

SECTION 40 71 00

MAGNETIC FLOW METER

PART 1 GENERAL

1.1 DESCRIPTION

- A. Scope:
 - 1. Provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish, install, calibrate, test, start-up, and place in satisfactory operation a magnetic flow meter.
- B. Related Sections:
 - 1. Section 09 91 00 – Painting and Protective Coatings.
 - 2. Division 26 Sections.

1.2 REFERENCES

- A. Standards referenced in this Section are:
 - 1. ISA 5.1, Instrumentation Symbols and Identification.
 - 2. ISA 5.4, Instrument Loop Diagrams.
 - 3. ISA 20, Specification Forms for Process Measurement & Control Instruments, Primary Elements & Control Valves.
 - 4. NEMA 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
 - 5. UL 50, Safety Enclosures for Electrical Equipment, Non-Environmental Considerations.
 - 6. UL 508A, Industrial Control Panels.
 - 7. UL 698A, Standard for Industrial Control Panels Relating to Hazardous (Classified) Locations.
 - 8. UL 2062, Enclosures for Use in Hazardous (Classified) Locations.

1.3 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Manufacturer: Manufacturers of magnetic flow meters furnished under this Section shall be experienced producing similar equipment and shall have the following qualifications:
 - a. Shall manufacture magnetic flow meters that are fully-developed, field-proven, and of standardized designs.

1.4 SUBMITTALS

- A. Action Submittals: Submit the following:
 - 1. Shop Drawings:
 - a. Manufacturer's product name and complete model number of devices proposed for use, including manufacturer's name and address.
 - b. Data sheets and manufacturer's catalog literature.
 - c. Description of construction features.
 - d. Performance and operation data.

- e. Installation, mounting, and calibration details; instructions and recommendations.
 - f. Service requirements.
 - g. Dimensions of magnetic flow meter and details of mating flanges and upstream/downstream straight run pipe lengths required.
 - h. Range of each device and calibration information.
 - i. Descriptions of materials of construction and listing of NEMA ratings for equipment.
 - 2. Product Data:
 - a. Manufacturer's literature, illustrations, specifications and engineering data including; dimensions, material size, weight and parts list for all components in sufficient detail to allow an item-by-item comparison with the Contract Documents.
- B. Informational Submittals: Submit the following:
- 1. Manufacturer's Instructions:
 - a. Shipping, handling, storage, installation, and start-up instructions.
 - 2. Source Quality Control Submittals:
 - a. Factory test reports and results.
 - 3. Special Procedure Submittals:
 - a. Submit written procedure for system checkout to ENGINEER.
 - b. Submit notification to OWNER and ENGINEER at least 14 days before readiness to begin system checkout, but not prior to CFPUA's approval of the checkout procedure. Schedule system checkout on dates agreed to by OWNER and ENGINEER.
 - 4. Field Quality Control Submittals:
 - a. Submit the following prior to commencing system checkout and start-up.
 - 1) Completed calibration sheets for magnetic flow meter showing five-point calibration (0, 25, 50, 75, 100 percent of span), signed by factory-authorized serviceman.
 - b. Field calibration reports
 - c. Field testing reports.
 - 5. Supplier's Reports:
 - a. Installation inspection and check-out report.
 - b. Submit written report of results of each visit to Site by Supplier's service technician, including purpose and time of visit, tasks performed, and results obtained. Submit within two days of completion of visit to the Site.
 - 6. Qualifications Statements:
 - a. Manufacturer, when required by ENGINEER.
- C. Closeout Submittals: Submit the following:
- 1. Operations and Maintenance Data:
 - a. Include acceptable test reports, maintenance data and schedules, description of operation, wiring diagrams, and list of spare parts recommended for one year of operation with current price list.
- D. Maintenance Materials Submittals: Submit the following:
- 1. Spare Parts and Test Equipment:
 - a. Provide replacement spool piece where bypass piping is not provided.
 - b. Transmitter.

- c. Furnish a recommended list of additional spare parts and test equipment and itemized price.

1.5 STORAGE AND HANDLING

- A. Prior to packaging, each manufacturer or Supplier shall securely attach tag number and instructions for proper field handling and installation to each instrument.
- B. Comply with Section 01 60 00 - Product Requirements.

PART 2 PRODUCTS

2.1 MAGNETIC FLOW METERS

- A. Manufacturers:
 - 1. ABB Magmaster, plus MFF.
 - 2. Emerson/Rosemount 8700 Series.
 - 3. Toshiba LF 654 Series.
 - 4. Or as approved.
- B. Method of Operation: Produce a pulsed DC magnetic field that, when applied to a conductive liquid, generates an induced voltage as the liquid flows through the magnetic field. Generate voltage directly proportional to the flow of the metered liquid. Identify the ratio of flow velocity to voltage generated for all meter sizes, thereby permitting primary head and transmitter direct adaption and interchangeability without circuit modifications or system recalibration.
- C. Performance Requirements:
 - 1. Range:
 - a. Minimum Flow Rate: < _____ > GPM (Engineer to provide).
 - b. Maximum Flow Rate: < _____ > GPM (Engineer to provide).
 - c. Average Flow Rate: < _____ > GPM (Engineer to provide).
 - 2. Indication: Provide remote panel mounting for digital display of flowrate and totalized flow.
 - 3. Accuracy (with analog output):
 - a. ± 0.5 percent of flow rate, or better, over a range from 1 fps to 31 fps.
 - b. ± 0.005 fps, or better, at flows below 1 fps.
 - c. Accuracy unaffected by changes in fluid velocity, density, pressure, temperature or conductivity (above minimum conductivity limits).
 - d. System accuracy shall be proven by submittal of flow test curves of the actual meters being furnished.
 - 1) Test curves shall show a minimum of ten equally spaced flow points. Tests shall be performed using water and a weight or volume tank. A "master meter" used as a reference standard is not acceptable.
 - 4. Repeatability: ± 0.15 percent of flow rate, or ± 0.0015 fps, whichever is greater.
 - 5. Drift: Complete zero stability.
 - 6. Minimum Fluid Conductivity Limit: Five microsiemens per centimeter or less.
 - 7. Minimum Pre-amp Input Impedance: 1012 ohms.

8. Power:
 - a. 120 VAC $\pm$ 10 percent, 60 Hz, $\pm$ 3 Hz power supply.
 - b. Power Consumption shall not exceed 50 watts for flowtube and transmitter combined.
9. Output:
 - a. 4 to 20 mA DC, direct acting and isolated, into 0 to 1000 ohms.
 - b. High accuracy, field adjustable scaled pulse output (0.1 to 10 Hz or greater) to drive local totalizer.
10. Operating Temperature: Suitable for operation with process fluid temperature from 0° to 140°F.
11. Pressure Rating: Greater than or equal to 150 psi or test pressure specified in Section 33 05 05.31, Hydrostatic Testing, for appropriate piping system.

2.2 FLOW TUBE

- A. Size: < _____ > inches.
- B. Flow Tube Material: Type 304 stainless steel.
- C. Housing:
 1. Material: Carbon steel with corrosion-resistant polyurethane paint finish.
 2. Pressure Rating: 150 psi minimum.
- D. Liner Material: Neoprene, Polyurethane, or Teflon (PTFE).
- E. Electrodes Design and Material: Type 316L stainless steel or Hastalloy C.
- F. Minimum Conductivity: 5 uS/cm (20 uS/cm for demineralized water).
- G. Grounding Rings:
 1. Provide each primary head with two grounding rings installed on each end of the primary head.
- H. Accidental Submergence Ratings: IP67; accidental submergence to 30 feet for up to 48 hours.
- I. Zero Stability: Provide a zero stability feature as an inherent characteristic of the flowmeter system to avoid zero drift.

2.3 FLOW TRANSMITTER

- A. Description: Microprocessor-based transmitter unit requiring no calibration over its expected life, under normal use.
- B. Power Supply: Operate meters from 120 VAC ($\pm$ 1 percent) at 60 Hz ($\pm$ 5 percent). Factory-wire and assembly primary head and transmitter components, ready for external field connections. Provide required lengths of shielded signal cable for connecting the primary head and transmitter for the raceway route as detailed.

- C. Housing: NEMA 4X enclosure; remotely mounted as indicated in the Schedule at the end of this Section.
- D. Accuracy:
 - 1. ± 1.0 percent of flow rate or better for flows above 1 foot/second.
 - 2. ± 0.5 percent of flow rate or better for flows above 2 foot/second.
- E. Low Flow Cutoff: Adjustable low flow cutoff set point. Output shall be driven to zero (4 mAdc) when flow falls below low flow cutoff point.
- F. Empty Pipe Detection: Drive output to zero (4 mAdc) when empty pipe is detected.
- G. Totalization: Provide totalization of flow for direction of measured flow.
- H. Temperature Range: -18 to 60 degrees C.
- I. Outputs:
 - 1. 4-20 mA 0 to 1000 ohms, providing 50 megohms of isolation from ground, and isolated from the transmitter's power supply. Minimum of 250 ohms is required for HART communicator.
 - 2. Pulse output with minimum time duration of 0.5 seconds.

2.4 ACCESSORIES

- A. Mounting:
 - 1. Provide complete Type 316 stainless steel mounting hardware for all transmitter and driver electronics locally mounted and remotely mounted from the flow tubes.
 - 2. Type of mounting (wall, support frame or pipe stand) as required inside vault and remote enclosure.
- B. Shielded cable assemblies of sufficient length for connection between flowtube and transmitter electronics.
- C. Type 316 stainless steel grounding rings for flowtubes.
- D. Type 316 stainless steel grounding straps.

2.5 AC POWER ON-OFF SWITCH

- A. Function: Local power on-off selector switch for magnetic flowmeters. All four-wire transmitters shall be provided with a 120 VAC power on-off selector switch located at the instrument.
- B. Construction Features:
 - 1. Selector Switch: NEMA 4X rated, SPDT.
 - 2. Enclosure: NEMA 4X rated, non-metallic.
 - 3. Products and Manufacturers: Provide one of the following:
 - a. Allen Bradley 800H rosie glass polyester enclosure.
 - b. Or Pre-Approved equal.

2.6 SOURCE QUALITY CONTROL

- A. Section 01 40 00 – Quality Requirements.
- B. Provide shop inspection and testing of meters.
- C. Certificate of Compliance:
 - 1. If manufacturer is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at manufacturer's facility conforms to Contract Documents.
 - 2. Specified shop tests are not required for Work performed by approved manufacturer.

PART 3 EXECUTION

3.1 INSTALLATION

- A. To create optimum flow conditions, install meter with the manufacturer's recommended straight length of pipe on the inlet side and outlet side of meter. Consult with specific meter manufacturer for optimum installation instructions.
- B. Installation in accordance with manufacturer's instructions.
- C. Grounding:
 - 1. If the magnetic flowmeter does not provide a continuous flange-to-flange conductive path outside the area of the magnetic field, install ground rings and connect to each other with a No. 6 AWG ground wire.
 - 2. Ground magnetic flowmeter to the structure ground with a No. 6 AWG ground wire.
- D. Electrical work for underground and potential flooding areas:
 - 1. Install drip leg in the conduit system and slope conduit downward away from magnetic flowmeter. Provide drain fitting in low part of conduit system to drain conduit system.
 - 2. Seal conduit entrance into magnetic flowmeter with RTV silicone sealant.
 - 3. Follow manufacturer's instruction as required to maintain IP67 or IP68 rating.
- E. Support piping adjacent to meter such that no weight is carried on meter casings.

3.2 CALIBRATION

- A. Factory-set full-scale output to maximum flow rates.
- B. Calibrate pulse output to provide a pulse every 1,000 gallons.

3.3 MANUFACTURER'S START-UP SERVICES

- A. Manufacturer must certify that meter is properly designed and installed.
- B. Provide a minimum of 8 hours of service.

END OF SECTION