

CHAPTER 11 SEWER PUMP STATION ELECTRICAL

11.1 GENERAL

- A. Electrical work shall be as indicated on the drawings, including all items which may be reasonably implied in order to provide a complete and operational system
- B. All work shall be in accordance with the most current edition of the National Electric Code, as well as local Inspection Department requirements that has jurisdiction.
- C. All work must be performed using a licensed electrician.
- D. Obtain necessary permits and pay associated fees prior to starting work.
- E. Make necessary arrangements with the utility for power service and arrange for temporary power as required.
- F. Power Supply
 - 1. Single phase power is allowed for motors 5 hp or less.
 - 2. 3 phase is required on all pumps greater than 5 hp, if pumps are optimized for elevation & 3 phase power is not available, then VFD's will be approved on a case by case basis by BJWSA.
- G. All power lines within the site shall be underground. No overhead power line will be allowed to cross the site.
- H. Main power lines shall be stranded copper and shall either be THHN, THWN, RHW, or XHHW.
- I. Underground conduit from junction boxes shall be a minimum of 2-inch Schedule 80 PVC. Schedule 40 PVC may also be used if encased in concrete. Above ground conduit shall be schedule 40 hot dipped galvanized conduit. Separate conduits shall be provided for each pump power cable and one conduit for all float wires. Conduits inside the pump station wet well shall extend to the closest end of the access hatch and terminate with bell ends or bushings.
- J. Motor starting equipment and circuit breakers shall be G.E. Main circuit breaker disconnect shall be housed in a separate locking NEMA 4x stainless steel enclosure mounted on the control panel bracket. Main breaker shall have a lockable externally mounted control lever and shall be rated for service entrance application. The minimum size shall be 20X16X8 for 100 amp and 24X16X8 over 100 amp. Voltage shall be clearly labeled on disconnect.
- K. A generator receptacle shall be provided and mounted on a separate cast aluminum enclosure and wired to match existing generator. Generation system shall be tested utilizing BJWSA's generator prior to acceptance. A receptacle cover plate must be screwed or bolted on with draw down bolts. All mounting hardware shall be stainless steel.
 - 1. 100 amp receptacle (4 wire – 4 pole) with stainless steel hooks and wing nuts for less than 9.5 HP
 - 2. 200 amp receptacle (4 wire – 4 pole) for 9.5 HP and larger
- L. Stainless Steel Enclosed Lightning/Surge Arrestors
 - 1. Shall be connected to the main disconnect for each phase of incoming service.
 - 2. Shall to be mounted outside the main control panel
 - 3. Shall have a 160,000 surge current rating,

4. LED indication lights per phase and integral fused disconnect.
5. Shall be PTX 160 as manufactured by IT in a NEMA 4X stainless steel enclosure or pre-approved equipment.
- M. Electrical grounding shall consist of 3-5/8" diameter, 10-FT long copper clad ground rods, set in a 6' triangular spacing.
- N. Electrical supply, control, and alarm circuits shall be designed to provide strain relief and to allow disconnection from outside of the wet well. Terminals and connectors shall be protected from corrosion by location outside the wet well and through use of watertight seals. No connections or terminals are allowed within the wet well. If located outside, weather proof equipment shall be used.

11.2 MAIN CONTROL PANEL

- A. Enclosure shall be NEMA 4x stainless steel with toggle latches, drip shield, and a single handled three-point latch system with padlocking provisions. Screw-type latches nor wall mounting through the enclosure will not be accepted. Print pocket shall be provided on the inside of exterior door.
- B. Electrical schematic shall be plastic laminate affixed inside the control panel door.
- C. Electrical control panels shall be of sufficient size to house all control equipment. All panel penetrations for conduit shall be from the bottom.
- D. A double throw walking beam transfer switch shall be mounted inside the main control panel. Transfer switch shall be wired to provide power from either the main power source or from the remote generator receptacle. A NEMA 4X SS Transfer switch mounted on the control panel rack is an acceptable alternate control.
- E. The enclosure shall be fully gasketed. The enclosure shall be equipped with a removable hinged inner door constructed on minimum .090" 5052 H-32 marine alloy aluminum. A minimum of the following components shall be installed on the aluminum inner door:
 1. Pump motor circuit breakers by General Electric with operators
 2. Main and emergency breakers by General Electric with walking beam mechanical interlock.
 3. Hand-Off-Automatic (HOA) selector switches shall be non-spring loaded and oil tight.
 4. Test-Normal-Reset spring return selector switches for overtemp
 5. Test-Normal-Reset spring return selector switches for seal failure
 6. Lead 1 – Lead 2 – Automatic alternator selector switch
 7. Six digit elapse time meter without reset for each motor
 8. Two ammeters with Off-L1-L2-L3 selector switches, with appropriate scale ranges. One ammeter for each pump motor.
 9. 25 HP and larger motors shall have a voltmeter with Off-L1-L2-L3 selector switches
 10. On/Off switch for yard light
 11. The following LED indicating lamps:
 - a) Pump Running (green)
 - b) Seal Failure (red)
 - c) Overheat Failure (red)
 - d) High Level Alarm (red)
 - e) Phase Failure (red)
 - f) Float Levels (yellow)

- g) Lag Pump Operation (red)
- h) Power On (white)
- i) Power on Led light on each power leg

12. Pushbuttons for:

- a) Alarm horn silence (internally mounted)
- b) Reset motor overload
- c) Lag pump operation reset
- d) Float level test

13. Bubbler type level control system consisting of Solid State Level Controller with the including, but not limited to, the following functions:

- a) LCD level display
- b) 4 adjustable setpoints with LED trip indication
- c) Level simulator
- d) Plug in pressure transducer with 4-20mA output
- e) Air Flow Meter
- f) Dual Air Pump with selector switch

F. Seal failure relays shall be plug in pin type with indicator lights.

G. Control wire to be MTW 90 degree C, #14 AWG. Color code and number all wiring as indicated on the factory-wiring diagram. All wiring shall be neatly grouped in plastic wire troughs except wiring from bookplate to the door shall be done in separate bundled harness. All wires shall have a wrap-around wire identification number at both ends of the wire as shown in the wiring diagram. All components shall be identified with the same number shown in the wiring diagram. All door-mounted components shall have engraved nameplates that are white with black lettering.

H. Analog field wiring shall be #16 AWG TSP and should not be bundled with 120 VAC discrete or power wiring.

I. A time delay relay to prevent the pumps (duplex) from starting simultaneously after power failure.

J. All Pilot devices shall be heavy duty 30mm and shall be manufactured by General Electric.

K. A minimum of the following components shall be mounted on the minimum 0.25" aluminum back plate:

1. Fuseless NEMA rated combination motor starters with thermal magnetic circuit breakers. Starters shall be heavy duty industrial contactors, minimum size 1 (Definite Purpose contactors are not acceptable), with 3 phase adjustable bimetallic overload protection. Manufacturer shall be General Electric.
2. 24 VAC transformer shall be provided for float operation.
3. 3 KVA, 115 VAC control circuit transformers with primary circuit breaker and secondary circuit breaker (when required)
4. Circuit breakers shall be provided for:
 - a) Control Panel Power
 - b) Duplex receptacle 20 amp
 - c) Yard Light
 - d) SCADA/Dialer
 - e) Spare

5. Automatic electrical pump alternator
6. Control relays shall be plug-and socket solid state with indicator light manufactured by Square D, Allen Bradley, or G.E.
7. Surge Suppressor
8. Power terminals and control terminals, each shall have minimum of $\frac{1}{4}$ " flat head set screws.
9. Condensation protective space heater with adjustable thermostat
10. Phase failure relay shall monitor:
 - a) Phase failure
 - b) Phase reversal
 - c) Low voltage (Brown Outs)
11. Dual heavy duty vibrating reed type air compressors with all necessary valves, fittings, tubing and bulkheads
- L. A separately mounted weather proof alarm light with junction box and red globe shall be provided so that it is prominently viewed.
- M. A separately mounted 4" diameter air bell assembly constructed of schedule 80 – 316 stainless steel shall be provided. Air bell assembly shall be supported by $\frac{1}{4}$ " – 316 stainless steel cable. Air tube shall be 3/8" Kynar secured to cable mounting bracket. Air tubing from the junction box into the bottom of the control panel shall be 3/8" - 316 stainless steel.
- N. All conduits entering the control panels or other enclosures from the wet well shall be sealed with gas-tight fittings (Myers type hubs) & sloped to the wet well.
- O. A minimum of 3 NEMA 4X junction boxes with hinges, toggle latches, and terminal blocks shall be provided for pumps, air bubbler tubing, and floats.
- P. Control sequence shall be designed so that panel returns to normal automatic operation after a power failure. Manual reset shall not be necessary. The control sequence shall also be designed to allow back up float operation in the event of a level controller failure.

11.3 SUBMERSIBLE PUMP STATIONS

- A. Control Panel
 1. Electrical control panel bracket shall be made of hot-dipped galvanized steel unistrut with 316 stainless steel hardware and shall be adequately grounded. Support/bracket design shall provide for no deflection.
 2. Concrete pad shall be provided for the electrical control panel and shall extend a minimum of three feet (3') measured from the face of all panel components and supports. [Detail shows on 1 ft from panel to edge of concrete pad.] Concrete pad shall be a minimum of 5.5" thick, faced with $\frac{1}{2}$ " expansion material between precast structures, and shall be flush with the wetwell top.
 3. A weatherproof alarm horn with weatherproof box shall be mounted on the side of the control panel. Horn shall be activated at high water level. All installations requiring penetration of the control panel shall be made in such a manner and with approved devices that will maintain the panel's rating. Panels shall be factory assembled and shall bear a UL label certifying this rating.
 4. Yard light shall be 120V 500W Quartz or Halogen floodlight pointed at the control panel. Light shall be controlled by a switch mounted in control panel, not the circuit breaker.
 5. A 20 amp, 115/120 volt GFI Duplex Receptacle shall be mounted on the side of the

panel and equipped with in-use weatherproof cover.

B. Pumps

1. Pump motor power cables shall be designed for flexibility and serviceability under conditions of severe usage and shall meet the requirements of the Mine Safety and Health Administration for trailing cables. Power cable terminal fittings shall be corrosive-resistant and constructed in a manner to prevent the entry of moisture into the cable. They shall be provided with stain relief appurtenances and shall be designed to facilitate field connection.
2. Provide power and control cables of adequate length to reach the junction box without splicing.

11.4 ABOVE GROUND SUCTION LIFT PUMP STATION

- A. All electrical conduits shall be installed in the slab
- B. Conduits will be installed so they exit the slab and run to the bottom of the panel
- C. No conduits can be installed horizontally along the walls of the building, unless installed by the manufacturer in the case of premanufactured buildings.
- D. Control panels and other electrical enclosures should be wall mounted so the door can be opened past 90 degrees with a person standing in front of the enclosure. See safety drawing.
- E. Main disconnect shall be located outside of the building and be lockable in both the on and off position.
- F. Conduit from the wet well shall terminate in a junction box outside of the building with seal offs before conduit is installed in the slab under the building.
- G. Inside the building there shall be a minimum of 4 duplex receptacles, one mounted on each wall. There shall also be a receptacle mounted on the outside of the building by the door near wet well hatch.
- H. Provide lighting in the building to provide a minimum of 2 watts illumination per square foot.

11.5 QUALITY ASSURANCE

- A. All work must be performed using licensed electrical contractors approved by BJWSA.
- B. Must comply with the requirements of the National Electrical Code and with local codes and ordinances.
- C. Electrical permit shall be obtained for at the Beaufort or Jasper County Codes Department.

11.6 SUBMITTALS

- A. Submit shop drawings and manufacturer's data on all products.
- B. No equipment may be installed prior to submittal approval by the OWNER'S representative.

11.7 PRODUCTS/MATERIALS

- A. **Standards:** Use only new materials conforming to the standards of Underwriters Laboratories.
- B. **Wiring:** Copper, #12 AWG minimum, type THWN. For runs over 100', use #10 AWG in lieu of #12. In the control panel, #16 AWG is permitted. All wiring to be stranded conductor type.

C. **Support Channel:** Hot dipped galvanized steel, stainless steel, or aluminum with stainless steel hardware or stainless steel.

11.8 INSTALLATION

- A. Install all wiring in conduit. Use galvanized rigid steel, IMC, or stainless steel channel for all exposed runs, and Schedule 80 PVC for all underground conduit or Schedule 40 PVC for underground conduits embedded in concrete. Use flexible liquid tight conduit for connections to transformers and other vibrating equipment.
- B. Provide a separate ground conductor in addition to the raceway where indicated on the Drawings.
- C. The following minimum information on laminated water proof and UV stable media shall be permanently attached to the inside of control panel outer door:
 1. Complete wiring Schematic including remote communication.
 2. Certified pump Curve with design flow and head indicated.

11.9 ELECTRICAL SPARE PARTS

See spare parts requirements for Sewer Pump Stations and Appurtenances Chapter: 10.6.

END OF SECTION