**SECTION 40 71 13 13**

**ELECTROMAGNETIC FLOW MEASURING SYSTEM**

**PART 1 GENERAL**

**1.01 SUMMARY**

1. Provide a two-wire, loop powered flow meter for permanent installation. The meters shall utilize bipolar pulse DC coil excitation to measure voltage induced by the flow of conductive liquid through a magnetic flux. The voltage shall be linearly proportional to flow velocity from 0.033 to 33 feet per second.
2. Related Sections:
   1. Control and Information System Scope and General Requirements
   2. Powered Instruments, General

**1.02 SUBMITTALS**

1. Furnish complete Product Data, Shop Drawings, Test Reports, Operating Manuals, Record Drawings, Manufacturer’s certifications, Manufacturer’s Field Reports
2. Product Data:
   1. Dimensional Drawings.
   2. Materials of Construction:
      1. Metering Tube.
      2. Liner.
      3. Electrodes.
      4. Flanges.
   3. Measurement accuracy.
   4. Range and range ability.
   5. Enclosure Rating.
   6. Classification Rating.
   7. Power:
      1. Voltage.
      2. Wattage.
   8. Output options.

**1.03 QUALITY ASSURANCE**

1. Manufacture instruments facilities certified to the quality standards of ISO Standard 9001 - Quality Systems - Model for Quality Assurance in Design/Development, Production, Installation, and Servicing.

**1.04 DELIVERY, STORAGE, AND HANDLING**

1. Store all instruments in a dedicated structure with space conditioning to meet the recommended storage requirements provided by the Manufacturer.
2. Any instruments that are not stored in strict conformance with the Manufacturer’s recommendation shall be replaced.

**1.05 PROJECT OR SITE CONDITIONS**

1. Provide instruments suitable for the installed site conditions including, but not limited to, material compatibility, site altitude, process and ambient temperature, and humidity conditions.

**1.06 WARRANTY**

1. The meter shall have standard one year warranty from date of shipment.
2. The meter shall be commissioned by a factory certified technician and shall be have a three year warranty from date of shipment.

**1.07 MAINTENANCE**

A. Provide all parts, materials, fluids, etc. necessary for maintenance and calibration purposes throughout the warranty period. Deliver all of these supplies before project substantial completion.

**1.08 LIFECYCLE MANAGEMENT**

A. Equipment life cycle management shall be via web enabled system. System shall contain records related to initial factory settings, subsequent field calibrations, and full history of calibrations, service and software related to the specific device(s).

**PART 2 PRODUCTS**

**2.01 MANUFACTURER**

1. One of the following:
   1. Endress+Hauser- Promag P 200

**2.02 MANUFACTURED UNITS**

A. The flow meter shall consist of a sensor and transmitter in a compact form and have a nominal diameter of 1/2” to 8” with a PTFE lining.

B. The sensor shall include compatible wetted electrode materials suitable for the intended application in either T316L stainless steel, Alloy C22, Tantalum or Platinum.

B. The sensor shall follow ISO and DVGW fitting lengths and be supplied with flanged process connections defined in the instrument schedule which follow ANSI B16.5.

C. The transmitter shall have a robust housing, NEMA 4X (IP 66/67) and be provided with an AlSi10Mg corrosion resistant coating.

D. The transmitter shall have 4-line, backlit touch control operation without opening the housing, suitable for operation in hazardous areas.

E. The transmitter shall have a menu guided HMI structure for straightforward commissioning in the field and connections to all mainstream transmitter power supplies and input cards of process control systems.

F. The transmitter shall safeguard against entering of invalid data for the particular meter size and all programming parameters shall be access-code protected with a minimum requirement of dual passwords according to data sensitivity.

G. The transmitter shall have digital communication via either HART®, Profibus® PA or FOUNDATION Fieldbus® and be intrinsically safe for installation in classified areas (per cCSAus, ATEX, IECEx).

H. The transmitter shall operate on 18 to 35 volts DC loop powered.

I. The transmitter shall retain all setup parameters and accumulated measurements internally in non-volatile memory in the event of power failure. The memory unit shall be transferrable from a damaged unit or used for a duplicate device with no loss of device parameters or data stored.

J. The transmitter and sensor shall include a method to verify flow meter performance to the original manufacturer specifications.

1. The verification technique shall not require external handhelds, interfaces, special tooling or electrical access for a verification to be performed.

2. The transmitter shall store up to eight verifications in the microprocessor.

3. A verification of the system shall be possible at any time, locally or remotely, on demand and under process conditions.

**2.03 ACCESSORIES**

* + 1. Stainless steel tag - labeled to match the Contract Documents.
    2. Provide grounding rings, as per manufacture’s recommendations.
    3. Provide galvanic isolation gaskets, nylon/Teflon flange bolt insulation bushing and nylon washers. For all meters used on catholically protected pipeline.
    4. Provide sun shield for outdoor installations.

**2.04 SOURCE QUALITY CONTROL & CALIBRATION**

1. Magnetic flow meters shall be factory calibrated on an ISO-17025 accredited test stand per “General Requirements for the Competence of Testing and Calibration Laboratories” with certified accuracy traceable to NIST.
2. Each meter shall ship with a certificate of a 3-point calibration report exceeding stated accuracy of 0.5%.
3. A real-time computer generated printout of the actual calibration data points indicate apparent and actual flows. The flow calibration data points will be confirmed by the manufacturer and will be supplied with shipment of the meters to the project site.
4. Provide complete documentation covering the traceability of all calibration instruments.
5. Provide ISA data sheet ISA-TR20.00.01. Use the latest revision of form 20F2321. Complete the form with all known data, and dash out the inapplicable fields. Incomplete data sheets submitted will be result in a rejected submittal.
6. Provide complete documentation covering the traceability of all calibration instruments.
7. The flow metering system shall permit a traceable and attested method of metrological verification. The verification will permit long term analysis of the transmitter linearity, repeatability and sensor stability and prediction of device out of specification. The verification must be by a method which follows ISO 9001 Section 7.6.a.

**2.05 SAFETY**

A. All electrical equipment shall meet the requirements of ANSI/NFPA 70, NATIONAL ELECTRIC CODE, latest addition.

B. All devices shall be certified for use in hazardous areas: Class 1, Div. 1 or 2, Groups A to D (minimum) with a T3 temperature rating (200 deg. C).

C. All devices shall be suitable for use as non-incendive devices when used with appropriate non-incendive associated equipment.

D. Devices with intrinsically safe ratings will normally be acceptable with vendor’s approval.

E. Electrical equipment housing shall conform to NEMA 4x classification.

F. Non-intrinsically safe electrical equipment shall be approved by a Nationally Recognized Testing Laboratory (NRTL) such as CSA, ATEX, IECEx, etc. to meet the specified electrical area classification.

G. Electrical equipment specified as intrinsically safe shall qualify as “simple apparatus” or NTRL approved intrinsically safe equipment per ANSI/ISA-RP12.6 “Installation of Intrinsically Safe Systems for Hazardous (Classified) Locations”, latest edition.

**PART 3 EXECUTION**

3.01 EXAMINATION

1. Examine the complete set of plans, the process fluids, pressures, and temperatures and furnish instruments that are compatible with installed process condition.
2. Examine the installation location for the instrument and verify that the instrument will work properly when installed.

3.02 INSTALLATION

1. As shown on installation details and mechanical Drawings.
2. As recommended by the manufacturer’s installation and operation manual.
3. Specific attention should be given to the following technical requirements:
   * + 1. Verify ground rings have been installed according to the Manufacturer’s recommendations.
     1. Reduced inlet installations must be accompanied by manufacturer’s documented evidence of third party testing and data collection in comparison to a traceable standard.

3.03 FIELD QUALITY CONTROL

1. Demonstrate the performance of all instruments to the ENGINEER before commissioning.
2. ENGINEER to witness all instrument calibration verification in the field.
3. Each instrument shall be tested before commissioning and the ENGINEER shall witness the response in the PLC control system and associated registers.
4. Manufacturers Field Services are available for start-up and commissioning by a Factory field service representative or a manufacturer’s authorized service provider (ASP) – the warranty against manufacturing defects is three years.
5. Manufacturer representative shall verify installation of all installed flow tubes and transmitters.
6. Manufacturer representative shall notify the ENGINEER in writing of any problems or discrepancies and proposed solutions.
7. Manufacturer representative shall perform field verification at the time of installation for long-term analysis of device linearity, repeatability and electronics health. A comparative report shall be generated for each meter tested.
8. Manufacturer representative shall generate a configuration report for each meter.

3.04 ADJUSTING

1. Verify factory calibration of all instruments in accordance with the Manufacturer’s instructions.

3.05 PROTECTION

1. All instruments shall be fully protected after installation and before commissioning. Replace any instruments damaged before commissioning:
   * + 1. The ENGINEER shall be the sole party responsible for determining the corrective measures.