



ST. TAMMANY PARISH

MICHAEL B. COOPER
PARISH PRESIDENT

July 29, 2024

Please find the following addendum to the below mentioned BID.

Addendum No.: 3

Bid#: 24-27-2

Project Name: Post Oak Sewer Consolidation & Faubourg Lift Station Improvements

Bid Due Date: Thursday, August 1, 2024

GENERAL INFORMATION:

Receipt of this addendum shall be acknowledged by inserting its number in the space provided on the Proposal.

1. Approved Equal – MasterLife 300 Series (Attached)
2. Approved Equal – Mainstay Composite Liner System (Attached)
3. Remove and replace the following sections in their entirety: (Attached)

Electrical Specifications:

- 16010 Basic Electrical Requirements
 - 16050 Basic Electrical Materials & Methods
 - 16200 Standby Power Generator
 - 16400 Service & Distribution
 - 16900 Process Instrumentation and Control
4. Remove and replace Electrical Plan Sheets E-01 thru E-08 (Attached)



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QUESTIONS & ANSWERS:

Question 1: Are the location and quantity of bore pits dictated by the contract documents?

Answer 1: No they are not. However, the locations, size, and quantity of bore pits shall be kept to a minimum.

Question 2: What are the requirements/options regarding wet well and manhole coatings and admixtures?

Answer 2: The requirements are shown in the specifications and drawings. Work shall be done during low flow periods.

Question 3: Confirm voltage at Post Oak and Faubourg Lift Stations.

Answer 3: Refer General Information #3 Revised specifications

Question 4: What is the Engineer's Construction Cost Estimate.

Answer 4: The Construction Cost Estimate is \$2,692,520.00.

Question 5: Please clarify acceptable test lengths for HDPE pipe.

Answer 5: Hydrostatic pressure testing of installed HDPE shall be for the entire length of pipe at a time. Segmental testing shall not be allowed.

Question 6: Is this project tax exempt?

Answer 6: See Specification Section 2; Instruction to Bidders Paragraph 11, where states in parts "...The price in the Bid shall include all costs necessary for the complete performance of the work in full conformity with the conditions of the Contract Documents, and shall include all applicable Federal, State, Parish, Municipal or other taxes."

Question 7: Is the contractor to provide a trailer for the resident inspector/engineer?

Answer 7: It is up to the contractor.

Question 8: Is the owner responsible for testing or is the contractor?



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Answer 8: See Specification Section 01410; Testing Laboratory Services, paragraph 1.01 where states in part “Contractor shall employ and pay for the services of an independent testing laboratory to perform specified testing...”.

Question 9: Please provide the geotechnical reports for this project especial at or near each lift station.

Answer 9: There was no Geotechnical report performed.

Question 10: KSB Pumping system has requested to be added as an equivalent system.

Answer 10: The KSB system is Not considered an equivalent system.

ATTACHMENTS:

1. Pre-Bid Sign-in Sheet.pdf
2. Electrical changes description – letter dated July 18, 2024 from Parish Engineering.pdf
3. Electrical Specifications: - Revised (07.29.24).pdf
 - 16010 Basic Electrical Requirements
 - 16050 Basic Electrical Materials & Methods
 - 16200 Standby Power Generator
 - 16400 Service & Distribution
 - 16900 Process Instrumentation and Control
4. Electrical Plan Sheets E-01 thru E-08 – Revised (07.29.24).pdf
5. Mainstay Composite Liner System.pdf
6. MasterLife 300 Series.pdf

<< End of Addendum No. Three (3) >>



7600 Innovation Park Drive

Baton Rouge, LA 70820

P: 225.332.0222

parisheng.com | contact@parisheng.com

July 18, 2024

Post Oak Sewer Consolidation
& Faubourg Lift Station Improvements
Madisonville, LA
PEC Project No. 11707

ADDENDUM #3

The following items shall be considered part of the Contract Documents for the above referenced project and shall take precedence over any conflicting statements contained therein. Revise all other notes, schedules, details, elevations, and sections as required.

ELECTRICAL ITEMS:

Clarifications:

1. The Contractor shall coordinate demolition scope and phasing of the project with the civil drawings. The existing wastewater treatment plant shall remain operational during construction. The Contractor is responsible for coordinating temporary power to the existing treatment plant and shall include the associated costs in bids.

Drawings:

1. Sheet Number E-01
 - a. Added note instructing the contractor to coordinate scope of demolition and phasing with the civil drawings.
 - i. This note also instructs the contractor to include temporary power to the existing wastewater treatment plant by means of temporary generator or by temporary utility power, including coordinating with Cleco.
 - b. Updated references to "util. co." to indicate Cleco as the utility company.
 - c. Updated the note for the new service to indicate a 200A, 120/240 Volt, single phase service.
 - d. Added new panel "P" to the list of equipment on the new rack.
2. Sheet Number E-02
 - a. Updated the riser diagram to reflect a new 120/240 Volt single phase service.
 - i. Generator updated to 120/240 Volt single phase.
 - ii. Updated conduit and wire sizes.
 - iii. Included a single to three phase converter from new panel "P" to new control panel "CP".
 1. Added manufacturers and model numbers for phase converter.
 - iv. Updated circuit numbers.

- v. Replaced ground rods with groundwells.
 - b. Updated schedule for panel “CP”.
 - c. Added schedule for panel “P”.
 - d. Updated load summary.
 - e. Removed ground rod detail.
3. Sheet Number E-03
- a. Indicated the ground rod in the support rack steel grounding detail is within the groundwell.
4. Sheet Number E-05
- a. Updated references to “util. co.” to indicate Cleco.
 - b. Updated pump ratings to 480V/3Ø, 85 HP.
 - c. Updated generator rating to 260 kW.
 - d. Updated fixture type “B” description to include glare shields.
5. Sheet Number E-06
- a. Updated panel “CP” schedule.
 - b. Added panel “LP” schedule.
 - c. Updated riser diagram.
 - i. Updated service to a 277/480 Volt, three phase, 4-wire system.
 - ii. Updated conduit and wire sizes.
 - iii. Replaced ground rods with groundwells.
 - iv. Added 10 kVA transformer.
 - v. Added panel “LP”.
 - vi. Updated circuit numbers.
 - d. Updated load summary.
6. Sheet Number E-07
- a. Updated Support Rack Steel Ground Detail and Generator Pad Detail to indicate that the ground rod shown is within groundwells.
 - b. Removed ground rod detail.
7. Sheet Number E-08
- a. Updated the controls diagram.
 - i. Updated service to a 277/480 Volt, three phase, 4-wire system at 500A.
 - ii. Updated conduit and wire sizes.
 - iii. Added 10 kVA transformer.
 - iv. Added panel “LP”.
 - v. Updated circuit numbers.

Specifications:

1. Section 16010
- a. Added verbiage for the phase converter as part of the scope.
 - b. Updated the service entrance ratings for each site under paragraph “1.01 Scope.”
 - c. Added phase converter and transformer to paragraph 2.02A.
2. Section 16050
- a. Added conductor color coding for 120/240 Volt single phase and 277/480 Volt three phase systems.

3. Section 16200

- a. Updated paragraph 1.03D to include Generac Industrial as an acceptable alternative to the specified equipment.
- b. Updated the voltage and power output ratings for the generators in paragraph 2.01C.
- c. Updated the transfer switch amperage rating and contact voltage ratings for each site in paragraph 2.09B.

4. Section 16400

- a. Updated paragraph 1.01A to include the voltage systems for each site.
- b. Added paragraph “2.04 Dry-Type Transformers.”

5. Section 16900

- a. Updated paragraph 3.02A to list 277/480 Volt, three-phase, four-wire as the system type.
- b. Updated paragraph 3.02D to indicate a 480 Volt breaker.
- c. Updated paragraph 3.02E to indicate 480 Volt fuses.
- d. Added paragraphs 3.02J, 3.02K, and 3.02L.

PRIOR APPROVAL:

NOTE: Acceptance of a particular manufacturer does not excuse that manufacturer from meeting the plans and specification. Compliance with specifications is the responsibility of the prior approval manufacturer.

<u>Product</u>	<u>Model</u>
Fixture Type “A”	Day-Brite
Fixture Type “B”	Gardco
Pole	United Lighting Standards

If you have any questions, please contact our office.

Parish Engineering, LLC

Attachments:

- Sheet E-01
- Sheet E-02
- Sheet E-03
- Sheet E-05
- Sheet E-06
- Sheet E-07
- Sheet E-08
- Specification Section 16010
- Specification Section 16050
- Specification Section 16200
- Specification Section 16400
- Specification Section 16900



DIVISION 16 - ELECTRICAL
SECTION 16010 - BASIC ELECTRICAL REQUIREMENTS

PART 1.00 GENERAL

1.01 SCOPE

- A. The work to be performed under these specifications shall include the furnishing of all labor, materials, equipment and services required for a complete electrical system as specified herein and as shown by the Drawings. A state of Louisiana licensed Electrical Contractor shall perform the work specified herein. The work includes but is not limited to:
1. Demolishing the existing electrical service as shown on the Drawings and providing a new 120/240 Volt, 1-Phase, 3-wire service at the Post Oak site and 277/480 Volt, 3-phase, 4-wire service at the Faubourg site, including coordinating with the local utility company. Include all associated costs in bid.
 2. Demolishing the existing electrical equipment as shown on the Drawings.
 3. Furnishing and installing new lighting and controls.
 4. Furnishing and installing new disconnect switches, panels, variable frequency drives, phase converters, and transformers as shown on the Drawings.
 5. Furnishing and installing new breakers, conduits, and conductors to feed existing pumps.
 6. Furnishing and installing new pump control panel with breakers, meter and main disconnect, pump controls, status indication lamps, and low voltage breakers as directed by the Owner's selected control panel manufacturer.
 7. Installing and connecting pump power and control cables furnished with the pump control panel, including motor power and control cables, and level controls.
 8. Furnishing and installing grounding as required for each site as shown on the drawings.
 9. Furnishing and installing a new natural gas generator and automatic transfer switch at each site as shown on the Drawings.
 10. Installation of temporary construction power required by the General Contractor and Sub-Contractors during the construction period.

1.02 GENERAL CONDITIONS

- A. The General Conditions and Supplementary General Conditions are a part of this section of these Specifications. The Contractor is cautioned to read and be thoroughly familiar with all provisions of the General Conditions. These conditions shall be complied with in every aspect. The word "shall" where used, is to be understood, as mandatory and the

word "should" as advisory. "May" is used in the permissive sense.

1.03 GENERAL REQUIREMENTS

- A. The Contractor is referred to all of the Drawings for building construction as well as the electrical Drawings.
- B. The Contractor shall examine the site and shall verify to his own satisfaction the location of all utilities, and shall adequately inform himself as to their relation to his work before entering into a Contract and he shall base his bid on any conditions, which may be encountered during the progress of the work. Contractor is responsible for all utility cost required to bring the new service to the new elevated platforms.
- C. The Contractor shall furnish and install properly all materials, devices, equipment, supports, controls, appurtenances, etc., mentioned or required to make complete or satisfactory installations in working order whether shown or not. All electrical equipment shall be connected in accordance with manufacturer's instructions. All work shall be executed in a workmanlike manner and shall present a neat and mechanical appearance when completed.
- D. Electrical service required for all equipment furnished under this general contract shall be roughed-in and connected by the Contractor. It is the responsibility of the Contractor to obtain correct roughing-in dimensions and requirements for this equipment. Refer to the Mechanical and Architectural Sections for these Specifications.

1.04 MINIMUM STANDARDS

- A. Applicable rules of the National Electrical Code apply as a minimum standard for this contract, but do not replace or reduce any specific requirement herein.

1.05 DRAWINGS

- A. Plans and detail sketches are submitted to limit, explain, and define structural conditions, specified requirements, conduit sizes, and manner of erecting work. The Contractor is cautioned to field check and verify all existing conditions before bidding, as no extra compensation will be allowed for conditions found different than represented in the construction drawings and/or specifications. Written approval of the Engineer shall be obtained prior to any alterations or additions to specified work.
- B. Structural or other conditions may require certain modifications from the manner of installation shown, and such deviations are permissible and shall be made as required, but specified sizes and requirements necessary for satisfactory operations shall remain unchanged. Shifting of conduits or equipment shall be referred to the Engineer for approval. Extra charges will not be allowed for these changes without the written approval of Engineer.
- C. The drawings and these specifications are complementary to each other and what is called

for by one shall be binding as if called for by both.

- D. General arrangement of work is indicated on plans. Due to the small scale of the drawings, offsets, fittings, and boxes required are not all indicated; provide fittings, boxes, etc., as needed in accordance with codes and accepted practices.

1.06 SUPERVISION

- A. The Contractor shall personally or through an authorized and competent representative, constantly supervise the work from beginning to completion and final acceptance. So far as possible, he shall keep the same foreman and workmen throughout the project duration.
- B. During its progress, the work shall be subject to inspection by representatives of the Engineer, at which times the Contractor shall furnish required information.
- C. It is not the Engineer's duty to direct or guarantee the work of the Contractor, but to assist the Owner in obtaining a complete building in accordance with plans, specifications and addenda and to furnish engineering services in accordance with recognized practices.

1.07 PRIOR APPROVALS

- A. The Contractor shall base his proposal on materials as specified herein. Any references to a specific manufacturer or trade name is made to establish a standard of quality and to define a type of product and in no way is intended to indicate a preference for a particular manufacturer. It is the intent of these specifications to allow all manufacturers of equipment, products, etc., judged equal to the specified product to bid on a competitive basis.
- B. Requests for substitutions or prior approvals shall be made as indicated in the Instructions to Bidders, General Conditions of the Contract for Construction, Supplementary General Conditions, Special Conditions and/or general requirements.

1.08 MEASUREMENTS

- A. The Contractor shall verify all measurements and shall be responsible for the correctness of same, before ordering any materials or doing any work. No extra charge or compensation will be allowed for any differences between the actual measurements and those indicated on the drawings.

1.09 LAWS, PERMITS AND FEES

- A. The entire electrical work shall comply with the rules and regulations of the City, Parish, and State, including the State Fire Marshal and State Board of Health, whether so shown on plans or not. The Contractor shall pay fees for permits, inspections, etc., and shall arrange with the inspecting authorities all required inspections. The Contractor shall contact utility companies and make arrangements for all service connections, verifying locations with the utility and paying all charges pertaining thereto.
- B. The Contractor shall contact the local utility company regarding connection of permanent

service and include in his bid any fees, construction charges or other charges associated with obtaining electrical service to the facility.

1.10 SITE INSPECTION

- A. The Contractor shall visit the site and familiarize himself with difficulties attendant to the successful execution of the work before bidding. Failure to visit the site shall not relieve the Contractor of the extent or conditions of the work required of him.

PART 2.00 PRODUCTS

2.01 MATERIAL AND EQUIPMENT

- A. All materials, equipment, and accessories installed under this Contract, whether approved or not, shall be new and shall conform to all rules, codes, etc., as recommended or adopted by the National Association(s) governing the manufacture, rating and testing of such materials, equipment, and accessories.

2.02 SHOP DRAWINGS

- A. The Contractor shall submit to the Architect complete descriptive and dimensional data on the following items for review and approval:
 1. Pump Control Panels
 2. Disconnect Switches
 3. Light Fixtures and Controls
 4. Panelboards
 5. Surge Protective Device
 6. Motor Electrical Data
 7. Conduits, Fittings, and Bushings
 8. Conductors
 9. Variable Frequency Drives
 10. Natural Gas Generator
 11. Automatic Transfer Switch
 12. Single to Three Phase Converter
 13. Transformers

PART 3.00 METHODS OF INSTALLATIONS

3.01 CONTRACTOR COORDINATION

- A. The Drawings are diagrammatic in nature. Cooperate with other trades so the interferences of facilities and equipment will be avoided.

3.02 PAINTING

- A. Painting shall be performed as described in the painting specifications. No painting will be required by the Contractor except for touch-up of factory finishes on equipment furnished under this contract.

3.03 APPLICABLE GENERAL CODES AND REGULATIONS

- A. All electrical work and equipment, in whole or in part, shall conform to the applicable portions of the following specifications, codes and regulations in effect on that date of invitation for bids, and shall form a part of this specification.
 - 1. National Electrical Code, Latest Edition as accepted by the State Fire Marshal
 - 2. National Electrical Manufacturers Association Standards
 - 3. National Fire Protection Association Recommended Practices
 - 4. Local, City and State Codes and Ordinances
 - 5. National Board of Fire Underwriter's Recommended Practices
 - 6. Life Safety Code, Latest Edition as accepted by the State Fire Marshal
 - 7. International Building Code
- B. Equipment that has been inspected and approved by the Underwriter's Laboratory shall bear its label or appear on its list of approved apparatus.

3.04 TESTS AND INSPECTIONS

- A. The Contractor shall assist in making periodic inspections or tests required by the Architect or Engineer. When requested, the Contractor shall provide the assistance of foremen and qualified craftsmen for reasonable duration of each test, etc.

3.05 SAFETY PRECAUTIONS DURING CONSTRUCTION

- A. It shall be the Contractor's responsibility to furnish and install proper guards and instruction signs for prevention of accidents and to provide and maintain for the duration of construction any installations needed for safety of life and property.

3.06 SLEEVES, INSERTS AND OPENINGS

- A. This Contractor shall plan work in advance of pouring concrete floors or walls. He shall furnish and install all sleeves or openings through floors or walls required for passage of conduits, pipes, or ducts installed by him. This Contractor shall furnish and install inserts and hangers required to support bus bars, bus ducts, conduit, cables, pull boxes, etc.
- B. Sleeves shall be of 16-gauge galvanized sheet steel, rigidly supported and suitably packed to prevent ingress of wet concrete. If the sleeves, hangers, inserts, etc., are improperly installed, this Contractor shall, at his own expense, do all necessary cutting and patching to rectify the errors.

3.07 MOTOR AND CONTROL WIRING

- A. Other Contractors will furnish and install motors and will furnish motor starters and control panels except where noted otherwise. The Contractor shall connect motors and shall install and connect starters where called for.

3.08 EQUIPMENT NAMEPLATE

- A. Each item of electrical equipment installed by the Contractor shall be provided with an engraved nameplate noting the equipment's function or designation. Nameplates shall be engraved laminated plastic with black letters on a white background. Letters shall be 1/4" high, all caps.

3.09 PANELBOARD SCHEDULES

- A. The Contractor shall provide, and affix typed panelboard schedules for each panelboard (if required). Schedule will accurately list equipment served by each branch circuit.

3.10 COMPLETION

- A. The Contractor shall leave all electrical equipment with proper connections, and in proper working order. He shall test the entire electrical system in the presence of the Engineer or his representative to show that it is properly installed. Contractor shall leave all panels and switches completely fused or complete with circuit breakers.

3.11 RECORD DRAWINGS

- A. The Contractor shall furnish one (1) complete set of drawings on which any changes in the work shall be shown. These drawings must be turned over to the Architect prior to final acceptance of the work. In the event unforeseen obstructions occur in the work, the Contractor shall confer with the Engineer and obtain his written consent before undertaking any deviation from the governing plans.

3.12 GUARANTEE

- A. The Contractor shall guarantee to keep the entire electrical system as installed by him or his subcontractors in repair and in perfect working order for one (1) year from the date of the final Certification of Final Acceptance, and shall furnish free of cost to the Owner, all material and labor necessary to comply with the above guarantee; said guarantee shall be based upon defective material and workmanship. In any case where equipment has a factory warranty exceeding this one-year limit, the full extent of the warranty shall apply.

3.13 CLEANING

- A. When all work has been finally tested, the Contractor shall clean all fixtures, equipment, conduits, ducts, and all exposed work. All cover plates and other finished products shall be thoroughly cleaned.

3.14 INSTRUCTION MANUALS

- A. The Contractor shall provide three (3) operating and maintenance instruction manuals on all systems and equipment installed in the electrical work.

3.15 CONTRACTOR SPECIAL NOTE

- A. The Contractor is again cautioned to refer to all parts of these Specifications and all

Drawings, not just electrical sections, and the individual cross references made to other standard specifications or details describing any electrical work, which may be required under these other sections. The Contractor is cautioned to note carefully any other sections which may reference electrical work in order for this Contractor to fully understand the wiring requirements and electrical work that is required. Any conflicts found between the electrical sections of these Specifications or Drawings shall be immediately directed to the General Contractor for clarification.

- B. These Specifications and the electrical Drawings size equipment, wire, conduit, etc. based on the horsepower of motors and/or wattages of equipment as shown on the plans or specified herein. The Contractor shall install electrical raceways, conductors, fuses, safety switches, breakers, contactors, starters or any other electrical equipment with the capacities to suit the horsepower and/or wattages of the equipment actually furnished and installed. The Contractor shall not furnish or install any electrical raceways, conductors, safety switches, contactors or motor starters of sizes smaller than those shown on the Drawings or specified herein. The Contractor shall coordinate with the various sections of the Specifications and/or Drawings and with the various Sub-Contractors to provide the properly sized equipment without additional cost to the Owner.
- C. The Contractor shall be required to install electrical conduit and wire underground in some areas. Contractor is cautioned to exercise extreme care when digging to not damage any existing utilities or equipment. Contractor shall be required to repair any utilities or equipment he may damage during construction.
- D. The Contractor will be required to modify existing electrical services and equipment. Contractor shall not disconnect service to any equipment or make any equipment modifications without coordinating all such work with the Owner prior to initiating the work. All existing equipment shall remain in operation during the construction except for the minimal down time required for the tie-in or modification of the equipment.

END OF SECTION



DIVISION 16 - ELECTRICAL
SECTION 16050 - BASIC ELECTRICAL MATERIALS AND METHODS

PART 1.00 GENERAL

1.01 GENERAL REQUIREMENTS

- A. All material furnished shall be new and shall conform to all rules and codes as recommended or adopted by the National Association governing the manufacture, rating and testing of the material. All electrical equipment shall be UL listed for the intended use.

PART 2.00 PRODUCTS

2.01 RACEWAYS AND FITTINGS

- A. Raceways permitted on this project shall be hot dipped galvanized rigid aluminum conduit; flexible metallic tubing; liquid-tight flexible metal conduit; and rigid polyvinyl chloride (PVC) conduit. All conduits shall be new and shall bear the inspection label of the Underwriter's Laboratories, Inc.
- B. Metallic conduit shall be metalized, or hot-dipped galvanized. Non-metallic conduit shall be schedule 40 PVC.
- C. Fittings for conduit shall be an approved type specially designed and manufactured for their purpose. Rigid metal conduit fittings, bushings, and other components shall be galvanized. Setscrew connector fittings shall not be permitted. All fittings for rigid steel or aluminum conduit shall be threaded and coupled unless specifically approved otherwise by the Engineer.

2.02 EXPOSED CONDUIT

- A. Exposed conduit shall be firmly supported on galvanized hangers; on brackets, hangers, or pipe straps; or by beam clamps. Conduit installed exposed shall be neatly aligned and run at right angles to the building walls or walls of the rooms in which they are installed. All exposed conduit shall be located to avoid all conflicts with architectural or mechanical components.

2.03 FLEXIBLE CONDUIT

- A. Liquid-tight flexible metal conduit shall have a spiral wound, flexible, galvanized steel core and a tough extruded synthetic moisture-tight outer covering. All flexible conduits shall be UL listed and not exceed 24" without engineers approval.

2.04 GALVANIZED CONDUIT

- A. Galvanized conduit furnished in accordance with these specifications shall be of Aluminum piping, galvanized inside and outside, and shall conform in all respects to the American Standard Association rigid Aluminum Conduit Specification C80.1-1959 and Underwriter's Laboratories Specifications.

- B. The galvanized coat of zinc shall be of uniform thickness applied by the hot-dipped process to not only the inside surfaces of the conduit, but also to the threads of the conduit. It shall be further dipped in a chromic acid bath so as to chemically form a corrosive resistant protective coating of zinc chromate over hot-dipped galvanized surface. Each piece of conduit shall be straight, free from blisters and other debris, cut square and taper reamed, and furnished with coupling in 10 foot length threaded each end. The interior threaded surface of each coupling shall be galvanized to insure 100% galvanic protection on all surfaces. The hot galvanized zinc chromate on the inside and outside surfaces shall be sufficiently elastic to prevent cracking or flaking when sample of finished conduit is bent 90° at a minimum temperature of 60°F, the inner edge of the bend having a radius of six (6) times the inside diameter of the conduit.

2.05 RACEWAYS

- A. Lay-in duct, JIC Wireway and troughs shall be NEMA 1 for indoor application and NEMA 4X Stainless Steel for out door or applications exposed to weather or water. Raceways shall be sized as noted on Drawings, and shall have hinged or screw covers with captive screws. Finish shall be gray enamel. All components shall be UL listed for steel enclosed wireway or auxiliary gutter.

2.06 OUTLET AND SWITCH BOXES

- A. Outlet boxes in concealed conduit systems shall be flush mounted. Boxes shall be galvanized steel of sufficient size to accommodate devices shown and shall have raised covers where required to meet requirements of NEC Article 314.
- B. All boxes shall be stamped, one piece, galvanized steel, of proper size and shape for conduits entering them, and shall be UL listed and NEC approved for the intended use. Boxes shall be installed so that device and/or coverplates shall be tight and plumb with wall finish, have all unused openings closed with knock-out plugs, and be weatherproof for exterior locations.
- C. Boxes for lighting fixtures shall be 4 inches octagon, not less than 1 1/2 inches deep, with fixtures stud fastened through from back box. Where boxes are installed in a concrete slab, boxes designed for this application shall be used.
- D. Outlet boxes for switches in concealed work shall be standard switch boxes of required number of gangs. Outlet boxes for receptacles, telephone, and communication use in concealed work shall be 4 inch square, not less than 1 1/2 inches deep. Outlet boxes for switches and receptacles installed in exposed conduit system shall be cast type FS or FD, number of gang as required. Outlet boxes for telephone and communication use in exposed systems to be cast, 4 inches square, not less than 1 1/2 inches deep.
- E. Boxes shall not to be installed back to back in walls. Offset with connecting conduit as specified. Do not use long, extended boxes that would effectively couple light and sound between adjoining spaces.

2.07 WIRE (600 VOLT AND BELOW)

- A. All conductors used in the work shall be of soft drawn annealed copper having a conductivity of not less than 98% of that of pure copper. Conductors shall be standard code gauge in size, insulated and shall have insulation rated for use at 600 volts.
- B. Unless noted otherwise or specified, insulation shall be type THW, THWN, or THHN for sizes up to and including No. 2 AWG. Insulation for wire sizes larger than No. 2 AWG shall be type THW, XHHW, or THHN. Lighting fixture wire shall be heat resistant type TF (150°C) with 300-volt insulation minimum. Wires shall be of the single conductor type. Sizes No. 8 AWG and larger shall be stranded. Sizes No. 12 thru No. 14 shall be single strand solid copper.
- C. Throughout the system, all conductors shall be identified as to the phase and voltage of the system by color-coding in accordance with NEC 210.5. Color-coding shall be continuous the full length of the wire with surface printing at regular intervals on all conductors and for neutral conductors.
- D. Color coding shall be as follows:

<u>3phase 120/240V System</u>	<u>1phase 120/240V System</u>
Phase 1-Black	Phase 1-Black
Phase 2-Orange	Phase 2-Red
Phase 3-Blue	
Neutral-White	Neutral-White
Ground-Green	Ground-Green
<u>3phase 277/480V System</u>	
Phase 1-Brown	
Phase 2-Orange	
Phase 3-Yellow	
Neutral-Gray	
Ground-Green	

2.08 GROUND RODS

- A. Ground rods shall be continuous rods in length as shown on the Drawings. Rods shall be copperbonded driven rod type. The copper jacket shall be electrolytically bonded to the high strength steel core. Copperbonded ground rods shall meet or exceed requirements of UL Specification No. 467 (ANSI C-33.8-1972).
- B. Connections to ground rods shall be with heavy duty bronze ground rod clamps. Clamp shall have hex head set screw.

2.09 WEATHERPROOF RECEPTACLES

- A. Weatherproof receptacles shall be GFCI duplex receptacles as specified under WIRING DEVICES, mounted in a cast iron type FD conduit box and fitted with gasketed metal cover with spring. Weatherproof receptacles shall be flush mounted in exterior walls.

2.10 WIRING DEVICES

- A. Wiring devices shall be as listed. The color of device shall match color of outlet cover plate. It shall be the responsibility of the Contractor to provide plugs, receptacles and fittings required for any equipment furnished or installed or connected under the contract. Color as selected by the Engineer.

	Leviton	P & S	Hubbell
Toggle Switches: 20A 120/277V			
Single pole	1221-I	20AC1-I	1221-I
Three-way	1223-I	20AC3-I	1223-I
Duplex Receptacle: 20A, 125V, NEMA 5 20R	5362-I	5362-I	5363-I
Ground Fault Circuit Interrupter: 20A, 125V, Feed Through, NEMA 5 20R	6899-I	2091-S	GF 5362-I

- B. Quad receptacles shall be 20 amp, 125 volt rated, NEMA 5-20R, with two (2) duplex receptacles or single four-plex device.

2.11 OUTLET COVER PLATES

- A. Unless otherwise specified, all outlets shall be fitted with cover plates. Cover plates shall be standard size, uniform in design and finish for switches, receptacles and other outlets requiring cover plates. Plates shall be one piece of the required number of gangs. All cover plates shall be stainless steel type. Engineer shall select cover plate color.

2.12 CONDUIT SEAL FITTINGS

- A. Conduit seals shall be installed where shown on the drawings. Conduit seals shall be UL listed for use in hazardous locations when Kwiko A Sealing Compound or Crouse-Hinds Chico A Sealing Compound are used to make the seal. Fittings shall be malleable iron construction with galvanized finish, and suitable for use with threaded metal conduit. Fittings shall be installed in accordance with National Electrical Code Article 500 requirements.

PART 3.00 EXECUTION

3.01 WIRING - GENERAL

- A. Unless otherwise specified, all wiring shall be installed in conduit. No wire shall be smaller than No. 12 unless noted otherwise. Wiring for low voltage control may be #14 AWG. Wire for each branch circuit shall be of single size and type from the branch circuit protective device the last outlet of the circuit. BX wiring shall not be allowed.
- B. Feeders, motor circuit conductors and main service entrance conductors shall run their entire length without joints or splices. Wiring for branch circuits shall run the entire length

without splices, with splices and joints made only at outlets or in accessible junction boxes only when absolutely necessary and approved by the Engineer. Joints and splices in branch circuit wiring shall be made with compression type solderless connectors.

- C. Connectors of the non-metallic screw on type are not acceptable. Terminations or splices for conductors No. 6 AWG and larger shall utilize bolted connecting lugs. All splices and terminations shall be insulated in an approved manner by an integral or separate cover or by taping to provide insulating value equal to that of the conductors being joined.
- D. Type THW or THWN conductors may be connected directly to recessed fixtures only when the fixtures are equipped with outlet boxes listed by Underwriter's Laboratories, Inc. for use with wire having insulation rated for maximum operating temperatures of 75°C (167°F); otherwise, for fixtures not rated for 75°C directly connection, use 125°C insulated conductors from the fixture to an outlet box placed at least one (1) foot, but not more than four (4) feet from the fixture.
- E. Branch circuit home run numbers shown on the drawings shall be used as a guide for connection of circuit wiring to similarly number protective devices in branch circuit panelboards. Requests for changes in the plans shall be directed to the Engineer. No changes shall be made without approval from the Engineer.
- F. Each circuit shall be furnished with its own neutral conductor. There shall be no sharing of neutral conductors.
- G. In instances where a junction box, wireway, etc. contains three (3) or more branch circuits, the feeders shall be labeled within the junction box, wireway, etc. with circuit location, including panel name and breaker number. Labeling shall be neatly typed and affixed to each feeder. Labeling shall meet all applicable Code requirements.
- H. No more than three (3) 20A/1P circuits may be installed in a single conduit. Circuits may not share grounds or neutrals. Conductors sharing raceways shall be derated per table 310.15(B)(3)(a) of the NEC.

3.02 ELECTRICAL SERVICE GROUNDING

- A. Main electrical service equipment, conduit work, motors, panelboards and all other electrical equipment shall be effectively and permanently grounded. Grounding connections and conductor sizes shall be in accordance with requirements of the National Electrical Code, Article 250 and local or State ordinances.
- B. Provide as part of the service grounding system an ufer ground in the building slab. The ufer ground shall be 20' long bare #4 copper wire and bonded to the main service ground lug with a grounding electrode cable of the size indicated on the drawings.
- C. The building foundation steel and structural steel (if applicable) shall be connected to the service entrance ground lug with a grounding electrode cable of the size indicated on the drawings.
- D. All ground lugs shall be properly torqued, as per the gear manufacturer's instructions and

provide pictures of all ground connections to the Engineer for inspection before they are covered.

- E. All grounding connections shall be mechanically made. Cadweld style connections are not permitted.

3.03 EQUIPMENT GROUNDING

- A. All conduit entering panelboards shall be grounded to the panelboard by means of a grounding type locknut installed on the inside of the panelboard. Where the continuity of the metallic conduit system is interrupted by a section of non-metallic conduit, a separate grounding conductor, sized in accordance with NEC table 250.122 shall be installed in the conduit with the insulated conductors. A separate grounding conductor, as described above or as called for on the plans, shall be run in the conduit with the circuit conductors for all circuits serving multi-outlet assemblies.
- B. Conduit runs shall be increased in size where necessary to accommodate the grounding conductor in addition to circuit conductors. The grounding screw on all grounding type receptacles shall be securely grounded to the outlet box using a No. 12 green insulated conductor attached to the outlet box with lug screw.
- C. The grounding screw on all grounding type receptacles shall be securely grounded to the outlet box using a No. 12 green insulated conductor attached to the outlet box with lug screw. Ground screws shall be green.
- D. All switch legs shall include a green ground conductor connected to the circuit ground conductor and terminated in the switch outlet box.

3.04 CONDUIT - MATERIALS AND METHODS

- A. Conduit shall be installed as per NEC and NEMA regulations and the manufacturer's recommendations. Conduit shall be as follows:
- B. Rigid Aluminum Conduit shall be used for all conduits exposed to the weather, and underground conduit except where non-metallic conduit is specified or approved. Underground and under slab runs are to be watertight. All horizontal runs of underground conduit shall utilize rigid Aluminum elbows on vertical risers.
- C. All conduits routed underground shall not be placed in building slab. Conduits larger than 1" routed under building slab shall be routed below the vapor barrier. Minimum conduit size allowed to be routed underground shall be 3/4". Conduits routed under building slab may be PVC. All conduits rising vertically out of slab or out of ground shall be rigid steel.
- D. Non-metallic conduit, minimum schedule 40 PVC, shall be permitted to be installed underground. Non-metallic conduit shall not be used in any environmental air plenum. If PVC conduit is run, a full sized grounding conductor shall be pulled with the circuit conductors. PVC conduit shall not be run exposed. Where PVC conduit is run underground, it shall be encased in concrete or run minimum 24" below grade, or at the

depth below grade shown on the drawings.

- E. Flexible metal conduit or liquid-tight flexible metal conduit shall be used for the final connection of runs to motors. Flexible conduit shall be at least twelve (12) inches, but not more than 24 inches long without engineers approval. Where used, an external grounding conductor shall be run with conduit unless conductor is made as a part of the conduit.

3.05 CONDUIT - GENERAL

- A. Fittings for rigid Aluminum conduits shall be hot-dipped galvanized Aluminum and shall be of a type especially designed and manufactured for their purpose. Rigid conduit joints for single conduit runs shall be made with threaded fittings made tight with at least five threads fully engaged. Fittings for rigid non-metallic conduit shall be solvent welded.
- B. Where they enter boxes or cabinets that do not have threaded hubs, conduits shall be secured in place with galvanized locknuts inside and outside the cabinet and shall have bushings inside. Conduits larger than 1-1/4 inch shall have galvanized locknuts and galvanized bushings.
- C. All conduits shall be installed concealed or as indicated or scheduled on the drawings and shall be of sufficient size to accommodate the required number of insulated conductors including equipment grounding conductor where such grounding conductor is required or specified.
- D. Conduit runs shall be straight; elbows and bends shall be uniform, symmetrical and free from dents or flattening. Exposed conduits shall be installed with runs parallel or perpendicular to walls, ceilings or structural members and shall be located to avoid any conflicts with ceiling inserts.
- E. All conduits shall be cut square and reamed at the ends. The conduit system shall be complete and cleaned before any conductors are installed. Open ends of all conduits shall be capped until conductors are installed. A non-metallic fish wire shall be installed in all empty conduits. Empty conduit shall remain capped.
- F. Contractor shall refer to National Electrical Code Appendix C, Conduit and Tubing Fill Tables for Conductors and Fixture Wire of the Same Size. Contractor shall refer to the appropriate table for the conduit and wire condition and shall install wiring in accordance with code requirements.

3.06 SUPPORTS AND FITTINGS

- A. The Contractor shall furnish and install all supports for equipment under this contract. Supports shall be spaced at intervals of eight (8) feet maximum for rigid conduit as necessary to obtain rigid support. Perforated strap supports will not be permitted.
- B. All conduits shall be firmly secured with pipe clamps, conduit straps, or suspension hangers as appropriate. Fasten to steel with screws in tapped holes, to wood with wood screws, and to masonry with expansion anchors. Expansion anchors shall have a minimum pull out load of 1,200 pounds and an ultimate shear load of 1,950 pounds.

- C. All conduit, fixtures, and accessories shall be rigidly supported to form a firm, well-braced installation.
- E. Joints shall be made tight with standard galvanized or sheradized couplings; corners turned with fittings, elbows, or long radius bends.
- F. Setscrew conduit fittings shall not be permitted.

3.07 FLEXIBLE CONDUIT

- A. Flexible metal conduit may be used for short final connections to equipment where permitted by governing codes. Flexible metal conduit shall be sized and supported in accordance with Article 350 of the NEC or more stringent local codes. A separate equipment-grounding conductor sized in accordance with NEC Table 250.122 shall be installed in flexible conduit unless exceptions are allowed by governing codes and if the fittings used are UL listed for the purpose.
- B. Liquid-tight flexible metal conduit shall be used where flexible conduit is permitted and desired and conditions of installation, operation, or maintenance require protection from liquids, vapors, or solids and in other hazardous locations where specifically approved. Flexible conduit for all exterior motor connections shall be liquid tight. Liquid-tight flexible conduit shall be used with terminal fittings approved for the purpose.

3.08 WEATHERPROOF EQUIPMENT

- A. All disconnect switches, starters, and other electrical equipment located on the exterior of the building or exposed to the outside shall be enclosed in a NEMA 4X Stainless Steel enclosure. All lighting fixtures or other devices located on an exterior wall of the building shall be mounted on a flush-mounted, cast outlet box.
- B. All lighting fixtures or other devices located on an exterior wall of the building shall be mounted on a flush-mounted, cast outlet box.

3.09 UNDERGROUND CONDUIT

- A. Conduit run underground shall be routed at least 24" below top of grade. Conduit shall be securely supported on plastic spacers placed at intervals of 4' maximum and tied in place securely. Maintain 2" separation between conduits. Conduit joints shall be made up watertight to prevent the entrance of moisture. Provide warning tape approximately 12" above buried conduits.
- B. Horizontal portions of conduit installed underground 1" and larger may be schedule 40 PVC plastic. Vertical portions of underground conduit shall be rigid galvanized Aluminum with an approved metallic bushing at point of entry. Termination elbows shall be rigid galvanized Aluminum installed using a plastic-to-metal adapter. A full sized copper, grounding conductor shall be provided for the full length of each non-metallic conduit, terminated with an accessible connection to a ground lug on the cabinet or Aluminum conduit extension.

3.10 WEATHERPROOF EQUIPMENT

- A. All disconnect switches, starters, and other electrical equipment located on the exterior of the building or exposed to the outside shall be enclosed in a rain-tight enclosure.
- B. All lighting fixtures or other devices located on an exterior wall of the building shall be mounted on a flush-mounted, cast outlet box.

3.11 MOUNTING HEIGHTS

- A. Unless otherwise noted on the drawings, the following mounting heights apply:

Receptacles	4'-0"
Toggle Switches	4'-0"
Panelboards	6'-0" to top
Safety Switches	5'-0" to top
Motor Control Equipment	5'-0" to top

- B. Under permission of the Engineer, mounting heights may be adjusted to facilitate equipment arrangements. Dimensions above refer to the centerline of the device unless noted otherwise.

3.12 HOUSE KEEPING PADS

- A. All floor and ground mounted electrical equipment - panels, switchboards, motor control centers, transformers, etc. shall be installed with a reinforced concrete housekeeping pad, whether shown on the drawings or not. The pad shall extend 4" above either the finished floor or final grade (as applicable), have 45 degree chamfered edges, and be constructed of 3000psi concrete. The pad shall extend 3" beyond the edge of the respective electrical equipment.

END OF SECTION



DIVISION 16 – ELECTRICAL
SECTION 16200 - STANDBY POWER GENERATOR

PART 1.00 GENERAL

1.01 DESCRIPTION OF SYSTEM

- A. Provide a standby power system to supply electrical power in event of failure of normal supply, consisting of a liquid cooled engine, an AC alternator and system controls with all necessary accessories for a complete operating system, including but not limited to the items as specified hereinafter.
- B. Provide an automatic transfer switch described elsewhere in this specification so that the system comes on-line fully automatically, and on restoration of utility power automatically retransfers load to normal power, shuts down the generator and returns to readiness for another operating cycle.

1.02 REQUIREMENTS OF REGULATORY AGENCIES

- A. The electric generating system consists of a prime mover, generator, governor, coupling and all controls which must have been tested as a complete unit.
- B. Conform to current edition of the NEC and applicable inspection authorities.
- C. Transfer switch to be labeled under UL 1008.

1.03 QUALITY ASSURANCE

- A. This system shall be supplied by a manufacturer who has been regularly engaged in the production of engine-alternator sets, automatic transfer switches, and associated controls for a minimum of ten years, so there is one source of supply and responsibility.
- B. The manufacturer shall have printed literature and brochures describing the standard series specified, not a one of kind fabrication.
- C. The manufacturer shall maintain an authorized service center within 75 miles of the Project site, capable of providing training, parts, and emergency repairs.
- D. The basis for this specification is Cummins Power Generation and Generac Industrial equipment; approved equals may be considered if equipment performance is shown to meet the requirements herein.

1.04 WARRANTY

- A. Base Warranty: Manufacturer shall provide base warranty coverage on the material and workmanship of the generator set for a minimum of twenty-four (24) months for Standby product from registered commissioning and start-up.

1.05 SUBMITTALS

- A. Product Data: For each type of packaged engine generator indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. In addition, include the following:
 - 1. Thermal damage curve for generator.
 - 2. Time-current characteristic curves for generator protective device.
 - 3. Sound test data, based on a free field requirement.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, and location and size of each field connection.
 - 1. Dimensioned outline plan and elevation drawings of engine-generator set and other components specified.
 - 2. Wiring Diagrams: Control interconnection, Customer connections.
- C. Certifications:
 - 1. Submit statement of compliance which states the proposed product(s) is certified to the emissions standards required by the location for EPA, stationary emergency application.
- D. Warranty:
 - 1. Submit manufacturer's warranty statement to be provided for this Project.

PART 2.00 PRODUCTS

2.01 ENGINE-GENERATOR SET

- A. Factory-assembled and -tested, engine-generator set.
- B. Mounting Frame: Maintain alignment of mounted components without depending on concrete foundation; and have lifting attachments.
 - 1. Rigging Information: Indicate location of each lifting attachment, generator-set center of gravity, and total package weight in submittal drawings.
- C. Capacities and Characteristics:
 - 1. Power Output Ratings: Electrical output power rating for Standby operation of not less than 260kW, at 80 percent lagging power factor, 277/480V Wye, Three phase, 4-wire, 60 hertz for the Faubourg site. Electrical output power rating for Standby operation of not less than 50kW, at 80 percent lagging power factor, 120/240V Single phase, 3-wire, 60 hertz for the Post Oak site.
 - 2. Alternator shall be capable of recovering to a minimum of 90% of rated no load voltage. Following the application of the specified kVA load at near zero power factor applied to the generator set.
 - 3. Nameplates: For each major system component to identify manufacturer's name and address, and model and serial number of component. The engine-generator nameplate shall include information of the power output rating of the equipment.

D. Generator-Set Performance:

1. Steady-State Voltage Operational Bandwidth: 1.0 percent of rated output voltage from no load to full load.
2. Transient Voltage Performance: Not more than 11 percent variation for 50 percent step-load increase or decrease. Voltage shall recover and remain within the steady-state operating band within 3 seconds. On application of a 100% load step the generator set shall recover to stable voltage within 10 seconds.
3. Steady-State Frequency Operational Bandwidth: 0.5 percent of rated frequency from no load to full load.
4. Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there shall be no random speed variations outside the steady-state operational band and no hunting or surging of speed.
5. Transient Frequency Performance: Not more than 4 percent variation for 50 percent step-load increase or decrease. Frequency shall recover and remain within the steady-state operating band within 1 seconds. On application of a 100% load step the generator set shall recover to stable frequency within 10 seconds.
6. Output Waveform: At full load, harmonic content measured line to line or line to neutral shall not exceed 5 percent total and 3 percent for any single harmonic. Telephone influence factor, determined according to NEMA MG 1, shall not exceed 50.
7. Sustained Short-Circuit Current: (For engine-generator sets using a PMG-excited alternator) For a 3-phase, bolted short circuit at system output terminals, system shall supply a minimum of 300 percent of rated full-load current for not less than 8 seconds without damage to generator system components. For a 1- phase, bolted short circuit at system output terminals, system shall regulate both voltage and current to prevent over-voltage conditions on the non-faulted phases.
8. Start Time: Comply with NFPA 110, Level 1, Type 10, system requirements.
9. Ambient Condition Performance: Engine generator shall be designed to allow operation at full rated load in an ambient temperature under site conditions, based on highest ambient condition. Ambient temperature shall be as measured at the air inlet to the engine generator for enclosed units, and at the control of the engine generator for machines installed in equipment rooms.

2.02 ENGINE

- A. Fuel: Natural Gas
- B. Rated Engine Speed: 1800RPM.
- C. Lubrication System: The following items are mounted on engine or skid:
 1. Lube oil pump: shall be positive displacement, mechanical, full pressure pump.
 2. Filter and Strainer: Provided by the engine manufacturer of record to provide adequate filtration for the prime mover to be used.
 3. Crankcase Drain: Arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps, siphons, special tools, or appliances.

- D. Engine Fuel System: The engine fuel system shall be installed in strict compliance to the engine manufacturer's instructions
- E. Coolant Jacket Heater: Electric-immersion type, factory installed in coolant jacket system. Comply with NFPA 110 requirements for Level 1 equipment for heater capacity and performance.
 - 1. Designed for operation on a single 120 VAC, Single phase, 60Hz power connection. Heater voltage shall be shown on the project drawings.
 - 2. Installed with isolation valves to isolate the heater for replacement of the element without draining the engine cooling system or significant coolant loss.
 - 3. Provided with a 12VDC thermostat, installed at the engine thermostat housing
- F. Governor: Adjustable isochronous, with speed sensing. The governing system dynamic capabilities shall be controlled as a function of engine coolant temperature to provide fast, stable operation at varying engine operating temperature conditions. The control system shall actively control the fuel rate as appropriate to the state of the engine generator. Fuel rate shall be regulated as a function of starting, accelerating to start disconnect speed, accelerating to rated speed, and operating in various isochronous states.
- G. Cooling System: Closed loop, liquid cooled
 - 1. The generator set manufacturer shall provide prototype test data for the specific hardware proposed demonstrating that the machine will operate at rated standby load in an outdoor ambient condition of 50 deg C.
 - 2. Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anticorrosion additives as recommended by engine manufacturer.
 - 3. Size of Radiator overflow tank: Adequate to contain expansion of total system coolant from cold start to 110 percent load condition.
 - 4. Expansion Tank: Constructed of welded steel plate and rated to withstand maximum closed-loop coolant system pressure for engine used. Equip with gage glass and petcock.
 - 5. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.
 - 6. Duct Flange: Generator sets installed indoors shall be provided with a flexible radiator duct adapter flange.
- H. Muffler/Silencer: Selected with performance as required to meet sound requirements of the application, sized as recommended by engine manufacturer and selected with exhaust piping system to not exceed engine manufacturer's engine backpressure requirements. For generator sets with outdoor enclosures the silencer shall be inside the enclosure.
- I. Air-Intake Filter: Engine-mounted air cleaner with replaceable dry-filter element and restriction indicator.
- J. Starting System: 12 or 24V, as recommended by the engine manufacturer; electric, with negative ground.
 - 1. Components: Sized so they will not be damaged during a full engine-cranking cycle with ambient temperature at maximum specified in Part 1 "Project Conditions" Article.

2. Cranking Cycle: As required by NFPA 110 for level 1 systems.
3. Battery Cable: Size as recommended by engine manufacturer for cable length as required. Include required interconnecting conductors and connection accessories.
4. Battery Compartment: Factory fabricated of metal with acid-resistant finish.
5. Battery-Charging Alternator: Factory mounted on engine with solid-state voltage regulation. The battery charging alternator shall have sufficient capacity to recharge the batteries with all parasitic loads connected within 4 hours after a normal engine starting sequence.
6. Battery Chargers: Unit shall comply with UL 1236, provide fully regulated, constant voltage, current limited, battery charger for each battery bank. It will include the following features:
 - a. Operation: Equalizing-charging rate based on generator set manufacturer's recommendations shall be initiated automatically after battery has lost charge until an adjustable equalizing voltage is achieved at battery terminals. Unit shall then be automatically switched to a lower float-charging mode and shall continue to operate in that mode until battery is discharged again.
 - b. Automatic Temperature Compensation: Adjust float and equalize voltages for variations in ambient temperature from minus 20 deg C to plus 40 deg C to prevent overcharging at high temperatures and undercharging at low temperatures.
 - c. Automatic Voltage Regulation: Maintain constant output voltage regardless of input voltage variations up to plus or minus 10 percent.
 - d. Safety Functions: Sense abnormally low battery voltage and close contacts providing low battery voltage indication on control and monitoring panel. Sense high battery voltage and loss of ac input or dc output of battery charger. Either condition shall close contacts that provide a battery-charger malfunction indication at system control and monitoring panel.
 - e. Provide LED indication of general charger condition, including charging, faults, and modes. Provide a LCD display to indicate charge rate and battery voltage. Charger shall provide relay contacts for fault conditions as required by NFPA110.
 - f. Enclosure and Mounting: NEMA, Type 1, wall-mounted cabinet.

2.03 CONTROL AND MONITORING

- A. Engine generator control shall be microprocessor based and provide automatic starting, monitoring, protection and control functions for the unit.
- B. Automatic Starting System Sequence of Operation: When mode-selector switch on the control and monitoring panel is in the automatic position, remote-control contacts in one or more separate automatic transfer switches initiate starting and stopping of generator set. When mode-selector switch is switched to the on position, generator set starts. The off position of same switch initiates generator-set shutdown. (Switches with different configurations but equal functions are acceptable.) When generator set is running, specified system or equipment failures or derangements automatically shut down

generator set and initiate alarms. Operation of the local (generator set-mounted) and/or remote emergency-stop switch also shuts down generator set.

- C. Manual Starting System Sequence of Operation: Switching on-off switch on the generator control panel to the on position starts generator set. The off position of same switch initiates generator-set shutdown. When generator set is running, specified system or equipment failures or derangements automatically shut down generator set and initiate alarms. Operation of the local (generator set-mounted) and/or remote emergency-stop switch also shuts down generator set.
- D. Configuration: Operating and safety indications, protective devices, system controls, engine gages and associated equipment shall be grouped in a common control and monitoring panel. Mounting method shall isolate the control panel from generator-set vibration. AC output power circuit breakers and other output power equipment shall not be mounted in the control enclosure.
- E. Indicating and Protective Devices and Controls: As required by NFPA 110 for Level 1 system, and the following:
1. AC voltmeter (3-phase, line to line and line to neutral values).
 2. AC ammeter (3-phases).
 3. AC frequency meter.
 4. AC kVA output (total and for each phase). Display shall indicate power flow direction.
 5. Ammeter-voltmeter displays shall simultaneously display conditions for all three phases.
 6. Emergency Stop Switch: Switch shall be a red "mushroom head" pushbutton device complete with lock-out/tag-out provisions. Depressing switch shall cause the generator set to immediately stop the generator set and prevent it from operating.
 7. Fault Reset Switch: Supply a dedicated control switch to reset/clear fault conditions.
 8. DC voltmeter (alternator battery charging).
 9. Engine-coolant temperature gage.
 10. Engine lubricating-oil pressure gage.
 11. Running-time meter.
 12. Generator-voltage and frequency digital raise/lower switches. Rheostats for these functions are not acceptable. The control shall adjustment of these parameters in a range of plus or minus 5% of the voltage and frequency operating set point (not nominal voltage and frequency values.)
 13. AC Protective Equipment: The control system shall include over/under voltage, over current, short circuit, loss of voltage reference, and over excitation shut down protection. There shall be an overload warning, and overcurrent warning alarm.
 14. Status LED indicating lamps to indicate remote start signal present at the control, existing alarm condition, not in auto, and generator set running.
 15. A graphical display panel with appropriate navigation devices shall be provided to view all information noted above, as well as all engine status and alarm/shutdown conditions (including those from an integrated engine emission control system).

The display shall also include integrated provisions for adjustment of the gain and stability settings for the governing and voltage regulation systems.

16. Panel lighting system to allow viewing and operation of the control when the generator room or enclosure is not lighted.
 17. DC control Power Monitoring: The control system shall continuously monitor DC power supply to the control, and annunciate low or high voltage conditions. It shall also provide an alarm indicating imminent failure of the battery bank based on degraded voltage recover on loading (engine cranking).
- F. Common Remote Audible Alarm: Comply with NFPA 110 requirements for Level 1 systems. Include necessary contacts and terminals in control and monitoring panel.
1. Overcrank shutdown.
 2. Coolant low-temperature alarm.
 3. Control switch not in auto position.
 4. Battery-charger malfunction alarm.
 5. Battery low-voltage alarm.
- G. Remote Alarm Annunciator: Comply with NFPA 110. An LED labeled with proper alarm conditions shall identify each alarm event and a common audible signal shall sound for each alarm condition.

2.04 GENERATOR, EXCITER, AND VOLTAGE REGULATOR

- A. Comply with NEMA MG 1.
- B. Drive: Generator shaft shall be directly connected to engine shaft. Exciter shall be rotated integrally with generator rotor.
- C. Electrical Insulation: Class H
- D. Temperature Rise: 105 / Class H environment.
- E. Construction shall prevent mechanical, electrical, and thermal damage due to vibration, over speed up to 125 percent of rating, and heat during operation at 110 percent of rated capacity.
- F. Permanent Magnet Generator (PMG) shall provide excitation power for optimum motor starting and short circuit performance.
- G. Enclosure: Drip-proof.
- H. Voltage Regulator: SCR type, Separate from exciter, providing performance as specified. The voltage regulation system shall be microprocessor-controlled, full wave rectified, and provide a pulse-width modulated signal to the exciter. No exceptions or deviations to these requirements will be permitted.

- I. The alternator shall be provided with anti-condensation heater(s) in all applications where the generator set is provided in an outdoor enclosure, or when the generator set is installed in a coastal or tropical environment.
- J. Windings: Two-thirds pitch stator winding and fully linked amortisseur winding.
- K. Subtransient Reactance: 15 percent maximum, based on the rating of the engine generator set.

2.05 OUTDOOR GENERATOR-SET ENCLOSURE

- A. Description: Sound Attenuated Aluminum housing. Multiple panels shall be lockable and provide adequate access to components requiring maintenance. Instruments, control, and battery system shall be mounted within enclosure.
- B. Construction:
 - 1. Hinged Doors: With padlocking provisions. Restraint/Hold back hardware to prevent door to keep door open at 180 degrees during maintenance. Rain lips over all doors.
 - 2. Exhaust System:
 - a. Muffler Location: Within enclosure.
 - 3. Hardware: All hardware and hinges shall be stainless steel.
 - 4. Wind Rating: Wind rating shall be 150 mph
 - 5. Mounting Base: Suitable for mounting on housekeeping pad.
 - 6. A weather protective enclosure shall be provided which allows the generator set to operate at full rated load with a static pressure drop equal to or less than 0.5 inches of water.
- C. Engine Cooling Airflow through Enclosure: Housing shall provide ample airflow for engine generator operation at rated load in an ambient temperature of 50 deg C.
- D. Sound Performance: Reduce the sound level of the engine generator while operating at full rated load to a maximum of 72 dBA measured at any location 7 m from the engine generator in a free field environment.
- E. Site Provisions:
 - 1. Lifting: Complete assembly of engine generator, enclosure shall be designed to be lifted into place as a single unit, using spreader bars.

2.06 VIBRATION ISOLATION DEVICES

- A. Vibration Isolation: Generators installed on grade shall be provided with elastomeric isolator pads integral to the generator, unless the engine manufacturer requires use of spring isolation.

2.07 FINISHES

- A. Indoor and Outdoor Enclosures and Components: Powder-coated and baked over corrosion-resistant pretreatment and compatible primer. Manufacturer's standard color or as directed on the drawings.

2.08 SOURCE QUALITY CONTROL

- A. Prototype Testing: Factory test engine-generator set using same engine model, constructed of identical or equivalent components and equipped with identical or equivalent accessories.
 - 1. Tests: Comply with NFPA 110, Level 1 Energy Converters. In addition, the equipment engine, skid, cooling system, and alternator shall have been subjected to actual prototype tests to validate the capability of the design under the abnormal conditions noted in NFPA110. Calculations and testing on similar equipment which are allowed under NFPA110 are not sufficient to meet this requirement.
- B. Project-Specific Equipment Tests: Before shipment, factory test engine-generator set manufactured specifically for this Project. Perform tests at rated load and power factor. Include the following tests:
 - 1. Test engine generator set manufactured for this Project to demonstrate compatibility and functionality.
 - 2. Full load run.
 - 3. Maximum power.
 - 4. Voltage regulation.
 - 5. Steady-state governing.
 - 6. Single-step load pickup.
 - 7. Simulated safety shutdowns.
 - 8. Provide 14 days' advance notice of tests and opportunity for observation of tests by Owner's representative.

2.09 AUTOMATIC TRANSFER SWITCH

- A. The automatic transfer switch shall be furnished by the manufacturer of the engine-generator set so as to maintain system compatibility and local service responsibility for the complete emergency power system. It shall be listed by Underwriter's Laboratory, Standard 1008 with circuit breaker protection. Representative production samples of the transfer switch supplied shall have demonstrated through tests the ability to withstand at least 10,000 mechanical operation cycles. One operation cycle is the electrically operated transfer from normal to emergency and back to normal. Wiring must comply with NEC table 373-6(b). The manufacturer shall furnish schematic and wiring diagrams for the particular automatic transfer switch and a typical wiring diagram for the entire system.
- B. The automatic transfer switch shall be rated for 500 amperes continuous operation at the Faubourg site and 225 amperes continuous operation at the Post Oak site in ambient temperatures of -40 Degrees Fahrenheit (-40 Degrees Celsius) to +122 Degrees Fahrenheit (+50 Degrees Celsius) and shall be service entrance listed. Main power switch contacts shall be rated for 240 Volt AC minimum at the Post Oak site and 600 Volt AC

minimum at the Faubourg site. Where the line side overcurrent protection is provided by circuit breakers, the short circuit withstand and closing ratings shall be 65,000 amperes RMS. These RMS symmetrical fault current ratings shall be the rating listed in the UL listing or component recognition procedures for the transfer switch. All withstand tests shall be performed with the overcurrent protective devices located external to the transfer switch.

- C. The transfer switch shall be double throw construction, positively electrically and mechanically interlocked to prevent simultaneous closing and mechanically held in both normal and emergency positions. Independent break before make action shall be used to positively prevent dangerous source to source connections. When switching the neutral, this action prevents the objectionable ground currents and nuisance ground fault tripping that can result from overlapping designs. The transfer switch shall be approved for manual operation. The electrical operating means shall be by electric solenoid. Every portion of the contactor is to be positively mechanically connected. No clutch or friction drive mechanism is allowed, and parts are to be kept to a minimum. This transfer switch shall not contain integral overcurrent devices in the main power circuit, including molded case circuit breakers or fuses.
- D. The transfer switch electrical actuator shall have an independent disconnect means to disable the electrical operation during manual switching. Maximum electrical transfer time in either direction shall be 160 milliseconds, exclusive of time delays. Main switch contacts shall be high pressure silver alloy contacts to resist burning and pitting for long life operation.
- E. There shall be two SPDT, 10 ampere, 250 volt auxiliary switches on both normal and emergency sides, operated by the transfer switch. Full rated neutral bar with lugs for normal, emergency and load conductors shall be provided inside the cabinet.
- F. All control equipment shall be mounted on the inside of the cabinet door in a metal lockable enclosure with transparent safety shield to protect all solid state circuit boards. This will allow for ease of service access when main cabinet lockable door is open, but to prevent access by unauthorized personnel. Control boards shall have installed cover plates to avoid shock hazard while making control adjustments. The solid state voltage sensors and time delay modules shall be plug-in circuit boards with silver or gold contacts for ease of service.
- G. A solid state undervoltage sensor shall monitor all phases of the normal source and provide adjustable ranges for field adjustments for specific application needs. Pick-up and drop-out settings shall be adjustable from a minimum of 70% to a maximum of 95% of nominal voltage. A utility sensing interface shall be used, stepping down line voltage to 24VAC, helping to protect the printed circuit board from voltage spikes and increasing personnel safety when troubleshooting.
- H. The control unit shall signal the engine-generator set to start in the event of a power interruption. A set of contacts shall close to start the engine and open for engine shutdown. A solid state time delay start (adjustable, .1 to 10 seconds) shall delay this signal to avoid nuisance start-ups on momentary voltage dips or power outages.

- I. The control units shall transfer the load to the engine-generator set after it reaches proper voltage and frequency. A solid state time delay (adjustable, 5 seconds-3 minutes) shall delay this transfer to allow the engine-generator to warm-up before application of load. There shall be a switch to bypass this warm-up timer when immediate transfer is required.
- J. The controller shall retransfer the load to the line after normal power restoration. A return to utility timer (adjustable, 1-30 minutes) shall delay this transfer to avoid short term normal power restoration.
- K. The operating power for transfer and retransfer shall be obtained from the source to which the load is being transferred. Controls shall provide an automatic retransfer of the load from emergency to normal if the emergency source fails with the normal source available.
- L. The control shall signal the engine-generator to stop after the load retransfers to normal. A solid state engine cool down timer (adjustable, 1-30 minutes) shall permit the engine to run unloaded to cool down before shutdown.
- M. Provide an engine minimum run timer (adjustable, 5-30 minutes) to ensure an adequate engine run period.
- N. Provide a solid state plant exercise clock to start the generator set exercise period. Clock shall have a one week cycle and be powered by the load side of the transfer switch. A battery must be supplied to maintain the circuit board clock operation when the load side of the transfer switch is de-energized. Include a switch to select if the load will transfer to the engine-generator set during the exercise period.
- O. Control shall include a digital display interface enabling the operator to establish unit exercise time within a twenty four hour period. Additional switch settings enable any combination of days within a week for unit exercise. This control is completely self-contained, eliminating the need for the operator to handle pins and jumper wires.
- P. Front mounted controls shall include a selector switch to provide for a NORMAL TEST mode with full use of time delays, FAST TEST mode which bypasses all time delays to allow for testing the entire system in less than one minute, or AUTOMATIC mode to set the system for normal operation.
- Q. Provide bright lamps to indicate the transfer switch position in either UTILITY (white) or EMERGENCY (red). A third lamp is needed to indicate STANDBY OPERATING (amber). These lights must be energized from utility or the engine-generator set.
- R. Provide a manual operating handle to allow for manual transfer. This handle must be mounted inside the lockable enclosure so accessible only by authorized personnel.
- S. Provide LED status lights to give a visual readout of the operating sequence. This shall include utility on , engine warmup, engine warmup bypass, standby voltage "ready", standby frequency "ready", standby on, transfer to standby, inphase monitor, time delay neutral, return to utility, engine cool down, engine minimum run and fast test mode.

- T. The transfer switch mechanism and controls are to be mounted in a NEMA 4X enclosure.

PART 3.00 EXECUTION

3.01 INSTALLATION

- A. Comply with packaged engine-generator manufacturers' written installation, application, and alignment instructions and with NFPA 110.
- B. Equipment shall be installed by the contractor in accordance with final submittals and contract documents. Installation shall comply with applicable state and local codes as required by the authority having jurisdiction. Install equipment in accordance with manufacturer's instructions and instructions included in the listing or labeling of UL listed products.
- C. Installation of equipment shall include furnishing and installing all interconnecting wiring between all major equipment provided for the on-site power system. The contractor shall also perform interconnecting wiring between equipment sections (when required), under the supervision of the equipment supplier.
- D. Equipment shall be installed on concrete housekeeping pads. Equipment shall be permanently fastened to the pad in accordance with manufacturer's instructions and seismic requirements of the site.
- E. Equipment shall be initially started and operated by representatives of the manufacturer. All protective settings shall be adjusted as instructed by the consulting engineer.
- F. All equipment shall be physically inspected for damage. Scratches and other installation damage shall be repaired prior to final system testing. Equipment shall be thoroughly cleaned to remove all dirt and construction debris prior to initial operation and final testing of the system.
- G. On completion of the installation by the electrical contractor, the generator set supplier shall conduct a site evaluation to verify that the equipment is installed per manufacturer's recommended practice.

3.02 ON-SITE ACCEPTANCE TEST

- A. The complete installation shall be tested to verify compliance with the performance requirements of this specification following completion of all site work. Testing shall be conducted by representatives of the manufacturer, with required fuel supplied by Contractor. The Engineer shall be notified in advance and shall have the option to witness the tests. The generator set manufacturer shall provide a site test specification covering the entire system. Tests shall include:
- B. Prior to start of active testing, all field connections for wiring, power conductors, and bus bar connections shall be checked for proper tightening torque.

- C. Installation acceptance tests to be conducted on site shall include a "cold start" test, a two hour full load (resistive) test, and a one-step rated load pickup test in accordance with NFPA 110. Provide a resistive load bank and make temporary connections for full load test, if necessary.
- D. Perform a power failure test on the entire installed system. This test shall be conducted by opening the power supply from the utility service and observing proper operation of the system for at least 2 hours. Coordinate timing and obtain approval for start of test with site personnel.

3.03 TRAINING

- A. The equipment supplier shall provide training for the facility operating personnel covering operation and maintenance of the equipment provided. The training program shall be not less than 4 hours in duration and the class size shall be limited to 5 persons. Training date shall be coordinated with the facility owner.

3.04 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

3.05 SERVICE AND SUPPORT

- A. The generator set supplier shall maintain service parts inventory for the entire power system at a central location which is accessible to the service location 24 hours per day, 365 days per year. The inventory shall have a commercial value of \$3 million or more. The manufacturer of the generator set shall maintain a central parts inventory to support the supplier, covering all the major components of the power system, including engines, alternators, control systems, paralleling electronics, and power transfer equipment.
- B. The generator set shall be serviced by a local service organization that is trained and factory certified in generator set service. The supplier shall maintain an inventory of critical power system replacement parts in the local service location. Service vehicles shall be stocked with critical replacement parts. The service organization shall be on call 24 hours per day, 365 days per year. The service organization shall be physically located within 50 of the site.
- C. The manufacturer shall maintain model and serial number records of each generator set provided for at least 20 years.

END OF SECTION



DIVISION 16 - ELECTRICAL
SECTION 16400 - SERVICE AND DISTRIBUTION

PART 1.00 GENERAL

1.01 SYSTEM VOLTAGE

- A. The service shall be rated 120/240 Volt, 1-phase, 3-wire at the Post Oak site and 277/480 Volt, 3-phase, 4-wire at the Faubourg site as shown on the Drawings.

1.02 TERMINATIONS

- A. All wiring shall be sized based on 75°C rated conductors. All connectors shall be rated for 75°C in accordance with N.E.C. Article 110-14 requirements.

PART 2.00 PRODUCTS

2.01 SAFETY SWITCHES

- A. Furnish and install safety switches as shown on the Drawings. All switches shall be fused NEMA 4X Stainless Steel Heavy Duty Type HD and Underwriter's Laboratories listed. All switches shall have blades that are fully visible in the "OFF" position with the door open. Switches shall be dead-front construction with permanently attached arc suppressers. Lugs shall be UL listed for copper and aluminum conductor and front removable. All current carrying parts shall be plated to resist corrosion. Switches shall be quick-make, quick-break type. During operation of the switch, the movable contacts shall not be able to be restrained by the handle once the closing or the opening action of the contacts has been initiated. Switches shall have cover interlocks to prevent opening of the switch door while the switch is in the "ON" position or closing the switch with the door open. Switch shall have padlocking capabilities in the "OFF" position.
- B. Safety switches shall be rated 600 volts for 480 volt service and rated 240 volts for 208 volt service. Switches shall be motor rated when used for motor loads. Switches shall be NEMA 1 enclosed for indoor applications and NEMA 4X Stainless Steel for outdoor or wet area locations.
- C. Switches used for service entrance shall be service entrance rated. Safety switches shall be furnished complete with fuses.
- D. Safety switches shall be Square D Heavy Duty Class 3110 type, Eaton Heavy Duty type, or prior approved equal.

2.02 FUSES

- A. All fuse holders shall be provided with dual-element, time-lag fuses as scheduled on the Drawings or as recommended by the equipment manufacturer. Fuses shall be rated 200,000 AIC. Fuses shall be Buss Fusetron, Economy Econ, or Gould Shawmut Tri-Onic for component protection and Buss Limitron, Economy Econolin, or Gould Shawmut Amp-Trap for circuit protection.

2.03 CIRCUIT BREAKER PANELBOARDS

- A. Panelboards shall be sized as shown on the drawings and schedules, and shall be the bolted breaker panelboard type. Panelboards shall have copper bussing. Loadcenters shall not be permitted.
- B. All branch breakers are to be quick-make, quick-break (over center toggle device) with trip indication and common trip on all multiple breakers. Trip indication shall be clearly shown by breaker handle taking a position between "ON" and "OFF" position. Breakers shall be ambient compensated to carry full NEC load in 120 degree F room temperature. Panelboards shall have distributed phase busing throughout. Any two adjacent single pole breakers shall be replaceable by a two pole breaker, and any three adjacent single pole breakers shall be replaceable by a three pole breaker.
- C. Minimum interrupting capacity of breakers shall be as shown on panel schedules. No breakers shall be rated less than 10,000 RMS symmetrical amperes.
- D. Branch breakers shall be numbered 1, 3, 5, etc. from top to bottom beginning at the top of the left hand column so that #1 shall be on phase A, #3 on phase B, and #5 on phase C.
- E. All breakers shall be bolt on type. Panelboards for 120/208 volt or 120/240 volt service shall be Square D type NQ, Eaton Pow-R-Line series, or prior approved equal. Panelboards for 277/480 volt service shall be Square D type NEHB, Eaton Pow-R-Line series, or prior approved equal.

2.04 DRY TYPE TRANSFORMERS

- A. Contractor shall install dry type transformer(s) in the size and at the location(s) as shown on the drawings. Transformers will be used to step down voltage from 480 volts to 120/208 volts. All transformers shall comply and must be tested in accordance with UL, NEMA and ANSI standards. Transformers shall be energy efficient and shall meet NEMA Standard TP-1 requirements.
- B. Transformers shall have the KVA ratings shown on the drawings. Transformers shall be three phase type rated for 480 volts primary and 120/208 volt secondary as shown on the drawings. Transformers shall be self-cooled. When transformer is delivering full KVA load continuously, temperature rise shall not exceed 150 degrees C above a 40 degree C ambient with 200 degrees C temperature class insulation system. The average sound level shall not exceed NEMA standards. Transformers shall have four external type taps, two 2-1/2% FCBN and two 2-1/2% FCAN. Windings shall be copper.
- C. Transformers rated larger than 112.5KVA shall be provided with Class 155 or higher insulation system and shall be completely enclosed except for ventilating openings. Transformers larger than 112.5KVA shall comply with NEC Article 450.21(B) Exception No. 2, to allow transformers to be installed inside non fire rated rooms.
- D. Transformers shall be floor mounted on isolation pads. Enclosure shall be heavy gauge steel with ventilation openings protected against falling dirt and drip, and shall be shielded

against actual touching of live parts. A nameplate in accordance with NEMA standards shall be permanently affixed to the enclosure.

- E. Transformers shall be equal to Square D Class 7400 Dry Type, Eaton DT-3 Series, or prior approved equal.

PART 3.00 EXECUTION

3.01 COORDINATION

- A. Contractor shall coordinate all service and distribution work with other crafts on the project.

3.02 TEST AND BALANCING

- A. At such times as the Architect directs, the Contractor shall conduct in the Architect's presence operating tests to demonstrate the electrical systems are installed and will operate properly and in accordance with the requirements of the specifications. The Contractor shall furnish instruments and personnel required for such tests. Any work that is found to be defective, or material that are found to vary from the requirements of the drawings or specifications shall be replaced by the Contractor without additional cost of the Owner.

3.03 EMERGENCY CIRCUITS

- A. All wiring for emergency power and lighting circuits shall be run in conduits independent of all other circuits or conductors. Emergency circuit installations shall be made in accordance with National Electrical Code Article 700.9.

3.04 EQUIPMENT FUSING

- A. All equipment shall be furnished complete with fuses as described herein and/or as shown on the Drawings. Contractor shall furnish one set of spare fuses for each size fuse furnished on the project. Fuses shall be delivered to Owner prior to acceptance of project.
- B. Fusing for protective equipment shall be of the type specifically designed for the intended application. Fuses for service entrance rated equipment shall be Class L. Fuses for branch circuit protection shall be Class RK5 unless specified otherwise. Provide protective fuses as specifically required by the equipment manufacturer.

3.05 INSTALLATION

- A. The Electrical Contractor shall place a sign at the Main Switchboard indicating the type and location of the emergency generator in accordance with National Electrical Code Article 702.8(A) requirements.
- B. Disconnecting means shall be provided for each motor and motor controller, and shall be located within sight from the controller and motor locations in accordance with National

Electrical Code Article 430.102 requirements.

END OF SECTION



DIVISION 16 - ELECTRICAL
SECTION 16900 - PROCESS INSTRUMENTATION AND CONTROL

PART 1.00 GENERAL

1.01 WORK INCLUDED

The work covered under this section of the specifications includes the furnishing and installing of all instrumentation and control hereinafter specified to perform the intended function for the Faubourg stie.

1.02 RELATED WORK

- A. Section 16050 – Basic Electrical Material and Methods
- B. Division 11 Specifications

PART 2.00 PRODUCTS

2.01 SYSTEM SUPPLIER

- A. All instrumentation and control systems equipment shall be furnished by a System Supplier. The System Supplier shall provide and be responsible for the proper operation of all Process Instrumentation and Controls and Control Panels. The System Supplier shall perform in house submittal drawings and assembly of products. Subcontracting submittal drawings and equipment assembly will not be permitted.
- B. Substitutions of functions or equipment specified will not be acceptable.
- C. The entire system shall be warranted for one year from date of substantial completion.
- D. The Contractor shall assign full responsibility for the function operation of all new instrumentation and control systems to a System Supplier. This System Supplier shall be responsible for all coordination necessary in order to select, to furnish, to supervise installation and connections, to calibrate, and to place into operation all instrumentation and controls along with all other equipment and accessories as specified herein. The System Supplier shall be a licensed electrical contractor in the state of Louisiana.
- E. The System Supplier shall be one of established favorable reputation who has designed and produced similar systems and components for a period of at least (10) ten years.
- F. It shall be required of the System Supplier to execute and submit a guarantee to assume full responsibility as defined in Section 2.01, paragraph 'A' above. It is the duty of the Contractor to include this guarantee with his Bidding Documents.
- G. Only the guarantee of the System Supplier whose name the Contractor has inserted in his Bidding Documents is required. Failure by a System Supplier to provide a written guarantee with his proposal shall be deemed by the Contractor as "NO BID" and that System Supplier will not be acceptable. The written guarantee shall be on the named System Supplier's letterhead and shall be signed by a responsible representative who will

be primarily involved in the fulfillment of this guarantee. The written guarantee shall be stated as follows:

“... (Name of Single Source System Supplier)...guarantees that the proposal offered provides for complete compliance with all requirements of this section of the project specifications without exceptions to these specifications.

Full responsibility will be placed upon... (Name of Single Source System Supplier)...for all coordination necessary to select, to furnish, to supervise installation and connections, to calibrate, and to place into operation Process Instrumentation and Controls, Control Panels, and all other equipment and accessories needed to provide a complete operating system to comply with requirements of this section of the project specifications.

... (Name of Single Source System Supplier)... guarantees to provide all submittal drawings, instruction manuals, and qualified personnel for specified field services and training, all as defined within this section of the project specifications.”

... (Name of Single Source System Supplier)... is a licensed electrical contractor in the state of Louisiana; Certificate of Responsibility No. _____, name of qualifying party ;

Guarantee on system function and equipment shall be one (1) year from date of substantial completion or partial acceptance.

2.02 SUBMITTAL DRAWINGS

- A. Descriptive literature and drawings for equipment and systems being furnished under this section shall be included in two submittals as a maximum. If two submittals are made, the first shall include all primary devices, transmitters, sensors, and field mounted equipment. The second submittal will include the balance of the submittal required. The submittal shall include as a minimum, equipment specifications, dimensional drawings, flow and other calculations, schematic drawings of each and every system within the complete offering, and such other information requested by the Engineer or considered necessary to the proper installation of the equipment. Furnish submittals in a Bound Booklet Form 8.5” X 11”. No sheets shall be larger than 8.5” X 11”. Foldout larger sheets will not be acceptable. This submittal shall include coordinated information and drawings for all items that the Single Source System Supplier is required to furnish under this section of the specifications, all in one integrated and coordinated manual. Each item of a submittal shall carry the appropriate title and be indexed against the appropriate specification item.
- B. A quantity of eight (8) sets of submittals shall be furnished for the Engineer's approval.

2.03 INSTRUCTION MANUALS

Prior to 65% of the value of job completion, System Supplier shall furnish two (2) copies to the Engineer and one (1) copy to the Owner of all descriptive matter and complete system operation instruction manuals in separate indexed binders coordinated with the equipment that is furnished and installed for approval. System Supplier shall incorporate Engineer's comments and resubmit for approval within thirty (30) days of receipt of Engineer's comments. Once final approval is

obtained, System Supplier shall furnish two (2) copies to the Owner and two (2) to the Engineer.
2.04 RELATED SYSTEM COMPONENTS

The attention of the System Supplier is called to sections concerned with electrical work, chemical feeders, valves, piping, etc., and such other devices not specified under this section, but related to it.

PART 3 CONTROL PANEL SPECIFICATIONS

3.01 GENERAL

- A. Enclosure shall be constructed of 12-gauge stainless steel. Seams shall be continuously welded and ground smooth without holes or knockouts. Provide a seamless foam-in-place oil-resistant gasket to assure water tight and dust tight seal. Provide a rolled lip around three sides of door and all sides of enclosure opening to exclude liquids and contaminants. Provide an internal 3-point latch and padlocking powerglide handle to assure security and a water-tight seal while still allowing convenient access. Door shall be removable by pulling a stainless steel continuous hinge pin. Double-door enclosures shall come complete with twelve-inch (12") stainless steel floor stands welded to the enclosure. Enclosure shall be factory painted with white polyester powder paint inside and out over pretreated surfaces. The enclosure shall be rated NEMA Type 4X and be manufactured by Hoffman, Saginaw Control & Engineering (SCE) or approved equal. Enclosure backplate shall be a minimum of 12-gauge steel, finished with white polyester powder paint or a conductive, corrosion-resistant coating.
- B. All power and control wires shall be stranded copper type MTW. All wiring shall be in covered plastic wireway.
- C. All points necessary for external connection in the controller, whether power or control, shall be wired to a terminal strip located at the top or bottom of the enclosure as directed by the engineer. The terminal strip shall be permanently marked with the same designation as the wire connected to it.
- D. All power and control wires shall be marked at both ends using self-adhering wire markers. No two wires having different functions within the control panel shall have the same markings.
- E. All circuit breakers, starters, and other control devices mounted within the controller panel shall be labeled for identification both within the panel and on the wiring schematic with corresponding designations.
- F. Control power shall be 120 volts and shall be protected by a correctly sized circuit breaker. If required, provide a properly sized control power transformer with primary over current protection.
- G. Each starter shall be provided with overload protection in all three phases and each individual starter shall have phase failure protection.
- H. All selector switches, pilot lights and control devices shall be visible and operable from the

Controller exterior door or an interior deadfront panel when required. The deadfront panel shall be constructed of anodized aluminum and shall have a continuous aluminum hinge. An anodized aluminum deadfront shall be utilized when the Controller environment is not conducive to exposed controls or as specified on drawings.

- I. All approval drawings shall be prepared per J.I.C. standards for engineers review prior to any fabrication of control equipment. The Controller shall be produced by a UL 508 listed shop. Proof of label availability shall be submitted with above drawing.
- J. The controller manufacturer shall provide a written warranty with approval drawings covering all Control materials and parts furnished for a period ending one year after final acceptance of the project. This warranty shall cover all material replacement, all labor, and all travel expenses.
- K. The controller manufacturer shall show satisfactory evidence that he maintains a fully equipped factory organization capable of furnishing adequate service for the equipment furnished, including replacement parts within a 200-mile radius of the job site. Suppliers employing outside organizations for "ON CALL" service shall not be considered.
- L. The controller manufacturer shall have a service department capable to respond in emergency condition twenty-four/seven and three-hundred sixty-five days a year (24/7/365).
- M. The quality establishing brand for the control panel(s) shall be that as manufactured by Control Systems, Inc. of Jackson, MS.

3.02 TRIPLEX LIFT STATION CONTROL PANEL

- A. SERVICE ENTRANCE: The control panel shall be designed for 277/480-volt, three-phase, four-wire power. The control panel shall be rated NEMA 4X, as indicated on drawing.
- B. MAIN BREAKER: Provide a properly sized Main Breaker, as shown on the drawings. In addition, provide a through the door operator mounted on the interior deadfront. The operator shall prevent the deadfront from being opened while the breaker is in the "ON" position.
- C. POWER DISTRIBUTION BLOCKS: Provide properly sized Power Distribution Block(s) (PDB), as required for the control panel. Power distribution blocks shall be UL Listed and rated for the voltage and ampere rating as required; manufactured by Marathon, Square D, or approved equal. Provide necessary lugs for service entrance neutral.
- D. MISCELLANEOUS FEEDER BREAKERS: Provide a 60-amp, 480-volt, 3-pole feeder breaker to feed the external Main Surge Protection Device.
- E. POWER MONITOR: Provide a service entrance rated Power Monitor (PM), per Component Specifications. Power monitor shall constantly monitor the three-phase voltages to detect harmful power line conditions, caused by single-phasing, low voltage, phase reversal, and voltage unbalance. When a harmful condition is detected, no three-phase motors shall be allowed to operate. Phase monitor shall be protected by 1 amp,

480-volt fuses on the primary side.

- F. PUMPS NO.1, NO.2 AND NO.3: Provide a combination circuit breaker and externally mounted Variable Frequency Drive starter (VFD), per Component Specifications, for each pump. The Variable Frequency Drive shall come complete with an externally mounted 5% Line and Load Reactor (LR), “**if required,**” per Component Specifications, to attenuate harmonics and provide protection from transients. Acceptable VFD manufactures shall be Allen-Bradley Power Flex 753, Danfoss VLT Aqua, Invertek Optidrive or approved equal. The Full Load Amperes (FLA) of the variable frequency drive **must be** greater than the Full Load Amperes of the motor horsepower being furnished. The **Contractor** must use properly sized cable with ground from the starter to the motor. Motor cable ground conductor shall land on a terminal on the VFD, per VFD manufacturer’s requirements. The VFD keypad shall be accessible through or installed on the deadfront door of the control panel. In addition, provide the following additional equipment and controls:
1. The pumps shall be controlled by a Quadraplex Pump Controller (QC1-3), per Component Specifications. The controller shall be capable of operating with float switches or a level controller with dry contact outputs for All-Stop, Lead Start, Lag 1 Start and Lag 2 Start during normal operation. In the automatic mode, the Quadraplex Pump Controller shall receive stop and start commands from the Level Meter/Controller, submersible transducer and back-up float switches, all as described below. All pumps shall be exercised uniformly. The frequency drive controller (FDC1-3) shall balance pump speeds based on the number of pumps running and level of liquid in wet pit. The Quadraplex Pump Controller shall provide variable delays for Power-On, Motor Failure, Motor Start, and Short Cycle. Field adjustable motor failure delays shall be provided in the range of five (5) seconds to five (5) minutes. Adjustable power-on delay shall also be included for the pump during initial startup or after a power failure. The Quadraplex Pump Controller shall be a standard, catalogued product of a water and wastewater automation equipment manufacturer regularly engaged in the design and manufacture of such equipment for a period of at least fifteen (15) years. In addition, perform all control functions as specified in Component Specifications Section. The Quadraplex Controller shall have the following operators and indicators:
 - a. Manual-Off-Automatic selector switch
 - b. Green “Running” LED
 - c. Red “Failure” LED
 - d. Green pump “Start” pilot lights for Lead Lag.
 - e. Amber pump “Stop” pilot lights for Lead Lag.
 2. Provide a Quadraplex Alarm Telemetry system (QCAT), per Component Specifications, for the Quadraplex Controller, which provides auxiliary normally open relay contact outputs for the following quadraplex controller alarms: auxiliary alarm, improper sequence, Motor No.1 Failure, Motor No.2 Failure, Motor No.3 Failure, Motor No.4, Failure Motor No.1 Seal Failure, Motor No.2 Seal Failure, Motor No.3 Seal Failure, Motor No.4 Seal Failure, Improper Sequence, One (1) Auxiliary Contact, and High Level or Flow. Alarm telemetry system shall be capable of integrating with a customer furnished future alarm dialer, SCADA

system, FUTURE telemetry equipment, etc.

3. Provide a Motor Monitors (MM-1, MM-2 and MM-3) complete with properly sized Current Transformer, both per Component Specifications. The Motor Monitor shall provide a positive run signal, monitor motor running current, and indicate motor running time and motor full load running amperes. In addition, the motor monitor shall come complete with high and low amperes set points for the pump.
- G. VARIABLE FREQUENCY DRIVE CONTROLLER: Provide a Frequency Drive Controller (FDC1-3), per Component Specifications. The frequency drive controller shall balance pump speeds based on the level of liquid in the wetwell. The operator shall be able to select a signal level at which point the VFD(s) will operate at minimum speed and a signal level at which point the VFD(s) will operate at maximum speed when the controller is receiving a positive motor running signal for at least one motor. As the input signal increases from the minimum setting to the maximum setting, the VFD(s) shall increase in speed linearly. The operator shall be able to select individual minimum and maximum speed settings with one or more motors operating. All control setpoints shall be field adjustable throughout the complete signal range from the front of the controller. Setpoints shall be displayed on a digital readout at any time via pushbutton.
- H. LEVEL METER/CONTROLLER: Provide a Level Meter/Controller, (LMC-WW), per Component Specifications. All control setpoints shall be field adjustable throughout the complete signal range from the front of the meter/controller. Setpoints shall be displayed on a digital readout at any time via pushbutton. The setpoints shall be field adjustable to operate on rising above or falling below the desired setpoint. The Level Meter/Controller shall be a standard, catalogued product of a water and wastewater automation equipment manufacturer regularly engaged in the design and manufacture of such equipment for a period of at least fifteen (15) years. The Level Meter/Controller shall receive an analog signal from the wet pit submersible pressure level transmitter. Back-up float switches shall be utilized in the event of a submersible pressure level transmitter failure and activate the common alarm light. The Level Meter/Controller shall provide OFF-ON set point controls for the Quadraplex Controller (QC1-3). Provide the following set points for this controller.
1. High Level Alarm (Rising Level)
 2. Lag 2 Pump Start (Rising Level)
 3. Lag 1 Pump Start (Rising Level)
 4. Lead Pump Start (Rising Level)
 5. Pump(s) Stop (Falling Level)
 6. Low Level Alarm (Falling Level)
 7. Provide one (6) spare setpoints for future use.

In addition, provide a signal failure relay option with two relays, to energize when the transducer signal goes above 20mA or falls below 4mA. The relays can energize on both high/low conditions or one can energize on high failure (signal above 20mA) and the other on low failure (signal loss). This failure alarm shall also energize a front panel flashing LED alarm indicator.

- I. ANALOG SIGNAL LINE FILTER: Provide an analog signal Line Filter (LF-WW), per Component Specifications, for the wetwell level/meter controller.

- J. DISTRIBUTION TRANSFORMER FEEDER BREAKER: Provide a 30 amp, 2 pole, 480-volt main circuit breaker to feed the 25kVA Distribution Transformer.
- K. DISTRIBUTION TRANSFORMER: Provide a 480-volt primary, 120/240 volt, single-phase, three-wire secondary, 10kVA, dry type distribution transformer as shown on drawings. Transformer shall be dry-type, UL rated 180°C system with an average maximum rise by resistance of 115°C in a maximum ambient of 40°C. Transformer shall be self-cooled by natural convection and shall have isolating windings. Transformer shall have copper windings.
- L. DISTRIBUTION PANEL LP: Provide an eighteen (12) circuit Distribution Panel equal to Square D Company type NQ with 50 amp, 2-pole main breaker, and number of branch breakers as shown on drawing Distribution Panel Schedule.
- M. CONTROL POWER SURGE PROTECTOR: Provide a single phase, in-line (series) 120 volt, single-phase, 20A continuous power Surge Protection Device (SPD-2), per Component Specifications, designed to protect all of the loads fed from the control power circuit. Device shall have protection modes and protection status indication of each mode when power is present (L-N, L-G, N-G).
- N. GROUND FAULT INTERRUPTER RECEPTACLE: Provide a 120 Volt, 15 amp, Weatherproof Duplex GFCI Receptacle mounted on the side of enclosure for electrical hand tool use. Receptacle shall come complete with a weatherproof cover. Cover shall be UL listed for wet locations, with cover closed, and shall be constructed of tough plastic that is resistant to high impact and sunlight. In addition, the cover shall be non-corrosive, non-conductive and protect against rain, snow and ice.
- O. CABINET INTERIOR LIGHTS: Provide (2) two 120Vac LED interior panel lights (CL1 & CL2) switching via movement detector. Panel lights shall be mounted at the top of the interior of the control panel to automatically illuminate the interior deadfront doors and the backplate of the enclosure. Interior lights shall be Finder model number 7L43.0.230.2200, or approved equal.
- P. ENCLOSURE EXHAUST FAN: Provide four (4) filtered steel louvers and two (2) six-inch (6") thermostatically controlled exhaust fans to properly ventilate the controller enclosure. Exhaust fans shall operate based on temperature setting or when the variable frequency drive operates. Exhaust fan shall be mounted near the top of the enclosure. In addition, provide a Thermostat (TH), per Component Specifications, to control the exhaust fans.
- Q. COMMON ALARM LIGHT: Provide a weatherproof exterior Alarm Light (AL), per Component Specifications, with red push-to-test pilot light enclosed in a cast aluminum box with a one hole plate mounted on top of the enclosure with a myers hub. The alarm light shall burn dim and steady during normal conditions to indicate electrical power "ON" and lamp good. During any alarm condition, the alarm light shall flash brightly.

PART 4 FIELD INSTRUMENTATION

- 4.01 SUBMERSIBLE PRESSURE/LEVEL TRANSMITTER: Provide a Submersible Pressure/Level Transmitter (LT-WW), per Component Specifications, for the lift station wetwell (see detail on

drawings). Submersible pressure/level transmitter shall provide an analog level signal to the wetwell level/meter controller, proportional to the level in the wetwell.

SUBMERSIBLE PRESSURE/LEVEL TRANSMITTER INSTALLATION: The submersible pressure/level transmitter shall be field installed by the Contractor, per project engineer's direction. Transmitter shall be suspended six-inches (6") above the bottom of the storage unit.

JUNCTION BOX AND ANALOG SIGNAL LINE FILTER: Provide and install a properly sized NEMA 4 rated junction box, suited for outdoor/wet locations, complete with an analog signal Line Filter (LF), per Component Specifications, for the submersible pressure/level transmitter. Junction shall have a 1/8" drain/breather hole installed in the bottom of the enclosure. Line filter shall protect associated equipment from transient voltage surges and induced voltages. Junction box shall be field installed by the Contractor in close proximity of the submersible pressure level transmitter. The Contractor shall be responsible for properly sealing the conduits entering the junction box.

- 4.02 **AUXILIARY BACKUP FLOAT SWITCHES:** Provide a backup float control system, as shown on the drawing, to operate the pumps in the event of a Submersible Pressure/Level Transmitter failure. Provide four (4) back-up Float Switches (F), per Component Specifications, mounted in wetwell. Backup float switches shall be set at one foot (1') above normal level inputs from the primary digital meter/controller. Normal operating levels shall be set per Project Engineers direction.
- 4.03 **FREE STANDING ENCLOSURE MOUNTING:** Control panel's free-standing double-door enclosures leg stands shall be securely fastened to concrete base with wedge anchors, sleeve anchors, drop-in anchors or equivalent. All mounting hardware shall be hot dipped galvanized or stainless steel. Zinc plated material shall not be accepted. Anchor embedment shall be a minimum of three inches (3"). Control panel(s) shall be accurately leveled following the manufacturer's instructions. The leveling shall be checked in the presence of the Project Engineer and shall be to then engineer's satisfaction. Control panel installation shall be the responsibility of the **Contractor**.
- 4.04 **RESPONSIBILITY:** The Contractor shall be responsible for coordinating all work covered in this section with the Association, Contractor and Engineer. All work shall be performed based on the standards of the National Electric Code (NEC) currently in force by the Authority Having Jurisdiction (AHJ).
- 4.05 **CONDUITS:** All conduits entering control panels shall be properly sealed, per plans, to ensure corrosive gasses, and water/moisture does not enter into panel. It is the responsibility of the Contractor to provide and install adequate conduit seals. It is recommended that re-enterable sealant compounds are used; equal to 3M Scotchcast 2112C or Alesko Epoxy Sealing Putty.
- 4.06 **GROUNDING:** All control panels shall be properly grounded per Section 16060 – Grounding and Bonding for Electrical Systems. The Contractor shall provide certified test reports of ground resistance.
- A. Certification that the materials and installation are in accordance with the drawings and specifications.
 - B. Certification by the Contractor that the complete installation has been properly installed and tested.

PART 5 COMPONENT SPECIFICATIONS

5.01 PHASE FAILURE/UNBALANCE/UNDER VOLTAGE/REVERSAL RELAY: Phase monitor shall be designed to protect 3-phase motors regardless of size and for use with 200 – 240 or 425 – 485 VAC, 50 to 60 Hz motors to prevent damage. The unit shall constantly monitor the three phase voltages to detect harmful power line conditions, caused by single phasing, low voltage, phase reversal and voltage unbalance. When a harmful condition is detected, an output relay is deactivated after a trip delay. The output relay shall reactivate after power line conditions return to an acceptable level for the specified Restart Delay. The trip delay shall prevent nuisance tripping due to rapidly fluctuating power line conditions. Phase monitor shall have the following features and functions.

- A. Under Voltage:
 - Trip: -15% of setting for 230V (-10% for 480V)
 - Reset: -12% of setting for 230V (-8% for 480V)
- B. Over Voltage:
 - Trip: -15% of setting for 230V (-10% for 480V)
 - Reset: -12% of setting for 230V (-8% for 480V)
- C. Phase Unbalance:
 - Trip: 7% with 5 second trip delay
 - 15% with 1 second trip delay
 - Reset: 6%
- D. Trip Delay:
 - 5 seconds (delay is reduced to 1 second if Phase Unbalance is 15% or greater)
- E. Reset Delay:
 - 2 seconds standard (5-60 seconds optional)
- F. Voltage Range: 200V to 240V or 425V to 525V
- G. Output Rating: 10A resistive @ 240VAC
6A resistive @ 240VAC
- H. Operating Temp: -40°C to +50°C, -38°F to +122°F
- I. Storage Temp: -45°C to +85°C, -47°F to +185°F
- J. Enclosure: Lexan, surface mount
- K. UL and cUL listed

TAG
PM

SERVICE
Electrical System Power Monitor

5.02 VARIABLE FREQUENCY DRIVE: Variable Frequency Drives shall conform to the following specifications:

- A. General Requirements
 - 1. The VFD shall convert the input AC main power to an adjustable frequency and voltage as defined in the following sections.
 - 2. The VFD shall be listed and labeled as a complete unit and shall include all accessories and requirements as described in this section.
- B. Certifications

1. Listed to UL508C and CAN/CSA-C22.2 No. 14-05
2. In conformity with EMC Directive (2004/108/EC) and Low Voltage Directive (2006/95/EC). Standards applied; EN 61800-3:2004, EN 61800-5-1:2007
3. TÜV Rheinland - standards applied: EN 61800-3:2004, EN 61800-5-1:2007, EN ISO 13849-1:2008, EN ISO 13849-2:2003, EN 61800-5-2:2007, EN 61508 PARTS 1-7:2000, EN 62061:2005, and EN 60204-1:2006
4. Electric Power Research Institute. Certified compliant with standards SEMI F47 and IEC 61000-4-34

C. Hardware

1. Utilize Diode Bridge or SCR Bridge on the input rectifier.
2. Utilize DC bus inductor on all six-pulse VFDs only.
3. Utilize switching logic power supply operating from the DC bus.
4. Incorporate phase to phase and phase to ground MOV protection on the AC input line.
5. Microprocessor based inverter logic shall be isolated from power circuits.
6. Utilize latest generation IGBT inverter section.
7. Battery receptacle for Lithium battery power to the Real Time Clock.
8. Additional DPI port for handheld and remote HIM options.
9. Dedicated Digital Input for hardware enable.
10. Conformal coated printed circuit boards.
11. Optional onboard 24V DC Auxiliary Control Power Supply.

D. Control Logic

1. Ability to operate with motor disconnected.
2. Provide a controlled shut down, when properly protected, with no component failure in the event of an output phase to phase or phase to ground short circuit. Provide annunciation of the fault condition.
3. Provide multiple programmable stop modes including Ramp, Coast, DC-Brake, Ramp-to Hold, Fast Braking, and Current Limit Stop.
4. Provide multiple acceleration and deceleration rates.
5. Adjustable output frequency up to 650Hz.

E. Motor Control Modes

1. Selectable Sensorless Vector, Flux Vector, V/Hz, and Adjustable Voltage
2. Control modes selectable through programming.
3. The drive shall be supplied with a Start-up and Auto-tune mode.
4. The V/Hz mode shall be programmable for fan curve or full custom patterns.
5. Capable of Open Loop V/Hz.

F. Current Limit

1. Programmable current limit from 20 to 160% of rated output current.
2. Current limit shall be active for all drive states: accelerating, constant speed and decelerating.

3. The drive shall employ PI regulation with an adjustable gain for smooth transition in and out of current limit.

G. Acceleration / Deceleration

1. Accel/Decel settings shall provide separate adjustments to allow either setting to be adjusted from 0 to 3600 seconds.
2. A second set of remotely selectable accel/decel settings shall be accessible through digital inputs.

H. Speed Profiles

1. Programming capability shall allow the user to produce speed profiles with linear acceleration/deceleration or "S Curve" profiles that provide changing accel/decel rates.
2. S Curve profiles shall be adjustable.

I. Adjustments

1. A digital interface can be used for all set-up, operation and adjustment settings.
2. All adjustments shall be stored in nonvolatile memory (EEPROM).
3. EEPROM memory for factory default values shall be provided.

J. Process PID Control

1. The drive shall incorporate an internal process PI regulator with proportional and integral gain adjustments as well as error inversion and output clamping functions.
2. The feedback shall be configurable for normal or square root functions. If the feedback indicates that the process is moving away from the set-point, the regulator shall adjust the drive output until the feedback equals the reference.
3. Process control shall be capable of being enabled or disabled with a hardwire input. Transitioning in and out of process control shall be capable of being tuned for faster response by preloading the integrator.
4. Protection shall be provided for a loss of feedback or reference signal.

K. Skip Frequencies

1. Three adjustable set points that lock out continuous operation at frequencies which may produce mechanical resonance shall be provided.
2. The set points shall have a bandwidth adjustable from Maximum Reverse Speed to Maximum Forward Speed.
3. Speed to Maximum Forward Speed.

L. Fault Reset / Run

1. The drive shall provide up to nine automatic fault reset and restarts following a fault condition before locking out and requiring manual restart.
2. The automatic mode shall not be applicable to a ground fault, shorted output faults and other internal microprocessor faults.
3. The time between restarts shall be adjustable from 0.5 seconds to 30 seconds.

M. Run on Power Up

A user programmable restart function shall be provided to allow restart of the equipment after restoration of power after long duration power outages. Restart time dependent on presence of incoming signal.

N. Fault Memory

1. The last 32 fault codes shall be stored and time stamped in a fault buffer.
2. Information about the drive's condition at the time of the last fault such as operating frequency, output current, dc bus voltage and twenty-seven other status conditions shall be stored.
3. A power-up marker shall be provided at each power-up time to aid in analyzing fault data.
4. The last 32 alarm codes shall be stored and time stamped for additional troubleshooting reference.

O. Overload Protection

1. The drive shall provide internal class 10 adjustable overload protection.
2. Overload protection shall be speed sensitive and adjustable.
3. A viewable parameter shall store the overload usage.

P. Auto Economizer

1. An auto economizer feature shall be available to automatically reduce the output voltage when the drive is operating in an idle mode (drive output current less than programmed motor FLA). The voltage shall be reduced to minimize flux current in a lightly loaded motor thus reducing kW usage.
2. When the load increases, the drive shall automatically return to normal operation.

Q. Terminal Blocks

1. Separate terminal blocks shall be provided for control and power wiring.
2. I/O terminal blocks shall be removable with wiring in place.

R. Flying Start

The drive shall be capable of determining the speed and direction of a spinning motor and adjust its output to "pick-up" the motor at the rotating speed. This feature is disabled by default.

S. Inputs and Outputs

1. The Input / Output option modules shall consist of both analog and digital I/O.
2. No jumpers or switches shall be required to configure digital inputs and outputs.
3. All digital input and output functions shall be fully programmable.
4. The control terminal blocks shall be rated for 115V AC.

5. Inputs shall be optically isolated from the drive control logic.
6. The control interface card shall provide input terminals for access to fixed drive functions that include start, stop, external fault, speed, and enable.
7. The VFD shall be capable of supporting up to 7 analog inputs, 7 analog outputs, 21 digital inputs, 7 relay outputs, 7 transistor outputs, and 3 positive temperature coefficient (PTC) inputs.
8. The Input / Output option modules shall have the following features:
 - a) Analog Inputs:
 - i. Quantity two (2) differentially isolated, $\pm 10\text{V}$ (bi-polar), 88k ohm input impedance, 11 bit plus sign.
 - ii. Analog inputs shall be user programmable for a variety of uses including frequency command and process loop input. Analog inputs shall be user programmable for function scaling (including invert), offset, signal loss detect and square root.
 - b) Analog Outputs:
 - i. Quantity two (2) $\pm 10\text{V}$ (bi-polar) / 11 bit & sign, 2 k Ω minimum load, 4-20 mA, 11 bit plus sign, 400 Ω maximum load.
 - ii. The analog output shall be user programmable to be proportional to one of fourteen process parameters including output frequency, output current, encoder feedback, output power.
 - iii. Programming shall be available to select either absolute or signed values of these parameters.
 - c) Digital Inputs:
 - i. Quantity of six (6) digital inputs rated 24V DC/115V AC.
 - ii. All inputs shall be individually programmable for multiple functions including: Start, Run, Stop, Auxiliary Fault, Speed Select, Jog and Process PI functions.
 - d) Digital Outputs:
 - i. At least one (1) relay output (N.O. or N.C.).
 - ii. For 240V AC or 24V DC, N.O. contact output ratings shall be 2 amp max., general purpose (inductive)/resistive. N.C. contact output ratings shall be 2 amp max., resistive only.
 - iii. Relays shall be programmable to multiple conditions including: Fault, Alarm, At Speed, Drive Ready and PI Excess Error.
 - iv. Timers shall be available for each output to control the amount of time, after the occurring event, that the output relay actually changes state.
 - v. At least one (1) transistor output.
 - vi. For 24V DC, transistor output rating shall be 1 amp max, Resistive.

T. Reference Signals

1. The drive shall be capable of using the following input reference signals:
 - a) Analog inputs
 - b) Preset speeds
 - c) Remote potentiometer
 - d) Digital MOP
 - e) Human Interface Module
 - f) Communication modules

U. Loss of Reference

1. The drive shall be capable of sensing reference loss conditions.
2. In the event of loss of the reference signal, the drive shall be user programmable to the following:
 - a) Fault the drive and coast to stop.
 - b) Issue a minor fault - allows the drive to continue running while some types of faults are present.
 - c) Alarm and maintain last reference.
3. When using a communications network to control the drive, the communications adapter shall have these configurable responses to network disruptions and controller idle (fault or program) conditions:
 - a) Fault
 - b) Stop
 - c) Zero Data
 - d) Hold Last State
 - e) Send Fault Configuration

V. Metering

1. At a minimum, the following parameters shall be accessible through the Human Interface Module, if installed:
 - a) Output Current in Amps
 - b) Output Voltage in Volts
 - c) Output Power in kW
 - d) Elapsed MWh
 - e) DC Bus Voltage
 - f) Frequency
 - g) Heatsink Temperature
 - h) Last eight (32) faults
 - i) Elapsed Run Time
 - j) IGBT Temperature

W. Faults

1. At a minimum, the following faults shall be accessible through the Human Interface Module:
 - a) Power Loss
 - b) Undervoltage
 - c) Overvoltage
 - d) Motor Overload
 - e) Heat Sink Over-temperature
 - f) Maximum Retries
 - g) Phase to Phase and Phase to Ground Faults

X. Predictive Diagnostics

1. At a minimum, the following predictive diagnostic features shall be provided:
 - a) Relay Output Life Cycles based on load type and amps.
 - b) Hours of Fan Life based on load and ambient temperature.
 - c) Motor Bearing life based on expected hours of use.
 - d) Motor Lubrication schedule based on hours of use.
 - e) Machine Bearing life based on expected hours of use.

Y. Real-Time Clock

1. Shall be capable of providing time stamped events.
2. Shall have the ability to be set locally or via a remote controller.
3. Shall provide the ability to be programmable for month, day, year and local time zones in HH:MM:SS.

Z. Installation: Installation shall be in compliance with manufacturer's instructions, drawings and recommendations.

AA. Start-up

1. Certified factory start-up shall be provided for each VFD provided.
2. Service engineers shall be employed by the manufacturer or be certified by the manufacturer and provide start-up services including physical inspection of drive and connected wiring and final adjustments to meet specified performance requirements.

BB. Product Support

1. Factory trained application engineering and service personnel that are familiar with the VFD products offered shall be locally available.
2. A 24 hour, 365 day technical support line shall be available.

CC. Manufacturers

1. Allen-Bradley – PowerFlex 753 VFD.

2. Invertek – Optidrive
3. Danfoss – VLT Aqua
4. Substitutions must be submitted in writing three (3) weeks prior to original bid date with supporting documentation demonstrating that the alternative manufacturer meets all aspects of the specification herein.

DD. Warranty: The manufacturer shall provide their standard parts warranty for eighteen (18) months from the date of shipment or twelve (12) months from the date of being energized, whichever occurs first. Warranty shall be twenty-four (24) months from the date of certified start-up, not to exceed thirty (30) months from the date of shipment.

TAG
VFD

SERVICE
Variable Frequency Drive (Qty. 3)

5.03 LINE REACTOR: Provide a Line Reactor for each Variable Frequency Drive being furnished. The Reactor shall be properly rated for the motor amperes required. The Reactor shall have a 5% filter rating to alternate harmonics and provide protection from transients. Line reactor(s) shall have the following features.

- A. Standard impedance values by calculation: 1.5%, 2%, 3%, 4%, 5% available
- B. Impedance Basis: Reactor rated current, line voltage, frequency and inductance
- C. Service Factor: Reactors rated 1 to 750 Amps - 150% of rating; Reactors rated above 750 Amps - 125% of rated minimum.
- D. Overload Rating: 200% of rated for 30 minutes; 300% of rated for 1 minute
- E. Maximum System Voltage: 600 Volts (units with terminal blocks); 690 Volts (units with box lugs or tab terminals)
- F. Maximum Switching Frequency: 20 kHz
- G. Insulation System: Class N (200°C 392°F)
- H. Temperature Rise (*open or enclosed reactors*): 135°C 275°F (maximum)
- I. Ambient Temperature (*open or enclosed reactors*): 45°C 113°F (Full rated)
- J. Altitude (*maximum*): 1000 meters
- K. Fundamental Frequency (*Line or Load*): 50/60 Hz
- L. Approvals: CE, UL-508, CSA C22.2
- M. Inductance Curve (*typical*): 100% at 100% current; 100% at 150% current; 50% at 350% current (minimum)
- N. Inductance Tolerance: +/- 10%
- O. Impregnation: High Bond Strength "Solvent-Less" Epoxy, 200° C; UL94HB recognized
- P. Dielectric Strength: 3000 volts RMS (4243 volts peak)
- Q. dV/dT Protection: Meets NEMA MG-1, part 31 (same as inverter duty motors)
- R. Agency Approvals: UL-508 File E180243 Component Listed (1 amp – 2400 amps); UL-508 File E180243 UL Listed NEMA 1 units (1 amp – 2400 amps)
Note: Short Circuit rating not required under Exception No.1 of UL508A SB4.2.1 effective 4/25/06; CSA C22.2 File LR29753-13 CSA Certified (1 amp – 2400 amps); Class N, 200° C File E66214, Type 200-18, UL Recognized Insulation System; CE Marked
- S. Material: Core Steel: Electrical grade high frequency silicon steel; Windings: High dielectric withstand solid copper conductor (220° C); Enclosures: Sheet steel per UL and CSA requirements. Painted ANSI-61 Grey; Brackets: ASTM structural steel or structural aluminum; Sheet Insulation: DuPont Nomex 410 (220° C); Epoxy: Ripley Resin Type 468-2 (220° C)

- T. Construction: CORE: Electrical grade silicon steel magnetic laminations; Windings: 3000 volts RMS dielectric strength (coil-to-coil & coil-to-core);
- U. Assembly: Windings are assembled onto EI laminations, secured in place & epoxy impregnated for minimum noise & maximum structural rigidity.
- V. Testing: Inductance, Hi-Pot 3000 Volts RMS (5656 volts peak)

TAG
LR

SERVICE
VFD Line Reactor (Qty. 3 – if required)

5.04 QUADRAPLEX PUMP CONTROLLER: Provide a Quadraplex Pump Controller, including the following features for each pump:

A. OPERATORS AND INDICATORS

1. Manual-Off-Automatic selector switch
2. Green "Running" pilot light
3. Red "Failure" pilot light
4. Red "Seal Failure" pilot light (if required)
5. Green pump "Start" pilot lights for Lead, Lag 1, Lag 2, and Lag 3.
6. Amber pump "Stop" pilot lights for Lead, Lag 1, Lag 2, and Lag 3.

B. LEVEL INPUTS

1. Individual "Start" and "Stop" level control points shall be provided for each pump or field adjustable controls shall be provided to allow the first "Stop" level control point to stop all of the pumps.
2. Provide a High liquid level alarm input sensing point, as required for the application.
3. Provide pilot light indicators for each level input sensing point.
4. Provide manual override inputs for each pump, which can be used to override the quadraplex controller's pump call-for outputs when the controls are in the Automatic mode. Inputs shall be provided to start or stop each pump from a remote location.
5. All pump control inputs shall be optically isolated and their power limited to 24V DC with a maximum current of 16mA DC for intrinsic safety.

C. PUMP SEQUENCING

1. Automatic pump alternations on each lead pump "Call" cycle. Pump alternation shall be field selectable to alternate on a first pump "On", first pump "Off" basis or on a last pump "On", first pump "Off" basis.
2. The pumps shall also alternate as lead pump, when the lead pump reaches a field adjustable running time period, which shall have a time range from 10 minutes to 21 hours.
3. Provide a field adjustable failure time delay for each pump. If a pump fails to run, or if that pump's selector switch is placed in the off position, provide controls to start the next pump in the sequence at the failed or disabled pump's operating call-for input setting.
4. If a pump fails to run, that pump shall automatically become the last called for

- pump in the operating sequence. Normal pump alternation shall resume when the failure condition is corrected and the failed pump has been reset.
5. Provide individual field adjustable time controls to delay starting each pump in the automatic mode after power failure or during initial start.
 6. Provide stagger stop feature to require the pumps to stop a minimum of two (2) seconds apart during the condition that two or more pumps are running when signaled to stop. Provide stagger start feature to start the pumps a minimum of three (3) seconds apart during conditions that two or more pumps are called for simultaneously.
 7. Provide controls to remove any pump(s) from the alternating sequence, making the removed pump(s) the last pump(s) to be called for if the input conditions require it.
 8. Pump failure, Seal failure, High-level alarm, and Improper Sequence alarm red pilot lights shall flash when activated.
 9. Provide automatic controls to alternate on Pump Failure, Seal Failure, or when a pump is running in Automatic and is manually turned off.
 10. When pump seal failures are not needed, the seal failure circuitry for each pump shall be able to indicate an auxiliary condition by flashing or steady operation without interfering with the controller operation.

D. INPUT MONITORING AND CONTROL

1. The Manual-Off-Automatic switches shall bypass all of the controls and energize their respective pump outputs when placed in the Manual position. In the Manual and Off modes, pump failure alarms shall be disabled.
2. The Manual-Off-Automatic switches shall be used to reset a pump failure alarm after the failure condition has been cleared, by manually switching the failed pump to the OFF position and back to Automatic.
3. Provide automatic input sequence monitoring, such that if the first "All Pumps Stop" input fails to activate, and any two start inputs are activated, the lead pump shall start.
 - a. If a third start input is activated, start the first lag pump.
 - b. If a fourth start input is activated, start the second lag pump.
 - c. If the high-level alarm input is activated, start all pumps.
4. When operating in a "Last On, First Off" mode, each pump that is started is turned off at the next lower start input setting during the "improper sequence". That is, the Lag 2 pump will turn off at the Lag 1 Start setting, Lag 1 will turn off at the Lead Start setting, and the Lead pump will run until the Lead Start input turns off.
5. When operating in a "First On, First Off" mode, the Lead pump will turn off first, followed by the Lag 1, Lag 2, and Lag 3 pumps.
6. Provide a red pilot light indicator to alarm "Improper Input Sequence" when any of the above-described conditions occurs. Also, provide a manual reset pushbutton switch for clearing the Improper Sequence alarm.
7. If the "improper sequence" clears itself, the pumps will return to normal operation. The alarm will continue to be energized until manually reset.

E. ANNUNCIATING

Provide individual discrete pump running output contacts for each pump.

1. Provide individual discrete "Alarm Telemetry" dry contact outputs for the following alarms:
 - a. Each pump failure
 - b. Each pump seal failure
 - c. High level alarm
 - d. Improper level input Sequence
2. Provide a Common Alarm discrete output contact that will actuate when any alarm condition occurs.
3. Provide an exterior alarm light output, which allows the light to dim glow under normal conditions to indicate power on, and lamp good. The light shall flash brightly during any alarm condition.

TAG
QC1-3

SERVICE
Quadraplex Pump Controller

5.05 QUADRAPLEX ALARM TELEMETRY OPTION: Provide an Alarm Telemetry system for the Quadraplex Controller, which provides auxiliary normally open relay contact outputs for the following quadraplex controller alarms: Motor No.1 Failure, Motor No.2 Failure, Motor No.3 Failure, Motor No.4 Failure, Motor No.1 Seal Failure, Motor No.2 Seal Failure, Motor No.3 Seal Failure, Motor No.4 Seal Failure, Improper Sequence, One (1) Auxiliary Contact, and High Level. Provide the following features for the QCAT system.

- A. Input voltage: 12VDC; Duty Cycle: Continuous
- B. The control circuitry shall be solid-state and contain an integral power supply with proper surge and over-current protection.
- C. Provide an individual Normally Open, Dry-Contact output for each alarm that has a contact rating of 5 Amps @ 120V AC, resistive.
- D. Provide individual LED indicators for each output relay to show when each relay is energized.
- E. Output terminals labeled for easy field identification.

TAG
QCAT

SERVICE
Quadraplex Alarm Telemetry System

5.06 MOTOR MONITOR: Provide an electronic solid state Motor Monitor powered by 120 volt AC that will accept a zero (0) to five (5) amp input signal condition the signal to perform ON/OFF or OPEN/CLOSE discrete dry type setpoint contact conditions based on the input signal value. The Motor Monitor shall have the following features.

- A. Provide an LCD readout meter providing field adjustable scales of 0-25.0, 0-50.0, 0-100.0,

0-250, 0-500 and 0-1000 to accurately indicate the motor full load current using the 0-5 amp input signal.

- B. The Monitor shall be capable of displaying motor total running time up to 99,999.9 hours and be provided with reset capability from the rear of the monitor. The display shall include a non-volatile EEPROM memory backup that does not require battery backup during power failure.
- C. Provide two (2) separate field adjustable setpoints, each with discrete, isolated sealed SPDT relay output contacts. The setting of each setpoint shall be adjustable throughout the complete signal range from the front of the Monitor. Each set point shall be provided with a field adjustable "ON" and "OFF" time delay, adjustable from zero (0) to fifteen (15) seconds. The actual setting of each setpoint shall be able to be displayed on the LCD readout at any time. An LED indicator shall be provided for each setpoint and shall operate as follows:
 - 1. Setpoint No. 1: When setpoint is timing, the indicator shall burn amber. After timing period and current is at or above setpoint, indicator shall burn green.
 - 2. Setpoint No. 2: When set point is timing, the indicator shall burn amber. After set timing period and current is at or above setpoint, indicator shall burn red.

TAG

MM-1

MM-2

MM-3

SERVICE

Pump No. 1 Motor Monitor

Pump No. 2 Motor Monitor

Pump No.3 Motor Monitor

5.07 CURRENT TRANSFORMER: Current transformers insulation class shall be 0.6 KV BIL, 10 KV Full Wave. They shall be manufactured to meet the requirements of UL1244 and have a minimum accuracy of 60Hz of 2%. Current transformers shall be provided with brass stud terminals and mounting bracket.

5.08 LEVEL METER/CONTROLLER: Provide an electronic, solid-state, proportional Level Meter/Controller that will accept a four (4) to twenty (20) mA or a one (1) to five (5) volt DC signal. In addition, condition the signal to provide a valid basis for control and then perform ON/OFF or OPEN/CLOSE discrete dry type set point contact conditions based on the input value of the analog input signal. The Level Meter/Controller shall have the following features.

- A. Provided with a 3.5 digit LED (or LCD if required) readout meter in feet of water. The display shall be capable of being calibrated from the front of the unit and have a maximum display of 1999, with a decimal point that is user selectable.
- B. The display zero indication shall be able to be offset anywhere within the range of the meter, with a minimum range of 60 counts.
- C. Provide six (6) or twelve (12) separate setpoints each with discrete, isolated sealed SPDT relay output contacts.
- D. Provide excitation voltage to drive a transducer/transmitter and condition its output signal to provide a continuous display of level.

- E. The setpoints shall be field adjustable to operate on rising above or falling below the setpoint.
- F. An LED indicator shall be provided for each setpoint to indicate when it is activated.
- G. The actual setting of each setpoint shall be able to be displayed on the digital readout at any time.
- H. The setting of each setpoint shall be adjustable throughout the complete signal range from the front of the meter/controller.
- I. Provide a means of manually ramping the meter/controller, up and down, throughout its complete signal range, to test the operation of the setpoints.
- J. The meter/controller shall come complete with a four (4) to twenty (20) mA, or a one (1) to five (5) volt DC output signal for additional monitoring and control devices.
- K. Provide a signal failure relay option with two relays, to energize when the input signal goes above 20 mA or below 4 mA. The relays can energize on both high/low conditions or one can energize on high failure and the other on low failure. In addition, either relay may be set to 'flash' on and off during the failure condition. This failure alarm shall also energize a front panel flashing LED alarm indicator.
- L. Provide a Lamp Test feature to test the digital display and individual LED setpoint indicators.

<u>TAG</u>	<u>SERVICE</u>	<u>SCALE</u>
LMC-WW	Wetwell Level Controller	0-35 feet

5.09 TELEMETRY LINE FILTER: Provide a telemetry line filter with a fast-acting design to protect data and communications equipment from transient voltage surges and induced voltages. The filter shall be a low-impedance, two-stage hybrid design with a first stage consisting of a heavy-duty energy handling gas discharge tube having a breakdown voltage rating between 200 and 350 volts. Impulse breakdown at 100 volts per microsecond shall equal 600 volts. A filter capacitor shall be connected across the lines, rated a 1kv. The second stage shall consist of two current limiting resistors, a fast-acting solid-state transient voltage surge absorber from each line to ground to protect each line up to a maximum continuous voltage of 30V AC or 38V DC with a 50 nanosecond response time. In addition, a separate bi-directional transient voltage surge absorber rated at 1500W @ 33V DC, which is connected across the two lines, for maximum protection. Integral wiring terminal blocks shall be included for both line and equipment sides of the filter. The filter shall be mountable directly on the panel backplate or be able to use track mounting if required.

<u>TAG</u>	<u>SERVICE</u>
LF-WW	Analog Signal Line Filter

5.10 SUBMERSIBLE PRESSURE/LEVEL TRANSMITTER: Provide a solid-state direct submersible level sensor and transducer designed as pressure sensor for continuous, hydrostatic level measurement in open containers/basins. Transmitter shall have a high resistance to overload and aggressive media with a ceramic diaphragm and enclosed in 316L stainless steel housing. The range of the transmitter shall be as required for the desired application with excitation voltage of 10 - 35V DC. Instrument cable shall be commercially available shielded instrument cable with a

minimum of forty-five foot (45') cable length. The transmitter shall be capable of being supported by its own cable. The electronics shall be completely potted and provide a 4 – 20mA analog output to the level meter/controller. The accuracy shall be $\pm 0.2\%$ full scale. The transmitter shall be mounted near the bottom of the vessel with support bracket and be cable connected. Transmitter shall have Drinking water approvals: KTW, NSF, and ACS; and approvals by: ATEX, FM, and CSA.

- A. Application: Type of pressure: Relative Pressure, Liquids
- B. Operating Voltage: 10-30 V DC
- C. Electrical Design: DC
- D. Output Function: 4-20 mA analog
- E. Measuring Range: 0 – 0.6 bar (0 – 8.70 psi)
- F. Pressure Rating: 4 bar (58 psi)
- G. Bursting Pressure Min.: 4.8 bar (69.62 psi)
- H. Characteristics Deviation: < 0.25 (BFSL) / 0.5 *
- I. Connection: PUR cable / 15 m
- J. Housing Materials: Stainless Steel 316Ti / 1.4571; PA
- K. Medium Temperature: -10 – 50 °C
- L. Ambient Temperature: -10 – 50 °C
- M. Protection: IP 68
- N. MTTF: 732 years

<u>TAG</u>	<u>SERVICE</u>	<u>SCALE</u>
LT-WW	Wetwell Level Transmitter	0-35 feet

- 5.11 FLOAT SWITCHES: The float switch shall be a direct acting switch and contain a single pole mercury switch, which actuates when the longitudinal axis of the float is horizontal and de-actuates when the liquid level falls 1" below the actuation elevation. The float shall have a chemical resistant polypropylene casing with a firmly bonded electrical cable protruding. One end of the cable shall be permanently connected to the enclosed mercury switch and the entire assembly shall be capsulated to form a completely watertight and impact resistance unit. Float shall include a bracket for support pipe mounting.

<u>TAG</u>	<u>SERVICE</u>
F	Wetwell Float Switches (Qty. 4)

- 5.12 VARIABLE FREQUENCY DRIVE CONTROLLER: Provide an electronic solid state controller that can be field configured or programmed to control the speed of up to four Variable Frequency Drives. The controller shall have the following features.

- A. Provide four separate isolated output signals, each producing a four (4) to twenty (20) mA output to signal or pace each drive and motor.
- B. Provide a 3½-digit LED readout meter on face of controller that can be field calibrated in feet, psi, temperature, etc. This readout shall indicate the value of an input 4-20 mA DC signal. The controller shall monitor this input signal and condition the four analog output signals based on this signal and the individual field set Low and High adjustment points.
- C. Provide four input points to receive a dry contact positive running signal from each of four motors.

- D. The operator shall be able to select a signal level at which point the drive will operate at minimum speed and a signal level at which point the drive will operate at maximum speed when the controller is receiving a positive motor running signal for one motor. As the input signal increases from the minimum setting to the maximum setting, the drive shall increase in speed linearly. The operator shall be able to select individual minimum and maximum speed setting with one, two, three and four motors operating.
- E. Provide a 3½-digit LED readout meter on face of controller indicating analog output signals to Variable Frequency Drives. Provide an inconspicuous selector switch to drive the analog output signals to four (4) or twenty (20) mA for testing purposes.
- F. Provide four individual green LED pilot lights to indicate when 1, 2, 3 or 4 motor running input signals are being received.
- G. Provide a Lamp Test feature to illuminate the front panel pilot lights and all digital display segments via a remote pushbutton.
- H. In general, the operator shall be able to select four (4) individual speed ranges over the complete range of the input analog signal being received, selecting a Low and High speed setting for each range depending on whether 1, 2, 3 or 4 motors are operating.
- I. The actual setting of each set point shall be able to be displayed on the digital readout at any time and the setting of each set point shall be adjustable, throughout the complete signal range, from the front of the controller.

TAG
FDC1-3

SERVICE
Wet Well VFD Pump Controller

- 5.13 THERMOSTAT: Provide a non-programmable line volt mechanical thermostat with bi-metal actuator type sensor. The thermostat shall have an adjustable temperature range of 50 to 90 degrees F with a differential of 2 to 4 degrees F. This thermostat shall have a SPDT contact rated at 120V/22A. The thermostat shall be certified UL and CSA. Enclosure shall be NEMA 1 with an external adjustment knob.

TAG
TH

SERVICE
Thermostat

- 5.14 CONTROL POWER SURGE PROTECTION DEVICE (SPD): The surge protection device shall be mounted in the control panel in series with the control power circuit. Provide a single-phase, in-line series AC power line surge protector with the following features:

- A. Rated voltage shall be 120 VAC @ 60Hz.
- B. Current rating shall be 20 Amps @ 40°C.
- C. The protection circuitry shall automatically reset after the transient has passed.
- D. Protection modes shall be: Line to Neutral, Line to Ground, and Neutral to Ground.
- E. Provide three (3) Green LED indicators to indicate protection status of each mode when power is present (L-N, L-G, N-G).

- F. Varistors with integral thermally activated elements shall be used to open in the event of overheating due to the abnormal overvoltage, limited current conditions outlined in UL1449. The lower inductance of the varistors shall result in improved clamping performance to fast overvoltage transients.
- G. Metal Oxide Varistors (MOV) shall have cured, flame retardant epoxy polymer coating meeting UL94V-0 requirements.
- H. Electromagnetic Interference (EMI) filtration shall be incorporated into the unit to dampen unwanted signals from the protected side of the unit.
- I. Operating temperature shall be -40 to +70°C.
- J. Screw terminals shall be provided for all wiring.
- K. Maximum continuous operating VAC shall be 115% of rated line voltage.

TAG
SPD-2

SERVICE
Control Power Surge Protection Device

- 5.15 COMMON ALARM LIGHT: Alarm Light shall be RAB catalog number VBR100/GL100PGR or equal. Alarm light enclosure shall be constructed of die cast aluminum with a sturdy mounting bracket. Alarm light shall be suitable for wet location and comply with UL standard 1598, for hazardous locations where the lamp, socket and wiring require protection from rain, corrosive fumes, non-combustible dusts, moisture, non-explosive vapors and gases. The alarm light shall burn dim and steady during normal conditions to indicate electrical power "ON" and lamp good. During any alarm condition, the alarm light shall flash brightly. Alarm light mounted on the side of the enclosure or as directed by the project engineer.

TAG
AL

SERVICE
Common Alarm Light

PART 6 EXECUTION

6.01 ENGINEERING SUPERVISION

- A. The services of a qualified representative of the selected Single Source System Supplier shall be provided to inspect the completed installation, suggest all adjustments necessary to place the system in proper operation, and instruct operating personnel in the care and operation of the equipment furnished. A minimum of one (1) day and one (1) trip start-up service and training operating personnel shall be included. The services shall be furnished by the Contractor as a part of the work included under this section of the specifications.
- B. The System Supplier shall show satisfactory evidence that he maintains, a fully equipped factory organization capable of furnishing adequate service for the equipment furnished, included replacement parts. Suppliers employing outside organizations for "ON CALL" service shall not be considered.

6.02 GENERAL INSTALLATION

- A. Installation of instrumentation and controls shall be in strict compliance with the manufacturer's instruction. The locations of these items as shown on the Contract Drawings are approximate only. Exact locations shall be as approved by the Engineer during construction. It is the duty of the Contractor to obtain, in the field, all relevant

information required for proper placement of instrumentation and controls. In the case of interference with other work, proceed as instructed by the Engineer and provide all materials and labor required to prevent construction delays.

- B. Execution of the installation shall be in full accordance with codes and local rulings. The Contractor shall be responsible for any expenses that are a result of work performed contrary to said codes and regulations.
- C. The System Supplier shall coordinate with the Contractor the installation, the location of process equipment, and connections of process equipment to related equipment panels, subject to the Engineer's approval. The equipment being furnished with electrical controls or instrumentation must be submitted to the System Supplier for approval and coordination with all other control and instrumentation on this project. This engineer will not approve any equipment submittal until this coordination has been accomplished.

6.03 SPARE PARTS

A one-year supply of manufactures' recommended spare parts shall be provided. The spare parts shall be packaged for long-term storage and shall be protected against humidity and temperature. A spare parts list shall be furnished listing manufacture, device model number, part number and quantity supplied.

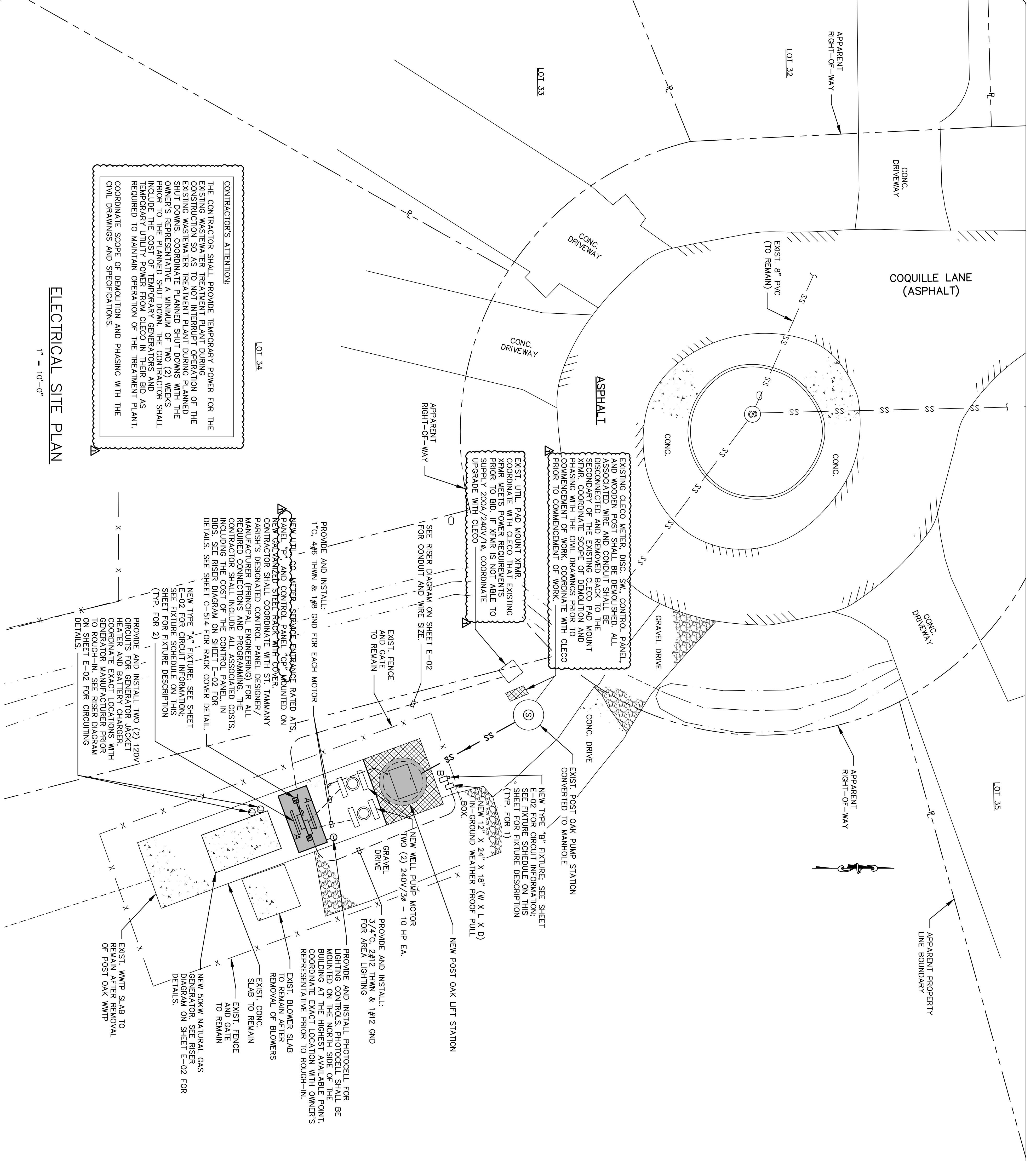
6.04 DELIVERY AND HANDLING

After delivery to the jobsite, the Contractor shall store the control panel off of the ground in a dry location until such time as it is mounted and supplied with electrical service. The contractor shall also ensure that the pump power and control cords, as well as control floats, are protected from submergence until they are properly installed and sealed.

6.05 CONTROL PANEL STAND (when required)

Each control panel stand shall be fabricated per the detail indicated in the plans. Control panel stand legs shall be cemented into the ground a minimum of three feet (3') deep. The control panel shall be bolted at all four corners to the control panel stand with stainless steel hardware. Control panels shall be installed following manufacturer's instructions properly leveled.

END OF SECTION



CONTRACTOR'S ATTENTION:
 THE CONTRACTOR SHALL PROVIDE TEMPORARY POWER FOR THE EXISTING WASTEWATER TREATMENT PLANT DURING CONSTRUCTION SO AS TO NOT INTERRUPT OPERATION OF THE EXISTING WASTEWATER TREATMENT PLANT DURING PLANNED SHUT DOWNS. COORDINATE PLANNED SHUT DOWNS WITH THE OWNER'S REPRESENTATIVE A MINIMUM OF TWO (2) WEEKS PRIOR TO THE PLANNED SHUT DOWN. THE CONTRACTOR SHALL INCLUDE THE COST OF TEMPORARY GENERATORS AND TEMPORARY UTILITY POWER FROM CLECO IN THEIR BID AS REQUIRED TO MAINTAIN OPERATION OF THE TREATMENT PLANT. COORDINATE SCOPE OF DEMOLITION AND PHASING WITH THE CIVIL DRAWINGS AND SPECIFICATIONS.

EXISTING CLECO METER, DISC. S.W. CONTROL PANEL AND WOODEN POST SHALL BE DEMOLISHED. ALL ASSOCIATED WIRE AND CONDUIT SHALL BE DISCONNECTED AND REMOVED BACK TO THE SECONDARY OF THE EXISTING CLECO PAD MOUNT FROM COORDINATE WITH THE CIVIL DRAWINGS AND PHASING WITH THE CIVIL DRAWINGS PRIOR TO COMMENCEMENT OF WORK.
 COORDINATE WITH CLECO FOR MOUNTING OF NEW METER AND CONTROL PANEL. SUPPLY 200A/240V/1% COORDINATE WITH CLECO FOR MOUNTING OF NEW METER AND CONTROL PANEL.

NEW UTIL. CO. METER, SERVICE ENTRANCE RATED A1S, 1" C, 4#8 THWN & 1#8 GND FOR EACH MOTOR PROVIDE AND INSTALL:
 SEE RISER DIAGRAM ON SHEET E-02 FOR CONDUIT AND WIRE SIZE.
 PROVIDE AND INSTALL TWO (2) 120V HEATER AND BATTERY CHARGER COORDINATE EXACT LOCATIONS WITH GENERATOR MANUFACTURER PRIOR TO ROUGH-IN. SEE RISER DIAGRAM ON SHEET E-02 FOR CIRCUITING DETAILS.

NEW TYPE "B" FIXTURE. SEE SHEET E-02 FOR CIRCUIT INFORMATION. SEE FIXTURE SCHEDULE ON THIS SHEET FOR FIXTURE DESCRIPTION (TYPE FOR 1)
 NEW 12" X 24" X 18" (W X L X D) IN-GROUND WEATHER PROOF PULL BOX.
 PROVIDE AND INSTALL:
 3/4" C, 2#12 THWN & 1#12 GND FOR AREA LIGHTING
 PROVIDE AND INSTALL PHOTOCELL FOR LIGHTING CONTROLS. PHOTOCELL SHALL BE MOUNTED ON THE NORTH SIDE OF THE BUILDING AT THE HIGHEST AVAILABLE POINT. COORDINATE EXACT LOCATION WITH OWNER'S REPRESENTATIVE PRIOR TO ROUGH-IN.
 EXIST. BLOWER SLAB TO REMAIN AFTER REMOVAL OF BLOWERS
 EXIST. CONC. SLAB TO REMAIN
 EXIST. FENCE AND GATE TO REMAIN
 NEW 50KW NATURAL GAS GENERATOR. SEE RISER DIAGRAM ON SHEET E-02 FOR DETAILS.

EXIST. WWPF SLAB TO REMAIN AFTER REMOVAL OF POST OAK WWPF
 PROVIDE AND INSTALL TWO (2) 120V HEATER AND BATTERY CHARGER COORDINATE EXACT LOCATIONS WITH GENERATOR MANUFACTURER PRIOR TO ROUGH-IN. SEE RISER DIAGRAM ON SHEET E-02 FOR CIRCUITING DETAILS.

ELECTRICAL SITE PLAN

1" = 10'-0"

SYMBOL SCHEDULE

	POWER PANEL
	FUSED SAFETY DISCONNECT SWITCH
	WEATHERPROOF
	ELECTRICAL CONDUIT ROUTED UNDERGROUND
	GROUND FAULT INTERRUPTER DUPLEX RECEPTACLE
	LED FIXTURE. "A" DENOTES TYPE
	EMERGENCY LIGHTING UNIT

ELECTRICAL GENERAL NOTES

- ALL ELECTRICAL WORK SHALL BE DONE IN STRICT ACCORDANCE WITH THE LATEST EDITION OF THE NATIONAL ELECTRICAL CODE. ALL WORK SHOWN IS NEW UNLESS NOTED OTHERWISE.
- THE CONDUIT SYSTEM, ALL ELECTRICAL EQUIPMENT, ALL STEEL STRUCTURES, MOTOR FRAMES, ETC. SHALL BE CONNECTED TO THE GROUNDING SYSTEM PER ARTICLE 250 OF THE NATIONAL ELECTRICAL CODE.
- ALL EQUIPMENT LOCATIONS SHALL BE VERIFIED IN THE FIELD WITH MECHANICAL TRADES. CONDUIT ROUTING AND EQUIPMENT LOCATIONS SHOWN ARE DIAGRAMATIC ONLY. THE EXACT LOCATION OF ALL EQUIPMENT AND ROUTING OF CABLES SHALL BE COORDINATED WITH & APPROVED BY ST. TAMMANY PARISH'S REPRESENTATIVE DURING CONSTRUCTION.
- LOCATIONS OF CONDUITS, BOXES, FITTINGS, ETC., ARE DIAGRAMATIC. IT SHALL BE THE ELECTRICAL CONTRACTOR'S RESPONSIBILITY TO VERIFY ALL SIZES AND LOCATIONS. REVIEW ALL MECHANICAL SHOP DRAWINGS AND COORDINATE WITH THE MECHANICAL CONTRACTOR, PUMPER AND ENGINEER TO INSURE THE TIMELY DELIVERY AND PROPER INSTALLATION OF ALL ELECTRICAL EQUIPMENT. (I.E. CONTROL PANELS, AREA LIGHTING, ETC.)
- BEFORE INSTALLATION, THE ELECTRICAL CONTRACTOR SHALL SUBMIT DETAILED LAYOUT DRAWINGS TO THE ENGINEER FOR REVIEW COVERING PROPOSED LOCATIONS, MOUNTING AND ROUTING FOR ALL CONDUITS, SERVICES, FITTINGS, GROUND RODS, AREA LIGHTING, CONTROL PANELS, SUPPORTS, ETC.
- ENCLOSURE, JUNCTION BOXES, RECEPTACLES AND ALL OTHER ELECTRICAL EQUIPMENT USED OUTDOOR SHALL BE OF NEMA 4X (STAINLESS STEEL) CONSTRUCTION UNLESS OTHERWISE NOTED.
- MINIMUM CONDUIT SIZE IS 3/4". ALL EXPOSED CONDUIT SHALL BE RIGID STEEL AND ALL DUCT BANK CONDUIT SHALL BE SCHEDULE 40PVC UNLESS NOTED OTHERWISE.
- THE ELECTRICAL CONTRACTOR AND CAREFULLY REVIEW THE MECHANICAL CONTRACTOR AND CAREFULLY REVIEW THE MECHANICAL CONTRACTOR'S RESPONSIBILITY TO INSURE THAT ALL WIRE AND CONDUIT NEEDED FOR ELECTRICAL APURTENANCES, ASSOCIATED WITH MECHANICAL PACKAGES, ARE PROVIDED EVEN IF NOT SPECIFICALLY CALLED FOR IN THE PLANS AND SPECIFICATIONS.
- THERE SHALL BE WARNING LABELS LOCATED ON THE FRONT OF EACH ELECTRICAL ENCLOSURE. SEE SIGNAGE DETAIL ON SHEET E-02.
- CONTRACTOR SHALL COORDINATE ALL ASPECTS OF NEW SERVICE, INCLUDING LEAD TIMES, WITH UTILITY COMPANY AND INCLUDE ALL COSTS IN BID.
- WARNING TAPE SHALL BE INSTALLED 12 TO 18 INCHES BELOW GRADE OVER ALL CONDUITS.
- PROVIDE 1/4" MINIMUM DIAMETER PULL ROPE. PULL ROPE SHALL NOT BE NYLON STRING.
- FOR SERVICE ENTRANCE CONDUITS, UTILIZE LONG RADIUS (36") CONDUIT BENDS.
- ALL CONDUIT RISERS FROM UNDERGROUND SHALL HAVE RIGID METAL ELLS AND RISERS.
- BEFORE CONSTRUCTION, CONTRACTOR SHALL VERIFY THE LOCATION OF ALL EXISTING UNDERGROUND UTILITIES. AVOID DISTURBANCE OF EXISTING UTILITIES NOT INCLUDED IN THIS PRODUCT.
- SETScrew conduit fittings shall not be permitted.
- CONTRACTOR SHALL MAKE ALL NECESSARY INTERCONNECTIONS BETWEEN CONTROL PANELS AND EQUIPMENT FURNISHED BY OTHERS AS INSTRUCTED BY THE SUPPLIER OF SUCH EQUIPMENT. COORDINATE WITH THE EQUIPMENT SUPPLIER PRIOR TO BIDDING AND INCLUDE ALL ASSOCIATED COSTS IN BIDS.
- COORDINATE SCOPE OF DEMOLITION WITH THE CIVIL DRAWINGS AND INCLUDE ALL ASSOCIATED COSTS IN BIDS.

FIXTURE SCHEDULE

- LED VAPORIGHT FIXTURE, POLYCARBONATE HOUSING, SURFACE MOUNT, 4,000 LUMENS, 4000K, 120 VOLT, LITHONIA LIGHTING #CSVT-148-AL03-AV01-T-SMW3-80CRH; FAIL-SAFE #4XRV73-1D5-4-C-UNV-1840-01-U; OR PRIOR APPROVED EQUAL
- AREA LIGHTING FIXTURE WITH HOUSESIDE SHIELD, DIE-CAST ALUMINUM HOUSING, POLE MOUNT, 20,800 LUMENS, 4000K, 120 VOLT, LITHONIA LIGHTING #DSX1-LED-P6-40K-70CR1-1FTM-MVOLT-SP45-HS; BEACON #RAR2-320L-165-4K7-4F-UNV-ASQ; OR PRIOR APPROVED EQUAL

DEPT. OF UTILITIES
 ST. TAMMANY PARISH
 GOVERNMENT
 620 N. TYLER STREET
 COVINGTON, LA 70433

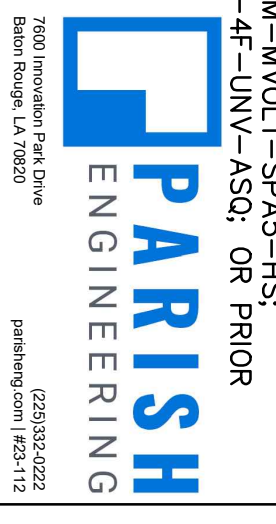
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1	ADDENDUM NO. 3 07.29.24	07/24

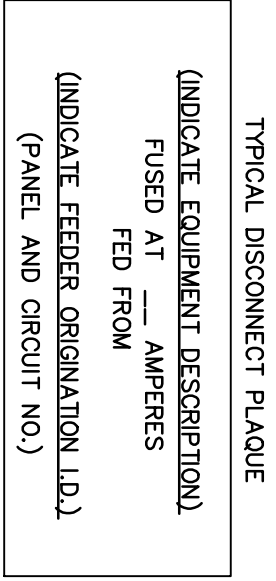
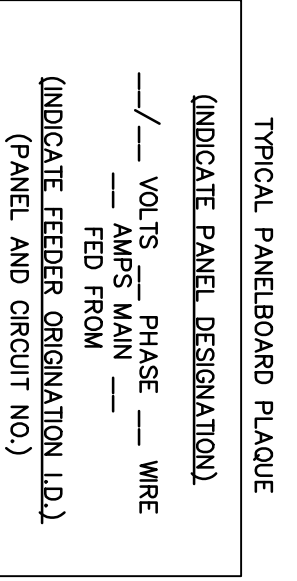
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DRAWN BY:	CC
CHECKED BY:	SG
SUBMITTED BY:	MT
PROJECT No.:	TU23000171 TU23000175
ISSUE DATE:	06/2024
APPROVED BY:	MT
SHEET SIZE:	ANSI D
SCALE:	AS SHOWN



POST OAK SEWER CONSOLIDATION AND FAUBOURG LIFT STATION IMPROVEMENTS
 ST. TAMMANY PARISH, LOUISIANA
 PROJECT No.: TU23000171 & TU23000175
 NEW POST OAK LIFT STATION - ELECTRICAL SITE PLAN

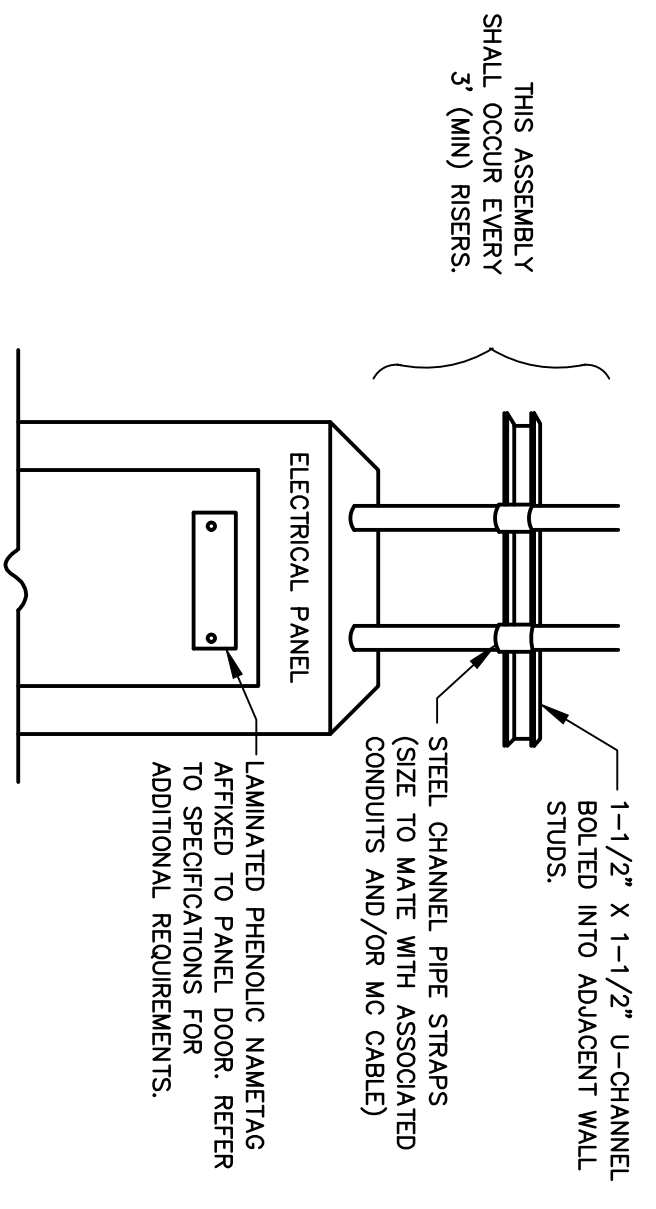
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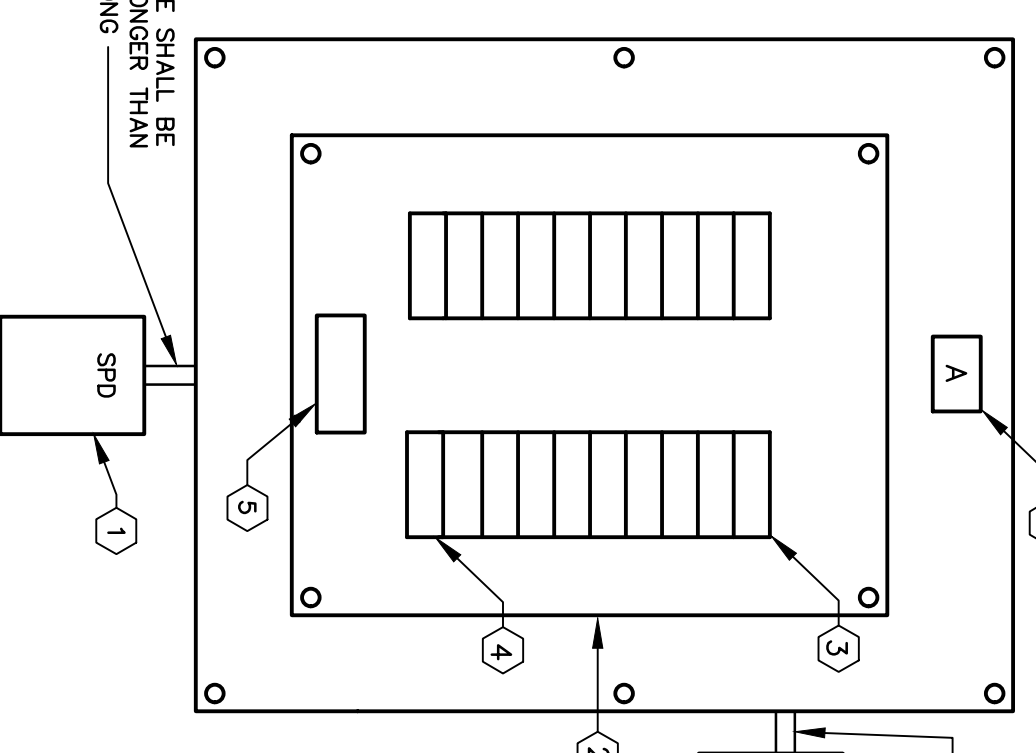


SIGNAGE NOTES:
SEE SPECIFICATIONS FOR MATERIALS, COLORS SIZE LETTERING, ETC.
ATTACH PLAQUES USING INDUSTRIAL GRADE DOUBLE FACE ADHESIVE.

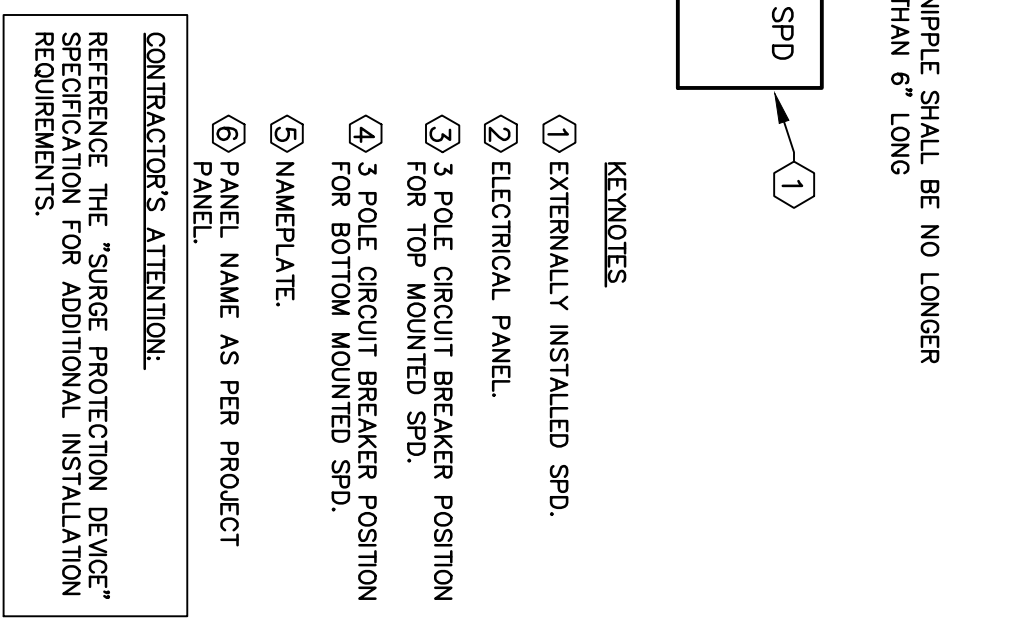
EQUIPMENT SIGNAGE



CONDUIT SUPPORT DETAIL



SPD INSTALLATION DETAIL



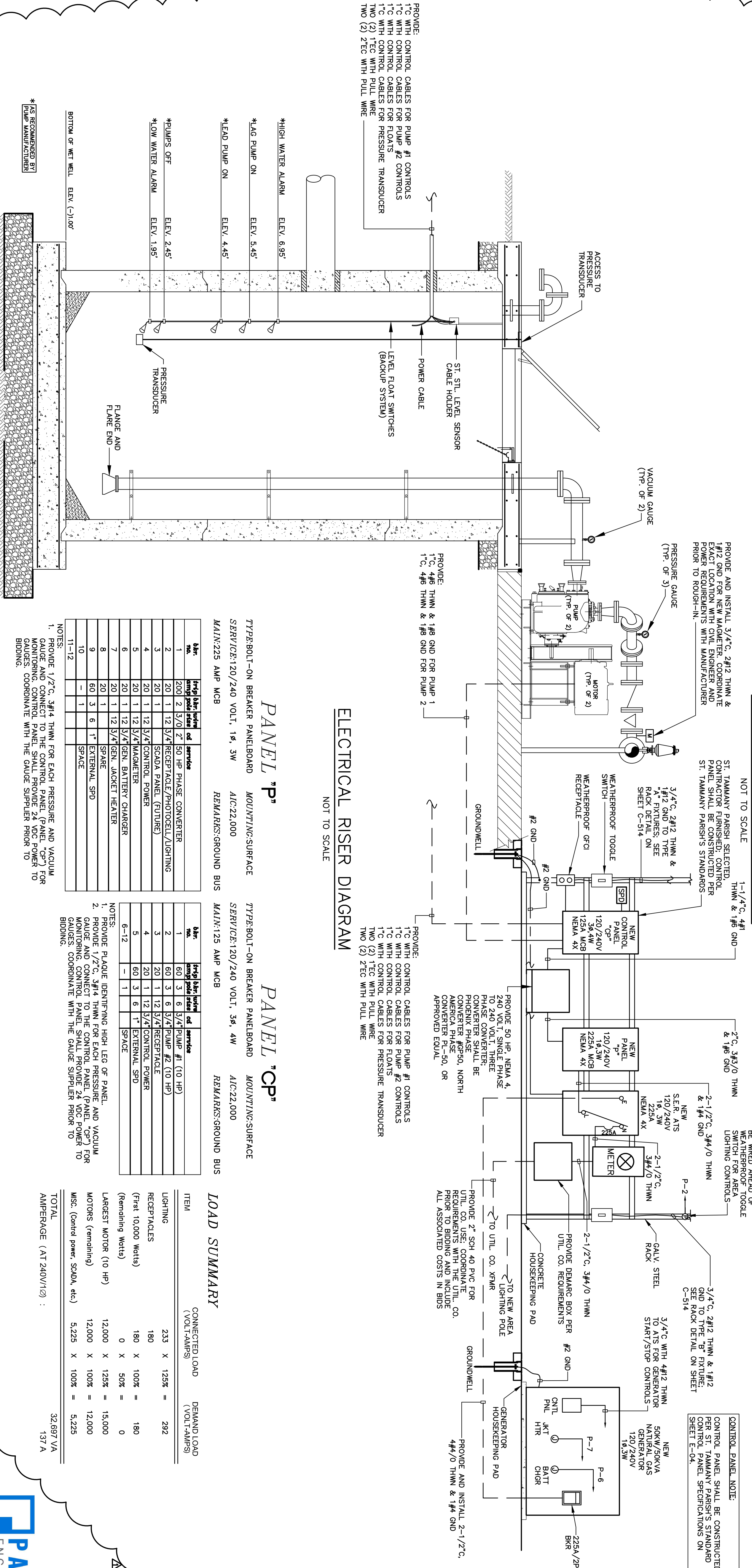
SIGNAGE DETAIL

SIGNAGE NOTES:
1. NAMEPLATES TO BE FABRICATED FROM LAMACOID PLASTIC WITH BLACK OUTER LAMINATION AND A WHITE INNER LAMINATION.
2. LETTERING SHALL BE 1/4" HIGH CAPS, EXCEPT AS NOTED ON SCHEDULE.
3. ENGRAVE LETTERS TO EXPOSE WHITE LAMINATION.
4. ATTACH NAMEPLATES ON EQUIPMENT IN A PROMINENT PLACE. USE TWO (2) MOUNTING SCREWS PER NAMEPLATE. NAMEPLATES SHALL BE FASTENED TO THE BOND GEMENT ON ALL OTHER TYPE ENCLOSURES. ASSURE THAT SURFACE IS CLEAN AND FREE OF PAINT.

CONDUIT SUPPORT DETAIL

CONDUIT SUPPORT DETAIL

EQUIPMENT SIGNAGE



ELECTRICAL RISER DIAGRAM

PANEL "P"

TYPE-BOLT-ON BREAKER PANELBOARD MOUNTING-SURFACE
SERV/ICE:120/240 VOLT, 1Ø, 3W AIC:22,000
MAIN:225 AMP MCB

NO.	DESCRIPTION	AMP	TRIP	TYPE	REMARKS
1	50 HP PHASE CONVERTER	200	2	3/20"	
2	50 HP PHASE CONVERTER	200	2	3/20"	
3	RECEPTACLE/PHOTOCELL/LIGHTING	20	1	1/2"	
4	SCADA PANEL (FUTURE)	20	1	1/2"	
5	120/240V CONTROL POWER	20	1	1/2"	
6	50A GEN. BATTERY CHARGER	20	1	1/2"	
7	120/240V GEN. BATTERY CHARGER	20	1	1/2"	
8	SPARE	60	3	6"	
9	EXTERNAL SPD	60	3	6"	
10	SPACE	-	1	1"	
11-12					

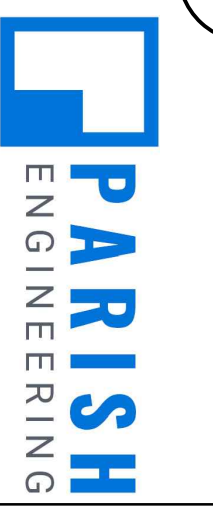
PANEL "CP"

TYPE-BOLT-ON BREAKER PANELBOARD MOUNTING-SURFACE
SERV/ICE:120/240 VOLT, 3Ø, 4W AIC:22,000
MAIN:125 AMP MCB

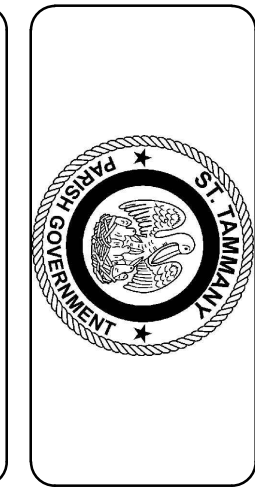
NO.	DESCRIPTION	AMP	TRIP	TYPE	REMARKS
1	10 HP PHASE CONVERTER	60	3	6"	
2	10 HP PHASE CONVERTER	60	3	6"	
3	RECEPTACLE	20	1	1/2"	
4	120/240V CONTROL POWER	20	1	1/2"	
5	SPARE	60	3	6"	
6-12					

LOAD SUMMARY

ITEM	CONNECTED LOAD (VOLT-AMPS)	DEMAND LOAD (VOLT-AMPS)
LIGHTING	233 X 125 =	292
RECEPTACLES (First 10,000 Watts)	180 X 100 =	180
(Remaining Watts)	0 X 50 =	0
LARGEST MOTOR (10 HP)	12,000 X 125 =	15,000
MOTORS (remaining)	12,000 X 100 =	12,000
MISC. (Control power, SCADA, etc.)	5,225 X 100 =	5,225
TOTAL		32,697 VA
		137 A



7800 International Park Drive
Bossier Rouge, LA 70609
504.833.2222
parisheng.com | 18261172



DEPT. OF UTILITIES
ST. TAMMANY PARISH
GOVERNMENT
620 N. TYLER STREET
COVINGTON, LA 70433

DATE: 07/24
DESCRIPTION OF REVISION: ADDENDUM NO. 3
07.29.24

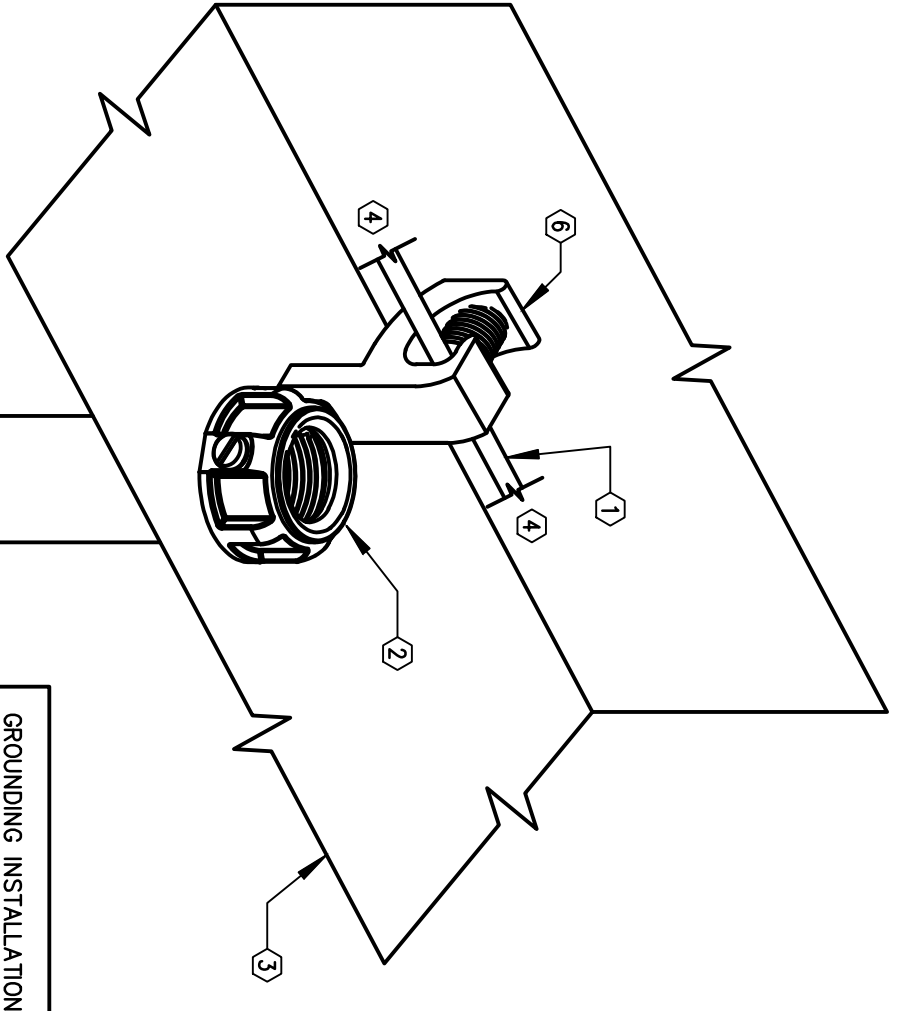
No.	DESCRIPTION OF REVISION	DATE:
1	ADDENDUM NO. 3	07.29.24

DESIGNED BY: CC
DRAWN BY: CC
CHECKED BY: SG
SUBMITTED BY: MT
PROJECT No.: TU23000171
TU23000175
ISSUE DATE: 06/2024
APPROVED BY: MT
SHEET SIZE: ANSI D
SCALE: AS SHOWN

MOHAMED ALI
REGISTERED ELECTRICAL ENGINEER
STATE OF LOUISIANA
NO. 07182024

POST OAK SEWER CONSOLIDATION AND FAUBOURG LIFT STATION IMPROVEMENTS
ST. TAMMANY PARISH, LOUISIANA
PROJECT No.: TU23000171 & TU23000175
NEW POST OAK LIFT STATION - RISER DIAGRAM, SCHEDULE, & DETAILS

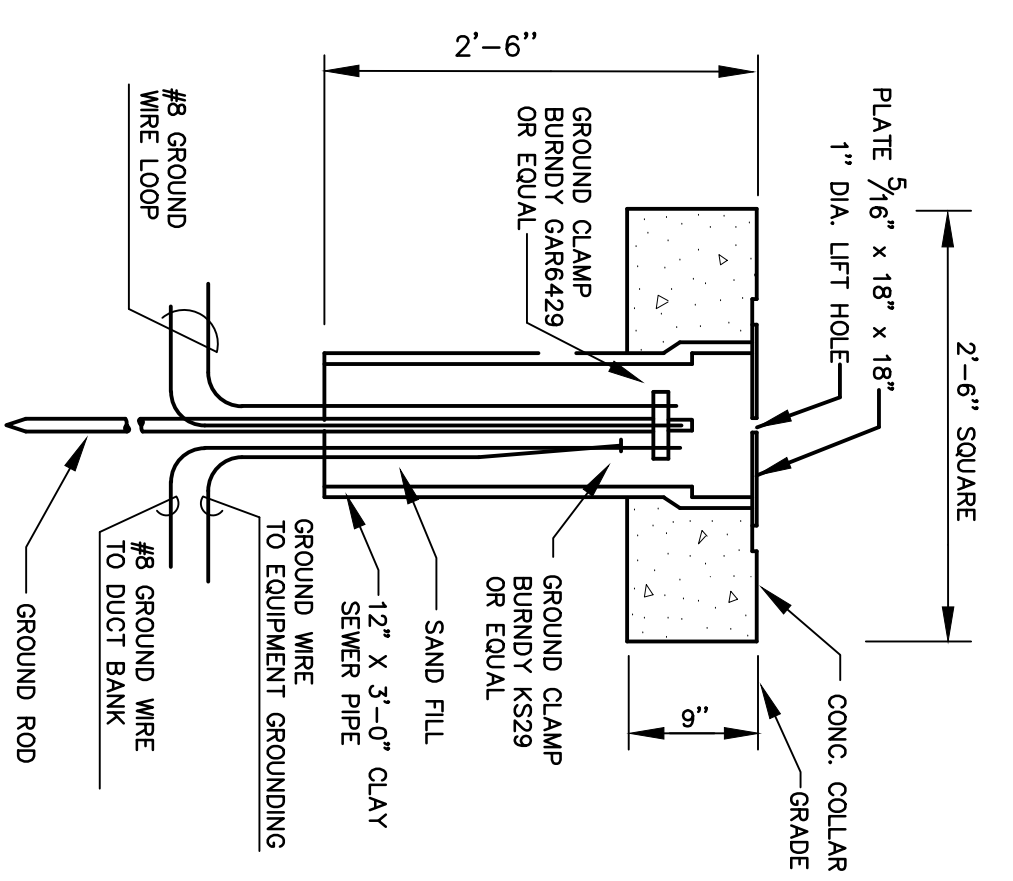
SHEET NO. E-02
SHEET 36 of 42



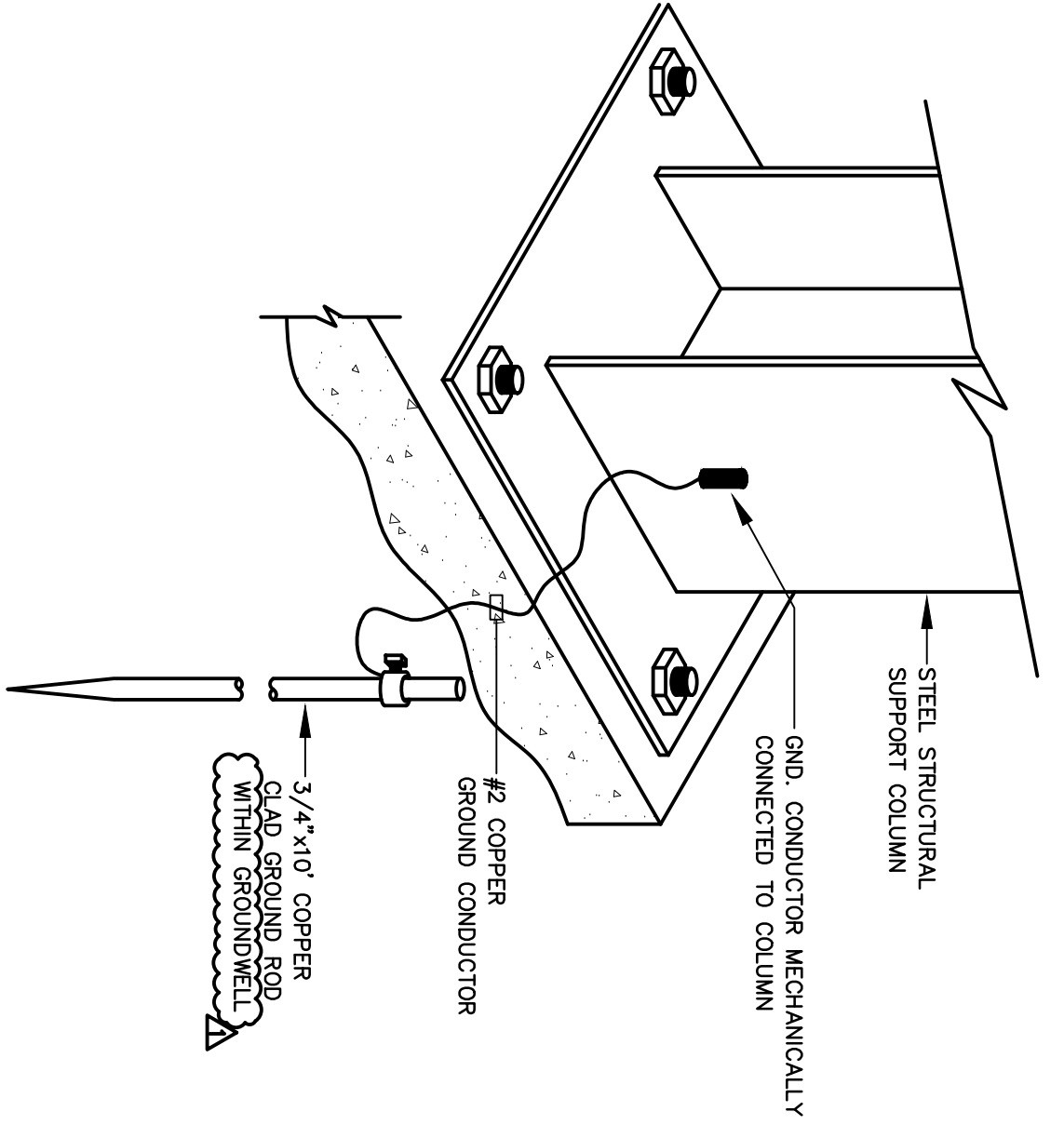
GROUNDING INSTALLATION SHALL MEET ALL REQUIREMENTS OF NEC 250.92.

- DETAIL NOTES**
- 1 SUPPLY SIDE EQUIPMENT BONDING JUMPER.
 - 2 UL 487 LISTED GROUNDING BUSHING BY APPLETON, EATON, OR APPROVED EQUIVALENT.
 - 3 ENCLOSURE.
 - 4 TO ENCLOSURE GROUND BUS OR ADDITIONAL CONDUITS (AS REQUIRED).
 - 5 INCOMING CONDUIT.
 - 6 INTEGRAL BRACKET FOR ATTACHMENT OF BONDING JUMPER.

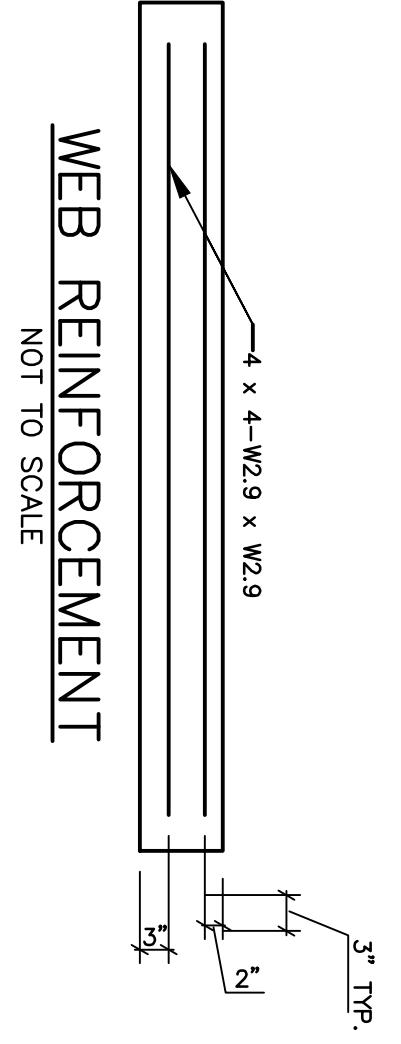
CONDUIT GROUND BUSHING
NOT TO SCALE



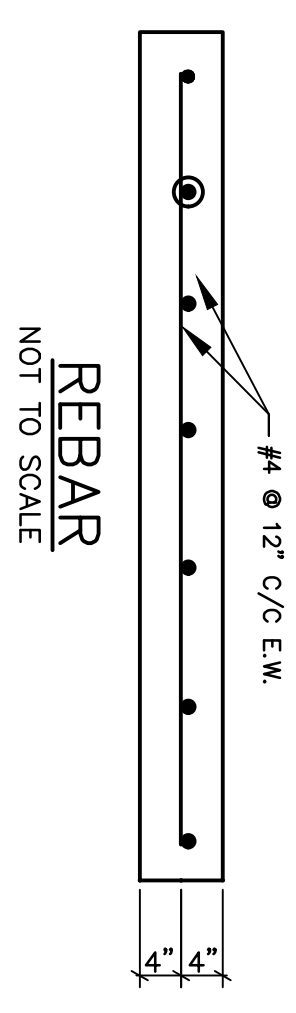
GROUNDWELL DETAIL
NOT TO SCALE



SUPPORT RACK STEEL GROUNDING DETAIL
NOT TO SCALE



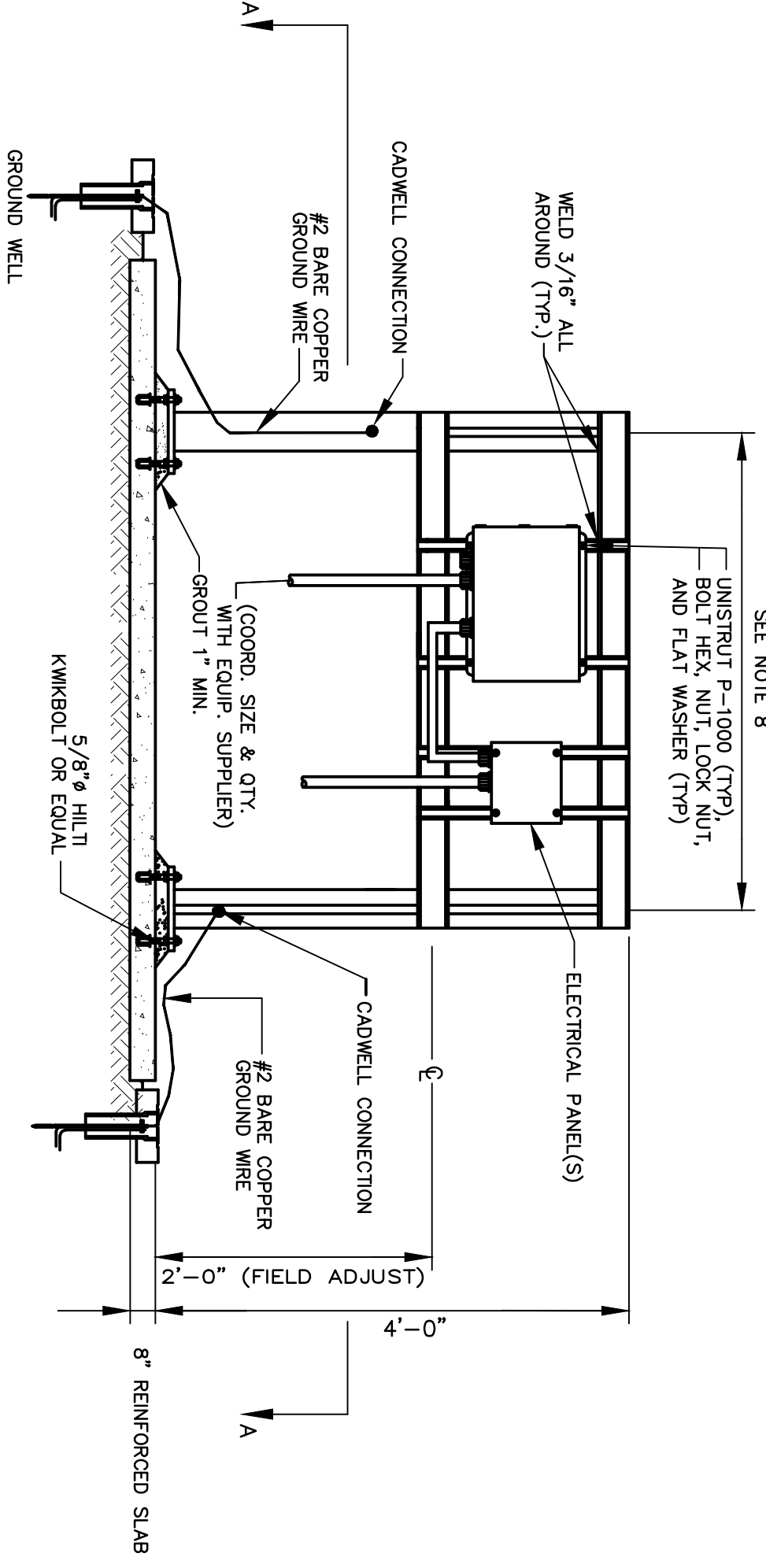
WEB REINFORCEMENT
NOT TO SCALE



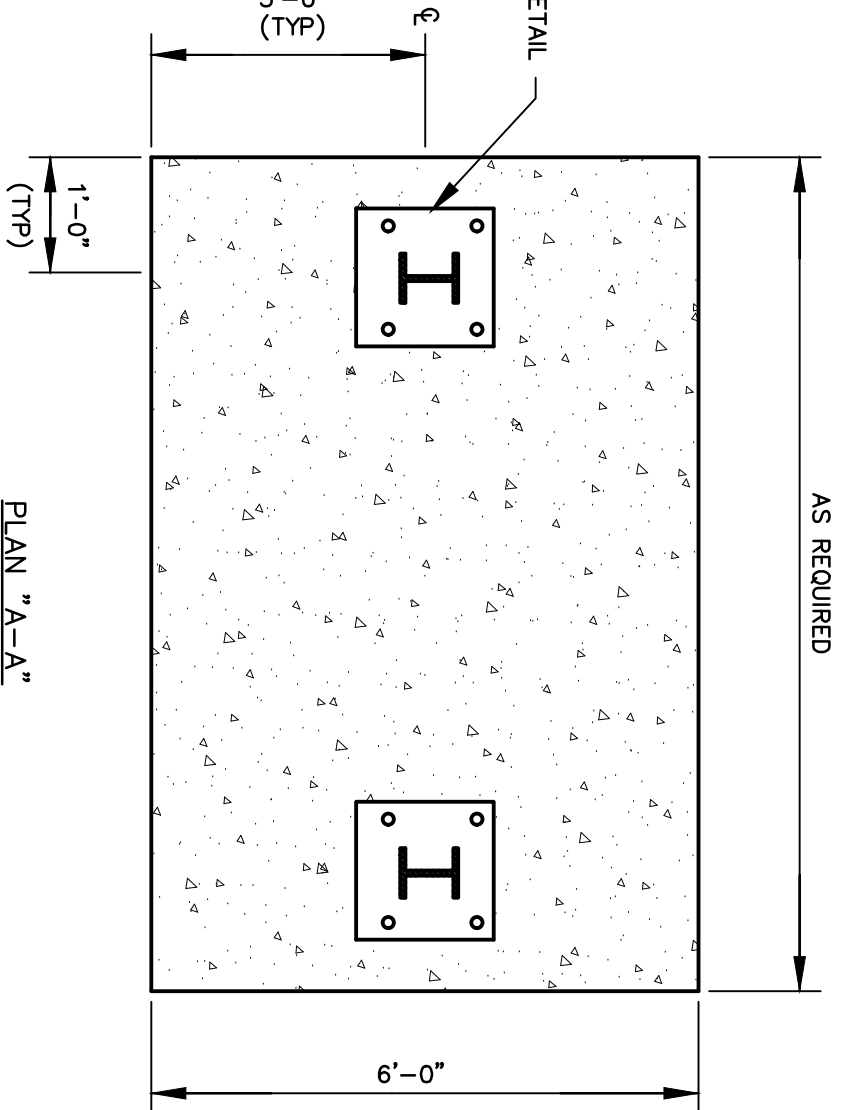
REBAR
NOT TO SCALE

CONCRETE PAD
ELEVATION

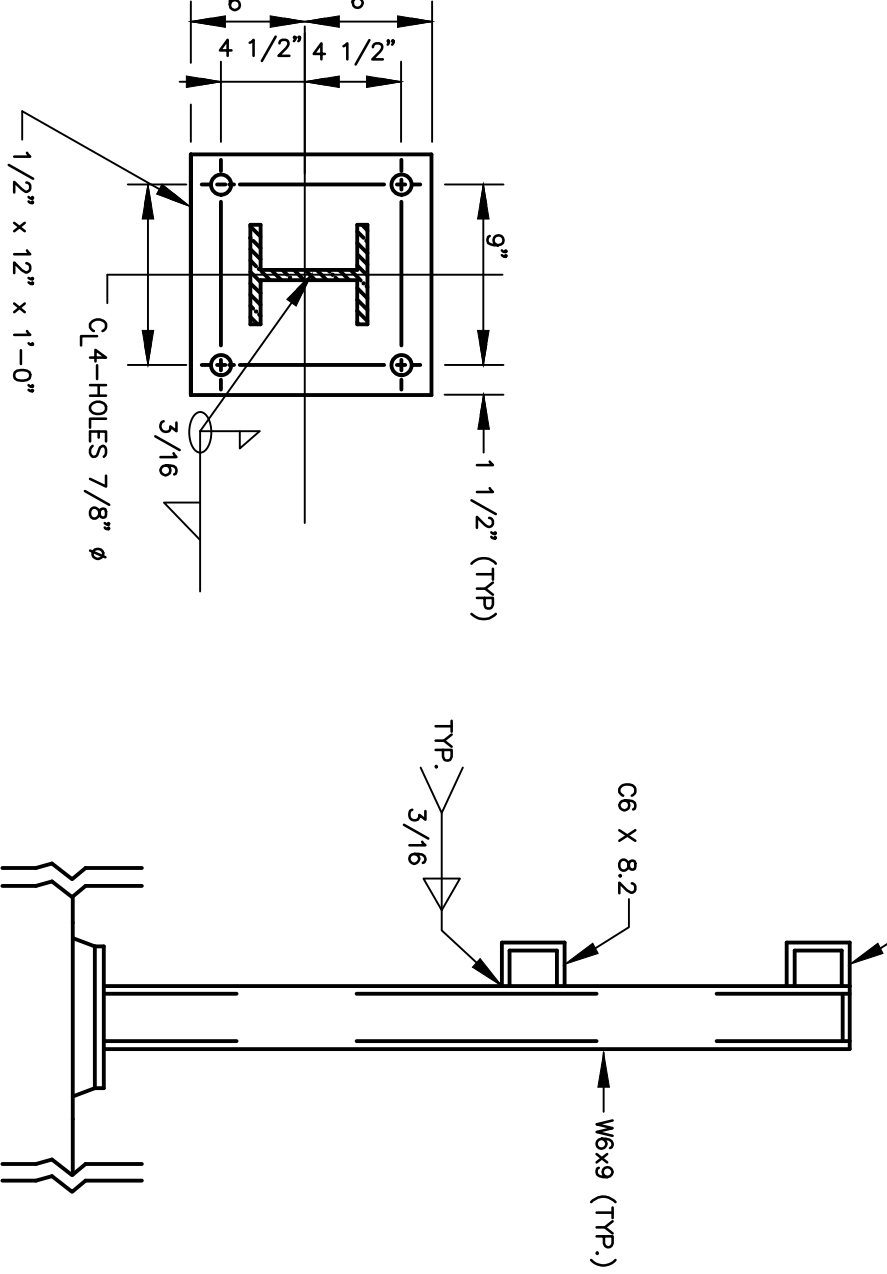
THIS DETAIL IS INTENDED TO SHOW TYPICAL EQUIPMENT MOUNTING TECHNIQUES. ALL EQUIPMENT IS NOT SHOWN FOR CLARITY.



ELEVATION VIEW
NOT TO SCALE

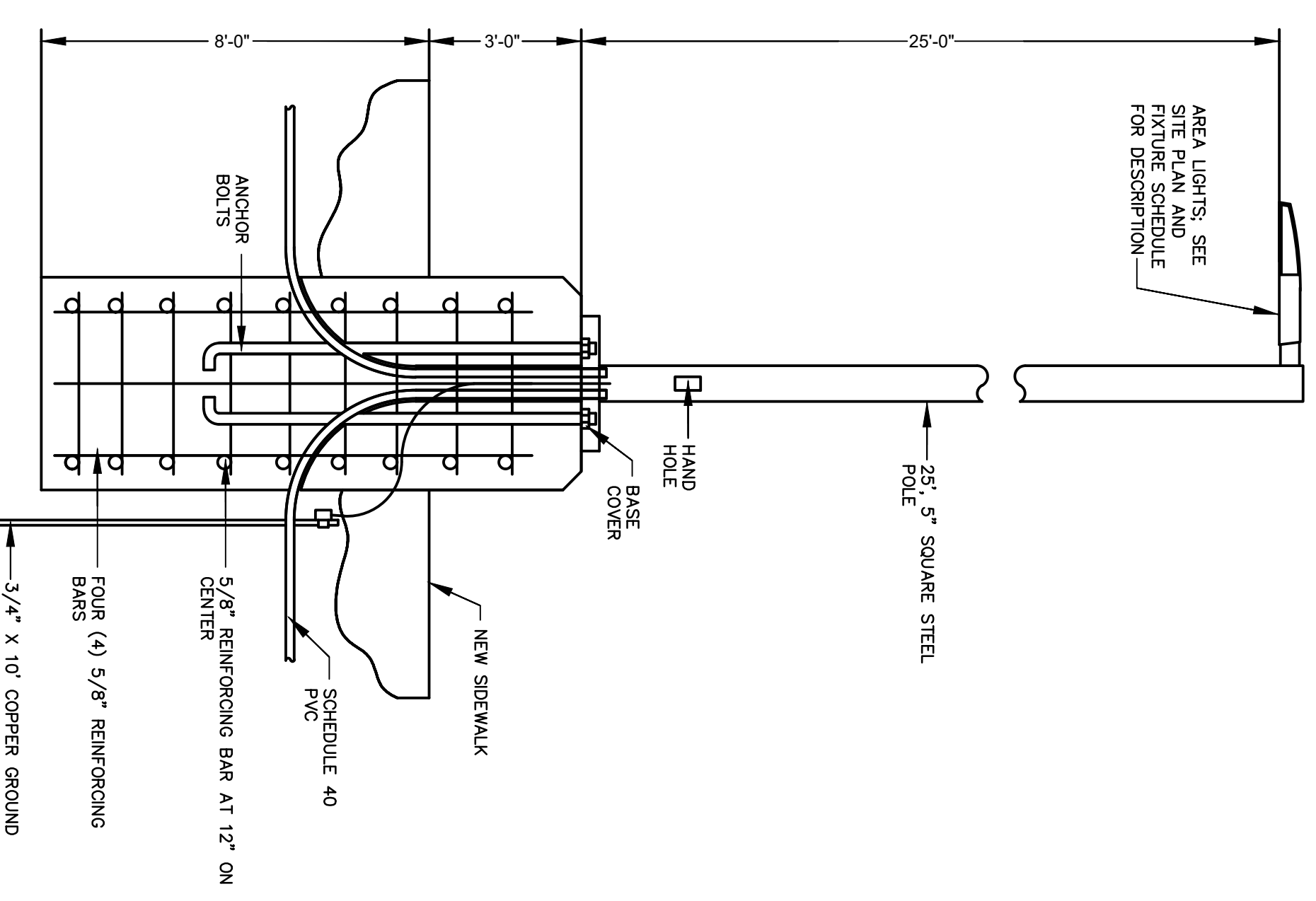


CONCRETE PAD
NOT TO SCALE



BASE PLATE DETAIL
NOT TO SCALE

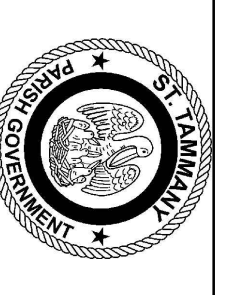
SIDE VIEW
NOT TO SCALE



AREA LIGHTING POLE DETAIL
NOT TO SCALE

- SWITCH RACK NOTES:**
1. VERIFY ALL DIMENSIONS BEFORE FABRICATION.
 2. REMOVE BURRS AND GRIND SHARP CORNERS AND EDGES. TOUCH UP AS REQUIRED AFTER WELDING AND DRILLING.
 3. FIELD GROUT UNDER BASE PLATE.
 4. ANCHOR BOLTS SHALL BE 4 INCH IN CONCRETE AND SHALL BE PROVIDED WITH HEX NUTS AND WASHERS.
 5. ALL ALUMINIUM SHALL BE 6061.
 6. MINIMUM CONCRETE STRENGTH SHALL BE 3000 PSI.
 7. MAXIMUM OF 6 FEET BETWEEN SUPPORT COLUMNS.
 8. ALL UNISTRUT SHALL BE ALUMINIUM TYPE.

TYP. ELECTRIC SWITCH RACK DETAIL
NOT TO SCALE



DEPT. OF UTILITIES
ST. TAMMANY PARISH
GOVERNMENT
620 N. TYLER STREET
COVINGTON, LA 70433

DATE: 07/24

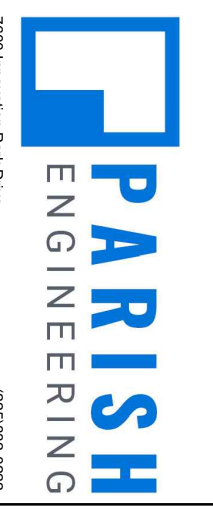
No.	DESCRIPTION OF REVISION
1	ADDENDUM NO. 3 07.29.24

DESIGNED BY:	CC
DRAWN BY:	CC
CHECKED BY:	SG
SUBMITTED BY:	MT
PROJECT No.:	TU23000171 TU23000175
ISSUE DATE:	06/2024
APPROVED BY:	MT
SHEET SIZE:	ANSI D
SCALE:	AS SHOWN



POST OAK SEWER CONSOLIDATION AND FAUBOURG LIFT STATION IMPROVEMENTS
ST. TAMMANY PARISH, LOUISIANA
PROJECT No.: TU23000171 & TU23000175

NEW POST OAK LIFT STATION - ELECTRICAL DETAILS



SHEET NO. E-03 SHEET 37 of 42

SYMBOL SCHEDULE	
	POWER PANEL
	FUSED SAFETY DISCONNECT SWITCH
	WEATHERPROOF
	ELECTRICAL CONDUIT ROUTED UNDERGROUND
	GROUND FAULT INTERRUPTER DUPLEX RECEPTACLE
	LED FIXTURES *X* DENOTES TUBE
	EMERGENCY LIGHTING UNIT

ELECTRICAL GENERAL NOTES

- ALL ELECTRICAL WORK SHALL BE DONE IN STRICT ACCORDANCE WITH THE LATEST EDITION OF THE NATIONAL ELECTRICAL CODE. ALL WORK SHOWN IS NEW UNLESS NOTED OTHERWISE.
- THE CONDUIT SYSTEM, ALL ELECTRICAL EQUIPMENT, ALL STEEL STRUCTURES, MOTOR FRAMES, ETC. SHALL BE CONNECTED TO THE GROUNDING SYSTEM PER ARTICLE 250 OF THE NATIONAL ELECTRICAL CODE.
- ALL EQUIPMENT LOCATIONS SHALL BE VERIFIED IN THE FIELD WITH MECHANICAL TRADES, CONDUIT ROUTING AND EQUIPMENT LOCATIONS SHOWN ARE DIAGRAMMATIC ONLY. THE EXACT LOCATION OF ALL EQUIPMENT AND ROUTING OF CABLES SHALL BE COORDINATED WITH & APPROVED BY ST. TAMMANY PARISH'S REPRESENTATIVE DURING CONSTRUCTION.
- LOCATIONS OF CONDUITS, BOXES, FITTINGS, ETC. ARE DIAGRAMMATIC. IT SHALL BE THE ELECTRICAL CONTRACTOR'S RESPONSIBILITY TO VERIFY ALL SIZES AND LOCATIONS WITH ALL MECHANICAL, SHOP DRAWINGS, AND COORDINATE WITH THE MECHANICAL CONTRACTOR, OWNER, AND ENGINEER TO INSURE THE TIMELY DELIVERY AND PROPER INSTALLATION OF ALL ELECTRICAL EQUIPMENT. (I.E. CONTROL PANELS, AREA LIGHTING, ETC.)
- BEFORE INSTALLATION, THE ELECTRICAL CONTRACTOR SHALL SUBMIT DETAILED LAYOUT DRAWINGS TO THE ENGINEER FOR REVIEW COVERING PROPOSED LOCATIONS, MOUNTING, AND ROUTING FOR ALL CONDUITS, SERVICES, FITTINGS, GROUND RODS, AREA LIGHTING, CONTROL PANELS, SUPPORTS, ETC.
- ENCLOSURE, JUNCTION BOXES, RECEPTACLES AND ALL OTHER ELECTRICAL EQUIPMENT USED OUTDOOR SHALL BE OF NEMA 4X (STAINLESS STEEL) CONSTRUCTION UNLESS OTHERWISE NOTED.
- MINIMUM CONDUIT SIZE IS 3/4", ALL EXPOSED CONDUIT SHALL BE RIGID STEEL AND ALL DUCT BANK CONDUIT SHALL BE SCHEDULE 40 PVC UNLESS NOTED OTHERWISE.
- THE ELECTRICAL CONTRACTOR SHALL COORDINATE WITH THE MECHANICAL CONTRACTOR AND CAREFULLY REVIEW THE MECHANICAL PACKAGES PROPOSED TO BE SUPPLIED. IT SHALL BE THE ELECTRICAL CONTRACTOR'S RESPONSIBILITY TO INSURE THAT ALL WIRE AND CONDUIT NEEDED FOR ELECTRICAL APURTENANCES, ASSOCIATED WITH MECHANICAL PACKAGES, ARE PROVIDED EVEN IF NOT SPECIFICALLY CALLED FOR IN THE PLANS AND SPECIFICATIONS.
- HERE SHALL BE WARNING LABELS LOCATED ON THE FRONT OF EACH ELECTRICAL ENCLOSURE. SEE SIGNAGE DETAIL ON SHEET E-06.
- CONTRACTOR SHALL COORDINATE ALL ASPECTS OF NEW SERVICE INCLUDING LEAD TIMES, WITH UTILITY COMPANY AND INCLUDE ALL COSTS IN BID.
- WARNING TAPE SHALL BE INSTALLED 12 TO 18 INCHES BELOW GRADE OVER ALL CONDUITS.
- PROVIDE 1/4" MINIMUM DIAMETER PULL ROPE. PULL ROPE SHALL NOT BE NYLON STRING.
- FOR SERVICE ENTRANCE CONDUITS, UTILIZE LONG RADIUS (36") CONDUIT BENDS.
- ALL CONDUIT RISERS FROM UNDERGROUND SHALL HAVE RIGID METAL ELLS AND RISERS.
- PRIOR TO CONSTRUCTION, CONTRACTOR SHALL VERIFY THE LOCATION OF ALL EXISTING UNDERGROUND UTILITIES. AVOID DISTURBANCE OF EXISTING UTILITIES NOT INCLUDED IN THIS PROJECT.
- SETS CREW CONDUIT FITTINGS SHALL NOT BE PERMITTED.
- CONTRACTOR SHALL MAKE ALL NECESSARY INTERCONNECTIONS BETWEEN CONTROL PANELS AND EQUIPMENT TERMINATED BY OTHERS AS INSTRUCTED BY THE SUPPLIER OF SUCH EQUIPMENT. COORDINATE WITH THE EQUIPMENT SUPPLIER PRIOR TO BIDDING AND INCLUDE ALL ASSOCIATED COSTS IN BIDS.

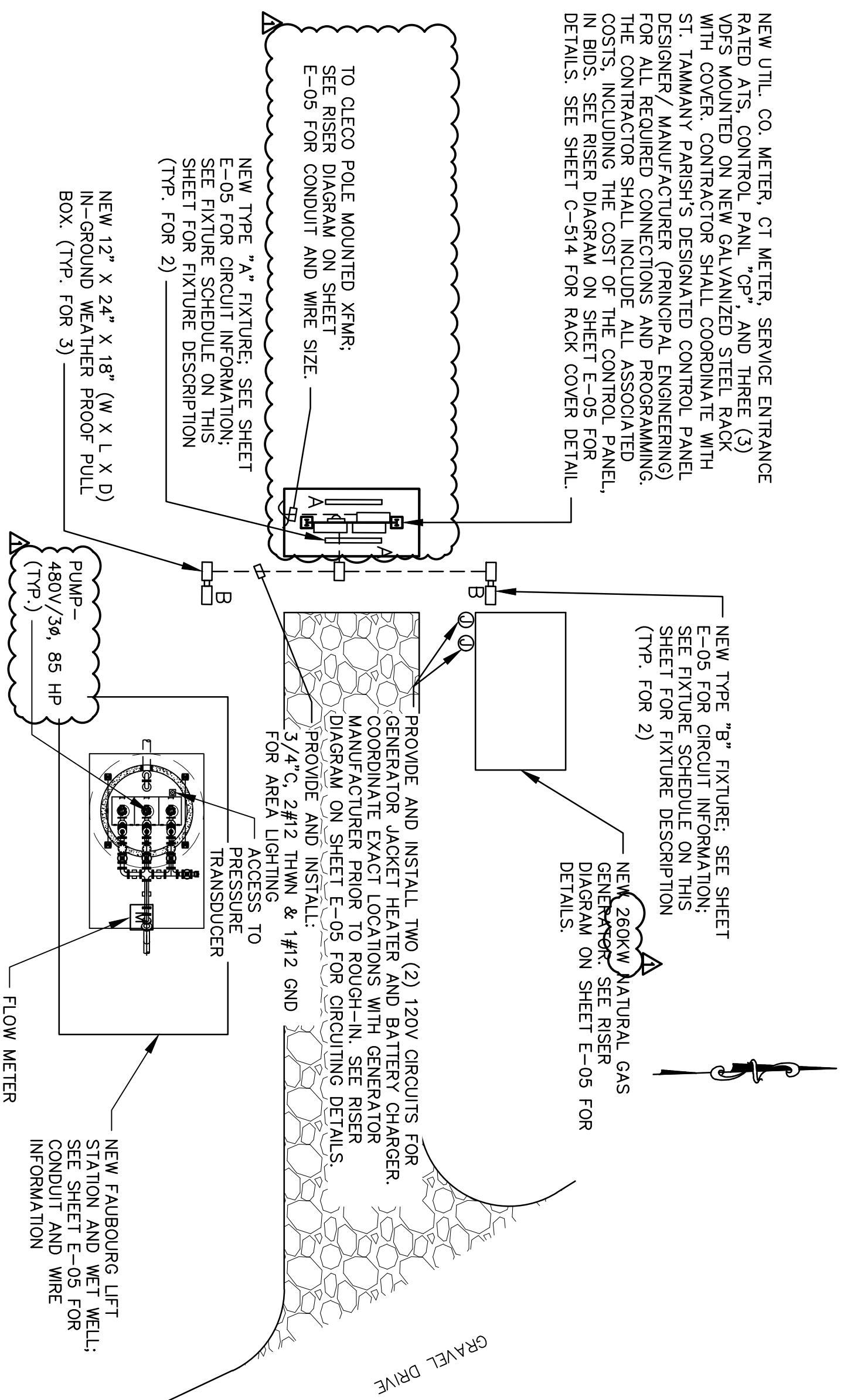
LIGHTING FIXTURE SCHEDULE

- LED VAPORTIGHT FIXTURE, POLYCARBONATE HOUSING, CHAIN HANGER, MOUNT AT 10'-0" AFF, 4,000 LUMENS, 4000K, 120 VOLT, LITHONIA LIGHTING
#CSV1-L48-AL03-MVOLT-SMW3-80CRI-HC36 OR PRIOR APPROVED EQUAL
- LED AREA LIGHTING FIXTURE WITH GLARE SHIELD, DIE-CAST ALUMINUM HOUSING, POLE MOUNT, 20,000 LUMENS, 4000K, 120 VOLT, LITHONIA LIGHTING
#DSX1-LED-P6-40K-70CRI-14LG-MVOLT-SPAS-EGSR- BEACON #RAR2-320L-165-4K7-4W-UNV-ASD OR PRIOR APPROVED EQUAL

SYMBOL LEGEND					
	DOOR/DEADFRONT MOUNTED DEVICE		JUNCTION BOX		GROUND
	BACKPLATE MOUNTED DEVICE		POWER DISTRIBUTION BLOCK		NON-FUSED DISCONNECT SWITCH
	BACKPLATE MOUNTED DEVICE		SCADA EQUIPMENT		

COMPONENT LEGEND

	SPD	SURGE SUPPRESSION DEVICE - SEE COMPONENT SPECIFICATIONS		FFC	VARIABLE FREQUENCY DRIVE CONTROLLER - SEE COMPONENT SPECIFICATIONS
	PM	PHASE MONITOR - SEE COMPONENT SPECIFICATIONS		LMC	LEVEL METER CONTROLLER - SEE COMPONENT SPECIFICATIONS
	QPC	QUADRAPEX PUMP CONTROLLER - SEE COMPONENT SPECIFICATIONS		LB	ANALOG SIGNAL LINE FILTER - SEE COMPONENT SPECIFICATIONS
	VFD	VARIABLE FREQUENCY DRIVE - SEE COMPONENT SPECIFICATIONS		LT	LEVEL TRANSMITTER - SEE COMPONENT SPECIFICATIONS
	LR	LINE REACTOR - SEE COMPONENT SPECIFICATIONS		FS	FLOAT SWITCH - SEE COMPONENT SPECIFICATIONS
	CAT	ALARM TELEMETRY MODULE - SEE COMPONENT SPECIFICATIONS		TH	THERMOSTAT - SEE COMPONENT SPECIFICATIONS
	MM	MOTOR MONITOR - SEE COMPONENT SPECIFICATIONS		CF	EXHAUST FAN - SEE COMPONENT SPECIFICATIONS
	CT	CURRENT TRANSFORMER - SEE COMPONENT SPECIFICATIONS		AL	COMMON ALARM/CABINET LIGHT - SEE COMPONENT SPECIFICATIONS



ELECTRICAL SITE PLAN

1" = 10'-0"



ST. TAMMANY PARISH GOVERNMENT
620 N. TYLER STREET
COVINGTON, LA 70433

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07/24

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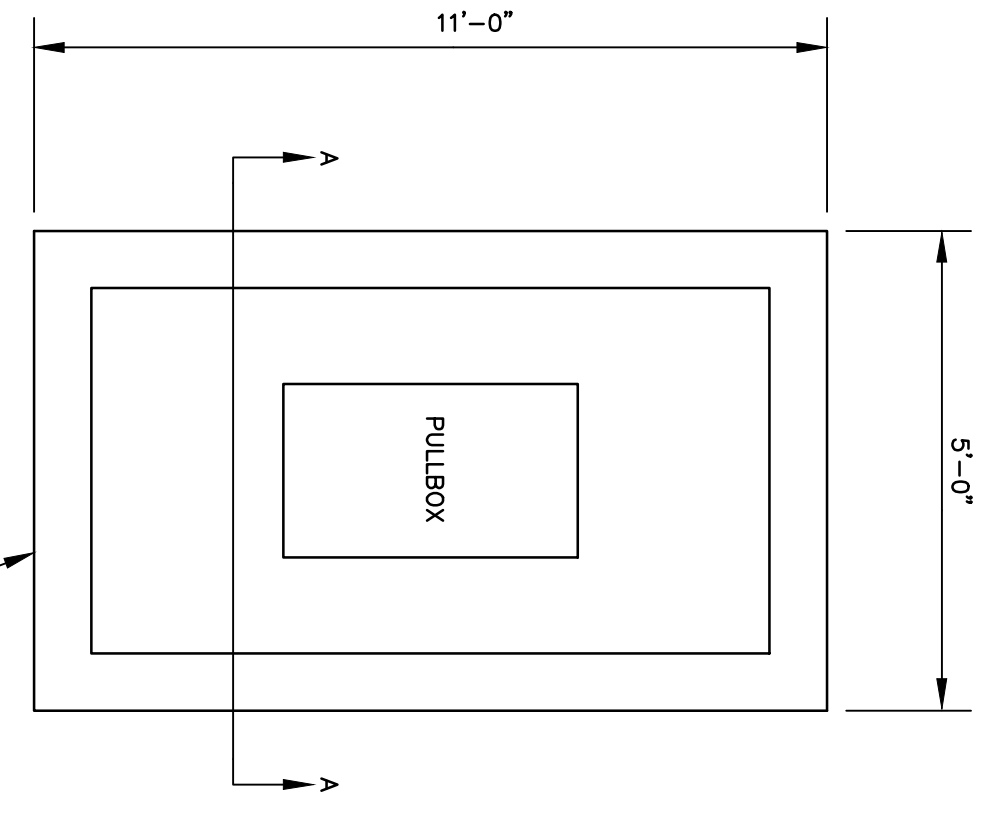
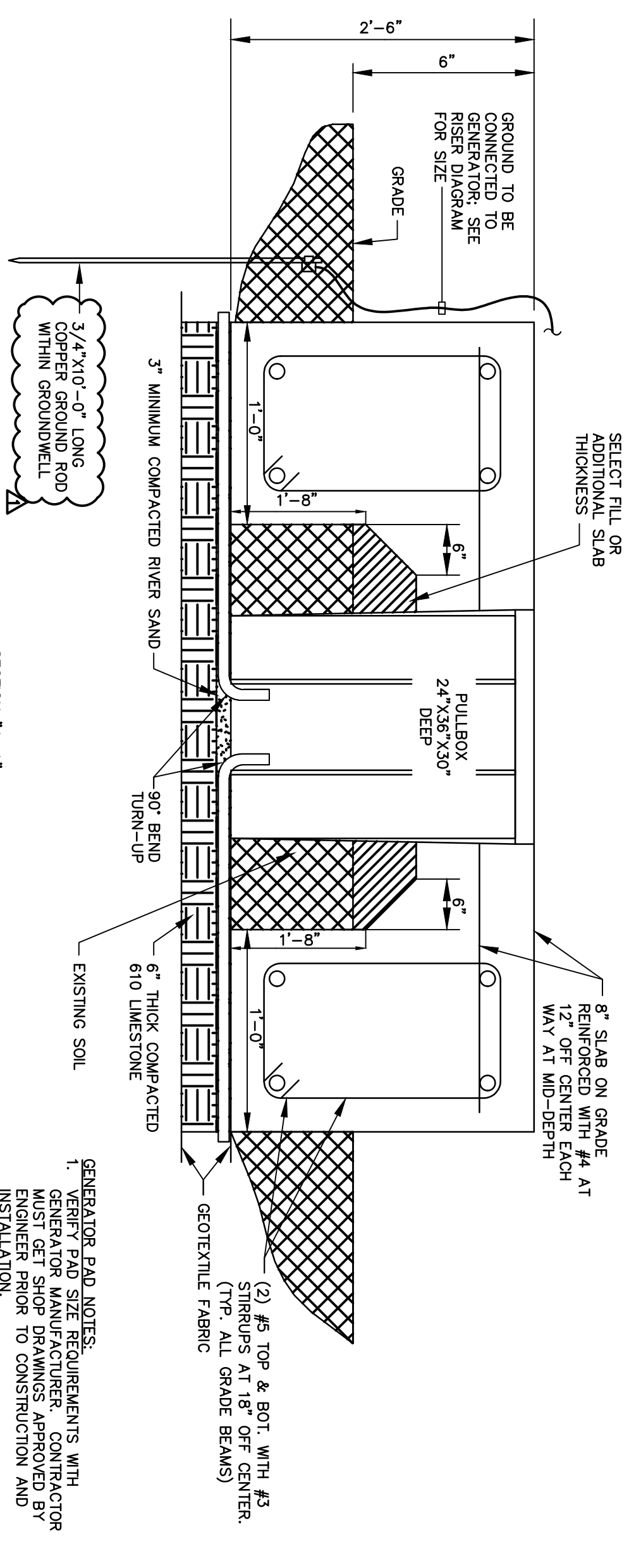
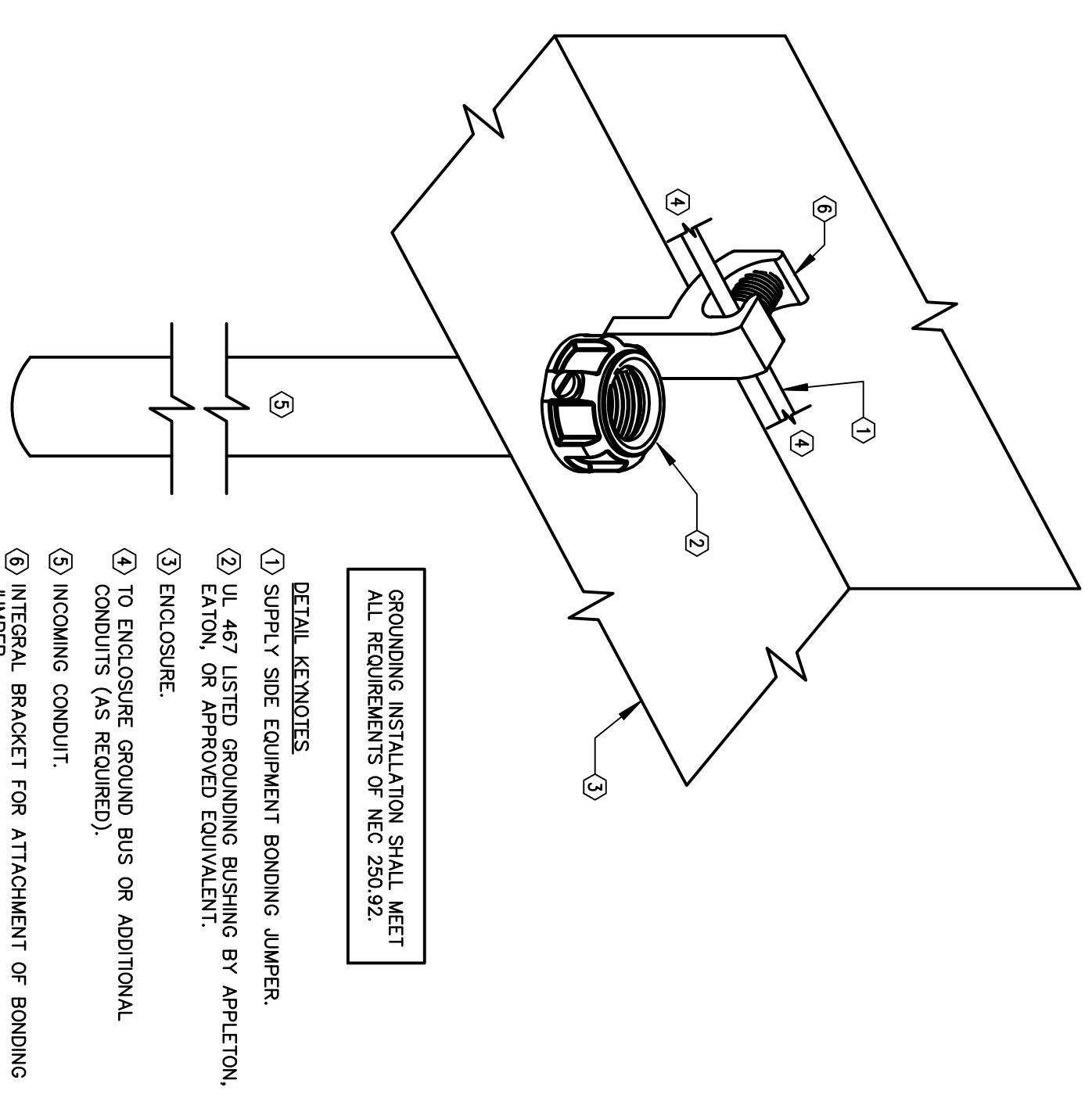
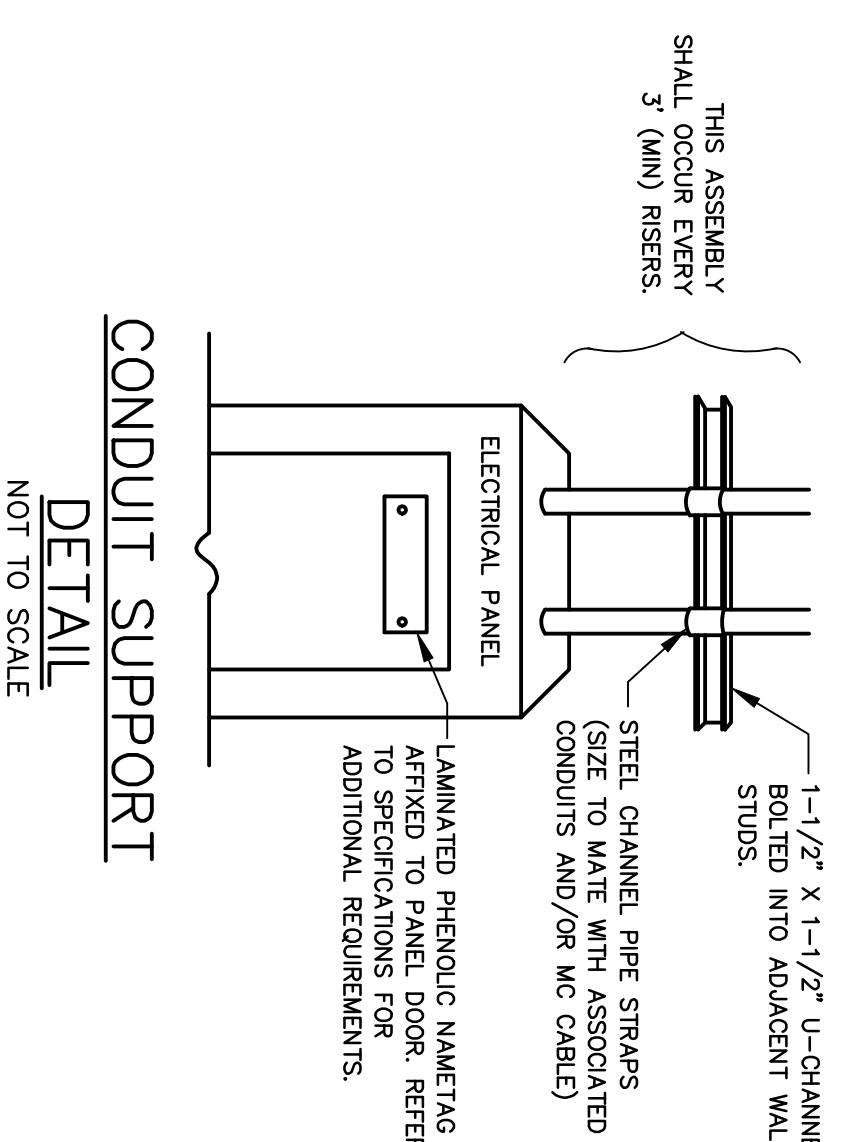
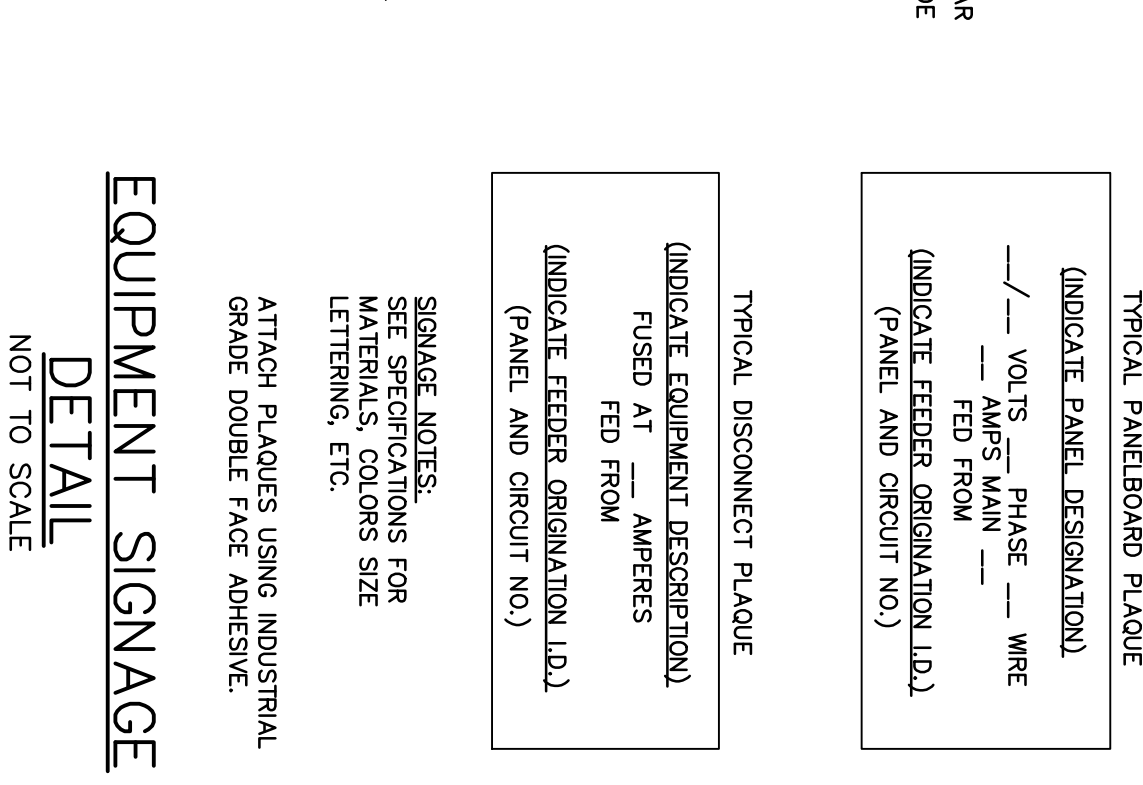
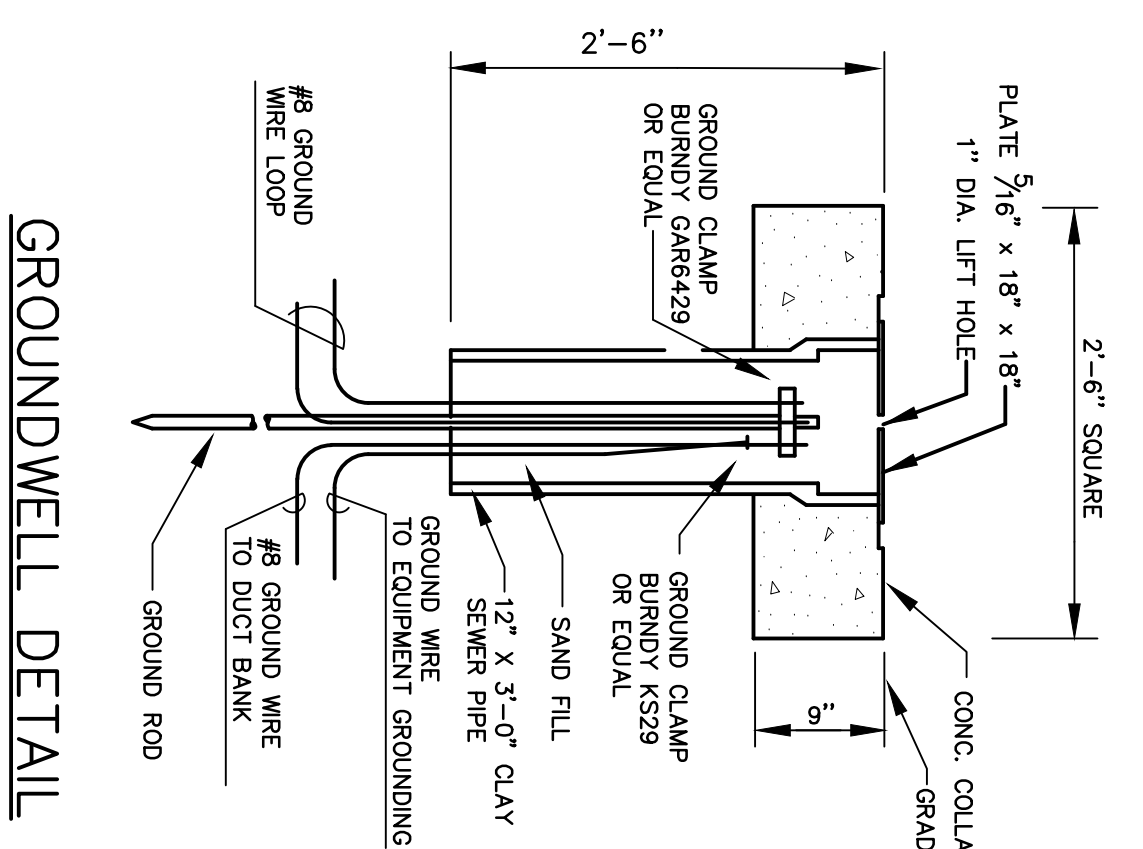
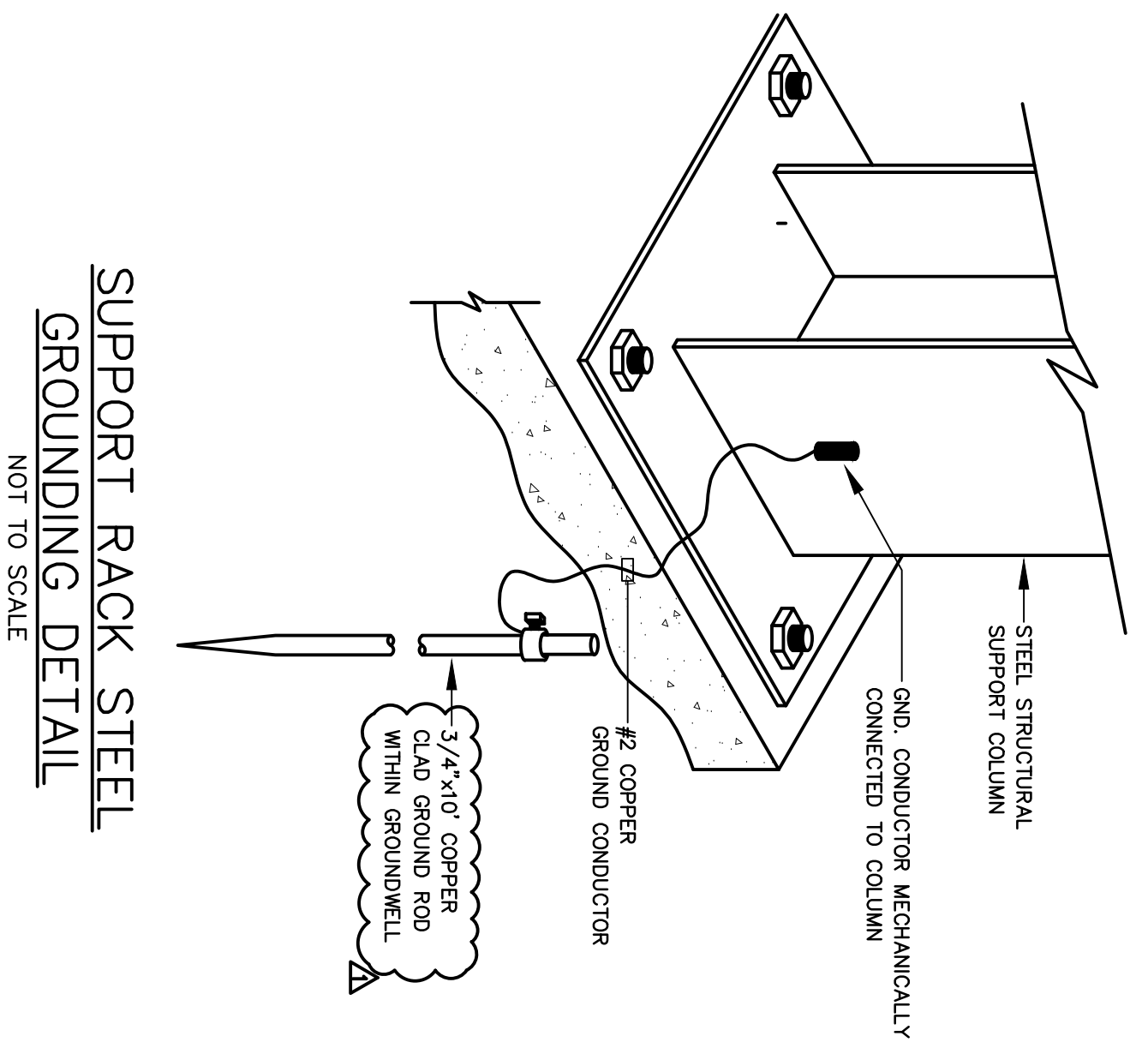
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PROJECT No.:	TU23000171 TU23000175
ISSUE DATE:	06/2024
APPROVED BY:	MT
SHEET SIZE:	ANSI D
SCALE:	AS SHOWN

STATE OF LOUISIANA
MICHAEL T. GIBSON
REGISTERED PROFESSIONAL ENGINEER
No. 10718, EXPIRES 07/18/2024

POST OAK SEWER CONSOLIDATION AND FAUBOURG LIFT STATION IMPROVEMENTS
ST. TAMMANY PARISH, LOUISIANA
PROJECT No.: TU23000171 & TU23000175
NEW FAUBOURG LIFT STATION - ELECTRICAL SITE PLAN

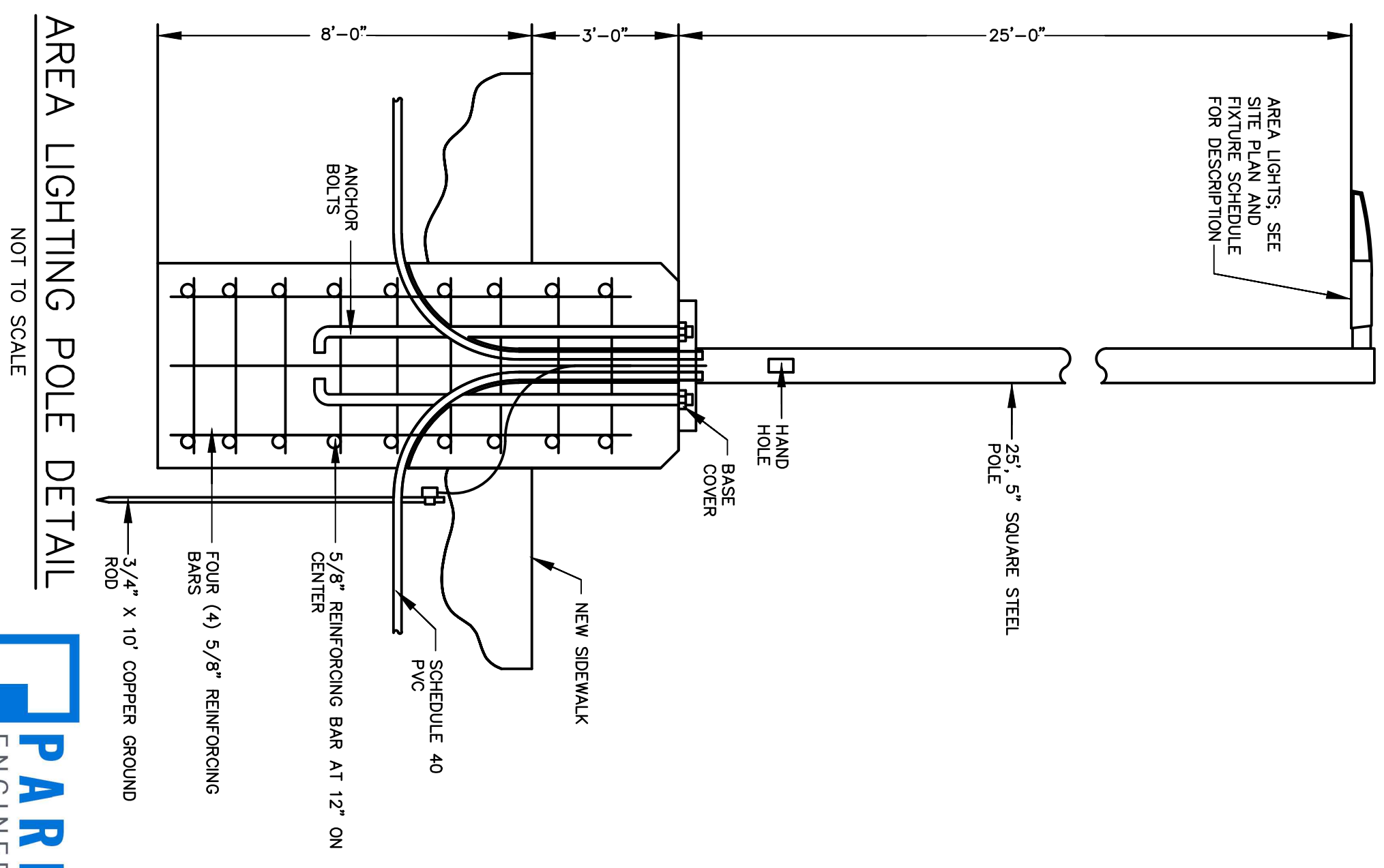
PARISH ENGINEERING
7200 Riverchase Parkway East
Bossier Ridge, LA 70605
(504) 835-2222
parisheng.com | 1828-1172

SHEET NO.
E-05
SHEET 39 of 42



CONDUIT GROUND BUSHING DETAIL
NOT TO SCALE

GENERATOR PAD DETAIL
NOT TO SCALE

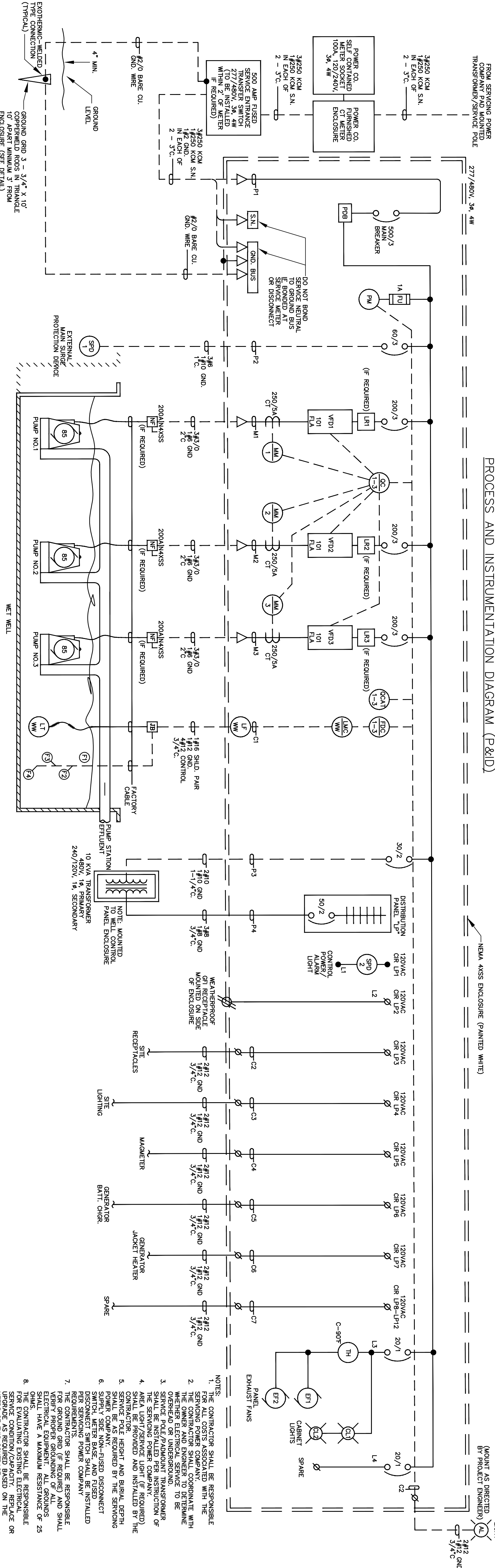


AREA LIGHTING POLE DETAIL
NOT TO SCALE



SHEET NO. E-07 SHEET 41 of 42	POST OAK SEWER CONSOLIDATION AND FAUBOURG LIFT STATION IMPROVEMENTS ST. TAMMANY PARISH, LOUISIANA PROJECT No.: TU23000171 & TU23000175 NEW FAUBOURG LIFT STATION - ELECTRICAL DETAILS		DESIGNED BY: CC DRAWN BY: CC CHECKED BY: SG SUBMITTED BY: MT PROJECT No.: TU23000171 TU23000175 ISSUE DATE: 06/2024 APPROVED BY: MT SHEET SIZE: ANSI D SCALE: AS SHOWN	No. 1 DESCRIPTION OF REVISION ADDENDUM NO. 3 07.29.24	DATE: 07/24		DEPT. OF UTILITIES ST. TAMMANY PARISH GOVERNMENT 620 N. TYLER STREET COVINGTON, LA 70433
			SHEET NO. E-07 SHEET 41 of 42				

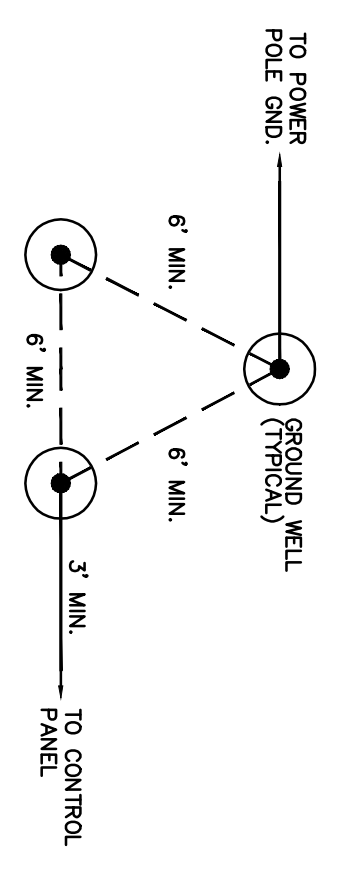
**FAUBOURG LIFT STATION CONTROL PANEL
ONE LINE POWER DIAGRAM AND
PROCESS AND INSTRUMENTATION DIAGRAM (P&ID)**



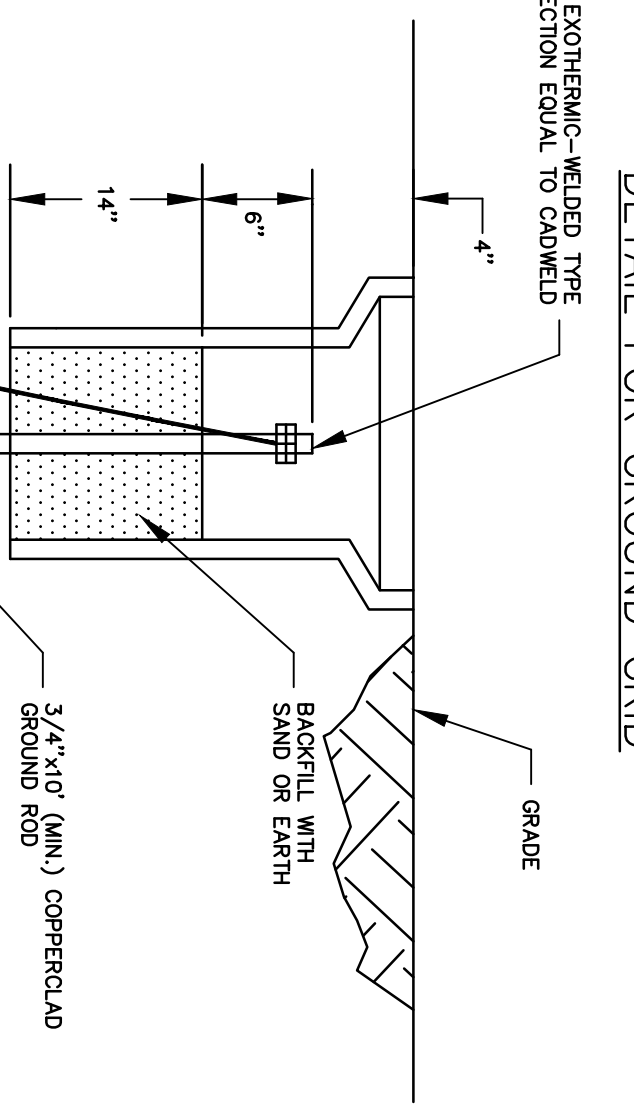
OPERATIONAL DESCRIPTION USING VARIABLE FREQUENCY DRIVES) & SUBMERSIBLE TRANSDUCEUR

EQUIPMENT	COMMON ALARMS
<p>WETWELL NO.1, NO.2 & NO.3</p> <p>WETWELL PUMPS SHALL OPERATE ON A LEVEL/BASIS AS CONTROLLED BY THE QUADRADEX PUMP CONTROLLER (QCT-3). PER PROJECT SPECIFICATIONS, IN THE EVENT OF A LEVEL TRANSMITTER FAILURE, PUMPS SHALL NOT BE ALLOWED TO OPERATE ON HIGH TEMPERATURE AND SHALL ALTERNATE TO THE NEXT AVAILABLE PUMP. ALL PUMPS SHALL BE EXERCISED UNFORMALLY. FLOWS SHALL BE SET AS DIRECTED BY THE PROJECT ENGINEER. THE COMMON ALARM LIGHT SHALL BE ACTIVATED IN THE EVENT OF A LEVEL TRANSMITTER FAILURE. PUMPS SHALL NOT BE ALLOWED TO OPERATE ON HIGH TEMPERATURE AND SHALL ALTERNATE TO THE NEXT AVAILABLE PUMP.</p>	<p>THE ALARM LIGHT SHALL BURN DIM AND STEADY DURING NORMAL CONDITIONS AND FLASH BRIGHTLY DURING THE FOLLOWING ALARM CONDITIONS: WETWELL HIGH LEVEL (QTY. OF 3) PUMPS HIGH/OVER-TEMP (QTY. OF 3) IMPROPER SEQUENCE</p>

GROUND DETAIL OVERVIEW

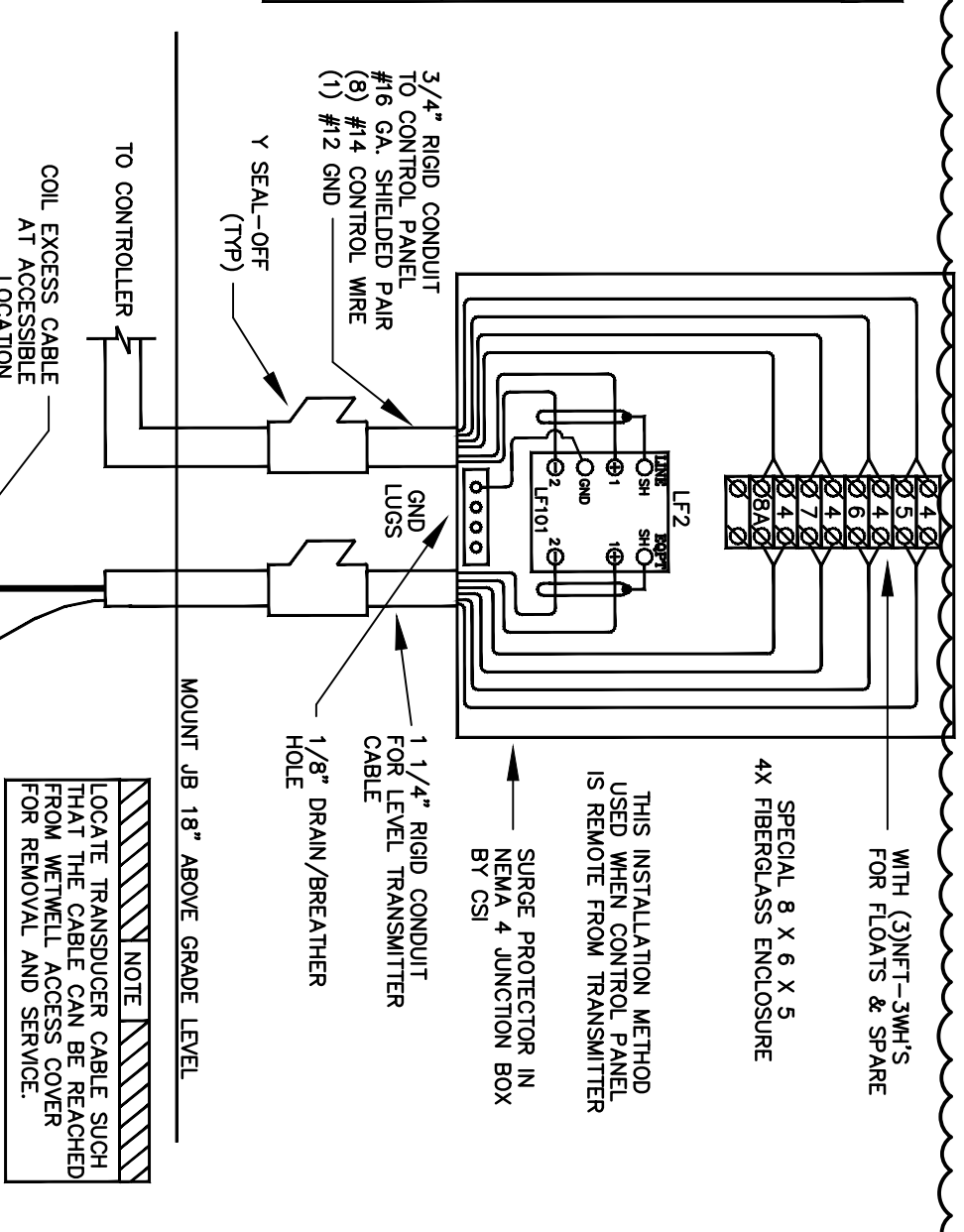


**SINGLE GROUND WELL
DETAIL FOR GROUND GRID**

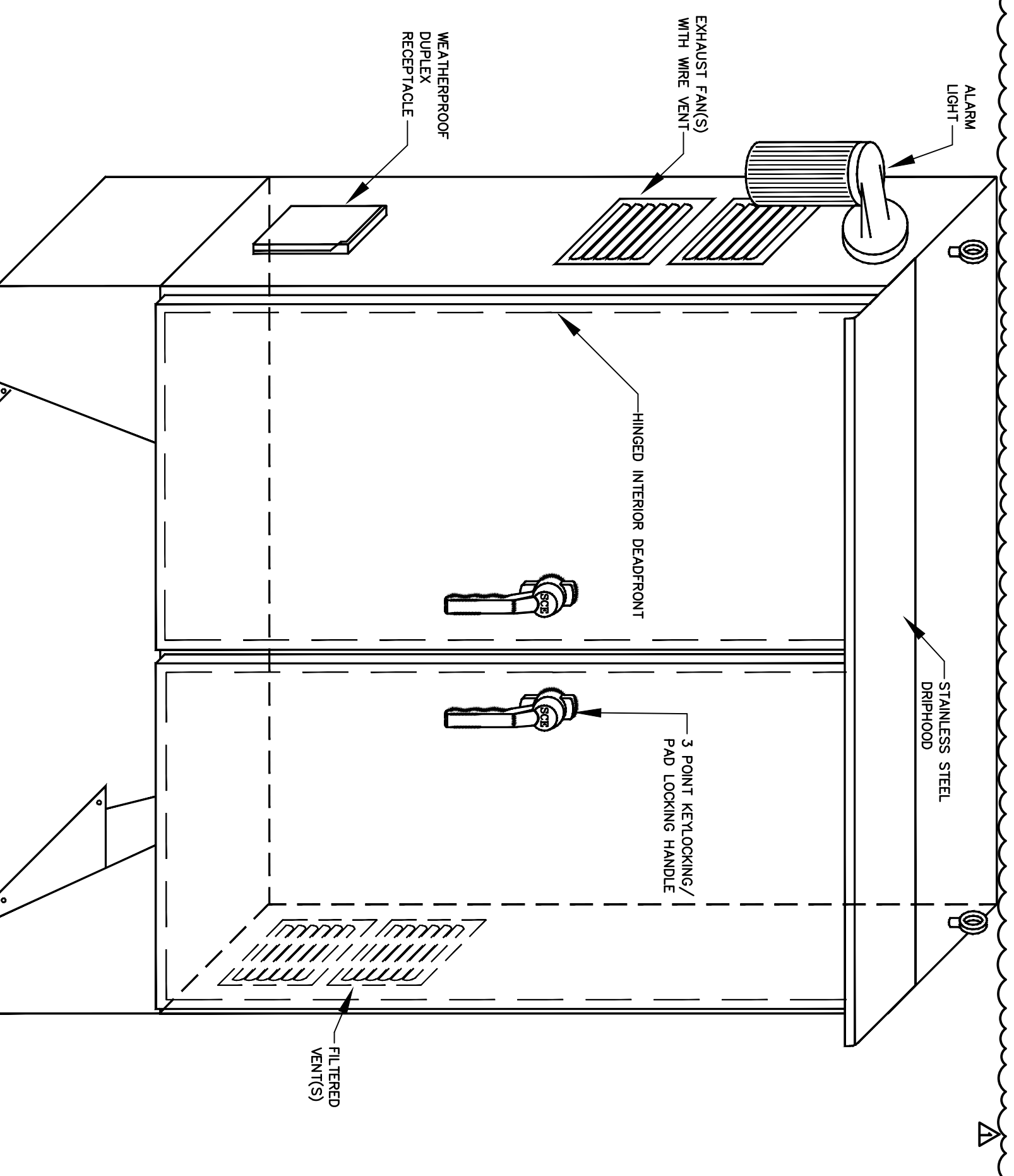


- GROUNDING NOTES:**
- GROUNDING SYSTEM IN ACCORDANCE WITH THE NATIONAL ELECTRIC CODE (NEC) ARTICLE 250 ALONG WITH ANY LOCAL AND STATE CODES. CONDUIT WORK, BUILDINGS, FENCES, MOTORS, PANELBOARDS, AND ALL ELECTRICAL EQUIPMENT ARE TO BE GROUNDED TO THE SAME SYSTEM.
 - FEDER CONDUITS SHALL PROVIDE A GOOD PATH TO SYSTEM GROUNDING SYSTEM RESISTANCE TO GROUND OF 25 OHMS OR LESS.
 - GROUNDING SYSTEM RESISTANCE TO GROUND OF 25 OHMS OR LESS SHALL BE THE GOAL AND A RESISTANCE OF 5 OHMS OR LESS SHALL BE THE GOAL.
 - PROVIDE CERTIFIED TEST REPORTS OF GROUND RESISTANCE.

**SUBMERSIBLE LEVEL TRANSMITTER/FLOAT
INSTALLATION DETAIL**

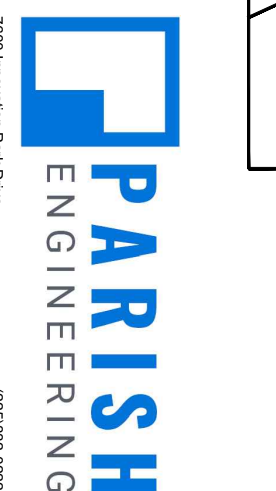


**TRIPLEX CONTROL PANEL
ENCLOSURE DETAIL**



- TRANSMITTER NOTES:**
- NIGHT-EIGHT FEET (98') OF SIGNAL CABLE IS SUPPLIED WITH TRANSMITTER. CABLE SHALL BE TENSIONED AND INSTALLED BY THE GENERAL CONTRACTOR.
 - CONTRACTOR TO CONNECT SIGNAL CABLES PER DETAIL.
 - PROVIDE T-SEAL OFF FITTINGS ON ALL CONDUITS, FILL WITH SEALING COMPOUND IMMEDIATELY AFTER CONDUIT ENTRY DETAIL.
- STILLING WELL NOTES:**
- STILLING WELL SHALL BE SUPPLIED AND INSTALLED BY THE GENERAL CONTRACTOR.
 - STILLING WELL SHALL CONSIST OF EVERY 6' THROUGHOUT ENTIRE LENGTH OF PIPE.
 - CONNECT STILLING WELL TO MOUNTING HARDWARE SHALL BE HOT DIPPED GALVANIZED OR STAINLESS STEEL.
- FLLOAT NOTE:**
- FLOATS SHALL BE MOUNTED IN THE WETWELL AT PROPER LEVEL(S) WITH APPROPRIATE ATTACHMENT DEVICES/HARDWARE.

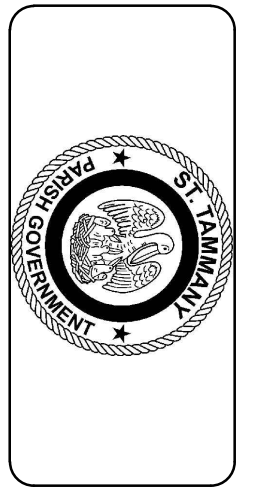
- NOTES:**
- THE CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING THE NECESSARY PERMITS FOR THE SERVICING POWER COMPANY.
 - THE CONTRACTOR SHALL COORDINATE WITH THE SERVICING POWER COMPANY TO BE WITHIN ELECTRICAL SERVICE TO BE OVERHEAD OR UNDERGROUND.
 - SERVICE POLE/PANMOUNT TRANSFORMER SHALL BE PROVIDED AND INSTALLED BY THE SERVICING POWER COMPANY.
 - AREA LIGHT/SERVICE LIGHT (IF REQUIRED) BY THE SERVICING POWER COMPANY.
 - SERVICE POLE HEIGHT AND BURIAL DEPTH SHALL BE AS REQUIRED BY THE SERVICING POWER COMPANY.
 - SERVICE POLE SHALL BE INSTALLED BY THE SERVICING POWER COMPANY.
 - DISCONNECT SWITCH SHALL BE INSTALLED BY THE SERVICING POWER COMPANY.
 - THE CONTRACTOR SHALL BE RESPONSIBLE FOR GROUND GRID (IF REQUIRED) AND SHALL PROVIDE ALL ELECTRICAL EQUIPMENT. ALL GROUNDS SHALL HAVE A MAXIMUM RESISTANCE OF 25 OHMS OR LESS.
 - THE CONTRACTOR SHALL BE RESPONSIBLE FOR EVALUATING EXISTING ELECTRICAL SERVICE CONDITION/CAPACITY, REPLACE OR REPAIR AS NECESSARY.
 - THE CONTRACTOR SHALL BE RESPONSIBLE FOR THIS CONTRACT.



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DEPT. OF UTILITIES
ST. TAMMANY PARISH
GOVERNMENT
620 N. TYLER STREET
COVINGTON, LA 70433



The Mainstay Composite Liner

The Mainstay® Composite Liner is a manhole rehabilitation system consisting of a high strength restoration mortar (typically Mainstay ML-72) and an epoxy corrosion barrier coating (typically Mainstay DS-5) that cure simultaneously to repair and protect brick and concrete manholes, lift stations, wet wells, and other sanitary sewer structures. The mortar is first shot onto a new or deteriorated substrate, and an epoxy topcoat is then immediately applied while the mortar is still soft. The concurrent application of these materials creates a monolithic surface that cures into a strong, highly corrosion resistant, and continuous manhole lining, free of pinholes, holidays, and voids. The mortar and topcoat are tightly bonded not only to the substrate but also to each other.



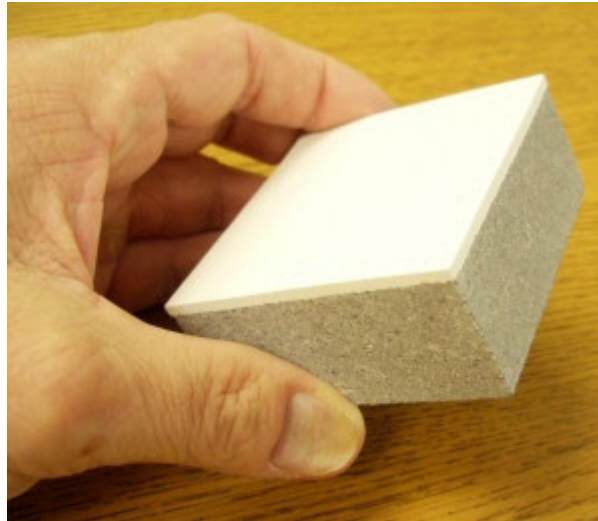
Recommended For:

- Manhole rehabilitation
- Lift station restoration
- Wet well repair
- Wastewater treatment plant headworks
- Clarifiers
- Digesters
- Sumps
- Sewer pipe
- Trenches
- Paper mills
- Chemical processing plants



Advantages of the Mainstay Composite Liner:

- There is no wait time for the mortar to cure after it is applied to the manhole because the epoxy topcoat is applied while the mortar is still soft.
- This system is specifically designed for use in moisture laden environments. Restoration mortars used in the Mainstay Composite Liner are properly applied when the surface of the concrete or brick manhole remains damp.
- Mainstay ML-72 mortar is a high-build restoration mortar that can be applied to vertical manhole surfaces up to 5" thick, often restoring the manhole substrate to its original thickness.
- Mainstay DS-5 is a 100% solids epoxy coating. It contains no solvent and may be applied to the manhole up to 125 mils in a single coat.



3	03 30 00	Cast-in-Place Concrete
	03 40 00	Precast Concrete
	31 00 00	Earthwork
7	07 16 16	Crystalline Waterproofing



MasterLife® 300D

Crystalline Capillary Waterproofing Admixture

MasterLife 300C

Concentrated Crystalline Capillary Waterproofing Admixture

Description

MasterLife 300D and MasterLife 300C concentrated version are integral crystalline capillary waterproofing admixtures for concrete. They are designed for use in above- and below-grade applications.

The MasterLife 300 series of admixtures meet ASTM C 494/C 494M requirements for Type S, Specific Performance, admixtures.

A red-pigmented version of MasterLife 300D admixture is also available.

Applications

Recommended for use in:

- Foundations
- Sewage and water treatment plants
- Water tanks and reservoirs
- Swimming pools
- Underground vaults
- Tunnel and subway systems
- Secondary containment structures
- Below-grade parking structures
- Precast components
- Water features
- Geotechnical grouting and ground improvement

Features

- Crystalline cementitious materials
- Integral addition
- Allow concrete to breathe

Benefits

- Reduce concrete permeability and, penetration of water and other liquids
- Seal hairline cracks
- Resist positive and negative side hydrostatic pressure
- Protect against sewage and industrial wastes

Performance Characteristics

Setting Time: The MasterLife 300 series of admixtures have little to no effect on concrete setting time within the recommended dosage ranges. However, time of setting testing is strongly recommended under project conditions when combinations of supplementary cementitious materials and/or admixtures are used, especially in cooler ambient conditions.

Permeability: The MasterLife 300 series of capillary waterproofing admixtures are portland cement-based crystalline cementitious materials that react in concrete to form non-soluble crystalline hydration products in the capillary pores of the concrete. These crystalline hydration products effectively reduce the permeability of concrete thus reducing capillary absorption and the penetration of water and other liquids.

Typical Data for MasterLife 300D admixture @ 2% by mass of cement (Independent Testing, except *)

Performance characteristic	Test method	Performance relative to untreated concrete mixture
Water Penetration	DIN 1048	100% reduction
Water Permeability	CRD-C 48	60% reduction
Capillary Absorption*	ASTM C 1585	43% reduction
Compressive Strength	ASTM C 39/C 39M	Nominal increase



Note: All the MasterLife 300 series of admixtures contain similar amounts of active ingredients at their recommended dosage ranges and, hence, provide similar performance characteristics.

Guidelines for Use

Concrete Quality: Crystalline capillary waterproofing admixtures such as the MasterLife 300 series of admixtures are categorized as Permeability-Reducing Admixtures (PRAs) in ACI 212.3R-16, Report on Chemical Admixtures for Concrete. These admixtures "are intended to be used in, and complement, well-proportioned concrete mixtures, not to compensate for poorly proportioned concrete mixtures. Although recommendations differ from each manufacturer, a w/cm of 0.45 or less is typical for concrete designed to resist water movement." In accordance with the recommendations provided in ACI 318, ACI 350 and ACI 212.3R, Master Builders Solutions recommends the use of the MasterLife 300 series of admixtures in good quality concrete with a maximum water-cementitious materials ratio of 0.45 and a minimum compressive strength of 4000 psi (28 MPa).

The MasterLife 300 series of admixtures meet the requirements for PRAs for concrete exposed to hydrostatic conditions (PRAH), as defined in ACI 212.3R-16.

Master Builders Solutions recommends adherence to the following guidelines provided in ACI 212.3R-16 when the MasterLife 300 series of admixtures are used:

"If the PRAH forms part of a primary waterproofing system, consider crack control measures (control joints), the admixture's crack sealing abilities, treatment of construction joints, and compatible repair systems. Also consider using concrete with the lowest drying shrinkage possible."

Dosage: For most applications, the recommended optimum dosage of MasterLife 300D admixture is 2% by mass of cement. The dosage of the red-pigmented version of MasterLife 300D admixture is 2.5% by mass of cement and the dosage of MasterLife 300C admixture is 1% by mass of cement. The minimum recommended dosages are 12 lb/yd³ (7.2 kg/m³) of concrete for MasterLife 300D admixture, 6 lb/yd³ (3.6 kg/m³) of concrete for MasterLife 300C admixture and 15 lb/yd³ (9.0 kg/m³) of concrete for red-pigmented version of MasterLife 300D admixture. Depending on the types of cementitious materials and the proportions of the project-specific concrete mixtures, dosages above or below the above values may be recommended for optimum performance. Consult your local sales representative for assistance in determining the appropriate dosage of the MasterLife 300 series of admixtures for your project.

Dispensing and Mixing: The MasterLife 300 series of admixtures are batched at the concrete production plant in a manner similar to that for cement or other cementitious materials. The admixtures may be batched in either a central or truck mixer. Follow the procedures outlined in ASTM C 94/C 94M, Standard Specification for Ready-Mixed Concrete, for general batching and mixing instructions for concrete. Provide at least 5 minutes of mixing after the addition of the MasterLife 300 series of admixtures to ensure thorough and uniform distribution of the admixture in the concrete mixture.

Product Notes

Corrosivity – Non-Chloride, Non-Corrosive: The MasterLife 300 series of admixtures will neither initiate nor promote corrosion of reinforcing or prestressing steel embedded in concrete or of galvanized steel floor and roof systems. Neither calcium chloride nor other chloride-based ingredients are used in the manufacture of the MasterLife 300 series of admixtures.

Compatibility: The MasterLife 300 series of admixtures can be used with portland cements approved under ASTM, AASHTO or CRD specifications. They are compatible with most concrete admixtures, including all Master Builders Solutions admixtures. The MasterLife 300 series of admixtures are recommended for use with high-range water-reducing admixtures, such as the MasterGlenium® series, for maximum workability while maintaining a low water-cementitious materials ratio.

Storage and Handling

The MasterLife 300 series of admixtures must be stored in a clean, dry area and must be protected from exposure to moisture. MasterLife 300D admixture must be maintained at a minimum temperature of 45 °F (7 °C). Preferably, MasterLife 300C admixture in water-soluble pods should be stored at ambient temperatures in the range of 40 °F to 105 °F (4 °C to 41 °C). If stored below 40 °F (4 °C), the water-soluble pods can become brittle and split open while handling. To alleviate this, it is recommended to warm the pails with the pods to temperatures above 40 °F (4 °C) before use. The MasterLife 300 series of admixtures have a shelf life of one year when stored under recommended conditions.

Packaging

MasterLife 300D admixture is available in 12 lb (5.5 kg) and 24 lb (11 kg) shreddable bags, and in 12 lb (5.5 kg) water-soluble pods. The red-pigmented version of MasterLife 300D admixture is available in 15 lb (7 kg) and 30 lb (14 kg) shreddable bags. MasterLife 300C admixture is available in 6 lb (2.7 kg) water-soluble pods.

Related Documents

Safety Data Sheets: MasterLife 300D admixture and MasterLife 300C admixture

Additional Information

For additional information on the MasterLife 300 series of admixtures or their use in developing concrete mixtures with special performance characteristics, contact your local sales representative.

Master Builders Solutions creates technologies for the construction industry inspiring people to build better. We are active in ~40 countries and operate 35 production sites with over 1,600 employees. We develop, produce, and market high-quality chemical admixtures, as well as adjacent core technologies, to master the challenges of today and support a decarbonized future. Our people are pivotal and pair leading technologies and a strong brand heritage to surpass our customers' expectations and drive continuous value creation.

Limited Warranty Notice

Master Builders Solutions Admixtures US, LLC ("Master Builders Solutions") warrants this product to be free from manufacturing defects and to meet the technical properties on the current Technical Data Guide, if used as directed within shelf life. Satisfactory results depend not only on quality products but also upon many factors beyond our control. MASTER BUILDERS SOLUTIONS MAKES NO OTHER WARRANTY OR GUARANTEE, EXPRESS OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE WITH RESPECT TO ITS PRODUCTS. The sole and exclusive remedy of Purchaser for any claim concerning this product, including but not limited to, claims alleging breach of warranty, negligence, strict liability or otherwise, is shipment to purchaser of product equal to the amount of product that fails to meet this warranty or refund of the original purchase price of product that fails to meet this warranty, at the sole option of Master Builders Solutions. Any claims concerning this product must be received in writing within one (1) year from the date of shipment and any claims not presented within that period are waived by Purchaser. MASTER BUILDERS SOLUTIONS WILL NOT BE RESPONSIBLE FOR ANY SPECIAL, INCIDENTAL, CONSEQUENTIAL (INCLUDING LOST PROFITS) OR PUNITIVE DAMAGES OF ANY KIND.

Purchaser must determine the suitability of the products for the intended use and assumes all risks and liabilities in connection therewith. This information and all further technical advice are based on Master Builders Solutions' present knowledge and experience. However, Master Builders Solutions assumes no liability for providing such information and advice including the extent to which such information and advice may relate to existing third party intellectual property rights, especially patent rights, nor shall any legal relationship be created by or arise from the provision of such information and advice. Master Builders Solutions reserves the right to make any changes according to technological progress or further developments. The Purchaser of the Product(s) must test the product(s) for suitability for the intended application and purpose before proceeding with a full application of the product(s). Performance of the product described herein should be verified by testing and carried out by qualified experts.

03 30 00	Cast-in-Place Concrete
03 40 00	Precast Concrete
03 70 00	Mass Concrete
31 00 00	Earthwork

MasterLife[®] 300L

Liquid Crystalline Capillary Waterproofing Admixture

Description

MasterLife 300L is a liquid crystalline capillary waterproofing admixture for concrete. It is designed for use in above- and below-grade applications. MasterLife 300L admixture will meet ASTM C494/C494M requirements for Type S, Specific Performance, admixtures.

Applications

Recommended for use in:

- Foundations
- Sewage and water treatment plants
- Water tanks and reservoirs
- Swimming pools
- Underground vaults
- Tunnels and subway systems
- Secondary containment structures
- Below-grade parking structures
- Precast components
- Water features
- Geotechnical grouting and ground improvement
- Tinted concrete elements

Features

- Unique liquid crystalline formulation
- Automated dispenser / integral addition

Benefits

- Reduces concrete permeability
- Reduces penetration of water and other liquids
- Resists positive and negative side hydrostatic pressure
- Protects against sewage and industrial waste
- Seals hairline cracks
- Allows concrete to breathe
- Accurate dosing and addition verification with batch ticket printout
- Enhanced safety during batching
- No packaging waste or disposal cost

Performance Characteristics

The MasterLife 300L admixture is a permeability-reducing admixtures (PRAHs) as described in the American Concrete Institute's ACI 212 document Report on Chemical Admixtures for concrete. This product has been evaluated using industry recognized tests for waterproofing characteristics such as water penetration and water permeability under pressure and capillary absorption. Data from third-party, independent testing is available upon request.

Hardened Properties: The MasterLife 300L crystalline capillary waterproofing admixture reacts in concrete to form non-soluble crystalline hydration products in the capillary pores of the concrete. These crystalline hydration products effectively reduce the permeability of concrete thus reducing capillary absorption and the penetration of water and other liquids.

Guidelines for Use

Concrete Quality: Crystalline capillary waterproofing admixtures such as the MasterLife 300 series of admixtures are categorized as Permeability-Reducing Admixtures (PRAs) in ACI 212.3R-16, Report on Chemical Admixtures for Concrete. These admixtures "are intended to be used in, and complement, well-proportioned concrete mixtures, not to compensate for poorly proportioned concrete mixtures. Although recommendations differ from each manufacturer, a w/cm of 0.45 or less is typical for concrete designed to resist water movement." In accordance with the recommendations provided in ACI 318, ACI 350 and ACI 212.3R, Master Builders Solutions recommends the use of the MasterLife 300 series of admixtures in good quality concrete with a maximum water-cementitious materials ratio of 0.45 and a minimum compressive strength of 4000 psi (28 MPa). The MasterLife 300 series of admixtures meet the requirements for PRAs for concrete exposed to hydrostatic conditions (PRAH), as defined in ACI 212.3R-16. Master Builders Solutions recommends adherence to the following guidelines provided in ACI 212.3R-16 when the MasterLife 300 series of admixtures are used: "If the PRAH forms part of a primary waterproofing system, consider crack control measures (control joints), the admixture's crack sealing abilities, treatment of construction joints, and compatible repair systems. Also consider using concrete with the lowest drying shrinkage possible."

Dosage: MasterLife 300L admixture is recommended for use at a dosage of 1.25 gal/yd³ (6.2 L/m³).

Dispensing and Mixing: Mixture Proportions: The mix water content should be reduced by 1.25 gal/yd³ [6.2 L/m³] to account for the quantity of MasterLife 300L admixture used. MasterLife 300L admixture may be added to the concrete mixture during the initial batch sequence at the production plant or at the jobsite. If the delayed addition method is used, mixing at high speed for 3–5 minutes after the addition of MasterLife 300L admixture will result in mixture uniformity.

Product Notes

Corrosivity - Non-Chloride, Non-Corrosive: MasterLife 300L admixture will neither initiate nor promote corrosion of reinforcing steel, prestressing steel or of galvanized steel floor and roof systems. Neither calcium chloride nor other chloride-based ingredients are used in the manufacture of MasterLife 300L admixture.

Compatibility - Admixtures: MasterLife 300L admixture is compatible with most admixtures used in the production of quality concrete, including normal, mid-range and high-range water-reducers, retarders, accelerators and corrosion inhibitors. For air-entrained concrete applications, MasterLife 300L admixture is recommended for use with high-range water-reducing admixtures, such as the MasterGlenium® series, for maximum workability while maintaining a low water-cementitious materials ratio. MasterLife 300L admixture can also be used with MasterAir® AE 200, MasterAir AE VR10 and MasterAir AE 90 air-entraining admixtures. The dosage of air-entraining admixture should be established through truck trial.

Compatibility - Cementitious Materials: MasterLife 300L admixture can be used with portland cements approved under ASTM, AASHTO or CRD specifications and supplementary cementitious materials used in concretes. Trial mixes with MasterLife 300L admixture are required before project start to ensure compatibility and desired results, especially due to potential variations in material response. Different sources of cementitious materials and variations between material batches may affect setting time, slump, or other performance attributes including compressive strength. Consult your local sales representative for recommended concrete mixture adjustments if necessary.

Tinted Concrete: MasterLife 300L admixture can be used in combination with a coloring admixture, such as MasterColor Medium Red liquid admixture, to produce tinted concrete.

Packaging

MasterLife 300L admixture is available in 265 gal (1003 L) totes and by bulk delivery.

Storage and Handling

Storage Temperature: MasterLife 300L admixture should be stored at ambient temperatures above 40 °F (5 °C), and precautions should be taken to protect the admixture from freezing. If MasterLife 300L admixture freezes, thaw and reconstitute by mild mechanical agitation. Do not use pressurized air for agitation.

Shelf Life

MasterLife 300L admixture has a minimum shelf life of 12 months when stored under recommended conditions. Depending on storage conditions, the shelf life may be greater than stated. Please contact your local sales representative regarding suitability for use if the shelf life of MasterLife 300L admixture has been exceeded.

Related Documents

Safety Data Sheet: MasterLife 300L admixture

Additional Information

For additional information on MasterLife 300L admixture, or its use in developing a concrete mixture with special performance characteristics, contact your local sales representative.

Master Builders Solutions creates technologies for the construction industry inspiring people to build better. We are active in ~40 countries and operate 35 production sites with over 1,600 employees. We develop, produce, and market high-quality chemical admixtures, as well as adjacent core technologies, to master the challenges of today and support a decarbonized future. Our people are pivotal and pair leading technologies and a strong brand heritage to surpass our customers' expectations and drive continuous value creation.

Limited Warranty Notice

Master Builders Solutions warrants this product to be free from manufacturing defects and to meet the technical properties on the current Technical Data Guide, if used as directed within shelf life. Satisfactory results depend not only on quality products but also upon many factors beyond our control. MASTER BUILDERS SOLUTIONS MAKES NO OTHER WARRANTY OR GUARANTEE, EXPRESS OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE WITH RESPECT TO ITS PRODUCTS. The sole and exclusive remedy of Purchaser for any claim concerning this product, including but not limited to, claims alleging breach of warranty, negligence, strict liability or otherwise, is shipment to purchaser of product equal to the amount of product that fails to meet this warranty or refund of the original purchase price of product that fails to meet this warranty, at the sole option of Master Builders Solutions. Any claims concerning this product must be received in writing within one (1) year from the date of shipment and any claims not presented within that period are waived by Purchaser. MASTER BUILDERS SOLUTIONS WILL NOT BE RESPONSIBLE FOR ANY SPECIAL, INCIDENTAL, CONSEQUENTIAL (INCLUDING LOST PROFITS) OR PUNITIVE DAMAGES OF ANY KIND.

Purchaser must determine the suitability of the products for the intended use and assumes all risks and liabilities in connection therewith. This information and all further technical advice are based on Master Builders Solutions' present knowledge and experience. However, Master Builders Solutions assumes no liability for providing such information and advice including the extent to which such information and advice may relate to existing third party intellectual property rights, especially patent rights, nor shall any legal relationship be created by or arise from the provision of such information and advice. Master Builders Solutions reserves the right to make any changes according to technological progress or further developments. The Purchaser of the Product(s) must test the product(s) for suitability for the intended application and purpose before proceeding with a full application of the product(s). Performance of the product described herein should be verified by testing and carried out by qualified experts.



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www.master-builders-solutions.com/en-us

Master Builders Solutions Admixtures US, LLC

23700 Chagrin Boulevard
Beachwood, Ohio, 44122-5544
USA ■ 800-628-9990

Master Builders Solutions Canada, Inc.

1800 Clark Boulevard
Brampton, Ontario L6T 4M7
CANADA ■ 289-360-1300