**SECTION 40 71 66**

**ULTRASONIC BIOGAS FLOW MEASURING SYSTEM**

***PART 1 – GENERAL***

**1.01 SUMMARY**

A. Provide an ultrasonic loop powered flow meter for permanent installation on the anaerobic digestion wet biogas. The measuring principle must be unaffected by changing gas or moisture composition. The meter shall use a transit time ultrasound signal to measure the volume flow and generate a real time fraction measurement of methane in wet conditions.

**1.02 SUBMITTALS**

1. Furnish complete Product Data, Operating Manuals, Manufacturer’s Certifications, Sample Calibration sheets, and (where available and appropriate) Manufacturer’s Field Reports and Test Reports.
2. Product Data:
   1. Dimensional Drawings.
   2. Materials of Construction:
      1. Metering Tube.
      2. Integral Flanges.
      3. Integral Transmitter.
   3. Measurement accuracy.
   4. Range and range ability.
   5. Enclosure Rating.
   6. Classification Rating.
   7. Calibration certificates.
   8. Power:
      1. Voltage.
      2. Wattage.
   9. Output options.

**1.03 QUALITY ASSURANCE**

1. Manufacturer instruments facilities certified to the quality standards of ISO Standard 9001 - Quality Systems - Model for Quality Assurance in Design/Development, Production, Installation, and Servicing.
2. The ultrasonic flow sensor will be flow calibrated against an accredited ISO-17025 flow test stand on gas with certified accuracy traceable to NIST.

**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, process and ambient temperature and pressure, and humidity conditions.

**1.06 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***

* 1. **MANUFACTURER**

1. Endress+Hauser - Proline Prosonic B 200

**2.02 MANUFACTURED UNITS**

A. The ultrasonic flow meter shall consist of a single transmitter mounted integral to an assembled sensor meter body.

B. The sensor shall contain either a single pair of ultrasonic measuring transducers, or two pairs configured in a two-chord arrangement, depending upon the selected meter size.

C. The ultrasonic transducers shall use a special matching layer on the sensor emitting face so as to optimize acoustic signal strength for biogas application.

D. The sensor meter body shall consist of an inline measuring pipe which is integrated into the piping system by ASME B16.5 Class 150# lap joint flanges.

E. The sensor shall be suitable for process temperature between +32 and +176 degrees F and have an integrated temperature sensor option.

F. The transmitter shall sequentially drive the measuring transducers as transmitters and as receivers as a two-wire, loop powered device.

G. The transmitter electronics and software shall evaluate and condition the sensor signals and convert them into measurement variables. The variables shall include volume flow, corrected volume, corrected methane volume, energy flow, methane fraction, calorific value and temperature.

H. The system shall integrate a 4-line display and touch-pad HMI to facilitate device programming in either a compact OR remote version for ease of use.

I. The transmitter enclosure must provide a NEMA 4X and IP66/67 degree of ingress protection.

J. The transmitter output options shall be

1. 4-20 mA HART and Pulse/Frequency Status (mandatory)

K. The transmitter input (4-20mA) shall be

1. 4-20 mA passive, configurable for remote pressure input (compensation)

L. The transmitter and sensor must include a method to verify flow meter performance to manufacturer specifications. The system must be traceable to factory calibration using a third party, attested onboard system.

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

N. The transmitter shall store verification data in the microprocessor. A field verification of the system shall be possible at any time, on demand. The verification report shall be compliant to common quality systems such as ISO- 9000 7.6.a to prove reliability of the meter specified accuracy.

**2.03 ACCESSORIES**

A. No additional accessories are needed for commissioning or normal operation. An optional tool may be required to support extraction of ultrasonic sensors from the meter body under process pressure in the event that cleaning or replacement becomes necessary.

**2.04 SOURCE QUALITY CONTROL & CALIBRATION**

1. Ultrasonic flow meters shall be factory flow calibrated against an ISO-17025 accredited test stand per “General Requirements for the Competence of Testing and Calibration Laboratories” with certified accuracy traceable to NIST
2. Evidence of accreditation must originate from a national verification agency such as A2LA.

C. Each meter shall ship with a certified calibration report exceeding stated standard accuracy of 1.5% of rate for an operable flow range of 10:1; an optional calibration accuracy of 1.5% of rate for an operable flow range of 30:1 is available.

D. 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.

E. Provide complete documentation covering the traceability of all calibrated instruments.

**2.05 SAFETY**

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

1. All devices shall be certified for use in hazardous areas to Class I, Division 1, Groups A-D; both intrinsically safe (Ex-i) and flameproof (Ex-d) methods should be available.
2. All devices shall be suitable for use as non-incendive devices when used with appropriate non-incendive associated equipment. Devices with intrinsically safe ratings will normally be acceptable with vendor’s approval.
3. Electrical equipment housing shall conform to NEMA classification.

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

F. 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 expected process gas composition, 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 in manufacturer’s Technical Information, Operating Instructions 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 or special requirements within the piping system:
   * + 1. Provide proper, undisturbed straight run diameters before (20D or 10D) and after (3D) the measurement location depending on the number of acoustic paths used (1 or 2 acoustic paths)
       2. If the inlet run diameters cannot be observed, the use of a flow conditioner is recommended. Install the flow conditioner per the manufacturer’s 20:80 ratio recommendations.
       3. The addition of an inline flow conditioner shall reduce the proper undisturbed straight run diameters before (10D or 5D) and after (3D) the measurement location depending on the number of acoustic paths used (1 or 2 acoustic paths)

3.03 FIELD QUALITY CONTROL

1. Verify the correct function of all instruments during commissioning through key functional diagnostic.
2. Each instrument shall be tested before commissioning to ensure interoperability in the PLC control system and associated registers.
3. Manufacturer’s Field Services:
4. Manufacturers’ representative shall verify installation of all installed flow tubes and transmitters.
5. Notify the ENGINEER in writing of any problems or discrepancies and proposed solutions.

3.04 ADJUSTING

1. Verify factory electronic calibration (including all I/O) 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.