

## SECTION 13430 - CONTROL PANELS AND CONSOLES

### PART 1 - GENERAL

#### 1.01 SUMMARY

- A. Section Includes:
  - 1. Control panels and consoles.
  - 2. Switches, push-buttons, lights.
  - 3. Relays.
  - 4. Intrinsically safe isolator relays.
  - 5. Timing devices.
  - 6. Terminal blocks.
  - 7. Control power transformers.
  - 8. Transient Voltage Surge Suppression
  - 9. Annunciator.

#### 1.02 SUBMITTALS

- A. Shop Drawings: Submit in accordance with Sections 01300 and 13410, Shop Drawings covering the items included under this Section.

#### 1.03 QUALITY ASSURANCE

- A. Regulatory Requirements:
  - 1. Codes, Ordinances, and Industrial Standards: Design, testing, assembly, and methods of installation for materials, electrical equipment, and accessories proposed under this Section shall conform to National Electric Code and to applicable State and local requirements including OSHA and NFPA.
  - 2. UL listing and labeling of custom-built panels (UL 508) shall be adhered to under this Contract.

### PART 2 - PRODUCTS

#### 2.01 MANUFACTURERS

- A. Subject to compliance with specified requirements, manufacturers offering products which may be incorporated in Work include:
  - 1. Switches, Push-Buttons, Lights:
    - a. Allen-Bradley (Type 800MR).
    - b. Square D Co.
  - 2. Relays:
    - a. Allen-Bradley.
    - b. Square D Co. (Type KU).
  - 3. Signal Switching Relay:
    - a. Allen-Bradley.
    - b. Square D Co.
  - 4. Intrinsically Safe Isolator Relay:
    - a. Allen-Bradley.

- b. Warrick Controls.
- c. B/W Controls, Inc.
- d. R. Stahl, Inc.
- 5. Synchronous Timers:
  - a. Allen-Bradley.
  - b. Square D Co.
  - c. Diversified Electronics.
- 6. Solid-State Timers:
  - a. Allen-Bradley.
  - b. Square D Co.
  - c. Diversified Electronics.
- 7. Synchronous Repeat Cycle Timers:
  - a. Allen-Bradley.
  - b. Square D Co.
  - c. Diversified Electronics.
- 8. Solid State Repeat Cycle Timers:
  - a. Allen-Bradley.
  - b. Square D Co.
  - c. Diversified Electronics.
- 9. Programmable Timers:
  - a. Allen-Bradley.
  - b. Square D Co.
  - c. Omron.
- 10. Terminal Blocks:
  - a. Allen-Bradley (Type 1492J3 or Type 1492CA1).
  - b. Square D Co. (Class 9080, Type KCA-1).
- 11. Fusible Terminal Blocks:
  - a. Allen-Bradley (Type 1492-CE6).
  - b. Altech (Type CAFL4U).
  - c. Square D Co. (Class 9080, Type KH-1).
  - d. Thomas & Betts (Series 300 or 0300).
  - e. Weidmueller (SAKS1 or ASK1).
- 12. Control Power Transformers:
  - a. Allen-Bradley.
  - b. Square D Co.
  - c. Acme.
  - d. Sola.
- 13. Transient Voltage Surge Suppression:
  - a. Eaton
  - b. Mersen.
  - c. Square D Co.
  - d. Sola.
- 14. Graphic Display:
  - a. Dynics.
  - b. Allen-Bradley PanelView Plus.
- 15. Textured Polyurethane Enamel:
  - a. Sherwin-Williams, Polane T and/or Polane HST.
  - b. Tnemec.
- 16. Wire Markers:
  - a. Allen-Bradley.

- b. Brady.

## 2.02 CONTROL PANELS AND CONSOLES

### A. Sheet Metal Construction:

1. Panels and consoles shall be fabricated from sheet steel, aluminum or stainless steel welded and bolted into a rigid self-supporting structure a maximum of 90 inches high and a minimum of 12 inches deep (sheet steel not allowed for outdoor applications). Overall length shall be coordinated with space requirements as indicated by Drawings. Changes in length from that shown on Drawings must be brought to attention of ENGINEER within 90 days of Contract Award. Cost to modify floor plan or wall opening shall be at CONTRACTOR's expense after this 90-day period. Panel face layouts shown on Drawings are intended to indicate relative position of all components. Supplier shall fix exact locations and overall dimensions to meet requirements of its equipment.
2. Panel and console bodies shall be 12-gauge minimum steel (including stainless) for panels up to 42 inches in width, and 10-gauge minimum steel for panels exceeding 42 inches in width. Aluminum panels shall be type 5052 alloy with continuously welded seams. Panel subplates shall be same gauge as enclosure. Stiffening members shall be provided for strength and stiffness as required. Sheet steel shall not be used for outdoor enclosures.
3. Sufficient space shall be provided between edge of panel subplate and outside walls of panel body to ensure adequate wire-way space for external wires entering panel. Panel subplate shall be mounted on collar studs for easy removal. Print pockets shall be provided on each panel. Brackets welded to inside of panel, complete with lights, shall be provided on panels where indicated by Drawings.
4. Identification plates (interior and exterior) shall be laminated phenolic with black letters engraved on a white background and mounted with screws or double-back adhesive foam tape.
5. All components inside panel shall have identification plates. This includes instruments, relays, switches, circuit boards in plug-in racks, etc. Identification plates shall include engineering symbols (FBQ-1, SW-3, FIC-4, CR-1, etc.). Switches and circuit breakers inside panel shall have names (Horn, Audio Tone, Panel Power, etc.) on identification plates as well as engineering symbol.
6. Identification plates shall be located on or adjacent to device they are identifying and shall be readable without looking around, under, or on top of device to find identification plate.

### B. Access:

1. Wall- and/or floor-mounted control panels shall have continuous piano-hinged doors for ease of access. Door openings shall expose a minimum of 80 percent of panel interior. Door openings shall be sealed with a 0.125-inch thick minimum cellular neoprene gasket cemented with oil-resistant adhesive and held in place with a retaining strip. Print pockets shall be provided on each door. Two door enclosures shall have a removable center post. Panel doors less than 40 inches high shall be equipped with a 2-point latching mechanism. Panel doors 40 inches high or more shall be equipped with a 3-point latching mechanism.
2. Components and terminals shall be accessible without removing another component except covers. Swing out sections shall be used if mounting space is required that is not normally accessible.
3. Floor mounted interior panels shall have open bottoms except where structural members are required.

### C. Finish:

1. Panel face openings for mounting equipment shall be smoothly finished cut with counterboring and trim strips provided as required to give a neat finished appearance. Bezels shall be used on all front panel-mounted devices to cover panel cutouts. A chrome-plated or stainless-steel bezel shall be used at parting line of panels that have shipping splits or at parting line of panels placed end to end.
2. Graphic plates, when used, shall be fastened to panel frame with fasteners not visible from front of graphic.
3. After fabrication, panel surfaces shall be given a phosphatizing treatment inside and out, and then finished with 2 coats of textured polyurethane enamel. Panel interior shall be painted white, ANSI No. 51. Exterior color will be selected by ENGINEER & approved by OWNER.
4. Panels shall have identical exterior finishes as selected by ENGINEER. Panel finishes on matching colored panels shall be identical. It is supplier's responsibility to achieve this result, especially for panels fabricated in different shops.

D. Pneumatics:

1. Interior panel piping shall be grouped, supported, and terminated at bottom of panel at bulkhead fittings unless indicated otherwise. Terminations shall be clearly tagged.
2. Tubing shall be color-coded per ISA 7.0.01. Pneumatic systems shall be tested per ISA 7.0.01.

E. Electrical:

1. Internal panel wiring shall be 19 strand No. 16 AWG, 90°C MTW, Class C stranded, or TFFN/MTW approved as 90°C MTW. All panel wiring not run in wire ducts shall be bundled and tied. Each wire shall be identified at both ends with same exclusive number. Number shall be same number shown on control schematic. Number shall not be used again for any other purpose. Wires marked differently on each end will not be accepted. Wire markers shall be provided on end of each wire at termination point.
2. Control wiring associated with control circuits de-energized when main disconnect is opened shall be color-coded red. Control wiring associated with control circuits which remains "hot" when main disconnect is opened shall be color-coded yellow. DC control wiring shall be color-coded blue. Ground wires shall be color-coded green. Terminal blocks shall be numbered in numerical order. Yellow wiring leaving panel shall be brought to an isolated set of terminal blocks.
3. Provide a copper ground bus 0.1 by 0.5 by 6-inch minimum in enclosure to which all instrument grounds and panel enclosure are tied. Separate ground wire shall be run from instrument enclosure ground terminal directly to ground bus. Instrument ground wires looped from one instrument to another will not be accepted. Under no circumstances shall neutral side of power source or any other terminals used for grounding power circuits be used as an instrument common.
4. Wires to internal components shall be connected to inside of terminal strip. Wires to external components shall be connected to outside of terminal strip. No more than 2 wires shall be connected to one terminal point.
5. Panel wire duct shall be provided between each row of components and adjacent to each terminal strip. Wire ducts shall be a minimum of 1-inch wide and 3 inches deep with removable snap-on covers and slotted walls for easy wire entrance. Wire ducts shall be constructed of nonmetallic materials with a voltage insulation in excess of maximum voltage carried therein.
6. Floor-standing panels and consoles shall be equipped with a flange mounted 600V rated main circuit breaker or non-automatic trip disconnect switch. Single phase, 60 hertz power at voltage shown on Drawings shall be supplied to main disconnect. Panel fabricator shall provide any additional voltages and power requirements at control panel to meet requirements of equipment contained therein.

7. Disconnect and transformer shall have enclosed protected terminations to prevent accidental shock.
8. Within each control panel a Transient Voltage Surge Suppression (TVSS) device shall be installed at the main disconnect and shall be sized for the control panel feeder size.
9. Relays, timers, etc., installed on panel subplate shall be provided with a minimum spacing between component and wire duct of 1.5 inches above and 1 inch below the socket. Minimum spacing between adjacent components shall be 0.25 inch. Relays, timers, etc., shown in schematics are intended to show function. Additional relays may be required in conjunction with items shown to provide total number of contacts required. Where limit, pressure, float switches, etc., are used and more than SPDT contacts are indicated by schematics, provide additional contacts required by using auxiliary relays. However, if a DPDT switch is called for, using a SPDT with a relay will not be accepted. All control and pilot devices such as relays, timers, etc., shall be 24 VDC, 3 amp rated except where noted with coil voltage as required. At least one N.O. spare contact shall be provided on each relay.

F. Panel/Subplate Layout:

1. Panel face-mounted equipment shall consist of pilot lights, push-buttons, selector switches, meters, indicating timer, etc. Spacing between horizontal rows of components shall be 1.5 inches minimum; spacing between vertical columns of components shall be 1.875 inches minimum. Components shall be grouped and/or located as indicated on Drawings. Distance from bottom row of components to floor shall be not less than 36 inches. Top row of recording and indicating instruments shall be centered approximately 60 inches above floor. Maximum height for annunciator windows shall be 85 inches above floor. In general, indicating lights, push-buttons, etc., shall be mounted in accordance with sequence of operation from left to right and top to bottom.
2. A minimum of 2 inches shall be provided between terminal strips and wire ducts or terminal strips and terminal strips. In general, terminal strips shall be mounted on vertical edges of subplate. Where terminal strips are mounted side-by-side, terminals shall be elevated 1.5 inches above subplate to allow wires to pass underneath.
3. Subplates shall have a minimum of 15 percent spare mounting space, and terminal strips shall have a minimum of 20 percent spare terminal blocks.

### 2.03 SWITCH, PUSH BUTTONS, LIGHTS

- A. Selector switches shall be 120 VAC rated, oil-tight construction with standard operator knob.
- B. Start push buttons shall be 120 VAC rated, oil-tight construction with extended guard and black color insert.
- C. Stop push-buttons shall have a half-guard with red color insert. Contacts shall be rated NEMA B-150 and P-150.
- D. Pilot lights shall be light emitting diode (LED) type with push-to-test, oil-tight construction with cap colors and voltages as required. Nameplates for each switch and light shall conform to manufacturer's series and type with engraving as called for on Drawings.

### 2.04 RELAYS

- A. Control Relays: Switching and output relays shall be plug-in type (Octal base 11-pin finger safe) with contacts rated 120 VAC, minimum 3 amp with 24 VDC coil, indicating light, manual operator,

and plastic transparent cover. Relays shall not be used for switching 1-5 VDC or 4-20 mA signals associated with instruments.

- B. Signal Switching Relays: Instrument relays shall be those relays switching a 1-5 VDC or 4-20 mA signal. Instrument relays shall be transparent enclosed plug-in type with indicating LED and mechanical holding mechanism. Relay contacts shall be dry circuit type rated 250 mA maximum. Contact material shall be a gold-platinum-silver alloy.
- C. Intrinsically Safe Isolator Relay:
  - 1. Intrinsically safe relay shall be provided between raw sewage floats and control circuits or where shown on Drawings.
  - 2. Relay shall operate at 24 VDC plus 10 percent with a switch rating of 1 amp rms and maximum holding current of 20 milliamp for solid-state devices. Relay shall be rated for ambient temperatures of 32 degrees F to 120 degrees F.
  - 3. Output shall be N.O. or N.C. Equipment supplier is responsible for choosing proper output for float specified and circuits specified. If float and circuit are not defined, intrinsically safe relay shall be of such a polarity as to fail in a safe condition for function being performed.
  - 4. When intrinsically safe relay is required in panels exposed to outdoor temperatures, relays shall be rated for ambient temperatures of -40 to 120 degrees F, or thermostatically controlled heaters must be added to panel to maintain an ambient in panel of 32 to 120 degrees F.

## 2.05 TIMING DEVICES

- A. Synchronous and solid-state timers shall be plug-in type.
- B. Synchronous timers with ON or OFF delay cycles shall operate at 24 VDC, 60 hertz. Time interval shall be as shown on Drawings or as required.
- C. Solid-state timers with ON or OFF delay cycles shall operate at 24 VDC, 60 hertz. Solid-state device may be analog or digital in operation. Time interval shall be as shown on Drawings or as required.
- D. Synchronous repeat cycle timers with adjustable ON-OFF cycles shall operate at 24 VDC, 60 hertz. Time interval shall be as shown on Drawings or as required.
- E. Solid-state repeat cycle timers with adjustable ON-OFF cycles shall operate at 24 VDC, 60 hertz. Solid-state device may be analog or digital in operation. Time interval shall be as shown on Drawings or as required.
- F. Programmable Timer: Programmable timers shall be a solid-state time switch suitable for flush mounting on a control panel. Timer shall have a LCD digital display for programming and indicating time of day and day of week. Built-in rechargeable battery shall retain program during loss of power.
  - 1. Programming shall be done by front-mounted push buttons. HART protocol programmable functions are preferred.

## 2.06 TERMINAL BLOCKS

- A. Terminal blocks shall be 300 or 600 volt rated, channel-mounted box lug with pressure plate type or binding head screw type with pressure plate, and shall have a white marking strip. Terminal blocks shall be color-coded according to the following coloring scheme:

Black	120V power circuits de-energized when main disconnect is opened.
White	120V neutral conductors.
Red	120V control circuits de-energized when main disconnect is opened.
Yellow	120V control circuits which remain hot when main disconnect is opened.
Gray	Terminal blocks for DC wiring.
Gray	Terminal blocks for shields in DC wiring.
Green	Ground terminal blocks.

- B. For terminals associated with 120V non-isolated input cards, individual circuit breakers shall be used for 120V power to field devices.
- C. Provide a minimum of 20 percent spare terminals for each type and color of terminal used. All terminals of a given color shall be grouped with other terminals of the same color.

## 2.07 CONTROL POWER TRANSFORMERS

- A. Control power transformers shall be sized to handle in-rush currents and to accommodate continuous load of circuits plus 25 percent future load with 5 percent or less voltage drop. Transformer primary voltage shall be as indicated on Drawings.

## 2.08 Transient Voltage Surge Suppression (TVSS)

- A. Transient Voltage Surge Suppression (TVSS) device shall be installed at the main disconnect. TVSS shall be sized for the control panel feeder size and shall protect equipment from a peak surge of 45kA per mode and minimum 80kA peak surge per phase. Protection modes shall include phase to phase, and phase to ground for three phase panels, and shall include phase to neutral, phase to ground and neutral to ground for single phase panels. TVSS shall have a status LED indicating that it is operating properly.

## PART 3 - EXECUTION

### 3.01 GENERAL

- A. Examination, Installation, Field Quality Control, Demonstration: In accordance with Section 13410.

END OF SECTION