**SECTION 40 71 73**

**Coriolis Mass Flow Meters**

***PART 1- GENERAL***

**1.01 SUMMARY**

1. Coriolis flow meter for permanent installation above ground. The meter shall utilize a measuring principle based on the controlled generation of Coriolis forces, whereby both translational and rotational movements are superimposed. The Coriolis flow meter shall produce flow rate, density, temperature and viscosity measurements when specified.
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. Sensor.
      2. Flanges.
   3. Measurement accuracy.
   4. Range and rangeability.
   5. Enclosure Rating.
   6. Classification Rating.
   7. Power:
      1. Voltage.
      2. Wattage.
   8. Output options.

**1.03 QUALITY ASSURANCE**

1. Manufacture facilities shall be 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 CALIBRATION AND WARRANTY**

1. The meter shall have standard one year warranty from date of shipment and if the meter is commissioned by a factory certified technician, the warranty is extended to three years from the date of shipment.

**1.07 MAINTENANCE**

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

**1.08 LIFECYCLE MANAGEMENT**

A. Instrument documentation, like original calibration certificates, manuals and product status information shall be accessed via a web enabled system with a license. The instrument-specific information shall be accessed via its serial number. When services are provided by an authorized service provider the services information like subsequent field calibrations shall be archived and accessible via this web enabled system.

***PART 2 -PRODUCTS***

**2.01 MANUFACTURER**

1. Endress+Hauser Promass I 100, Model 8I1B

**2.02 MANUFACTURED UNITS**

1. The flow meter shall be a flanged or hygienic fitting sensor (by application and instrument schedule) and transmitter mounted integral (compact) to the sensor.
2. The flow metering system shall be microprocessor based and possess a method in which to store the sensor calibration and transmitter setup information in non-volatile memory. The electronics shall be interchangeable for meters sizes 3/8”- 3”.
3. The sensor shall be the proper size to measure the design flow rate of the piping and measure bi-directional flow as a standard.
4. The sensor shall include a single, straight tube titanium design to promote easy installation and maintenance.
5. The system shall simultaneously produce several process variables (ex. mass flow, volume flow, density, temperature or viscosity) while in operation.
6. The system shall be a compact design insensitive to external vibrations and immune from external piping forces due to robust design
7. The measuring principal shall operate independently of physical fluid properties, such as viscosity and density.

1. The transmitter shall be a three-stage microprocessor controller mounted integrally or remotely as specified in the instrument schedule. The transmitter shall operate on a 20 - 30 VDC power supply. The transmitter housing will carry a NEMA 4X rating and shall be constructed to prevent moisture ingress, promote corrosion resistance, and be impervious to saline environments.

1. The transmitter shall allow programming that can be operated via an onboard web server.

2. The transmitter display shall indicate simultaneous flow rate and total flow with 3 Totalizers (forward, reverse and net total) and user-selectable engineering units, readout of diagnostic error messages, and support 12 standard languages.

3 The transmitter shall safeguard against entering of invalid data for the particular meter size and all programming parameters shall be access-code protected.

4. The transmitter output shall be specified, as either:

4-20mA HART®, 0-20mA, pulse/frequency/switch. Or

Modbus RS-485, or

Profibus® DP, or

Profinet®, or

EtherNet/IP™

5. The transmitter output(s) shall be integral to the Coriolis flowmeter transmitter electronics; using an external third party signal converter is unacceptable.

6. The transmitter output selected must be supported by add-on instructions (AOI), or Level 3 add-on profiles (AOP or GSD files), device drivers, instructions and pre-engineered code.

7. The transmitter shall support commissioning options via a service interface or device driver less operation via an internal web server accessible through a transmitter accessible RJ-45 port (excluding Modbus RS-485).

8. The transmitter shall retain all setup parameters and accumulated measurements internally in non-volatile memory in the event of power failure.

9. The transmitter shall be protected against voltage spikes from the power source with internal transient protection. Power consumption shall be no more than 3.3W, independent of meter size.

10. The transmitter and sensor must include an ISO traceable and accredited means of in-situ verification to validate measurement quality over the lifespan. The verification technique shall not require external handhelds, interfaces or special tooling for a verification to be performed.

11. The transmitter shall store data in the microprocessor which enables a field verification of the system parameters at any time in the service life. The verification report shall be compliant to common quality systems such as ISO 9000:2008 7.6.a to prove reliability of the meter accuracy

**2.03 ACCESSORIES**

* + 1. Stainless steel tag - labeled to match the contract documents.

**2.04 SOURCE QUALITY CONTROL & CALIBRATION**

1. Coriolis flow meters shall be factory calibrated on an ISO 17025 accredited test stand with certified accuracy traceable to NIST per “General Requirements for the Competence of Testing and Calibration Laboratories”
2. Evidence of accreditation must originate from a national verification agency such as A2LA.
3. Each meter shall ship with a certificate of a 2-point calibration report exceeding stated standard accuracy of 0.1% of rate.
4. A real-time computer generated printout of the actual calibration data points shall indicate apparent and actual flows. The flow calibration data shall be confirmed by the manufacturer and shipped with the meters to the project site.
5. The manufacturer shall provide complete documentation covering the traceability of all calibration instruments.
6. The manufacturer shall provide ISA data sheet ISA-TR20.00.01 as latest revision of form 20F2321. The manufacturer shall complete the form with all known data and model codes and dash out the inapplicable fields. Incomplete data sheets submitted will result in a rejected submittal.

**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, dependent on the output protocol selected.

C. At a minimum, the device shall allow installation in a Class I, Division 2, Group A to D as a non-incendive design (*Ex nA, Ex nL*).

D. Devices intended for Class I, Division 1, Group A to D; Class II Division 1 Group E to G; or Class IIIinstallationshall be supplied in an intrinsically safe design (*Ex i*).

E. All devices shall be suitable for use as non-incendive devices when used with appropriate non-incendive associated equipment. Devices with intrinsically safe ratings must follow the installation guidelines of the manufacturer.

F. Electrical equipment housing shall conform to NEMA 4X classification.

G. Non-intrinsically safe electrical equipment shall be approved by a Nationally Recognized Testing Laboratory (NRTL) such as CSA, FM, or UL for the specified electrical area classification.

H. 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.

I. Device failure modes, self-monitoring characteristics and diagnosis shall follow NAMUR standards NE 43 and NE 107

***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 flow meter is not installed at the high point of a piping system or directly upstream of a free pipe outlet in a downward flowing pipe.

3.03 FIELD QUALITY CONTROL

1. Each instrument shall be tested before commissioning and the ENGINEER shall witness the interface capability in the PLC control system and associated registers.
   * + 1. Each instrument shall provide direct programming capability through the PLC
       2. Each instrument shall provide direct control of totalizer reset functions through the PLC
       3. Each instrument shall be supported with a device profile permitting direct integration in the PLC
2. The ENGINEER shall witness all instrument verifications in the field.
3. 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.
4. Manufacturer representative shall verify installation of all installed flow tubes and transmitters.
5. Manufacturer representative shall notify the ENGINEER in writing of any problems or discrepancies and proposed solutions.
6. 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.
7. Manufacturer representative shall generate a configuration report for each meter.

3.04 ADJUSTING

1. Verify factory setup 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