



**ALAMEDA COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT  
(ZONE 7 WATER AGENCY)**

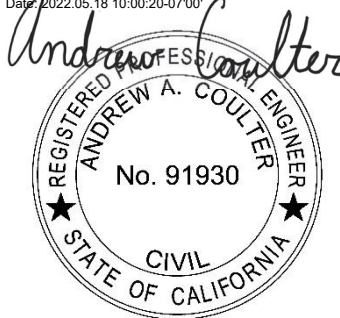
**MOCHO GROUNDWATER DEMINERALIZATION PLANT  
CONCENTRATE CONDITIONING SYSTEM PROJECT**

**PROJECT NO. 294-21**

**ADDENDUM NO. 3  
TO THE  
BID DOCUMENTS**

**MAY 17, 2022**

Digitally signed by Andrew Appling Coulter  
Contact Info: Carollo Engineers, Inc.  
Date: 2022.05.18 10:00:20-07'00'





This Addendum No. 3 ("Addendum") is dated the date set forth above and modifies certain Bidding Documents issued by the Alameda County Flood Control and Water Conservation District, acting by and through its Zone 7 Water Agency ("District") in connection with the District's Mocho Groundwater Demineralization Plant Concentrate Conditioning System Project, Project No. 294-21. There are no other amendments to the Bidding Documents other than expressly contained in Addendum No. 1, Addendum No. 2, and this Addendum No. 3.

The following clarifications and/or modifications shall be incorporated into plans and specifications for the above-referenced project shall become part of the Contract Documents. All other provisions and requirements shall remain unchanged.

**Please be reminded that all bidders shall acknowledge receipt of this Addendum No. 3 in Document 00400 (Bid Form) and failure to acknowledge addendum in the Bid Form may render the bid non-responsive and may be cause for its rejection.**

**Acknowledgement of receipt of Addendum No. 3 for the Mocho Groundwater Demineralization Plant Concentrate Conditioning System Project, Project No. 294-21.**

Please also sign and email a copy of this page to Athena Watson, Zone 7 Water Agency, at [awatson@zone7water.com](mailto:awatson@zone7water.com) to acknowledge receipt of Addendum No. 3 for this project.

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Signature and Print Name

Date

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Company

## SPECIFICATIONS

The following sections have been modified as indicated below:

1. DOCUMENT 00400 – BID FORM:
  - a. REPLACE document in its entirety with the attached document.
2. SECTION 01100 – SUMMARY:
  - a. ADD sub paragraph 1.3.D.9. as follows:

**"9. Bid Item 9: Temporary and Permanent Feeders to Panelboard H-4 and the Well Pump Soft Starter.** The lump sum price paid under this item shall be full payment for furnishing all materials, supplies, equipment, tools, facilities, dust control, and performing all labor and services necessary for and required in conjunction with, or properly incidental to, the construction of temporary and permanent feeders to Panelboard H-4 and the Well Pump Soft Starter in the Mocho 4 Well Building from the existing medium voltage switchgear."
3. SECTION 01452 – REGULATORY QUALITY ASSURANCE:
  - a. REPLACE paragraph 1.08.A. with the following:

"Owner will employ (one) 1 or more registered design professionals who will provide structural observation(s) during construction."
  - b. REPLACE paragraph 3.03 A.1. and its subparagraphs with the following:

"1. All structures in all areas:

    - a. Roof truss system at beginning of installation.
    - b. Roof connections between new roof trusses and existing CMU tower. Twice: once at beginning of installation and once near completion while corrections can be made.
    - c. Roof lateral force resisting system: trusses, connectors, and sheathing, near completion while corrections can be made."
  - c. DELETE Attachment C1 named "Masonry Special Inspection Schedule – 'Level B'".
4. SECTION 09\_96\_01 – HIGH-PERFORMANCE COATINGS:
  - a. REPLACE Appendix A and Appendix B in their entirety with the attached documents.
5. SECTION 22\_45\_17 - EMERGENCY EYE/FACE WASH AND SHOWER EQUIPMENT:
  - a. ADD the following as paragraph 1.01.A.2.:

"2. Tankless water heater."

b. ADD article 2.02:

"2.02 TANKLESS WATER HEATER

A. Tankless electric water heaters:

1. High temperature limit switch with automatic reset.
2. Compression fittings.
3. Maximum operating pressure of 150 psig.
4. Power: 480 volt, 3 phase, 60 hertz
  - a. Provide fused disconnect switch.
5. Heating Element Capacity: 54 kilowatts.
6. Temperature rise shall be 18 degrees Fahrenheit at 20 gallons per minute water flow.
7. Cabinet shall be NEMA 4X stainless steel construction.
8. Flow switch activated:
  - a. Ni Chrome heating coils activate at 1.5 gpm.
9. Manufacturers: One of the following or approved equal:
  - a. Haws, Model 9327.
  - b. Eemax, similar model.
  - c. Keltech, similar model."

6. SECTION 26\_05\_00 – COMMON WORK RESULTS FOR ELECTRICAL:

- a. ADD the following as paragraph 1.04.B.3 and renumber the subsequent paragraph:

"3. Intercept existing Power Feeds from Existing Medium Voltage Switchgear to Panelboard H-4 and Well Pump Soft Starter, and reroute as required if existing conduit path is determined to interfere with new construction on Mocho 4 Building. Provide temporary power feeds to Panelboard H-4 and Well Pump as required during relocation of the existing power feeds. Mocho 4 Building must remain in operation during construction."

7. SECTION 26\_05\_13 – MEDIUM VOLTAGE CABLES:

- a. ADD attached section in its entirety.

8. SECTION 26\_05\_22 – MEDIUM VOLTAGE CABLE CONNECTIONS:

- a. ADD attached section in its entirety.

9. SECTION 26\_05\_33 – CONDUITS:

- a. REPLACE section in its entirety with the attached section.

10. SECTION 26\_05\_44 – DUCT BANKS:

- a. ADD attached section in its entirety.

11. SECTION 26\_06\_01A – CONDUIT SCHEDULE AREA 08:

- a. REPLACE document in its entirety with the attached document.

## **DRAWINGS**

The following Drawings have been modified as indicated below:

1. DRAWING A03:

- a. REVISE the 2019 California Energy Conservation Code Table to the enclosed updated U-Value Provided. REVISE asterack to read as follows: "IN ACCORDANCE WITH THE 2019 CALIFORNIA ENERGY CODE SECTION 100.0 SCOPE, SUBSECTION (e)2.C UNCONDITIONED NONRESIDENTIAL BUILDINGS AND PROCESS BUILDINGS APPLICABILITY IS LIMITED."

2. DRAWING E03:

- a. Drawing modified to include the installation of a new electrical ductbank.

3. DRAWING E05:

- a. Drawing modified to include the installation of a new electrical ductbank and new conduits.

4. DRAWING E06:

- a. Drawing modified to show the routing of two new conduits.

5. DRAWING E12:

- a. ADD attached drawing in its entirety. Includes a duct bank section of the electrical ductbank shown on Drawing E03.

6. DRAWING TE01:

- a. ADDED Typical Detail EM001.

## **BID DOCUMENTS**

### **ATTACHMENT A SPECIFICATIONS**

The following Specification Documents and Sections are attached to Addendum No. 3 and are made a part of the Contract either as new documents or replacing existing documents.

1. DOCUMENT 00400 – BID FORM.

2. SECTION 09\_96\_01 – HIGH-PERFORMANCE COATINGS, APPENDIX A AND APPENDIX B.

3. SECTION 26\_05\_13 – MEDIUM VOLTAGE CABLES.

4. SECTION 26\_05\_22 – MEDIUM VOLTAGE CABLE CONNECTIONS.
5. SECTION 26\_05\_33 – CONDUITS.
6. SECTION 26\_05\_44 – DUCT BANKS.
7. SECTION 26\_06\_01A – CONDUIT SCHEDULE AREA 08.

## **ATTACHMENT B DRAWINGS**

The following Drawings are attached to Addendum No. 3 and are made a part of the Contract either as new drawings or replacing existing drawings.

1. DRAWING A01.
2. DRAWING E03.
3. DRAWING E05.
4. DRAWING E06.
5. DRAWING E12.
6. DRAWING TE01.





**DOCUMENT 00400**

**BID FORM**

To be submitted as part of Bidder's Envelope by the time and date specified in Document 00200 (Instructions to Bidders), paragraph 1.

TO THE HONORABLE BOARD OF DIRECTORS OF THE ZONE 7 WATER AGENCY OF THE ALAMEDA COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

THIS BID IS SUBMITTED BY:

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(Firm/Company Name)

**Re: Project No. 294-21, Mocho Groundwater Demineralization Plant Concentrate Conditioning System Project**

1. The undersigned Bidder proposes and agrees, if this Bid is accepted, to enter into an agreement with the Alameda County Flood Control and Water Conservation District, acting by and through its Zone 7 Water Agency, a public agency of the State of California ("District") in the form included in the Contract Documents, Document 00520 (Agreement), to perform and furnish all Work as specified or indicated in the Contract Documents for the Contract Sum and within the Contract Time indicated in this Bid and in accordance with all other terms and conditions of the Contract Documents.
2. Bidder accepts all of the terms and conditions of the Contract Documents, Document 00100 (Advertisement for Bids), and Document 00200 (Instructions to Bidders), including, without limitation, those dealing with the disposition of Bid Security. This Bid will remain subject to acceptance for 90 Days after the day of Bid opening.
3. In submitting this Bid, Bidder represents:
  - (a) Bidder has examined all of the Contract Documents and the following Addenda (receipt of all of which is hereby acknowledged).

(b)

<b>Addendum Number</b>	<b>Addendum Date</b>	<b>Signature of Bidder</b>

- (c) Bidder has visited the Site and performed all tasks, research, investigation, reviews, examinations, and analysis and given notices, regarding the Project and the Site, as set forth in Document 00520 (Agreement), Article 5.
  - (d) Bidder has given District prompt written notice of all conflicts, errors, ambiguities, or discrepancies that it has discovered in or among the Contract Documents and as-built drawings and actual conditions and the written resolution thereof through Addenda issued by District is acceptable to Contractor.
  - (e) In accordance with California Public Contract Code Section 200 et seq., ("Iran Contracting Act of 2010"), Bidder certifies that Bidder is not identified on the list created by the California Department of General Services (DGS) in accordance with California Public Contract Code Section 2203(b) as a Person engaging in investment activities in Iran.
  - (f) Bidder shall comply with California Executive Order No. N-6-22, regarding sanctions in response to Russian aggression in Ukraine.
4. Based on the foregoing, Bidder proposes and agrees to fully perform the Work within the time stated and in strict accordance with the Contract Documents for the following sums of money listed in the following Schedule of Bid Prices:

#### SCHEDULE OF BID PRICES

All Bid items, including lump sums and unit prices, must be filled in completely. Bid items are described in Section 01100 (Summary of Work). Quote in figures only, unless words are specifically requested.

ITEM	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	TOTAL
1	Mobilization and Demobilization	1	LS	—	\$
2	Sheeting / Shoring / Bracing	1	LS	—	\$
3	Demolition of Existing Facilities	1	LS	—	\$
4	New Sulfuric Acid Metering and Storage Area	1	LS	—	\$
5	Mocho 4 Wellhouse Structural Improvements and Roof Replacement	1	LS	—	\$
6	MGDP VFDs Installation and Concentrate Sump Modifications	1	LS	—	\$
7	All Work of Contract Documents other than Work separately provided for under other Bid Items	1	LS	—	\$
8	<del>Extra Work Allowance (to be used as directed by the Engineer)</del>	±	LS	Allowance Item	\$ 500,000
8	Extra Work Allowance (to be used as directed by the Engineer)	1	LS	Allowance Item	\$250,000 <sup>AD3</sup>
9	Temporary and permanent feeders to Panelboard H-4 and the Well Pump Soft Starter.	1	LS	—	\$ <sup>AD3</sup>
<b>TOTAL BID PRICE</b>					\$

5. Subcontractors for work included in all Bid items are listed on the attached Document 00430 (Subcontractors List).
6. The undersigned Bidder understands that District reserves the right to reject this Bid.
7. If written notice of the acceptance of this Bid, hereinafter referred to as Notice of Award, is mailed or delivered to the undersigned Bidder within the time described in paragraph 2 of this Document 00400 or at any other time thereafter before it is withdrawn, the undersigned Bidder will execute and deliver the documents required by Document 00200 (Instructions to Bidders) within the times specified therein. These documents include, but are not limited to, Document 00520 (Agreement), Document 00610 (Construction Performance Bond), Document 00620 (Construction Labor and Material Payment Bond) and insurance certificates and endorsements required by Document 00700 (General Conditions).
8. Notice of Award or request for additional information may be addressed to the undersigned Bidder at the address set forth below.
9. The undersigned Bidder herewith encloses cash, a cashier's check, or certified check of or on a responsible bank in the United States, or a corporate surety bond furnished by a surety authorized to do a surety business in the State of California, in the form specified in Document 00200 (Instructions to Bidders), in the amount of ten percent (10%) of the Total Bid Price and made payable to "Zone 7 Water Agency."
10. The undersigned Bidder agrees to commence Work under the Contract Documents on the date established in Document 00700 (General Conditions) and to complete all work within the time specified in Document 00520 (Agreement). The undersigned Bidder acknowledges that District has reserved the right to delay or modify the commencement date. The undersigned Bidder further acknowledges District has reserved the right to perform independent work at the Site, the extent of such work may not be determined until after the opening of the Bids, and that the undersigned Bidder will be required to cooperate with such other work in accordance with the requirements of the Contract Documents.
11. The undersigned Bidder agrees that, in accordance with Document 00700 (General Conditions), liquidated damages for failure to complete all Work in the Contract within the time specified in Document 00800 (Supplementary Conditions – Division 0) shall be as set forth in Document 00800 (Supplementary Conditions – Division 0).

12. The names of all persons interested in the foregoing Bid as principals are:

(IMPORTANT NOTICE: If Bidder or other interested person is a corporation, give the legal name of corporation, state where incorporated, and names of president and secretary thereof; if a partnership, give name of the firm and names of all individual co-partners composing the firm; if Bidder or other interested person is an individual, give first and last names in full).

**NAME OF BIDDER:** \_\_\_\_\_

Licensed in accordance with an act for the registration of Contractors, and with license number: \_\_\_\_\_ Expiration: \_\_\_\_\_

Where incorporated, if applicable \_\_\_\_\_

Contractor Registration Number & Expiration Date \_\_\_\_\_ Principals \_\_\_\_\_

I certify (or declare) under penalty of perjury under the laws of the State of California that the foregoing is true and correct.

\_\_\_\_\_  
Signature of Bidder

NOTE: If Bidder is a corporation, set forth the legal name of the corporation together with the signature of the officer or officers authorized to sign contracts on behalf of the corporation. If Bidder is a partnership, set forth the name of the firm together with the signature of the partner or partners authorized to sign contracts on behalf of the partnership.

Business Address: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Contractor's Representative(s), (name, title): \_\_\_\_\_  
\_\_\_\_\_

Officers authorized to sign contracts: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Telephone Number(s): \_\_\_\_\_

Fax Number(s): \_\_\_\_\_

Date of Bid: \_\_\_\_\_

END OF DOCUMENT

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<sup>AD3</sup> Addendum No. 3

APPENDIX A <sup>AD3</sup>  
Schedule of Surfaces to be Coated

- A. The following schedule is incomplete. Coat unlisted surfaces with same coating system as similar listed surfaces. Contact Engineer for clarification.

EPU-M-1	Metals, exterior, non-immersed
EPX-M-2	Metals, interior, non-immersed
EPX-M-5	Aluminum surfaces in contact with concrete or masonry. Locations where Alkali-resistant bitumastic is specified.
EPX-M-6-BG	Below Grade Valves
VE-M-1	Pipes
VE-C-1	Secondary containment ,walls,pedestal bases and floor slab

Notes:

1: Non-immersed ferrous metal surfaces include:

- a. Doors, doorframes, ventilators, louvers, grilles, exposed sheet metal, and flashing.
- b. Pipe, valves, pipe hangers, supports and saddles, conduit, cable tray hangers, and supports.
- c. Motors and motor accessory equipment.
- d. Drive gear, drive housing, coupling housings, and miscellaneous gear drive equipment.
- e. Structural steel.
- f. Exterior of tanks and other containment vessels.
- g. Mechanical equipment supports, drive units, and accessories.
- h. Bare electrical equipment: boxes, exposed conduit, and accessories.
- i. Pumps not submerged.
- j. Other miscellaneous metals.

2: Immersed ferrous metal surfaces include:

- a. Interior surfaces of ferrous metal tanks.
- b. Field priming of ferrous metal surfaces with defective shop-prime coat; including non-submerged service.
- c. Sump pumps, including underside of base plates and submerged suction and discharge piping.
- d. Exterior of submerged piping and valves other than stainless steel or PVC piping.
- e. Other submerged iron and steel metal unless specified otherwise.

Appendix B			
Coating Detail Sheet			
Coating System	EPU-M-1		
Coating Material	Two coats epoxy with polyurethane finish coat		
Substrate	Metal		
Products: One of the following or equal:	Primer	Intermediate Coat	Finish Coat
Carboline	Carboguard 890	Carboguard 890	Carbothane 134 VOC
International Paint	Devran 224V	Devran 224V	Devthane 379H
PPG	Amerlock 2VOC	Amerlock 2VOC	Amershield VOC
Sherwin Williams	Macropoxy 646 100	Macropoxy 646 100	Hi Solids Polyurethane 250
Tnemec	Series 66HS	Series 66HS	Series 1095
Service Condition	Interior or Exterior, subject to direct sunlight. Non-immersion.		
Surface Preparation			
General	Prepare surfaces as specified in this Section and as follows.		
Ferrous Metal	Bare surfaces: SSPC-SP10, Near-White Blast Cleaning. Shop primed surfaces: SSPC-SP2, Hand Tool Cleaning or SSPC-SP3, Power Tool Cleaning. Damaged primer or rust: SSPC-SP10, Near White Blast Cleaning and spot prime.		
Nonferrous Metal	SSPC-SP16, Brush Blast Cleaning.		
Galvanized Metal	SSPC-SP16, Brush Blast Cleaning. Test for surface contaminants.		
Surface profile			
Ferrous Metal	2.5 to 3.0 mils		
Nonferrous Metal	1.5 to 2.0 mils		
Galvanized Metal	1.5 to 2.0 mils		
System Thickness (Dry Film)			
Total	10 to 13 mils		
Primer	4 to 5 mils		
Intermediate Coat	4 to 5 mils		
Finish Coat	2 to 3 mils		
Application			
Special CTR Training	Not required.		



Appendix B			
Coating Detail Sheet			
Coating System	EPX-M-2		
Coating Material	Epoxy		
Substrate	Metal		
Products: One of the following or equal:	Primer	Intermediate Coat	Finish Coat
Carboline	Carboguard 890	Carboguard 890	Carboguard 890
International Paint	Bar-Rust 236	Bar-Rust 236	Bar-Rust 236
PPG	Amerlock 2/400 Series	Amerlock 2/400 Series	Amerlock 2/400 Series
Sherwin Williams	TankClad HS	TankClad HS	TankClad HS
Tnemec	Series 66HS	Series 66HS	Series 66HS
Service Condition	Immersed, non-immersed, moderately corrosive environment.		
Surface Preparation			
General	Prepare surfaces as specified in this Section and as follows.		
Ferrous Metal	Bare surfaces: SSPC-SP5, White Metal Blast Cleaning. Shop primed surfaces: SSPC-SP7, Brush-Off Blast Cleaning. Damaged primer or rust: SSPC-SP5, White Metal Blast Cleaning and spot prime.		
Nonferrous Metal	SSPC-SP16, Brush-Off Blast Cleaning.		
Galvanized Metal	SSPC-SP16, Brush-Off Blast Cleaning.		
Surface profile			
Ferrous Metal	2 to 4 mils		
Nonferrous Metal	1.0 to 1.5 mils		
Galvanized Metal	1.0 to 1.5 mils		
System Thickness (Dry Film)			
Total	12 to 16 mils		
Primer	4 to 6 mils		
Intermediate Coat	4 to 6 mils		
Finish Coat	4 to 6 mils		
Application			
Special CTR Training	Not required.		

Appendix B			
Coating Detail Sheet			
Coating System	EPX-M-5		
Coating Material	Epoxy mastic		
Substrate	Metal		
Products: One of the following or equal:	Primer	Intermediate Coat	Finish Coat
Carboline	CSM recommended	None applied	Carbomastic 15
International Paint	CSM recommended	Bar-Rust 231LV	Bar-Rust 231LV
PPG	No product specified	No product specified	No product specified
Sherwin Williams	CSM recommended	No product specified	No product specified
Tnemec	CSM recommended	Series 135	Series 135
Service Condition	Interior, corrosive environment, confined enclosures, where minimal surface preparation is possible.		
Surface Preparation			
General	Prepare surfaces as specified in this Section and as follows.		
Ferrous Metal	Bare surfaces: SSPC-SP11, Power to Cleaning to Bare Metal. Shop primed surfaces: SSPC-SP3, Power Tool Cleaning. Damaged primer or rust: SSPC-SP11, Power to Cleaning to Bare Metal.		
Nonferrous Metal	SSPC-SP16, Brush-Off Blast Cleaning.		
Surface profile			
Ferrous Metal	2.0 to 2.5 mils		
Nonferrous Metal	1.0 to 1.5 mils		
System Thickness (Dry Film)			
Total	15 to 19 mils		
Primer	2 to 4 mils		
Finish Coat	15 mils		
Application			
Special CTR Training	Not Required.		

Appendix B			
Coating Detail Sheet			
Coating System	EPX-M-6-BG		
Coating Material	Epoxy		
Substrate	Metal		
Products: One of the following or equal:	Primer	Intermediate Coat	Finish Coat
Carboline	Carboguard 890	Carboguard 890	Carboguard 890
International Paint	Bar-Rust 236	Bar-Rust 236	Bar-Rust 236
PPG	Amerlock 400	Amerlock 400	Amerlock 400
Sherwin Williams	No product specified	No product specified	No product specified
Tnemec	Series 66HS	Series 66HS	Series 66HS
Service Condition	Below grade in contact with soil.		
Surface Preparation			
General	Prepare surfaces as specified in this Section and as follows.		
Ferrous Metal	SSPC-SP10, Near White Metal Blast Cleaning.		
Nonferrous Metal	SSPC-SP16, Brush-Off Blast Cleaning.		
Galvanized Metal	SSPC-SP16, Brush-Off Blast Cleaning.		
Surface profile			
Ferrous Metal	2.5 to 3.0 mils		
Nonferrous Metal	1.5 to 2.0 mils		
Galvanized Metal	1.5 to 2.0 mils		
System Thickness (Dry Film)			
Total	16 mils		
Primer	4 to 6 mils		
Intermediate Coat	4 to 6 mils		
Finish Coat	4 to 6 mils		
Application			
General	Fill all bugholes with a filler/surfacer compatible with the coating.		
Special CTR Training	Not Required.		

Appendix B			
Coating Detail Sheet			
Coating System	VE-M-1		
Coating Material	Vinyl Ester		
Substrate	Metal		
Products: One of the following or equal:	Primer	Intermediate Coat	Finish Coat
International Paint			Ceilcote Flakeline 232.
PPG			Nova Rez 370
Sherwin Williams			CorCote VEN
Tnemec			Series 120-5001
Service Condition	Immersion or non-immersion (primary or secondary containment) very corrosive - indoors or exterior.		
Surface Preparation			
General	Prepare surfaces as specified in this Section and as follows.		
Ferrous Metal	Bare surfaces: SSPC-SP5, White Metal Blast Cleaning. Shop primed surfaces: SSPC-SP7, Brush-Off Blast Cleaning. Damaged primer or rust: SSPC-SP5, White Metal Blast Cleaning and spot prime.		
Surface profile			
Ferrous Metal	4.0 mils		
System Thickness (Dry Film)			
Total	60 to 65 mils		
Application			
Special CTR Training	Required.		

Appendix B			
Coating Detail Sheet			
Coating System	VE-C-1		
Coating Material	Vinyl Ester - fiber reinforced with flexible basecoat		
Substrate	Concrete		
Products: One of the following or equal:	Primer	Intermediate Coat	Finish Coat
International Paint			Ceilcote Flakeline 232.
PPG			Nova Rez 370
Sherwin Williams			CorCote VEN
Tnemec			Series 120-5001
Service Condition	Immersed, non-immersed, very corrosive environment, color not required, new or existing construction. Primary or secondary containment indoors or exterior. Provide flexible base coat and fiberglass reinforcing to bridge concrete cracks up to 50 mils.		
General	Prepare surfaces as specified in this Section and as follows.		
Concrete	Apply flexible complete parge coat over all concrete surfaces after surface preparation is accepted. Completely fill all bugholes with the same material. Brush blast clean, if parge coat is non-polymer modified, after adequate cure per CSM's instructions to produce a uniform anchor pattern. Let concrete substrate cure under warm conditions (minimum of 75 degrees F) for at least 5 days before coating application if using wet abrasive or water jet surface preparation. Sawcut 1/4" minimum deep groove and provide coating termination and transition details as shown on the drawings and in accordance with CSM's standard details including terminations, transitions at corners, cracks, pipe penetrations, terminations at metal embedments, and other details. Vacuum all surfaces to be coated after surface preparation and curing to remove all loose dirt, dust, or other loose materials.		
Existing Coated Concrete	Prepare as for new concrete. Apply a skim coat of a surfacer or filler material to restore the substrate to a coatable condition.		
Surface profile			
Concrete	ICRI CSP 5.		
Existing Coated Concrete	ICRI CSP 5.		
System Thickness (Dry Film)			
Parge coat	Completely cover the substrate with flexible parge coat above filled voids by 1/8 inch (125 mils) of thickness.		
Total	60 to 65 mils in addition to the parge coat.		
Primer	Per CSM's recommendations.		
Intermediate Coat	25 to 30 mils with 1.5 oz fiberglass cloth. Saturate fiberglass and roll flat with a wet ribbed roller. Sand all seams flat and remove protruding fiberglass strands.		
Finish Coat	25 to 30 mils. Broadcast 20 to 40 mesh silica sand or aluminum oxide into the wet finish coat to saturation. Remove excess with stiff bristle broom after curing.		
Application			
General	Trowel-apply surfacers or filler materials CSM's recommendations. Work surfacer/filler into all voids to displace air and fill bugholes.		
Special CTR Training	Required.		

AD3 Addendum No. 3



New Section

**SECTION 26\_05\_13<sup>AD3</sup>**

**MEDIUM VOLTAGE CABLES**

**PART 1 GENERAL**

**1.01 SUMMARY**

- A. Section includes: Medium voltage cables rated 5,000 through 35,000 volts.

**1.02 REFERENCES**

- A. As specified in Section 26\_05\_00 - Common Work Results for Electrical.
- B. Association of Edison Illuminating Companies (AEIC):
  - 1. CS8 - Specification for Extruded Dielectric, Shielded Power Cables Rated 5 through 46 kV.
- C. ASTM International (ASTM):
  - 1. B3 - Standard Specification for Soft or Annealed Copper Wire.
  - 2. B8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft.
  - 3. B496 - Standard Specification for Compact Round Concentric-Lay-Stranded Copper Conductors.
- D. Insulated Cable Engineers Association (ICEA):
  - 1. S-93-639 - 5-46 kV Shielded Power Cable for Use in the Distribution of Electrical Energy.
  - 2. S-94-649 - Standard for Concentric Neutral Cables Rated 5 Through 46 kV.
  - 3. S-97-682 - Standard for Utility Shielded Power Cables Rated 5 Through 46 kV.
- E. Underwriter's Laboratories (UL):
  - 1. 1072 - Standard for Safety for Medium-Voltage Power Cables.

**1.03 DEFINITIONS**

- A. As specified in Section 26\_05\_00 - Common Work Results for Electrical.
- B. Definitions of terms and other electrical considerations as set forth by:
  - 1. ICEA.
  - 2. ASTM.

## **1.04 SYSTEM DESCRIPTION**

- A. Furnish and install the complete medium voltage cable system.

## **1.05 SUBMITTALS**

- A. Furnish submittals as specified in Sections 01330 - Submittal Procedures.
- B. Product data:
  - 1. Manufacturer.
  - 2. Voltage class.
  - 3. Conductor:
    - a. Size.
    - b. Material.
    - c. Stranding.
  - 4. Insulation:
    - a. Type.
    - b. Level.
  - 5. Shielding.
  - 6. Temperature rating.
  - 7. Jacket material.
- C. Shop drawings:
  - 1. Show splice locations.
  - 2. Provide details on the pull plan:
    - a. Show splice locations, if applicable.
    - b. Cable layout locations, if applicable.
    - c. Actions for protecting cables at each phase of the installation.
- D. Calculations:
  - 1. Submit cable pulling calculations to the Engineer for review and comment showing that the maximum cable tension and sidewall pressure will not exceed Manufacturer recommended values:
    - a. Provide a table showing the manufacturer's recommended maximum cable tension and sidewall pressure for each cable type and size included in the calculations.
      - 1) Increase the coefficient of friction for the calculation until either maximum cable tension or maximum sidewall pressure is reached. If maximum sidewall pressure is reached before maximum tension, the tension at which the maximum sidewall pressure is reached will be the maximum pull tension for the pull.
  - 2. Submit the calculations to the Engineer a minimum of 2 weeks before conduit installation.



- E. Qualifications:
  - 1. Submit qualifications for the individual(s) that will be performing medium voltage cable splices and terminations at least 30 calendar days before splicing or terminating.
  - 2. Documentation that the individual has received training by splice/termination Manufacturer or an independent testing laboratory.
  - 3. A statement of the number of years in which the individual has been splicing and terminating medium voltage cable.
- F. Test reports:
  - 1. Submit AC withstand partial discharge (corona) test x-y plots after manufacture and prior to shipment.
  - 2. Submit field test reports as specified in Section 26\_08\_50 - Field Electrical Acceptance Tests.
- G. Cable lengths:
  - 1. Submit installed cable lengths using a conduit measuring tape for all medium voltage circuits.
- H. Record documents:
  - 1. Submit record documents with any field modification.

#### **1.06 QUALITY ASSURANCE**

- A. Manufacturer qualifications: Minimum of 10 years of experience in manufacturing medium voltage power cables.
- B. Medium voltage cables shall be UL listed and labeled.

#### **1.07 DELIVERY STORAGE AND HANDLING**

- A. Cables stored and or cut on site shall have the ends turned down, and sealed with cable manufacturer's standard cable end seals, or field installed heat-shrink cable end seals.

#### **1.08 PROJECT/SITE CONDITIONS (NOT USED)**

#### **1.09 SEQUENCING (NOT USED)**

#### **1.10 SCHEDULING (NOT USED)**

#### **1.11 WARRANTY**

- A. As specified in Section 01770 – Contract Closeout.

#### **1.12 SYSTEM START-UP (NOT USED)**

### **1.13 OWNER'S INSTRUCTIONS (NOT USED)**

### **1.14 MAINTENANCE (NOT USED)**

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. One of the following or equal: Engineer knows of no equal.
  - 1. Okonite Co.
  - 2. General Cable.
  - 3. Southwire Co.

### **2.02 EXISTING PRODUCTS (NOT USED)**

### **2.03 MATERIALS**

- A. Conductors:
  - 1. Annealed uncoated copper in accordance with ASTM B3.
  - 2. Compact stranded in accordance with ASTM B496.
- B. Insulation:
  - 1. Ethylene propylene rubber, (EPR).
- C. Jacket:
  - 1. Polyvinyl chloride (PVC).

### **2.04 MANUFACTURED UNITS**

- A. General:
  - 1. Permanently mark each cable with the following at 24-inch intervals:
    - a. American Wire Gauge (AWG) size or circular mill area.
    - b. Voltage rating.
    - c. Grade of insulation.
    - d. UL symbol.
    - e. Manufacturer's name.
- B. Medium voltage cable:
  - 1. Provide cables manufactured in the last 12 months.
  - 2. Voltage ratings as indicated on the Drawings or on the conduit schedule.
  - 3. Type MV-105:
    - a. Rated for 105 degrees Celsius.
  - 4. Single-conductor:
    - a. Stranding:
      - 1) In accordance with ASTM B3 and B8 Class B.

5. Conductor screen:
  - a. Extruded semiconducting thermosetting compound.
  - b. Applied directly over the conductor.
  - c. In accordance with:
    - 1) AEIC CS8.
    - 2) UL 1072.
6. Insulation level:
  - a. 133 percent.
  - b. Insulation screen:
    - 1) Extruded semiconducting thermosetting compound.
    - 2) Applied directly over the insulation.
    - 3) In accordance with:
      - a) ICEA S-93-639 and ICEA S-97-682.
      - b) Free-striping.
    - 4) Provide color differentiation between semi-conducting layers and insulation.
7. Shield:
  - a. 5-mil annealed copper tape with an overlap of 25 percent.
8. Applications:
  - a. Suitable for use in wet and dry locations in conduit and underground duct systems.
  - b. Cables larger than AWG 1/0 suitable for CT use in cable tray.

## **2.05 EQUIPMENT (NOT USED)**

## **2.06 COMPONENTS (NOT USED)**

## **2.07 ACCESSORIES (NOT USED)**

## **2.08 MIXES (NOT USED)**

## **2.09 FABRICATION (NOT USED)**

## **2.10 FINISHES (NOT USED)**

## **2.11 SOURCE QUALITY CONTROL**

- A. Manufacturer cable in accordance with the latest standards of the ASTM and ICEA and test full cable length by these standards:
  1. AC withstand partial discharge (corona) test per AEIC CS8 and ICEA S-94-649.
    - a. Results not to exceed 5 picocoulombs.
- B. Provide cable reels with both ends of cables available for high-potential testing before installation.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION (NOT USED)**

### **3.02 PREPARATION (NOT USED)**

### **3.03 INSTALLATION**

- A. Install and terminate cable per manufacturer recommendations:
  - 1. Use proper stripping and terminating tools to ensure integrity of insulation.
  - 2. Ground shield at all terminations and splices.
  - 3. Maintain manufacturer's or NEC's minimum bending radius, whichever is larger.
  - 4. Do not bend, kink, or nick cable jacket or insulation.
  - 5. Properly coat wires and cables with pulling compound recommended by cable manufacturer before pulling into conduits and prevent mechanical damage to conductors during installation:
    - a. Other lubricants substituted must be accompanied by a statement from cable manufacturer as to its acceptable use with cables being installed.
  - 6. Do not exceed the pulling tension and sidewall pressures recommended by cable manufacturer. Install additional pull boxes as required to meet cable manufacturer's recommendations.
  - 7. Electrical identification: As specified in Section 26\_05\_53 - Identification for Electrical Systems.
  - 8. Use only tools that are recommended by the termination or splice manufacturer.
  - 9. Use a dynamometer during cable pulling operations to monitor cable pulling tensions.
- B. Do not install cables until the Engineer reviews the Contractor prepared cable-pulling calculations:
  - 1. Cable pulling crew shall have "in hand" all cable pulling calculations and cable pulling limitations.
- C. Cable pulling requirements:
  - 1. Pull cable directly from reels into the ducts.
  - 2. Cable may not be laid on the ground or otherwise handled for cutting or sorting without protection from debris or physical damage.
  - 3. Follow cable manufacture installation instructions for proper handling.
  - 4. Do not pull cables through more than one intermediate manhole on one pull.
  - 5. Seal all cable ends against moisture or lubricant prior to pulling.
  - 6. Use non-metallic pull ropes to prevent cutting of duct materials.

7. Pull cables from conductor, do not use cable pulling socks that attach to the insulation.
8. Cables cut in the field shall have the cut ends immediately sealed to prevent entrance of moisture.

D. Installation of cables in manholes and handholes:

1. Install cables not utilizing the shortest route but routed along those walls providing the longest route and the maximum spare cable lengths.
2. Run all cables closely parallel to the walls, not interfering with duct entrances.
3. Support cables on brackets and cable insulators spaced at a maximum of four feet.
4. In existing manholes and handholes 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 for a neat and workmanlike installation with all cables properly arranged and supported.

E. Splices:

1. Provide continuous circuits from origin to termination:
  - a. Provide where necessary when cable pulling tension or sidewall pressure exceeds manufacturer recommendation for the cable.
2. Make splices in manholes or pull boxes only:
  - a. Leave sufficient slack to make proper connections.
  - b. Do not pull splices into conduit.

### **3.04 ERECTION, INSTALLATION, APPLICATION, CONSTRUCTION (NOT USED)**

### **3.05 REPAIR/RESTORATION (NOT USED)**

### **3.06 RE-INSTALLATION (NOT USED)**

### **3.07 COMMISSIONING**

- A. As specified in Section 01640 – Startup and Testing.

### **3.08 FIELD QUALITY CONTROL**

- A. After cable installation, test in accordance with ICEA/NEMA, including voltage tests, hi-potential tests, before energizing the circuits.
  1. Verify that no equipment is connected to the cables during tests.

### **3.09 ADJUSTING (NOT USED)**

### **3.10 CLEANING (NOT USED)**

**3.11 PROTECTION (NOT USED)**

**3.12 SCHEDULES (NOT USED)**

END OF SECTION

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<sup>AD3</sup> Addendum No. 3

New Section

**SECTION 26\_05\_22<sup>AD3</sup>**

**MEDIUM VOLTAGE CABLE CONNECTIONS**

**PART 1 GENERAL**

**1.01 SUMMARY**

- A. Section includes:
  - 1. Terminations.
  - 2. Splices.

**1.02 REFERENCES**

- A. As specified in Section 26\_05\_00 - Common Work Results for Electrical.
- B. Institute of Electrical and Electronics Engineers (IEEE):
  - 1. 48 - IEEE Standard for Test Procedures and Requirements for Alternating-Current Cable Terminations Used on Shielded Cables Having Laminated Insulation Rated 2.5 kV through 765 kV or Extruded Insulation Rated 2.5 kV through 500 KV.
  - 2. 386 - Standard for Separable Insulated Connector Systems for Power Distribution Systems Rated 2.5kV through 35kV.
  - 3. 404 - IEEE Standard for Extruded and Laminated Dielectric Shielded Cable Joints Rated 2.5 kV to 500 kV.
- C. Underwriters Laboratories, Inc. (UL).

**1.03 DEFINITIONS**

- A. As specified in Section 26\_05\_00 - Common Work Results for Electrical.

**1.04 SYSTEM DESCRIPTION**

- A. Provide a complete system of cables connectors, terminators, fittings, etc. for a complete cabling system suitable for the cables and conductors used.

**1.05 SUBMITTALS**

- A. Furnish submittals as specified in Sections 01330 - Submittal Procedures.
- B. Product data:
  - 1. Catalog cutsheets.
  - 2. Installation instructions.

3. Medium voltage systems:
  - a. Documentation demonstrating compliance with the required tests.
  - b. Characteristics and installation procedures for all splices, terminators, and junction modules.
- C. Shop drawings:
  1. Drawings showing the installation of junction modules, splices, and terminators.
- D. Operation and maintenance manuals:
  1. Drawings and data for medium voltage cable connectors, splices, and junction modules.

## **1.06 QUALITY ASSURANCE**

- A. All materials shall be UL listed.

## **1.07 DELIVERY, STORAGE, AND HANDLING (NOT USED)**

## **1.08 PROJECT OR SITE CONDITIONS**

- A. As specified in Section 01811 – Project Design Criteria.

## **1.09 SEQUENCING (NOT USED)**

## **1.10 SCHEDULING (NOT USED)**

## **1.11 WARRANTY**

- A. As specified in Section 01770 – Contract Closeout.

## **1.12 SYSTEM START-UP (NOT USED)**

## **1.13 OWNER'S INSTRUCTIONS (NOT USED)**

## **1.14 MAINTENANCE (NOT USED)**

# **PART 2 PRODUCTS**

## **2.01 MANUFACTURERS**

- A. Manufacturers for each type of technology are specified with the equipment in this Section.

## **2.02 EXISTING PRODUCTS (NOT USED)**

## **2.03 MATERIALS (NOT USED)**



## 2.04 MANUFACTURED UNITS (NOT USED)

## 2.05 EQUIPMENT

### A. Tape:

1. Fire and electric arc proofing tape:
  - a. Minimum 30-mil, flexible, elastomer tape that expands in fire to form an insulating firewall between flame and cable.
  - b. Bind in place with glass cloth electrical tape.
  - c. Manufacturers: The following or equal:
    - 1) 3M, Scotch Number 77.
2. Glass cloth electrical tape:
  - a. Thermosetting, 7.4-mil silicone adhesive that performs at Class H temperatures 180 degrees Celsius (356 degrees Fahrenheit).
  - b. Use for the following applications:
    - 1) To secure non-PSA insulations such as glass in high-temperature areas.
    - 2) Splice wire rated at 150 degrees Celsius, 180 degrees Celsius, and 200 degrees Celsius.
    - 3) For binding fire and electric arc proofing tape.
  - c. Meeting and complying with:
    - 1) UL recognized component listing for 200 degrees Celsius (Guide OANZ2, File E17385).
  - d. Manufacturers: The following or equal:
    - 1) 3M, Scotch Number 69.
3. Self-fusing silicone rubber tape:
  - a. High-temperature, 12-mil, track resistant, insulating tape.
  - b. Composed of fully cured inorganic silicone rubber.
  - c. Use as a protective overwrap for terminating medium voltage cables.
  - d. Manufacturers: The following or equal:
    - 1) 3M, Scotch Number 70.

### B. Lugs:

1. Tin-plated copper.
2. Compression type.
3. Two-hole blade.
4. UL listed.

### C. Cable splices and terminations:

1. Splices:
  - a. Permanent in-line splice.
  - b. Suitable for submersible, direct burial applications.
  - c. Electrical requirements:
    - 1) Continuous current rating equal to cable.

- 2) 5 to 8 kilovolts (kV) voltage class:
  - a) Maximum voltage phase-ground.
  - b) Minimum partial discharge voltage (less than 3 pC) 7 kV.
  - c) AC withstand, 1 minute: 23 kV.
  - d) AC withstand, 1 hour: 35 kV.
  - e) AC withstand, 5 hour: 23 kV.
  - f) DC withstand, 15 minutes: 45 kV.
  - g) Impulse withstand, 1.2 by 50 microsecond 95 kV (crest).
- 3) 15 kV voltage class:
  - a) Minimum partial discharge voltage (less than 3 pC): 13 kV.
  - b) AC withstand, 1 minute: 35 KV.
  - c) AC withstand, 1 hour: 53 kV.
  - d) AC withstand, 5 hour: 35 kV.
  - e) DC withstand, 15 minutes: 70 kV.
  - f) Impulse withstand, 1.2 by 50 microsecond 110 kV (crest).
- d. Power cable splices for shielded solid dielectric plastic-insulated cables shall utilize factory engineered kits containing all necessary components to maintain primary cable insulation level and metallic shielding/grounding systems.
- e. Splice insulation shall be of a uniform cross-section heat-shrinkable polymeric construction with a linear stress relief system, a high dielectric strength insulating material, and an integrally bonded outer conductive layer for shielding. The splice shall be covered with a heavy-wall heat-shrinkable sleeve overlapping the cable insulation, with a waterproof mastic seal on both ends.
- f. The splice shall accommodate a range of cable sizes and be completely independent of cable manufacturer's tolerances. When assembled on cables the splice shall be capable of passing the electrical test in accordance with:
  - 1) IEEE 48.
  - 2) IEEE 404.
- g. Manufacturers: The following or equal:
  - 1) Raychem.
2. Live front terminators:
  - a. Terminators for shielded solid dielectric plastic-insulated cables shall utilize factory engineered kits containing all necessary components to terminate the primary cables and shield systems.
  - b. All locations exterior of buildings shall be considered outdoors and appropriate heat-shrinkable skirts of a non-tracking material shall be installed.
  - c. Terminators shall be of a material that will relieve the voltage stresses at the point of termination.
  - d. Non-tracking.
  - e. Ultraviolet, ozone, sulfur dioxide resistant.

- f. Terminator insulation shall be of a uniform cross-section heat-shrinkable polymeric construction with a linear stress relief system.
- g. Electrical requirements:
  - 1) Continuous current rating equal to cable.
  - 2) 5 to 8 kV voltage class:
    - a) Minimum partial discharge voltage (less than 3 pC) 9 kV.
    - b) AC withstand, 1 minute: 35 kV.
    - c) DC withstand, 15 minutes: 65 kV.
    - d) Impulse withstand, 1.2 by 50 microsecond (outdoor) 95 kV (crest).
    - e) Impulse withstand, 1.2 by 50 microsecond (indoor) 80 kV (crest).
    - f) Wet withstand, 10 seconds: 30 kV RMS.
    - g) Dry withstand, 6 hours: 25 kV RMS.
  - 3) 15 KV voltage class:
    - a) Minimum partial discharge voltage (less than 3 pC) 13 kV.
    - b) AC withstand, 1 minute: 50 kV.
    - c) DC withstand, 15 minutes: 75 kV.
    - d) Impulse withstand, 1.2 by 50 microsecond (outdoor) 110 kV (crest).
    - e) Impulse withstand, 1.2 by 50 microsecond (indoor) 95 kV (crest).
    - f) Wet withstand, 10 seconds: 45 kV RMS.
    - g) Dry withstand, 6 hours: 35 kV RMS.
- h. The terminator kit shall accommodate a range of cable sizes and be completely independent of cable manufacturer's tolerances. When assembled on cables the terminator shall be capable of passing the electrical test in accordance with:
  - 1) IEEE 48.
- i. Manufacturers: The following or equal:
  - 1) Raychem.
- 3. Dead front terminators (600 Amperes):
  - a. Terminators for shielded solid dielectric plastic-insulated cables shall be factory engineered kits containing all necessary components to terminate the primary cables and shield systems.
  - b. Modular, pre-molded, fully shielded dead front system.
  - c. Submersible.
  - d. Capable of mating with any manufacturer's interface in accordance with IEEE 386.
  - e. Crimp connector suitable for copper conductors using standard compression tools to join the conductor to the interface.
  - f. To be used as an elbow or a "T".
  - g. Cable stress relief adapters to connect the cable insulation to the dead front terminator.

- h. Heat shrink seal over the junction between the cable insulation and the terminator body.
  - i. Conductor shield shall be grounded near the termination and connected to the conductive shield of the terminator.
  - j. Terminator shall be bolted to the bushing or connector plug, with an insulating plug to cover the connection.
  - k. Conductive cap covering the insulating plug.
  - l. Conductive shield to provide reliable continuity between jacket of cable and connector.
  - m. Conductive insert around connector to prevent corona.
  - n. With a capacitive test point on the insulating plug to allow circuit testing without disturbing the connection.
  - o. Electrical requirements:
    - 1) Voltage class: 15 kV:
      - a) Maximum voltage:
        - (1) Phase to Ground: 8.3 KV RMS.
        - (2) Phase to Phase: 14.4 KV RMS.
      - b) Withstand voltage:
        - (1) Impulse (1.2 by 50 microseconds) 95 KV Crest.
        - (2) AC 1 minute: 34 KV.
        - (3) DC 15 minutes: 53 KV.
      - c) Minimum corona extinction level:
        - (1) 11 kV RMS.
      - d) Continuous current rating:
        - (1) 600 amps RMS.
      - e) Momentary rating:
        - (1) 25,000 amps RMS at .17 seconds.
        - (2) 10,000 amps RMS at 3.0 seconds.
  - p. Manufacturers: One of the following or equal:
    - 1) Elastimold.
    - 2) 3M.
    - 3) Cooper.
4. Dead front terminators (200 Amperes):
- a. Terminators for shielded solid dielectric plastic-insulated cables shall be factory engineered kits containing all necessary components to terminate the primary cables and shield systems.
  - b. Modular, pre-molded, fully shielded dead front system.
  - c. Loadbreak type.
  - d. Submersible.
  - e. Capable of mating with any manufacturer's interface in accordance with IEEE 386.
  - f. Crimp connector suitable for copper conductors using standard compression tools to join the conductor to the interface.
  - g. To be used as an elbow or a "T".

- h. Heat shrink seal over the junction between the cable insulation and the terminator body.
  - i. Conductor shield shall be grounded near the termination and connected to the conductive shield of the terminator.
  - j. Conductive shield to provide reliable continuity between jacket of cable and connector.
  - k. Conductive insert around connector to prevent corona.
  - l. With a capacitive test point with protective cover to allow circuit testing without disturbing the connection.
  - m. With hold-down bail to hold connector to terminal or junction bushing.
  - n. Electrical requirements:
    - 1) Voltage class 15 kV.
    - 2) Withstand voltage:
      - a) Impulse (1.2 by 50 microsecond) 95 kV Crest.
      - b) AC 1 minute: 34 kV.
      - c) DC 15 minutes: 53 kV.
    - 3) Minimum corona extinction level:
      - a) Eleven kV RMS.
    - 4) Continuous current rating:
      - a) 200 A RMS.
    - 5) Momentary rating:
      - a) 10,000 A RMS, symmetrical at 0.17 seconds.
      - b) 3,500 A RMS, symmetrical at 3.0 seconds.
  - o. Manufacturers: One of the following or equal:
    - 1) Elastimold.
    - 2) 3M.
    - 3) Cooper.
5. Cap all unused taps with an insulating cap approved for the application:
- a. Manufacturers: One of the following or equal:
    - 1) Elastimold.
    - 2) 3M.
    - 3) Cooper.
- D. Insulated standoff bushings:
- 1. Rated for 200 amps and 15 kV.
  - 2. Fully compliant with IEEE 386.
  - 3. Molded EPDM rubber body with metal bracket.
  - 4. Eyebolt for securing the bushing in a parking stand.
  - 5. Ground lug.
  - 6. Manufacturers: One of the following or equal:
    - a. Eaton.
    - b. Hubbell.

## 2.06 COMPONENTS (NOT USED)

**2.07 ACCESSORIES (NOT USED)**

**2.08 MIXES (NOT USED)**

**2.09 FABRICATION (NOT USED)**

**2.10 FINISHES (NOT USED)**

**2.11 SOURCE QUALITY CONTROL (NOT USED)**

**PART 3 EXECUTION**

**3.01 EXAMINATION (NOT USED)**

**3.02 PREPARATION (NOT USED)**

**3.03 INSTALLATION**

- A. Medium voltage systems:
  - 1. Ground shield at all terminators and splices.
  - 2. Install cable lugs, terminators, and splices in conformance with the manufacturer's specifications.
  - 3. Fireproof all exposed portions of cables.
    - a. Half-lapped layer of fire and electric arc proofing tape, secured with double-wrapped band of glass cloth electrical tape at each end.
- B. Insulated standoff bushings:
  - 1. Provide an insulated standoff bushing in dead-front transformer parking stand.
- C. Medium voltage switchgear connections:
  - 1. Tape or provide insulated boots on all cable connections at medium voltage switchgear to maintain the switchgear BIL rating.
  - 2. Make the connections in accordance with the manufacturer's guidelines.

**3.04 ERECTION, INSTALLATION, APPLICATION, CONSTRUCTION (NOT USED)**

**3.05 REPAIR/RESTORATION (NOT USED)**

**3.06 RE-INSTALLATION (NOT USED)**

**3.07 COMMISSIONING**

- A. As specified in Section 01640 – Startup and Testing.

**3.08 FIELD QUALITY CONTROL (NOT USED)**

**3.09 ADJUSTING (NOT USED)**

**3.10 CLEANING (NOT USED)**

**3.11 PROTECTION (NOT USED)**

**3.12 SCHEDULES (NOT USED)**

END OF SECTION

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<sup>AD3</sup> Addendum No. 3





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## PART 1 GENERAL

### 1.01 SUMMARY

- A. Section includes:
  - 1. Metallic conduits.
  - 2. Nonmetallic conduits.
  - 3. Conduit bodies.
  - 4. Conduit fittings and accessories.
  - 5. Conduit installation.

### 1.02 REFERENCES

- A. As specified in Section 26\_05\_00 - Common Work Results for Electrical.
- B. American National Standards Institute (ANSI):
  - 1. C80.1 - Electrical Rigid Steel Conduit.
- C. National Electrical Manufacturer's Association (NEMA):
  - 1. RN-1 - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Steel Conduit.
- D. Underwriters Laboratories (UL):
  - 1. 6 - Standard for Electrical Rigid Metal Conduit - Steel.
  - 2. 360 - Standard for Liquidtight Flexible Steel Conduit.
  - 3. 1660 - Standard for Liquidtight Flexible Nonmetallic Conduit.

### 1.03 DEFINITIONS

- A. As specified in Section 26\_05\_00 - Common Work Results for Electrical.
- B. Specific definitions and abbreviations:
  - 1. Conduit bodies: A separate portion of a conduit system that provides access through a removable cover to the interior of the system at a junction of 2 or more conduit sections. Includes, but not limited to, Shapes C, E, LB, T, X, etc.
  - 2. Conduit fitting: An accessory that primarily serves a mechanical purpose. Includes, but not limited to, bushings, locknuts, hubs, couplings, reducers, etc.
  - 3. GRC: Galvanized rigid steel conduit.
  - 4. PCS: Polyvinyl chloride (PVC) coated rigid steel conduit.
  - 5. **PVC: Polyvinyl chloride rigid nonmetallic conduit.**<sup>AD3</sup>
  - ~~5-6.~~ SLT: Sealtight-liquidtight flexible conduit.
  - ~~6-7.~~ NPT: National pipe thread.

## 1.04 SUBMITTALS

- A. Furnish submittals as specified in Sections 01330 - Submittal Procedures and 26\_05\_00 - Common Work Results for Electrical.
- B. Product data:
  - 1. Furnish complete manufacturer's catalog sheets for every type and size of conduit, fitting, conduit body, and accessories to be used on the Project.
  - 2. Furnish complete manufacturer's recommended special tools to be used for installation if required.
  - 3. Certified test results for PVC-coated metallic conduit showing the adhesive bond is stronger than the tensile strength of the PVC.
- C. Shop drawings:
  - 1. Furnish conduit routing plans for conduits before the installation of any conduit.
  - 2. Detail the intended routing of each conduit, conduit material and include supporting methods.
  - 3. Number conduits in accordance with the Contract Documents.
    - a. Provide conduit labels as specified in Section 26\_05\_53 - Identification for Electrical Systems.
- D. Certifications:
  - 1. Furnish PVC-coated conduit manufacturer's valid, unexpired certification for each installer.
- E. Record Documents:
  - 1. Incorporate all changes in conduit routing on electrical plan drawings.
  - 2. Dimension underground and concealed conduits from building lines.
  - 3. Furnish hard copy drawings.
- F. Installation drawings: Installation drawings, including individual conduit numbers, routing, sizes, cable sizes, and circuit numbers for each conduit.

## 1.05 QUALITY ASSURANCE

- A. As specified in Section 26\_05\_00 - Common Work Results for Electrical.
- B. All conduits, conduit bodies, and fittings shall be UL listed and labeled.
- C. Every installer of PVC-coated metallic conduit shall be certified by the manufacturer for installation of the conduit, and be able to present a valid, unexpired installer certification card prior to installation beginning.

## 1.06 DELIVERY, STORAGE, AND HANDLING

- A. As specified in Section 26\_05\_00 - Common Work Results for Electrical.

- B. Do not expose non-metallic conduit to direct sunlight.
- C. Do not store conduit in direct contact with the ground.

## **1.07 PROJECT OR SITE CONDITIONS**

- A. As specified in Section 26\_05\_00 - Common Work Results for Electrical.

## **1.08 SEQUENCING**

- A. Before installing any conduit or locating any device box:
  - 1. Examine the complete set of Drawings and Specifications, and all applicable shop drawings.
  - 2. Verify all dimensions and space requirements and make any minor adjustments to the conduit system as required to avoid conflicts with the building structure, other equipment, or the work of other trades.
- B. Duct bank construction and direct buried conduit installation have a prerequisite of fulfilling all aspects of Section 33\_05\_01 – Subsurface Utility Engineering.<sup>AD3</sup>

## **1.09 SCHEDULING (NOT USED)**

## **1.10 WARRANTY**

- A. As specified in Section 26\_05\_00 - Common Work Results for Electrical.

## **1.11 SYSTEM START-UP**

- A. As specified in Section 26\_05\_00 - Common Work Results for Electrical.

## **1.12 OWNER'S INSTRUCTIONS (NOT USED)**

## **1.13 MAINTENANCE (NOT USED)**

# **PART 2 PRODUCTS**

## **2.01 MANUFACTURERS**

- A. Galvanized rigid steel conduit:
  - 1. One of the following or approved equal:
    - a. Western Tube and Conduit.
    - b. Allied Tube and Conduit.
    - c. Wheatland Tube Co.
- B. PVC-coated rigid steel conduit:
  - 1. One of the following or approved equal:
    - a. Robroy Ind.

- b. Ocal, Inc.
- c. Calbond.
- d. Allied.
- e. NEC, Inc. BlackGuard.

**C. Rigid nonmetallic PVC conduit:**

- 1. One of the following or equal:
  - a. Carlon.
  - b. Cantex.
  - c. Triangle Conduit and Cable.<sup>AD3</sup>

**~~C~~.D. Sealtight-liquidtight flexible conduit:**

- 1. One of the following or approved equal:
  - a. Southwire.
  - b. AFC Cable Systems.
  - c. Electri-Flex Co.
  - d. Anaconda.

**~~D~~.E. Conduit bodies:**

- 1. One of the following or approved equal:
  - a. Crouse-Hinds.
  - b. Appleton.
  - c. O-Z/Gedney.
  - d. Ocal, Inc.
  - e. Robroy Ind.
  - f. Calbond.
  - g. Carlon.

**~~E~~.F. Joint compound:**

- 1. The following or approved equal:
  - a. Thomas & Betts.

**~~F~~.G. Galvanized rigid steel conduit expansion fittings:**

- 1. One of the following or approved equal:
  - a. Crouse-Hinds.
  - b. Appleton.
  - c. O-Z/Gedney.

**~~G~~.H. PVC-coated rigid steel conduit expansion fittings:**

- 1. One of the following or approved equal:
  - a. Ocal, Inc.
  - b. Robroy Ind.
  - c. NEC, Inc. BlackGuard.

**~~H~~.I. Conduit hangers and supports:**

- 1. As specified in Section 26\_05\_29 - Hangers and Supports.

- ~~I.J.~~ Conduit through wall and floor seals:
1. The following or approved equal:
    - a. O-Z/Gedney:
      - 1) Type "WSK."
      - 2) Type "CSM."

## **2.02 SYSTEM DESCRIPTION**

- A. Provide conduits, conduit bodies, fittings, junction boxes, and all necessary components, whether or not indicated on the Drawings, as required, to install a complete electrical raceway system.
- B. Provide location and protection of existing underground utilities, underground conduit trenching, conduit and backfill necessary for the complete installation of underground conduits.

## **2.03 EXISTING PRODUCTS (NOT USED)**

## **2.04 MATERIALS (NOT USED)**

## **2.05 MANUFACTURED UNITS (NOT USED)**

## **2.06 EQUIPMENT (NOT USED)**

## **2.07 COMPONENTS**

- A. GRC:
  1. All threads: NPT standard conduit threads with a 3/4-inch taper per foot:
    - a. Running conduit threads are not acceptable.
  2. Hot-dip galvanized inside and out:
    - a. Ensures complete coverage and heats the zinc and steel to a temperature that ensures the zinc alloys with the steel over the entire surface.
    - b. Electro-galvanizing is not acceptable.
  3. Manufactured in accordance with:
    - a. UL-6.
    - b. ANSI C80.1.
- B. PCS:
  1. The steel conduit, before PVC coating, shall be new, unused, hot-dip galvanized material, conforming to the requirements for Type GRC.
  2. Coated conduit NEMA Standard RN-1:
    - a. The galvanized coating may not be disturbed or reduced in thickness during the cleaning and preparatory process.

3. Factory-bonded PVC jacket:
  - a. The exterior galvanized surfaces shall be coated with primer before PVC coating to ensure a bond between the zinc substrate and the PVC coating.
  - b. Nominal thickness of the exterior PVC coating shall be 0.040 inch except where part configuration or application of the piece dictates otherwise.
  - c. PVC coating on conduits and associated fittings shall have no sags, blisters, lumps, or other surface defects and shall be free of holes and holidays.
  - d. The PVC adhesive bond on conduits and fittings shall be greater than the tensile strength of the PVC plastic coating:
    - 1) Confirm bond with certified test results.
4. A urethane coating shall be uniformly and consistently applied to the interior of all conduits and fittings:
  - a. Nominal thickness of 0.002 inch.
  - b. Conduits having areas with thin or no coating are not acceptable.
  - c. All threads shall be coated with urethane.
5. The PVC exterior and urethane interior coatings applied to the conduits shall afford sufficient flexibility to permit field bending without cracking or flaking at temperature above 30 degrees Fahrenheit (-1 degree Celsius).
6. PCS conduit bodies and fittings:
  - a. Malleable iron.
  - b. The conduit body, before PVC coating, shall be new, unused material and shall conform to appropriate UL standards.
  - c. The PVC coating on the outside of conduit bodies shall be 0.040-inch thick and have a series of ribs to protect the coating from tool damage during installation.
  - d. 0.002-inch interior urethane coating.
  - e. Utilize the PVC coating as an integral part of the gasket design.
  - f. Stainless steel cover screw heads shall be encapsulated with plastic to ensure corrosion protection.
  - g. A PVC sleeve extending 1 conduit diameter or 2 inches, whichever is less, shall be formed at each female conduit opening.
    - 1) The inside diameter of the sleeve shall be the same as the outside diameter of the conduit to be used.
    - 2) The sleeve shall provide a vapor- and moisture resistant seal at every connection.
    - 3) Fittings shall be Form 8 and supplied with plastic encapsulated stainless steel cover screws. Fittings shall be UL Type 4X. Fittings shall be from the same manufacturer as the conduit in order to maintain system continuity and warranty.

**C. PVC:**

1. Extruded from virgin PVC compound:
  - a. Schedule 40 unless otherwise specified.
  - b. Schedule 80 extra-heavy wall where specified.
2. Rated for 90 degrees Celsius conductors or cable.
3. Rated for use in direct sunlight.<sup>AD3</sup>

**~~C~~.D. SLT:**

1. Temperature rated for use in the ambient temperature at the installed location but not less than the following:
  - a. General purpose:
    - 1) Temperature range: -20 degrees Celsius to +80 degrees Celsius.
  - b. Oil-resistant:
    - 1) Temperature range: -20 degrees Celsius to +60 degrees Celsius.
2. Sunlight-resistant, weatherproof, and watertight.
3. Manufactured from single strip steel, hot-dip galvanized on all 4 sides before conduit fabrication.
4. Strip steel spiral wound resulting in an interior that is smooth and clean for easy wire pulling.
5. Overall PVC jacket.
6. With integral copper ground wire, built in the core, in conduit trade sizes 1/2 inch through 1-1/4 inch.

**~~D~~.E. Conduit bodies:**

1. Material consistent with conduit type:
  - a. Malleable iron bodies and covers when used with Type GRC.
  - b. PVC-coated malleable iron bodies and covers when used with Type PCS.
  - c. PVC bodies and covers when used with Type PVC.<sup>AD3</sup>
2. Conduit bodies to conform to Form 8, Mark 9, or Mogul design:
  - a. Mogul design conforming to NEC requirements for bending space for large conductors for conduit trade sizes of 1 inch and larger with conductors #4 AWG and larger, or where required for wire-bending space.
3. Gasketed covers attached to bodies with stainless steel screws secured to threaded holes in conduit body.

**2.08 ACCESSORIES****A. Connectors and fittings:**

1. Manufactured with compatible materials to the corresponding conduit.



- B. Insulated throat metallic bushings:
  - 1. Construction:
    - a. Malleable iron or zinc-plated steel when used with steel conduit.
    - b. Positive metallic conduit end stop.
    - c. Integrally molded non-combustible phenolic-insulated surfaces rated at 150 degrees Celsius.
    - d. Use fully insulated bushings on nonmetallic conduit system made of high-impact 150 degrees Celsius rated non-combustible thermosetting phenolic.
- C. Insulated grounding bushings:
  - 1. Construction:
    - a. Malleable iron or steel, zinc-plated, with a positive metallic end stop.
    - b. Integrally molded non-combustible phenolic-insulated surfaces rated at 150 degrees Celsius.
    - c. Tin-plated copper grounding saddle for use with copper.
- D. Electrical unions (Erickson Couplings):
  - 1. Construction:
    - a. Malleable iron for use with steel conduit.
    - b. PVC-coated malleable iron for use with PCS conduit.
    - c. Concrete tight, 3-piece construction.
    - d. Rated for Class I Division 1 Group D in hazardous areas.
- E. SLT fittings:
  - 1. Construction:
    - a. Malleable iron.
    - b. Furnished with locknut and sealing ring.
    - c. Liquidtight, raintight, oiltight.
    - d. Insulated throat.
    - e. Furnish as straight, 45-degree elbows, and 90-degree elbows.
    - f. Designed to prevent sleeving:
      - 1) Verify complete bonding of the raceway jacket to the plastic gasket seal.
    - g. Equipped with grounding device to provide ground continuity irrespective of raceway core construction. Grounding device, if inserted into raceway and directly in contact with conductors, shall have rolled-over edges for sizes under 5 inches.
    - h. Where terminated into a threadless opening using a threaded hub fitting, a suitable moisture-resistant/oil-resistant synthetic rubber gasket shall be provided between the outside of the box or enclosure and the fitting shoulder. Gasket shall be adequately protected by and permanently bonded to a metallic retainer.

2. Corrosion-resistant and outdoor SLT fittings:
  - a. Construction:
    - 1) PVC-coated liquidtight fittings with a bonded 0.040-inch-thick PVC coating on the metal connector to form a seal around the SLT conduit.
    - 2) Insulated throat and an integral sealing ring.
- F. Hubs for threaded attachment of steel conduit to sheet metal enclosures:
  1. Construction:
    - a. Insulated throat.
    - b. PVC-coated when used in corrosive areas.
    - c. Bonding locknut.
    - d. Recessed neoprene O-ring to ensure watertight and dusttight connector.
    - e. 1/2-inch through 1-1/4-inch steel zinc electroplated.
    - f. 1-1/2-inch through 6-inch malleable iron zinc plated.
  2. Usage:
    - a. All conduits in damp, wet, outdoor, and corrosive areas shall use threaded hubs for connections to sheet metal enclosures.
- G. PVC fittings:
  1. Materials:
    - a. All devices shall be made of PVC, using the same materials as used for Type PVC conduit.
    - b. All metal hardware shall be stainless steel.<sup>AD3</sup>
- ~~G.H.~~ Through wall and floor seals:
  1. Materials:
    - a. Body: Casting of malleable or ductile iron with a hot-dip galvanized finish
    - a. Grommet: Neoprene.
    - b. Pressure rings: PVC-coated steel.
    - c. Disc material: PVC-coated steel.
- ~~H.I.~~ Expansion/deflection couplings:
  1. Use to compensate for movement in any directions between 2 conduit ends where they connect.
  2. Shall allow movement of 3/4 inch from the normal in all directions.
  3. Shall allow angular movement for a deflection of 30 degrees from normal in any direction.
  4. Constructed to maintain electrical continuity of the conduit system.
  5. Materials:
    - a. End couplings: Bronze or galvanized ductile iron.
    - a. Sleeve: Neoprene.
    - b. Bands: Stainless steel.
    - c. Bonding jumper: Tinned copper braid.

**~~I.J.~~** Expansion couplings:

1. Shall allow for expansion and contraction of conduit:
  - a. Permitting 8-inch movement, 4 inches in either direction.
2. Constructed to maintain electrical continuity of the conduit system.
3. Materials:
  - a. Head: Malleable or ductile iron.
  - a. Sleeve: Steel.
  - b. Insulating bushing: Phenolic.
  - c. Finish: Hot-dip galvanized.
  - d. PVC-coated steel when used with Type PCS.

**~~J.K.~~** Conduit markers:

1. As specified in Section 26\_05\_53 - Identification for Electrical Systems.

**2.09 MIXES (NOT USED)****2.10 FABRICATION (NOT USED)****2.11 FINISHES (NOT USED)****2.12 SOURCE QUALITY CONTROL**

- A. As specified in Section 26\_05\_00 - Common Work Results for Electrical.

**PART 3 EXECUTION****3.01 EXAMINATION (NOT USED)****3.02 PREPARATION (NOT USED)****3.03 INSTALLATION**

- A. As specified in Section 26\_05\_00 - Common Work Results for Electrical.

**B. General:**

1. Conduit routing:
  - a. The electrical drawings are diagrammatic in nature:
    - 1) Install conduit runs as specified with schematic representation indicated on the Drawings and as specified.
    - 2) Modify conduit runs to suit field conditions, as accepted by the Engineer:
      - a) Make changes in conduit locations that are consistent with the design intent but are dimensionally different, or routing to bypass obstructions.
      - b) Make changes in conduit routing due to the relocation of equipment.

- 3) The electrical drawings do not indicate all required junction boxes and pull boxes:
    - a) Provide junction boxes and pull boxes to facilitate wire pulling as required:
      - (1) To meet cable manufacturer's pulling tension requirements.
      - (2) To limit total conduit bends between pull locations.
    - b) Install junction boxes and pull boxes at locations acceptable to the Engineer.
  - b. The Contractor is responsible for any deviations in general location, conduit size, routing, or changes to the conduit schedule without the express written approval or direction by the Engineer:
    - 1) The Engineer is the sole source in determining whether the change is constituted as a deviation:
    - 2) Perform any changes resulting in additional conduits, or extra work from such deviations.
    - 3) Incorporate any deviations on the Record Documents.
  - c. Owner reserves the right to deduct the amount of applicable reimbursement, equivalent to the cost of the engineering effort required to show those unauthorized changes on Record Drawings.
2. Use only tools recommended by the conduit manufacturer for assembling the conduit system.
  3. Provide adequate clearances from high-temperature surfaces for all conduit runs. Provide minimum clearances as follows:
    - a. Clearance of 6 inches from surfaces 113 degrees Fahrenheit to 149 degrees Fahrenheit.
    - b. Clearance of 12 inches from surfaces greater than 149 degrees Fahrenheit.
    - c. Keep conduits at least 6 inches from the coverings on hot water and steam pipes, 18 inches from the coverings on flues and breechings, and 12 inches from fuel lines and gas lines.
    - d. Where it is necessary to route conduits close to high-temperature surfaces, provide a high-reflectance thermal barrier between the conduit and the surface.
  4. Support conduit runs on water-bearing walls a minimum of 7/8-inch away from wall on an accepted preformed channel:
    - a. Do not run conduits within water-bearing walls unless otherwise indicated on the Drawings.
  5. Do not install 1-inch or larger conduits in or through structural members unless approved by the Engineer.
  6. Run conduits exposed to view parallel with or at right angles to structural members, walls, or lines of the building:
    - a. Install straight and true conduit runs with uniform and symmetrical elbows, offsets, and bends.

- b. Make changes in direction with long radius bends or with conduit bodies.
  - 7. Install conduits with total conduit bends between pull locations less than or approved equal to 270 degrees.
  - 8. Route all exposed conduits to preserve headroom, access space and workspace, and to prevent tripping hazards and clearance problems:
    - a. Install conduit runs so that runs do not interfere with proper and safe operation of equipment and do not block or interfere with ingress or egress, including equipment-removal hatches.
    - b. Route conduits to avoid drains or other gravity lines. Where conflicts occur, relocate the conduit as required.
  - 9. When installing conduits through existing slabs or walls, make provisions for locating any possible conflicting items where the conduit is to penetrate. Use tone signal or X-ray methods to make certain that no penetrations will be made into the existing conduits, piping, cables, post-tensioning cables, etc.
  - 10. Plug conduits brought into pull boxes, manholes, handholes, and other openings until used to prevent entrance of moisture.
  - 11. Install conduits through wall and floor seals where indicated on the Drawings.
  - 12. For existing and new 2-inch and larger conduit runs, snake conduits with a conduit cleaner equipped with a cylindrical mandrel of a diameter not less than 85 percent of nominal diameter of the conduit:
    - a. Remove and replace conduits through which mandrel will not pass.
  - 13. Provide all sleeves and openings required for the passage of electrical raceways or cables even when these openings or sleeves are not specifically indicated on the Drawings.
  - 14. Install complete conduit systems before conductors are installed.
  - 15. Provide metallic conduits terminating in transformer, switchgear, motor control center, or other equipment conduit windows with grounding bushings and ground with a minimum No. 6 AWG ground wire.
- C. Equipment grounding conductors:
- 1. Provide a separate, green insulated, grounding conductor in each raceway independent of raceway material:
    - a. Multi-conductor power and control cables shall include an integral green insulated grounding conductor.
    - b. Provide a separate grounding conductor in each individual raceway for parallel feeders.
  - 2. Conductors shall be the same type and insulation as the circuit conductors:
    - a. Use 600-volt insulation for the equipment grounding conductors for medium voltage systems.
  - 3. Minimum size in accordance with the NEC.

## D. Lighting and receptacle conduits:

1. Provide conduit runs for lighting and receptacle circuits, whether or not indicated on the Drawings:
2. Install conduits in accordance with the requirements of this Section unless otherwise indicated.
3. Minimum conduit size:
  - a. 3/4-inch for exposed conduits.
  - b. 1-inch for underground or in-slab conduits.
4. Provide conduit materials for the installed location as specified in Section 26\_05\_00 - Common Work Results for Electrical.

## E. Conduit usage:

1. Exposed conduits:
  - a. Rigid conduit:
    - 1) Install the rigid conduit type for each location as specified in Section 26\_05\_00 - Common Work Results for Electrical.
    - 2) Minimum size: 3/4-inch.
  - b. Flexible conduit:
    - 1) Use flexible conduit for final connections between rigid conduit and motors, vibrating equipment, instruments, control equipment, or where required for equipment servicing:
      - a) Use Type SLT with rigid metallic conduit.
    - 2) Minimum size: 3/4-inch:
      - a) 1/2 when required for connection to instruments.
    - 3) Maximum length:
      - a) Fixed equipment:

Conduit Trade Size	Flexible Conduit Length (inch)
3/4	18
1	18
1-1/4	18
1-1/2	18
2	36
2-1/2	36
3	36
3-1/2	38
4	40

## b) Removable instruments or hinged equipment:

- (1) As required to allow complete removal or full movement without disconnecting or stressing the conduit.

2. Concrete-encased and embedded conduits:
  - a. Straight runs and bends less than 45 degrees:
    - 1) Type PVC Schedule 40.
  - b. Bends with total deflection greater than 45 degrees:
    - 1) PCS.
  - c. Entering and exiting duct bank, underground or embedded conduit runs a minimum 12 inches above and below grade, finished floor, or entering equipment:
    - 1) PCS.
  - d. Minimum size:
    - 1) 2-inch in duct banks.
    - 2) Provide conduit fittings to enlarge the conduit from the exposed size in the conduit schedule as required.<sup>AD3</sup>
- ~~2-3.~~ PVC-coated rigid metallic conduit:
  - a. Use specifically manufactured or machined threading dies to manufacturer's specifications to accommodate the PVC jacket.
  - b. Repair damage to PVC coatings with manufacturer supplied touchup compound or PVC Coating Repair Kit for PVC Coated Raceway Systems.

F. Conduit joints and bends:

1. General:
  - a. Where conduit is underground, under slabs on grade, exposed to the weather, or in NEMA Type 4 or NEMA Type 4X locations, make joints liquidtight.
  - b. Keep bends and offsets in conduit runs to an absolute minimum.
  - c. All bends shall be symmetrical.
  - d. The following conduit systems shall use large-radius sweep elbows:
    - 1) Underground conduits.
    - 2) Conduits containing shielded cables.
    - 3) Conduits containing medium-voltage cables.<sup>AD3</sup>
  - e. Provide large-radius factory-made bends for 1-1/4-inch trade size or larger.
  - f. Make field bends with a radius of not less than the requirements found in the NEC:
    - 1) The minimum bending radius of the cable must be less than the radius of the conduit bend.
    - 2) Make all field bends with power bending equipment or manual benders specifically intended for the purpose:
      - a) Make bends so that the conduit is not damaged and the internal diameter is not effectively reduced.
      - b) For the serving utilities, make bends to meet their requirements.
  - g. Replace all deformed, flattened, or kinked conduit.

2. Threaded conduit:
  - a. Cut threads on rigid metallic conduit with a standard conduit-cutting die that provides a 3/4-inch per foot taper and to a length such that all bare metal exposed by the threading operation is completely covered by the couplings or fittings used. In addition, cut the lengths of the thread such that all joints become secure and wrench-tight just preceding the point where the conduit ends would butt together in couplings or where conduit ends would butt into the ends or shoulders of other fittings.
  - b. Thoroughly ream conduit after threads have been cut to remove burrs.
  - c. Use bushings or conduit fittings at conduit terminations.
  - d. On exposed conduits, repair scratches and other defects with galvanizing repair stick, Enterprise Galvanizing "Galvabar™," or CRC "Zinc It."
  - e. Coat conduit threads with an approved electrically conductive sealant and corrosion inhibitor that is not harmful to the conductor insulation:
    - 1) Apply to the male threads and tighten joints securely.
    - 2) Clean excess sealant from exposed threads after assembly.
  - f. Securely tighten all threaded connections.
  - g. Any exposed threaded surfaces must be cleaned and coated with a galvanizing solution so that all exposed surfaces have a galvanized protective coating.
3. PVC:
  - a. Use approved solvent-weld cement specifically manufactured for the purpose. Spray-type cement is not allowed.
  - b. Apply heat for bends so that conduit does not distort or discolor. Use a spring mandrel as required to ensure full inside diameter at all bends:
    - 1) Utilize a heater specifically for PVC conduit as recommended by the conduit manufacturer.<sup>AD3</sup>

G. Conduit sealing and drainage:

1. Conduit drainage and sealing other than required for hazardous and classified areas:
  - a. Provide sealing and drainage in vertical drops of long (in excess of 20 feet), exterior, above-grade conduit runs at the points at which the conduit enters buildings, switchgear, control panels, lighting panelboards, and other similar enclosures.
  - b. Provide seal fittings with drains in vertical drops directly above grade for exterior and above-grade conduit runs that are extended below grade.



- c. Provide conduit seals with drains in areas of high humidity and rapidly changing temperatures:
  - 1) Where portions of an interior raceway pass through walls, ceilings, or floors that separate adjacent areas having widely different temperatures.
- d. Provide conduit seals similar to O-Z/Gedney (Type CSM) on all conduits between corrosive and non-corrosive areas.
- e. Seal one end only of all underground conduits at highest point with O-Z/Gedney sealing (non-hazardous) filling, or approved equal.
- 2. Install seals with drains at any location along conduit runs where moisture may condense or accumulate. This requirement includes, but is not limited to, the following locations: control panels, junction boxes, pullboxes, or low points of the conduit.

H. Conduit supports:

- 1. General:
  - a. Provide appropriate hangers, supports, fasteners, and seismic restraints to suit applications:
    - 1) As specified in Section 26\_05\_29 - Hangers and Supports.
    - 2) Provide support materials consistent with the type of conduit being installed as specified in Section 26\_05\_00 - Common Work Results for Electrical.
  - b. Support conduit at the intervals required by the NEC.
  - c. Perforated strap and plumbers' tape are not acceptable for conduit supports.
- 2. Conduit on concrete or masonry:
  - a. Use 1-hole malleable iron straps with metallic or plastic expansion anchors and screws or support from preset inserts.
  - b. Use preset inserts in concrete when possible.
  - c. Use pipe spacers (clamp backs) in wet locations.
- 3. Suspended conduit:
  - a. Use malleable-iron factory-made split-hinged pipe rings with threaded suspension rods sized for the weight to be carried (minimum 3/8-inch diameter), Kindorf, or approved equal.
  - b. For grouped conduits, construct racks with threaded rods and tiered angle iron or preformed channel cross members. Clamp each conduit individually to a cross member. Where rods are more than 2-feet long, provide rigid sway bracing.
- 4. Supports at structural steel members:
  - a. Use beam clamps.
  - b. Drilling or welding may be used only as specified or with approval of the Engineer.
- 5. PVC-coated rigid metal systems:
  - a. Provide right-angle beam clamps and "U" bolts specially formed and sized to snugly fit the outside diameter of the coated conduit.

Provide "U" bolts with PVC-encapsulated nuts that cover the exposed portions of the threads.

- b. Securely fasten exposed conduits with Type 316 stainless steel clamps or straps.

I. Expansion or expansion/deflection fittings:

- 1. General:
  - a. Align expansion coupling with the conduit run to prevent binding.
  - b. Follow manufacturer's instructions to set the piston opening.
  - c. Install expansion fittings across concrete expansion joints and at other locations where necessary to compensate for thermal or mechanical expansion and contraction.
  - d. Furnish fittings of the same material as the conduit system.
- 2. For metallic conduit, provide expansion or expansion/deflection couplings, as appropriate, where:
  - a. Install expansion fittings a minimum of every 200 feet in straight conduit runs.

J. Empty conduits:

- 1. Provide a pull tape in each empty conduit more than 10 feet in length.
- 2. Seal ends of all conduits with approved, manufactured conduit seals, caps, or plugs immediately after installation:
  - a. Keep ends sealed until immediately before pulling conductors.

K. Miscellaneous:

- 1. Provide electrical unions at all points of union between ends of rigid conduit systems that cannot otherwise be coupled:
  - a. Running threads and threadless couplings are not allowed.
- 2. Replace any conduits installed that the Engineer determines do not meet the requirements of this Specification.
- 3. Provide conduit housekeeping curb around all embedded or below-grade conduits exiting or entering the slab, per the Typical Details.

### **3.04 ERECTION, INSTALLATION, APPLICATIONS, CONSTRUCTION (NOT USED)**

### **3.05 REPAIR/RESTORATION (NOT USED)**

### **3.06 RE-INSTALLATION (NOT USED)**

### **3.07 COMMISSIONING**

- A. As specified in Section 01640 – Startup and Testing.

### **3.08 FIELD QUALITY CONTROL**

A. As specified in Section 26\_05\_00 - Common Work Results for Electrical.

### **3.09 ADJUSTING (NOT USED)**

### **3.10 CLEANING (NOT USED)**

### **3.11 PROTECTION**

A. As specified in Section 26\_05\_00 - Common Work Results for Electrical.

### **3.12 SCHEDULES (NOT USED)**

END OF SECTION

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<sup>AD3</sup> Addendum No. 3



New Section

**SECTION 26\_05\_44<sup>AD3</sup>**

**DUCT BANKS**

**PART 1 GENERAL**

**1.01 SUMMARY**

- A. Section includes:
  - 1. Electrical underground duct banks.
  - 2. Duct bank installation requirements.

**1.02 REFERENCES**

- A. As specified in Section 26\_05\_00 - Common Work Results for Electrical.

**1.03 DEFINITIONS**

- A. As specified in Section 26\_05\_00 - Common Work Results for Electrical.

**1.04 SYSTEM DESCRIPTION**

- A. Provide location and protection of existing underground utilities, duct bank, trenching, forming, rebar, spacers, conduit, concrete, backfill, and compaction necessary for the complete installation of the duct banks.
- B. Provide reinforced concrete duct banks for all conduits installed below grade, on the site, below structures, or in contact with the earth, unless otherwise indicated on the Drawings.

**1.05 SUBMITTALS**

- A. Furnish submittals as specified in Sections 01330 - Submittal Procedures and 26\_05\_00 - Common Work Results for Electrical.
- B. Product data:
  - 1. PVC conduit spacers.
  - 2. Detectable underground marking tape.
  - 3. Pull line.
- C. Shop drawings:
  - 1. Submit site plan drawings of duct banks including underground profiles indicating all underground utilities.
  - 2. Submit cross section of each duct bank with dimensions.

3. For duct bank routings crossing under building footers or foundations alternative to designed routings indicated on the Drawings:
  - a. Submit shop drawings detailing the new building footer crossing locations and plan drawings labeling all equipment to be installed on top of the new routing for approval by the project Structural Engineer.

#### **1.06 QUALITY ASSURANCE**

- A. As specified in Section 26\_05\_00 - Common Work Results for Electrical.

#### **1.07 DELIVERY, STORAGE, AND HANDLING**

- A. As specified in Section 26\_05\_00 - Common Work Results for Electrical.

#### **1.08 PROJECT OR SITE CONDITIONS**

- A. As specified in Section 26\_05\_00 - Common Work Results for Electrical.
- B. Duct bank sections indicated on the Drawings are an initial arrangement and may need to be modified due to existing site conditions, existing underground utilities, and infrastructure.
  1. Reorganize duct bank section with approval of Engineer.

#### **1.09 SCHEDULING**

- A. Schedule a coordination meeting to adjust duct bank configurations and routing for each duct bank section after trenching and exposure of any underground utilities within the vicinity of the duct bank route. The meeting shall determine the final configuration of the duct bank before installation.

#### **1.10 WARRANTY**

- A. As specified in Section 26\_05\_00 - Common Work Results for Electrical.

#### **1.11 SYSTEM START-UP**

- A. As specified in Section 26\_05\_00 - Common Work Results for Electrical.

#### **1.12 OWNER'S INSTRUCTIONS (NOT USED)**

#### **1.13 MAINTENANCE (NOT USED)**

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Conduit spacers:
  - 1. One of the following or equal:
    - a. Carlon Snap-Loc.
    - b. Cantex.
    - c. Osburn Associates, Inc.
- B. Detectable underground marking tape:
  - 1. One of the following or equal:
    - a. Blackburn Manufacturing Co.
    - b. Pro-Line Safety Products.
    - c. Panduit.
- C. Pull line:
  - 1. One of the following or equal:
    - a. Arnco.
    - b. Greenlee.
    - c. Osburn Associates, Inc.
- D. Duct seal:
  - 1. The following or equal:
    - a. O-Z/Gedney type DUX.

### **2.02 EXISTING PRODUCTS (NOT USED)**

### **2.03 MATERIALS**

- A. Provide conduit as specified in Section 26\_05\_33 - Conduits.
- B. Provide reinforcing steel as specified in Section 03\_20\_00 - Concrete Reinforcing:
  - 1. Provide minimum Number 4 reinforcing steel.

### **2.04 MANUFACTURED UNITS**

- A. Conduit spacers:
  - 1. Provide conduit spacers recommended by the conduit manufacturer or specified above.
  - 2. Saddle type.
  - 3. Non-metallic, non-corrosive, non-conductive.
  - 4. Interlocking type:
    - a. Vertical interlocking.
    - b. Horizontal interlocking.
  - 5. Suitable for concrete encasement.

6. Molded-in rebar holder.
  7. Accommodates 2-inch through 6-inch conduit sizes.
  8. Relieves the conduit from both horizontal and vertical stresses.
- B. Pull line:
1. Minimum 1/4-inch wide, flat design.
  2. Polyester.
  3. Minimum pulling strength 1,200 pounds.
- C. Detectable marking tape:
1. Provide a detectable tape, locatable by a cable or metal detector from above the undisturbed grade.
  2. Aluminum core laminated between polyethylene film.
  3. 6-inch wide red tape imprinted with black lettering stating "CAUTION - BURIED ELECTRIC LINE BELOW" or equivalent.
- D. Duct seal:
1. Non-hardening sealing compound.
  2. Flexible, can be applied by hand.
  3. UL Listed for use with installed conductors.

## **2.05 EQUIPMENT (NOT USED)**

## **2.06 COMPONENTS (NOT USED)**

## **2.07 ACCESSORIES (NOT USED)**

## **2.08 MIXES**

- A. Concrete mix requirements as specified in Section 03\_30\_00 - Cast-in-Place Concrete.
- B. Provide a red-oxide conduit encasement coloring agent as specified in Section 03\_30\_00 - Cast-in-Place Concrete.

## **2.09 FABRICATION (NOT USED)**

## **2.10 FINISHES (NOT USED)**

## **2.11 SOURCE QUALITY CONTROL (NOT USED)**

# **PART 3 EXECUTION**

## **3.01 EXAMINATION (NOT USED)**

## **3.02 PREPARATION (NOT USED)**



### 3.03 INSTALLATION

- A. As specified in Section 26\_05\_00 - Common Work Results for Electrical.
- B. Duct banks:
  - 1. Install duct banks encased in concrete at least 24 inches below finish grade, unless otherwise indicated on the Drawings.
  - 2. Damage minimization:
    - a. Conduit should not be left exposed in an open trench longer than is necessary.
    - b. Protect all underground duct banks against damage during pouring of concrete or backfilling.
  - 3. All plastic conduit fittings to be joined should be exposed to the same temperature conditions for a reasonable length of time before assembly.
  - 4. Provide No. 4/0 American Wire Gauge bare copper ground wire the entire length of duct bank and bond to the grounding system at each end of the duct bank and every 20 feet to steel reinforcing bar.
  - 5. Install underground ducts to be self-draining:
    - a. Slope duct banks away from buildings to manholes, handholes, or pullboxes.
    - b. Slope duct banks uniformly from manholes, handholes, or pullboxes to manholes, handholes, or pullboxes or both ways from high points between manholes, handholes, or pullboxes.
    - c. Slope a minimum of 1/4 inch per 10 feet.
  - 6. Where new duct banks join to existing manholes, handholes, or pullboxes, make the proper fittings and fabricate the concrete envelopes to ensure smooth durable transitions, as indicated on the Drawings.
  - 7. Install pull line in spare conduits:
    - a. Provide adequate pull line at both ends of conduits to facilitate conductor pulling.
    - b. Cap above ground spare conduit risers at each end with screw-on conduit caps.
- C. Trenching:
  - 1. Perform trenching as specified in Section 31\_23\_35 - Trenching.
  - 2. Trench must be uniformly graded with the bottom, rock free and covered with select material.
  - 3. Whenever possible, use the walls of the trench as forms for concrete encasement:
    - a. Forms are required where the soil is not self-supporting.
  - 4. Damage occurring to existing ducts, conduits, cables, and other utilities during duct bank installation shall be remediated to the satisfaction of the Owner.

## D. Duct spacing:

1. Separate conduits with manufactured plastic spacers using a minimum space between the outside surfaces of adjacent conduits of 2 inches, unless otherwise indicated on the Drawings:
  - a. Separate medium voltage ducts a minimum of 7.5 inches on center.
2. Install spacers to maintain uniform spacing of duct assembly a minimum of 4 inches above the bottom of the trench during concrete pour. Install spacers on 8-foot maximum intervals:
  - a. Due to some distortion of conduit from heat, and other means, it may be necessary to install extra spacers within the duct bank:
    - 1) Install the intermediate set of spacers within normal required spacing to maintain the proper horizontal clearance:
      - a) Clearance is required to allow the proper amount of concrete to infiltrate vertically among the duct to ensure proper protection.
3. Spacers shall not be located at the center of a bend:
  - a. Locate spacer in the tangent, free of the coupling on fabricated bends.
  - b. Locate spacers midway between the tangent and the center bend on trench formed sweeps.

## E. Terminating:

1. Use bell ends in duct at entrances into cable vaults.
2. Make conduit entrances into cable vaults tangential to walls of cable vault.
3. Form trapezoidal transitions between duct bank and cable vaults as needed in order to ensure adequate cable bending radius for the duct bank-to-vault transition.
4. Install duct seal in all conduits including spare conduits, at both ends, entrance to manholes/handholes, and building/equipment stub-ups. Form by hand to conduit and around cables to develop moisture barrier.

## F. Concrete:

1. Install concrete as specified in Section 03\_30\_00 - Cast-in-Place Concrete.
2. Provide tie wires in accordance with Section 03\_20\_00 - Concrete Reinforcing to prevent displacement of the conduits during pouring of concrete:
  - a. Tie wire shall not act as a substitute for spacers.
3. Install minimum 3-inch cover around conduit and rebar.
4. Consolidation of encasement concrete around duct banks shall be by hand puddling. Mechanical vibrators are acceptable for use outside of the rebar cage.
5. Conduit is subject to temperature rise. As concrete cures, allow the free end to expand by pouring the concrete from the center of the run or from one tie in point.

- G. Marking tape:
  - 1. Install a detectable marking tape 12 inches above the duct bank the entire length of the duct bank.
- H. For conduit installations beneath building slabs:
  - 1. Duct banks shall be continued under building slabs to the final destination of the conduits.
    - a. Construct separate duct banks as required.
    - b. Concrete for encasement under building slabs need not be colored red.
    - c. For duct banks crossing under building footers or foundations, install the top of the duct bank a minimum of 6 inches below the footer.
    - d. Where duct banks enter through building walls, foundation walls, stem walls, etc. make connections as indicated on the Drawings.
    - e. Where duct banks terminate with conduit risers entering building walls, install an expansion/deflection fitting or a flat-wise elbow (elbow parallel to building wall) in order to accommodate differential movement between the conduits and structure.
- I. Restore all surfaces to their original condition as specified in Section 32\_01\_15 - Pavement Restoration and Rehabilitation, unless otherwise specified.

### **3.04 ERECTION, INSTALLATION, APPLICATION, CONSTRUCTION (NOT USED)**

### **3.05 REPAIR/RESTORATION (NOT USED)**

### **3.06 RE-INSTALLATION (NOT USED)**

### **3.07 COMMISSIONING**

- A. As specified in Section 01640 – Startup and Testing.

### **3.08 FIELD QUALITY CONTROL**

- A. As specified in Section 26\_05\_00 - Common Work Results for Electrical.

### **3.09 ADJUSTING (NOT USED)**

### **3.10 CLEANING**

- A. Clean conduits of dirt and debris by use of an appropriately sized steel mandrel no less than 1/2 inch smaller than the inside diameter of the conduit.

### **3.11 PROTECTION**

- A. As specified in Section 26\_05\_00 - Common Work Results for Electrical.
- B. Provide shoring and pumping to protect the excavation and safety of workers.
- C. Protect excavations with barricades as required by applicable safety regulations.

### **3.12 SCHEDULES (NOT USED)**

END OF SECTION

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<sup>AD3</sup> Addendum No. 3

## **SECTION 26\_06\_01A**

### **CONDUIT SCHEDULE AREA 08**

#### **PART 1 GENERAL**

##### **1.01 SUMMARY**

- A. Conduit requirements:
  - 1. As defined in Section 26\_05\_00 and Section 26\_05\_33.
- B. Cable requirements and definitions:
  - 1. As defined in Section 26\_05\_00 and Section 26\_05\_18.
  - 2. 2/CS#16: 2 conductor, 16 gauge, twisted shielded pair.
  - 3. \*/C#Y: Multiconductor cable (\* indicates number of conductors, Y indicates conductor size and insulation).
  - 4. CAT6: Category 6 Ethernet cable.
  - 5. MFR: Manufacturer or vendor furnished cable.
  - 6. PULL: Pull Rope.
  - 7. VFD: Shielded VFD cable with integral ground.

#### **PART 2 PRODUCTS**

Not Used.

#### **PART 3 EXECUTION**

##### **3.01 CONDUIT SCHEDULE**

- A. Conduit Schedule is presented on the following pages.

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CONDUIT			CONDUCTORS			GROUND				
NUMBER	DWG	SIZE	#	SIZE	TYPE	#	SIZE	TYPE	DESCRIPTION	CONNECTING SEGMENTS
C-08-100	E06	0.75"	2 2	#12 #14	XHHW-2 XHHW-2	1	#12	XHHW-2	FR: J-BOX TO: PB-08-01 2 #12 >> LSH-85011 POWER 2 #14 >> LSH-85011 CONTROL	C-08-101
C-08-101	E06	1.5"	6 26	#12 #14	XHHW-2 XHHW-2	1	#12	XHHW-2	FR: PB-08-01 TO: PCP-204 2 #12 >> LSH-85011 POWER 2 #14 >> LSH-85011 CONTROL 2 #14 >> FSH_85021 CONTROL 4 #14 >> LCP_85214 CONTROL 10 #14 >> EDR_85121 CONTROL 2 #14 >> LCP_85401 CONTROL 2 #14 >> LCP_85411 CONTROL 2 #12 >> LCP_85411 POWER 2 #14 >> LCP_85402 CONTROL 2 #14 >> LCP_85412 CONTROL 2 #12 >> LCP_85412 POWER	C-08-100 C-08-100 C-08-120 C-08-150 C-08-160 C-08-224 C-08-224 C-08-224 C-08-224
C-08-102	E06	0.75"	4	#14	XHHW-2	1	#14	XHHW-2	FR: LSH_85011 TO: LCP_85010 4 #14 >> LSH_85011 CONTROL	
C-08-120	E06	0.75"	2	#14	XHHW-2	1	#14	XHHW-2	FR: FSH_85021 TO: PB-08-01 2 #14 >> FSH_85021 CONTROL	C-08-101
C-08-130	E06	0.75"	1	MFR	CABLE	1	#14	XHHW-2	FR: LIT_85122 TO: CONDUIT TEE 1 MFR >> LIT_85122 CONTROL	C-08-141
C-08-140	E06	0.75"	2	#14	XHHW-2	1	#14	XHHW-2	FR: LSHH_85213 TO: CONDUIT TEE 2 #14 >> LSHH_85213 CONTROL	C-08-141
C-08-141	E06	0.75"	2 1	#14 MFR	XHHW-2 CABLE	1	#14	XHHW-2	FR: CONDUIT TEE TO: LCP_85214 1 MFR >> LIT_85122 CONTROL 2 #14 >> LSHH_85213 CONTROL	C-08-130 C-08-140
C-08-150	E06	0.75"	4	#14	XHHW-2	1	#14	XHHW-2	FR: LCP_85214 TO: PB-08-01 4 #14 >> LCP_85214 CONTROL	C-08-101
C-08-160	E06	0.75"	10	#14	XHHW-2	1	#14	XHHW-2	FR: EDR_85121 TO: PB-08-01 10 #14 >> EDR_85121 CONTROL	C-08-101
C-08-170	E06	0.75"	2	#14	XHHW-2	1	#14	XHHW-2	FR: PSH_85211 TO: CONDUIT TEE 2 #14 >> PSH_85211 CONTROL	C-08-181
C-08-180	E06	0.75"	2	#14	XHHW-2	1	#14	XHHW-2	FR: PSH_85221 TO: CONDUIT TEE 2 #14 >> PSH_85221 CONTROL	C-08-181
C-08-181	E06	0.75"	4	#14	XHHW-2	1	#14	XHHW-2	FR: CONDUIT TEE TO: VCP_85231 2 #14 >> PSH_85211 CONTROL 2 #14 >> PSH_85221 CONTROL	C-08-170 C-08-180
C-08-190	E06	0.75"	2	#12	XHHW-2	1	#12	XHHW-2	FR: FIT_85231 TO: PB-08-03 2 #12 >> FIT_85231 POWER	
C-08-210	E06	0.75"	4	#14	XHHW-2	1	#14	XHHW-2	FR: LCP_85401 TO: LCP_85411 4 #14 >> LCP_85401 CONTROL	
C-08-211	E06	0.75"	4	#14	XHHW-2	1	#14	XHHW-2	FR: LCP_85401 TO: LCP_85412 4 #14 >> LCP_85401 CONTROL	
C-08-212	E06	0.75"	2	#14	XHHW-2	1	#14	XHHW-2	FR: LCP_85401 TO: J-BOX 2 #14 >> LCP_85401 CONTROL	C-08-224
C-08-213	E06	0.75"	2	#14	XHHW-2	1	#14	XHHW-2	FR: LCP_85411 TO: J-BOX 2 #14 >> LCP_85411 CONTROL	C-08-224
C-08-220	E06	0.75"	4	#14	XHHW-2	1	#14	XHHW-2	FR: LCP_85402 TO: LCP_85411 4 #14 >> LCP_85401 CONTROL	

# CONDUIT SCHEDULE AREA 08

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CONDUIT			CONDUCTORS			GROUND				
NUMBER	DWG	SIZE	#	SIZE	TYPE	#	SIZE	TYPE	DESCRIPTION	CONNECTING SEGMENTS
C-08-221	E06	0.75"	4	#14	XHHW-2	1	#14	XHHW-2	FR: LCP_85402 TO: LCP_85412 4 #14 >> LCP_85401 CONTROL	
C-08-222	E06	0.75"	2	#14	XHHW-2	1	#14	XHHW-2	FR: LCP_85402 TO: J-BOX 2 #14 >> LCP_85402 CONTROL	C-08-224
C-08-223	E06	0.75"	2	#14	XHHW-2	1	#14	XHHW-2	FR: LCP_85412 TO: J-BOX 2 #14 >> LCP_85412 CONTROL	C-08-224
C-08-224	E06	1"	4 8	#12 #14	XHHW-2 XHHW-2	1	#12	XHHW-2	FR: J-BOX TO: PB-08-01 2 #14 >> LCP_85401 CONTROL 2 #14 >> LCP_85411 CONTROL 2 #12 >> LCP_85411 POWER 2 #14 >> LCP_85402 CONTROL 2 #14 >> LCP_85412 CONTROL 2 #12 >> LCP_85412 POWER	C-08-101 C-08-212 C-08-213 C-08-213 C-08-222 C-08-223 C-08-223
C-08-900	E06	1"	1	PULL	ROPE				FR: J-BOX TO: J-BOX 1 PULL >> SPARE	
C-08-901	E06	1"	1	PULL	ROPE				FR: J-BOX TO: SECURITY PANEL 1 PULL >> SPARE	
L-08-100	E06	0.75"	2	#10	XHHW-2	1	#10	XHHW-2	FR: LCP_85010 TO: PB-08-03 2 #10 >> LCP_85010 POWER	L-08-101
L-08-101	E06	1.5"	2 6	#6 #10	XHHW-2 XHHW-2	1	#8	XHHW-2	FR: PB-08-03 TO: PNL-L4 2 #10 >> LCP_85010 POWER 2 #10 >> LCP_85214 POWER 2 #6 >> VCP_85231 POWER 2 #10 >> EDR_85121 POWER	L-08-100 L-08-150 L-08-175 L-08-161
L-08-102	E06	0.75"	2	#12	XHHW-2	1	#12	XHHW-2	FR: PMP_85010 TO: LCP_85010 2 #12 >> PMP_85010 POWER	
L-08-150	E06	0.75"	2	#10	XHHW-2	1	#10	XHHW-2	FR: LCP_85214 TO: PB-08-03 2 #10 >> LCP_85214 POWER	L-08-101
L-08-160	E06	0.75"	2	#12	XHHW-2	1	#12	XHHW-2	FR: EDR_85121 TO: DISC_85121 2 #12 >> EDR_85121 POWER	
L-08-161	E06	0.75"	2	#10	XHHW-2	1	#10	XHHW-2	FR: DISC_85121 TO: PB-08-04 2 #10 >> EDR_85121 POWER	L-08-101 P-08-160
L-08-170	E06	1.5"	1	2/C-#10:VFD		1	#14	XHHW-2	FR: PMP_85211 TO: VCP_85231 1 2/C-#10:VFD >> PMP_85211 POWER	
L-08-175	E06	0.75"	2	#6	XHHW-2	1	#8	XHHW-2	FR: VCP_85231 TO: PB-08-03 2 #6 >> VCP_85231 POWER	L-08-101
L-08-180	E06	1.5"	1	2/C-#10:VFD		1	#14	XHHW-2	FR: PMP_85221 TO: VCP_85231 1 2/C-#10:VFD >> PMP_85221 POWER	
L-08-200	E06	0.75"	2	#12	XHHW-2	1	#12	XHHW-2	FR: UPS_85401 TO: PNL-L4 2 #12 >> UPS_85401 POWER	
L-08-210	E06	0.75"	2	#12	XHHW-2	1	#12	XHHW-2	FR: EF_85401 TO: DISC_85401 2 #12 >> EF_85401 POWER	
L-08-211	E06	0.75"	2	#12	XHHW-2	1	#12	XHHW-2	FR: LCP_85401 TO: DISC_85401 2 #12 >> LCP_85401 POWER	
L-08-212	E06	0.75"	2	#12	XHHW-2	1	#12	XHHW-2	FR: LCP_85401 TO: J-BOX 2 #12 >> LCP_85401 POWER	L-08-214

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CONDUIT			CONDUCTORS			GROUND			DESCRIPTION	CONNECTING SEGMENTS
NUMBER	DWG	SIZE	#	SIZE	TYPE	#	SIZE	TYPE		
L-08-213		0.75"	2	#12	XHHW-2	1	#12	XHHW-2	FR: LCP_85411 TO: J-BOX 2 #12 >> LCP_85411 POWER	L-08-214
L-08-214		0.75"	6	#12	XHHW-2	1	#12	XHHW-2	FR: J-BOX TO: UPS_85401 2 #12 >> LCP_85412 POWER 2 #12 >> LCP_85411 POWER 2 #12 >> LCP_85401 POWER	L-08-223 L-08-213 L-08-212
L-08-220	E06	0.75"	2	#12	XHHW-2	1	#12	XHHW-2	FR: EF_85402 TO: DISC_854402 2 #12 >> EF_85402 POWER	
L-08-221	E06	0.75"	2	#12	XHHW-2	1	#12	XHHW-2	FR: LCP_85402 TO: DISC_85402 2 #12 >> LCP_85402 POWER	
L-08-222	E06	0.75"	2	#12	XHHW-2	1	#12	XHHW-2	FR: LCP-85402 TO: PB-08-03 2 #12 >> LCP_85402 POWER	
L-08-223		0.75"	2	#12	XHHW-2	1	#12	XHHW-2	FR: LCP_85412 TO: J-BOX 2 #12 >> LCP_85412 POWER	L-08-214
M-08-300		5"	3	#1:25KV	25KV-EPR	1	#2	XHHW-2	FR: WELL PUMP SOFT STARTER TO: EXISTING MV SWITCHGEAR 3 #1:25KV >> WELL PUMP SOFT STARTER POWER	
N-08-175	E06	1"	2		CAT6	1	#14	XHHW-2	FR: VCP_85231 TO: CONDUIT TEE 2 CAT6 >> VCP_85231 NETWORK	N-08-176
N-08-176	E06	1"	3		CAT6	1	#14	XHHW-2	FR: CONDUIT TEE TO: PB-08-02 2 CAT6 >> VCP_85231 NETWORK 1 CAT6 >> FIT_85231 NETWORK	N-08-177 N-08-175 N-08-190
N-08-177	E06	1"	3		CAT6	1	#14	XHHW-2	FR: PB-08-02 TO: PCP-204 2 CAT6 >> VCP_85231 NETWORK 1 CAT6 >> FIT_85231 NETWORK	N-08-176 N-08-176
N-08-190	E06	0.75"	1		CAT6	1	#14	XHHW-2	FR: FIT_85231 TO: CONDUIT TEE 1 CAT6 >> FIT_85231 NETWORK	N-08-176
N-08-200	E06	0.75"	1		CAT6	1	#14	XHHW-2	FR: UPS_85401 TO: PCP-204 1 CAT6 >> UPS_85401 NETWORK	
P-08-110	E06	1.5"	3	#3	XHHW-2	1	#8	XHHW-2	FR: EWH_85021 TO: PB-08-04 3 #3 >> EWH_85021 POWER	P-08-112
P-08-112	E06	1.5"	3 3	#3 #12	XHHW-2 XHHW-2	1	#8	XHHW-2	FR: PB-08-04 TO: PNL-H4 3 #3 >> EWH_85021 POWER 3 #12 >> EDR_85121 POWER	P-08-110 P-08-161
P-08-300		2"	3	#4/0	XHHW-2	1	#4	XHHW-2	FR: PNL-H4 TO: EXISTING MV SWITCHGEAR 3 #4/0 >> PNL-H4 POWER	
S-08-130	E06	0.75"	1	2/CS-#16		1	#14	XHHW-2	FR: LIT_85122 TO: PB-08-02 1 2/CS-#16 >> LIT_85122 SIGNAL	S-08-131
S-08-131	E06	0.75"	2	2/CS-#16		1	#14	XHHW-2	FR: PB-08-02 TO: PCP-204 1 2/CS-#16 >> LIT_85122 SIGNAL 1 2/CS-#16 >> FIT_85231 SIGNAL	S-08-130 S-08-191
S-08-190	E06	0.75"	1	MFR	CABLE	1	#14	XHHW-2	FR: FE_85231 TO: FIT_85231 1 MFR >> FE_85231 SIGNAL	
S-08-191	E06	0.75"	1	2/CS-#16		1	#14	XHHW-2	FR: FIT_85231 TO: PB-08-02 1 2/CS-#16 >> FIT_85231 SIGNAL	S-08-131

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CONDUIT			CONDUCTORS			GROUND				
NUMBER	DWG	SIZE	#	SIZE	TYPE	#	SIZE	TYPE	DESCRIPTION	CONNECTING SEGMENTS
S-08-240	E05 E06	0.75"	1	2/CS-#16		1	#14	XHHW-2	FR: WM04-AIT TO: PCP-204 1 2/CS-#16 >> WM04-AIT SIGNAL	

END OF CONDUIT SCHEDULE

END OF SECTION



Plot Date: 12-MAY-2022 4:13:34 PM

User: svcPW

3

Model: Layout1 ColorTable: gshade.ctb DesignScript: Carollo\_Std\_Pen\_v0905.pen PlotScale: 1:1

LAST SAVED BY: DEAR

2019 CALIFORNIA BUILDING CODE, TITLE 24 (VOL. I & II)

ROOM NO.	ROOM NAME	OCCUPANCY	CONSTRUCTION TYPE	BASIC ALLOW STORIES/HEIGHT	ACTUAL SQ FT	BASIC ALLOWABLE AREA	ALLOWABLE FLOOR AREA PER OCC	OCCUPANCY LOAD	EXITS REQUIRED/ PROVIDED	SPRINKLERED	OCCUPANCY SEPARATION	ACCESSIBILITY	COMMENTS:
EQUIPMENT BUILDING - REFERENCE DRAWING A02													
101	CHEMICAL ROOM	H-3	II-B	2 STORIES/55 FT	482	15,500	300	2	2/2	YES	2-HR	* NR	-
-	EXISTING BUILDING	EXISTING	EXISTING	EXISTING	EXISTING	EXISTING	EXISTING	EXISTING	EXISTING	EXISTING	EXISTING	EXISTING	-
BUILDING ACTUAL													
		H-3	II-B	28' - 0"	482	15,500	300	2					

\* MACHINERY SPACES VISITED ONLY BY SERVICE PERSONNEL FOR MAINTENANCE, REPAIR OR OCCASIONAL MONITORING OF EQUIPMENT SHALL NOT BE REQUIRED TO COMPLY WITH ACCESSIBILITY (PER CHAPTER 11B, SECTION 11B-203.5, MACHINERY SPACES).

DOOR & HARDWARE SCHEDULE

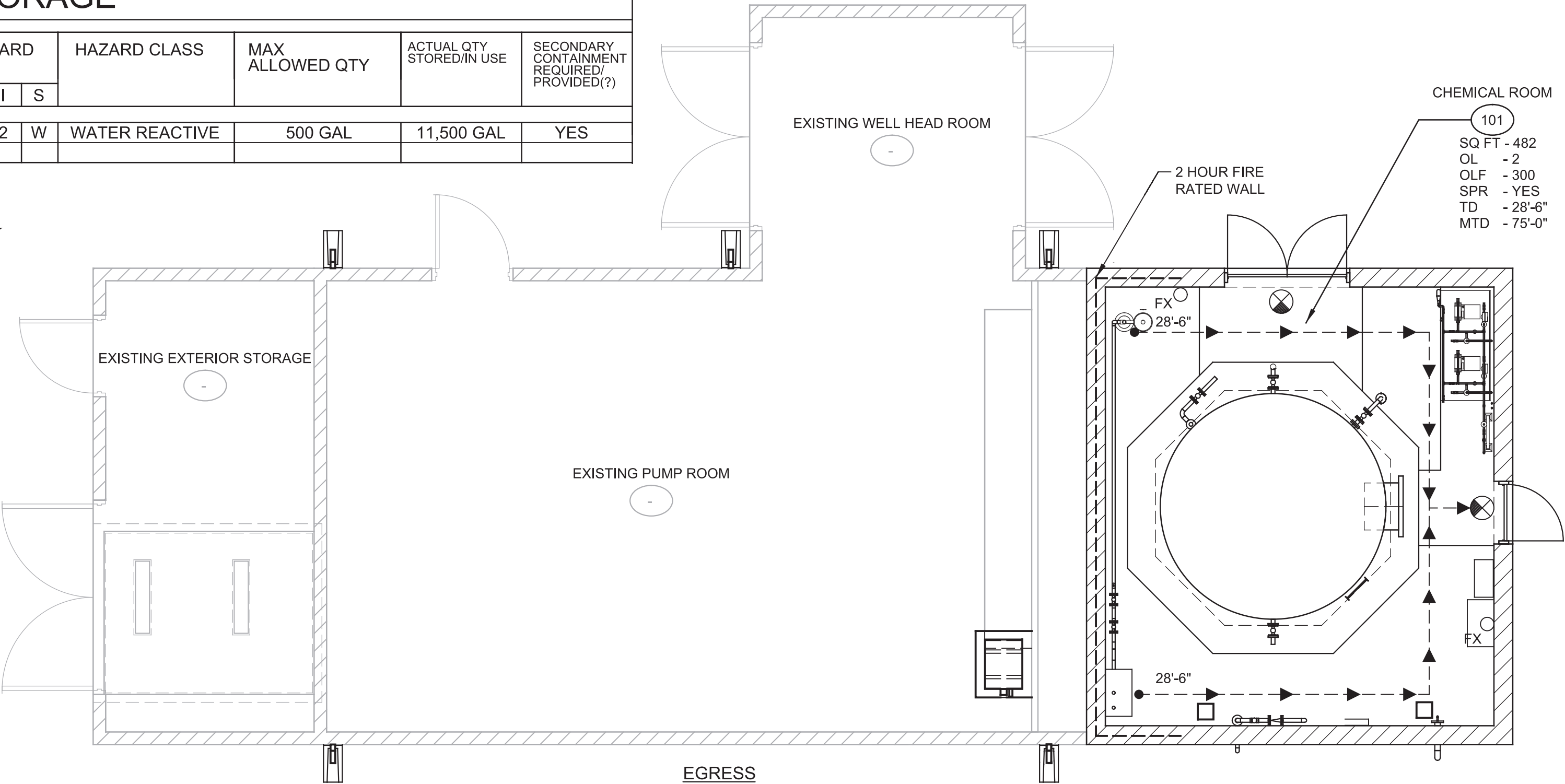
DOOR & HARDWARE SCHEDULE										AJ103 TYP		AJ100 TYP		AJ105 TYP		AJ107 TYP		AJ109 TYP						
DOOR NO.	DOOR						FRAME						DETAILS			HW GROUP	UL LABEL	CARD READER	PANIC HARDWARE	REMARKS				
	WIDTH	HEIGHT	THICK	MATL	FINISH	TYPE	WIDTH	HEIGHT	DEPTH	TYPE	MATL	FINISH	HEAD	JAMB	SILL									
EQUIPMENT BUILDING - REFERENCE DRAWING A02																								
D101-01	(PR) 3'-2"	7'-10"	1 3/4"	HM	COATING	F	6'-8"	8'-0"	5 3/4"	R	HM	COATING	C	C	E	HW 1	NR	NR	R	-				
D101-02	3'-0"	7'-2"	1 3/4"	HM	COATING	F	3'-4"	7'-4"	5 3/4"	R	HM	COATING	C	C	E	HW 2	NR	NR	R	-				

ROOM FINISH SCHEDULE

ROOM FINISH SCHEDULE															
ROOM NO.	ROOM NAME	FLOOR		BASE	NORTH WALL		EAST WALL		SOUTH WALL		WEST WALL		CEILING		
		MATL	FINISH	MATL	MATL	FINISH	MATL	FINISH	MATL	FINISH	MATL	FINISH	MATL	HEIGHT	FINISH
EQUIPMENT BUILDING - REFERENCE DRAWING A02															
101	CHEMICAL ROOM	CONC	SEALANT	CMU	CMU	STD. GREY	CMU	STD. GREY	CMU	STD. GREY	CMU	STD. GREY	EXPO	VARIES	GALV.
-	EXISTING BUILDING	EXISTING	EXISTING	EXISTING	EXISTING	EXISTING	EXISTING	EXISTING	EXISTING	EXISTING	EXISTING	EXISTING	EXISTING	EXISTING	EXISTING

HAZARDOUS MATERIAL IN USE/STORAGE

ROOM NO.	MATERIAL & CONCENTRATION	CAS #	NFPA HAZARD RATING				HAZARD CLASS	MAX ALLOWED QTY	ACTUAL QTY STORED/IN USE	SECONDARY CONTAINMENT REQUIRED/ PROVIDED(?)
			H	F	I	S				
101	SULFURIC ACID, 93%	7664-93-9	3	0	2	W	WATER REACTIVE	500 GAL	11,500 GAL	YES



**A PLAN**  
SCALE: 3/16" = 1'-0"  
FILE: 12204A10A100

2019 CALIFORNIA ENERGY CONSERVATION CODE

BUILDING ENVELOPE REQUIREMENTS - COUNTY: ALAMEDA - CLIMATE ZONE: 12 - COMMERCIAL BUILDING

ENVELOPE COMPONENT	U - VALUE REQUIRED	U - VALUE PROVIDED
ROOFS	U - 0.034	R-12.4
WALLS ABOVE GRADE, MASS HEAVY	U - 0.253	U-0.253
SLAB ON GRADE FLOORS	U - 0.071	NR
RAISED FLOORS	U - 0.092	NR
AIR BARRIER	NR	NR
DOORS - SWINGING	U - 0.70	U-0.70
DOORS - NONSWINGING	U - 1.45	NR
FIXED FENESTRATION	U - 0.36	NR
OPERABLE FENESTRATION	U - 0.46	NR

\* IN ACCORDANCE WITH THE 2019 CALIFORNIA ENERGY CODE SECTION 100.0 SCOPE, SUBSECTION (e)2.C UNCONDITIONED NONRESIDENTIAL BUILDINGS AND PROCESS BUILDINGS APPLICABILITY IS LIMITED

CODE ANALYSIS ABBREVIATION LIST:

ci	CONTINUOUS INSULATION
CMU	CONCRETE MASONRY UNIT
EXPO	EXPOSED MATERIAL
F-1	FACTORY INDUSTRIAL GROUP, MODERATE HAZARD OCCUPANCY (2019, TITLE 24)
FX/FXE	FIRE EXTINGUISHER, TYPE AS INDICATED REFER TO SPECIFICATION SECTION 10_44_00
GALV.	GALVANIZED IN ACCORDANCE WITH STRUCTURAL SPECIFICATIONS
HW	HARDWARE GROUP, REFERENCE SPECIFICATION SECTION 08_1_0
MTL DECK	METAL DECK, PER STRUCTURAL DRAWINGS
NR	NOT REQUIRED
PR	PAIR
R	REQUIRED
R-VALUE	THERMAL RESISTANCE, IS THE INVERSE OF THE TIME RATE OF HEAT FLOW THROUGH A BODY FROM ONE OF ITS BOUNDING SURFACES TO THE OTHER SURFACE FOR A UNIT TEMPERATURE DIFFERENCE BETWEEN THE TWO SURFACES, UNDER STEADY STATE CONDITIONS, PER UNIT AREA (2019, TITLE 24)
SPEC	SPECIFICATION SECTION
SQ FT	SQUARE FEET
U-FACTOR	THERMAL TRANSMITTANCE, IS THE COEFFICIENT OF HEAT TRANSMISSION (AIR TO AIR) THROUGH A BUILDING COMPONENT OR ASSEMBLY, EQUAL TO THE TIME RATE OF HEAT FLOW PER UNIT AREA AND UNIT TEMPERATURE DIFFERENCE BETWEEN THE WARM SIDE AND COLD SIDE AIR FILMS (2019, TITLE 24)

EGRESS ABBREVIATION AND SYMBOL LIST

SQ FT:	SQUARE FEET
OL:	OCCUPANT LOAD
OLF:	OCCUPANT LOAD FACTOR
SPR:	AUTOMATIC SPRINKLER
TD:	TRAVEL DISTANCE
MTD:	MAX TRAVEL DISTANCE
NA:	NOT APPLICABLE
•••	DIRECTION OF EGRESS PATH
##	LENGTH OF EGRESS IN FEET
⊗	EXIT SIGN
○	FIRE EXTINGUISHER (FX)

1	05-16-22	MEH	REVISED PER ADDENDUM 3
REV	DATE	BY	Description



Designed	MEH
Drawn	BCM
Checked	JA
Date	MARCH 2022



**ZONE 7 WATER AGENCY**  
100 NORTH CANYONS PARKWAY  
LIVERMORE CALIFORNIA, 94551

BAR IS ONE INCH  
AT FULL SCALE  
0 1"  
IF NOT ONE INCH  
SCALE ACCORDINGLY

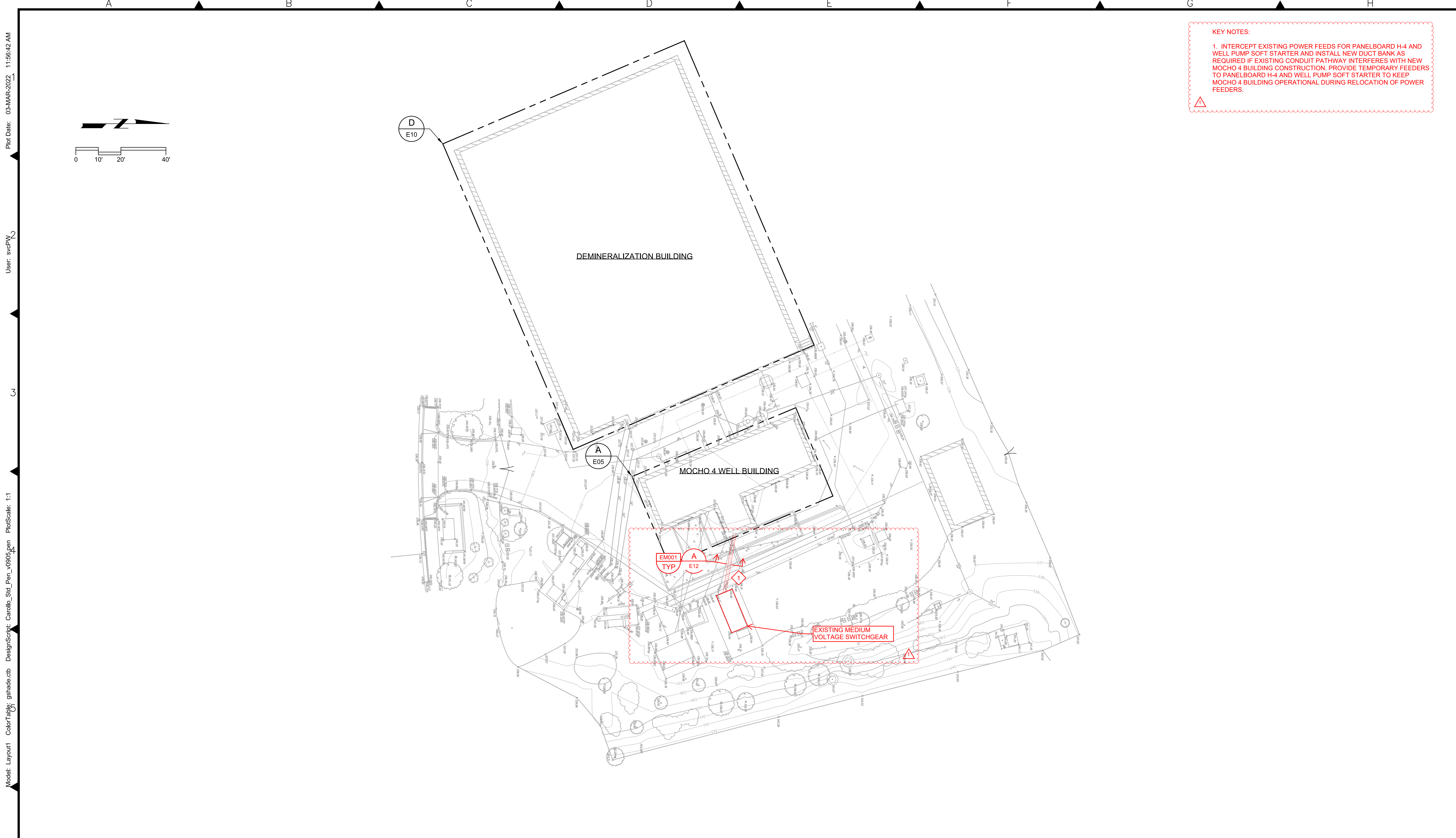
**ZONE 7 WATER AGENCY**  
**CONCENTRATE CONDITIONING SYSTEM PROJECT**

ARCHITECTURAL  
**SULFURIC ACID STORAGE AREA**  
**BUILDING CODES, SCHEDULES, AND PLAN**

SHEET NO.	20 OF 102
DRAWING NO.	A01
FILE NO.	WC-295

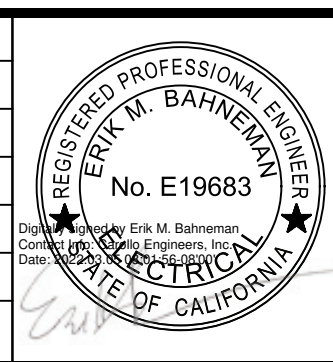
PROJECT NO. 294-21



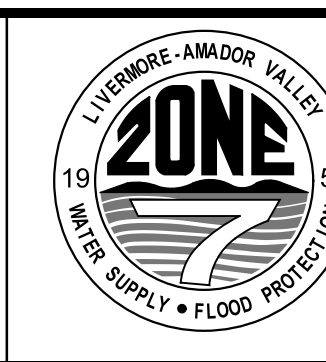


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PlotScale: 1:1  
LAST SAVED BY: jlsan@carollo.com

REV	DATE	BY	Description
1	05-16-2022	JLW	REVISED PER ADDENDUM 3



Designed	JLW
Drawn	JJS
Checked	EMB
Date	MARCH 2022

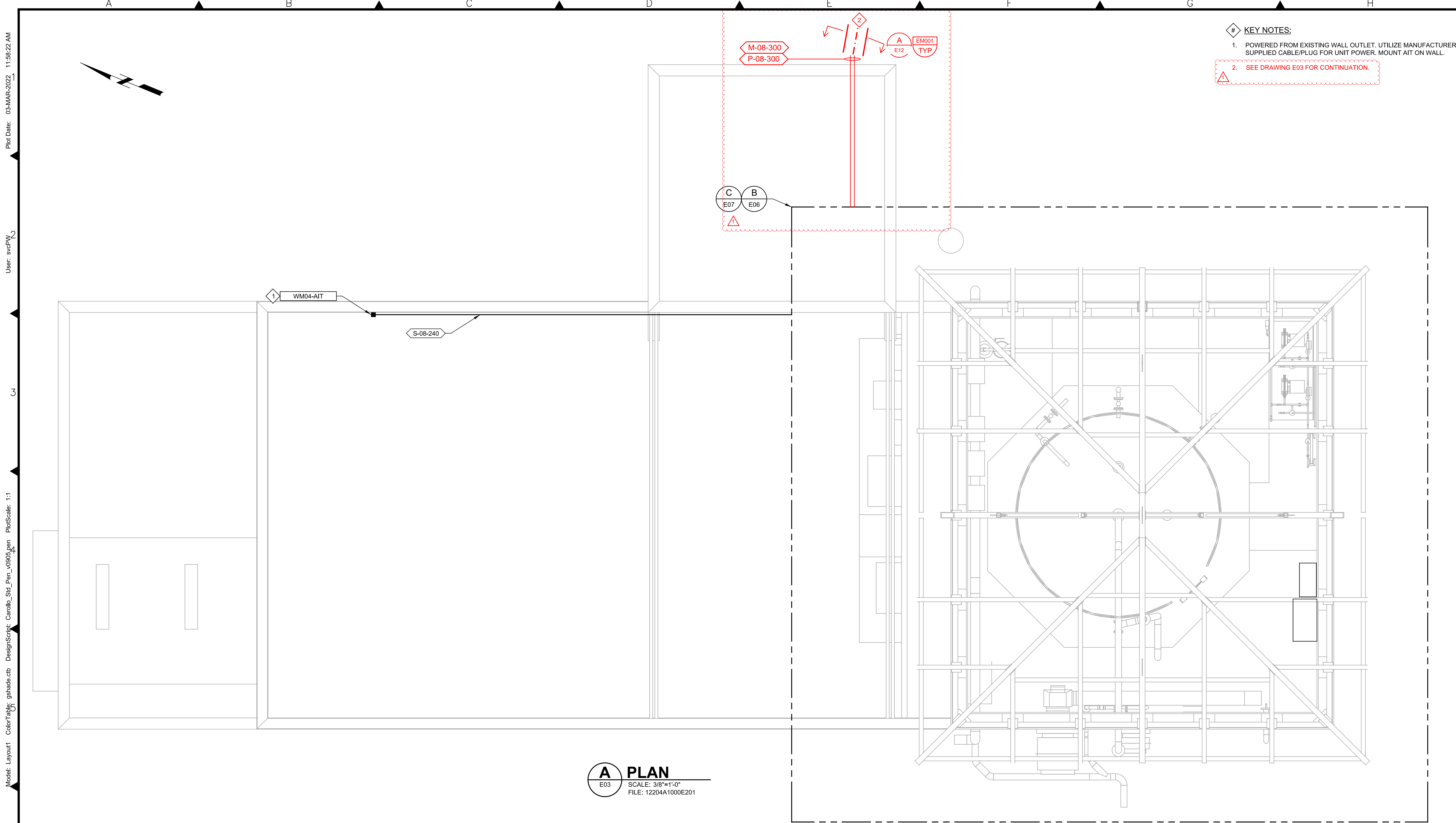


**ZONE 7 WATER AGENCY**  
100 NORTH CANYONS PARKWAY  
LIVERMORE CALIFORNIA, 94551

BAR IS ONE INCH  
AT FULL SCALE  
0 1"  
IF NOT ONE INCH  
SCALE ACCORDINGLY

<b>ZONE 7 WATER AGENCY</b> <b>CONCENTRATE CONDITIONING SYSTEM PROJECT</b>		SHEET NO. 51 OF 102
ELECTRICAL <b>SITE PLAN</b>		DRAWING NO. <b>E03</b>
		FILE NO. WC-295

PROJECT NO. 294-21



Model: Layout1  
ColorTable: gshade.ctb  
DesignScript: Carollo\_Sld\_Pen\_v0905.pen  
PlotScale: 1:1  
Plot Date: 03-MAR-2022 11:58:22 AM  
User: svcPW

REV	DATE	BY	Description
1	05-16-2022	JLW	REVISED PER ADDENDUM 3

Designed  
JLW

Drawn  
JJS

Checked  
EMB

Date  
MARCH 2022

**ZONE 7 WATER AGENCY**  
100 NORTH CANYONS PARKWAY  
LIVERMORE CALIFORNIA, 94551

BAR IS ONE INCH  
AT FULL SCALE  
0 1"  
IF NOT ONE INCH  
SCALE ACCORDINGLY

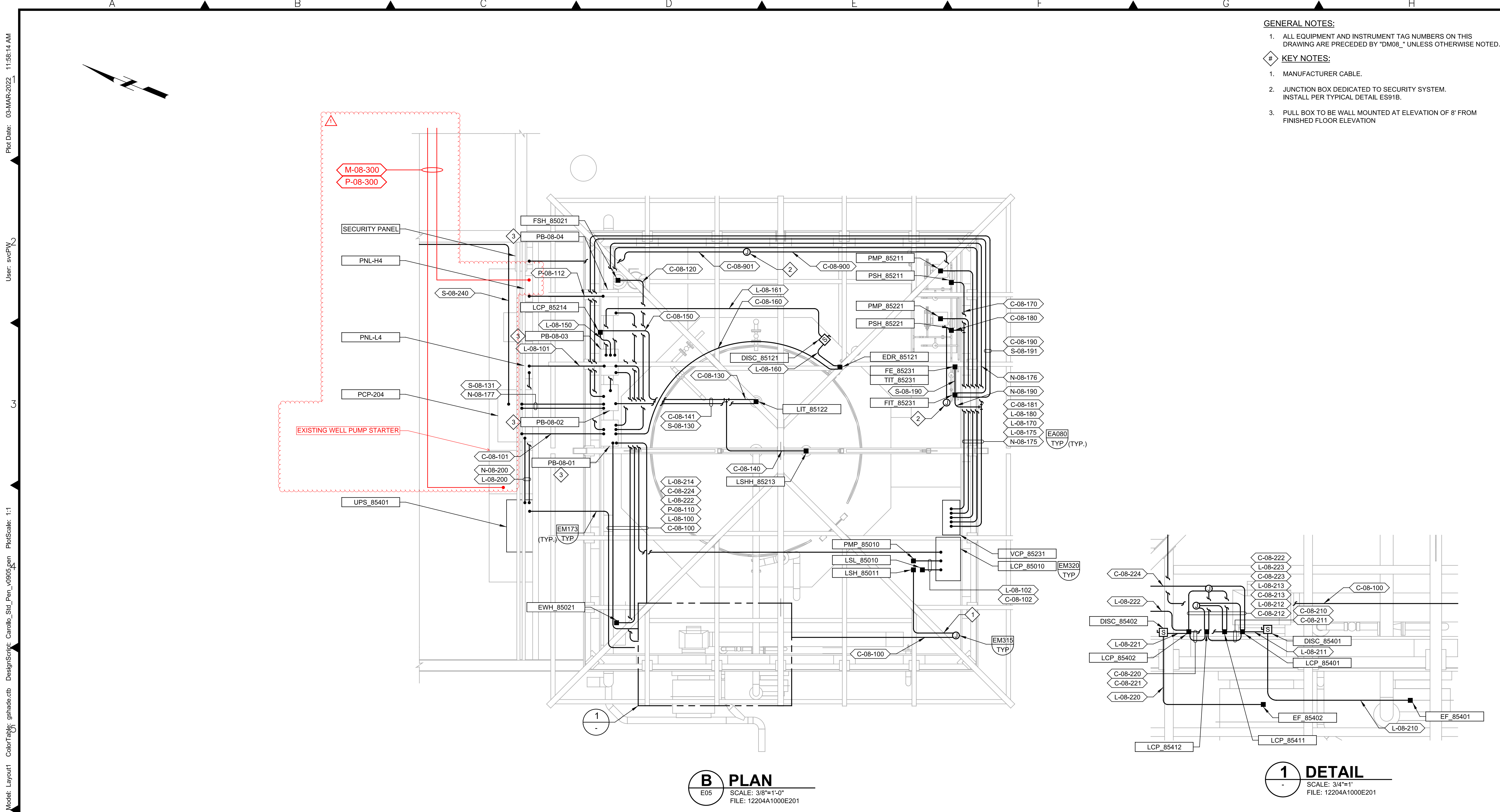
**ZONE 7 WATER AGENCY**  
**CONCENTRATE CONDITIONING SYSTEM PROJECT**  
  
**MOCHO 4 WELL BUILDING - PLAN**

SHEET NO.  
53 OF 102  
DRAWING NO.  
**E05**  
FILE NO.  
WC-295

PROJECT NO. 294-21

PROJECT NO. 12204A10  
FILE NAME: 12204A1000E05.dgn








- GENERAL NOTES:**
1. ALL EQUIPMENT AND INSTRUMENT TAG NUMBERS ON THIS DRAWING ARE PRECEDED BY "DM08\_" UNLESS OTHERWISE NOTED.
- KEY NOTES:**
1. MANUFACTURER CABLE.
  2. JUNCTION BOX DEDICATED TO SECURITY SYSTEM. INSTALL PER TYPICAL DETAIL ES91B.
  3. PULL BOX TO BE WALL MOUNTED AT ELEVATION OF 8' FROM FINISHED FLOOR ELEVATION

**B PLAN**  
E05  
SCALE: 3/8"=1'-0"  
FILE: 12204A1000E201

**1 DETAIL**  
SCALE: 3/4"=1'  
FILE: 12204A1000E201

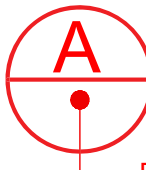
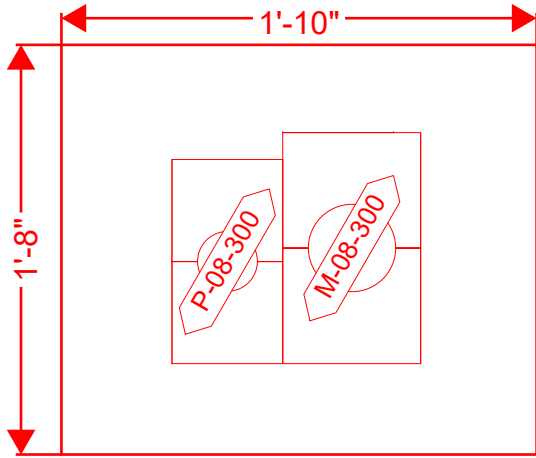
LAST SAVED BY: gshade.ctb Model: Layout1 ColorTable: gshade.ctb DesignScript: Carollo_Std_Pen_v0905.pen PlotScale: 1:1 Plot Date: 03-MAR-2022 11:58:14 AM User: svcPW						Designed JLW Drawn JJS Checked EMB Date MARCH 2022			 <b>ZONE 7 WATER AGENCY</b> 100 NORTH CANYONS PARKWAY LIVERMORE CALIFORNIA, 94551		BAR IS ONE INCH AT FULL SCALE 0 1" IF NOT ONE INCH SCALE ACCORDINGLY	<b>ZONE 7 WATER AGENCY CONCENTRATE CONDITIONING SYSTEM PROJECT</b>  ELECTRICAL <b>SULFURIC ACID STORAGE AREA PLAN AND DETAIL</b>		SHEET NO. 54 OF 102 DRAWING NO. <b>E06</b> FILE NO. WC-295 PROJECT NO. 294-21
REV	DATE	BY	DESCRIPTION											
	05-16-2022	JLW	REVISED PER ADDENDUM 3											

Plot Date: 03-MAR-2022 11:58:13 AM

User: svcPW

Model: Layout1 ColorTable: gshade.ctb DesignScript: Carollo\_Sld\_Pen\_v0905.pen PlotScale: 1:1

LAST SAVED BY: csa020val



**DUCT BANK SECTION**

E03, E05

Designed JLW
Drawn
Checked
Date MARCH 2022



**ZONE 7 WATER AGENCY**  
100 NORTH CANYONS PARKWAY  
LIVERMORE CALIFORNIA, 94551

BAR IS ONE INCH  
AT FULL SCALE.  
0 1"  
IF NOT ONE INCH  
SCALE ACCORDINGLY

**ZONE 7 WATER AGENCY  
CONCENTRATE CONDITIONING SYSTEM PROJECT**

ELECTRICAL

**DUCT BANK - SECTIONS**

SHEET NO. OF 102
DRAWING NO. <b>E12</b>
FILE NO. WC-295

PROJECT NO. 294-21

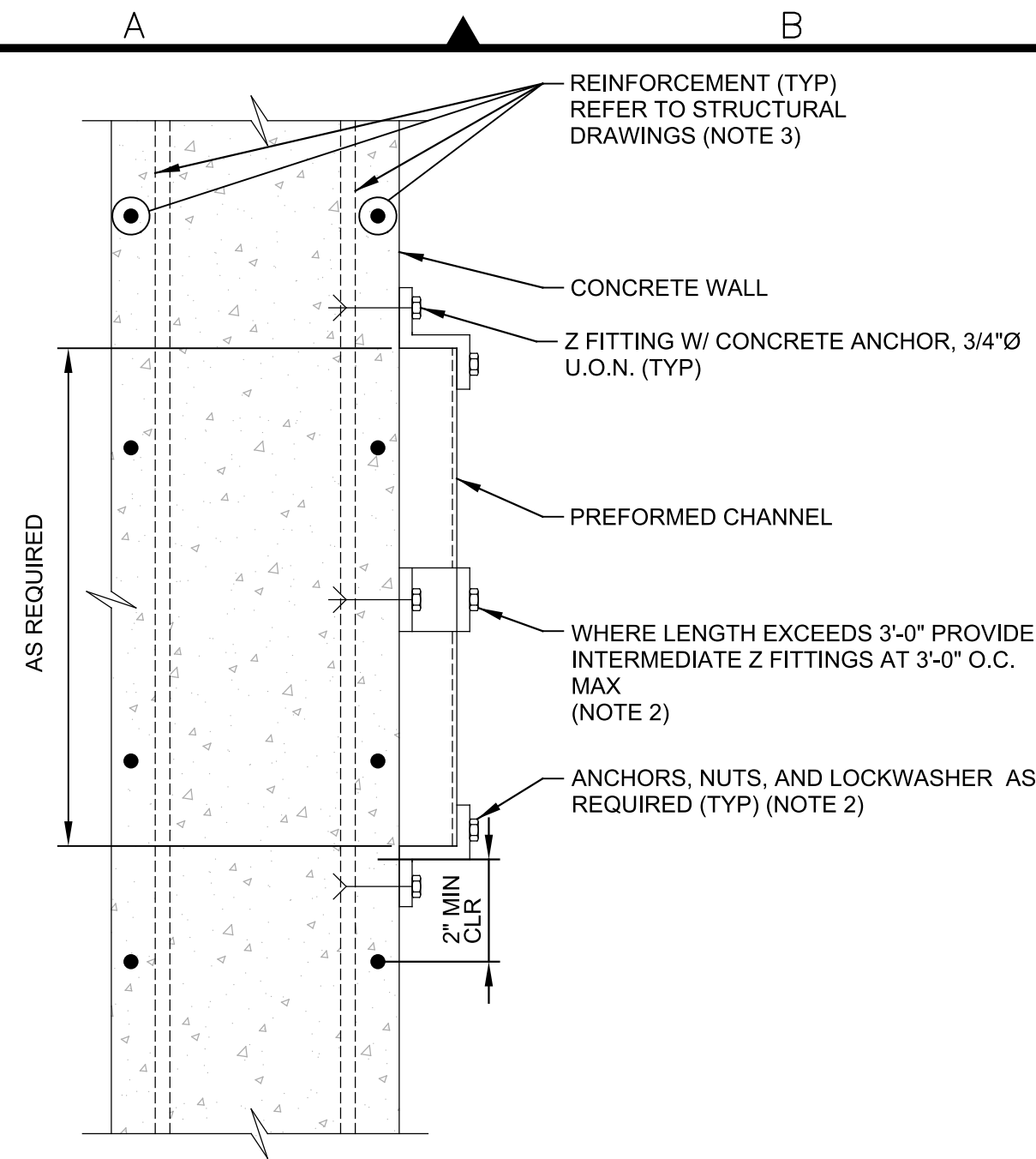


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User: svcPW

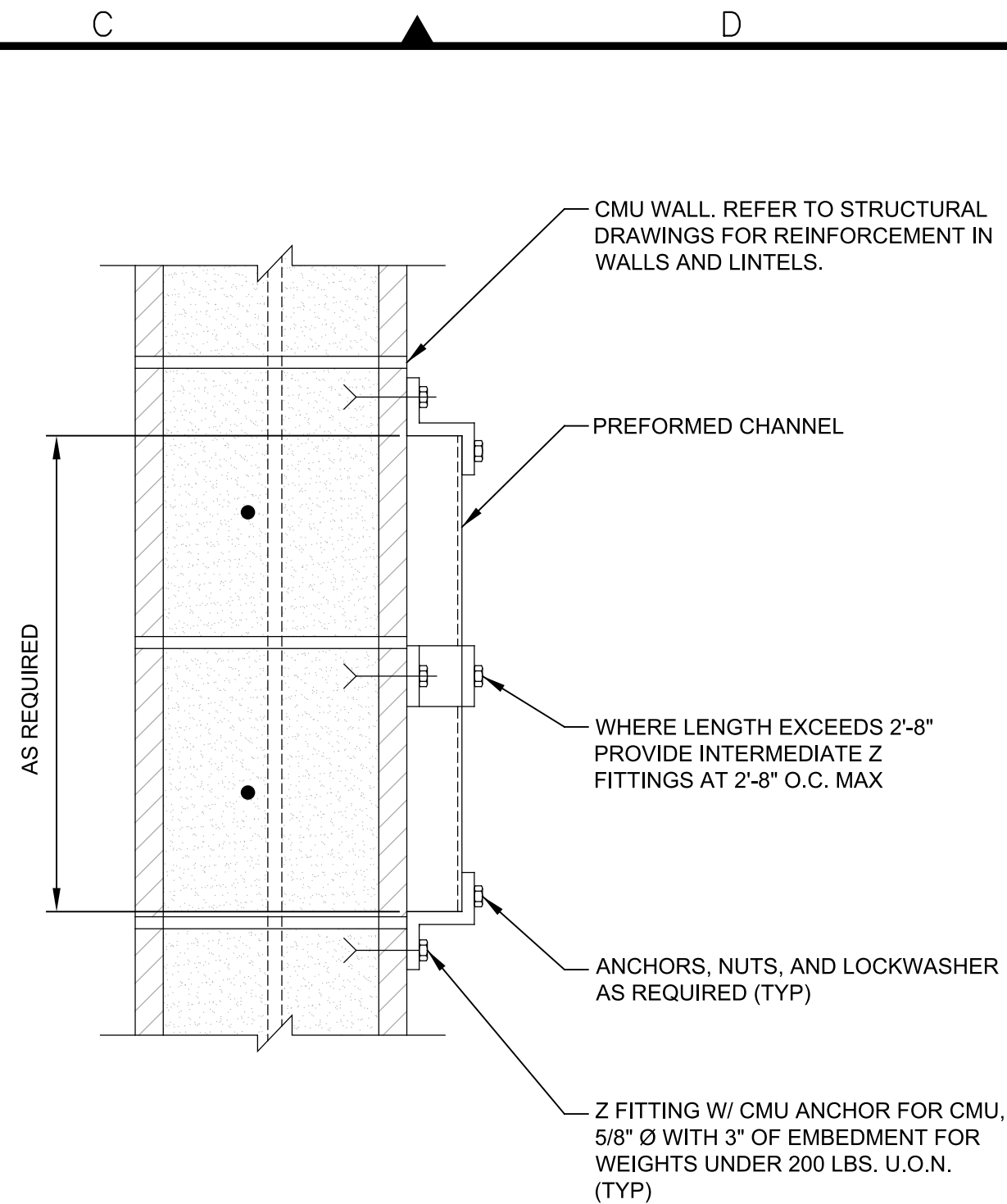
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LAST SAVED BY: csa0204



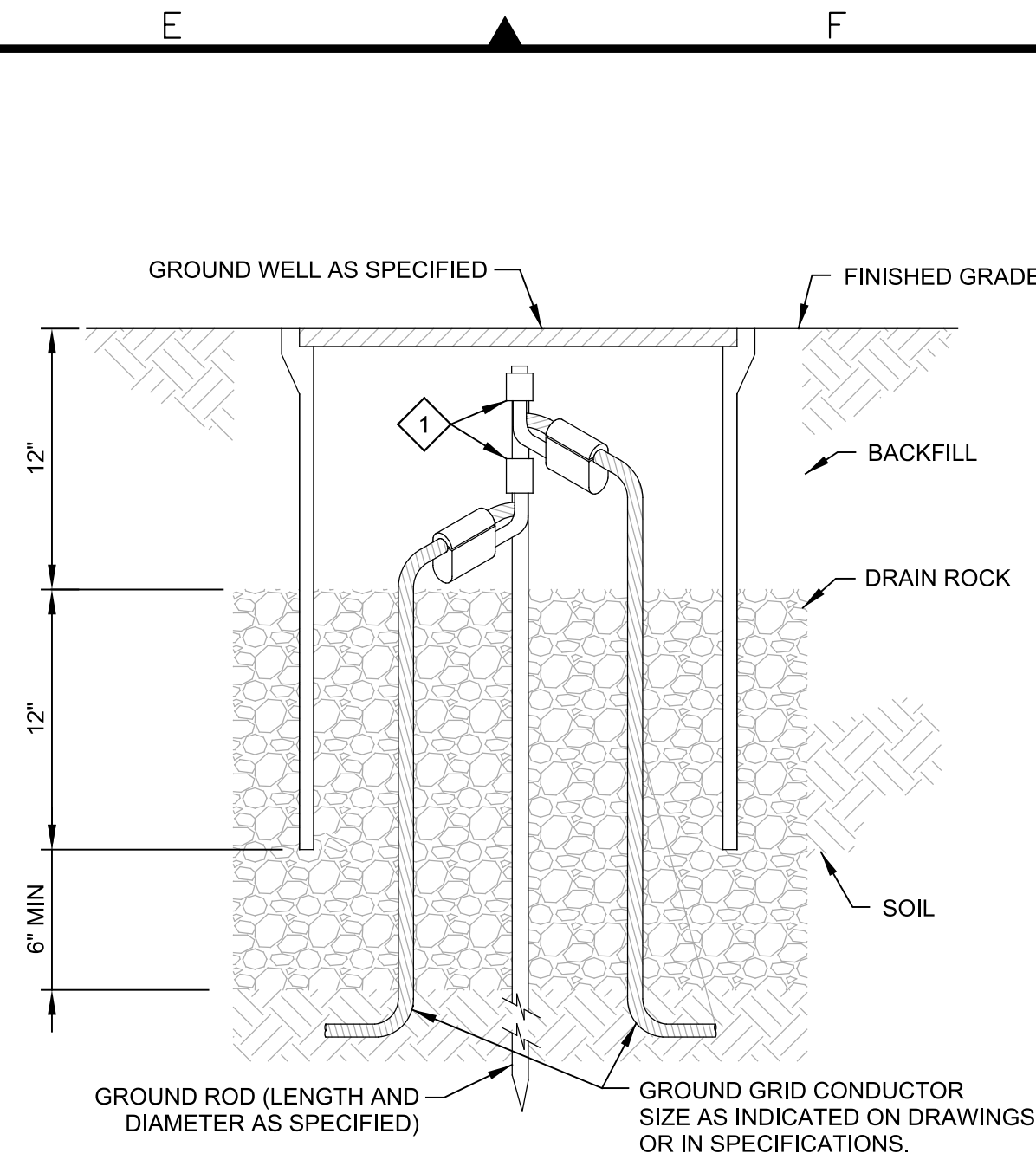
- GENERAL NOTES:**
- THIS DETAIL TYPICAL FOR BOTH VERTICAL AND HORIZONTAL MOUNTING.
  - SUPPORTS TO BE SPACED IN ACCORDANCE WITH NEC REQUIREMENTS. CONCRETE ANCHORS SHALL BE PER THE SPECIFICATIONS.
  - REFER TO STRUCTURAL DRAWINGS FOR ORIENTATION OF REINFORCEMENT AND BARS.

**EA070** PREFORMED CHANNEL ATTACHMENT TO CONCRETE WALL  
TYP S



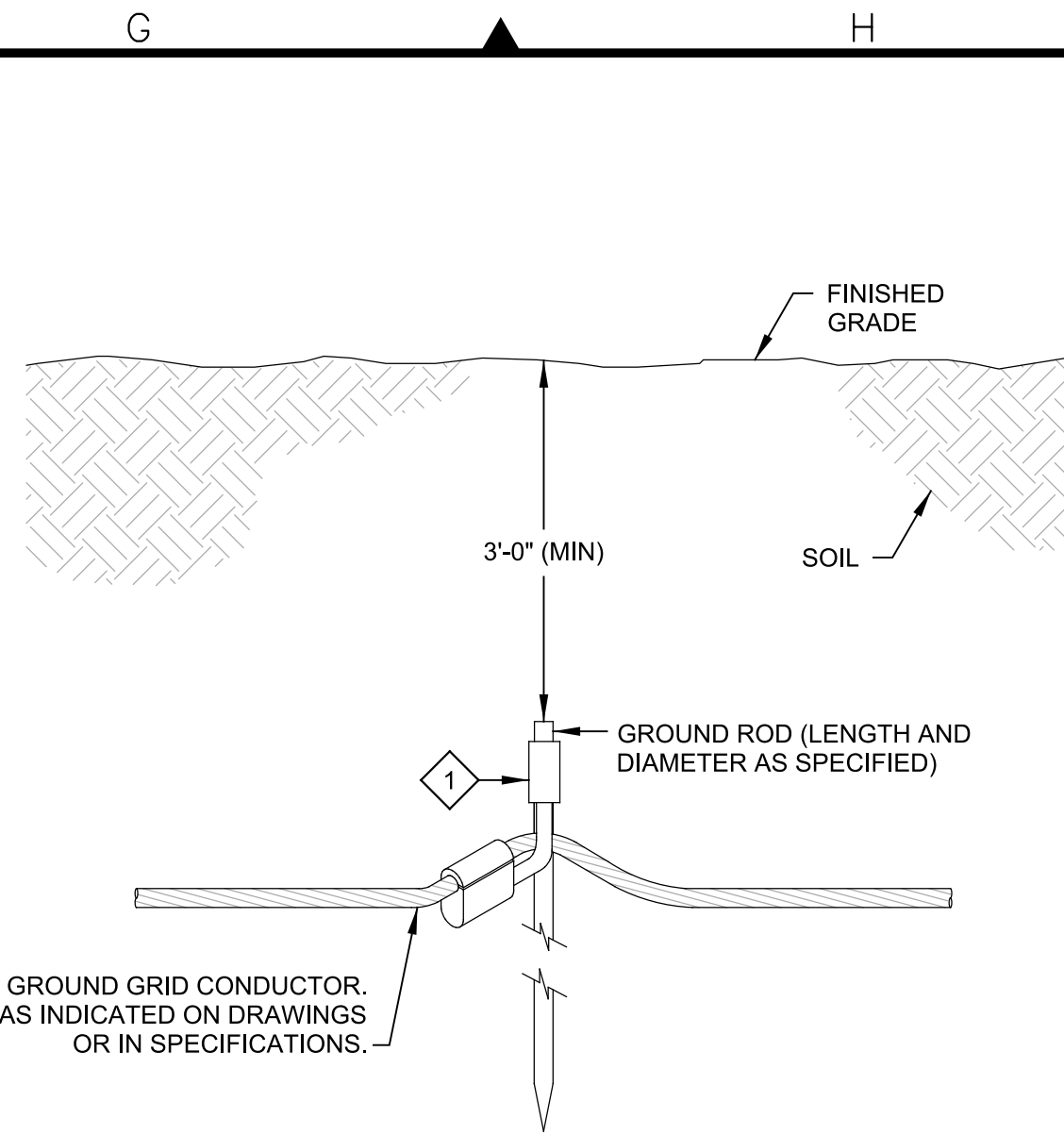
- GENERAL NOTES:**
- THIS DETAIL TYPICAL FOR BOTH VERTICAL AND HORIZONTAL MOUNTING.
  - SUPPORTS TO BE SPACED IN ACCORDANCE WITH NEC REQUIREMENTS. CONCRETE ANCHORS SHALL BE PER THE SPECIFICATIONS.

**EA080** PREFORMED CHANNEL ATTACHMENT TO FULLY GROUTED CMU WALL  
TYP S



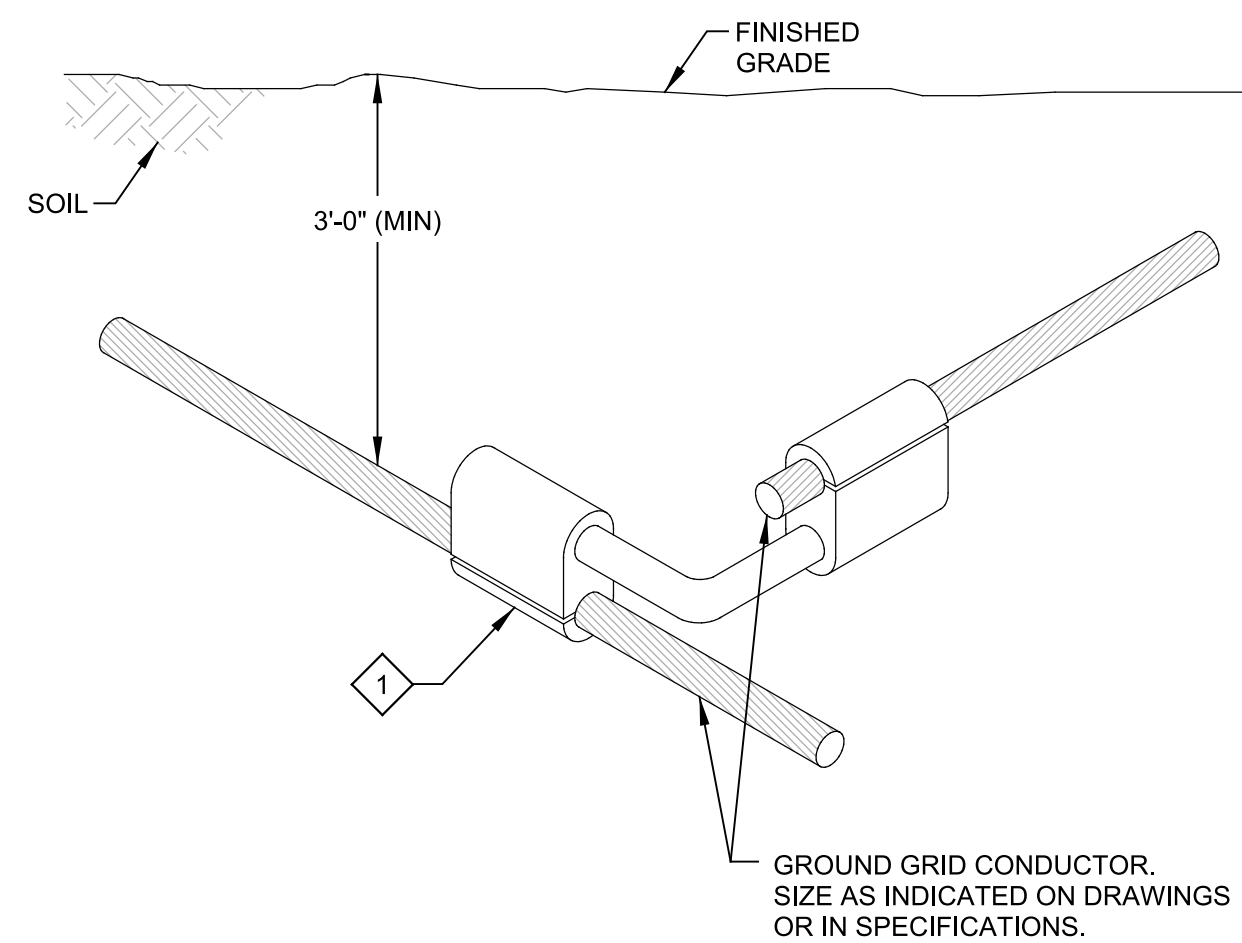
- KEY NOTES:**
- GROUND ROD TO GROUND GRID CROSS CONNECTOR. SIZE FOR ROD AND CABLE PER CONNECTOR MANUFACTURERS GUIDELINES.

**EG001** GROUND ROD AND GROUNDWELL COMPRESSION CONNECTION  
TYP S



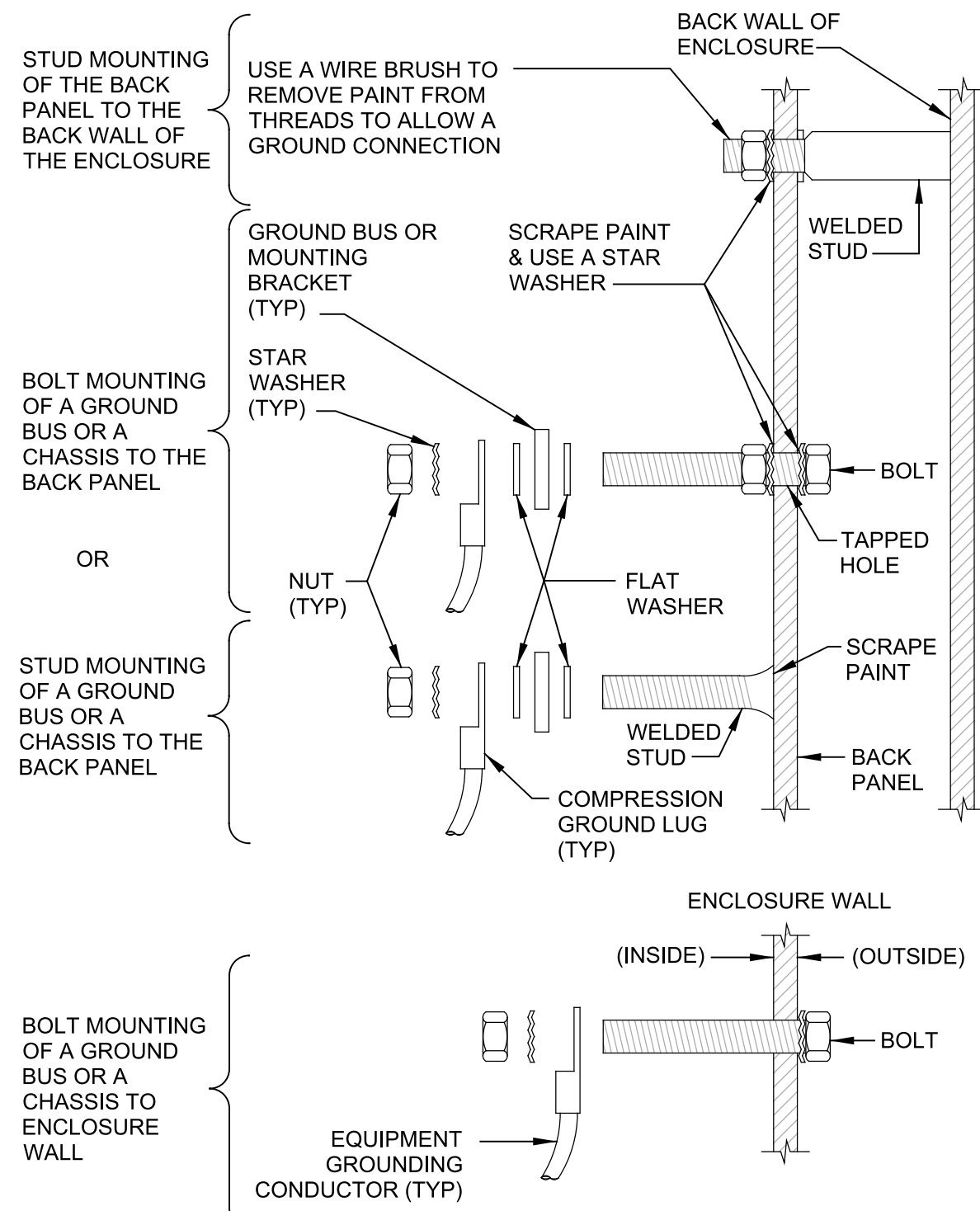
- KEY NOTES:**
- GROUND ROD TO GROUND GRID CROSS CONNECTOR. SIZE FOR ROD AND CABLE PER CONNECTOR MANUFACTURERS GUIDELINES.

**EG002** GROUND ROD COMPRESSION CONNECTION  
TYP S

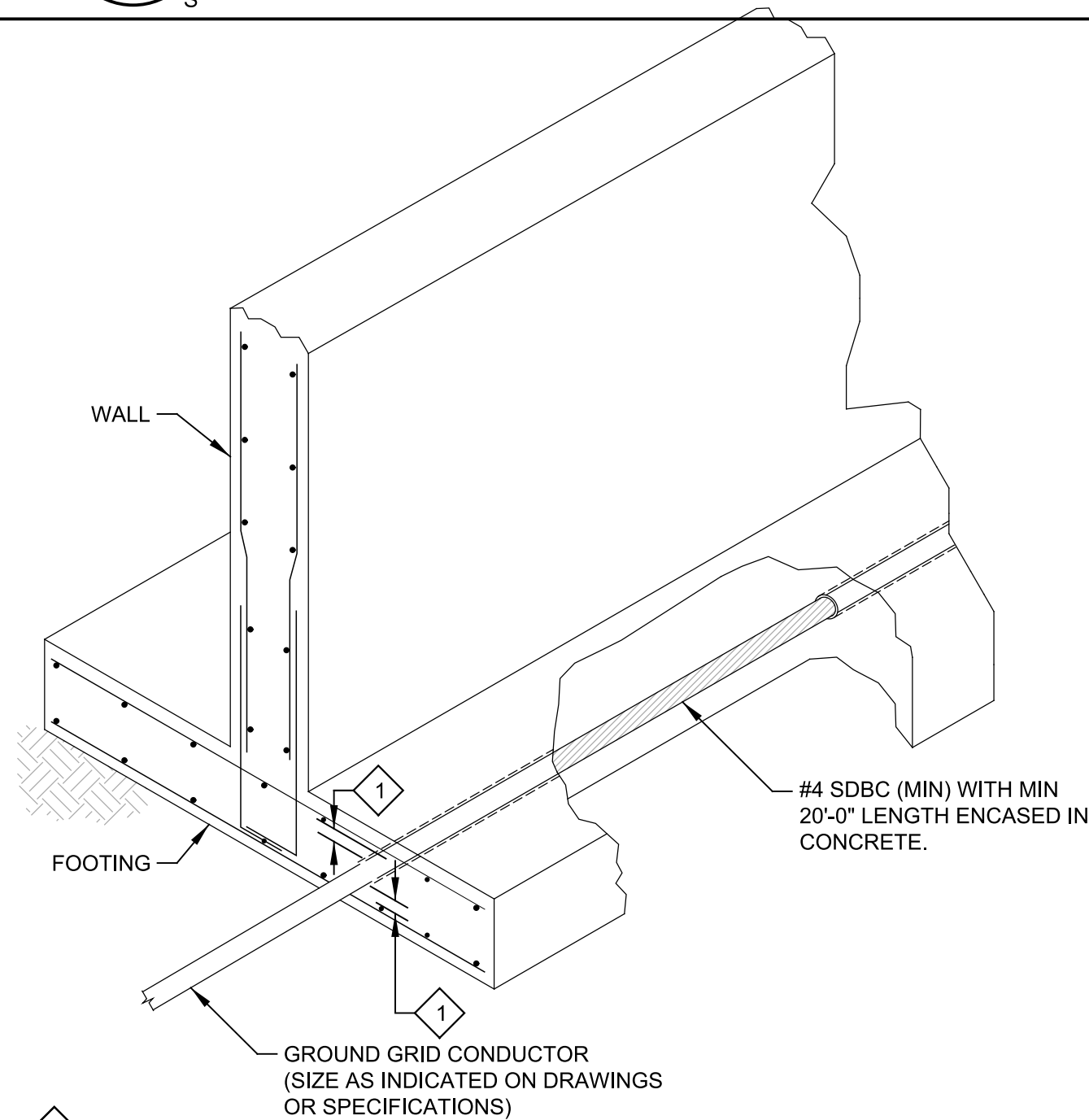


- KEY NOTES:**
- GROUND GRID CROSS CONNECTOR. SIZE FOR CABLE PER CONNECTOR MANUFACTURERS GUIDELINES.

**EG101** COPPER GROUNDING CABLE CONNECTION  
TYP S

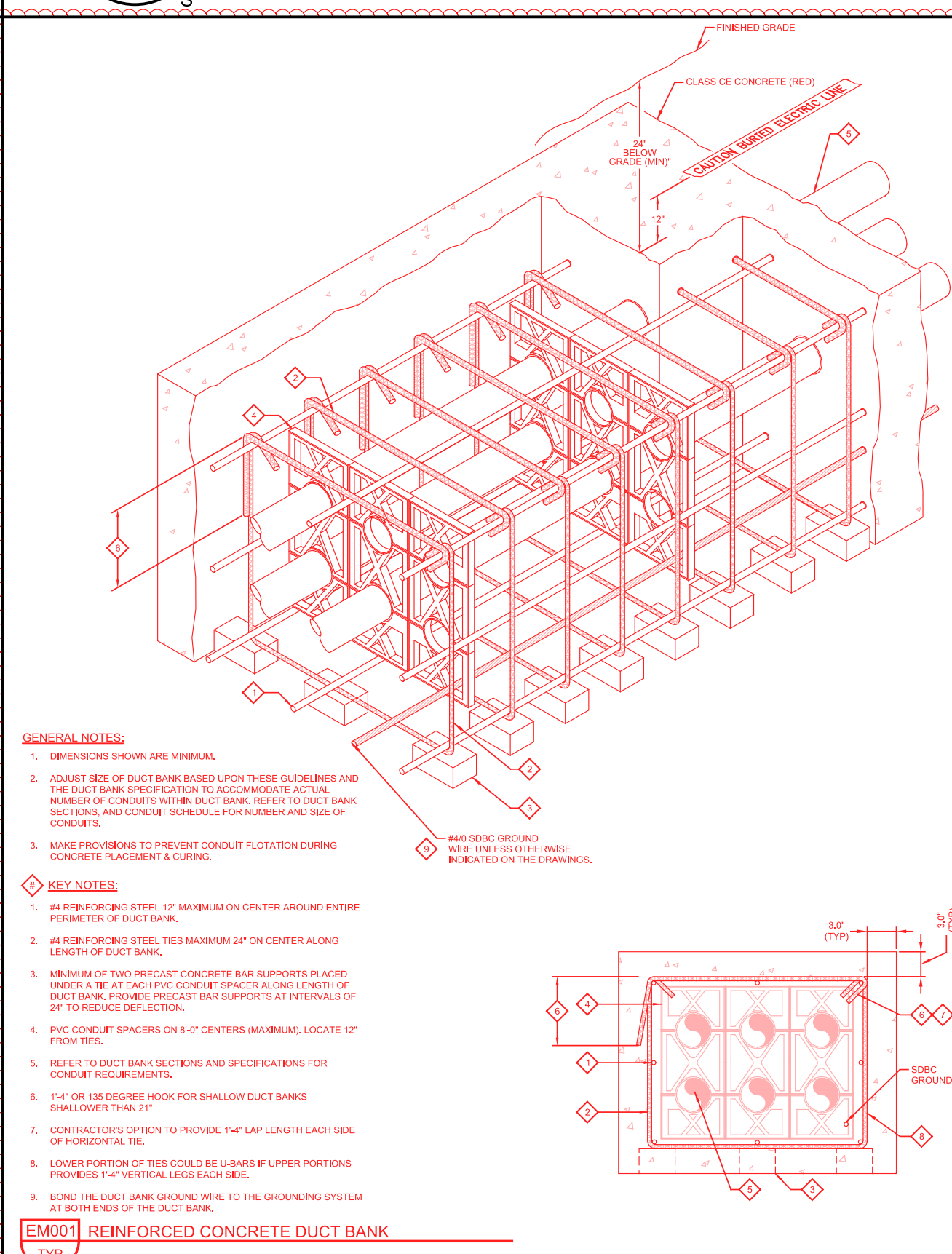


**EG205** ENCLOSURE GROUNDING DETAILS  
TYP S



- KEY NOTES:**
- GROUND GRID CONDUCTOR TO BE FULLY ENCASED IN CONCRETE. PROVIDE MIN 1 1/2\"/>

**EG304** GROUNDING CONNECTION TO FOOTING (UFER)  
TYP S



- GENERAL NOTES:**
- MINIMUMS SHOWN ARE MINIMUM.
  - ADJUST SIZE OF DUCT BANK BASED UPON THESE GUIDELINES AND THE DUCT BANK SPECIFICATION TO ACCOMMODATE ACTUAL NUMBER OF CONDUITS WITHIN DUCT BANK. REFER TO DUCT BANK SECTIONS AND CONDUIT SCHEDULE FOR NUMBER AND SIZE OF CONDUITS.
  - MAKE PROVISIONS TO PREVENT CONDUIT FLOTATION DURING CONCRETE PLACEMENT & CURING.
- KEY NOTES:**
- #4 REINFORCING STEEL 12\"/>
  - #4 REINFORCING STEEL TIES MAXIMUM 24\"/>
  - MINIMUM OF TWO PRECAST CONCRETE BAR SUPPORTS PLACED UNDER A TIE AT EACH PVC CONDUIT SPACER ALONG LENGTH OF DUCT BANK. PROVIDE PRECAST BAR SUPPORTS AT INTERVALS OF 24\"/>
  - PVC CONDUIT SPACERS ON 6\"/>
  - REFER TO DUCT BANK SECTIONS AND SPECIFICATIONS FOR CONDUIT REQUIREMENTS.
  - 1-4\"/>
  - CONTRACTORS OPTION TO PROVIDE 1-4\"/>
  - LOWER PORTION OF TIES COULD BE LABIAS IF UPPER PORTIONS PROVIDE 1-4\"/>
  - SEAL THE DUCT BANK GROUND WIRE TO THE GROUNDING SYSTEM AT BOTH ENDS OF THE DUCT BANK.
- EM001 REINFORCED CONCRETE DUCT BANK**  
TYP S

**ZONE 7 WATER AGENCY**  
**CONCENTRATE CONDITIONING SYSTEM PROJECT**  
TYPICALS  
**TYPICAL DETAILS - ELECTRICAL**

SHEET NO.  
84 OF 102  
DRAWING NO.  
**TE01**  
FILE NO.  
WC-295

PROJECT NO. 294-21