MONROE COUNTY DRAIN COMISSION

SPECIAL PROVISION
FOR
PUMP STATION EQUIPMENT, ELECTRICAL

a. Description. This work consists of furnishing, installing and supplying the labor, equipment and materials required to install the pump station electrical equipment as detailed on the plans and this special provision or as directed by the Engineer. This work must follow industry standards and conform to the details shown on the plans.

b. Materials. Provide new materials that meet the current standards and practices of the *NEC, ANSI, ASTM, UL, NEMA*, the standard specifications, *MIOSHA*, and this special provision.

Ensure all electrical devices furnished under this contract are new and be received at the job site in the manufacturer's shipping container which clearly identifies the items. Used, rebuilt, or discontinued models are prohibited for installation under this contract.

Ensure all components installed in hazardous areas indicated on the plans are explosion proof or intrinsically safe as outlined in the *NEC*.

1. Conduit and Fittings. Use Polyvinyl Chloride (PVC) coated rigid steel for all exposed conduit and fittings in the pump station and all exposed exterior conduit and fittings. Ensure couplings and connectors are threaded type. Ensure outdoor buried conduit is Schedule 80 PVC with PVC coated rigid steel sweeps.

Ensure conduit terminations consists of double locknuts and insulated bushings, wet location connectors, or threaded hubs as applicable to maintain the ratings of the enclosure to which it is being terminated.

Ensure all joints in conduits are made with standard couplings unless neither conduit can be turned; then, ensure the union is made with a threaded rigid split coupling or three piece couplings. Running threads is prohibited.

Provide UL labeled flexible liquid tight metal conduit for connections to vibrating or rotating equipment.

Flexible steel conduit is prohibited.

2. Wire and Cable. Ensure indoor feeder circuit, branch circuit and control circuit wiring is stranded copper, 600 volt (V) insulation, UL Type "THW", "THWN", or "XHHW" moisture and heat resistant thermoplastic approved by the *NEC* for operating temperature of 75 degrees C and for installation in wet or dry locations.

Use UL Type "XHHW" heat resistant wire when wiring between fixtures and their adjacent outlets.

Use single conductor stranded copper cable that has corona, ozone, heat and moisture

resistance cross-linked polyethylene 600 volt insulation, or approved equal, rated to withstand a copper temperature of 90 degrees C without deterioration for 480 V standards service. Ensure cable meets applicable *ICEA Standards*, and is *UL* labeled, type “XHHW”.

Ensure all wire and cable, including feeders, main and branch circuits, is color coded as follows:

480/277 V	
Color	Phase
Brown	A
Orange	B
Yellow	C
Gray	Neutral
Green	Ground

Ensure conductors No. 8 and smaller have color coded insulation. Ensure conductors No. 6 and larger have terminations and conductors in pull boxes taped with colored tape, not less than 2 inches wide.

3. Pull Boxes. Provide pull boxes, junction boxes, and cable support boxes of proper size and design in accordance with the *NEC* and as required to facilitate installation of wires. Ensure covers are gasketed and held in place with corrosion resistant machine screws. Provide cable supports for vertical runs at code required locations, with pull or junctions boxes. Ensure boxes are *NEMA 4X* stainless steel construction or *NEMA 7* where indicated on the plans.

4. Wiring Devices. Ensure wiring devices (switches, receptacles and other such appurtenances) are rated for 20 Amperes (Amps) at 120 V alternating current (AC) unless otherwise indicated.

5. Outlet Boxes. Ensure outlet boxes for exposed work are of PVC coated steel construction with threaded shallow depth ferris box (UL Type “FS”) openings unless otherwise indicated.

6. Lighting Fixtures. Provide the lighting fixture types, as shown in the lighting fixture schedule on the plans, that are complete, including all power supplies, drivers, fuses, support brackets and other parts and devices necessary for complete operation. Ensure lighting fixtures are to utilize light emitting diodes (LEDs) as the light source and must operate on 120 V as depicted on plans. Provide LEDs of the color temperature as follows: 3,000K (±500K) for the Machine Room, 5,000K (±500K) for the Rake Room, and 4,000K (±500K) for all other spaces. They must have 100,000 hour rating for 70 percent lumen-depreciation (minimum) with lumen output within 20 percent of listed fixture. Clean all fixtures at the end of the project.

A. Provide Mark A, pendant mounted, LED Hazardous (Class I, Division 2) and wet location light fixtures manufactured by one of the following: Hubbell, Thomas & Betts, or Cooper.

B. Provide Mark B, wall mounted, high abuse, include glare sheild LED light fixtures with battery backup and photocell manufactured by one of the following: Luminaire LED, Lithonia, or Cooper.

C. Provide Mark C battery operated twin LED lamp head light fixtures manufactured by one of the following: Lithonia, Crouse-Hinds, or Kenall.

Automatic Transfer Switch – Service Entrance Contactor – Manufacture Eaton ATC-300+ – Ensure automatic transfer switch comply with NEC, NEMA, UL and are as shown on plans, final design and selection to by Contractors Electrical Engineer.

7. Motor Control Centers. Manufacture Allen Bradley - Ensure motor control centers comply with *NEC, NEMA, UL*, and are as shown on plans. Provide motor control centers of code grade gauge steel, of the dead front safety type with AIC ratings not less than that shown on the plans, with circuit breakers and motor starters as indicated on the plans. Ensure the main bus is copper. Ensure the horizontal bus bars are fully rated for the entire length of the motor control centers. Ensure vertical bus bars are sized for loads served. Ensure enclosure is of *NEMA*-type rating as indicated on the plans. Ensure motor control centers conform to the arrangements and details on the plans and to the spaces designated for installation.

Variable Frequency Drives. Manufacture Allen Bradley – Ensure variable frequency drives compatible with MCC and Pump Controls System, Constant torque, rated for the pump operating amperage. The final design and selection to by Contractors Electrical Engineer and Pump System Integrator.

Lighting Transformer. Provide 480 V primary with 240/120 V single phase secondary. Ensure the transformer is rated for 115 degrees C temperature rise above 40 degrees C ambient. Ensure all insulating materials are in accordance with *NEMA ST20 standards*. Ensure the transformer is in a heavy duty stainless steel waterproof enclosure. Design the transformer to be either floor or wall mounted.

Branch Circuit Panelboards. Provide branch circuit panelboards of code grade gauge stainless steel, dead front safety type with 22,000 AIC single or multi-pole circuit breaker, with branches of the number and amp rating as indicated on the plans. Ensure the main bus is copper. Provide bolt-on breakers only. Fabricate distribution panel enclosures in sections not exceeding 36 inches in width and 6 inches in depth.

Ensure panels have a main circuit breaker as indicated on the plans, and have 22,000 Root Mean Square (RMS) symmetrical interrupting capacity for 120/240 V panels.

8. Receptacles. Provide receptacles that are a duplex convenience ground type, unless otherwise specified, with weather tight gasket and covers, and install in exposed cast conduit standard depth ferris boxes (UL Type “FD”) with metal mounting ears. This includes receptacles used for disconnects.

Ensure convenience receptacles are rated 20 amps with back and side wiring and with exposed metal parts finished to resist corrosion.

Ensure special purpose receptacles are rated 20 amps, 230 V, unless otherwise called for on the plans.

Ensure receptacles have a wet location, cast metal spring type cover for each receptacle mounted on an UL Type “FS” and UL Type “FD” box.

9. Light Switches. Ensure switches are UL “T” rated. Ensure switches and receptacles are heavy duty, specification grade and as called for on the plans.

Ensure device covers are listed for wet location, cast metal, for UL Type “FD” box application, unless otherwise called for on the plans.

10. Grounding and Bonding. Ensure ground rod electrodes are of copper-clad material, 3/4-inch diameter and a minimum of 10 feet in length.

11. Supporting Devices. Ensure support systems are capable of supporting the weight of said equipment, conduit, and wiring.

Ensure fastening equipment is of stainless steel construction. Ensure all channel strut and fastening products are of stainless steel construction.

12. Transient Voltage Surge Suppressors (TVSS). Ensure the main electrical distribution panelboard and the branch circuit panelboard are protected with a TVSS that meets the requirements of *ANSI/UL 1449* and *ANSI/IEEE C.62.41-1980* and provided with a fused or circuit breaker disconnecting means. Ensure the units are rated 600 V, 100 KA per phase, Line-to-Line, Line-to-Neutral, and Line-to-Ground.

13. Pump Control Panel Control Sequence. Design to control the operation of up to four pumps in a pump-down mode in accordance with the level in the wet well as monitored by a radar level controller and high and low float switches. To minimize the number of pump starts per hour, provide first-on, first-off alternation. Furnish all necessary, circuit breakers, motor circuit protectors, power supplies and automatic control equipment etc., in a single enclosure. Incorporate all pumps into the alternation sequence. Provide each pump with an adjustable 0 to 60 second start time delay. If the high level alarm float switch is activated, bypass the normal level sensor control and start all pumps in the Auto mode. Adjust the start time delays to provide a staggered start of the pumps. When started by the high level alarm float, the pumps must run until the level in the wet well drops to the low level float switch elevation. The float switch control logic must function independently of the pump controller specified below.

A. Enclosure. Provide *NEMA 4X,* 14 gauge minimum 316 grade stainless steel, with inner doors sized as required for the equipment provided. Fabricate the enclosure in sections not exceeding 36 inches in width and 24 inches in depth, unless otherwise indicated. Ensure enclosure is mounted at 6 foot-0 inches to top of enclosure. Provide jumpers to bond section to section field connections of bus and interconnecting wiring. Provide enclosure sections with lifting eyes. Provide a thermostatically controlled 120 V heater within each enclosure to prevent condensation. Ensure control panel is *UL* listed.

B. Control Relays. Provide *NEMA* rated industrial control relays with 120 V field replaceable coils and a minimum of two normally open and two normally closed contacts. Ensure contacts have plug-in type cartridges and are arranged for easy contact conversion or replacement. Provide contact current ratings sufficient for the purpose specified. Plug-in style *IEC* rated relays are prohibited.

C. Time Delay Relays. Provide industrial grade, *NEMA* rated type with timer head. Ensure relays operate at 120 V with adjustable time delays.

D. Intrinsically Safe Relays. Provide intrinsically safe relays for the high and low wet well level float switches.

E. Equipment Hour Meter. Provide all pumps with a mechanical, five digit (hours and tenths) hour meter. Mount on the pump control cabinet inner door as indicated on the plans.

F. Selector Switches. Provide heavy duty, three-position, 30 mm, Hand-Off-Auto selector switches, mounted flush on the control cabinet inner door as indicated on the plans.

G. Pilot Lights. Provide heavy-duty, 30mm, push to test alarm and running pilot lights on the pump control cabinet inner door as indicated on the plans. Provide pilot lights with LED type lamps and lens colors as indicated on the plans; G indicates a green lens, R indicates a red lens.

H. Phase Monitor Relays. Provide phase monitor relays with a voltage range of 200 V to 480 V, and protect against phase loss, phase unbalance, phase reversal and under/over voltage. Ensure output contact rating is 10 amps. Ensure phase monitor relays reset automatically and are provided with adjustable time delays on drop out and reset. Ensure phase monitor relays are surface Deutsches Institut fur Normung (DIN) rail mounted.

I. Circuit Breakers. Provide motor circuit protectors with adjustable instantaneous trip for pump motors. Provide thermal magnetic type circuit breakers for control circuit overcurrent protection.

L. Terminal Blocks. Provide 1⅜ inch, DIN rail mount sectional type with white marking strip for numbered identification, recessed screw head, compression clamp, 600 V, 60 A maximum rating.

M. Control Panel Wiring. Ensure panel wiring is a minimum 14 American Wire Gauge-Machine Tool Wire (AWG-MTW), 60 degree C rated for AC connections. Ensure thermoplastic wire cover is rated at 600 V and be colored red for AC wires; light blue for direct current (DC) wires, canary yellow for wires interconnecting with other control panels or systems which may be energized from alternate power source; green on all ground wire connections; black for power source and white for power neutral.

14. Conduit to Wall Penetration Seals. Manufacturers must be Thunderline, Link-Seal, Flexicraft, Matcor or approved equal. Ensure seals have interlocking, bolted rubber links shaped to the annular space between the pipe and the concrete cored opening. Size and number of rubber links to suit the pipe outside diameter and sleeve as recommended by the manufacturer. Ensure all hardware is stainless steel.

15. Pump Control System. Manufacture: Allen Bradley Compactlogix 5370 Ensure the pump controller is microprocessor-based with a pump module, user interface and 120 V power supply. Ensure the processor has a speed of 200 megahertz (MHz), 64 megabyte (MB) random access memory (RAM), and 32 MB of flash memory. Ensure the software supports a four pump operation (minimum). Ensure there is a time delay between start-up of pumps during loss of power. Ensure the controller operates in the “pump down” mode.

Ensure the system provides monitoring, control, alarming (including alarm dialing) and configuration. Ensure the system provides a web-based interface to the user which does not require any equipment or software installed by the user, except for Internet Explorer and an internet connection. Ensure the system uses the cellular data network for communicating between remote sites and the web interface. Ensure the system delivers alarm messages via mobile phone messaging or via email and allows alarm acknowledgement via web site access or mobile phone.

Provide a cellular modem for wireless data communications with the Internet. Ensure modem includes standards-based quad-band global system for mobile communications/general packet radio service (GSM/GPRS) Class 10 performance; recommended standard number 232 (RS-232), universal serial bus (USB) and Ethernet interfaces; embedded transmission control protocol/internet protocol (TCP/IP) protocol stack; and supports 850/900/1800/1900 MHz cellular connectivity. Ensure a 2.0 decibel isotropic (dbi) gain, ground dependent antenna housed in a high impact ultraviolet polyvinyl chloride (UVPVC) radome is provided. Provide RG58 low loss antenna cable with appropriate connectors and surge suppression in lengths as required to connect the cellular modem to the antenna. Coordinate activation of cellular service at each pumping station site.

Provide the pump controller with the capability and all necessary hardware to monitor station three phase power and three phase motor current for each pump installed. Ensure the three phase power monitoring circuitry includes fuse protection.

Provide the pump controller with the capability of calculating flow based upon wet well level and volume as indicated on the plans.

Ensure the level control is Vegapuls C21 80GHZ Radar with Vegmet Controller. Ensure accuracy is ±0.25 percent of full scale. Ensure probe output is a 4-20mA DC signal, is 2-wire, loop powered, and includes intrinsically safe barriers. Ensure lightning protection is also provided. Ensure cable length is long enough to go from the wet well to the junction box.

16. Float Switches. Ensure float switches are Teflon coated, stainless steel, direct acting type, approximately 5 inches in diameter with potted single-pole double-throw (SPDT) mercury contact switch, narrow activation range. Provide with 16 gauge, chlorinated polyethylene (CPE) jacketed cable of sufficient length to reach the terminal box as indicated on the plans. Cable splicing is prohibited. Provide float switches with suitable clamps for installation on a stainless steel suspension cable. Provide stainless steel suspension cable and plastisol coated cast iron weight. Ensure float switches are 120 VAC, normally opened contacts, hermetically sealed, rated for duty in sewage applications.

17. Caution Tag. Ensure each panel receiving power from a separate source, which is not disconnected by the primary disconnect means, has a laminated orange tag 3-inches wide by 1.5-inches high with 3/8-inch high white lettering reading: “CAUTION -SEPARATE VOLTAGE SOURCE”.

18. Nameplates. Ensure nameplates for safety switches, lighting panels, starter enclosures, panelboards, etc, are laminated white plastic with black lettering, and are attached with sheet metal screws. Ensure nameplates are 2½-inches by 3/4-inches. First line character size 1/4-inches high, second line 3/16-inches high. Ensure all panelboards

include the final typed circuit directory installed inside of cover.

Ensure field located instruments and devices are equipped and identified with 1-inch by 3-inch engraved nameplates (similar to panelboard nameplate) and affixed to their respective device in a positive but flexible method (wire strap or similar means).

19. Fans and Motors. Fans must provide a minimum of 30 air exchanges per hour. Ensure all fan motors are totally enclosed fan cooled (TEFC). Ensure the fan is air movement and control (AMCA) “B” rated and equipped with aluminum fan wheels. Ensure fan shrouds, motor and fan wheel are removable for service. Provide *MIOSHA* approved guards. Provide manual motor starter at machine room entrance or access hatch. Ensure fan is automatically controlled as indicated in wiring diagram.

20. Electric Unit Heaters. Ensure electric unit heater provides a minimum of 5 kilowatts of heat per hour. Provide wash down style, 304 stainless steel case, *UL* listed, stainless steel tubular elements, TEFC motor, *NEMA 4X* electrical enclosure, hi limit safety, integral thermostat, and stainless steel universal mounting bracket.

21. Intake Air Louvers. Provide 6 inch deep drainable blade aluminum intake louvers of the size indicated on the plans. Louvers must provide a minimum free area of 50 percent.

22. Back Draft Dampers. Provide commercial grade aluminum, gravity back draft dampers. Ensure damper provides less than 12 cubic feet per minute per square foot leakage at 0.5 inch water column pressure difference.

23. Mixes. Ensure patches, conduit sealing compound, fire stop compound, etc., are mixed in accordance with the manufacturer’s recommendations.

c. Construction. Ensure all work meets the current standards and practices of the *NEC, ANSI*, the standard specifications, *MIOSHA*, and this special provision. Ensure all electrical work is done by a licensed electrician and in accordance with the *NEC*. Electronically submit a copy of the license to the Engineer.

Construct and install all materials and components at the locations indicated on the plans unless otherwise approved by the Engineer.

Provide temporary seals on outlet boxes during construction.

Preassemble, to the degree possible, panelboards, control panels, relay panels, etc. This preassembly should be done off site in a clean shop environment by the Contractor or manufacturer. Configure equipment to fit through the hatch size indicated on the plans.

Ensure all wire and cable is continuous in the same color code and type to its extreme termination point. The use of different type of insulated wire to the same device or equipment is prohibited.

Install electrical grounding system in accordance with *NEC* requirements. Measure grounding system resistance using the “fall of potential” method. Ensure this test is witnessed by the Engineer, with the final test results electronically submitted to the Engineer for final approval.

Install support systems that are adequate for the weight of equipment, conduit, and associated

wiring. Ensure support devices are not fastened to piping, ductwork, mechanical equipment or conduit.

Install surface mounted cabinets and panelboards with minimum of four anchors. Provide stainless steel channel supports to stand cabinet 1-inch off wall. All freestanding electrical equipment is to be installed on a raised, 6-inch, reinforced concrete pad.

Provide wire markers on each conductor in panelboard or pump control cabinet gutters, pull boxes, outlets, junction boxes and load connection. Identify with branch circuit and feeder number for power and lighting circuits, and with control wire number as identified on the schematic and interconnection diagrams for control wiring. Ensure wire markers are preprinted and not pieced from single and/or double-digit tags. Embossed tape is prohibited for any application.

1. Submersible Pump Wiring. Verify that the motor cable is of sufficient length for termination in the pump junction panel. Ensure motor cabling is one continuous length. Cable splicing is prohibited. Only cable specially developed by the manufacturer can be used for replacement. Ensure cable replacement is performed by factory authorized and trained service personnel.

Provide an electrical system Short Circuit and Arc Flash hazard study in accordance with *NFPA 70E, OSHA 29-CRF, part 1910 Sub-part S* and *IEEE 1584 standard*. Upon acceptance of the study, furnish and install on the appropriate equipment, preprinted, adhesive backed arc-flash warning labels which incorporate the information in subsection c.2 of this special provision. Ensure the study addresses the following:

A. Determine the available short circuit and ground fault currents available at each bus. Incorporate the motor contribution in determining the momentary and interrupting ratings of the protective devices.

B. Determine the flash hazard protection boundary, limited approach boundary, restricted boundary, prohibited boundary, incident energy level, required personal protective equipment class and type of fire rated clothing required.

2. Submittals. When directed by the Engineer or required by the specifications, submit samples of materials and accessory equipment such as light fixtures, switches, receptacles, etc. Do not use these materials in the work until the Engineer has had ample time to determine the products suitability and compliance with the specifications. All document submittals must be in Electronic Portable Document Format (PDF). Submitted samples will be returned in 15 working days. Electronically submit the following information for approval by the Engineer.

A. Electronically submit catalog cuts and/or product data sheets in PDF format to the Engineer for review and approval. Provide catalog cuts for standard manufactured items such as conduit and conduit fittings, electric heaters, fans, light fixtures, lighting panels, instrument motors, switches, disconnects, transformers, wire, etc. Ensure each sheet identifies the exact equipment for which it is intended. Ensure all pertinent information such as physical dimensions, current rating, horsepower, kilowatt rating, phase, power factor, voltage, *NEMA* classifications, material type and identified with a *UL* label.

B. Control Cabinet Plans. Provide a custom wiring diagram for this specific application in PDF format. Ensure wiring diagrams are in ladder diagram format, comply with the latest *NFPA 79* and *IEEE 315* standards and are complete with line numbers, wire numbers and terminal numbers. Clearly identify field wiring connections. Provide cabinet exterior and interior sub-plate dimensioned plans. Provide a written sequence of operation on the control cabinet plans.

C. Electronically submit a schedule that outlines the steps to be taken to maintain electrical service and showing the coordination effort which will be taken to coordinate the work between the various trades.

The approval of Shop Drawings does not relieve the Contractor from the responsibility to correct errors or omissions, or to provide adequate field measurements, and quantities of materials that may be required. It is the Contractor's responsibility to call attention to all deviations from the plans, specifications and details. If deviations have not been clearly identified, they will not be considered as part of the shop drawing approval.

d. Measurement and Payment. The completed work, as described, will be measured as a lump sum and paid for at the contract price using the following pay item:

Pay Item	**Pay Unit**
Pump Electrical (Lighthouse)	Lump Sum
Electrical Equipment Enclosure (Lighthouse)	Lump Sum

MONROE COUNTY DRAIN COMISSION

SPECIAL PROVISION
FOR
PUMP STATION EQUIPMENT, EMERGENCY GENERATOR

a. Description. This work consists of providing all labor, equipment and materials required for furnishing and installing the new emergency generator equipment in the pump station as detailed on the plans.

Emergency generator equipment includes those items listed herein and, at a minimum, includes factory assembled generator set equipment with digital (microprocessor-based) electronic generator set controls, digital governor and digital voltage regulator , anchor bolts, natural gas piping tie-in per utility and generator requirements. The emergency generator must be permanently connected to the pump station electrical system.

b. Materials. Ensure mechanical materials are in accordance with section 405 of the Standard Specifications for Construction, *ASTM standards*, and as specified herein. Generator must be Cummins Model C125NR natural gas 125 KW Standby spark ignited generator set.

1. Generator Performance. Ensure the generator system are approved for use in areas classified as *NEC Class I, Division 2, Group C or D* with a *Factory Mutual* (*FM)*, *UL, or approved equal* listing by a Nationally Recognized Testing Laboratory as per OSHA.

2. Generator System Performance Requirements.

   A. Voltage regulation shall be plus or minus 0.5 percent for any constant load between no load and rated load. Random voltage variation with any steady load from no load to full load shall not exceed plus or minus 0.5 percent.

   B. Frequency regulation shall be isochronous from steady state no load to steady state rated load. Random frequency variation with any steady load from no load to full load shall not exceed plus or minus 0.5%.

   C. The natural gas engine generator set shall accept a single step load of 100% nameplate kW and power factor, less applicable de-rating factors, with the engine generator set at operating temperature.

   D. The generator set 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. Maximum voltage dip on application of this load, considering both alternator performance and engine speed changes shall not exceed 25%.

   E. The alternator shall produce a clean AC voltage waveform, with not more than 5% total harmonic distortion at full linear load, when measured from line to neutral, and with not more than 3% in any single harmonic, and no 3rd order harmonics or their multiples. Telephone influence factor shall be less than 40.

F. The generator set shall be certified by the engine manufacturer to be suitable for use at the installed location and rating, and shall meet all applicable exhaust emission requirements at the time of commissioning.

G. The generator set shall be compatible with VFD's on equipment motors

H. Transient Frequency Performance: Less than 2-Hz variation for 50% step-load increase or decrease. Frequency shall recover and remain within the steady-state operating band within three second

I. The AC generator shall be; synchronous, four pole, 2/3 pitch, revolving field, drip-proof construction, single pre-lubricated sealed bearing, air cooled by a direct drive centrifugal blower fan, and directly connected to the engine with flexible drive disc. All insulation system components shall meet NEMA MG1 temperature limits for Class H insulation system and shall be UL 1446 listed. Actual temperature rise measured by resistance method at full load shall not exceed 125°C.

J. The generator shall be capable of delivering rated output (KVA) at rated frequency and power factor, at any voltage not more than 5 percent above or below rated voltage.

K. A permanent magnet generator (PMG) shall be included to provide a reliable source of excitation power for optimum motor starting and short circuit performance. The PMG and controls shall be capable of sustaining and regulating current supplied to a single phase or three phase fault at approximately 300% of rated current for not more than 10 seconds.

L. For generator set rated 600 V ac and lower: the sub-transient reactance of the alternator shall not exceed 15 percent, based on the standby rating of the generator set.

3. Generator Construction.

A. The engine-generator set shall be mounted on a heavy-duty steel base to maintain alignment between components. The base shall incorporate a battery tray with hold-down clamps within the rails.

B. All switches, lamps, and meters in the control system shall be oil-tight and dust-tight. All active control components shall be installed within a UL/NEMA 3R enclosure. There shall be no exposed points in the control (with the door open) that operate in excess of 50 V.

C. The engine shall be fueled by natural gas, 4 cycle, radiator and fan cooled. The horsepower rating of the engine at its minimum tolerance level shall be sufficient to drive the alternator and all connected accessories. Two cycle engines are not acceptable.

D. Engine protection devices shall have sensing elements located on the engine to initiate preliminary alarms and engine shutdowns as per manufacturer's recommendation.

E. Engine shall be radiator cooled by engine mounted radiator system including belt driven pusher fan, cooling pump, and thermostat temperature control. Performance of components shall be as required by set manufacturer.

F. Contractor shall provide the generator set with suitable spring / pad type vibration isolators and mount on structural steel base.

G. Starting and control batteries shall be calcium/lead antimony type, 24 V DC, sized as recommended by the engine manufacturer.

H. Exhaust system shall be installed according to the engine manufacturer's recommendations and applicable codes and standards

I. Battery charger Provide a minimum 10 amp battery charger for each generator set battery bank. Generator sets incorporating two battery banks shall be provided with two chargers connected together and operating in parallel, with alarm output(s) connected in parallel.

J. Enclosure. Provide enclosure with muffler installed Sound Level 2.

4. Connections

A. The generator set load connections shall be composed of silver or tin plated copper bus bars, drilled to accept mechanical or compression terminations of the number and type as shown on the Drawings. Sufficient lug space shall be provided for use with cables of the number and size as shown on the Drawings.

B. Power connections to auxiliary devices shall be made at the devices, with required protection located at a wall-mounted common distribution panel.

C. Generator set control interfaces to other system components shall be made on a permanently labeled terminal block assembly. Labels describing connection point functions shall be provided

5. Miscellaneous Items.

A. Anchor Bolts. Supply stainless steel adhesive anchors of size and length recommended by the pump supplier.

B. Grouting. Ensure grout is as required by the pump supplier with minimum requirements as indicated on the plans. Ensure grout is non-shrink in accordance with section 702 of the Standard Specifications for Construction.

C. Spare Parts. TBD

c. Construction. Ensure construction methods are in accordance with manufacturer's recommendations, the standard specifications and as modified herein. Ensure that the following

requirements are met by the generator supplier and manufacturer.

1. Generator Supervision. All installation and start-up services shall be provided by technicians specifically trained and certified by the manufacturer to support the products provided. Ensure a qualified generator manufacturer's representative provides onsite generator installation supervision for a minimum of 3 work days, not necessarily continuous.

2. Submittals. Do not use any materials in the work until the Engineer has had ample time to determine the products' suitability and compliance with the specifications. Ensure all submittals are in electronic portable document format (PDF). Allow a minimum of 15 work days for review and approval.

Review and approval of submittals are only to determine compliance with information given on the plans, specifications and details and conformance with the design concept of the completed project as a functioning whole. The Contractor is responsible for all matters relating to fabrication, shipping, handling, storage, assembly, installation, and construction, for all safety aspects of performing the work, and for coordinating the work.

Submit the following information for review and approval by the Engineer:

A. Shop Drawings. Submit shop drawings for all equipment to be used, including \accessories. Shop drawings must contain the following: manufacturer and model; performance and fuel requirement data; equipment outline drawing with dimensions; equipment assembly drawing, anchor, conduit and fuel pipe connections with parts list; detailed data.

The review of shop drawings does not relieve the Contractor from the responsibility to correct errors or omissions or to provide adequate field measurements as may be required. It is the Contractor's responsibility to call attention to all deviations from the plans, specifications, and details. If deviations have not been clearly identified, they will not be considered as part of the shop drawing review.

B. Catalog Cuts and/or Product Data Sheets. Submit catalog cuts and/or product data sheets for standard manufactured items such as conduit and conduit fittings, piping, etc. Each sheet must identify the exact equipment for which it is intended and contain all pertinent information such as physical dimensions, materials, and approved listings such as *UL* label or other testing agencies.

C. Operation and Maintenance (O&M) Manuals. Submit O&M manuals for each facility. Ensure O&M manuals contain the following: equipment function; normal operating characteristics and limiting conditions; assembly, installation, alignment, adjustment, and checking instructions; operating instructions for start-up, routine and normal operating, regulation and control, and shutdown and emergency conditions; lubrication and maintenance instructions; guide to troubleshooting; parts lists and predicted life of parts subject to wear; outline, cross-sections, assembly drawings, engineering data, and wiring diagrams; test data and performance curves.

3. Generator Supplier's Field Services. Ensure the generator supplier arranges and pays for a representative of the generator manufacturer to perform the following for each facility:

- Check the work and assist in start-up.
- Demonstrate the operation and maintenance of the generator equipment to the appropriate Department personnel.
- Review the O&M manual with MCDC personnel.
- Provide a minimum onsite time of 3 work days (not necessarily continuous) for start-up, operation and maintenance demonstration, and review.
- Promptly make all changes and additions required by manufacturer's representative.
- Provide a written letter of acceptance of installation along with the warranty information required herein.

4. Project Closeout Documentation. Provide the following documentation to the Engineer prior to project closeout for each facility: generator manufacturer's installation test and inspection reports; record drawings; and warranty certificates.

Operational Guarantees and Equipment Warranties. The generator must have a 5 year non-prorated warranty against material and workmanship covering parts and labor on the generator equipment. Ensure this warranty is provided by the manufacturer, their representative, or by an insurance policy obtained by the Contractor naming the Department as the policy holder. The generator manufacturer must have an established factory authorized service and repair facility within a 100 mile radius of the location of the installed generator.

5. Sequence of Construction. General Contractor to prepare and schedule construction activities for the installation of the Emergency Generator equipment and utilities

A. Coordinate with the electrical and gas utility company to arrange for proper scheduling of any required utility work.

d. Measurement and Payment. The completed work, as described, will be measured and paid for at the contract unit price using the following pay items:

Pay Item	**Pay Unit**
Back-Up Generator (Lighthouse)	Lump Sum

1. **Generator Equipment includes** all equipment associated with the tie-in of the generator equipment such as piping to gas service, anchoring and installing discharge piping and will be paid for in accordance with this special provision and the Standard Specifications for Construction.

MONROE COUNTY DRAIN COMMISSION

SPECIAL PROVISION
FOR
PUMP STATION EQUIPMENT, MECHANICAL AND SUBMERSIBLE PUMPS

a. Description. This work consists of providing all labor, equipment and materials required for furnishing and installing the new mechanical equipment in the pump station as detailed on the plans.

Pumping equipment includes those items listed herein and, at a minimum, includes non-clog pumps, motor, mounting base, lift system, anchor bolts, base plates, support brackets and fasteners. The pump must be automatically connected to the discharge piping when lowered into place on the discharge connection.

b. Materials. Ensure mechanical materials are in accordance with section 405 of the Standard Specifications for Construction, *ASTM standards*, and as specified herein. Pumps must be Flygt, or approved equal.

1. Pump Performance. Ensure the pump systems, including pump motor and cable, are approved for use in areas classified as *NEC Class I, Division 1, Group C or D* with a *Factory Mutual* (*FM)*, *UL, or approved equal* listing by a Nationally Recognized Testing Laboratory as per OSHA.

Ensure all pumps supplied are factory tested, including hydrostatic testing, at 1½ times the operating point or 1¼ times the shut-off head, whichever is greater.

2. Pump Performance Requirements. See Table 1 for pump performance criteria.

Table 1: Pump Requirements

Name	Location	Pump Type	No. of Pumps	Capacity (gpm) Each Pump	Head (a) (feet)	Min Overall Efficiency at Design Point (b)	Min HP	Max Motor RPM
Lighthouse	Lighthouse	Sub-mersible	2	4000	17	82%	50	1800

3. Pumping Equipment

A. Pumps. Ensure major pump components are of gray cast iron, *ASTM A 48*, *Class 35B*, with smooth surfaces devoid of blow holes or other irregularities. Ensure lifting handles and all exposed nuts or bolts are of stainless steel construction. Ensure metal surfaces other than stainless steel or brass, are protected by a factory applied spray coating of acrylic dispersion zinc phosphate primer with a polyester resin paint finish on the exterior of the pump.

B. Pump Configuration. Supply a mating discharge connection for each pump. The pump must automatically and firmly connect to the discharge connection guided by no

more than two stainless steel guide bars extending from the top of the station to the discharge connection. No portion of the pump can bear directly on the sump floor. Ensure each pump is fitted with 50 feet of stainless steel lifting chain. The working load of the lifting system must be 50 percent greater than the pump unit weight.

C. Motor. Ensure motor is a 3-Phase, 60 hertz, 480 volt, Class H rated, 1.15 service factor, sealed submersible type suitable for installation in a Class I, Division 2 Hazardous Location. Ensure the motor is capable of no less than 30 evenly spaced starts per hour. Embed three thermal switches in the stator end coils, one per phase winding, to monitor the stator temperature.

Ensure motor horsepower is sufficient so that the pump is non-overloading throughout its entire performance curve, from shut-off to run-out. Ensure the motor and cable is capable of continuous submergence underwater without loss of watertight integrity to a depth of 60 feet or greater.

D. Bearings. Provide upper and lower bearings for a minimum L10 bearing life, as defined by the *American Bearing Manufacturers Association (ABMA)*, of 50,000 hours at any usable portion of the pump curve, and all anticipated axial and radial loads. Provide sealed and permanently lubricated bearings using high temperature grease.

E. Mechanical Seal. Provide the pump with tandem mechanical seal running in an oil reservoir. Ensure the lower seal faces are tungsten carbide and the upper seal faces are carbon. Ensure each pair of seal faces are held in contact by separate spring systems. Ensure all metal parts of seal including spring, all external fasteners, and the shaft are stainless steel.

F. Pump Shaft. Ensure the pump and motor shaft are a single piece unit. Shafts using mechanical couplings are prohibited. Ensure the shaft is stainless steel meeting the requirements of *ASTM A 479 S43100-T* or *ASTM A 276 type 420*. Shaft sleeves are prohibited.

G. Impeller. Ensure the impeller is a non-clog type. Ensure the impeller is made of gray cast iron (*ASTM A 48 Class 35B*) or chrome cast iron. Ensure the impeller is statically and dynamically balanced. Ensure wear rings, when part of the impeller design, are chromium-nickel steel or high-alloy gray cast iron.

H. Cable and Cable Entry Seal. Ensure power and control cables are designed specifically for use with submersible pumps. Size the power cable according to the *NEC* and *ICEA* standards. Ensure both cables are of sufficient length to reach the junction box without splices. Ensure the outer jacket of the cables are oil resistant rubber.

I. Pump Protection. Provide one thermal switch per stator phase winding connected in series to monitor the temperature of the motor. Upon opening of the switch the motor must stop and activate an alarm. Ensure moisture detection is provided to alarm if there is seal leakage. Ensure the thermal switch and float are connected to a control and status monitoring unit. Design the control and status monitoring unit to be mounted in the pump control panel.

I. Check Valve. Provide an elbow ball type check valve on the discharge of each pump, reference Szuster Systems type ESK.

4. Miscellaneous Items.

A. Anchor Bolts. Supply stainless steel adhesive anchors of size and length recommended by the pump supplier.

B. Grouting. Ensure grout is as required by the pump supplier with minimum requirements as indicated on the plans. Ensure grout is non-shrink in accordance with section 702 of the Standard Specifications for Construction.

C. Piping and Fittings. Provide discharge pipe and fittings as shown on the plans for the station. Ensure pipes are hot dipped galvanized carbon steel

(1) Provide piping per ASME B31.3 piping shall be minimum schedule 40
(2) Provide fittings per ASME B16.9
(3) Provide flanges conforming to ASME *B16.5*.
(4) Provide flange hardware is type 304 stainless steel.
(5) Provide flange gaskets are rubber and be full face.

D. PVC Piping and Fittings. Provide vent pipe and fittings. Ensure vent pipe is Schedule 80 PVC.

F. Spare Parts. Provide one spare impeller and one spare set of mechanical seals for each pump.

c. Construction. Ensure construction methods are in accordance with manufacturer's recommendations, the standard specifications and as modified herein. Ensure that the following requirements are met by the pump supplier and manufacturer.

1. Pump Installation Supervision. Ensure a qualified pump manufacturer's representative provides onsite pump installation supervision for a minimum of 3 work days, not necessarily continuous.

2. Submittals. Do not use any materials in the work until the Engineer has had ample time to determine the products' suitability and compliance with the specifications. Ensure all submittals are in electronic portable document format (PDF). Allow a minimum of 15 work days for review and approval.

Review and approval of submittals are only to determine compliance with information given on the plans, specifications and details and conformance with the design concept of the completed project as a functioning whole. The Contractor is responsible for all matters relating to fabrication, shipping, handling, storage, assembly, installation, and construction, for all safety aspects of performing the work, and for coordinating the work.

Submit the following information for review and approval by the Engineer:

A. Shop Drawings. Submit shop drawings for all equipment to be used, including but not limited to pumps and accessories. Shop drawings must contain the following: manufacturer and model; performance curves and power requirement data; equipment outline drawing with dimensions; equipment assembly drawing (exploded view) with parts list; detailed motor and electrical data.

The review of shop drawings does not relieve the Contractor from the responsibility to correct errors or omissions or to provide adequate field measurements as may be required. It is the Contractor's responsibility to call attention to all deviations from the plans, specifications, and details. If deviations have not been clearly identified, they will not be considered as part of the shop drawing review.

B. Catalog Cuts and/or Product Data Sheets. Submit catalog cuts and/or product data sheets for standard manufactured items such as conduit and conduit fittings, piping, etc. Each sheet must identify the exact equipment for which it is intended and contain all pertinent information such as physical dimensions, materials, and approved listings such as *UL* label or other testing agencies.

C. Operation and Maintenance (O&M) Manuals. Submit O&M manuals for each facility. Ensure O&M manuals contain the following: equipment function; normal operating characteristics and limiting conditions; assembly, installation, alignment, adjustment, and checking instructions; operating instructions for start-up, routine and normal operating, regulation and control, and shutdown and emergency conditions; lubrication and maintenance instructions; guide to troubleshooting; parts lists and predicted life of parts subject to wear; outline, cross-sections, assembly drawings, engineering data, and wiring diagrams; test data and performance curves.

3. Pump Supplier's Field Services. Ensure the pump supplier arranges and pays for a representative of the pump manufacturer to perform the following for each facility:

- Check the work and assist in start-up.
- Demonstrate the operation and maintenance of the pumping equipment to the appropriate Department personnel.
- Review the O&M manual with Department personnel.
- Provide a minimum onsite time of 3 work days (not necessarily continuous) for start-up, operation and maintenance demonstration, and review.
- Promptly make all changes and additions required by manufacturer's representative.
- Provide a written letter of acceptance of installation along with the warranty information required herein.

4. Project Closeout Documentation. Provide the following documentation to the Engineer prior to project closeout for each facility: pump manufacturer's installation test and inspection reports; record drawings; and warranty certificates.

Operational Guarantees and Equipment Warranties. The submersible pumps must have a 5 year non-prorated warranty against material and workmanship covering parts and labor on motors and pumps. Ensure this warranty is provided by the manufacturer, their representative, or by an insurance policy obtained by the Contractor naming the Department as the policy holder. The pump and motor manufacturer must have an established factory authorized service and repair facility within a 100 mile radius of the location of the installed pumps.

5. Sequence of Construction. Submit a sequence of construction schedule prior to beginning the work. Ensure the schedule is prepared in recognition of the following constraints:

A. Arrange work to provide for Department personnel access and for operation and maintenance of the existing facilities at all times.

B. The existing pump station equipment may not be demolished until newly installed pump(s) are operational and commissioned.

C. Coordinate with the electrical utility company to arrange for proper scheduling of any required utility work.

d. Measurement and Payment. The completed work, as described, will be measured and paid for at the contract unit price using the following pay items:

Pay Item	**Pay Unit**
Pump Equipment (Lighthouse)	Lump Sum
Piping Discharge (Lighthouse)	Lump Sum

1. **Mechanical Equipment, Submersible Pumps (Lighthouse.)** includes all mechanical equipment associated with the pump station such as piping, and installing discharge piping and will be paid for in accordance with this special provision and the Standard Specifications for Construction.

MONROE COUNTY DRAIN COMISSION

SPECIAL PROVISION
FOR
PUMP STATION METAL WORK, MISCELLANEOUS, MODIFIED

a. Description. This work consists of designing, furnishing, and installing guardrails, grab bars, ladders, stairs, access covers including butyl rubber gaskets where indicated on plans, pre-manufactured roof hatches, grating, and other miscellaneous metal work as noted on the plans. Complete this work in accordance with the standard specifications and this special provision.

b. Materials. Provide materials meeting the requirements specified in the following sections of the Standard Specifications for Construction.

Grout, Type H-1 702
Bolt, Adhesive Anchored..... 712
Structural Steel..... 906
Anchor Bolts..... 908
Miscellaneous Metal Products 908
Tubing, Steel Railings 908

Provide steel meeting *ASTM A 36* unless otherwise noted on the plans or in this special provision.

1. Guardrail and Grab Bar. Provide 2-rail, Schedule 40 steel pipe of all-welded construction for guardrail and grab bars. Ground smooth all welds. Shop fabricate and hot dip galvanize (*ASTM A 123*) after fabrication. Ensure design and fabrication meets the minimum requirements of *OSHA* and *MIOSHA* standards and the *Michigan Building Code 2006*.

2. Ladders. Shop fabricate and hot dip galvanize (*ASTM A 123*) after fabrication. Ensure treads are galvanized, welded steel grating with serrated surface and abrasive safety nosing. Ensure connections are bolted, welded, or by other means approved by the Engineer. Design and fabricate to meet the minimum requirements of *OSHA* and *MIOSHA* standards and the *Michigan Building Code 2006*. Provide safety ladder-up device at ladders at locations shown on the plans.

4. Steel Access Covers. Ensure fabricated covers and steel bars are hot dip galvanized (*ASTM A 123*) after fabrication.

6. Stairs. Ensure exterior stairs are industrial-type with steel framing, steel stringers with closures for exposed ends, steel bar grating treads, and welded steel pipe guardrail and handrail.

Fabricate treads from welded or pressure-locked steel grating with a serrated surface. Provide steel angle or steel plate carrier at each end for stringer connections. Secure treads to stringers with bolts.

Design and fabricate stairs to meet the minimum requirements of *OSHA* and *MIOSHA* standards

and the *Michigan Building Code 2006*. Shop fabricate and hot dip galvanize (*ASTM A 123*) after fabrication.

8. Pre-Manufactured Roof Hatches. Ensure clear openings for hatches are of sizes indicated on the plans. Frame and door must be aluminum with stainless-steel hinges and pins unless otherwise called for on the plans. Ensure hatches have diamond-patterned surface, exterior locking mechanism, integral drainage frames, spring-assisted opening, and safety grating. Ensure all hardware is stainless steel unless otherwise noted on the plans. Ensure all aluminum surfaces in contact with concrete or other dissimilar metals receives bituminous coating approved by the Engineer, or equal. Ensure frames are neatly mitered and have welded corners and anchors. Locate drain at corner nearest to exterior pump station wall.

Select hatches from the companies listed below or an Engineer approved equal.

Company
Bilco Company
Babcock-Davis, Inc
Halliday Products, Inc

9. Grating. Shop fabricate and hot dip galvanize (*ASTM A 123*) after fabrication. Ensure grating has a serrated surface for slip resistance. Ensure grating meets the minimum size as shown on the plans.

c. Construction. Construct in accordance with section 405 of the Standard Specifications for Construction, as shown on the plans and as modified herein.

1. Guardrail and Grab Bar. Attach to existing concrete with stainless steel anchor bolts of the size and number as shown on the plans. Ensure bolts are mechanical expansion anchored per subsection 712.03.K of the Standard Specifications for Construction. Locate bolt hole locations using actual guardrail or grab bar section as a template. Grout voids to provide flush mount.

2. Ladders. Attach to existing concrete with stainless steel anchor bolts of the size and number as shown on the plans. Ensure bolts are mechanical expansion anchored per subsection 712.03.K of the Standard Specifications for Construction. Locate bolt hole locations using actual ladder section as a template. Install ladder plumb and to the lines shown on the plans. Grout voids to provide flush mount.

4. Steel Access Covers. Install covers over proposed openings and secure to concrete using galvanized steel bar as shown on the plans. Install covers level and square.

6. Stairs. Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction. Install in accordance with manufacturer's installation recommendations.

8. Pre-manufactured Roof Hatches. Install units level and square, and in accordance with hatch manufacturer's installation recommendations. Provide mechanical fasteners consistent

with the roof hatch manufacturer's requirements.

Adjust reinforcing around perimeter of hatch to maintain required concrete clear cover.

9. Grating. Attach to framing with stainless steel saddle clips in accordance with manufacturer's recommendations.

10. Shop Drawing Submittals. When directed by the Engineer or required by the specifications, submit shop drawings and product data to the Engineer for review electronically in Portable Document Format (PDF). Do not use these materials in the work until the Engineer has had ample time to determine the products suitability and compliance with the specifications. Submittals will be returned in 15 working days. Submit the following information for approval by the Engineer.

Electronically submit catalog cuts and/or product data sheets. Provide catalog cuts for standard manufactured items and mill reports covering chemical and physical properties. Each sheet must identify the exact equipment for which it is intended. Ensure all pertinent information such as physical dimensions and approved listings or testing agencies is provided.

Electronically submit shop drawings showing layout, fabrication dimensions, welded and bolted connection details, anchoring details, and erection information. Include pull out and shear strength information for recommended anchor bolts. Include manufacturer's product literature and installation instructions for the trash rack.

The approval of shop drawings does not relieve the Contractor from the responsibility to correct errors or omissions or to provide adequate field measurements as may be required. It is the Contractors responsibility to call attention to all deviations from the plans, specifications and details. If deviations have not been clearly identified, they will not be considered as part of the shop drawing approval.

d. Measurement and Payment. The completed work, as described, will be measured as a lump sum and paid for at the contract price using the following pay item:

Pay Item	**Pay Unit**
Pump Basin Structure (Lighthouse)	Lump Sum

Pump Basin Structure (Lighthouse) includes all of the miscellaneous metal work materials and labor associated with the pump station and in accordance with subsection 405.04, as detailed on the plans and this special provision.

MONROE COUNTY
DRAIN COMMISSIONER
DAVID P. THOMPSON

ADDENDUM No. 1

Monroe Consolidated Drain Improvements
June 13, 2022

The following items are being included or have been revised from the original format provided.

1. Special Provision for Pump Station Equipment, Electrical
2. Special Provision for Pump Station Equipment, Emergency Generator
3. Special Provision for Pump Station Equipment, Mechanical and Submersible Pumps
4. Special Provision for Pump Station Metal Work, Miscellaneous, Modified
5. Geotechnical Investigation Report