SECTION 13 1604 – WATER FEATURE FIELD INSTRUMENTS, SWITCHES, AND ALARMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This section includes the following:
 - 1. Field Instruments:
 - a. Ultrasonic Level Indicators
 - b. Pressure Sensors
 - c. Temperature Sensor and Transmitter
 - d. Flow Sensor and Transmitter
 - e. ORP Sensor and Controller
 - 2. Field Switches:
 - a. Vacuum Limit Switch
 - b. Pressure Switch
 - c. Flow Switch
 - d. Liquid Level Switch
 - e. Floor High Level Switch
 - f. Selector Switches
 - g. Time Delay Switches
 - 3. Field Alarms
- 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 1605 WATER FEATURE CONTROL PANELS
 - 13. SECTION 13 1607 WATER FEATURE PROGRAMMABLE LOGIC CONTROLLERS
 - 14. SECTION 13 1609 WATER FEATURE DISCONNECTS, MCC, AND STARTERS
 - 15. SECTION 13 1610 WATER FEATURE ELECTRICAL ACCESSORIES
 - 16. SECTION 26 0000 ELECTRICAL
- C. References:
 - 1. NEMA Enclosure Types
 - 2. NFPA 70 National Electrical Code
 - 3. Underwriters Laboratories (UL)
- 1.2 SUBMITTALS FOR REVIEW
 - A. SECTION 01 3300 SUBMITTAL PROCEDURES
 - B. Product Data: Submit Manufacturer's literature, cut sheets indicating mounting instructions, sensor dimensions, materials, electrical requirements, and operational parameters.

- C. Shop Drawings: Submit Shop Drawings indicating location of all Field Switches, Sensors, and Meters, including the following:
 - 1. Connection Diagrams
 - 2. Loop Diagrams
- D. Operation and Maintenance Data: Provide Manufacturer's instructions for installation, calibration, start-up, troubleshooting, and schedule maintenance recommendations.
- E. Certifications: Provide Factory and Field Calibration Sheets for each instrument and device that requires setup and calibration. Provide Certification certifying each instrument and device has been setup and calibrated by a gualified individual.
- F. Warranty: Submit Manufacturer's warranty and ensure forms have been completed in the owner's name and registered with the Manufacturer, where applicable.

PART 2 - PRODUCTS

- 2.1 ULTRASONIC LEVEL SENSOR / TRANSMITTER
 - A. Acceptable Manufacturers
 - 1. Flowline EchoSonic Level Sensor/Transmitter
 - 2. IMO Industries, Incorporated GEMS Sensors, ULS-60
 - 3. Approved Equal
 - B. Sensor and transmitter shall be one integral unit.
 - C. Output signal shall be 4-20-mA two wire with 500-ohm loop resistance (at 24 VDC).
 - D. Sensor shall have a minimum resolution of 1/8-inch (3mm).
 - E. Configuration adjustment, test and calibration shall be accomplished by means of software connection with a USB interface.
 - F. Enclosure shall be type 6P encapsulated and submersible rated.
 - G. Transducer shall be PVDF material.
 - H. Sensor shall have a minimum range of 6-inches (150mm) to 9.8-feet (3m) with a 4-inch (100mm) maximum deadband.

2.2 PRESSURE SENSOR

- A. Acceptable Manufacturers
 - 1. IMO Industries, Incorporated GEMS Sensor Division, 200 Series
 - 2. Approved Equal
- B. Range: Vacuum to 100 psi (690 kPa)
- C. Operating Temperature: Water (Fresh or Salt) to 140 °F (60 °C)
- D. Operating Pressure (max): 150 psi (1.0 MPa)
- E. Output: 4-20 mA
- F. Electrical connection to be NEMA 4X or IP66 rated.
- 2.3 TEMPERATURE SENSOR AND TRANSMITTER
 - A. RTD Sensor
 - 1. Acceptable Manufacturers
 - a. Trerice

- b. Approved Equal
- 2. Stem: 316L Stainless Steel
- 3. Head: Polypropylene
- 4. Connection: 1/2-inch (15mm) NPT spring loaded
- 5. Conduit Connection: 3/4-inch (20mm) NPT female
- 6. Use with 316L Stainless Steel thermowell provided by the same Manufacturer.

B. Transmitter

- 1. Acceptable Manufacturers
 - a. Trerice
 - b. Approved Equal
- 2. Transmitter shall be fully compatible with sensor.
- 3. Transmitter to have 4-20 mA output.

2.4 FLOW SENSOR AND TRANSMITTER

- A. Insertion Type Magnetic Flowmeter flow sensor
 - 1. Acceptable Manufacturers
 - a. Georg Fischer Signet: Model 2551
 - b. Approved Equal
 - The electromagnetic insertion flow sensor shall generate an electrical signal proportional flow velocity from a range of 0.15-33 feet per second. The output signals shall be optional 4-20 mA analog, or digital S3L / open-collector pulse with maximum pull-up voltage of 30 vdc, and a maximum current sink of 50 mA.
 - 3. Sensor shall operate with a power input of 5 26.4 vdc, with a maximum current draw of 15 mA.
 - 4. The microprocessor-based sensor shall include Empty Pipe Detection, LED-assisted troubleshooting, and Bi-Directional span capability (in 4-20 mA models). An optional USB to Digital (S3L) Configuration/Diagnostic Tool shall be used to span (in 4-20 mA models), and/or customize performance features including Noise Rejection Filter, Low Flow Cutoff, Averaging Time, and Sensitivity.
 - 5. The sensor shall utilize an Installation Fitting that is factory set to control proper flow sensor insertion depth and orientate sensor to be parallel with fluid flow.
 - 6. The sensor shall not create a pressure drop of >1 psi at any flow rate.
 - 7. With a fully developed flow profile the sensor output shall be linear to ±1-percent of full range, with a repeatability of ±0.5-percent of full range, and supplied with a certificate traceable to N.I.S.T.
 - 8. Three optional sensor lengths shall allow the flow sensor to install into pipes from 0.5 to 36 inches.
 - 9. The sensor body shall be 316L Polypropylene with stainless steel electrodes and grounding ring: Optional PVDF/Titanium, PVDF/Hastelloy-C, or PVDF/316LSS.
 - 10. The flow sensor shall be equipped with dual O-ring seals. The elastomeric seals shall be FPM-Viton[®] (standard) with optional EPDM or FFPM-Kalrez[®].
- B. Flow Transmitter
 - 1. Acceptable Manufacturers
 - a. Georg Fischer Signet model 9900
 - b. Approved equal
 - 2. General:

- a. Transmitter shall be modular design with a functional base unit and optional field replaceable output modules.
- b. Printed circuit boards shall be conformally coated or potted with an epoxy solution.
- c. Transmitter shall offer field, integral, and panel mounting options with NEMA 4X, CE, and UL approvals/ratings and removable terminal blocks for filed wiring interface.
- 3. Inputs
 - a. Transmitter shall be used for, and not limited to, Georg Fischer Signet Flow, pH, ORP,
 Conductivity / Resistivity, Salinity, Temperature, and Level measurements able to accept Signet's
 Digital (S3L) signals as well as open collector and AC frequency inputs.
 - b. Transmitter shall operate on loop power or 12 to 32 VDC from a DC power supply.
 - c. Transmitter shall provide over-voltage protection for 1.5 times the max voltage rating for this device as well as reverse-voltage protection.
- 4. Outputs
 - a. Open Collector shall operate up to 30 VDC and have a maximum current rating of 50 mA allowing for the NPN open collector output that can be used in a NPN or PNP configuration.
 - b. 2 SPDT, Form C relays shall accept up to 30 VDC or 250 VAC and a maximum current of 5A for any measurement, such as primary or secondary, as a relay output source.
 - c. Relay outputs hall allow for the following relay modes: Off, Low, High, Window (Inside/Outside), Volumetric Pulse, Totalizer Volume, Cyc High, Cyc Low, Proportional Pulse, PWM, and USP.
 - d. Relays shall allow for a hysteresis value, relay time delay, and relay test mode.
 - e. Relays shall be replaceable without having to replace the transmitter.
 - f. 4-20 mA current loop outputs shall comply with the ANSI-ISA 50.00.01 Class H Standard. 4-20 mA outputs shall be isolated and offer forward or reversible scaling.
 - g. User confirmation and adjustment of current outputs.
 - h. Provide user-selectable current output value in case of error conditions.
- 5. Calibration
 - a. Transmitter shall provide a method for single or dual point calibration by user.
 - b. Transmitter shall provide a method for the device to auto buffer recognition.
 - c. Shall allow for users to reset the measurement('s) calibration.
 - d. Shall provide a menu to allow the user to enter the last cal date.
 - e. Shall provide the means to hold outputs during calibration.
- 6. Security to be provided via standard or enhance password/code.
- 7. Signal Conditioning to be provided via user-selectable times for averaging the processed input signal including a sensitivity function that can override the averaging function if the user-specified set point is reached.
- 2.5 ORP SENSOR AND CONTROLLER
 - A. ORP Sensor
 - 1. Acceptable Manufacturers
 - a. DEL Ozone
 - b. Sensorex
 - c. GF Signet Company
 - d. Approved Equal
 - 2. 1/2-inch (15mm) MPT insertion mount with 1/2-inch (15mm) conduit threads on opposite end
 - 3. Flat-tip sensor design.

SOMMET BLANC SPECIFICATIONS

- 4. Compatible with insertion dry tap mounting to allow for cleaning of the probe without system shutdown.
- Β. **ORP** Meter/Controller
 - 1. Acceptable Manufacturers
 - a. Hanna Instruments
 - b. GF Signet Company, 3-8350 Series
 - c. Approved Equal
 - Controller shall be fully compatible with sensor. 2.
 - Device shall meet NEMA 4X and IP65 Standards. 3.
 - 4. ORP reading shall be in millivolts (mV) and setpoint shall be displayed.
 - 5. Setpoint shall be adjustable by front panel controls.
 - 6. Transmitter to have an isolated 4-20 mA output with an open collector output.
 - 7. Transmitter to have Hold and Simulate functions selectable by the Operator.

2.6 **GENERAL SWITCH REQUIREMENTS**

- A. Switches shall provide ON-OFF control action in response to changes in a measured variable.
- Β. Unless otherwise scheduled, provide switches with Form C (SPDT) electrical contacts.
- C. Switch contacts in 120 VAC circuits will be rated NEMA B150, and switch contacts in 24 VDC circuits will be NEMA P150, unless otherwise noted.
- D. Electrical contacts will be hermetically sealed and either mercury or snap action type.
- Ε. Switched to be automatic reset type.

2.7 FIELD SWITCHES

- Α. Vacuum Limit Switch
 - 1. Acceptable Manufacturers
 - a. Static-O-Ring, No. 54NN-K117-N4-B1A
 - b. Square D Company, Class 9016, Type GAW2
 - c. Approved Equal
 - 2. Range: Must have an adjustable setpoint from atmospheric pressure down to a minimum of 15-inch Hg (-50 kPa vacuum).
 - 3. Process connection: 1/4-inch (8mm) NPT
 - 3/4-inch (20mm) NPT conduit fitting 4. Conduit Connection:
 - 5. Over-range Rating: 100 psi (690 kPa)
 - 6. Housing: NEMA 4X
 - 7. DPDT N.O. & N.C. contacts rated for a minimum 1 amp at 250-VAC.
- Β. **Pressure Switch**
 - 1. Acceptable Manufacturers
 - a. IMO Industries, Incorporated – GEMS Sensors, 2200 Series
 - b. Approved Equal
 - 2. Range: Vacuum to 100 psi (690 kPa) 3.
 - Over-range Rating: 200 psi (1.4 MPa)
 - 1/4-inch (8mm) NPT minimum 4. Process Connection:
 - Electrical connection to be shielded PVC cable 5.
 - 6. Housing: NEMA 4X
 - Output: 4-20 mA 7.

- C. Flow Switches
 - 1. Acceptable Manufacturers
 - a. IMO Industries, Incorporated GEMS Sensors, FS-550 Series
 - b. Approved Equal
 - 2. Wetted Materials: Housing, Paddle, and Spring to be 316L S. S., Teflon, Or Ceramic
 - 3. Operating Pressure: 2,000 psig (14 MPa) maximum
 - 4. Pressure Drop: 3 psig (20 kPa) maximum
 - 5. Operating Temperature: -30 to 300 °F (-35 to 150 °C)
 - 6. Setpoint Accuracy: +/- 25%
 - 7. Switch Rating: SPDT, 20 VA
 - 8. Repeatability: +/- 5%
- D. Liquid Level Switches
 - 1. Small Tank Float Type Switches
 - a. Acceptable Manufacturers
 - i. IMO Industries, Incorporated GEMS Sensors, LS-3 (Vertical Mount)
 - ii. IMO Industries, Incorporated GEMS Sensors, LS-6 or LS-7 (Horizontal Mount)

20 VA

- iii. Approved Equal
- b. Wetted Parts to be 316 Stainless Steel, Polypropylene, Teflon, or Kynar (PVDF).
- c. Operating Temperature: Water (Fresh or Salt) to 140 °F (60 °C)
- d. Minimum Liquid Specific Gravity: 0.65
- e. Operating Pressure: 150 psi (1.0 MPa) maximum
- f. Switch Rating:
- g. Electrical Termination: No. 22 AWG, minimum of 12 inches (300mm) long, Polymeric Lead Wires.
- h. Selectable Normally Open (NO) or Normally Closed (NC) operation by inverting float on unit stem.
- 2. Electro-Optic Switches
 - a. Acceptable Manufacturers
 - i. IMO Industries, Incorporated GEMS Sensors, ELS-1100
 - ii. Approved Equal
 - b. Housing and Prism: Polysulfone
 - c. Operating Pressure: 0 to 150 psi (1.0 MPa)
 - d. Operating Temperature: 0 to 176 °F (-17.8 to 80 °C)
 - e. Input Power: 10-28 VDC
 - f. Mounting Type: 1/4-inch (8mm) NPT and 3/8-inch (10mm) NPT Conduit.
 - g. Repeatability: +/- 1 mm
 - h. Electrical Termination: No. 22 AWG, minimum 12 inches (300mm) long lead wires with PVC jacket.
- 3. Ultrasonic Type Switches
 - a. Acceptable Manufacturers
 - i. IMO Industries, Incorporated GEMS Sensors, ULS-60
 - ii. Flowline Liquid Intelligence, LU12-5061
 - iii. Approved Equal
 - b. Enclosure: Engineered Plastic NEMA 4X with 1/2-inch (15mm) NPT Conduit fitting.
 - c. Sensor Material: Kynar (PVDF)

- d. Deadband: 3.6-inch (91mm) maximum
- e. Output:
 - i. 4-20 mA.
 - ii. Two (2) relay channels for control and alarm with potentiometer calibration. Relays to have a minimum 20-VA rating.
- E. Floor High Level Switch

4.

- 1. Acceptable Manufacturers
 - a. IMO Industries, Incorporated GEMS Sensors, LS-1700
 - b. Approved Equal
- 2. Stem Material: 316 Stainless Steel
- 3. Float Material:
 - Buna rature: Water (Fresh or Salt) to 300 °F (149 °C)
 - Operating Temperature: Water (Fresh or Salt) to 300 °F (149 ° Switch Operation: Normally Open (Reversible)
- 5.Switch Operation:Normally6.Actuation Level:9/16-inc
- 6.
 Actuation Level:
 9/16-inch (14.28mm)

 7.
 Switch Type:
 SPST (20 VA)
- Electrical Termination: No. 22 AWG, minimum of 24-inches (600mm) long, Polymeric Lead Wires.
- 9. Provide a junction box with the Floor High Level Switch.
 - a. Acceptable Manufacturers
 - i. Hoffman AS404SC
 - ii. Approved Equal
 - b. Meets NEMA Type 12
 - c. 16-gauge Steel with seams continuously welded and ground smooth
 - d. Oil-resistant gasket
 - e. ANSI 61 Gray polyester powder paint inside and out
 - f. Flat Cover Plate
- F. Selector Switches
 - 1. Acceptable Manufacturers
 - a. Square D, Type K
 - b. Allen-Bradley, Bulleting 800T
 - c. Micro Switch Division of Honeywell, Type PT
 - d. Eaton Corporation
 - e. Culter-Hammer Products, Type T
 - f. General Electric Company, Type CR
 - g. Approved Equal
 - 2. General: Heavy Duty oil-tight with operators as specified. Engrave position legends on switch faceplate. Switches for electrical circuits shall have silver butting or sliding contacts, rated 10 amperes continuous at 120-VAC.
 - 3. Motorized Backwash Control Valve Black knob operator switch, four position, maintained contact.
- G. Time Delay Switches
 - 1. Acceptable Manufacturers
 - a. Tork, A500 Series
 - b. Approved Equal
 - 2. General: Switch shall be a spring wound, interval time switch.
 - 3. Ratings:

- a. Single-pole, single throw.
- b. 20 amp at 125-VAC.
- c. 0-to-30-minute time duration.
- d. Color: Ivory or as specified by Architect/Landscape Architect.
- e. Install in standard 2- by 4-inch (50 by 100mm) electrical box with decorative cover plate.

2.8 FIELD ALARMS

- A. Emergency Shutdown Alarm Horn
 - 1. Acceptable Manufacturers
 - a. Cooper Wheelock
 - b. Approved Equal
 - 2. Alarm shall be an audible and strobe type.
 - 3. Audible tone shall be a selectable choice of either continuous horn or temporal pattern.
 - 4. Each tone shall have 3 dBa settings (99, 95, and 90 dBa) to choose from.
 - 5. Shall be available with a weatherproof model for outdoor use.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install components as per the Manufacturer's recommendation.

3.2 GENERAL

- A. Erect and install all instruments, control systems, and equipment furnished and required by the Contract Documents.
- B. Furnish and install all tubing, piping, fittings, and valves required to install, connect, and complete the instrumentation and control systems as specified and indicated.
- C. Connect tube, pipe, and support all equipment erected and installed as specified.
- D. Calibrate all instruments furnished by this section.
- E. Perform loop checking and functional testing as specified.
- F. Provide all testing instruments, calibration standards, and devices required to perform calibration and testing procedures.
- G. Provide skilled labor and technical assistance to the Manufacturer's Service Representative for the calibration and start-up of control systems and equipment.
- H. Coordinate and consult with the control systems service representative as required.
- I. Place instruments and controls into successful operation.
- J. Install all prefabricated cable as required in this section.
- K. Wire all instrumentation and control devices as required in this section.

3.3 FLOW SWITCH

- A. Switch shall be installed in a 1-inch (25mm) NPT pipe tap or saddle fitting.
- B. The Contractor shall cut paddle length to suit pipe diameter in accordance with the Manufacturer's recommendations.
- 3.4 LIQUID LEVEL SWITCHES
 - 1. Float: Install as shown on Contract Documents and in accordance with Manufacturer's Installation Instructions.

3.5 FLOOR HIGH LEVEL SWITCHES

- A. Install switches in lowest area of the mechanical room with electrical equipment, such as pump pits.
- B. Provide one switch for each separate area.
- C. Mount switch junction box a maximum of 3-inches (75mm) from the floor.
- D. Adjust the location of the float to be within the manufacturer specified actuation distance.
- E. Provide necessary electrical connections and controls to trip the shunt trip for main circuit breaker for the equipment room upon actuation of the switch.
- 3.6 HYDROTHERAPY JET PUMP AND/OR BLOWER TIME SWITCH
 - A. Switch shall be installed in a plastic 2- by 4-inch (50 by 100mm) or 4- by 4-inch (100 by 100mm) electrical box with a plastic cover plate. Provide and in-service weatherproof cover if located outside.
 - B. Install switch in a secure and accessible manner to the spa/hot tub.
- 3.7 EMERGENCY SHUTDOWN ALARM HORN
 - A. Alarm Horn shall provide an audible warning of an emergency switch actuation.
 - B. Alarm Horn shall remain on continuous until the emergency switch is reset.

END OF SECTION