM#0002)~~ Submerged valves must be provided with all stainless-steel connectors. The stem housing extensions shall be properly supported and braced.
6. All butterfly type valves 8 inches and larger shall be fitted with a water tight gear operator.
7. All valves located 7 feet or greater off the floor shall be fitted with a chain operator.
8. All submerged valves, valves buried below grade, or valves not readily accessible, shall be provided with a stainless-steel reach rod and handle.
- H. Pipe and valve identification
 1. All exposed pool piping shall be equipped with color coded flow directional arrows at thirty (30) inch intervals per local and state swimming pool health code. The Contractor shall verify that all pool piping identification is in accordance with all local and state health regulations.
 2. All valves shall be identified with minimum 1-1/2-inch diameter brass tags stamped with minimum 1/2-inch high numbers and attached to valves with #16 brass jack chain. (Plastic laminate engraved tags with nylon attachment acceptable.) Valves shall be described as to their function and referenced in the operating instruction manual and wall mounted piping diagram to be prepared by the CONTRACTOR.

2.6 CHEMICAL TREATMENT SYSTEMS

A. Calcium Hypochlorite (Chlorinator Briquettes)

1. Shop drawings complete with a piping diagram depicting the location in which the dry chlorination feeder is to be connected to the system shall be provided and approved prior to installation. Installation of the system shall be as specified in the manufacturer's directions and no exceptions shall be taken.
2. A factory-authorized representative shall provide training to the owner and the training shall be video recorded per 131100, Section 1.12 of the project contract documents.

(AM#0002) >~~3. Accu-Tab PowerBase~~ < (AM#0002)

a. General Description

1) The system shall be designed to feed low concentrations of calcium hypochlorite in solution intermittently or continuously as required for pool applications. The system shall be a single pre-assembled, package unit with a welded aluminum frame consisting of chlorinator, electrical box, centrifugal pump, and solution tank for ease of installation and operation. (AM#0002) >
~~The system shall be the Accu-Tab PowerBase. Only Accu-Tab Blue SI~~
< (AM#0002) calcium hypochlorite tablets shall be used, the patented blue colorant added for safety (to help prevent accidental mixing with other chemicals).

2) The base proposal requires providing equipment as specified herein, though substitutions will be considered. The bidder is cautioned that substitutions must meet the quality and operational requirements of each feature specified in Section 2 below. Batch systems with pressure mixing components producing chlorine concentrations exceeding the limits of the specifications will not be considered.

3) Any system offered shall use an NSF Standard 50 listed erosion feeder and tablet combination and shall be capable of meeting all requirements of the Health Department having jurisdiction over the installation.

(AM#0002) >~~4) Basis of Design:~~ < (AM#0002)

a) Competition Pool Tank B: ~~— (AM#0002) > 10.2 lbs/hour Model~~
~~3070AT~~ < (AM#0002)

b) Competition Pool Tank A: ~~— (AM#0002) > 10.2 lbs/hour Model~~
~~3070AT~~ < (AM#0002)

b. System Features

1) A maximum chlorine solution level of 0.05% (500 ppm) shall be maintained to prevent calcification in system components. Systems producing chlorine concentrations higher than 0.05% shall not be acceptable.

2) Delivery shall be by erosion feed technology to control

accurate and consistent concentration limits in the chlorine treatment solution. Soaking type, spray and/or vortex technology systems shall not be acceptable.

3) The chlorinator shall automatically and continuously feed a limited quantity of chlorine in solution as needed; when the system is not running, no more chlorine than that amount which can be fed in one minute or less shall be left in the tank to prevent dilution. Batch systems preparing excess quantities of solution for delivery over an extended period shall not be acceptable.

4) A centrifugal pump wired to the system electrical box shall feed freshly mixed chlorine treatment solution only as required for maximum efficiency. Batch systems requiring the use of a metering pump or pumps to feed pre-prepared standing solution shall not be acceptable.

5) All piping in the chlorinator unit shall be Schedule 40 PVC. Systems with flexible tubing shall not be acceptable.

c. System Components

1) Tablet Chlorinator. ~~(AM#0002) >Accu-Tab PowerBase< (AM#0002)~~ Chlorinators are designed exclusively for ~~(AM#0002) >Accu-Tab Blue SI< (AM#0002)~~ calcium hypochlorite tablets. Tablets are placed on a sieve plate inside the chlorinator; as water flows across the sieve plate, the tablets erode at a rate proportional to the flow rate.

2) Inlet Water Supply Connection.

a) ~~(AM#0002) >Model 3070AT< (AM#0002)~~ 1-1/2" FNPT (water supply of 30 GPM required).

3) Inlet Solenoid Valve. Opens and closes on command when the system receives a signal. 110 VAC required from chemical controller. ~~(AM#0002) >Applicable to models 3140AT and 3500.< (AM#0002)~~

4) Inlet Water Strainer. A strainer to protect chlorinator components from start-up debris and sand from broken filter laterals.

5) Flow Meter. A rotameter flow meter, measuring the flow of the water-eroding stream to the chlorinator.

6) Inlet Control Valve. PVC gate valve mounted in line with the flow meter allows operator to adjust flow of water-dissolving stream. ~~(AM#0002) >Applicable to models 3140AT and 3500.< (AM#0002)~~

7) Solution Tank. PowerBase 3500 made of HDPE, all others made of PVC. Capacities:-

a) ~~Model 3070AT~~ ~~(AM#0002) >22 gallon< (AM#0002)~~

8) Float Valve. Made from Schedule 80 PVC and 316L stainless steel, this float valve maintains the solution tank level.

9) High Level Switch. Prevents the solution tank from overflowing. High level: when activated, a switch opens the circuit to the solenoid valve, causing the solenoid valve to close. (AM#0002) >Applicable to models 3140AT and 3500.< (AM#0002)

10) Solution Delivery Pump. Delivers chlorinated solution to the return line. A single-stage centrifugal pump is provided for systems with pressures up to 20 PSIG. (For systems requiring a discharge pressures greater than 20 PSIG, a custom selected pump shall be utilized.)

11) Discharge Check Valve. A PVC swing check valve prevents reverse flow of water into the system.

12) Discharge Control Valve (manual). Used to balance system output water flow with system input water flow.

13) Outlet Connection

a) (AM#0002) >Model 3070AT< (AM#0002) 1.5" NPT

14) Aluminum Frame. Type 6061-T.

15) Nema 4X Electrical Enclosure

d. Optional Equipment

1) High Pressure Pump. On systems requiring unit discharge pressures greater than 20 PSIG.

2) High-High-Low (HHL) Level Switch. A second-high level switch (Hi-Hi) is installed above the high-level switch that will run the solution delivery pump in case of an upset condition in the solution tank. A low-level switch will protect the pump by preventing it from running dry.

e. Electrical Requirements

1) Two electrical circuits are required for operation: (1) 110v 15-amp power, and (1) 110v control circuit from a pool controller.

4. On Site Chlorine Generation System

- a. The chemical sanitizer for the training tanks shall be sodium hypochlorite, generated on site in an off line installation. (AM#0002) >On Site Chlorine Generator shall be ChlorKing X Gen 80 R or approved equal.< (AM#0002) On-site generator shall be skid mounted, self-contained system and one system shall supply chlorine to the training tanks. On-site chlorine generator system shall be provided as a complete operational system.
- b. The system shall be NSF International standard 50 listed, and certified for use in training tanks. The electrical wiring, breakers, and disconnect boxes provided at the facility shall be UL listed components.
- c. The chlorine generator shall produce sodium hypochlorite in a production tank from a concentration of 5,000ppm sodium chloride

fed from a saturated salt feeder, or from a sea water feed system. No salt allowed to be added to the pool directly.

- d. The chlorine generator must re-circulate the training tank water through the production tank to re-use any salt in the training tank.
- e. The chlorine generator shall not require a water softener, produce from 96 lbs per day of equivalent chlorine as a solution of sodium hypochlorite, and function in water temperatures between 15C and 40C.
- f. The system functions at salt concentrations of 5000ppm in the production tank. (No salt is added to the tank)
- g. Training tanks chlorine delivery is controlled by a venturi distribution system.
- h. Flow through the cell is adjustable to meet production requirements. Flow switches are included as safety devices.
- i. The system shall include a hydrogen dilution blower to safely remove hydrogen from the production tank. Hydrogen shall be vented from the production tank using the supplied ventilation port on the top of the production tank at the time of field installation. The system will not allow chlorine production if the hydrogen dilution blower is not active and no air movement is detected. The maximum length of vent run shall be 40ft unless otherwise specified.
- j. The system shall be pre-wired, ready for field connection of power tied to the pool pump and control circuits. The plumbing of the production tank and accessories shall be done at the time of the installation.
- k. The system shall be capable of satisfactory performance if installed as per the manufacturer's recommendations (reference the installation manual). An authorized representative shall be located within a reasonable distance of the facility and shall be available to install and service the system as required.
- l. The power supply system shall be bonded via the bonding lug to the local common bonding grid. (ALL EQUIPMENT MUST BE BONDED) The bonding connector shall be conductively connected to the grounding means.
- m. The system shall have salt concentration displayed in PPM.
- n. The (AM#0002) >X-Gen-80-R-system< (AM#0002) shall operate on a 240V, 60 hz, 32 amp (60 amp breaker required) power supply and shall be water cooled without fans.
- o. Contractor shall provide all equipment, tanks, and plumbing required for a fully functional system.

B. pH Buffering System (CO2)

- 1. Shop drawings complete with a piping diagram depicting the location in which the CO2 feeder is to be connected to the system shall be provided

and approved prior to installation. Installation of the system shall be as specified in the manufacturer's directions and no exceptions shall be taken.

2. Bulk Storage

- a. Provide a system for storing, regulating and feeding carbon dioxide for pH control. The system shall consist of CO2 storage tank(s), a lockable fill box for bulk delivery, a pressure reducing/regulating system, a feed and rate of flow adjustment control system, injection system/mass transfer system, and all valves, tubing, fittings and appurtenances required for a complete and operable system. The system is to include the following components.

1) CO2 Storage Tanks

a) Provide one (4) 600 lb. mass storage tank(s) meeting ASME requirements, specifically designed and configured for use with CO2. The tank(s) shall be of an insulated, vacuum-jacketed double wall construction with a rated service pressure of at least 292 psig. The outer shell shall be stainless steel and given a 10-mil dry film thickness epoxy coating, the inner shell shall be of stainless steel.

b) Each tank shall include shut off and pressure regulating valves, gauges for accurate output pressure control, a 350 psig pressure relief valve, and shall be provided with a dual pressure building/economizer regulator that includes a 7.5-amp, 120 VAC heater extending into the tank and the liquid CO2.

c) Usage rate capacity shall have a range of 3.2 pounds per day to 20 pounds per hour. Secure tank to building wall with a coped saddle and a 16 GA x 3" stainless steel strap bolted to wall.

d) Fill tank with CO2 for initial testing and operation and provide full tank(s) at the time of Owner acceptance.

(AM#0002) >

~~e) The tank(s) shall be as manufactured by Taylor Wharton, MVE, or approved equal.~~ < (AM#0002)

2) Remote Fill Box

a) Provide a remote fill station capable of filling the tank(s) at the rate of approximately 30 to 50 pounds per minute in a manner that does not require entry to the storage room containing the CO2 tank(s). Length of tubing between remote fill box and bulk storage tank shall not be more than 20', unless otherwise noted. Each fill station shall consist of a flush mounted (recessed) lockable fill box located at the exterior of the building, as indicated, connected to the CO2 system. It shall include a quick disconnect and automatic closure coupling. Box shall be 8" x 8" x 2" and constructed of painted 16 gauge galvanized or stainless steel or sized to module with exterior masonry.

b) Tanks are to be connected to outside fill station(s), as indicated, with two lengths of 1/2 inch ODT copper for the

purpose: one to transfer liquid to the tanks from a bulk delivery vehicle, and the other from the relief valves to the outside of the building. All copper tubing from remote fill box to storage tank shall be fitted with either double ferrule swage fittings, or silver soldered fittings.

3) Dual Tank Switchover System

a) Dual tank automatic switchover system with gauges.
~~(AM#0002) > Strantrol CO2 10, one (1) required. < (AM#0002)~~

3. Adjustable Rate of Flow Feed Unit(s)

- a. Provide an adjustable rate of flow feed unit to control the flow of CO2 from the storage tank(s) to each feature to receive CO2. The feed unit(s) shall be connected to the storage system with thick wall 3/8-inch OD reinforced braided polyethylene tubing enclosed in schedule 40 PVC. Feed system shall include 120-volt AC solenoid operated valve for remote on/off control of CO2.

~~(AM#0002) >~~

~~1) Competition Pool Tank B requires one (1) Stranco Model # CO2-9, 20-200 SCFH~~

~~2) Competition Pool Tank A requires one (1) Stranco Model # CO2-9, 20-200 SCFH < (AM#0002)~~

- b. Injection System: Provide one (1) system for each body of water; a wet stone diffuser designed for use with CO2, sized to the pipe in which it is to be inserted and for the maximum anticipated rate of CO2 flow. Provide with pipe saddle connector and all fittings and connectors required for a complete and operable installation.

C. pH Buffering System (Muriatic Acid)

1. Chemical feeders for muriatic acid shall be peristaltic type pumps. Chemical feed pump(s) shall be provided and connected to the filtered water return lines to the pool(s) as shown on the pool plans. The pump(s) shall be capable of feeding a solution to the pool(s) to maintain pH level against the back pressure involved and shall be fully adjustable while in operation.
2. The pump(s) shall be provided complete with fractional horsepower motor for 120V 60 Hz current, plastic feed lines, and fitting necessary for connections to pool system piping.
3. The chemical pump(s) shall be electrically connected to and operated by the water chemistry controllers.
4. The acid pump(s) shall be affixed with a metallic stamped label indicating the chemical being pumped and the pool to which it is connected.
5. Provide non-metallic wall mounted shelf support for the chemical feeder(s).
6. Provide six (6) fifteen (15) gallon acid drums.
7. Provide four (4) two drum modular spill platform. Platform shall be

molded high-density polyethylene with removable polyethylene grating. Platform shall be 26.25" x 51.5" x 6.5" with a spill capacity of 30 gallons and a load capacity of 5,000 pounds. ~~(AM#0002) >Platform shall be an Eagle two drum modular spill platform model 1632 or approved equal. < (AM#0002) -~~

8. Provide one (1) low profile ramp. Ramp shall be molded high-density polyethylene. ~~(AM#0002) >Ramp shall be an Eagle low profile ramp model 1689 or approved equal. < (AM#0002)~~
9. Provide ~~(AM#0002) >"Vapor Shield" < (AM#0002)~~ vent check valve for the acid drum/tank which seals container while allowing the liquid to be removed via pump. The Vapor-Shield shall prevent an internal vacuum and collapse of a sealed container. It will also prevent the pump from developing a vacuum-lock while attempting to remove the liquid from the sealed container. The Vapor-Shield shall prevent the release of any acid vapors. The Vapor-Shield body shall be constructed entirely from schedule 80 PVC with polypropylene tube fittings and factory-installed acid resistant viton sealant on all threaded connections. The diaphragm and o-rings shall be constructed of acid resistant viton. No metallic or materials not rated appropriate for use with acid shall be used. ~~(AM#0002) >The vent fitting Vapor Shield < (AM#0002)~~ shall be fitted with a ¾" male NPT threaded fitting to allow for the installation onto any common: five (5) through fifty-two (52) gallon acid shipping container caps and lids. The unit shall be supplied with no less than fifteen (15) feet of 3/8" polyethylene tubing. ~~(AM#0002) >Recreonics catalog no. 52-095. < (AM#0002)~~ An Acid Fume Scrubber, ~~(AM#0002) >part #7747090 < (AM#0002)~~, with refill reagent kit, ~~(AM#0002) >#7747091, manufactured by ProMinent shall be considered an equal. < (AM#0002)~~
10. Chemical feeders ~~(AM#0002) >to be manufactured by ProMinent, G. H. Stenner & Co., or approved equal. < (AM#0002)~~
 - a. Competition Pool Tank B Acid Pump (one required):
~~(AM#0002) >Model 45M3 < (AM#0002)~~ — 22 GPD
 - b. Competition Pool Tank A Acid Pump (one required):
~~(AM#0002) >Model 45M3 < (AM#0002)~~ — 22 GPD
- D. Ultraviolet Dechloramination and Disinfection System
 1. Ultraviolet Disinfection Equipment: Shall operate within the UVC electromagnetic spectrum emitting wavelengths in the range of 200nm to 400nm. This required wavelength will provide constant disinfection/inactivation of bacteria, algae, molds, viruses and destruction of Monochloramines, Trichloramines, and Dichloramines. ~~(AM#0002) >Ultraviolet Lamp/Chamber and Spectra Touch Control Panel by Engineered Treatment Systems or approved by Contracting Officer. Any deviation/exception must be provided in writing to and approved by the designer prior to the bid date.~~
 - ~~a. Ultraviolet disinfection equipment by Aquionics and Prominent are approved equals. < (AM#0002)~~
 2. The UV System shall have a MET or equivalent (ETL, CSA, or UL) listing, be NSF-50 2014 certified including Section 14.18 (crypto inactivation) or 3rd party validated to the USEPA UVDGM 2006 Guidelines.
 - a. Equipment General Description: The Ultraviolet System shall be

provided in a complete package to include: 316L Schedule 10 Stainless Steel Chamber, Spectra Touch Control System located in a NEMA 12 (IP52) rated panel, Medium Pressure Bulb(s) designed to emit wavelengths within the UVC electromagnetic spectrum, UV EZ Clean strainer, automatic wiper system, and Project Commissioning by a Certified ETS Ultraviolet Technician.

3. (AM#0002) ~~ECF~~ (AM#0002) Units: Ultraviolet manufacturer to offer unit capability of a horizontal OR vertical installation application using state of art design and direct flow through characteristics. Direct flow will be required in order to reduce total head loss through the system. Unit shall be a Multiple Lamp medium pressure system with a bulb range of (2) 1.0 kW - (4) 3.0 kW power range. Multiple lamp system is required in order to maintain quality disinfection in the event of a single bulb failure. ANSI or PN (as specified) flange range of 4"/100MM - 12"/300MM and flow pattern of 350 to 3700 GPM (1540 m3/hr to 16,313 m3/hr). @ 94% UVT. Any systems validated or designed for flows based on 98 % UVT are not acceptable. Chamber and Control Cabinet shall be as indicated on the drawings. Electrical requirements are indicated in the table below. The electrical contractor is to take into account plus/minus 3% for external breaker. All required electrical work to be performed by licensed electrician.

Pool Type	Model Number	US EPA 3-log and calculated 40mg/cm2 (GPM)	Calculated 60 mJ/cm2 (GPM)	Lamps	Power (KW)	Voltage (V) with Breaker Size
Competitive Pool Tank B	<u>(AM#0002)</u> ~~(AM#0002)~~ ~~ECF 430-12~~ <u>< (AM#0002)</u>	3705	3350	4-3.0kW	12.0	480 V (3cp) - 50A
Competitive Pool Tank A	<u>(AM#0002)</u> ~~(AM#0002)~~ ~~ECF 430-12~~ <u>< (AM#0002)</u>	3705	3350	4-3.0kW	12.0	480 V (3cp) - 50A

4. Ultraviolet Chamber

- a. Pressure rated for 100 psi/8 Bar (tested to 150 psi/11 Bar), and pressure drop across the unit will be minimal. The unit shall be constructed of 316L stainless steel, schedule 10 pipe, passivated to prevent corrosion within the harsh pool environment. The Ultraviolet chamber shall come complete with the following equipment.

1) Ultraviolet intensity monitor factory calibrated to provide intensity in mw/cm2, it must include a built-in alarm system to notify operator when output level drops below required level of 60 mJ/cm2 for indoor pools or 40mj/cm2 for outdoor pools (or operator set dosing levels).

2) Ultraviolet temperature control system shall be provided to maintain system integrity in the event of flow interruptions to the chamber.

3) Ultraviolet chamber shall come complete with annealed quartz sleeve with "O" ring seals for water tightness.

4) Chambers shall be complete with ANSI or DN flanges (as specified) and all ports or vents shall be threaded NPT. The Ultraviolet chamber must be capable of installation in the system so that it remains full under all conditions.

5) The Ultraviolet unit must be complete with integrated brackets or feet for ease of installation in either vertical or horizontal mounting.

6) The Chamber shall have a sacrificial anode attached to the chamber, extending inside the chamber and be bonded to the installation bond loop.

5. Ultraviolet Lamp

- a. Ultraviolet lamp shall be medium pressure high intensity. Lamp shall be designed to emit continuous Ultraviolet wavelengths in the range of 200nm to 400nm. This will provide optimal disinfection benefits and destruction of the Monochloramine, Dichloramine, and Trichloramine compounds. Lamp must remain unaffected by temperature variance of 0 degrees F (-17 C) to 200 degrees Fahrenheit (93 degrees Celsius).
- b. The lamp system must provide a constant dose of not less than 60 mJ/cm² until the end of the lamp life for indoor applications and not less than 40 mJ/cm² for outdoor disinfection and this must be based on constantly monitoring the full recirculating flow rate, not on a side stream treatment. The system must be equipped with variable power control to control the intensity & dose of the lamp in 1% increments.

6. Automatic Wiper System

- a. An automatic cleaning system shall be provided for cleaning of quartz sleeve and Ultraviolet monitor probe. The system shall travel the entire length of the quartz sleeve twice per desired cleaning cycle. Precision molded wiper rings shall be provided to ensure thorough quartz tube cleaning and quartz tube protection. Wiper cycle shall be user selectable and adjustable within a range of 5 minutes to 24 hours depending on anticipated application and deposit build-up.

7. UV Strainer

- a. The UV system must be provided with a downstream strainer to protect against the possibility of lamp/quartz breakage traveling downstream.

8. Ultraviolet Control System

- a. Control cabinet shall be (AM#0002) >an ETS SPECTRA< (AM#0002) Touch control unit - (AM#0002) >and or pre approved equal< (AM#0002). The cabinet shall be an epoxy coated NEMA 12 / IP52 rated cabinet. If mounted outdoors it must be a NEMA4X / IP56 rated cabinet with an integral A/C unit to protect the components from the environment. The power must be controllable to provide full power,

half power and infinite variable power based on real time interface with changes in UVT, Flow Rate or Combined Chloramines. Three levels of operation shall be provided to meet the needs of the operator and pool environment: Simple Control (start, stop and reset), Full Parameter Display, and Customized Operator Configuration. Modes of operation shall be password protected to secure system critical setup functions. Touch Control system shall have clearly identifiable start, stop, and reset icons (suitable for gloved operation) with Running and Fault LCD indicators.

1) The main Touch screen shall display a minimum of the following: Ultraviolet calculated dose (derived from flow and intensity inputs), Ultraviolet intensity (as a % and mw/cm2), Lamp Current, Flow rate (accepts signal from optional flow meter - displayed as gallons per minute or m3/hour), Chamber temperature (displayed as deg. F or deg. C), Operation hour meter, and fault indicators to include Lamp fault, low Ultraviolet & temperature alarm, Ground fault trip, Wiper fault. All alarm functions shall have simple text message display to assist in fault finding.

2) Touch Control system shall have a minimum of the following system interface controls: Remote operation, Process interrupt features (from valves, flow meters), Low UV dose (configurable to shut down or alarm only), Flow meter input, Auto-Restrike, Half to full power Ultraviolet setting with 24 hour/7 day settable timer. Variable power/Dose pacing interface.

3) Touch Control system shall have built in data-logging capabilities to record the following information: Ultraviolet intensity required, Ultraviolet intensity measured, Lamp current, Chamber temperature, Flow rate (if flow meter is connected), Time and date stamp, all alarms generated.

4) Touch Control system must be able to be interfaced with a Chemistry Controller that can measure Total or Combined Chloramines in order to maintain the proper dosage required during the life of the lamp.

5) Touch Control system must be able to interface with any automatic or semi-automatic filtration controller.

6) Touch Control system must be capable of operating through Ethernet or Wi Fi.

7) Touch Control system must be capable of interfacing with a SCADA system including both Profibus and Modbus.

9. System Startup

a. Install in accordance with contract documents and manufacturer's instructions.

b. Commissioning:

1) Ultraviolet Chamber and Control Panel shall be commissioned by a qualified factory trained technician to institute the warranty.

2) Final electrical and control cabling will be connected from the Touch Control cabinet to the Ultraviolet disinfection chamber during the commissioning process.

3) Daily operation and simple maintenance instructions shall be provided during the commissioning process.

10. Warranty

- a. All components, excluding lamps, quartz and seals, shall have a limited warranty to be free from defects in workmanship and materials for a period of 12 months from date of start-up. Medium pressure Ultraviolet bulbs shall be warranted for a period of 8,000 hours. Intermittently operated lamps (>1 on/off cycle per day) will be replaced free of charge should failure occur prior to 4,000 hours and replacement will be prorated between 4,000 and 8,000 hours.
- b. Manufacturer must maintain spare or replacement parts in the USA for same day or not longer than next day delivery in North America.

2.7 WATER CHEMISTRY MONITORING AND CONTROL SYSTEMS

A. The water chemistry control system for the competition pool Tank A and Tank B shall provide continuous monitoring and control of sanitizers, oxidizers, pH, ORP, free chlorine, total chlorine, combined chlorine, temperature, system flow rate, and water chemistry balance calculations. Controller shall have the ability to call for pH from both CO2 and Muriatic acid systems on a user programmable time-of-day schedule to alternate between feeding CO2 or acid. (For use on pools with both CO2 and acid). The controller shall manage the recirculation pump with a programmable Fireman Cycle feature, which automatically turns off the Heater, UV and Auxiliary systems prior to shutting off the recirculation pump. All line-voltage wiring shall be performed in a separate NEMA 4X enclosure that precludes access to the controller electronics. Installation of the system shall be per the manufacturer's specification and no exceptions shall be allowed. A factory trained/authorized representative shall provide training to the Owner and the training shall be videotaped per 131100, Section 1.12 of the project contract documents. (AM#0002) ~~>The specified controller, a BECSys7 manufactured by BECS Technology, Inc. shall be provided or Chemtrol by SB Control Systems, AcuTrol by Pentair, ProMinent, or a technically equal system capable of providing equal performance for all operating functions.~~ <(AM#0002)

B. Certifications

1. The controller shall carry the following product certifications
 - a. NSF/ANSI Standard 50;
 - b. UL 61010-1

C. Sensors

1. The controller shall come with the following sensors
 - a. pH - The controller shall provide a measurement of pH by utilizing a sensor with the following characteristics:

- 1) 0 - 14 sensing range
 - 2) ABS body with ½" NPT process connection
 - 3) Minimum of 32 milliliters of inorganic electrolyte gel; organic electrolytes, susceptible to breakdown in the presence of strong oxidants, shall not be considered equal
 - 4) A porous Teflon liquid junction to provide a stable, low impedance reference contact, and to prevent fouling and clogging of the liquid junction
 - 5) A silver/silver chloride (Ag/AgCl) reference element
 - 6) A general-purpose glass membrane pH sensing element
 - 7) Operating temperature range of 0 - 80 degrees C
 - 8) Operating pressure range of 0 - 100 psiG.
 - 9) The controller shall continuously monitor, display and data log pH with 0.1 or 0.01 resolution (programmable).
- b. ORP - The controller shall provide a measurement of ORP by utilizing a sensor with the following characteristics:
- 1) -1000 to +1000mV sensing range
 - 2) ABS body with ½" NPT process connection
 - 3) Minimum of 32 milliliters of inorganic electrolyte gel; organic electrolytes, susceptible to breakdown in the presence of strong oxidants, shall not be considered equal
 - 4) A porous Teflon liquid junction to provide a stable, low impedance reference contact, and to prevent fouling and clogging of the liquid junction
 - 5) A silver/silver chloride (Ag/AgCl) reference element
 - 6) A solid platinum or solid gold ORP sensing element with a minimum of 1 cm² surface area; platinum-plated and gold-plated sensing elements, which are susceptible to abrasives, shall not be considered equal
 - 7) Operating temperature range of 0 - 80 degrees C
 - 8) Operating pressure range of 0 - 100 psig
 - 9) The controller shall continuously monitor, display and data log ORP with 1mV resolution
- c. Flow Sensor - The controller shall provide a measurement of pool circulation flow rate and volume by utilizing a flow sensor with the following characteristics:
- 1) 0-8800 gpm (0-33265 liter/min) measuring range,
 - 2) Magmeter flow sensor with a frequency output,

- 3) Dual O-ring seal,
 - 4) Cable to meet length requirement for installation,
 - 5) Saddle to meet return line size,
 - 6) Flow volume: 999 trillion gallons, 1-gallon resolution; 999 trillion liters, 1-liter resolution.
 - 7) The controller shall continuously monitor, display and data log flow rate with 0.1 gpm resolution.
- d. Temperature - The controller shall provide a measurement of water temperature by utilizing a sensor with the following characteristics:
- 1) 32 - 212°F (0 - 100°C) sensing range;
 - 2) 2 wire, 100 Ω resistive temperature detector (RTD) with a 0.00385 Alpha.
 - 3) The controller shall continuously monitor, display and data log temperature with 1°F resolution.
- e. Free Chlorine Sensor - The controller shall provide a measurement of free chlorine by utilizing an amperometric sensor with the following characteristics:
- 1) 0.0 to 20.0 mg/l (ppm) measuring range with fully selectable scale,
 - 2) 32 - 113 F operating temperature range,
 - 3) A PVC body,
 - 4) Replaceable PTFE membrane and electrolyte,
 - 5) Gold cathode and silver/silver chloride anode.
 - 6) The controller shall continuously monitor, display and data log free chlorine with 0.1 mg/l resolution.
- f. 4-20mA Sensors
- 1) Total Chlorine Sensor (with Combined Chlorine Reading) - The controller shall provide measurement of total chlorine utilizing a sensor with the following characteristics:
 - a) 0.0 to 20.0 mg/l (ppm) measuring range,
 - b) 41 - 113 F operating temperature range,
 - c) Replaceable PTFE membrane and electrolyte,
 - d) Gold cathode.
 - e) The controller shall continuously monitor, display and data log total chlorine with 0.1 mg/l resolution. The controller

shall also continuously monitor, display and data log combined chlorine (from the total chlorine and free chlorine sensors) with 0.1 mg/l resolution.

D. User Interface

1. Standard Display - The standard display shall be a backlit transfective LCD with 14-line x 40 alpha/numeric graphical characters that will continuously display information related to the following:
 - a. All installed sensor readings
 - b. Set points, with current control status
 - c. All active alarms, including time activated
 - d. Smart menus w/ integrated on-screen help
 - e. Contrast adjustment of the backlit LCD shall be provided through clearly marked keys on the front-panel without the need for access to internal controller circuitry. After initial adjustment, controller shall monitor internal temperature and automatically adjust contrast to prevent LCD blackout in extreme ambient temperature conditions. Controllers that do not include front-panel contrast adjustment and automatic temperature compensation shall not be considered equal.
 - f. The standard user interface shall include single-touch access to Set Points, Relay Modes, Calibrations, Backwash status and settings, Menu access, and Reset Fail/Safes. An alphanumeric keypad shall be provided for ease of system configuration.

E. Control Functions

1. Water Chemistry
 - a. pH Control: The controller shall continuously control pH. Chemical feed shall be configurable for feed-up, feed-down, or dual feed and either on/off or time-based proportional feed.
 - b. Sanitizer Control: The controller shall continuously control sanitizer based upon the ORP reading, the amperometric sensor, or both with a bracketed control program. Chemical feed shall be configurable for either on/off or time-based proportional feed.
 - c. Bracketed Sanitizer Control: With the amperometric ppm sensor, the controller shall be configurable for bracketed sanitizer control; The bracketed control algorithm shall allow either the ORP or ppm setpoint to be chosen as the primary control point, while using other parameter to create a secondary boundary (min and max settings) that must be maintained in addition to the primary control point.
 - d. Sanitizer Booster Feed: The controller shall have a sanitizer booster program with selectable ORP and/or ppm set points with separate ending set points, allowing the option of the booster sanitizer to control to a lower set point while the primary system can recover.

- e. UV Control: A Fireman Cycle feature shall turn off (ramp down) the UV relay 0 to 60 minutes (settable) prior to backwash initiation or recirculation pump shutdown.
 - f. Auxiliary: A Fireman Cycle feature shall turn off (ramp down) the Auxiliary relay 0 to 60 minutes (settable) prior to backwash initiation or recirculation pump shutdown. The Fireman control and relay shall have the ability to be renamed in the menus to provide the Fireman Cycle feature for Auxiliary equipment instead of ozone as needed.
 - g. Combined Chlorine UV Control: The controller shall provide turndown control of a UV system based upon combined chlorine set point; when combined chlorine is below set point the UV system will be turned down to decrease energy consumption and extend bulb life.
 - h. Superchlorination: The controller shall have a programmable superchlorination function, based upon ORP or ppm superchlor setpoint, which is triggered manually.
 - i. Dechlorination: The controller shall have a programmable dechlorination function, based upon ORP or ppm dechlor setpoint, which is triggered either manually or by the completion of the superchlorination function.
 - j. LSI & RSI: The controller shall compute the Langelier Saturation Index and the Ryznar Saturation Index based upon current inputs and the Ca Hardness and Alkalinity entered by the operator.
2. Expanded
- a. Flow Monitoring: The controller shall continuously monitor, display, and datalog system flow, maintaining a total flow volume. A Low Flow Alarm shall be operator settable, which can be programmed to disable chemical feeds. Controller shall also have a Minimum Flow Rate setting to turn off heater whenever system flow is less than this programmed minimum level.
 - b. Heater Control: The controller shall perform on/off control of a heater based upon an operator settable temperature set point. A Fireman Cycle feature shall turn off the Heater 0 to 60 minutes (settable) prior to recirculation pump shutdown. The controller shall immediately turn off the Heater when system flow is less than the heater Minimum Flow Rate setting. The Heater control algorithm shall include an Energy Conservation mode, with on/off set time and secondary temperature set point.
 - c. Sensor Wash: The controller shall include a programmable sensor wash with start and end time, feed duration, and number of cycles to allow multiple feed cycles per day.
3. Energy Conservation
- a. Alternate Setpoints: The controller shall have alternate Sanitizer, Heater, and Autofill setpoints, based upon a 4 event 28-day timer.
 - b. Energy Conservation Mode: The controller shall have the

capability to disable all mechanical and chemical functions during programmed conservation cycle. The Energy Conservation Mode shall include the ability to periodically monitor and satisfy all operation requirements based upon a programmed time schedule.

F. Main Recirculation Pump

1. On/Off Control with Relay

- a. Controller shall provide the capability to interface to and control a recirculation pump with a programmable relay. The controller shall provide 3 operator-settable independent Fireman Cycle settings and relays for the Heater, UV and Auxiliary controls. The controller shall include the following capabilities, available as appropriate based upon installed sensors and implemented features:

1) Fireman Cycle: Upon the following events, the controller shall automatically delay recirculation pump shutdown until the Heater, UV and Auxiliary controls have been deactivated and the corresponding Fireman Cycles have expired:

- a) Backwash Operations
- b) Energy Conservation mode (24 hr., 7-day function)
- c) Manual off (per Operator)

2) Immediate: Upon the following events, the controller shall immediately turn off the recirculation pump (and Heater, UV and Auxiliary controls), without first satisfying Fireman Cycle timing requirements:

- a) Surge Tank Level Low Alarm: Turn off pump immediately (surge tank is almost empty)
- b) Strainer Vacuum High Alarm: Turn off pump immediately (possible entrapment)
- c) Emergency shutdown, triggered by front-panel Emergency Off: Turn off pump immediately (per Operator)

2. VFD Interface with 4-20mA signal

- a. Controller shall provide the capability to interface to and control a recirculation pump equipped with a Variable Frequency Drive (VFD) through a 4-20mA signal. The controller programming shall allow the operator to manage the VFD entirely from the water chemistry controller, by providing the following capabilities:

1) Programmable setpoint specified as either flow rate, effluent filter pressure, or fixed setting,

2) Four programmable operator-triggered alternate profiles ("Manual Turndowns"),

3) Four programmable scheduled alternate profiles ("Scheduled Turndowns"),

- 4) Override setting for backwash,
- 5) Ramp up and ramp down settings,
- 6) Minimum output setting.
- 7) Remote access to current VFD status and all VFD parameters shall be provided through the BECSys for Windows PC software provided with controller. The name of each alternate profile shall be changeable by the operator, so that VFD menus and data log entries are intuitive and recognizable by the users of the system.
- 8) Systems that do not provide both local and remote management of the VFD through the water chemistry controller shall not be considered equal.

G. Control Outputs

1. Relay Outputs

a. Solid-State Relays

1) The controller shall come with a total of 4 integral line or dry contact 5A solid-state relay outputs capable of switching 3A under all normal operating conditions, accounting for the effects of the temperature gradient inside the NEMA 4X enclosure. Systems that utilize relays that are not de-rated must submit an engineering evaluation justifying the use of relays at their full, optimal-condition capacity. All solid-state relays shall have a provision for an electrical interlock with the circulation pump motor starter.

2. Mechanical Relays

a. The controller shall come with a total of 5 mechanical relays:

- 1) 1 integral 8A dry contact mechanical relay, and
- 2) 4 integral 3A dry contact or line powered mechanical relays.
- 3) Since mechanical relays have the inherent risk of failing in the closed (active) position, as a safety measure the controller shall preclude the ability to assign any of the integral mechanical relays to chemical feed functions. Systems that do not preclude mechanical relays from being configured for chemical feeds shall not be considered equal. All mechanical relays shall have a provision for an electrical interlock with the circulation pump motor starter.

3. Expansion Relay Outputs

- a. The controller shall be capable of expanding the number of relay outputs available by adding up to 3 expansion modules in any combination.

4. Solid-State Relay Expansion Modules

- a. Each Solid-State Relay Expansion Module provides 5 integral 5A

solid state dry contact or line powered relays capable of switching 3A under all normal operating conditions. Systems that utilize relays that are not de-rated must submit an engineering evaluation justifying the use of relays at their full, optimal-condition capacity. All solid-state relays shall have a provision for an electrical interlock with the circulation pump motor starter.

5. Mechanical Relay Expansion Modules

- a. Each Mechanical Relay Expansion Module provides 5 integral mechanical relays:
 - 1) 1 integral 8A dry contact mechanical relay, and
 - 2) 4 integral 3A dry contact or line powered mechanical relays.
 - 3) Since mechanical relays have the inherent risk of failing in the closed (active) position, as a safety measure the controller shall preclude the ability to assign any of the integral mechanical relays to chemical feed functions. Systems that do not preclude mechanical relays from being configured for chemical feeds shall not be considered equal. All mechanical relays shall have a provision for an electrical interlock with the circulation pump motor starter.

6. 4-20mA Outputs

- a. The controller shall come with eight separately isolated 4-20mA output signals with a load capacity of 440 Ω per output channel. Each output signal shall be independently configurable for either of the following functions:
 - 1) Any enabled input, scaled between two operator-defined end points,
 - 2) VFD control of recirculation pump.

H. Safety Features

1. Manual-On limit

- a. The controller shall have built-in limits to the amount of time any relay control output may be forced on (i.e. in "Manual On" mode). This is an important safety feature to prevent control outputs from inadvertently being left forced on after service or diagnostics.

2. High/Low Alarm Settings & Control Lockouts

- a. The controller shall have programmable high and low alarm settings for pH, ORP, PPM, temperature, low flow & no flow and chemical overfeed, turbidity, pressure & vacuum, surge tank levels, chemical inventory. The controller shall have a programmable lockout of sanitizer feed upon pH high or low alarm.

3. No Flow Alarm & Flow Restored Delay

- a. The controller shall activate a No Flow alarm when the dedicated sample stream flow switch indicates there is insufficient flow through the sample stream. This No Flow alarm shall lockout all chemical feed control operations. The controller shall include a Flow Restored Delay, which shall extend the No Flow lockout user-programmable amount of time after the No Flow alarm ends (i.e. flow is restored). This feature is necessary to assure that the system has valid, stable sensor readings of circulating water prior to making chemical feed control decisions.
4. Feed Limit Alarms
 - a. The controller shall trigger a FailSafe alarm if a chemical feed relay remains on longer than the programmable Feed Limit Timer. Chemical feeds shall automatically be disabled if the corresponding reading goes into a FailSafe alarm condition.
5. Emergency Off
 - a. The controller shall have a dedicated Emergency Off button on the front panel of the system, which immediately halts all chemical feeds and control outputs when pressed. This feature shall be password protectable, which shall require entry of one of the Security passwords.
6. Safety shield
 - a. The controller shall include a safety shield or other mechanism for allowing fuse replacement without access to high voltage circuitry or wiring.
- I. Security
 1. The controller shall have three security password levels: six for operators, two for managers and one for the distributor providing for a history of access identified by the user.
- J. Data Logging
 1. The controller shall have 512K battery backed-up RAM for input level recording and events. All input level shall be recorded for 10 to 56 days depending on sample rate (2 to 10 minutes).
 2. The controller shall record and maintain the latest 1100 events over a maximum of 14 days recording all alarms, parameter changes, user logins, and operational cycles related to all control features.
- K. Local Alarms Indicators
 1. The controller shall signal all alarm conditions with the following indicators:
 - a. A bright red flashing LED on the front of the controller,
 - b. Activation of a master alarm signal provided as a dry contact relay enabling the use of 0-240 VAC alarms, and
 - c. Each active alarm listed on the LCD display along with time activated.

L. Remote Communication, Access & Alarm Notification

1. Ethernet

- a. The controller shall come with a standard, integral 100BaseT Ethernet connection. The controller shall be capable of providing Remote Access via PC with Ethernet connection and Alarm Notification via email or text message via an Ethernet connection to the Internet.

2. Remote Access

- a. The controller manufacturer shall provide ~~(AM#0002) >BEC Sys for Windows <(AM#0002)~~ graphical remote operation software, for interactive connection to the controller from a PC. Remote operation software shall be Vista-compatible, and have all of the following operational modes:

1) Site Data Base - for organizing and accessing multiple controllers on site, or at multiple sites.

2) Graphical Operator's Console - to display current readings, setpoints, alarm points and control status in an easy-to-read graphical mode.

3) Data Log Graphing - to review data logs with time-synchronized event data; data log traces shall be configurable, with color and line style selectable by operator.

4) Full Menu Tree - All system parameters accessible through a full menu tree interface.

5) Auto-Polling - to allow automatic download of data logs from all controllers in site database.

3. Alarm Notification

- a. The controller shall be capable of providing alarm notification to 8 different recipients. Each recipient shall be individually configurable to receive alarm notification by one of the following methods.

1) Email: Notification message shall include system type, serial number, location, system ID, and all active alarm including the date and time each alarm was triggered.

2) Text Message: Notification message shall include system type, serial number, location, system ID, and all active alarm including the date and time each alarm was triggered.

3) Fax: Notification message shall include system type, serial number, location, system ID, and all active alarm including the date and time each alarm was triggered.

4) Numeric Pager: Notification message shall include callback number. Controller shall acknowledge pager notification when callback is received, and not notify subsequent recipients programmed for pager notification.

4. Ethernet with MODBUS TCP/IP: The controller shall come with a standard, integral 100BaseT Ethernet connection that supports a MODBUS TCP/IP connection to 3rd party applications such as EMS, BMS, BAC and SCADA systems. The MODBUS TCP/IP connection shall support access to Inputs (current readings), System Information, Set Points, Alarm Points, Control Status and Alarms. Set Points and Alarm Points shall be modifiable from the 3rd party application via the MODBUS TCP/IP interface.

5. Wi-Fi

- a. The controller shall come with a (AM#0002)>BECSys<(AM#0002) Wi-Fi module, which allows wireless integration into existing Wi-Fi networks.

- M. Enclosures

1. The controller shall be housed in a NEMA 4X polycarbonate enclosure.

2. Field wiring enclosure. All high voltage field wiring shall be through a separate NEMA 4X enclosure that precludes access to controller electronics. All high voltage connections shall be clearly identified, and a field wiring diagram shall be provided with the controller for installer reference. All controller high-voltage relay assignment parameters shall be programmed at the factory prior to delivery to installation location.

- N. Flow Cell

1. PVC flow cell

- a. The flow cell shall have a PVC body with two ½" NPT ports for pH and ORP sensors, two ¼"NPT ports for temperature sensor and sensor wash acid injection, and a clear acrylic front viewing window. The flowcell design shall provide precise sample flow rate and water velocity regulation past the probes. The flowcell shall come provided with PVC ½" isolation ball valves, PVC ¼" wet test valve and standard reed or optional rotary flow switch.
 - b. Each flow cell shall be equipped with a pressure-sensing device. The pressure sensor shall consist of a compound pressure/vacuum gauge manufactured in stainless steel, 2 ½" diameter, liquid filled with an operating pressure range of 0 to 60 psig and vacuum of 0 to -30 in./ Hg.

2. Lighted flow cell

- a. The flow cell shall have a polyethylene body with two ½" NPT ports for pH and ORP sensors, two ¼"NPT ports for temperature sensor and sensor wash acid injection, integrated flow switch and clear acrylic front viewing windows. The flow cell shall also include a port for the CP-1 free chlorine sensor, if present. The flow cell shall be backlit to support inspection of sensors, and red LEDs shall illuminate to indicate a No Flow condition. The flow cell design shall provide precise sample flow rate and water velocity regulation past the sensors. The flow cell shall come provided with PVC ½" isolation ball valves and PVC ¼" wet test valve.

- b. Each flowcell shall be equipped with a pressure-sensing device. The pressure sensor shall consist of a compound pressure/vacuum gauge manufactured in stainless steel, 2 ½" diameter, liquid filled with an operating pressure range of 0 to 60 psig and vacuum of 0 to -30 in./ Hg.

O. Start-up and Manuals

- 1. The control system shall be provided with on-site start-up, on-site operator training, and 1-year on-site warranty service performed by a representative trained and authorized by the controller manufacturer.
- 2. Manufacturer shall supply an Operation and Maintenance Manual describing features, operating instructions, maintenance procedures and replacement parts.

2.8 FLOW METERS

A. Flow Meter

- 1. Flow meters (2 required) shall be installed according to the manufacturer in the filtered water return lines to each of the pools. ~~(AM#0002) >Flow sensor shall be the GF Signet 2551 insertion magmeter.<~~ (AM#0002) Provide the coaxial cable from the sensor to the display/transmitter. Flow meter accuracy shall be +/- 2% of reading.
- 2. Backwash piping flow meter (2 required) shall be a pilot, impact ball, variable area type with one piece, impact resistant machined acrylic plastic body. GPM scale to be permanently etched or imprinted on the meter. Flow rate indicator to be of stainless-steel material. Scale range to be appropriate for specific flow rate. Pipe size to accommodate backwash rate. ~~(AM#0002) >Backwash piping flow meter shall be BLUE WHITE series F 300 or approved equal.<~~ (AM#0002)

B. Refill Flow Meter

- 1. Refill flow meter (2 required) shall be installed on dilution piping to backwash tank. Flow meter shall be one-piece meter body of injected molded polysulfone adapters, viton o-ring seals, and 316L stainless steel floats and float guide, impact resistant machined acrylic plastic body. GPM scale to be permanently etched or imprinted on the meter. Flow rate indicator to be of stainless-steel material. Scale range to be appropriate for specific flow rate. ~~(AM#0002) >Manufacturer shall be BLUE WHITE or approved equal Model F 45750L 12, 3/4" M/NPT @ 1.0 to 10.0 GPM.<~~ (AM#0002)

2.9 WATER LEVEL CONTROLLERS

A. In Surge Tank Water Level Controller

- 1. Provide a water level sensing and control system for each of the Training Tanks that will monitor the water level in the surge tank and automatically activate the auto water make-up control valve. For sensing water level and activating make-up water control valve for each pool, use ~~(AM#0002) >Series ELC 810<~~ (AM#0002) Controller housed in a watertight NEMA 4X UL94 5V UL flammability rated polycarbonate enclosure to meet IP66 and NEMA 4, 4X, 12 and 13 ratings. The Controller shall utilize two sensor(s) to control water level.

(AM#0002) > ~~ELC-810 S~~series< (AM#0002) shall have a menu-driven LCD display screen and utilize a five-switch user interface for navigation through the menu. The menu shall allow changing the following settings: delay to shutoff, alternate sensor option, maximum time on, manual override, delay to normal, type of sensor, high level option, flow sensor active, and sounder with alarm. All menu settings shall be capable of password protection. The Controller shall be capable of displaying the following data: last fill time, last drain time, last alarm. The Controller shall be capable of determining the following: maximum time on exceeded, over current to solenoid valve, no valve/valve wiring problem, and sensor not working properly. The Controller shall have a low voltage interlock with auto water make-up solenoid valve, shall provide adjustable time delay for increasing level and manual override; and shall require 115 VAC, 1 phase, 60 Hz power. Manufactured by AquatiControl Technology, (AM#0002) > ~~Model- ELC-810 DS-ST-XXX~~ < (AM#0002 (Contractor to coordinate the specific length(s) of cable required for each controller prior to ordering). Refer to drawings for additional information. Provided and installed by CONTRACTOR and connected by electrical.

2. Provide a solenoid valve for high level sensor, normally opened, stainless steel fitted, bronze body, 24 VAC slow closing type. Size to pipe. Interlock with automatic water level control system. Refer to the Drawings for additional information. (AM#0002) > Such as ASCO or approved equal. < (AM#0002)
3. Provide a proximity switch sensor that shall be sensitive to within +/- 1/8" (4mm) of nominal water level. Supply voltage to sensor shall be 12V to 24V DC from Controller. Current consumption shall be < or = 15mA. Response frequency shall be 100Hz. Maximum control output shall be 200mA. Sensor operating temperature shall be -25 Deg. C to 70 Deg. C. Operating humidity shall range from 35% RH to 95% RH. Sensor shall be mounted in a 1" SCH80 PVC pipe (length to be determined by depth of surge tank). Sensing pipe to be mounted to surge tank wall with composite/non-metallic hangers and stainless-steel hardware. Sensing pipe shall be capable of being submerged under water safely. Refer to drawings for additional information.
4. Wiring from the sensor to the Controller shall be provided and shall be connected to the terminal points mounted within a corrosion-resistant, nonmetallic NEMA 4X enclosure. All wiring connections shall be made through the bottom of the enclosure. The enclosure size shall be no less than 8" wide x 5" high x 4" deep. The access door shall be the entire front face panel of the enclosure. Confirm location in field.
5. Major components shall be plugged in using WAGO terminal blocks for ease of installation and replacement. Unit shall be designed to activate a 24-volt AC solenoid valve.
6. Provide a make-up water solenoid valve, normally closed, stainless steel fitted, bronze body, 24 VAC slow closing type. Size to pipe. Interlock with automatic water level control system. Refer to the Drawings for additional information. (AM#0002) > Such as ASCO or approved equal. < (AM#0002)
7. Discharge of make-up water shall be into a fill standpipe and piping to the Competition Pools. Refer to the Drawings for additional information.

2.10 INSERTS AND ANCHOR SOCKETS

A. Sockets and anchors shall be provided as stainless steel or cast bronze for swimming pool accessories. The CONTRACTOR shall confirm compatibility of deck equipment and deck anchors with the deck equipment manufacturer. All anchors or sockets shall be provided with flush closure caps and escutcheons with set screws where indicated. Escutcheons shall be of the keyhole or oblong shape, similar to the casted, electro-polished stainless-steel escutcheon with set screw ~~(AM#0002) >by Paragon #28303SS or approved equal.~~ <(AM#0002)

1. Anchor sockets for all railings and grab rails shall be of the wedge type, cast bronze, 4 inches in depth and made to receive 1.50-inch OD tubing ~~(AM#0002) >as manufactured by Paragon #28105, or approved equal.~~ <(AM#0002) The wedge shall be cast bronze, incorporate a stainless-steel tightening bolt and flat washer, and be designed as the sacrificial element to the anchor system. All metallic components shall be passivated, in compliance with ASTM A967-99, incorporating organic acid passivation techniques for maximum corrosion resistance.
2. Anchor sockets for all stanchions shall be of cast bronze, sized to receive a full 6 inches penetration of 1.900-inch OD tubing ~~(AM#0002) >as manufactured by Paragon Aquatics Catalog No. 38201TC, Spectrum Products No. 23626, Kiefer No. 700103, or approved equal.~~ Each anchor socket is to be provided with a flush threaded, vandal proof closure cap ~~Paragon Aquatics Catalog No. 38201TC or Spectrum Products No. 23628, or Kiefer No. 700103C,~~ and a grounding lug with screw. Provide ~~Paragon Aquatics catalog no. 38303, Spectrum Products catalog no. 23630, Kiefer No. 700103K, or approved equal~~ <(AM#0002) spanner wrenches for removing the closure cap.
3. Cup anchors for floating lane lines and tethers points shall be incorporated into the perimeter overflow system. Cup anchors shall be 316L stainless steel with stainless steel threaded eyebolts. The heavy-duty cup anchors shall be 3-3/8" in diameter. ~~(AM#0002) >Cup anchors shall be Spectrum round cup anchor, part no. 58316, SR Smith-Lane Line Wall Anchor, part no. WA 100, or approved equal.~~ <(AM#0002)
4. Anchors for bulkhead locations shall be provided by the bulkhead manufacturer and installed into the gutter system by the CONTRACTOR where shown on drawings.
5. Recessed steps shall be a single molding of white ABS with an integral slip resistant tread surface. The step shall be 16.5 in. wide by 6 in. deep. All portions of the backside shall be completely filled with non-shrink grout and set into the wall block-out and mortared in with non-shrink grout. ~~(AM#0002) >Step by KDI Paragon, S.R. Smith, or approved equal.~~ <(AM#0002)

2.11 DECK EQUIPMENT

A. Stainless Steel Powder Coating

1. Provide powder coating for all stainless-steel rail goods in pool natatorium. Base metal shall be prepared in accordance with manufacturer recommendations to ensure proper primer adhesion. Base metal shall be coated with a zinc rich primer with a thickness ranging from 2- 2.5 mil. Primer coat shall be covered with specified color base

coat of exterior grade TGIC polyester powder with a thickness ranging from 2-2.5 mil.. Base coat shall be covered with an exterior grade TGIC polyester clear coat with a thickness range of 1-2 mil. All coating layers shall be baked in a manner ensuring successful cross linking of all layers. The total thickness of the final coating shall be between 5 and 7 mil over the entire part surface. Colors shall be selected by Contracting Officer..1.

(AM#0002) >

~~2. The coating shall be manufactured by Spectrum Products 800 791 8056 or an approved equal.1.~~ < (AM#0002)

B. Grab rails shall be provided as required in the quantities and to the dimensions as shown on the drawings. Grab rails shall be fabricated of one continuous length of polished and buffed tubing. The tubing shall be

ASTM A554 grade 316L stainless steel, 1.50-inch OD x .120-inch minimum wall thickness, polished and buffed to 320 grit finish and shall be passivated, in compliance with ASTM A967-99, incorporating organic acid passivation techniques for maximum corrosion resistance. All bends shall be smooth and free of wrinkles. Grab rails shall be pretzel bend style with dimensions as indicated in the plans ~~-(AM#0002) >and as manufactured by Spectrum, SR Smith, Paragon, or approved equal.~~ < (AM#0002)

C. Stanchion posts (backstroke) shall be provided as required and in the quantities shown on the drawings. The posts shall be a straight length of type 316L stainless steel tubing, 1.900 in. OD x .145 in. wall thickness x 8 ft. 0 in. overall length, polished and buffed to 320 grit finish.

Stanchions shall be capped at one end with a closure plug containing a U-shaped hook and fitted with a stainless-steel eyebolt attached to an adjustable nickel-plated bronze sliding collar. ~~(AM#0002) >Stanchion shall be as manufactured by Paragon Aquatics, catalog no. 38106, or Spectrum Products catalog no. 23614 with Paragon Aquatics catalog no. 38301 or Spectrum Products catalog no. 23625, sliding collar, with eyebolt or approved equal.~~ < (AM#0002)

D. Lifeguard Chairs

1. Lifeguard chairs shall be constructed of UV inhibited recycled HDPE chairs. Maximum seat height shall be (AM#0002) >36"/48" / and 66" above the pool deck. All joints shall be secured using T- 316L stainless steel screws. Chair shall include umbrella guide and holders. Refer to (AM#0002) >architect Contracting Officer <(AM#0002) for color finish.

b. Lifeguard chairs (AM#0002) >(89 required at 48" seat height) ~~shall be Spectrum Mendota #45023, Tailwind Furniture model no. LG510, Kiefer Forever Guard Chair model no. 500231, SR Smith Sentry #SLGC42, or approved equal.~~

c. Lifeguard chairs (4* required at 66" seat height) ~~shall be Spectrum Mendota #47747, Tailwind Furniture model no. LG515, Kiefer Forever Guard Chair model no. 500230, SR Smith Sentry #SLGC42, or approved equal.~~ < (AM#0002)

E. Surge tank access hatch (2 required) shall be provided as shown on the drawings. The access hatch shall be a single door 3 ft.-2 in. x 2 ft.6 in with 1" fillable pan to receive ceramic tile and grout or concrete fill to match the surrounding deck. The frame shall be ¼ inch extruded aluminum with built in neoprene cushion and continuous anchor flange. Door shall be ¼" aluminum plate reinforced with aluminum stiffeners as required.

Door shall be equipped with heavy continuous stainless-steel hinges and shall have compression spring operators for easy operation. Door shall open to 90 degrees and lock automatically in that position. Door shall be built to withstand a live load of 150 lbs. per square foot and equipped with a continuous Type 316L stainless steel hinge, tubular type, and an automatic hold open arm with release handle. All hardware is to be type 316L, 18-8, stainless steel. A flush lift handle and a snap lock with removable key wrench shall be provided. Factory finish shall be mill finish with bituminous coating applied to the exterior of the frame. The access door shall be Type TER-3 single leaf pan type door ~~-(AM#0002) >as-~~ ~~manufactured by the Bileo Company.~~ <(AM#0002) >

F. Surge tank and backwash catch basin ladder rungs shall be ½ inch Grade 60 steel encased with co-polymer polypropylene plastic. (AM#0002) >as- ~~manufactured by M.A. Industries, Inc, phone 770-487-7761~~ <(AM#0002)

G. Provided a ship's ladder in the size and shape shown on the drawings. Ladder shall be aluminum with aluminum stiffeners if required by OSHA.

2.12 LOOSE EQUIPMENT

A. Competition floating lane ropes shall be as shown on the drawings and described in these specifications. Floating lane ropes shall be a non-turbulent type with wave quelling floats and 3/16" stainless steel coated cable. Floats shall be injection-molded polyethylene. Colors to alternate the length of the pool with a contrasting solid color for the final 15 feet (Contracting Officer to select colors). All floating lane ropes shall be provided as completely assembled and installed with take up reel, type 304 stainless steel spring and cable lock, hooks, and wrench. 5/8" wrench shall be made of a forged steel shaft with a polished chrome finish. The take up reel shall be constructed of type 304 stainless steel. The spool shall be a bronze nickel-plated casting with a nylon sleeve. (AM#0002) > ~~Floating lane ropes shall be similar to Competitor Swim Products, Competitor 4" Racing Lanes, Kiefer Advantage I (4.5, or Anti Wave ForeRunner (4.75")), Pre-assembled and sized to fit the length of the pool. Provide Competitor~~ <(AM#0002) lane rope extension hooks as detailed on the drawings complete with protective sleeve. Floating lane ropes with disconnects for shorter distance is acceptable. Provide contrasting disks located 15 meters from each end to meet resurfacing requirement. This requirement shall be met for each possible course length.

Quantities:

Competition Pool:

- Provide 44 at 25 meters
- Provide 22 at 50 meters
- Provide 10 additional extension hooks
- Provide one spare floating lane rope that can accommodate all race courses (disconnects are acceptable)

B. Backstroke flags:

1. Backstroke flags shall be made of Nylon material, triangular in shape (12" wide x 17" long), and alternating in color, and sewn onto a Nylon tape. Additional tape shall be provided at both ends for fastening to the stanchions. Submit samples for review and approval. (AM#0002) > ~~Equipment shall be Kiefer Nylon Backstroke Flags, #600120, or approved equal.~~ <(AM#0002)

C. Lane rope storage reel shall be fabricated from two powder-coated enclosed aluminum wheels joined together by a 1-1/4-inch aluminum axle. This unit must ride easily on four 6" stainless steel casters with individual brakes. The reel shall have a collapsible tow handle for safe movability. The storage reel should be able to hold 902' of 4" lane ropes or 492' of 6" lane ropes. The CONTRACTOR is responsible for assembly. The correct number of storage reels shall be provided to store all lane line markers. ~~(AM#0002) > Lane line storage reel to be Competitor Swim Products Elite Stor Lane Reel, Catalog #200-850 with Competitor storage reel cover, catalog #200-861, or approved equal. < (AM#0002)~~

D. Pace Clocks

1. Battery powered pace clock (2 required) shall be a portable type with stand, 31-inch octagonal face with a stabilizing foot and a built-in recessed handle. ~~(AM#0002) > The pace clock shall be the Kiefer, 31" pace clock, catalog #210403 or approved equal. < (AM#0002)~~ Color selections shall be made by the Contracting Officer.

E. Lifeline shall be 3/4 inch blue and white polyethylene rope with floats that are 5-inch diameter by 9-inch-long. Floats to be spaced on five-foot centers. All metallic rope hooks shall be stainless steel. Provide lifeline at five-foot break between shallow and deep water as shown on the drawings. ~~(AM#0002) > Lifeline to be equal to Recreonics no. 14-381.BW or Lincoln Aquatics 44-115 safety line rope, Recreonics no. 14-381 or Lincoln Aquatics 44-190 locking 5" x 9" floats, and Recreonics no. 14-456 or Lincoln Aquatics 44-125 rope end hooks. < (AM#0002)~~

F. T-wrench for operation of valve extensions shall be fabricated of 3/4" diameter SCH 40 stainless steel pipe. The T-wrench shall be 4'-0" in length with a 24" long welded "T" handle. The wrench shall be fitted with a 3/4" square stainless-steel male end, 1" in length, for operation of valve extensions at the surge tank. Two complete T-wrenches shall be provided.

2.13 MAINTENANCE EQUIPMENT

A. The following items are to be supplied by the CONTRACTOR unless otherwise noted. All proprietary names are to designate performance only. Equal products will be accepted.

1. Wall brush (4 required) - Brush backing shall be a flexible polyethylene material with five (5) rows of nylon bristles. Pool brush holder shall be permanent mold cast aluminum with hydrofoil flap. Holder shall have stainless steel screws to facilitate brush changes. Handle bracket shall be quick detachable mount to fit standard 1 1/4 or 1 1/2 inch diameter handles. ~~(AM#0002) > Brush to be Recreonics no. 10-135, Lincoln Aquatics 31-020, or approved equal. < (AM#0002)~~
2. Skimming net (4 required) - Skimmer head shall consist of one-piece molded plastic frame with a reinforced, integral handle bracket suitable for quick attachment to a standard 1 1/4 or 1 1/2 inch diameter handle using bolts and wing nut. The standard nylon net shall be attached to the frame using the groove and spline method. Net depth shall be 4 inches minimum in the center. Skimmer net shall be manufactured by Skimlife No. SS8 or approved equal.
3. Telescopic Poles (8 required) - Cleaning tool handle shall be of the telescopic design and fabricated from corrosion resistant, high-quality anodized aluminum. Poles shall be fully adjustable, to desired length,

with a simple twist of a cycolac threaded locking device. Poles shall consist of a 1-inch tube fitted inside a 1¼ inch tube and be adjustable from a range of 8 ft. to 16 ft. Handle shall be adjustable from 8 ft. to approximately 16 ft. having a threaded bushing type clamp to lock handle at desired position. ~~(AM#0002) >Poles shall be manufactured by Pool King or approved equal.~~ <(AM#0002)

4. Portable Vacuum Poles

- a. Telescopic poles fiberglass poles (1 required) - Vacuum head attachment poles are to have a super-tough 1¼ inch fiberglass handle. Poles are to be 8 ft. each, totaling a 24 ft. length for vacuum head attachment. ~~(AM#0002) >Poles are to be Recreonics No. 10-370 with quick change adapter Recreonics no. 10-374 or approved equal.~~ <(AM#0002)

5. Test Kits

- a. Provide two (2) test kits

- 1) The first test kit shall feature liquid reagents, color comparator, waterproofing instructions and treatment charts, chemistry guide and water gram. Test kit to have the ability to test for free and total chlorine (0.5 - 5.0 ppm), bromine (1-10 ppm), pH (7.0 - 8.0), acid and base demand, total alkalinity, calcium hardness and cyanuric acid. ~~(AM#0002) >Test kit shall be Taylor Complete 2005 test kit or approved equal.~~ <(AM#0002)

- 2) The second test kit shall be photometric and utilize tablet reagents for stability that will allow accurate measurement of free and total chlorine (0-10 ppm), bromine, pH, alkalinity, calcium hardness, and cyanuric acid. The test kit shall have solid-state digital electronics and built-in filters. The test kit shall be direct-reading with automatic blank settings, automatic power cut-off, and store the last 10 results in nonvolatile memory. Test kit shall be ~~(AM#0002) >a Pooltest 6 system based on the Palintest system of water analysis. Provide SPH 006D Pooltest 6 Hard Carry Case Kit and SPC 006 Check Standard or AquaPRO 6 Test Kit manufactured by Orbeo Hellige Inc. and Reference Standard Kit (LP275680).~~ <(AM#0002)

6. Vacuum Cleaner

- a. Vacuum cleaner (filtered water return to pool) - (2 required) to be complete with a 36-inch dual manifold head with 75 feet of 1-1/2-inch floating hose. ~~(AM#0002) >Hose to be Recreonics, catalog no. 10-429, Lincoln Aquatics no. 29-065 or approved equal.~~ <(AM#0002) 24 ft. stainless steel pole shall be available for attachment. The portable cartridge vacuum cleaner system shall include a 155 square foot T-316 stainless steel up-flow single cartridge filter, a 1 HP self-priming thermoplastic self-priming pump 1-1/2-inch suction and discharge connection and 110 cubic inch strainer capacity. ~~(AM#0002) >Cartridge shall be Harmsec no. ST/155 or approved equal.~~ <(AM#0002) The system shall be provided with one spare cartridge filter. The pump motor shall be 115 volt single phase, 60-cycle, open-drip proof and shall be UL and NSF listed. The pump motor shall be provided with a 120-volt Hubbell switch, weather proof switch cover, in-line pre-wired GFCI and a 100' power cord. The cord shall be wired to a 20-amp,

115/230-volt switch which shall be mounted on pump motor. All interconnecting pipe and fittings shall be schedule 40 PVC. The entire assembly shall be bolted to a T-316 stainless steel cart and shall have pneumatic wheels with grease fittings and roller bearing hubs. ~~(AM#0002) >Unit to be Recreonics, catalog no. 10-806, Lincoln Aquatics no. 27-010, or approved equal.~~ < (AM#0002) Accessories shall include a 1-1/2-inch x 25 ft. discharge hose with stainless steel hose clamp. ~~(AM#0002) >Hose to be manufactured by Quaker Plastic Corporation no. QT-131 or approved equal.~~ < (AM#0002)

7. Robotic Pool Cleaner

- 1) Provide two (2) dual motor driven automatic swimming pool vacuum device. Cleaner weighs 49 lbs and has internal water-cooled brushless drive motor with automatic program to clean the pool floor and walls, travelling 1¼ ft per second, scrubbing pool surfaces with onboard rubber brushes and two power-washing jets. Two separate internal oil-cooled, water-cooled, brushless pump motors filter 9,600 GPH, vacuuming a 3 ft wide path using four offset 5½ square inch suction inlets underneath, filtering fine debris <10 microns small and solids as large as 1½ inch into two internal reusable filter bags. Solid ½" 316 stainless steel axles extend the length of the cleaner connecting to a commercial-grade drive-train with Kevlar reinforced drive belts. Stainless steel reinforced side plates are capped with soft gray tracking wheels for durability and corner and curve tracking agility. Unit complete with remote control, air sensor, UltraKart, 120 ft cord, set of SK3016BL deep clean super brushes (for most surfaces), 2 filter bags, digital timer, power supply with 24-volt transformer, 1-hour cleaning cycle delay option, operator manual. Requires 110-volt GFCI receptacle onsite, consumes 5 amps electricity. ~~(AM#0002) >The pool cleaner shall be a DuraMax Duo as manufactured by Aqua Products, Inc., or approved equal.~~ < (AM#0002) Include with 150 ft cord optional. Optional standard or raised high infrared (if needed to detect large obstacles or bulkheads).

8. Stainless Steel Cleaner - Provide a stainless-steel cleaner. The cleaner shall comprise of one (1) gallon of organic passivation solution. It shall be complete with instructions for proper maintenance of stainless-steel surfaces and material safety data sheets for the passivation solution. ~~(AM#0002) >The cleaner shall be the Spectra Clean System 2 as manufactured by Spectrum Products.~~ < (AM#0002) Product to be applied with 3M scouring pad, or equivalent.

2.14 SAFETY EQUIPMENT

A. The following items are to be supplied by the CONTRACTOR unless otherwise noted. All proprietary names are to designate performance only. Equal products will be accepted.

1. Ring buoy and extension rope (6 required) - Buoy shall be 24-inch diameter vinyl clad PVC foam with a metal ring molded inside. Buoy shall have a 3/8-inch polyethylene rope attached to it at four points and be a minimum 60 feet in length. Preserver shall be U.S.C.G. approved. Buoy and rope to be mounted at each lifeguard chair on hooks. ~~(AM#0002) >Ring buoy to be manufactured by Cal June no. C-24 WH or approved equal. Throw rope to be Recreonics no. 12-261, Lincoln Aquatics No. 42-050, or approved equal.~~ < (AM#0002)

2. Life hook and fiberglass pole (4 required) - Life hook shall be an anodized aluminum 3/8-inch OD "shepherd's crook" with a 1-1/8-inch OD handle attachment suitable for a 1¼-inch 16 ft. fiberglass extension pole. Each life hook shall be provided with a separate 16 ft pole. Hook shall be of looped construction. Each pole to be provided with a set of spring type stainless steel pole clamps for mounting on each lifeguard chair. ~~(AM#0002) > Life hook shall be manufactured by Rainbow no. 153 or approved equal. Pole clamps shall be Recreonics no. 10-353, or approved equal, and fiberglass poles shall be equal to Recreonics no. 10-372.~~ < (AM#0002)
3. Spineboards (2 required) - Spineboard shall be 72" long x 20" wide, constructed of 100% virgin high density polyethylene. The design shall provide stiffness and torsional rigidity while remaining lightweight. The spineboard shall accommodate up to 500 lbs and shall feature customizable buoyancy that allows users to adjust the buoyancy by inserting polyethylene foam rods (supplied with the spineboard). There shall be (10) handholds around the perimeter of the board. The spineboard shall be supplied with one (1) 2-piece head immobilizer, one (1) head strap, four (4) body straps, one (1) head immobilizer with head bed, and two (2) flotation rods. ~~(AM#0002) > The spineboard shall be CJ Rescue 6 package as manufactured by CJ spineboard at 1-206-824-8886 or approved equal.~~ < (AM#0002) The CONTRACTOR shall provide one (1) set of heavy-duty stainless-steel utility hooks per spineboard for storing the spineboard at a convenient and readily accessible location near the pool < (AM#0002) > ~~(Recreonics catalog no. 10-362).~~ < (AM#0002)
4. Rescue tube (12 required) - Provide one rescue tube for each lifeguard chair. ~~(AM#0002) > Rescue tube to be Recreonics No. 12-303 or approved equal.~~ < (AM#0002)
5. Safety eyeglasses - Provided a safety eyeglass dispenser station containing ten (10) pairs of safety glasses. Eyeglasses shall be ANSI/OSHA accepted ~~(AM#0002) > and be equal to Lab Safety Supply Inc. (1-800-356-0783) no. WQ-14740B.~~ < (AM#0002)
6. Bag Valve Masks - Provide two (2) bag valve mask assistant resuscitation systems, one size Adult (1500ml tidal volume) and one size Infant/Child (450ml tidal volume). Product shall be a latex free disposable bag mask unit with support strap, transparent patient valve, and textured surface to eliminate slipping. Integral swivel valve, available with a closed reservoir system. Standard pack includes resuscitator, oxygen reservoir and a transparent bag for storage. ~~(AM#0002) > Bag Valve Masks shall be Ambu SPUR II or approved equal.~~ < (AM#0002)
7. AED - Provide two (2) Automated External Defibrillator and one (1) trainer AED corresponding to the chosen AED per facility level for the aquatic facility. Product location shall be coordinated with the Contracting Officer. ~~(AM#0002) > AED shall be Recreonics No. 12-430, Lincoln Aquatics No. 48-013, or approved equal and must have an available training AED device. AED Cabinet shall be Recreonics No. 12-434, Lincoln Aquatics No. 48-023, or approved equal.~~ < (AM#0002)

2.15 THERMOMETERS

- A. The following items are to be supplied by the CONTRACTOR unless

otherwise noted. All proprietary names are to designate performance only. Equal products will be accepted.

1. Portable thermometer (2 required) shall be a molded ABS plastic tube body type with the ability to measure temperature in both degrees Fahrenheit and Celsius. A 3 ft. polyethylene cord is to be attached to thermometer. ~~(AM#0002) > Thermometer is to be manufactured by Pac Fab/Rainbow no. R141036 or approved equal. < (AM#0002)~~
2. Inline thermometer to be near the heating loop and shall have a 9-inch adjustable angle with a minimum 6-inch stem. There shall be a minimum of two (2) thermometers per loop and must have ability to read temperature in both degrees Fahrenheit and Celsius. ~~(AM#0002) > Thermometers are to be Recreonics no. 32-702, Lincoln Aquatics no. 21-125, or approved equal. < (AM#0002)~~

2.16 SWIMMING POOL FINISHES

A. Paint

1. Scope consist of the interior surfaces of the gutter trough and surge tank shall be coated with a high build epoxy. The color shall be white.
2. Coating shall be a low VOC compliant polyamidoamine epoxy suitable for chlorinated water below 3.2 ppm for installation on concrete surfaces. CONTRACTOR shall provide on-site technical services and approval from the coating manufacturer prior to application and during the coating application. ~~(AM#0002) > Coating shall be Tnemec Series 161HS, Induron Perma Clean II Semi Gloss or approved equal. < (AM#0002)~~ Color shall be white.

3. Surface Preparation

a. Cast-In-Place Concrete

1) Allow concrete to cure a minimum of 28 days at 60 deg. F. Brush-off pool interior surfaces, then blast clean to remove laitance and weak surface concrete to produce an anchor profile similar to medium grade sandpaper referencing SSPC-SP13/NACE 6, ICRI-CSP 2-4 Surface Preparation of Concrete. Blasting shall open up surface voids, holes and irregularities. No holes or holidays in the paint membrane will be allowed. Fill with ~~(AM#0002) > an approved~~ grout or ~~Tnemec Series 215 s~~ Surfacing Epoxy, or ~~Induron EFS707~~ ~~< (AM#0002)~~ Epoxy Surfacer and Filler, any hole or irregularity that cannot be satisfactorily painted. Do not entirely remove the surface or completely expose underlying aggregate. After blasting, neutralize concrete with a solution of 2 cups aqua ammonia per 5 gallons of water. Flush with clean water and allow to thoroughly dry.

4. Application Procedures

- a. Before applying any material, measure and record the temperature and relative humidity. Apply only if temperature is above 55 deg. F. and at no lower temperature than 5 deg. F. above the dew point. Do not apply when the relative humidity is greater than 85%. If possible, plan the painting schedule so that all painting is done in the coolest part of the day. Provide proper

ventilation so that paint fumes do not become concentrated.

5. Application of the Primer

- a. After the pool surface has been thoroughly dried and cleaned the primer coat can be applied. Surface spreading rate shall be observed as not to exceed the recommended manufacturer's rate of application. The primer will be applied at a minimum rate of 200 SF per gallon and shall conform to local VOC requirements. A good heavy coat shall be applied. A rough or porous concrete pool will require more paint than recommended. On particularly rough surfaces two coats are recommended in order to provide a smooth, uniform finish. Note: Any marks or irregularities that show through the primer will also be apparent when the finish coat is applied.

- 6. Application will be made by brush, roll, lambs wool applicator, or spray. When the finish coat is to be a color other than white the primer will be tinted.

7. Application of the Finish

- a. After the primer is dry enough to walk on without removing or marking surface, apply the finish coat(s) in accordance with the manufacturer's instructions. Application shall be done by the use of a brush, roller, lamb's wool applicator, or spray methods at a rate of 150-250 SF per gallon. Allow a minimum of 5 hours (at 75 deg. F) drying time between coats. Two coats of finish paint are recommended to improve upon general appearance of pool shell. Allow 7 days curing (at 77 deg. F.) before filling the pool.

- 8. Application of pool striping, depth markings, warning signs and wall targets, shall be done after final coat of finish paint has cured for at least 24 hours.

- 9. Slip resistant additive shall be applied to the all outdoor areas, entry steps, ramp areas, zero entry and all deck markings.

- 10. Final paint coating shall be allowed to dry a minimum of 7 days at 35-degree Fahrenheit or above, before filling the pool.

B. Pool Cementitious Finish- Reference specification section 131104, Swimming Pool Cementitious Finish.

C. Pool Tile - Reference specification section 131103, Swimming Pool Tile.

2.17 SEALANTS

A. Provide sealed expansion joints as shown on the pool and pool structural drawings or noted on the Contractor's construction/expansion joint layout, and as required. Expansion joints shall be constructed and sealed as indicated and in accordance with the manufacturer's recommendation. ~~(AM#0002) >Sealant to be manufactured by LATICRETE International, Inc., Mapei, or Deck-O-Seal.< (AM#0002)~~

1. For submerged joints:

- a. ~~(AM#0002) >Latasil, Oene< (AM#0002)~~ component, neutral cure, high performance, 100% silicone sealant in the color(s) as selected.

Shall be used in conjunction with (AM#0002)>Latasil-9118<(AM#0002) Primer per manufacturer's recommendations.

- b. (AM#0002)>Mapesil-T,<(AM#0002)-100% silicone sealant in the color(s) as selected.
2. For joints behind the coping, or other horizontal deck joints:
 - a. (AM#0002)>Deck-O-Seal,T=two <(AM#0002) component (gun-grade or pourable, self-leveling), high resilience, non sag, non flowing, polysulfide-based sealing compound in the color(s) as selected. Shall be used in conjunction with P/G Primer per manufacture's recommendations.
- B. Material Storage
1. All materials are to be stored in the original unopened factory containers in a cool dry location 60 to 80 degrees F. Protected from the elements and the hazards of construction. Open only as many containers as can be used in any particular period.
- C. Joint Preparation
1. Clean the joints of all deleterious material, to sound, clean and dry substrate.
 2. Joint is to be formed or filled with an approved, resilient, non-asphaltic, closed cell, polyethylene joint filler material down to firm substrate. Allow space at the top of the joint for the installation of (AM#0002)>approved-<(AM#0002) closed cell polyethylene backer rod and install same to the required depth below the surface of the slab to control the depth of the sealant bead to within manufacturer requirements.
- D. Surface Preparation
1. Concrete surfaces to receive sealant must be fully cured, clean, dry and free of dirt, dust and any deleterious material that might compromise the adhesion and performance of the sealant. Curing aids, form release agents and joint former residue must be completely removed, if necessary, by sand blasting and/or grinding. Loose dust must be brushed off.
 2. Prime all surfaces to receive (AM#0002)>Latasil sealant with Latasil-9118 Primer prior to sealant application, and surfaces to receive Deck-O-Seal sealant with P/G<(AM#0002) Primer prior to application.
- E. Application
1. Apply sealant in accordance with the manufacturer's recommendations.
 2. Tool the joint immediately after application to insure a firm, intimate contact with the joint interface.
 3. Remove excess sealant and smears from adjacent surfaces with Xylol or Toluol before sealant cures.
 4. After the sealant has fully cured (generally a minimum period of five days at 72 degrees and 50% humidity), paint the surface of the sealant

with a chlorine resistant chlorinated rubber or equivalent pool paint, (AM#0002) >such as Ramuc, in a compatible color as selected by the Contracting Officer. ~~NOTE: Latasil cannot be painted.~~ <(AM#0002)

2.18 AQUATIC FACILITY MANAGEMENT APPLICATION

- A. Contractor to provide a one-year license and basic start-up training for a CMAHC Certified web-based digital application for managing the aquatic facility. Digital application shall include fully customizable check lists, pool testing documentation with NSPF dosage calculations and MAHC references, MAHC compliant lifeguard in service documentation with the ability to link to employee tracking module, pool closure forms, and incident reports. Web-based digital application shall be Facility Manager (contact Johnathan Nies at 303-323-8527 or online at <https://counsilmanhunsaker.com/shop> or approved equal.)
- B. Contractor shall have web-based digital application representative provide one-hour of online training.
- C. Contractor shall set up web-based digital application in Owners name 30 days prior to facility opening.

2.19 UNDERWATER LIGHTS

- A. Underwater lights shall be equivalent to 500 watts of incandescent light. Underwater lights shall be UL listed and, in the quantities, shown and as detailed in the construction drawings and as described in these specifications. Coordinate for proper installation. Refer to the drawings for quantities and locations.
- B. The pool underwater lights shall be 120VAC, 55 watts LED-type, and equivalent to 500 watts of incandescent light. Fixture housing shall be stainless steel construction with minimum wall thickness of 0.020 inch per UL 676 underwater pool lighting standard. The niche shall be stainless steel with cast brass mounting ring or PVC plastic with stainless steel mounting ring. Brass construction pressure grounding lug on interior and exterior services. Lens shall be 8-3/8 diameter clear tempered heat resistant glass. Gasket to be single-piece "U" shaped santoprene or silicone. Fasteners shall be silicon-bronze or stainless steel. The light fixture shall be supplied with a #16-3 STW (120V) or 12-3 SJTW (12V) submersible cord with ground wire positively grounded inside the fixture. Cord entrance shall be a watertight seal and epoxy encapsulated. Light fixture to be (AM#0002) >IntelliBrite 5g White LED pool light ~~series by Pentair Commercial Pool and Aquatics or approved equal.~~ <(AM#0002) Underwater lights shall be provided with cord length as required to allow for deck relamping of all fixtures.
- C. Junction boxes shall be provided in the quantities required and shall be located at least 8" above the pool coping and 5' from the pool edge. Refer to the Electrical drawings. Cord length shall be sufficient to run from fixture to the junction box with sufficient cable in the niche to re-lamp the fixture on the deck. Junction boxes shall be furnished by the Contractor and installed by Electrical.

2.20 MOVABLE BULKHEAD

- A. Material
 - 1. The CONTRACTOR shall provide and install a horizontal, hybrid

variable/fixed flotation, stainless steel/composite, movable bulkhead (3 required) fabricated to match the design of the end wall gutter. The bulkhead must span the width of the pool. The dimensions are nominally 6 feet 0 inches wide by 82 feet 1 inches long by 5 feet 0 inches deep. The top of the bulkhead shall be designed as a walkway and shall be flush with the pool deck as shown and extended over the rollout gutter at entire perimeter.

2. The entire submerged bulkhead structural framework shall be constructed of 304L stainless steel. All associated hardware shall be a minimum 18-8 stainless steel. The structure of the bulkhead shall meet the loading/deflection criteria specified in this section.
3. Above the pool waterline, the bulkhead structure shall be constructed entirely of non-corrosive (fiberglass) structural composite members.
4. All the welds of the structural framework shall be electro-chemically cleaned and passivated to ensure the full development of the protective chromium oxide layer. There shall be no exposed stainless steel welded joints at or above the pool waterline.

B. Basic Performance Requirements

1. The bulkhead shall permit swimmers, coaches and officials to use the bulkhead for their specific purpose without undue deflection or movement, and without the accumulation of water on top of the bulkhead.
2. The bulkhead shall support a uniform live load of 35 lbs/ft² at a vertical deflection not to exceed L/240 provided that all other bending and shear stresses fall within their allowable stress limits as determined by allowable stress design or factored loading method.
3. Camber shall be incorporated into the bulkhead such that the bulkhead shall have zero deflection under its own dead load.
4. Lateral deflection of the bulkhead, caused by swimmers and/or the use of tensioned racing lane lines, shall not exceed a total of 1/2". Bulkheads incorporating sweep to counteract this deflection, or the use of tensioned lines on the side of the bulkhead opposite the racing side, shall not be acceptable.
5. Lateral lane line loads shall not exceed 100 lbf which is to be ensured by providing a torque on each lane line ratchet of < 10 lbf-ft. Lateral deflection of the bulkhead shall be designed based on a 200 lbf lateral lane line load. Lane line anchors shall have a minimum pullout resistance of 500 lbf each.
6. The bulkhead shall be shipped, complete, with a combination fixed and variable buoyancy system to facilitate smooth movement through the water. The rate of motion of the bulkhead through the water, during transit, shall not be less than 7 ft/min as moved by two faculty members of average size and strength, one member on each side.
7. It shall also be designed to ensure maximum stability of the bulkhead when locked in its designated locations.
8. The geometry and appurtenances of the bulkhead shall be designed and constructed in strict accordance with the governing competitive facility codes.

9. Swimming Pool Construction Notice: Operational tolerances for this equipment are minimal. It is a prerequisite that the swimming pool tank be constructed and finished with all walls in the horizontal and vertical, straight and true, and without protrusions of any kind. The contractor shall verify conditions are correct and notify the equipment installer and the manufacturer of any pool structure abnormality or field condition that can adversely affect the final outcome of the bulkhead installation or its subsequent operation.
- C. Buoyancy System
 1. The buoyancy chambers shall be constructed of 304L stainless steel.
 2. The buoyancy system shall provide variable as well as fixed buoyancy.
 3. The system by which air shall be delivered to the buoyancy chambers shall be of PVC, or other inert or polymer material, with a minimum pressure rating of 50 PSIG.
 4. The air inlet connections for the buoyancy system shall finish flush with the enclosure grating and shall be protected from dirt entrainment.
- D. Framework Enclosure Grating
 1. The sides of the bulkhead shall be fitted with a flow-through, permanently slip-resistant, PVC I-beam grating. Grating made of ABS plastic or fiberglass are not acceptable.
 2. A minimum of 28% net open area must be provided on the exposed side gratings of the bulkhead. Said grating shall also be of a design to prevent entrapment.
 3. The top surface of the bulkhead shall be a polymer composite, extruded, structural box-tube oriented perpendicular to the bulkhead's long dimension. This extrusion shall incorporate a permanent slip-resistant texture and it shall be mechanically fastened to the composite super structure.
- E. Finishes & Anchoring/Bonding
 1. A continuous, non-metallic, non-corrosive composite fascia shall be provided that covers all ends of the enclosure grating and box-tube top surfaces. The fascia shall be manufactured of a non-metallic, polymer composite material specifically designed for use in a swimming pool environment. Bulkheads incorporating stainless steel or other metallic fascia or structural components above the pool waterline shall not be acceptable.
 2. All primary bulkhead structural, grating, fascia, trim panels and top surfaces above the pool waterline shall be of non-metallic, non-corrosive materials.
 3. Polymer wear/guide pads shall be provided at any end surface of the bulkhead that may come into contact with the pool sidewall or deck at any time during transit. These wear pads shall also serve as a bearing material when the bulkhead is deflated and stationary.
 4. Tamperproof locking devices, as well as their corresponding anchor

points, shall be provided by the manufacturer and shall be of a minimum 304L stainless steel. Bonding of the bulkhead to the pool shall be by others.

5. One single-bar security rail shall be provided at each end of the bulkhead. These rails shall be custom-fabricated of polished, tubular stainless steel. Corresponding 304L stainless steel anchors shall be installed integral to structural framework. Polymer construction anchor covers shall be provided for when the rail is not in use.

F. Targets and Marking System

1. The bulkhead shall be manufactured with lane targets on one or both sides as illustrated by the drawings.
2. Targets shall be sized and placed in accordance with the governing competitive facility codes so long as the depth of bulkhead permits.
3. Targets shall be permanent, slip resistant, and shall be permanently adhered to the bulkhead grating. Mechanically attached panels, paint, or other coatings are not acceptable.

G. Racing Line, Lifeline Anchors

1. There shall be fully recessed line anchors positioned at waterline on one or both side of the bulkhead as illustrated by the drawings.
2. Anchors shall be permanently attached and located in accordance with competitive facility codes.

H. Shipping, Delivery & Storage

1. Factory photographs of the assembled bulkhead shall be forwarded to the appropriate party prior to shipment.
2. The bulkhead shall be shipped to the jobsite in modular sections or as one piece as the corresponding overall geometry and reasonable shipping size dictate. Coordinate on site delivery to minimize handling and storage
3. The bulkhead shall be unloaded and stored in strict accordance with the manufacturer's operation and maintenance manuals. Failure to do so may void the warranty.
4. The owner/contractor is fully responsible for the safe storage of the bulkhead including damage done by others, weather, vandalism, etc.

I. Installation

1. Location - Refer to the project drawings and manufacturer's submittal drawings for the bulkhead location.
2. Conflicts - The contractor shall promptly notify the Contracting Officer, in writing, of any conflict between any requirements of the general contract documents and the manufacturer's specific written instructions prior to proceeding with installation.
3. The installation shall be true, level and plumb with the existing structure to permit full range of movement.

4. The exposed surfaces will be free of all imperfections or irregularities. A field inspection by the Contracting Officer will be conducted upon completion of the installation to ensure compliance before acceptance.
 5. During installation, protection shall be provided for the existing deck, pool walls, pool floor and general building construction. The Contractor shall bear the costs for replacement or repair as a result of damage by neglect.
 6. Support jacks shall be used beneath the bulkhead until the pool is filled and the bulkhead becomes self-supporting.
 7. All costs for installation onto the pool gutter, adjustments, certification of dimensions and cleanup upon completion shall be borne by the Contractor.
 8. Contractor shall locate the anchor plates at each stop point and at end walls. Race course dimensions shall be field certified in compliance with the competitive standards having jurisdiction and be submitted to Contracting Officer in writing by the certifying engineer or land surveyor.
 9. The bulkhead shall not be moved until water is in the pool and at the level of the gutter lip.
 10. Provide instruction to the Owner's personnel in use, operation, and maintenance of the bulkhead.
- J. Quality Assurance
1. A factory quality control program must be submitted to the Contracting Officer with submittals, which ensures that structural tolerances critical for Movable Bulkheads used for competition have been maintained.
 2. Prior to startup and instruction, the manufacturer shall provide the Owner with two complete sets of printed maintenance and operating instructions for the bulkhead and its accessory equipment.
 3. A manufacturer's representative shall instruct the facility personnel, responsible for the use, care, operation, and maintenance of the equipment, in regard to the complete operation and general maintenance of the bulkhead.

(AM#0002) >

~~K. Basis of design: The bulkhead shall be manufactured by Whitten Products, 13 Green Mountain Drive, Cohoes, NY 12047, (518.783.0474), E-mail sales@aquaticgroup.com. Fiberglass bulkheads manufactured by Stark Bulkheads, 20405 69th Ave. N.E., Arlington, WA 98223, www.starkbulkheads.com shall be approved as equal.~~ < (AM#0002)

2.21 POOL COVERS

A. The swimming pool cover system shall be the standard catalogued product of a company regularly engaged in the manufacture of such products.

~~(AM#0002) > Alternate swimming pool cover systems shall not be considered unless equal to the specified product and must be submitted for approval~~

~~not less than ten (10) days prior to bid date.~~ < (AM#0002) Submittal data must include complete documentation relating to all the specified features and include manufacturer's sales literature, specification sheets, energy conservation audit, installation/maintenance manuals and engineering drawings.

B. The swimming pool cover system shall be of the energy conservation type. The covers shall be supplied in panel sections, allowing for ease of storage, and ease of installation and removal. The cover panel materials shall withstand the commercial aquatic facility's environment. Panels shall receive edging materials to strengthen the panel and to allow for deployment and retrieval without damaging the panel's main body materials. All materials shall be ultraviolet stabilized to ensure long life. The cover panels shall be reversible, allowing for the panels to be rotated, using both sides and end to end, every other year, supporting additional panel life. Warning labels shall be affixed in four places to both sides of the panel and shall instruct in the panels proper use and warn patrons of hazards associated with covered swimming pools. Cover panel systems shall be supplied with a protector, for use when panels are not deployed.

< (AM#0002) >

~~C. Basis of design: The swimming pool cover system and its accessory items shall be manufactured by Spectrum Products, T Star Enterprises, or approved equal.~~ < (AM#0002)

D. Cover Material

1. Material shall be woven, twelve by twelve count per inch, high-density polyethylene, ultraviolet stabilized film fabric, flame laminated to both sides of a 1/8-inch thick, closed cell, medium density, white, polyethylene foam. The woven polyethylene film fabric shall be coated on the exposed sides with an ultraviolet stabilized, chemically resistant polyethylene coating. The combination of film, foam and woven components shall be non-toxic, non-absorbent, non-permeable and buoyant. Color shall be blue on upper surface and on under surface. In addition to the above, cover shall meet the following requirements:
2. Cover Design Criteria
 - a. Cover panels shall be divided into widths suitable for convenient daily use (removal and deployment), totally covering the surface of the swimming pool without gaps or overlaps. Cover panels shall be compatible for use with storage reel(s) and not exceed a width equal to one foot less than the length of the storage reel winding tube on which it is to be stored.
3. Edging
 - a. Protective-reinforcement edging shall be installed along ends and sides of each panel. A weighted non-metallic/non-corroding material shall be sewn into the panel protective edging. The weighted edge shall be flat and shall conform to the shape of the cover. Cover end edges shall be reinforced with a double layer of polyethylene-coated film fabric. The end edging shall be designed, in such a manner as, to prevent panels from diving when they are being pulled across the surface of the swimming pool. The encapsulated weighted edging shall be wrapped around the cover corners. The entire corner construction shall be reinforced with

a 1/8-inch thick load dispersion plate. Both ends of each cover panel shall be equipped with no less than three (3) non-corrosive/metallic grommets and quick-release loops for easy connection to a storage reel or to the next cover panel.

4. Sewing

- a. All sewing shall be double locking chain stitch, using ultraviolet stabilized, chemically resistant, 100% polyester thread. Main body seams shall be double overlap parallel double chain lock stitched. No butt, welded, glued or heat-sealed seams will be employed. All sewing shall be accomplished with computer-controlled machines, synchronizing speed with stitch length to assure uniformity and strength.

5. Warning Labels

- a. Warning labels consistent with the recommendations of the Federal Consumer Protection Agency shall be permanently affixed to each end of each cover panel and to the sides of perimeter panels on both side of the panel.

(AM#0002) >

~~E. Products~~

- ~~1. The pool cover system shall be the Marias II for standard rectangular swimming pools model #500013 by Spectrum Products, the Energy Saver by T Star Enterprises, or approved equal.~~
- ~~2. The pool cover system shall be the Marias II for irregular shaped swimming pools model #500014 by Spectrum Products, the Energy Saver by T Star Enterprises, or approved equal.~~ < (AM#0002)
3. The Portable Storage Reel Assembly shall be (AM#0002) >a the Bitterroot II 15-foot double tube storage reel ~~model #50130 or approved equal.~~ < (AM#0002)

2.22 POOL HEATERS

- A. The pool heater for the competition pool Tank B and Tank A shall have an input rating of (AM#0002) > ~~30,000 Btu/hr.~~ < (AM#0002)
1. Competition Pool Tank A input rating of 2,900,000 Btu/hr. (AM#0002) > ~~(2) model APN1500~~ < (AM#0002)
2. Competition Pool Tank B input rating of 3,300,000 Btu/hr. (AM#0002) > ~~(2) Model APN1750~~ < (AM#0002)

(AM#0002) >

~~B. Basis of design: the pool heater for the competition pools shall be manufactured by LOCHINVAR, model AQUAS Commercial Model APN.~~ < (AM#0002)

C. The pool heater shall be orificed for operation on (Natural Gas).

D. The package system shall be made of a BOILER plant with a Shell and Tube POOL HEAT EXCHANGER. The design of the system shall be such that pool water, shall be heated indirectly by the Shell and Tube Heat exchanger and is never directly heated by the boiler plant. The BOILER and the POOL HEAT EXCHANGER shall be completely factory piped and assembled and shall include

a cast iron circulating pump, expansion tank, flow switch, ASME Certified pressure relief valve set for 50psi, automatic fill valve with pressure reducer and a temperature / pressure gauge. The entire package shall be skid mounted, pre-piped, assembled, and pressure tested and ready for installation.

E. The BOILER components shall be as follows:

1. The BOILER shall bear the ASME "H" stamp for 160 psi working pressure and shall be National Board listed. There shall be no banding material, bolts, gaskets or "O" rings in the header configuration. The 316L stainless steel combustion chamber shall be designed to drain condensation to the bottom of the heat exchanger assembly. A built-in trap shall allow condensation to drain from the heat exchanger assembly. The complete heat exchanger assembly shall carry a ten (10) year limited warranty.
2. The BOILER shall be certified and listed by C.S.A. International under the latest edition of the harmonized ANSI Z21.13 test standard for the U.S. and Canada. The BOILER shall comply with the energy efficiency requirements of the latest edition of the ASHRAE 90.1 Standard and the minimum efficiency requirements of the latest edition of the BTS2000 Standard. All models shall operate up to 97% thermal efficiency with pool water temperatures below 100°F. The BOILER shall be certified for indoor installation.
3. The BOILER shall be constructed with a heavy gauge steel jacket assembly, primed and pre-painted on both sides. The combustion chamber shall be sealed and completely enclosed, independent of the outer jacket assembly, so that integrity of the outer jacket does not affect a proper seal. A burner/flame observation port shall be provided. The burner shall be a premix design and constructed of high temperature stainless steel with a woven metal fiber outer covering to provide modulating firing rates. The BOILER shall be supplied with a gas valve designed with negative pressure regulation and be equipped with a variable speed blower system, to precisely control the fuel/air mixture to provide modulating boiler firing rates for maximum efficiency. The BOILER with 399,000 through 800,000 Btu/hr input shall be capable of full modulation firing down to 20% of rated input with a turndown ratio of 5:1. The BOILER with 1,000,000 through 1,500,000 Btu/hr input shall be capable of full modulation firing down to 10% of rated input with a turndown ratio of 10:1. The BOILER shall operate in a safe condition at a de-rated output with gas supply pressures as low as 4 inches of water column.
4. The BOILER shall utilize a 24 VAC control circuit and components. The control system shall have an electronic display for boiler set-up, boiler status, and boiler diagnostics. All components shall be easily accessed and serviceable from the front and top of the jacket. The BOILER shall be equipped with a temperature/pressure gauge; high limit temperature control with manual reset; ASME certified pressure relief valve set for 30 psi; outlet water temperature sensor; return water temperature sensor; outdoor air sensor, flue temperature sensor; flow switch.
5. The BOILER with 399,000 thru 800,000 Btu/hr input shall feature the "SMART SYSTEM" control with an LCD display and navigation dial. The BOILER with 1,000,000 thru 1,500,000 Btu/hr input shall feature the "SMART TOUCH" control with an LCD touch screen display. The BOILER

shall have password security, pump delay with freeze protection, pump exercise, domestic hot water prioritization and PC port connection. The BOILER shall allow 0-10 VDC input connection for BMS control and have built-in "Cascade" to sequence and rotate while maintaining modulation of up to eight packages without utilization of an external controller. Supply voltage shall be 120 volt/60 hertz/ single phase.

6. The BOILER shall be equipped with two terminal strips for electrical connection. A low voltage connection board with 28 data points for safety and operating controls, i.e., Auxiliary Relay, Auxiliary Proving Switch, Manual Reset Low Water Cutoff, Flow Switch, High and Low Gas Pressure switches, Tank Thermostat, Wall Thermostat/Zone Control, System Supply Sensor, Outdoor Sensor, Building Management System signal and Cascade control circuit. A high voltage terminal strip shall be provided for Supply voltage. The high voltage terminal strip plus integral relays are provided for independent pump control of the System pump, the Boiler pump and the Domestic Hot Water pump. The dry pump contacts shall be sized for up to 1.5 hp/120V, 3 hp/240V or 30 amp pumps.
7. The BOILER shall be installed and vented with one of the venting installations described below (confirm venting installation/configuration with Building Mechanical Engineer):
 - a. Direct Vent Sidewall system with a horizontal sidewall termination of both the vent and combustion air. The flue shall be PVC, CPVC or Stainless Steel sealed vent material terminating at the sidewall with the manufacturers specified vent termination. A separate pipe shall supply combustion air directly to the BOILER from the outside. The air inlet pipe may be PVC, CPVC, ABS, Galvanized, Dryer Vent, or Stainless Steel sealed pipe. The air inlet must terminate on the same sidewall with the manufacturer's specified air inlet cap. The BOILER's total combined air intake length shall not exceed 100 equivalent feet. The BOILER's total combined exhaust venting length shall not exceed 100 equivalent feet. Foam Core pipe is not an approved material for exhaust piping.
 - b. Direct Vent Vertical system with a vertical roof top termination of both the vent and combustion air. The flue shall be PVC, CPVC or Stainless Steel sealed vent material terminating at the roof top with the manufacturers specified vent termination. A separate pipe shall supply combustion air directly to the BOILER from the outside. The air inlet pipe may be PVC, CPVC, ABS, Galvanized, Dryer Vent, or Stainless Steel sealed pipe. The air inlet must terminate on the roof top with the manufacturer's specified air inlet cap. The BOILER's total combined air intake length shall not exceed 100 equivalent feet. The BOILER's total combined exhaust venting length shall not exceed 100 equivalent feet. Foam Core pipe is not an approved material for exhaust piping.
 - c. Sidewall Vent with Room Air system with a horizontal sidewall termination of the vent with the combustion air drawn from the interior of the building. The flue shall be PVC, CPVC or Stainless Steel sealed vent material terminating at the sidewall with the manufacturers specified vent termination. The BOILER's total combined exhaust venting length shall not exceed 100 equivalent feet. Foam Core pipe is not an approved material for exhaust piping.

- d. Vertical Vent with Room Air system with a vertical rooftop termination of the vent with the combustion air drawn from the interior of the building. The flue shall be PVC, CPVC or Stainless Steel sealed vent material terminating at the rooftop with the manufacturers specified vent termination. The BOILER's total combined exhaust venting length shall not exceed 100 equivalent feet. Foam Core pipe is not an approved material for exhaust piping.
 - e. Vertical Vent with Sidewall Air system with a vertical rooftop termination of the vent with the combustion air being drawn horizontally from a sidewall. The flue shall be PVC, CPVC, or Stainless Steel sealed vent material terminating at the roof top with the manufacturers specified vent termination. A separate pipe shall supply combustion air directly to the POOL HEATER from the outside. The air inlet may be PVC, CPVC, ABS, Galvanized, Dryer Vent, or Stainless Steel sealed pipe. The air inlet must terminate on a sidewall using the manufacturers specified air inlet cap. The BOILER's total combined air intake length shall not exceed 100 equivalent feet. The BOILER's total combined exhaust venting length shall not exceed 100 equivalent feet. Foam Core pipe is not an approved material for exhaust piping.
 - f. The BOILER shall have an independent laboratory rating for Oxides of Nitrogen (NOx) of 20 ppm or less corrected to 3% O₂. The manufacturer shall verify proper operation of the burner, all controls and the heat exchanger by connection to water and venting for a factory fire test prior to shipping.
 - g. The BOILER shall operate at altitudes up to 4,500 feet above sea level without additional parts or adjustments.
 - h. The BOILER shall be suitable for use with polypropylene glycol, up to 50% concentration without contingencies.
- 8. The SHELL AND TUBE POOL HEAT EXCHANGER shall have a working pressure of 87 psi and shall be constructed of Cupro-Nickel Tubes and Bronze Headers and carry a one (1) year limited warranty. The POOL HEAT EXCHANGER shall be sized so that heat can be transferred into the pool water with an efficiency of up to 99%. The entire assembly shall be mounted on "I" beam skids to facilitate handling and installation.
 - 9. The CIRCULATING PUMP shall be constructed of cast iron and operate on a 120 volt, 60 Hz, 1 phase power supply (unless otherwise specified). The pump shall be factory wired to run with intermittent pump operation
 - 10. The EXPANSION TANK shall be of a bladder type design and shall be sized adequately to allow for the expansion of the boiler water when heated.
 - 11. The FLOW SWITCH shall be of a paddle type design and shall be wired to the internal boiler control safety circuitry so to not allow the boiler to operate when there is not sufficient flow.
 - 12. The AUTOMATIC FILL VALVE WITH PRESSURE REDUCER shall be factory set for 15 psi and shall allow fresh water to be added to the boiler system only when the water pressure has fallen below the pressure setting.

13. The PRESSURE RELIEF VALVE shall be ASME Certified and have a setting of 50 psi.
14. The TEMPERATURE AND PRESSURE GAUGE shall be capable of reading temperature in both degrees Fahrenheit and degrees Celsius. The Pressure units shall be read in pounds per square inch (psi)
15. The Contractor shall provide the pool water heating system. Heating system to include all piping, heaters, booster pumps, controls, gauges, thermostats, control valves and wiring required to draw water from the recirculation piping, heat the water and return it back to the recirculation piping. The Contractor shall interlock pool heating system with pool recirculation pumps.
16. Contractor shall have pool heater manufacturer representative on site to start and adjust pool heater. Copies of the startup report shall be sent to the Manufacturer and Contracting Officer prior to final site observation and shall include the following information for each pool heater:
 - a. Temperature settings
 - b. Inlet Gas Supply Pressure
 - c. Manifold Gas Pressure
 - d. Air Pressure
 - e. Gas Piping Configuration
 - f. Venting Configuration
 - g. Booster pump interlocked with recirculation pump
 - h. Flow switch installed
 - i. A component and integrated check shall be made of all controls. Factory tests do not substitute for this test.

2.24 UNDERWATER CAMERAS

A. Underwater cameras shall be a package including (6) total underwater cameras consisting of (4) floor mount and (2) wall hung. One complete package shall be supplied for each training tank (6 cameras Tank A, 6 cameras Tank B). Cameras to live feed to a screen or ipad as well as have capability to record and playback video. Provide the quantities shown and detailed in the construction drawings and as described in these specifications. Coordinate for proper installation. Refer to the drawings for quantities and locations.

B. Camera shall be 1080P @ ~1MB/s - 1 hour of video = 3600MB or 3.6GB, shutter speed - Auto or manual setting - up to 1/10000 seconds selectable, frame rate (AM#0002) > ~~SwimPro Crystal Frame Technology~~, < (AM#0002) swimming pool grade stainless steel, white balancing setting - adjustable blue and red compensation, lens - horizontal viewing range of ~8ft/2.4m at 6.5ft / 2m distance and high durability.

1. Floor Mount (4) - pool grade stainless steel, angle / rotation

adjustable, portable and light weight in design.

- a. Accessories - cable to be stranded 8 core military grade Ethernet cable, IP68 cable connector to connect a (AM#0002) ~~SwimPro~~ wireless module or ~~SwimPro~~ Cable. <(AM#0002)>
- 2. Wall Hung (2) - portable static wall bracket shall be pool grade anodized aluminum, height / angle / rotation adjustable with a total length of ~2ft or 60cm (additional height add-ons should be included for a depth of ~4ft, and fold up for wash storage.2.
 - a. Accessories - cable to be stranded 8 core military grade Ethernet cable, IP68 cable connector to connect a (AM#0002) ~~SwimPro~~ wireless module or ~~SwimPro~~ Cable. <(AM#0002)>
- 3. Software shall be provided for live feed analysis as well as video playback. Features shall include tracking bar, fast-forward, pause, slow-motion, play, frame-by-frame, annotation, draw on screen, arrow, grid, shapes and remote control recording. System shall work with ipad or other wireless device for visual feedback.

PART 3 EXECUTION

3.1 EXISTING CONDITION, INSPECTION AND PREPARATION

- A. Carefully examine all of the contract documents for requirements that affect the work of this section. Prior to starting any work, notify the General Contractor of defects requiring correction. Do not start work until conditions are satisfactory.
- B. Verify that all work by others, related to this section, has been completed. This includes all earthwork, concrete work, and mechanical, electrical and plumbing connections.
- C. Protect all materials and work completed by others from damage while completing the work in this section.

3.2 FIELD MEASUREMENTS

- A. Verify benchmark and pool location prior to layout.
- B. If field measurements differ from the construction drawing dimensions, notification shall be given to the Contracting Officer prior to proceeding with work.

3.3 EXCAVATION, REINFORCING STEEL AND SWIMMING POOL PNEUMATICALLY APPLIED OR CAST-IN-PLACE CONCRETE

- A. Reference Division 31 - Earthwork
- B. Reference Section 13 11 02 - Swimming Pool Pneumatically Applied Concrete
- C. Reference Section 13 11 01 - Swimming Pool Cast-In-Place Concrete

3.4 TOLERANCES FOR CONSTRUCTION OF THE POOL SHELL

- A. The completed structures shall be constructed level and to the

dimensions, elevation, depths and thickness as shown on the plans.

B. The elevation tolerance of the pool shell and gutter lip shall be plus or minus 1/8 inch.

C. The vertical wall surface tolerance of the pool shell, for the first 36 inches from the water surface shall be plus or minus 1/4 inch from plumb measured with a 6-foot straight edge.

D. For competitive race courses, the following pool shell tolerances shall apply:

Course	Tolerance	Minimum	Maximum
25 Yard	+ 1 3/16" /- 0"	75' - 3/4"	75' - 1 15/16"
25 Meter	+ 0.010 M	25.02 M	25.03 M
50 Meter	+0.010 M	50.02 M	50.03 M

1. The above dimensions include allowances for a touchpad at each end of the course. The maximum dimension includes the construction tolerance. These above tolerances also apply to courses utilizing moveable bulkhead(s).

2. The above dimensions apply to a vertical plane extending 1'-0" above and 3'-0" below the surface of the water at all points of both end walls.

E. The CONTRACTOR shall provide the services of a registered engineer or land surveyor who shall measure and certify the elevations of the gutter lip at 10-foot centers as well as the length of each lane for each possible racing course. Courses designed with touchpads for competition shall be measured and certified with touchpads in place. Course length survey must be made with the pool filled with water between 78- and 82-degrees Fahrenheit. Forms for the lane measurements are available from USA Swimming (719-866-4578) and must be submitted by the Contractor.

F. Ground wires or grade pins, if used, shall be installed in such a manner that they accurately outline the section of the pool shell as indicated on the plans. They shall be located at intervals sufficient to insure proper thickness throughout and shall be maintained tight. Grade pins or grounding wires shall not be permanently embedded in the pool shell.

3.5 WATER TIGHTNESS TEST

A. This test applies to the pool(s), the surge tank(s), and the gutter system(s). The water tightness test shall be completed prior to the application of the pool finish.

B. Water Tightness Test Procedure

1. Preparation

a. Allow the concrete structure to set 28 days for curing purposes. Once the pool shell has gained sufficient strength to withstand the test load and after all the outlets have been securely sealed, the pool shall be filled with water.

2. Fill: Fill and then isolate the pool(s), the surge tank(s), and the gutter system(s). The water tightness test shall begin after the vessel has been filled for a minimum of three (3) days. During the filling, all outlets shall be monitored for water tightness and all concrete joints shall be monitored for any visible leakage. If any visible leakage from the vessel is observed, the condition shall be corrected prior to the start of the test.
 - a. After the initial fill, all ground water shall be removed from the pool sight sump or the pool location de-watering system. This shall be completed prior to the start of the water tightness test. De-watering of the pool sight sump shall be maintained during the entire duration of the test.
3. Evaporation Measurement Procedure
 - a. Fill a floating, restrained, partially filled, calibrated, open container with water and allow the container to float within the pool during the testing period. This will be used to measure evaporation.
4. Measurement
 - a. On a separate sheet of paper draw a sketch of the pool. Measurements shall be taken at the pool(s), the surge tank(s), and the gutter system(s). Multiple test points with averaging are recommended for vessels which will be exposed to wind. Document the separate findings on the chart below. Repeat the measurements and document every 12 hours for a total of three (3) days. The General Contractor shall check the pool(s), the surge tank(s), and the gutter system(s) for water loss with the Contracting Officer every 12 hours. The Contractor(s) shall submit photo documentation of each measurement with the completed water tightness report.

Total Allowable Water Loss	Total Gallons		(0.0%) x 0.001 =	Allowable Loss	Pan Depth Per 24 Hrs.
Pool Measurements	Competition Pool Tank A	Competition Pool Tank B	Gutter Sysstem	Surge Tank	Pan Measurements
12 Hrs.					
24 Hrs.					
36 Hrs.					
48 Hrs.					
60 Hrs.					
72 Hrs.					

5. Total Loss = 7.481 x Structure Surface Area (SF) x Total Water Loss per Day (FT) - Evaporation per Day (FT) + Precipitation per Day (FT)

- a. Day #1 =
 - b. Day #2 =
 - c. Day #3 =
6. Repair
- a. The allowable leakage rate for an unlined pool structure shall not exceed 0.1 percent of the total water volume in a 24-hour period. (Example: 0.001 x 200,000-gallon pool = 200 gallons per 24-hour period.) This excludes the loss/addition of evaporation/precipitation.
7. Absorption
- a. Waiting 3 days after the initial water fill will allow the concrete to absorb water and shall be sufficient to minimize the effect of absorption on the test results.
8. Evaporation
- a. Evaporation shall not have a significant effect on natatoria that are completely enclosed with no air circulation during the water tightness test. However, evaporation will have a significant effect on the water level in natatoria that has air movement across the water surface or are still partially uncovered.
9. If leaks are detected, repair the vessel and make water tight in accordance with these requirements.
10. With regard to this test, the curing requirements, the final fill and the cost of the water for two (2) complete fillings shall be borne by the Owner. Any subsequent fillings or partial fillings (more than 25%) of the pool shall be by the CONTRACTOR, at its own expense.

3.6 PIPING INSTALLATION

3.6.1 Tests

A. General

- 1. Provide and erect, according to the best practices of the trade, all piping shown on the drawings and required for the complete installation of these systems. The piping shown on the drawings shall be considered as diagrammatic in indicating the general run and connections and may or may not in all parts be shown in its true position. The piping may have to be off set, lowered or raised as required or as directed at the site. This does not relieve the CONTRACTOR from responsibility for the proper erection of the systems or piping in every respect suitable for the work intended as described in the specifications and approved by the Contracting Officer. In the erection of all piping, it shall be properly supported, and proper provisions shall be made for expansion, contraction and anchoring of piping. All piping shall be cut accurately for fabrication to measurements established at the construction site. Pipe shall be worked into place without springing and/or forcing, properly clearing all windows, doors, and other openings and equipment. Cutting or other weakening of the building structure to facilitate installation will not be permitted. All pipes

shall have burrs and/or cutting slag removed by reaming or other cleaning methods in strict accordance with the manufacturer's instructions. All changes in direction shall be made with fittings. All open ends of pipes and equipment shall be properly capped or plugged to keep dirt and other foreign materials out of the systems. Plugs of rags, wool, cotton waste or similar materials will not be used in plugging. All piping shall be arranged so as not to interfere with removal and maintenance of equipment, filters or devices, and so as not to block access to manholes, access openings, etc. Flanges or unions as applicable for the type of piping specified shall be provided in the piping at connections to all items of equipment. All piping shall be installed to ensure noiseless circulation. All valves and specialties shall be so placed to permit easy operation and access.

B. Pipe Hangers and Supports

1. Pipes shall be adequately supported by pipe hangers and supports specified in Paragraph 2.05 Pipe, Hangers, and Valves.
2. Horizontal PVC Schedule 80 piping shall be supported in accordance with the manufacturer's recommendations for fluid temperature not exceeding 120-degree F and as listed below:

Nominal Pipe Size (Inch)	Hanger Support Spacing (Feet)	Minimum Rod Size for Single Rod Hanger (Inch)
1-1/4" and less	5	3/8"
1-1/2" to 3"	6	1/2"
4" - 6"	8	5/8"
8" to 12"	10	7/8"
Greater than 12"	12	1"

3. Horizontal CPVC Schedule 80 piping shall be supported in accordance with the manufacturer's recommendations for fluid temperature not exceeding 140-degree F and as listed below:

Nominal Pipe Size (Inch)	Hanger Support Spacing (Feet)	Minimum Rod Size for Single Rod Hanger (Inch)
1/2" and less*	4	3/8"
3/4" to 2"	6	3/8"
2-1/2" to 3"	7	1/2"
4" to 8 "	8	7/8"
Greater than 12"	10	1"

- C. Provide means of preventing dissimilar metal contact such as

plastic-coated hangers, copper colored epoxy paint, or non adhesive isolation tape.

D. Install hangers to provide a minimum of 1-inch space between finished covering and adjacent work.

E. Place a hanger within 12 inches of each horizontal elbow.

F. Support vertical piping independently of connected horizontal piping. Support vertical pipes at every floor. Wherever possible, locate riser clamps directly below pipe couplings or shear lugs.

G. Where several pipes can be installed in parallel and at the same elevation, provide trapeze hangers as specified in section 2.05.C.3. Trapeze hangers shall be spaced according to the smallest pipe size or install intermediate supports according to the support spacing schedules.

H. Do not support piping from other pipes, ductwork or other equipment that is not building structure. Do not modify building structure for hanger installation.

I. Concrete Inserts

1. Provide inserts for placement in form work before concrete is poured.
2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
3. Where concrete slabs form finished ceilings, provide inserts to be flush with the slab surface.
4. Provide hook rods to concrete reinforcement section for inserts carrying pipe over 4 inches.

J. Pipe Hangers and Supports

1. All piping shall be rigidly supported from the building structure by means of hanger assemblies properly selected and sized for the application in accordance with the manufacturer's recommendations and specifications.
2. All piping in a service tunnel, if required shall be supported by a structure of the CONTRACTOR'S design. The structure shall be non-corrodible and shall be of a size and configuration to rigidly support all the piping as shown in the plans at a minimum spacing as shown below.
3. Piping hangers shall be spaced per the below schedule and shall have hangers not more than one foot on each side of every change in direction. The piping systems shall be installed in an approved manner and shall not overload the building structural frame. The CONTRACTOR shall provide additional hangers and miscellaneous steel supports as required to distribute the piping system load over several structural members where required or directed. Maximum allowable spacing for piping shall be as follows:

PVC Piping	Maximum Spacing
3/4" thru 2"	5'-0"
2-1/2" thru 4"	6'-0"
6" thru 10"	9'-0"
12" thru 14"	12'-0"

4. Round rods supporting the pipe hangers shall be of the following dimensions:

1/2" to 2" pipe	-3/8" rod
2-1/2" to 3" pipe	-1/2" rod
4" to 5" pipe	-5/8" rod
6" pipe	-3/4" rod

5. Hanger rods shall be galvanized steel. Provide for controlling level and slope by turn buckles or other approved means of adjustment and incorporate lock nuts.
6. Where piping is installed side by side, the CONTRACTOR will support the piping by utilizing trapeze type hanger assemblies. Horizontal trapeze member shall be non-metallic channel. The CONTRACTOR shall provide heavier members as required for the load to be supported for the entire span distance. Hanger rods shall be as specified above and properly sized for the load supported, but not less than 5/8 inches diameter.
7. The use of pipe hooks, chains, or perforated iron for pipe hanger supports will not be permitted.
8. Attachment of piping hangers to the building structure shall be provided in a manner approved by the Contracting Officer. The CONTRACTOR shall provide concrete inserts to be installed by the General Contractor in the building construction at the time the concrete is poured, and hangers shall be attached to these inserts.

K. Piping Installation

1. Trench bottoms shall be smooth and free of rocks and debris. If the trench is dug in ledge rock, hardpan or where large boulders are not removed, place 3 inches of sand or compacted fine-grained soil below pipe. Pipe must be supported over its entire length with firm, stable material. Blocking will not be used to change pipe grade or provide intermittent support over low sections in the trench. Surround the pipe with backfill meeting the requirements of Section 312000 with a particle size of 1-1/2 inch or less and in accordance with the project geotechnical report. Compact in layers not to exceed 6 inches with

vibratory method. Follow installation methods of ASTM D27744 "Underground Installation of Thermoplastic Pressure Piping".

2. Installations are to be installed in a straight run of pipe, with a minimum 10 pipe diameters upstream and minimum 5 pipe diameters downstream of any pipe fitting.

L. Flushing, Draining and Cleaning Pipe Systems

1. The CONTRACTOR shall flush out all water systems with water before placing them in operation. Other systems shall be cleaned by using compressed air or nitrogen. After systems are in operation and during the test period, all strainer screens shall be removed and thoroughly cleaned.

M. Expansion and Contraction

1. The CONTRACTOR shall make all necessary provisions for expansion and contraction of piping with offsets, loops, flexible connections and anchors as required to prevent undue strain. The CONTRACTOR shall provide shop drawings for proposed method and arrangement for control of expansion and contraction of piping.

N. Testing

1. All piping installation and pressure testing shall be reviewed by the Owner's testing agency before commencement of backfilling. A minimum notice of one (1) week is required prior to review. Results of review shall be documented.
2. All pool related piping shall be hydraulically pressure tested (with water, not air) to a pressure of not less than 50 PSI for a period of no less than two (2) hours.
3. Contractor is responsible for the maintenance of a sustained 20 PSI pressure on all pool related piping throughout the course of construction.
4. The Contractor shall adhere to the applicable provisions of Division 22 - Plumbing, "General Provisions" and "Basic Materials and Methods" for installation of piping system.

3.7 EQUIPMENT AND SYSTEMS INSTALLATION

A. The CONTRACTOR shall assemble and install all equipment, special parts and accessories as shown on pool drawings, specifications and shop drawings of the equipment suppliers.

B. The CONTRACTOR shall provide all anchors and inserts to be imbedded in the deck including all fittings, inserts and structure sleeves and required anchorage as shown on the plans and as indicated in this section of the specifications. Equipment shall be set true and plumb, using factory jigs where available. Removable equipment items shall be easily removable from anchors and shall fit without noticeable wobble.

C. Provide templates for all equipment anchors. Provide anchor bolts of the size and spacing as required by the equipment manufacturer. All anchor bolts shall be stainless steel Type 316L and of a length capable of adequate anchorage into rough slab-on-grade allowing for finish deck tile

and setting bed. Anchors shall be set and cast into place during building concrete work. Inspect all anchor settings for horizontal and vertical alignment prior to placing concrete.

D. The CONTRACTOR shall install all equipment and systems in accordance with manufacturer's directions. Equipment shall all be assembled and in place for final observation.

E. All items necessary to complete this section are shown on the plans or described in the specifications including items that may be purchased by the Owner. Items are detailed and specified as a guide for dimensional purposes. The CONTRACTOR must make provisions accordingly and submit shop drawings and submittals based on that data.

3.8 START-UP AND INSTRUCTIONS

A. The CONTRACTOR shall supply the services of an experienced swimming pool operator/instructor for a period of not less than two days (total 16 hours) after the pool(s) have been filled and initially placed in operation. During this period, the Owner's representatives who will be operating the pool(s) shall be thoroughly instructed in all phases of the pool's operation. The CONTRACTOR shall deliver six (6) complete sets of operating and maintenance instructions for the swimming pool, structures, finishes and all component equipment. Prior to leaving the job, the CONTRACTOR shall obtain written certification from the designated Owner's representative acknowledging that the instruction period has been completed and all necessary operating information provided. The CONTRACTOR shall, in his contract, include the cost of two (2) additional days (total 16 hours) of instruction and operational check out by the qualified representative of the CONTRACTOR during the first season of operation.

B. Written reports of each of these visits outlining the pool's operation, competence and performance of the pool's operation personnel, and other pertinent comments shall be submitted to the Contracting Officer within one (1) week after each visit.

C. The CONTRACTOR shall provide specific written procedures to be followed for emptying and refilling the pool as mentioned previously in this section. The procedures must be included in the bound volume of operating instructions and references in the front index with a note headed by the words: "CAUTION -- VERY IMPORTANT".

-- End of Section --

SECTION 13 11 01

SWIMMING POOL CAST-IN-PLACE CONCRETE

<AMENDMENT NO. 0002>

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

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 117	(2010; Errata 2011) Specifications for Tolerances for Concrete Construction and Materials and Commentary
ACI 301	(2016) Specifications for Structural Concrete
ACI 302.1R	(2015) Guide for Concrete Floor and Slab Construction
ACI 306.1	(1990; R 2002) Standard Specification for Cold Weather Concreting
ACI 308.1	(2011) Specification for Curing Concrete
ACI 318	(2014; Errata 1-2 2014; Errata 3-5 2015; Errata 6 2016; Errata 7-9 2017) Building Code Requirements for Structural Concrete (ACI 318-14) and Commentary (ACI 318R-14)
ACI 347R	(2014; Errata 1 2017) Guide to Formwork for Concrete

ASTM INTERNATIONAL (ASTM)

ASTM A615/A615M	(2016) Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
ASTM C31/C31M	(2019) Standard Practice for Making and Curing Concrete Test Specimens in the Field
ASTM C33/C33M	(2018) Standard Specification for Concrete Aggregates
ASTM C39/C39M	(2018) Standard Test Method for

Compressive Strength of Cylindrical
Concrete Specimens

ASTM C42/C42M	(2018a) Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
ASTM C94/C94M	(2018) Standard Specification for Ready-Mixed Concrete
ASTM C109/C109M	(2016a) Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or (50-mm) Cube Specimens)
ASTM C143/C143M	(2015) Standard Test Method for Slump of Hydraulic-Cement Concrete
ASTM C150/C150M	(2018) 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 C219	(2017) Standard Terminology Relating to Hydraulic Cement
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	(2017) Standard Specification for Chemical Admixtures for Concrete
ASTM C1017/C1017M	(2013; E 2015) Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete
ASTM C1059/C1059M	(2013) Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete
ASTM C1064/C1064M	(2017) Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete
ASTM C1077	(2017) Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for

Testing Agency Evaluation

ASTM D448

(2012; R 2017) Standard Classification for Sizes of Aggregate for Road and Bridge Construction

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 E329

(2018) Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection

1.3 SUMMARY

- A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes for the following:

1. Swimming pools:
 - a. Bottom slab.
 - b. Walls
 - c. Miscellaneous features, slabs on grade and all other elements.
2. Surge tanks:
 - a. Bottom slab, walls and top slab.

- B. Related Requirements:

1. Division 03 for all concrete not related to swimming pool construction.
2. Division 03 or Division 13 for water tightness testing.
3. Shotcrete may be substituted for swimming pool cast-in-place walls.

1.4 DEFINITIONS

- A. Cementitious Materials: Portland cement alone; materials subject to compliance with requirements.
- B. W/C Ratio: The ratio by weight of water to cementitious materials.

1.5 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
 - a. Contractor's superintendent.
 - b. Independent testing agency responsible for concrete design

mixtures.

- c. Ready-mix concrete manufacturer.
- d. Concrete Subcontractor.
- e. Special Pool finish Subcontractor.

2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, forms and form removal limitations, anchor rod and anchorage device installation tolerances if required for equipment installation, under slab pipe encasement requirements, and concrete protection.

1.6 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

Minutes of preinstallation conference; G

SD-02 Shop Drawings

Steel Reinforcement; G

Construction Joint Layout; G

Formwork; G

SD-03 Product Data

Product Data for each type of product; G

Design Mixtures for each concrete mixture; G

SD-04 Samples

Waterstops; G

SD-06 Test Reports

Aggregates; G

SD-07 Certificates

Qualification Data; G

Cementitious Materials; G

Admixtures; G

Form materials and form-release agents; G

Steel reinforcement and accessories; G

Waterstops; G

Curing compounds; G

Bonding agents; G

Curing Compounds; G

Joint-filler strips; G

Repair materials; G

Dowel bar substitutes; G

SD-09 Manufacturer's Field Reports

Field quality-control reports; G

1.7 ACTON SUBMITTALS

- A. **Product Data:** For each type of product.
- B. **Design Mixtures:** For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
 - 1. Indicate amounts of mixing water to be withheld for later addition at Project site.
- C. **Steel Reinforcement Shop Drawings:** Placing Drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.
- D. **Construction Joint Layout:** Indicate proposed construction joints required to construct the structure.
 - 1. Location of construction joints is subject to approval of the Engineer.
- E. **Samples:** For **waterstops**.

1.8 INFORMATIONAL SUBMITTALS

- A. **Qualification Data:** For manufacturer.
- B. **Material Certificates:** For each of the following, signed by manufacturers:
 - 1. **Cementitious materials.**
 - 2. **Admixtures.**
 - 3. **Form materials and form-release agents.**
 - 4. **Steel reinforcement and accessories.**
 - 5. **Waterstops.**
 - 6. **Curing compounds.**

7. Bonding agents.
8. Joint-filler strips, if required.
9. Repair materials.
10. ~~Dowel bar substitutes.~~

C. Material Test Reports: For the following, from a qualified testing agency:

1. **Aggregates**: Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.

D. **Formwork** Shop Drawings: Prepared by or under the supervision of a qualified professional engineer, detailing fabrication, assembly, and support of formwork.

E. **Field quality-control reports.**

F. **Minutes of preinstallation conference.**

1.9 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with **ASTM C94/C94M** requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to **ASTM C1077** and **ASTM E329** for testing indicated.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician, Grade I. Testing agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician, Grade II.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

1.11 FIELD CONDITIONS

B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

1. When average high and low temperature is expected to fall below 40 deg F (4.4 deg C) for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301 (ACI 301M).
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

B. Hot-Weather Placement: Comply with ACI 301 (ACI 301M) and as follows:

1. Maintain concrete temperature below 90 deg F (32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

PART 2 PRODUCTS

2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 301 (ACI 301M).
2. ACI 117 (ACI 117M).

2.2 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

1. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:

a. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.

B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Void Forms (if indicated on drawings): Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.

D. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch (19 by 19 mm), minimum.

- E. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.
 - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- F. Form Ties: Factory-fabricated, removable or snap-off glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
 - 1. Furnish units that leave no corrodible metal closer than 1 inch (25 mm) to the plane of exposed concrete surface.
 - 2. Furnish ties that, when removed, leave holes no larger than 1 inch (25 mm) in diameter in concrete surface.
 - 3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.3 STEEL REINFORCEMENT

- A. Reinforcing Bars: **ASTM A615/A615M**, Grade 60 (Grade 420), deformed.

2.4 REINFORCEMENT ACCESSORIES

- A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
 - 1. For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.
- B. Dowel Bar Substitutes: Tapered, threaded couplers, pre-assembled to reinforcing with mounting plate for attachment to form work and a pressed in metal disc thread protector which can be easily removed. The mechanical connection shall meet building code requirements of developing in tension or compression. The mechanical connection shall be the positive locking, taper threaded type coupler manufactured from high quality steel. The bar ends must be taper threaded using the manufacturer's requirements.
 - 1. Lenton Form Saver; Erico Corp.

2.5 CONCRETE MATERIALS

- A. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.
- B. Cementitious Materials:
 - 1. Portland Cement: **ASTM C150/C150M**, Type I/II, gray.

- C. Normal-Weight Aggregates: ASTM C33/C33M, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.
 - 1. Maximum Coarse-Aggregate Size: 1 inch (25 mm) nominal.
 - 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
 - D. Air-Entraining Admixture: ASTM C260/C260M.
 - E. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
 - 1. Water-Reducing Admixture: ASTM C494/C494M, Type A.
 - 2. Retarding Admixture: ASTM C494/C494M, Type B.
 - 3. Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type D.
 - 4. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
 - 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type G.
 - 6. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II.
 - F. Water: ASTM C 94/C 94M and potable.
- 2.6 WATERSTOPS
- A. Flexible PVC Waterstops: CE CRD-C 572, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.

(AM#0002) >

~~1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:~~

~~a. Sika Greenstreak.~~

~~b. Vinylex Waterstop & Accessories.~~ < (AM#0002) >

- 2. Profile: Ribbed without center bulb, non-tapered.
- 3. Dimensions: 4 inches by 3/16 inch thick (100 mm by 4.75 mm thick); nontapered.
- B. Non-Expanding Plastic Adhesive Waterstops: Manufactured rectangular or trapezoidal strip, single-component, self-sealing adhesive compound, for adhesive bonding to concrete, 5/8 by 1-1/2 inch.
 - 1. Products: Subject to compliance with requirements, provide the following:

(AM#0002) >

- ~~a. Synko Flex SF302, Henry Company.~~
- ~~1) Synko Flex SF311 Solvent Based Primer. < (AM#0002)~~

2.7 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

(AM#0002) >

- ~~1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:~~

- ~~a. BASF Corporation Construction Systems; Confilm.~~
- ~~b. ChemMasters, Inc; Spray Film.~~
- ~~c. Dayton Superior; AquaFilm J74RTU.~~
- ~~d. Euclid Chemical Company (The); an RPM company; Eucobar.~~
- ~~e. L&M Construction Chemicals, Inc; E-CON.~~
- ~~f. Metalerete Industries; Waterhold.~~
- ~~g. Sika Corporation; Caltexol CIMPILM.~~
- ~~h. TK Products; TK 2120 TRI FILM. < (AM#0002)~~

- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.
- C. Moisture-Retaining Cover: ASTM C171, polyethylene film or white burlap-polyethylene sheet.
- D. Water: Potable.
- E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C309, Type 1, Class B, 18 to 25 percent solids, nondissipating, certified by curing compound manufacturer to not interfere with bonding of pool finish.

(AM#0002) >

- ~~1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to the following:~~

- ~~a. BASF Corporation Construction Systems; MasterKure CC 200 WB (Pre 2014: Kure N Seal W).~~
- ~~b. Dayton Superior; Cure & Seal 1315 J22 WB.~~
- ~~c. Euclid Chemical Company (The); an RPM company; Diamond Clear VOX.~~
- ~~d. L&M Construction Chemicals, Inc; Dress & Seal WB.~~
- ~~e. SpecChem, LLC; Cure & Seal WB 25.~~
- ~~f. W.R. Meadows, Inc; Vocomp 20. < (AM#0002)~~

2.8 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D1751, asphalt-saturated cellulosic fiber.
 - 1. Provide for cast-in-place concrete coping.
- B. Bonding Agent: ASTM C1059/C1059M, Type II, nonredispersible, acrylic

emulsion or styrene butadiene.

(AM#0002) >

~~1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:~~

- ~~a. Dayton Superior Corporation; Conspec Strong Bond.~~
- ~~b. Euclid Chemical Company (The), an RPM company; Flex-Con.~~
- ~~c. W. R. Meadows, Inc.; Sealtight Acry Lok.~~
- ~~d. Kaufman Products, Inc.; Surebond.~~ < (AM#0002)

2.9 REPAIR MATERIALS

- A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch (3.2 mm) and that can be feathered at edges to match adjacent floor elevations.

(AM#0002) >

~~1. Xypex Concrete Waterproofing by Crystallization, Xypex Chemical Corporation.~~

~~a. Xypex Concentrate.~~ < (AM#0002)

- 2. Cement Binder: ASTM C150/C150M, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C219.
- 3. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
- 4. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3.2 to 6 mm) or coarse sand as recommended by underlayment manufacturer.
- 5. Compressive Strength: Not less than 4100 psi (29 MPa) at 28 days when tested according to ASTM C109/C109M.

- B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch (6.4 mm) and that can be filled in over a scarified surface to match adjacent floor elevations.

(AM#0002) >

~~1. Xypex Concrete Waterproofing by Crystallization, Xypex Chemical Corporation.~~

~~a. Xypex Concentrate.~~ < (AM#0002)

- 2. Cement Binder: ASTM C150/C150M, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C219.
- 3. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
- 4. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3.2 to 6 mm) or coarse sand as recommended by topping manufacturer.
- 5. Compressive Strength: Not less than 5000 psi (34.5 MPa) at 28 days when tested according to ASTM C109/C109M.

2.10 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to **ACI 301** (ACI 301M).
 - 1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
- B. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.
- C. Admixtures: Use admixtures according to manufacturer's written instructions.
 - 1. Use water-reducing, high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
 - 2. Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions
 - 3. Use water-reducing admixture in pumped concrete and concrete with a w/c ratio below 0.50.

2.11 CONCRETE MIXTURES FOR SWIMMING POOL ELEMENTS

- A. Slabs, Walls, Coping and Other Elements: Normal-weight concrete.
 - 1. Minimum Compressive Strength: 4000 psi (27.6 MPa) at 28 days.
 - 2. Maximum W/C Ratio: 0.42.
 - 3. Minimum Cement Content: 600 lb/cu. yd.
 - 4. Slump Limit: 4 inches (100 mm), 8 inches (200 mm) for concrete with verified slump of 2 to 4 inches (50 to 100 mm) before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch (25 mm).
 - 5. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 1-inch (25-mm) nominal maximum aggregate size.

2.12 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.13 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to **ASTM C94/C94M**, and furnish batch ticket information.
 - 1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

2.14 DRAINAGE FILL

- A. Drainage Course under bottom slabs: Narrowly graded mixture of frost-free, washed crushed stone, or crushed or uncrushed gravel; **ASTM D448**; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch (37.5-mm) sieve and 0 to 5 percent passing a No. 8 (2.36-mm) sieve.

PART 3 EXECUTION

3.1 FORMWORK INSTALLATION

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301 (ACI 301M), to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117 (ACI 117M).
- C. Limit concrete surface irregularities, designated by **ACI 347R** as abrupt or gradual, as follows:
 - 1. Class A, 1/8 inch (3.2 mm) for smooth-formed finished surfaces.
 - 2. Class D, 1 inch (25 mm) for rough-formed finished surfaces.
- D. Construct forms tight enough to prevent loss of concrete mortar.
- E. Construct forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
 - 1. Install keyways, reglets, recesses, and the like, for easy removal.
 - 2. Do not use rust-stained steel form-facing material.
- F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
- G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- H. Chamfer exterior corners and edges of permanently exposed concrete.
 - 1. Comply with pool and gutter profile shown if edges not shown to be chamfered.
- I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

- J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEMS INSTALLATION

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 1. If required for equipment or piping installation, install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303.

3.3 REMOVING AND REUSING FORMS

- A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations, and curing and protection operations need to be maintained.
 - 1. Leave formwork for beam soffits, joists, slabs, and other structural elements that support weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.
 - 2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
- B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material are not acceptable for exposed surfaces. Apply new form-release agent.
- C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Engineer.

3.4 SHORING AND RESHORING INSTLLATION

- A. Comply with **ACI 318** (ACI 318M) and **ACI 301** (ACI 301M) for design, installation, and removal of shoring and reshoring.
 - 1. Do not remove shoring or reshoring until measurement of slab tolerances is complete.
- B. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

3.5 STEEL REINFORCEMENT INSTALLATION

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- E. Dowel bar substitutes may be used in lieu of lap splices.

3.6 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Engineer.
 - 1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
 - 2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches (38 mm) into concrete.
 - 3. Locate joints for beams and slabs in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
 - 4. Locate horizontal joints in walls and columns at underside of slabs and beams.
 - 5. Vertical joints in walls shall be located at corners, and in concealed locations where possible.
 - 6. Use a bonding agent:
 - a. At locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
 - b. At cove joint where cove mortar is placed against hardened wall and slab.
 - c. At coping where coping is placed against hardened wall.
- C. Contraction Joints in Slabs: No contraction joints shall be placed in pool bottom slab.
- D. Joints in Coping:
 - 1. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated, or, 2 feet maximum.

Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:

a. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch (3.2 mm). Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.

b. Isolation Joints: Install vertical joint-filler strips at _ feet.

1) Terminate full-width joint-filler strips not less than 1/2 inch (13 mm) or more than 1 inch (25 mm) below finished concrete surface where joint sealants are indicated.

3.7 WATERSTOP INSTALLATION

A. Flexible Waterstops: Install in construction joints and at other joints indicated to form a continuous diaphragm. Install in longest lengths practicable. Support and protect exposed waterstops during progress of the Work. Field fabricate joints in waterstops according to manufacturer's written instructions.

B. Non-Expanding Strip Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions, adhesive bonding, mechanically fastening, and firmly pressing into place. Install in longest lengths practicable.

3.8 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections are completed.

B. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301 (ACI 301M).

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

C. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

1. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.

2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301 (ACI 301M).

3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches (150 mm) into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion,

limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

- D. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
 - 1. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 - 2. Maintain reinforcement in position on chairs during concrete placement.
 - 3. Screed slab surfaces with a straightedge and strike off to correct elevations.
 - 4. Slope surfaces uniformly to drains where required.
 - 5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

3.9 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
 - 1. Apply to concrete surfaces not exposed to public view.
symmetrical
- B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
 - 1. Apply to concrete surfaces exposed to public view, to receive a rubbed finish, or to be covered with a coating or covering material applied directly to concrete.
- C. Rubbed Finish: Apply the following to smooth-formed-finished as-cast concrete where indicated:
 - 1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
- D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.+

3.10 FINISHING SLABS AND WALLS

- A. General: Comply with **ACI 302.1R** recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Verify all finish requirements with swimming pool finish subcontractor before finishing concrete.
 - 1. Provide certification, with swimming pool finish subcontractor, that concrete finish complies with manufacturer's recommendations for final pool finish.
- C. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch (6 mm) in one direction.
 - 1. Apply scratch finish to surfaces to receive mortar setting beds for bonded cementitious floor finishes.
- D. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.
 - 1. Apply float finish to surfaces to receive trowel finish.
- E. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
 - 1. Apply a trowel finish to surfaces exposed to view or to be covered with ceramic tile, paint, or another thin-film-finish coating system.
 - 2. Finish and measure surface, so gap at any point between concrete surface and an unlevelled, freestanding, 10-ft.- (3.05-m-) long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/8 inch (3.2 mm).

3.11 MISCELLANEOUS CONCRETE ITEMS INSTALLATION

- A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

3.12 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with **ACI 306.1** for cold-weather protection and ACI 301 (ACI 301M) for hot-weather protection during curing.

- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for remainder of curing period.
- D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
- E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
 - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - a. Water.
 - b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.
 - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
 - 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
 - a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer.

3.13 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Engineer. Remove and replace concrete that cannot be repaired and patched to Engineer's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 (1.18-mm) sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets,

fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch (13 mm) in any dimension to solid concrete. Limit cut depth to 3/4 inch (19 mm). Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
 2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar matches surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
 3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Engineer.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch (0.25 mm) wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
 2. After concrete has cured at least 14 days, correct high areas by grinding.
 3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
 4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
 5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch (6 mm) to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
 6. Repair defective areas, except random cracks and single holes 1 inch (25 mm) or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch

(19-mm) clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

7. Repair random cracks and single holes 1 inch (25 mm) or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

- E. Repair materials and installation not specified above may be used, subject to Engineer's approval.

3.14 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

- B. Inspections:

1. Steel reinforcement placement.
2. Headed bolts (if required for equipment and piping installation).
3. Verification of use of required design mixture.
4. Concrete placement, including conveying and depositing.
5. Curing procedures and maintenance of curing temperature.
6. Verification of concrete strength before removal of shores and forms from beams and slabs.

- C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to [ASTM C172/C172M](#) shall be performed according to the following requirements:

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd. (4 cu. m), but less than 25 cu. yd. (19 cu. m), plus one set for each additional 50 cu. yd. (38 cu. m) or fraction thereof.
 - a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
2. Slump: [ASTM C143/C143M](#); one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
3. Air Content: [ASTM C231/C231M](#), pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: [ASTM C1064/C1064M](#); one test hourly when air temperature is 40 deg F (4.4 deg C) and below or 80 deg F (27 deg C) and above, and one test for each composite sample.

5. Compression Test Specimens: ASTM C31/C31M.
 - a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
6. Compressive-Strength Tests: ASTM C39/C39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
7. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa).
8. Test results shall be reported in writing to Engineer, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
9. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Engineer but will not be used as sole basis for approval or rejection of concrete.
10. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Engineer. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42/C42M or by other methods as directed by Engineer.
11. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
12. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

-- End of Section --

SECTION 13 11 03

SWIMMING POOL TILE
<AMENDMENT NO. 0002>

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The drawings and General Provisions of the contract, including General and Supplementary Conditions apply to work of this section.

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 302.1R (2015) Guide for Concrete Floor and Slab Construction

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A108.1A (1999) Specifications for Installation of Ceramic Tile

ANSI A137.1 (2012) American National Standards Specifications for Ceramic Tile

ASTM INTERNATIONAL (ASTM)

ASTM D5957 (2013) Standard Guide for Flood Testing Horizontal Waterproofing Installations

1.3 SUMMARY

- A. The cementitious pool finish shall have ceramic tile markings and trim at locations including the pool vertical tile band, nosings, depth transitions, toe ledge, recessed wall steps, depth markings, wall targets, floor lane markings and all other tile installations as shown and detailed on the contract drawings and in strict accordance with these specifications. (AM#0002)> Reference Finish Schedule Specification 09 06 00 and interior finish schedules on plans for tile color and pattern.

- B. The CONTRACTOR shall furnish and install the work of this section.

1.4 RELATED SECTIONS

- A. Division 1 - Mock Ups
B. Division 7 - Joint Sealers
C. Division 9 - Ceramic Tile

- D. Section 13 11 00 - Swimming Pool
- E. Section 13 11 04 - Swimming Pool Cementitious Finish

1.5 QUALITY ASSURANCE

- A. Reference Standards: Conform to the following standards unless otherwise required herein.

- a. A108.01 - General Requirements: Subsurfaces and Preparations by Other Trades.
 - b. A108.02 - General Requirements: Materials, Environmental, and Workmanship.
 - c. A108.1, Glazed Wall Tile, Ceramic Mosaic Tile, Quarry Tile and Paver Tile installed with Portland Cement Mortar.
 - d. A108.1C - Contractor's Option: Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar or Installation of Ceramic Tile on a Cured Portland Cement Mortar or Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry Set or Latex-Portland Cement Mortar.
 - e. A108.5 - Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar.
 - f. A108.6 - Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile Setting and Grouting Epoxy for the Epoxy Grouting Installation Process.
 - g. A108.10 - Installation of Grout in Tile Work.
 - h. A137.1 Standard Specifications for Ceramic Tile.
- 2. American Society for Testing and Materials (ASTM)
 - a. C144-99, Aggregate for Masonry Mortar
 - b. C150-00, Portland Cement
 - c. C171-97a, Sheet Materials for Curing Concrete
 - d. C206-97, Finishing Hydrated Lime
 - e. C207-91 (R1997), Hydrated Lime for Masonry Purposes
 - f. D5957, Standard Guide for Flood Testing Horizontal Waterproofing Installations
 - g. F-1869, Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride
 - h. F-2170, Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using In Situ Probes
 - 3. Tile Council of North America (TCNA); 2013 Edition, Handbook for Ceramic Tile Installation.

4. International Standards Organization (ISO)
 - a. ISO 13007 - Part 1: 2004 Ceramic Tiles - Grouts and adhesives; specifies the value of performance requirements for all tile adhesives.
 - b. ISO 13007 - Part 2: 2005 Ceramic Tiles - Grouts and adhesives; test method for adhesives.
 - c. ISO 13007 - Part 3: 2005 Ceramic Tiles - Grouts and adhesives; terms, definitions and specifications for grout.
 - d. ISO 13007 - Part 4: 2005 Ceramic Tiles - Test methods for grout.
 5. American Concrete Institute
 - a. ACI 302 - Guide for Concrete and Floor Slab Construction
 6. International Concrete Repair Institute (ICRI)
 - a. Concrete Surface Profile (CSP)
- B. Tile installers shall have two years experience in similar pool projects which the Owner may require written proof thereof and proper tools to install tile.

(AM#0002) >

~~1.6 MANUFACTURERS~~

- ~~A. Subject to compliance with requirements provide ceramic tile, mortar and grout of the following manufacturers: American Olean Tile Co. (tile), Dal Tile Co. (tile), Buchtal (tile), KlinkerSire (tile), Mapei Corp. (thin set, waterproofing, grout and admixtures), and Latierete International Inc. (thin set, waterproofing, grout and admixtures) or approved equal.~~

< (AM#0002)

1.6 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-02 Shop Drawings

Tile Layout; G

Joint Layout; G

Patterns; G

Color Arrangement; G

Perimeter Conditions; G

Junctions with dissimilar materials; G

Thresholds and setting details; G

SD-03 Product Data

Adhesives and grouts; G

SD-04 Samples

mounted tile samples; G

SD-08 Manufacturer's Instructions

Manufacturer's installation instruction; G

Maintenance Data; G

1.7 ACTON SUBMITTALS

- A. Submit shop drawings indicating tile layout, patterns, joint layout, color arrangement, perimeter conditions, junctions with dissimilar materials, thresholds and setting details.
- B. Submit product data indicating material specifications, characteristics, and instructions for using adhesives and grouts.
- C. Samples:
 1. Mount tile and apply grout on 24 x 24-inch backerboard to indicate pattern, color variation and grout joint size variations of each pattern. Furnish mounted tile samples as requested by the Contracting Officer.
- D. Submit manufacturer's installation instruction.
- E. Submit maintenance data.
 1. Include recommended cleaning and stain removal methods, cleaning materials.

1.8 PRODUCT DELIVERY AND STORAGE

- A. Deliver tile materials to site in unopened factory containers sealed with grade seals bearing printed name or manufacturer and the words "Standard Grade". Keep the grade seals intact and containers dry until tiles are used. Keep cementitious materials dry until used.

1.9 JOB CONDITIONS

- A. Inspect and verify job conditions. Report all defects in base surfaces for correction before proceeding.
- B. Maintain a temperature range of 40 degrees Fahrenheit to 90 degrees Fahrenheit during installation of tile and grout materials. Tile installation should cure for a minimum 14 days with average a

temperature of 70 degrees, while maintaining the minimum 40 degrees and maximum 90 degrees Fahrenheit, prior to filling pool with water.

- C. Vent temporary heaters to outside to avoid carbon dioxide damage to the new tile work.

1.10 COLORS

- A. Colors to be selected by the Contracting Officer. Note that swimming pool regulations may dictate color selections within the pool tank. See 2.01 Tile Materials for price group breakdowns.

1.11 WARRANTIES

- A. The CONTRACTOR warrants to the Owner that materials and equipment furnished under the contract will be of good quality and new unless otherwise required or permitted by the contract documents, that the work will be free from defects not inherent in the quality required or permitted and that the work will conform with the requirements of the contract documents. Work not conforming to these requirements including substitutions not properly approved and authorized, may be considered defective. The CONTRACTOR'S warranty excludes remedy for damage or defect caused by abuse, improper or insufficient maintenance, improper operation, modifications not executed by the CONTRACTOR or improper wear and tear under normal usage. If required by the Owner, the CONTRACTOR shall furnish satisfactory evidence as to the kind and quality of materials and equipment. All warranties shall be for a period of five years, unless otherwise specified.
- B. All setting materials shall be provided by the same manufacturer. All mixing materials and application procedures shall be done in accordance with manufacturer's recommendations and requirements. Documentation shall be provided to this effect by the contractor with verification from the manufacturer. This documentation shall be included in the operations and maintenance manual under warranties as documentation qualifying the project for a 15 Year Systems Warranty by Laticrete International, Inc., Mapei, Inc. or approved equal.
- C. The CONTRACTOR shall agree to repair or replace any work at no cost to the Owner upon written notification from the Owner within the warranty period. Pro-rated warranties are not acceptable.

PART 2 PRODUCTS

2.1 TILE MATERIALS

- A. Standard grade conforming to ANSI A137.1. Provide trimmer units as indicated and specified, including special shapes as detailed or required. Tile patterns and colors shall be as indicated and specified, colors of approved shades. Mesh mounted or perforated paper backed tile is not allowed where the mesh of paper remains as a permanent part of the installation. If dot mounting is used, a minimum of 67% of the depth of the tile shall be free from any dots to ensure proper grout curing. All 2" x 2" tiles shall be face mounted as guaranteed suitable for pool use by the manufacturer.
(AM#0002)>Reference Finish Schedule Specification 09 06 00 and interior finish schedules on drawings for color and pattern.<(AM#0002)
- B. All tile shall be "frost-proof".

C. Unglazed Ceramic Mosaic Tile

1. Slip-resistant porcelain unglazed ceramic mosaic tile, cushion or all-purpose edges, two-inch square (AM#0002) ~~> from price group 2~~ for floor lane lines and targets, waterline band on walls, and ~~stair treads toe ledges~~ < (AM#0002) unless otherwise noted. Minimum dynamic coefficient of friction shall be 0.42 for wet surfaces and (AM#0002) > 0.65 ~~for ramped surfaces. Where (special shapes) are required they shall be selected from price group 3. Equivalents provided by Knoxtile, Dal Tile or American Olean. For wet surfaces: Buchtal Chroma Mosaics with front mount film (seven color options) 2x2 7161HVF or American Olean Unglazed color body porcelain mosaics 2"x2", price group 1-3. For ramps: Buchtal Chroma non slip mosaics with glass fiber net (four color options) 2x2 7161H. Or for wet surfaces or ramps: Buchtal Chroma non slip 5x5 32020H thirteen color options) or Dal Tile or American Olean Unglazed color body mosaics 2"x2" with 7.5% abrasive grain (7 color options). All colors to be selected by the Contracting Officer.~~
2. Ceramic tile band below the pool gutter lip, ~~recessed steps and toe ledge shall be selected by Contracting Officer from Dal Tile, Keystone Unglazed Mosaic, 2" x 2" price group 4, American Olean Unglazed color body porcelain mosaics 2"x2" price group 1-3, or powder glazed 2x2 Buchtal Chroma Mosaics provided by Knoxtile.~~
3. The 15-meter resurfacing marker shall be ceramic tile ~~selected by the Contracting Officer from Dal Tile, Keystone Unglazed Mosaic, 2"x2", price group 4, American Olean Unglazed color body porcelain mosaics 2"x2", price group 1-3.~~ The color of the resurfacing marker shall be contrasting with the deck band.
4. Contrasting ceramic tile nosings at underwater shelf edge ~~recessed steps~~ and toe ledge shall be ~~selected by the Contracting Officer from Dal Tile, Keystone Unglazed Mosaic, price group 3 and 4, American Olean Unglazed color body porcelain mosaics 2"x2", price group 1-3, or Safety Edge Tile from Inlays, Inc.; Black CPC00022, Blue CPC00021, Brown CPC00023 and Green CPC00024.~~
5. 4" wide contrasting ceramic tile stripe and 12" lane markers on the pool floor and wall targets shall be ~~selected by Contracting Officer from Dal Tile, Keystone Unglazed Mosaic, 2"x2" price group 3, American Olean Unglazed color body porcelain mosaics 2"x2" price group 3, or from Knoxtile, as 4x4 Buchtal Chroma Colors 22010H 717, 5556 Grey Black and 5535 Blue or 2x2 Mosaic 7160HVF 5535 Grey Black. < (AM#0002)~~ The main race course wall targets and lane markers shall be black. The cross-course wall targets and lane markers shall be midnight blue.

D. Provide tile trim units where indicated or necessary for a complete and finished installation. Provide rounded units for external and internal corners and angles. Provide trim units of material and finish identical to the adjoining tile.

E. Message Tile and Depth Markings

1. Horizontal and vertical depth markings and warning signs shall be 6" x 6" with 4" high numbers and letters. All horizontal depth

markers shall be slip resistant. Single tile abbreviations shall be used for 'FT' and 'IN'.

2.2 TRAINING TANK TILE SETTING MATERIALS AND INSTALLATION

A. Surface Preparation

1. Surface preparation shall be in accordance with ACI 302.1R. The surface shall be structurally sound and free of any foreign substances and debris that could reduce or impair adhesion. Sound and remove all loose concrete to firm substrate. Surfaces shall be roughened to a CSP of 3 to 5 (reference ICRI CSP Standards 7 to 9 for acceptable profile height). Thoroughly wash/rinse with clean potable water. Surface defects or holes in the substrate shall be patched per manufacturer's recommendations.

B. Slurry Bond Coat

1. Horizontal surfaces to receive a thick bed mortar application shall be installed over a slurry bond coat (AM#0002) ~~> of either Latierete 254 Platinum one step, polymer fortified, thin set mortar, or Mapei 4:1 bag mix with Planierete AC Additive~~ over a clean concrete slab, in compliance with ANSI A108.1A (2.2 & 5.2). ~~As manufactured by Latierete International, Mapei, Inc., or approved equal.~~ < (AM#0002) Note that slurry bond coats are not required under vertical applications of the render and scratch coat.

C. Mortar & Leveling Beds

1. Bonded Thick Bed Method (Floor / Horizontal Surfaces): Provide a dry pack, thick mortar bed on horizontal surfaces (AM#0002) ~~> consisting of either Latierete 3701 Fortified Mortar Bed, or Mapei, 4:1 bag mix with Planierete AC Additive.~~ < (AM#0002) Apply over a properly prepared slurry bond coat. Maximum lift thickness not to exceed 2".
2. Render- Scratch and Float Coats (Wall / Vertical Surfaces): Provide wall render (scratch and float coats) on vertical competition turning surfaces to a depth of 4 feet below the water surface, consisting of either Latierete 3701 Fortified Mortar Bed, or Mapei, 4:1 bag mix with Planierete AC additive for lift thicknesses up to ½". Wall render is made to a plastic consistency when used vertically. Fill all holes and bring surface up to line and plane as required. (AM#0002) ~~> As manufactured by Latierete International, Mapei, Inc. or approved equal.~~ < (AM#0002) Note that slurry bond coats are not required under vertical applications of the render and scratch coat. (Refer to Course Length Tolerances for competitive pools.)

D. Tile Thin-Set

1. Use (AM#0002) ~~> either Latierete 254 Platinum one-step, polymer fortified, thin-set mortar or Mapei Ultraflex 3 one step, polymer modified, thin set mortar, used in accordance with the manufacturer's requirements. As manufactured by Latierete International, Mapei, Inc., or approved equal.~~ < (AM#0002)

E. Tile Grout

1. Use (AM#0002) ~~>either Latierete Spectra LOCK Pro Premium Grout or Mapei Kerapoxy CQ Grout~~ in accordance with the manufacturer's requirements ~~as manufactured by Latierete International, Mapei, Inc. or approved equal.~~ < (AM#0002)

F. Elastomeric Sealant

1. Use (AM#0002) ~~>Latierete Latasil < (AM#0002)~~ sealant for all inside/outside corners, expansion/movement joints, and to seal lighting/plumbing fixture penetrations. Apply sealant over (AM#0002) ~~> Latasil 9118 < (AM#0002)~~ primer. All primer and sealant installation shall be in accordance with the manufacturer's requirements. (AM#0002) ~~> As manufactured by Latierete International, Inc., or approved equal.~~ < (AM#0002)
- G. All mixing and application procedures shall be done in accordance with the manufacturer's recommendations and requirements. The manufacturer's representative shall visit the site to verify field conditions, confirm materials and application requirements and ascertain that all materials and systems are so installed. Documentation shall be provided to this effect.

PART 3 EXECUTION

3.1 PREPARATION

- A. Complete water tightness test prior to tile installation. Concrete tank shall be watertight per ASTM D5957, the Tile Council of North America, and specification 13 11 00.
- B. Clean substrates of dust, dirt, oil, grease and deleterious substances and mechanically roughen concrete and shotcrete for bond. Conform to applicable reference standards and to recommendations of manufacturers of materials used and meeting ICRI, CSP of 3-5.
- C. Substrates to Receive Mortar Setting Beds
 1. Dampen concrete substrate to receive tile work according to above referenced standards or tile manufacturer's instructions, as required.
- D. Substrates to receive thin set tile applications shall meet normal construction tolerances of 1/4" in 10' where competition tolerances do not apply and shall meet competition tolerances where required elsewhere in these specifications, and shall be free of bumps, dips and surface irregularities that may effect the satisfactory installation of the tile.
- E. Tile Wetting
 1. Dampen tile according to above reference standards or tile manufacturer's instructions, as required.
- F. Screeds
 1. Accurately set temporary screeds to control the finish plane of mortar-bed set tile and remove as soon as setting bed is sufficiently hardened. Fill void spaces from screeds with same

mortar.

3.2 TILE INSTALLATION

- A. Arrange tile according to patterns detailed. Set tile with flush well-fitted joints, finished in true planes, plumb, square, joints of uniform size. Provide approved trimmers as shown or required. Cut tile without marring. Carefully grind and joint tile edges and cuts.
- B. Follow Tile Council of North America installation methods P601 and B417 to achieve total tile system thickness for thin or thick-set.

1. Thick Set

a. Apply specified setting bed mortar, up to 2" in thickness, on cured and dried concrete pool shell. Tamp and screed to required planes. Spread no more mortar than can be covered with tile before initial set. Do not use re-tempered mortar. Trowel 3/32" to 1/8" thick bond coat over plastic setting bed mortar just before setting tile or apply bond coat to back of each tile placed. 95% coverage of the back of the tile or tile sheet is required. Set tile in position and beat firmly into the setting bed mortar. Bring tile faces to a true and correct plane. Complete all beating and leveling before mortar sets and in no case later than one hour after first placing. When ready, wet and remove paper and glue avoiding excess water. At this time adjust any out-of-line or out-of-level tile.

2. Thin Set

a. Apply specified bond coat on cured and dried concrete pool shell. Trowel 3/32" to 1/8" thick bond coat over concrete pool shell just before setting tile or apply bond coat to back of each tile placed. 95% coverage of the back of the tile or tile sheet is required. Set tile in position and beat firmly into the setting bed mortar. Bring tile faces to a true and correct plane. Complete all beating and leveling before mortar sets and in no case later than one hour after first placing. When ready, wet and remove paper and glue avoiding excess water. At this time adjust any out-of-line or out-of-level tile.

- C. Finished tile surface shall be level and in plane, with no sharp or protruding edges. Tiles out of plane more than 1/16" shall be removed and replaced. Sharp edges shall be stoned smooth.

D. Grout Joint Sizes

- 1. Unless otherwise approved, install tile with uniform 3/32-inch joint width. A maximum 1/8" joint width may be utilized to meet specific installation requirements, if required.

E. Ceramic Tile Joint Grouting

- 1. Mix grout to a thick creamy consistency and force into joints for entire thick depth, flush with surface. Clean off all excess and fill skips and gaps before grout sets. Color selection by Contracting Officer. Provide dampness for minimum 3-day curing and polish with clean dry cloths (not required when epoxy grouts are used).

F. Expansion Joints

1. Place expansion joint per applicable TCNA Method P601MB, P601TB, or P602 and conforming to Method EJ171. Provide shop drawings showing backer rod and joint dimensions. All expansion, control, construction, cold, and seismic joints in the pool structure should continue through the tile work, including such joints at vertical surfaces. Movement joints shall be placed at all changes in direction and elevation. Refer to the structural engineer for additional required movement joints. Joint size shall be a minimum of 1/8". Joints through tile work directly over structural joints shall not be narrower than the structural joint. The Contractor shall use cement compatible coatings when using chalk lines for joint layout purposes.

G. Fill and Empty Rates

1. Use a fill and drain rate of 2 feet per 24 hours to minimize thermal shock and structural movement. Maintain a temperature differential of 10 degrees Fahrenheit or less between the pool water and the substrate during fill and drain cycles.

3.3 TESTING AND INSPECTION

- A. Before filling of the pool, and its subsequent provisional acceptance at substantial completion, the tile installation shall be visually inspected and sounded in the presence of the Contracting Officer to verify adhesion of the tile to its substrate as well as its overall compliance with the requirements of this Section.
- B. Any and all tile work found to be loose, improperly adhered, out of plane, misaligned or otherwise non-conforming shall be removed and replaced at no additional cost to the Owner.

3.4 CLEANING

- A. Upon completion of placement and grouting, clean tile installation as recommended by TCNA and manufacturers of proprietary materials. Tile shall be cleaned with pH neutral solutions, free of both sodium and potassium, in accordance with the tile and grout manufacturer's printed instruction.
- B. Leave finished installation clean and free of cracked, chipped, broken, un-bonded or otherwise defective tile work.
- C. Protect installed tile work with non-staining Kraft paper, polyethylene sheeting, or other approved heavy covering during the construction period to prevent damage.

3.5 REPLACEMENT TILE

- A. Provide Owner with approximately 10% or 25 square feet (whichever is least) of each color and type tile used on the project for Owner's repair and replacement requirements.

-- End of Section --

SECTION 13 11 04

SWIMMING POOL CEMENTITIOUS FINISH

<AMENDMENT NO. 0002>

PART 1 GENERAL

1.1 SUMMARY

- A. Provide a conventional proprietary aggregate plaster finish to the pool structure(s). Provide installation of bond coat prior to application of pool finishes. A ceramic tile trim shall be furnished and installed on the pool vertical tile band, nosings, depth transitions, toe ledge, recessed wall steps, depth markings, wall targets, floor lane markings and all other tile installations as shown and detailed on the contract drawings and in strict accordance with these specifications. (AM#0002)>Reference Finish Schedule Specification 09 06 00 ad interior finish schedules on plans for tile.<(AM#0002)
- B. Provide water analysis and pre-fill requirements.

1.2 SUBMITTALS

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

SD-04 Samples

Pool Plaster; G

SD-06 Test Reports

Domestic water analysis; G

Calculation of amounts of chemicals required; G

SD-07 Certificates

Materials; G

1.3 ACTION SUBMITTALS

- A. Samples
1. Prepare 12-inch square panel at the site showing color and texture for pool plaster. Finished cementitious finish work shall match the approved sample panel.
- B. Certificates
1. Submit certificates attesting that the materials furnished meet the requirements specified herein.

C. Test Report

1. Submit results of domestic water analysis and calculation of amounts of chemicals required to balance pool water on initial fill of pool.

1.4 PRODUCT DELIVERY AND STORAGE

- A. Deliver manufactured materials to site in manufacturers' original unbroken packages or containers bearing manufacturers' name and brand labels. Keep cementitious materials dry until ready to be used and stored off the ground, under cover and away from damp surfaces.

1.5 JOB CONDITIONS

- A. Apply plaster in training tanks only when ambient temperature is above 40 degrees F and below 90 degrees F and protect applied plaster from rapid drying by sun or wind until curing is completed or pool is filled with water. Confirm and comply with all applicable manufacturer's installation requirements.

1.6 QUALITY ASSURANCE

- A. Plaster installers shall have two years' experience in similar pool projects which the Owner may require written proof thereof and proper tools to install plaster.

1.7 SURFACE PREPARATION

A. Surface Preparation

1. Surface shall be structurally sound and free of any foreign substances and debris that could reduce or impair adhesion, free of dirt, oil, grease or other foreign materials. Sound and remove all loose concrete to firm substrate. Surfaces shall be roughened by sand blasting, water jetting, shot blasting, scarifying, or grinding. Pressure-wash the entire surface. Wash with trisodium phosphate (TSP) using a stiff broom. Thoroughly wash/rinse with clean potable water. Surface defects or holes in the substrate shall be patched per manufacturer's recommendations.
2. Apply and cure bond coat per manufacturer's recommendations. After proper curing of bond coat, lightly moisten with clean potable water prior to application of cementitious finish. Ensure bond coat is free of any foreign matter prior to plastering.

PART 2 PRODUCTS

(AM#0002)>Provide one of the following cementitious finish options at the pool tanks:

2.1 DIAMOND BRITE (AM#0002)>QUARTZ AGGREGATE PLASTER FINISH<(AM#0002)

- A. The CONTRACTOR shall install a slip-resistant proprietary plaster finish in the areas indicated on the drawings. Description: (AM#0002)>~~Diamond Brite~~ finish shall be a blend of selected quartz aggregates and fortified white Portland cement. Color and texture shall be selected by the Contracting Officer. Confirm all installation requirements with the manufacturer.

B. Bond Coat

(AM#0002) >

1. ~~Bond Kote by SCM, Inc., or approved equal.~~ < (AM#0002) Apply and cure bond coat per manufacturer's recommendations. After proper curing of bond coat, lightly moisten with clean potable water prior to application of cementitious finish. Ensure bond coat is free of any foreign matter prior to plastering.

C. Mixing

1. Thoroughly mix (AM#0002) >~~Diamond Brite~~ < (AM#0002) to a homogeneous lump-free consistency using 1-1/2 to 2 gallons of potable water per 80 lb. bag.

D. Application

1. (AM#0002) >~~Diamond Brite shall be applied~~ < (AM#0002) to a uniform thickness of 3/8" to 1/2" over the entire surface. The walls shall be scratch-coated followed by a finish coat. Material applied to the floor after the walls have been applied shall be accelerated to assure uniform setting time throughout the pool surface.

E. Coverage

1. Each 80 lb. bag shall cover approximately 25 square feet to a thickness of 3/8".

F. Proprietary plaster finish is to be applied by a licensed applicator as approved by the manufacturer.

2.2 (AM#0002) >~~PEBBLE SHEEN~~PEBBLE AGGREGATE PLASTER FINISH< (AM#0002)

- A. The CONTRACTOR shall install a slip-resistant pebble stone surface in the areas as indicated on the drawings. Description: (AM#0002) >~~Pebble Sheen~~ < (AM#0002) finish shall be a blend of selected colored aggregates and fortified white Portland cement. Color and texture shall be selected by the Contracting Officer. (AM#0002) >~~Finish to consist of Pebble Sheen as supplied by Pebble Technology, Inc. (480) 948-5058, or approved equal.~~ < (AM#0002) Confirm all installation requirements with the manufacturer.

B. Surface Preparation

1. Surface shall be structurally sound and free of any foreign substances and debris that could reduce or impair adhesion, free of dirt, oil, grease or other foreign materials. Sound and remove all loose concrete to firm substrate. Surfaces shall be roughened by sand blasting, water jetting, shot blasting, scarifying, or grinding. Pressure-wash the entire surface. Wash with trisodium phosphate (TSP) using a stiff broom. Thoroughly wash/rinse with clean potable water. Surface defects or holes in the substrate shall be patched per manufacturer's recommendations. Lightly moisten walls and floors prior to application (AM#0002) >~~of Pebble Sheen.~~ < (AM#0002)

C. Bond Coat

1. (AM#0002) > ~~Scratch Kote System by Multicoat Corporation, Bond Kote~~

~~by SGM, Inc., or approved equal.~~ (AM#0002) >Apply and cure bond coat per manufacturer's recommendations. After proper curing of bond coat, lightly moisten with clean potable water prior to application of cementitious finish. Ensure bond coat is free of any foreign matter prior to plastering.

- D. The cement-pebble stone mixture is to be pneumatically applied to the pool surface.
- E. After application of (AM#0002) >~~Pebble Sheen~~ <(AM#0002) material the surface is to be hand troweled for exposure of pebble material.
- F. Spray down troweled surface with water to remove excess cement and exposure of pebbles.
- G. Surface is allowed a minimum of a 24-hour hardening period. Upon hardening the surface is cleansed with an approved solution as provided by the manufacturer for final exposure and luster of pebble surface.
- H. Surface is to be buffed so as to ensure all sharp edges are removed and final surface texture is per the manufacturer's recommendations.
- I. Natural pebble stone surface is to be applied by a licensed applicator as approved by the manufacturer.

PART 3 EXECUTION

3.1 PREPARATION OF SURFACES AND BOND COAT

- A. Clean base surfaces of projections, dust, loose particles, grease, bond breakers, and foreign matter; make sufficiently rough to provide a strong mechanical bond. Sandblast, acid etch, or waterblast to achieve appropriate profile. If acid etching, surfaces must be neutralized, and power washed prior to proceeding. Do not apply cementitious finishes directly to the surfaces of masonry or concrete that is coated with any acidic solution compound or similar agent until compound or agent is completely removed by water blasting. Thoroughly wash entire surface with 2,000 psi high-pressure water immediately prior to application of finishes. Wet cementitious base surfaces with a fine fog water spray to produce a uniformly moist condition and check screeds, pool equipment, and accessories for correct alignment before work is started. Do not apply finish materials to base surfaces containing frost. Install temporary coverings as required to protect adjoining surfaces from staining or damage by plastering operations.
- B. Prepare and clean concrete surfaces by removing oil or grease. Repair all cracks, surface damage as required prior to proceeding. Protect or mask all adjacent surfaces that are not scheduled to receive cementitious finish. If expansion or construction joints exist in the areas where cementitious finish will be applied cover plastic joints for protection (if plastic joints are used). Additionally, mark joints for saw-cutting if area will be saw-cut.
- C. Apply and cure bond coat per manufacturer's recommendations. After proper curing of bond coat, lightly moisten with clean potable water prior to application of cementitious finish. Ensure bond coat is free of any foreign matter prior to plastering.
- D. Contractor to thoroughly verify the site conditions prior to the

application of cementitious finish. Verify concrete is free of ridges and sharp projections. Verify that all concrete surfaces that are to receive a cementitious finish have cured for a minimum of 5 days. Consideration should be given for the application of a primer for all concrete structures that is over 28 days old to improve bonding.

3.2 APPLICAITON OF CEMENTITIOUS FINISH

A. General

1. Confirm all application requirements with the manufacturer. Apply finish plaster to the properly prepared substrate at the minimum thickness required by the manufacturer, but no less than 3/8-inch thickness at any location. Apply finish plaster by hand or machine. If plastering machine is used, control fluidity of plaster to have a slump not exceeding 2-1/2 inches when tested using a 2" by 4" by 6" high slump cone. Do not add additional water to the mix subsequent to determining water content to meet this slump. Perform slump test according to following procedure:
 - a. Place cone on level, dry non-absorptive base plate.
 - b. While holding cone firmly against base plate, fill cone with plaster taken directly from hose or nozzle of plastering machine, tamping with a metal rod during filling to release all air bubbles.
 - c. Screed off plaster level with top of cone. Remove cone by lifting it straight up with a slow and smooth motion.
 - d. Place cone in a vertical position adjacent to freed plaster sample suing care not to jiggle base plate.
 - e. Lay straightedge across top of cone being careful not to vibrate cone; measure slump in inches from bottom edge of straightedge to the top of slumped plaster sample.

B. Workmanship

1. Unless otherwise required by the manufacturer, apply finish plaster in two coats by "double-back" method with second coat applied as soon as first coat is tamped and initially floated. Apply plaster with sufficient pressure to provide a good bond on bases. Work plaster to screeds at intervals of from 5 feet to 8 feet on straight surfaces. Apply smooth trowel finish without waves, cracks, trowel marks, ridges, pits, crazing, dis-coloration, projections, or other imperfections. Form plaster carefully around curves and angles, well up to screeds. Take special care to prevent sagging and consequent drooping of applications. Produce surfaces free of visible junction marks in finish coat where one day's work adjoins another. Finish proprietary plaster as required by the manufacturer.
2. All cementitious finishes shall be applied by a licensed applicator as approved by the manufacturer.

C. Curing

1. Curing cementitious finishes with fine fog water spray applied to finish coat as frequently as required to prevent dry-out of

surface, or as directed by the manufacturer of the cementitious finish. Keep plaster damp until pool is filled. Prevent damage or staining of plaster by troweling or curing.

D. Patching, Pointing, and Cleaning Up

1. Upon completion, cut out and patch loose, cracked, damaged, or defective plaster; patches matching existing plaster in texture, color, and finish, flush with adjoining plaster. Perform pointing and patching of surfaces and plasterwork abutting or adjoining any other finish work in a neat and workmanlike manner. If 10 percent or more of the pools plaster finish is found to be defective, the plaster shall be removed and replaced complete from all surfaces. Remove plaster droppings or spattering from all surfaces. Leave plaster surfaces in clean, unblemished condition ready for pool filling. Remove protective coverings from adjoining surfaces. Remove rubbish and debris from the site.

3.3 PRE-FILL SPECIFICATION

- A. Contractor shall employ a qualified water testing agency to analyze the domestic water with which the pool will be filled within 2 weeks of the plaster date and shall employ a training tank experienced water chemistry consultant to determine types and quantities of chemicals required to ensure calcium-balanced water immediately upon the completion of water filling. Refer to section 13 11 00 for water filling requirements.
 1. Have on hand quantities of the chemicals as determine above, plus 25% overage for follow-up treatment. These chemicals, typically including calcium chloride, bicarbonate of soda, and muriatic acid are in addition to standard bromine/chlorine products and alkalizer/pH control products required elsewhere.
- B. The pool(s) shall not be plastered until directed by the Owner's representative and the filtration system and chlorination system are complete and ready for start-up. The Contractor shall supply all chemicals required for treatment of the pool water.
- C. The Contractor shall submit domestic water analysis to the Contracting Officer at least 2 weeks prior to filling the pool(s).

-- End of Section --

SECTION 13 11 06

SWIMMING POOL TIMING SYSTEM

<AMENDMENT NO. 0002>

PART 1 GENERAL

1.1 RELATED DOCUMENTS

The BIDDING REQUIREMENTS, CONTRACT FORMS, AND CONDITIONS OF THE CONTRACT and applicable parts of DIVISION 1 - GENERAL REQUIREMENTS, as listed in the Table of Contents, shall be included in and made a part of this Section.

1.2 SUMMARY OF WORK

1.2.1 Introduction

1. Provide all labor, materials, equipment and services necessary to install a complete electronic timing and scoreboard system with multi-sport capability for race swimming, and pace clock.

1.2.2 Work Included in this Section

1. It is the intent of this section to place the entire responsibility for the complete electronic timing and scoreboard system (including all appropriate connections) with multi-sport capability under one vested supplier. The supplier is responsible for providing full integration of this system. Multiple suppliers for a system will not be approved.

1.2.3 Related Work Specified in Electrical Sections

Reference Division 26 - Electrical. Work to be completed by other contractors.

1. Ground and bond all pool structures, fittings and equipment in accordance with Article 680 of the N.E.C. Test and verify that the system electrical ground is true and solid. Provide certification to this effort.
2. Obtain permits, inspections, and approvals of all wiring including grounding and bonding of all metal components associated with the pool in accordance with Local, State and National Electrical Codes.
3. Install power, conduits, electrical boxes, ethernet connections and wiring for the Contractor furnished electronic timing and scoreboard system with multi-sport capability for race swimming, and pace clock.
4. Supply junction boxes for all equipment outlined in these specifications and depicted on the timing system drawings

(AM#0002) >

~~1.2.4 Basis of Design~~

- ~~1. The complete electronic timing and scoreboard system with multi sport capability is based upon Colorado Timing System, Inc.~~

~~1.3 ACCEPTABLE MANUFACTURERS AND SUPPLIERS~~~~Colorado Time Systems, Inc., 1551 East 11th Street, Loveland, CO 80537,
970 667 1000. (Basis of Design.)~~

< (AM#0002)

1.3 REFERENCES

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

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI B1.1 (1982; 1984) Unified Inch Screw Threads

ANSI B212.15 (1994) Cutting Tools - Carbide-Tipped
Masonry Drills & Blanks for Carbide-Tipped
Masonry Drills

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B18.21.1 (2009; R 2016) Washers: Helical
Spring-Lock, Tooth Lock, and Plain Washers
(Inch Series)

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

ASTM INTERNATIONAL (ASTM)

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

ASTM A123/A123M (2017) Standard Specification for Zinc
(Hot-Dip Galvanized) Coatings on Iron and
Steel Products

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

ASTM A575 (1996; E 2013; R 2013) Standard
Specification for Steel Bars, Carbon,
Merchant Quality, M-Grades

ASTM A576 (2017) Standard Specification for Steel
Bars, Carbon, Hot-Wrought, Special Quality

ASTM A635/A635M (2019) Standard Specification for Steel,
Sheet and Strip, Heavy-Thickness Coils,
Hot-Rolled, Alloy, Carbon, Structural,
High-Strength Low-Alloy, and High-Strength
Low-Alloy with Improved Formability

ASTM A1011/A1011M (2018a) Standard Specification for Steel
Sheet and Strip, Hot-Rolled, Carbon,
Structural, High-Strength Low-Alloy,

High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength

ASTM B633

(2019) Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel

ASTM E488

(1996) Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements

ASTM F594

(2009; E 2015) Standard Specification for Stainless Steel Nuts

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70

(2017; ERTA 1-2 2017; TIA 17-1; TIA 17-2; TIA 17-3; TIA 17-4; TIA 17-5; TIA 17-6; TIA 17-7; TIA 17-8; TIA 17-9; TIA 17-10; TIA 17-11; TIA 17-12; TIA 17-13; TIA 17-14; TIA 17-15; TIA 17-16; TIA 17-17) National Electrical Code

1.4 SEQUENCING AND SCHEDULING

Specification subparagraph text.

1.5 SUBMITTALS

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

SD-03 Product Data

Product Data; G

SD-05 Design Data

System Layout; G

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals; G

Manuals shall include a complete parts list.

SD-11 Closeout Submittals

Warranty for each piece of equipment within this section; G

1.6 JOB CONDITIONS

1. Manufacturers proposing to submit a quotation for the electronic timing and scoreboard system must confirm that all embedded items are compatible with the installation of their respective systems.
2. Manufacturers shall review the construction documents and shall notify

the Contracting Officer 10 days prior to the bid date of conflicts or additions to the work of other subcontractors for the proper installation of their system.

1.7 WARRANTY

1. The CONTRACTOR shall warranty the completed installation of all systems in this section for one year.
2. The manufacturer shall warranty the scoreboard, computer consoles, touchpads, pace clocks and starting system for two years.
3. The manufacturer shall warranty the titanium timing system wall plate and deck plates for five years.

PART 2 PRODUCTS

2.1 SCOREBOARD SYSTEM

2.1.1 Full Color Video Display - (Quantity 2)

1. Full Color Video Display system shall display all necessary information to time swimming, in compliance with the appropriate sanctioning body - USA SWIMMING.

(AM#0002) >

~~a. Basis of Design: Multi Sport LED Scoreboard System is based upon Colorado Timing System, Inc.~~ < (AM#0002) >

2. Display shall include: Full matrix LED scoreboard with computer controller, flat-wall mounting hardware and data/fiber cable up to 500'.
3. Display shall be a full color LED matrix display. Display shall be comprised of red, blue and green LEDs to form pixels. Display shall be capable of 16.8 million shades of color.
4. Display should be capable of 10-bit video processing, refresh rate of 240Hz, four levels of dimming capability and allow for Gamma correction.

Display intensity shall be adjustable between 562-1500 nits for INDOOR.
5. The display shall have a built-in graphics and animation capability with Windows- based software. Graphics and animation shall have the capacity of being displayed on the entire matrix. All MS Windows fonts shall be compatible with the display.
6. Display must have the ability to show live video or DVD's.
7. Display shall allow for front or rear access points for service.
8. Display shall include 2% spare critical parts.
9. Operation temperature shall be between 14F - 140F (-10c - 60c).
10. Humidity tolerance shall be between 0%-95%.
11. Each indoor pixel shall be comprised of 3 LEDs.

12. Scoreboard Details:

- a. Minimum Viewing Distance: 24 ft to 350 ft.
- b. Pixel Spacing: 8 MM
- c. Active Area: 8.4' (H) x 15.2' (W)
- d. Pixel configuration shall be: 184,320 PIXELS
- e. Weight: 2000 LBS

2.1.2 Scoreboard Hanging Requirements

Scoreboard manufacturer shall provide drawings with hanging information.

1. Material: Scoreboard hangers shall be galvanized steel for an indoor natatorium.
2. Coordinate scoreboard hanging requirements with structural engineer prior to the submittal process.

Anchors

1. Hollow Block Construction

- a. Sleeve type anchors feature a split expansion sleeve over a threaded stud bolt body and integral expander, nut and washer. Anchors shall be made of zinc plated Carbon Steel, or Type 18-8 Stainless Steel. Anchors should be installed with carbide tipped hammer drill bits made in accordance to ANSI B212.15-1994. Anchors shall be tested to ASTM E488 criteria and shall meet or exceed U.S. Government G.S.A. specification A-A-55614 Type 2 (Formerly GSA: FF-S-325 Group VIII, Type 2), California State Fire Marshal, Factory Mutual and Underwriters Laboratories.

2. Filled Block or Solid Concrete Construction:

- a. The anchor shall be a torque-controlled expansion anchor, which provides consistent performance for a wide range of mechanical anchor applications. This anchor series is available in carbon steel with zinc electroplated coating, carbon steel with hot-dip galvanized coating, 304 stainless steel and 316 stainless steel versions. The threaded stud version of the anchor is available in a variety of diameters ranging from 1/4- to 1-in. depending on the steel and coating type. Applicable base materials include normal-weight concrete, structural lightweight concrete, lightweight concrete over metal deck, and grout-filled concrete masonry. Basis of design is AISI Type 316 stainless steel KWIK Bolt 3 (KB3) manufactured by Hilti, Inc.
- b. Three anchors shall have an anchor body, nut and washer that conform to AISI Type 316. The expansion wedges conform to AISI Type 316 stainless steel.
- c. Anchor bodies smaller than 3/4-inch, excluding all KWIK Bolt 3 Countersunk, are produced from AISI Type 304 or Type 316 stainless steel having the bolt fracture loads shown in table 1. Anchor bodies 3/4-inch and larger, and all stainless-steel KWIK Bolt 3

Countersunk anchor bodies, are produced from AISI Type 304 or Type 316 stainless steel having the mechanical properties shown in table 1. Nuts meet the dimensional requirements of ASTM F594. Washers meet the dimensional requirements of ASME B18.21.1, Type A, plain. Stainless steel expansion wedges for AISI Type 304 are made from either AISI Type 304 or Type 316. Stainless steel expansion wedges for AISI Type 316 anchors are made from type 316. All stainless-steel nuts and washers for AISI Type 304 or Type 316 anchors are manufactured from AISI Type 304 or 316, respectively.

Supports

1. Unistrut (LED Board)

a. Material

- 1) Fittings, unless noted, are made from hot-rolled, pickled and oiled steel plates, strip or coil, and conform to ASTM A575, ASTM A576, ASTM A635/A635M, or ASTM A36/A36M. The fitting steel also meets the physical requirements of ASTM A1011/A1011M SS GR 33. The pick-ling of the steel produces a smooth surface free from scale. Many fittings are also available in stainless steel, aluminum and fiberglass. Consult factory for ordering information.

b. Finishes

- 2) Fittings are available in: Perma-Green III (GR), Electro-galvanized (EG), conforming to ASTM B633 Type III SC1; Hot-dipped galvanized (HG), conforming to ASTM A123/A123M or ASTM A153/A153M.

Brackets

1. Per ANSI B1.1- Surface roughness per ASME B46.1- Surface roughness on holes 250 MAX unless otherwise specified. Variations in form from unmachined features are permitted within established - all filets 0.005-0.020 (APPROX. RADIUS) - Screw threads per ANSI B1.1- Pipe threads commercial standards. All edges and corners 0.005-0.020 (approx. radius or chamfer).
2. All materials and components used in the assembly of this item must be RoHS complaint material: 12GA (.105) HRS. The finish shall be ZINC CLEAR CHROMATE PLATED. Manufacturer shall break all sharp edges and corners.
3. All support hardware, brackets, fasteners, hangers, etc. used during installation of the scoreboard shall be Zinc Clear Chromated Plated.

2.2 MULTI-SPORT COMPUTER/TIMING SYSTEM - (Quantity 2)

A.Multi-Sport Computer/Timing System shall be supplied with all necessary software to time swimming, in compliance with the appropriate sanctioning body - USA SWIMMING.

(AM#0002) >

~~1. Basis of Design: Multi Sport Computer/Timing System is based upon the GEN7 TIMING as manufacturer by Colorado Timing System, Inc.~~

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- B. Multi-Sport Computer/Timing System shall be a standalone unit with physical connections to timing inputs. Timer shall be controlled by user interface device (e.g., computer, tablet, etc.) via USB or TCP/IP.
1. Timer PC or tablet interface device shall be supplied with all necessary software to time and score swimming in compliance with the appropriate governing organization(s) - USA SWIMMING.
 2. Configuration of race courses shall be through graphical user interface. It is unacceptable that race configurations need specific cable connections to system connections such as wall plates defining a specific end of a course.
 3. User interface shall display complete race status. The interface shall be capable of functioning as miniature scoreboard displaying information simultaneously for all active lanes including lane number, current length in race or final place, split or finish time, relay judging status indicator, and backup time and backup button status.
 4. Timer shall automatically flag timing discrepancies (in the user interface, on the results printouts and in stored memory) greater than a user defined interval between touch pad and backup times.
- C. Multi-Sport Computer/Timing System input/output ports must include:
1. Shall accept inputs for up to 4 courses of up to 32 lanes each for a serial in-deck wiring installation and shall be able to time them simultaneously.
 2. Up to 8 timers shall be supported to accept inputs of the same in-deck wiring installation for parallel race timing and backup.
 3. Shall accept on-deck cable harness inputs for up to 20 lanes near end and/or far end.
 4. Shall communicate with meet management peripheral software on a two-way "handshake" basis, enabling the meet manager's resident computer to query the timer's memory via the USB port or via the network at any time for any race results.
 5. Shall provide backup time via push button provided on a per lane basis should swimmer fail to trigger touch pad or touch pad fail to register. Timer to be capable of accepting up to three backup button times per lane.
 6. Shall automatically compare the touch pad hit of an incoming swimmer with the starting swimmer's time of departure from the optional relay-judging platform. Results display both "plus" and "minus" takeoff times and can be printed and stored in race memory.
- D. Accuracy of Multi-Sport Computer/Timing System:
1. Shall time to a user-selectable resolution from 1 second to .001 second. It shall take starts and finishes from the near end and/or far end of the pool. It shall accept inputs from the start system; touch pads, up to three manual button backup times per lane, and relay judging platforms.

2. Shall be able to evaluate and report multiple states of timing component input condition, ranging from excellent to failure. It is unacceptable that only two states such as on or off are reported.
 3. Shall have touch pad delay feature with ability to program delays from 1 to 99 seconds.
 4. Shall permit the operator to correct for an erroneous touch by adding/subtracting a touch pad hit to correct the lengths completed. The interface shall not permit the operator to finish a race in any lane; timers including such a function are unacceptable because they permit the possibility of cheating.
 5. Later recall of stored race data shall allow for a re-run of a given race including changes in user decisions.
- E. Multi-Sport Computer/Timing System Detection:
1. Shall be capable of detecting timing components such as pushbuttons, touchpads, RJPs, speakers, Speedlight and start systems connected to an in-deck system and capable of detecting touchpads and RJPs connected to an on-deck system.
 2. Shall be capable of reporting corrosion in the in-deck wiring installation.
- F. Multi-Sport Computer/Timing System shall run off a 12 Volt power supply connected to a standard 110/240 VAC outlet and will automatically switch to (and display on screen of connected interface device) internal battery power source, in case of line power failure without affecting the continuity and accuracy of the timing system.
- G. Multi-Sport Computer/Timing System shall interface to single-line and multi-line scoreboard and shall post immediate results to scoreboard in "Lane" or "Place" order (user selectable). The timer shall also have the capability to pull race results from memory and post those results to the scoreboard in "Lane" or "Place" order (user selectable).
- H. Multi-Sport Computer/Timing System shall include internal clock calendar with self-sustaining battery to time/date stamp all results.
- I. Multi-Sport Computer/Timing System shall meet acceptable safety standards. Shall be UL approved, or equivalent.
- J. Multi-Sport Computer/Timing System Storage and Internal Memory:
1. System shall store each and every timing input state change. It is not acceptable that state changes get discarded and are not available for later re-evaluation of a race.
 2. All race data, including near and far end splits, shall be stored to internal memory for later recall to facilitate meet management connectivity and printing. Printed reports shall include cumulative and subtractive splits as well as relay judging times (when required).
 3. Meet memory shall be capable of being transferred to external

storage (via USB) or cloud data backup services (e.g., DropBox, Google Drive).

- K. Multi-Sport Computer/Timing System shall have an Automatic Event Sequencer that is capable of holding both standard and user defined event sequences. The event order will be able to be downloaded from meet management software. The desired order is user selectable. EVENT SEQUENCES with appropriate race distance and race description for high school, college meets, and two "User Defined" meets to permit construction of custom meets, USA SWIMMING. When recalled from memory, race distance and descriptions are automatically selected for the operator.
- L. Multi-Sport Computer/Timing System shall have a user interface software that permits operation of essential functions including Lane Off/On, Finish Arm, Split Arm, & Print Results directly from the main screen to ensure speed and simplicity of operation during critical race times. The interface shall permit the operator to edit a time when required or to disqualify a lane (DQ), automatically posting it to the scoreboard, and provide automatic re-ranking of results. Any corrections generated by the operator (edit or disqualification) shall be clearly identified on the results printouts.
- M. Multi-Sport Computer/Timing System shall include electronic beeper and LED signaling to indicate touchpad, backup button and RJP inputs. Timers which do not allow the user to configure (enable/disable) this feature are unacceptable.
- N. Multi-Sport Computer/Timing System connectivity shall include:
 - 1. USB (Type A) port for external storage
 - 2. USB (Type B) port for meet management connectivity
 - 3. USB (Type B) port for user interface computer connectivity
 - 4. Ethernet port for network connectivity
 - 5. 3 independent scoreboard output ports
 - 6. Wireless 2.4 GHz scoreboard connectivity
 - 7. Connection for in-deck wiring and two connections for on-deck (near and far end) wiring
 - 8. Start system connection directly to timer.
 - 9. External DC power port
- O. Multi-Sport Computer/Timing System shall be capable of updating internal software/firmware via Internet connection.
- P. Multi-Sport Computer/Timing System software shall have the ability to adjust the intensity of LED scoreboard brightness.

2.3 SWIMMING TIMING SYSTEM CONNECTORS

2.3.1 General Description

- 1. The timing system shall employ topology of a single communication bus to which all timing and connectivity nodes are connected and communicate with each other
- 2. Connection points shall be production items and not a one off or prototypes
- 3. Exposed connectors shall feature titanium contacts. They shall be wet

pluggable and electrically passive if not connected. No maintenance to prevent corrosion of deck plate connector contacts shall be needed.

4. Self-test capabilities to detect compromised timing bus wire terminations and scoreboard bus wire terminations

2.3.2 Wall Plates - (located in timing/computer office 2nd Floor)

1. Wall plates shall be provided as required in the quantities as shown on the drawings. Wall plates shall be the termination point for connections between deck cables, timers, start system, and other wall plates.

(AM#0002) >

~~a. Basis of Design: Wall plates are based upon TITANIUM SERIAL WALL PLATE as manufactured by Colorado Timing System, Inc.~~ < (AM#0002)

2. Wall plates must allow for any, or all, of the following connections depending on location and usage:

- a. Connection to the timer.

- 1) Connectivity to all timing courses and one scoreboard bus with one cable connection
- 2) Detection of presence or absence of connected timer
- 3) Diagnostic capabilities to detect anomalies with connectors (corrosion, shorts)

- b. Connection to a start system and shall provide the following:

- 1) Inputs for start system and speaker.
- 2) Diagnostic capabilities to detect anomalies with connectors (corrosion, shorts) and anomalies with the speaker input or start system.
- 3) Detection of presence or absence of speaker input or start system.

- c. Connection to a scoreboard and shall provide the following:

- 1) Detection of presence or absence of connected scoreboard.
- 2) Self-test capabilities to detect compromised timing bus wire terminations.

3. Junction Boxes (Provided by Electrical Contractor)

- a. Wall plate timing system components shall fit into an 8" x 8" x 7" PVC junction box.
- b. Acceptable Manufacturer: Cantex (P/N 5133708) or similar box that will fit wall plate assembly of the following dimensions: 7.5" x 7.5" x 6" +-0.05", cover plate width shall be 9.8" +-0.02" square.
- c. All conduit interconnects between timing system boxes (deck plates and wall plates) shall be PVC. Refer to drawings for sizing.

Verify routing of conduit with timing system manufacturer prior to install.

2.3.2.1 Bulkhead Deck Plate

- 1 Bulkhead deck plates shall be provided as required in the quantities as shown on the drawings.

(AM#0002)>

~~a. Basis of Design: Bulkhead deck plates are based upon TITANIUM SERIAL BULKHEAD DECK PLATE as manufactured by Colorado Timing System, Inc.~~ <(AM#0002)

2. Connection to bulkhead that shall provide the following:

- a. Detection of presense or absence of connected bulkhead.
- b. Self-test capabilities to detect compromised timing bus wire terminations.
- c. Diagnostic capabilities to detect anomalies with connectors (corrosion, shorts).

3. Junction Boxes (Provided by Electrical Contractor):

- a. In deck system components shall fit into a 4" x 4" x 6" PVC junction box.
- b. All conduit interconnects between timing system boxes (deck plates and wall plates) shall be PVC. Refer to drawings for sizing.
- c. Verify routing of conduit with timing system manufacturer prior to install.

2.4 SWIMMING TIMING START SYSTEM

- A. Swimming Timing Start System (2 required) shall be provided to start the automatic swim timing system. The start system shall drive speakers mounted under the starting blocks, the relay judging platform strobe lights and deck side start indicators, with microphone.

(AM#0002)>

~~1. Basis of Design: Swimming Timing Start System is based upon the INFINITY SERIES START SYSTEM as manufactured by Colorado Timing System, Inc.~~ <(AM#0002)

- B. System shall have one internal, moisture and corrosion resistant 40-watt speaker, wired microphone with 25 ft of data cable, internal battery with charger and external 360-degree strobe. Tabletop or deck mounting options.
- C. Start system shall have a high impact resistant plastic molded enclosure.
- D. System shall include a portable tripod for the start system and 25 ft jumper cable.
- E. There shall be a LED warning light on the system showing when the

internal batteries are starting to get low on power.

2.5 SWIMMING TIMING COMPONENTS

2.5.1 Gutter Hung Touchpads

1. Provide 22 touchpads (20 required + 2 spare) to time swimming, in compliance with the appropriate sanctioning body.

(AM#0002) >

~~a. Basis of Design: The gutter hung touchpad is based upon the AQUAGRIP GUTTER HUNG TOUCHPAD as manufactured by Colorado Timing System, Inc.~~ < (AM#0002)

2. Touchpad shall be constructed of an all-plastic exterior with only electrical connector metal exposed. Touchpad shall be the following dimensions:
 - a. Touch pad shall be the TP-78G AQUAGRIP, 78" wide x 22" tall x 0.3" thick.
3. Touchpad shall have a uniform fine grit and non-abrasive surface that prevents swimmer slippage in any direction.
4. Touchpad markings shall have contrasting colors with a 2" black border and black end-wall cross pattern for portion covered by touchpads.
5. Touchpad brackets shall be custom made to fit the pool. Contractor to provide sufficient number of brackets for support of each touchpad.
 - a. Contractor to provide an additional 2 spare touchpad brackets.
6. Touchpad shall have a two-year warranty without a requirement to purchase a protective touchpad cart.
7. Touchpad caddy for storing the number of touch pads supplied shall be CAD-TP/P.

2.5.2 Swimming Timing Systems Caddies

1. Provide touchpad caddy for storing all touch pads. The correct number of touchpad caddies shall be supplied to store all touchpads. Caddy shall be sized to match timing system touch pad widths. Touchpad caddy shall consist of an aluminum frame with four freewheeling casters. The CONTRACTOR is responsible for assembly. (AM#0002) > ~~Touchpad caddy shall be CAD TP/P as manufactured by Colorado Timing Systems, Inc.~~ < (AM#0002)

2.6 PACE CLOCKS

1. Pace clocks shall be provided as required in the quantities as shown on the drawings.

(AM#0002) >

~~a. Basis of Design: SLIM PACE CLOCKS as manufactured by Colorado Timing System, Inc.~~ < (AM#0002)

2. Pace clock shall include thirteen (13") high visibility LED digits, with variable intensity settings. The pace clock shall include a rugged powder-coated aluminum enclosure, conformal coated to protect against

corrosion, a real time of day clock, and shall be suitable for indoor or outdoor use.

3. Pace clock shall include twelve (12) operating channels to eliminate interference.
4. Pace clocks have an integrated real time of day chip (RTC). If multiple pace clocks are used in a facility, they will synchronize the time automatically.
5. Pace clock shall include a wireless frequency of 2.4 GHz and have autosensing power capabilities for 120/240 VAC.
6. Pace clock shall have four (13") digits.
 - a. Overall Size (H x W x D): 19.25" x 42.25" x 2.8"
 - b. Weight: 15 lbs

PART 3 EXECUTION

3.1 EXISTING CONDITIONS

- A. Verify that all work by others, related to this section, is installed.
- B. Carefully examine all the construction documents that affect the work of this section.
- C. Prior to starting work, notify the Contracting Officer and General Contractor of any defects requiring correction.
- D. Protect other materials and installed work against damage while completing work in this section.

3.2 INSTALLATION

- A. Furnish and install all custom cables, connectors, scoreboard mounting brackets, and fasteners.
- B. Provide scaffolding and labor for mounting scoreboard and pulling cables.
- C. Furnish and install equipment in accordance with the manufacturer's drawings and instructions.
- D. Provide scoreboard mounting, all timing system cable terminations, system checkout, and local operator training at time of installation. Training shall consist of one 4-hour session.
- E. Furnish as-built drawings precisely locating all items.
- F. Wiring and grounding shall be installed in strict accordance with the latest edition of the **NFPA 70** National Electric Code - Article 680.

-- End of Section --

SECTION 14 21 23

ELECTRIC TRACTION PASSENGER ELEVATORS
<AMENDMENT NO. 0002>

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 7 (2017) Minimum Design Loads for Buildings and Other Structures

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M (2015; Errata 1 2015; Errata 2 2016) Structural Welding Code - Steel

ASME INTERNATIONAL (ASME)

ASME A17.1/CSA B44 (2016) Safety Code for Elevators and Escalators

ASME A17.2 (2017) Guide for Inspection of Elevators, Escalators, and Moving Walks Includes Inspection Procedures for Electric Traction and Winding Drum Elevators, Hydraulic Elevators, and Escalators and Moving Walks

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C62.41 (1991; R 1995) Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits

INTERNATIONAL CODE COUNCIL (ICC)

ICC IBC (2018) International Building Code

NATIONAL ELEVATOR INDUSTRY, INC. (NEII)

NEII-1 (2000; R thru 2017) Building Transportation Standards and Guidelines, including the Performance Standards Matrix for New Elevator Installation

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2017; ERTA 1-2 2017; TIA 17-1; TIA 17-2; TIA 17-3; TIA 17-4; TIA 17-5; TIA 17-6; TIA 17-7; TIA 17-8; TIA 17-9; TIA 17-10;

	TIA 17-11; TIA 17-12; TIA 17-13; TIA 17-14; TIA 17-15; TIA 17-16; TIA 17-17) National Electrical Code
NFPA 70E	(2018; TIA 18-1; TIA 81-2) Standard for Electrical Safety in the Workplace
NFPA 72	(2019; TIA 19-1; ERTA 2019) National Fire Alarm and Signaling Code
NFPA 101	(2018; TIA 18-1; TIA 18-2; TIA 18-3) Life Safety Code
U.S. DEPARTMENT OF DEFENSE (DOD)	
UFC 3-560-01	(2017, with Change 1, 2018) Operations and Maintenance: Electrical Safety
U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)	
36 CFR 1191	Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines

1.2 SUBMITTALS

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

SD-02 Shop Drawings

Elevator System; G
Elevator Components; G
Elevator Machine; G
Elevator Controller; G
Wiring Diagrams; G

SD-03 Product Data

Elevator and Accessories; G
Elevator Components; G
Data Sheets; G
Elevator Microprocessor Controller; G

SD-05 Design Data

Emergency Power Systems
Heat Loads
Reaction Loads

SD-07 Certificates

Elevator Parts and Components Price Lists; G

Warranty
Endorsement Letter
Welders' Qualifications
Elevator Controller Certification; G

SD-10 Operation and Maintenance Data

Elevator, Data Package 4; G
Maintenance Control Program (MCP); G
Software and Documentation; G

Submit in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA and 01 78 24.05 20 FACILITY OPERATION AND MAINTENANCE SUPPORT INFORMATION.

1.2.1 Shop Drawing Requirements

Provide assembly and arrangement of elevators, accessories, and elevator components. Show location of elevator machine in elevator machine room (MR) or machinery space (MS). Show location of elevator controller. Provide details for materials and equipment, including but not limited to operating and signal fixtures, doors, door and car frames, car enclosure, controllers, motors, guide rails and brackets, layout of hoistway in plan and elevation, and other layout information and clearance dimensions.

1.2.2 Product Data Requirements

Provide manufacturers' product data for all elevator components, including but not limited to the following: elevator controller, hoist machine and drive motor, design counterbalance, hoist ropes and shackles, overspeed governor, emergency braking system, car and hall fixture buttons and switches, cab, machine room, control room, and machinery space communication devices, door operator, door protection system, and car and counterweight roller guides and buffers. For data sheets, provide document identification number or bulletin number, published or copyrighted prior to the date of contract bid opening. Provide controller manufacturer's published procedures for performance of each and all testing required by ASME A17.1/CSA B44.

1.2.3 Design Data

1.2.3.1 Reaction Loads

Provide calculations by registered professional engineer for reaction loads imposed on building by elevator system. Calculations must comply with ASCE 7 and ASME A17.1/CSA B44

1.2.3.2 Heat Loads

Provide calculations from elevator manufacturer, or by registered professional engineer, for total anticipated heat loads generated by all of the elevator equipment.

1.2.3.3 Emergency Power Systems

Where the facility does have an emergency power system, confirm the elevators that will be connected to the emergency power system. Confirm the complete emergency power system and sequence of operation for all

elevators, including elevator sequential operation and operation of the elevator lobby manual selection switch. Provide wiring diagrams for building emergency power interface with elevator controls. For elevators not supplied by an emergency power system, provide manufacturers' product data for auxiliary power systems.

1.2.4 Welders' Requirements

Comply with AWS D1.1/D1.1M, Section 5. Include certified copies of field welders' qualifications. List welders' names with corresponding code marks to identify each welder's welding work

1.2.5 Maintenance Control Program (MCP)

For each elevator, prepare and provide a written Maintenance Control Program (MCP) that complies with ASME A17.1/CSA B44 Section 8.6, including written documentation that details the test procedures for each and every test that is required to be performed by ASME A17.1/CSA B44. Assemble all MCP documentation, and supporting technical attachments, in a single MCP package and provide in both electronic and hard copy. Assemble entire hard copy MCP in 3-ring binders. For each elevator provided, the MCP must include only documentation and instruction that apply to the elevator specified.

For each elevator, provide an additional, separate binder that includes all maintenance, repair, replacement, call back, and other records required by ASME A17.1/CSA B44. The records binder must be kept at a location designated by the owner, maintained by elevator maintenance and service personnel, and be available at all times to authorized personnel.

Provide detailed information regarding emergency service procedures and elevator installation company personnel contact information. Provide a listing of all tools to be provided to the Contracting Officer as components of the elevator system.

1.3 QUALITY ASSURANCE

1.3.1 Qualification

Provide a designed and engineered elevator system by an elevator contractor regularly engaged in the installation of elevator systems. Provide elevator components manufactured by companies regularly engaged in the manufacture of elevator components. Utilize only licensed and certified elevator personnel for the installation, adjusting, testing, and servicing of the elevators.

1.3.1.1 Elevator Contractor's Elevator Technicians

For elevator installations in the United States, including United States territories, perform all elevator related work under the direct guidance of a state certified elevator technician with a minimum of three years of experience in the installation of elevator systems of the type and complexity specified in the contract documents. Provide an endorsement letter from the elevator manufacturer, certifying that the elevator specialist is qualified. All elevator technicians must carry a current certification issued by one of the following organizations:

- a. National Association of Elevator Contractors (NAEC)

b. National Elevator Industry Education Program (NEIEP)

1.3.2 Manufacturers' Technical Support

Provide elevator components from manufacturers that provide factory training and online and live telephone elevator technical support to any elevator installation, service, and maintenance contractor. Provide elevator components from manufacturers that guarantee accessibility to all replacement and repair parts and components to any elevator installation, service, and maintenance contractor. Use only elevator component manufacturers that provide current published [price lists](#) for all elevator parts and components.

1.3.3 Operation and Maintenance Data

Assemble all shop drawing and product data material into O&M Data Packages in accordance with Article SUBMITTALS. Provide two complete O&M Data Packages in hard copy and two complete electronic O&M data packages on separate CDs, in PDF format. Provide all O&M Data Packages to Contracting Officer. Include controller diagnostic documentation and software as required under Article CONTROL EQUIPMENT.

1.3.4 Wiring Diagrams

Provide complete [wiring diagrams](#) and sequence of operations, which show electrical connections and functions of elevator systems. Provide one set ([11 inch by 17 inch](#) minimum size) of wiring diagrams, with individual sheets laminated in plastic and assembled in binder, to be stored in the machine room or control room cabinet. Provide one additional hard copy set and two complete electronic sets on separate CDs, in PDF format. Provide all wiring diagram sets to the Contracting Officer. Coded diagrams are not acceptable unless fully identified.

1.4 NEW INSTALLATION SERVICE

Provide elevator [warranty](#) service in accordance with the manufacturer's maintenance plan, warranty requirements, and applicable safety codes, for a period of 12 months after the date of acceptance by Contracting Officer. Perform this work during regular working hours. Provide supplies and parts to keep elevator system in operation. Perform service only by factory trained personnel. Provide Monthly services to include repairs, adjustments, greasing, oiling, and cleaning. Provide service log in elevator machine room or control room cabinet and update Monthly, throughout the one-year warranty period.

Provide 24-hour emergency service, with one hour on-site response time, during this period without additional cost to the Government.

1.4.1 Periodic Elevator Certification Inspection and Testing

Provide elevator mechanic to support QEI Certified Elevator Inspector in the periodic six-month and the annual Category 1 elevator certification inspection and testing. Perform Category 1 inspection and testing no greater than 30 days prior to the end of the warranty period. Perform all elevator certification testing in the presence of QEI Certified Elevator Inspector.

In conjunction with the testing noted above, test systems for Emergency Power Operation. Schedule so that testing does not interfere with building

operations.

1.5 FIRE PROTECTION SYSTEM

Coordinate interface between building fire protection system and elevator controls.

Additional fire protection requirements are located in: Section 21 13 13.00 20 WET PIPE SPRINKLER SYSTEM, FIRE PROTECTION; and Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

1.5.1 Fire Alarm Initiating Devices

Fire alarm initiating devices are specified in 28 31 76 INTERIOR FIRE ALARM AND MASS NOTIFICATINO SYSTEM, including conduit and wiring from each detector to fire protection addressable modules.

1.5.2 Fire Sprinklers

Provide fire sprinklers in accordance with all applicable safety codes and with Section 21 13 13.00 20 WET PIPE SPRINKLER SYSTEM, FIRE PROTECTION. Provide shutoff valve, check valve, and non-adjustable, zero time-delay flow switch, in each sprinkler line immediately outside of each machine room, control room, and hoistway, as applicable. Provide inspectors' test valve for periodic testing of flow switch and shunt trip disconnect.

Pipe sprinkler piping serving these spaces in a series manner with no laterals. Locate inspectors' test connection at the end of pipe runs such that operation of the test connection will purge air from system piping.

1.5.3 Shunt Trip Disconnect

Provide flow switches specified in paragraph FIRE SPRINKLERS to comply with ASME A17.1/CSA B44 and NFPA 72 for shunt trip of the main line power supply. For each elevator, provide control wiring connecting the flow switch to a shunt trip equipped circuit breaker located in the elevator machine room or control room. Upon flow of water, flow switch will instantaneously cause opening of the shunt-trip circuit breaker and remove power from the elevator. Flow switch must also send a signal to fire alarm control panel to indicate water flow condition.

PART 2 PRODUCTS

2.1 ELEVATOR DESCRIPTION

Provide elevator system that complies with ASME A17.1/CSA B44 in its entirety, ASME A17.2 in its entirety, and additional requirements specified herein. Provide elevator system that meets or exceeds the NEII-1 Ride Quality Performance Standards Matrix (RQPSM). For elevator speeds of 500 fpm and higher, comply with the RQPSM "High Performance" criteria. For elevator speeds 350 fpm, up to but not including 500 fpm, comply with the RQPSM "Intermediate Performance" criteria.

Provide and install elevators in accordance with 36 CFR 1191 - ABAAS, ICC IBC, IEEE C62.41, NFPA 70 and NFPA 101 requirements.

2.1.1 Elevator Design Parameters

2.1.1.1 Elevator No.1 (EMSA)

- a. Type: Geared
- b. Rated load: 3500 lb.
- c. Rated Speed: 200 fpm
- d. Car Door Type: Single-speed center slide.
- e. Car Door Opening Width: 3 ft.-6 in. minimum.

2.1.2 Cab Enclosure and Hoistway Entrance Assemblies

Provide finishes as indicated.

2.2 ELEVATOR OPERATION

ASME A17.1/CSA B44, Introduction, Section 3, Definitions.

2.2.1 Single, Two-Stop, Automatic Operation

Provide Single Two-Stop Automatic Operation.

2.3 SPECIAL OPERATION AND CONTROL

Provide the following special operations and control systems.

2.3.1 Keys for Elevator Key Switches

Provide a minimum of twelve keys per unique cylinder used on all key switches for a single elevator. Provide keys with brass or fiberglass tags marked "PROPERTY OF THE U.S. GOVERNMENT" on one side with function of key or approved code number on the other side.

2.3.2 Firefighters' Emergency Operation (FEO)

Provide FEO equipment and signaling devices. The designated level for the FEO Phase I key operated switch is the Mezzanine Level floor. In the FEO Phase I fixture, provide FEO Operating Instructions.

2.3.2.1 Firefighters' Emergency Operation (FEO) Key Box

Provide flush mounted, locking, FEO Key Box of a minimum size of 5 inch W by 9 inch H by 1.5 inch D. Install at a height of 6 feet above floor level and directly above the FEO Phase I key switch. Provide box equipped with lock that uses the FEO K1 key.

2.3.3 Hoistway Access Operation

Provide hoistway access operation with switches at top and bottom terminal landings. Locate switch 6 feet above floor level, within 12 inches of elevator hoistway entrance frame or with the ferrule exposed when located in the elevator entrance frame.

2.3.4 In-Car Inspection Operation

Provide In-Car Inspection Operation.

2.3.5 Independent Service

Provide exposed key-operated switch in car operating panel to enable independent service and simultaneously disable in-car signals and landing-call responses. Provide indicator lights that automatically illuminate during independent service. For duplex or group operation, if one car is removed from group another car will respond to its hall calls.

2.3.6 Mechanical Platform Access

Provide exposed key-operated switch in car operating panel requiring key operation to access the Mechanical Platform. Provide indicator lights that automatically illuminate during service.

2.3.7 Elevator Auxiliary Power Operating System

Provide elevator auxiliary power operating system for elevator 1.

2.4 ELEVATOR DRIVE MACHINE, HOIST MOTOR, AND DRIVE MOTOR

Provide elevator drive machine, hoist motor, and motor drive system that is designed to be installed in an elevator shaft. The elevator machine, motor, and drive configuration and installation design must be mechanically and electrically interchangeable with a minimum of two other elevator manufacturer's drive machines that are readily available in the elevator industry. Paint or finish ferrous surfaces with a minimum of one coat of manufacturer applied rust- inhibiting paint.

Design the elevator drive system so that the hoist motor amperage does not exceed the motor data tag full load amperage in any operating condition, exclusive of acceleration and deceleration. Provide elevator hoist motor that is designed with Class F insulation and rated for 120 starts/hr. Design the elevator drive system to limit Total Harmonic Distortion to a maximum of 5 percent. No single harmonic may exceed 3 percent.

Provide an elevator drive machine designed for and provided with stranded steel wire rope or manufacturer's standard belts for elevator suspension and counterbalance. The minimum acceptable diameter of suspension and counterweight ropes is $\frac{3}{8}$ inches. Aramid fiber ropes, coated steel ropes, and non-circular coated steel belts may not be used for elevator suspension or counterbalance.

The elevator drive machine must be equipped with machine manufacturer's designed and installed standard means for the manual release of the driving-machine brake.

2.4.1 Manufacturer's Factory Training and Technical Support

Provide an elevator drive machine from a manufacturer that provides comprehensive factory training and technical support for installation, adjustment, service, and maintenance of the drive system. The training and support must be identified as available to any licensed elevator contractor. Provide verification of an established and documented training schedule, with pricing, for factory training classes that have been provided for a minimum period of one year prior to contract award date.

The elevator drive system must be identified as available for purchase and installation by any licensed elevator contractor. All drive system related components, parts, diagnostic tools, and software must be available for purchase, installation, and use by any licensed elevator contractor; "exchange-only" provisions for the purchase of spare parts are not acceptable.

2.4.2 Ascending Car Overspeed and Unintended Car Movement Protection

Provide elevator Ascending Car Overspeed and Unintended Car Movement Protection means that is designed to act directly upon, and apply a retarding force to, the elevator suspension ropes. In addition to the requirements of ASME A17.1/CSA B44, the means must be designed to detect and stop movement of the elevator suspension ropes that occurs as a result of loss of traction between the suspension ropes or belts and the elevator machine drive sheave.

2.5 CONTROL EQUIPMENT

Enclose all elevator control equipment in factory-primed and baked-enamel coated sheet-metal cabinets with ventilation louvers and removable or hinged doors. Mount cabinets at a height of 10 inches above machine room or control room finish floor.

2.5.1 Motor Control Equipment

Provide variable voltage with silicon controlled rectifier (SCR) or Variable-Frequency Variable Voltage (VVVF) alternating current (ac) drive control.

2.5.1.1 Electrical Isolation Protection

Provide individual isolation transformers and individual choke reactors for each individual hoist motor. Provide filtering to maintain harmonic distortion below IEEE C62.41 standards as measured at the elevator machine room or control room disconnect.

2.5.2 Elevator Microprocessor Controller

For each individual elevator controller, and for each group controller, provide a microprocessor controller that complies with the following paragraphs. Provide controller(s) package that includes all hardware and software required for the installation, maintenance, and service of the elevator, in its' entirety. Provide verification of technical support service that the controller manufacturer provides to any licensed elevator installation, service, and maintenance company.

Provide an elevator controller from a manufacturer that provides comprehensive factory training to include controller installation, adjustment, service, and maintenance. The training must be identified as available to any licensed elevator contractor. Provide verification of an established and documented training schedule, with pricing, for factory training classes that manufacturer has provided for a minimum period of one year prior to contract award date.

The elevator controller must be identified as available for purchase and installation by any licensed elevator contractor. All components, parts, diagnostic tools, and software must be available for purchase and

installation and use by any licensed elevator contractor; "exchange-only" provisions for the purchase of spare parts are not acceptable. The elevator controller manufacturer must publish an industry competitive price listing for all controller parts, diagnostic tools, and software.

Provide verification of telephone and internet based technical support service that the elevator controller manufacturer provides to any licensed elevator installation, service, and maintenance company at an industry competitive price. The service must include live telephone based technical support for installation, adjustment, maintenance, and troubleshooting of the elevator controller and related elevator components. The service must be available during standard working hours.

Provide an elevator controller that is designed to automatically reestablish normal elevator operation following any temporary loss of power, regardless of duration.

2.5.2.1 Elevator Controller Interface Cabinet

For each individual elevator microprocessor controller, provide a separate elevator control cabinet with an integrated human interface system. For group elevator installations, a single cabinet and interface system with full access to each elevator controller may be utilized. The separate controller interface cabinet must be supplied by the elevator controller manufacturer and include a minimum 12 inch wide keyboard and a minimum 10 inch monitor. The elevator controller interface cabinet must comply with arc-flash protection requirements of NFPA 70E and UFC 3-560-01.

2.5.2.1.1 Elevator Microprocessor Human Interface

The interface system must provide complete elevator controller interface capability and must include the elevator controller manufacturer's comprehensive package of installation and diagnostic software. The microprocessor interface system must provide unrestricted access to all parameters, all levels of adjustment, and all flags necessary for installation, adjustment, maintenance, and troubleshooting of each elevator and for the elevator group. All software programming must be stored in non-volatile memory. The elevator controller fault log must provide non-volatile memory fault log storage of all faults, trouble calls, and fault history for a minimum of one year and the ability to download or print the fault log. The controller interface must also provide the capability to display and diagnose trouble calls, faults, and shutdowns. Expiring software, degrading operation, and "key" access controls are not acceptable.

2.5.2.2 Software and Documentation

Provide three copies of the manufacturer's maintenance and service diagnostic software, with complete software documentation, that will enable the same level of unrestricted access to all controllers of the same make and model, regardless of the installation date or location. Provide signed certification, from the manufacturer's corporate headquarters, that guarantees that the microprocessor software and access system will not terminate the unlimited and unrestricted access at any future date.

2.5.2.3 Elevator Controller Certification

For elevator installations in the United States, including United States territories, provide an elevator microprocessor controller that has a

current certificate of safety code compliance issued by the Technical Standards and Safety Authority (TSSA), Toronto, Canada.

2.6 OPERATING PANELS, SIGNAL FIXTURES, AND COMMUNICATIONS CABINETS

For all panels and fixtures, provide identical and uniform fixture design, material, finish, and components for all elevators. For all panels and fixtures, legibly and indelibly identify all buttons and all operating positions for each device. Use engraving and backfilling, or photo etching, for button and switch designations. Do not use attached signs. Provide elevator manufacturers' standard grade for all key switches unless otherwise specified. All illuminating panels and fixture components must utilize LED lighting for energy efficiency.

2.6.1 Car and Hall Buttons

For all cab and landing fixture buttons, provide industry-standard, vandal resistant push buttons with positive-stop assembly design. Buttons must be minimum 3/4 inch diameter, satin-finish stainless steel, with illuminating LED halo.

2.6.2 Passenger Car-Operating Panel

Provide each car with one car operating panel that contains operation controls and communication devices. Provide exposed, flush mounted buttons for the controls identified in subparagraph PASSENGER CONTROLS. Provide a lockable service cabinet for the controls listed in subparagraph SERVICE CONTROLS. Use engraving and backfilling or photo etching for button and switch designations. Do not use attached signs.

2.6.2.1 Passenger Controls

In addition to ASME A17.1/CSA B44 requirements, provide the following operating controls, identified as indicated:

- a. LED illuminating car-call buttons identified to correspond to landings served by the elevator.
- b. "DOOR OPEN" and "DOOR CLOSE" buttons. For front and rear openings at the same floor, include the identification "F" and "R" for each opening.
- c. Red, illuminating "ALARM" button.
- d. Key-operated "Independent Service" switch.
- e. "Help" communication device to include communication between elevator cab and elevator machine room or control room.

2.6.2.2 Service Controls

In addition to ASME A17.1/CSA B44 requirements, provide the following operating controls, identified as indicated:

- a. Provide a key-operated, three-position switch for "In car Inspection Operation" and "Hoistway Access". The center switch position will provide normal, automatic operation.
- b. "Car Light" switch.

- c. "Car Fan" switch with two speed settings identified.
- d. 120-volt ac 60 Hz single-phase duplex electrical outlet of ground-fault-circuit-interrupt (GFCI) design.

2.6.2.3 Certificate Window

Provide a minimum 4 inch wide by 6 inch high certificate window for elevator inspection certificate. Locate window in the Service Controls door of the Car Operating Panel.

2.6.2.4 Emergency Signaling Devices

Provide an audible signaling device, operable from the Car Operating Panel button marked "ALARM". The audible signaling device must have a sound pressure rating between 80 and 90 dBA at 10 ft. Provide battery backup power capable of operating the audible signaling device for at least one hour.

2.6.3 Elevator In-Car Position Indicators

For all elevators, provide illuminating LED position indicator in the Car Operating Panel.

2.6.4 Elevator In-Car Direction Indicators

For 2-stop elevator installations, provide visual direction indicators and audible car arrival signal in the elevator car door jamb, in accordance with ABA Standards. Visual indicators must be visible from the hall call fixture.

2.6.5 Hall Call Landing Fixtures

Provide a hall call fixture adjacent to each elevator. Provide a single push-button for terminal landings and dual push-buttons, up and down, at intermediate landings.

2.6.5.1 Designated Landing Hall Call Fixture

2.6.5.1.1 Location of COMMUNICATION MEANS FAILURE (CMF) Visual Signal

When required by ASME A17.1/CSA B44, provide an elevator CMF audible and illuminating signal, and reset switch, in the FEO Designated Landing hall call fixture. Mount the signal and reset switch at a minimum of 7 inches above the "UP" hall call button.

2.6.5.1.2 COMMUNICATION MEANS FAILURE (CMF) Visual and Audible Signal Operation

Provide a CMF visual and audible signal system that conforms to ASME A17.1/CSA B44. Provide continuous verification of operability of the telephone line and immediate activation of audible and visual signals when verification means determines that the telephone line is not functioning. Provide illumination of visual signal at one second intervals. Provide a minimum of 65 dBA audible signal at 30 second intervals.

2.6.5.1.3 Firefighters' Emergency Operation Phase I Switch and Visual Signal

When required by ASME A17.1/CSA B44, provide an elevator Firefighters'

Emergency Operation Phase I switch and illuminating visual signal in the FEO Designated Landing hall call fixture. Provide FEO Phase I visual signal that is designed with intermittent, flashing, illumination when actuated by the machine room, control room, or hoistway fire alarm initiating device. Locate FEO Phase I key switch above the CMF visual signal with a minimum of 6 inches vertical between the centerlines of the CMF signal and the FEO Phase I key switch. Locate FEO Phase I visual signal directly above the Phase I switch. In addition, locate Elevator Corridor Call Station Pictograph at top of hall call fixture.

2.6.6 Elevator Car Position and Direction Indicators and Car Arrival Signal

For elevator installations with three or more stops, provide a separate hall landing fixture that includes the visual elevator position indicator, visual direction indicators, and audible car arrival signal, in accordance with ABA Standards.

2.6.7 Designated Landing Elevator Identification Fixture

For duplex and group elevator installations, provide a separate elevator identification fixture for each elevator, with identification engraved and backfilled with a contrasting color. Number elevators from left to right, as seen during primary approach from building main entrance to elevator lobby. For multiple elevator groups, begin numbering with group that is closest to the building main entrance.

2.6.8 Emergency or Standby Power

When emergency or standby power is provided for elevator operation, provide an elevator emergency power visual indicator that conforms to ASME A17.1/CSA B44. Locate the visual signal in the Firefighters Emergency Operation fixture for each simplex elevator and for each elevator group. When an emergency power selector switch is required, provide switch in a separate, flush mounted fixture located at the designated level, in view of all elevator entrances.

2.7 CAR DOOR EQUIPMENT

2.7.1 Car Door Operator

Provide elevator door operator equipment and circuitry that is designed and installed as discreet communication. Serial communication must not be used for this system.

2.7.2 Infra-red Curtain Unit

Provide Infra-red Curtain Unit (ICU) with multiple infra-red beams that protect to the full height and width of the door opening. Provide door nudging operation.

2.8 PASSENGER ELEVATOR GUIDES, PLATFORM, AND ENCLOSURE

2.8.1 Roller Guides

Provide coil-spring loaded roller guide assemblies in adjustable mountings on each side of car and counterweight frames in accurate alignment at top and bottom of frames.

2.8.2 Car Enclosure Wall Panels, Return Panels, Doors, Entrance Columns, and Transom

Provide 14 Gauge minimum stainless steel cab wall panels and entrance components. Use same material and finish for all hoistway and car entrance assemblies. Apply sound-deadening material on exterior of all cab wall panels.

Refer to Interior Room Finish Schedule for floor finish.

Cab walls to be powder coated steel (AM#0002) > (equal to ThyssenKrupp Smoked Silver) .< (AM#0002)

Cab base to be powder coated steel (AM#0002) > (equal to ThyssenKrupp Chalkboard) .< (AM#0002)

Cab ceiling to be powder coated (AM#0002) > (equal to ThyssenKrupp Smoked Silver) < (AM#0002) metal pan ceiling with nine LED lights.

Handrails to be 4" flat bar type, brushed stainless steel, located on back and 2 side walls.

Cab sill to be aluminum.

Braille signage to be surface-mount, cast plate with raised floor elevator identification.

2.8.3 Car Enclosure Top

Provide reinforced, 12 gauge minimum steel car enclosure top. Provide hinged emergency exit with lock that complies with the seismic risk zone 2 or greater design requirements of ASME A17.1/CSA B44. Locate emergency exit hinge towards the rear of the elevator cab. Design and configure the elevator cab interior ceiling to provide convenient and unobstructed access to, and use of, emergency exit from inside the elevator cab.

2.8.4 Car Door

Provide 16 gauge minimum stainless steel car doors of sandwich construction with flush surfaces on car and landing sides. Provide a minimum of 2 door guide assemblies per door panel, one guide at leading and one at trailing door edge with guides in the sill groove their entire length of travel.

2.8.5 Car Entrance Sill

Provide one piece cast nickel silver, stainless steel, or white bronze entrance sill(s). Set sills level and flush with floor finish. Use same material for hoistway and car entrance sills.

2.8.6 Cab Finish Floor

Provide cab finish floor with top of finish floor flush with the cab sill.

2.8.7 Car Fan

Provide 2-speed fan for car enclosure forced ventilation. Fan must be mounted in the car enclosure top.

2.8.8 Car Lighting

Utilize LED lighting for elevator car interior illumination. Provide a minimum of 10 foot-candles, measured at all areas of the car enclosure floor. Provide automatic car lighting operation that will turn off car lights after 3 minutes of inactivity. Car lights must automatically turn on upon actuation of an elevator car or hall call.

2.8.9 Car Protection Pads and Hooks

Provide fire retardant, hanging car protection pads that provide protection for all car interior wall panels. Provide permanently installed studs in car that are designed for hanging the car protection pads in the car.

2.9 PASSENGER ELEVATOR HOISTWAY DOORS AND ENTRANCES

Provide hoistway entrance assemblies with a minimum 1-1/2 hour fire rating. Use same material and finish for all hoistway and car entrance assemblies.

2.9.1 Hoistway Entrance Frames

Provide 14 gage minimum stainless steel hoistway entrance frames. Solidly grout uprights of entrance ways to height of 5 feet.

2.9.2 Hoistway Entrance Sills

Provide one-piece cast nickel silver, stainless steel, or white bronze entrance sills. Set top of landing sill flush with top of finish floor. Solidly grout under full length of sill. Use same material for all hoistway and car entrance sills.

2.9.3 Hoistway Entrance Doors

Provide stainless steel non-vision construction hoistway entrance doors with flush surfaces on car and landing sides. Provide a minimum of 2 door guide assemblies per door panel, one guide at leading edge and one at trailing edge with guides in the sill groove the entire length of door travel. Use same material and finish for all hoistway and car entrance assemblies.

2.9.4 Hoistway Entrance Door Track Dust Covers

Provide sheet metal hoistway door track dust covers at each landing. Dust covers must cover top and hoistway side of door locks and door roller tracks, and extend the full width of the door track and associated hardware. Dust cover sections will not exceed 3 feet in length.

2.10 HOISTWAY EQUIPMENT

2.10.1 Car and Counterweight Guide Rails and Fastenings

Provide T-section type guide rails for car and counterweight. Paint rail shanks with one coat of black enamel.

2.10.2 Pit Equipment and Support Channels

Provide rail-to-rail pit channels to serve as mounting surface for main guide rails and counterweight guide rails. In addition, pit channels will

serve as mounting surfaces for car and counterweight buffers. Method of installation of channels, brackets and buffer mounts will be such that pit waterproofing is not punctured.

2.10.3 Pit "STOP" Switch

Provide push-to-stop/pull-to-run type pit "STOP" switch.

2.10.4 Traveling Cables

Suspend traveling cables by means of self-tightening webbed devices or internal suspension members.

2.10.5 Hoistway Pit Ladder

Provide continuous horizontal rungs for the full height of the pit ladder.

PART 3 EXECUTION

3.1 INSTALLATION

Install in accordance with DOD design criteria, contract specifications, manufacturer's instructions, **NEII-1** Building Transportation Standards and Guidelines, and all applicable building and safety code requirements.

3.1.1 Structural Members and Finish Materials

Do not cut or alter structural members. Do not alter finish materials from manufacturer's original design. Restore any damaged or defaced work to original condition.

3.1.2 Miscellaneous Requirements

Provide recesses, cutouts, slots, holes, patching, grouting, and refinishing to accommodate elevator installation. Use core drilling to drill all new holes in concrete. Finish work to be straight, level, and plumb. During installation, protect machinery and equipment from dirt, water, or mechanical damage. At completion, clean all work and spot paint.

3.2 FIELD QUALITY CONTROL

The Contractor will provide and utilize a third-party licensed and certified Qualified Elevator Inspector (QEI) to conduct elevator pre-acceptance inspection and testing. The QEI must perform inspections and witness tests to ensure that the installation conforms to all applicable safety codes and contract requirements. The QEI will be directly employed by the Contractor and independent of the elevator contractor.

Upon completion, the QEI must provide written test data for all **ASME A17.1/CSA B44** Acceptance Tests and written certification that the elevator is complete and ready for final Acceptance Inspection, Testing, and Commissioning.

3.3 ACCEPTANCE INSPECTION, TESTING AND COMMISSIONING

When elevator system installation is complete and ready for final inspection, notify Contracting Officer that elevator system is ready for Acceptance Inspection, Testing, and Commissioning. Provide QEI

certification specified in Article FIELD QUALITY CONTROL.

Contracting Officer will obtain the services of a third-party QEI Certified Elevator Inspector. The QEI must utilize an Elevator Acceptance Inspection Form to record the results of inspection and all testing and to identify safety code and contract deficiencies. Specific values must be provided for all tests required by ASME A17.1/CSA B44, ASME A17.2, and contract documents. Upon completion of inspection and testing, the QEI must sign a copy of the completed forms and provide to the Contracting Officer. Within 2 weeks of the inspection, the QEI must also prepare a formal inspection report, including all test results and deficiencies. Upon successful completion of inspection and testing, the QEI will complete, sign, and provide a certificate of compliance with ASME A17.1/CSA B44.

3.3.1 Acceptance Inspection Support

Prime and Elevator Contractors must provide inspection support and perform all required tests, in order to demonstrate proper operation of each elevator system and to prove that each system complies with contract requirements and all applicable building and safety codes. Inspection procedures in ASME A17.2 form a part of this inspection and acceptance testing. All inspection and testing must be conducted in the presence of the Qualified Elevator Inspector (QEI).

If the elevator does not comply with all contract and safety code requirements on the initial Acceptance Inspection and Test, the Contractor is responsible for all costs involved with re-inspection and re-testing required as a result of contractor delays and discrepancies discovered during inspection and testing.

3.3.2 Testing Materials and Instruments

Provide all testing materials and instruments necessary for Acceptance Inspection, Testing and Commissioning. At a minimum, include calibrated test weights, tachometer, accelerometer, hydraulic pressure gauge, 600-volt megohm meter, volt meter and ammeter, infrared temperature gauge, door pressure gage, dynamometer, and 20 foot tape measure.

3.3.3 Field Tests

3.3.3.1 Endurance Tests

Test each elevator for a period of one hour continuous, automatic operation, with specified rated load in the elevator cab. During the one hour test, stop car at each floor, in both directions of travel, and allow automatic door open and close operation. The requirements for Automatic Operation, Rated Speed, Leveling, Temperature Rise and Motor Amperes must be met throughout the duration of the Endurance Test. Restart the one hour test period from the beginning, following any shutdown or failure.

3.3.3.2 Speed Tests

Determine actual speed of each elevator, in both directions of travel, with rated load and with no load in elevator car. Make Speed tests at the beginning and at the end of the Endurance test. Determine speed by tachometer reading or accelerometer, excluding accelerating and slow-down zones. Under all conditions, minimum acceptable elevator speed is the Rated speed specified. Maximum acceptable elevator speed is 110 percent of Rated speed.

3.3.3.3 Leveling Tests

Test elevator car leveling operation and provide a leveling accuracy equal to or less than 1/8 inch at each floor with no load in car, balanced load in car, and with rated load in car, in both directions of travel. Determine leveling accuracy at the beginning and at the end of the endurance tests.

3.3.3.4 Temperature Rise Tests

Determine temperature rise of elevator drive machine motor during one-hour full-load test run. Under these conditions, maximum temperature rise must not exceed acceptable temperature rise indicated on manufacturer's data plate. Start test only when equipment is within 5 degrees C of ambient temperature.

3.3.3.5 Balanced Load Test

Place balanced load in the elevator cab, according to the manufacturer's designed counterbalance. Perform electrical and mechanical balanced load tests of car and counterweight.

3.3.3.6 Motor Ampere Tests

At beginning and end of Endurance test, measure and record motor amperage in both directions of travel and in both no-load and rated load conditions.

3.3.3.7 Elevator Performance and Ride Quality Testing

Evaluate elevator performance to ensure compliance with specification requirements related to the NEII-1 Performance Standards Matrix for New Elevator Installations.

-- End of Section --

SECTION 25 08 10

UTILITY MONITORING AND CONTROL SYSTEM TESTING
<AMENDMENT NO. 0002>

PART 1 GENERAL

1.1 REFERENCES

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

CONSUMER TECHNOLOGY ASSOCIATION (CTA)

CTA CTA-709.1-D	(2014) Control Network Protocol Specification
CTA CTA-709.3	(1999; R 2015) Free-Topology Twisted-Pair Channel Specification
CTA CTA-852-C	(2014) Tunneling Device Area Network Protocols Over Internet Protocol Channels

1.2 DEFINITIONS

1.2.1 Algorithm

A set of well-defined rules or procedures for solving a problem or providing an output from a specific set of inputs.

1.2.2 Analog

A continuously varying signal value (temperature current, velocity, etc.).

1.2.3 Analog to Digital (A/D) Converter

An A/D converter is a circuit or device whose input is information in analog form and whose output is the same information in digital form.

1.2.4 CTA CTA-709.1-D

"Control Network Protocol Specification", Standard communication protocol for networked control systems that provides peer-to-peer communications.

1.2.5 Application Specific Controller

A device that is furnished with a pre-established built in application that is configurable but not re-programmable.

1.2.6 Architecture

Architecture is the general organization and structure of hardware and software.

1.2.7 Binary

A two-state system where an "ON" condition is represented by a high signal level and an "OFF" condition is represented by a low signal level.

1.2.8 Building Point of Connection (BPOC)

The point of connection between the UMCS network backbone and the building network backbone. The hardware at this location, which performs/provides the connection is referred to as the BPOC Hardware.

1.2.9 Control Wiring

This includes conduit, wire, and wiring devices to install complete HVAC control systems, including motor control circuits, interlocks, sensors, PE and EP switches, and like devices. This also includes all wiring from node to node, and nodes to all sensors and points defined in the I/O summary shown on drawings or specified herein, and required to execute the sequence of operation. Does not include line voltage power wiring.

1.2.10 Demand

The maximum rate of use of electrical energy averaged over a specific interval of time, usually expressed in kW.

1.2.11 Diagnostic Program

Machine-executable instructions used to detect and isolate system and component malfunctions.

1.2.12 Distributed Control

A system whereby all control processing is decentralized and independent of a central computer. In regards to a LonWorks based system, it also means where the control logic for a single piece of building level control resides in more than one controller (node).

1.2.13 Graphical User Interface (GUI)

Human-machine interfacing allows the operator to manage, command, monitor, and program the system.

1.2.14 Integration

Establishing communication between two or more systems to create a single system.

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~~1.2.15 Interoperable~~

~~Two devices are interoperable if installed into the same system and they communicate with each other without the use of another device (such as a gateway).~~

~~1.2.16 LonTalk(r)~~

~~Open communication protocol developed by the Echelon(r) Corporation.~~

~~1.2.17 LONWORKS(r)~~

~~The communication technology developed by Echelon(r) Corporation for control systems developed. The technology is based on the CTA CTA-709.1-D protocol and employs interoperable devices along with the capability to openly manage these devices using a network configuration tool.~~

~~1.2.18 LONMARK(r) International (LONMARK(r) Interoperability Assoc.)~~

~~Standards committee consisting of numerous independent product developers and systems integrators dedicated to determining and maintaining the interoperability guidelines for the LONWORKS(r) industry.~~

~~1.2.19 LonMarked(r)~~

~~A device that has been certified for compliance with LonMark(r) standards by the LonMark(r) International.~~

~~1.2.20 LONWORKS(r) Application Specific Controller (ASC)~~

~~A networked device or node that contains a complete, configurable application that is specific to a particular task.~~

~~1.2.21 LONWORKS(r) General Purpose Programmable Controller~~

~~A programmable control product, that unlike an ASC, is not installed with a fixed factory installed application program. The application in the controller is custom software produced by the integrator specifically for the project.~~

~~1.2.22 LONWORKS(r) Network Services (LNS)~~

~~The database format for addressing nodes and variable bindings node to node.~~

~~1.2.23 Network~~

~~A system of distributed control units that are linked together on a communication bus. A network allows sharing of point information between all control units. Additionally, a network provides central monitoring and control of the entire system from any distributed control unit location.~~

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1.2.15 Network Configuration Tool

Software used to create and modify the control network database and configure controllers.

1.2.16 Node ID

A unique 48-bit node identification (ID) tag given to each node by Echelon Corporation.

1.2.17 Node

An intelligent LONWORKS(r) device with a node ID and communicates via CTA CTA-709.1-D and is connected to an CTA CTA-709.1-D network.

1.2.18 Operating System (OS)

Software which controls the execution of computer programs and which provides scheduling, debugging, input/output controls, accounting, compilation, storage assignment, data management, and related services.

1.2.19 Operator Workstation (OWS)

The OWS consists of a high-level processing desktop or laptop computer that provides a graphic user interface to network.

1.2.20 Peripheral

Input/Output (I/O) equipment used to communicate to and from the computer and make hard copies of system outputs and magnetic files.

1.2.21 Router

A device which routes messages destined for a node on another segment subnet or domain of the control network. The device controls message traffic based on node address and priority. Routers may also serve as communication links between powerline, twisted pair, fiber, coax, and RF media.

1.2.22 Standard Network Variable Type (SNVT)

A network variable of a standard format type used to define data information transmitted and receive by the individual nodes.

1.2.23 UMCS Network Media

Transmission equipment including cables and interface modules (excluding MODEMs) permitting transmission of digital information.

1.2.24 XIF

"External Interface File" contains the contents of the manufacturer's product documentation.

1.2.25 Gateway

A device that translates from one protocol to another. Gateways are also called Communications Bridges or Protocol Translators.

1.3 SYSTEM DESCRIPTION

- a. The purpose of this Specification is to define generic Factory, Performance Verification, and Endurance Test procedures for Utility Monitoring and Control Systems (UMCS) and building level DDC. These tests are to be used to assure that the physical and performance requirements of UMCS and building level DDC are tested, and that the test results are adequately documented. The Government will base certain contractual decisions on the results of these tests.
- b. This document covers the factory, performance verification, and endurance test procedures for the Utility Monitoring and Control System (UMCS) and Direct Digital Control for HVAC. It has been written for a host based system where the LONWORKS(r) LNS database resides on the main computer (server) and communicates over the Ethernet (TCP/IP)

connection to the field level controller nodes. The system shall be comprised of the server hardware and software, IP network hardware and software, and building point of connection (BPOC) hardware and software.

- c. The contractor who provided building level DDC under Section 23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC is responsible for testing the building level DDC. All control testing and controller tuning required under Section 23 09 00 shall be completed and approved before performing Performance Verification and Endurance Tests under this section.
- d. The following UFGS: Section 25 10 10 UTILITY MONITORING AND CONTROL SYSTEM (UMCS) FRONT END AND INTEGRATION and Section 23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC shall be part of the contract documents.

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~~1.3.1 Factory Test~~

~~Conduct a factory test at a company site. Perform some of the basic functions of the UMCS and building level DDC, to assure that the performance requirements of the specifications are met.~~

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1.3.1 Performance Verification and Endurance Test

- a. Shall be conducted on hardware and software installed at the jobsite to assure that the physical and performance requirements of specifications are met. Tests on network media shall include all contractor furnished media and shall include at least one type of each device installed.
- b. Shall be conducted under normal mode operation, unless otherwise indicated in the initial conditions description for each test. System normal mode describes a condition in which the system is performing its assigned tasks in accordance with the contract requirements.
- c. Shall utilize the operator workstation (OWS) to issue commands or verify status data.

1.3.2 Test Equipment and Setup

All test equipment calibrations shall be traceable to NIST. The accuracy of the test equipment and overall test method shall be at least twice the maximum accuracy required for the test. For example, if a temperature sensor has an accuracy of +1 degree F over the executed range, the test instrument used shall have an accuracy of at least +0.5 degree F or better. Provide all test equipment unless otherwise noted in the contract documents.

1.4 SUBMITTALS

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

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~~SD-01 Preconstruction Submittals~~

~~Factory Test; G~~

< (AM#0002)

SD-06 Test Reports

UMCS and Building Level DDC Testing Sequence
Performance Verification Test; G
Endurance Testing

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 UMCS AND BUILDING LEVEL DDC TESTING SEQUENCE

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~~Perform a successful factory test prior to start of installation work, as described in this section. < (AM#0002)~~ During the installation phase, perform all required field testing requirements on the UMCS and building level DDC as specified in Sections 25 10 10 UTILITY MONITORING AND CONTROL SYSTEM (UMCS) FRONT END AND INTEGRATION and 23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC, to verify that systems are functioning and installed in accordance with specifications. Submit field test report prior to start of PVT and endurance testing. After completing all required field testing, perform a successful PVT and endurance test. All tests shall be successfully completed, and test reports received, prior to final acceptance of the UMCS and building level DDC. Perform and document Contractor field test on UMCS and building level DDC.

3.2 COORDINATION

Coordinate the testing schedule with the Government. Coordination shall include controls specified in other sections or divisions which include controls and control devices that are to be part of or interfaced to the UMCS specified in this section.

3.3 PROTECTION

Protect all work and material from damage by the work or workers. The Contractor is liable for any damage caused and responsible for the work and equipment until finally inspected, tested, and accepted. Protect the work against theft, and carefully store material and equipment received onsite that is not immediately installed.

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~~3.4 FACTORY TEST~~

~~3.4.1 Factory Test Plan~~

~~Prior to the scheduling of the factory tests, provide the Government with a Factory Test Plan for approval, and wait to receive notification of approval of the Test Plan and Procedures before performing the tests. The plan shall include the following, as a minimum:~~

- ~~a. System one line block diagram of equipment used in the factory test model, indicating servers, workstations, peripherals, network~~

~~equipment, controllers, and instrumentation.~~

~~b. System hardware description used in the factory test.~~

~~c. System software description used in the factory test.~~

~~d. Listing of control and status points in the factory test model; plus a table with the following information:~~

- ~~(1) Input and output variables.~~
- ~~(2) SNVTs for each variable.~~
- ~~(3) Expected engineering units for each variable.~~
- ~~(4) Node ID.~~
- ~~(5) Domain & subnet addressing.~~

~~e. Required passwords for each operator access level.~~

~~f. List of other test equipment.~~

~~3.4.2 Test Procedures~~

~~Develop the factory test procedures from the generic test procedures in ATTACHMENT A. The test procedures shall consist of detailed instructions for test setup, execution, and evaluation of test results. Edit the generic test procedure for the provided UMCS and building level DDC. Perform a factory test on a model of the UMCS and building level DDC for the Government to verify the system will function to the requirements of the contract documents. The test architecture shall mimic a two building arrangement. There shall be a TCP/IP layer with two Internet Protocol (IP) to Lon routers. Below each of the routers shall be both programmable (GPPC) and application specific controllers (ASC). One server and one workstation with printers shall be connected to the IP layer. There shall be simulated input devices connected to controllers to enable the creation of changing variables. If, during testing, the system fails a portion of a test, the Government will inform the Contractor if the entire test or only the portion that failed shall be re-performed. Give the Government a written report of those items which failed, what the problem was, and what was done to correct it. Provide onsite technical support to perform the PVT. ATTACHMENT A presents the generic Test Procedures with the following information:~~

~~a. Test identification number.~~

~~b. Test title.~~

~~c. Objective.~~

~~d. Initial conditions (if applicable).~~

~~e. Test equipment (if required).~~

~~f. Sequence of events.~~

~~g. Expected results.~~

~~3.4.3 Test Report~~

~~Submit a factory final, complete test report after completing the test, consisting of the following, as a minimum:~~

- ~~a. Section one of the submittal shall be a short summary of the factory test.~~
- ~~b. Section two of the submittal shall be a copy of the test plans.~~
- ~~c. Section three shall be the executed test procedure and shall be divided using tabs. Each tab section shall include all pertinent information pertaining to the executed and approved test, showing date and Government representative who witnessed/approved the test.~~

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3.4 FIELD TEST REQUIREMENTS

The UMCS contractor shall perform and document contractor start-up and field tests as required by Sections 25 10 10 UTILITY MONITORING AND CONTROL SYSTEM (UMCS) FRONT END AND INTEGRATION and 23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC. The field test validates that the UMCS and building level DDC are in operation without any problems or system errors prior to starting a PVT. Validate that all software along with all hardware is installed to meet or exceed the contract document requirements. This includes all LONWORKS(r) networking and monitoring hardware and all peripherals associated with the network and hardware. Start-up and field testing shall include:

3.4.1 Start-up Testing

All testing listed in Sections 25 10 10 and 23 09 00 shall be completed.

3.4.2 Point-to-Point Testing

All point-to-point testing of end field devices through proper input/output to graphic and operator interface shall be completed and approved.

3.4.3 Field Calibration

All field calibration shall be completed and approved.

3.4.4 Detailed Functional Testing

Detailed functional tests, verified by the Government that the system operation adheres to the Sequences of Operation.

3.4.5 Alarms and InterlocksAll alarm limits and testing shall be completed.

3.4.6 System Schedules and Setpoints

All schedule start/stops and system setpoints shall be entered, operating, and approved.

3.5 PERFORMANCE VERIFICATION TEST

3.5.1 Test Plan

Prior to the scheduling of the performance verification tests, provide the Government with a Performance Verification and Endurance Test Plan and Procedures for approval, and receive notification of approval of the Test Plan and Procedures. The plan shall include the following, as a minimum:

- a. Installed system one-line block diagram, indicating servers, workstations, peripherals, network equipment, controllers, and instrumentation.
- b. Installed system hardware description.
- c. Installed system software description (AM#0002) >, including any software revisions made since the factory test. < (AM#0002)
- d. Listing of control and status points installed in the system; plus a table with the following information:
 - (1) Input and output variables.
 - (2) SNVTs for each variable.
 - (3) Expected engineering units for each variable.
 - (4) Node ID.
 - (5) Domain & subnet addressing.
- e. Required passwords for each operator access level.
- f. List of other test equipment.

3.5.2 Test Procedures

Develop the performance verification test procedures from the generic test procedures in ATTACHMENT A. The test procedures shall consist of detailed instructions for test setup, execution, and evaluation of test results. Edit the generic test procedure for the provided UMCS and building level DDC. Perform a performance verification test (PVT) on the completed UMCS and building level DDC for the Government to verify the system is completely functional. If, during testing, the system fails a portion of a test, the Government will inform the Contractor if the entire test or only the portion that failed shall be re-performed. Give the Government a written report of those items which failed, what the problem was, and what was done to correct it. Provide on-site technical support to perform the PVT. ATTACHMENT A presents the generic UMCS Performance Verification Test Procedures with the following information:

- a. Test identification number.
- b. Test title.
- c. Objective.
- d. Initial conditions (if applicable).
- e. Test equipment (if required).
- f. Sequence of events.
- g. Expected results.

3.5.3 Test Report

Submit a final, complete PVT test report, after completing the test, consisting of the following, as a minimum:

- a. Section one of the submittal shall be a short summary of the

performance verification test.

- b. Section two of the submittal shall be a copy of the test plans.
- c. Section three shall be the executed test procedure and shall be divided using tabs. Each tab section shall include all pertinent information pertaining to the executed and approved test, showing date and Government representative who witnessed/approved the test.

3.6 ENDURANCE TESTING

3.6.1 General

Endurance Test shall be designed to demonstrate the specified overall system reliability requirement of the completed system. Conduct the Endurance Test in four phases as described below. The Endurance Test shall not be started until the Government notifies the Contractor, in writing, that the Performance Verification Tests have been satisfactorily completed, training as specified has been completed, correction of all outstanding deficiencies has been satisfactorily completed, and that the Contractor has permission to start the Endurance Test. Provide an operator to man the system eight hours per day during first shift operations, including weekends and holidays, during Phase I and Phase III Endurance testing, in addition to any Government personnel that may be made available. The Government may terminate testing at any time if the system fails to perform as specified. Upon termination of testing by the Government or by the Contractor, commence an assessment period as described for Phase II and Phase IV. Upon successful completion of the Endurance Test, submit test reports to the Government explaining in detail the nature of any failures, corrective action taken, and results of tests performed, prior to acceptance of the system. Keep a record of the time and cause of each outage that takes place during the test period.

3.6.2 Phase I

During the Phase I testing, operate the system as specified for 24 hours per day, 7 days per week, for 15 consecutive calendar days, including holidays. Do not make repairs during this phase of testing unless authorized by the Government, in writing. If the system experiences no failures during the Phase I test, proceed directly to Phase III testing, after receiving written permission from the Government.

3.6.3 Phase II

In Phase II, which occurs after the conclusion of Phase I, identify all failures, determine the causes of all failures, repair all failures, and submit a test failure report to the Government. After submitting the written report, convene a test review meeting at the job site to present the results and recommendations to the Government. The meeting shall be scheduled no earlier than five business days after receipt of the report by the Government. As a part of this test review meeting, demonstrate that all failures have been corrected by performing appropriate Performance Verification Tests. Based on the Contractor's report, the test review meeting, and the Contractor's recommendation, the Government will independently determine the restart point and may require that the Phase I test be totally or partially rerun. Do not commence any required retesting until after receipt of written notification by the Government.

3.6.4 Phase III

After the conclusion of any retesting which the Government may require, repeat the Phase II assessment as if Phase I had just been completed. If the retest is completed without any failures, proceed directly to Phase III testing, after receiving written permission from the Government. During Phase III testing, operate the system as specified for 24 hours per day, 7 days per week, for 15 consecutive calendar days, including holidays. Do not make repairs during this phase of testing unless authorized by the Government, in writing.

3.6.5 Phase IV

In Phase IV, which occurs after the conclusion of Phase III, identify all failures, determine the causes of all failures, repair all failures, and submit a test failure report to the Government. After submitting the written report, convene a test review meeting at the job site to present the results and recommendations to the Government. The meeting shall not be scheduled earlier than five business days after receipt of the report by the Government. As a part of this test review meeting, demonstrate that all failures have been corrected by performing appropriate Performance Verification Tests. Based on the Contractor's report, the test review meeting, and the Contractor's recommendation, the Government will independently determine the restart point and may require that the Phase III test be totally or partially rerun. Do not commence any required retesting until after receipt of written notification by the Government. After the conclusion of any retesting which the Government may require, the Phase IV assessment shall be repeated as if Phase III had just been completed. The Contractor will not be held responsible for failures resulting from the following:

- a. An outage of the main power supply in excess of the capability of any backup power source, provided that the automatic initiation of all backup sources was accomplished and that automatic shutdown and restart of the UMCS performed as specified.
- b. Failure of a Government-furnished communications link, provided that the LON nodes and LON routers automatically and correctly operate in the stand-alone mode as specified, and that the failure was not due to contractor furnished equipment, installation, or software.
- c. Failure of existing Government-owned equipment, provided that the failure was not due to contractor-furnished equipment, installation, or software.

3.6.6 Failure Reports

Provide UMCS Endurance Test Failure Reports. UMCS Test Failure Reports shall explain in detail the nature of each failure, corrective action taken, results of tests performed. If any failures occur during Phase I or Phase III testing, recommend the point at which the Phase I or Phase III testing, as applicable, should be resumed.

3.7 ATTACHMENT A

TEST PROCEDURES

TITLE: Test Index

OBJECTIVE: The following is an index of tests.

NOTES: Tests one through twenty contain specific "item(s)" that apply to Sections 25 10 10 UTILITY MONITORING AND CONTROL SYSTEM (UMCS) FRONT END AND INTEGRATION) and 23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC. The following index of tests provides a summary of which "items numbers" apply to which specification.

Test No.	Test Title	Section 23 09 00, Section 25 10 10	DDC for HVAC
One	Initial System Equipment Verification	Items 1 through 15	Items 16 through 32
Two	System Start-up	Items 1 through 4	Items 5 and 6
Three	Monitor and Control Software	Items 1 through 5	Not Applicable
Four	Graphic Display of Data	Items 1 through 18	Not Applicable
Five	Graphic Navigation Scheme	Items 1 and 2	Not Applicable
Six	Command Functions	Items 1 through 6	Not Applicable
Seven	Command Input Errors	Items 1 through 6	Items 1 through 6
Eight	Special Functions	Item 1	Not Applicable
Nine	Software Editing Tools	Items 1 through 42	Items 1 through 42
Ten	Scheduling	Items 1 through 7	Items 8 through 10
Eleven	Alarm function	Items 1 through 15	item 16
Twelve	Trending	Items 1 through 8	Not Applicable
Thirteen	Demand Limiting	Items 1 through 8	Not Applicable
Fourteen	Report Generation	Items 1 through 6	Not Applicable
Fifteen	UPS Test	Items 1 through 5	Not Applicable
Sixteen	CTA CTA-709.1-D to IP Router Test	Items 1 through 3	Not Applicable
Seventeen	CTA CTA-709.1-D Router and Repeater	Not Applicable	Items 1 through 4
Eighteen	CTA CTA-709.1-D Gateway Test	Items 1 through 5	Items 1 through 5

Test No.	Test Title	Section 23 09 00, Section 25 10 10	DDC for HVAC
Nineteen	Local Display Panel	Not Applicable	Items 1 through 5
Twenty	Network Configuration Tool	Items 1 through 8	Items 1 through 8
Twenty-One	Custom Tests	Item 1 and 2	Item 1 and 2

PVT Checklist**OBJECTIVE:**

1. Inspect/test/verify that building-level DDC system is compliant with Section 23 09 00 and capable of integration with UMCS

INITIAL REQUIREMENTS/CONDITIONS

1. The following tests shall be completed and documentation shall be submitted to the Government.

2. Date of Checklist: _____
3. Time of Checklist: _____
4. Contractor's Representative: _____
5. Government's Representative: _____

CHECKLIST PROCEDURES

<u>Item</u>	<u>Action Item</u>	<u>Expected Results</u>	<u>Approved</u>
UMCS AND DDC FOR HVAC			
1	Draft or Final As-Built Drawings	Drawings submitted and approved	_____
		Point schedule(s) showing all required UMCS SNVTs submitted	_____
		Point schedules(s) showing device network addresses submitted	_____
		Local display panel (LDP) locations indicated on drawings submitted	_____
	Notes: _____		

2	Network Bandwidth Test Report	Test completed, accepted, and a report documenting results submitted	_____
	Notes: _____		

3	Programming software	Most recent version of the programming software for each type of GPPC has been submitted	_____
	Notes: _____		

<u>Item</u>	<u>Action Item</u>	<u>Expected Results</u>	<u>Approved</u>
4	XIF Files	External interface files (XIF) files for each model of LONWORKS®-based DDC hardware has been submitted	_____
	Notes: _____		
5	LNS Database	Copies of the LNS database for the completed control network has been submitted	_____
	Notes: _____		
6	LNS Plug-in	LNS Plug-ins for each application specific controller has been submitted	_____
	Notes: _____		
7	Start-up testing report	Start-up has been successfully completed and testing report submitted	_____
		Controller tuning has been completed and document on point schedule	_____
		Calibration accuracy check completed and documented in test report	_____
		Actuator range check completed and documented in test report	_____
		Functional test to demonstrate control sequence completed and documented in test report	_____
	Notes: _____		
8	Software License	Software licenses received for all software on the project	_____
	Notes: _____		

<u>Item</u>	<u>Action Item</u>	<u>Expected Results</u>	<u>Approved</u>

End of Test

Specific Abbreviations:

- Y = Yes
- N = No
- NA = Not Applicable

TEST NUMBER: One**TITLE:** Initial System Equipment Verification**OBJECTIVE:**

1. To verify that the hardware and software components of the system provided by the Contractor are in accordance with the contract plans and specifications and all approved submittals.

INITIAL REQUIREMENTS/CONDITIONS

1. Submittals

a. Submit a detailed list of all approved hardware with Manufacturer, model number and location. This list is based on the contract plans, specifications, change orders (if any) and approved submittals which shall be available for reference purposes during the test.

b. Submit a detailed list of all approved software with revision number and purpose of software. This list is based on the contract plans, specifications, change orders (if any) and approved submittals which shall be available for reference purposes during the test.

2. Equipment

a. Verify all equipment is functional.

3. Reference Documentation

a. List user manual documentation and sections pertaining to the testing.

4. Date of Test: _____

5. Time of Test: _____

6. Contractor's Representative: _____

7. Government's Representative: _____

TEST PROCEDURES

<u>Item</u>	<u>Action Item</u>	<u>Expected Results</u>	<u>Approved</u>
UMCS			
1	The workstation hardware is installed and complies with specification paragraph titled "Workstation Hardware".	_____	_____
	Notes: _____		
2	The Server hardware is installed and complies with specification paragraph titled "Server Hardware".	_____	_____
	Notes: _____		

<u>Item</u>	<u>Action Item</u>	<u>Expected Results</u>	<u>Approved</u>
3	The fiber optic patch panel is installed and complies with specification paragraph titled "Fiber Optic Patch Panel".	_____	_____
	Notes: _____		
4	The fiber optic media converter is installed and complies with specification paragraph titled "Fiber Optic Media Converter".	_____	_____
	Notes: _____		
5	The Ethernet switch is installed and complies with specification paragraph titled "Ethernet Switch".	_____	_____
	Notes: _____		
6	The IP router is installed and complies with specification paragraph titled "IP Router".	_____	_____
	Notes: _____		
7	The CTA CTA-709.1-D to IP router is installed and complies with specification paragraph titled "CTA CTA-709.1-D to IP Router".	_____	
	Notes: _____		
8	The CTA CTA-709.1-D gateway is installed and complies with specification paragraph titled "CTA CTA-709.1-D Gateway".	_____	
	Notes: _____		

<u>Item</u>	<u>Action Item</u>	<u>Expected Results</u>	<u>Approved</u>
9	The alarm printer is installed and complies with specification paragraphs titled "PRINTERS" and "Alarm Printer".	_____	_____
	Notes: _____		
10	The laser printer is installed and complies with specification paragraphs titled "PRINTERS" and "Laser Printer".	_____	_____
	Notes: _____		
11	The color printer is installed and complies with specification paragraphs titled "PRINTERS" and "Color Printer".	_____	_____
	Notes: _____		
12	The operating system is installed and complies with specification paragraph titled "Operating System (OS)".	_____	_____
	Notes: _____		
13	The office automation software is installed and complies with specification paragraph titled "Office Automation Software".	_____	_____
	Notes: _____		
14	The virus protection software is installed and complies with specification paragraph titled "Virus Protection Software".	_____	_____
	Notes: _____		
15	The configuration server is installed and complies with specification paragraph titled		

<u>Item</u>	<u>Action Item</u>	<u>Expected Results</u>	<u>Approved</u>
	"CTA CTA-852-C Configuration Server".		
	Notes: _____		

DDC FOR HVAC			
16	The CTA CTA-709.1-D Router is installed and complies with specification paragraph titled "CTA CTA-709.1-D Router".		
	Notes: _____		

17	The CTA CTA-709.3 Repeater is installed and complies with specification paragraph titled "CTA CTA-709.3 Repeater".		
	Notes: _____		

18	The TP/FT-10 network is installed in accordance with CTA CTA-709.3, with double-terminated bus topology.		
	Notes: _____		

19	Network wiring extends to the location of UMCS BPOC.		
	Notes: _____		

20	The Gateway is installed and complies with specification paragraph titled "Gateway".		
	Notes: _____		

21	All control valves are installed and comply with their associated specification paragraph under the section titled "Control Valves".		
	Notes: _____		

<u>Item</u>	<u>Action Item</u>	<u>Expected Results</u>	<u>Approved</u>
22	All dampers are installed and comply with their associated specification paragraph under the section titled "Dampers".	_____	_____
	Notes: _____		
23	All sensors are installed and comply with their associated specification paragraph under the section titled "Sensors".	_____	_____
	Notes: _____		
24	All indicating devices are installed and comply with their associated specification paragraph under the section titled "Indicating Devices".	_____	_____
	Notes: _____		
25	All user input devices are installed and comply with their associated specification paragraph under the section titled "User Input Devices".	_____	_____
	Notes: _____		
26	All output devices are installed and comply with their associated specification paragraph under the section titled "Output Devices".	_____	_____
	Notes: _____		
27	All multifunction devices are installed and comply with their associated specification paragraph under the section titled "Multifunction Devices".	_____	_____
	Notes: _____		

<u>Item</u>	<u>Action Item</u>	<u>Expected Results</u>	<u>Approved</u>
28	All compressed air equipment is installed and complies with their associated specification paragraph under the section titled "Compressed Air".	_____	_____
	Notes: _____		
29	All ASCs are installed and comply with the specification paragraph titled "Application Specific Controller".	_____	_____
	Notes: _____		
30	All LDPs and laptop computers are provided and comply with the specification paragraph titled "Local Display Panel".	_____	_____
	Notes: _____		
31	All GPPCs are installed and comply with the specification paragraph titled "General Purpose Programmable Controller".	_____	_____
	Notes: _____		
32	LNS-based system used to address nodes, bind variables, and LNS database of network exists on system.	_____	_____
	Notes: _____		

End of Test

Specific Abbreviations:

Y = Yes

N = No

NA = Not Applicable

TEST NUMBER: Two
TITLE: System Start-up

OBJECTIVE:

1. To validate that the system properly initializes and that the GUI properly reconnects to all communicating devices.
2. To validate that both application specific and programmable devices retain all vital information upon a power cycle.

INITIAL REQUIREMENTS/CONDITIONS

1. Submittals
 - a. Provide a list of all software that will be used to verify point connection at field level controllers and user interface.
 - b. Provide a list of all software need to verify application specific and programmable controller start-up.
2. Equipment
 - a. All peripherals and cables shall be connected in accordance with manufacturer's requirements.
 - b. The workstation shall be in the off mode.
 - c. All controls shall be fully functional and tested.
 - d. A programmable and application specific controller shall be randomly selected for the test.
3. Date of Test: _____
4. Time of Test: _____
5. Contractor's Representative: _____
6. Government's Representative: _____

TEST PROCEDURES

<u>Item</u>	<u>Action Item</u>	<u>Expected Results</u>	<u>Approved</u>
UMCS			
1	Energize the workstation.	The workstation will power-up and perform its start-up procedure without generating any errors or problems.	_____
	a) Operating system	Operating system shall be latest version of windows.	_____
	b) Start Network Configuration Tool.	The Network Configuration Tool drawing will open.	_____
	c) Start the System Plug-in.	The System plug-in will open.	_____
	d) Start the Server.	The Server will start.	_____
	e) Start the Workstation.	The Workstation will start. The operator shall now have the ability to view data from any device on the	_____

<u>Item</u>	<u>Action Item</u>	<u>Expected Results</u>	<u>Approved</u>
		network.	
	Notes: _____		

2	Check the communication from the server to the controllers.	Within the workstation software, when a device is selected, dynamic points lists become visible. Dynamic data represents success. A completion event failure message represents failure.	
	Notes: _____		

3	Verify on-line status.	All devices shall have on-line status indicated by the workstation software (green indicator).	
	Notes: _____		

4	View data from the graphical environment.	When a graphics page is opened, the points on the page should update. Question marks in lieu of data reflect failure.	
	Notes: _____		

DDC FOR HVAC			
5	Verify that configuration data in application specific controllers is written to EEPROM.	All configuration parameters should be accessible.	
	a) Open the LONWORKS® plug-in.	Software should open without errors.	
	b) Note several parameters such as temperature setpoints and flow settings.	Operator is able to view a sample of parameters (data values and setpoints).	
	c) Remove power from the controller for a minimum of 3 minutes.	Device should go off-line in Network Configuration Tool and workstation/server.	
	d) Replace power to the controller.	Device should return to on-line status.	
	e) Using the plug-in, verify that the parameters have not	Parameters shall not have changed.	

<u>Item</u>	<u>Action Item</u>	<u>Expected Results</u>	<u>Approved</u>
	changes. Notes: _____		
6	Verify that configuration data in programmable controllers is retained after a power cycle.		
a)	From the Workstation view several configuration parameters and note the values.	Values of the parameters can be viewed from the tree structure.	_____
b)	Remove power for a minimum of 3 minutes.	Controller will go offline in workstation software.	_____
c)	Replace power to the controller.	Controller will return to online status.	_____
d)	From the Workstation view the same configuration parameters and note the values.	Parameters values shall not have changed.	_____
	Notes: _____		

End of Test

Specific Abbreviations:

Y = Yes

N = No

NA = Not Applicable

TEST NUMBER: Three**TITLE:** Monitor and Control (M&C) Software Passwords**OBJECTIVE:**

1. To validate that the system utilizes four basic password levels
2. To validate that each password level has the specified authority

INITIAL REQUIREMENTS/CONDITIONS

1. Submittals
 - a. Provide documentation of M&C user password capacity in comparison with specification.
 - b. Provide a complete list of all users along with their passwords and user level prior to testing.
2. Equipment
 - a. Server and Workstation
3. Reference Documentation
 - a. Provide user manual documentation for setting up passwords
4. Date of Test: _____
5. Time of Test: _____
6. Contractor's Representative: _____
7. Government's Representative: _____

TEST PROCEDURES

<u>Item</u>	<u>Action Item</u>	<u>Expected Results</u>	<u>Approved</u>
UMCS			
1	Create password for new users.	New users shall exist in the server Database.	_____
	a) Set-up 4 users.	_____	_____
	b) Assign different levels to each.	_____	_____
	Notes: _____		

2	Demonstrate level 1 authority.	_____	_____
	a) Sign in as the level 1 user.	Sign in shall be successful.	_____
	b) Attempt to view a system graphic.	Action shall be possible.	_____
	c) Attempt to acknowledge an alarm.	Action shall be denied.	_____
	d) Attempt to configure a trend.	Action shall be denied.	_____
	e) Attempt to configure a report.	Action shall be denied.	_____

<u>Item</u>	<u>Action Item</u>	<u>Expected Results</u>	<u>Approved</u>
	f) Attempt to override a point.	Action shall be denied.	_____
	g) Attempt to configure an alarm.	Action shall be denied.	_____
	h) Attempt to configure a schedule.	Action shall be denied.	_____
	i) Attempt to configure a demand limiting parameter.	Action shall be denied.	_____
	j) Attempt to modify a graphic page.	Action shall be denied.	_____
	k) Attempt to create a custom program.	Action shall be denied.	_____
Notes: _____			

3	Demonstrate level 2 authority.	_____	_____
	a) Sign in as the level 2 user.	Sign in shall be successful.	_____
	b) Attempt to view a system graphic.	Action shall be possible.	_____
	c) Attempt to acknowledge an alarm.	Action shall be possible.	_____
	d) Attempt to configure a trend.	Action shall be possible.	_____
	e) Attempt to configure a report.	Action shall be possible.	_____
	f) Attempt to override a point.	Action shall be denied.	_____
	g) Attempt to configure an alarm.	Action shall be denied.	_____
	h) Attempt to configure a schedule.	Action shall be denied.	_____
	i) Attempt to configure a demand limiting parameter.	Action shall be denied.	_____
	j) Attempt to modify a graphic page.	Action shall be denied.	_____
	k) Attempt to create a custom program.	Action shall be denied.	_____
Notes: _____			

4	Demonstrate level 3 authority.	_____	_____
	a) Sign in as the level 3 user.	Sign in shall be successful.	_____
	b) Attempt to view a system graphic.	Action shall be possible.	_____
	c) Attempt to acknowledge an alarm.	Action shall be possible.	_____
	d) Attempt to configure a	Action shall be possible.	_____

<u>Item</u>	<u>Action Item</u>	<u>Expected Results</u>	<u>Approved</u>
	trend.		
e)	Attempt to configure a report.	Action shall be possible.	
f)	Attempt to override a point.	Action shall be possible.	
g)	Attempt to configure an alarm.	Action shall be possible.	
h)	Attempt to configure a schedule.	Action shall be possible.	
i)	Attempt to configure a demand limiting parameter.	Action shall be possible.	
j)	Attempt to modify a graphic page.	Action shall be denied.	
k)	Attempt to create a custom program.	Action shall be denied.	

Notes: _____

5	Demonstrate level 4 authority.		
a)	Sign in as the level 3 user.	Sign in shall be successful.	
b)	Attempt to view a system graphic.	Action shall be possible.	
c)	Attempt to acknowledge an alarm.	Action shall be possible.	
d)	Attempt to configure a trend.	Action shall be possible.	
e)	Attempt to configure a report.	Action shall be possible.	
f)	Attempt to override a point.	Action shall be possible.	
g)	Attempt to configure an alarm.	Action shall be possible.	
h)	Attempt to configure a schedule.	Action shall be possible.	
i)	Attempt to configure a demand limiting parameter.	Action shall be possible.	
j)	Attempt to modify a graphic page program.	Action shall be possible.	
k)	Attempt to create a custom program.	Action shall be possible.	

Notes: _____

End of Test

Specific Abbreviations:

Y = Yes

N = No

NA = Not Applicable

TEST NUMBER: Four
TITLE: Graphic Display of Data

OBJECTIVE:

1. To validate that floor plans and equipment can be graphically displayed through GUI.
2. To validate the proper display of alarms on GUI.
3. To validate the proper display of trend data on GUI.

INITIAL REQUIREMENTS/CONDITIONS

1. Submittals
 - a. Provide hard copies of "snap shots" of sample graphics pages prior to testing.
2. Equipment
 - a. Complete all graphics.
3. Reference Documentation
 - a. List user manual documentation and sections pertaining to the testing.
4. Notes
 - a. Different types of data and states should be clearly distinguishable from each other.
5. Date of Test: _____
6. Time of Test: _____
7. Contractor's Representative: _____
8. Government's Representative: _____

TEST PROCEDURES

<u>Item</u>	<u>Action Item</u>	<u>Expected Results</u>	<u>Approved</u>
1	Demonstrate the use of a three dimensional representation of a mechanical system.	Equipment shall be represented in a three dimensional manner.	_____
	Notes: _____		_____
2	Demonstrate the presentation of real time data.	Dynamic real time data shall be presented on a graphics page.	_____
	Notes: _____		_____
3	Demonstrate the presentation of user	A user defined parameter such as a setpoint shall be	

<u>Item</u>	<u>Action Item</u>	<u>Expected Results</u>	<u>Approved</u>
	entered data.	presented on a graphics page. Different types of data and states should be clearly distinguishable from each other.	_____
	Notes: _____		
4	Demonstrate the presentation of a point in override.	An indication of override condition shall be viewable on the graphic page. Different types of data and states should be clearly distinguishable from each other.	_____
	Notes: _____		
5	Demonstrate the presentation of a device in the alarm state.	An indication of the alarm state shall be viewable on the graphic page. Different types of data and states should be clearly distinguishable from each other.	_____
	Notes: _____		
6	Demonstrate the presentation of data that is out of range.	An indication of out of range condition shall be viewable on the graphic page. Different types of data and states should be clearly distinguishable from each other.	_____
	Notes: _____		
7	Demonstrate the presentation of missing data (controller is offline).	An indication of missing data shall be viewable on the graphic page. Different types of data and states should be clearly distinguishable from each other.	_____
	Notes: _____		

<u>Item</u>	<u>Action Item</u>	<u>Expected Results</u>	<u>Approved</u>
8	Demonstrate an error message when the operator attempts to execute in improper command.	An error message shall be displayed.	_____
	Notes: _____		
9	Demonstrate point and click access to context sensitive help.	Operator shall be able to easily access context sensitive help using the mouse.	_____
	Notes: _____		
10	Demonstrate point and click access to an engineering diagram.	Operator shall be able to access an engineering diagram using the mouse.	_____
	Notes: _____		
11	Demonstrate the creation of an engineering diagram.	Operator shall be able to create an engineering diagram.	_____
	Notes: _____		
12	Demonstrate the printing of a prepared report.	Operator shall be able to print a report using the mouse.	_____
	Notes: _____		
13	Demonstrate the display of one or more points.	Operator shall be able to request the display of one or more points.	_____
	Notes: _____		
14	Demonstrate the operator override of a point.	Operator shall be able to override a point.	_____
	Notes: _____		

<u>Item</u>	<u>Action Item</u>	<u>Expected Results</u>	<u>Approved</u>
15	Demonstrate the modification of a time schedule.	Operator shall be able to modify a time schedule.	_____
	Notes: _____		
16	Demonstrate the execution of a report.	Operator shall be able to initiate a report.	_____
	Notes: _____		
17	Demonstrate the presentation of an alarm to include:	Operator shall be able to view an alarm with all of the required data.	_____
	a) Identification	_____	_____
	b) Date and time	_____	_____
	c) Alarm Type	_____	_____
	d) Set Points	_____	_____
	e) Units	_____	_____
	f) Current Value	_____	_____
	g) Priority	_____	_____
	h) Associated message & Secondary message	_____	_____
	Notes: _____		
18	Demonstrate the presentation of real time trend data.	Operator shall be able to view real time trend data as a function of time.	_____
	Notes: _____		

End of Test

Specific Abbreviations:

Y = Yes

N = No

NA = Not Applicable

TEST NUMBER: Five
TITLE: Graphic Navigation Scheme

OBJECTIVE:

1. To validate hierarchical graphic displays from main screen to end devices.

INITIAL REQUIREMENTS/CONDITIONS

1. Submittals
 - a. Provide a hierarchical block diagram of the system network prior to testing.
2. Equipment
 - a. Have all programming completed to demonstrate graphic display.
3. Reference Documentation
 - a. List user manual documentation and sections pertaining to the testing.
4. Date of Test: _____
5. Time of Test: _____
6. Contractor's Representative: _____
7. Government's Representative: _____

TEST PROCEDURES

<u>Item</u>	<u>Action Item</u>	<u>Expected Results</u>	<u>Approved</u>
UMCS			
1	Demonstrate the creation of a hierarchical tree structure for the presentation of point data with at least five levels.	Operator shall be able to organize point data graphic display in a hierarchical tree structure based on any organization desired. A typical organization could be: - Installation - Building - Building sub area - Main System-Unit - Terminal Unit	_____
Notes: _____			
2	Demonstrate the creation of a hierarchical navigation structure for the graphic pages.	Operator shall be able or organize the graphical navigation from page to page using any hierarchical structure desired.	

<u>Item</u>	<u>Action Item</u>	<u>Expected Results</u>	<u>Approved</u>
		Examples:	
		Home page to building 1	
		Building 1 to AHU 1	
		Building 1 back to Home Page	
		Building 1 to 1st Floor Plan	
		AHU 1 back to Building 1	
		AHU 1 back to Home Page	
		AHU 1 to Terminal Unit	
		Summary	
		1st Floor Plan back to	
		Building 1	
		1st Floor Plan back to	
		Home Page	
		1st Floor Plan to Any	
		Terminal Device	
		Terminal Unit Summary back	
		to AHU 1	
		Terminal Unit Summary back	
		to Building 1	
		Terminal Unit Summary back	
		to Home Page	
		Terminal Unit Summary to	
		Individual Device	

Notes: _____

End of Test

Specific Abbreviations:

Y = Yes

N = No

NA = Not Applicable

TEST NUMBER: Six
TITLE: Command Functions

OBJECTIVE:

1. To demonstrate the functionality and ability to execute command to the end devices.

INITIAL REQUIREMENTS/CONDITIONS

1. Submittals
 - a. Provide documentation of all command functions prior to testing.
2. Equipment
 - a. Have all command functions programmed and functional.
3. Reference Documentation
 - a. List user manual documentation and sections pertaining to the testing.
4. Date of Test: _____
5. Time of Test: _____
6. Contractor's Representative: _____
7. Government's Representative: _____

TEST PROCEDURES

<u>Item</u>	<u>Action Item</u>	<u>Expected Results</u>	<u>Approved</u>
UMCS AND DDC FOR HVAC			
1	From the tree structure, modify a parameter such as a set point.	The modified value shall be downloaded to the controller without delay and the controller performance shall be viewable by the monitoring of other dynamic points.	_____
Notes: _____			
2	From a graphic page, modify a parameter such as a set point.	The modified value shall be downloaded to the controller without delay and the controller performance shall be viewable by the monitoring of dynamic points.	_____
Notes: _____			
3	From the tree structure, place an analog output point under operator	The analog output point shall accept the assigned value and ignore changes	_____

<u>Item</u>	<u>Action Item</u>	<u>Expected Results</u>	<u>Approved</u>
	override and assign a fixed value.	from application logic until the point is taken out of override.	_____
	Notes: _____		
4	From a graphic page, place an analog output point under operator override and assign a fixed value.	The analog output point shall accept the assigned value and ignore changes from application logic until the point is taken out of override.	_____
	Notes: _____		
5	From the tree structure, place a digital output point under operator override and assign a fixed value.	The digital output point shall accept the assigned value and ignore changes from application logic until the point is taken out of override.	_____
	Notes: _____		
6	From a graphic page, place a digital output point under operator override and assign a fixed value.	The digital output point shall accept the assigned value and ignore changes from application logic until the point is taken out of override.	_____
	Notes: _____		

End of Test

Specific Abbreviations:

Y = Yes

N = No

NA = Not Applicable

TEST NUMBER: Seven
TITLE: Command Input Errors

OBJECTIVE:

1. To validate that the system ensures the necessary authority for command inputs
2. To validate that the system can control the range of command input values

INITIAL REQUIREMENTS/CONDITIONS

1. Submittals
 - a. Provide all command input error messages prior to testing.
2. Equipment
 - a. UMCS and DDC hardware and software
3. Reference Documentation
 - a. List user manual documentation and sections pertaining to the testing.
4. Date of Test: _____
5. Time of Test: _____
6. Contractor's Representative: _____
7. Government's Representative: _____

TEST PROCEDURES

<u>Item</u>	<u>Action Item</u>	<u>Expected Results</u>	<u>Approved</u>
UMCS AND DDC FOR HVAC			
1	Login using a password with point command.	Login occurs.	_____
	Notes: _____		

2	Request a display of a SNVT.	The system displays the controllers SNVT value.	_____
	Notes: _____		

3	Override the SNVT point to a selected value.	The SNVT value override changes the value in the controller.	_____
	Notes: _____		

4	Release the override of	The SNVT value returns to	

<u>Item</u>	<u>Action Item</u>	<u>Expected Results</u>	<u>Approved</u>
	a SNVT.	normal.	_____
	Notes: _____		

5	For an nvi to a controller with a limit of 50 to 80, command the nvi to a value of 90.	The value will go the maximum of 80.	_____
	Notes: _____		

6	For an nvi to a controller for which the operator only has read privileges, command the nvi to a value of 90.	The operator will be denied the ability to command the nvi to any value.	_____
	Notes: _____		

End of Test

Specific Abbreviations:

Y = Yes

N = No

NA = Not Applicable

TEST NUMBER: Eight
TITLE: Special Functions

OBJECTIVE:

1. Verify system has special integration as defined.

INITIAL REQUIREMENTS/CONDITIONS

1. Submittals
 - a. Provide documentation of all integrations prior to testing.
2. Equipment
 - a. Have all UMCS and DDC hardware and software programmed, integrated, and completed.
3. Reference Documentation
 - a. List user manual documentation and sections pertaining to the testing.
4. Date of Test: _____
5. Time of Test: _____
6. Contractor's Representative: _____
7. Government's Representative: _____

TEST PROCEDURES

<u>Item</u>	<u>Action Item</u>	<u>Expected Results</u>	<u>Approved</u>
UMCS			
1	Verify that a building that uses controls from a vendor other than the one being installed can be integrated into the GUI without any loss of functionality. (A simulated building will be set up using an IP-L router and controllers from Honeywell, TAC, Trane, etc.)	Data from the other vendors controllers shall be integrated into the GUI and the same functionality that would exist if the controllers were from the same manufacture shall exist.	_____
	Notes: _____		

End of Test

Specific Abbreviations:

Y = Yes
 N = No
 NA = Not Applicable

TEST NUMBER: Nine
TITLE: Software editing tools

OBJECTIVE:

1. To validate the performance of the M & C application programming tool for the GPPC.
2. To validate the performance of the display editing tool.
3. To validate the performance of the report generation display tool.

INITIAL REQUIREMENTS/CONDITIONS

1. Submittals
 - a. Provide documentation and a backup softcopy of the editing tool prior to testing.
 - b. Provide documentation of any future software upgrade versions that pertain to the software-editing tool.
2. Equipment
 - a. Have working knowledge of the full capability of the software-editing tool.
3. Reference Documentation
 - a. List user manual documentation and sections pertaining to the testing.
4. Date of Test: _____
5. Time of Test: _____
6. Contractor's Representative: _____
7. Government's Representative: _____

TEST PROCEDURES

<u>Item</u>	<u>Action Item</u>	<u>Expected Results</u>	<u>Approved</u>
UMCS and DDC for HVAC			
1	Demonstrate the programming of an override function in a GPPC.	Operator shall be able to use the programmed function to override an output point in a GPPC.	_____
	Notes: _____		_____
2	Demonstrate software that enables the monitoring of data from a GPPC.	Operator shall be able to monitor points from a GPPC.	_____
	Notes: _____		_____
3	Demonstrate timer	Control logic shall honor	

<u>Item</u>	<u>Action Item</u>	<u>Expected Results</u>	<u>Approved</u>
	functions within applications of GPPC.	the built in timers.	
	a) delay on		
	b) delay off		
	c) one second delays		
	d) interval timers		
	Notes: _____		

4	Demonstrate logic loops ("for" and "while") in GPPC.	Control logic shall honor the criteria.	
	Notes: _____		

5	Demonstrate if-then-else logic in GPPC.	Control logic shall properly follow the if, then, else requirements.	
	Notes: _____		

6	Demonstrate basic math functions in GPPC.	Control logic shall properly execute math functions.	
	Notes: _____		

7	Demonstrate Boolean math functions in GPPC.	Control logic shall properly execute the functions.	
	Notes: _____		

8	Demonstrate exponential math functions in GPPC.	Control logic shall properly execute the functions.	
	Notes: _____		

9	Demonstrate trigonometric math functions in GPPC.	Control logic shall properly execute the functions.	
	Notes: _____		

10	Demonstrate bitwise math functions in GPPC.	Control logic shall properly execute the functions.	

<u>Item</u>	<u>Action Item</u>	<u>Expected Results</u>	<u>Approved</u>
	Notes: _____		

11	Create a user defined subroutine/function in GPPC.	Subroutine/function shall work correctly and be easily reused.	_____
	Notes: _____		

12	Create alarm conditions in GPPC.	Alarm variables shall be created according to the criteria.	_____
	Notes: _____		

13	Create and save a graphic symbol at the server.	Symbol shall be reusable on a new graphic.	_____
	Notes: _____		

14	Modify a graphic symbol at the server.	Operator shall be able to open an existing symbol and make changes.	_____
	Notes: _____		

15	Save a graphic symbol to a library at the server.	Symbol shall be available from the library for reuse.	_____
	Notes: _____		

16	Delete a graphic symbol at the server.	Symbol shall no longer exist for use.	_____
	Notes: _____		

17	Place a graphic symbol on a new graphic page at server.	When the new page is opened, the symbol shall be there.	_____
	Notes: _____		

<u>Item</u>	<u>Action Item</u>	<u>Expected Results</u>	<u>Approved</u>
18	Associate particular conditions with particular displays at the server.	When the conditional variable changes, the display should change.	_____
	Notes: _____		
19	Overlay alphanumeric text on a graphic at the server.	Text shall properly display.	_____
	Notes: _____		
20	Create a new graphic from an old one at the server.	New graphic shall properly display.	_____
	Notes: _____		
21	Place dynamic data on a graphic at the server.	The dynamic data shall be viewable on the graphic.	_____
	Notes: _____		
22	Define the background color of a new graphic at the server.	The new graphic shall show the selected background color.	_____
	Notes: _____		
23	Define a foreground color for an element on a graphic to distinguish it from the background color at the server.	The color of the dynamic data that uses the foreground color shall display in the foreground color.	_____
	Notes: _____		
24	Position a symbol on a graphic at the server.	The operator shall be able to place a symbol at any location on a graphic.	_____
	Notes: _____		

<u>Item</u>	<u>Action Item</u>	<u>Expected Results</u>	<u>Approved</u>
25	Position and edit alphanumeric descriptors at the server.	The alphanumeric display shall be as designed.	_____
	Notes: _____		
26	Draw lines on a graphic at the server.	Lines shall display as drawn.	_____
	Notes: _____		
27	Associate source of dynamic data for presentation on a graphic at the server.	Correct data shall be displayed.	_____
	Notes: _____		
28	Display analog data on a graphic page at the server.	Correct data shall be displayed.	_____
	Notes: _____		
29	Demonstrate the movement of the curser (crosshairs) by the use of the mouse at the server.	Crosshairs shall follow the commands from the mouse.	_____
	Notes: _____		
30	Demonstrate the simultaneous use of multiple graphics (coincident graphics) at the server.	Operator shall see the use of the tile function and the use of the tab function to manage multiple graphics.	_____
	Notes: _____		
31	Associate graphic properties such as color with the values from dynamic variables at	Graphic properties shall change as the value of the dynamic variable changes.	

<u>Item</u>	<u>Action Item</u>	<u>Expected Results</u>	<u>Approved</u>
	the server.		
	Notes: _____		

32	Create conditional displays based on the value of a dynamic variable at the server.	The graphic display shall change as the dynamic variable changes.	
	Notes: _____		

33	Review the standard symbol library at the	Operator shall see how to access symbols from the standard symbol library.	
	Notes: _____		

34	Demonstrate how to move data from the database to a report at the server.	The executed report shall contain data from the database.	
	Notes: _____		

35	Add comments and headers to a report at the server.	The executed report shall contain the comments and headers.	
	Notes: _____		

36	Demonstrate the time stamping of data in a report at the server.	Data presented in a report shall include the date and time the data was sampled.	
	Notes: _____		

37	Demonstrate the time stamping of the report generation at the server.	A report shall include the date and time it executed.	
	Notes: _____		

38	Demonstrate basic mathematical manipulation	Report shall display the results of the mathematical	

<u>Item</u>	<u>Action Item</u>	<u>Expected Results</u>	<u>Approved</u>
	of data within a report (daily averages, highs, lows, etc.) at the server.	manipulations.	_____
	Notes: _____		
39	Demonstrate the operator's ability to select either automatic or manual generation of a report.	Reports shall execute per the operator's instructions. Report one shall execute per the operator's instructions. Report two shall execute automatically on a time basis per operator's instructions.	_____
	Notes: _____		
40	Demonstrate the selection of either display, print to printer or print to file.	Reports shall execute per the operator's instructions. Report one is printed to printer. Report two is printed to file.	_____
	Notes: _____		
41	Demonstrate how a modified application program is imported into the server database for presentation to the workstations.	Modified list of variables shall be available from a workstation.	_____
	Notes: _____		
42	Demonstrate how a new device is added to the server database for presentation to the workstations.	New list of variables from the new device shall be available from a workstation.	_____
	Notes: _____		

End of Test

<u>Item</u>	<u>Action Item</u>	<u>Expected Results</u>	<u>Approved</u>
Specific Abbreviations:			
Y = Yes			
N = No			
NA = Not Applicable			

TEST NUMBER: Ten
TITLE: Scheduling

OBJECTIVE:

1. Verify that M&C software has ability to operate end devices off a time of day schedule utilizing defined parameters.

INITIAL REQUIREMENTS/CONDITIONS

1. Submittals
 - a. Provide documentation of the minimum programmable schedules in comparison to the specification requirement prior to testing.
 - b. Provide documentation of all schedules programmed in the UMCS prior to testing.
 - c. Provide a trend or report log of all equipment on a schedule prior to testing.
2. Equipment
 - a. Have GPPC and ASC with all scheduling completed for testing.
3. Reference Documentation
 - a. List user manual documentation and sections pertaining to the testing.
4. Date of Test: _____
5. Time of Test: _____
6. Contractor's Representative: _____
7. Government's Representative: _____

TEST PROCEDURES

<u>Item</u>	<u>Action Item</u>	<u>Expected Results</u>	<u>Approved</u>
UMCS			
1	Demonstrate the basic functionality of a time schedule by monitoring the value of SNVT_occupancy as the time changes through a start time or a stop time.	The value of SNVT_occupancy shall properly track the time schedule.	_____
	Notes: _____		
2	Setup a weekly time schedule for a demo system with independent times for each day of the week and with up to 6 events per day.	Scheduling software shall accommodate the described requirements.	_____

<u>Item</u>	<u>Action Item</u>	<u>Expected Results</u>	<u>Approved</u>
	Notes: _____		

3	Setup a special event or date specific time schedule and verify that this schedule takes precedence over the weekly schedule.	The special event schedule shall take precedence.	_____
	Notes: _____		

4	Setup a group time schedule for a collection of systems. This group schedule shall take precedence over the individual time schedules.	The group schedule shall take precedence.	_____
	Notes: _____		

5	Demonstrate operator access to a time schedule from a graphic page.	Operator shall be able to access the time scheduling editor from a graphic page.	_____
	Notes: _____		

6	Display the current date and time on a graphic page.	Operator shall be able to view the current date and time from a graphic page.	_____
	Notes: _____		

7	Demonstrate automatic daylight savings time adjustment.	Time of day shifts automatically.	_____
	Notes: _____		

HVAC			
8	Demonstrate the ability of GPPC to accept an occupied, unoccupied and standby command from the UMCS.	Equipment shall change modes based on the UMCS or from "system scheduler" SNVT schedule data.	_____

<u>Item</u>	<u>Action Item</u>	<u>Expected Results</u>	<u>Approved</u>
	Notes: _____		

9	Demonstrate the ability of ASC to accept an occupied, unoccupied and standby command from the UMCS.	Equipment shall change modes based on the UMCS SVNT schedule data.	_____
	Notes: _____		

10	Demonstrate use of the default schedule when communication is lost to the UMCS.	Equipment should use the default schedule until communication is reestablished.	_____
	Notes: _____		

End of Test

Specific Abbreviations:

Y = Yes

N = No

NA = Not Applicable

TEST NUMBER: Eleven
TITLE: Alarm Function

OBJECTIVE:

1. Verify M&C software is capable of alarm notification and routing.

INITIAL REQUIREMENTS/CONDITIONS

1. Submittals
 - a. Provide documentation of alarm managing capacity in comparison with specification.
 - b. Provide documentation of all alarm types and priorities utilized in the M&C prior to testing.
 - c. Provide documentation of the alarm routing in this particular M&C.
2. Equipment
 - a. Provide GPPC and ASC will alarms programmed.
3. Reference Documentation
 - a. List user manual documentation and sections pertaining to the testing.
4. Date of Test: _____
5. Time of Test: _____
6. Contractor's Representative: _____
7. Government's Representative: _____

TEST PROCEDURES

<u>Item</u>	<u>Action Item</u>	<u>Expected Results</u>	<u>Approved</u>
UMCS			
1	Initiate a basic binary alarm condition such as a fan fail to start.	The nvo (SNVT) displayed on designated server/workstation shall change from a value of 0 to a value of 1. The alarm shall be presented in the alarm window. The alarm shall define the source of the alarm. The alarm shall define the time of the alarm. The alarm shall present its assigned priority. The alarm shall display a text message.	_____

<u>Item</u>	<u>Action Item</u>	<u>Expected Results</u>	<u>Approved</u>
	Notes: _____		

2	Demonstrate the capability of associating a secondary text message with the alarm.	With a simple point and click, the operator shall have access to the secondary text message.	_____
	Notes: _____		

3	Acknowledge the alarm.	The status of the alarm shall changed to acknowledged. The user that acknowledged the alarm shall be recorded along with the date and time of the action.	_____
	Notes: _____		

4	Demonstrate the "pop up" of the alarm window when an alarm occurs.	When the alarm occurs, the alarm window shall automatically open.	_____
	Notes: _____		

5	Demonstrate the capability to send a numeric page when an alarm occurs.	The numeric page is received.	_____
	Notes: _____		

6	Demonstrate the capability to send an e-mail when an alarm occurs.	The e-mail shall be received.	_____
	Notes: _____		

7	Demonstrate the printing of an alarm on the alarm printer.	The printer shall print the alarm.	_____
	Notes: _____		

<u>Item</u>	<u>Action Item</u>	<u>Expected Results</u>	<u>Approved</u>
8	Identify the file on the hard disk that contains all of the alarms.	Opening the file shall display a list of all of the alarms.	_____
	Notes: _____		
9	Execute a user sort on the alarm file.	The presentation shall follow the defined sort.	_____
	Notes: _____		
10	Print the alarm file.	Paper copy shall be printed.	_____
	Notes: _____		
11	Take an application specific controller off-line.	An alarm should be generated.	_____
	Notes: _____		
12	Take a programmable controller off line.	An alarm should be generated.	_____
	Notes: _____		
13	Simulate a data circuit going off line.	An alarm should be generated.	_____
	Notes: _____		
14	Simulate a point not responding to a command.	An alarm should be generated.	_____
	Notes: _____		
15	Simulate a change of state without command.	An alarm should be generated.	_____
	Notes: _____		

<u>Item</u>	<u>Action Item</u>	<u>Expected Results</u>	<u>Approved</u>
DDC FOR HVAC			
16	Initiate an alarm condition such as a fan fail to start.	DDC system shall dial a pager and send a numerical alarm. DDC system shall dial an e-mail server. The node shall be able to dial and connect to a remote server and send an e-mail via Simple Mail Transfer Protocol (SMTP). DDC system shall send an e-mail over IP Network. The alarm handling node shall be capable of connecting to an IP network and sending e-mail via Simple Mail Transfer Protocol (SMTP).	

Notes: _____

End of Test

Specific Abbreviations:

Y = Yes

N = No

NA = Not Applicable

TEST NUMBER: Twelve
TITLE: Trending

OBJECTIVE:

1. To validate the capability for historical trend data collection and presentation

2. To validate the capability for real time trend data collection and presentation

INITIAL REQUIREMENTS/CONDITIONS

1. Submittals

a. Provide documentation of trending capability in comparison with specification.

2. Equipment

a. Provide GPPC or ASC and workstation/server programmed with trend data.

3. Reference Documentation

a. List user manual documentation and sections pertaining to the testing.

4. Date of Test: _____

5. Time of Test: _____

6. Contractor's Representative: _____

7. Government's Representative: _____

TEST PROCEDURES

<u>Item</u>	<u>Action Item</u>	<u>Expected Results</u>	<u>Approved</u>
UMCS			
1	Set up a trend with a 1 second sample rate.	It shall be possible to collect data on a 1 second sample rate.	_____
	Notes: _____		
2	Set up a trend to start and stop at specific times.	It shall be possible to start and stop a trend based on time.	_____
	Notes: _____		
3	Open a trend data display that has 8 values trended versus time. a) historical data	Trend plots shall show all 8 variables as a function of time.	_____ _____

<u>Item</u>	<u>Action Item</u>	<u>Expected Results</u>	<u>Approved</u>
	b) instantaneous data		
	Notes: _____		

4	Open a pre-programmed trend data presentation.	Trend plot shall open without operator programming.	_____
	Notes: _____		

5	Open the trend configuration dialog box and set up a trend.	Operator shall be able to configure a trend plot.	_____
	Notes: _____		

6	Set up a trend for a randomly selected binary value and a randomly selected analog value.	Any binary or analog variable shall be trendable.	_____
	Notes: _____		

7	Verify that historical trend data is stored on the hard drive.	With the controller offline, historical trend data from that controller shall be presented in a graphical form.	_____
	Notes: _____		

8	Export trend log data to Microsoft Excel for manipulation and printing by the operator.	Data shall be presented in a ****.xls form.	_____
	Notes: _____		

End of Test

Specific Abbreviations:

Y = Yes

N = No

NA = Not Applicable

TEST NUMBER: Thirteen
TITLE: Demand Limiting

OBJECTIVE:

1. Verify M&C software has the capability of performing demand-limiting strategies

INITIAL REQUIREMENTS/CONDITIONS

1. Submittals
 - a. Provide documentation of the specific equipment being monitored.
 - b. Provide documentation of the load shed priority and the equipment associated with the priorities.
2. Equipment
 - a. Provide GPPC and ASC programmed for demand-limit strategies.
3. Reference Documentation
 - a. List user manual documentation and sections pertaining to the testing.
4. Date of Test: _____
5. Time of Test: _____
6. Contractor's Representative: _____
7. Government's Representative: _____

TEST PROCEDURES

<u>Item</u>	<u>Action Item</u>	<u>Expected Results</u>	<u>Approved</u>
UMCS			
1	From the home page of the M&C go to or click on the graphical demand-limiting page.	The demand-limiting page will open without any errors.	_____
	Notes: _____		_____
2	Document the present kW load_____.	The M&C will display the actual kW.	_____
	Notes: _____		_____
3	Set kW limit setpoint to cause program to shed load. _____		_____
	Notes: _____		_____

<u>Item</u>	<u>Action Item</u>	<u>Expected Results</u>	<u>Approved</u>
4	Turn off 25% of the mechanical equipment being monitored.	The kW usage will decrease.	_____
	Notes: _____		
5	Allow the building(s) to remain at 75% for a given time as to generate a temperature load.	The building(s) will warm-up/cool down.	_____
	Notes: _____		
6	After time period has expired, turn all equipment on at the same time.	The kW usage will greatly increase. The M&C will stop other pieces of equipment as to shed the load. The equipment shut down will be priority based. After the building(s) come under temperature control the M&C will start all of the equipment. The equipment start up will be priority based.	_____
	Notes: _____		
7	Verify the building(s) remain under temperature control and go back to the home page.	The building(s) will come under control. The home page will be displayed.	_____
	Notes: _____		
8	Reset kW setpoint to normal limits.	The UMCS goes back to normal control.	_____
	Notes: _____		

<u>Item</u>	<u>Action Item</u>	<u>Expected Results</u>	<u>Approved</u>
End of Test			

Specific Abbreviations:
Y = Yes
N = No
NA = Not Applicable

TEST NUMBER: Fourteen
TITLE: Report Generation

OBJECTIVE:

1. To demonstrate that M&C software has ability to generate reports in a fixed format initialized by operator request

INITIAL REQUIREMENTS/CONDITIONS

1. Submittals
 - a. Provide documentation of all report logs set-up and the equipment associated with the report logs.
2. Equipment
 - a. Provide server/workstation, GPPC, ASC and I/O to create reports.
3. Reference Documentation
 - a. List user manual documentation and sections pertaining to the testing.
4. Date of Test: _____
5. Time of Test: _____
6. Contractor's Representative: _____
7. Government's Representative: _____

TEST PROCEDURES

<u>Item</u>	<u>Action Item</u>	<u>Expected Results</u>	<u>Approved</u>
UMCS			
1	Manually generate a report for viewing on the workstation.	Report shall present itself for viewing without disrupting the operation of the control system.	_____
	Notes: _____		
2	Manually generate a report and direct it to a specific printer.	Report shall print on the specified printer.	_____
	Notes: _____		
3	Verify that the report contains the date and time associated with the raw data.	Data samples listed in the report shall have the associated date and time the samples were collected.	_____
	Notes: _____		

<u>Item</u>	<u>Action Item</u>	<u>Expected Results</u>	<u>Approved</u>
4	Verify that the report has the date and time the report was generated.	The report shall include the date and time of the report generation.	_____
	Notes: _____		
5	Save a report to a file that is compatible with Microsoft Office products.	The report shall be saved in a ***.xls format.	_____
	Notes: _____		
6	Generate a comma delimited file with trend log data.	The comma delimited data shall be produced.	_____
	Notes: _____		

End of Test

Specific Abbreviations:

Y = Yes

N = No

NA = Not Applicable

TEST NUMBER: Fifteen
TITLE: UPS Test

OBJECTIVE:

1. Validate UPS requirements

INITIAL REQUIREMENTS/CONDITIONS

1. Submittals
 - a. The Contractor provides documentation on UPS.
2. Equipment
 - a. The server/workstation and the UPS needs to be on and operating for a minimum of one week.
3. Reference Documentation
 - a. List user manual documentation and sections pertaining to the testing.
4. Date of Test: _____
5. Time of Test: _____
6. Contractor's Representative: _____
7. Government's Representative: _____

TEST PROCEDURES

<u>Item</u>	<u>Action Item</u>	<u>Expected Results</u>	<u>Approved</u>
UMCS			
1	The UMCS home graphic page is called up.	The home page is displayed.	_____
	Notes: _____		
2	Unplug the UPS from the wall outlet.	The UMCS home page remains displayed. UPS LED-warning lights if applicable. UPS sound audible warning alarm if applicable.	_____
	Notes: _____		
3	Log out of the home page of the M&C and then log back into it.	The UPS will not affect the UMCS hardware and all associated software.	_____
	Notes: _____		

<u>Item</u>	<u>Action Item</u>	<u>Expected Results</u>	<u>Approved</u>
4	Allow the UPS to be unplugged for 20 minutes.	The UPS will not affect the UMCS hardware and all associated software.	_____
	Notes: _____		
5	Return the UPS plug to the wall outlet.	The UPS will not affect the UMCS hardware and all associated software.	_____
	Notes: _____		

End of Test

Specific Abbreviations:

Y = Yes

N = No

NA = Not Applicable

TEST NUMBER: Sixteen

TITLE: CTA CTA-709.1-D to IP Router Test

OBJECTIVE:

1. Validate CTA CTA-709.1-D to IP Router requirements

INITIAL REQUIREMENTS/CONDITIONS

1. Submittals
 - a. Submittal information on router and O&M manual on network analysis tool.
2. Equipment
 - a. The router needs to be on and operating.
 - b. Provide a LONWORKS® network analysis tool and router configuration tool.
3. Reference Documentation
 - a. List user manual documentation and sections pertaining to the testing.
4. Date of Test: _____
5. Time of Test: _____
6. Contractor's Representative: _____
7. Government's Representative: _____

TEST PROCEDURES

<u>Item</u>	<u>Action Item</u>	<u>Expected Results</u>	<u>Approved</u>
UMCS			
1	Connect and open network analysis tool and verify router.	Tool shall identify function, network address, and identifier of the device.	_____
	Notes: _____		
2	Using router configuration tool, open network properties dialog box.	Router shall be utilizing a static IP address and shall not be configured for DHCP.	_____
	Notes: _____		

(AM#0002) >

- 3 Confirm- BACnet ~~LON~~ data is _____ All ~~LONWORKS®~~ BACnet network transmitted to/from ~~LON~~ _____ data is being transmitted BACnet bus to IP network. _____ to/from the IP network. _____

<u>Item</u>	<u>Action Item</u>	<u>Expected Results</u>	<u>Approved</u>
<(AM#0002)			
Notes: _____			

End of Test

Specific Abbreviations:
Y = Yes
N = No
NA = Not Applicable

TEST NUMBER: Seventeen

TITLE: CTA CTA-709.1-D Router and Repeater

OBJECTIVE:

1. Validate EIA-709.1B Router and Repeater requirements

INITIAL REQUIREMENTS/CONDITIONS

1. Submittals
 - a. Submittal information on router/repeater and O&M Manual on network analysis tool.
2. Equipment
 - a. The router needs to be on and operating for a minimum of one week.
 - b. The repeater needs to be on and operating for a minimum of one week.
 - c. Provide a LONWORKS® network analysis tool and router/repeater configuration tool.
3. Reference Documentation
 - a. List user manual documentation and sections pertaining to the testing.
4. Date of Test: _____
5. Time of Test: _____
6. Contractor's Representative: _____
7. Government's Representative: _____

TEST PROCEDURES

<u>Item</u>	<u>Action Item</u>	<u>Expected Results</u>	<u>Approved</u>
DDC FOR HVAC			
1	Connect and open network analysis tool and verify router and repeater.	Tool shall identify function, network address, and identifier of the devices. _____	
	Notes: _____		
2	Using router configuration tool, open the properties dialog box. Verify what data is configured to pass through router.	Only the data that is configured to pass through the router is being sent. _____	
	Notes: _____		
3	Using repeater	Dialog box opens.	

<u>Item</u>	<u>Action Item</u>	<u>Expected Results</u>	<u>Approved</u>
	configuration tool, open the properties dialog box.		_____
	Notes: _____		_____
4	Verify that repeater is configured as a repeater and that all data is being sent.	Verify that all data is being sent through the repeater.	_____
	Notes: _____		_____

End of Test

Specific Abbreviations:

Y = Yes

N = No

NA = Not Applicable

TEST NUMBER: Eighteen

TITLE: CTA CTA-709.1-D Gateway Test

OBJECTIVE:

1. Validate CTA CTA-709.1-D Gateway requirements.

INITIAL REQUIREMENTS/CONDITIONS

1. Submittals
 - a. Provide a list of all software that will be used to verify CTA CTA-709.1-D Gateway configuration.
 - b. Provide a LonMark external interface file (XIF) for the gateway.
2. Equipment
 - a. The gateway needs to be on and operating.
 - b. Provide a LonWorks® network analysis tool and gateway configuration tool.
3. Reference Documentation
 - a. List user manual documentation and sections pertaining to the testing.
4. Date of Test: _____
5. Time of Test: _____
6. Contractor's Representative: _____
7. Government's Representative: _____

TEST PROCEDURES

<u>Item</u>	<u>Action Item</u>	<u>Expected Results</u>	<u>Approved</u>
UMCS and DDC FOR HVAC			
1	Connect a LONWORKS® Network Analysis Tool to the network.	a. Tool shall identify function, network address, and identifier of the device. b. All network traffic from gateway shall be utilizing the CTA CTA-709.1-D protocol.	_____
Notes: _____			
2	Use gateway configuration tool to verify or create a binding from gateway to a LONWORKS® controller on the network.	a. Gateway allows binding of the Standard Network Variable Types from the gateway to a LONWORKS® controller. b. Information from gateway should be bounded and	

<u>Item</u>	<u>Action Item</u>	<u>Expected Results</u>	<u>Approved</u>
		LONWORKS® controller should be receiving data.	_____
	Notes: _____		
3	Using gateway or network configuration tool verify the following:		
	Open the properties dialog box for one of the configured SNVTs.	Gateway should allow the SNVT to be transmitted on "min", "max" and "delta".	_____
	Rename one of the SNVTs from the gateway.	Gateway should allow all variable names to be customized.	_____
	Check total capacity of Gateway.	Gateway shall have 50% extra capacity to map over additional points.	_____
	Notes: _____		
4	Press service pin on gateway.	Gateway should broadcast the neuron ID and Program ID over the network.	_____
	Notes: _____		
5	Remove power source from gateway for two hours. Then return power to gateway.	Gateway should retain all configuration data.	_____
	Notes: _____		

End of Test

Specific Abbreviations:

Y = Yes

N = No

NA = Not Applicable

TEST NUMBER: Nineteen**TITLE:** Local Display Panel (LDP)**OBJECTIVE:**

1. To demonstrate capability of the Local display panel to view and override control points

INITIAL REQUIREMENTS/CONDITIONS

1. Submittal
 - a. O & M Manual for LDP
2. Equipment
 - a. Hardware and software to connect and demo LDP configuration tool
3. Reference Documentation
 - a. List user manual documentation and sections pertaining to the testing.
4. Date of Test: _____
5. Time of Test: _____
6. Contractor's Representative: _____
7. Government's Representative: _____

TEST PROCEDURES

<u>Item</u>	<u>Action Item</u>	<u>Expected Results</u>	<u>Approved</u>
DDC FOR HVAC			
1	Connect LDP to LON bus. Push service pin button on LDP.	LDP Controller should broadcast its neuron ID.	_____
	Notes: _____		
2	Use navigation buttons on LDP to display a status point such as a temperature or fan status.	LCP should allow user to read all status points.	_____
	Notes: _____		
3	Use navigation buttons to display a control point such as a discharge air temperature setpoint.	LCP should allow user to read all control points.	_____
	Notes: _____		

<u>Item</u>	<u>Action Item</u>	<u>Expected Results</u>	<u>Approved</u>
4	Use LDP to override setpoint.	System accepts new setpoint. Verify system reacts to new setpoint.	_____
	Notes: _____		
5	Use LDP to release local control override.	Verify system returns to normal control.	_____
	Notes: _____		

End of Test

Specific Abbreviations:

Y = Yes

N = No

NA = Not Applicable

TEST NUMBER: Twenty
TITLE: Network Configuration Tool

OBJECTIVE:

1. To validate the performance of the network configuration tool

INITIAL REQUIREMENTS/CONDITIONS

1. Submittal
 - a. Network configuration tool manuals
2. Equipment
 - a. Hardware, network connection, LNS database, and network configuration tool
3. Reference Documentation
 - a. List user manual documentation and sections pertaining to the testing.
4. Date of Test: _____
5. Time of Test: _____
6. Contractor's Representative: _____
7. Government's Representative: _____

TEST PROCEDURES

<u>Item</u>	<u>Action Item</u>	<u>Expected Results</u>	<u>Approved</u>
UMCS AND DDC FOR HVAC			
1	Open network configuration tool and verify LNS data for project opens is being used.	The Network Configuration Tool is being used and entire LNS database for project is exposed.	_____
	Notes: _____		
2	Open a typical LNS plug-in.	Plug-in shall open and enable configuration of the device.	_____
	Notes: _____		
3	Reconstruct a database by connecting to an existing network and uploading the data.	The database and drawing shall be created.	_____
	Notes: _____		

<u>Item</u>	<u>Action Item</u>	<u>Expected Results</u>	<u>Approved</u>
4	Verify that a graphical interface is use.	Note that Network Configuration Tool uses Visio (type) as a graphical interface.	_____
	Notes: _____		
5	Print the graphical representation.	Printing shall be successful.	_____
	Notes: _____		
6	Merge two LNS databases into a single database.	The merge shall be successful.	_____
	Notes: _____		
7	Print reports from network configuration tool.	Address table, SNVT I/O table, and SCPT/UCPT table reports shall be successfully printed.	_____
	Notes: _____		
8	Randomly select a sample of network variable and confirm they are using correct SNVT types.	Correct SNVT types were used.	_____
	Notes: _____		

End of Test

Specific Abbreviations:

Y = Yes

N = No

NA = Not Applicable

TEST NUMBER: Twenty one
TITLE: Custom Tests

OBJECTIVE:

1. To test custom applications for UMCS and/or DDC for HVAC, that are specific to a project

INITIAL REQUIREMENTS/CONDITIONS

1. Submittal
 - a. Documents related to custom application - to be identified
2. Equipment
 - a. Equipment to be provided related to custom application - to be identified
3. Date of Test: _____
4. Time of Test: _____
5. Contractor's Representative: _____
6. Government's Representative: _____

TEST PROCEDURES

<u>Item</u>	<u>Action Item</u>	<u>Expected Results</u>	<u>Approved</u>
UMCS AND DDC FOR HVAC			
1	Identify special tests for the UMCS that relate to a custom application for a specific project - to be completed by designer.	To be completed by designer.	_____
	Notes: _____		
2	Identify special tests for the DDC for HVAC systems that relate to a custom application for a specific project - to be completed by designer.	To be completed by designer.	_____
	Notes: _____		

End of Test

Specific Abbreviations:

Y = Yes
 N = No
 NA = Not Applicable

-- End of Section --

SECTION 26 27 13.10 30

ELECTRIC METERS
<AMENDMENT NO. 0002>

PART 1 GENERAL

1.1 REFERENCES

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

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
- IEEE C37.90.1 (2013) Standard for Surge Withstand Capability (SWC) Tests for Relays and Relay Systems Associated with Electric Power Apparatus
- IEEE C57.13 (2016) Requirements for Instrument Transformers

INTERNATIONAL ELECTROTECHNICAL COMMISSION (IEC)

- IEC 61000-4-5 (2017) Electromagnetic Compatibility (EMC) - Part 4-5: Testing and Measurement Techniques - Surge Immunity Test
- IEC 62053-22 (2003; Corr 1 2018) Electricity Metering Equipment (A.C.) - Particular Requirements - Part 22: Static Meters for Active Energy (Classes 0,2 S and 0,5 S)

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

- ANSI C12.18 (2006; R 2016) Protocol Specification for ANSI Type 2 Optical Port
- ANSI C12.20 (2015; E 2018) Electricity Meters - 0.1, 0.2, and 0.5 Accuracy Classes
- ANSI C62.61 (1993) American National Standard for Gas Tube Surge Arresters on Wire Line Telephone Circuits

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

- NFPA 70 (2017; ERTA 1-2 2017; TIA 17-1; TIA 17-2; TIA 17-3; TIA 17-4; TIA 17-5; TIA 17-6; TIA 17-7; TIA 17-8; TIA 17-9; TIA 17-10;

TIA 17-11; TIA 17-12; TIA 17-13; TIA
17-14; TIA 17-15; TIA 17-16; TIA 17-17)
National Electrical Code

1.2 DEFINITIONS

Unless otherwise specified or indicated, electrical and electronics terms used in this specification and on the drawings shall be as defined in IEEE 100.

1.3 SUBMITTALS

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

- a. Maintenance manual shall provide:
 1. Condensed description of how the equipment operates.
 2. Block diagram indicating major assemblies.
 3. Troubleshooting information
 4. Preventive maintenance.
 5. Spare parts information.
- b. Provide operation and maintenance manuals required by submittal item "SD-10 Operation and Maintenance Data."

SD-02 Shop Drawings

SD-03 Product Data

Power Meters; G

Current Transformers; G

Potential Transformer; G

Communications Module; G

Protocol Modules; G

Data Recorder; G

Modem; G

Submittals shall include manufacturer's information for each component, device, and accessory provided with the meter, protocol module or communications module.

SD-06 Test Reports

Acceptance Checks and Tests; G

SD-10 Operation and Maintenance Data

Power Meters; G

Communications Module; G

Protocol Modules; G

Data Recorder; G

Modem; G

SD-11 Closeout Submittals

System Function Verification; G

1.4 QUALITY ASSURANCE

1.4.1 Installation Drawings

Drawings shall indicate but not be limited to the following:

a. Elementary diagrams and wiring diagrams with terminals identified of advanced meter, current transformers, potential transformers, protocol modules, communications modules, Ethernet connections. For each meter installation, provide a diagram identified by the building number.

b. One-line diagram, including meters, current transformers, potential transformers, protocol modules, communications modules, Ethernet connections, and fuses. For each meter installation, provide a diagram identified by the building number.

1.4.2 Standard Products

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

1.4.3 Alternative Qualifications

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

1.4.4 Material and Equipment Manufacturing Data

Products manufactured more than 2 years prior to date of delivery to site shall not be used, unless specified otherwise.

1.5 WARRANTY

The equipment items shall be supported by service organizations which are

reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

1.6 SYSTEM DESCRIPTION

1.6.1 System Requirements

The metering and reading system, consisting of commercial, off-the-shelf meters, [protocol modules](#), communications modules, and communication channels, will be used to record the electricity consumption and other values as described in the sections that follow and as shown on the drawings.

1.6.2 Selection Criteria

Metering components are part of a system that includes the physical meter, [data recorder](#) function and communications ([modem](#)) method. Every building site identified shall include sufficient metering components to measure the electrical parameters identified and to store and communicate the values as required in the following sections. Contractor shall verify that the metering system installed on any building site is compatible with the facility-wide communication and meter-reading protocol system. Contractor must connect the metering system to the facility-wide energy and utility monitoring and control system.

PART 2 PRODUCTS

2.1 POWER METERS

2.1.1 Physical and Common Requirements

- a. Metering system components shall be installed according to this specification.
- c. Power meter shall be panel-mounted design ~~(AM#0002) >equal to the~~ [\(AM#0002\)](#) Schneider Electric PowerLogic ION series.
- i. Surge withstand shall conform to [IEEE C37.90.1](#).
- j. Meter shall have a standard 4 -year warranty.
- k. Meter shall comply with [IEC 62053-22](#) (Part 21: Static Meter for Active Energy, classes 0.2S and 0.5S), certified by a qualified third party test laboratory.

2.1.2 Voltage Requirements

- a. Meter shall be capable of connection to the service voltage phases and magnitude being monitored. If the meter is not rated for the service voltage, provide suitable potential transformers to send an acceptable voltage to the meter.
- b. Meter shall be capable of connection to the service voltage indicated in the Metering System Schedule:
- c. Meter shall accept independent voltage inputs from each phase. Meter shall be auto-ranging over the full range of input voltages.

- d. Voltage input shall be optically isolated to 2500 volts DC from signal and communications outputs. Components shall meet or exceed [IEEE C37.90.1](#) (Surge Withstand Capability).
- e. The Contractor shall be responsible for determining the actual voltage ratio of each [potential transformer](#). Transformer shall conform to [IEEE C57.13](#) and the following requirements.
 - 1. Type: Dry type, of two-winding construction.
 - 2. Weather: Outdoor or Indoor rated for the application.
 - 3. Frequency: Nominal 60Hz, 50Hz for those bases that operate on 50Hz.
 - 4. Accuracy: Plus or minus 0.3% at 60Hz or 0.3% for those systems that operate at 50Hz.

2.1.1.3 [Current](#) Requirements

- a. Meter shall accept independent current inputs from each phase. Current transformer shall be installed with a full load rating as shown in the schedule.
- b. Single ratio current transformer shall have an Accuracy Class of 0.6 with a maximum error of +/- 0.6% at 5.0 amps.
- c. Current transformer shall have:
 - 1. Insulation Class: All 600 volt and below current transformers shall be rated 10 KV BIL. Current transformers for 2400 and 4160 volt service shall be rated 25 KV BIL.
 - 2. Frequency: Nominal 60Hz, 50Hz for bases that operate on 50Hz.
 - 3. Burden: Burden class shall be selected for the load.
 - 4. Phase Angle Range: 0 to 60 degrees.
- d. Meter shall accept current input from standard instrument transformers (5A secondary current transformers.)
- e. Current inputs shall have a continuous rating in accordance with [IEEE C57.13](#).
- f. Multi-ratio current transformer where indicated shall have a top range equal to or greater than the actual load. The Contractor shall be responsible for determining the actual ratio of each transformer. Current transformer shall conform to [IEEE C57.13](#).

2.1.1.4 Electrical Measurements

Power meter shall transmit the following measurements and report the following quantities:

- a. Current, per phase, and three phase total.
- b. Voltage, per phase, and three phase total phase to phase, and phase to neutral.

- c. Real power (KW), per phase and three-phase total.
- d. Reactive power (kVAR), three-phase total.
- e. Apparant power (kVA), three-phase total.
- f. Power factor, per-phase and three-phase total.
- g. Real Energy, (kWH), three-phase total.
- h. Historical power data shall include each of the above real-time power variables for the following time periods: 1. Past 24 hours, by hour. 2. Past 7 days, by day. 3. Past 30 days, by day. 4. Past 365 days by month.

2.1.5 Meter Accuracy

Power meter shall provide the following accuracies. Accuracies shall be measured as percent of reading at standard meter test points.

- a. Power meter shall meet ANSI C12.20 for Class 0.2 and IEC 62053-22 accuracy requirements.

2.1.6 An on the Meter Display, Output and Reading Capabilities

Meter shall include the following output signals.

- a. The meter will have a face display plate and shall display every electrical parameter indicated to be recorded. Meters shall not be required to indicate interval data collected in a data logger with a communications output feature. Peak values, instantaneous and cumulative values shall be displayed.
- f. Meter shall have two form C, dry contact relay outputs for alarm or control.

2.1.7 Installation Methods

- a. Transformer mounted (XFMR)
 - 1. Meter base shall be located outside on the secondary side of the pad-mounted transformer.
- b. Stand-mounted adjacent to transformer ("STAND" in Metering Systems Schedule)
 - 1. Meter base shall be mounted on a structural steel pole approximately 4 feet from the transformer pad. See detail on the drawings.
- c. Building mounted ("BLDG" in Metering Systems Schedule)
 - 1. Meter base shall be mounted on the side of the existing building near the service entrance. See detail on the drawings.
- d. Panel mounted. ("PNL" in Metering Systems Schedule)
 - 1. Meter shall be mounted where directed. See detail on the drawings.

e. Common features.

1. PTs (if required for proper voltage range) and CTs shall be physically connected to the service entrance cables inside the service entrance disconnect enclosure.

2.1.1.8 Disconnecting Switches

- a. Disconnecting wiring blocks shall be provided between the current transformer and the meter. A shorting mechanism shall be built into the wiring block to allow the current transformer wiring to be changed without removing power to the transformer. The wiring blocks shall be located where they are accessible without the necessity of disconnecting power to the transformer. For multi-ratio current transformers, provide a shorting block from each tap to the common lead.
- b. Voltage-monitoring circuits shall be equipped with disconnect switches to isolate the meter base or socket from the voltage source.

2.1.1.9 Meter Programming

- a. Power meter shall be programmable by software supplied by the meter manufacturer.
- b. Software shall have a user-friendly, Windows-compatible interface.
- c. Software shall operate on Windows operating systems.
- d. Software shall allow the user to configure the meter, troubleshoot meter, query and display meter parameters and configuration data and stored values.
- e. Meter firmware shall be upgradeable through one of the communications ports without removing the unit from service.

2.2 COMMUNICATIONS

2.2.1 Communications Methods

2.2.1.1 Optical Port

The optical port shall communicate with a hand-held reading device according to the following requirements.

a. Communications standards

1. ANSI C12.18
2. MV90 protocol
3. ANSI C12.20

b. Read operations

1. Current kWh values
2. Demand (kW) values since last reset
3. Last reset value

4. Meter status

5. Load profile

- c. Write operations

1. Meter setup

2.2.1.2 Serial Port

Provide serial port for connection to modem module where required in this specification.

2. \RS485

2.2.1.3 Ethernet

For those meters using the Ethernet, logged information shall be sent using open standard Internet Protocols.

- a. On-board Ethernet port support

1. HTTP

2. SMTP

- (a) Modbus

- b. Distribute stored data by

1. FTP

2.2.2 Communications Protocols and Methods

Communications protocols and methods shall be native to the meter. Provide [communications module](#)(s) as required to accomplish the following.

- a. Meter shall include an IR port ("IR" in Metering Systems Schedule) for communication to external devices such as handheld readers that support a minimum speed of 9600 baud.

- b. Meter shall include one or RS-485 ("RS485" in Metering Systems Schedule) digital communication port. Each port shall be user configurable with regard to speed, protocol, address, and other communications parameters. Ports shall support a minimum communication speed of 9600 baud for the RS232 port.

2.2.3 Communications Channels Surge Protection

Communications equipment shall be protected against surges induced on its communications channels. Communication interfaces to all field equipment shall be protected to meet the requirements of [IEEE C37.90.1](#) or the requirements of [IEC 61000-4-5](#), test level 4, while the equipment is operating. Fuses shall not be used for surge protection. Metallic cables and conductors which serve as communications channels between buildings shall have surge protection installed at equipment rated for the application installed at each end, within [3 feet](#) of the building cable

entrance. Surge protectors shall meet the requirements of the applicable extension of ANSI C62 (for example, ANSI C62.61).

2.3 METER DATA PROTOCOL

Power meters shall have communicating data protocols native or provided in supplemental modules to communicate with the communications methods that follow.

2.3.1 Open Protocol

Power meter shall support the following open protocols. Contractor shall verify that the meter native protocol is consistent with the facility data recording and communication and data storage system. Contractor shall provide additional converters and protocol modules as required for a complete measurement, recording, communicating and data storage system.

- a. Meter shall be fully supported by MV-90 software system or existing AMR software that is MV-90 compatible.
- b. For systems that use proprietary software, an alternative, competitive software system must be available.

Systems capable of using more than one brand of commercially available meters are expected. In addition, if proprietary meter reading software is used, meters are to be capable of being read by more than one manufacturer's software.

2.4 SPARE PARTS

2.4.1 Parts List

Provide spare parts as follows:

- a. Power meter - two for each type used.
- b. Current transformer - three for each type used.
- c. Potential transformer - three for each type used.
- d. Communications module - one for each type used.
- e. Protocol module - one for each type used.
- f. Other electronic and power components - one for each type used.

2.5 METERING SYSTEM SCHEDULE

Metering System Schedule is available at

<http://www.wbdg.org/ffc/dod/unified-facilities-guide-specifications-ufgs/forms-graphics->

PART 3 EXECUTION

3.1 INSTALLATION

Electrical installations shall conform to IEEE C2, NFPA 70, and to the requirements specified herein. Provide new equipment and materials unless indicated or specified otherwise.

3.1.1 Scheduling of Work and Outages

The Contract Clauses shall govern regarding permission for power outages, scheduling of work, coordination with Government personnel, and special working conditions.

3.2 FIELD APPLIED PAINTING

Where field painting of enclosures is required to correct damage to the manufacturer's factory-applied coatings, provide manufacturer's recommended coatings and apply in accordance with manufacturer's instructions.

3.3 FIELD QUALITY CONTROL

3.3.1 Performance of Acceptance Checks and Tests

3.3.1.1 Meter Assembly

a. Visual and mechanical inspection

1. Compare equipment nameplate data with specification and approved shop drawings.
2. Inspect physical and mechanical condition.
3. Inspect all bolted electrical connections for high resistance using low-resistance ohmmeter, verifying tightness of accessible bolted electrical connections by calibrated torque-wrench method.
4. Verify grounding of metering enclosure.
5. Verify the presence of surge arresters.
6. Verify that the CT ratio and the PT ratio are properly included in the meter multiplier or the programming of the meter.

b. Electrical tests

1. Calibrate watthour meters according to manufacturer's published data.
2. Verify that correct multiplier has been placed on face or meter where applicable.
3. Prior to system acceptance, the Contractor will demonstrate and confirm the meter is properly wired and is displaying correct and accurate electrical information.

3.3.1.2 Current Transformers

a. Visual and mechanical inspection

1. Compare equipment nameplate data with specification and approved shop drawings.
2. Inspect physical and mechanical condition.
3. Verify correct connection.

4. Inspect all bolted electrical connections for high resistance using low-resistance ohmmeter, verifying tightness of accessible bolted electrical connections by calibrated torque-wrench method.
5. Verify that required grounding and shorting connections provide good contact.

b. Electrical tests

1. Perform resistance measurements through all bolted connections with low-resistance ohmmeter, if applicable.
2. Perform insulation-resistance test.
3. Perform a polarity test.
4. Perform a ratio-verification test.

3.3.1.3 Potential Transformers

a. Visual and mechanical inspection

1. PT's are rigidly mounted.
2. PT's are correct voltage.
3. Verify that adequate clearances exist between primary and secondary circuit.

b. Electrical tests

1. Perform a ratio-verification test.

3.3.2 Follow-Up [System Function Verification](#)

Upon completion of acceptance checks and tests, the Contractor shall 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 shall be given 5 working days' advance notice of the dates and times of checking and testing.

3.3.3 Training

The Contractor shall conduct a training course for meter configuration, operation, and maintenance of the system as specified. The training shall be oriented for all components and systems installed under this contract. Training manuals shall be delivered for 2 trainees with two additional copies delivered for archiving at the project site. The Contractor shall furnish all audiovisual equipment and all other training materials and supplies. A training day is defined as eight hours of classroom instruction, including two 15-minute breaks and excluding lunchtime, Monday through Friday, during the daytime shift in effect at the training facility. For guidance in planning the required instruction, the Contractor shall assume that attendees have a high school education or equivalent, and are familiar with utility systems. Approval of the planned training schedule shall be obtained from the Government at least 30 days prior to the training.

a. Training: The course shall be taught at the project site within thirty days after completion of the installation for a period of one day(s). A maximum of 6 personnel will attend the course. The training shall include:

1. Physical layout of each piece of hardware.
2. Meter configuration, troubleshooting and diagnostics procedures.
3. Repair instructions.
4. Preventive maintenance procedures and schedules.
5. Testing and calibration procedures.

-- End of Section --

SECTION 31 00 00

EARTHWORK

<AMENDMENT NO. 0002>

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN 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 WATER WORKS ASSOCIATION (AWWA)

AWWA C600 (2017) Installation of Ductile-Iron Mains
and Their Appurtenances

AMERICAN WOOD PROTECTION ASSOCIATION (AWPA)

AWPA P5 (2015) Standard for Waterborne
Preservatives

ASTM INTERNATIONAL (ASTM)

ASTM C33/C33M (2018) Standard Specification for Concrete
Aggregates

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

ASTM D698 (2012; E 2014; E 2015) Laboratory
Compaction Characteristics of Soil Using
Standard Effort (12,400 ft-lbf/cu. ft.
(600 kN-m/cu. m.))

ASTM D1140 (2017) Standard Test Methods for
Determining the Amount of Material Finer
than 75- μ m (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/ft ³) (2700 kN-m/m ³)
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 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

1.2 DEFINITIONS

1.2.1 Satisfactory Materials

Satisfactory materials comprise any materials classified by ASTM D2487 as GW, GP, GM, GP-GM, GW-GM, GC, GP-GC, GM-GC, SW, SP, SM, SC, CL, CH,. Satisfactory materials for grading comprise stones less than 8 inches, except for fill material for pavements and railroads which comprise stones less than 3 inches in any dimension.

1.2.2 Unsatisfactory Materials

Unsatisfactory materials include materials classified in ASTM D 2487 as Pt, OH, OL, ML, MH and any other materials not defined as satisfactory.

Unsatisfactory materials also include man-made fills; trash; refuse; backfills from previous construction; and material classified as satisfactory which contains root and other organic matter or frozen material. Notify the Contracting Officer when encountering any contaminated materials.

1.2.3 Cohesionless and Cohesive Materials

Cohesionless materials include materials classified in ASTM D2487 as GW, GP, SW, and SP. Cohesive materials include materials classified as GC, SC, ML, CL, MH, and CH. Materials classified as GM and SM will be identified as cohesionless only when the fines are nonplastic. Perform testing, required for classifying materials, in accordance with ASTM D4318, ASTM C136/C136M and ASTM D1140.

1.2.4 Degree of Compaction

Degree of compaction required, except as noted in the second sentence, is expressed as a percentage of the maximum density obtained by the test procedure presented in [ASTM D1557](#) abbreviated as a percent of laboratory maximum density. Since [ASTM D1557](#) applies only to soils that have 30 percent or less by weight of their particles retained on the [3/4 inch](#) sieve, express the degree of compaction for material having more than 30 percent by weight of their particles retained on the [3/4 inch](#) sieve as a percentage of the maximum density in accordance with [AASHTO T 180](#) and corrected with [AASHTO T 224](#). To maintain the same percentage of coarse material, use the "remove and replace" procedure as described in NOTE 8 of Paragraph 7.2 in [AASHTO T 180](#).

1.2.5 Topsoil

Material suitable for topsoils obtained from offsite areas and 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.

1.2.6 Hard/Unyielding Materials

Hard/Unyielding materials comprise weathered rock, dense consolidated deposits, or conglomerate materials which are not included in the definition of "rock" with stones greater than [2 inch](#) in any dimension or as defined by the pipe manufacturer, whichever is smaller. These materials usually require the use of heavy excavation equipment, ripper teeth, or jack hammers for removal.

1.2.7 Rock

Solid homogeneous interlocking crystalline material with firmly cemented, laminated, or foliated masses or conglomerate deposits, neither of which can be removed without systematic drilling and blasting, drilling and the use of expansion jacks or feather wedges, or the use of backhoe-mounted pneumatic hole punchers or rock breakers; also large boulders, buried masonry, or concrete other than pavement exceeding [1/2 cubic yard](#) in volume. Removal of hard material will not be considered rock excavation because of intermittent drilling and blasting that is performed merely to increase production.

1.2.8 Unstable Material

Unstable materials are too wet to properly support the utility pipe, conduit, or appurtenant structure.

1.2.9 Select Granular Material

1.2.9.1 General Requirements

Select granular material consist of materials classified as GW, GP, SW, or SP by [ASTM D2487](#) where indicated. The liquid limit of such material must not exceed 35 percent or less, and a plasticity index of not less than 8 when tested in accordance with [ASTM D4318](#). The plasticity index must not be greater than 12 percent when tested in accordance with [ASTM D4318](#), and not more than 35 percent by weight may be finer than [No. 200](#) sieve when

tested in accordance with ASTM D1140.

1.2.10 Initial Backfill Material

Initial backfill consists of select granular material or satisfactory materials free from rocks 2 inches or larger in any dimension or free from rocks of such size as recommended by the pipe manufacturer, whichever is smaller. When the pipe is coated or wrapped for corrosion protection, free the initial backfill material of stones larger than 1 inches in any dimension or as recommended by the pipe manufacturer, whichever is smaller.

Select clay backfill shall be a satisfactory material having a liquid limit of 35 percent or less, and a plasticity index of not less than 8 nor greater than 20 when tested in accordance with ASTM D 4318, and classifying as a CL in accordance with ASTM D 2487.

Cohesionless materials include materials classified in ASTM D 2487 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.

1.2.11 Expansive Soils

Expansive soils are defined as soils that have a plasticity index equal to or greater than (AM#0002) > 35 < (AM#0002)— when tested in accordance with ASTM D4318.

Nonexpansive soils should meet the requirements of Texas Department of Transportation Standard Specification for Base Course, Item 247, Type A, Grade 1 or 2, with plasticity index of not less than 4 percent nor greater than 12 percent when tested in accordance with ASTM D 4318.

1.2.12 Nonfrost Susceptible (NFS) Material

Nonfrost susceptible material are a uniformly graded washed sand with a maximum particle size of 1 inch and less than 5 percent passing the No. 200 size sieve, and with not more than 3 percent by weight finer than 0.02 mm grain size.

1.2.13 Pile Supported Structure

As used herein, a structure where both the foundation and floor slab are pile supported.

1.3 SYSTEM DESCRIPTION

Subsurface soil boring logs are shown on the drawings . The subsoil investigation report is included as an attachment to the specification. The geotechnical report is provided for information only. These data represent the best subsurface information available; however, variations may exist in the subsurface between boring locations.

1.3.1 Classification of Excavation

Finish the specified excavation on a classified basis, in accordance with the following designations and classifications.

1.3.1.1 Common Excavation

Include common excavation with the satisfactory removal and disposal of all materials not classified as rock excavation.

1.3.1.2 Rock Excavation

Submit notification of encountering rock in the project. Include rock excavation with blasting, excavating, grading, disposing of material classified as rock, and the satisfactory removal and disposal of boulders 1/2 cubic yard or more in volume; solid rock; rock material that is in ledges, bedded deposits, and unstratified masses, which cannot be removed without systematic drilling and blasting; firmly cemented conglomerate deposits possessing the characteristics of solid rock impossible to remove without systematic drilling and blasting; and hard materials (see Definitions). Include the removal of any concrete or masonry structures, except pavements, exceeding 1/2 cubic yard in volume that may be encountered in the work in this classification. If at any time during excavation, including excavation from borrow areas, the Contractor encounters material that may be classified as rock excavation, uncover such material and notify the Contracting Officer. Do not proceed with the excavation of this material until the Contracting Officer has classified the materials as common excavation or rock excavation and has taken cross sections as required. Failure on the part of the Contractor to uncover such material, notify the Contracting Officer, and allow ample time for classification and cross sectioning of the undisturbed surface of such material will cause the forfeiture of the Contractor's right of claim to any classification or volume of material to be paid for other than that allowed by the Contracting Officer for the areas of work in which such deposits occur.

1.3.2 Blasting

Blasting will not be permitted.

1.3.3 Dewatering Work Plan

Submit procedures for accomplishing dewatering work.

1.4 SUBMITTALS

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

SD-01 Preconstruction Submittals

Shoring; G
Dewatering Work Plan; G

SD-03 Product Data

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

SD-06 Test Reports

Testing

Borrow Site Testing

Within 24 hours of conclusion of physical tests, submit 4 copies of test results, including calibration curves and results of calibration tests. (Digital submittal to the COR can be acceptable at the COR descretion)

SD-07 Certificates

Testing

PART 2 PRODUCTS

2.1 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 tests have been approved by the Contracting Officer.

2.2 BURIED WARNING AND IDENTIFICATION TAPE

Provide 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
Blue	Water Systems
Green	Sewer Systems

Warning Tape Color Codes	
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 TXDOT for construction indicated.

2.4.1 Rock

Provide rock fragments sufficiently durable to ensure permanence in the structure and the environment in which it is to be used. Use rock fragments free from cracks, seams, and other defects that would increase the risk of deterioration from natural causes. Provide fragments sized so that no individual fragment exceeds a weight of 80 pounds and that no more than 10 percent of the mixture, by weight, consists of fragments weighing 2 pounds or less each. Provide rock with a minimum specific gravity of 2.50. Do not permit the inclusion of more than trace 1 percent quantities of dirt, sand, clay, and rock fines.

2.5 CAPILLARY WATER BARRIER

Provide capillary water barrier of clean, poorly graded crushed rock, crushed gravel, or uncrushed gravel placed beneath a building slab with or without a vapor barrier to cut off the capillary flow of pore water to the area immediately below. Conform to ASTM C33/C33M for fine aggregate grading with a maximum of 3 percent by weight passing ASTM D1140, No. 200 sieve, or or coarse aggregate Size 57, 67, or 77.

2.6 PIPE CASING

2.6.1 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. Stockpile in laydown area or as directed by COR or Remove from the site any surplus of topsoil from excavations and gradings.

3.2 GENERAL EXCAVATION

Perform excavation of every type of material encountered within the limits of the project to the lines, grades, and elevations indicated and as specified. Perform the grading in accordance with the typical sections shown and the tolerances specified in paragraph FINISHING. Transport satisfactory excavated materials and place in fill or embankment within the limits of the work. Excavate unsatisfactory materials encountered within the limits of the work below grade and replace with satisfactory materials as directed. Include such excavated material and the satisfactory material ordered as replacement in excavation. Dispose surplus satisfactory excavated material not required for fill or embankment in areas approved for surplus material storage or designated waste areas. Dispose unsatisfactory excavated material in designated waste or spoil areas. During construction, perform excavation and fill in a manner and sequence that will provide proper drainage at all times. Excavate material required for fill or embankment in excess of that produced by excavation within the grading limits **from the borrow areas indicated or** from other approved areas selected by the Contractor as specified.

3.2.1 Ditches, Gutters, and Channel Changes

Finish excavation of ditches, gutters, and channel changes by cutting accurately to the cross sections, grades, and elevations shown on Drawing. 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 maximum **4 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. Where pile foundations are to be used, stop the excavation of each pit at an elevation 1 foot above the base of the footing, as specified, before piles are driven. After the pile driving has been completed, remove loose and displaced material and complete excavation, leaving a smooth, solid, undisturbed surface to receive the concrete or masonry.

Care of Water: Drainage of ground and surface water from the project site continually throughout the construction contract is essential. The contractor shall be required to protect the excavation and all constructed work throughout the life of the contract by means of ditches, berms, sumps with pumps, and any other means required to continually and effectively remove water from the site at all times. Ponding of water in the excavation or around the piers is unacceptable at any time. In addition, utility trenching, grading, and retention basins shall be constructed so as not to supply water directly or indirectly to the building or underlying active clay shale via the pervious gravel stratum. Such exposure of the underlying shale primary to surface runoff during construction could extend the active zone (via fractures) to much greater depths within the shale. This would activate these highly expansive materials and result in expansion pressures on the foundation elements that could create distress on the structural system of the facility.

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 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 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 within 3 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. Take control measures by the time the excavation reaches the water level in order to maintain the integrity of the in situ material. While the excavation is open, maintain the water level continuously, at least 2 feet below the working level. Relieve hydrostatic head in previous zones below subgrade elevation in layered soils to prevent

uplift.

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 4 feet high, cut back to a stable slope, or provide with equivalent means of protection for employees who may be exposed to moving ground or cave in. Shore vertical trench walls more than 4 feet high. Excavate trench walls which are cut back to at least the angle of repose of the soil. Give special attention to slopes which may be adversely affected by weather or moisture content. Do not exceed the trench width below the pipe top of 24 inches plus pipe outside diameter (O.D.) for pipes of less than 24 inches inside diameter, and do not exceed 36 inches plus pipe outside diameter for sizes larger than 24 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 2 inch 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 2 inch 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 least 12 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. Specify removal of unstable material. 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. Excavation made with power-driven equipment is not permitted within 2 feet of known Government-owned utility or subsurface construction. For work immediately adjacent to or for excavations exposing a utility or other buried obstruction, excavate by hand. Start hand excavation on each side of the indicated obstruction and continue until the obstruction is uncovered or until clearance for the new grade is assured. Support uncovered lines or other existing work affected by the contract excavation until approval for backfill is granted by the Contracting Officer. Report damage to utility lines or subsurface construction immediately to the Contracting Officer.

3.2.7 Structural Excavation

Ensure that footing subgrades have been inspected and approved by the Contracting Officer prior to concrete placement. Excavate to bottom of pile cap prior to placing or driving piles, unless authorized otherwise by the Contracting Officer. Backfill and compact over excavations and changes in grade due to pile driving operations to 95 percent of ASTM D698 maximum density.

3.3 SELECTION OF BORROW MATERIAL

Select borrow material to meet the requirements and conditions of the particular fill or embankment for which it is to be used. Obtain borrow material from the borrow areas from approved private sources. Unless otherwise provided in the contract, the Contractor is responsible for obtaining the right to procure material, pay royalties and other charges involved, and bear the expense of developing the sources, including rights-of-way for hauling from the owners. Borrow material from approved sources on Government-controlled land may be obtained without payment of royalties. Unless specifically provided, do not obtain borrow within the limits of the project site without prior written approval. Consider necessary clearing, grubbing, and satisfactory drainage of borrow pits and the disposal of debris thereon related operations to the borrow excavation.

3.4 OPENING AND DRAINAGE OF EXCAVATION AND BORROW PITS

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

3.5 SHORING

3.5.1 General Requirements

Submit a Shoring and Sheet piling plan for approval 15 days prior to starting work. Submit drawings and calculations, certified by a registered professional engineer, describing the methods for shoring and sheet piling of

excavations. Finish shoring, including sheet piling, and install as necessary to protect workmen, banks, adjacent paving, structures, and utilities. Remove shoring, bracing, and sheeting as excavations are backfilled, in a manner to prevent caving.

3.5.2 Geotechnical Engineer

Hire a Professional Geotechnical Engineer to provide inspection of excavations and soil/groundwater conditions throughout construction. The Geotechnical Engineer is responsible for performing pre-construction and periodic site visits throughout construction to assess site conditions. The Geotechnical Engineer is responsible for updating the excavation, sheeting and dewatering plans as construction progresses to reflect changing conditions and submit an updated plan if necessary. Submit a monthly written report, informing the Contractor and Contracting Officer of the status of the plan and an accounting of the Contractor's adherence to the plan addressing any present or potential problems. The Contracting Officer is responsible for arranging meetings with the Geotechnical Engineer at any time throughout the contract duration.

3.6 GRADING AREAS

Where indicated, divide work into grading areas within which satisfactory excavated material will be placed in embankments, fills, and required backfills. Do not haul satisfactory material excavated in one grading area to another grading area except when so directed in writing. Place and grade stockpiles of satisfactory and unsatisfactory as specified. Keep stockpiles in a neat and well drained condition, giving due consideration to drainage at all times. Clear, grub, and seal by rubber-tired equipment, the ground surface at stockpile locations; separately stockpile excavated satisfactory and unsatisfactory materials. Protect stockpiles of satisfactory materials from contamination which may destroy the quality and fitness of the stockpiled material. If the Contractor fails to protect the stockpiles, and any material becomes unsatisfactory, remove and replace such material with satisfactory material from approved sources.

3.7 FINAL GRADE OF SURFACES TO SUPPORT CONCRETE

Do not excavate to final grade until just before concrete is to be placed. For pile foundations, stop the excavation at an elevation of from 6 to 12 inches above the bottom of the footing before driving piles. After pile driving has been completed, complete the remainder of the excavation to the elevations shown. Only use excavation methods that will leave the foundation rock in a solid and unshattered condition. Roughen the level surfaces, and cut the sloped surfaces, as indicated, into rough steps or benches to provide a satisfactory bond. Protect shales from slaking and all surfaces from erosion resulting from ponding or water flow.

3.8 GROUND SURFACE PREPARATION

3.8.1 General Requirements

Remove and replace unsatisfactory material with satisfactory materials, as directed by the Contracting Officer, in surfaces to receive fill or in excavated areas. Scarify the surface to a depth of 6 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. Finish compaction by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, or other approved equipment well suited to the soil being compacted. Moisten material as necessary to plus or minus 2 percent of optimum moisture .

3.9 UTILIZATION OF EXCAVATED MATERIALS

Dispose unsatisfactory materials removing from excavations into designated waste disposal or spoil areas. Use satisfactory material removed from excavations, insofar as practicable, in the construction of fills, embankments, subgrades, shoulders, bedding (as backfill), and for similar purposes. Submit procedure and location for disposal of unused satisfactory material. Submit proposed source of borrow material. Do not waste any satisfactory excavated material without specific written authorization. Dispose of satisfactory material, authorized to be wasted, in designated areas approved for surplus material storage or designated waste areas as directed. Clear and grub newly designated waste areas on Government-controlled land before disposal of waste material thereon. Stockpile and use coarse rock from excavations for constructing slopes or embankments adjacent to streams, or sides and bottoms of channels and for protecting against erosion. Do not dispose excavated material to obstruct the flow of any stream, endanger a partly finished structure, impair the efficiency or appearance of any structure, or be detrimental to the completed work in any way.

3.10 BURIED TAPE AND DETECTION WIRE

3.10.1 Buried Warning and Identification Tape

Provide buried utility lines with utility identification tape. Bury tape 12 inches below finished grade; under pavements and slabs, bury tape 6 inches below top of subgrade.

3.10.2 Buried Detection Wire

Bury detection wire directly above non-metallic piping at a distance not to exceed 12 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 of 3 feet of wire, coiled, remaining accessible in each manhole. Furnish insulated wire over its 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 materia not more than 8 inches in depth. Compact to at least 90 percent laboratory maximum density for cohesive materials or 95 percent laboratory maximum density for cohesionless

materials, to prevent wedging action or eccentric loading upon or against the structure. Backfill material must be within the range of -2 to +2 percent of optimum moisture content at the time of compaction.

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.

The recommendation to use ribbed mat foundation is contingent upon adequate site preparation. The following site preparation is recommended by the Geotechnical Engineer's report for dumpster pad and similar pads.

a. Clear the surface of existing turf and dispose of as directed by the Contracting Officer (CO).

b. Remove 4 feet of surficial expansive soil. The exposed subgrade must be proof rolled with an appropriate type of roller. The contractor shall choose the type of compaction equipment that suits the soil conditions. Test the proof-rolled surface to ensure that a minimum of 95% of the Modified Proctor maximum density of the material is achieved.

c. Replace the excavated material with nonexpansive fill in loose lifts of 8 inches and compact to a minimum of 95% of the Modified proctor maximum density (ASTM D1557) of the material. If necessary, additional fill material may be imported to raise the compacted soil to the required elevation.

d. Adequacy of compaction shall be tested at frequency as specified in the report.

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.

3.11.1.1 Replacement of Unyielding Material

Replace unyielding material removed from the bottom of the trench with select granular material or initial backfill material.

3.11.1.2 Replacement of Unstable Material

Replace unstable material removed from the bottom of the trench or excavation with select granular material placed in layers not exceeding 6 inches loose thickness.

3.11.1.3 Bedding and Initial Backfill

Provide bedding of the type and thickness shown. Place initial backfill material and compact it with approved tampers to a height of at least one foot above the utility pipe or conduit. Bring up the backfill evenly on both sides of the pipe for the full length of the pipe. Take care to ensure thorough compaction of the fill under the haunches of the pipe. Except as specified otherwise in the individual piping section, provide bedding for buried piping in accordance with AWWA C600, Type 4, except as specified herein. Compact backfill to top of pipe to 95 percent of

ASTM D698 maximum density. Provide plastic piping with bedding to spring line of pipe. Provide materials as follows:

3.11.1.3.1 Class I

Angular, 0.25 to 1.5 inch, graded stone, including a number of fill materials that have regional significance such as coral, slag, cinders, crushed stone, and crushed shells.

3.11.1.3.2 Class II

Coarse sands and gravels with maximum particle size of 1.5 inch, including various graded sands and gravels containing small percentages of fines, generally granular and noncohesive, either wet or dry. Soil Types GW, GP, SW, and SP are included in this class as specified in ASTM D2487.

3.11.1.3.3 Sand

Clean, coarse-grained sand classified as fine aggregate in accordance with Section 2.1.2, meeting the gradation requirements for fine aggregate of table 2 section 2.1.2 TXDOT specifications (latest edition)

3.11.1.3.4 Gravel and Crushed Stone

Clean, coarsely graded natural gravel, crushed stone or a combination thereof identified as course aggregate in accordance with Section TCDOT 2.1.2 gradation course aggregate of the TXDOT or having a classification of GW in accordance with ASTM D2487 for bedding and backfill. Do not exceed maximum particle size of 3 inches.

Backfill for pipes, Angular Gravel Material: Angular crushed washed stone; free of shale, clay, friable material and debris; graded according to ASTM C136; within the following limits:

Percent Passing per Sieve Size:

1 1/2 inches:	100.
1 inch:	90 to 100.
3/4 inch:	20 to 55.
1/2 inch:	0 to 10.
3/8 inch:	0 to 5.

3.11.1.4 Final Backfill

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

3.11.1.4.1 Roadways, Railroads, and Airfields

Place backfill up to the required elevation as specified. Do not permit water flooding or jetting methods of compaction.

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 for cohesive soils and 90 percent maximum density for cohesionless soils. Do not permit compaction by water flooding or jetting. Apply this requirement to all other areas not specifically designated above.

3.11.2 Backfill for Appurtenances

After the manhole, catchbasin, inlet, or similar structure has been constructed, 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 SPECIAL REQUIREMENTS

Special requirements for both excavation and backfill relating to the specific utilities are as follows:

3.12.1 Gas Distribution

Excavate trenches to a depth that will provide a minimum 18 inches of cover in rock excavation and a minimum 24 inch of cover in other excavation.

3.12.2 Water Lines

Excavate trenches to a depth that provides a minimum cover of 3 feet from the existing ground surface, or from the indicated finished grade, whichever is lower, to the top of the pipe. For fire protection yard mains or piping, an additional 6 inch of cover is required.

3.12.3 Heat Distribution System

Free initial backfill material of stones larger than 1/4 inch in any dimension.

3.12.4 Electrical Distribution System

Provide a minimum cover of 24 inches from the finished grade to direct burial cable and conduit or duct line, unless otherwise indicated.

3.12.5 Rip-Rap Construction

Construct rip-rap on filter fabric in the areas indicated. Trim and dress indicated areas to conform to cross sections, lines and grades shown within a tolerance of 0.1 foot.

3.12.5.1 Bedding Placement

Spread filter fabric bedding material uniformly to a thickness of at least 3 inches on prepared subgrade as indicated.

3.12.5.2 Stone Placement

Place rock for rip-rap on prepared bedding material to produce a well graded mass with the minimum practicable percentage of voids in conformance with lines and grades indicated. Distribute larger rock fragments, with dimensions extending the full depth of the rip-rap throughout the entire mass and eliminate "pockets" of small rock fragments. Rearrange individual pieces by mechanical equipment or by hand as necessary to obtain the distribution of fragment sizes specified above.

3.13 EMBANKMENTS

3.13.1 Earth Embankments

Construct earth embankments from satisfactory materials free of organic or frozen material and rocks with any dimension greater than 3 inches. Place the material in successive horizontal layers of loose material not more than 8 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 for cohesive materials or 95 percent laboratory maximum density for cohesionless materials. Backfill material must be within the range of -2 to +2 percent of optimum moisture content at the time of compaction.

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 sheepfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment.

3.14 SUBGRADE PREPARATION

3.14.1 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. After stripping, proof roll the existing subgrade of the 3 with six passes of a dump truck loaded or water truck weighing at least 35-ton under the observation of the Geotechnical Engineer or his representative to locate any and all unstable subgrade areas. Where rutting or pumping is observed during proof rolling, the unstable soils should be over excavated and replaced with an approved low volume change soil as described below if it cannot be effectively compacted in-place. After successful proof rolling the site, we recommend scarifying the exposed subgrade soil to a depth of 9-inches, moisture conditioning, and compacting it in accordance with the recommendations presented in the next paragraph. Any additional fill required to raise the subgrade to the final elevation(s) below the building floor slab system shall be select material.

Select fill should be placed in controlled lifts not exceeding 8 inches in loose thickness and compacted to at least 92 percent of laboratory maximum density as determined in accordance with ASTM D 1557.

The soil fill should be placed in a maximum of 6 inch compacted lifts, moisture conditioned between ± 2 percentage points of its optimum moisture and compacted to a minimum of 92 percent of laboratory maximum density as determined in accordance with ASTM D 1557. Each successive layer of new soil shall be placed only after the previous layer has been successfully compacted and tested to verify that the compacted engineered fill has met the aforementioned criteria.

For portions of the building pad that will be a cut section, subgrade preparation should consist of removing all existing materials to a depth that allows a minimum 12 -inch void to be formed below the floor slab system. The upper 6 inches of existing subgrade exposed after cut and/or fill operations shall be scarified, moistened, and recompacted to the same density required for select fill.

Operate the truck in a systematic manner to ensure the number of passes

over all areas, and at speeds between 2-1/2 to 3-1/2 mph. Notify the Contracting Officer a minimum of 3 days prior to proof rolling. Perform proof rolling in the presence of the Contracting Officer.

3.14.2 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. Excavate rock encountered in the cut section to a depth of 6 inches below finished grade for the subgrade. Bring up low areas resulting from removal of unsatisfactory material or excavation of rock to required grade with satisfactory materials, and shape the entire subgrade to line, grade, and cross section and compact as specified. After rolling, 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.

3.14.3 Compaction

Finish compaction by sheepfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment. Except for paved areas and railroads, compact each layer of the embankment to at least 92 percent of laboratory maximum density.

3.14.3.1 Subgrade for Pavements

Lime Stabilization. Atterberg limits test results indicate that the clay overburden is highly expansive. A layer of lime-stabilized subgrade is typically recommended to improve the strength characteristics of pavement sections at Lackland Air Force Base. Properly designed and constructed existing pavement structures at Lackland Air Force Base and pavement structures constructed on similar subgrade soils at nearby Fort Sam Houston have achieved excellent performance. Therefore, lime stabilization is recommended for new pavement structures. Compact subgrade for pavements to at least 92 percentage laboratory maximum density for the depth below the surface of the pavement shown. When more than one soil classification is present in the subgrade, thoroughly blend, reshape, and compact the top 12 inch of subgrade.

3.15 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 capillary water barrier under concrete floor and area-way slabs grade directly on the subgrade and compact with a minimum of two passes of a hand-operated plate-type vibratory compactor.

3.15.3 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. Do not spread topsoil when frozen or excessively wet or dry. Obtain material required for topsoil in excess of that produced by excavation within the grading limits from offsite areas .

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. 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 100 cubic yards stockpiled or in-place source material. Determine gradation of fill and backfill material in accordance with ASTM C136/C136M .

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 2000 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 Check Tests on In-Place Densities

If ASTM D6938 is used, check in-place densities by ASTM D1556/D1556M as follows:

- a. One check test per lift for each 2000 square feet, or fraction thereof, of each lift of fill or backfill compacted by other than hand-operated machines.
- b. One check test per lift for each 2000 square feet, of fill or backfill areas compacted by hand-operated machines.
- c. One check test per lift for each 1000 linear feet, or fraction thereof, of embankment or backfill for roads .

3.17.4 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.

3.17.5 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 LOT of fill and backfill, or when any change in material occurs which may affect the optimum moisture content or laboratory maximum density. LOT equals one lift of fill (empacment) not to exceed 5000 feet.

3.17.6 Tolerance Tests for Subgrades

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

3.17.7 Displacement of Sewers

After other required tests have been performed and the trench backfill compacted to the finished grade surface, inspect the pipe to determine whether significant displacement has occurred. Conduct this inspection in the presence of the Contracting Officer. Inspect pipe sizes larger than 36 inches, while inspecting smaller diameter pipe by shining a light or laser between manholes or manhole locations, or by the use of television cameras passed through the pipe. If, in the judgment of the Contracting Officer, the interior of the pipe shows poor alignment or any other defects that would cause improper functioning of the system, replace or repair the defects as directed at no additional cost to the Government.

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 removed from Government property and delivered to a licensed/permitted facility or to a location approved by the Contracting Officer..

-- End of Section --

SECTION 32 31 13.53

HIGH-SECURITY FENCES (CHAIN LINK AND ORNAMENTAL) AND GATES
<AMENDMENT NO. 0002>

PART 1 GENERAL

1.1 REFERENCES

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

ASTM INTERNATIONAL (ASTM)

ASTM A116	(2011) Standard Specification for Metallic-Coated, Steel Woven Wire Fence Fabric
ASTM A121	(2013) Standard Specification for Metallic-Coated Carbon Steel Barbed Wire
ASTM A153/A153M	(2016) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A240/A240M	(2018) Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
ASTM A392	(2011a; R 2017) Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric
ASTM A478	(1997; R 2019) Standard Specification for Chromium-Nickel Stainless Steel Weaving and Knitting Wire
ASTM A702	(2013) Standard Specification for Steel Fence Posts and Assemblies, Hot Wrought
ASTM A780/A780M	(2009; R 2015) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
ASTM A824	(2011; R 2017) Standard Specification for Metallic-Coated Steel Marcellled Tension Wire for Use With Chain Link Fence
ASTM C94/C94M	(2018) 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 F900	(2011; R 2017) Standard Specification for Industrial and Commercial Swing Gates
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
ASTM F1184	(2016) Industrial and Commercial Horizontal Slide Gates
ASTM F1910	(1998; R 2018) Standard Specification for Long Barbed Tape Obstacles

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

Fence Installation Drawings; G

SD-03 Product Data

Fabric
Posts
Post Caps
Line Posts

Tension Wire
Barbed Wire
Barbed Wire Supporting Arms
Barbed Tape
Latches
Hinges
Stops
Keepers
Rollers
Padlocks
Wire Ties
(AM#0002)>
~~Ornamental Fence Systems~~
<(AM#0002)
Swing Gates
Slide Gates_

(AM#0002)>
~~Fence Fabric Reinforcement~~
 <(AM#0002)

SD-07 Certificates

Chain Link Fence
 Fabric
 Barbed Wire
 Gate Hardware and Accessories
 Concrete
 Gate Operator

SD-10 Operation and Maintenance Data

Electro-Mechanical Locks
 Gate Operator
 Operating and maintenance instructions

1.3 DELIVERY, STORAGE, AND HANDLING

Deliver materials to site in an undamaged condition. Store materials elevated off of the ground to protect against oxidation caused by ground contact.

PART 2 PRODUCTS

2.1 COMPONENTS

2.1.1 Chain Link Fence Fabric

2.1.1.1 General

Provide [ASTM A392](#), Class 1, zinc-coated steel wire with minimum coating weight of 1.2 ounces of zinc per square foot of coated surface. Fabricate fence fabric of 9 gauge wire woven in 2 inch mesh conforming to [ASTM A116](#). Provide twisted and barbed fabric on the top selvage and knuckled on the bottom selvage.

2.1.2 Posts

2.1.2.1 Metal Posts for Chain Link Fence

Provide posts conforming to [ASTM F1083](#), zinc-coated. Group IA, with external coating Type A steel pipe. Group IC steel pipe, zinc-coated with external coating Type A or Type B and Group II, roll-formed steel sections, meeting the strength and coating requirements of [ASTM F1043](#) and [ASTM A702](#). Group III, [ASTM F1043](#) steel H-section may be used for line posts in lieu of line post shapes specified for the other classes. Provide either Group IA steel pipe posts, Group IC, Group II, roll-formed steel sections, or Group III steel H-sections and be zinc coated (Type A) and polyvinyl chloride coated conforming to the requirements of [ASTM F1043](#). Provide sizes as shown on the drawings. Use line posts and terminal (corner, gate, and pull) posts of the same designation throughout the fence. Provide gate post for the gate type specified subject to the limitation specified in [ASTM F900](#) and/or [ASTM F1184](#).

2.1.2.2 Accessories

- a. Provide accessories conforming to **ASTM F626**. Coat ferrous accessories with zinc or aluminum coating.
- b. Provide truss rods (with turnbuckles or other means of adjustment) for each terminal post.
- c. Provide **barbed wire supporting arms** of the single arm type and of the design required for the post furnished. Secure arms by top tension wire.
- d. Furnish **post caps** in accordance with manufacturer's standard accessories.
- e. Provide 9 gauge steel tie wire for attaching fabric to rails, braces, and posts and match the coating of the fence fabric. Provide miscellaneous hardware coatings which conform to **ASTM A153/A153M** unless modified.

2.1.3 Chain Link Gates

2.1.3.1 Gate Assembly

Provide gate assembly conforming to **ASTM F900** and/or **ASTM F1184** of the type and swing shown. Provide gate frames conforming to strength and coating requirements of **ASTM F1083** for Group IA, steel pipe, with external coating Type A, nominal pipe size (NPS) 1-1/2. Provide gate frames conforming to strength and coating requirements of **ASTM F1043**, for Group IC, steel pipe with external coating Type A or Type B, nominal pipe size (NPS) 1-1/2. Use gate fabric that matches the specified chain link fabric.

2.1.3.2 Gate Leaves

For gate leaves, more than **8 feet** wide, provide either intermediate members and diagonal truss rods or tubular members as necessary to provide rigid construction, free from sag or twist. For gate leaves less than **8 feet** wide, provide truss rods or intermediate braces. Provide intermediate braces on all gate frames with an electro-mechanical lock. Attach fabric to the gate frame by method standard with the manufacturer. Welding is not an acceptable method for attaching fabric to gate frames.

2.1.3.3 Gate Hardware and Accessories

Submit manufacturer's catalog data. Furnish and install **latches, hinges, stops, keepers, rollers**, and other hardware items as required for the operation of the gate. All items are required to match the material characteristics of the fence system being installed. Arrange latches for padlocking so that the padlock will be accessible from both sides of the gate. Provide stops for holding the gates in the open position. For high security applications, extend each end member of gate frames sufficiently above the top member to carry three strands of barbed wire in horizontal alignment with barbed wire strands on the fence.

(AM#0002) >

~~2.1.4 Ornamental Fence Gates~~~~2.1.4.1 Swing Gates~~

~~Submit manufacturer's catalog data. Fabricate swing gates by welding 2 sq in tubular steel ends and rails. Use pickets that match the adjacent fence construction. Reinforce gates to ensure assembly sags no more than 1% of the gate leaf width or 2 in, whichever is less. Size gate posts to accommodate the weight and width of each gate leaf. Mount gates to posts with weldable steel plates or blocks, pressed steel, or malleable iron hinges. Hot dip galvanize all hinges with a minimum zinc weight of 1.20 oz/sq ft. Secure all tamper points by welding or peening the threads. Use swing gate latches and drop bar guides manufactured of pressed steel, hot dipped galvanized with a minimum zinc weight of 1.20 oz/sq ft. Finish all gate hardware in the same color/coating as the fence system.~~

~~2.1.4.2 Slide Gates~~

~~Submit manufacturer's catalog data. Fabricate slide gates by welding 2 sq in tubular steel ends and rails. Use pickets that match the adjacent fence construction. Select the type and class of slide gate to comply with ASTM F1184. Size gate posts to accommodate the weight and width of each gate leaf in accordance with ASTM F1184, or per manufacturer's recommendations. [Specify Type II, Class 2, interior roller design for cantilever slide gates.]~~

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2.1.4 Padlocks

Provide padlocks conforming to ASTM F883, Type PO1, Options A, B, and G , Grade 6. Size 1-3/4 inch. Key all padlocks alike.

2.2 MATERIALS

2.2.1 Wire

2.2.1.1 Wire Ties

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

2.2.1.2 Barbed Wire

Provide barbed wire conforming to ASTM A121 zinc-coated, Type Z, Class 3, round, 4-point barbs spaced no more than 5 inches apart.

2.2.1.3 Tension Wire

Provide Type I or Type II tension wire, Class 4 coating, in accordance with ASTM A824.

2.2.2 Barbed Tape

Provide reinforced barbed tape, double coil , for fence toppings fabricated from 430 series stainless steel with a hardness range of Rockwell (30N) 37-45 conforming to the requirements of ASTM A240/A240M. Provide stainless steel strip 0.025 inch thick by 1 inch wide before fabrication. Provide barbs that are a minimum of 1.2 inch in length, in groups of 4, spaced on 4 inch centers. Use stainless steel core wire with a 0.098 inch diameter and

a minimum tensile strength of 140 psi and conforming to ASTM A478. The above requirements also apply to reinforced barbed tape, single coil, for ground application. Use No. 16 AWG stainless steel twistable wire ties for attaching the barbed tape to the barbed wire.

Ensure long barbed tape obstacles conform to ASTM F1910.

2.2.3 Concrete

ASTM C94/C94M, using 3/4 inch maximum size aggregate, and having minimum compressive strength of 3000 psi at 28 days. Use grout consisting of one part portland cement to three parts clean, well-graded sand and the minimum amount of water to produce a workable mix.

PART 3 EXECUTION

3.1 PREPARATION

Perform complete installation conforming to ASTM F567.

3.1.1 Line and Grade

Install fence to the lines and grades indicated. Clear the area on either side of the fence line to the extent indicated. Space line posts equidistant at intervals not exceeding 10 feet. Set terminal (corner, gate, and pull) posts whenever abrupt changes in vertical and horizontal alignment are encountered. Provide continuous fabric between terminal posts; however, ensure runs between terminal posts do not exceed 500 feet. Repair any damage to galvanized surfaces, including welding, with paint containing zinc dust in accordance with ASTM A780/A780M.

3.1.2 Excavation

Excavate holes to depths indicated. Clear all post holes of loose material and spread waste material where directed. Eliminate ground surface irregularities along the fence line to the extent necessary to maintain a 1 inch clearance between the bottom of the fabric and finish grade.

3.2 INSTALLATION

3.2.1 Installation Drawings

Submit complete Fence Installation Drawings for review and approval by the Contracting Officer prior to shipment. Submit drawing details that include, but are not limited to the following information: Fence Installation Drawings, Location of gate, corner, end, and pull posts, Gate Assembly, Turnstiles, and Gate Hardware and Accessories. Install fence system per approved drawings.

3.2.2 Security Fencing

Install new security fencing, remove existing security fencing, and perform related work to provide continuous security for facility. Schedule and fully coordinate work with Contracting Officer.

3.2.3 Posts

3.2.3.1 Earth and Bedrock

- a. Set posts plumb and in alignment. Except where solid rock is encountered, set posts in concrete to the depth indicated on the drawings. Where solid rock is encountered with no overburden, set posts to a minimum depth of 18 inches in rock. Where solid rock is covered with an overburden of soil or loose rock, set posts to the minimum depth indicated on the drawing unless a penetration of 18 inches in solid rock is achieved before reaching the indicated depth, in which case terminate depth of penetration. Grout all portions of posts set in rock.
- b. Set portions of posts not set in rock in concrete from the rock to ground level. Set posts in holes not less than the diameter shown on the drawings. Make diameters of holes in solid rock at least 1 inch greater than the largest cross section of the post. Thoroughly consolidate concrete and grout around each post, free of voids and finished to form a dome. Allow concrete and grout to cure for 72 hours prior to attachment of any item to the posts. Group II line posts may be mechanically driven, for temporary fence construction only, if rock is not encountered. Set driven posts to a minimum depth of 3 feet and protect with drive caps when setting.
- c. Test fence post rigidity by applying a 50 pound force on the post, perpendicular to the fabric, at 5 feet above ground. Ensure post movement measured at the point where the force is applied is less than or equal to 3/4 inch from the relaxed position. Test every tenth post for rigidity. When a post fails this test, make further tests on the next four posts on either side of the failed post. Remove, replace, and retest all failed parts at the Contractor's expense.

3.2.4 Rails

Bolt bottom rail to double rail ends and securely fasten double rail ends to the posts. Peen bolts to prevent easy removal. Install bottom rail before chain link fabric.

3.2.5 Fabric

- a. Set fabric height at 7 feet.
- b. Install chain link fabric on the side of the post indicated. Attach fabric to terminal posts with stretcher bars and tension bands. Space bands at approximately 15 inch intervals. Install fabric and pull taut to provide a smooth and uniform appearance free from sag, without permanently distorting the fabric diamond or reducing the fabric height. Fasten fabric to line posts at approximately 15 inch intervals and fastened to all rails and tension wires at approximately 24 inch intervals.
- c. Cut fabric by untwisting and removing pickets. Accomplish splicing by weaving a single picket into the ends of the rolls to be joined. Install the bottom of the fabric 2 plus or minus 1/2 inch above the ground.
- d. After the fabric installation is complete, exercise the fabric by applying a 50 pound push-pull force at the center of the fabric between

posts; use a 30 pound pull at the center of the panel to ensure fabric deflection of not more than 2.5 inches when pulling fabric from the post side of the fence. Every second fence panel is required to meet this requirement. Resecure and retest all failed panels at the Contractor's expense.

3.2.6 Supporting Arms

Install barbed wire supporting arms and barbed wire as indicated on the drawings and as recommended by the manufacturer. Anchor supporting arms with 3/8 inch diameter plain pin rivets or, at the Contractor's option, with studs driven by low-velocity explosive-actuated tools for steel, wrought iron, ductile iron, or malleable iron. Do not use explosive-actuated tool to drive studs into gray iron or other material that can be fractured. Use a minimum of two studs per support arm. Pull barbed wire taut and attach to the arms with clips or other means that will prevent easy removal.

3.2.7 Gate Installation

- a. Install gates at the locations shown. Mount gates to swing as indicated. Install latches, stops, and keepers as required. Install Slide gates as recommended by the manufacturer.
- b. Attach padlocks to gates or gate posts with chains. Weld or otherwise secure hinge pins, and hardware assembly to prevent removal.
- c. Submit 6 copies of operating and maintenance instructions. Outline the step-by-step procedures required for system startup, operation, and shutdown. Include the manufacturer's name, model number, service manual, parts list, and brief description of all equipment and their basic operating features. Include in the maintenance instructions routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guide. Also include the general gate layout, equipment layout and simplified wiring and control diagrams of the system as installed.

3.2.8 Grounding

- a. Ground fencing as specified.
- b. Ground fences crossed by overhead powerlines in excess of 600 volts and ground all electrical equipment attached to the fence.
- c. 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. Ensure grounding locations are located no more than 650 feet apart. Bond each gate panel with a flexible bond strap to its gate post. Ground fences crossed by powerlines of 600 volts or more at or near the point of crossing and at distances not exceeding 150 feet on each side of crossing.

3.3 CLOSEOUT ACTIVITIES

3.3.1 Cleanup

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

-- End of Section --

SECTION 32 92 23

SODDING

<AMENDMENT NO. 0002>

PART 1 GENERAL

1.1 REFERENCES

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

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, Section 32 93 00 EXTERIOR PLANTS, 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 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-03 Product Data

Fertilizer

Include physical characteristics, and recommendations.

SD-06 Test Reports

Topsoil composition tests (reports and recommendations).

SD-07 Certificates

Sod farm certification for sods. Indicate type of sod in accordance with TPI GSS.

1.5 DELIVERY, STORAGE, AND HANDLING

1.5.1 Delivery

1.5.1.1 Sod Protection

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

1.5.2 Storage

1.5.2.1 Sod Storage

Lightly sprinkle with water, cover with moist burlap, straw, or other approved covering; and protect from exposure to wind and direct sunlight until planted. Provide covering that will allow air to circulate so that internal heat will not develop. Do not store sod longer than 24 hours. Do not store directly on concrete or bituminous surfaces.

1.5.2.2 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 frozen, snow covered, muddy, or when air temperature exceeds 96 degrees Fahrenheit.

1.7 TIME LIMITATIONS

1.7.1 Sod

Place sod a maximum of thirty six hours after initial harvesting, in accordance with TPI GSS as modified herein.

PART 2 PRODUCTS

2.1 SODS

2.1.1 Classification

Nursery grown, certified as classified in the TPI GSS. Machine cut sod at a uniform thickness of 3/4 inch within a tolerance of 1/4 inch, excluding top growth and thatch. Each individual sod piece shall be strong enough to support its own weight when lifted by the ends. Broken pads, irregularly shaped pieces, and torn or uneven ends will be rejected. Wood pegs and wire staples for anchorage shall be as recommended by sod supplier.

2.1.2 Purity

Sod species shall be genetically pure, free of weeds, pests, and disease.

2.1.3 Planting Dates

Lay sod from April to June for warm season spring planting and from September to December for cool season fall planting.

2.1.4 Composition

2.1.4.1 Proportion

Proportion grass species as follows.

Botanical Name	Common Name	Percent
Cyodon dactylon 'Tifway 419' _____	Tifway 419 Bermuda _____	100 _____

2.1.4.2 Sod Farm Overseeding

At the sod farm provide sod with overseeding of annual rye grass seedtype recommended by seed producer.

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.

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	__10__ percent
Clay	__28__ percent
Sand	__48__ percent
pH	_7.5__
Soluble Salts	__<500__ ppm maximum

2.3 SOIL CONDITIONERS

Add conditioners to topsoil as required to bring into compliance with "composition" standard for topsoil as specified herein. (AM#0002) > Utilize Compost that contains soil texture, nutrients , micronutrients required to bring existing topsoil to ideal condition. <(AM#0002)

2.4.1

Plant Available Nutrients Analysis- texture 5,
 % O.M. (Active) 7.20,
 Carbonate *CO3) eh,
 pH (STD Unit) 7.10,
 Salts-EC(mmhos/com) 1.43
 Nutrients in Parts Per Million (ppm) - Carbon Dioxide Extraction - CO2
 Mimics plant roots natural Extraction.
 Nitrate-nitrogen (NO3-N) -2
 Phosphorous (P2 O5-P) - 72
 Nutrients in parts per Million (ppm)
 Potassium ((k-H2O) 222/(K-CO2) 269)
 Sodium ((Na-H2O-140)/ (Na-CO2-146))
 Calcium (Ca-H2O) 340/ (Ca-CO2) 949)
 Magnesium (((Mg-H2O) 91/((Mg-CO2) 215)
 Ratios ((Na/Ca) 0/(Na/Mg) 2)
 Micronutrients
 Zinc (Zn)- 17.03
 Iron (Fe) 137.37
 Manganese (Mn) 76.58
 Copper (Cu) 3.92
 Comments: Low

Plant Available Nutrients Analysis-
 Texture 5,
 % O.M. (Active) 4.64
 Carbonate *CO3) eh,

pH (STD Unit) 7.42,
 Salts-EC(mmhos/com) 1.26
 Nutrients in Parts Per Million (ppm) - Carbon Dioxide Extraction - CO2
 Mimics plant roots natural Extraction.
 Nitrate-nitrogen (NO3-N) -1
 Phosphorous (P2 O5-P) - 57
 Nutrients in parts per Million (ppm)
 Potassium ((k-H2O) 165/(K-CO2) 196)
 Sodium ((Na-H2O-136)/ (Na-CO2-154))
 Calcium (Ca-H2O)266/ (Ca-CO2) 932)
 Magnesium ((Mg-H2O)76/(Mg-CO2)221)
 Ratios ((Na/Ca)1/(Na/Mg)2)
 Micronutrients
 Zinc (Zn)- 15.57
 Iron (Fe) 135.50
 Manganese (Mn) 78.38
 Copper (Cu) 3.39
 Comments: Adequate

Plant Available Nutrients Analysis-
 % O.M. (Active) >3.00
 Carbonate *CO3) M-H,
 pH (STD Unit) 6.1-7.9
 Salts-EC(mmhos/com) <10.00
 Nutrients in Parts Per Million (ppm) - Carbon Dioxide Extraction - CO2
 Mimics plant roots natural Extraction.
 Nitrate-nitrogen (NO3-N) -50-199
 Phosphorous (P2 O5-P) - 20-69
 Nutrients in parts per Million (ppm)
 Potassium ((k-H2O) 100-249/(K-CO2) 175-499)
 Sodium ((Na-H2O-<349)/ (Na-CO2-<499))
 Calcium (Ca-H2O)75-224/ (Ca-CO2) 300-899)
 Magnesium ((Mg-H2O)25-99/(Mg-CO2)75-199)
 Ratios ((Na/Ca)<5/(Na/Mg)<10)
 Micronutrients
 Zinc (Zn)- 5-15
 Iron (Fe) 15-30
 Manganese (Mn) 15-35
 Copper (Cu) 2-4
 Boron (B) 1-3
 Sovita Maturity Index >4
 Comments:

2.4 FERTILIZER

2.4.1 Granular Fertilizer

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

20 percent available nitrogen
 20 percent available phosphorus
 5 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 or on-site topsoil to meet indicated finish grade. After areas have been brought to indicated finish grade, incorporate 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.

3.1.2.1 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 as recommended by manufacture

3.2 SODDING

3.2.1 Finished Grade and Topsoil

Prior to the commencement of the sodding operation, the Contractor shall verify that finished grades are as indicated on drawings; the placing of topsoil, smooth grading, and compaction requirements have been completed in accordance with Section 31 00 00 EARTHWORK.

The prepared surface shall be a maximum 1 inch below the adjoining grade of any surfaced area. New surfaces shall be blended to existing areas. The prepared surface shall be completed with a light raking to remove from the surface debris and stones over a minimum 5/8 inch in any dimension.

3.2.2 Placing

Place sod a maximum of 36 hours after initial harvesting, in accordance with TPI GSS as modified herein.

3.2.3 Sodding Slopes and Ditches

For slopes 3:1 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.

-- End of Section --

SECTION 33 82 00

TELECOMMUNICATIONS OUTSIDE PLANT (OSP)

<AMENDMENT NO. 0002>

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to 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

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 ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

- ANSI C62.61 (1993) American National Standard for Gas Tube Surge Arresters on Wire Line Telephone Circuits

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

- NFPA 70 (2017; ERTA 1-2 2017; TIA 17-1; TIA 17-2;

TIA 17-3; TIA 17-4; TIA 17-5; TIA 17-6;
 TIA 17-7; TIA 17-8; TIA 17-9; TIA 17-10;
 TIA 17-11; TIA 17-12; TIA 17-13; TIA
 17-14; TIA 17-15; TIA 17-16; TIA 17-17)
 National Electrical Code

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

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 345-72 (1985) Filled Splice Closures (PE-74)

RUS Bull 345-83 (1979; Rev Oct 1982) Gas Tube Surge Arrestors (PE-80)

RUS Bull 1751F-630 (1996) Design of Aerial Plant

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)

RUS Bull 1753F-401 (1995) Splicing Copper and Fiber Optic Cables (PC-2)

UNDERWRITERS LABORATORIES (UL)

UL 83 (2017) UL Standard for Safety Thermoplastic-Insulated Wires and Cables

UL 497 (2001; Reprint Jul 2013) Protectors for Paired Conductor Communication Circuits

UL 510 (2017) UL Standard for Safety Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape

1.2 RELATED REQUIREMENTS

Section 27 10 00, BUILDING TELECOMMUNICATIONS CABLING SYSTEM, 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

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" 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

Telecommunications Outside Plant; G

Telecommunications Entrance Facility Drawings; G

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

Cable splices, and connectors; G

Closures; G

Building protector assemblies; G

Protector modules; G

Cross-connect terminal cabinets; 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

SD-07 Certificates

Telecommunications Contractor Qualifications; G

Key Personnel Qualifications; G

Minimum Manufacturer's Qualifications; G

SD-08 Manufacturer's Instructions

Building protector assembly installation; G

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

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

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. The telecommunications outside plant (OSP) shop drawings shall be included in the operation and maintenance manuals.

1.6.1.2 Telecommunications Entrance Facility Drawings

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 and copper 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 copper conductor and 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. Pre-test all existing copper cables that are being spliced into.

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 2 years prior to bid opening. The 2-year period shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period. 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 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 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 record documentation as specified in Section 27 10 00 BUILDING

TELECOMMUNICATIONS CABLING SYSTEM.

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 Building Protector Assemblies

Provide self-contained 5 pin unit supplied with a field cable stub factory connected to protector socket blocks to terminate and accept protector modules for 25 pairs of outside cable. Building protector assembly shall have interconnecting hardware for connection to interior cabling at full capacity. Provide manufacturers instructions for building protector assembly installation. Provide copper cable interconnecting hardware as specified in Section 27 10 00 BUILDING TELECOMMUNICATIONS CABLING SYSTEM.

2.2.2 Protector Modules

Provide in accordance with UL 497 three-electrode gas tube or solid state type 5 pin rated for the application. Provide gas tube protection modules in accordance with RUS Bull 345-83 and shall be heavy duty, A>10kA, B>400, C>65A where A is the maximum single impulse discharge current, B is the impulse life and C is the AC discharge current in accordance with ANSI C62.61. The gas modules shall shunt high voltage to ground, fail short, and be equipped with an external spark gap and heat coils in accordance with UL 497. Provide the number of surge protection modules equal to the number of pairs of exterior cable of the building protector assembly.

2.2.3 Fiber Optic Terminations

Provide fiber optic cable terminations as specified in 27 10 00 BUILDING TELECOMMUNICATIONS CABLING SYSTEM.

2.3 CLOSURES

2.3.1 Copper Conductor Closures

2.3.1.1 Aerial Cable Closures

Provide cable closure assembly consisting of a frame with clamps, a lift-off polyethylene cover, cable nozzles, and drop wire rings. Closure shall be suitable for use on Figure 8 cables. Closures shall be free breathing and suitable for housing of the type indicated splices of non-pressurized communications cables and shall be sized as indicated. The closure shall be constructed with ultraviolet resistant PVC.

2.3.1.2 Underground Cable Closures

- a. Aboveground: Provide aboveground closures constructed of not less than 14 gauge steel and acceptable for stake mounting in accordance with [RUS 1755.910](#). Closures shall be sized and contain a marker as indicated. Covers shall be secured to prevent unauthorized entry.
- b. Direct burial: Provide buried closure suitable for enclosing a straight, butt, and branch splice in a container into which can be poured an encapsulating compound. Closure shall have adequate strength to protect the splice and maintain cable shield electrical continuity in the buried environment. Encapsulating compound shall be reenterable and shall not alter the chemical stability of the closure. Provide filled splice cases in accordance with [RUS Bull 345-72](#).
- c. In vault or manhole: Provide underground closure suitable to house a straight, butt, and branch splice in a protective pressurized housing. Closure shall be stainless steel supplying structural strength necessary to pass the mechanical and electrical requirements in a vault or manhole environment. Splice cases shall be flash tested and have a minimum of 7 to 9 PSI back pressure. Splice cases must hold pressure for 24 hours.

2.3.2 Fiber Optic Closures

2.3.2.1 Aerial

Provide aerial closure that is free breathing and suitable for housing splice organizer of non -pressurized cables. Closure shall be constructed from heavy PVC with ultraviolet resistance.

2.3.2.2 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.

2.3.2.3 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 PAD MOUNTED [CROSS-CONNECT TERMINAL CABINETS](#)

Provide in accordance with [RUS 1755.910](#) and the following:

- a. Constructed of 14 gauge steel.
- b. Equipped with a double set of hinged doors with closed-cell foam weatherstripping. Doors shall be locked and contain a marker as indicated.

- d. Complete with cross connect modules to terminate number of pairs as indicated.
- e. Sized as indicated.

2.5 CABLE SPLICES, AND CONNECTORS

2.5.1 Copper Cable Splices

Provide ,PICABOND in-line splices of a moisture resistant, two-wire insulation displacement connector in fold-back configuration and in accordance with **RUS Bull 1753F-401**. Cable splice type and procedure shall be preapproved by base telecom. Provide correct connector size to accommodate the cable gauge of the supplied cable.

2.5.2 Copper Cable Splice Connector

Provide splice connectors with a polycarbonate body and cap and a tin-plated brass contact element. Connector shall accommodate 22 to 26 AWG solid wire with a maximum insulation diameter of **0.065 inch**. Fill connector with sealant grease to make a moisture resistant connection, in accordance with **RUS Bull 1753F-401**.

2.5.3 Fiber Optic Cable Splices

Provide fiber optic cable splices and splicing materials for fusion 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.

2.5.4 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.

2.5.5 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**.

2.6 CONDUIT

Provide conduit as specified in Section **33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION**.

2.7 PLASTIC INSULATING TAPE

UL 510.

2.8 WIRE AND CABLE

2.8.1 Copper Conductor Cable

Solid copper conductors, covered with an extruded solid insulating compound. Insulated conductors shall be twisted into pairs which are then stranded or oscillated to form a cylindrical core. For special high frequency applications, the cable core shall be separated into compartments. Cable shall be completed by the application of a suitable core wrapping material, a corrugated copper or plastic coated aluminum shield, and an overall extruded jacket. Telecommunications contractor shall verify distances between splice points prior to ordering cable in specific cut lengths. Gauge of conductor shall determine the range of numbers of pairs specified; 19 gauge (6 to 400 pairs), 22 gauge (6 to 1200 pairs), 24 gauge (6 to 2100 pairs), and 26 gauge (6 to 3000 pairs). Copper conductor shall conform to the following:

2.8.1.1 Underground

Provide filled cable meeting the requirements of ICEA S-99-689 (AM#0002)> and ~~RUS 1755.390~~ <(AM#0002) RUS 1755.890.

2.8.1.2 Screen

Provide screen-compartmental core cable filled cable meeting the requirements of ICEA S-99-689 -(AM#0002)> and ~~RUS 1755.390~~ .<(AM#0002)

2.8.2 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. 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

2.8.2.1 Strength Members

Provide central, 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.

2.8.2.2 Shielding or Other Metallic Covering

Provide bare aluminum or coated aluminum, single tape covering or shield in accordance with ICEA S-87-640.

2.8.2.3 Performance Requirements

Provide fiber optic cable with optical and mechanical performance requirements in accordance with ICEA S-87-640.

2.8.3 Grounding and Bonding Conductors

Provide grounding and bonding conductors in accordance with **RUS 1755.200**, **TIA-607**, **IEEE C2**, 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**.

2.9 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 stainless steel or polyethylene and labeled in accordance with **TIA-606**. Handwritten labeling is unacceptable.

2.9.1 Stainless Steel

Provide stainless steel, cable tags **1 5/8 inches** in diameter **1/16 inch** thick minimum, and circular in shape. Tags shall be die stamped with numbers, letters, and symbols not less than **0.25 inch** high and approximately **0.015 inch** deep in normal block style.

2.9.2 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.

2.10 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.

2.11 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.

2.12 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.

2.13 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.

2.14 TESTS, INSPECTIONS, AND VERIFICATIONS

2.14.1 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. 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 Cable Protection

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.

3.1.3.1 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.

3.1.4 Underground Duct

Provide underground duct and connections to existing manholes, handholes, as specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION with any additional requirements as specified herein.

3.1.5 Reconditioning of Surfaces

Provide reconditioning of surfaces as specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION.

3.1.6 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.

3.1.7 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.

3.1.7.1 Cable Tensions

Obtain from the cable manufacturer and provide to the Contracting Officer, the maximum allowable pulling tension. This tension shall not be exceeded.

3.1.7.2 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.

3.1.7.3 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.

3.1.8 Cable Splicing

3.1.8.1 Copper Conductor Splices

Perform splicing in accordance with requirements of RUS Bull 1753F-401 except that direct buried splices and twisted and soldered splices are not allowed. Exception does not apply for pairs assigned for carrier application.

3.1.8.2 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.

3.1.9 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.

3.1.10 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.

3.1.10.1 Telecommunications Master Ground Bar (TMGB)

The TMGB 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 TMGB for connection point for cable stub shields to connector blocks and CD protector assemblies as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

3.1.10.2 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 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 as indicated 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 APPLIED PAINTING

Provide ferrous metallic enclosure finishes in accordance with the following procedures. Ensure that surfaces are dry and clean when the coating is applied. Coat joints and crevices. Prior to assembly, paint surfaces which will be concealed or inaccessible after assembly. Apply primer and finish coat in accordance with the manufacturer's recommendations.

3.4 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.

3.5 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.

3.5.1 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.

3.5.1.1 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.

3.5.1.2 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.

3.5.1.3 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.

3.5.2 Acceptance Tests

Perform acceptance testing in accordance with [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. Provide calibration certificates for all testing equipment. After final manhole inspections provide a copy of the corrected red lined drawings. Prior to the final corrected red line submittal provide a preliminary rough draft as-built for verification.

3.5.2.1 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

3.5.2.2 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.

3.5.3 Soil Density Tests

- b. Determine soil-density relationships as specified for soil tests in Section 31 00 00 EARTHWORK.

-- End of Section --

SECTION 33 11 00.11**POLYVINYL CHLORIDE (PVC) PIPE****PART 1: GENERAL****1.01 SECTION INCLUDES**

PVC pressure pipe and fabricated fittings in nominal sizes 4-inches through 12-inches with cast iron pipe equivalent outside diameters.

1.02 SUBMITTALS

Submit manufacturer's product data, installation instructions and certification for all materials to be furnished in accordance with Specification Section 01 33 00. Submit classification and gradation test results for embedment and pipe backfill material.

PART 2: PRODUCTS

Research has documented that certain pipe materials (such as polyvinyl chloride, polyethylene, and polybutylene) and certain elastomers (such as those used in gasket material) may be subject to permeation by lower-molecular weight organic solvents or petroleum products. Products supplied under this Section assume that petroleum products or organic solvents will not be encountered. If during the course of pipeline installation the Contractor identifies, or suspects the presence of petroleum products or any unknown chemical substance, notify AW immediately. Stop installing piping in the area of suspected contamination until direction is provided by AW Project Manager..

PVC Schedule 40 or 80 is not permitted for conveying wastewater or potable water within distribution or collection systems. However, it may be used in other applications, such as conveying chemicals or for drainage.

2.01 PIPE MATERIALS – WATER DISTRIBUTION

All PVC pipe shall be PVC 1120 pressure pipe made from class 12454 material as defined by ASTM D1784 with outside diameter dimensions of steel or cast iron pipe. The PVC compounds shall be treated or certified suitable for potable water products by the National Sanitation Foundation Testing Laboratory (NSF Standard No. 61). PVC pipe to be used for potable water shall be blue in color.

PVC Pipe 4-inch through 12-inch:

AWWA Standard C900, DR14 and where permitted DR18. DR25 pipe will not be allowed. PVC pipe has recently been upgraded by pressure class, however American Water does not allow pipe in its system to be fully subject to the revised pressures in AWWA C900. DR14 shall not be subjected to pressures exceeding 250 psi. DR18 shall not be subjected to pressures exceeding 200 psi.

2.02 GRAVITY SEWER PIPE

- A. PVC gravity sanitary sewer pipe shall be green in color and in accordance with provisions in following table except where specified differently on the Drawings:

B.

Type of service	Acceptable Materials
Gravity Mains with depth of cover $\leq$ 10 feet	PVC SDR 35
Gravity Mains with depth of cover 10-15 feet	PVC SDR 26
Gravity Mains with depth of cover > 15 feet	Ductile Iron Pipe

- C. When solid wall PVC pipe 18-inches to 27-inches in diameter is required in SDR 26, provide pipe conforming to ASTM F679, except provide wall thickness as required for SDR 26 and pipe strength of 115 psi.
- D. For sewers up to 12-inch diameter crossing over water lines, or crossing under water lines with less than 2-feet separation, provide minimum 150 psi pressure rated pipe conforming to ASTM D2241 with suitable PVC adapter couplings.
- E. Joints: Spigot and integral wall section bell with solid cross section elastomeric or rubber ring gasket conforming to requirements of ASTM D3212 and ASTM F477, or ASTM D3139 and ASTM F477. Gaskets shall be factory-assembled and securely bonded in place to prevent displacement. Manufacturer shall test sample from each batch conforming to requirements ASTM D2444
- F. Fittings: Provide PVC gravity sewer sanitary bends, tee, or wye fittings for new sanitary sewer construction. PVC pipe fittings shall be full-bodied, either injection molded or factory fabricated. Saddle-type tee or wye fittings are not acceptable.
- G. Pipe Stiffness. Determine pipe stiffness at 5 percent deflection in accordance with Test Method D 2412. Minimum pipe stiffness shall be 46 psi. For diameters 4-inches through 18-inches, test three specimens, each a minimum of 6-inches (150 mm) in length. For diameters 21-inch through 36-inch, test three specimens, each a minimum of 12-inch (300 mm) in length.
- H. Flattening. Flatten three specimens of pipe, prepared in accordance with Paragraph 2.04F, in suitable press until internal diameter has been reduced to 60 percent of original inside diameter of pipe. Rate of loading shall be uniform. Test specimens, when examined under normal light and with unaided eye, shall show no evidence of splitting, cracking, breaking, or separation of pipe walls or bracing profiles. Perform the flattening test in conjunction with pipe stiffness test.
- I. Joint Tightness. Test for joint tightness in accordance with ASTM D3212, except that joint shall remain watertight at minimum deflection of 5 percent. Manufacturer will be

required to provide independent third party certification for joint testing each diameter of storm sewer pipe.

- J. Purpose of Tests. Flattening and pipe stiffness tests are intended to be routine quality control tests. Joint tightness test is intended to qualify pipe to specified level of performance.

2.03 SANITARY SEWER FORCE MAIN PIPE

- A. PVC sanitary sewer force main pipe shall be green in color. Provide approved PVC pressure pipe conforming to requirements for water service pipe, and conforming to minimum working pressure rating specified in Section 33 34 00 - Sanitary Sewer Force Mains.
- B. Acceptable pipe joints are integral bell-and-spigot, containing a bonded-in elastomeric sealing ring meeting requirements of ASTM F477. In designated areas requiring restrained joint pipe and fittings, use approved joint restraint device conforming to UNI-B-13, for PVC pipe 12-inch diameter and less.
- C. Fittings: Provide ductile iron fittings as per Section - Ductile Iron Pipe and Fittings, except furnish fittings with one of following approved internal linings:
 - 1. Nominal 40 Mils (35 Mils minimum) virgin polyethylene complying with ASTM D 1248, heat fused to interior surface of fitting
 - 2. Nominal 40 Mils (35 Mils minimum) polyurethane
 - 3. Nominal 40 Mils (35 Mils minimum) ceramic epoxy
 - 4. Nominal 40 Mils (35 Mils minimum) fusion bonded epoxy
- D. Exterior Protection: Provide polyethylene wrapping of ductile-iron fittings as required by Section 33 11 00.17 - Polyethylene Wrap.
- E. Hydrostatic Tests: Hydrostatically test pressure rated pipe in accordance with Specifications.

2.04 RECEIVING, HANDLING AND STORAGE

- A. Inspect pipe and appurtenances for defects prior to installation in the trench. Set aside and clearly mark defective, damaged or unsound material and hold material for inspection by AW.
- B. Load and unload all materials in accordance with the manufacturer's recommendations and in such a manner as to prevent damage. Do not drop pipe and accessories or handle them in a rough manner.
- C. Provide safe storage for all materials. Cover stored pipe that will be exposed to sunlight for periods longer than 6 months. Cover with canvas or other opaque material with provision for adequate air circulation. PVC pipe shall not be stored close to heat sources, such as heaters, boilers, steam lines, or engine exhaust.

PART 3: EXECUTION

3.01 INSTALLATION

Follow the provisions of Section - Piping - General Provisions, and Sanitary Sewer Force Mains in addition to the following requirements:

- A. Remove all dirt and foreign matter from pipe before lowering it into the trench. Do not place debris, hand tools, clothing or other materials in the pipe. Keep pipe clean during and after laying.
- B. Lay pipe with the bell end pointing in the direction of work progress. Do not roll, drop or dump pipe or appurtenances into the trench.
- C. Assemble push-on joints in accordance with the pipe manufacturer's recommendations. Assemble mechanical joints in accordance with the fitting manufacturer's recommendations.
- D. Cut pipe with pipe saws, circular saws, handsaws, or similar equipment. Provide a smooth end at a right angle to the longitudinal axis of the pipe. Deburr, bevel, and re-mark insertion line on spigot ends. Match factory bevel length and angle for field bevels. When connecting to certain shallow depth bells, such as those on some cast iron fittings and valves, cut off the factory bevel and prepare a deburred, square cut end with a slight outer bevel.
- E. Clean the sealing surface of the spigot end, the pipe bell, the coupler or fitting, and the elastomeric gaskets immediately before assembly. Do not remove factory installed gaskets for cleaning. Keep the joint free of dirt, sand, grit, grease or any foreign material. Apply approved lubricant when assembling gasketed joints in accordance with the pipe manufacturer's requirements. The use of improper lubricants can damage gaskets. Excessive lubricant use can make disinfection more difficult and cause taste and odor problems when the line is placed in service.
- F. Good pipe alignment is essential for proper joint assembly. Align the spigot to the bell and insert the spigot into the bell until it contacts the gasket uniformly. Do not swing or "stab" the joint; that is, do not suspend the pipe and swing it into the bell. The spigot end of the pipe is marked by the manufacturer to indicate the proper depth of insertion. Avoid metal to plastic contact with the pushing the pipe home (use wood or other material to cushion moving the pipe).
- G. Assemble pipe using the following types of joints:
 - 1. Gasketed bell joint – Integral with the pipe or fitting
 - 2. Gasketed coupling – A double gasketed coupling
 - 3. Mechanical joint – Any of the several joint designs that have gaskets and bolts manufactured in accordance with AWWA standards.

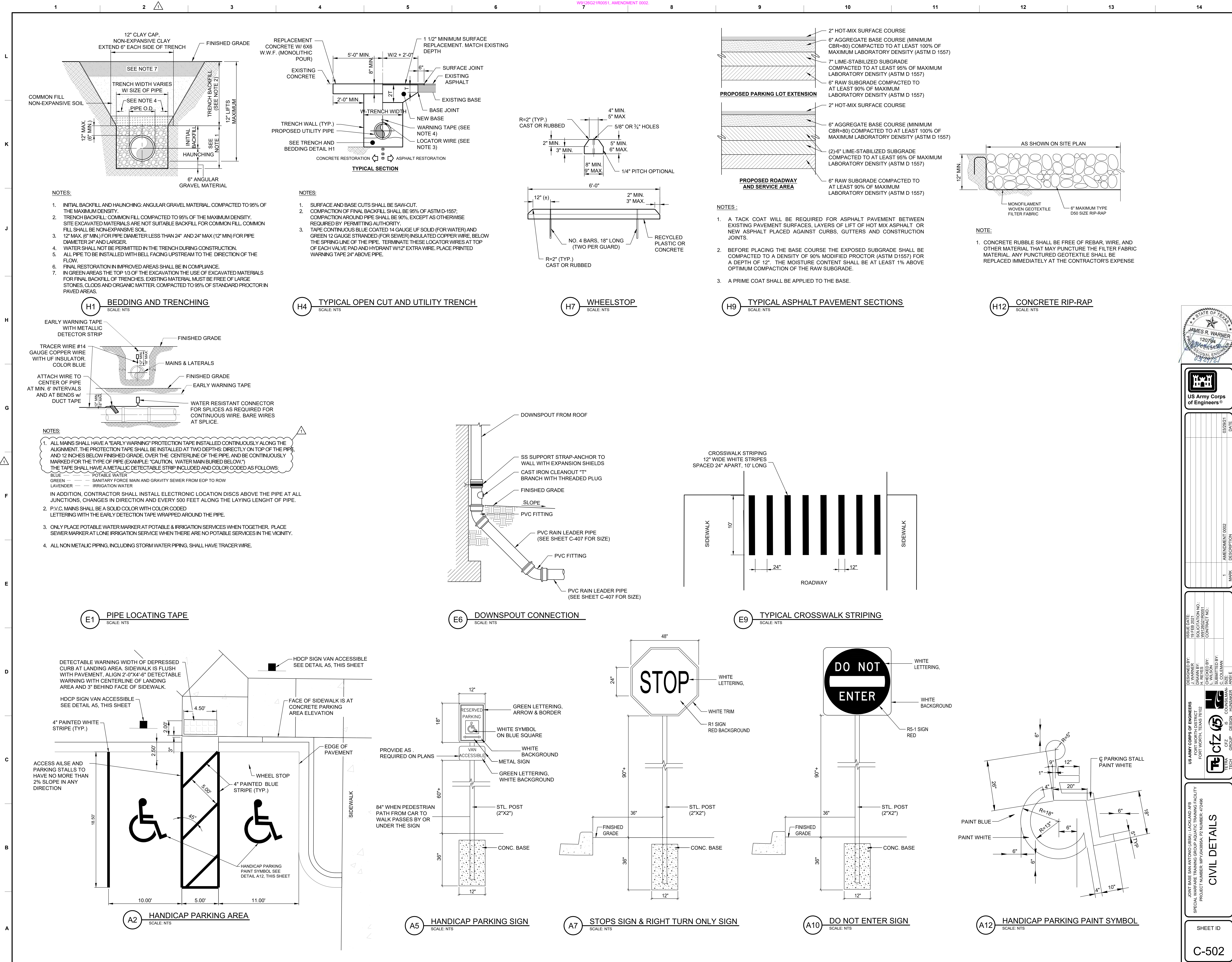
H. Tracer Wire

1. Place tracer wire in accordance with Section - Tracer Wire.
2. The wire shall be contiguous except at test stations, valve boxes, and where splicing is required. All splices shall be encased ~~with a 3M DBR or approved equal.~~ **(AM#0002)>** **<(AM#0002)**

I. All pressure and leakage testing shall be done in accordance with Specification Section 33 01 10.13 – Pressure and Leakage Tests**J. PVC pipe fittings shall employ ductile iron pipe fittings per Specifications 15105. See detail drawings for transitions between different pipe materials.****K. Gaskets - Gaskets shall be as provided or recommended by the manufacturer and satisfy AWWA standard C111 in all respects. Where ductile iron pipe and PVC pipe are directly connected, the appropriate gasket material for this purpose shall be employed. As noted in the products section of this specification, some gasket materials are prone to permeation of certain hydrocarbons which may exist in the soil (see Part 2). Under these conditions and at the discretion of AW's Project Manager, Contractor shall require contractor to provide FKM (Viton, Flourel) gasket material in areas of concern.****3.02 SERVICE CONNECTIONS**

- A. Install service connections in accordance with AWWA Standard C605 and the manufacturer's recommendations using the following methods:**
1. Tapping is only permitted through the use of service clamps or saddles.
 2. Using injection molded couplings with threaded outlets.
 3. Tapping with large service connections through appropriately sized tang sleeves and valves.
 4. Direct tapping of 1-inch and smaller service connections is not permitted. Use service saddles only for AWWA Standard C900 pipe, for nominal pipe sizes 6-inch through 12-inch. Corporation stops shall be threaded and conform to AWWA Standard C800.
 5. The distance between the PVC pipe joint and a service tap (2-inches and smaller) shall be a minimum of 3 feet. The distance between the PVC pipe joint and a service tap (4-inches and larger) shall be a minimum of 4 feet. Where necessary, excavate along the pipe to confirm the acceptable distance before starting the tap.

END OF SECTION 33 11 00.11



STATE OF TEXAS

JAMES R. WARNER

120796

Professional Engineer

03/29/21

US Army Corps of Engineers®

ISSUE DATE: 03/29/21

DESIGNED BY: J. WILSON

DRAWN BY: L. WILSON

SUBMITTED BY: J. WILSON

CONTRACT NO: 120796

PROJECT NO: 120796

CONTRACT NO: 120796

US ARMY CORPS OF ENGINEERS

FORT WORTH DISTRICT

FORT WORTH, TEXAS 76116

PROJECT NO: 120796

CONTRACT NO: 120796

CONTRACT NO: 120796

JOINT BASE SAN ANTONIO (JBSA) - LACKLAND AFB

SPECIAL WARFARE TRAINING GROUP AQUATIC TRAINING FACILITY

PROJECT NUMBER: WPAJ0986A.12 NUMBER: 42686

CONTRACT NO: 120796

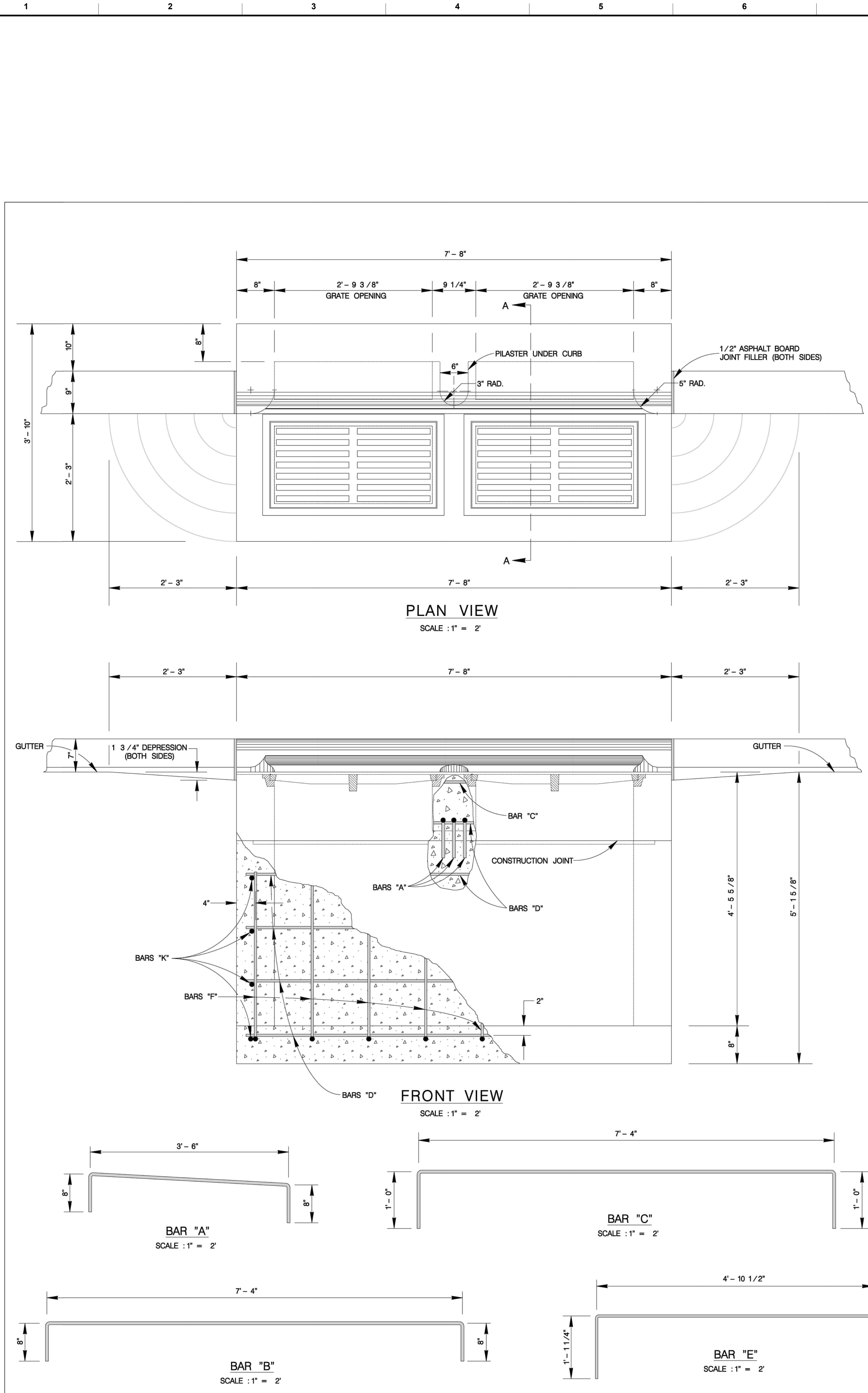
CONTRACT NO: 120796

CIVIL DETAILS

SHEET ID

C-502

READY TO ADVERTISE



GENERAL NOTES

1. ALL BARS INTERCEPTING REINFORCED CONCRETE PIPE SHALL BE FIELD CUT.
2. CONCRETE FOR STRUCTURES SHALL BE CLASS "A", 3000 P.S.I. IN 28 DAYS.
3. ALL DIMENSIONS RELATING TO REINFORCING STEEL ARE TO CENTER OF BARS.
4. ALL EXPOSED CORNERS SHALL BE CHAMFERED 3/4".
5. CONSTRUCTION JOINT SHOWN AT FLOWLINE MAY BE RAISED A MAXIMUM OF 6" AT THE OPTION OF THE CONTRACTOR. ADJUST LENGTH OF VERTICAL STEEL AS REQUIRED.
6. ALL REINFORCING STEEL SHALL BE MEET A.S.T.M. SPECIFICATION A16-56T NEW BILLET-STEEL, INTERMEDIATE GRADE AND A.S.T.M. A305-56, MINIMUM REQUIREMENTS FOR DEFORMED STEEL BARS.
7. PAYMENT FOR ALL EXCAVATION, BACKFILLING, CONCRETE AND REINFORCING STEEL SHALL BE INCLUDED IN THE UNIT COST OF ITEM 403 "STORM SEWER JUNCTION BOXES AND INLETS".

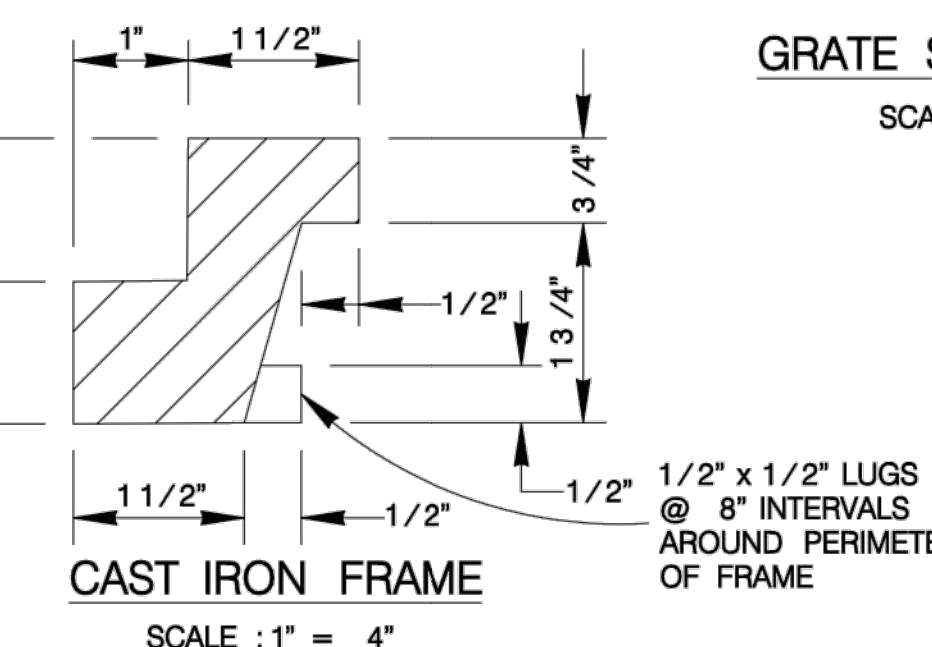
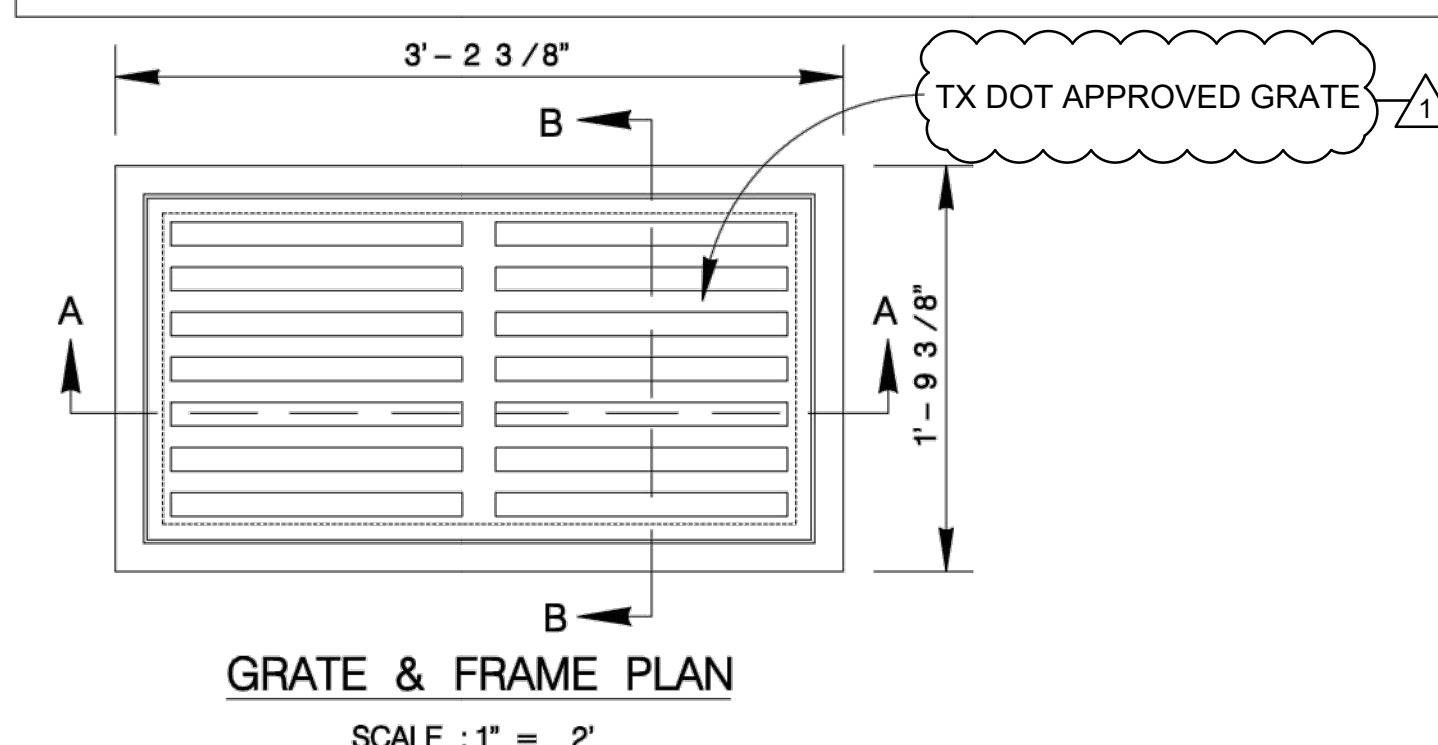
REINFORCING STEEL SCHEDULE

SHAPE	BAR	NO.	SIZE	SPACE	LENGTH	WEIGHT
	A	3	5	2 5/8" C-C	4' - 10"	15
	B	4	5	AS SHOWN	8' - 8"	36
	C	2	4	AS SHOWN	9' - 4"	12
STRAIGHT	D	16	4	AS SHOWN	7' - 4"	78
	E	11	4	9"	5' - 11 3/4"	44
STRAIGHT	F	8	4	12"	8' - 8"	46
	K	8	4	12"	2' - 10"	15
TOTAL =						246 LBS.

ESTIMATED QUANTITIES

ITEM	UNIT	NEAT QUANTITY
CLASS "A" CONCRETE	C.Y.	*3.38
REINFORCING STEEL	LBS.	*246
STORM SEWER CASTINGS	LBS.	564

*THESE FIGURES DO NOT EXCLUDE CONCRETE & STEEL INTERCEPTED BY REINFORCED CONCRETE PIPE.

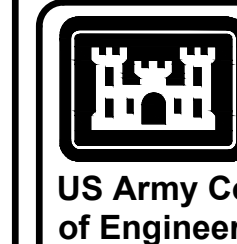


JANUARY 2005

CITY OF SAN ANTONIO
CAPITAL IMPROVEMENTS MANAGEMENT SERVICES DEPARTMENT

TYPE "B" INLET
STANDARDS

% SUBMITTAL PROJECT NO.: DATE:
DRWN. BY: V. VASQUEZ DSGN. BY: CHKD. BY: SHEET NO.: OF



DATE	DESCRIPTION
03/29/21	1 AMENDMENT 0002

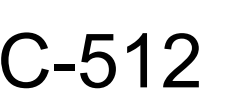
DESIGNED BY: FORT WORTH DISTRICT FORT WORTH, TEXAS 76102	ISSUE DATE: 03/29/21
DRAWN BY: H. REYES	SUBMITTAL NO.: W9126G21R0051
CHECKED BY: L. WILSON	CONTRACT NO.:
APPROVED BY: [Signature]	CONTRACTOR:
SCALE:	CONTRACTOR:
DATE:	CONTRACTOR:

JOINT BASE SAN ANTONIO (JBSA) - LACKLAND AFB
SPECIAL WARFARE TRAINING GROUP AQUATIC TRAINING FACILITY
PROJECT NUMBER: W9126G21R0051-12 NUMBER: 42666
CIVIL DETAILS

SHEET ID

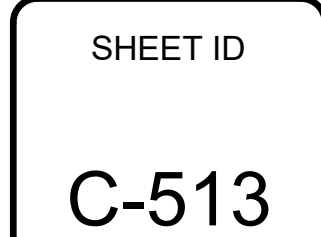
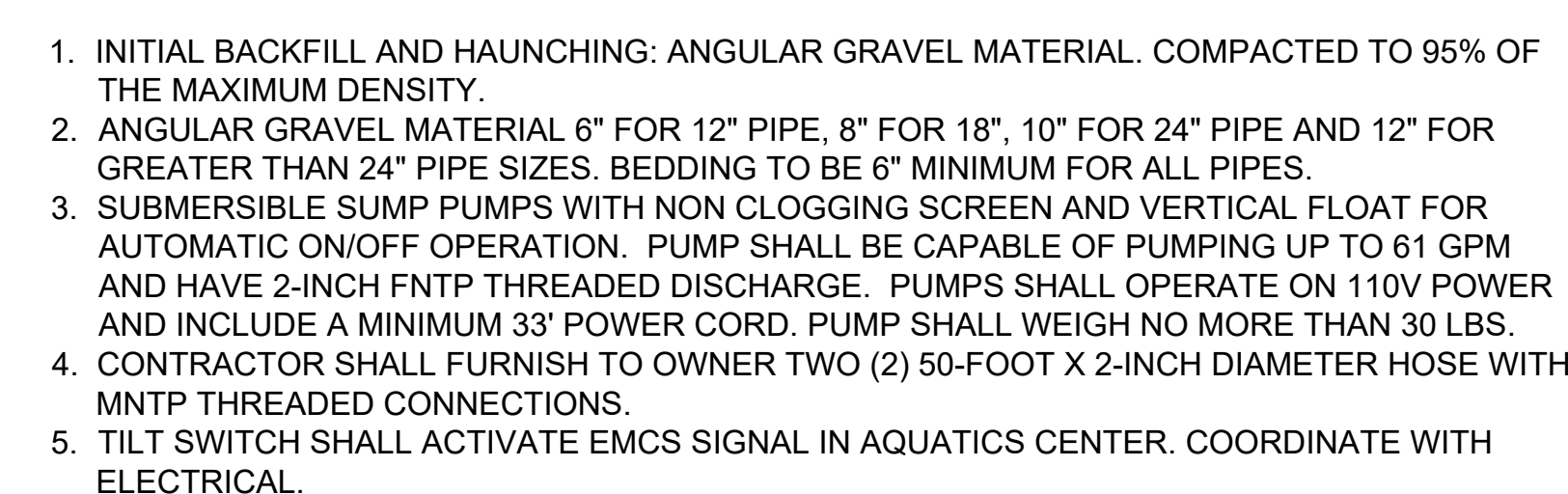
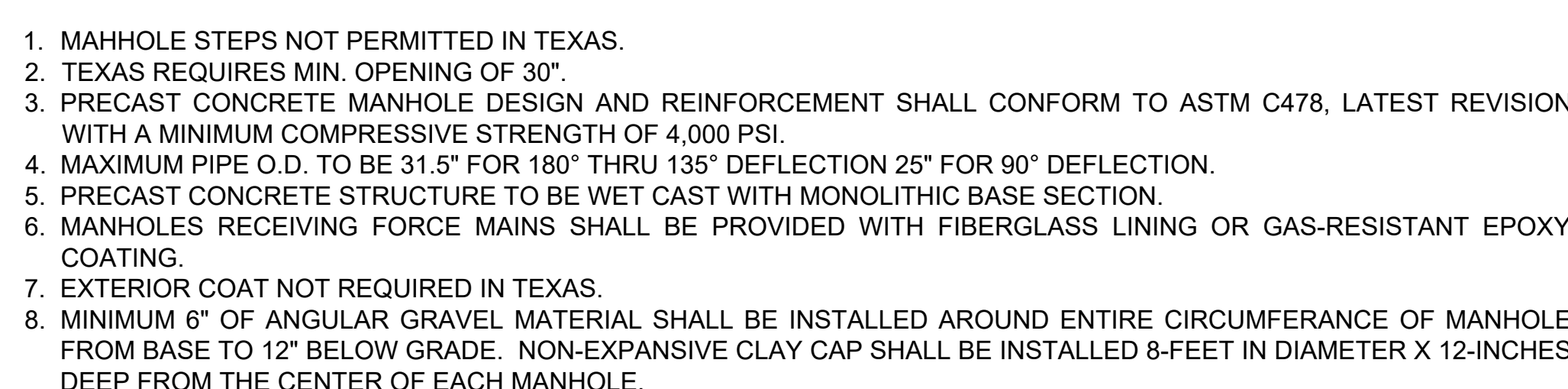
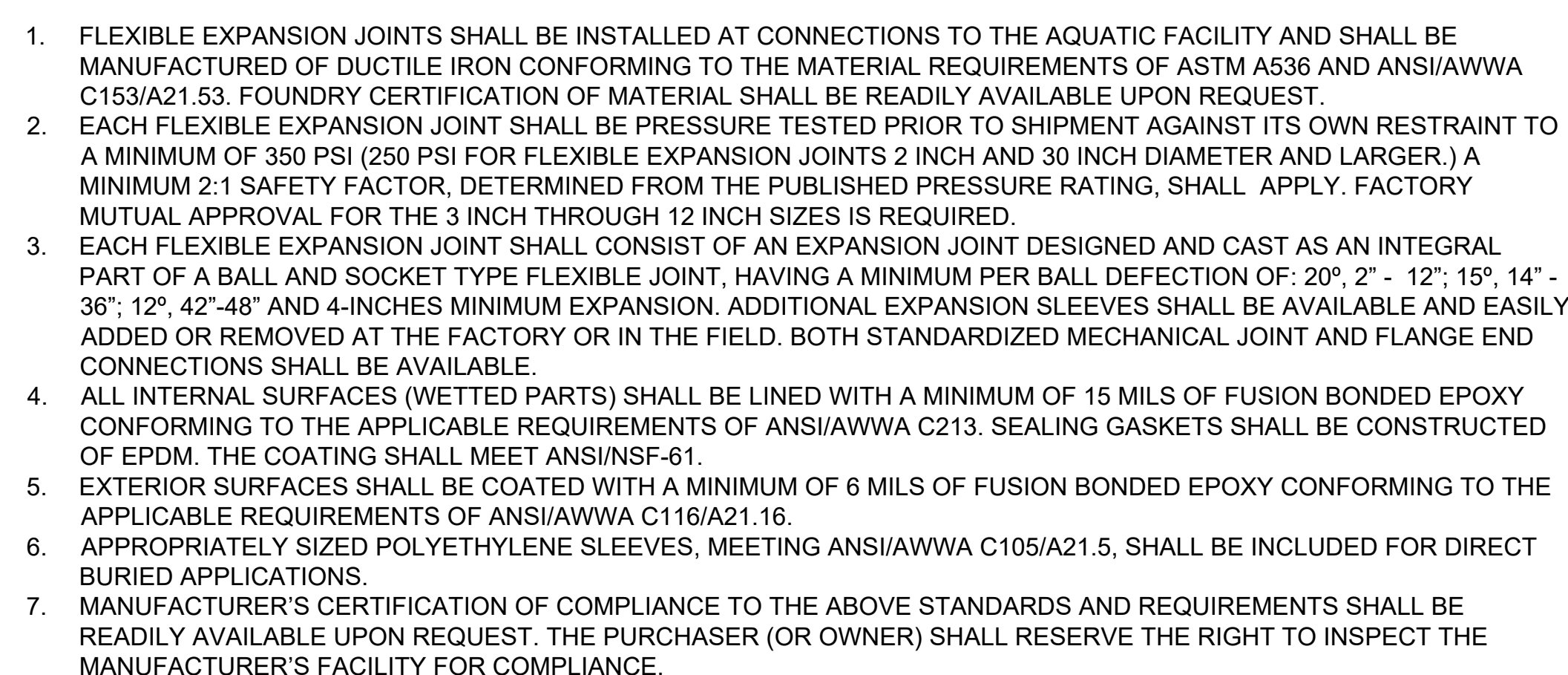
C-509

READY TO ADVERTISE

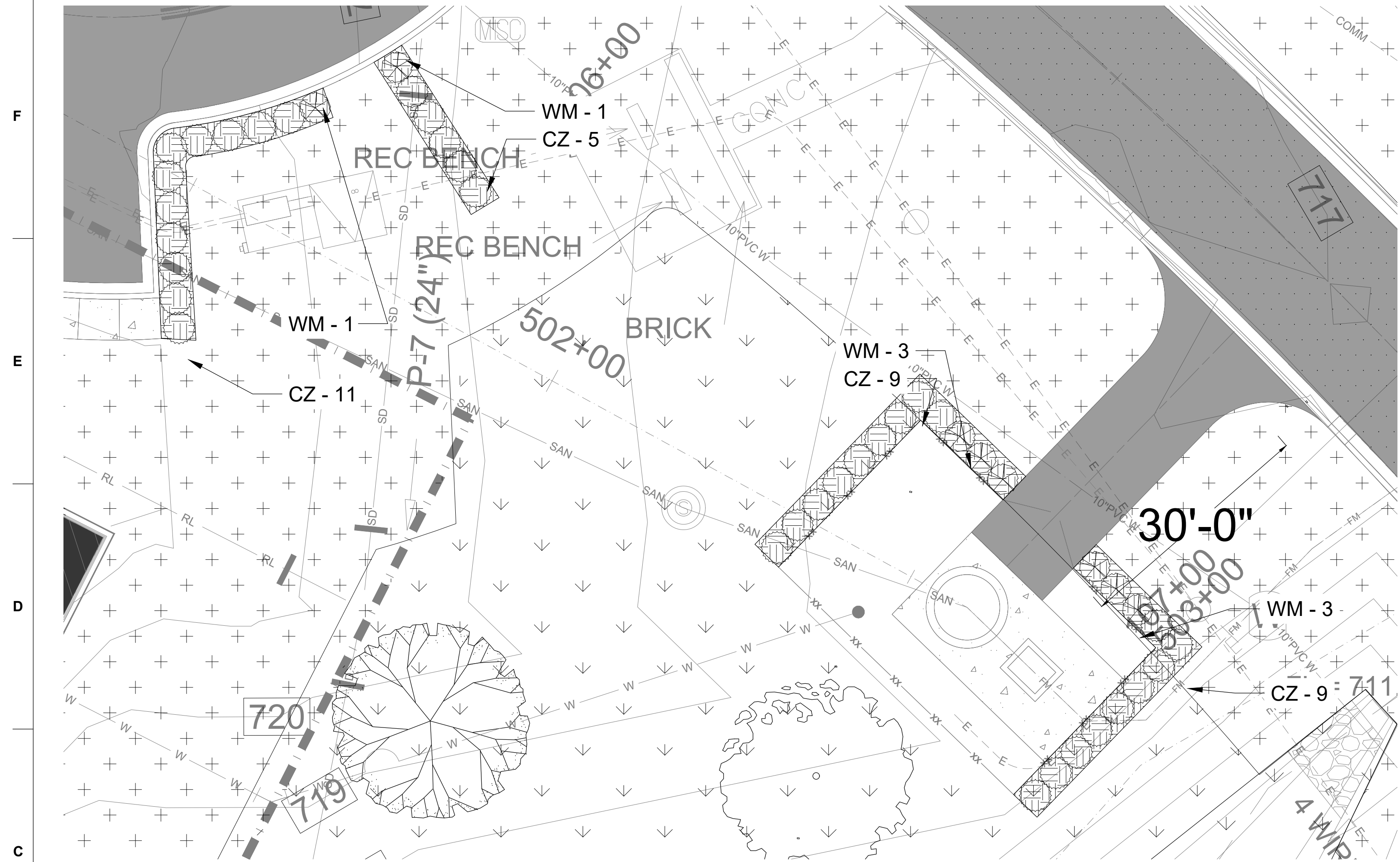
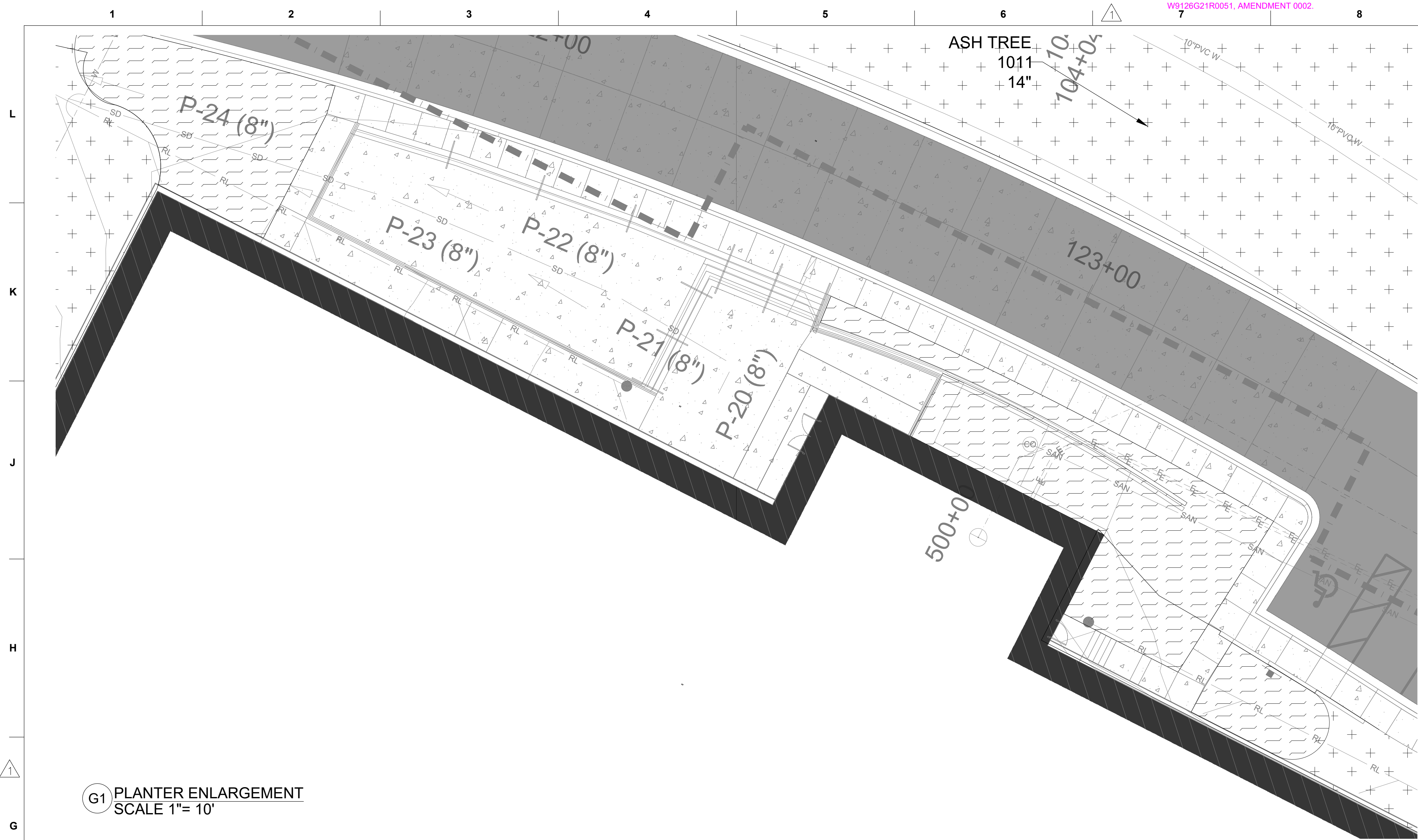




DUCTILE IRON AND PVC (AWWA C-900 AND C-905) PIPE						
PIPE SIZE (IN)	NOMINAL SLEEVE DIA (IN)	"A" (IN)		PIPE SIZE (IN)	NOMINAL SLEEVE DIA (IN)	"A" (IN)
2	4	6		16	22	26
2-1/2	5	9		18	24	28
3	6	10		20	27	31
4	8	12		24	30	34
6	10	14		30	38	42
8	12	16		36	44-1/2	48-1/2
10	16	20		42	50-1/2	54-1/2
12	18	22		48	57	61
14	20	24				





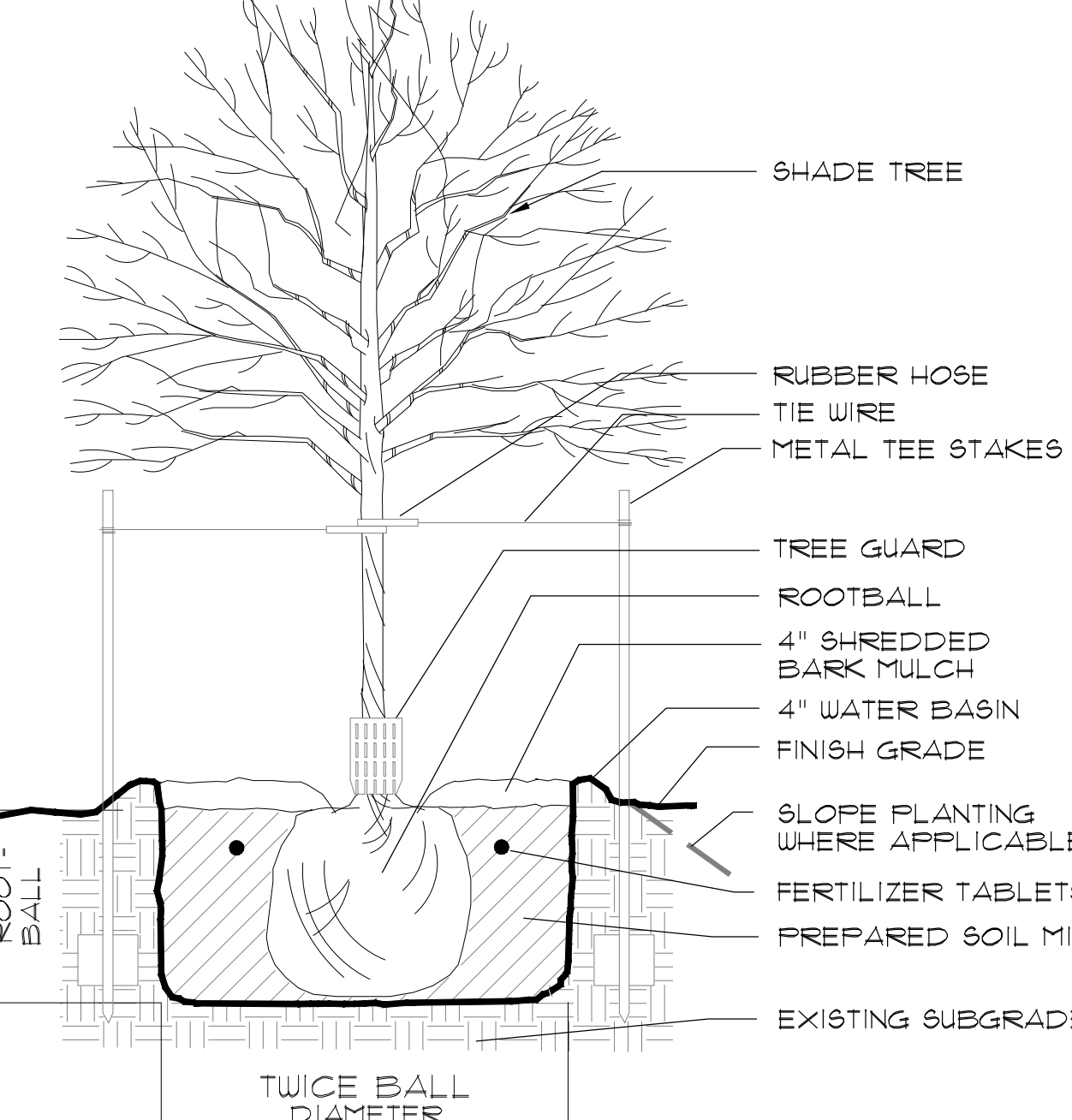
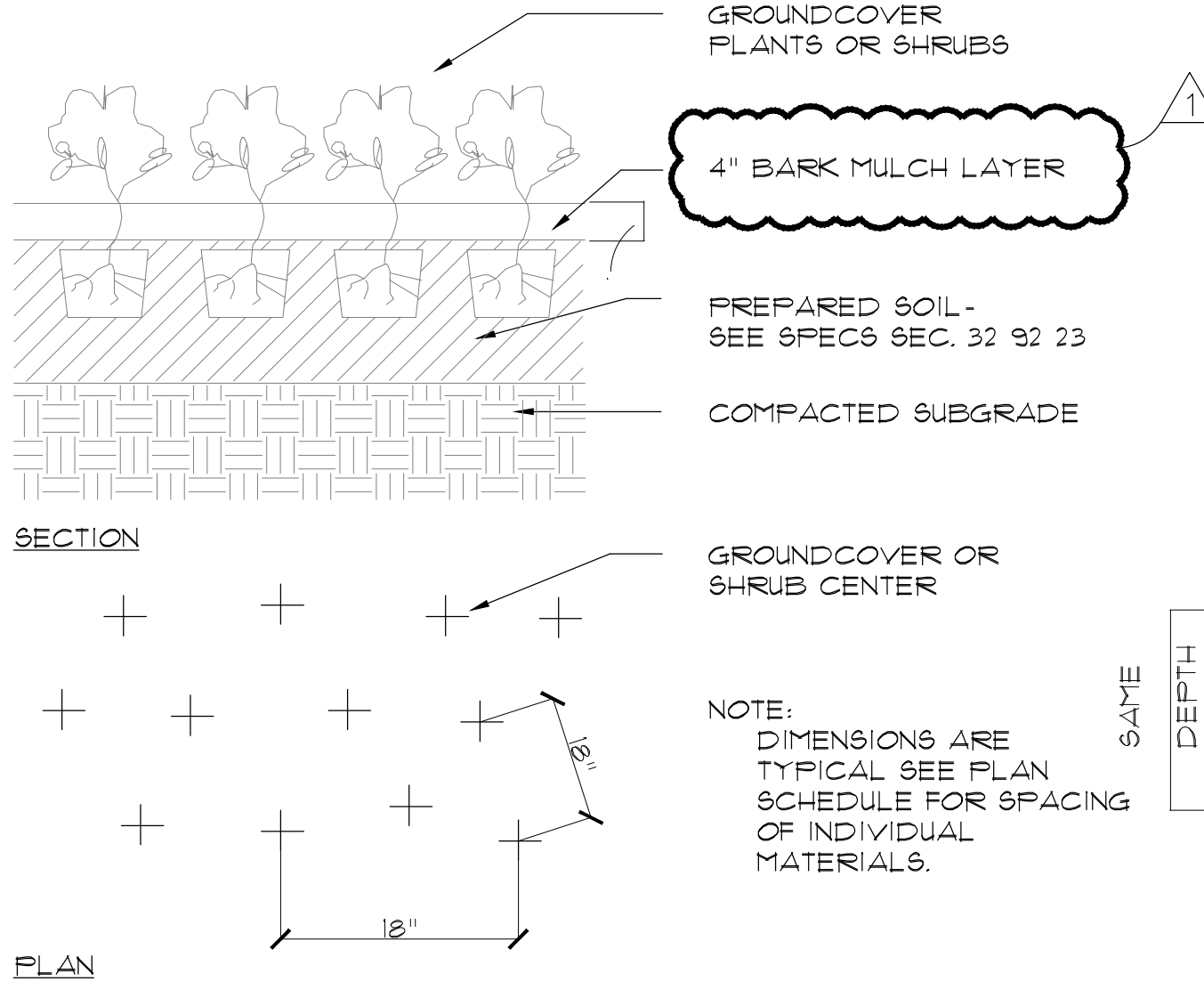
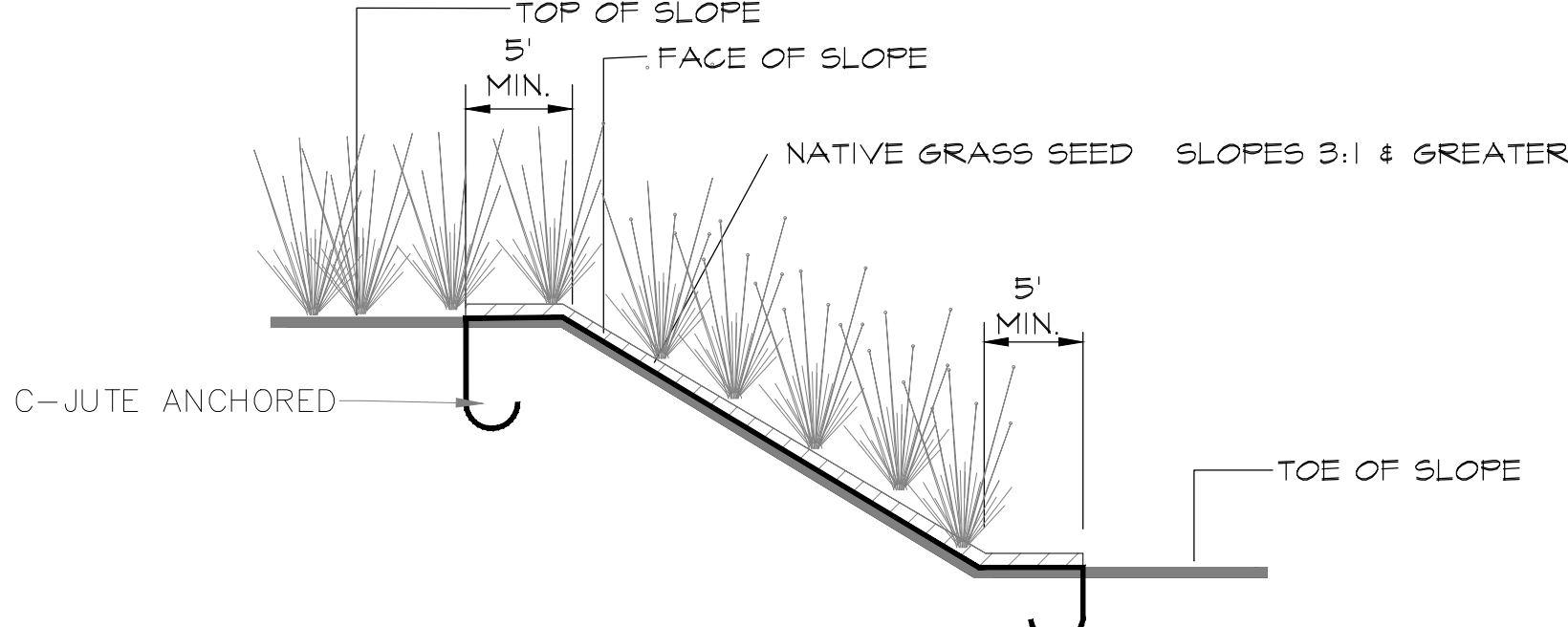


PLANTING NOTES:

- 1. LANDSCAPE CONTRACTOR SHALL BE RESPONSIBLE FOR MAKING HIMSELF FAMILIAR WITH THE SPECIFICATIONS AND ALL SUBMITTAL REQUIREMENTS. IT IS THE RESPONSIBILITY OF THE LANDSCAPE CONTRACTOR TO NOTIFY THE LANDSCAPE ARCHITECT FOR SITE INSPECTIONS AS SPECIFIED IN THE SPECIFICATIONS. FAILURE TO NOTIFY THE LANDSCAPE ARCHITECT DOES NOT RELIEVE THE CONTRACTOR FROM INSPECTION APPROVAL AND WILL REQUIRE THE CONTRACTOR TO INSTALL/REPAIR WORK AS REQUIRED FOR APPROVAL AT THE COST OF THE CONTRACTOR. LANDSCAPE CONTRACTOR IS TO INFORM LANDSCAPE ARCHITECT OF THE START DATE OF WORK.
 - 2. THE LANDSCAPE CONTRACTOR IS TO NOTIFY TEXAS ONE CALL (800-245-4545) AND 800 DIG TESS (800-344-8377) 72 HOURS PRIOR TO ANY EXCAVATION. LANDSCAPE CONTRACTOR SHALL BE RESPONSIBLE FOR MAKING HIMSELF FAMILIAR WITH ALL UNDERGROUND UTILITIES, PIPES AND STRUCTURES. LANDSCAPE CONTRACTOR SHALL TAKE SOLE RESPONSIBILITY FOR ANY COST INCURRED DUE TO DAMAGE OF SAID UTILITIES WHETHER OR NOT TEXAS ONE CALL IS NOTIFIED.
 - 3. DO NOT WILLINGLY PROCEED WITH CONSTRUCTION AS DESIGNED WHEN IT IS OBVIOUS THAT UNKNOWN OBSTRUCTION AND/OR GRADE DIFFERENCES EXIST THAT MAY NOT HAVE BEEN KNOWN DURING DESIGN. SUCH CONDITIONS SHALL BE IMMEDIATELY BROUGHT TO THE ATTENTION OF THE LANDSCAPE ARCHITECT. THE CONTRACTOR SHALL ASSUME FULL RESPONSIBILITY FOR ALL NECESSARY REVISIONS DUE TO FAILURE TO GIVE SUCH NOTIFICATION.
 - 4. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ANY COORDINATION WITH SUBCONTRACTORS AS REQUIRED TO ACCOMPLISH PLANTING OPERATIONS.
 - 5. IF CONFLICTS ARISE BETWEEN SIZE OF AREAS AND PLANS, CONTRACTOR IS TO CONTACT LANDSCAPE ARCHITECT FOR RESOLUTION. FAILURE TO MAKE SUCH CONFLICTS KNOWN WILL RESULT IN CONTRACTOR'S LIABILITY TO RELOCATE THE MATERIALS.
 - 6. SEE SPECIFICATIONS FOR PLANTING REQUIREMENTS, MATERIALS AND EXECUTION.
- TILL 4" OF LANDSCAPE SOIL MIX INTO NEW BED AREAS. LANDSCAPE SOIL MIX SHALL BE GARDENVILLE LANDSCAPE 4-WAY MIX (651-6115) OR EQUAL.
 - PROVIDE 1/8" X 4" STEEL EDGING BETWEEN ALL BED AREAS AND LAWN AREAS.
 - SPRAY ALL EXISTING GRASS IN NEW BED AREAS WITH ROUNDUP.
 - GROUNDCOVER SHALL BE PLANTED AS INDICATED ON PLAN. GROUNDCOVERS SHALL BE TRIANGULARLY SPACED. ALL GROUNDCOVERS SHALL BE HELD BACK 6" FROM EDGE OF NEW SHRUB PLANTINGS
 - INSTALL 4" OF SHREDDED PINE BARK MULCH IN ALL BED AREAS.
- 7 STEEP SLOPE REFER TO DETAIL E6/ L-401.

LEGEND

- EXISTING TREES TO REMAIN
 - SOLID SOD MANICURED GRASS ADJACENT TO BUILDING AND WALKWAYS
 - GROUND COVER
 - MULCH
 - (WM) WAX MYRTLE
 - (CZ) GREEB CLOUD CENIZO
- FOR PLANT SCHEDULE REFER TO DETAIL A7 /L-401



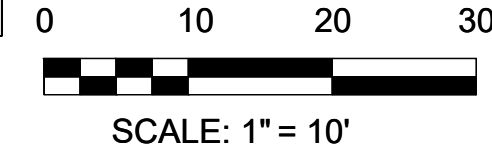
E6 NATIVE GRASSES ON SLOPES NTS

E9 TRIANGLE SPACING PLANTING DETAIL NTS

E11 SHADE TREE PLANTING NTS

PLANT SCHEDULE:										
KEY	COMMON NAME	SCIENTIFIC NAME	REMARKS	MAX HEIGHT	CALIPER SPREAD	B & B BOX	MIN. ROOT SPREAD OR BALL DIMENSION		MIN. PIT SIZE	
							DEPTH	DIA.	DEPTH	DIA.
	TREES									
CE	CEDAR ELM	ULMUS CRASSIFOLIA	2"- 2 1/2" CAL. SINGLE TRUNK,	50'- 70' HT.	2"- 2 1/2" CAL.	30G CONTAINER	24-28"	5'-7' SPRD.		
LO	LIVE OAK	QUERCUS VIRGINIANA	2"- 2 1/2" CAL. SINGLE TRUNK,	25'-60' HT	2 3/4"- 2 1/4"	65G CONTAINER	24-28"	5'-7" SPRD.		
MS	MEXICAN SYCAMORE	PLATANUS MEXICANA	2"- 2 1/2" CAL. SINGLE TRUNK,	60'+ HT	2"- 2 1/2" CAL.	30G CONTAINER	3'-4'	50'-70' SPRD.		
	SHRUBS									
CZ	GREEN CLOUD CENIZO	LEUCOPHYLLUM FRUTESCENS (GREEN CLOUD)	FULL AND BUSHY		3'X2' WIDE	5 GAL				
WM	WAX MYRTLE	MYRICA CERIFERA	FULL AND BUSHY		4'X3' WIDE	10 GAL				
	GROUNDCOVER/VINES									
GE	GERMANDER	CREEPING TEUCRIUM COSSONII	PLANT 18" ON CENTER TRIANGULATED SPACING	4'- 6" HT	18"- 24" SPRD	1 GAL.				
	LAWN									
	TIFWAY 419 BERMUDA	CYNODON DACTYLON 'TIFWAY 419'	SOLID SOD				S.Y.	S.Y.		
	GRASS SEED MIX									
	CALICHE MIX	BLUE GRAMA, BUFFALOGRASS, GREEN SPRANGLETOP, CURLY MESQUITE, HALL'S PANICUM, INDIANGRASS, LITTLE BLUESTEM, PURPLE THREE-AWN, PRAIRIE WILDRIE, RED LOVEGRASS, TEXAS CUPGRASS, SAND DROPSEED, SAND LOVEGRASS, WHITE TRIDENS, SIDEOATS GRAMA, SLIM TRIDENS, CANE BLUESTEM.	FOR SUNNY AREAS; AVAILABLE FROM NATIVE AMERICAN SEED	1'-3' HT.		1 LB/ 1000 SF				
	MISCELLANEOUS MATERIALS									
	SANDY LOAM SOIL		AS NEEDED							
	ENRICH		COMPOST FOR EXISTING TOPSOIL 2"							
	4WAY		FOR GROUND COVER BED 2"							
	MULCH		FOR GROUND COVER, SHRUB BEDS AND TREES. 2"				C.Y.	C.Y.		
	STEEL EDGING		FOR SHRUB BEDS AND TREES							
	GATOR BAGS									

A7 PLANT SCHEDULE



STATE OF TEXAS
ALBERT & FERNANDEZ JR
218
2/19/2021

US Army Corps of Engineers®

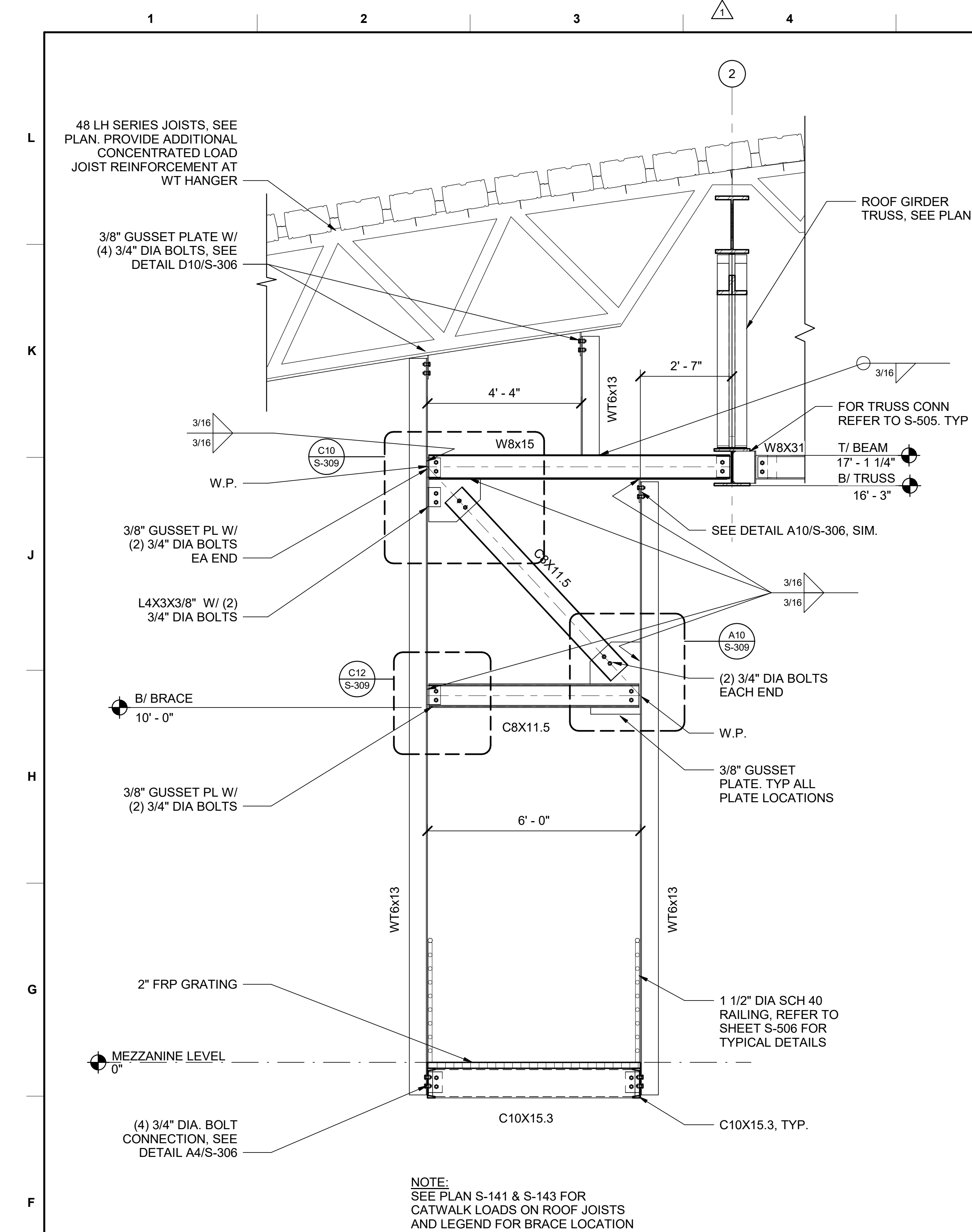
ISSUE DATE:
DESIGNED BY:
DRAWN BY:
CHECKED BY:
SUBMITTED BY:
DATE:
SCALE:

US ARMY CORPS OF ENGINEERS
FORT WORTH DISTRICT
FORT WORTH, TEXAS 76102

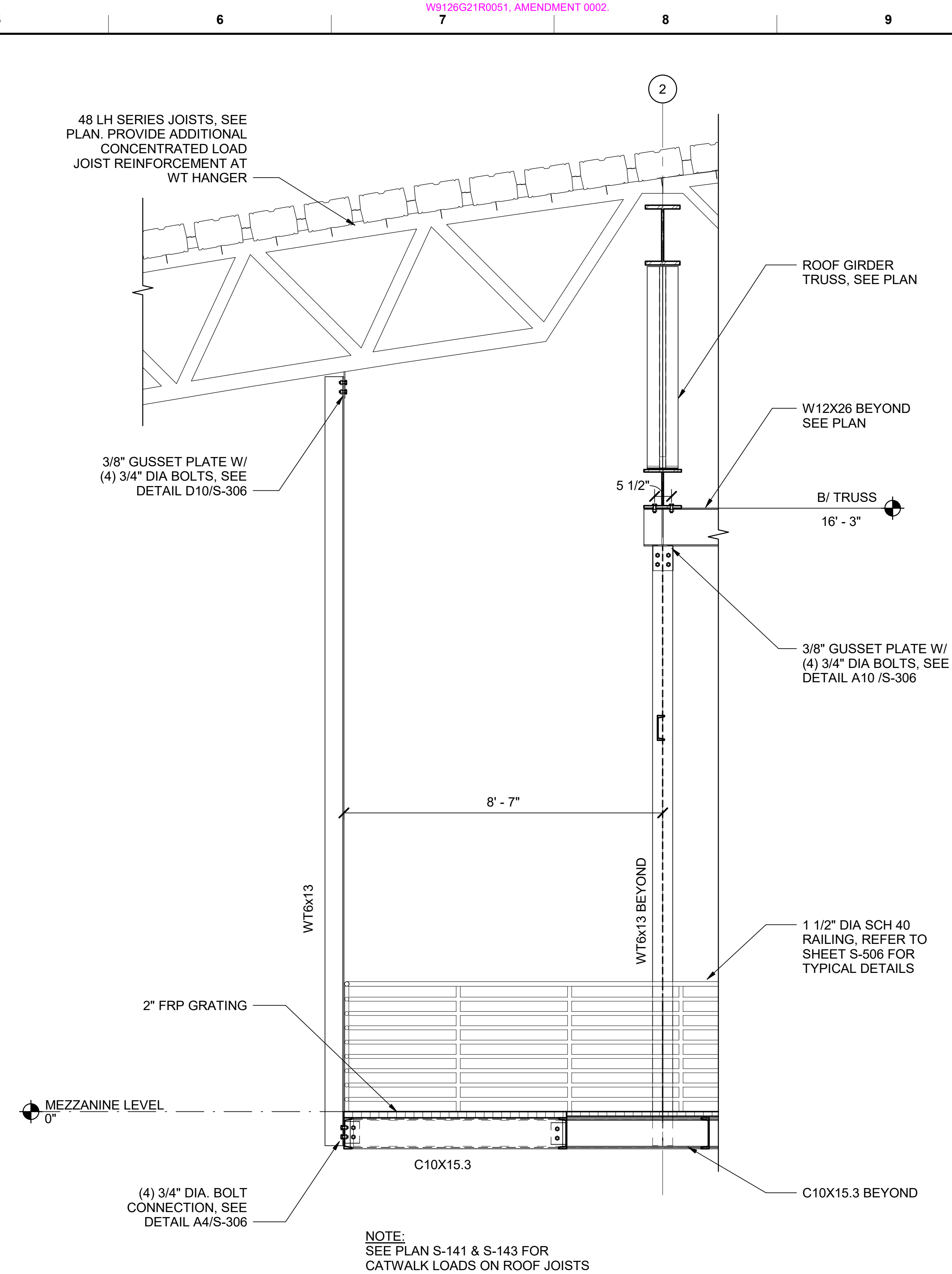
JOINT BASE SAN ANTONIO (JBSA) - LACKLAND AFB
SPECIAL WARFARE TRAINING GROUP AQUATIC TRAINING FACILITY
PROJECT NUMBER: WPI043985A, P2 NUMBER: 12496

LANDSCAPE PLAN

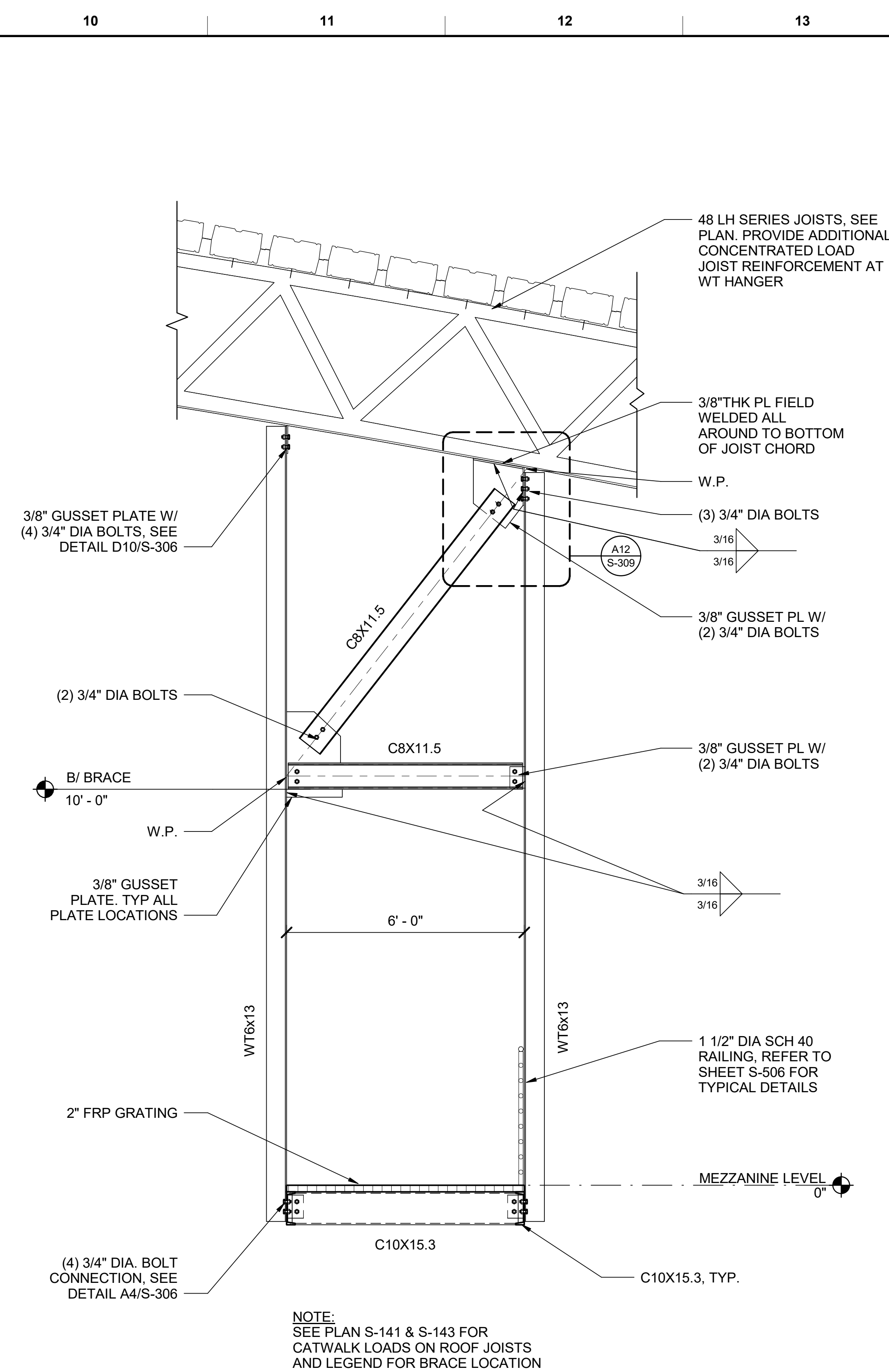
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L-401



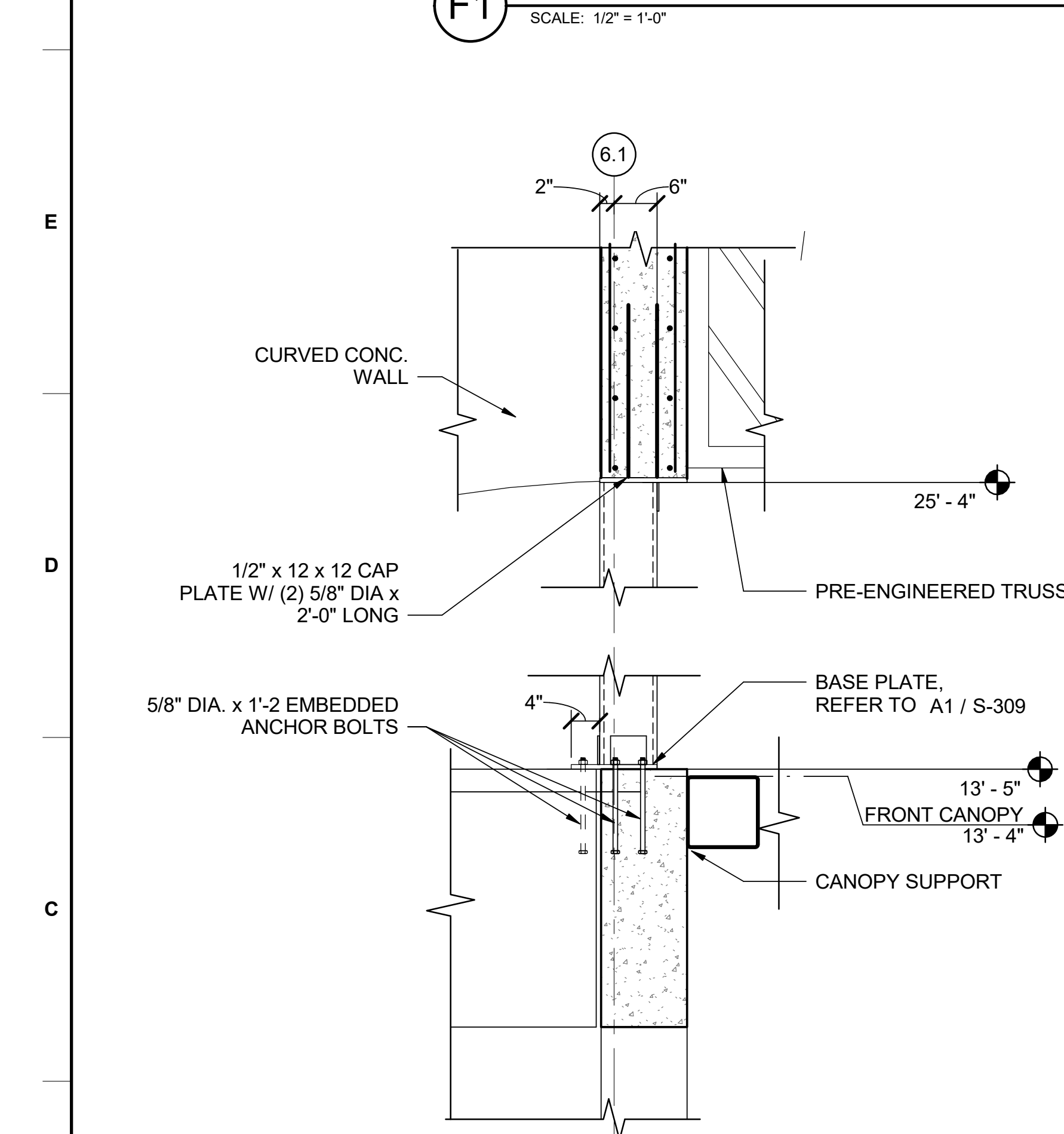
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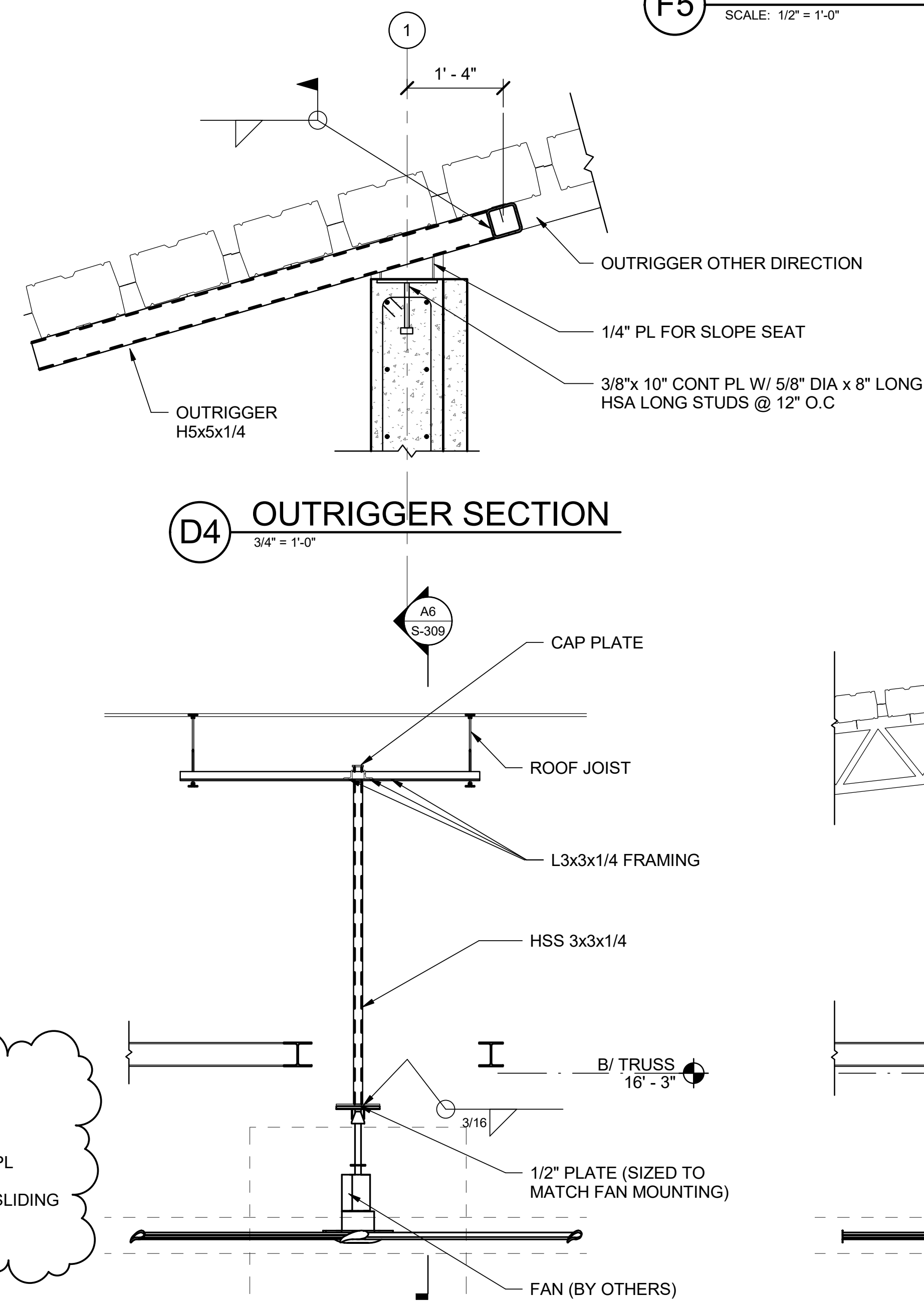
E5 CATWALK HANGER SECTION



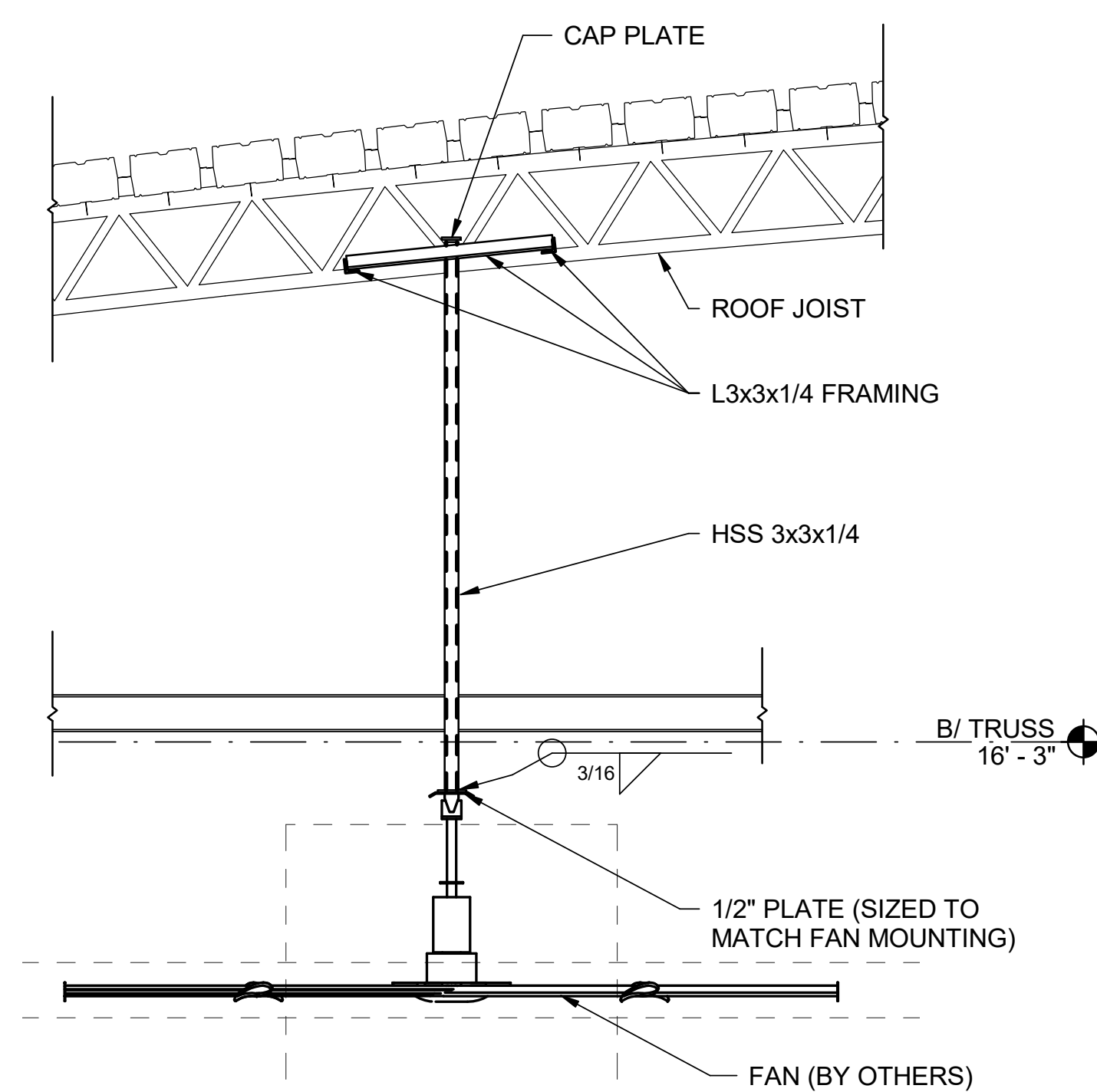
E10 CATWALK HANGER SECTION



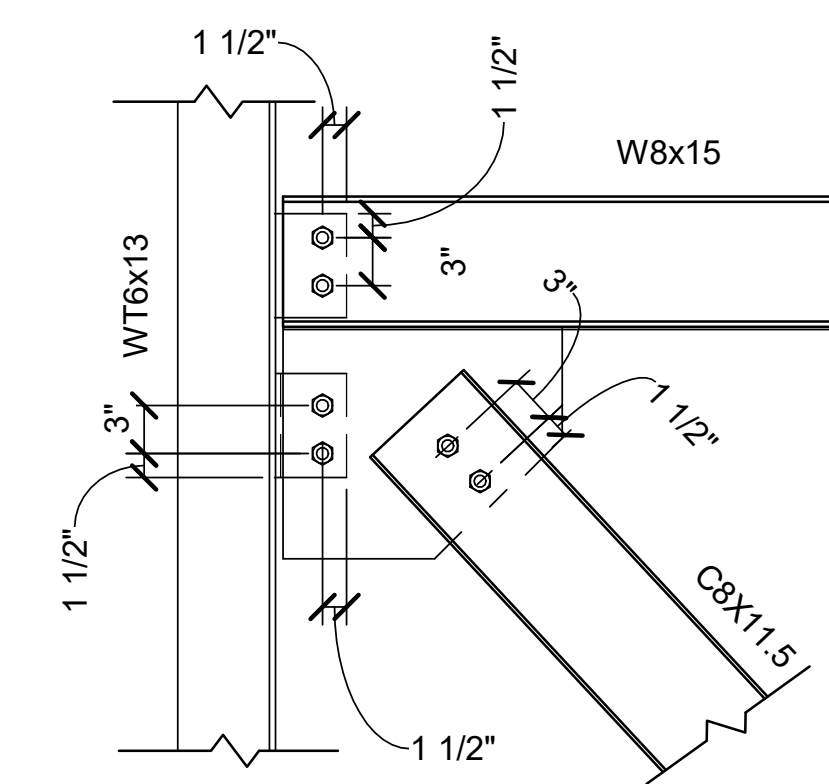
P4 HSS POST AT FRONT GLAZED OPNG



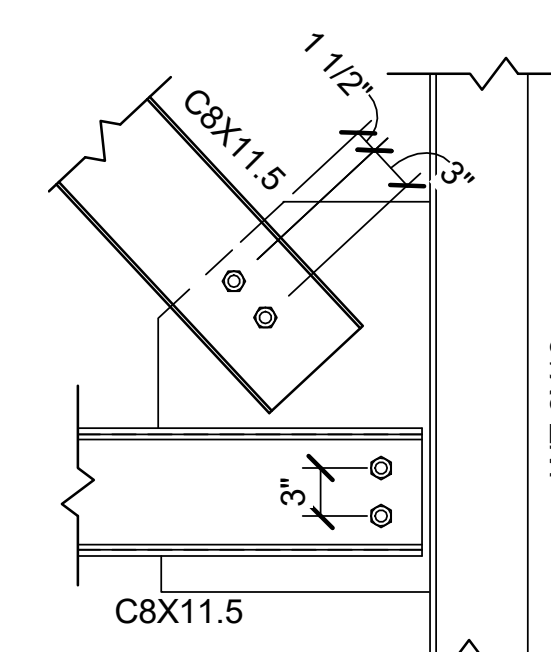
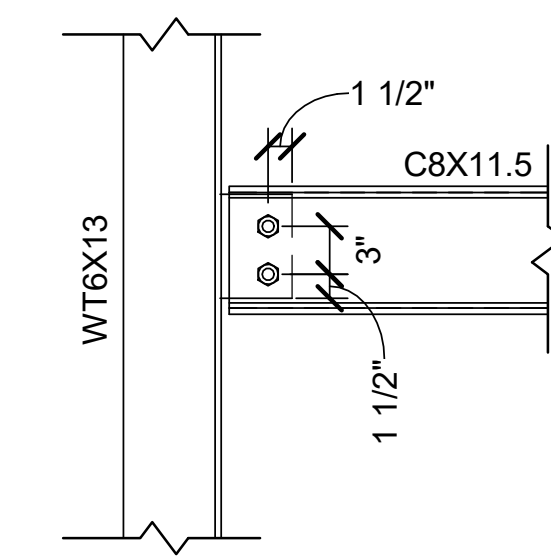
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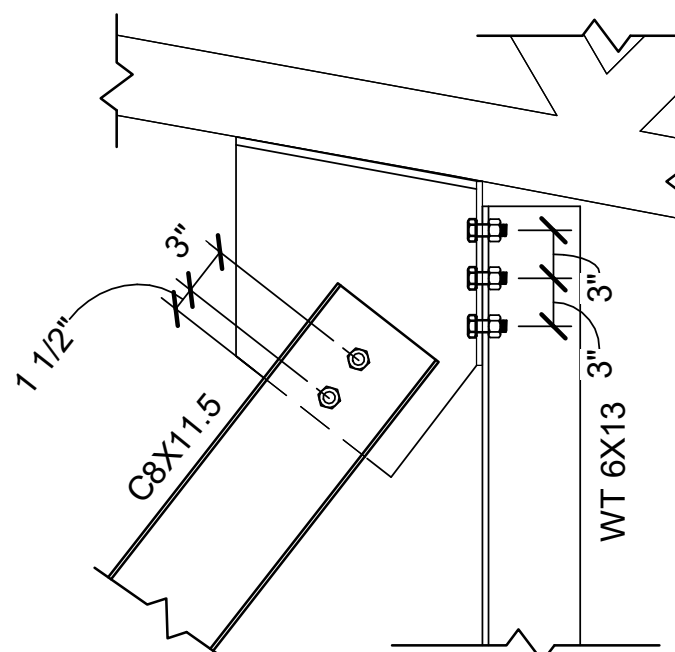
FAN STRUCTURAL SUPPORTS



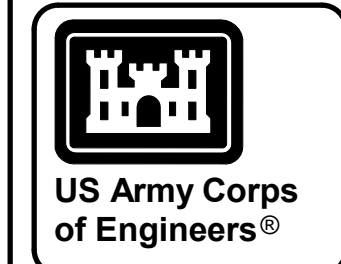
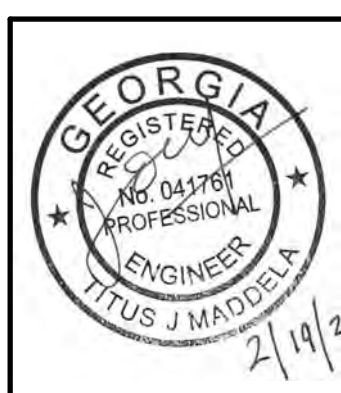
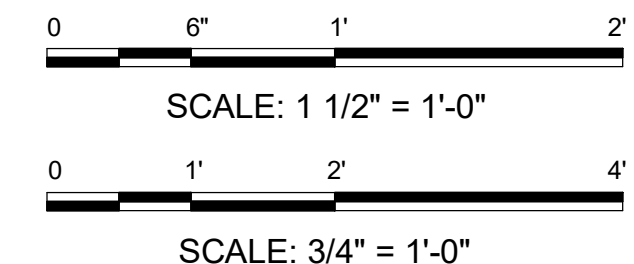
SECTION

SECTION A10

SECTION

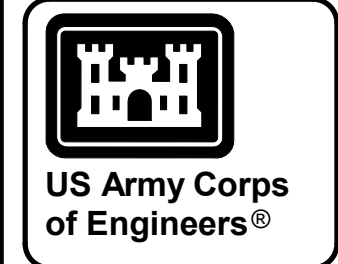
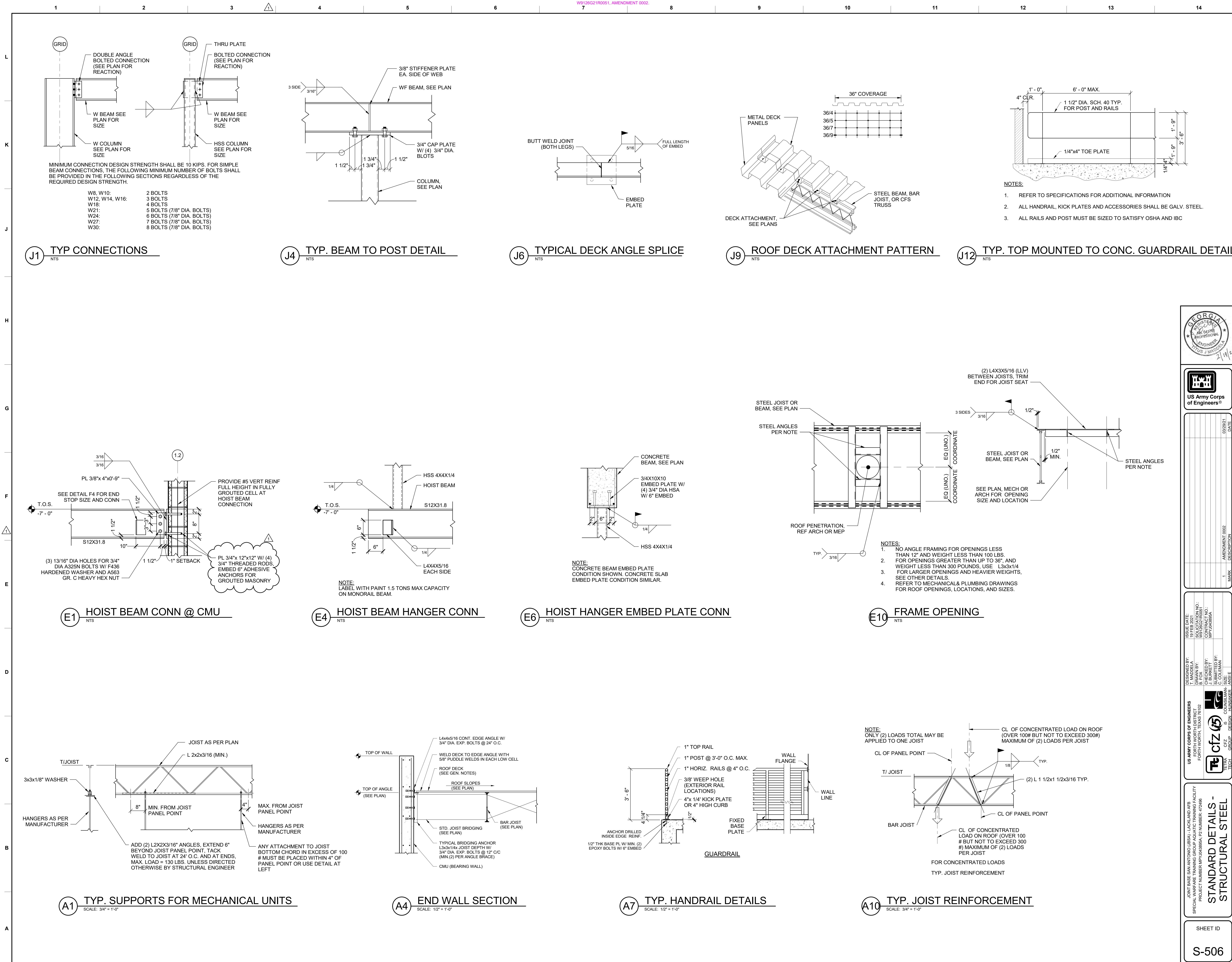


SECTION

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JOINT BASE SAN ANTONIO (JBSA) - LACKLAND AFB
SPECIAL WARFARE TRAINING GROUP AQUATIC TRAINING FACILITY
PROJECT NUMBER MPJ043855A P2 NUMBER 472486

**SECTIONS - ROOF AREA 1
AND 3**



NO.	DATE	DESCRIPTION
1	02/25/21	AMENDMENT 002

DESIGNED BY: T. J. MANNING 18 FEB 2021	APPROVED BY: J. BURKETT 18 FEB 2021
DRAWN BY: J. BURKETT	CHECKED BY: C. COLEMAN
SOLICITATION NO.: MPY1043856A	
CONTRACT NO.: MPY1043856A	

JOINT BASE SAN ANTONIO (JBSA) - LACKLAND AFB
SPECIAL WARFARE TRAINING GROUP AQUATIC TRAINING FACILITY
PROJECT NUMBER: WPAJAS68A P2 NUMBER: 4266

**STANDARD DETAILS -
STRUCTURAL STEEL**

SHEET ID
S-506

EXTERIOR MATERIAL FINISH LEGEND

BASIS OF DESIGN - LISTED BELOW FOR DESIGN INTENT. REFER TO SPECIFICATIONS FOR PRODUCT/MATERIAL SELECTION REQUIREMENTS

- BRICK TYPE 1: MERIDIAN BRICK
COLOR: BESSEMER COLLECTION, PEBBLE
- BRICK TYPE 2: MERIDIAN BRICK
COLOR: BESSEMER COLLECTION, MANHATTAN
- EXTERIOR CONCRETE PILASTER: TRIAD ASSOCIATES, INC.
FINISH/COLOR: EXPOSED AGGREGATE - LARGE DRIFTWOOD
W/ BLUE GLASS BLEND
- IWP A: KINGSPAN, BENCHMARK DESIGNWALL 1000
FINISH/COLOR: EMBOSSED - TAUPESTONE
- IWP B: KINGSPAN, BENCHMARK DESIGNWALL 1000
FINISH/COLOR: NON-EMBOSSED - BRIGHT SILVER
- IWP C: KINGSPAN, BENCHMARK DESIGNWALL 1000
FINISH/COLOR: SHADOWLINE - TAHOE BLUE
- IWP D: KINGSPAN, BENCHMARK DESIGNWALL 1000
FINISH/COLOR: NON-EMBOSSED - WEATHERED ZINC

STOREFRONT: KAWNEER
FINISH/COLOR: ALUMINUM, PREFINISHED PERMAFLUOR COATING SYSTEM - BONE WHITE

TRANSLUCENT WALL PANEL SYSTEM: KALWALL
FINISH/COLOR: STANDARD GRID, ALUMINUM, PREFINISHED - KCRF WHITE 00

PRECAST SILL: ADVANCED ARCHITECTURAL STONE
FINISH/COLOR: CUSTOM BUFF

CANOPY SYSTEM: AMETCO, MANUFACTURING CORP. (ALUMINUM SUNSHADE PANELS)
FINISH/COLOR: GALVANIZED STEEL - COATING SYSTEM - BONE WHITE (ENTIRE CANOPY)
C-CHANNEL PERIMETER TRIM COLOR: COATING SYSTEM - FORSYTHIA SW

ROOF SYSTEM 1: BERRIDGE CURVED ZEE-LOCK PANEL SYSTEM
FINISH/COLOR: STANDING SEAM, PREFINISHED - DARK BRONZE

ROOF SYSTEM 2: SIKA SARNAFIL SYSTEMS
FINISH/COLOR: ADHERED MEMBRANE - WHITE

GUTTER / DOWNSPOUT / FASCIA TRIM / COPING: FABRICATED
FINISH/COLOR: STEEL, PREFINISHED - MATCH ROOF SYSTEM 1 - DARK BRONZE

SOFFIT - TANK AREAS: IWPB - KINGSPAN, BENCHMARK DESIGNWALL 1000
FINISH/COLOR: NON-EMBOSSED - BRIGHT SILVER

SOFFIT - ENTRY TOWER: IWP A - KINGSPAN, BENCHMARK DESIGNWALL 1000
FINISH/COLOR: EMBOSSED - TAUPESTONE

SCREEN PANELS: AMETCO MANUFACTURING CORP. SHADOW 80
FINISH/COLOR: GALVANIZED WITH MANUFACTURING COATING - BRONZE

*NOTE
CONTRACTORS ARE FREE TO USE ANY PRODUCT
WHICH MEETS THE GOVERNMENT'S MINIMUM
REQUIREMENTS AND NOT IN CONFLICT WITH OTHER
CONTRACT PROVISIONS. UNLESS INDICATED
OTHERWISE ON THE PLANS OR SPECIFICATIONS
(E.G. SOLE-SOURCE), ALL LISTED MANUFACTURERS
ARE THE BASIS OF DESIGN. FOR THESE BASIS OF
DESIGN PRODUCTS, OTHER MANUFACTURERS MAY
BE SUBSTITUTED AS LONG AS THE STANDARD OF
QUALITY AND CHARACTERISTICS OF THE
SUBSTITUTED MANUFACTURER MEET OR EXCEED
THE STANDARD OF QUALITY AND CHARACTERISTICS
OF THE BASIS OF DESIGN.

KEYNOTES

- A1 ROOF SYSTEM 1: CURVED STEEL PANEL SYSTEM WITH 2" STANDING MECHANICALLY SEAMED SIDELAP OVER ICE AND WATER GUARD UNDERLAYMENT ON 1/2" COVERBOARD ON RIGID POLYISOCYANURATE INSULATION BOARD (R-30 MIN. 6") OVER 9" METAL STRUCTURAL DECK WITH SOUND ATTENUATION PROFILE.
- A2 ROOF SYSTEM 1: CURVED STEEL PANEL SYSTEM WITH 2" STANDING MECHANICALLY SEAMED SIDELAP OVER ICE AND WATER GUARD UNDERLAYMENT ON 1/2" COVERBOARD ON RIGID POLYISOCYANURATE INSULATION BOARD (R-30 MIN. 6") OVER 1-1/2" METAL DECK.
- A8 CANOPY, PREFABRICATED SUNSHADE PROFILE PANELS WITH HSS STRUCTURAL FRAMING AND C-CHANNEL PERIMETER BEAM, SEE STRUCTURAL FOR FRAMING.
- A9 PRE-FINISHED, KYNAR COATED, STEEL COPING CAP.
- A10 PRE-FINISHED, KYNAR COATED, STEEL GUTTER SYSTEM WITH DOWNSPOUT.
- A13 ROOF TOP EQUIPMENT, SEE MECHANICAL, PLUMBING AND ELECTRICAL. FOR EQUIPMENT SUPPORTS, SEE STRUCTURAL.
- A15 2 3/4" INSULATED TRANSLUCENT WALL PANEL SYSTEM IN THERMALLY BROKEN METAL FRAME.
- A16 PRE-FINISHED INSULATED ALUMINUM DOOR AND ALUMINUM FRAME. ALL EXTERIOR DOORS SHALL BE INSULATED AND INCLUDE WEATHER-STRIPPING.
- A17 ALUMINUM STOREFRONT SYSTEM WITH THERMALLY BROKEN METAL FRAME.
- A18 BRICK TYPE 1: MASONRY WITH AIR SPACE OVER AIR BARRIER, 2" SPF INSULATION OVER CONCRETE STRUCTURAL BEARING WALL.

KEYNOTES

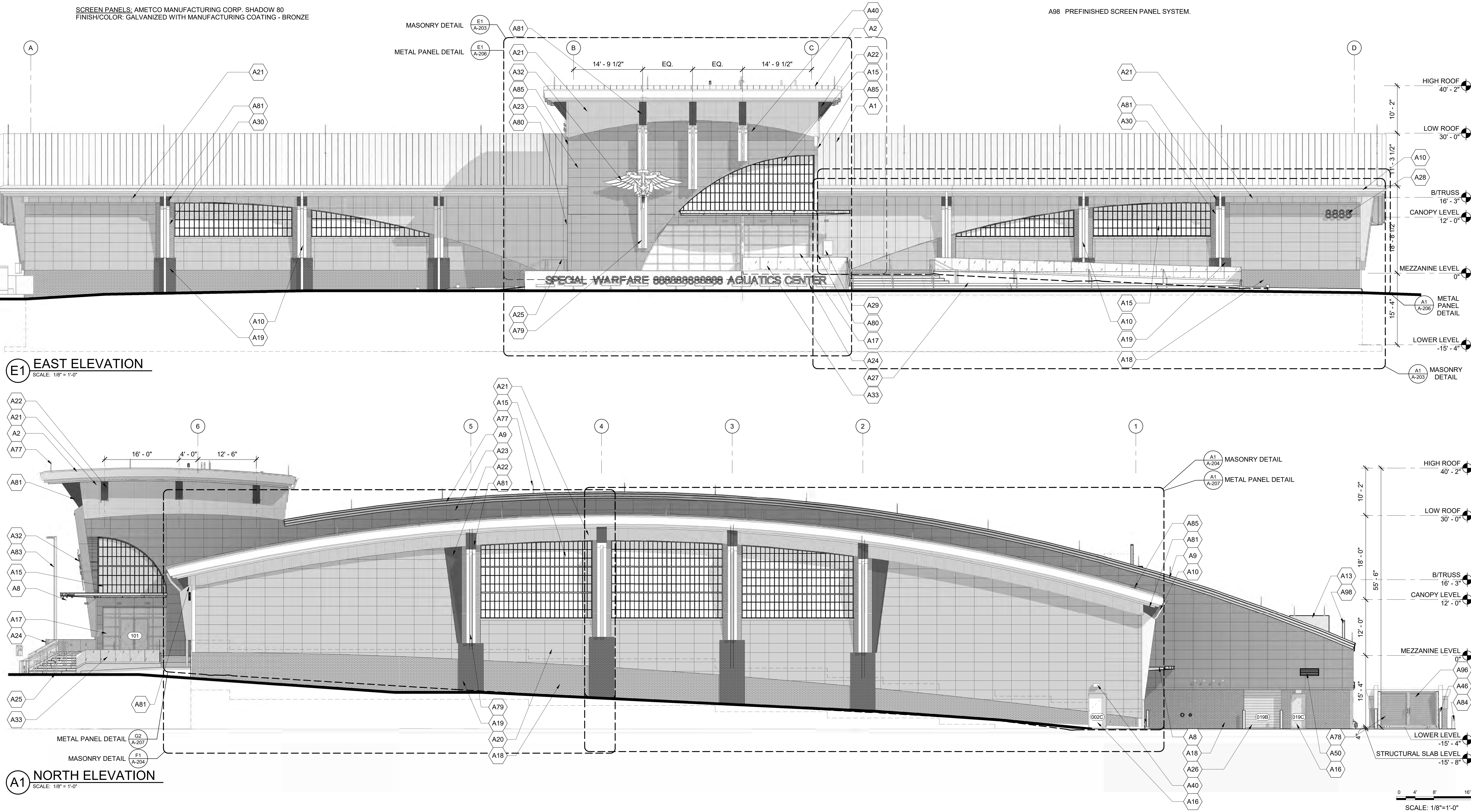
- A19 BRICK TYPE 2: MASONRY WITH AIR SPACE OVER AIR BARRIER, 2" SPF INSULATION OVER CONCRETE STRUCTURAL BEARING WALL.
- A20 IWP A: METAL PANEL SYSTEM OVER 3-5/8" METAL STUD FURRING OVER AIR BARRIER, 2" SPF INSULATION OVER CONCRETE STRUCTURAL BEARING WALL.
- A21 IWP B: METAL PANEL SYSTEM OVER 3-5/8" METAL STUD WITH 1-1/2" METAL FURRING OVER AIR BARRIER, 2" SPF INSULATION OVER CONCRETE STRUCTURAL BEARING WALL.
- A22 IWP C: METAL PANEL SYSTEM OVER 3-5/8" METAL STUD WITH 1-1/2" METAL FURRING OVER AIR BARRIER, 2" SPF INSULATION OVER CONCRETE STRUCTURAL BEARING WALL.
- A23 IWP D: METAL PANEL SYSTEM OVER 3-5/8" METAL STUD FURRING OVER AIR BARRIER, 2" SPF INSULATION OVER CONCRETE STRUCTURAL BEARING WALL.
- A24 CONCRETE RETAINING WALL WITH 20" CAST ALUMINUM WITH BRONZE ANODIZED FINISH BUILDING NAME. PIN SET WITH CONCEALED STUD STAND-OFF MOUNTING AND ACCENT LIGHTING.
- A25 STAINLESS STEEL PIPE RAILING AT STEPS.
- A26 PRE-FINISHED, INSULATED OVERHEAD COILING DOOR W/ MOTOR OPERATORS.
- A27 CONCRETE PLAZA, SEE STRUCTURAL. SEE A1/A-505 FOR EXTERIOR RAILINGS.
- A28 BUILDING SIGNAGE WITH 20" CAST ALUMINUM WITH BRONZE ANODIZED FINISH BUILDING NUMBERS WITH CONCEALED STUD STAND-OFF MOUNTING.
- A29 BUILDING SIGNAGE - CAST BRONZE PLAQUE, 24" WIDE X 36" TALL, PROVIDED BY GOVERNMENT'S CONTRACT REPRESENTATIVE, INSTALLED BY CONTRACTOR.

KEYNOTES

- A30 CONCRETE ACCENT PILASTER WITH PROFILE REVEAL FOR DOWNSPOUT. DOWNSPOUT TO TERMINATE WITH PIPE HUB AT GRADE OR CONCRETE RAMP, SEE CIVIL.
- A32 BUILDING EMBLEM - BRONZE FINISH WITH STEEL BRACING AT CONCRETE ACCENT PILASTER.
- A33 GLASS BARRIER SYSTEM WITH ALUMINUM CLADDING ATTACHED TO C CHANNEL. SEE DETAILS ON A408.
- A40 LIGHT FIXTURE, SEE ELECTRICAL DRAWINGS. TYPICAL
- A46 BOLLARD, SEE CIVIL A2/C-512.
- A50 PRE-FINISHED ALUMINUM DRAINABLE ARCHITECTURAL LOUVER WITH INSECT SCREEN (REFER TO MECHANICAL DRAWINGS/SCHEDULE FOR LOUVER SIZE).
- A77 LIGHTNING PROTECTION, SEE ELECTRICAL.
- A78 DUMPSTER ENCLOSURE.
- A79 CONCRETE ACCENT PILASTER WITH PROFILE REVEAL.
- A80 EXPANSION JOINT AT STRUCTURAL CONCRETE BEARING WALL, EXTERIOR MASONRY, METAL WALL PANEL SYSTEMS.
- A81 IWP C METAL PANEL PROFILE ATOP CONCRETE ACCENT PILASTER.
- A83 LIGHT POLE, SEE ELECTRICAL.
- A84 BOLLARD WITH INTEGRATED LIGHT FIXTURE SEE CIVIL AND ELECTRICAL.
- A85 BELLOWS EXPANSION JOINT AT PARAPET WALL.
- A96 PREFINISHED SWINGING SCREEN GATE SYSTEM. GATE HARDWARE SUPPLIED BY APPROVED SYSTEM MANUFACTURER.
- A98 PREFINISHED SCREEN PANEL SYSTEM.

GENERAL NOTES - ELEVATIONS

1. FOR STOREFRONT AND TRANSLUCENT WALL PANEL ELEVATIONS AND DETAILS, SEE SHEET A-602.
2. VERTICAL JOINT MASONRY VENTS LOCATED AT TOP OF WALL SHALL BE MODULAR INSERTS WITH INSECT RESISTANT VENT OPENINGS.
3. VENTS SHALL BE SPACED 24" O.C. IN BRICK MASONRY.
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7. ALIGN ALL HORIZONTAL AND VERTICAL JOINTS OF METAL PANELS AT ALL EXTERIOR ELEVATIONS.



REGISTERED ARCHITECT
STATE OF TEXAS

US Army Corps of Engineers®

03/29/21

1. AMENDMENT 0002

DESIGNED BY: [Signature]
DRAWN BY: [Signature]
CHECKED BY: [Signature]
DATE: [Signature]

US ARMY CORPS OF ENGINEERS
FORT WORTH DISTRICT
FORT WORTH, TEXAS 76102

PROJECT NUMBER: W9126G21R0001, AMENDMENT 0002

PROJECT NAME: SPECIAL WARFARE TRAINING GROUP AQUATIC TRAINING FACILITY

EXTERIOR ELEVATIONS

SHEET ID: A-201

READY TO ADVERTISE

	BRICK TYPE 1: MERIDIAN BRICK COLOR: BESSEMER COLLECTION, PEBBLE
	BRICK TYPE 2: MERIDIAN BRICK COLOR: BESSEMER COLLECTION, MANHATTAN
	EXTERIOR CONCRETE PILASTER: TRIAD ASSOCIATES, INC. FINISH/COLOR: EXPOSED AGGREGATE - LARGE DRIFTWOOD W/ BLUE GLASS BLEND
	IWP A: KINGSPAN, BENCHMARK DESIGNWALL 1000 FINISH/COLOR: EMBOSSED - TAUPESTONE
	IWP B: KINGSPAN, BENCHMARK DESIGNWALL 1000 FINISH/COLOR: NON-EMBOSSED - BRIGHT SILVER
	IWP C: KINGSPAN, BENCHMARK DESIGNWALL 1000 FINISH/COLOR: SHADOWLINE - TAHOE BLUE
	IWP D: KINGSPAN, BENCHMARK DESIGNWALL 1000 FINISH/COLOR: NON-EMBOSSED - WEATHERED ZINC

"NOTE
CONTRACTORS ARE FREE TO USE ANY PRODUCT
WHICH MEETS THE GOVERNMENT'S MINIMUM
REQUIREMENTS AND NOT IN CONFLICT WITH OTHER
CONTENTS OF SPECIFICATIONS, UNLESS INDICATED
OTHERWISE ON THE PLANS OR SPECIFICATIONS
(E.G. SOLE-SOURCE), ALL LISTED MANUFACTURERS
ARE THE BASIS OF DESIGN. FOR THESE BASIS OF
DESIGN PRODUCTS, OTHER MANUFACTURERS MAY
BE SUBSTITUTED AS LONG AS THE STANDARD OF
QUALITY AND CHARACTERISTICS OF THE
SUBSTITUTED MANUFACTURER MEET OR EXCEED
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OF THE BASIS OF DESIGN.

- A1 ROOF SYSTEM 1: CURVED STEEL PANEL SYSTEM WITH 2" STANDING MECHANICALLY SEALED SIDELAP OVER ICE AND WATER GARDER UNDERLAYMENT ON 1/2" COVERBOARD ON RIGID POLYISO-CYANURATE INSULATION BOARD (R-30 MIN. 6") OVER 9" METAL STRUCTURAL DECK WITH SOUND ATTENUATION PROFILE.
- A2 ROOF SYSTEM 1: CURVED STEEL PANEL SYSTEM WITH 2" STANDING MECHANICALLY SEALED SIDELAP OVER ICE AND WATER GARDER UNDERLAYMENT ON 1/2" COVERBOARD ON RIGID POLYISO-CYANURATE INSULATION BOARD (R-30 MIN. 6") OVER 1-1/2" METAL DECK.
- A8 CANOPY, PREFABRICATED SUNSHADE PROFILE PANELS WITH HSS STRUCTURAL FRAMING AND C-CHANNEL PERIMETER BEAM, SEE STRUCTURAL FOR FRAMING.
- A9 PRE-FINISHED, KYNAR COATED, STEEL COPING CAP.
- A10 PRE-FINISHED, KYNAR COATED, STEEL GUTTER SYSTEM WITH DOWNSPOUT.
- A13 ROOF TOP EQUIPMENT, SEE MECHANICAL, PLUMBING AND ELECTRICAL. FOR EQUIPMENT SUPPORTS, SEE STRUCTURAL.
- A15 2 3/4" INSULATED TRANSLUCENT WALL PANEL SYSTEM IN THERMALLY BROKEN METAL FRAME.
- A16 PRE-FINISHED INSULATED ALUMINUM DOOR AND ALUMINUM FRAME. ALL EXTERIOR DOORS SHALL BE INSULATED AND INCLUDE WEATHER-STRIPPING.

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A46 BOLLARD, SEE CIVIL A2/C-512.

A49 REFER TO MECHANICAL AND ELECTRICAL DRAWINGS FOR TYPE AND LOCATION OF DIFFUSERS, LIGHT FIXTURES, AND CEILING MOUNTED EQUIPMENT (TYPICAL).

A77 LIGHTNING PROTECTION, SEE ELECTRICAL.

A78 DUMPSTER ENCLOSURE.

A79 CONCRETE ACCENT PILASTER WITH PROFILE REVEAL.

A81 IWP C METAL PANEL PROFILE ATOP CONCRETE ACCENT PILASTER.

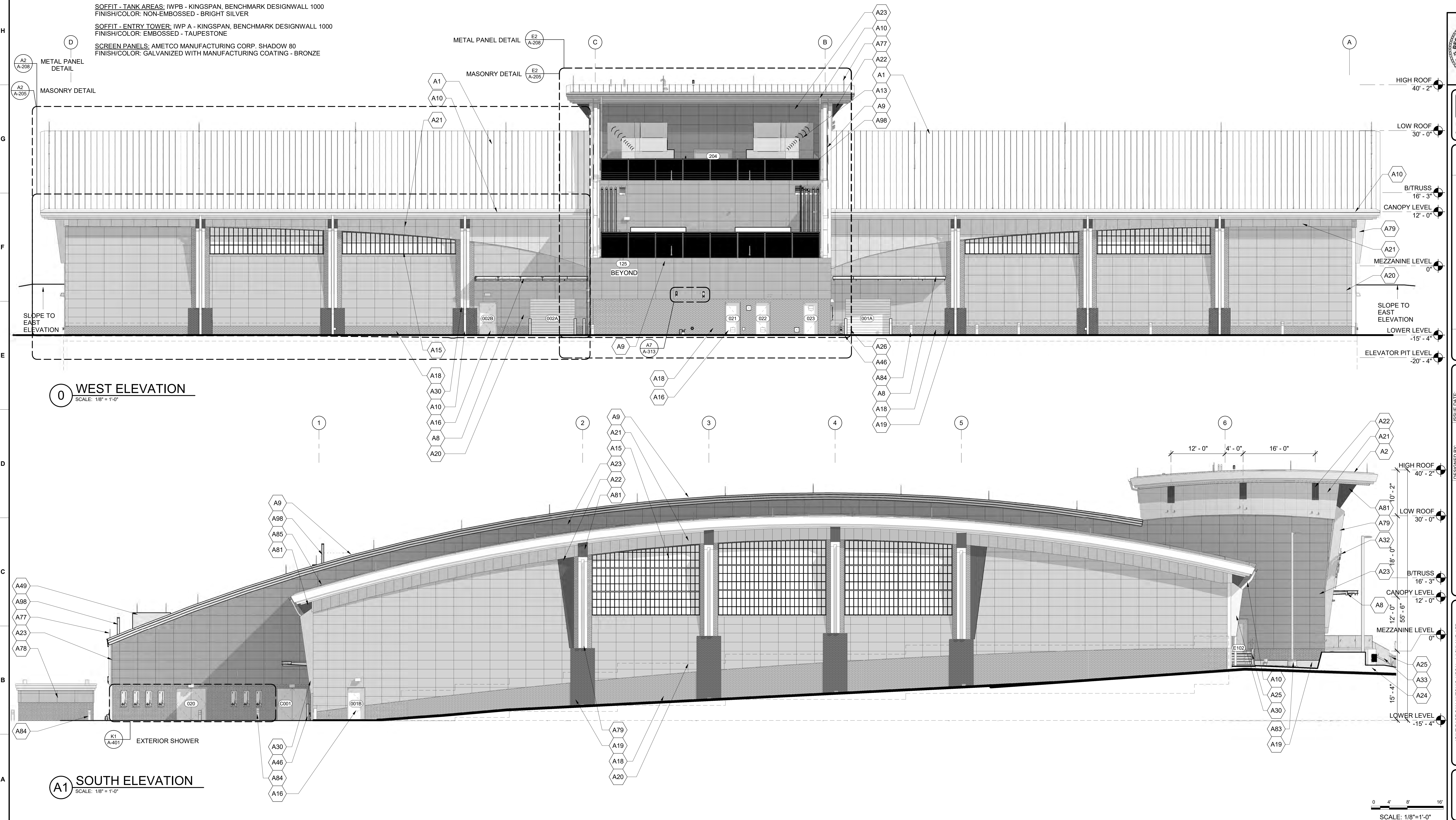
A83 LIGHT POLE, SEE ELECTRICAL.

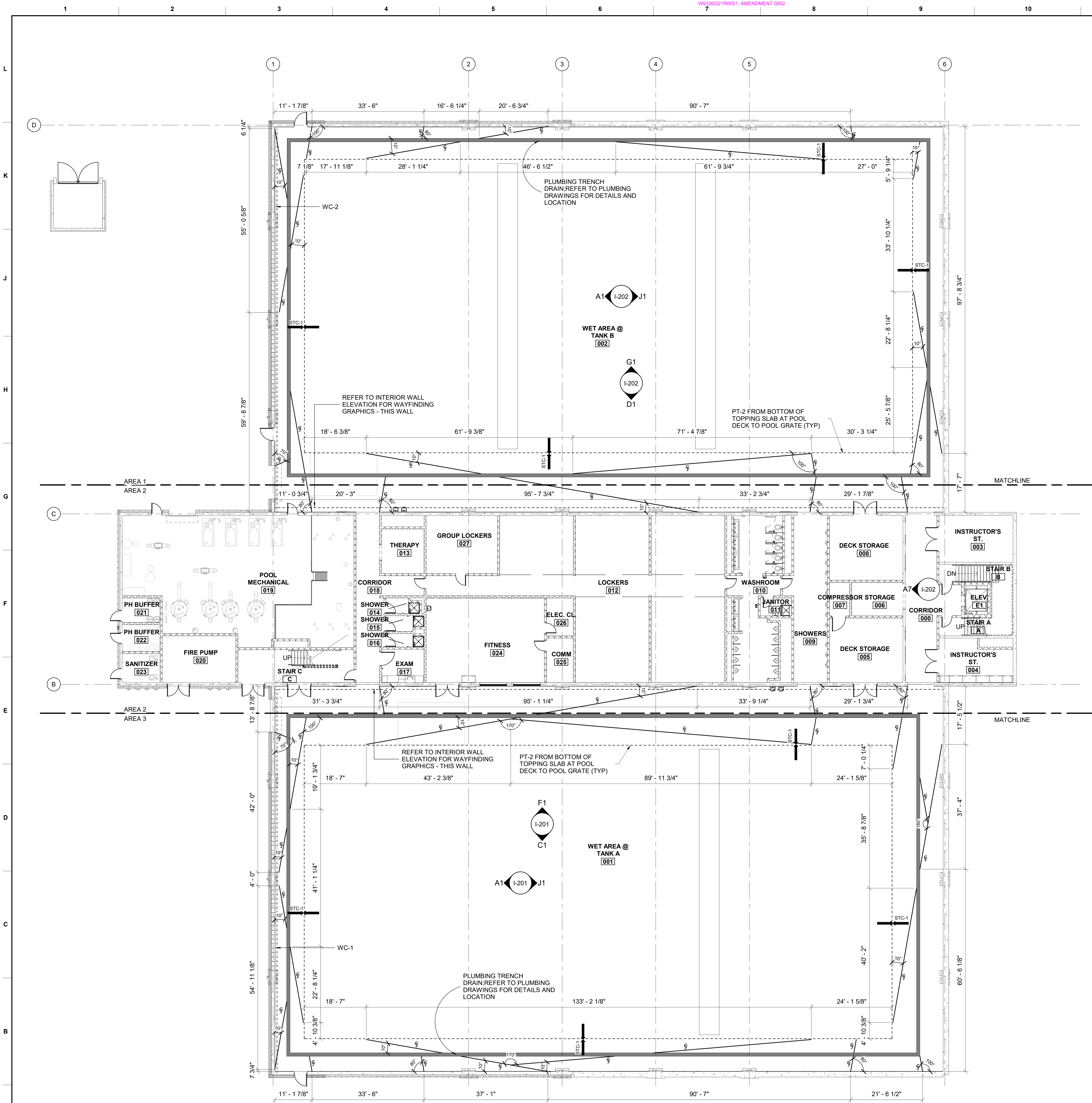
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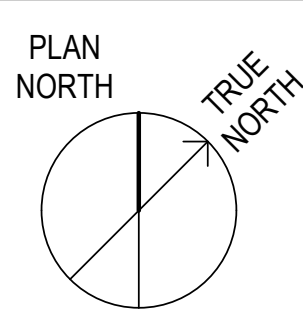
LEVEL 1 (LOWER LEVEL) - COMPOSITE FINISHES
SCALE: 3/32" = 1'-0"

GENERAL NOTES FINISHES

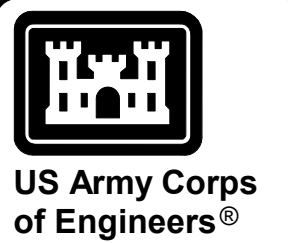
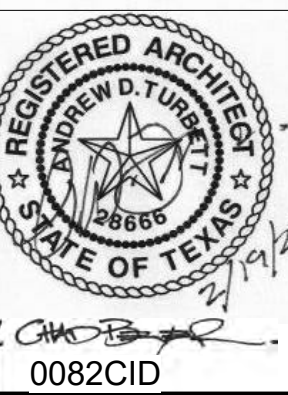
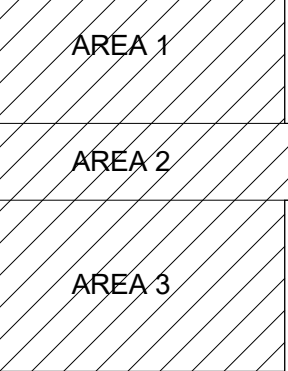
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- CONTRACTORS ARE FREE TO USE ANY PRODUCT WHICH MEETINGS THE GOVERNMENT'S MINIMUM REQUIREMENTS AND NOT IN CONFLICT WITH OTHER CONTRACT PROVISIONS. UNLESS INDICATED OTHERWISE ON THE PLANS OR SPECIFICATIONS, ALL LISTED MANUFACTURERS ARE THE BASIS OF DESIGN. FOR THESE BASIS OF DESIGN PRODUCTS, OTHER MANUFACTURER'S MAY BE SUBSTITUTED AS LONG AS THE STANDARD OF QUALITY AND CHARACTERISTICS OF THE SUBSTITUTED MANUFACTURER MEET OR EXCEED THE STANDARD QUALITY AND CHARACTERISTICS OF THE BASIS OF DESIGN.
- CENTER ALL TRANSITION STRIPS UNDER DOOR UNLESS NOTED OTHERWISE
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- PAINT ALL MIS. ITEMS TO MATCH WALL OR CEILING IN WHICH ITEM OCCURS
- IN ALL RESTROOMS, CEILINGS TO BE A MOISTURE RESISTANT GYPSUM BOARD
- ALL CUSTOM WALL GRAPHICS TO BE COMMERCIAL GRADE TYPE II VINYL, FLEXIBLE SUBSTRATE, FINISH: SMOOTH, BASIS OF DESIGN: MDC STUDIO 20 OZ/LYD, FABRIC BACKED WALLCOVERING. 54" WIDE PRINT WITH MINIMUM 6" IMAGE OVERHANG FOR TRIMMING AND FINISHING. FINAL IMAGE RESOLUTION TO BE 100-200 DPI. HANGING SURFACES TO BE CLEAN, SMOOTH, DRY, AND UNDAMAGED, FREE OF MILDEW AND STRUCTURALLY INTACT. DIGITAL IMAGE FILE AT APPROPRIATE RESOLUTION OF GRAPHIC TO BE PROVIDED TO CONTRACTOR UPON AWARD; REFER TO FINISH PLAN SHEETS I-110 AND I-601 FOR LOCATIONS AND SHEETS I-201 AND I-202 FOR IMAGE AND SIZES
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- FINISH LOCATIONS SPECIFIED IN THE INTERIOR ROOM FINISH SCHEDULE ON SHEET I-601 ARE BASED ON PLAN BUILDING NORTH ORIENTATION.

GENERAL NOTES - POOL DECK

- SYMBOL INDICATES CONTROL JOINT LOCATION



COMPOSITE KEY PLAN



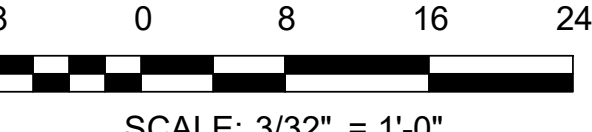
ISSUE DATE	DESCRIPTION
03/29/2021	1. AMENDMENT 002

DESIGNED BY: DRAWN BY: CHECKED BY: APPROVED BY:	ISSUE DATE: SOLUTION NO.: SHEET NO.: CONTRACT NO.:
US ARMY CORPS OF ENGINEERS FORT WORTH DISTRICT FORT WORTH, TEXAS 76102	TECH: [Signature] GROUP: [Signature]

JOINT BASE SAN ANTONIO (JBSA) - LACKLAND AFB SPECIAL WARFARE TRAINING GROUP AQUATIC TRAINING FACILITY PROJECT NUMBER: WFAJ0686A-12 NUMBER: 472496	LEVEL 1 (LOWER LEVEL) - COMPOSITE FINISHES

SHEET ID

I-110



READY TO ADVERTISE

REFER TO FINISH PLANS FOR LOCATIONS AND DETAILS (SHEETS I-110, I-112, I-120, I-122); REFER TO FINISH SCHEDULES FOR SPECIFICATIONS AND MORE INFORMATION (I-601)

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5 PAINT ALL MIS. ITEMS TO MATCH WALL OR CEILING IN WHICH ITEM OCCURS

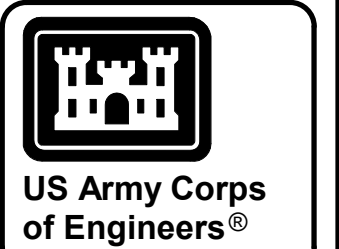
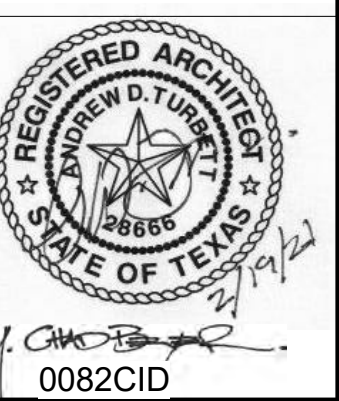
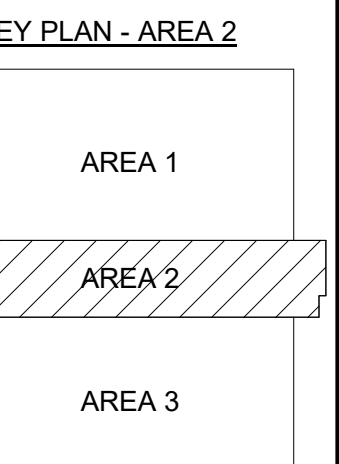
6 IN ALL RESTROOMS, CEILINGS TO BE A MOISTURE RESISTANT GYPSUM BOARD; EPNT-4

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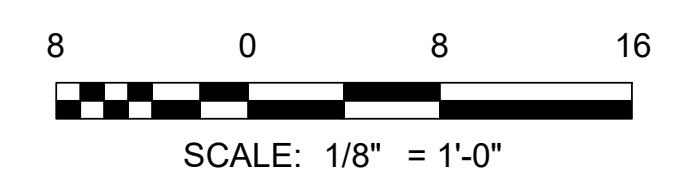
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US ARMY CORPS OF ENGINEERS		DESIGNED BY:	ISSUE DATE:
FORT WORTH, TEXAS		C.BEVER	19 FEB 2021
FORT WORTH, TEXAS 76102		DRAWN BY:	SOLICITATION NO.:
		M.ARMISTEAD	WH126527 R0051
		CHECKED BY:	CONTRACT NO.:
		A.TURBETT	
		APPROVED BY:	
		C.VERMAN	
		SIZE:	
		ANSI	

JOINT BASE SAN ANTONIO (JBSA) - LACKLAND AFB
SPECIAL WARFARE TRAINING GROUP AQUATICS TRAINING FACILITY
PROJECT NUMBER: MPYJ043895A, P2 NUMBER: 472486

112



READY TO ADVERTISE

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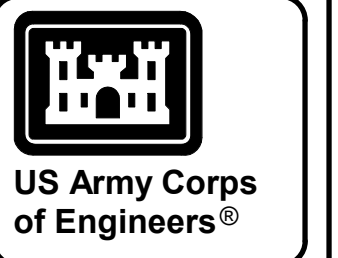
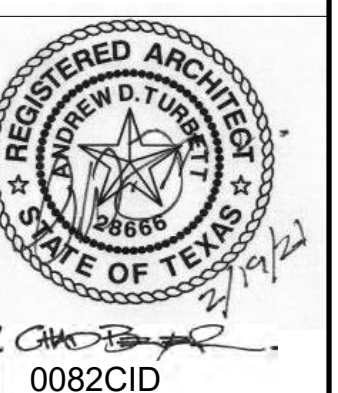
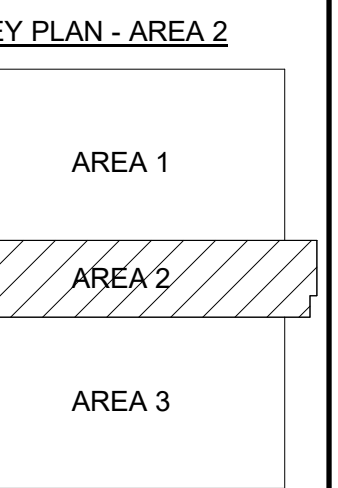
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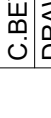
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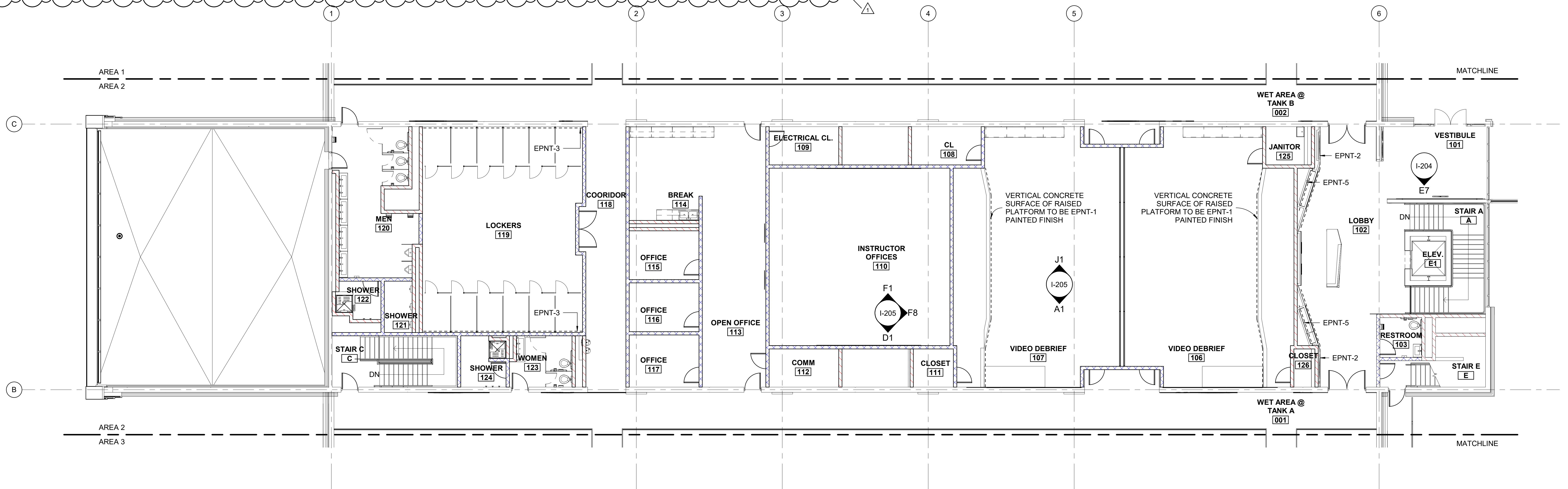
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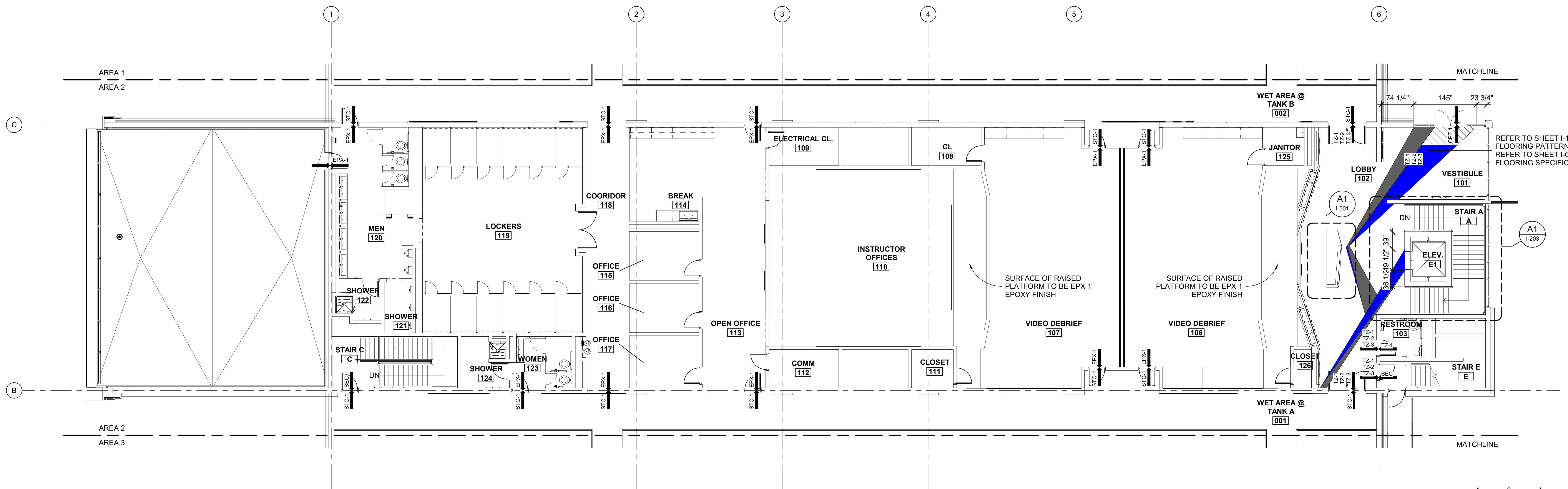
US ARMY CORPS OF ENGINEERS		DESIGNED BY: C.BEVER		ISSUE DATE: 19 FEB 2021	
FORT WORTH DISTRICT		DRAWN BY: C.BEVER		SOLICITATION NO.: W72604-R0051	
FORT WORTH, TEXAS 76102		CHECKED BY: A.TURBET		CONTRACT NO.:	
 		SUBMITTED BY: C.COLEMAN			
TETRA		SIZE:			
CFZ		COUNSLMAN-			
15		DESIGN			
TECH GROUP		HUNSAKER			
ANSI E					

JOINT BASE SAN ANTONIO (JBSA) - LACKLAND AFB
SPECIAL WARFARE TRAINING GROUP AQUATICS TRAINING FACILITY
PROJECT NUMBER: MPYJ043895A; P2 NUMBER: 472496

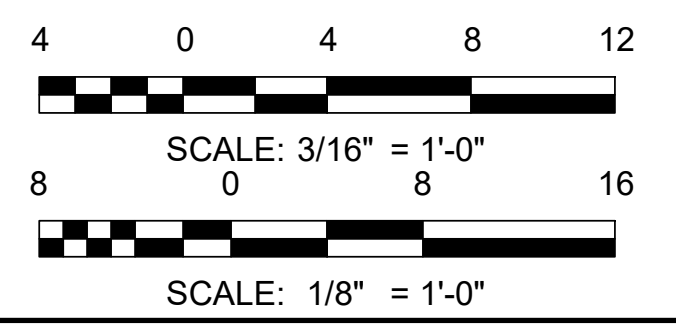
SHEET ID
I-122



(L1) SCALE: 1/8" = 1'-0"



SCALE: 1/8" = 1'-0"



INTERIOR ROOM FINISH SCHEDULE											
LEVEL	ROOM NAME	ROOM NO.	FLOORING		WALL FINISHES				CEILING TYPE	CEILING COLOR	COMMENTS/NOTES
			FLOOR	BASE	NORTH	WEST	SOUTH	EAST			
LEVEL 0	CRAWL SPACE	-	SEC	-	-	-	-	-	-	-	
LOWER LEVEL	CORRIDOR	000	EPX-1	EPXB	EPNT-1	EPNT-1/EPNT-3	EPNT-1	CMU-1	OPEN	EPNT-5	STRIKE LINE HEIGHT ON WALL FOR OPEN CEILING PAINTING AT 12'-0" AFF. UNO; ALUMINUM SCHLUTER TRANSITION STRIP INSTALLED AT DOOR THRESHOLD
LOWER LEVEL	WET AREA @ TANK A	001	STC-1	-	EPNT-1/EPNT-2/EPNT-3/EPNT-8	EPNT-1/EPNT-2	EPNT-1/EPNT-2/CMU-4	WC-2/EPNT-1	OPEN	EPNT-7	SEE INTERIOR ELEVATIONS FOR WALL GRAPHIC IMAGE & SIZE
LOWER LEVEL	WET AREA @ TANK B	002	STC-1	-	EPNT-1/EPNT-2/CMU-4	WC-1/EPNT-1	EPNT-1/EPNT-2	EPNT-1/EPNT-2	OPEN	EPNT-7	SEE INTERIOR ELEVATIONS FOR WALL GRAPHIC IMAGE & SIZE
LOWER LEVEL	INSTRUCTORS STORAGE	003	SEC	-	EPNT-1	CMU-1	EPNT-1	EPNT-1	OPEN	EPNT-5	STRIKE LINE HEIGHT ON WALL FOR OPEN CEILING PAINTING AT 12'-0" AFF. UNO; ALUMINUM SCHLUTER TRANSITION STRIP INSTALLED AT DOOR THRESHOLD
LOWER LEVEL	INSTRUCTORS STORAGE	004	SEC	-	EPNT-1/CMU-3	CMU-1	EPNT-1	EPNT-1	OPEN	EPNT-5	STRIKE LINE HEIGHT ON WALL FOR OPEN CEILING PAINTING AT 12'-0" AFF. UNO; ALUMINUM SCHLUTER TRANSITION STRIP INSTALLED AT DOOR THRESHOLD
LOWER LEVEL	DECK STORAGE	005	EPX-1	EPXB	CMU-1	CMU-1	EPNT-2	EPNT-2	OPEN	EPNT-5	STRIKE LINE HEIGHT ON WALL FOR OPEN CEILING PAINTING AT 12'-0" AFF. UNO; ALUMINUM SCHLUTER TRANSITION STRIP INSTALLED AT DOOR THRESHOLD
LOWER LEVEL	STORAGE	006	EPX-1	EPXB	CMU-1	CMU-1	CMU-1	EPNT-2	OPEN	EPNT-5	STRIKE LINE HEIGHT ON WALL FOR OPEN CEILING PAINTING AT 12'-0" AFF. UNO
LOWER LEVEL	COMPRESSOR	007	EPX-1	EPXB	CMU-1	CMU-1	CMU-1	CMU-1	OPEN	EPNT-5	STRIKE LINE HEIGHT ON WALL FOR OPEN CEILING PAINTING AT 12'-0" AFF. UNO
LOWER LEVEL	DECK STORAGE	008	EPX-1	EPXB	EPNT-1	CMU-1	CMU-1	EPNT-2	OPEN	EPNT-5	STRIKE LINE HEIGHT ON WALL FOR OPEN CEILING PAINTING AT 12'-0" AFF. UNO; ALUMINUM SCHLUTER TRANSITION STRIP INSTALLED AT DOOR THRESHOLD
LOWER LEVEL	SHOWERS	009	EPX-1	EPXB	EPNT-1	CMU-2	EPNT-1	CMU-2	OPEN	EPNT-5	STRIKE LINE HEIGHT ON WALL FOR OPEN CEILING PAINTING AT 12'-0" AFF. UNO
LOWER LEVEL	WASHROOM	010	EPX-1	EPXB	EPNT-1	CMU-2	EPNT-1	CMU-2	MRGWB	EPNT-4	STRIKE LINE HEIGHT ON WALL FOR OPEN CEILING PAINTING AT 12'-0" AFF. UNO
LOWER LEVEL	JANITOR	011	EPX-1	EPXB	CMU-2	CMU-2	CMU-2	CMU-2	OPEN	EPNT-5	STRIKE LINE HEIGHT ON WALL FOR OPEN CEILING PAINTING AT 12'-0" AFF. UNO
LOWER LEVEL	LOCKERS	012	EPX-1	EPXB	EPNT-1	CMU-2	EPNT-1	CMU-2	OPEN	EPNT-5	STRIKE LINE HEIGHT ON WALL FOR OPEN CEILING PAINTING AT 12'-0" AFF. UNO
LOWER LEVEL	THERAPY	013	EPX-1	EPXB	CMU-1	CMU-1	CMU-1	CMU-1	OPEN	EPNT-5	STRIKE LINE HEIGHT ON WALL FOR OPEN CEILING PAINTING AT 12'-0" AFF. UNO
LOWER LEVEL	SHOWER	014	EPX-1	EPXB	CMU-1	CMU-1	CMU-1	CMU-1	MRGWB	EPNT-4	
LOWER LEVEL	SHOWER	015	EPX-1	EPXB	CMU-1	CMU-1	CMU-1	CMU-1	MRGWB	EPNT-4	
LOWER LEVEL	SHOWER	016	EPX-1	EPXB	CMU-1	CMU-1	CMU-1	CMU-1	MRGWB	EPNT-4	
LOWER LEVEL	EXAM	017	EPX-1	EPXB	CMU-1	CMU-1	EPNT-1	CMU-1	ACT-1		
LOWER LEVEL	CORRIDOR	018	EPX-1	EPXB	EPNT-1	CMU-1	EPNT-1	CMU-1	OPEN	EPNT-5	STRIKE LINE HEIGHT ON WALL FOR OPEN CEILING PAINTING AT 12'-0" AFF. UNO; ALUMINUM SCHLUTER TRANSITION STRIP INSTALLED AT DOOR THRESHOLD
LOWER LEVEL	POOL MECHANICAL	019	SEC	-	EPNT-1	EPNT-1	CMU-1	CMU-1	OPEN	EPNT-5	STRIKE LINE HEIGHT ON WALL FOR OPEN CEILING PAINTING AT 12'-0" AFF. UNO
LOWER LEVEL	FIRE PUMP	020	SEC	-	CMU-1	CMU-1	EPNT-1	CMU-1	OPEN	EPNT-5	STRIKE LINE HEIGHT ON WALL FOR OPEN CEILING PAINTING AT 12'-0" AFF. UNO
LOWER LEVEL	PH BUFFER	021	SEC	-	CMU-1	EPNT-1	CMU-1	CMU-1	OPEN	EPNT-5	STRIKE LINE HEIGHT ON WALL FOR OPEN CEILING PAINTING AT 12'-0" AFF. UNO
LOWER LEVEL	PH BUFFER	022	SEC	-	CMU-1	EPNT-1	CMU-1	CMU-1	OPEN	EPNT-5	STRIKE LINE HEIGHT ON WALL FOR OPEN CEILING PAINTING AT 12'-0" AFF. UNO
LOWER LEVEL	SANITIZER	023	SEC	-	CMU-1	EPNT-1	EPNT-1	CMU-1	OPEN	EPNT-5	STRIKE LINE HEIGHT ON WALL FOR OPEN CEILING PAINTING AT 12'-0" AFF. UNO
LOWER LEVEL	FITNESS	024	MAT-1	-	CMU-2/MIRROR	CMU-1	EPNT-1	CMU-2	ACT-1		ALUMINUM SCHLUTER TRANSITION STRIP INSTALLED AT DOOR THRESHOLD
LOWER LEVEL	COMM	025	SEC	-	CMU-2	CMU-2	CMU-2	CMU-2	OPEN	EPNT-5	STRIKE LINE HEIGHT ON WALL FOR OPEN CEILING PAINTING AT 12'-0" AFF. UNO; ALUMINUM SCHLUTER TRANSITION STRIP INSTALLED AT DOOR THRESHOLD
LOWER LEVEL	ELEC. CL.	026	SEC	-	CMU-2	CMU-2	EPNT-1	CMU-2	OPEN	EPNT-5	STRIKE LINE HEIGHT ON WALL FOR OPEN CEILING PAINTING AT 12'-0" AFF. UNO
LOWER LEVEL	GROUP LOCKERS	027	EPX-1	EPXB	EPNT-1	CMU-1	CMU-1	CMU-2	OPEN	EPNT-5	STRIKE LINE HEIGHT ON WALL FOR OPEN CEILING PAINTING AT 12'-0" AFF. UNO
MECHANICAL PLATFORM LEVEL	ELECTRICAL	201	SEC	RB-1	EPNT-1	EPNT-1	CMU-3	EPNT-1	OPEN	EPNT-5	STRIKE LINE HEIGHT ON WALL FOR OPEN CEILING PAINTING AT 12'-0" AFF. UNO
MECHANICAL PLATFORM LEVEL	VESTIBULE	202	SEC	RB-1	CMU-3	EPNT-1	EPNT-1	CMU-3	OPEN	EPNT-5	STRIKE LINE HEIGHT ON WALL FOR OPEN CEILING PAINTING AT 12'-0" AFF. UNO
MECHANICAL PLATFORM LEVEL	MECH. HOT WATER	203	SEC	RB-1	EPNT-1	EPNT-1	EPNT-1	EPNT-1	OPEN	EPNT-5	STRIKE LINE HEIGHT ON WALL FOR OPEN CEILING PAINTING AT 12'-0" AFF. UNO

INTERIOR FINISH LEGEND				COMMENTS	
CODE	MATERIAL	MANUFACTURER	DESCRIPTION		
ACT-1	ACOUSTICAL CEILING TILE	ARMSTRONG	LYRA PLANT BASED 8360PB, 24X48X1 SQUARE REGULAR LAY IN TILE, COLOR BLACK; SUSPENDED FROM 15/16" EXPOSED TEE GRID, COLOR BLACK	CEILING TILE IN PRIVATE OFFICES, OPEN OFFICE, BREAK & FITNESS AREA	
ACT-2	ACOUSTICAL CEILING TILE - BLADE	ARMSTRONG	METALWORKS BLADES CLASSIC 8155M1, 4X22.5X1 METAL BLADE @ 6" O.C. TYP. COLOR SILVERLUME, SUSPENDED FROM PRELUDE 360 15/16" SUSPENSION SYSTEM	CEILING TILE IN LOBBY AREA ONLY; REFER TO REFLECTED CEILING PLAN FOR LOCATION & HEIGHT	
AP-3	ACOUSTICAL PANEL	3FORM	24"W X 24"W SQUARE HUSH BLOCK SOUND ABSORBING SHAPES, ADMIRAL SOLA FELT PANELS WALL MOUNTED	REFER TO ACOUSTICAL WALL ELEVATIONS FOR HUSH BLOCK PLACEMENT; SHEET I-205	
AP-4	ACOUSTICAL PANEL	3FORM	12"W X 24"W RECTANGLE HUSH BLOCK SOUND ABSORBING SHAPES, ADMIRAL SOLA FELT PANELS WALL MOUNTED	REFER TO ACOUSTICAL WALL ELEVATIONS FOR HUSH BLOCK PLACEMENT; SHEET I-205	
AP-5	ACOUSTICAL PANEL	3FORM	24"W X 24"W TRIANGLE HUSH BLOCK SOUND ABSORBING SHAPES, ADMIRAL SOLA FELT PANELS WALL MOUNTED	REFER TO ACOUSTICAL WALL ELEVATIONS FOR HUSH BLOCK PLACEMENT; SHEET I-205	
AP-6	ACOUSTICAL PANEL	3FORM	24"W X 24"W SQUARE HUSH BLOCK SOUND ABSORBING SHAPES, MINERAL SOLA FELT PANELS WALL MOUNTED	REFER TO ACOUSTICAL WALL ELEVATIONS FOR HUSH BLOCK PLACEMENT; SHEET I-205	
AP-7	ACOUSTICAL PANEL	3FORM	12"W X 24"W RECTANGLE HUSH BLOCK SOUND ABSORBING SHAPES, MINERAL SOLA FELT PANELS WALL MOUNTED	REFER TO ACOUSTICAL WALL ELEVATIONS FOR HUSH BLOCK PLACEMENT; SHEET I-205	
AP-8	ACOUSTICAL PANEL	3FORM	24"W X 24"W TRIANGLE HUSH BLOCK SOUND ABSORBING SHAPES, MINERAL SOLA FELT PANELS WALL MOUNTED	REFER TO ACOUSTICAL WALL ELEVATIONS FOR HUSH BLOCK PLACEMENT; SHEET I-205	
AP-9	ACOUSTICAL PANEL	3FORM	24"W X 24"W SQUARE HUSH BLOCK SOUND ABSORBING SHAPES, NICKEL SOLA FELT PANELS WALL MOUNTED	REFER TO ACOUSTICAL WALL ELEVATIONS FOR HUSH BLOCK PLACEMENT; SHEET I-205	
AP-10	ACOUSTICAL PANEL	3FORM	12"W X 24"W RECTANGLE HUSH BLOCK SOUND ABSORBING SHAPES, NICKEL SOLA FELT PANELS WALL MOUNTED	REFER TO ACOUSTICAL WALL ELEVATIONS FOR HUSH BLOCK PLACEMENT; SHEET I-205	
AP-11	ACOUSTICAL PANEL	3FORM	24"W X 24"W TRIANGLE HUSH BLOCK SOUND ABSORBING SHAPES, NICKEL SOLA FELT PANELS WALL MOUNTED	REFER TO ACOUSTICAL WALL ELEVATIONS FOR HUSH BLOCK PLACEMENT; SHEET I-205	
AP-12	ACOUSTICAL PANEL	3FORM - LIGHTART	54"W X 96"L WING SUSPENDED CEILING CLOUD, SQUARE, CITRINE SOLA FELT PANEL WITH SUSPENDED CABLE SYSTEM	REFER TO ACOUSTICAL WALL ELEVATIONS FOR HUSH BLOCK PLACEMENT; SHEET I-205	
CMU-1	GLAZED CMU BLOCK	ECHOLON ASTRA-GLAZE	8"TX16"TX12"W NOMINAL PLAIN PRE-FACED BLOCK, SATIN FINISH, RUNNING BOND INSTALLATION; COLOR: SILVER GRAY	REFER TO WALL FINISH PLAN FOR SINGLE VS DOUBLE SIDED COLOR LOCATIONS AND CLARIFICATION, SHEET I-112 & I-122	
CMU-2	GLAZED CMU BLOCK	ECHOLON ASTRA-GLAZE	8"TX16"TX12"W NOMINAL PLAIN PRE-FACED BLOCK, SATIN FINISH, RUNNING BOND INSTALLATION; COLOR: EARL GREY	REFER TO WALL FINISH PLAN FOR SINGLE VS DOUBLE SIDED COLOR LOCATIONS AND CLARIFICATION, SHEET I-112 & I-122	
CMU-3	GLAZED CMU BLOCK	ECHOLON ASTRA-GLAZE	8"TX16"TX12"W NOMINAL PLAIN PRE-FACED BLOCK, SATIN FINISH, RUNNING BOND INSTALLATION; COLOR: COSMIC BLUE	REFER TO WALL FINISH PLAN FOR SINGLE VS DOUBLE SIDED COLOR LOCATIONS AND CLARIFICATION, SHEET I-112 & I-122	
CMU-4	ACOUSTICAL CMU BLOCK	ECHOLON ACOUSTA-WALL	8"TX16"TX12"W NOMINAL PLAIN PRE-FACED BLOCK, SMOOTH FINISH, RUNNING BOND INSTALLATION; COLOR: HILLCREST GRAY		
CONC	CONCRETE TROUGH SINK	TRUEFORM	CONCRETE COLOR: CHARCOAL, SINK STYLE: RAMP, DRAIN FINISH: POLISHED; 60" ADA VANITIES TO RECEIVE (2) FAUCETS, 30" ADA VANITY TO RECEIVE (1) FAUCET	TYP. RESTROOM LAVATORY	
CPT-1	WALK OFF CARPET	J&J CARPET	INCognito MODULAR 1838 ESPIONAGE	RECESSED WALK OFF CARPET IN LOBBY; REFER TO THIS SHEET FOR SIZE & SHAPE AND REFER TO ARCHITECTURAL DRAWINGS FOR DETAILS	
ELEV-1	ELEVATOR CAB WALLS	THYSSENKRUPP	POWDER COATED STEEL, COLOR: SMOKED SILVER	REFER TO ELEVATOR DETAILS FOR FINISH LOCATION INFORMATION	
ELEV-2	ELEVATOR CAB BASE	THYSSENKRUPP	POWDER COATED STEEL, COLOR: CHALKBOARD	REFER TO ELEVATOR DETAILS FOR FINISH LOCATION INFORMATION	
ELEV-3	ELEVATOR CAB CEILING	THYSSENKRUPP	POWDER COATED STEEL, COLOR: SMOKED SILVER	REFER TO ELEVATOR DETAILS FOR FINISH LOCATION INFORMATION	
EPNT-1	EPOXY PAINT	SHERWIN WILLIAMS	SW 7673 PEWTER CAST	FIELD PAINT	
EPNT-2	EPOXY PAINT	SHERWIN WILLIAMS	SW 6524 COMMODORE	ACCENT PAINT	
EPNT-3	EPOXY PAINT	SHERWIN WILLIAMS	SW 7069 IRON ORE	ACCENT WALL PAINT & COLOR FOR POOL LANE MARKERS	
EPNT-4	EPOXY PAINT	SHERWIN WILLIAMS	SW 7047 PORPOISE	GYPSUM BOARD CEILINGS & SOFFITS	
EPNT-5	EPOXY PAINT	SHERWIN WILLIAMS	SW 6238 ICICLE	DOORS & DOOR FRAMES & EXPOSED STRUCTURE	
EPNT-6	EPOXY PAINT	SHERWIN WILLIAMS	SW 5907 FORSYTHIA	SUSPENDED CATWALK METAL GRATE AND METAL PAN STAIR FRAMES	
EPNT-7	EPOXY PAINT	SHERWIN WILLIAMS	HYBRIFLEX EC, 3/16" FLOOR SYSTEM: POLY CRETE SL BODY WITH CHIP BROADCAST, (1) DUR-A-GLAZE #4 TOPCOAT, ARMOR TOP GLOSS WITH GRIT; COLOR: OCEAN MICROCHIP	UNDERSIDE OF ROOF DECKING & POOL BULKHEAD METAL GRATE & VERTICAL CATWALK STRUCTURE	
EPX-1	EPOXY FLOORING	DUR-A-FLEX	HYBRIFLEX EC, 3/16" FLOOR SYSTEM: POLY CRETE SL BODY WITH CHIP BROADCAST, (1) DUR-A-GLAZE #4 TOPCOAT, ARMOR TOP GLOSS WITH GRIT; COLOR: OCEAN MICROCHIP	SUSPENDED CATWALK METAL GRATE UNDER FRAME	
EPXB	INTEGRATED EPOXY BASE	DUR-A-FLEX	HYBRIFLEX EC, POLY CRETE SL BODY WITH CHIP BROADCAST, (1) DUR-A-GLAZE #4 TOPCOAT, ARMOR TOP GLOSS WITH GRIT; COLOR: OCEAN MICROCHIP	TYPICAL EPOXY FLOORING	
MAT-1	INTERLOCKING RUBBER MAT FLOORING	AMERICAN FLOOR MATS	24"X24"X1" SQUARE TILE, SOLID BLACK/DARK GRAY/LIGHT GRAY, 95% COLOR FILL	TYP INTEGRATED BASE AT ALL WET AREAS WITH EPOXY FLOORING AND EXAM ROOM	
MIRROR	HIGH DEFINITION WALL MIRROR		48"X34"X1/4" HD TEMPERED GLASS WALL MIRROR WITH SAFETY BACKING	FITNESS AREA FLOORING	
MR-1	CMU MORTAR	I.DESIGN FLAMINGO BRIXMENT	X-25 CHARCOAL	FITNESS AREA WALL	
MRGWB	MOISTURE RESISTANT GYPSUM BOARD			TYP FOR ALL GLAZED CMU BLOCK	
PL-1	PLASTIC LAMINATE	CHEMETAL	#917 BRUSHED BLACK ALUMINUM	TYPICAL IN ALL WET AREAS	
PL-2	PLASTIC LAMINATE	WILSONART	#6281 SATIN BRUSHED SMOKE ALUMINUM	RECEPTION DESK BASE	
PL-3	PLASTIC LAMINATE	WILSONART	INDIGO D379-60; LINEARITY FINISH	RECEPTION DESK ACCENT	
PL-4	PLASTIC LAMINATE	WILSONART	7965K-12 WALNUT HEIGHTS; SOFTGRAIN FINISH	BREAK ROOM CASEWORK	
PL-5	PLASTIC LAMINATE	WILSONART	NORTH SEA D90-60; MATTE FINISH	RECEPTION DESK COUNTERTOP	
POOL	POOL TANK CONCRETE	SOUTHERN GROUT & MORTAR	EXPOSED AGGREGATE FINISH; COOL BLUE COLOR	VIDEO DEBRIEF, EXAM, FITNESS, STORAGE CASEWORK	
PT-1	CERAMIC TILE MOSAIC	DALTILE	KEYSTONES MOSAICS, 1X1X1/4 STRAIGHT JOINT PATTERN - 12X24 SHEET, BLACK D311	TYP POOL FINISH WALLS AND FLOOR	
PT-2	CERAMIC TILE MOSAIC	DALTILE	KEYSTONES MOSAICS, 2X2X1/4 STRAIGHT JOINT PATTERN - 12X24 SHEET, BEACH BLEND DK04: 33% D200 DESERT GRAY SPECKLE, 33% D209 NAVY SPECKLE, 34% D023 GALAXY	POOL FLOOR LANE MARKER, POOL TOE LEDGE, UNDERWATER POOL SHELF EDGE, POOL WALL TARGETS; REFER TO POOL DRAWINGS AND DETAILS FOR LOCATION DETAILS	
QZ-1	QUARTZ	HANSTONE QUARTZ	SILHOUETTE MV628	POOL LEDGE WALL ABOVE GRATE, BAND BELOW GUTTER LIP; REFER TO POOL DRAWINGS AND DETAILS FOR LOCATION DETAILS	
RB-1	RUBBER BASE	ROPPE	150 DARK GRAY, 700 SERIES	RECEPTION DESK TRANSITION COUNTERTOP & LEDGE	
SEC	SEALED CONCRETE		UNFINISHED CONCRETE SURFACES TO BE SEALED PRIOR TO ANY FINISH BEING APPLIED	WALL BASE, ALL AREAS EXPECT WET AREAS	
SKYFOLD	SKYFOLD WALL PARTITION FABRIC	BURCH FABRICS	STYLE DUNE, COLOR: 1215 RAVEN	TYP ALL CONCRETE SURFACES	
SPL-1	SIGNAGE LAMINATE FINISH	FORMICA	CITADEL 1097, MICRODOT	SIGNAGE FACE MATERIAL	
SPL-2	SIGNAGE LAMINATE FINISH	FORMICA	BLACK 909, MICRODOT	SIGNAGE BACKER MATERIALS	
SPL-3	SIGNAGE LAMINATE FINISH	FORMICA	DECOMETAL POLISHED ALUMINUM, SOLID METAL M610	SIGNAGE METAL ACCENT	
SPL-4	SIGNAGE LAMINATE FINISH	FORMICA	BLACK 909, SOLID	SIGNAGE RAISED TEXT	
SS-1	SOLID SURFACE	LIVINGSTONE	L714 RAIN DANCE	BREAK ROOM COUNTERTOPS	
SS-2	SOLID SURFACE	LIVINGSTONE	L715 ECLIPSE	VIDEO DEBRIEF, EXAM, FITNESS, STORAGE COUNTERTOP	
STC-1	STAINED CONCRETE - INTEGRAL	BUTTERFIELD COLOR	UN-MIX INTERGRAL CONCRETE COLOR, U29 SOAPSTONE	POOL DECK FINISH; SEE FINISH PLAN FOR CONTROL JOINT PATTERN	
STC-2	STAINED CONCRETE - APPLIED	SHERWIN WILLIAMS	INFUSION WATER BASED SEMI-TRANSPARENT DECORATIVE STAIN, TUMBLED STONE 45.11034-16	SURROUND POOL WALL FINISH; SEE INTERIOR ELEVATIONS FOR JOINT PATTERNS	
STONE	DECORATIVE WALL STONE	ARCUSSTONE	COLOR: SLATE 30, CUSTOM ARCUSSTONECOAT PRECOATED CAST SHAPES APPLIED OVER ARCUSSTONEPLASTER	DESIGN PROVIDED BY DESIGNER; CONTRACTOR TO PREPARE WALL SURFACE FOR MATERIALS PER MANUFACTURER'S GUIDELINES	
TP-1	TOILET PARTITIONS	BRADLEY CORP	STAINLESS STEEL TEXTURED FINISH CEILING MOUNTED PARTITIONS	TYPICAL	
TZ-1	TERRAZZO FLOORING	TERRAZZO BRAND PRODUCTS	ARCHITECTURAL SERIES 1.1, SEMI EXOTIC #1776	LOBBY/VESTIBULE & STAIR 'A' FLOORING; FLOOR FINISH PLAN FOR DETAILS	
TZ-2	TERRAZZO FLOORING	TERRAZZO BRAND PRODUCTS	ARCHITECTURAL SERIES 1.1, STANDARD # 52	LOBBY/VESTIBULE FLOORING; FLOOR FINISH PLAN FOR DETAILS	
TZ-3	TERRAZZO FLOORING	TERRAZZO BRAND PRODUCTS	ARCHITECTURAL SERIES 1.1, EXOTIC #395	LOBBY/VESTIBULE FLOORING; FLOOR FINISH PLAN FOR DETAILS	
WC-1	WALL COVERING	MDC STUDIO	DIGIPSV DIGITAL PRESSURE SENSITIVE 3M ENVISION FILM, 48" WIDE PRINT, 2 MIL THICK, PRESSURE ACTIVATED ADHESIVE BACKING	CUSTOM IMAGE GRAPHIC	
WC-2	WALL COVERING	MDC STUDIO	DIGIPSV DIGITAL PRESSURE SENSITIVE 3M ENVISION FILM, 48" WIDE PRINT, 2 MIL THICK, PRESSURE ACTIVATED ADHESIVE BACKING	CUSTOM IMAGE GRAPHIC	

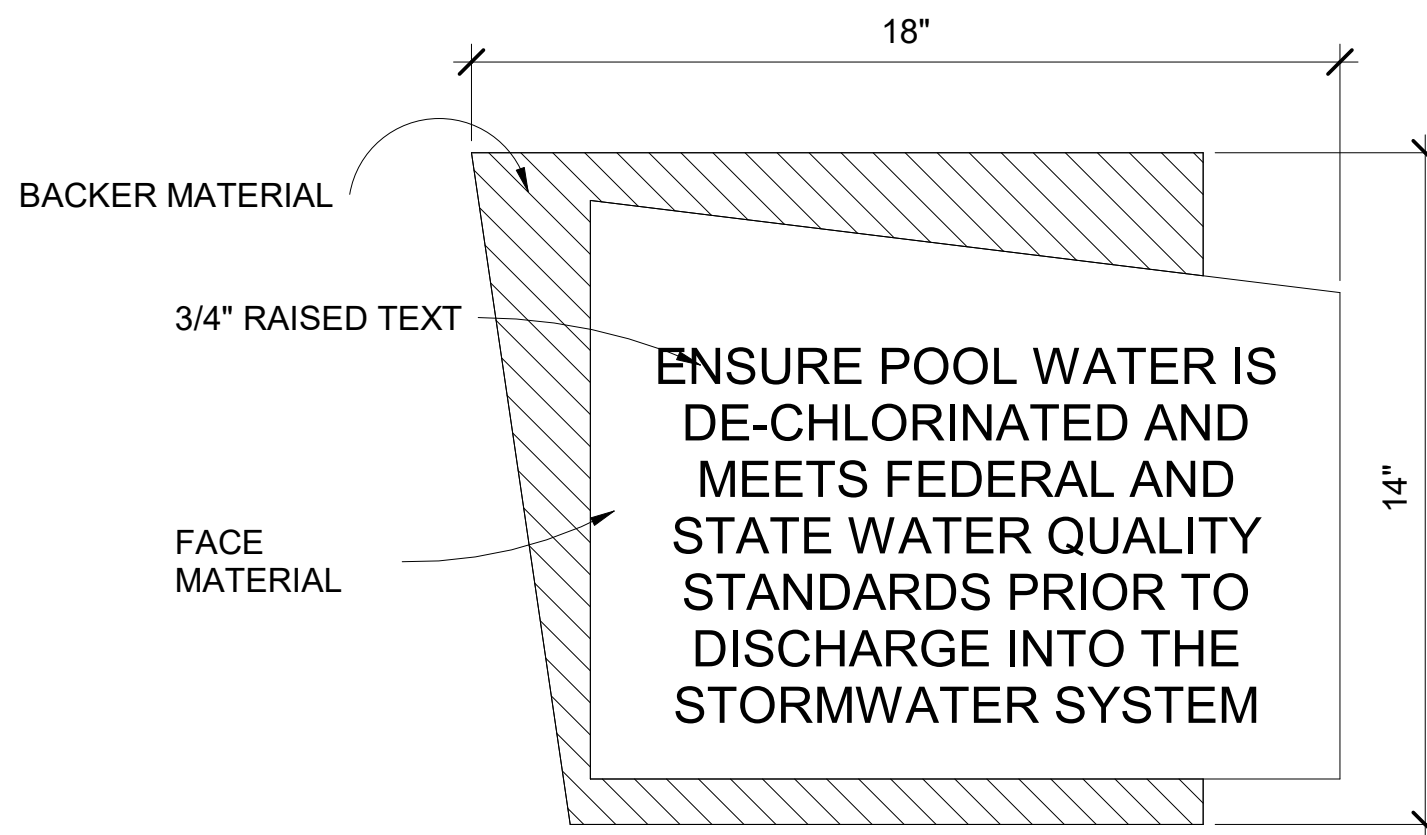
MEZT. ABENDT 002			8			9			10			11			12			13		
INTERIOR ROOM FINISH SCHEDULE																				
LEVEL	ROOM NAME	ROOM NO.	FLOORING		WALL FINISHES				CEILING TYPE	CEILING COLOR	COMMENTS/NOTES									
			FLOOR	BASE	NORTH	WEST	SOUTH	EAST												
MECHANICAL PLATFORM LEVEL	MECH. PLATFORM	204	SEC	RB-1	EPNT-1	EPNT-1	EPNT-1	EPNT-1	OPEN	EPNT-5	STRIKE LINE HEIGHT ON WALL FOR OPEN CEILING PAINTING AT 12'-0" AFF. UNO									
MEZZANINE LEVEL	VESTIBULE	101	TZ-1/TZ-2/TZ-3/CPT-1	TZ-1	EPNT-1	EPNT-1	EPNT-1	-	OPEN/MRGWB	EPNT-5	STRIKE LINE HEIGHT ON WALL FOR OPEN CEILING PAINTING AT 16'-0" AFF. UNO									
MEZZANINE LEVEL	LOBBY	102	TZ-1/TZ-2/TZ-3	TZ-1	EPNT-1	EPNT-2	EPNT-1	EPNT-1/CMU-3	ACT-1/ACT-3		ACT-3 INSTALLED IN LOWER CEILING OVER RECEPTION DESK - SEE REFLECTED CEILING PLAN FOR LOCATION; ALUMINUM SCHLUTER TRANSITION STRIP INSTALLED AT DOOR THRESHOLD									
MEZZANINE LEVEL	RESTROOM	103	TZ-1	TZ-1	CMU-3	CMU-3	CMU-3	CMU-3	MRGWB	EPNT-4	STRIKE LINE HEIGHT ON WALL FOR OPEN CEILING PAINTING AT 12'-0" AFF. UNO; ALUMINUM SCHLUTER TRANSITION STRIP INSTALLED AT DOOR THRESHOLD									
MEZZANINE LEVEL	BALCONY B	104	STC-1	-	-	-	-	-	OPEN	EPNT-5	STRIKE LINE HEIGHT ON WALL FOR OPEN CEILING PAINTING AT 12'-0" AFF. UNO; ALUMINUM SCHLUTER TRANSITION STRIP INSTALLED AT DOOR THRESHOLD									
MEZZANINE LEVEL	BALCONY A	105	STC-1	-	-	-	-	-	OPEN	EPNT-5	STRIKE LINE HEIGHT ON WALL FOR OPEN CEILING PAINTING AT 12'-0" AFF. UNO; ALUMINUM SCHLUTER TRANSITION STRIP INSTALLED AT DOOR THRESHOLD									
MEZZANINE LEVEL	VIDEO DEBRIEF	106	EPX-1	RB-1	EPNT-1/AP-3-11	CMU-1	EPNT-1/AP-3-11	CMU-1	ACT-1/MRGWB/AP-1	EPNT-4	REFER TO I-130 FOR AP-1 LAYOUT; SEE ACOUSTICAL WALL ELEVATIONS FOR HUSH BLOCK PLACEMENTS; ALUMINUM SCHLUTER TRANSITION STRIP INSTALLED AT DOOR THRESHOLD									
MEZZANINE LEVEL	VIDEO DEBRIEF	107	EPX-1	RB-1	EPNT-1/AP-3-11	CMU-1	EPNT-1/AP-3-11	CMU-1	ACT-1/MRGWB/AP-1	EPNT-4	REFER TO I-130 FOR AP-1 LAYOUT; SEE ACOUSTICAL WALL ELEVATIONS FOR HUSH BLOCK PLACEMENTS; ALUMINUM SCHLUTER TRANSITION STRIP INSTALLED AT DOOR THRESHOLD									
MEZZANINE LEVEL	CL	108	EPX-1	RB-1	EPNT-1	CMU-1	CMU-1	CMU-1	OPEN	EPNT-5	STRIKE LINE HEIGHT ON WALL FOR OPEN CEILING PAINTING AT 12'-0" AFF. UNO									
MEZZANINE LEVEL	ELECTRICAL CL.	109	EPX-1	RB-1	EPNT-1	CMU-1	CMU-1	CMU-1	OPEN	EPNT-5	STRIKE LINE HEIGHT ON WALL FOR OPEN CEILING PAINTING AT 12'-0" AFF. UNO									
MEZZANINE LEVEL	INSTRUCTOR OFFICE	110	EPX-1	RB-1	CMU-1/AP-3-11	CMU-1/AP-3-11	CMU-1/AP-3-11	CMU-1	ACT-1/AP-1	EPNT-5	REFER TO I-130 FOR AP-1 LAYOUT; SEE ACOUSTICAL WALL ELEVATIONS FOR HUSH BLOCK PLACEMENTS									
MEZZANINE LEVEL	RAMP	111	EPX-1	RB-1	CMU-1	CMU-1	EPNT-1	CMU-1	OPEN	EPNT-5	STRIKE LINE HEIGHT ON WALL FOR OPEN CEILING PAINTING AT 12'-0" AFF. UNO									
MEZZANINE LEVEL	COMM	112	EPX-1	RB-1	CMU-1	CMU-1	EPNT-1	CMU-1	OPEN		STRIKE LINE HEIGHT ON WALL FOR OPEN CEILING PAINTING AT 12'-0" ABOVE HIGHEST POINT									
MEZZANINE LEVEL	OPEN OFFICE	113	EPX-1	RB-1	EPNT-1	CMU-1	EPNT-1	CMU-1	ACT-1		ALUMINUM SCHLUTER TRANSITION STRIP INSTALLED AT DOOR THRESHOLD									
MEZZANINE LEVEL	BREAK OFFICE	114	EPX-1	RB-1	EPNT-1	CMU-2	CMU-1	-	ACT-1											
MEZZANINE LEVEL	OFFICE	115	EPX-1	RB-1	CMU-1	CMU-2	CMU-1	CMU-1	ACT-1											
MEZZANINE LEVEL	OFFICE	116	EPX-1	RB-1	CMU-1	CMU-2	CMU-1	CMU-1	ACT-1											
MEZZANINE LEVEL	OFFICE	117	EPX-1	RB-1	CMU-1	CMU-2	EPNT-1	CMU-1	ACT-1											
MEZZANINE LEVEL	CORRIDOR	118	EPX-1	RB-1	EPNT-1	CMU-2	EPNT-1	CMU-2	OPEN	EPNT-5	STRIKE LINE HEIGHT ON WALL FOR OPEN CEILING PAINTING AT 12'-0" AFF. UNO; ALUMINUM SCHLUTER TRANSITION STRIP INSTALLED AT DOOR THRESHOLD									
MEZZANINE LEVEL	LOCKERS	119	EPX-1	RB-1	EPNT-3	CMU-2	CMU-2	CMU-2	OPEN	EPNT-5	STRIKE LINE HEIGHT ON WALL FOR OPEN CEILING PAINTING AT 12'-0" AFF. UNO									
MEZZANINE LEVEL	MEN	120	EPX-1	EPXB	EPNT-1	CMU-2	CMU-2	CMU-2	MRGWB	EPNT-4	ALUMINUM SCHLUTER TRANSITION STRIP INSTALLED AT DOOR THRESHOLD									
MEZZANINE LEVEL	SHOWER	121	EPX-1	EPXB	CMU-2	CMU-2	CMU-2	CMU-2	MRGWB	EPNT-4										
MEZZANINE LEVEL	SHOWER	122	EPX-1	EPXB	CMU-2	CMU-2	CMU-2	CMU-2	MRGWB	EPNT-4										
MEZZANINE LEVEL	WOMEN	123	EPX-1	EPXB	CMU-2	CMU-2	EPNT-1	CMU-2	MRGWB	EPNT-4	ALUMINUM SCHLUTER TRANSITION STRIP INSTALLED AT DOOR THRESHOLD									
MEZZANINE LEVEL	SHOWER	124	EPX-1	EPXB	CMU-2	CMU-2	EPNT-1	CMU-2	MRGWB	EPNT-4										
MEZZANINE LEVEL	JANITOR	125	EPX-1	EPXB	EPNT-1	CMU-1	CMU-1	CMU-1	OPEN	EPNT-5	STRIKE LINE HEIGHT ON WALL FOR OPEN CEILING PAINTING AT 12'-0" AFF. UNO									
MEZZANINE LEVEL	RAMP	126	EPX-1	RB-1	CMU-1	CMU-1	EPNT-1	CMU-1	OPEN	EPNT-5	STRIKE LINE HEIGHT ON WALL FOR OPEN CEILING PAINTING AT 12'-0" AFF. UNO									
MEZZANINE LEVEL	STAIR A	A	TZ-1	TZ-1	CMU-1	CMU-3	CMU-3	EPNT-1	ACT-1		STRIKE LINE HEIGHT ON WALL FOR OPEN CEILING PAINTING AT 12'-0" ABOVE HIGHEST POINT									
MEZZANINE LEVEL	STAIR B	B	SEC	RB-1	EPNT-1	CMU-1	CMU-3	CMU-1	MRGWB	EPNT-4										
MEZZANINE LEVEL	STAIR C	C	SEC	RB-1	CMU-2	CMU-1	EPNT-1	CMU-1	MRGWB	EPNT-4	ALUMINUM SCHLUTER TRANSITION STRIP INSTALLED AT DOOR THRESHOLD									
MEZZANINE LEVEL	STAIR E	E	SEC	RB-1	CMU-3	CMU-3	EPNT-1	EPNT-1	MRWWB	EPNT-4	ALUMINUM SCHLUTER TRANSITION STRIP INSTALLED AT DOOR THRESHOLD									
MEZZANINE LEVEL	ELEV. CAB	E1	TZ-1	ELEV-2	ELEV-1	ELEV-1	ELEV-1	ELEV-1	ELEV-3		ALL BASE, WALL, AND CEILING FINISHES ARE BY THE ELEVATOR MANUFACTURER									

SIGN TYPE SCHEDULE

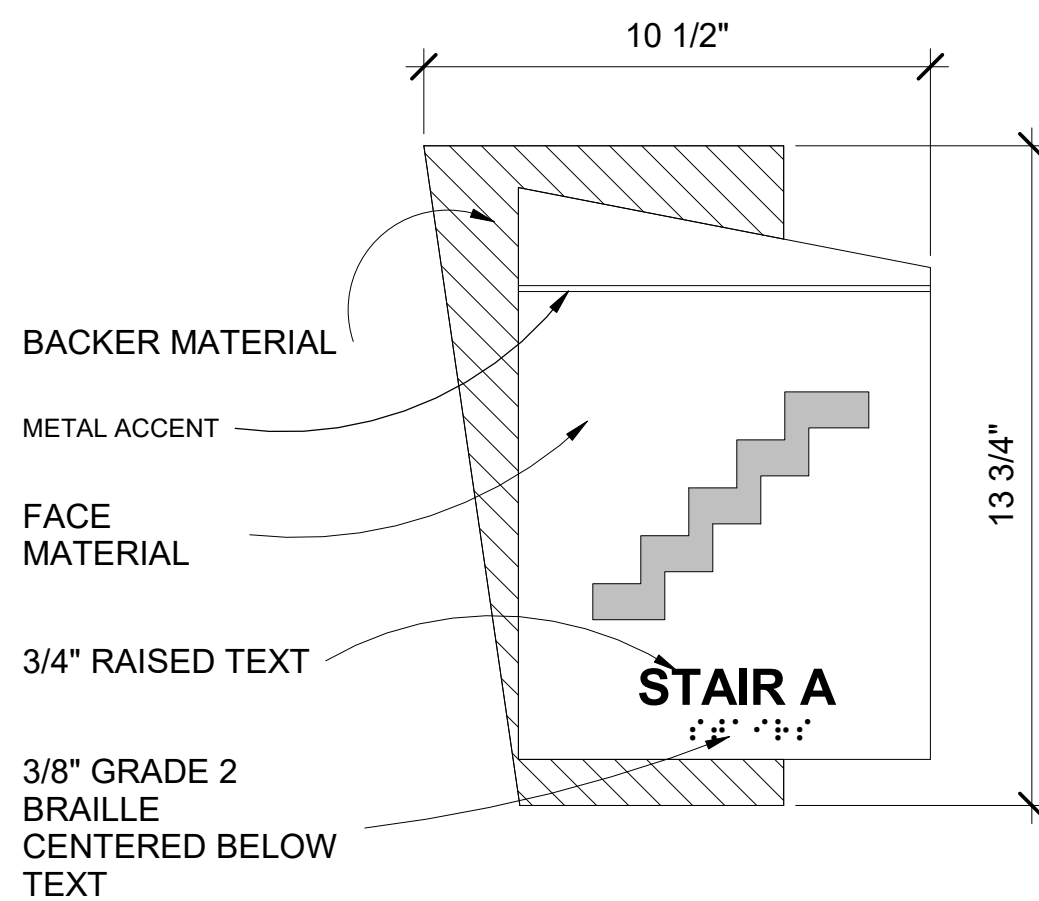
LEVEL	ROOM NAME	ROOM NUMBER	SIGN TYPE
LEVEL 0	CRAWL SPACE	-	N/A
LEVEL 0	POOL MECHANICAL	-	G
LOWER LEVEL	CORRIDOR	000	N/A
LOWER LEVEL	WET AREA @ TANK A	001	N/A
LOWER LEVEL	WET AREA @ TANK B	002	N/A
LOWER LEVEL	INSTRUCTORS STORAGE	003	E
LOWER LEVEL	INSTRUCTORS STORAGE	004	E
LOWER LEVEL	DECK STORAGE	005	B
LOWER LEVEL	STORAGE	006	N/A
LOWER LEVEL	COMPRESSOR	007	E
LOWER LEVEL	DECK STORAGE	008	B
LOWER LEVEL	SHOWERS	009	E
LOWER LEVEL	WASHROOM	010	B
LOWER LEVEL	JANITOR	011	E
LOWER LEVEL	LOCKERS	012	B
LOWER LEVEL	THERAPY	013	E
LOWER LEVEL	SHOWER	014	E
LOWER LEVEL	SHOWER	015	E
LOWER LEVEL	SHOWER	016	E
LOWER LEVEL	EXAM	017	E
LOWER LEVEL	CORRIDOR	018	N/A
LOWER LEVEL	POOL MECHANICAL	019	E
LOWER LEVEL	FIRE PUMP	020	E
LOWER LEVEL	PH BUFFER	021	E
LOWER LEVEL	PH BUFFER	022	E
LOWER LEVEL	SANITIZER	023	E
LOWER LEVEL	FITNESS	024	B
LOWER LEVEL	COMM	025	E
LOWER LEVEL	ELEC. CL.	026	E
MECHANICAL PLATFORM LEVEL	ELECTRICAL	201	E
MECHANICAL PLATFORM LEVEL	VESTIBULE	202	N/A
MECHANICAL PLATFORM LEVEL	MECH. HOT WATER	203	E
MECHANICAL PLATFORM LEVEL	MECH. PLATFORM	204	N/A
MEZZANINE LEVEL	VESTIBULE	101	N/A
MEZZANINE LEVEL	LOBBY	102	N/A
MEZZANINE LEVEL	RESTROOM	103	C
MEZZANINE LEVEL	BALCONY B	104	N/A
MEZZANINE LEVEL	BALCONY A	105	N/A
MEZZANINE LEVEL	VIDEO DEBRIEF	106	A
MEZZANINE LEVEL	VIDEO DEBRIEF	107	A
MEZZANINE LEVEL	CL	108	E
MEZZANINE LEVEL	ELECTRICAL CL.	109	E
MEZZANINE LEVEL	INSTRUCTOR OFFICE	110	B
MEZZANINE LEVEL	RAMP	111	N/A
MEZZANINE LEVEL	COMM	112	E
MEZZANINE LEVEL	OPEN OFFICE	113	B
MEZZANINE LEVEL	BREAK	114	B
MEZZANINE LEVEL	OFFICE	115	B
MEZZANINE LEVEL	OFFICE	116	B
MEZZANINE LEVEL	OFFICE	117	B
MEZZANINE LEVEL	CORRIDOR	118	N/A
MEZZANINE LEVEL	LOCKERS	119	B
MEZZANINE LEVEL	MEN	120	C
MEZZANINE LEVEL	SHOWER	121	N/A
MEZZANINE LEVEL	SHOWER	122	N/A
MEZZANINE LEVEL	WOMEN	123	C
MEZZANINE LEVEL	SHOWER	124	N/A
MEZZANINE LEVEL	JANITOR	125	E
MEZZANINE LEVEL	RAMP	126	N/A
MEZZANINE LEVEL	STAIR A	A	F
MEZZANINE LEVEL	STAIR B	B	F
MEZZANINE LEVEL	STAIR C	C	F
MEZZANINE LEVEL	STAIR E	E	F
MEZZANINE LEVEL	ELEV.	E1	D

GENERAL NOTES - SIGNAGE

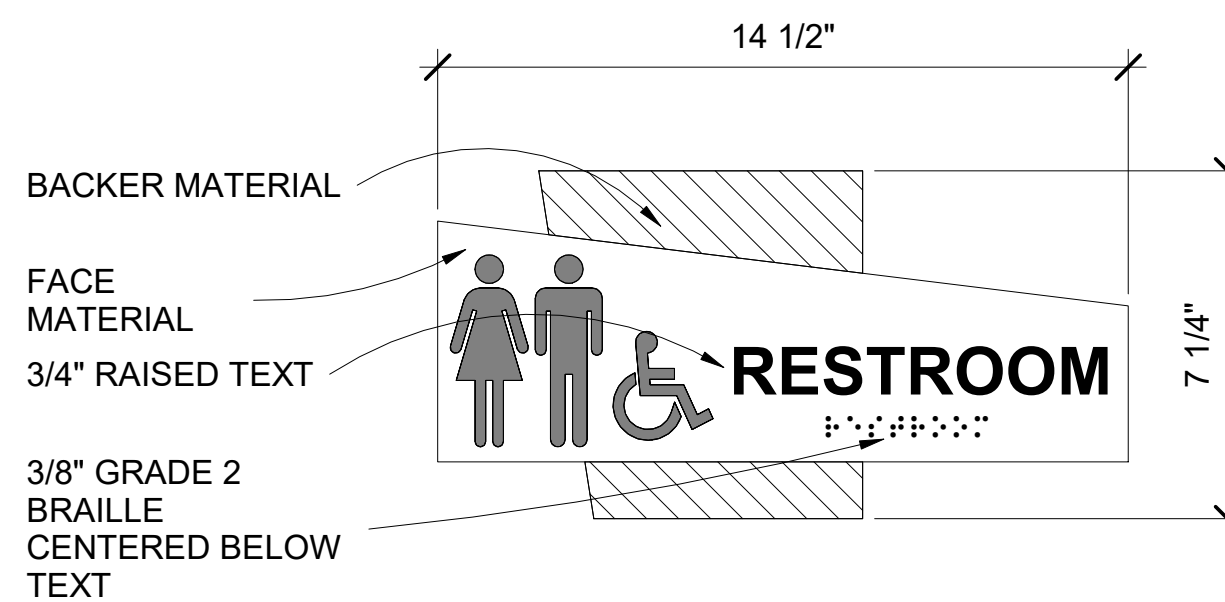
- 1 SIGNAGE WITH TACTILE LETTERING MUST COMPLY WITH ANSI A117.1
- 2 CONFIRM ALL TEXT WITH END USER
- 3 ALL SIGNAGE TO BE WALL MOUNTED UNLESS NOTED OTHERWISE. REFER TO DETAIL THIS SHEET FOR TYPICAL MOUNTED HEIGHTS
- 4 RESTROOM SIGNAGE WILL HAVE RAISED PICTOGRAMS FOR THE MALE AND FEMALE RESTROOMS AND THE UNIVERSAL SYMBOL FOR HANDICAP ACCESS AND RAISED BRAILLE BELOW.
- 5 REFER TO SIGNAGE PLANS, TYPICALS, AND SPECIFICATIONS FOR MORE INFORMATION.
- 6 PROVIDE SOFTWARE AND TRAINING FOR CHANGEABLE PAPER INSERT STRIPS TO BE EDITED ON CLIENTS COMPUTER. EXTRA STRIPS SHALL BE PROVIDED. MUST BE ABLE TO BE PRINTED ON A TYPICAL 8.5"x11" BLACK AND WHITE PRINTER
- 7 ALL FIRE WALLS, FIRE BARRIERS, FIRE PARTITIONS, SMOKE BARRIERS, AND SMOKE PARTITIONS OR ANY OTHER WALLS REQUIRED TO HAVE PROTECTED OPENINGS OR PENETRATIONS MUST BE PERMANENTLY IDENTIFIED BY STENCILING (PAINT) OR SIGNAGE IDENTIFYING THE RATING IN HOURS (i.e. 1-HR) WITH LETTERS NOT LESS THAN 1/2" HIGH AT INTERVALS NO GREATER THAN 8'-0" WITH AT LEAST ONE SUCH SIGN PER WALL FOR WALLS LESS THAN 8'-0" HORIZONTALLY, AND MIN. 10" ABOVE SCHEDULED CEILING.
- 8 PROVIDE BACK PANEL IF ANY SIGNS ARE INSTALLED ON GLASS.
- 9 ROOM NUMBERS LISTED IN SCHEDULE ARE GENERIC NUMBERS. ACTUAL ROOM NUMBERS TO BE LISTED ON SIGN ARE TO BE ESTABLISHED BY END USER. END USER TO PROVIDE FINAL ROOM NUMBERS TO CONTRACTOR BEFORE SIGN PURCHASE.
- 10 RESTROOMS NOT LABELED AS MEN'S AND WOMEN'S IN FLOOR PLAN ARE TO HAVE A UNISEX PICTOGRAM INCLUDING BOTH THE MALE AND FEMALE AND THE HANDICAP SYMBOL
- 11 HELVETICA NEUE 65 ROMAN FONT SHALL BE USED FOR ALL HEADER COPY AND FOR DIRECTIONAL ARROWS
- 12 HELVETICAL NEUE 55 ROMAN FONT SHALL BE USED FOR ALL BODY COPY
- 13 SIGNAGE SHOWN AS A BASIS OF DESIGN: TAKEFORM, INTERIOR SIGNAGE, OBLIQUE COLLECTION, FUSION 23 DESIGN.
SIGNAGE FINISHES BY TAKEFORM:
FACE MATERIAL: CITADEL MICRODOT LAMINATE.
BACKER MATERIAL: BLACK MICRODOT LAMINATE.
RAISED TEXT: BLACK.
METAL ACCENT: POLISHED.
INSERT BACKGROUND: DOVE.



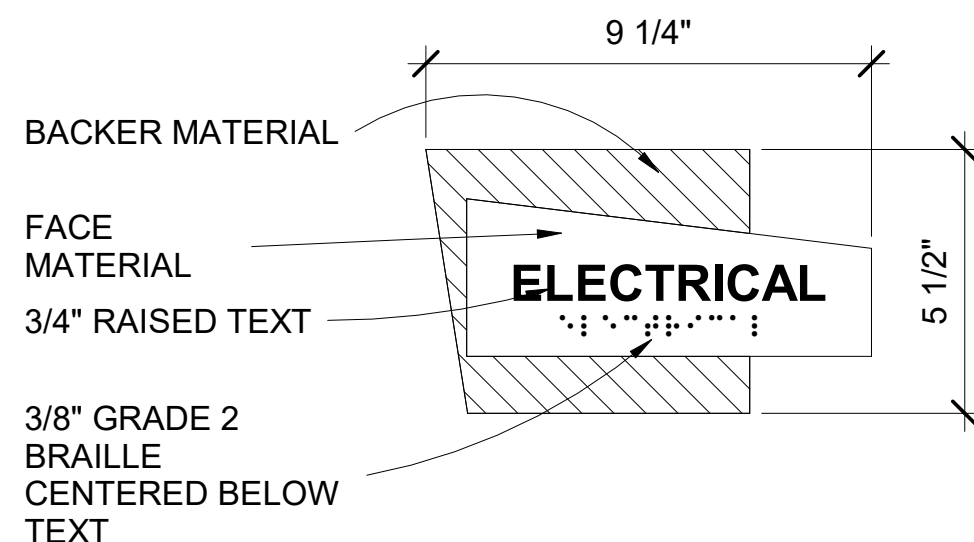
(G6) SIGN TYPE G - POOL EQUIPMENT
SCALE: 3" = 1'-0"



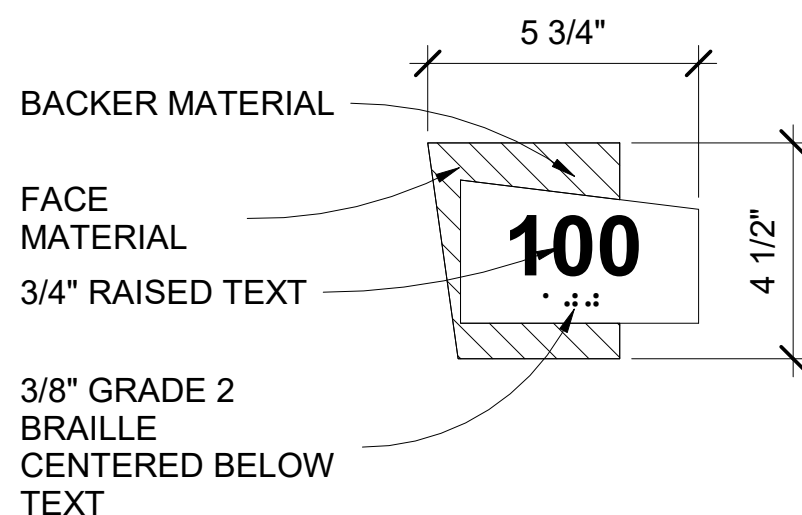
E6 SIGN TYPE F - STAIRS
SCALE: 3" = 1'-0"



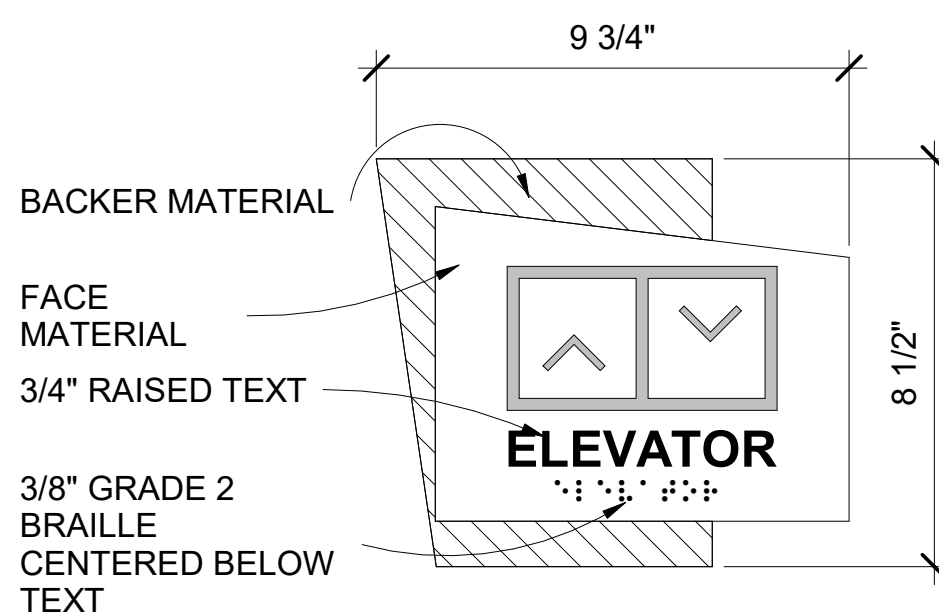
E9 SIGN TYPE C - RESTROOM
SCALE: 3" = 1'-0"



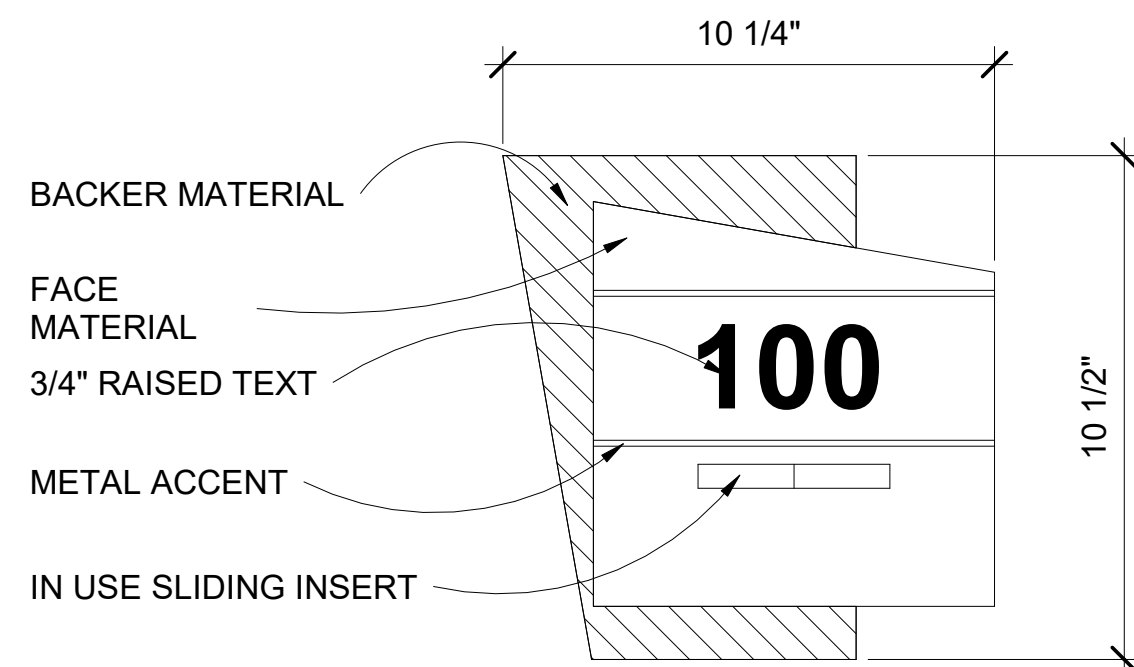
(C6) SIGN TYPE E - PERMANENT ROOM
SCALE: 3" = 1'-0"



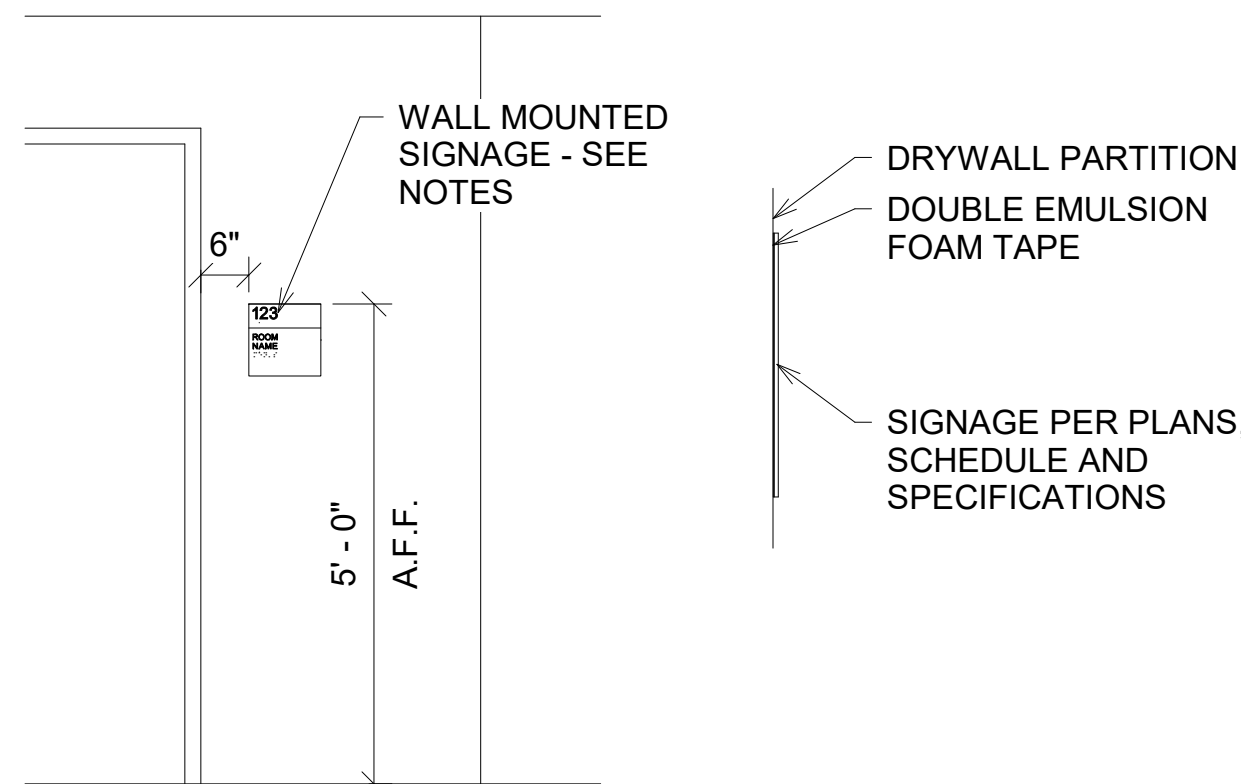
(C9) SIGN TYPE B - ROOM NUMBER
SCALE: 3" = 1'-0"



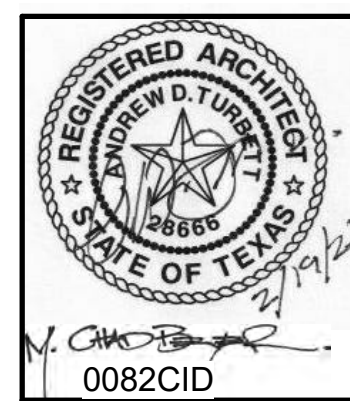
(A6) SIGN TYPE D - ELEVATOR
SCALE: 3" = 1'-0"



(A9) SIGN TYPE A - IN USE/OPEN ROOM
SCALE: 3" = 1'-0"



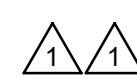
E12 SIGNAGE MOUNTING DETAILS

[illegible]

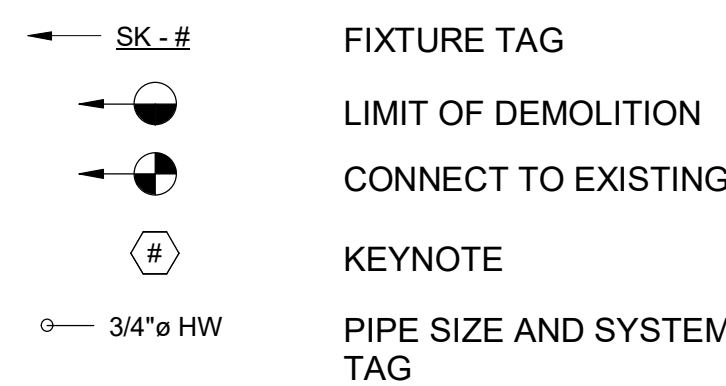
US ARMY CORPS OF ENGINEERS FORT WORTH DISTRICT FORT WORTH, TEXAS 76102	DESIGNED BY: C BEYER	ISSUE DATE: 19 FEB 2021
 	CHECKED BY: A TURBETT	NO. OF SHEETS: 1 OF 1
	SUBMITTED BY: C COLEMAN	CONTRACT NO.:
 	DESIGNED BY: C BEYER	ISSUE DATE: 19 FEB 2021
 	CHECKED BY: A TURBETT	NO. OF SHEETS: 1 OF 1
 	SUBMITTED BY: C COLEMAN	CONTRACT NO.:

JOINT BASE SAN ANTONIO (JBSA) - LACKLAND AFB
SPECIAL WARFARE TRAINING GROUP AQUATICS TRAINING
PROJECT NUMBER: MIP-264886A; P2 NUMBER: 472496

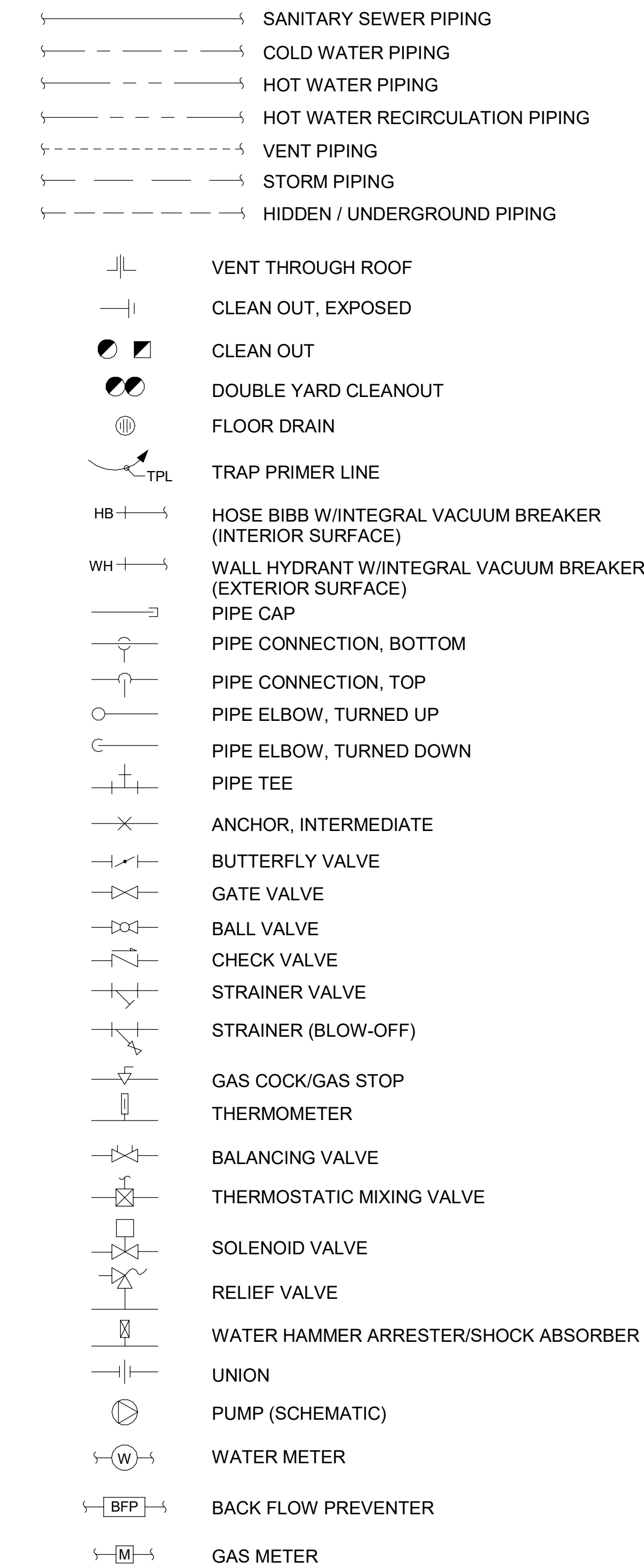
**SIGNAGE SCHEDULE &
TYPICALS**



SYMBOLS AND TAGS



PLUMBING LEGEND



PLUMBING ABBREVIATIONS

AFF	AREA DRAIN
AFF	ABOVE FINISHED FLOOR
AFG	ABOVE FINISHED GRADE
APPROX	APPROXIMATE
BFF	BELOW FINISHED FLOOR
BFP	BACKFLOW PREVENTER
CA	COMPRESSED AIR
CAP	CAPACITY
CD	CLEARWATER DRAINAGE
CO	CLEAN OUT
COND	CONDENSATE
CONN	CONNECTION
CONT	CONTINUATION
CW	DOMESTIC COLD WATER
D	DRAIN
DEG	DEGREES
DEMO	DEMOLITION
DIA	DIAMETER
DN	DOWN
DS	DOWNSPOUT
DWG	DRAWING
EA	EACH
EEW	EMERGENCY EYE/FACE WASH
ENT	ENTERING
ESS	EMERGENCY SAFETY SHOWER
ET	EXPANSION TANK
F	FAHRENHEIT
FCO	FLOOR CLEAN OUT
FD	FLOOR DRAIN
FM	FIRE HYDRANT
FM	FLOW METER
FPH	FREEZE PROOF HYDRANT
FBM	FEET PER MINUTE
G	NATURAL GAS
GAL	GALLONS
GD	GARBAGE DISPOSAL
GM	GAS METER
GPM	GALLONS PER MINUTE
GW/H	GAS WATER HEATER
HB	HOSE BIBB
HD	HUB DRAIN
HO	HUB OUTLET
HP	HORSEPOWER
HW	HOT WATER
HWR	HOT WATER RETURN
ID	INSIDE DIAMETER/DIMENSION
IE	INVERT ELEVATION
IMVB	ICE MAKER VALVE BOX
IN	INCH
IW	INDUSTRIAL WASTE
IWH	INSTANTANEOUS WATER HEATER
LAV	LAVATORY
M	METER
MAX	MAXIMUM
MEZZ	MEZZANINE
MFR	MANUFACTURER
MIN	MINIMUM
MISC	MISCELLANEOUS
N/A	NOT APPLICABLE
NFW	NON-POUTABLE WATER
NTS	NOT TO SCALE
OD	OUTSIDE DIAMETER
PCV	PRESSURE CONTROL VALVE
PD	PRESSURE DROP
PG	PRESSURE GAUGE
PRV	PRESSURE REDUCING VALVE
PSI	POUNDS PER SQUARE INCH
PTD	POOL TRENCH DRAIN
PVC	POLYVINYL CHLORIDE
PW	POTABLE WATER
R	RADIUS
RD	ROOF DRAIN
RP	RECIRCULATION PUMP
RBPB	REDUCED PRESSURE BACKFLOW PREVENTER
RPM	REVOLUTIONS PER MINUTE
SK	SINK
SP	SUMP PUMP
SPEC	SPECIFICATION
SS	SANITARY SEWER PIPING
ST	STROM DRAIN
STD	STANDARD
STO	STORM DRAIN EMERGENCY OVERFLOW
SW	SERVICE WATER
TBD	TO BE DETERMINED
TCV	TEMPERING VALVE
TD	TRENCH DRAIN
TEMP	TEMPERATURE
TMV	THERMOSTATIC MIXING VALVE
TP	TRAP PRIMER
TW	TEPID WATER
TYP	TYPICAL
UR	URINAL
V	VENT
VIF	VERIFY IN FIELD
VS	VENT STACK
VTR	VENT THRU ROOF
WB	WASHER BOX
WC	WATER CLOSET
WCO	WALL CLEAN OUT
WG	WATER GAUGE
WPD	WATER PRESSURE DROP
Ø	DIAMETER

GENERAL PLUMBING NOTES

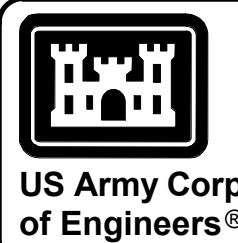
1. ALL EQUIPMENT AND PIPING SHALL BE INSTALLED IN COMPLIANCE WITH THE LATEST APPLICABLE EDITION OF THE INTERNATIONAL PLUMBING CODE, LOCAL UTILITIES, AND APPLICABLE PROVISIONS OF THE INTERNATIONAL FUEL GAS CODE (IFGC).
2. ALL INTERIOR FLOOR DRAINS AND OPEN RECEPTACLES WITH TRAPS SHALL BE PROTECTED BY A TRAP PRIMER (SEE SPECIFICATIONS AND PLANS FOR LOCATION AND TYPE.) PROVIDE 1/2" SLOPED LINE TO FLOOR DRAIN. SEE DETAILS SHEET.
3. WATER LINES SHALL NOT BE ROUTED ABOVE ANY ELECTRICAL ROOM OR ELECTRICAL PANELS OR TELEPHONE ROOMS.
4. THE CONTRACTOR IS RESPONSIBLE FOR COORDINATION WITH OTHER TRADES TO MINIMIZE SPATIAL CONFLICTS.
5. INSTALL BOTTOM OF ALL EXTERIOR WALL HYDRANTS AT 24" ABOVE FINISH GRADE ELEVATION.
6. PROVIDE ACCESS PANELS WITH SQUARE HINGED, LOCKING DOORS FOR ALL VALVES, SHOCK ABSORBERS AND TRAP PRIMERS CONCEALED.
7. CONTRACTOR SHALL VERIFY ALL FIELD CONDITIONS AND DIMENSIONS BEFORE CONSTRUCTION BEGINS, INCLUDING SEWER, DRAIN, AND CONDUIT INV. ELEV. CONTACT CONTRACTING OFFICER SHOULD DISCREPANCIES OCCUR.
8. CONTRACTORS ARE FREE TO USE ANY PRODUCT WHICH MEETS THE GOVERNMENT'S MINIMUM REQUIREMENTS AND NOT IN CONFLICT WITH OTHER CODES OR PROVISIONS, UNLESS INDICATED OTHERWISE ON THE PLANS OR SPECIFICATIONS (E.G. SOLE-SOURCE). ALL LISTED MANUFACTURERS ARE THE BASIS OF DESIGN. FOR THESE BASIS OF DESIGN PRODUCTS, OTHER MANUFACTURERS MAY BE SUBSTITUTED AS LONG AS THE STANDARD OF QUALITY AND CHARACTERISTICS OF THE SUBSTITUTED MANUFACTURER MEET OR EXCEED THE STANDARD OF QUALITY AND CHARACTERISTICS OF THE BASIS OF DESIGN.

NATURAL GAS PIPING NOTES

1. ALL NEW EXPOSED GAS PIPING SHALL BE PRIMED AND PAINTED. ALL NEW GAS PIPING WITHIN FINISHED SPACES SHALL BE PAINTED YELLOW AND LABELED IN ACCORDANCE WITH APPLICABLE CODE. ALL EXISTING UNPAINTED GAS PIPING IS TO REMAIN UNPAINTED.
2. COORDINATE NEW METER AND REGULATOR LOCATION FOR BUILDING WITH LOCAL UTILITIES.
3. ALL GAS PIPING SHALL BE LABELED AT BEGINNING, ALL ENDS, AND AT 6' INTERVALS DESIGNATING GAS & PRESSURE. LABELS SHALL BE PER SPECIFICATIONS.
4. PROVIDE/INSTALL THROUGH WALL PIPE PENETRATIONS AS REQUIRED WHERE PIPE ENTERS BUILDING. SLEEVE AND SEAL.
5. THIS CONTRACTOR SHALL CONNECT GAS PIPING AT A TOTAL BUILDING DEMAND OF 11,797 CFH. COORDINATE WITH LOCAL GAS COMPANY TO PROVIDE BUILDING CONNECTION AND 2 PSI PRESSURE FROM THE REGULATOR.

NOTES:

1. THIS LEGEND IS FOR REFERENCE ONLY
2. ALL SYMBOLS WHICH APPEAR WITHIN THE LEGEND MAY NOT APPLY
TO THIS PROJECT.

[illegible]

US ARMY CORPS OF ENGINEERS
FORT WORTH DISTRICT
FORT WORTH, TEXAS 76102

TECH TEAM
CFZ GROUP
DESIGN HUNTSVILLE
ANSIE

ISSUE DATE:
19 FEB 2021

SOLICITATION NO.:
W912G52R0081

CODING:
MPT-UD-3385EN

DESIGNED BY:
J. MARSH

DRAWN BY:
J. MARSH

CHECKED BY:
M. SUTHERLAND

SUBMITTED BY:
C. COLEMAN

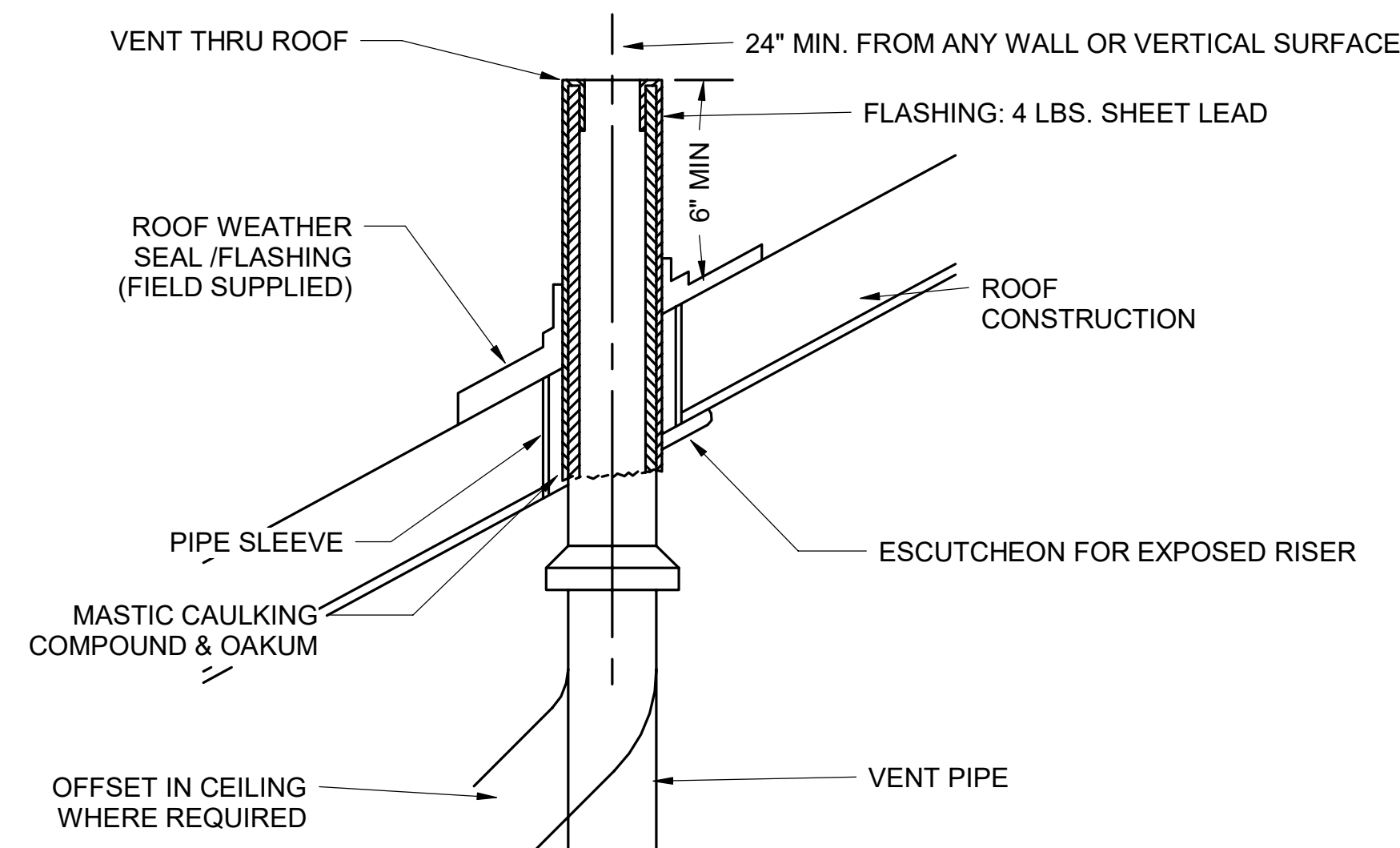
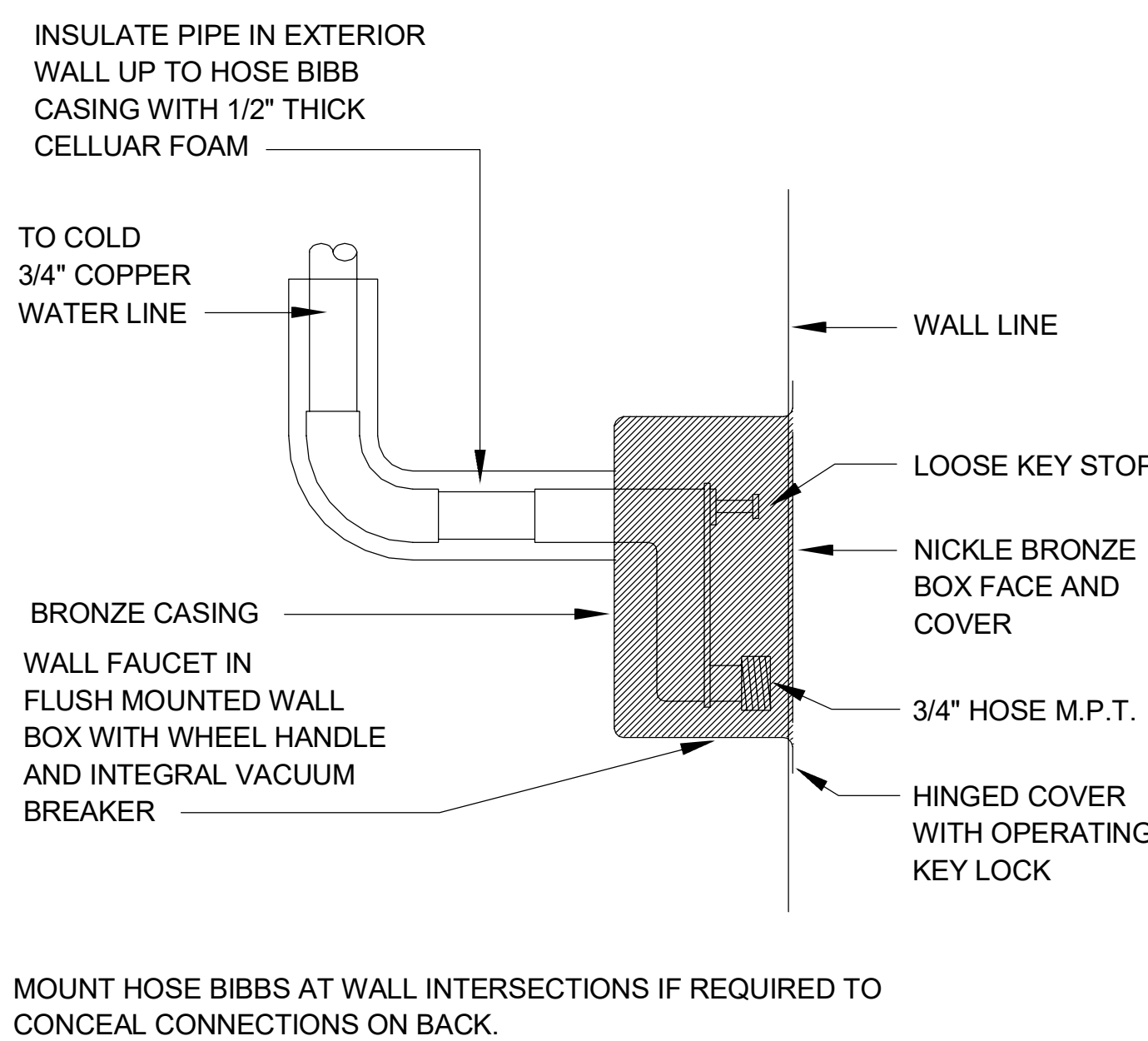
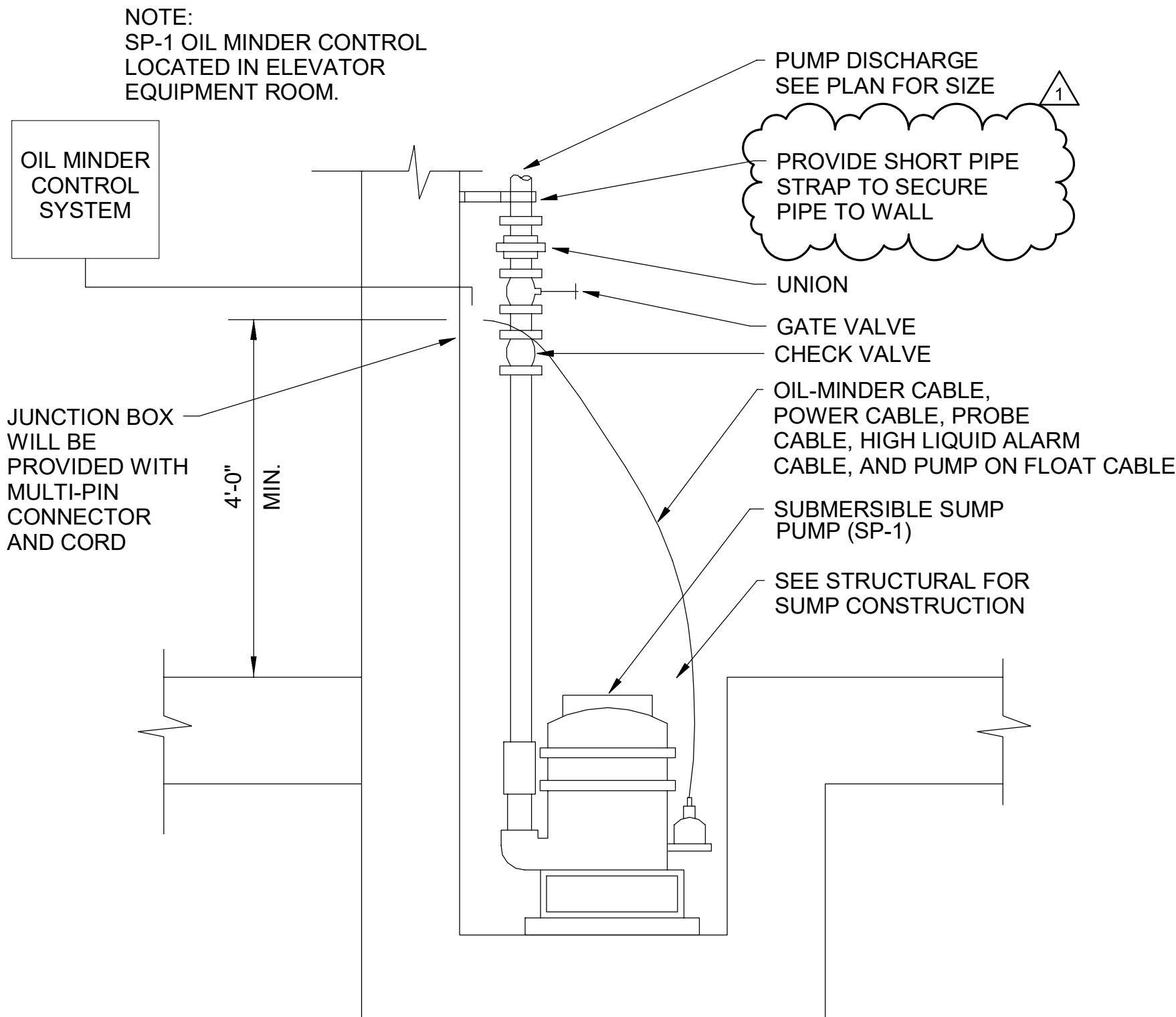
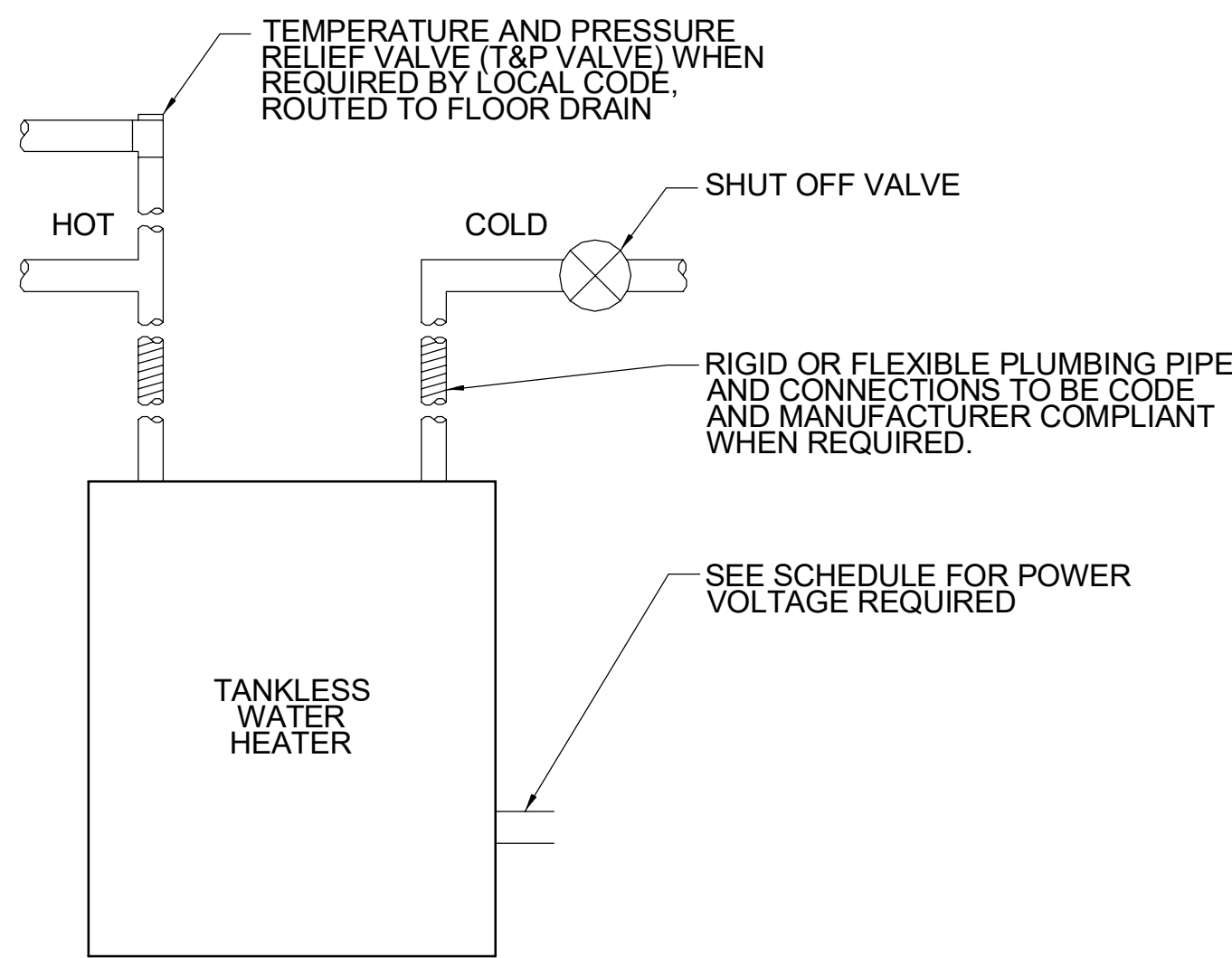
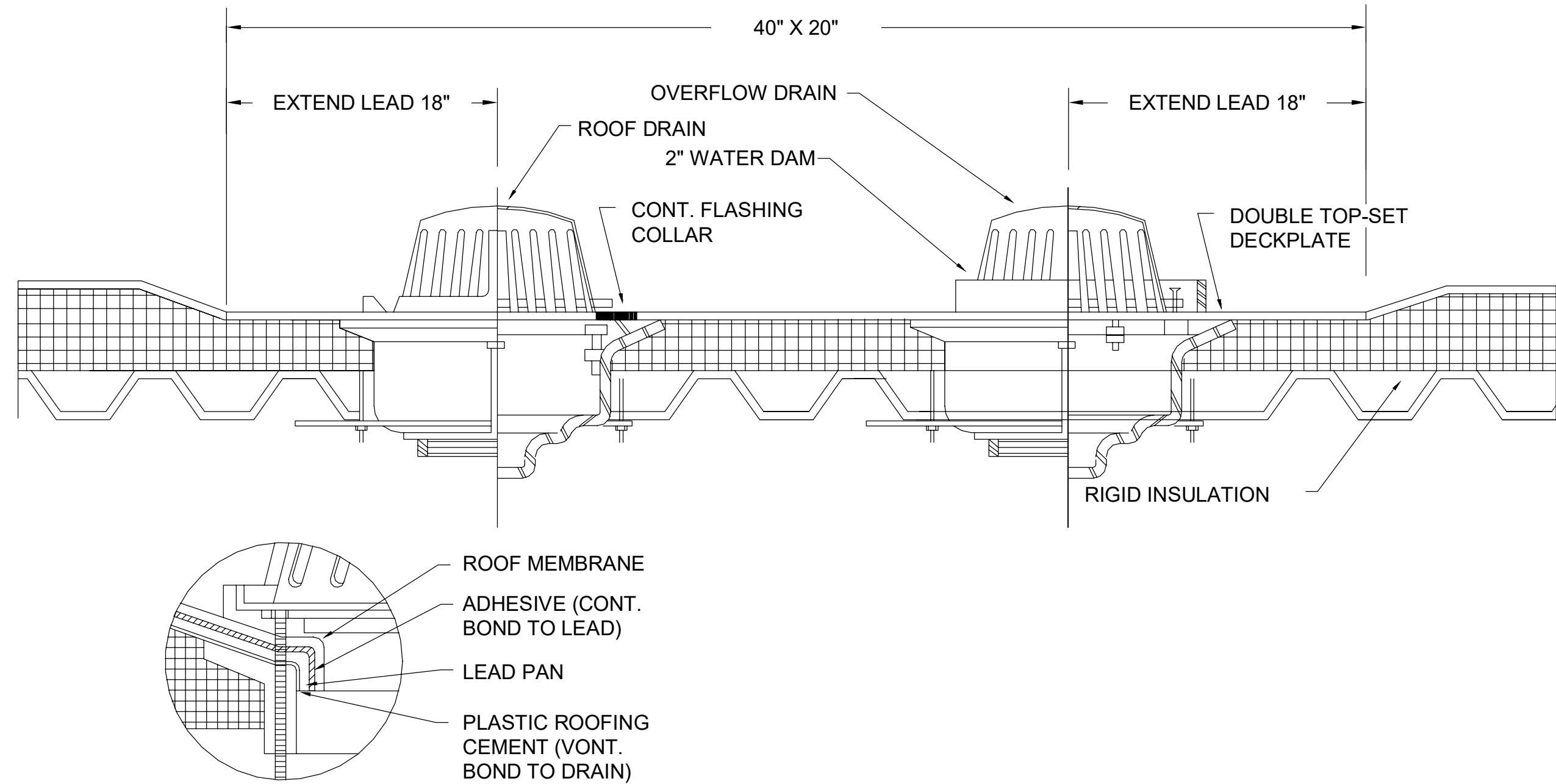
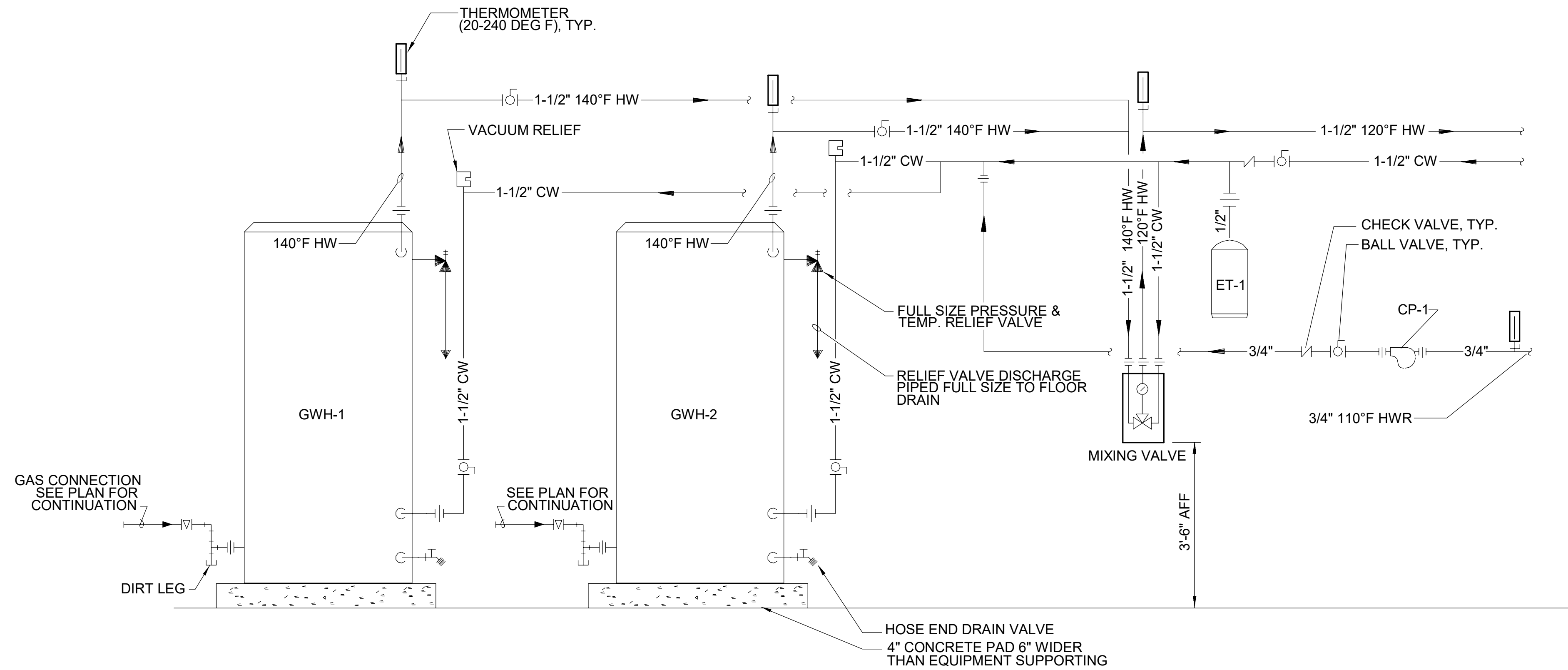
SIZE:
CONSILMAN

JOINT BASE SAN ANTONIO (JBSA) - LACKLAND AFB
 AIR WARFARE TRAINING GROUP AQUATIC TRAINING FACILITY
 PROJECT NUMBER: MPVJ043895A; P2 NUMBER: 472496

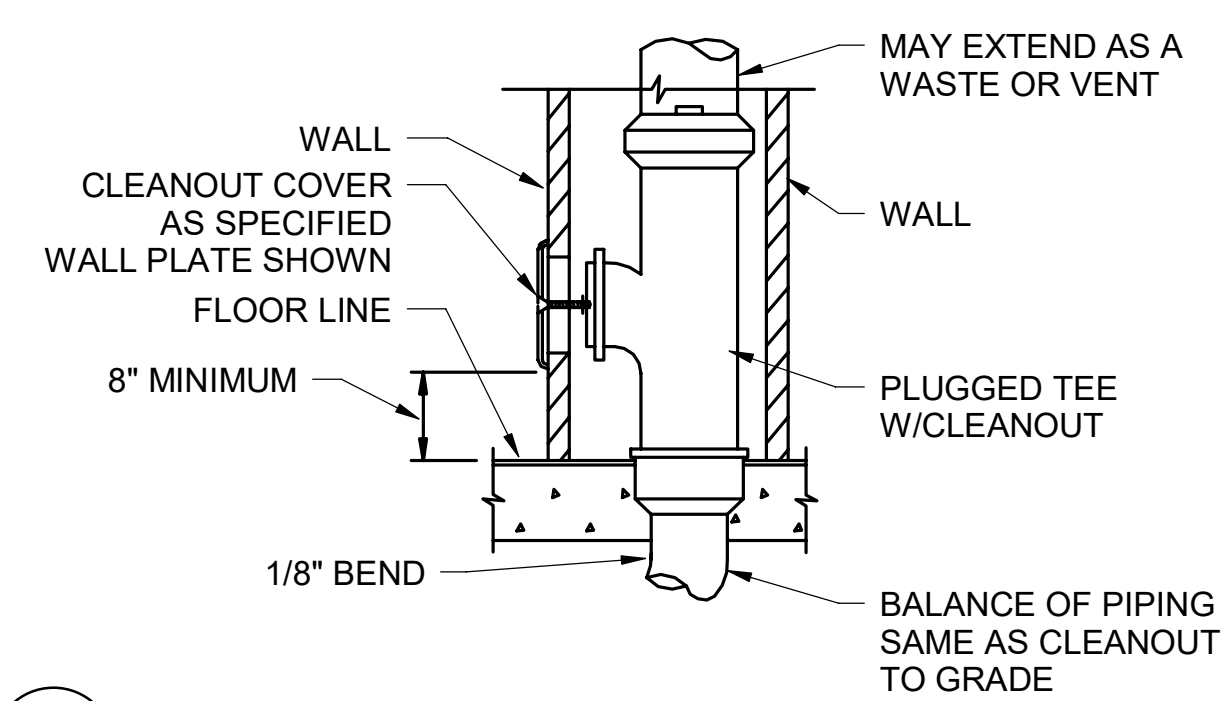
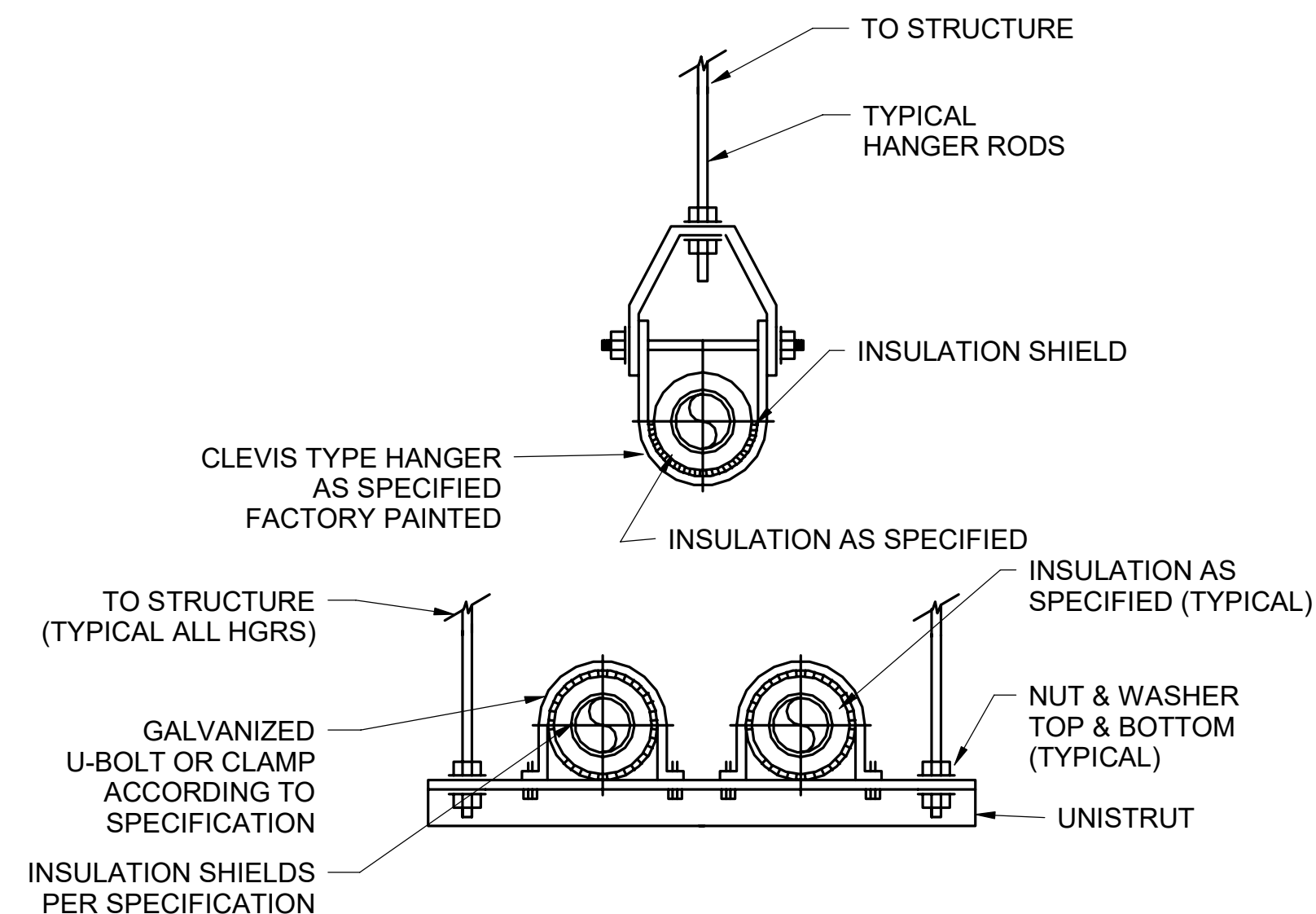
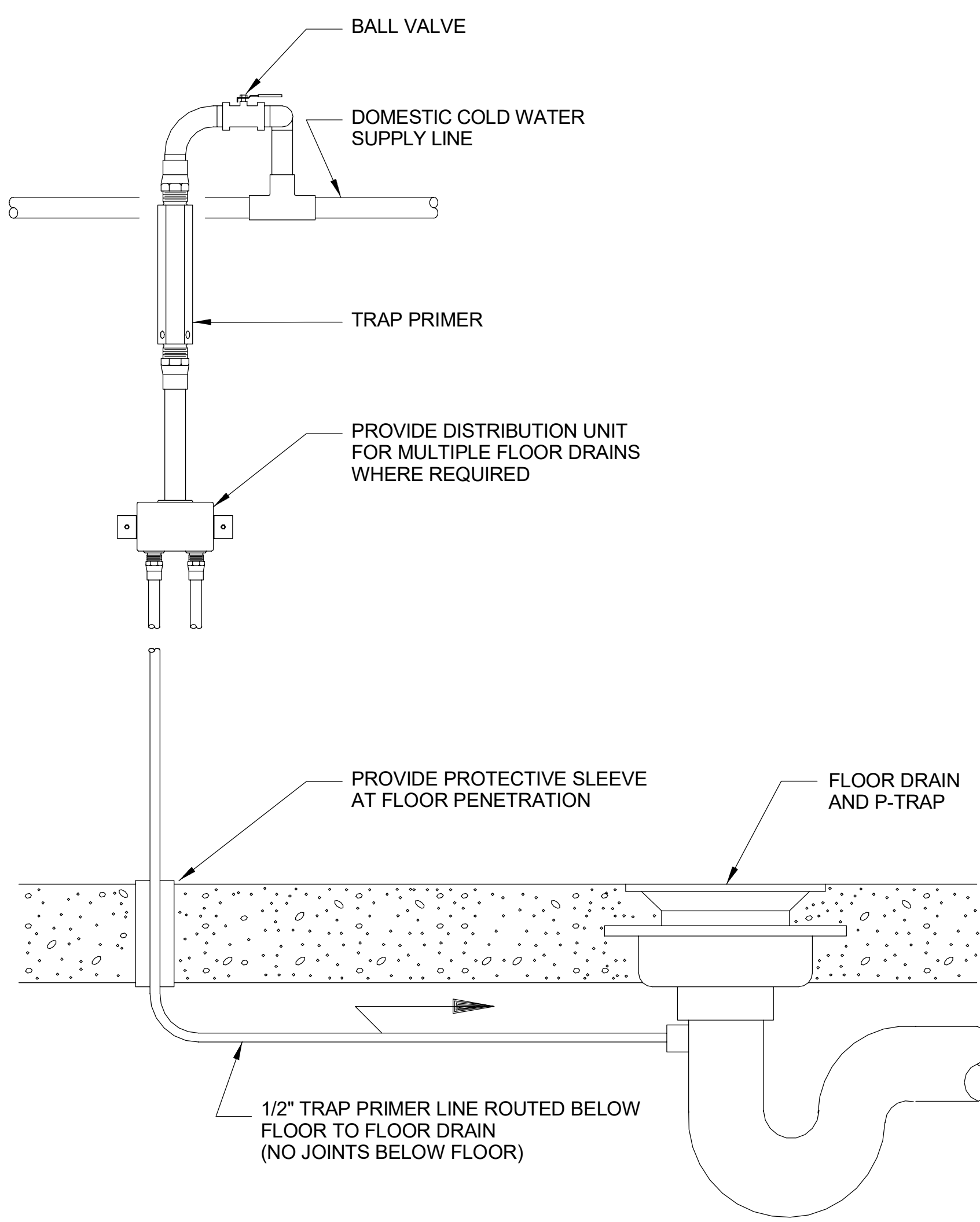
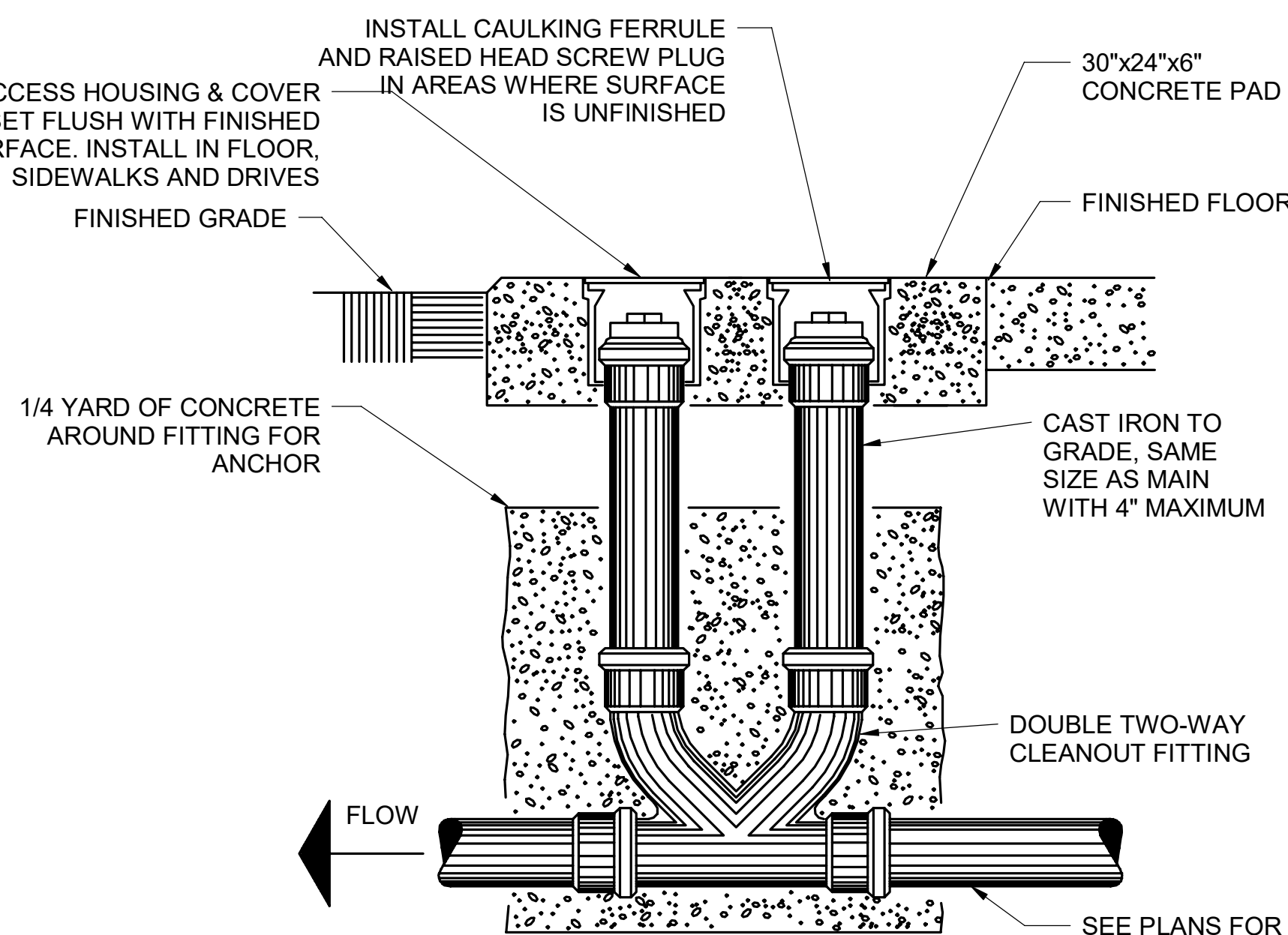
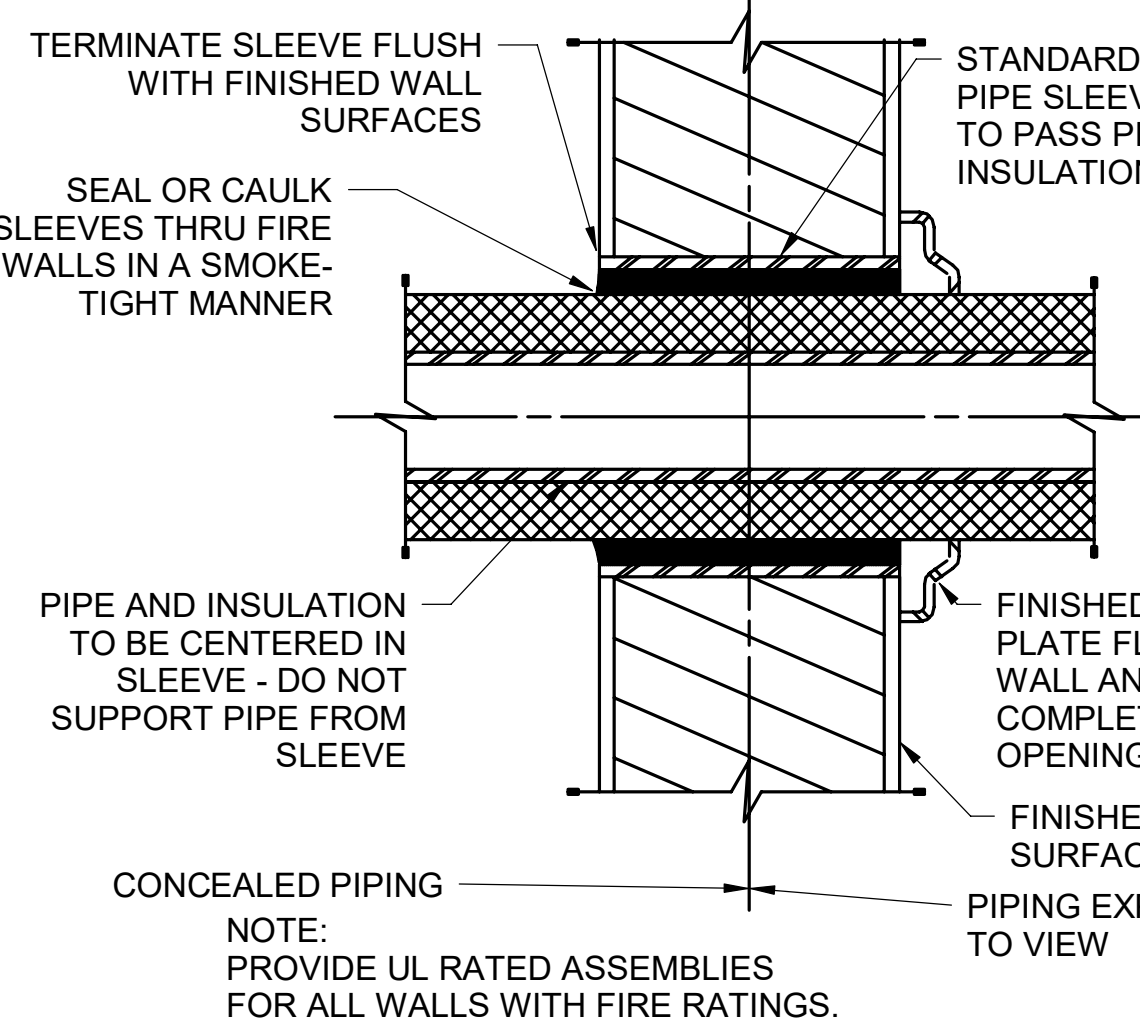
SHEET ID

P-001

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NOTES:
- WATER HEATER MUST BE INSTALLED TO CONFORM WITH CURRENT NATIONAL ELECTRIC CODE, AND ANY APPLICABLE LOCAL PLUMBING, ELECTRICAL, HEATING AND AIR CONDITIONING CODES.
- FOLLOW MANUFACTURER INSTALLATION INSTRUCTIONS



Donald S. Borden, P.E.

US Army Corps of Engineers®

1	MARK	DESCRIPTION	DATE

REVISIONS:

NO.	DATE	BY	DESCRIPTION
1	10 FEB 2021	J. MASHBY	SUBMITTAL NO. 1
2	10 FEB 2021	M. SUTHERLAND	CONTRACT NO. MPV042886A

DESIGNED BY: J. MASHBY
DRAWN BY: J. MASHBY
CHECKED BY: M. SUTHERLAND
IN CHARGE: C. COLEMAN

US ARMY CORPS OF ENGINEERS
FORT WORTH DISTRICT
FORT WORTH, TEXAS 76102

CFZ (5)
CFZ GROUP DESIGN INSURANCE ASSE

JOINT BASE SAN ANTONIO (JBSA) - LACKLAND AFB
SPECIAL WARFARE TRAINING GROUP AQUATIC TRAINING FACILITY
PROJECT NUMBER: WPTJ0685A-12 NUMBER: 47266

PLUMBING DETAILS

SHEET ID

P-501

CIRCULATING PUMP SCHEDULE										
MARK	MANUFACTURER / MODEL (BASIS OF DESIGN)	GPM	TD HEAD IN FT.	ELECTRICAL				SERVING	LOCATION	REMARKS
				HP	V	Φ	HZ			
CP-1	GRUNDFOS MAGNA3 25-80 F (N)	6	25	1/10	115	1	60	110" F RETURN	MECH. RM	STAINLESS STEEL HOUSING AND BMS CONTROLS

MARK	LOCATION	SERVICE	TYPE OF PUMP	FLOW (GPM)	HEAD (FT)	RPM	ELECTRICAL				REMARKS
							HP	V	Ø	HZ	
SP-1	ELEVATOR SUMP	SUMP PIT	SUMBERSIBLE	45	20	3,600	1/2	120	1	60	SEE NOTE - 1
SP-2	PUMP PIT SUMP	SUMP PIT	SUMBERSIBLE	30	10	-	1/3	115	1	60	SEE NOTE - 2
SP-3-1	BACKWASH SUMP	BACKWASH	SUMBERSIBLE	90	30	3,500	1	230	3	60	SEE NOTE - 3
SP-3-2	BACKWASH SUMP	BACKWASH	SUMBERSIBLE	90	30	3,500	1	230	3	60	SEE NOTE - 3
SP-4-1	*PROVIDED BY OWNER	UD1 CLEARANCE	SUMBERSIBLE	20	30	-	1/2	110	1	60	SEE NOTES - 4, 5
SP-4-2	*PROVIDED BY OWNER	UD2 CLEARANCE	SUMBERSIBLE	20	30	-	1/2	110	1	60	SEE NOTES - 4, 5

NOTES:

- STACOR SE-50 (BASIS OF DESIGN) OIL MINDER WITH CONTROL SYSTEM - SEE SPECIFICATIONS AND SIMILAR TO DETAIL ON P-501.
- LIBERTY SPAC-237 (BASIS OF DESIGN) ASSEMBLED SUMP PUMP PACKAGE - SEE SPECIFICATIONS.
- BELL & GOSSETT 2WF1032H (BASIS OF DESIGN), DUPLEX SUMP PUMP PACKAGE WITH CONTROL SYSTEM - SEE SPECIFICATIONS AND SIMILAR TO DETAIL ON P-502.
- PUMP SHALL NOT BE PERMANENTLY INSTALLED. PUMP SHALL BE FURNISHED TO OWNER FOR USE AT UNDER DRAIN MONITORING MANHOLES 1 AND 2 IF FLUID MONITORING SENSORS ACTIVATE.
- PUMP SHALL BE FURNISHED WITH 304 SS NON-CLOGGING SCREEN AND VERTICAL FLOAT FOR AUTOMATIC ON/OFF OPERATION. PUMP SHALL HAVE 2-INCH FNTP THREADED DISCHARGE. PUMP SHALL INCLUDE A MINIMUM 33" POWER CORD. PUMP SHALL WEIGH NO MORE THAN 30 LBS. PUMP SHALL BE FURNISHED WITH 50' x 2" DIAMETER HOSE WITH MNTP THREADED CONNECTIONS.

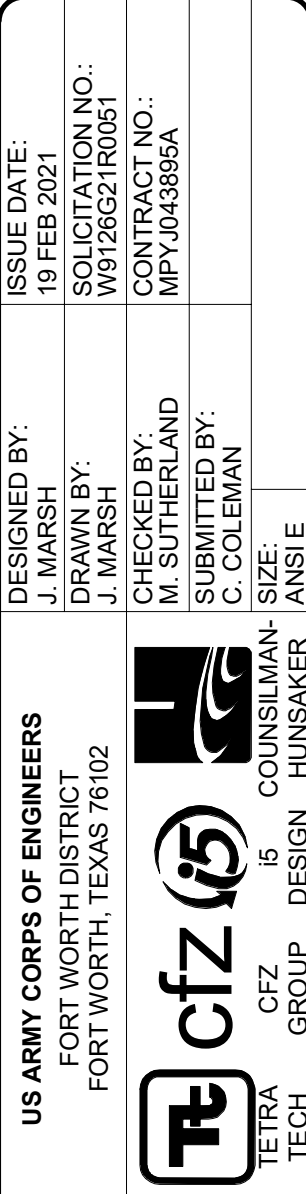
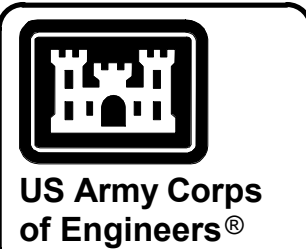
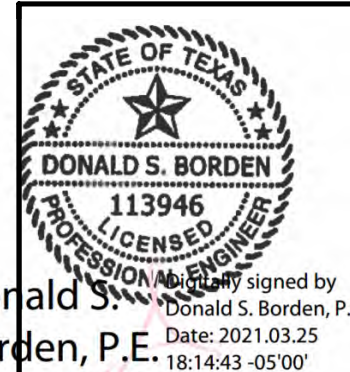
MARK	DESCRIPTION	MANUFACTURER (BASIS OF DESIGN)	MODEL (BASIS OF DESIGN)	CONNECTIONS				NOTES (BASIS OF DESIGN)
				CW	HW	WASTE	VENT	
P1	WATER CLOSET, WALL MOUNTED (1.28 GPF)	AMERICAN STANDARD	2859.128	1"	-	4"	2"	AMERICAN STANDARD FLUSH VALVE: INCLUDED; SEAT: 5901.100
P2	WATER CLOSET, WALL MOUNTED, H.C. (1.28 GPF)	AMERICAN STANDARD	2859.128	1"	-	4"	2"	AMERICAN STANDARD FLUSH VALVE: INCLUDED; SEAT: 5901.100
P3	URINAL, WALL MOUNTED (0.125 GPF)	AMERICAN STANDARD	6590.503	3/4"	-	2"	1-1/2"	AMERICAN STANDARD FLUSH VALVE: INCLUDED
P4	WALL MOUNTED 30" CONCRETE LAVATORY WITH SENSOR FAUCET, H.C. (0.35 GPM) (110°F HW SETPOINT)	TRUEFORM CONCRETE	FLO-30N-ADA	1/2"	1/2"	1-1/2"	1-1/2"	AMERICAN STANDARD FAUCET: 775B.303 INCLUDE SINGLE HARD WIRE: PK00.WRK, PROVIDE (2) FSB-L-CMU BRACKETS
P5	WALL MOUNTED 60" CONCRETE LAVATORY WITH SENSOR FAUCET (QTY. OF 2 PER SINK), (0.35 GPM) (110°F HW SETPOINT)	TRUEFORM CONCRETE	FLO-60N-ADA	1/2"	1/2"	1-1/2"	1-1/2"	AMERICAN STANDARD FAUCET: 775B.303, INCLUDE MULTI HARD WIRE: PK00-MAC, PROVIDE (2) FSB-L-CMU BRACKETS
P6	SHOWER (1.5 GPM) (110°F HW SETPOINT)	BRADLEY	WS-1X	3/4"	3/4"	-	-	-
P6A	SHOWER (1.5 GPM) (110°F HW SETPOINT)	BRADLEY	WS-1X	3/4"	3/4"	2"	1-1/2"	FREEDOM SHOWER BASIN: APA3636BFPAN
P7	SHOWER, H.C. (1.5 GPM) (110°F HW SETPOINT)	BRADLEY	WS-1X-HN	3/4"	3/4"	2"	1-1/2"	FREEDOM SHOWER BASIN: APA3636BFPAN
P8	EXTERIOR SHOWER (1.5 GPM) (110°F HW SETPOINT)	BRADLEY	WS-1X	3/4"	3/4"	-	-	ALL PIPING WITHIN CABINET SHALL BE HEAT TRACED
P9	KITCHEN SINK (1.5 GPM) (110°F HW SETPOINT)	ELKAY	LR3322	3/4"	3/4"	2"	1-1/2"	AMERICAN STANDARD FAUCET: 4175.500
P10	WATER COOLER (STANDARD HEIGHT)	ELKAY	LZS8WSLP	1/2"	-	2"	1-1/2"	PROVIDE WITH BOTTLE FILLING STATION
P11	HI-LOW WATER COOLER, H.C.	ELKAY	LZSTL8WSLP	1/2"	-	2"	1-1/2"	PROVIDE WITH BOTTLE FILLING STATION
P12	LAUNDRY TUB, FLOOR MOUNTED	FIAT PRODUCTS	FL-1	3/4"	3/4"	2"	1-1/2"	FIAT PRODUCTS FAUCET: A-1 WITH INTEGRAL VACUUM BREAKER
P13	MOP SINK	FIAT PRODUCTS	TSB3012	3/4"	3/4"	2"	1-1/2"	FIAT PRODUCTS FAUCET: 830AA WITH INTEGRAL VACUUM BREAKER, PROVIDE MOP BRACKET AND HOSE
P14	EMERGENCY EYE/FACE WASH	HAWS	7778B	-	1/2"	1-1/2"	1-1/2"	PROVIDE 70" TEPID THROUGH MIXING VALVE HAWS: 9201EW
P15	EXAM SINK (1.5 GPM) (110°F HW SETPOINT)	ELKAY	PSLVR1917LO	1/2"	1/2"	2"	1-1/2"	AMERICAN STANDARD FAUCET: 4175.500
FD1	FLOOR DRAIN, 5" STRAINER	ZURN	ZN415B	-	-	3"	1-1/2"	WITH TRAP PRIMER CONNECTION
FD2	FLOOR DRAIN, 6" STRAINER	ZURN	ZN415B	-	-	4"	1-1/2"	WITH TRAP PRIMER CONNECTION
FS1	FLOOR SINK	ZURN	Z1752-SDC	-	-	4"	1-1/2"	WITH TRAP PRIMER CONNECTION
AD1	AREA DRAIN	ZURN	ZN415	-	-	4"	-	WITHOUT TRAP
TD1(X)	TRENCH DRAIN SYSTEM WITH QUANTITY	J.R. SMITH	9930	-	-	3"	-	STAINLESS STEEL GRATE: 9870-451-SSPA
PTD	POOL TRENCH DRAIN SYSTEM	J.R. SMITH	9930	-	-	4"	-	STAINLESS STEEL GRATE: 9870-451-SSPA. SEE NOTE 3 BELOW.
HD	HUB DRAIN	ZURN	Z1870	-	-	4"	-	-
FPH	FREEZE PROOF HYDRANT BOX	ZURN	Z1320	3/4"	-	-	-	WITH ANTI-SIPHON AND AUTOMATIC DRAINING
HB	HYDRANT BOX	ZURN	Z1330	3/4"	-	-	-	WITH ANTI-SIPHON AND AUTOMATIC DRAINING
TP-1	TRAP PRIMER	ZURN	Z1022	1/2"	-	-	-	-
TP-2	TRAP PRIMER	ZURN	Z1022-DU2	1/2"	-	-	-	2 OUTLET DISTRIBUTION UNIT
TP-3	TRAP PRIMER	ZURN	Z1022-DU3	1/2"	-	-	-	3 OUTLET DISTRIBUTION UNIT
TP-4	TRAP PRIMER	ZURN	Z1022-DU4	1/2"	-	-	-	4 OUTLET DISTRIBUTION UNIT
ETP-1	ELECTRONIC TRAP PRIMER	ZURN	Z1020	1/2"	-	-	-	-
ETP-19	ELECTRONIC TRAP PRIMER	ZURN	Z1020-DU4(4)-DU3(1)	1/2"	-	-	-	INCLUDE 4 DISTRIBUTION UNITS WITH 4 OUTLETS AND 1 DISTRIBUTION WITH 3 OUTLETS
FCO	FLOOR CLEANOUT	ZURN	ZN1400	-	-	-	-	-
WCO	WALL CLEANOUT	ZURN	Z1446	-	-	-	-	-
DYCO	YARD CLEANOUT	ZURN	Z1400	-	-	-	-	-
BFP	BACKFLOW PREVENTER	ZURN	375	3/4"	-	-	-	-
TMV	THERMOSTATIC MIXING VALVE	WATTS	LFN170-M3	1-1/2"	1-1/2"	-	-	SET TO DELIVER 120°F
4" RD	4" ROOF DRAIN	ZURN	Z121	-	-	4"	-	-
4" ERD	4" EMERGENCY OVERFLOW ROOF DRAIN	ZURN	Z121	-	-	4"	-	-
6" RD	6" ROOF DRAIN	ZURN	Z121	-	-	6"	-	-
6" ERD	6" EMERGENCY OVERFLOW ROOF DRAIN	ZURN	Z121	-	-	6"	-	-
DS	DOWNSPOUT NOZZLE	ZURN	Z199	-	-	6" / 10"	-	-

WATER HEATER SCHEDULE												
MARK	LOCATION	MINIMUM STORAGE CAPACITY (GAL.)	MINIMUM RECOVERY (GPH)	DISCHARGE TEMP. °F	TEMP. RISE °F	ELECTRICAL			NATURAL GAS			 MANUFACTURER/MODEL (BASIS OF DESIGN)
						TOTAL KW	VOLTS/ PHASE	NUMBER OF ELEMENTS	CFH	PRESSURE IN W.C.	FLUE SIZE	
GWH-1	MECH. HOT WATER 203	100	570	140°	80°	N/A	115/1	N/A	400	7"	3"	BRADFORD WHITE: EF-100T-399N(A)
GWH-2	MECH. HOT WATER 203	100	570	140°	80°	N/A	115/1	N/A	400	7"	3"	BRADFORD WHITE: EF-100T-399N(A)
IWH-1	PH BUFFER 21	N/A	N/A	118°	56°	4.1	277/1	N/A	N/A	N/A	N/A	BRADFORD WHITE: KWICK SHOT ES-4100-5-S-10

NOTES:

1. PROVIDE OPTIONAL CONCENTRIC VENT KIT.
2. PROVIDE CONDENSATE NEUTRALIZATION KIT.
3. PIPING TO AND FROM EACH WATER HEATER AND HOT WATER STORAGE TANK SHALL BE ROUTED HORIZONTALLY AND DOWNWARD A MINIMUM OF 2 FEET BEFORE TURNING IN AN UPWARD DIRECTION.

EXPANSION TANK SCHEDULE							
MARK	SERVICE	MANUFACTURER / MODEL (BASIS OF DESIGN)	SYSTEM VOLUME (GALLONS)	TANK VOLUME (GALLONS)	MAXIMUM PRESSURE (PSIG)	LOCATION	REMARKS
ET-1	DOMESTIC HOT WATER	AMTROL / ST-12C	140	6.4	150	MECHANICAL ROOM 102	ASME-STAMPED, DIAPHRAGM TYPE, 55 PSIG PRECHARGED



L

K

NOTES:

1. NUMBER OF OCCUPANTS IS FOR INFORMATIONAL PURPOSES ONLY.
2. PRESSURIZATION IS ACHIEVED THROUGH ADDING 50 CFM PER DOOR.

LEED EQc2 - 30% Increased Ventilation?: NO

NO

OUTDOOR AIR INTAKE FLOW (CFM) , Vot

4755

G

F

NOTES:

1. NUMBER OF OCCUPANTS IS FOR INFORMATIONAL PURPOSES ONLY.

SYSTEM POPULATION (PEOPLE), Ps	120
OCCUPANT DIVERSITY, D = (Ps) / Total all zones (Pz)	0.91

UNCORRECTED OUTDOOR AIR INTAKE (CFM), V_{ou} :
SYSTEM VENTILATION EFFICIENCY, E_v :

APPENDIX A OVERRIDE FOR Ev:

OUTDOOR AIR INTAKE FLOW

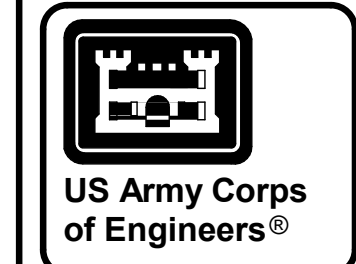
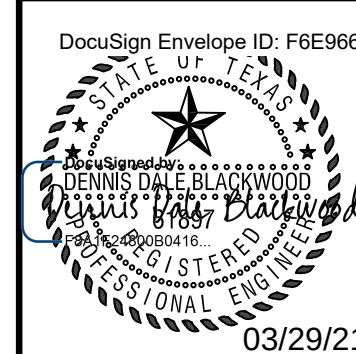
LEED EQc2 - 30% INCREASED VENTILATION:

D

C

B

A

[illegible]

US ARMY CORPS OF ENGINEERS
FORT WORTH DISTRICT
FORT WORTH, TEXAS 76102

DESIGNED BY: Designer
DRAWN BY: Author
CHECKED BY:
SUBMITTED BY: C. COLEMAN
SIZE: 1/8
CONSULTANT: HUNSAKER
TECH: CFZ
GROUP: DESIGN

ISSUE DATE:
19 FEB 2021

SOLICITATION NO.:
W9126521R0051

CONTRACT NO.:
MP13A3855A

ANSI E

JOINT BASE SAN ANTONIO (JBSA) - LACKLAND AFB
SPECIAL WARFARE TRAINING GROUP AQUATIC TRAINING FACILITY
PROJECT NUMBER: MPXJ043855A; P2 NUMBER: 472466

SHEET ID

M-003



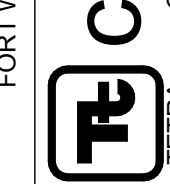


03/29/2021

DATE _____

ISSUE DATE:
19 FEB 2021
SOLICITATION
W9126G21R000
CONTRACT NO
MIPYJ043895A

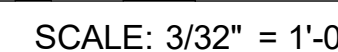
DESIGNED BY:	
Designer	
DRAWN BY:	
Author	
CHECKED BY:	
Checker	
SUBMITTED BY:	
C. COLEMAN	



JOINT BASE SAN ANTONIO (JBSA) - LACKLAND AFB
SPECIAL WARFARE TRAINING GROUP AQUATIC TRAINING FACILITY
PROJECT NUMBER: MPYJ043895A; P2 NUMBER: 472486

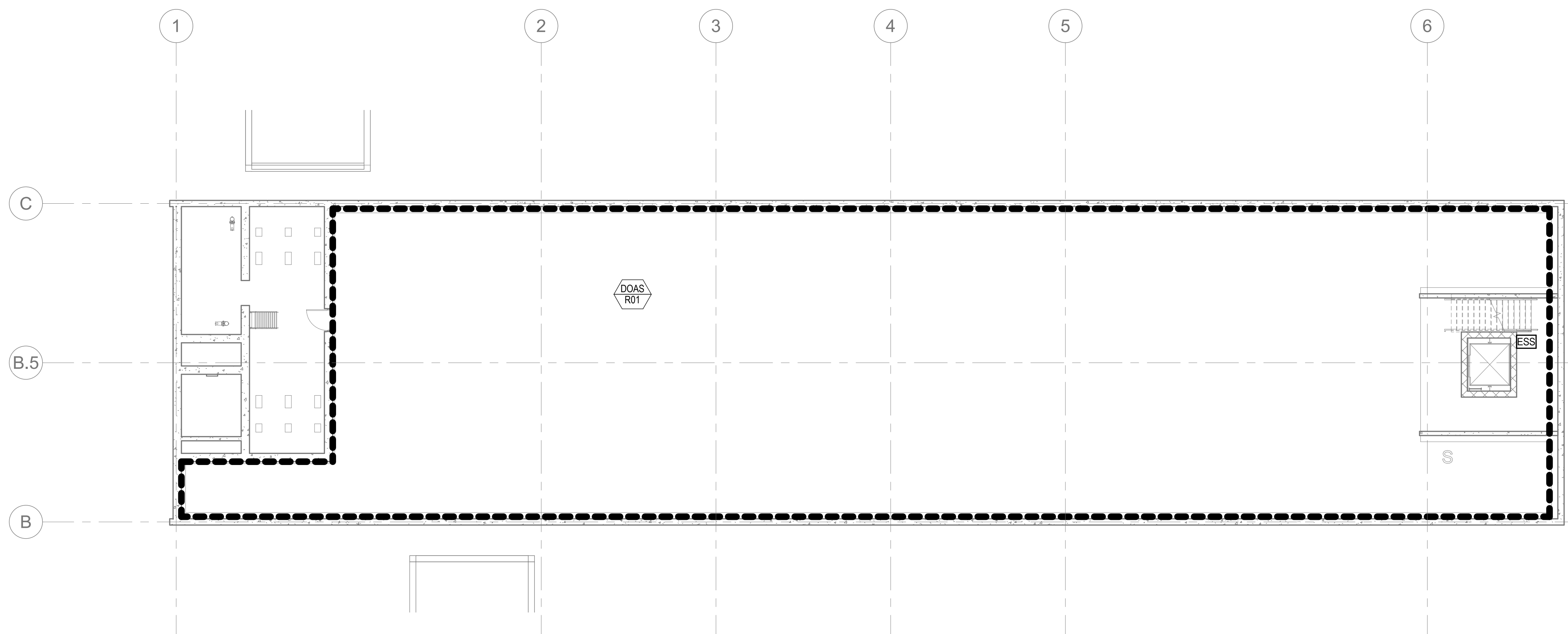
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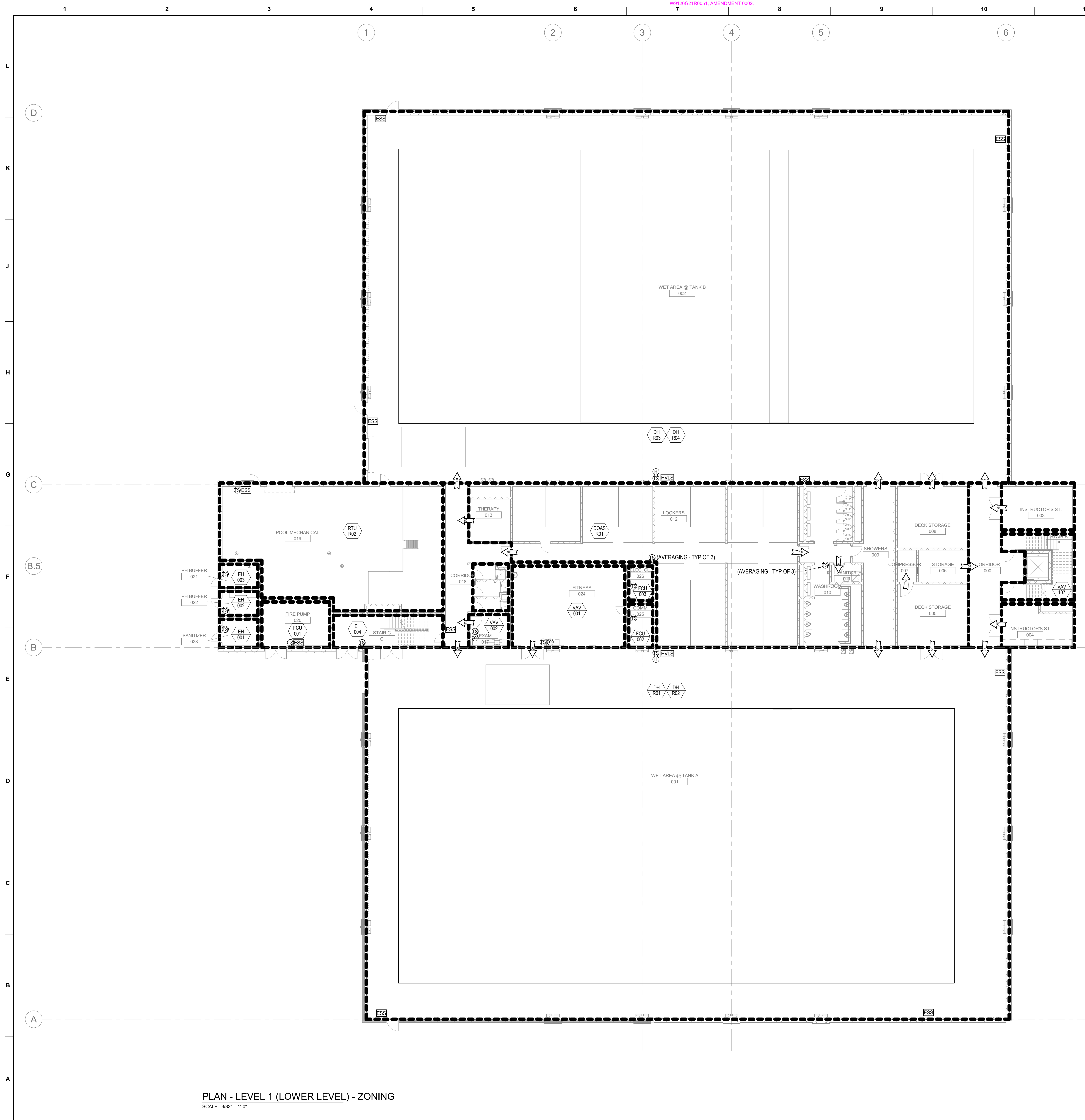
M-200



- A. COORDINATE ALL CONTROLS AND SEQUENCES OF OPERATION WITH THE ENERGY MANAGEMENT CONTROL SYSTEM (EMCS). PROVIDE ALL DEVICES, CONTROLLERS, SENSORS, CONDUIT, WIRING AND LABOR TO PROVIDE COMPLETE AND OPERATIONAL SYSTEM TO MEET THE OWNER'S PROJECT REQUIREMENTS AND THE DESIGN INTENT. CONDUCT THE FOLLOWING TESTS AND SPECIFICATIONS.
- B. ALL CONTROL CONDUIT AND WIRING SHALL COMPLY WITH THE ELECTRICAL CODE AND THE SPECIFICATIONS.
- C. EMERGENCY SHUTDOWN SWITCHES SHALL BE PROVIDED WITHIN 200 FT OF TRAVEL DISTANCE FROM ANYWHERE IN THE NORMALLY OCCUPIED BUILDING PER UFC4-010-01, Labeled Emergency Switches Shall Be Located Within 100 Feet Adjacent to Fire Alarm Pull Stations. LABEL IN A DIFFERENT COLOR THAN FIRE ALARM PULL STATIONS.
- D. ZONES SHOWN WITH MULTIPLE CO2 SENSORS SHALL TAKE THE HIGHEST READING FOR RESETING THE VAV MINIMUM POSITION. REFER TO THE CONTROLS SEQUENCE OF OPERATION.
- E. FLOW ARROWS DENOTE DESIGN AIRFLOW DELTAS FOR SPACE PRESSURIZATION VIA CFM OFFSETS.

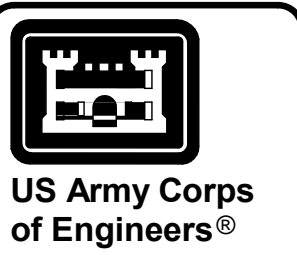
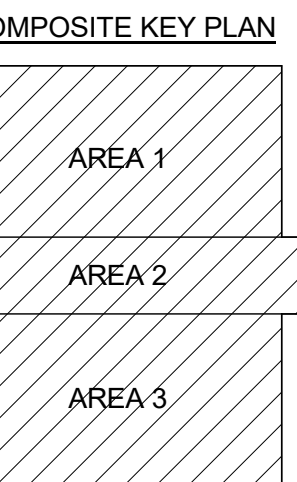
SCALE: 3/32" = 1'-0"





SHEET NOTES

- A. COORDINATE ALL CONTROLS AND SEQUENCES OF OPERATION WITH THE ENERGY MANAGEMENT CONTROL SYSTEM (EMCS). PROVIDE ALL DEVICES, CONTROLLERS, SENSORS, AND OUTPUTS TO THE WORK ORDER TO COMPLETE AND OPERATIONAL SYSTEM TO MEET THE OWNER'S PROJECT REQUIREMENTS AND THE DESIGN INDICATED ON THESE DRAWINGS AND SPECIFICATIONS.
- B. ALL CONTROL CONDUIT AND WIRING SHALL COMPLY WITH THE ELECTRICAL CODE AND THE SPECIFICATIONS.
- C. EMERGENCY SHUTDOWN SWITCHES SHALL BE PROVIDED WITHIN THE TRANSFER SWITCH ENCLOSURE FOR ANYWHERE IN THE NORMALLY CLOSED BUILDING PER IFC 410.01. LOCATE THE SWITCHES TO BE EASILY ACCESSIBLE AND ADJACENT TO FIRE ALARM PULL STATIONS. LABEL IN A DIFFERENT COLOR THAN FIRE ALARM PULL STATIONS.
- D. ZONES SHOWN WITH MULTIPLE CO2 SENSORS SHALL TAKE THE HIGHEST READING FOR RESETING THE VAV MINIMUM POSITION. PROVIDE A READING TO THE CONTROLS SEQUENCE OF OPERATION.
- E. FLOW ARROWS DENOTE DESIGN AIRFLOW DELTAS FOR SPACE PRESSURIZATION VIA CFM OFFSETS.

[illegible]

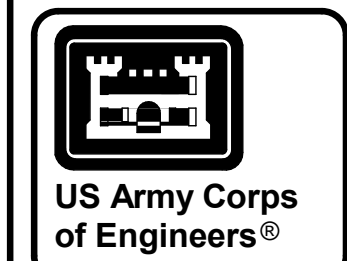
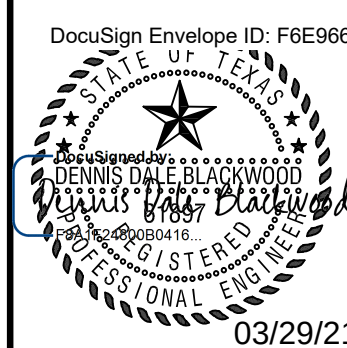
 TECH GROUP PETRY	 CFZ CONSULTING	 HUNSMAN GROUP	ANSIE DESIGN	COLEMAN SUBMITTER	CHECKED BY:	CONTRACT NO.:	ISSUE DATE:
					DESIGNED BY:	DRAWN BY:	W125G21R0001

PLAN - LEVEL 1 (LOWER LEVEL) - ZONING

SHEET ID
M-210

- A. COORDINATE ALL CONTROLS AND SEQUENCES OF OPERATION WITH THE ENERGY MANAGEMENT CONTROL SYSTEM (EMCS). PROVIDE ALL DEVICES, CONTROLLERS, SENSORS, AND OUTPUTS TO THE WORK ORDER TO COMPLETE AND OPERATIONAL SYSTEM TO MEET THE OWNER'S PROJECT REQUIREMENTS AND THE DESIGN INDICATED ON THESE DRAWINGS AND SPECIFICATIONS.
- B. ALL CONTROL CONDUIT AND WIRING SHALL COMPLY WITH THE ELECTRICAL CODE AND THE SPECIFICATIONS.
- C. EMERGENCY SHUTDOWN SWITCHES SHALL BE PROVIDED WITHIN THE TRANSFORMER ENCLOSURE FOR ANYWHERE IN THE NORMALLY OCCUPYING BUILDING PER IFC 4101.01 LOCATE THE SWITCHES TO BE EASILY ACCESSIBLE AND ADJACENT TO FIRE ALARM PULL STATIONS. LABEL IN A DIFFERENT COLOR THAN FIRE ALARM PULL STATIONS.
- D. ZONES SHOWN WITH MULTIPLE CO2 SENSORS SHALL TAKE THE HIGHEST READING FOR RESETTING THE VAV MINIMUM POSITION. PROVIDE A READING TO THE CONTROLS SEQUENCE OF OPERATION.
- E. FLOW ARROWS DENOTE DESIGN AIRFLOW DELTAS FOR SPACE PRESSURIZATION VIA CFM OFFSETS.

A diagram showing a cross-section of a structure with three distinct areas. The top section is labeled 'AREA 1', the middle section is labeled 'AREA 2', and the bottom section is labeled 'AREA 3'. The areas are separated by horizontal lines, and the entire structure is filled with diagonal hatching.

[illegible]

US ARMY CORPS OF ENGINEERS FORT WORTH DISTRICT FORT WORTH, TEXAS 76102		DESIGNED BY: Designer		ISSUE DATE: 19 FEB 2021	
		DRAWN BY: Checker		SOLICITATION NO.: W9127-17-2-0001	
		CHECKED BY: Checker		CONTRACT NO.: MP14043855A	
		SUBMITTED BY: C. COLEMAN			
  		SIZE: ANS I			
TETRA CFZ 5 TETRA GROUP DESIGN		HANSUMAKER			

JOINT BASE SAN ANTONIO (JBSA) - LACKLAND AFB
SPECIAL WARFARE TRAINING GROUP AQUATIC TRAINING FACILITY
PROJECT NUMBER: MPYJ0438954; P2 NUMBER: 472486

**PLAN - LEVEL 3 (MECH
PLATFORM) - ZONING**

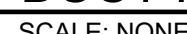
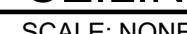
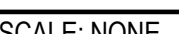
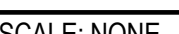
SHEET ID
M-230





SHEET ID

M-301







SHEET NOTES

AMENDMENT 0002

CONTRACTORS ARE FREE TO USE ANY PRODUCT WHICH MEETS THE GOVERNMENT'S MINIMUM REQUIREMENTS AND NOT IN CONFLICT WITH OTHER CONTRACT PROVISIONS. UNLESS INDICATED OTHERWISE ON THE PLANS OR SPECIFICATIONS (E.G. SOLE-SOURCE), ALL LISTED MANUFACTURERS ARE THE BASIS OF DESIGN. FOR THESE BASIS OF DESIGN PRODUCTS, OTHER MANUFACTURERS MAY BE SUBSTITUTED AS LONG AS THE STANDARD OF QUALITY AND CHARACTERISTICS OF THE SUBSTITUTED MANUFACTURER MEET OR EXCEED THE STANDARD OF QUALITY AND CHARACTERISTICS OF THE BASIS OF DESIGN.

ROOFTOP UNIT ACOUSTIC DATA

SOURCE	SOUND POWER BY OCTAVE BAND (dB)								OVERALL (dBA)
	63	125	250	500	1000	2000	4000	8000	
SUPPLY AIR	97	95	95	94	90	89	92	88	87
EXHAUST AIR	91	88	86	79	78	77	70	64	74
CASING EXHAUST	96	95	95	93	90	88	91	87	97

DocuSign Envelope ID: F6E96B81

STATE OF TEXAS
DENNIS DALE BLACKWOOD
REGISTERED PROFESSIONAL ENGINEER
03/29/21

SOURCE	SOUND POWER BY OCTAVE BAND (dB)								OVERALL (dBA)
	63	125	250	500	1000	2000	4000	8000	
SUPPLY AIR	70	74	77	75	68	66	66	71	-
EXHAUST AIR	79	94	88	87	88	88	84	85	79
CASING RADIATED	85	98	97	98	94	95	89	88	104



US Army Corps
of Engineers®

TAG	#	DEHUMIDIFICATION UNIT TAG	MANUFACTURER	MODEL NUMBER	AREA SERVED	LOCATION	FAN QUANTITY	FAN HP (EA.)	EAT	GPM	COOLING		ELECTRICAL				UNIT SIZE (L"XW"XH")	OPER. WT. (LBS)	NOTES
											NOM. CAP. (MBH)	VOLTS	PH	MCA (A)	MOCP (A)				
DC	R01	DH-1	SERESCO	NG-V-S2	TANK A	LOWER ROOF	6	3.4	105	100	776.3	460	3	28	35	148x101x79	3600	1-5	
DC	R02	DH-2	SERESCO	NG-V-S2	TANK A	LOWER ROOF	6	3.4	105	100	776.3	460	3	28	35	148x101x79	3600	1-5	
DC	R03	DH-3	SERESCO	NG-V-S2	TANK B	LOWER ROOF	6	3.4	105	100	776.3	460	3	28	35	148x101x79	3600	1-5	
DC	R04	DH-4	SERESCO	NG-V-S2	TANK B	LOWER ROOF	6	3.4	105	100	776.3	460	3	28	35	148x101x79	3600	1-5	

TAG	#	DEHUMIDIFICATION UNIT TAG	MANUFACTURER	MODEL NUMBER	AREA SERVED	LOCATION	FAN QUANTITY	FAN HP (EA.)	EAT	GPM	COOLING		ELECTRICAL				UNIT SIZE (L"XW"XH")	OPER. WT. (LBS)	NOTES
											NOM. CAP. (MBH)	VOLTS	PH	MCA (A)	MOCP (A)				
DC	R01	DH-1	SERESCO	NG-V-S2	TANK A	LOWER ROOF	6	3.4	105	100	776.3	460	3	28	35	148x101x79	3600	1-5	
DC	R02	DH-2	SERESCO	NG-V-S2	TANK A	LOWER ROOF	6	3.4	105	100	776.3	460	3	28	35	148x101x79	3600	1-5	
DC	R03	DH-3	SERESCO	NG-V-S2	TANK B	LOWER ROOF	6	3.4	105	100	776.3	460	3	28	35	148x101x79	3600	1-5	
DC	R04	DH-4	SERESCO	NG-V-S2	TANK B	LOWER ROOF	6	3.4	105	100	776.3	460	3	28	35	148x101x79	3600	1-5	

NOTES

1. COORDINATE WITH ELECTRICAL FOR POWER AND DISCONNECTS AS REQUIRED BY MANUFACTURER.
2. PROVIDE PVC CONNECTION PIPING TO DEHUMIDIFICATION UNIT PER MANUFACTURER'S REQUIREMENTS.
3. UNIT IS AN INTEGRATED PACKAGE WITH DEHUMIDIFICATION UNIT.
4. ASSUMED FOULING FACTOR OF 0.001.
5. FLUID TO BE 33% PROPYLENE GLYCOL SOLUTION.

				SYSTEM SERVED (TAG)		FLOW (GPM)	HEAD (FT WG)	MIN. EFF. %	MIN. EFF. %	NPSH (FT)	RPM	RPM	ELE CTRICAL			OPER. WT. (LBS)			
TAG	#	MANUFACTURER	MODEL NUMBER	TYPE									BHP	BHP	HP	VOLTS	PH	VFD	NOTES
P	001	GOULDs	4x4x7B	DC-R01/R02	INLINE	140.0	35	75	75	4.7	1750	1750	1.70	1.70	3	460	3	Yes	180 1-10
P	202	GOULDs	4x4x7B	DC-R01/R02	INLINE	140.0	35	75	75	4.7	1750	1750	1.70	1.70	3	460	3	Yes	180 1-10
P	201	WESSELS	GMPD-25100	DC-R01/R02	DUPLEX GLYCOL FEED TANK	1.8	160	-	-	-	-	-	0.00	-	1/2	120	1	No	1000 1,11
P	202	WESSELS	GMPD-25100	DC-R03/R04	DUPLEX GLYCOL FEED TANK	1.8	160	-	-	-	-	-	0.00	-	1/2	120	1	No	1000 1,11

				SYSTEM SERVED (TAG)		FLOW (GPM)	HEAD (FT WG)	MIN. EFF. %	MIN. EFF. %	NPSH (FT)	RPM	RPM	ELE CTRICAL			OPER. WT. (LBS)			
TAG	#	MANUFACTURER	MODEL NUMBER	TYPE									BHP	BHP	HP	VOLTS	PH	VFD	NOTES
P	001	GOULDS	4x4x7B	DC-R01/R02	INLINE	140.0	35	75	75	4.7	1750	1750	1.70	1.70	3	460	3	Yes	180 1-10
P	202	GOULDS	4x4x7B	DC-R01/R02	INLINE	140.0	35	75	75	4.7	1750	1750	1.70	1.70	3	460	3	Yes	180 1-10
P	201	WESSELS	GMPD-25100	DC-R01/R02	DUPLEX GLYCOL FEED TANK	1.8	160	-	-	-	-	-	0.00	-	1/2	120	1	No	1000 1,11
P	202	WESSELS	GMPD-25100	DC-R03/R04	DUPLEX GLYCOL FEED TANK	1.8	160	-	-	-	-	-	0.00	-	1/2	120	1	No	1000 1,11

NOTES

1. COORDINATE WITH ELECTRICAL FOR POWER AND DISCONNECT AS REQUIRED.
2. PROVIDE NON-OVERLOADING NEMA PREMIUM EFFICIENCY, INVERTER READER MOTOR.
3. PROVIDE TOTALLY ENCLOSED FAN COOLED (TEFC) MOTORS.
4. PROVIDE VARIABLE FREQUENCY DRIVE (VFD) BY MECHANICAL AND WIRED BY ELECTRICAL.
5. PROVIDE MOTOR SHAFT GROUNDING SYSTEM FOR MOTOR CONTROLLED BY VFD.
6. PUMP SYSTEM IS DOWNSTREAM OF POOL FILTERS AND DOES NOT REQUIRE AN ADDITIONAL STRAINER.
7. PROVIDE VIBRATION ISOLATION AND SEISMIC RESTRAINT PER SPECIFICATIONS.
8. PUMP SHUT OFF SHALL BE NO LESS THAN (120% OF THE TOTAL DESIGN HEAD) OR (TOTAL DESIGN HEAD +20FT), WHICHEVER IS LESS.
9. PUMP EFFICIENCY SHALL BE 70% MINIMUM, UNLESS PHYSICALLY IMPOSSIBLE.
10. TRIM IMPELLER TO LARGEST NON-OVERLOADING SIZE AT INDICATED HORSEPOWER, AND UTILIZE VFD FOR SYSTEM BALANCING TO DUTY POINT.
11. GYCOL SYSTEM HAVE 100 GALLON POLYETHYLENE TANKS, AND DUAL 1/2HP PUMPS FOR FEEDING TWO SYSTEMS.

						COOLING (95°F ODB/80°F IDB/67°F EWB)							ELECTRICAL											
TAG	#	FAN COIL	MANUFACTURER	MODEL NUMBER	AREA SERVED	LOCATION	NOM. CAP. (TYP)	EER	SEER	REFRIG TYPE	REFRIG RSBS	VOLTS	PH	MCA (A)	MCP (A)	EMERG POWER (W)	UNIT SIZE (L x W x H) (IN)	OPERATING WEIGHT (LBS.)	NOTES					
CJ	R001	FCU 001	LG	LSU180HVS	FIRE PUMP 020	MECHANICAL PLATFORM	29.5	12.6	21.5	R410A	3.53	208	1	13	20	No	34x14x32	117	-1.4					
CJ	R002	FCU 002	LG	LSU180HVS	COMM 025	MECHANICAL PLATFORM	29.5	12.6	21.5	R410A	3.53	208	1	13	20	No	34x14x32	117	-1.4					
CJ	R003	FCU 003	LG	LSU090HVS	ELEC 026	MECHANICAL PLATFORM	12.6	14.5	23.5	R410A	2.21	208	1	10	15	No	30x14x22	74	-1.4					
CJ	R101	FCU 101	LG	LSU180HVS	COMM 112	MECHANICAL PLATFORM	29.5	12.6	21.5	R410A	3.53	208	1	13	20	No	34x14x32	117	-1.4					
CJ	R102	FCU 102	LG	LSU180HVS	ELEC 109	MECHANICAL PLATFORM	29.5	12.6	21.5	R410A	3.53	208	1	13	20	No	34x14x32	117	-1.4					
CJ	R201	FCU 201	LG	LSU120HVS	ELEC 201		19.5	12.5	22.7	R410A	2.21	208	1	10	15	No	30x14x22	74	-1.4					
CJ	R202	FCU 202	LG	LSU180HVS	MECH HOT WATER 203	MECHANICAL PLATFORM	28	12.6	21.5	R410A	3.53	208	1	13	20	No	34x14x32	117	-1.4					

							COOLING (95°F ODB/80°F IDB/67°F EWB)					ELECTRICAL										
TAG	#	FAN COIL MODEL	MANUFACTURER	MODEL NUMBER	AREA SERVED	LOCATION	NOM. CAP. (TYP)	EER	SEER	REFRIG TYPE	REFRIG RSBS	VOLTS	PH	MCA (A)	MOPC (A)	EMERG POWER (W)	UNIT SIZE (X"HxH")	OPERATING WEIGHT (LBS.)	NOTES			
CJ	R001	FCU 001	LG	LSU180HVS	FIRE PUMP 020	MECHANICAL PLATFORM	29.5	12.6	21.5	R410A	3.53	208	1	13	20	No	34x14x32	117	-1.4			
CJ	R002	FCU 002	LG	LSU180HVS	COMM 025	MECHANICAL PLATFORM	29.5	12.6	21.5	R410A	3.53	208	1	13	20	No	34x14x32	117	-1.4			
CJ	R003	FCU 003	LG	LSU090HVS	ELEC 026	MECHANICAL PLATFORM	12.6	14.5	23.5	R410A	2.21	208	1	10	15	No	30x14x22	74	-1.4			
CJ	R101	FCU 101	LG	LSU180HVS	COMM 112	MECHANICAL PLATFORM	29.5	12.6	21.5	R410A	3.53	208	1	13	20	No	34x14x32	117	-1.4			
CJ	R102	FCU 102	LG	LSU180HVS	ELEC 109	MECHANICAL PLATFORM	29.5	12.6	21.5	R410A	3.53	208	1	13	20	No	34x14x32	117	-1.4			
CJ	R201	FCU 201	LG	LSU120HVS	ELEC 201	MECHANICAL PLATFORM	19.5	12.5	22.7	R410A	2.21	208	1	10	15	No	30x14x22	74	-1.4			
CJ	R202	FCU 202	LG	LSU180HVS	MECH HOT WATER 203	MECHANICAL PLATFORM	28	12.6	21.5	R410A	3.53	208	1	13	20	No	34x14x32	117	-1.4			

NOTES

1. COORDINATE WITH ELECTRICAL FOR POWER AND DISCONNECTS AS REQUIRED BY MANUFACTURER.
2. PROVIDE REFRIGERANT PIPING PER MANUFACTURER'S REQUIREMENTS.
3. PROVIDE MANUFACTURER'S CONTROL SYSTEM; SYSTEM WILL BE STANDALONE WITH NO INTERFACE TO EMCS
4. PROVIDE EXTENDED LINE LENGTH RATING, FOR UP TO 170FT.

TAG	#	COND UNIT	MANUFACTURER	MODEL NUMBER	LOCATION	COOLING CAPACITY		SUPPLY		ELECTRICAL		OPER. WT. (LBS)	NOTES
						TOTAL (MBH)	SENSIBLE (MBH)	AIR FLOW (CFM)	VOLTS	PH	UNIT SIZE (LxWxH)		
FCU	001	R001	LG	LSN180HSVS	FIRE PUMP 020	29.5	18.2	815	208	1	42x11x15	40	1-9
FCU	002	R002	LG	LSN180HSVS	COMM 025	29.5	18.2	706	208	1	40x8x14	26	1-9
FCU	003	R003	LG	LSN090HSVS	ELEC 026	12.6	8.7	459	208	1	32x6x12	18	1-9
FCU	101	R101	LG	LSN180HSVS	COMM 112	29.5	18.2	706	208	1	40x8x14	26	1-9
FCU	102	R201	LG	LSN120HSVS	ELEC 109	18	12	459	208	1	33x8x12	18	1-9
FCU	201	R201	LG	LSN090HSVS	ELEC 201	12.6	8.7	459	208	1	32x6x12	18	1-9
FCU	202	R202	LG	LSN180HSVS	MECH HOT WATER 203	29.5	18.2	706	208	1	40x8x14	26	1-9

NOTES

1. UNIT CONFIGURATION IS WALL MOUNT TYPE.
2. REFRIGERANT: R-410A
3. COOLING CAPACITY BASED ON 80°F/67°F/55°F ENTERING AIR AND 45°F COIL TEMPERATURES.
4. UNITS ARE COOLING ONLY.
5. COORDINATE WITH ELECTRICAL FOR POWER AND DISCONNECT AS REQUIRED.
6. PROVIDE HARD WIRED PROGRAMMABLE BISTABLE SWITCH AT EACH UNIT WITH THERMOSTATS SETPOINTS FOR AT LEAST FOUR SCHEDULING PERIODS WITHIN 24 HOURS. A SEPARATE EMCS TEMPERATURE SENSOR WILL BE UTILIZED FOR MONITORING SPACE TEMPERATURE.
7. FAN COIL UNIT IS POWERED FROM CORRESPONDING OUTDOOR CONDENSING UNIT.
8. PROVIDE WITH MANUFACTURER STANDARD AIR FILTER AND REFER TO SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS.
9. PROVIDE INTEGRATED CONDENSATE PUMP POWERED FROM FCU TERMINAL STRIP AND WITH ALARM CONNECTION TO FCU.

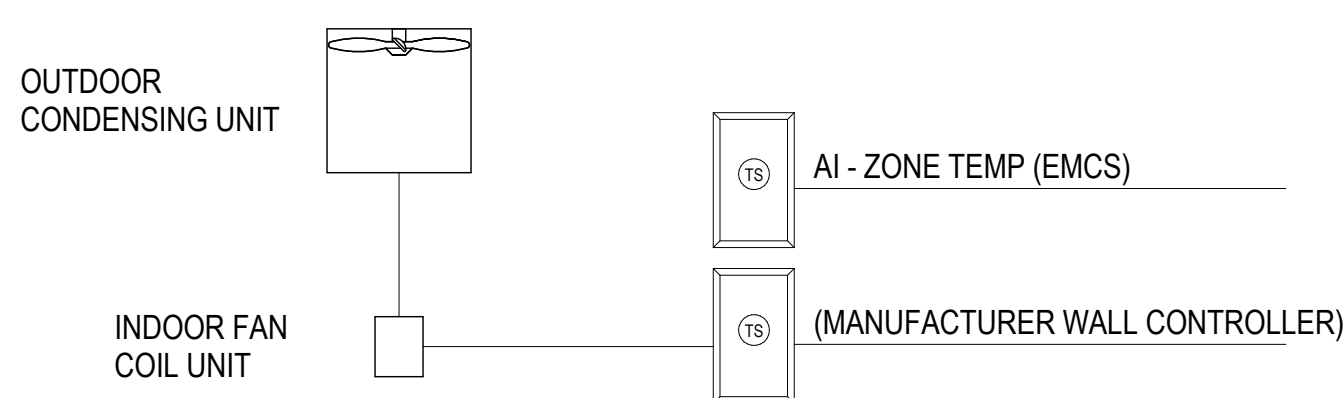
A. OUTDOOR SPLIT SYSTEM CONDENSING UNIT (LOCAL CONTROL ONLY)
B. INDOOR FAN COIL UNIT (LOCAL CONTROL ONLY)
C. TEMPERATURE SENSOR (EMCS)

2. RUN CONDITIONS - CONTINUOUS (VIA LOCAL WALL CONTROLLER):

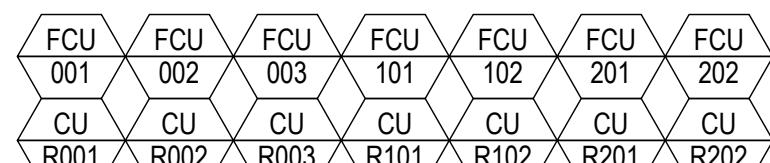
A. THE UNIT SHALL RUN CONTINUOUSLY UNLESS SHUTDOWN ON INTERNAL SAFETIES AND MAINTAIN THE FOLLOWING MODE:

a. COOLING SETPOINT: 75°F

3. ALARMS (VIA EMCS WALL SENSOR):
 - A. HIGH ZONE TEMP:
 - a. IF THE ZONE TEMPERATURE IS 5°F GREATER THAN THE COOLING SETPOINT.
 - B. LOW ZONE TEMP:
 - a. IF THE ZONE TEMPERATURE IS 10°F LESS THAN THE COOLING SETPOINT.



NOTES:
1. LOCATE PROGRAMMABLE MANUFACTURER WALL CONTROLLER AND EMCS TEMP SENSOR SIDE BY SIDE ON WALL.

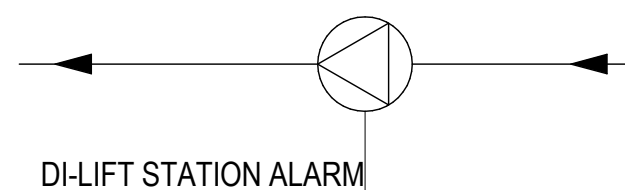


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NOTES:

1. REFER TO PLUMBING DRAWINGS FOR LOCATION/QUANTITY.
2. THE CONTROLLER SHALL MONITOR THE WATER METER FOR WATER CONSUMPTION ON AN CONTINUAL BASIS. THESE VALUES SHALL BE MADE AVAILABLE TO THE EMCS AT ALL TIMES.
3. ALARM SHALL BE GENERATED IF SENSOR READING INDICATES A LOSS OF READING OR OUTPUT FROM THE WATER METER.
4. PEAK DEMAND HISTORY: THE CONTROLLER SHALL MONITOR AND RECORD THE PEAK (HIGH AND LOW) DEMAND READINGS FROM THE WATER METER. PEAK READINGS SHALL BE RECORDED ON A 15-MINUTE DAILY, MONTH-TO-DATE, AND YEAR-TO-DATE BASIS.
5. USAGE HISTORY: THE CONTROLLER SHALL MONITOR AND RECORD WATER METER READINGS SO AS TO PROVIDE A WATER CONSUMPTION HISTORY. USAGE READINGS SHALL BE RECORDED ON A 15-MINUTE DAILY, MONTH-TO-DATE, AND YEAR-TO-DATE BASIS.

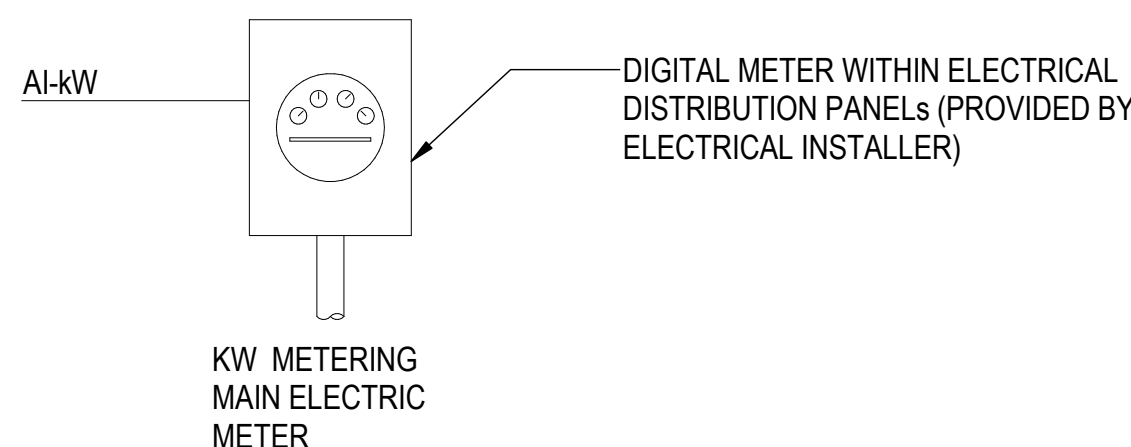
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NOTES:

1. REFER TO CIVIL DRAWINGS FOR LOCATION/QUANTITY.
2. ALARM SHALL PASS THRU ANY ALARM GENERATED BY THE LIFT STATION

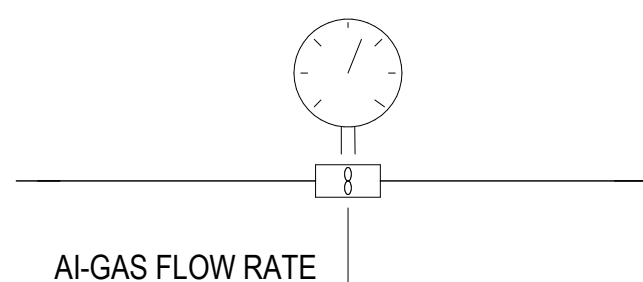
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NOTES:

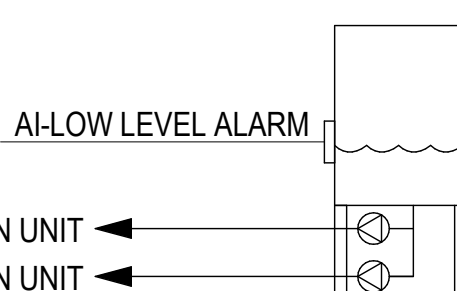
1. REFER TO ELECTRICAL DRAWINGS FOR LOCATION/QUANTITY
2. ELECTRIC SUBMETER: THE ELECTRICAL DISTRIBUTION PANELS ON THE PROJECT CONTAIN SUBMETERS. THE CONTROLLER SHALL MONITOR THE ELECTRIC SUBMETERS FOR ELECTRIC CONSUMPTION ON A CONTINUAL BASIS. THESE VALUES SHALL BE MADE AVAILABLE TO THE EMSG AT ALL TIMES.
3. VOLTAGE ALARM AND OUTPUT: THE CONTROLLER SHALL BE GENERATED BY THE EMSG TO INDICATE A LOSS OF PULSE OUTPUT FROM THE ELECTRIC SUBMETER.
4. PEAK DEMAND HISTORY: THE CONTROLLER SHALL MONITOR AND RECORD THE PEAK (HIGH AND LOW) DEMAND READINGS FROM THE ELECTRIC SUBMETER SEPARATELY FOR EACH MONTH. THE DATA SHALL BE RECORDED ON A 15-MINUTE, DAILY, MONTH-TO-DATE, AND YEAR-TO-DATE BASIS.
5. USAGE HISTORY: THE CONTROLLER SHALL MONITOR AND RECORD ELECTRIC SUBMETER READINGS SO AS TO PROVIDE A POWER CONSUMPTION HISTORY FOR EACH MONTH. THE DATA SHALL BE RECORDED ON A 15-MINUTE, DAILY, MONTH-TO-DATE, AND YEAR-TO-DATE BASIS.

SCALE: NONE



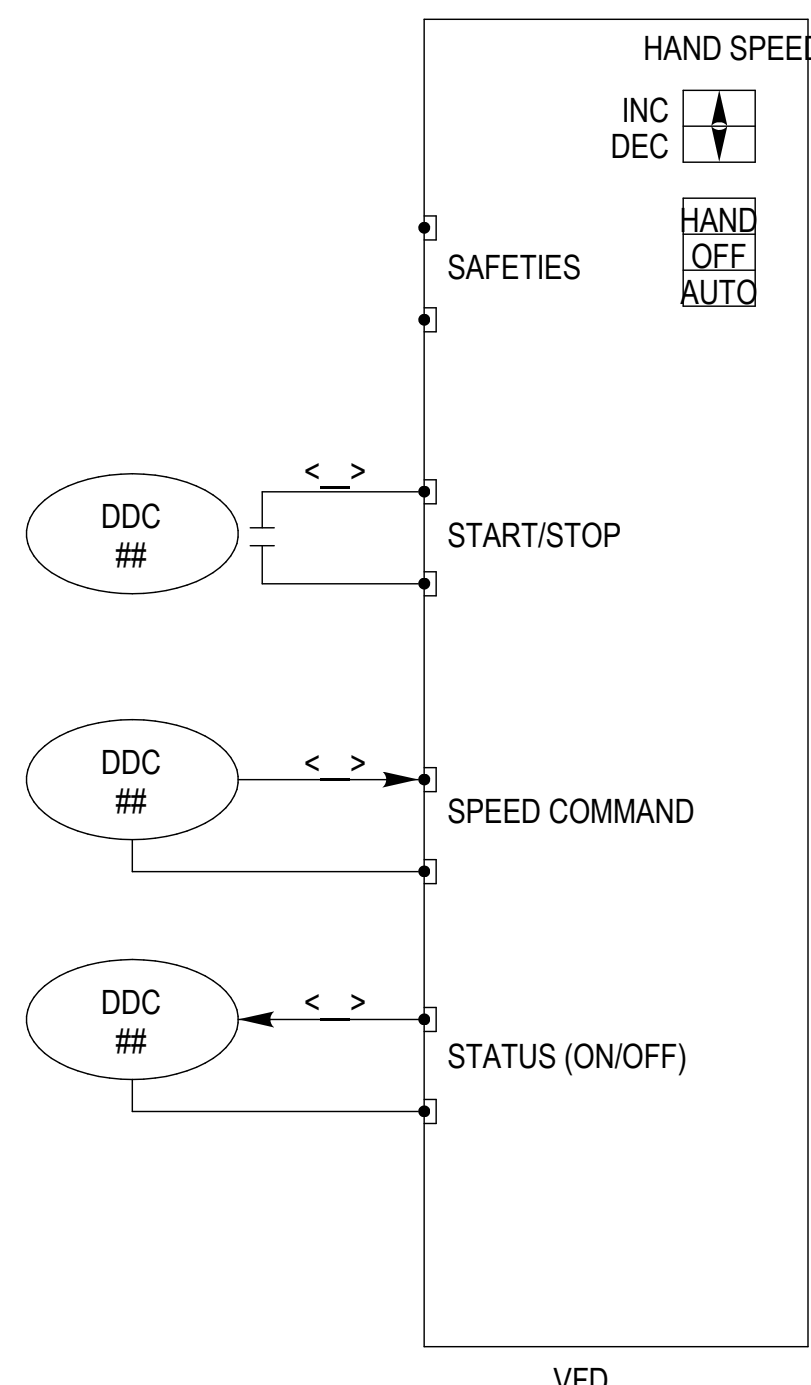
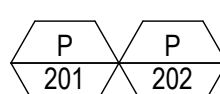
- NOTES:
1. REFER TO PLUMBING DRAWINGS FOR LOCATION/QUANTITY.
2. THE CONTROLLER SHALL MONITOR THE GAS METER FOR GAS CONSUMPTION ON A CONTINUAL BASIS. THESE VALUES SHALL BE MADE AVAILABLE TO THE EMCS AT ALL TIMES.
3. ALARM SHALL BE GENERATED IF SENSOR READING INDICATES A LOSS OF READING OR OUTPUT FROM THE GAS METER.
4. PEAK DEMAND HISTORY: THE CONTROLLER SHALL MONITOR AND RECORD THE PEAK (HIGH AND LOW) DEMAND READINGS FROM THE GAS METER. PEAK READINGS SHALL BE STORED ON A CONTINUAL BASIS. THE CONTROLLER SHALL STORE YEAR-TO-DATE BASIS.
5. USAGE HISTORY: THE CONTROLLER SHALL MONITOR AND RECORD GAS METER READINGS SO AS TO PROVIDE A GAS CONSUMPTION HISTORY. USAGE READINGS SHALL BE RECORDED ON A 15-MINUTE DAILY, MONTH-TO-DATE, AND YEAR-TO-DATE BASIS.

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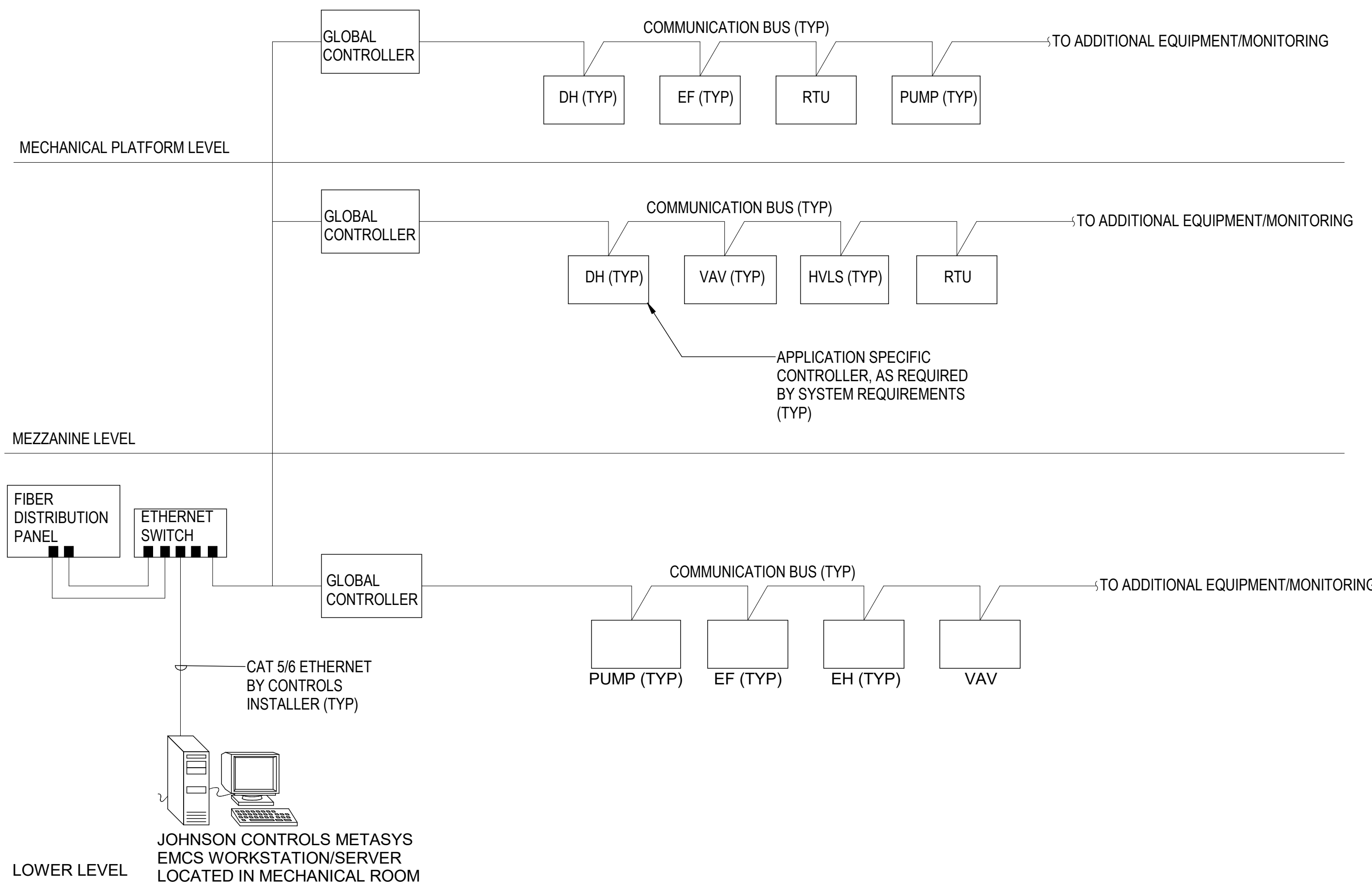
NOTES:
1. GLYCOL FEED SYSTEM HAS A SINGLE PRE-MIXED RESERVOIR
W/ DUPL EX PUMPS.

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NOTE:
1. THIS IS A FUNCTIONAL REPRESENTATION. CONTRACTOR
WIRING MAY DIFFER.

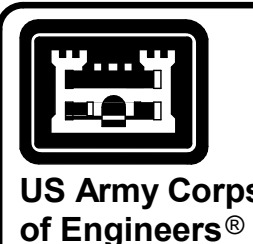
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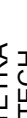
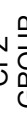
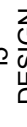
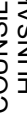


NOTES:

1. REFER TO 25 08 10 & 25 10 10 FOR UMCS AND 25 05 11 FOR CYBERSECURITY REQUIREMENTS
2. REFER TO PLANS FOR LOCATIONS OF EQUIPMENT.
3. REFER TO SPECIFICATIONS AND SEQUENCE OF OPERATION FOR ADDITIONAL REQUIREMENTS.
4. COORDINATE ALL WIRING WITH ELECTRICAL INSTALLER.
5. COORDINATE ALL EMCS WIRING AND DEVICES BETWEEN MECHANICAL INSTALLER AND CONTROLS INSTALLER
6. PROVIDE AREA AND NETWORK CONTROLLERS AS REQUIRED.

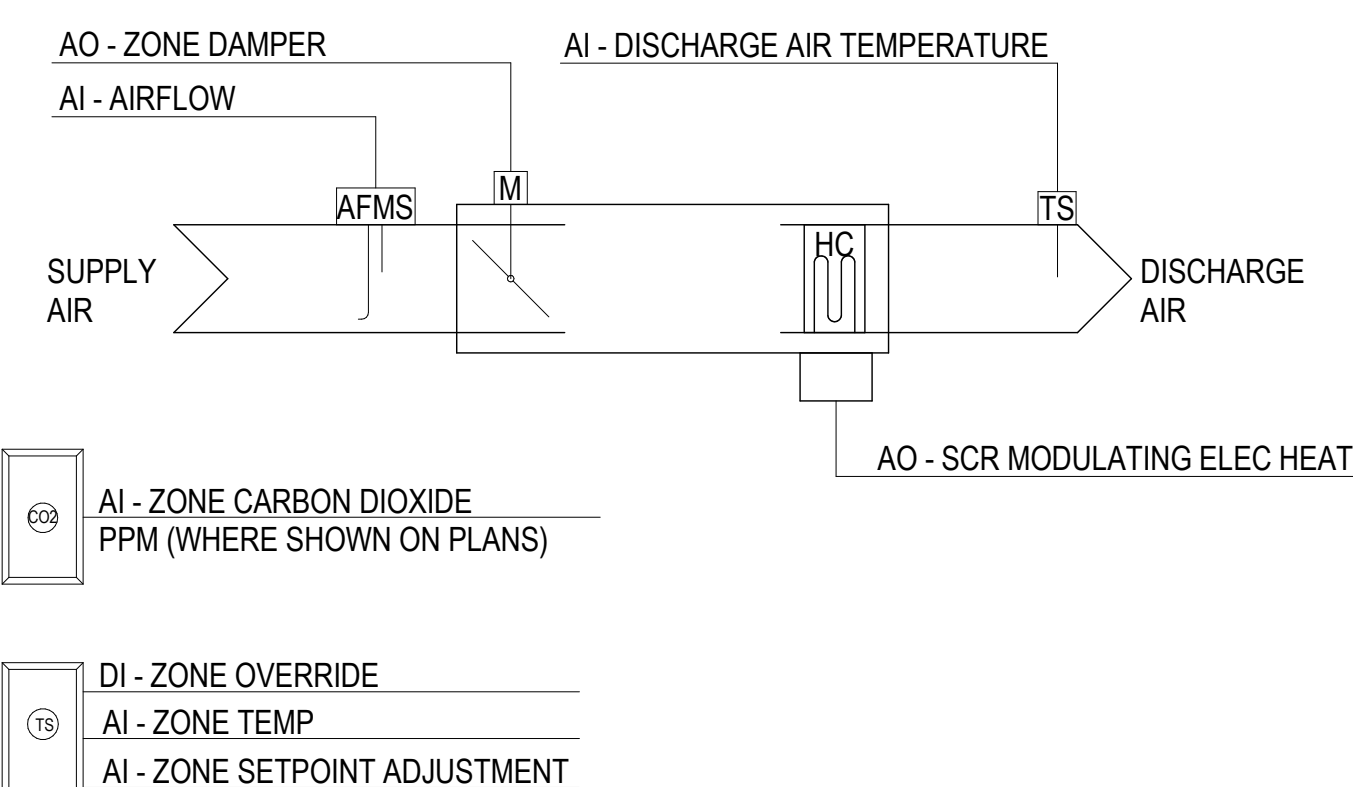
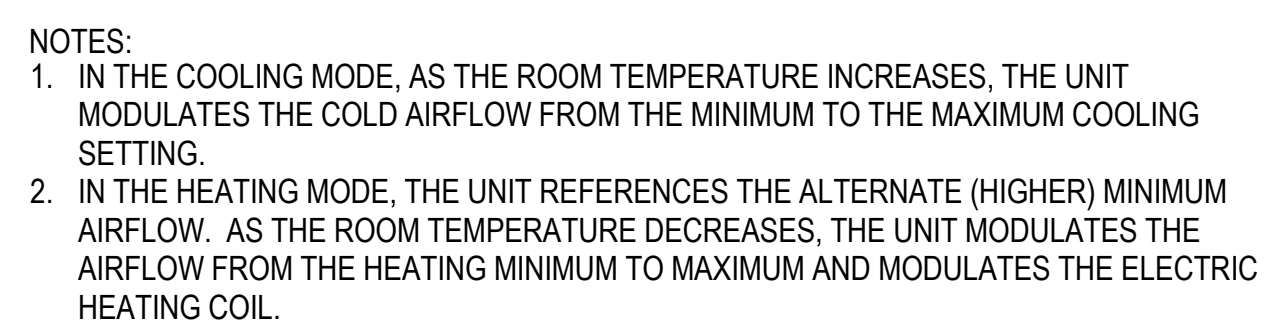
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 TETRA TECH	 CFZ	 HUNSAKER	 CNSILM	 GSE	 S&S	ISSUE DATE:	19 FEB 2021
						DESIGNED BY:	KAO
US ARMY CORPS OF ENGINEERS FORT WORTH DISTRICT FORT WORTH, TEXAS 76102	CFZ	HUNSAKER	CNSILM	GSE	S&S	DRAWN BY:	KAO
						CHECKED BY:	SAN
US ARMY CORPS OF ENGINEERS FORT WORTH DISTRICT FORT WORTH, TEXAS 76102	CFZ	HUNSAKER	CNSILM	GSE	S&S	SUBMITTED BY:	COLEMAN
						CONTRACT NO.:	MPVJ043856A
US ARMY CORPS OF ENGINEERS FORT WORTH DISTRICT FORT WORTH, TEXAS 76102	CFZ	HUNSAKER	CNSILM	GSE	S&S	WITNESSED BY:	KAO
						DATE:	19 FEB 2021

JOINT BASE SAN ANTONIO (JBSA) - LACKLAND AFB
SPECIAL WARFARE TRAINING GROUP AQUATIC TRAINING FACILITY
PROJECT NUMBER: NPVJ043895A, P2 NUMBER: 472486

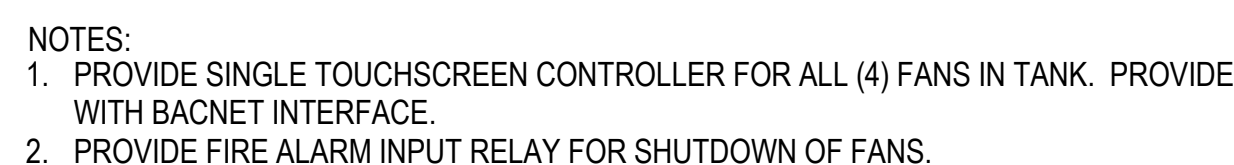
- 7. ALARMS:
 - A. HIGH ZONE TEMP:
 - a. IF THE ZONE TEMPERATURE IS 5°F GREATER THAN THE COOLING SETPOINT
 - B. LOW ZONE TEMP:
 - a. IF THE ZONE TEMPERATURE IS 5°F LESS THAN THE HEATING SETPOINT.
 - C. HIGH ZONE CARBON DIOXIDE CONCENTRATION:
 - a. IF THE ZONE CO2 CONCENTRATION IS GREATER THAN 1000 PPM.
 - D. HIGH DISCHARGE AIR TEMPERATURE:
 - a. IF THE DISCHARGE AIR TEMPERATURE IS GREATER THAN 100°F.
 - E. LOW DISCHARGE AIR TEMPERATURE:
 - a. IF THE DISCHARGE AIR TEMPERATURE IS LESS THAN 45°F.



NOTES:

1. ALL CONTROL POINTS TO BE CONNECTED DIRECTLY TO UNIT MOUNTED CONTROLLER WITH INTERFACE TO EMCS COMMUNICATION BUSS.
2. VAV CONTROL FOR TYPICAL SYSTEMS WITH ELECTRIC HEATING COIL.
3. PROVIDE PROGRAMMABLE OVERRIDE BUTTON AT EACH TEMPERATURE SENSOR AS AN OVERRIDE TO ENERGIZE HVAC SYSTEM AFTER NORMAL OCCUPIED HOURS.

4. FIRE ALARM SHUTDOWN:
 - A. UPON A SIGNAL FROM THE FIRE ALARM SYSTEM, THE FANS SHALL BE DISABLED UNTIL THE FIRE ALARM SIGNAL IS CLEARED.
5. ALARMS:
 - A. INDICATE ANY ALARM GENERATED FROM THE FAN VIA BACNET.

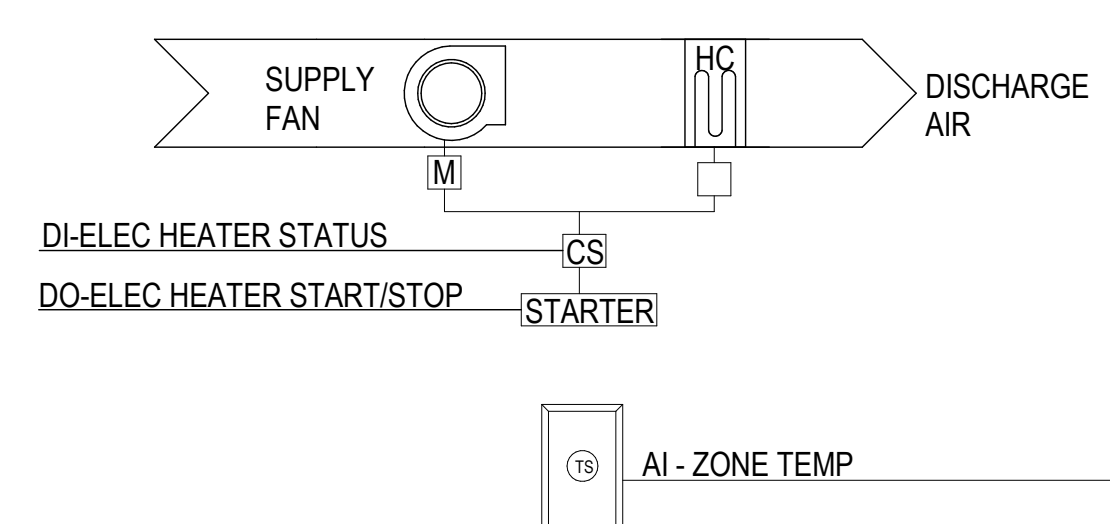


HVLS	HVLS	HVLS	HVLS	HVLS	HVLS	HVLS	HVLS
101	102	103	104	105	106	107	108

SCALE: NONE

SCALE: NONE

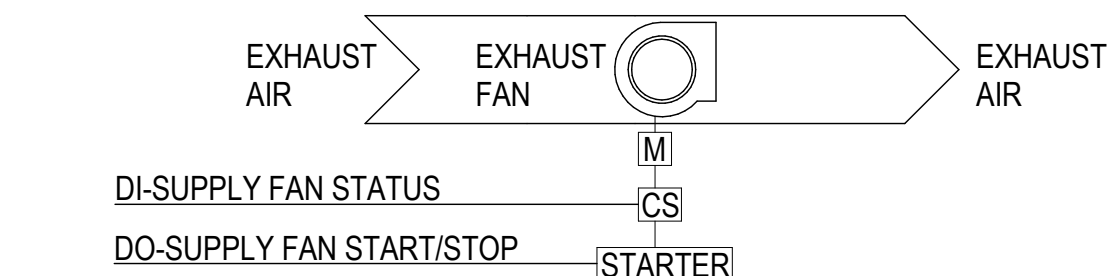
2. RUN CONDITIONS - CONTINUOUS:
 - A. THE UNIT FAN AND ELECTRIC COIL SHALL BE CONTINUOUSLY ENABLED WHEN OUTSIDE AIR TEMPERATURE IS LESS THAN 40°F TO MAINTAIN A ZONE TEMPERATURE HEATING SETPOINT OF 40°F (ADJUSTABLE).
3. ALARMS:
 - A. LOW ZONE TEMP:
 1. IF THE ZONE TEMPERATURE IS 5°F LESS THAN THE HEATING SETPOINT.



EH 001	EH 002	EH 003	EH 004

SCALE: NONE

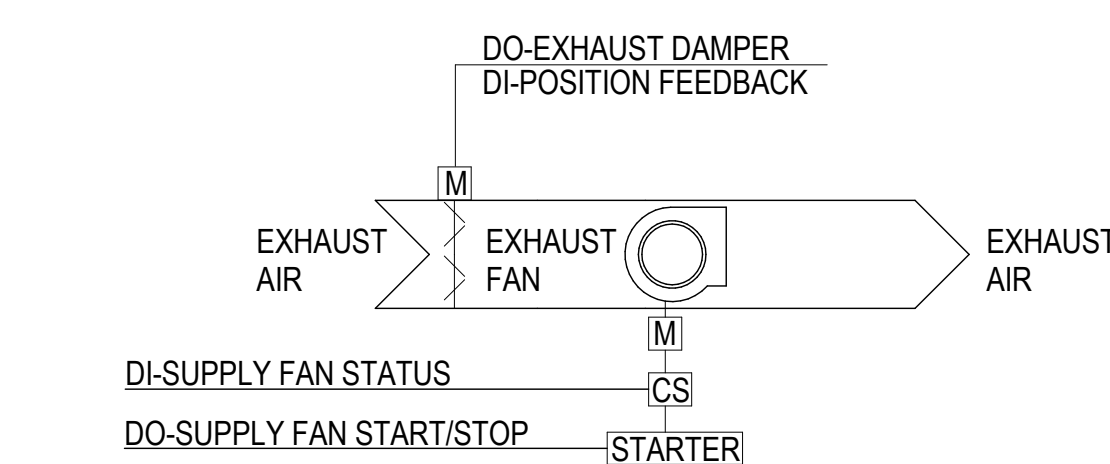
1. FEATURES:
 - A. EXHAUST FAN
2. RUN CONDITIONS – CONTINUOUS:
 - A. THE UNIT SHALL RUN CONTINUOUSLY UNLESS SHUTDOWN ON INTERNAL SAFETIES.
 - a. NOTE: FAN SHALL RUN CONTINUOUSLY, EVEN IF AN EMERGENCY SHUTDOWN SWITCH (ESS) IS ACTIVATED.



NOTES:
1. REFER TO PLANS FOR DUCTWORK ARRANGEMENT

SCALE: NONE

1. FEATURES:
 - A. EXHAUST FAN
 - B. MOTORIZED DAMPER
2. RUN CONDITIONS - SCHEDULED:
 - A. THE UNIT SHALL RUN AT CONSTANT SPEED ACCORDING TO A USER DEFINABLE TIME SCHEDULE IN THE FOLLOWING MODES INTERLOCKED WITH THE ASSOCIATED DEHUMIDIFICATION UNITS:
 - a. START UP/PURGE MODE
 - b. OCCUPIED MODE



NOTES:

1. REFER TO PLANS FOR DUCTWORK ARRANGEMENT.
2. REFER TO SEQUENCE OF OPERATION FOR ADDITIONAL REQUIREMENTS

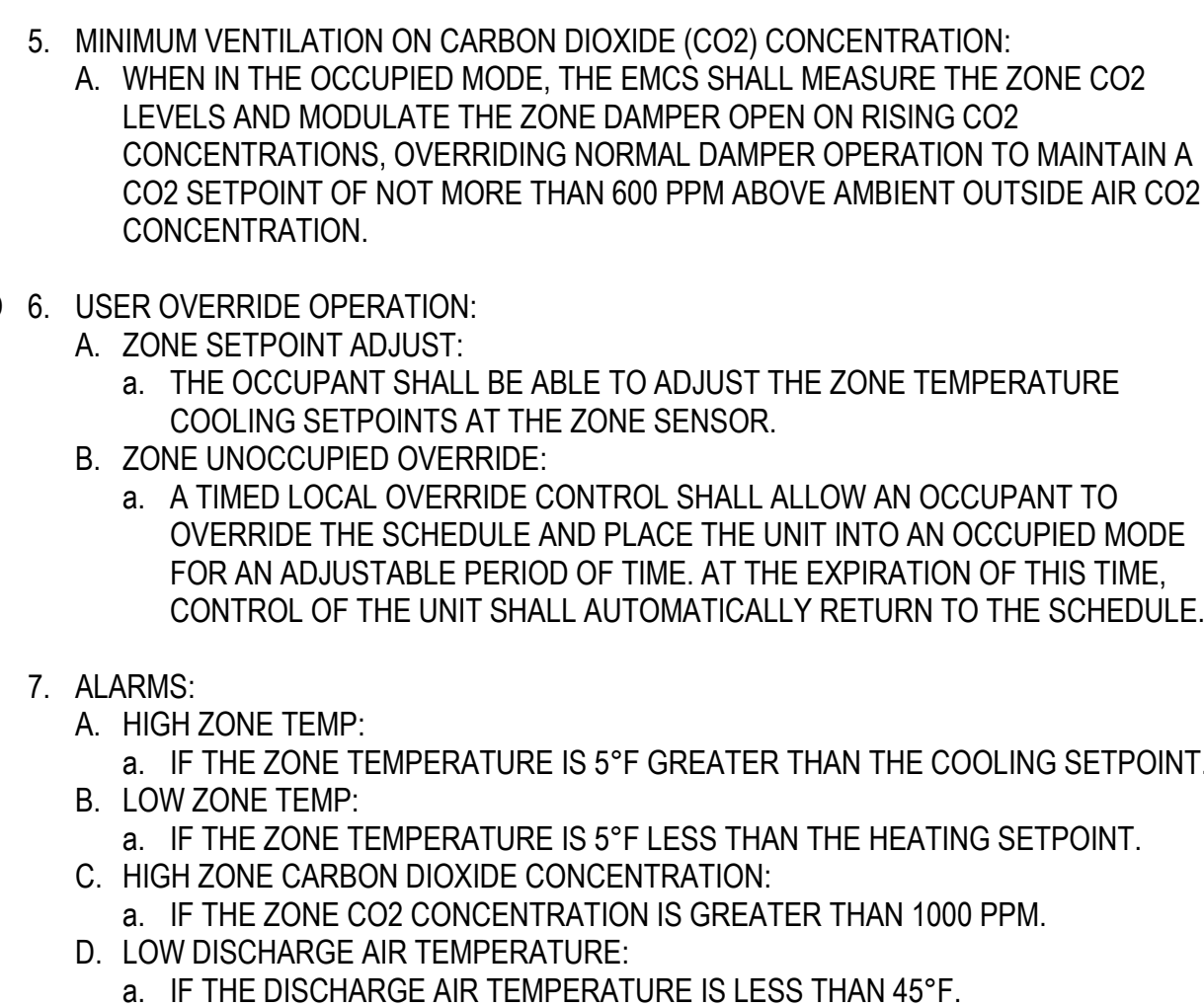
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2. RUN CONDITIONS - SCHEDULED:

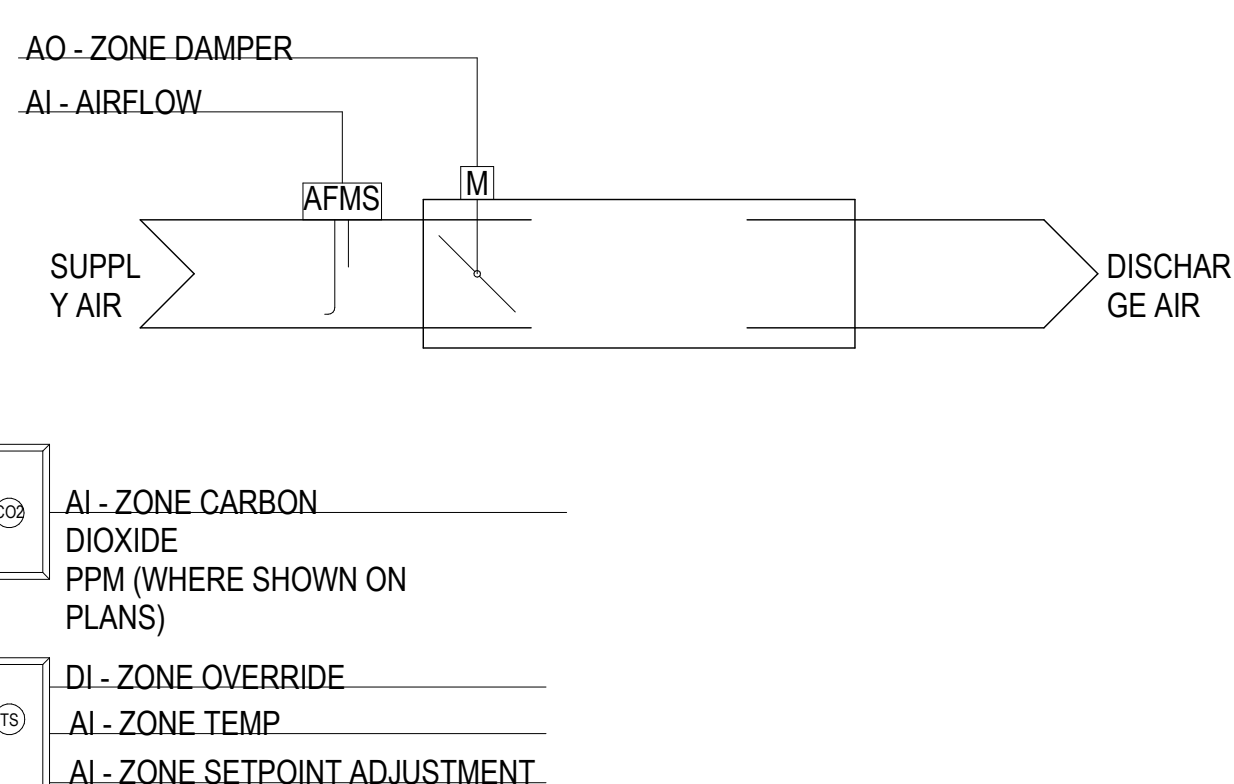
- a. THE UNIT SHALL RUN ACCORDING TO A USER DEFINABLE TIME SCHEDULE AND MAINTAIN THE FOLLOWING MODES:
 - 1. OCCUPIED MODE TEMPERATURES:
 - a. COOLING SETPOINT: 75°F
 - b. HEATING SETPOINT: 70°F
 - 2. UNOCCUPIED MODE TEMPERATURES:
 - a. COOLING SETPOINT: 86°F
 - b. HEATING SETPOINT: 58°F
- 3. FOUR AIRFLOW CONTROL SETPOINTS SHALL APPLY AS FOLLOWS:
 - a. OCCUPIED COOLING MAXIMUM AIR FLOW AS SCHEDULED
 - b. OCCUPIED HEATING MAXIMUM AIR FLOW AS SCHEDULED
 - c. OCCUPIED COOLING/HEATING MINIMUM AIR FLOW AS SCHEDULED
 - d. UNOCCUPIED COOLING/HEATING MINIMUM AIR FLOW AS SCHEDULED

3. AIR FLOW CONTROL:

- a. THE UNIT SHALL MAINTAIN ZONE SETPOINTS BY CONTROLLING THE AIRFLOW THROUGH ONE OF THE FOLLOWING:
 - 1. OCCUPIED:
 - a. WHEN ZONE TEMPERATURE IS GREATER THAN ITS COOLING SETPOINT, THE ZONE DAMPER SHALL MODULATE BETWEEN THE MINIMUM OCCUPIED AIRFLOW AND THE MAXIMUM COOLING AIRFLOW UNTIL THE ZONE IS SATISFIED.
 - b. WHEN THE ZONE TEMPERATURE IS BELOW THE COOLING SETPOINT THE ZONE DAMPER SHALL MAINTAIN THE MINIMUM REQUIRED ZONE VENTILATION.
 - 2. UNOCCUPIED:
 - a. WHEN THE ZONE IS UNOCCUPIED THE ZONE DAMPER SHALL CONTROL TO ITS MINIMUM UNOCCUPIED AIRFLOW.
 - b. WHEN THE ZONE TEMPERATURE IS GREATER THAN ITS COOLING SETPOINT, THE ZONE DAMPER SHALL MODULATE BETWEEN THE MINIMUM UNOCCUPIED AIRFLOW AND THE MAXIMUM COOLING AIRFLOW UNTIL THE ZONE IS SATISFIED.



A graph showing the relationship between Room Temperature Increase (X-axis) and CFM Increase (Y-axis). The Y-axis has two horizontal lines labeled 'MIN CFM' and 'MAX CFM'. The X-axis has a point labeled 'COOLING SETPOINT'. The graph shows a horizontal line at 'MIN CFM' until the 'COOLING SETPOINT', after which the line rises linearly to 'MAX CFM' and then remains constant. The rising portion is labeled 'COLD AIR FLOW'.



NOTES:

1. ALL CONTROL POINTS TO BE CONNECTED DIRECTLY TO UNIT MOUNTED CONTROLLER WITH INTERFACE TO EMCS COMMUNICATION BUSS.
2. PROVIDE PROGRAMMABLE OVERRIDE BUTTON AT EACH TEMPERATURE SENSOR AS AN OVERRIDE TO ENERGIZE HVAC SYSTEM AFTER NORMAL OCCUPIED HOURS.

A horizontal chain of 8 hexagonal cells. Each cell contains the text 'VAV' above a two-digit number. The numbers are 001, 002, 101, 102, 103, 104, 105, and 106, respectively, from left to right.

SCALE: NONE

[illegible]

US ARMY CORPS OF ENGINEERS		DESIGNED BY:		ISSUE DATE:	
FORT WORTH DISTRICT		KAO		19 FEB 2021	
FORT WORTH, TEXAS 76102		DRAWN BY:		SOLICITATION NO.:	
		KAO		W912622 R0051	
		CHECKED BY:		CONTRACT NO.:	
		KAO		W912622 R0051	
		C. COLEMAN		C. COLEMAN	
		SIZE:		CONSULTANT:	
		1/8"		HUNSAKER	
		CFZ		DESIGN	
		TECH		ANSI E	

JOINT BASE SAN ANTONIO (JBSA) - LACKLAND AFB
SPECIAL WARFARE TRAINING GROUP AQUATIC TRAINING FACILITY
PROJECT NUMBER: MPVJ043856A, P2 NUMBER: 472456

CONTROL POINT SCHEDULE

POINT NAME	EQUIPMENT	CONTROL POINT/SENSOR	SETTING (UNITS)	RANGE	I/O TYPE	TREND REQ'D	ALARM REQ'D	GRAPHICS VIEW (V) AND OVERRIDE (O)	NOTES	PRIMARY POINT INFORMATION				NETWORK DATA EXCHANGE		OVERRIDES			TREND OBJECT LOCATION (L OR R), TYPE AND INSTANCE NUMBER (PROVIDE DDC ID FOR REMOTE IN NOTES)	ALARM INFORMATION			CONFIGURATION INFORMATION
										OBJECT TYPE AND INSTANCE NUMBER (AND PROPERTY ID)	SVNT NAME	SVNT TYPE	NIAGAR A ID	DATA FROM	DATA TO	OBJECT TYPE & INSTANCE NUMBER OR COMMANDABLE	SVNT NAME	SVNT TYPE		ALARM TYPE (PROVIDE DDC ID FOR REMOTE IN NOTES)	NOTIFICATION CLASS OBJECT INSTANCE NUMBER	EVENT ENROLLMENT OBJECT INSTANCE NUMBER	
< >	GAS METER	GAS FLOW RATE	< > (CCF)	N/A	DIGITAL PULSE	Y	N	V															
< >	ELECTRIC SUBMETER	DEMAND (KW)	< > (KW)	N/A	DIGITAL PULSE	Y	N	V	CALCULATE KWH														
< >	GLYCOL PUMP LOW LEVEL ALARM	LOW LEVEL ALARM	N/A	NORMAL / ALARM	AI	N	Y	V															
< >	LIFT STATION ALARM	LIFT STATION ALARM	N/A	NORMAL / ALARM	AI	N	Y	V															
< >	WATER METER	WATER FLOW (GAL)	< > (GAL)	N/A	DIGITAL PULSE	Y	N	V															
< >	SPLIT SYSTEM	ZONE TEMPERATURE	< > (°F)	<MIN-MAX>	AI	Y	Y	V															
< >		OUTSIDE AIR DAMPER COMMAND	< %> OPEN	<0-100%> OPEN	AO	N	N	VO															
< >		OUTSIDE AIR DAMPER POSITION	< %> OPEN	<0-100%> OPEN	AI	Y	Y	V															
< >		AIRFLOW MEASUREMENT STATION	< > (CFM)	<MIN-MAX>	AI	Y	Y	V															
< >		PRE-FILTER DIFFERENTIAL PRESSURE	< > (IN. WG.)	<MIN-MAX>	AI	Y	Y	V															
< >		INTERMEDIATE FILTER DIFFERENTIAL PRESSURE	< > (IN. WG.)	<MIN-MAX>	AI	Y	Y	V															
< >		ENERGY RECOVERY WHEEL SPEED COMMAND	< > (HZ)	<0-60> HZ	AO	Y	N	V															
< >		ENERGY RECOVERY WHEEL SPEED	< > (RPM)	<MIN-MAX>	AI	Y	Y	V															
< >		DX COOLING COIL COOLING STAGE	< >	ON / OFF	DO	Y	Y	V	ONE PER CIRCUIT														
< >		FREEZE/STAT	< > (°F)	<MIN-MAX>	AO	N	Y	V															
< >		SUPPLY FAN VFD (SEE TYPICAL VFD)	SEE TYPICAL	SEE TYPICAL	VARIES	Y	Y	V															
< >		HOT GAS REHEAT	< %> OPEN	<0-100%> OPEN	AO	Y	Y	V															
< >	DOAS	SMOKE DETECTOR	N/A	NORMAL / ALARM	DI	N	Y	V															
< >		SUPPLY AIR RELATIVE HUMIDITY	< %RH>	<MIN-MAX>	AI	Y	Y	V															
< >		SUPPLY AIR TEMPERATURE	< > (°F)	<MIN-MAX>	AI	Y	Y	V															
< >		RETURN AIR TEMPERATURE	< > (°F)	<MIN-MAX>	AI	Y	Y	V															
< >		EXHAUST FILTER DIFFERENTIAL PRESSURE	< > (IN. WG.)	<MIN-MAX>	AI	Y	Y	V															
< >		RETURN FAN VFD (SEE TYPICAL VFD)	SEE TYPICAL	SEE TYPICAL	VARIES	Y	Y	V															
< >		EXHAUST PLENUM STATIC PRESSURE	< > (IN. WG.)	<MIN-MAX>	AI	Y	Y	V															
< >		EXHAUST AIR DAMPER COMMAND	< %> OPEN	<0-100%> OPEN	AO	N	N	VO															
< >		EXHAUST AIR DAMPER POSITION	< %> OPEN	<0-100%> OPEN	AI	Y	Y	V															
< >		ZONE TEMPERATURE	< > (°F)	<MIN-MAX>	AI	Y	Y	V	SEE PLANS FOR LOCATIONS. CALCULATE AVERAGE.														
< >		MISCELLANEOUS ALARMS	N/A	NORMAL / ALARM	--	N	Y	V															
< >		EMERGENCY SHUTDOWN	N/A	NORMAL / ALARM	--	N	Y	V															
< >		DRY COOLER ENABLE ON/OFF	N/A	ON/OFF	DO	N	N	V															
< >		DRY COOLER STATUS	N/A	ON/OFF/ALARM	DI	Y	Y	V															
< >		DRY COOLER ALARM	N/A	NORMAL / ALARM	DI	N	Y	V															
< >		HWS SUPPLY TEMPERATURE	< > (°F)	<MIN-MAX>	AI	Y	Y	V															
< >		HWR RETURN TEMPERATURE	< > (°F)	<MIN-MAX>	AI	Y	Y	V															
< >		HEATING WATER VALVE	< %> OPEN	<0-100%> OPEN	AO	Y	N	V															
< >		HOT WATER PUMP START/STOP	N/A	ON/OFF	DO	N	N	V															
< >		HOT WATER PUMP STATUS	N/A	ON/OFF/ALARM	DI	Y	Y	V															
< >		POOL WATER PUMP START/STOP	N/A	ON/OFF	DO	N	N	VO															
< >		POOL WATER PUMP STATUS	N/A	ON/OFF/ALARM	DI	Y	Y	V															
< >		POOL HEATING WATER SUPPLY TEMPERATURE	< > (°F)	<MIN-MAX>	AI	Y	Y	V															
< >		POOL HEATING WATER RETURN TEMPERATURE	< > (°F)	<MIN-MAX>	AI	Y	Y	V															
< >		ZONE TEMPERATURE	< > (°F)	<MIN-MAX>	AI	Y	Y	V	SEE PLANS FOR LOCATION.														
< >		ZONE RELATIVE HUMIDITY	< %RH>	<MIN-MAX>	AI	Y	Y	V	SEE PLANS FOR LOCATION.														
< >		PURGE OUTSIDE AIR DAMPER COMMAND	< %> OPEN	<0-100%> OPEN	AO	N	N	VO															
< >		PURGE OUTSIDE AIR DAMPER POSITION	< %> OPEN	<0-100%> OPEN	AI	Y	Y	V															
< >		FILTER DIFFERENTIAL PRESSURE	< > (IN. WG.)	<MIN-MAX>	AI	N	Y	V															
< >		DX COOLING COIL COOLING STAGE	< >	ON / OFF	DO	Y	Y	V	ONE PER CIRCUIT														
< >		COMPRESSOR STATUS	N/A	ON/OFF/ALARM	DI	N	Y	V															
< >		REHEAT AIR TEMPERATURE	< > (°F)	<MIN-MAX>	AI	Y	N	V															
< >		LOW TEMP FREEZE/STAT	< > (°F)	<MIN-MAX>	AI	N	Y	V															
< >		DUCT LOW STATIC SAFETY	N/A	NORMAL / ALARM	DI	N	Y	V															
< >	DEHUMIDIFICATION UNIT/RY COOLER	SUPPLY FAN VFD (SEE TYPICAL VFD)	SEE TYPICAL	SEE TYPICAL	VARIES	Y	Y	V															
< >		SUPPLY FAN STATUS	N/A	ON/OFF/ALARM	DI	N	Y	VO															
< >		MODULATING HEAT (GAS)	< %> OPEN	<0-100%> OPEN	AO	Y	Y	V															
< >		SMOKE DETECTOR	N/A	NORMAL / ALARM	DI	N	Y	V															
< >		SUPPLY AIR RELATIVE HUMIDITY	< %RH>	<MIN-MAX>	AI	Y	Y	V															
< >		SUPPLY AIR TEMPERATURE	< > (°F)	<MIN-MAX>	AI	Y	Y	V															
< >		OUTSIDE AIR DAMPER COMMAND	< %> OPEN	<0-100%> OPEN	AO	N	N	VO															
< >		OUTSIDE AIR DAMPER POSITION	< %> OPEN	<0-100%> OPEN	AI	Y	Y	V															
< >		FILTER DIFFERENTIAL PRESSURE	< > (IN. WG.)	<MIN-MAX>	AI	N	Y	V															
< >		AIRFLOW MEASUREMENT STATION	< > (CFM)	<MIN-MAX>																			

CONTROL POINT SCHEDULE

<< SECTION TO BE COMPLETED BY CONTROLS CONTRACTOR >>

1. THE CONTRACTOR SHALL COMPLETE THE POINTS SCHEDULE AS INDICATED IN THE SPECIFICATION AND IN ACCORDANCE WITH THE POINTS SCHEDULE INSTRUCTIONS DRAWINGS
2. UNIT MANUFACTURERS PROOFS AND SAFETIES: THE CONTRACTOR SHALL SHOW EACH PROOF AND SAFETY AS A SEPARATE ROW.
3. UNIT STATUS: SERVES AS A MONITORED POINT AT THE M&C SOFTWARE (FRONT-END) AND AS A COOLING REQUEST TO THE CONDENSING UNIT SERVING THIS SYSTEM.

TABLE CONTINUES ON M-705

DEVICE SCHEDULE

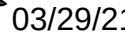
NOTES

BUILDING OCCUPANCY SCHEDULE

DAY	OFFICE OCCUPANCY HOURS	POOL OCCUPANCY HOURS
SUNDAY	NONE	6 AM - 12 PM
MONDAY	6 AM - 6 PM	6 AM - 6 PM
TUESDAY	6 AM - 6 PM	6 AM - 6 PM
WEDNESDAY	6 AM - 6 PM	6 AM - 6 PM
THURSDAY	6 AM - 6 PM	6 AM - 6 PM
FRIDAY	6 AM - 6 PM	6 AM - 6 PM
SATURDAY	NONE	6 AM - 12 PM

NOTES:

1. UNLESS NOTED OTHERWISE, OCCUPANCY SCHEDULES SHALL BE UTILIZED BY EMCS AND LOCAL PROGRAMMABLE THERMOSTATS. THE DEFAULT SCHEDULES ARE ADJUSTABLE AT THE EMCS.
2. EMCS SCHEDULES SHALL BE CAPABLE OF TEMPORARY SCHEDULING FOR HOLIDAYS AND EVENTS.
3. USER OVERRIDES AVAILABLE AT LOCAL CONTROLLERS SHALL PROVIDE A 2-HR TEMPORARY OVERRIDE AND AUTOMATICALLY RESUME DEFAULT SCHEDULE.

DATE _____

 US ARMY CORPS OF ENGINEERS FORT WORTH DISTRICT FORT WORTH, TEXAS 76102	 CFZ	 TETRA TECH	DESIGN GROUP DESIGN GROUP DESIGN GROUP	COUNSELMAN COUNSELMAN COUNSELMAN	SIZE SIZE SIZE	DESIGNED BY:	ISSUE DATE:
						DRAWN BY:	SOLICITATION NO.:
						KAO	W9126G21R0081
						SAN	CONTRACT NO.:
						SUBMITTED BY:	MPYJ43895A
						DATE:	

JOINT BASE SAN ANTONIO (JBSA) - LACKLAND AFB
SPECIAL WARFARE TRAINING GROUP AQUATIC TRAINING FACILITY
PROJECT NUMBER: MPYJ049855A; P2 NUMBER: 472496

L

K

J

H

G

F

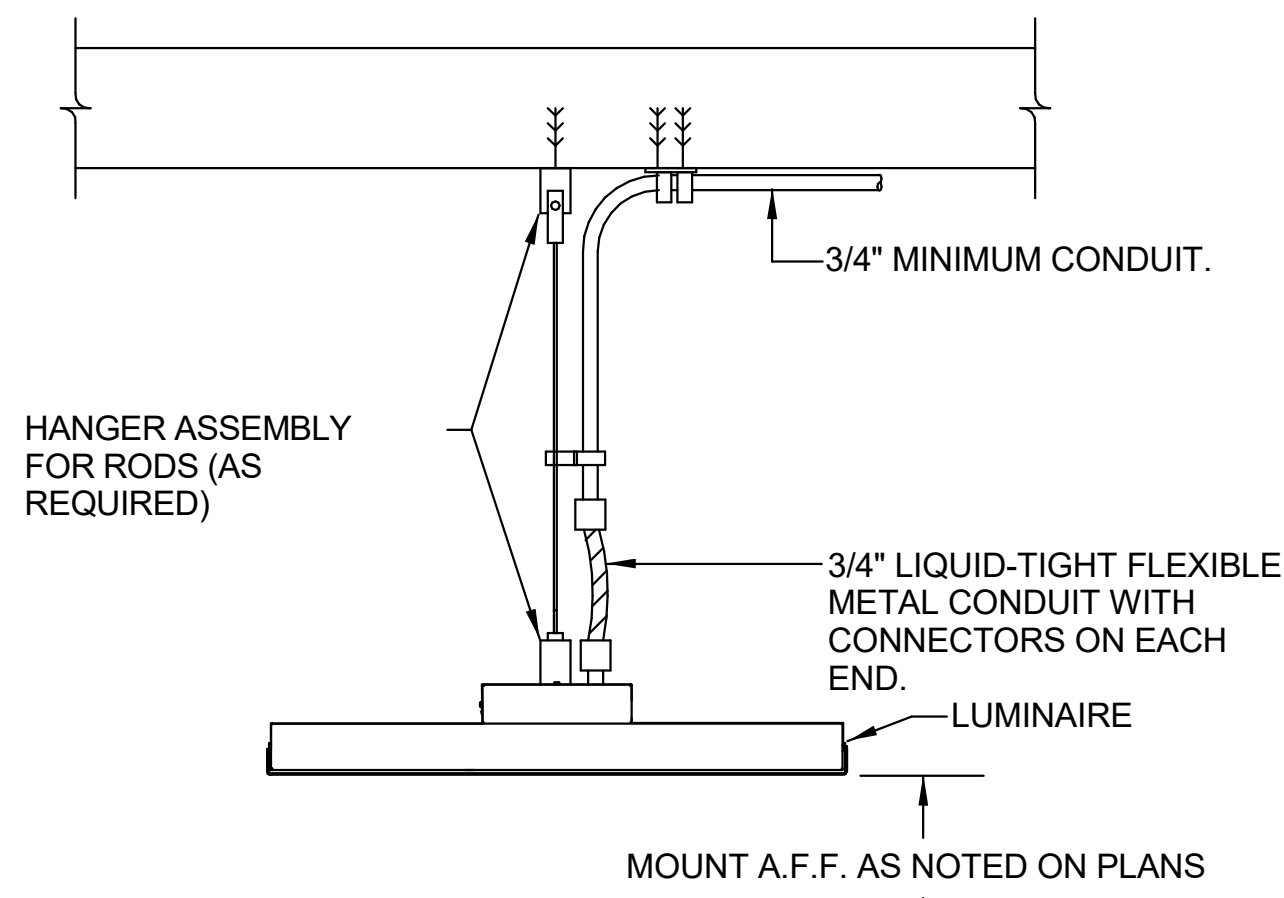
E

D

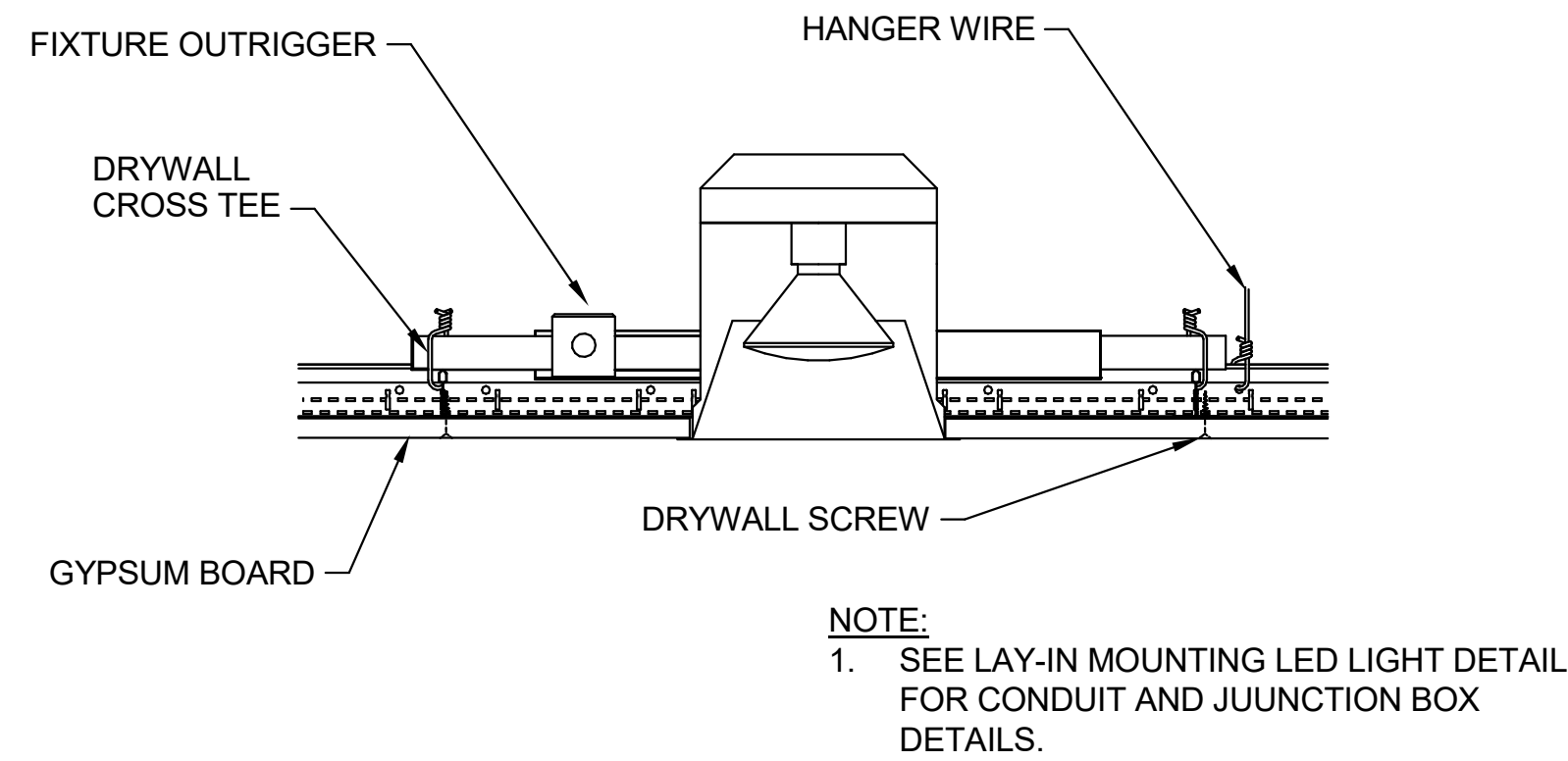
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B

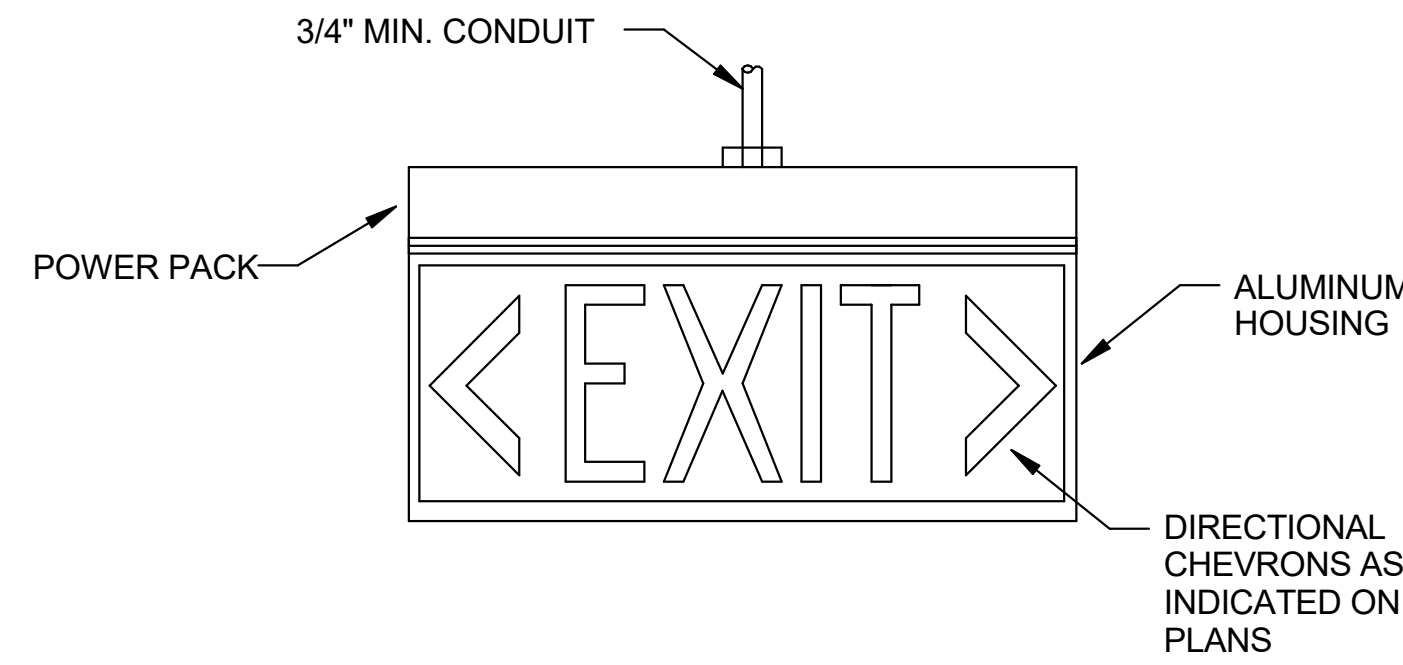
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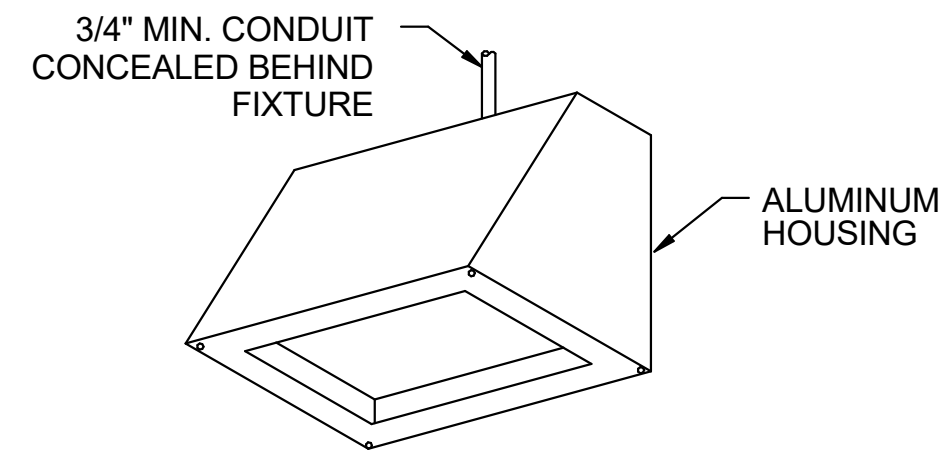
J1 PENDANT MOUNT LIGHT DETAIL
SCALE: SCALE: NTS



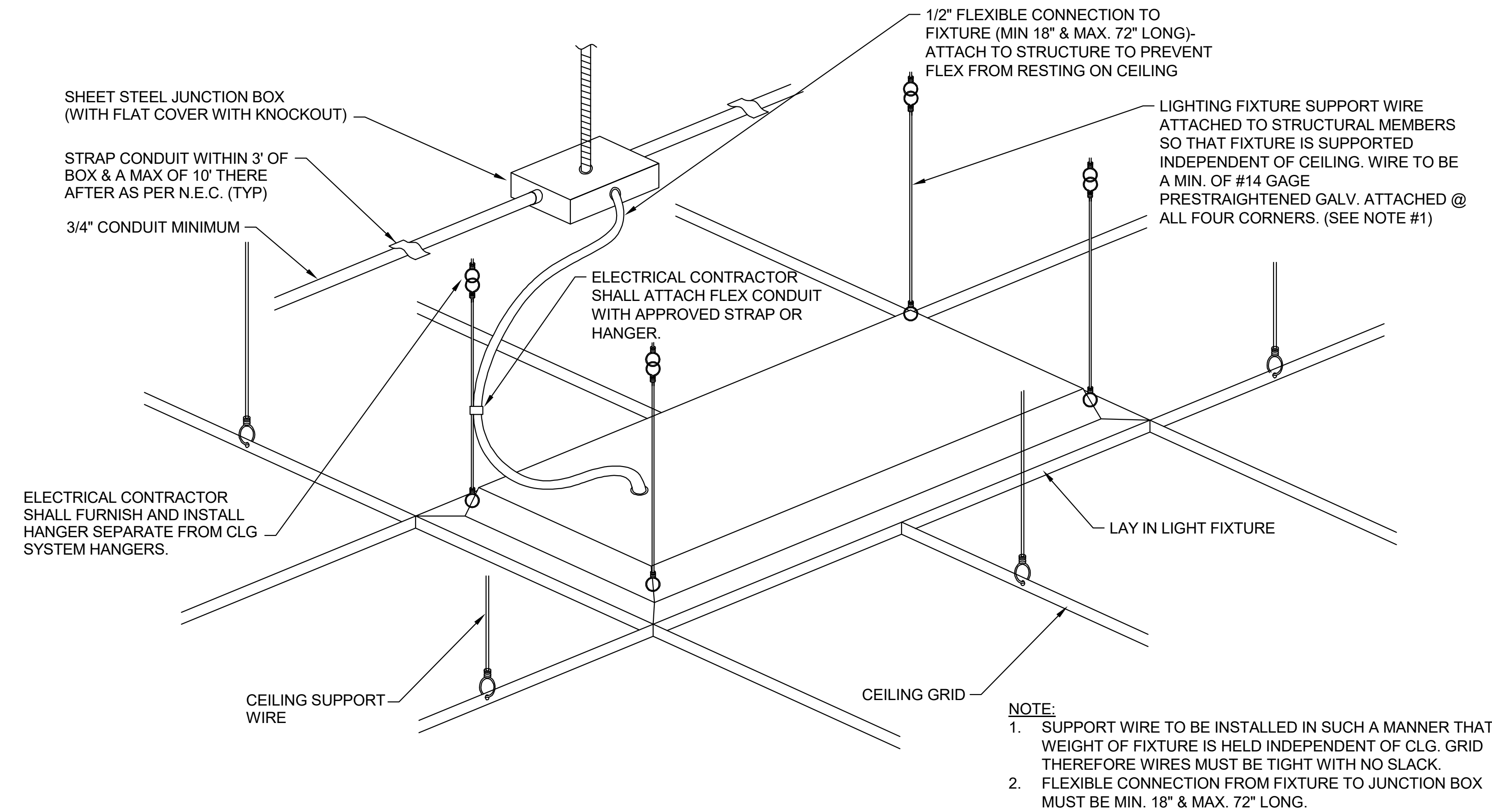
J4 RECESSED DOWN LIGHT DETAIL
SCALE: SCALE: NTS



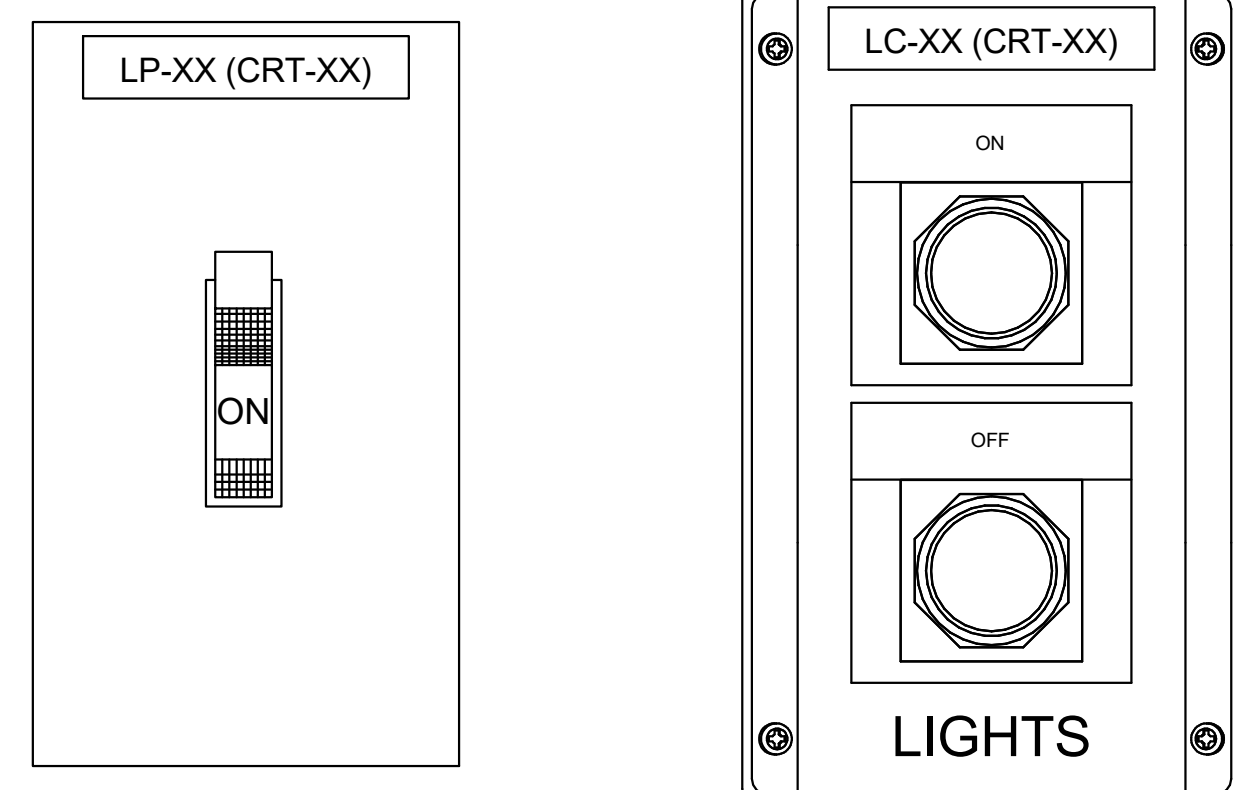
J8 EXIT SIGN DETAIL
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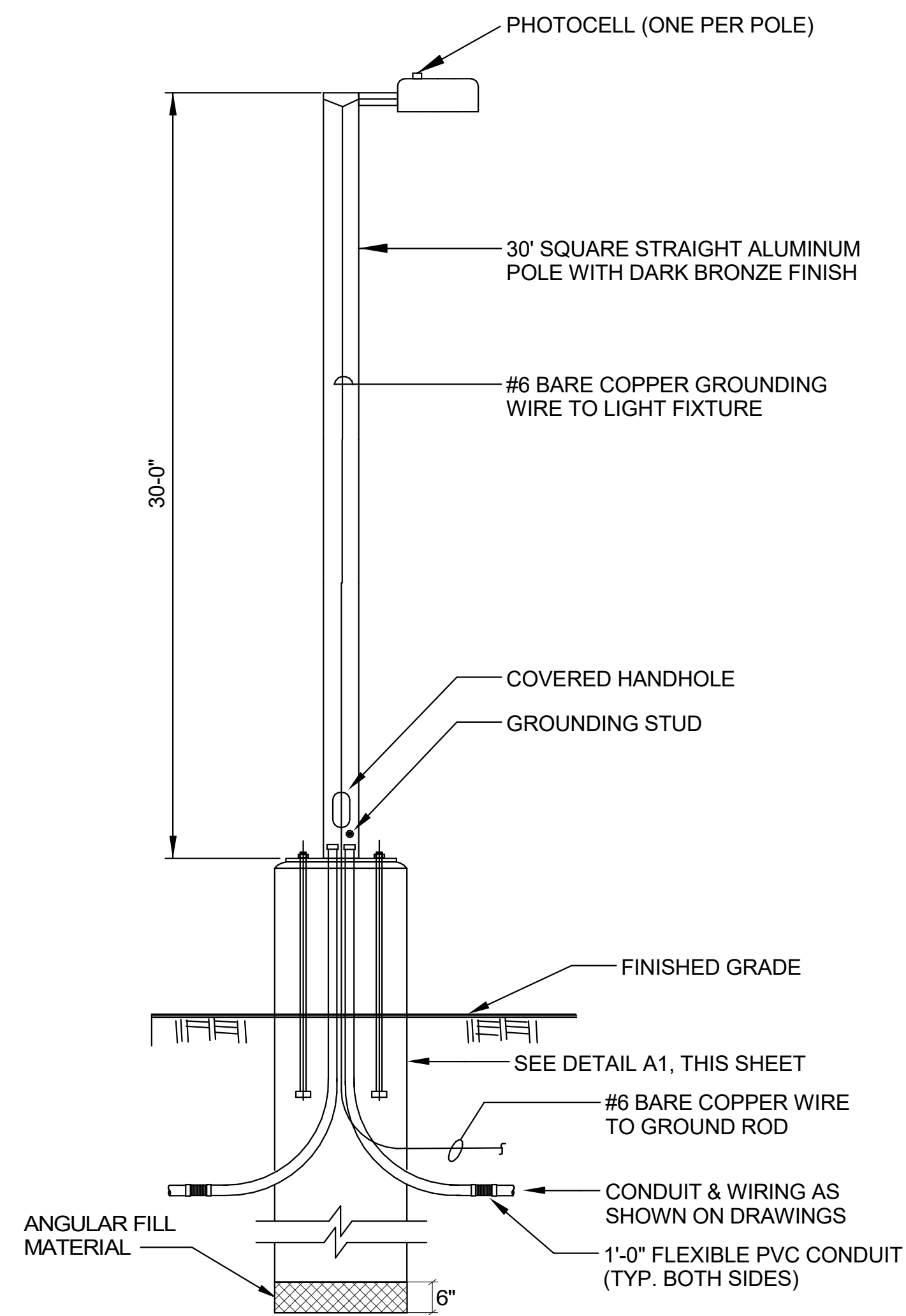
J11 WALL PACK DETAIL
SCALE: SCALE: NTS



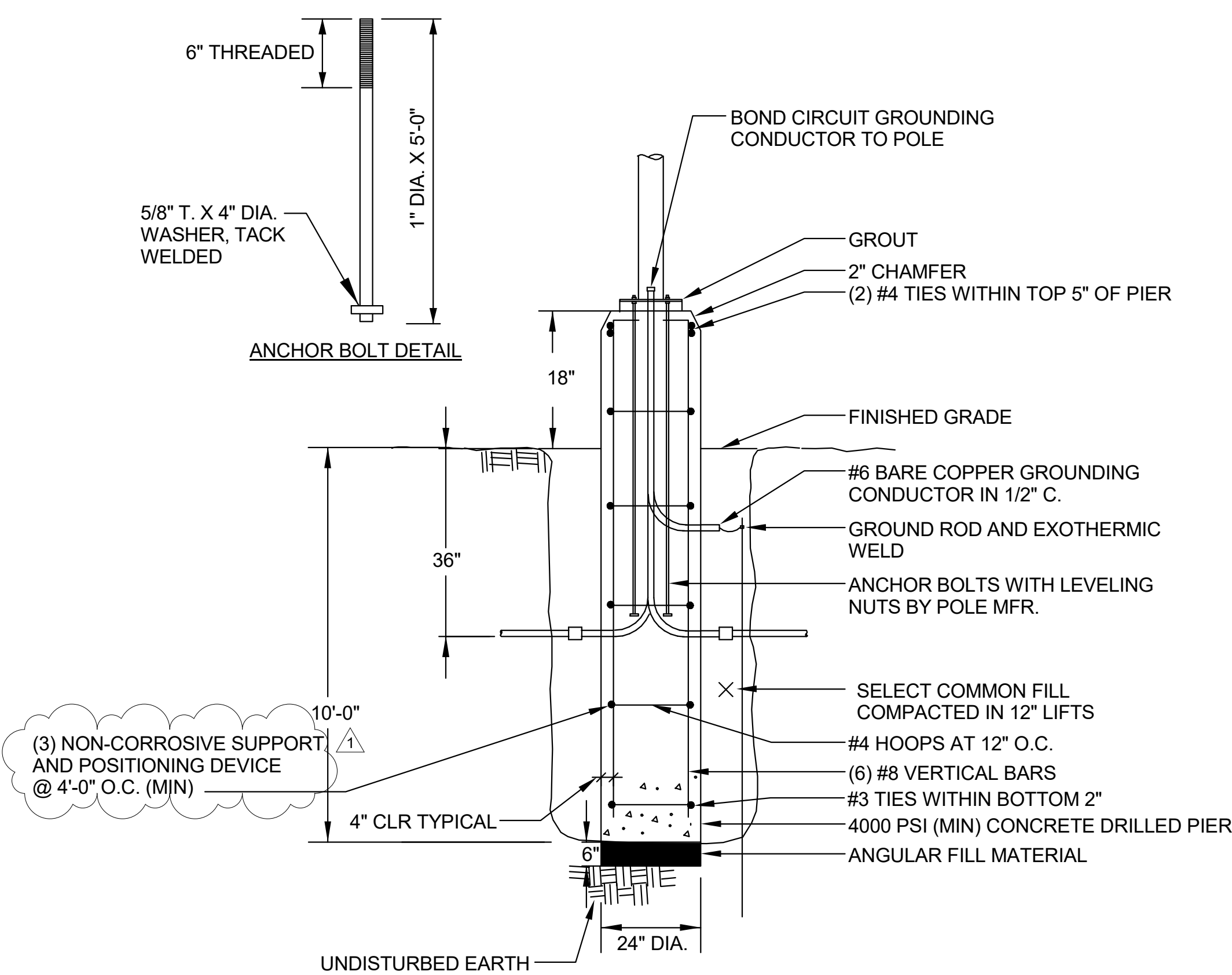
E1 LAY-IN MOUNTED LIGHT DETAIL
SCALE: SCALE: NTS



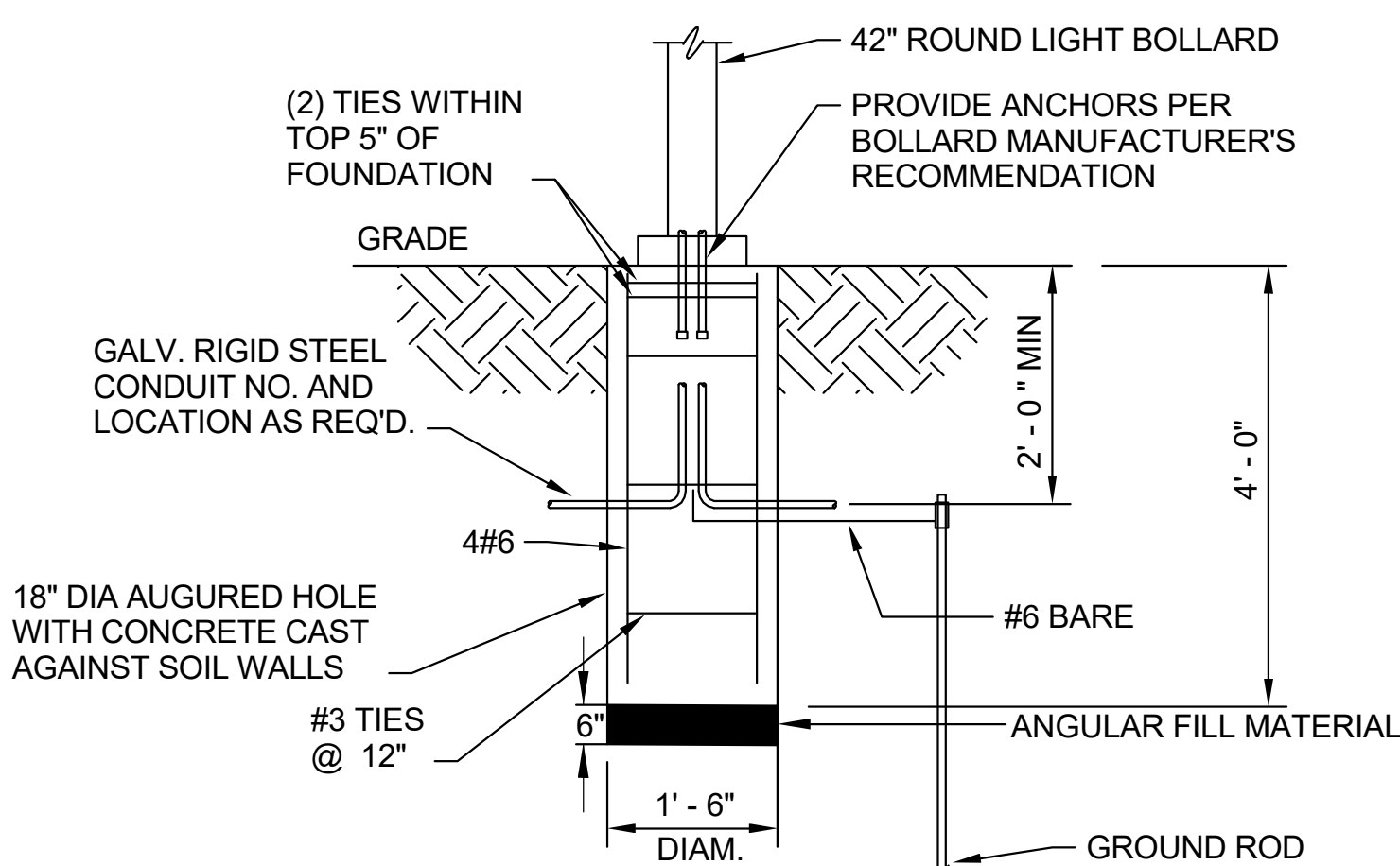
NOTE:
1. BLACK LETTERING ON WHITE BACKGROUND
E8 LIGHT SWITCH
SCALE: 12" = 1'-0"



E11 PARKING LOT LIGHT DETAIL
SCALE: SCALE: NTS

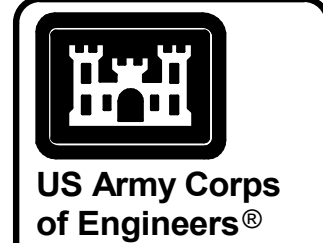


NOTES:
1. POLE/BASES SHALL BE RATED FOR 115 MPH MINIMUM WIND VELOCITY PER ASCE 7-10
A1 LIGHT POLE FOUNDATION DETAIL
SCALE: SCALE: NTS



A6 LIGHT BOLLARD FOUNDATION DETAIL
SCALE: SCALE: NTS

LIGHTING CONTROL SCHEDULE	
ROOM TYPE	LIGHTING CONTROL
AQUATIC TANK AREAS	MANUAL ON / MANUAL OFF WITH DAYLIGHT HARVESTING
BREAK ROOM	OCCUPANCY ON / OCCUPANCY OFF
CORRIDORS	OCCUPANCY ON / OCCUPANCY OFF
DEBRIEF ROOMS	MULTI-LEVEL SCENE CONTROL ON / OCCUPANCY OFF
EXAM ROOMS	MANUAL ON / OCCUPANCY OFF
FITNESS ROOMS	OCCUPANCY ON / OCCUPANCY OFF
LOBBY	OCCUPANCY ON / OCCUPANCY OFF
LOCKER ROOMS	OCCUPANCY ON / OCCUPANCY OFF
MECH/ELEC/COMM ROOMS	MANUAL ON / MANUAL OFF
OPEN OFFICES	OCCUPANCY ON / OCCUPANCY OFF
PRIVATE OFFICES	MANUAL ON / OCCUPANCY OFF
RESTROOMS	OCCUPANCY ON / OCCUPANCY OFF
SHOWERS	MANUAL ON / MANUAL OFF
STAIR LANDINGS	OCCUPANCY ON / OCCUPANCY OFF
STORAGE ROOMS/CLOSETS	MANUAL ON / OCCUPANCY OFF
THERAPY ROOMS	MANUAL ON / OCCUPANCY OFF
VESTIBULES	OCCUPANCY ON / OCCUPANCY OFF WITH DAYLIGHT HARVESTING
EXTERIOR LIGHTING	PHOTOCELL ON / TIMECLOCK OFF



DATE	DESCRIPTION
03/28/21	AMENDMENT 002

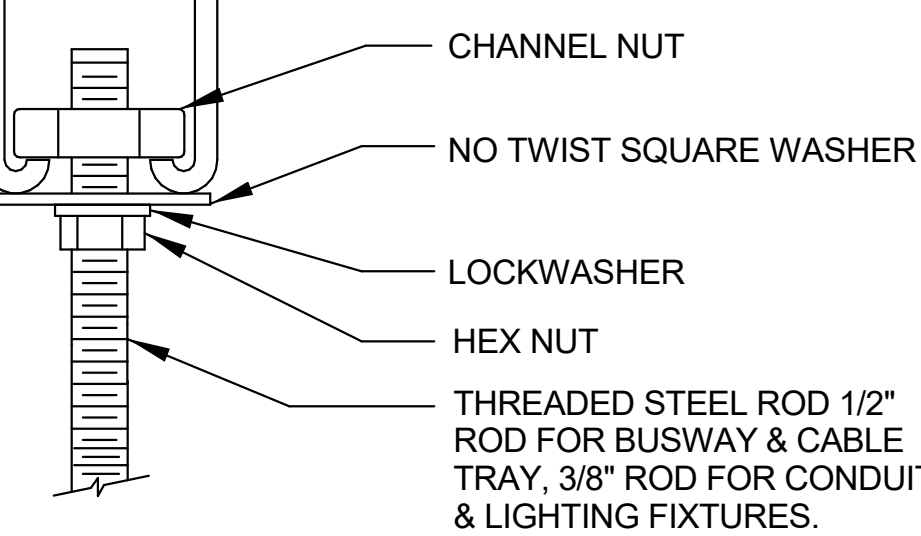
DESIGNED BY: L. MOORE	DATE: 10/15/2021
DRAWN BY: T. MOORE	SOLUTION NO.: MPY045856A
CHECKED BY: T. MOORE	CONTRACT NO.: MPY045856A
SUBMITTED BY: T. MOORE	CONTRACT NO.: MPY045856A

JOINT BASE SAN ANTONIO (JBSA) - LACKLAND AFB SPECIAL WARFARE TRAINING GROUP AQUATIC TRAINING FACILITY PROJECT NUMBER: MPY045856A, 12 NUMBER: 47266	ELECTRICAL DETAILS

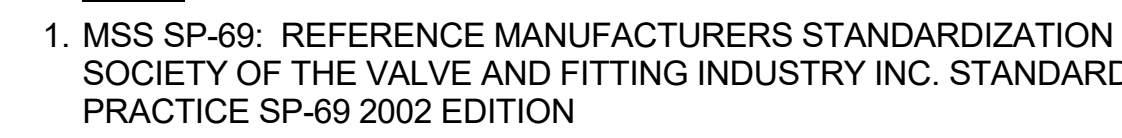


1. BLACK LETTERING ON WHITE BACKGROUND

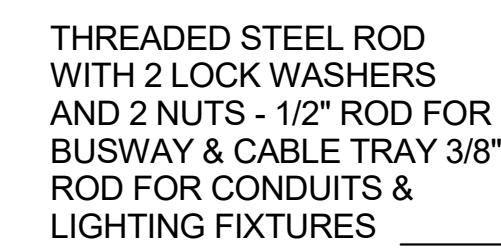
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SCALE:SCALE: NTS

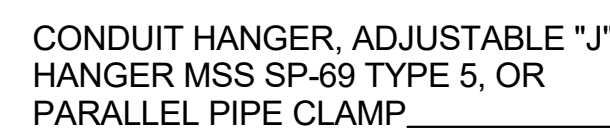


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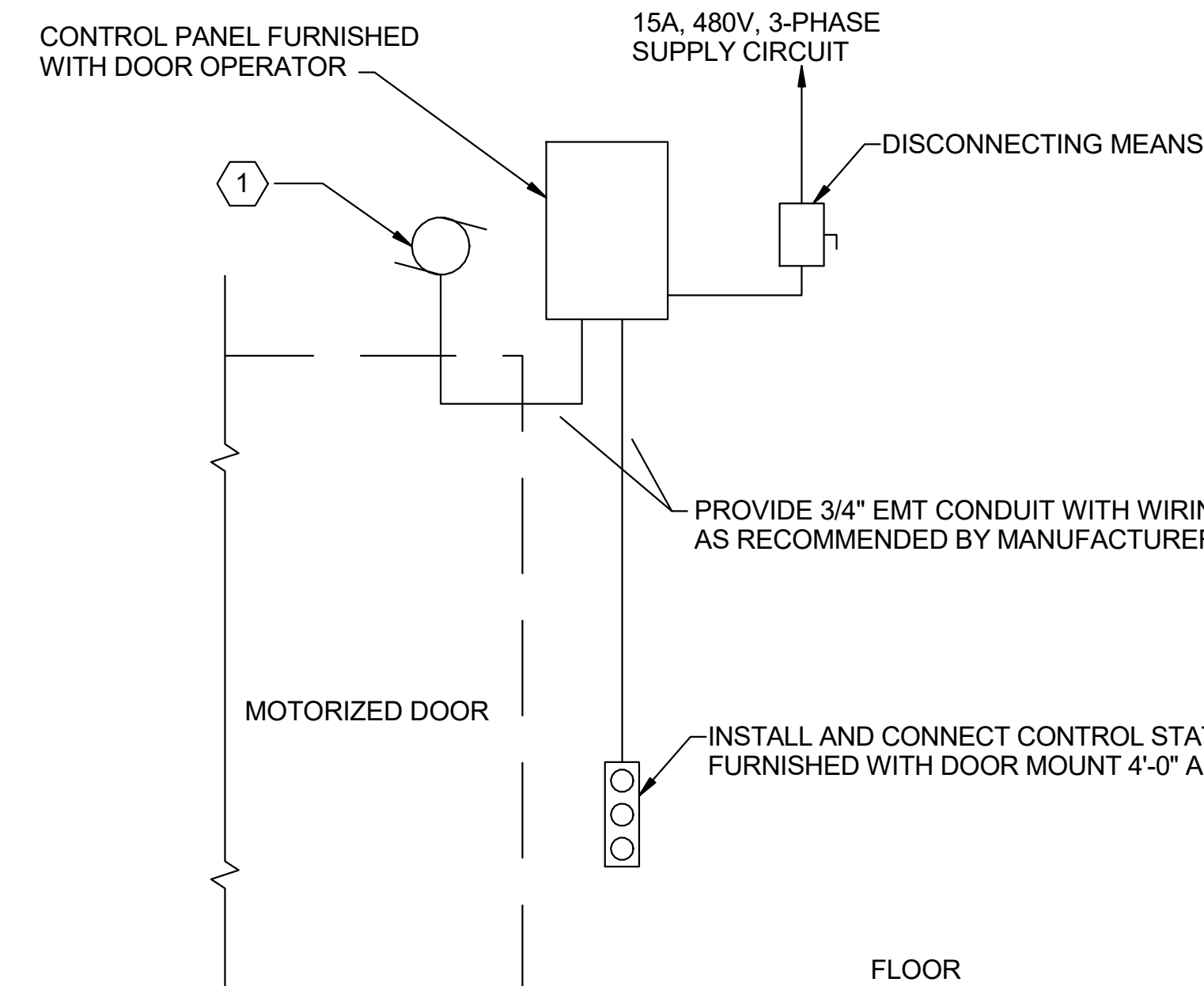
1. MSS SP-69: REFERENCE MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTING INDUSTRY INC. STANDARD PRACTICE SP-69 2002 EDITION

SCALE:SCALE: NT



1. SIDE BEAM CLAMP, INVERTED TOP BEAM CLAMP, OR J-BOLT TYPE BEAM CLAMP (WITH LOCKWASHER UNDER NUT INSTEAD OF BOLT HEAD) MAY BE SUBSTITUTED FOR BEAM CLAMP WITH RETAINING STRAP (SEE TYPICAL HANGER ROD CONNECTION DETAILS - SIMILAR.)

SCALE:SCALE: NTS



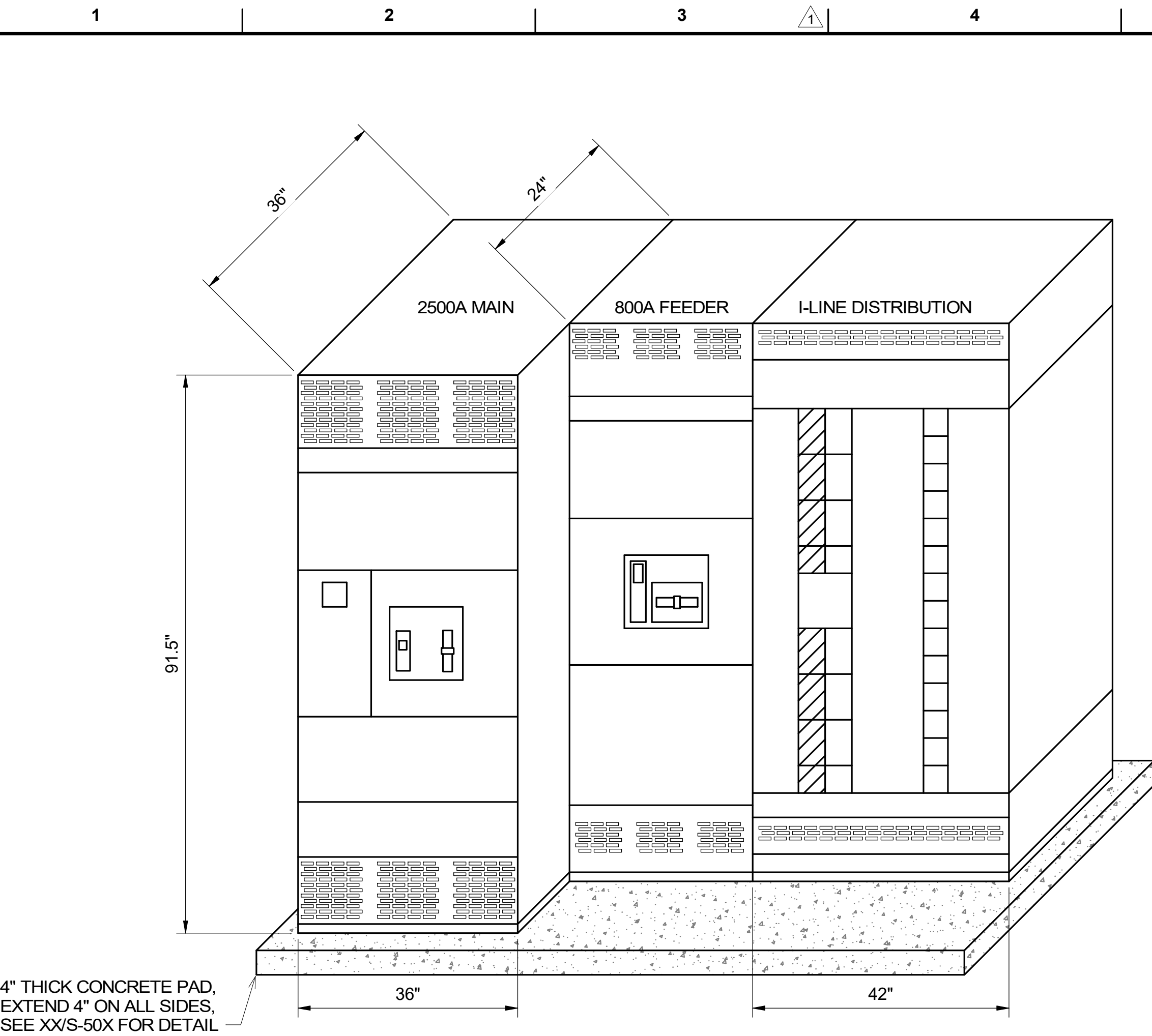
1 BASIS OF DESIGN IS FOR A 1 HP, 480 VOLT, THREE PHASE MOTOR. ACTUAL MOTOR PROVIDED SHALL NOT EXCEED 1-1/2 HP, 480 VOLT, THREE PHASE.

SCALE:SCALE: NT

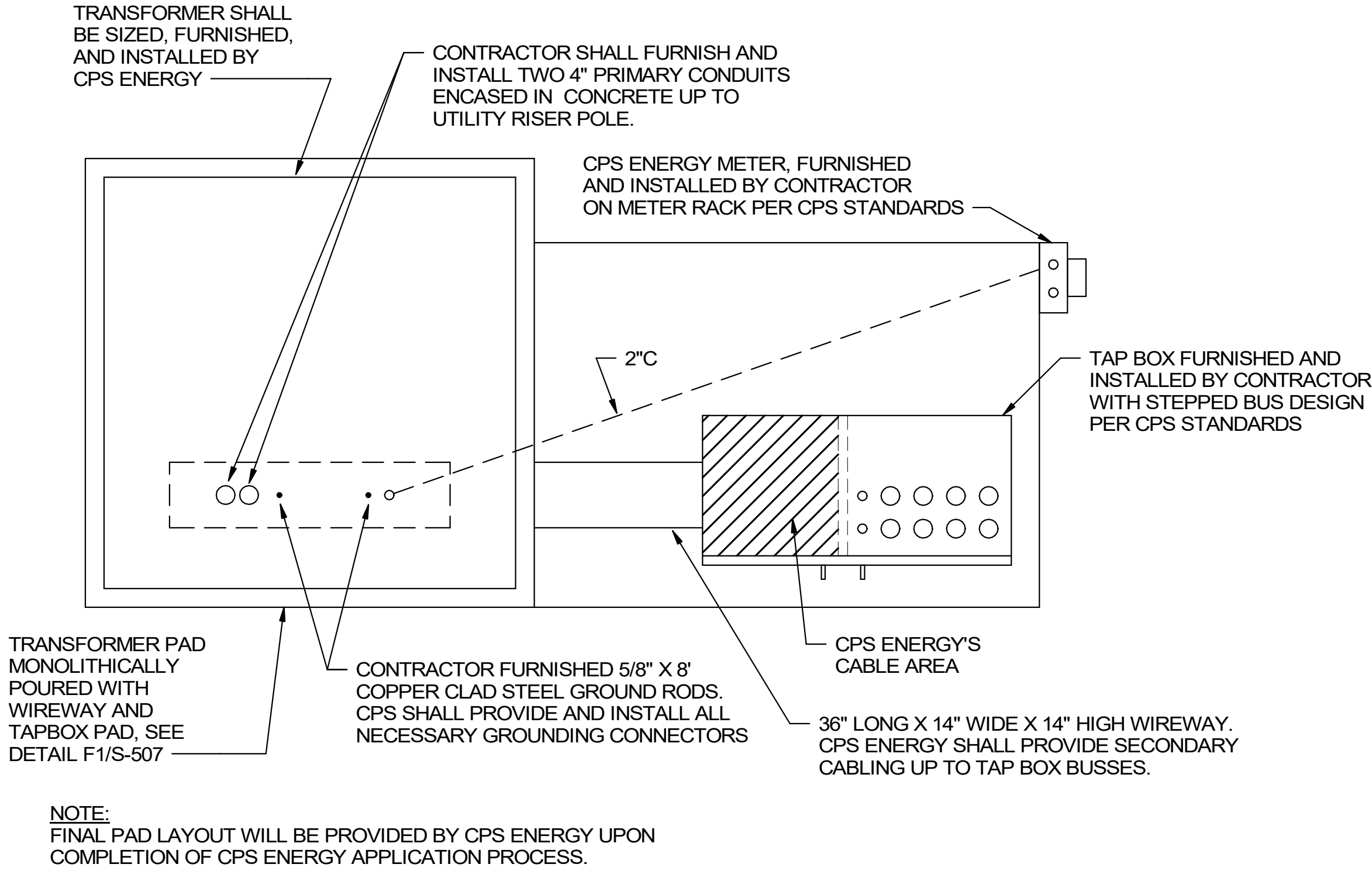
[illegible]

US ARMY CORPS OF ENGINEERS FORT WORTH DISTRICT FORT WORTH, TEXAS 76102	 	DESIGNED BY:	ISSUE DATE:
		L. CREECH DRAWN BY: J. CALVERO C. MOORE BY: T. MOORE SUBMITTED BY:	19 FEB 2021 SOLICITATION NO.: W9126Z21R0051 DRAWING NO.: MFLJ053858A
		SIZE:	
		5	
		CFZ	
		GROUP	
		DESIGN	
		CUNSLAMER	
		ANSI E	

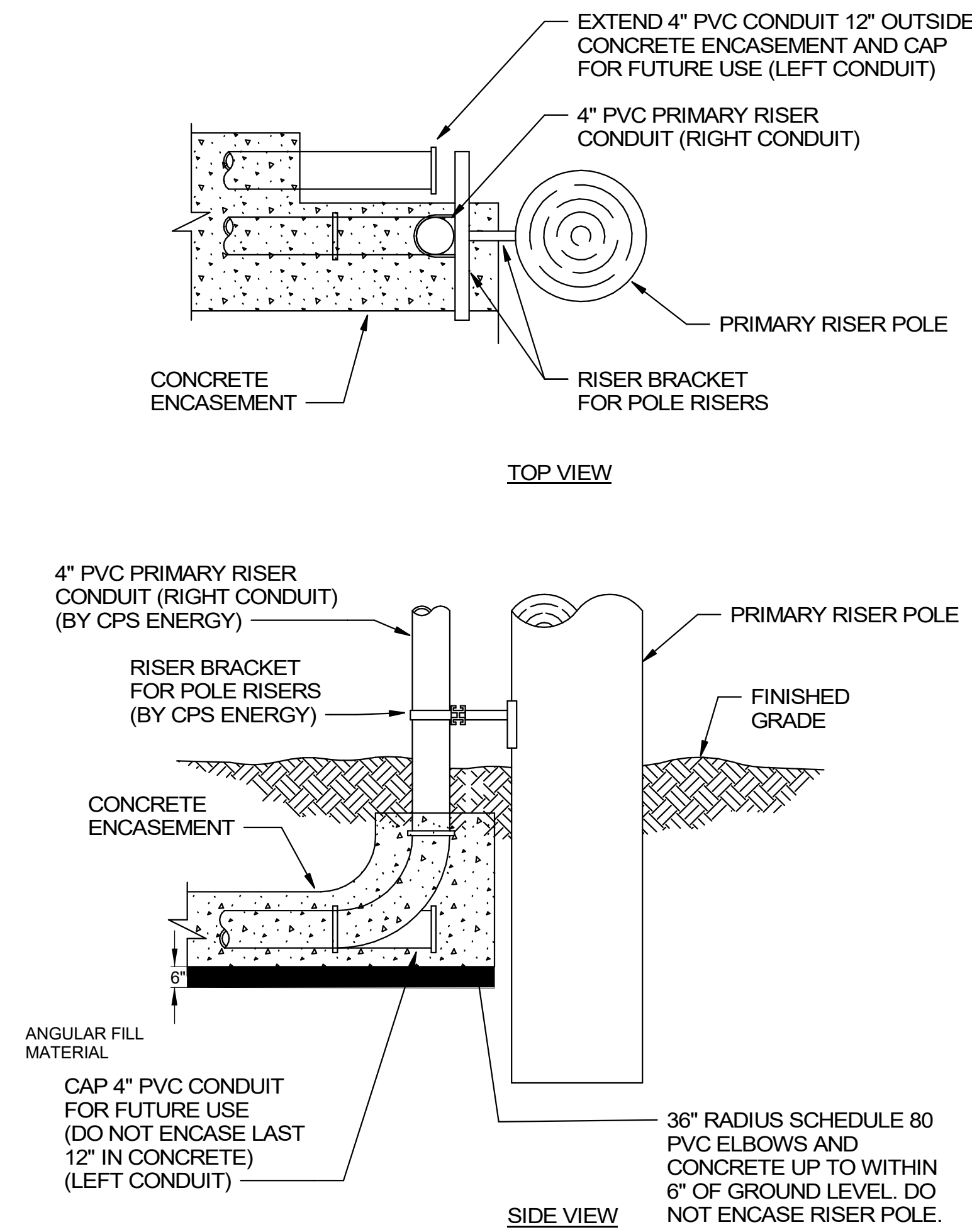
JOINT BASE SAN ANTONIO (JBSA) - LACKLAND AFB
SPECIAL WARFARE TRAINING GROUP AQUATIC TRAINING FACILITY
PROJECT NUMBER: MPYJ043855A; P2 NUMBER: 472496



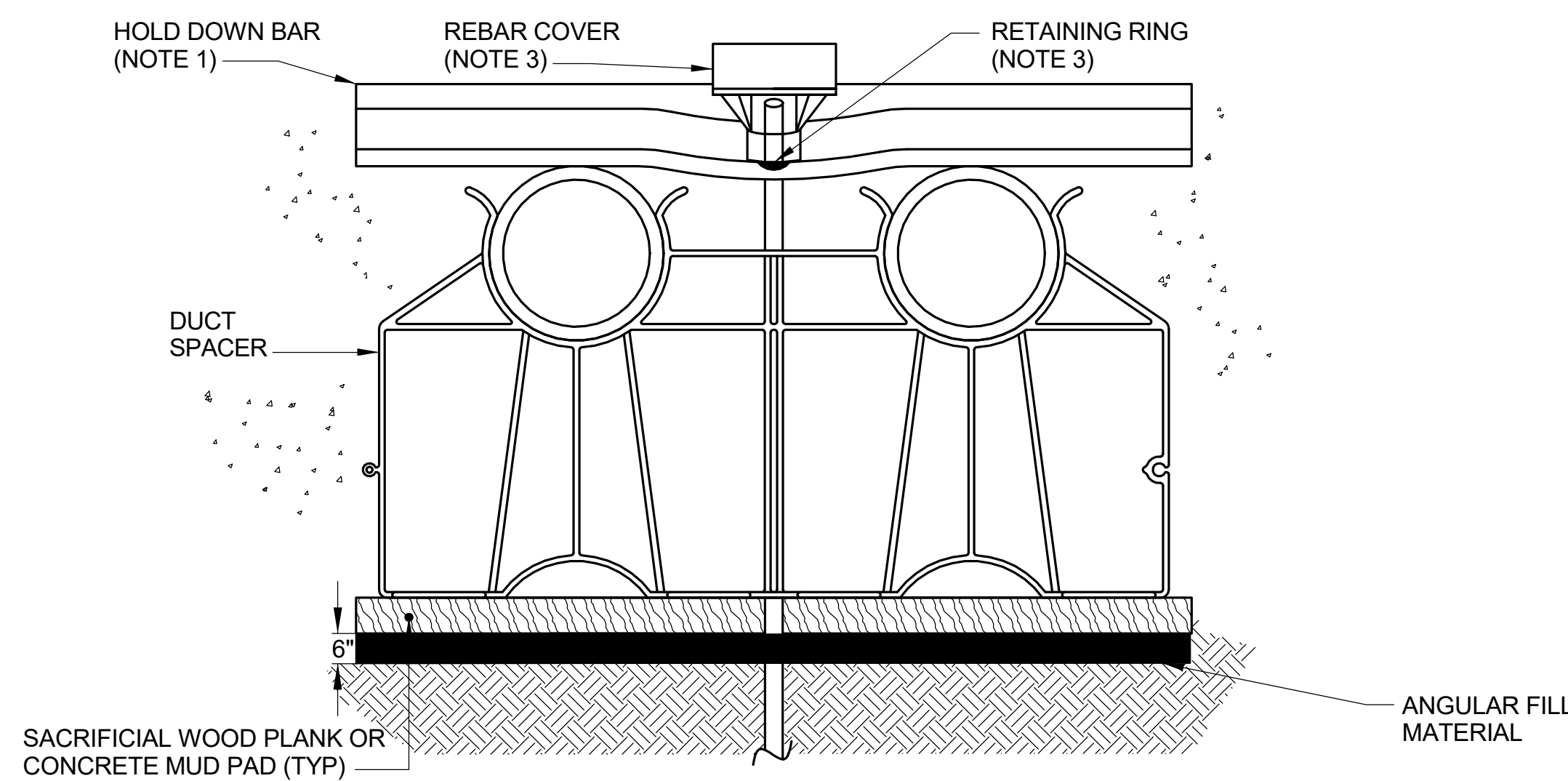
H1 SWITCHBOARD ELEVATION DETAIL
SCALE: SCALE: NTS



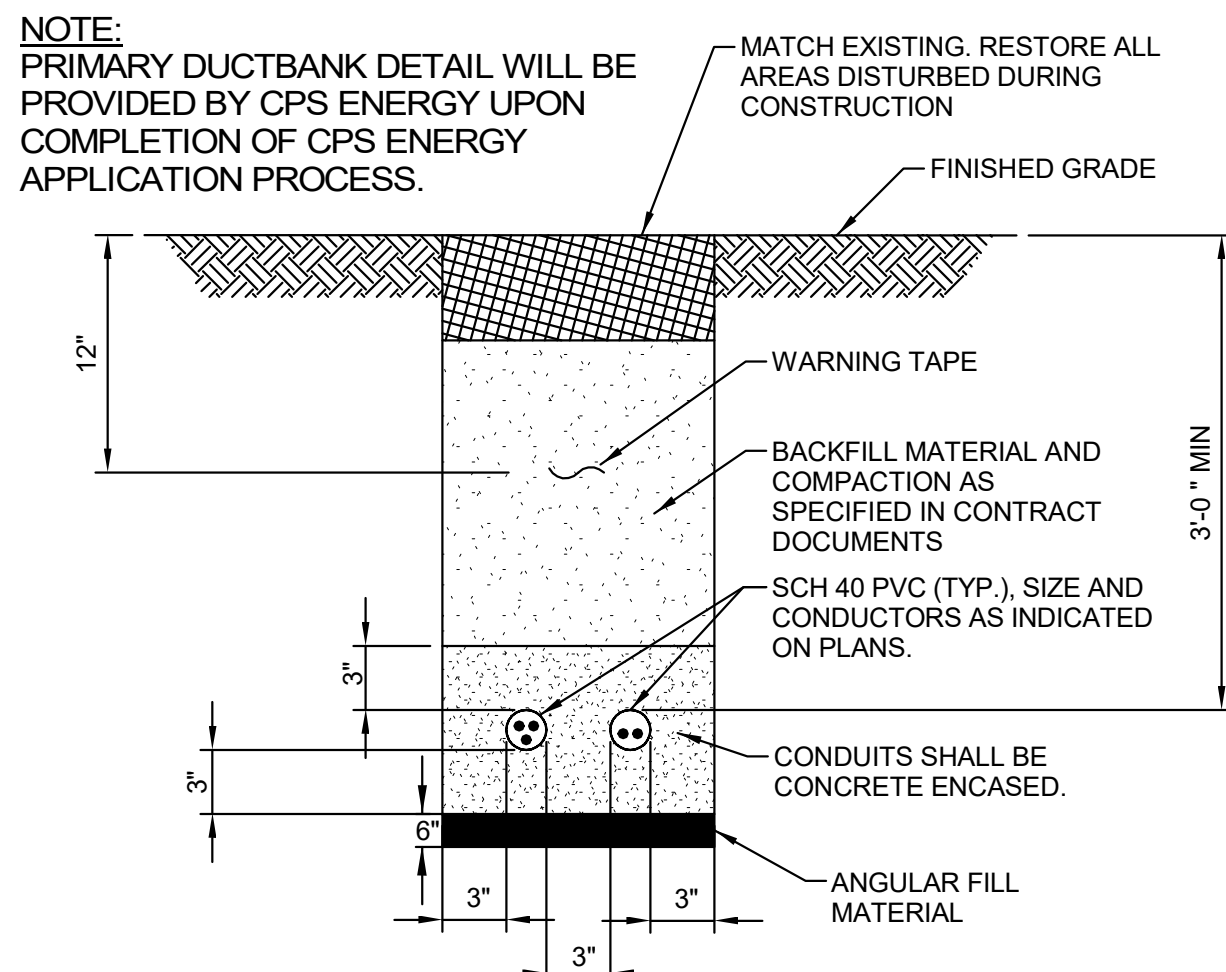
H6 TRANSFORMER PAD DETAIL
SCALE: SCALE: NTS



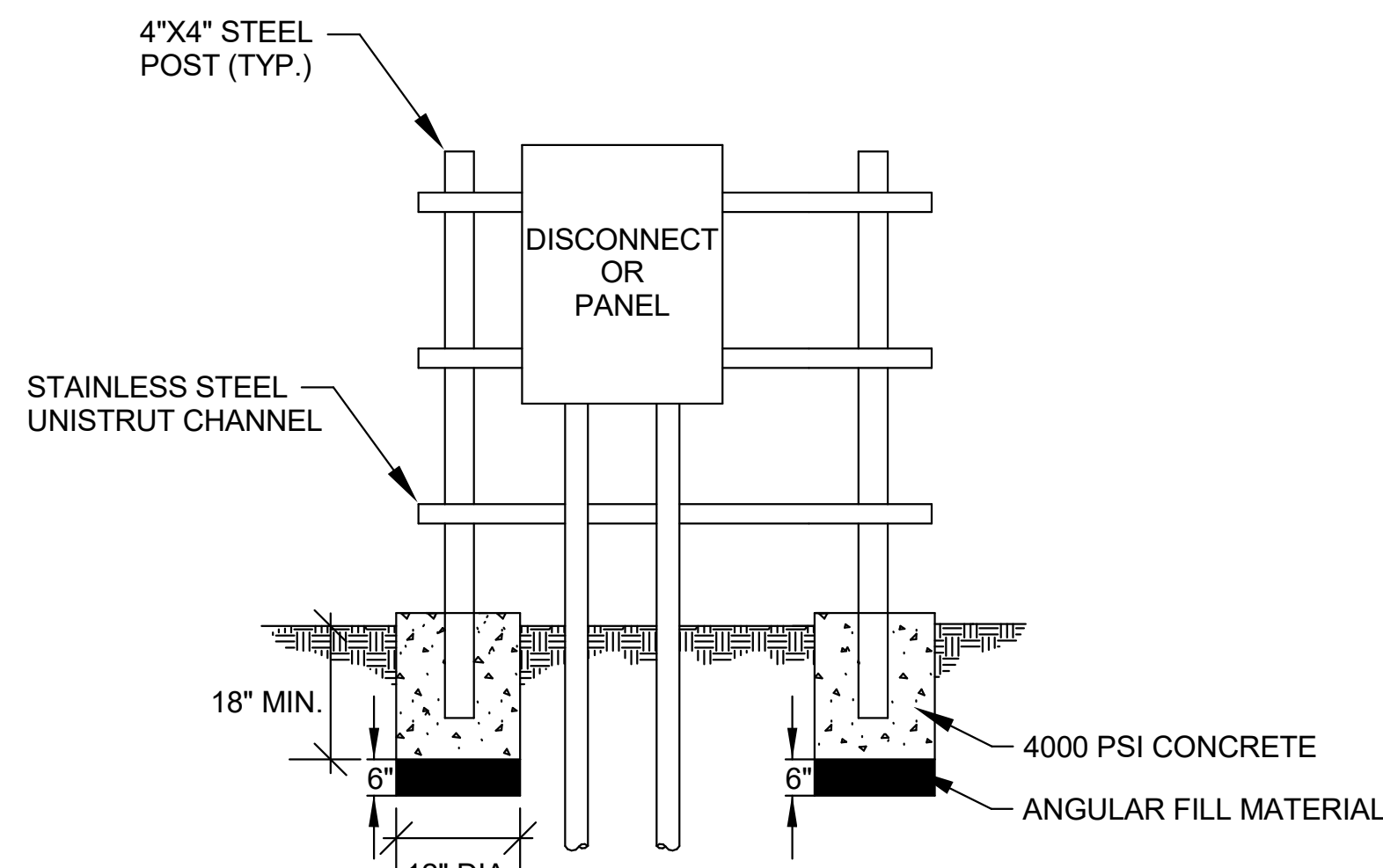
H10 UTILITY RISER DETAIL
SCALE: 12" = 1'-0"



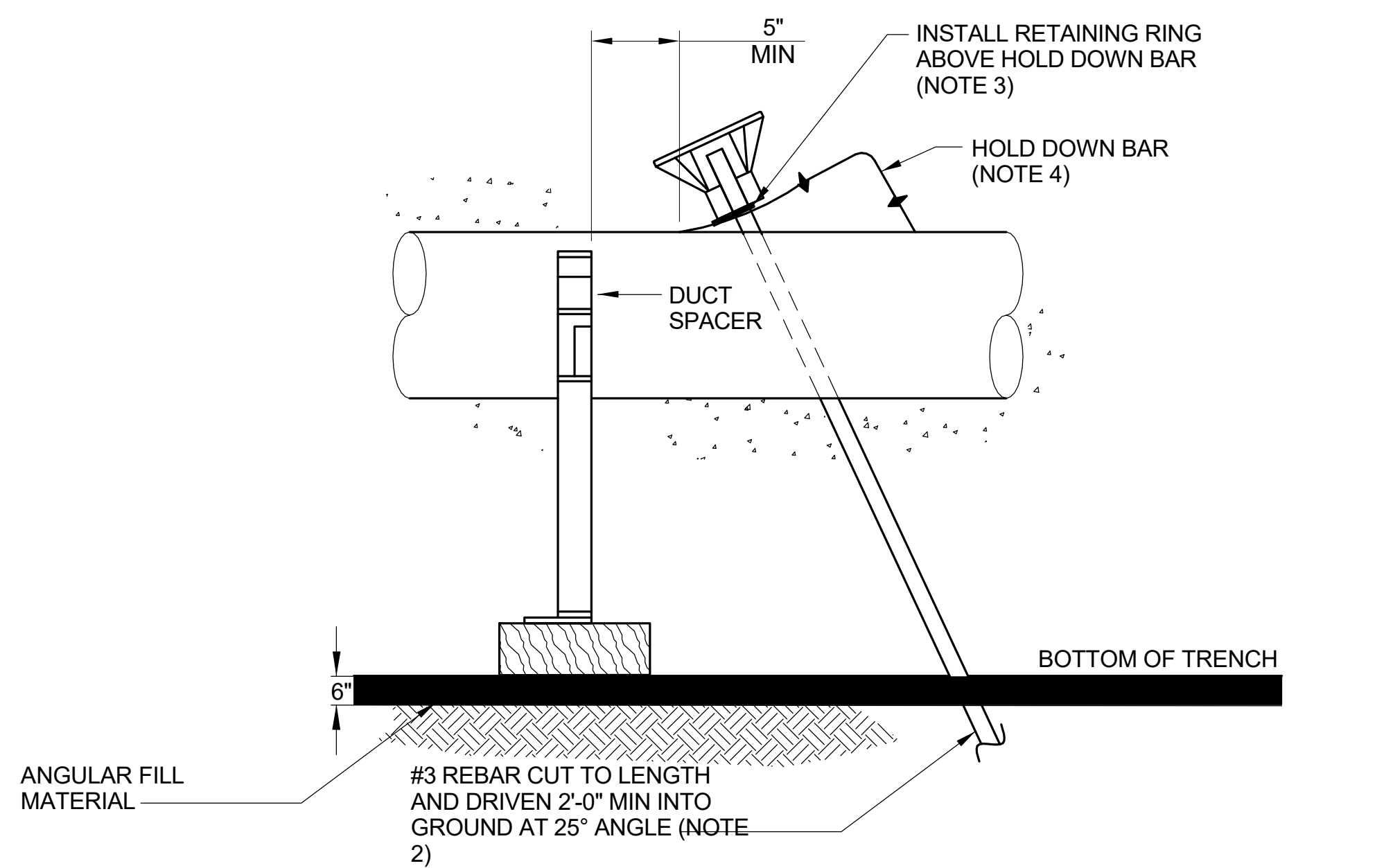
B1 HOLD DOWN BAR INSTALLATION
SCALE: SCALE: NTS



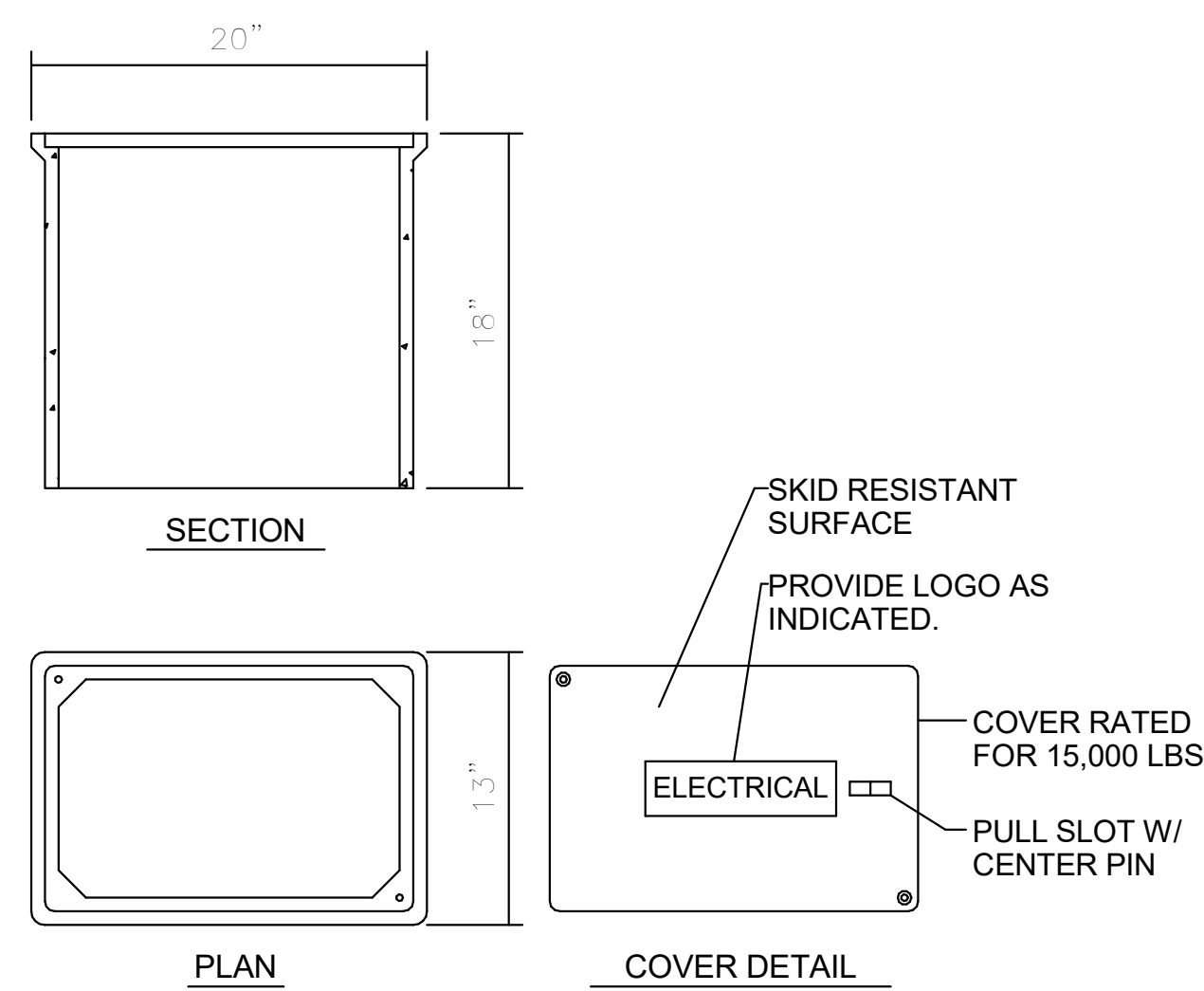
E5 TYPICAL DUCTBANK DETAIL
SCALE: SCALE: NTS



E9 EQUIPMENT RACK DETAIL
SCALE: SCALE: NTS

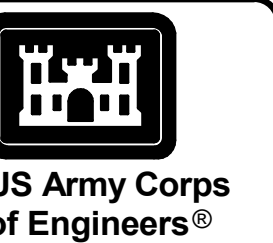


B5 SECONDARY DUCTBANK DETAIL
SCALE: SCALE: NTS



- NOTES:**
- HANDHOLES FOR LOW VOLTAGE CABLES INSTALLED IN PARKING LOTS, SIDEWALKS, AND TURFED AREAS SHALL BE FABRICATED FROM AN AGGREGATE CONSISTING OF SAND AND WITH CONTINUOUS WOVEN GLASS STRANDS HAVING AN OVERALL COMPRESSIVE STRENGTH OF AT LEAST 10,000 PSI AND A FLEXURAL STRENGTH OF AT LEAST 5,000 PSI. PULLBOX AND HANDHOLE COVERS IN SIDEWALKS, AND TURFED AREAS SHALL BE OF THE SAME MATERIAL AS THE BOX. CONCRETE PULLBOXES SHALL CONSIST OF PRECAST REINFORCED CONCRETE BOXES, EXTENSIONS, BASES, AND COVERS.
 - IN PAVED AREAS, FRAMES AND COVERS FOR HANDHOLE ENTRANCES IN VEHICULAR TRAFFIC AREAS SHALL BE FLUSH WITH THE FINISHED SURFACE OF THE PAVING. IN UNPAVED AREAS, THE TOP OF MANHOLE COVERS SHALL BE APPROXIMATELY 1/2" ABOVE THE FINISHED GRADE.

B9 PULL BOX DETAIL
SCALE: SCALE: NTS



DATE	REVISION	DESCRIPTION
03/20/21	1	AMENDMENT 002

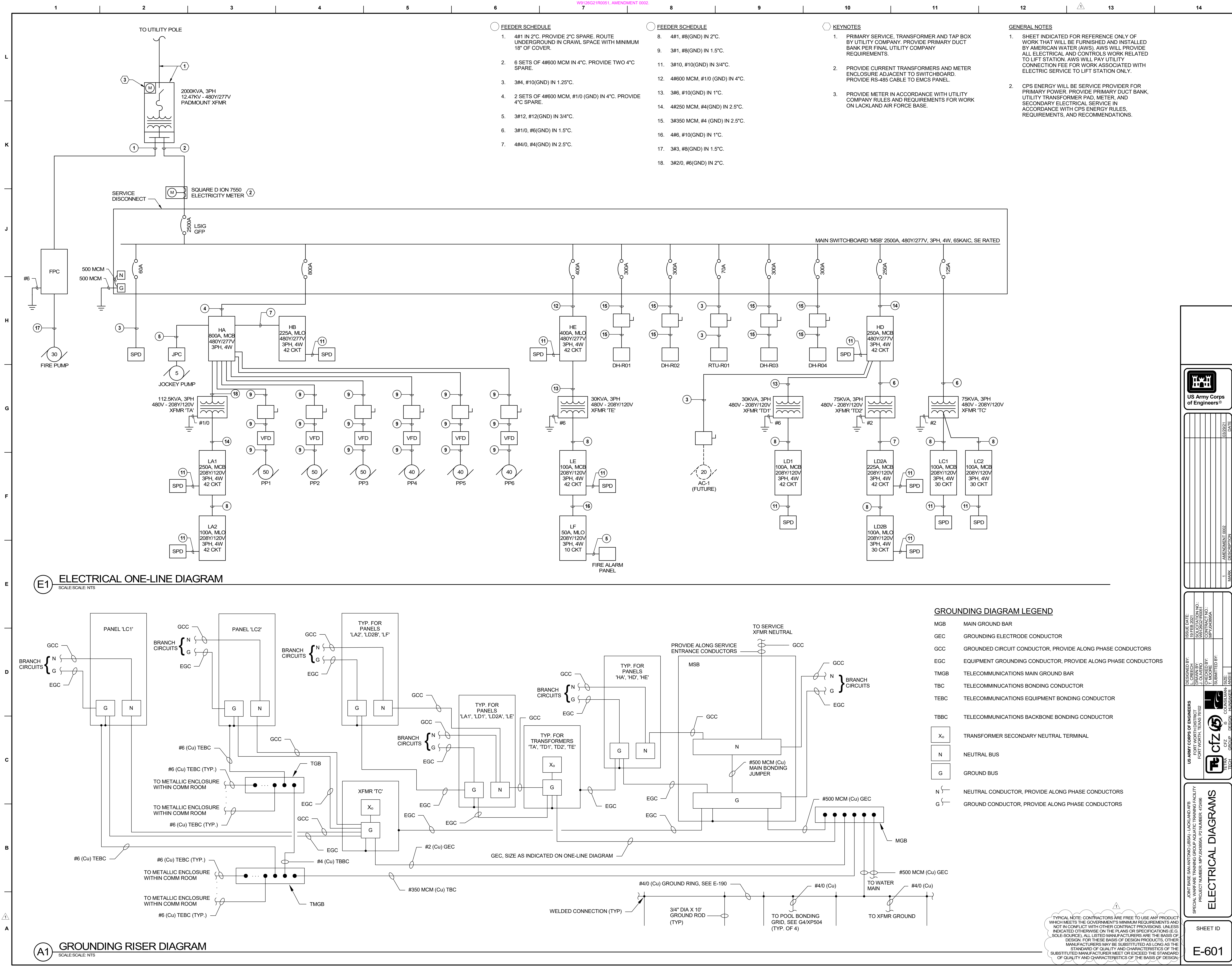
DESIGNED BY: DRAWN BY: CHECKED BY: SUBMITTED BY:	DESIGNED BY: DRAWN BY: CHECKED BY: SUBMITTED BY:	DESIGNED BY: DRAWN BY: CHECKED BY: SUBMITTED BY:	DESIGNED BY: DRAWN BY: CHECKED BY: SUBMITTED BY:

JOINT BASE SAN ANTONIO (JBSA) - LACKLAND AFB SPECIAL WARFARE TRAINING GROUP AQUATIC TRAINING FACILITY PROJECT NUMBER: WFAJ0686A-12-NUMBER-47246	ELECTRICAL DETAILS

SHEET ID

E-504

READY TO ADVERTISE



E1 ELECTRICAL ONE-LINE DIAGRAM
SCALE: 1/8" = 1'-0"

GROUNDING DIAGRAM LEGEND

MGB	MAIN GROUND BAR
GEC	GROUNDING ELECTRODE CONDUCTOR
GCC	GROUNDING CIRCUIT CONDUCTOR, PROVIDE ALONG PHASE CONDUCTORS
EGC	EQUIPMENT GROUNDING CONDUCTOR, PROVIDE ALONG PHASE CONDUCTORS
TMGB	TELECOMMUNICATIONS MAIN GROUND BAR
TBC	TELECOMMUNICATIONS BONDING CONDUCTOR
TEBC	TELECOMMUNICATIONS EQUIPMENT BONDING CONDUCTOR
TBBC	TELECOMMUNICATIONS BACKBONE BONDING CONDUCTOR
X ₀	TRANSFORMER SECONDARY NEUTRAL TERMINAL
N	NEUTRAL BUS
G	GROUND BUS
N	NEUTRAL CONDUCTOR, PROVIDE ALONG PHASE CONDUCTORS
G	GROUND CONDUCTOR, PROVIDE ALONG PHASE CONDUCTORS

A1 GROUNDING RISER DIAGRAM
SCALE: 1/8" = 1'-0"

TYPICAL NOTE: CONTRACTORS ARE FREE TO USE ANY PRODUCT WHICH MEETS THE GOVERNMENT'S MINIMUM REQUIREMENTS AND NOT IN CONFLICT WITH OTHER CONTRACT PROVISIONS, UNLESS INDICATED OTHERWISE ON THE PLANS OR SPECIFICATIONS (E.G. SOLE-SOURCE). ALL LISTED MANUFACTURERS ARE THE BASIS OF DESIGN. FOR THESE BASIS OF DESIGN PRODUCTS, OTHER MANUFACTURERS MAY BE SUBSTITUTED AS LONG AS THE STANDARD OF QUALITY AND CHARACTERISTICS OF THE SUBSTITUTED MANUFACTURER MEET OR EXCEED THE STANDARD OF QUALITY AND CHARACTERISTICS OF THE BASIS OF DESIGN.

US Army Corps of Engineers

PROJECT: JOINT BASE SAN ANTONIO (JBSA) - LACKLAND AFB
SHEET: E-601

DATE: 03/28/21

REVISIONS:

NO.	DATE	DESCRIPTION
1	03/28/21	ISSUED FOR CONSTRUCTION

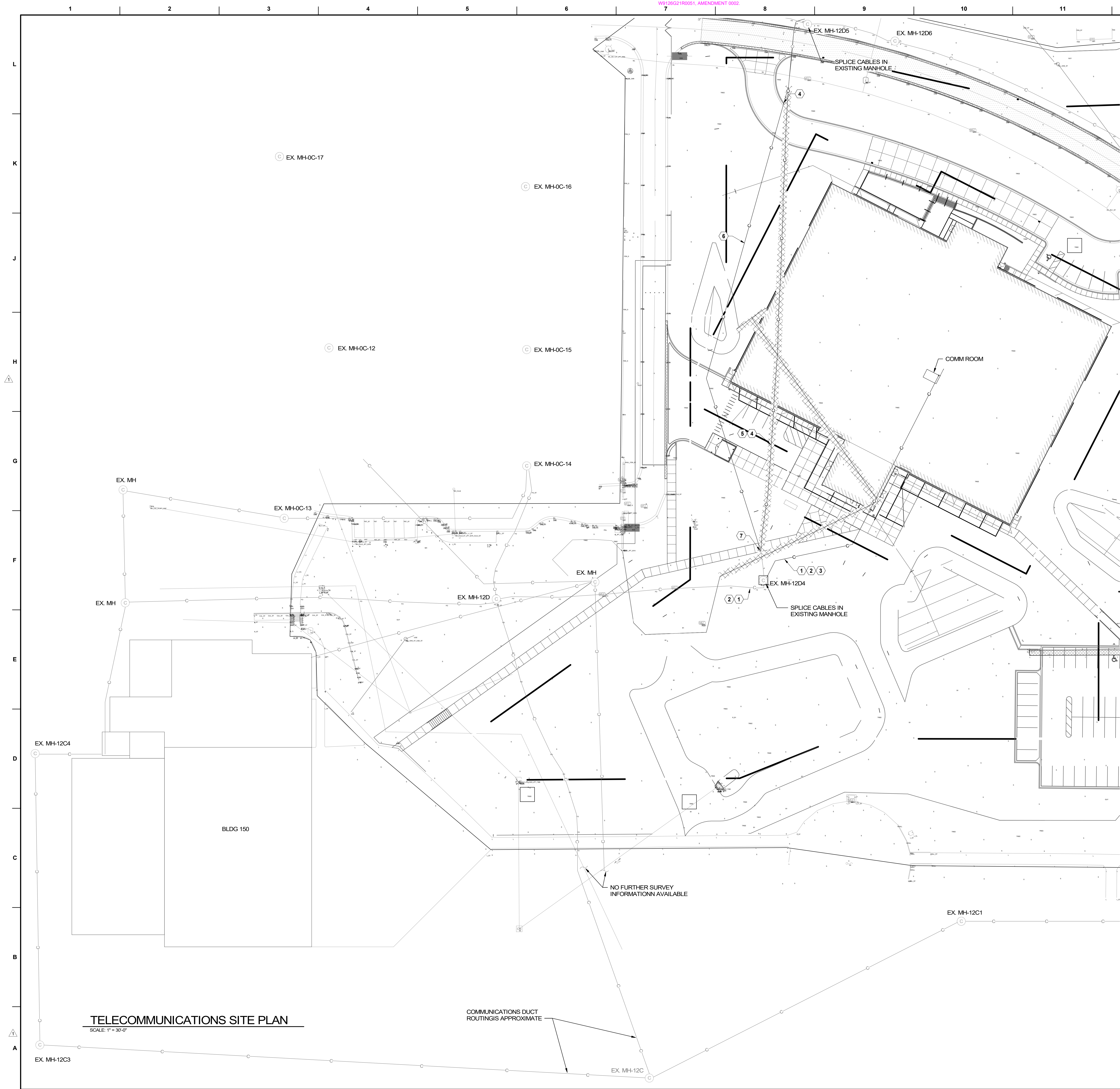
DESIGNED BY: [Signature]
CHECKED BY: [Signature]
SUBMITTED BY: [Signature]

US ARMY CORPS OF ENGINEERS
FORT WORTH DISTRICT
PROJECT NUMBER: W9126G21R0051, AMENDMENT 0002

ELECTRICAL DIAGRAMS

SHEET ID: E-601

READY TO ADVERTISE

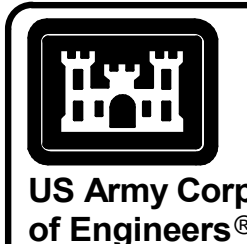
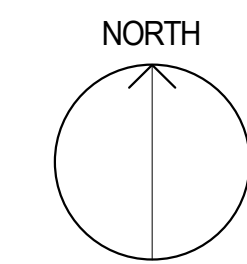


- GENERAL NOTES
1. SPECIAL CARE SHALL BE TAKEN TO AVOID DAMAGING EXISTING UTILITIES (WATER, SEWER, POWER, GAS, COMMUNICATIONS, ETC.). CONTRACTOR SHALL BE RESPONSIBLE FOR IDENTIFYING AND LOCATING ALL EXISTING SITE UTILITIES (OVERHEAD & UNDERGROUND) IN THE AREA OF EXCAVATION AND/OR DRILLING. NO ADDITIONAL COMPENSATION SHALL BE GIVEN FOR REPAIRS REQUIRED FOR ANY INCIDENTAL DAMAGES (WHICH MIGHT BE OCCASIONED BY THE CONTRACTOR'S FAILURE TO EXACTLY LOCATE AND PRESERVE ANY AND ALL UNDERGROUND UTILITIES. SUCH DAMAGES (IF HAPPENED) SHALL BE REPAIRED IMMEDIATELY TO RESUME SERVICES WITH MINIMAL OUTAGES AND AT NO ADDITIONAL COST TO THE GOVERNMENT.
 2. PROVIDE EXCAVATION AS REQUIRED FOR INSTALLATION OF EXTERIOR UNDERGROUND CONDUITS. REPLACE FILL MATERIAL AND COMPACT IN ACCORDANCE WITH CIVIL SPECIFICATIONS.
 3. INSTALLATION OF UNDERGROUND CONDUITS SHALL BE COORDINATED WITH GOVERNMENT CONTRACTING OFFICER AND JBSA COMMUNICATIONS SHOP PRIOR TO CONSTRUCTION.
 4. UNDER NO CIRCUMSTANCES SHALL DOWNTIME BE ALLOWABLE FOR 288-STRAND FIBER OPTIC CABLE INDICATED. REMAINING OUTSIDE PLANT COMMUNICATIONS CABLE ALLOW FOR LIMITED DOWNTIME. DOWNTIME SHALL BE LIMITED TO AFTER NORMAL BASE OPERATING HOURS AND SHALL BE COORDINATED WITH GOVERNMENT CONTRACTING OFFICER A MINIMUM OF 30 DAYS IN ADVANCE.

KEYNOTES

1. PROVIDE 12-STRAND SMFO FROM INT IN BUILDING 150 TO NEW COMM RM VIA MANHOLES 12C4, 12C3, 12C, 12D, AND 12D4.
2. PROVIDE 25-PAIR COPPER FROM SPLICE CASE IN MH-12C TO NEW COMM RM VIA MANHOLES 12D AND 12D4.
3. (2) 4" CONDUITS WITH (3) 3"x3-CELL MAXCELL INNERDUCT WITH (1) BEING TRACEABLE IN ONE OF THE 4" CONDUITS. THERE SHALL BE A TOTAL OF NINE INTERNAL PATHWAYS WITH ONE TRACER WIRE IN ONE OF THE 4" CONDUITS. THE SECOND 4" CONDUIT SHALL CONTAIN PULLSTRING ONLY.
4. RELOCATE 288-STRAND FO CABLE TO SPLIT CONDUIT. WIRING SHALL REMAIN OPERATIONAL THROUGHOUT COURSE OF CONSTRUCTION.
5. 12-STRAND FO CABLE AND 25-PAIR COPPER CABLES SHALL BE REMOVED TO MANHOLE MH-12D4. RE-PULL CABLE IN SPLIT CONDUIT.
6. CONDUIT SHALL BE INSTALLED IN SPLIT SECTION. INSTALL LOWER HALF OF CONDUIT PRIOR TO 288-STRAND FIBER RELOCATION. ENTIRE CONDUIT INSTALLATION SHALL BE CONCRETE ENCASED.
7. PROVIDE CONDUIT ADAPTER TO CONNECT EXISTING CONDUIT TO NEW CONDUIT.

TYPICAL NOTE: CONTRACTORS ARE FREE TO USE ANY PRODUCT WHICH MEETS THE GOVERNMENT'S MINIMUM REQUIREMENTS AND NOT IN CONFLICT WITH OTHER CONTRACT PROVISIONS, UNLESS INDICATED OTHERWISE ON THE PLANS OR SPECIFICATIONS (E.G. SOLE-SOURCE). ALL LISTED MANUFACTURERS ARE THE BASIS OF DESIGN. FOR THESE BASIS OF DESIGN PRODUCTS, OTHER MANUFACTURERS MAY BE SUBSTITUTED AS LONG AS THE STANDARD OF QUALITY AND CHARACTERISTICS OF THE SUBSTITUTED MANUFACTURER MEET OR EXCEED THE STANDARD OF QUALITY AND CHARACTERISTICS OF THE BASIS OF DESIGN.

[illegible]

US ARMY CORPS OF ENGINEERS	DESIGNED BY:	ISSUE DATE:
FORT WORTH DISTRICT	M. DUFF	19 FEB 2021
FORT WORTH, TEXAS 76102	DRAWN BY:	SOLICITATION NO.:
	T. MOORE	W958-19-2-0002
	CHECKED BY:	CONTRACT NO.:
	J. MOORE	MPY443865A
	SUBMITTED BY:	
SCALE:	SIZE:	
ANSI	HUNSMAN	
GROUP	COLLINS	
CTZ	DESIGN	
CFZ	TECH	
FCF	CFZ	

JOINT BASE SAN ANTONIO (JBSA) - LACKLAND AFB
SPECIAL WARFARE TRAINING GROUP AQUATIC TRAINING FACILITY
PROJECT NUMBER: WFYJ04-3885A, P2 NUMBER: 472496

SHEET ID
T-101



J1 **GUTTER**
SCALE 1/2" = 1'-0"



G1



D1 CONCI
SCALE 1/2" = 1'-0"



A1 BELOV



J4 HEA
SCALE NTS



G4

D4 FLOOR
SCALE 3" = 41.0'

STUB SIZE (NPS)	MINIMUM DEPTH
3" AND UNDER	12"
4"	14.25"
6"	19.5"
8"	24.5"
10"	30"
12"	35"

1. ALL MAIN DRAINS SHALL BE CONSTRUCTED TO COMPLY WITH THE VIRGINIA GRAEME BAKER ACT & ASME ANSI/APSP-16-2011.
2. MAIN DRAINS MAY USE MULTIPLE VGB COMPLIANT GRATES SECURELY FASTENED PER MANUFACTURER RECOMMENDATIONS.



B4 MAIN L

J7 TRAPE
SCALE 2" = 1' 0"



G7 FLOOR
SCALE 3" = 1'-0"



D7 FLOW
SCALE 3/4" = 1'

A7 WATER

J11 ADJUST
SCALE 3" = 1' 0"



G11 FLOOR
SCALE 3" = 1'-0"



D11 CLEVELAND
SCALE 1/4" = 1'

A11 SWIVE

[illegible]

	TETRA TECH	CFZ GROUP	IS DESIGN	COUNSLMAN HANSKAKER		US ARMY CORPS OF ENGINEERS FORT WORTH DISTRICT FORT WORTH, TEXAS 76102	
				SIZE:	DRAWN BY: S. PYLE	ISSUE DATE: 19 FEB 2021	SOLICITATION NO.: W3129521R0051
					CHECKED BY: D. BOKER		CONTRACT NO.: WFFJ-04-0680A
					SUBMITTED BY: C. COLEMAN		

JOINT BASE SAN ANTONIO (JBSA) - LACKLAND AFB
SPECIAL WARFARE TRAINING GROUP AQUATIC TRAINING FACILITY
PROJECT NUMBER: MPY J043856A; P2 NUMBER: 472486

MAIN DRAIN SCHEDULE

ID	DESCRIPTION	SIZE	QTY	DESIGN FLOW (GPM)	DESIGN VELOCITY (FPS)
M1	TANK B SET 1	18X54	2	1,750	0.55
M2	TANK B SET 2	18X54	2	1,750	0.55
M3	TANK A SET 1	18X54	2	1,600	0.50
M4	TANK A SET 2	18X54	2	1,600	0.50

PIPING LEGEND

LEGEND	QTY.	ITEM
		TANK B
	85	FLOOR INLET REFER: D4X/P504
	1	SIGHT SUMP REFER: G1X/P504
	6	GUTTER DROPOUT BOX REFER: J1X/P504
	4	MAIN DRAIN REFER: B4X/P504
		TANK A
	75	FLOOR INLET REFER: D4X/P504
	1	SIGHT SUMP REFER: G1X/P504
	6	GUTTER DROPOUT BOX REFER: J1X/P504
	4	MAIN DRAIN REFER: B4X/P504
		COMBINED
-----	N/A	BELOW GRADE PIPE

PUMP SCHEDULE

ID	DESCRIPTION	MANUFACTURER	MODEL	SIZE	GPM	TDH (FOH)	HP	NPSHR (FOH)	HAIR/LINT		NOTES
									N/A	SIZE	
PP1	TANK B RECIRCULATION PUMP 1 REFER: J11XP503	PACO	60123 LC	8.6	1,750	88	50	17.51	N/A	12X8	1,2,3
PP2	TANK B RECIRCULATION PUMP 2 REFER: J11XP503	PACO	60123 LC	8.6	1,750	88	50	17.51	N/A	12X8	1,2,3
PP3	TANK B RECIRCULATION PUMP 3 REFER: J11XP503	PACO	60123 LC	8.6	1,750	88	50	17.51	N/A	12X8	1,2,3
PP4	TANK A RECIRCULATION PUMP 1 REFER: J11XP503	PACO	60123 LC	8.6	1,600	88	50	16.42	N/A	12X8	1,2,3
PP5	TANK A RECIRCULATION PUMP 2 REFER: J11XP503	PACO	60123 LC	8.6	1,600	88	50	16.42	N/A	12X8	1,2,3
PP6	TANK A RECIRCULATION PUMP 3 REFER: J11XP503	PACO	60123 LC	8.6	1,600	88	50	16.42	N/A	12X8	1,2,3
PP13	TANK A DRAIN DOWN PUMP REFER: F7XP505	PENTAIR	WHISPERFLO-XFVS	2.2	180	40	5	N/A	INTEGRAL		1,2,3
PP14	TANK B DRAIN DOWN PUMP REFER: F7XP505	PENTAIR	WHISPERFLO-XFVS	2.2	180	40	5	N/A	INTEGRAL		1,2,3

NOTE:

1. PROVIDE WITH 460 VOLT, 3 PHASE, 60HZ, 1750 RPM MOTOR.
2. PROVIDE WITH CHECK VALVE.
3. PROVIDE VARIABLE FREQUENCY DRIVE.

CHEMICAL FEED SCHEDULE

ID	DESCRIPTION	MANUFACTURER	MODEL	TUBE #	HP	FLOW	NOTES
PP7	TANK B CHLORINATION BOOSTER PUMP REFER: B7/XP503	AXIALL	ACCUTAB	N/A	1	64.8 LBS/DAY	1,2,3,4
PP8	TANK A CHLORINATION BOOSTER PUMP REFER: B7/XP503	AXIALL	ACCUTAB 3070	N/A	1	64.5 LBS/DAY	1,2,3,4
PP9	TANK B ACID FEED PUMP REFER: A11/XP503	STENNER	45M	3	FRAC.	22 GAL/DAY	1,2,3,4
PP10	TANK A ACID FEED PUMP REFER: A11/XP503	STENNER	45M	3	FRAC.	22 GAL/DAY	1,2,3,4
PP11	TANK B GENX PUMP REFER: D11/XP503	CHLORKING	80-R	N/A	1	96 GAL/DAY	1,2,3,4
PP12	TANK A GENX PUMP REFER: D11/XP503	CHLORKING	80-R	N/A	1	96 GAL/DAY	1,2,3,4

NOTE:

1. PROVIDE WITH 120 VOLT, SINGLE PHASE, POWER SUPPLY.
2. INTERLOCK WITH TANK RECIRCULATION PUMP.
3. INTERLOCK CHEMICAL FEED PUMP WITH FILTER TO PREVENT FEEDING DURING PRE-COAT CYCLE.
4. SPECIFIC SALIENT CHARACTERISTICS OF EACH CHEMICAL FEED SYSTEM ARE IDENTIFIED IN THE SPECIFICATION.

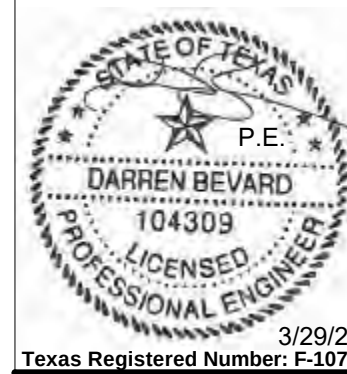
PIPE SCHEDULE

ID	DESCRIPTION
P1	12" FROM P37 & P38 TO PP1
P2	12" FROM P37 & P38 TO PP2
P3	12" FROM P37 & P38 TO PP3
P4	6" FROM TANK B FILL FUNNEL TO SURGE TANK
P5	12" FROM TANK B FILTERS TO TANK INLETS
P6	12" FROM TANK A FILTERS TO TANK INLETS
P7	6" FROM TANK A FILL FUNNEL TO SURGE TANK
P8	12" FROM P39 & P40 TO PP4
P9	12" FROM P39 & P40 TO PP5
P10	12" FROM P39 & P40 TO PP6
P11	10" FROM PP3 TO P51 & P52
P12	10" FROM PP2 TO P51 & P52
P13	10" FROM PP1 TO P51 & P52
P14	10" FROM PP4 TO P53 & P54
P15	10" FROM PP5 TO P53 & P54
P16	10" FROM PP6 TO P53 & P54
P17	10" FROM TANK A FILTER TO P6
P18	10" FROM TANK A FILTER TO P6
P19	10" FROM TANK B FILTER TO P5
P20	10" FROM TANK B FILTER TO P5
P21	6" PRECOAT LINE FROM TANK A FILTER TO PP4, PP5, & PP6
P22	6" PRECOAT LINE FROM TANK A FILTER TO PP4, PP5, & PP6
P23	6" PRECOAT LINE FROM TANK B FILTER TO PP1, PP2, & PP3
P24	6" PRECOAT LINE FROM TANK B FILTER TO PP1, PP2, & PP3
P25	4" FROM P5 TO TANK B HEATERS
P26	4" FROM TANK B HEATERS TO P5
P27	4" FROM P6 TO TANK A HEATERS
P28	4" FROM TANK A HEATERS TO P6
P29	4" FROM TANK A FILTER TO BACKWASH CATCH BASIN
P30	4" FROM TANK A FILTER TO BACKWASH CATCH BASIN
P31	4" FROM TANK B FILTER TO BACKWASH CATCH BASIN
P32	4" FROM TANK B FILTER TO BACKWASH CATCH BASIN
P33	4" FROM TANK A MAIN DRAINS TO PP13
P34	3" FROM PP13 TO DRAINAGE POND (REFER TO CIVIL FOR CONTINUATION)
P35	4" FROM TANK A MAIN DRAINS TO PP14
P36	3" FROM PP14 TO DRAINAGE POND (REFER TO CIVIL FOR CONTINUATION)
P37	12" FROM TANK B MAIN DRAINS TO P1, P2, & P3
P38	12" FROM TANK B MAIN DRAINS TO P1, P2, & P3
P39	12" FROM TANK A MAIN DRAINS TO P8, P9, & P10
P40	12" FROM TANK A MAIN DRAINS TO P8, P9, & P10
P41	10" FROM TANK B GUTTER DROPOUT BOX TO SURGE TANK
P42	10" FROM TANK B GUTTER DROPOUT BOX TO SURGE TANK
P43	16" FROM TANK B GUTTER DROPOUT BOXES TO SURGE TANK
P44	16" FROM TANK B GUTTER DROPOUT BOXES TO SURGE TANK
P45	10" FROM TANK A GUTTER DROPOUT BOX TO SURGE TANK
P46	10" FROM TANK A GUTTER DROPOUT BOX TO SURGE TANK
P47	14" FROM TANK A GUTTER DROPOUT BOXES TO SURGE TANK
P48	14" FROM TANK A GUTTER DROPOUT BOXES TO SURGE TANK
P49	3" TANK B SURGE TANK VENT
P50	3" TANK A SURGE TANK VENT
P51	10" FROM P11, P12, & P13 TO TANK B FILTER
P52	10" FROM P11, P12, & P13 TO TANK B FILTER
P53	10" FROM P14, P15, & P16 TO TANK A FILTER
P54	10" FROM P14, P15, & P16 TO TANK A FILTER

TANK HEATER SCHEDULE

TANK	N/A	BTUH	BOILER EFF (%)
TANK A	(2) APN 1500	1,500,000	96.2
TANK B	(2) APN 1500	1,700,000	96.2

NOTE:
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[illegible][illegible]

TANK SCHEDULES

JOINT BASE SAN ANTONIO (JBSA) - LACKLAND AFB
SPECIAL WARFARE TRAINING GROUP AQUATIC TRAINING FACILITY
PROJECT NUMBER: MDV 1042805A, DCN NUMBER: 474406

SHEET 10

XP601