

SECTION 26 29 15

PUMP CONTROL PANELS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. The Drawings and provisions of the General Conditions, Special Conditions, and the Sections included under General Requirements are included as part of this Section as though bound herein.

1.2 SUMMARY

- A. This section gives the requirements for installation of a pump control panel and components for control and monitoring operating status of the pump station.

1.3 CERTIFICATIONS

- A. The instrumentation panel and individual components shall be 3rd part listed; UL, ETL, CSA, etc.
- B. The control panel shall be listed to UL 698A, Industrial Control Panels Relating to Hazardous (Classified) Locations.

1.4 RELATED SECTIONS

- A. Section 40 78 00, Panel Mounted Instruments and Devices.

1.5 DESCRIPTION OF OPERATION

- A. The control panel shall control the operation of two pumps, unless indicated otherwise.
- B. Manual mode, selector switches in "HAND" position:
 - 1. Selected motor operates until the wetwell is pumped down to the Off level.
 - 2. Selected motor stops under overload or overtemperature conditions.
 - 3. "Pump Down" pushbutton will allow operation of motors below the low level shutoff level.
- C. Automatic mode, selector switches in "AUTO" position:
 - 1. Level Sensing:
 - a. For pump stations with pump motors rated less than 50 HP, float switches shall be used for level sensing.
 - b. For pump stations with pump motors rated 50 HP and higher, an analog level control system with a submersible level transducer shall be used for level sensing and control. In addition, float switches shall be used for backup High Alarm level, High/High Alarm Level and low Off level.
 - 2. One pump operates upon reaching the Lead level.

3. A second pump shall operate upon reaching the Lag level.
 4. Upon pumping down to the Off level, both pumps will shut down.
 5. The lead pump shall alternate for each pumping cycle.
 6. A time delay shall be introduced for the lag pump to prevent simultaneous starting after power failure or similar incidents.
- D. Relays, circuitry, etc. for monitoring and indication of the following shall be provided:
1. Motor RUN status.
 2. Pump leak detection / seal failure. A leak detection / seal failure condition shall not stop motors from operating.
 3. Motor overtemperature. A motor over-temperature condition shall prevent the motor from operating until the condition is cleared.
 4. Motor starter overload. A motor overload condition shall prevent the motor from operating until the condition is cleared by manual reset.
 5. Pump control panel power loss / phase failure.
 6. High wet well level and high/high wet well level.
 7. High/high wet well level
 8. Low wet well level. A low wet well level condition shall prevent motors from operating, unless manually bypassed by the momentary position "Pump Down" pushbutton.
- E. Alarm horns and lights:
1. Activated by:
 - a. High/high wet well level.
 - b. Motor overtemperature.
 - c. Motor starter overload.
 - d. Loss of utility power.
 - e. Generator pre-alarm / shutdown
 2. Alarm functions shall operate when power is lost by utilizing an uninterruptible power supply (UPS).
 - a. Include a duplex receptacle for 120v power connection to the UPS input.
 - b. Circuitry to be supplied from the UPS output includes, but is not limited to: power loss relay, float switches, overtemperature sensors, seal failure sensors, alarm horn, and alarm light.
 - c. Include a manual Bypass/UPS selector switch in the UPS output circuitry to accommodate bypassing the UPS. Circuitry shall be configured utilizing the power loss relay to automatically transfer to UPS power if the selector switch is in Bypass position and power is lost.
 - d. UPS Ratings: 120V input / output, 1500 VA / 865 W (minimum), extended run battery pack. Design Basis: APC #BR1500G + (1) BR24BPG.
 - e. See Section 40 78 00, Panel Mounted Instruments and Devices for UPS systems.
 3. Auxiliary signal, dry contacts shall be provided with circuitry wired to terminal blocks for connection to an external SCADA unit for the following:
 - a. Pump Run status.
 - b. High wet well level.
 - c. High/high wet well level
 - d. Motor overtemperature.
 - e. Motor starter overload.
 - f. Pump HOA not in Auto

g. Pump control panel power loss / phase failure.

F. See pump control panel detail on drawings for additional information.

1.6 SUBMITTALS

- A. General: Unless noted otherwise in the project manual, the Contractor shall submit PDF files of shop drawings, certified prints, literature, and cuts sheets for all control panels and accessory materials.
- B. Shop drawings adequate for control panel fabrication, installation and maintenance shall be submitted and approved prior to manufacture. The adequacy of shop drawings shall be determined solely by the Owner's Representative. Drawings shall include:
1. Elementary control (ladder) diagram.
 2. Interconnection wiring (schematic) diagram.
 3. Interior and exterior panel component layout drawings.
 4. Dimensioned outline drawing of the enclosure with mounting supports.
 5. Component catalog cuts and Contractor's installation drawings.
- C. Post fabrication submittals shall include:
1. Device nameplate list.
 2. Written certification of the UL serialized label for the pump control panel.
- D. Post installation submittals shall include four copies of operation and maintenance manuals.

PART 2 PRODUCTS

2.1 CONTROL PANEL

- A. General: Control panel shall consist of a main circuit breaker, phase monitor, surge protector, control power transformer, selector switches, pushbutton operators, auxiliary relays, timers, alternator, indicator lights, elapsed time meters, circuit breakers, motor starters with overloads, strip heater with thermostat, duplex GFCI receptacle, alarm strobe and horn, circuitry, battery backup for alarm circuitry, and terminal blocks with all components mounted in one common enclosure. The controls assembly shall provide means to operate each motor manually or automatically. Power supply shall be as indicated on the drawings. Control power shall be 120 volts.
- B. Short Circuit Current Rating (SCCR): The control panel shall be rated for minimum short circuit current as indicated in the project drawings. The control panel shall be marked with this SCCR rating. The control panel short circuit rating shall match that of the distribution panel or circuit breaker that supplies the pump control panel.
- C. Enclosure:
1. Located indoors in prefabricated FRP shelters: NEMA 4X, 316 stainless steel.
 2. Located indoors in prefabricated, precast concrete enclosures:

- a. When HVAC is provided for the enclosure and where approved of by CFPUA and recommended by the Engineer: NEMA 12. Exterior and interior steel surfaces of switchboard shall be properly cleaned and provided with rust-inhibiting phosphatized coating by switchboard manufacturer. Color and finish of switchboard shall be light gray.
- b. Otherwise, enclosure shall be NEMA 4X, 316 stainless steel.
3. Located outdoors: NEMA 4X, 316 stainless steel.
4. For NEMA 4X stainless steel enclosures; external hardware, hinges, etc., shall be 300 series stainless steel.
5. Weatherdoor: Gasketed, continuously hinged with doorstop, three-point latch, quick release latches and a hasp assembly for padlocking.
6. Deadfront / interior swing panel for mounting selector switches, pushbutton operators, and LED indicators: Continuously hinged deadfront held closed with two slotted nickel plated brass captive panel screws with knurled edges to allow for finger or screwdriver tightening.
7. Control compartment shall incorporate a fixed, rigid back panel on which control components shall be mounted. Back panel shall be secured to enclosure with collar PHASE studs. The back panel shall be 12-gauge galvanized steel, painted with heavy-duty epoxy enamel after fabrication. Back panel shall be tapped to accept all mounting screws. Self-tapping screws shall not be used to mount any component.
8. Mounting provisions: Mounting lugs shall be provided for rack mounted panels. Mounting feet shall be provided for self-supported panels.

D. Components:

1. A control panel main disconnect switch shall be circuit breaker type. The switch shall be lockable in either the ON or OFF position.
2. A phase monitor shall be connected to the main power input terminals to prevent motor operation upon phase loss, phase reversal, under-voltage, and phase imbalance conditions. Upon restoration of satisfactory input voltage, the unit shall automatically reset after a user programmable time delay. Phase monitor leads shall be fused in accordance with the manufacturer's requirements.
3. A surge protection device for the control panel shall be connected to the main power input terminals.
4. A 120V control power transformer shall be provided, sized in accordance with the loads to be supplied, plus 20% additional capacity.
5. Float switch circuitry from wastewater wet wells shall be connected to intrinsically safe relays / barriers.
6. Selector switches: See Section 40 78 00, Panel Mounted Instruments and Devices.
7. Motor operator selector switches shall be three position Hand-Off-Automatic type, shall permit over-ride of automatic control, and allow manual operation or shutdown of each motor.
8. Pushbutton operators: See Section 40 78 00, Panel Mounted Instruments and Devices.
9. Auxiliary and control relays: See Section 40 78 00, Panel Mounted Instruments and Devices.
10. Timer delay relays: See Section 40 78 00, Panel Mounted Instruments and Devices.

11. Alternator relays shall be enclosed, general purpose duplex alternating relays with plug-in bases and transparent polycarbonate dust cover.
 - a. Continuous rated coils with AC pickup voltages of 85% of nominal. Coil voltage as required.
 - b. Contacts rated at 120 VAC, 80 percent P.F., 10 amperes continuous, 30 amps make, 3 amps break.
 - c. Solid-state alternating circuit driving electro-mechanical relay coil.
 - d. Relays shall feature state indicating LEDs in the cover.
 - e. Provided for alternation of the lead pump for each run cycle.
12. Indicator lights: See Section 40 78 00, Panel Mounted Instruments and Devices.
13. Running time meters for each motor shall be provided. See Section 40 78 00, Panel Mounted Instruments and Devices.
14. Individual magnetic, instantaneous trip circuit breakers shall be provided for each motor. Breakers shall be lockable in the OFF position. Breakers shall be sized in accordance with the nameplate rating of the motor provided.
15. Starters:
 - a. For motors less than 20 HP: Individual full voltage across the line type.
 - b. For motors 20 HP and greater: Individual solid state soft start type.
 - c. For some project applications as coordinated with CFPUA, variable frequency drives may be required. See specification 262923.
 - d. Size starters in accordance with the nameplate rating of the motor provided.
 - e. Starters shall meet NEMA IC1, NEMA IC2, UL 508, & NEC requirements.
 - f. Replacement of coil and contacts shall not require removal of the starter or power wiring from the control panel.
 - g. Electronic Overloads: Relays shall be electronic type. Electronic relays shall be multi-function, adjustable, current sensing type, and include overload, phase-unbalance, phase-loss, and equipment type ground fault in one package.
 - h. Starters shall feature auxiliary contacts for run indication and overload shutdown.
16. A strip heater with thermostat shall be provided to prevent the formation of condensation within the control panel interior.
17. An LED light, switched when the panel door is opened shall be provided for the control panel interior.
18. A ground fault circuit interrupter receptacle shall be provided as a convenience outlet.
19. Alarm strobes / beacons:
 - a. One mounted such that it can viewed from the road right of way.
 - b. Red LED; 120,000 hour light source life.
 - c. Exterior device: NEMA 4X; mount to junction box in a waterproof matter with closed cell neoprene gasket.
 - d. The strobes shall flash at approximately 65 flashes per minute.
 - e. Design basis: Edwards 109R-N5, or equivalent by Federal Signal or Maxi-Signal.
20. Alarm horn shall be provided on the control panel exterior, with waterproof connections to the control panel. Design basis: Edwards 876-N5, or equivalent by Federal Signal or Maxi-Signal.
21. Alarm horns / beacon:
 - a. Combination audible / visual signal for mounting external to the pump control panel.

- b. Independent horn and beacon control.
 - c. Red Fresnel lens/dome; 60,000 hour LED light source.
 - d. Horn output for 85 dBA at 10'.
 - e. 120 VAC.
 - f. Design Basis: Federal Signal #AV1-LED-120R, or approved equivalent.
22. Terminal blocks shall be provided for connection of both internal connections and connections for external circuitry.
- a. Channel mounted, sectional type.
 - b. Rated 600 volts, 20 amps minimum.
23. Labeling:
- a. All switches, pilot lights, control devices, major components, etc., shall be clearly labeled according to function with engraved plastic plates, black with white core. Minimum letter size shall be 1/8-inch.
 - b. All conductors and terminal strips shall be labeled, matching schematic and wiring diagrams.
 - c. Identification labeling shall match the bill of materials, schematic diagram, and wiring diagram.
 - d. Schematic and wiring diagrams shall be displayed via a placard mounted to the inside surface of the panel door.
24. All other components necessary for a completely operable system performing the functions required shall be supplied.
- E. Operating Controls and Instruments: All operating controls and instruments shall be securely mounted in such a manner that any or all standard options specified may be added without rearrangement of existing controls and instruments. All controls and instruments shall be clearly labeled to indicate function.
- F. Wiring:
- 1. All wiring workmanship and schematic wiring diagrams shall be in compliance with applicable standards and specifications for industrial controls set forth by the Joint Industrial Council (JIC), National Machine Tool Builders Association (NMTBA), National Electrical Code (NEC), Division 16 of these specifications and other pertinent electrical codes and standards.
 - 2. All control circuit wiring shall be, stranded copper, color coded and clearly marked at each end to match schematic wiring diagrams, and of adequate size to safely carry required electrical loads. All control wires shall be marked using T&B Shur-code sleeve markers. All wires on the back panel shall be contained in wire troughs with removable covers to facilitate field repairs and addition of optional/additional components. Splices shall not be used.

2.2 ACCESSORIES

A. Float-Tilt Type Level Switches

- 1. Materials:
 - a. Float material: Polypropylene with internal polyurethane foam or Teflon coated 316 stainless steel, not less than 5" in diameter.
 - b. Cable jacket: CPE, PVC, Synthetic rubber jacket; provide 1/8" thick neoprene sleeve over the cable jacket from 5" above mounting assembly to 5" below cable hinge point; provide 1/8" thick neoprene sleeve over the cable jacket from 5" above float to the top of the float switch body.

- c. Cable clamp mounting assembly: 316 stainless steel, flanged & flared on both sides providing hinge point stress relief to both sides of the cable.
 - 2. Design and Fabrication:
 - a. Provide switch complete with flexible electrical cable.
 - b. Sealed & potted mercury-free switch in float.
 - c. Cable: 2-conductor plus ground, #16 gauge minimum stranded copper conductors, of sufficient length to reach the control panel without splices along the route as detailed in the project drawings.
 - d. SPST contact rated 100 VA minimum up to 250 VAC.
 - e. Direct acting float switch:
 - 1) Switch actuates on rising level.
 - 2) Switch de-actuates when liquid falls 1" below actuation level.
 - 3. A corrosion resistant weight shall be attached to a stainless steel support cable below the lowest float to hold the switches in place.
- B. Submersible Level Transducer
- 1. Material: 316 stainless steel
 - 2. Output Signal: 4-20 mA.
 - 3. Cable shall be continuous without splices from device to control panel along the route as detailed in the project drawings.
 - 4. Surge protection.
 - 5. Suitable for installation in Class I, Division 1, Group D hazardous locations.
 - 6. In addition to electrical conductors, the sensor support cable shall contain a tube which is vented to atmosphere to offset changes in barometric pressure.

2.3 OPERATIONS AND MAINTENANCE MANUALS

- A. Prepare an operation and maintenance manual for the duplex pump panel and control equipment. Manuals shall be made up with hard cover post type binders. Include index, tabbed section dividers, all approved shop drawings, installation, and maintenance instructions packed with equipment, and parts lists.
- B. Provide a written description of equipment operation, special features and maintenance requirements.
- C. Provide instructions for setting all adjustable components. Record the final field settings of all adjustable components in a comprehensive table.
- D. Large sheets shall be neatly folded and installed with post hole reinforcements such that sheets will unfold without need to open binder posts.

2.4 SPARE PARTS

- A. One complete set of fuses.
- B. One operating coil for each size of AC contactor provided.
- C. One set of overload relays for each type and rating provided.
- D. One pilot light with lens for each type provided.

PART 3 EXECUTION

3.1 COORDINATION

- A. Verify motor nameplate data prior to sizing components and preparing submittal information for this project.
- B. Make changes to the electrical design at no additional cost if the motors supplied have electrical ratings and characteristics different from the motor specified or shown. Provide calculations used to make revised component selections. Revised selections shall comply with the specifications. Verify that final field adjustments comply with factory recommendations.

3.2 SHIPMENT AND STORAGE

- A. Wrap pump panel enclosure surfaces in a protective plastic wrap before crating and shipment. Crate the pump control panel to protect it from damage during shipment and storage.
- B. Store all electrical materials and equipment at the site in trailers or temporary buildings that provide protection from the effects of weather.

3.3 INSTALLATION

- A. General: The Contractor shall receive, handle and store all equipment and materials to be installed, being careful to prevent any damage during transport and storage. All equipment stored shall be protected from weather in a manner recommended by the manufacturer.
 - 1. All equipment shall be handled and installed in accordance with written instructions and approved shop drawing details of the manufacturer and as required by the drawings.
 - 2. If the Contractor determines that existing conditions do not permit proper installation, he shall immediately notify the Owner's Representative.
 - 3. All control transformers to be mounted outside of pump control panel.
- B. Pump control panel and accessory equipment shall be installed in strict accordance with the manufacturer's instructions and good practice in a workmanship manner.
- C. Submersible level sensor shall be installed inside a PVC pipe to prevent movement due to turbulence and surges from pump operation.

3.4 START-UP TESTING

- A. Test instrumentation system for proper function and sequencing of all motors, indication, and remote notification capabilities.
- B. Conduct a test for observation by the Owner's representative to demonstrate operation in accordance with the drawings and specifications.

END OF SECTION