

SECTION 16700 INSTRUMENTATION

PART 1 GENERAL

1.1 DESCRIPTION

- A. Work Included
 - 1. Furnish and install all instrumentation and provide services as specified herein or as indicated on the Drawings.

1.2 QUALITY ASSURANCE

- A. Regulations and Standards
 - 1. UL Underwriters' Laboratories
 - 2. NEC National Electrical Code
 - 3. NEMA National Electrical Manufacturers Association
 - 4. ANSI American National Standards Institute
 - 5. IEEE Institute of Electrical and Electronic Engineers
 - 6. ISA Instrument Society of America
 - 7.
- B. All instrumentation equipment supplied shall be of the most current and proven design. Specifications and drawings call attention to certain features but do not purport to cover all details entering into the design of the instrumentation equipment.
- C. All necessary fuses and cables required for instrumentation equipment shall be provided with the equipment.

1.3 SUBMITTALS

- A. Shop Drawings
 - 1. Submit shop drawings on all instrumentation in accordance with the requirements of Section 01330. Shop drawings shall be complete in all respects and shall indicate all dimensions, installation methods, size, weight, capacity, ratings, integral controls and types of materials, elevations, and sections. Submittals shall include a complete bill of material, catalog information, descriptive literature of all components and wiring diagrams.

PART 2 PRODUCTS

2.1 MAGNETIC FLOW METERS

- A. Flow meter shall meet the requirements of AWWA C751-2019 and components in contact with the potable water shall meet the requirements of NST/ANSI/CAN 61-2023 and the Safe Drinking Water Act (SDWA).

- B. Magnetic flow meters shall be of the low frequency and short form characterized coil design. The characterized field principle of electro-magnetic induction shall produce a positive DC pulsed signal directly and linearly proportional to the flow rate.
- C. The meter body shall be carbon steel. The flow meter shall have a flanged body to fit between ANSI Class 150 pipe flanges. The flow meter shall have a polyurethane liner and Type 316 stainless steel electrodes. The electrodes shall be flush mounted type. Liners and electrodes shall be suitable for potable water. Provide all required mounting hardware, stainless steel grounding rings and grounding straps for the installation of the magnetic flow meter.
- D. The coils, which generate the field, shall be inside the pipe wall and shall be encapsulated in epoxy resin and encased behind the meter lining material. The ratio of flow velocity to reference voltage signals generated shall be compatible with the readout instrument without the necessity of circuit modifications. The meter shall have an average power consumption of 60 watts. Accuracy of the meter shall be $\pm 0.5\%$ of rate.
- E. The meter housing shall be splash-proof and weather resistant design. The meter shall be capable of accidental submergence in up to 30 feet of water for up to 48 hours without damage to the electronics.
- F. The meter shall be hydraulically calibrated at the manufacturer's calibration facility against a master meter, which is traceable to the National Bureau of Standards. Calibration curves shall be submitted for each flow meter for 3 points within the specified flow range.
- G. Complete zero stability shall be inherent characteristic of the meter system. This shall eliminate the requirement for valving downstream of the meter for creating a full pipe zero flow condition for calibration purposes. Meter systems requiring field zero adjustment will not be acceptable.
- H. The flow meter shall have a remote mounted microprocessor based, NEMA 4X signal converter. The signal converter shall have an LCD display to indicate the flow rate. The signal converter shall convert the meter's DC pulsed signal to a linear 4-20mA dc signal which is proportional to the flow rate. The converter shall operate on a 120V AC, 60 Hz power source and shall have RFI protection. Provide a signal cable to connect the signal converter to the flow meter. Length of cable shall be as required for the installation (See Electrical Drawings).
- I. The Magnetic Flow Meters shall be Endress & Hauser Promag W 400, Toshiba GF642, or equal.

SCHEDULE OF MAGNETIC FLOW METERS

SIZE	FLOW RANGE	LOCATION	SERVICE
1"	2.5 to 80 gpm	Well House	Potable water flow
6"	90 to 2,650 gpm	Well House	Potable water high flow

2.2 PRESSURE TRANSMITTERS:

- A. The components in contact with the potable water shall meet the requirements of NST/ANSI/CAN 61-2023 and the Safe Drinking Water Act (SDWA).
- B. The pressure transmitters shall be a single chamber capacitance type electronic transmitter, which shall produce a linear current output signal proportional to the gage pressure.
- C. The process connection shall be 1/4" NPT female and shall be 316L stainless steel. The transmitter shall have a ceramic process isolating diaphragm.
- D. The transmitter shall have a continuous 100 to 1 span adjustment. Reference accuracy shall be $\pm 0.05\%$ of span.
- E. Zero and span adjustment shall be electronic by means of zero and span buttons.
- F. Process temperature limits shall be -13 to +257°F. The temperature limits for the electronics shall be -4 to +158°F. Humidity limits shall be 0-100% relative humidity.
- G. The transmitter shall be a true 2-wire device with 24-volt DC power being derived from the control panel power supply. The electronic unit shall be of modular plug-in design utilizing integrated circuitry. The transmitter output shall be a linear 4-20mA dc signal with superimposed HART protocol.
- H. The range of the pressure transmitter shall be as indicated on the schedule below.
- I. The transmitter electronics housing shall be constructed of die cast aluminum with a polyurethane coating. The transmitter housing shall meet NEMA 4X requirements. The electrical connection shall be a 1/2" NPT conduit thread.
- J. Each transmitter shall be furnished with a mounting bracket and stainless steel bolts suitable for wall mounting the transmitter.
- K. Provide a calibration data sheet for each pressure transmitter.
- L. The pressure transmitters shall be Endress & Hauser Cerabar S PMC71, or equal.

SCHEDULE

PRESSURE RANGE	LOCATION	SERVICE
0-150 psi	Well House	Potable water pressure

2.3 SUBMERSIBLE LEVEL TRANSDUCERS:

- A. The submersible level transducers shall be an industrial submersible pressure transducer submerged in well water to accurately sense the hydrostatic level. The transducer shall be furnished with an integral signal cable with a molded cable seal.
- B. The transducer shall have a weatherproof housing constructed of 316 stainless steel. The transducer shall have a 1.65" sensing area and an integral diaphragm protector.
- C. The transducer shall operate in a temperature range of -4° to 176° F.
- D. The transducer cable shall be a polyethylene jacketed shielded cable. Length of cable shall be as required for transducer installation. Provide a stainless-steel cable hanger to support the cable.
- E. The pressure transducer shall be a 2-wire device with dc power being provided from the 24vdc power supply in the control panel. The transducer shall output a 4-20mA dc signal proportional to the wet well level.
- F. The accuracy shall be $\pm 0.05\%$ full span from 23° to 122° F with a resolution of $\pm 0.005\%$ full span.
- G. The submersible level transducers shall be In-Situ Level Troll 400, or equal.

SCHEDULE

ELEVATION	PRESSURE RANGE	LOCATION	SERVICE
Approximately 230 ft bls.	0 - 100 psia	Well House	Well level

2.4 CHLORINE RESIDUAL ANALYZERS:

- A. Chlorine residual analyzers shall use colorimetric DPD chemistry to continuously monitor the sampled water for free or total residual chlorine. The analyzer shall use a DPD indicator and a buffer solution.
- B. The analyzer shall be capable of measuring free or total residual chlorine by changing the indicator and buffer solutions.
- C. The analyzer shall take a measurement every 2.5 minutes and the results shall be displayed on a three-digit LCD readout in the range of 0-5 mg/l.

- D. The analyzer shall be designed for 30 days of unattended operation and shall use only 473 mL of each reagent per month.
- E. The analyzer shall operate with an LED light source with a peak wavelength of 520 nm.
- F. The analyzer shall measure a sample blank before each sample measurement to provide automatic zero reference to compensate for sample color and turbidity, and changes in light intensity due to voltage fluctuations or light source aging.
- G. The analyzer shall provide a minimum detection limit of 0.035 mg/L; precision of $\pm 5\%$ or 0.005 mg/L as Chlorine, whichever is greater; and an accuracy of $\pm 5\%$ or 0.035 mg/L as Chlorine, whichever is greater.
- H. The analyzer shall be furnished with a sample inlet fitting and a drain fitting.
- I. The analyzer shall be microprocessor controlled and shall be housed in an ABS plastic enclosure designed for wall mounting. The enclosure shall have two clear polycarbonate windows for viewing the measurement readout and the reagent levels.
- J. The analyzer shall operate on 120 volts, 1 phase power and shall be furnished with a power cord.
- K. The analyzer shall output a 4-20mA dc signal proportional to the chlorine residual.
- L. The analyzer shall have two user-selectable relay output alarms which are selectable for sample concentration alarm, analyzer system warning, or analyzer system shutdown alarm.
- M. The chlorine residual analyzers shall be Hach Model CL17 Free Chlorine Residual Analyzers.

SCHEDULE

RANGE	LOCATION	SERVICE
0 – 4.0 mg/L	Well House	Potable water

2.5 PH METERS:

- A. The pH meter shall consist of a pH sensor, a pH transmitter and interconnecting cable. The pH meter shall continuously monitor the pH of the water.
- B. The pH sensor shall have a ring-shaped PTFE diaphragm and fixed electrolyte. The pH sensor shall have a glass electrode and shall utilize Memosens technology. The pH sensor shall have a built-in temperature sensor.

- C. The pH transmitter shall be microprocessor-based and shall be housed in a NEMA 4X polycarbonate enclosure suitable for wall mounting. The transmitter shall have a two-line display to simultaneously display the pH and the temperature.
- D. The transmitter shall have a pH range of -2 to 16.
- E. The transmitter shall have a resolution of 0.01 pH, and an accuracy of $\pm 0.5\%$ of range.
- F. The transmitter shall operate on 120 volts, 1 phase power.
- G. The transmitter shall output a 4-20mA dc signal proportional to the measured pH.
- H. The pH meter shall be Hach.

SCHEDULE

RANGE	LOCATION	SERVICE
3.0 – 10.0	Well House	Potable water

2.6 PRESSURE SWITCHES

- A. Pressure switches shall be industrial type consisting of a Belleville spring with a diaphragm sensor. Pressure switches shall have an aluminum body, a stainless steel port, and wetted materials suitable for potable water.
- B. Pressure switches shall have 5 ampere, 120 volt contacts, threaded electrical conduit connection opening, 1/4" NPT bottom connection type pressure line opening, and NEMA 4X watertight enclosure.
- C. Pressure switches shall be Ashcroft, Omega, Dwyer or approved equal.

SCHEDULE

RANGE	LOCATION	SERVICE	Description
0 to 150 PSI adjustable	Well House	Low potable water pressure	DPDT
0 to 150 PSI adjustable	Well House	High potable water pressure	3PDT

2.7 NAMEPLATES

- A. Provide a laminated phenolic nameplate for each instrument. The nameplates shall be black with white engraved letters, and they shall be mounted on the front of each instrument or instrument enclosure, or where applicable attached to the instrument with a plastic wire tie. An instrument nameplate schedule shall be submitted to the Engineer for approval prior to performing any engraving.

PART 3 EXECUTION

3.1 INSTALLATION ASSISTANCE AND INSPECTION

- A. Provide the services of manufacturer's service representatives to assist in installation for all instrumentation specified herein.
- B. Each manufacturer's representative shall inspect the installation of each of their instruments and shall issue an installation certificate to the Owner and the Engineer for each instrument certifying that the instrument has been installed in accordance with the manufacturer's recommendations.

3.2 CALIBRATION

- A. Provide the services of manufacturer's service representatives to calibrate all instrumentation provided. All calibration shall be performed in the presence of the Engineer. The calibration of each instrument shall be performed after the instrument installation certificate has been issued.
- B. Each manufacturer's representative shall issue a calibration certificate to the Engineer for each instrument certifying that the instrument has been calibrated and is ready to be placed into service. The calibration certificates shall indicate the calibrated range or setpoint for each instrument.

3.3 TRAINING

- A. Provide four (4) hours of training on the instrumentation provided.
- B. All training shall be performed by a representative from the manufacturer and shall be specific to the instruments provided. Training shall include theory of operation, maintenance requirements, calibration methods and function of instrument in the Process Control System.

END OF SECTION

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