

SECTION 16160

WASTEWATER PUMPING STATION CONTROL PANEL

PART 1 GENERAL

1.1 DESCRIPTION

- A. The pumping station control panel shall be supplied containing all the electrical and mechanical equipment necessary to provide for the operation of two electrical submersible pumps. All panels shall include provisions for turning pumps on and off, manually and automatically, alternating lead pump with each pump cycle or manually, indications for operation and alarm conditions, testing and indication of all operational features, and terminal strip wired and indicated for all telemetry contacts. A minimum of 8 spare terminal strip contacts shall be provided to allow for expansion, repair or alterations.

1.2 QUALITY ASSURANCE

- A. All work shall comply with the applicable codes, standards, rules and regulations published by IEEE, ANSI, NEC, National Electric Safety Code and Nema Standard IC-1 Industrial Control.

1.3 SUBMITTALS

- A. Shop drawings shall be submitted showing layout materials and components for lift station control panels, as specified on the drawings.

PART 2 PRODUCTS

2.1 GENERAL

- A. The control panel shall be NEMA 4x, Type 304, 14 Gauge Stainless Steel with continuous welds on all seams. A rolled lip shall be provided around three sides of the door and around all sides of the enclosure opening. A neoprene gasket attached with oil resistant adhesive and held in place with stainless steel retaining clips shall be installed around the door. All hardware except the print pocket shall be stainless steel. Two modular replacement aluminum subpanels shall be provided to hold the components for the controls. The outer door shall contain a self storing wind resistant rod.
- B. Mounted on the exterior of the enclosure shall be a generator receptacle, power available light, high level alarm light, alarm bell, alarm reset button and 2 each air vents. All parts mounted to the enclosure shall be secured with stainless steel hardware.

- C. The power subpanel shall contain a main circuit breaker, emergency circuit breaker, motor circuit breakers, control circuit breaker, duplex receptacle breaker, across the line magnetic motor starters with over load protection on each leg, control voltage fuse transformer, alternator. All control wiring shall be color coded per IPCEA (minimum 18 colors) size 18 AWG, rated for 300 V, 80 degrees C, stranded, tinned copper with PVC phase monitor, relays, terminal strips, ground fault duplex receptacle, trouble light and neutral block. The main and emergency breaker shall be interlocked to assure only one breaker can operate at one time.
- D. The inner dead front door shall be constructed of .25" clear lexon. The inner dead front shall have rounded edges and shall be mounted on an .063" aluminum continuous aircraft hinge with a stainless steel pin. The inner dead front shall be fastened to the enclosure and hinged with stainless steel screws. The dead front shall be supported on the vertical break opposite the hinge with a continuous support and shall not depend on breakers or other components. The inner dead front shall contain breaker knock-outs for protrusion of the breaker handles. Mounted on the inner dead front door shall be level lights, pump run lights, elapsed time meters, HOA switches, 3 position alternator mode switch, trouble switch and thermal overload reset buttons. All components shall be equal to and directly interchangeable with those listed on the drawing.
- E. Each control panel shall be provided with a phase monitor and surge protection to ensure protection for each pump circuit.
- F. The panel shall be provided with a 60 watt coated panel convenience light to illuminate the interior of the panel at night. The switch for this light shall be a heavy duty single pole switch located on the inner dead front door.
- G. Provide two 2-1/2 inch diameter conduit knockout holes for electrical conduit mounting in the bottom of the cabinet. The knockout shall be located by the CONTRACTOR to suit junction box and taped closed for shipping.
- H. The duplex ground fault protected (15 amps) outlet shall be mounted internally in the bottom of the panel in an aluminum junction box.
- I. Two 1-1/2" emergency wire access covers shall be located internally in the bottom left of the panel, constructed of 1-1/2" Square D threaded closing plate.
- J. Each control panel shall have a control transformer, where required as indicated, to provide 120 volts single phase A.C. control power. Both legs of the primary shall be protected by a thermal magnetic Type FA 2 pole circuit breaker minimum frame size as manufactured by the Square D Company, one leg of the secondary of the control transformer shall be protected by a thermal magnetic, Type FA circuit breaker minimum frame size as manufactured by the Square D Company, the other leg shall be grounded. The capacity of the control transformer shall be adequate to operate all the control devices in the circuit to include power for motor space heaters (for motors

20 HP and above coordinate with motor manufacturer) with a minimum capacity of 0.75 KVA.

- K. Lightning arrestor, GE or equivalent, sized for voltage, current and phase for particular installation as approved by the ENGINEER and mounted on the outside bottom of the disconnect box.
- L. When a single phase control panel is specified, two single phase modules shall be installed on power subpanel. Equip panel with two extra run capacitors and two extra start capacitors as spare parts.
- M. Power meter shall be provided in a NEMA 4X enclosure.
- N. Provide a separate power disconnect switch located in line immediately after the power meter ahead of the control panel. The switch shall be housed in an aluminum or stainless steel NEMA 4X enclosure fitted with a locking hoop and padlock keyed to County Standards.

2.2 WIRING

- A. All wiring shall be neatly laced or shall be installed in plastic Panduit raceways. The raceways shall be sized so that not more than 50% of the design capacity is used.
- B. All terminations to external devices shall terminate on terminal blocks.
- C. All control wiring shall be color coded, size 18 AWG rated for 300 volts, 80 C, stranded tinned copper PVC insulated.
- D. A wiring and circuit schematic sized 11 inches by 17 inches shall be permanently affixed to the interior of the enclosure door. The schematic shall be extruded vinyl homopolymer laminate or approved equal. Also included in door shall be a print pocket large enough for an 8.5" x 11" clipboard to be mounted at start up. A plastic or aluminum warning sign with legend "DANGER-HIGH VOLTAGE" shall be mounted on the exterior main panel door. The warning sign design and colors shall be in accordance with OSHA specifications and must be affixed to door without screws or rivets. (No holes to be drilled in exterior door).
- E. All wiring shall be color coded and numbered as shown in the drawings.

2.3 NAME PLATES

- A. Each switch, circuit breaker, indicating light, push-button, meter, relay etc. shall have an engraved laminated plastic background color coded nameplate mounted above for proper identification: Red for alarm and emergency breaker, Black for power, Green for level, and blue for controls. Letters shall be a minimum of 1/4 inch in height.

2.4 OPERATION

- A. The control function provides for the operation of the lead pump under normal conditions. If the incoming flow exceeds the pumping capacity of the lead pump, the lag pump will automatically start to handle this increased flow. As the flow decreases, pumps will be shut off at the elevation shown on the plans. In the event of a malfunction or a flow that exceeds the capacity of the pumps, a voice reporter shall be activated announcing a high level condition. If the level continues to rise, an audible high level alarm and light will be activated to indicate high level condition at the site. A reset function shall lock out the audible alarm; however, the alarm light shall release only with the correction of the high level condition.
- B. In order to insure pump back-up guarantee and also to distribute almost equal pump time to each of the two pumps, an alternator shall be included in the panel. Under normal conditions, the lead pump will start (for example, it may be No. 1) and pump until it either pumps down the level in the wet well and shuts off or cannot keep up with the flow and requires the lag pump (#2) to come on. Should the lag pump be required, it will stay on until the desired shut off level is attained and both lead and lag pumps will shut down. When the wet well level increases where one pump is required, the alternator will request the lead pump (in this sequence pump #2) to start and the entire cycle will be repeated. The alternator will have the capability of setting either pump 1 or pump 2 to be lead pump continuously. This capability shall be accomplished by an alternator selector switch labeled Lead #1, Lead #2, Lead 3 and Auto.
- C. Should the "Pump-Off" regulator fail, the system will keep the station in operation and provide a visual indication of the regulator failure.
- D. In the event of phase reversal, loss of any phase, or low voltage of any phase, control voltage shall be interrupted through the phase monitor. The phase monitor shall automatically reset upon removal of any and all of the above conditions.

2.5 SPECIAL

- A. The above panel requirements describe a 230 volt, 3 phase power available, E-3 phase panel complete as described above. This shall apply in all cases, however, in special cases where only 230 volt, 1 phase power is available to the pump station, the following changes and additions are necessary:
 - 1. The phase monitor and circuit will be changed to accommodate a 230 volt relay which will monitor both legs.
 - 2. The lower left panel will contain for each pump a motor start relay, start capacitors, run capacitors and two 5 terminal-terminal strips for pump motor leads, color coded Red or mounted over a laminated Red plastic plate.
 - 3. In addition to schematic furnished on inside door, add single phase Module Schematic, 230 volt relay Conversion Schematic and Ammeter diagram.

2.6 RELAYS:

- A. Relay shall be general purpose plug in relay, 8 pin (DPDT) or 11 pin/blade (3PDT), with 220 VAC 10 AMP rated contacts. 24 volt coil relay shall have Octal-type mounting. 120 volt coil shall have square-base relay-type mounting. Relay shall be Syrelec model RPT-2C8-24A, RPT-3C11-24A, RKT-2C-110A, RKT-3C-110A, or approved equal.
- B. Time delay relay shall be general purpose 8 pin/blade or 11 pin/blade plug in timing relay with 24 VAC or 120 VAC coil, or time delay module in conjunction with standard relay above. Timing mode shall be on-delay adjustable for 0.5 seconds (maximum), to 30 seconds (minimum) with contacts rated at 220 VAC 10 AMP. 24 volt time delay relay shall be Turck Multi-prox, Inc., Time Cube CT2-E20 with Syrelec RPT-2C8,24A, or CT3-E20 with Syrelec RPT-3C11-24A, or approved equal. 120 volt time delay shall be Syrelec model K-AR2-F100-110 (K-AR2-F10-110 for relay - TD1) or K-AR2-B-110 or approved equal.
- C. 12 volt time delay relay shall be DIN Rail mounted with 12 volt DC coil, timing mode shall be on-delay adjustable for 1 second (maximum), to 90 seconds (minimum) will contact rated from 220 VAC at 10 amps. Time delay relays shall be Syrelec model B-AR-F100-12D, or approved equal.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Control panels shall be installed at the lift station sites as shown on the drawings.
- B. All work shall be in a neat and workmanlike manner by a certified master electrician holding a current competency card and registered with the State of Florida.
- C. Electrical work shall be coordinated so as not to interfere with or delay other construction operations.
- D. Perform all necessary cutting, sleeving, excavating and backfilling for the installation of the equipment and the restoration thereafter.
- E. Install all equipment and control devices furnished by equipment manufacturers with their equipment and complete wiring in accordance with manufacturer's recommendations and approved wiring diagrams. Any OWNER furnished equipment will be connected by the CONTRACTOR.
- F. The ends of all conduits shall be carefully reamed free from burrs after threading and before installation. All cuts shall be made square. All joints shall be made up tight. Care shall be taken to see that all power conduit runs either from a permanent and continuous ground connection point, or a bond wire is provided within the conduit.

- G. The CONTRACTOR shall permanently and effectively ground service neutral and all raceways, devices, and utilize equipment in accordance with requirements of National Electrical Code, and as shown on Drawings.

3.2 ELECTRICAL WORK - GENERAL

- A. See Section 16050.

3.3 GROUNDING - SECONDARY VOLTAGE SYSTEM

- A. See Section 16450.

3.4 DISCONNECT BOX

- A. A heavy duty Nema 4x lockable GE or equivalent nonfusible disconnect switch mounted in type 304 stainless steel enclosure. CONTRACTOR to use mounting provided. Holes are not to be drilled in disconnect box. Sized for voltage, current and phase for particular installation as approved by ENGINEER mounted in accordance with lift station drawing.

3.5 OUTSIDE LIGHTNING ARRESTOR

- A. A lightning arrestor, GE or approved equal, sized for voltage, current and phase for particular installation as approved by ENGINEER shall be mounted on the outside bottom of the disconnect box.

3.6 PUMP CABLE CONNECTORS AND SEALS

- A. CGB Connectors packed with removable sealants shall be installed in a ventilated enclosure under the control panel in accordance with the lift station drawing.

3.7 CONDUIT

- A. For all above ground conduit and installation, and from junction box into panel, refer to specification, RIGID STEEL CONDUIT section 16110.
- B. For all below ground conduit and installation and from junction box to wet well, refer to Specification, Non-Metallic Conduit Section 16110.

3.8 SPLICES

- A. All splices for conductors No. 12 through No. 6 AWG solid or stranded shall be made with "Scotchlock" spring connectors or the pressure wire type. For wire sizes larger than No. 6, splices shall be made with "OZ" Type "XW" or "XLP" as appropriate to the splice being installed. Equal fittings of Brundy and Penn Union may be used. Tape shall be equal to Scotch No. 33 plastic over splice and filler tape on splices shall be

equal to "Scotchfill". All Scotchlock splices in hand holes shall be dipped Glyptol for waterproofing.

3.9 PERMITS

- A. All required permits and inspection certificates shall be obtained and paid for by the CONTRACTOR and be made available to the OWNER at the completion of the work.

3.10 START-UP

- A. The manufacturer shall provide all necessary instruments and special apparatus to conduct any test that may be required to insure that the system is operating as designed. A written start-up report is required and must be furnished to OWNER within 30 days of start-up.

3.11 GUARANTEE

- A. Submit a written guarantee to the OWNER that all electrical work and material furnished provided under this contract is free of defects for a period of one year after final acceptance of the job. There will be no additional charge to the OWNER to repair or replace any such work which is found to be defective within the guarantee period. Should a defect occur and the CONTRACTOR or his representative not be available for immediate repair, an interim repair by others may be made without violation of the guarantee.

END OF SECTION

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