

## **SECTION 13315**

### **SCADA SYSTEM CONTROL PANELS**

#### **PART 1 - GENERAL**

##### **1.01. Scope of Work**

- A. This Specification Section covers work related to the control panels and enclosures to be supplied with the SCADA System.
- B. The control panels, as specified herein, shall be furnished by the same SYSTEM SUPPLIER furnishing services and equipment as defined under Specification Section 13300.
- C. The SYSTEM SUPPLIER shall design, furnish and install all interior wiring within the control panels and furnish complete wiring diagrams showing the electrical circuits inside the panel and interconnections between the panel and the external instruments and components.
- D. Size control panel(s) to adequately dissipate heat generated by equipment mounted inside or on the panel front face.

##### **1.02. Related Work**

- A. Specification Section 13300 defines work associated with the overall SCADA,
- B. PLC-based RTU as defined in Specification Section 13325 are to be mounted in control panels hereunder.
- C. The panels defined hereunder are installed under Division 15, Mechanical.
- D. Electrical equipment to be installed in PSCP are defined in Division 16.

##### **1.03. Submittals**

- A. Submit the following control panel shop drawings in a single package:
  - 1. Layout diagrams for all control panels and enclosures. Include panel elevations (front, side, interior), and sizing. Panel front elevations shall be of sufficient scale to allow all engraved nameplates and inscriptions to be legible without the use of schedules.
  - 2. A complete Bill of Materials for each panel cross-referenced to the panel layout drawings and identifying the manufacturer and complete part number of all components.
  - 3. Wiring diagrams for all control panels. Diagrams shall be complete electrical wiring diagrams showing all components and all auxiliary devices such as relays, alarms, fuses, lights, fans, heaters, etc. All wires and terminals shall be numbered on the diagrams, and line cross-

references shall be labeled. Include wiring interface to the PLCs where applicable. Include on these drawings a tag number to identify each component and referenced to a component identification list.

4. Data sheets for all components. The data sheets shall be marked to indicate those portions applicable to the components to be furnished.
5. Power requirements and heat dissipation summary for all control panels. Power requirements shall state required voltages, currents, and phase(s). Heat dissipations shall be maximums and shall be given in Btu/hr. The summary shall be supplemented with calculations.

## **PART 2 - PRODUCTS**

### **2.01. General Requirements**

- A. Equipment to be installed in a hazardous area shall meet Class, Group, and Division classification as shown on the Contract Electrical Drawings, or comply with the local or National Electrical Code, whichever is the most stringent requirement.
- B. Electronic equipment shall utilize printed circuitry suitably coated to prevent contamination by dust, moisture and fungus. Solid-state components shall be conservatively rated for their purpose, to assure optimum long-term performance and dependability over ambient atmosphere fluctuations and 0 to 100 percent relative humidity. The field mounted equipment and system components shall be designed for installation in dusty, humid, and slightly corrosive service conditions.
- C. Station Control Panels (PSCP) at remote SCADA sites shall be powered by a 480 VAC, 3-phase, 60 Hz source. All other panels shall be powered by 120 VAC single-phase, 60-Hz source. All regulators and power supplies required for compliance with the above shall be provided between power supply and interconnected equipment. Where equipment requires voltage regulation, constant voltage transformers shall be supplied.
- D. All equipment, cabinets and devices furnished hereunder shall be heavy-duty type, designed for continuous industrial service. The system shall contain products of a single MANUFACTURER, insofar as possible, and shall consist of equipment models which are currently in production.
- E. The equipment furnished shall be designed to operate satisfactorily between 0 degrees C and 40 degrees C for indoor panels and 50 degrees C for outdoor panels at up to 95 percent Relative Humidity (non condensing).
- F. Except where specifically noted otherwise, all outdoor panels and enclosures containing electronic or electrical components shall be equipped with sunshields on both sides, the front, the back and the top with a minimum separation of one inch and a maximum separation of one and one-half inches. Sun shields shall be 14 gauge Stainless Steel or 12 gauge Anodized Aluminum or thicker. Finish with reflective white, two part epoxy coating or reflective, white, polyester powder deposited coating.

- G. All outdoor control panels and enclosures shall be equipped with 3 ½" stainless steel mounting uni-struts across the width of the back. For free-standing panels the struts shall be located half-way up the panel and six inches from the top. For other panels they shall be located 3" from the top and 3" from the bottom.
- H. All switches shall have double-pole, double-throw contacts rated at a minimum of 600 volts-amperes (VA), unless specifically noted otherwise.
- I. All equipment shall be designed and constructed so that in the event of a power interruption, the equipment specified hereunder shall resume normal operation without manual resetting when power is restored.
- J. All discrete inputs entering the panel shall be wetted by 120 VAC. Provide isolation relays if necessary to accommodate this requirement.
- K. All discrete output signals shall be equipped with interposing relays to electrically isolate them from the control system I/O.

## **2.02. Lightning/Surge Suppression**

- A. Surge suppressors and arrestors meeting the requirements of ANSI Standard C-62.41 (latest revision) shall be provided as further detailed below.
- B. DC Signals. Lightning and surge protection shall be provided on all DC signal wires entering or leaving the panel. The protectors shall meet the following criteria:
  - 1. 35 mm DIN rail mounted with spring terminals.
  - 2. Response time of less than one nanosecond.
  - 3. Operating signal current: up to 0.5 A
  - 4. Capable of withstanding 5,000 Amps at IEEE/ANSI C-62.41 8 x 20 microseconds combination wave.
  - 5. Nominal series resistance of less than 2 ohms each leg
  - 6. Manufacturer/model:
    - a. Dehn DCO RK ME
    - b. Approved equal.
- C. AC Signals. Lightning and surge protectors for all incoming 120 VAC discrete signals lines shall meet the following criteria:
  - 1. Serial protection.
  - 2. Nominal operating voltage: 120 VAC 47/63 Hz.
  - 3. Response time of less than 0.25 nanoseconds.

4. Capable of withstanding up to 40,000 Amps at IEEE/ANSI C-62.41 8 x 20 microseconds combination wave.
  5. Manufacturer/model:
    - a. Phoenix Contact 2906840
    - b. Approved equal.
- D. 480 VAC Power. Lightning and surge protectors for 480 VAC power supply lines shall meet the following criteria:
1. Asco Model 430 Series or approved equal.
- E. 120 VAC Power. Lightning and surge protectors for 120 VAC power supply lines shall meet the following criteria:
1. Serial protection with replaceable fuse.
  2. Failure indicator.
  3. Response time of less than five nanoseconds.
  4. Capable of withstanding up to 10,000 Amps at IEEE/ANSI C-62.41 8 by 20 microseconds combination wave.
  5. Manufacturer/model:
    - a. Asco model 265.
    - b. Approved equal.

### **2.03. Pump Motor Control Components**

- A. Refer to Division 16 for requirements associated with Variable Frequency Drives, Soft Starts and related components.

### **2.04. Air Conditioning Unit**

- A. Each PSCP with a VFD shall be provided with an externally mounted AC unit.
- B. The AC unit shall not compromise the NEMA 4X rating of the PSCP.
- C. The AC unit shall maintain an internal PSCP temperature of no more than 25 degrees Celsius when the outside ambient temperature is 30 degrees Celsius with all internal components operating at maximum power.

### **2.05. Backup Control**

- A. Each PSCP shall be equipped with relay logic for backup operation in the event of a RTU fault.

- B. Each wet well shall contain three float switches; Pumping Off, Call Pump 1, and Call Pump 2.
- C. The logic shall function as follows:
  - 1. The logic shall enter a latch "In Backup" status if the RTU fails or the Call Pump 1 float stays tripped after an on-delay timer expires.
  - 2. Pump 1 shall be called to start.
  - 3. If the Call Pump 2 float stays tripped after an on-delay timer expires, call Pump 2 to start.
  - 4. The pumps shall continue to run until one of the following conditions occur:
    - a. The associated call float switch resets after an off-delay timer expires.
    - b. Backup status is reset by a local pushbutton or by the operator via the HMI/OIT screen.
    - c. The Pumping Off float switch trips after an on-delay timer expires.
- D. Stations with VFD driven pumps shall command the VFD to go to a preset speed when called to run in backup mode.

## **2.06. Control Panels and Enclosures**

- A. Finish:
  - 1. All front panel openings for panel-mounted equipment shall be cut with counter-boring and provided with trim strips as required to give a neat finished appearance.
  - 2. With the exception of stainless steel panels, all steel panel surfaces shall be treated with phosphatized treatment inside and out, and then finished on the exterior with two coats of baked enamel of the approved color. Interiors of panels shall be white, ANSI No. 51.
  - 3. Stainless steel panels shall be No. 7 polished, 316 stainless steel.
- B. Doors:
  - 1. All control panels shall have a continuous piano hinge door for ease of access. A minimum of 80% of the panel interior shall be exposed by doors.
  - 2. NEMA 4X rated panel door openings shall be sealed and fully gasketed.
  - 3. The inside of each door shall be equipped with a print pocket. Provide individually laminated 11x17 sheets for all wiring diagrams.

4. Two-door enclosures shall have a removable center post.
  5. Sealed panel doors shall be equipped with quick-release latches.
  6. NEMA 1 rated panel doors shall be equipped with a three-point latching mechanism.
  7. Where noted or shown on the drawings, doors shall be equipped with a fully gasketed glass window to allow viewing of internally mounted devices without opening the door.
- C. All components and terminals shall be accessible without removing other components except for covers.
- D. All conduit entry shall be from the bottom only.
- E. No components shall be mounted on the interior sides of any panel.
- F. All panels shall be provided with an isolated copper grounding bus to ground all signal shield connections.
- G. Control Panels containing SCADA control system equipment shall each be equipped with an internal, hand-switch controlled, LED light and 120V, 15 amp, duplex utility receptacle.
- H. All panels shall be provided with laminated as built electrical wiring diagrams in each panel.
- I. Nameplates:
1. All front-face panel mounted controls and indicators shall be equipped with 10-year outdoor-rated adhesive laminated plastic nameplates to completely define their use. Provide Brady Type BBP31 or BBP33 as applicable or approved equal.
  2. All internal components shall be equipped with identification tags
  3. Each wire shall be uniquely identified and shall be labeled.
- J. Power Supplies.
1. Uninterruptible power supplies (UPS) shall be provided in all control panels as follows:
    - a. Size the supplies for all internal equipment plus an additional 20% spare capacity.
    - b. Provide 15 minutes battery back-up capability at full load.
    - c. Provide relay option card for indication of "On UPS Power" and "Low Battery Level".

- d. For outdoor panels provide an UPS and battery rated for operation at up to 50 degrees C.
- K. Provide two diode-auctioneered DC power supplies for analog signal use.
  - 1. Provide individually fused DC power for field transmitters.
- L. Electrical:
  - 1. Main circuit breaker and branch circuit breaker for each branch circuit as required to distribute power from the main power feed.
  - 2. All breakers accessible when the panel door is open.
  - 3. No more than 20 devices on any single circuit.
  - 4. No more than 12 amps for any branch circuit.
  - 5. Panel (or site) lighting, receptacles, heaters, controls, telemetry and fans on separate branch circuits.
- M. Wiring:
  - 1. Power wiring shall be 300 volt, type THWN stranded copper, No. 14 AWG size, for 120V service.
  - 2. Discrete wiring shall be 300-volt type THWN stranded copper, sized for the current carried, but not smaller than No. 16 AWG.
  - 3. Analog signal wiring shall be 300 volt, stranded copper in twisted shield pairs, no smaller than No. 16 AWG.
  - 4. Panel wiring shall be routed within wire troughs or panduits.
  - 5. Hinge wiring shall be secured at each end with the bend portion protected by a plastic sleeve.
  - 6. Analog or dc wiring shall be separated from any ac power or control wiring by at least six inches.
  - 7. Terminal blocks shall be provided for all field wiring entering the panel. The greater of 4 or 15% spare terminal blocks shall be provided.
  - 8. No more than one wire per screw and yoke termination.
- N. Construction:
  - 1. Minimum metal thickness: 14-gauge.
  - 2. Stiffeners as required to prevent deflection under instrument loading and permit lifting without racking or distortion.

3. When required, removable lifting rings and fill plugs to replace rings after installation.
- O. Miscellaneous Equipment:
1. All panels shall be protected from internal corrosion by the use of corrosion – inhibiting vapor capsules, Northern Instruments Model Zerust VC, Hoffman, model A-HCI, or equal.
  2. All sealed panels shall be equipped with combination drain/breathers, Crouse-Hinds model ECD18; or equal.
  3. When noted on drawings, panels shall be equipped with thermostatically controlled space heaters to maintain internal temperatures above dew point.
- P. All panels shall be manufactured items, Hoffman Engineering, or equal.

## **2.07. Front Panel Devices**

- A. Potentiometer. Units shall meet the following:
1. Three-terminal potentiometers with a total resistance of 1000 ohms and a power dissipation rating of 2 watts
  2. Oil-tight construction, rated NEMA 13
  3. Resolution of 1 percent, and linearity of plus or minus 5 percent.
  4. Panel mounting accommodating panel thickness between 1/16 to ¼ inch.
  5. Legend plates with marking as noted.
  6. Allen-Bradley, type 800T, or equal.
- B. Selector Switch. Units shall meet the following:
1. Heavy-duty, oil-tight, industrial type selector switches rated for NEMA 4 service.
  2. Contacts rated for 120-volt ac service at 10 amperes continuous.
  3. Number of positions and contact arrangements as required.
  4. Factory-engraved legend plate indicating position definition.
  5. Panel mounting accommodating panel thickness between 1/16 to ¼ inch.
  6. Black knob type operator.
  7. Square D Class 9001, Type K; Allen-Bradley type 800T, or equal.



- C. Pushbutton. Units shall meet the following:
1. Heavy-duty, oil-tight, industrial type push buttons rated for NEMA 4 service.
  2. Contacts rated for 120-volt ac service at 10 amperes continuous.
  3. Number of positions and contact arrangements as required.
  4. Factory-engraved legend plate indicating function.
  5. Panel mounting accommodating panel thickness between 1/16 to ¼ inch.
  6. Operator: Red extended head for STOP, green flush head for START, black flush head for other functions.
  7. Square D Class 9001, Type K; Allen-Bradley type 800T, or equal.
- D. Indicating Light. Units shall meet the following:
1. Heavy-duty, oil-tight, push-to-test industrial type with integral transformer for 120V AC application.
  2. Rated for NEMA 4 service.
  3. Screwed on flat-faced lenses in colors shown on the drawings.
  4. Factory-engraved legend plates.
  5. Square D type K, Allen-Bradley Type 800T, or approved equal.

## **2.08. Internal Panel Components**

- A. Control/Interposing Relays: All relays shall meet the following:
1. Compact, general-purpose, plug-in type.
  2. Socket mounted.
  3. Contacts rated for not less than 10 amperes at 120V.
  4. Equipped with neon status lights and test buttons.
  5. Permanent, legible identification
  6. Potter & Brumfield series KRPA or approved equal.
- B. Time Delay Relay. Time delay relays shall meet the following:
1. Available functions: On delay, Off delay, or one shot.
  2. Socket mounted.

3. Knob adjustment.
  4. Contacts rated for not less than 10 amperes at 120V.
  5. Timing range as appropriate for the application.
  6. Magnecraft series W211 or approved equal.
- C. Terminal Blocks. Terminal blocks shall meet the following requirements:
1. Terminals capable of accepting 10-26 AWG wire.
  2. DIN-rail mounting.
  3. Connectors shall be either copper or steel. Use of aluminum connectors shall not be permitted without prior approval of the Engineer
  4. Phoenix Contact or approved equal.

## **2.09. Spares and Expendables**

- A. Provide the following spare parts:
1. One spare d.c. power supply of each type provided.
  2. Five spare relays of each type provided.
  3. 2 spare surge suppressors of each type provided
- B. Provide the following expendables:
1. 12 corrosion inhibitor capsules
  2. Ten spare fuses of each type and rating supplied.
  3. Ten spare indicator light bulbs (minimum of 10) of each type and color supplied.

## **PART 3 - EXECUTION**

### **3.01. Installation**

- A. Control Panels shall be installed at the locations indicated on the Contract Drawings.
- B. Control panels shall be provided to the mechanical subcontractor for installation.
- C. Verify the correct installation of all panels supplied under this Specification Section.

**END OF SECTION**