## SECTION 13 1605 – WATER FEATURE CONTROL PANELS

### PART 1 - GENERAL

## 1.1 SUMMARY

- A. This section includes the following:
  - 1. Panel Enclosures
  - 2. Panel Instruments and Devices
  - 3. Panel Accessories
  - 4. Panel Wiring
- B. Related Sections:
  - 1. SECTION 13 1502 WATER FEATURE PUMPS AND MOTORS
  - 2. SECTION 13 1503 WATER FEATURE FILTERS
  - 3. SECTION 13 1504 WATER FEATURE CHEMICAL FEED SYSTEMS
  - 4. SECTION 13 1505 WATER FEATURE OZONE GENERATION AND INJECTION
  - 5. SECTION 13 1506 WATER FEATURE UV STERILIZERS
  - 6. SECTION 13 1507 WATER FEATURE HEATERS
  - 7. SECTION 13 1508 WATER FEATURE HYDRONIC SYSTEMS
  - 8. SECTION 13 1509 WATER FEATURE CHILLERS
  - 9. SECTION 13 1510 WATER FEATURE HEAT EXCHANGERS
  - 10. SECTION 13 1511 WATER FEATURE VALVES, GAUGES, AND METERS
  - 11. SECTION 13 1602 WATER FEATURE CONTROLS
  - 12. SECTION 13 1607 WATER FEATURE PROGRAMMABLE LOGIC CONTROLLERS
  - 13. SECTION 13 1609 WATER FEATURE DISCONNECTS, MCC, AND STARTERS
  - 14. SECTION 13 1610 WATER FEATURE ELECTRICAL ACCESSORIES
  - 15. SECTION 26 0000 ELECTRICAL
- C. References:
  - 1. Instrument Society of America (ISA) ANSI/ISA-S5.4 Instrument Loop Diagrams
  - 2. NEMA 250 Enclosures for Electrical Equipment (1,000 Volts Maximum
  - 3. NFPA 70 National Electrical Code (NEC) Article 250 Grounding
  - 4. Underwriters Laboratories (UL)

## 1.2 SUBMITTALS FOR REVIEW

- A. SECTION 01 3300 SUBMITTAL PROCEDURES
- B. Product Data: Submit Manufacturer's literature for all components indicating component dimensions, weights, colors, and materials.
- C. Shop Drawings: Submit the following Shop Drawings, drawn to scale. Scale shall not be less than 1-inch equals 1-foot 0-inches (1" = 1'-0") for Imperial Units or 1:10 for Metric Units. Drawings shall identify all equipment, dimensions, materials, and colors.
  - 1. Panel Front View showing equipment arrangement and dimensional information.
  - 2. Panel Floor Plan and Side View showing dimensions, doors, and equipment layout inside the Panel.
  - 3. Drawings showing structural details of fabricated Panels and Mounting requirements.
  - Internal Interconnecting Wiring Diagrams showing Terminal Strips and all external devices connected to the Panel as required in SECTION 13 1602 – WATER FEATURE CONTROLS, design submittal for Loop and Schematic Diagrams.
  - 5. Complete Schematic and Diagrams including terminal block and wire identification number and device location symbols consistent with the Contract Documents.
  - 6. Panel Bill of Materials with detailed description of components and equipment data sheets.

- 7. Field Cable Number/ID and Terminations.
- 8. Factory Data Sheets for Instrumentation.
- D. Operation and Maintenance Data: Provide Manufacturer's instructions for installation, general assembly instructions, and maintenance and care recommendations for all components.
- E. Factory Test Certifications: Provide certification from the Panel Manufacturer indicating the Panel has been tested and is fully operational prior to shipping.
- F. Warranty: Provide a written warranty for assembled Panels and Components for a minimum of one (1) year from the date of installation.

## 1.3 QUALITY ASSURANCE

- A. Panel Builder Qualifications: Panel Builder shall have a minimum of five (5) years' experience in building Panels and performing all Work related to this section.
- B. The Contract Documents show the general arrangement of each Panel. The Panel Builder shall design the Panel layouts within the guidelines set forth and submit these layouts in accordance with the Submittals Section.
- C. Panels shall be built in accordance with the approved shop drawings. All components and operations shall be tested and working prior to shipping.
- D. Panels shall be shipped with one (1) complete copy of Schematic Diagrams including Terminal Block and Wire Identification Numbers.

## 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Deliver Panels to the job site in the Manufacturer's original, unopened packaging, clearly marked with Supplier's Name, Address, and Panel information.
- B. Storage and Handling: Store Panels in a well-ventilated, clean, dry covered area. Do not store in direct sunlight or where Panels can be damaged from water or moisture.

## PART 2 - PRODUCTS

- 2.1 PANEL ENCLOSURES
  - A. Acceptable Manufacturers
    - 1. Rittal Corporation
    - 2. Hoffman
    - 3. Approved Equal
  - B. General Enclosure Requirements
    - 1. Use NEMA 12 rated Panels for Indoor installation. Use NEMA 4X rated Panels for Outdoor installation. Specific requirements as specified herein or as indicated on the Contract Documents
    - 2. Size Panels in accordance with limitations indicated on the Contract Documents. Panel size is the specific requirement of the Panel Manufacturer.
    - 3. Cabinets less than 60-inches (1.5m) high shall be provided with floor stands to raise the top of the Panel to 60-inches (1.5m) above the floor or work platform, or if the Panel weighs less than 100 lbs (45 kg) and wall space is available, wall mounting may be used in lieu of a floor stand
    - 4. Structures and equipment shall be braced to prevent damage from seismic forces. Equipment shall not be required to function properly during periods of seismic disturbance but shall be capable of manual restart following a disturbance.
    - 5. Cutouts for future equipment shall be blanked off with suitable covers.
    - 6. Instrument tag numbers, if used, shall be identified on the Panel rear. Name Plates shall identify face-mounted instruments. Instruments shall be mounted in a manner that allows ease of access to components and ease of removal.

- Face-mounted instruments that are more than 6-inches (150mm) deep, weigh more than 10 lbs (4.5kg), or exert more than 4.0 ft-lbs (0.6kg-m) moment force on the face of the Panel shall be supported underneath at the rear.
- 8. Face-mounted equipment shall be flush or semi-flush with black escutcheons
- 9. Name Plates on internal and external instruments and devices:
  - Materials approximate dimensions and legends as indicated on the Contract Documents made of laminated phenolic material having engraved letters approximately 3/16-inch (5mm) high extending through the black face into the white layer; firmly secured to Panels.
- 10. Fabricated Custom Metal Panels:
  - a. Thoroughly clean, sand, and apply a minimum two (2) coats of rust inhibiting primer both inside and outside of Panels. Apply a minimum of two (2) coats of white enamel or lacquer on Panel interior surfaces. Smooth exterior surfaces and apply a minimum of two (2) coats of enamel, polyurethane, or lacquer finish. Furnish 2 quarts (1.9 liters) of finish color paint with the Panels to cover future scratches.
- 11. Provide Panels with an inside pocket to hold Panel Drawings. Ship Panels with one (1) copy of accepted Submittal Drawings in a sealed plastic bag stored in the Panel drawing pocket.
- C. Freestanding Custom Metal Panels:
  - Panel Custom Fabrication: Dust tight, completely enclosed cubicle formed from steel structural members and steel plates. Form base of heavy channel iron, with flanges up, and with 1/2-inch (12mm) holes drilled at 12-inch (300mm) spacing so that the Panel shall be bolted to the floor. Grind smooth welds, seams, and edges on exposed surfaces. Provide lifting facilities for handling and shipment.
  - 2. Panel Bracing: Suitably brace Panel structure for sufficient strength to support equipment mounted on or within, to withstand handling and shipment, to maintain alignment, and to be rigid and freestanding.
  - 3. Fabricate tops, sides, and rear from minimum 12-gauge (2.7mm) steel plates with stationary rear suitable for back-to-wall installation.
  - 4. Front Doors: use 12-gauge (2.7mm) steel plate, with turned-back edges suitably braced and supported to maintain alignment and rigidity without sagging; of sufficient width to permit door opening without interference with rear projection on flush mounted instruments, essentially fully height, with strong continuous piano type hinges.
  - 5. Positive Latches: Acting from a common door handle that shall hold doors securely compressed at top, side, and bottom against gaskets.
  - 6. Doors shall have padlock locking provisions. All Panels shall be keyed alike.
  - 7. Top and bottom with nominal 1 sq. foot (929 sq. cm) per section removable access plates that shall be drilled to accommodate external wiring and conduit. Arrange Panel internal components for external conduit and piping to enter the Panel either from above or below.
  - 8. Arrange Panel instruments and control devices in a logical configuration from an Operator's standpoint and as indicated on the Contract Documents.
  - 9. Locate Control Switches and Indicators within 60-inches (1.5m) and 36-inches (0.9m) above the base of the Panel.
  - 10. Provide duplex, grounded GFI receptacles for service and maintenance tools within the panel at spacing not greater than 5-feet (1.5m) throughout the length of the Panel. Provide lighting and receptacle circuit from a separate power source and fuse separately from the instrument systems.
- D. Wall-Mounted Panels
  - 1. Panels: Fabricate the enclosures from not less than 14-gauge (2mm) steel complete with full size gasketed doors with stainless steel three-point latch and hinges.

- 2. Construct instrument sub-panels from minimum 1/8-inch (3mm) thick steel, reinforced and braced as required to form a rigid assembly.
- 3. Mount components on easily removable steel sub-panels painted white.

# 2.2 PANEL INSTRUMENTS AND DEVICES

- A. General
  - 1. Instruments shall have matching or compatible fascia such as height, finish, color, and display color with a logically grouped panel display.
  - 2. Electronic Panel instruments shall be able to operate from 120-VAC plus or minus 10-percent, 60 Hertz (220 VAC +/- 10%, 50 Hz), and 24-VDC plus or minus 10-percent power supply. Instruments in the same panel shall be powered from the same power supply.
  - 3. Panel Instruments shall be capable of providing loop power (nominally 24 VDC) for all analog inputs and outputs. Signal circuits and power supply circuits shall be galvanically isolated from each other and the instrument case.
  - 4. Operating temperature range shall be from 40 to 120 °F (4.4 to 50 °C) and relative humidity to 90 percent non-condensing.
- B. Switches
  - 1. Acceptable Manufacturers
    - a. Micro Switch Division of Honeywell, Type PT
    - b. Eaton Corporation
    - c. Culter Hammer Products, Type T
    - d. General Electrical Company, Type CR
    - e. Square D Company, Type K
    - f. Allen-Bradley, Bulletin 800T
  - 2. Selector Switches: Heavy duty oil-type with gloved-hand or wind lever operator. Engrave position legends on switch faceplate. Switches for electrical circuits shall have silver butting or sliding contacts, rate 10-amperes continuous at 120-VAC.
  - 3. Contact Configuration: Switches used in electronic circuits shall have contacts with a minimum rating of 2-amperes.
- C. Indicator Lights
  - 1. Acceptable Manufacturers
    - a. Micro Switch Division of Honeywell, Type PT
    - b. Eaton Corporation
    - c. Culter Hammer Products, Type T
    - d. General Electrical Company, Type CR
    - e. Square D Company, Type K
    - f. Allen-Bradley, Bulletin 800T
  - 2. Heavy-duty, oil-tight type, which utilizes a 6 VDC lamp and built-in transformer. Engrave legends on the lens or on a legend faceplate. Lamps shall be easily replaceable from the front of the indicating light.
  - 3. Integrate a push-to-test feature with each indicating light, or a common test of all Panel Indicating Lights.
- D. Operator Panels
  - 1. Acceptable Manufacturers
    - a. Optimation, Incorporated, OP-620 Series
    - b. Approved Equal

- 2. Operator Panel shall connect to the PLC, and shall offer two (2) lines of 20 digital characters, plus user definable pushbuttons. Each pushbutton shall have LED indicators.
- 3. The Unit shall display up to 160 user definable status or variable messages.
- 4. The Operator Panel shall operate on 8-30 VDC.
- 5. Communications between the Operator Panel and the PLC shall be via RS232/RS422 4800 to 19200 baud.
- 6. The Unit shall be fully compatible with Allen-Bradley SLC 5-03 products.
- E. Control Relays
  - 1. Acceptable Manufacturers
    - a. Potter and Brumfield, Series KRP
    - b. Eagle Signal Controls, Series 22 or 80
    - c. Manufacturers of Struthers-Dunn, Incorporated, Series A3 or A4
    - d. IDEC, RH Series
  - 2. Provide Control Relays indicated in Instrument and Control Panels and Enclosures with plug-in socket base type with dustproof plastic enclosures.
  - 3. Relays: Relays shall function as indicated on the Contract Documents, in accordance with design requirement, and with not less than the number of poles shown on the Contract Documents. Provide form "C" double-throw contacts.
  - 4. Control circuits relays shall have silver-cadmium oxide contacts rated for 10-amperes at 120-VAC
  - 5. Electronic switch-duty relays shall have gold-plated or gold alloy contacts suitable for use with low level signals.
  - 6. Relays utilized for computer input, alarm input, or indicating light service shall have contacts rated not less than 5-amperes.
  - 7. Time delay relays shall have dials or switch settings engraved in seconds, with timing. repeatability of plus or minus 2.0-percent of setting.
  - 8. Provide latching and special purpose relays as indicated for the specific application.
  - 9. Relays shall have a built-in lamp, LED, or neon, to indicate an energized relay.
- F. 7-Day Electronic Digital Time Switch
  - 1. Acceptable Manufacturers
    - a. Tork, DIN 200
    - b. Paragon
  - 2. Unit shall program in AM/PM or 24-hour format and shall provide one (1) minute resolution
  - 3. The Unit shall have an LCD display.
  - 4. It shall be capable of a minimum of 48 event per channel per week and allow separate schedules for each day of the week.
  - 5. The Unit shall have 365 holiday capabilities with 16 single dates and 5 holiday blocks of unlimited duration.
  - 6. The Unit shall be selectable between Standard and Daylight Savings Time.
  - 7. Controller shall have automatic Leap Year correction.
  - 8. Controller shall have a 72-hour memory backup with rechargeable battery.
  - 9. The Unit shall be capable of manual override ON or OOF to the next scheduled event using one (1) button for each channel.
  - 10. Technical Specification:

Switching Interval:	1 minute
---------------------	----------

- b. Manual Override
- c. Input Voltage: 120 VAC, 50/60 Hz
- d. Power Consumption: 5 VA maximum
- e. Battery Backup: 150 hours

а

g.

f. Operating Temperature: 14 to 140 °F (-10 to 55 °C)

> 5.2 oz (147g) DIN Rail (35mm)

- Accuracy at 68 °F (20 °C): +/- 2.5 seconds per day
- h. Weight:
- i. Mounting:
- j. Dimensions:

i.	Width:	1-7/8-inch (48mm)
ii.	Depth:	2-7/8-inch (73mm)
iii.	Height:	3-1/4-inch (83mm)

- k. Output:
  - i. Switch Configuration: SPDT
  - ii. Switch Contact Rating: 16 A Resistive

#### 2.3 PANEL ACCESSORIES

- Α. **Terminal Strips** 
  - 1. Acceptable Manufacturers
    - Allen-Bradley, 1492-W Line a.
    - b. Entrelec M4/6 Series
    - Weidmuller SAKS c.
    - d. **Phoenix Contact**
    - e. Wago

)	Voltage Rating	600 V AC/DC
	voltage Nating.	

- Maximum Current: 3. 30 Amperes
- 4. Wire Range: No. 22 - No. 8 AWG
- 5. Density: 38 pieces per foot (125 per meter) -40 to 221 °F (-40 to 150 °C)
- Insulation Temperature Range: 6.
- 7. Color:
- **Plastic Wireway** Β.
  - Acceptable Manufacturers 1.
    - **IBOCO** Corporation, T1 Duct Series a.
    - Approved Equal b.
  - 2. Material: **Rigid PVC**, Self-extinguishing

Grav

- 3. Color: Light Grey or White
- 4. Standard Length: 6-feet 6-3/4-inches (6'-3.75") (2.0m)
- C. **DIN Mounting Rail** 
  - 1. Acceptable Manufacturers
    - **IBOCO** Corporation a.
    - b. Approved Equal
  - 2. Material:

RoHS Compliant, treated with galvanic zinc plating 6-microns

3. Minimum Thickness: 4. Standard Length:

6-feet 6-3/4-inches (6'-3.75") (2.0m)

- 2.4 PANEL WIRING
  - Α. Interconnecting wiring and wiring to terminals for external connection shall be MTW or SIS 16 AWG, stranded copper wire, insulated for not less than 600 volts, with a moisture-resistant and flameretardant covering rated for not less than 194 °F (90 °C) except circuits and special instrument interconnecting wiring that shall be in accordance with Manufacturer requirements.

- B. Panel Wiring Size:
  - 1. Power Distribution Wiring on the line side of pane fuses: Minimum 12 AWG.
  - 2. Secondary Power Distribution Wiring and Wiring for Control Circuits: Minimum 14 AWG.
  - 3. Annunciation and Indicating Light Circuits: Minimum 16 AWG.
  - 4. Electronic Analog Circuits within Instrument and Control Panels: Minimum 14 AWG, Twisted and shielded pairs or triads rated not less than 600 volts.
- C. Analog Circuits and AC Power Circuits: Separated
- D. Internal Panel Wire Colors:
  - 1. AC Power Distribution: Red
  - 2. DC Power Distribution:
  - 3. Instrument: Black and White shielded pair
- E. Other and in agreement with Manufacturer's wiring diagrams as stated on manufactured drawing legend.

Blue

## PART 3 - EXECUTION

## 3.1 INSTALLATION

- A. Install gasket and sealing material under panels with floor slab cutouts for conduit. Undercoat floor mounted panels.
- B. Install signal grounding conductor and grounding electrode as required by the Panel Manufacturer.
- C. Connect Panel equipment grounding (safety) terminal to the building or facility grounding grid with 6 AWG green insulated conductor.
- 3.2 CLEANING
  - A. Clean the interior and exterior of the Panel prior to applying power and energizing.
- 3.3 DEMONSTRATION
  - A. Demonstrate operation of equipment in accordance with the intent of the Contract Documents.
- 3.4 PROTECTION
  - A. Protect products until acceptance by the Owner.

END OF SECTION