**40.91.23.30 BTU ELECTROMAGNETIC FLOW METER**

**1.01 SUMMARY**

1. Section Includes: Flanged-body magnetic flow meters for permanent installations incorporating

BTU measurement in accordance with standard EN 1434- thermal energy metering.

1. Related Sections:
   1. Control and Information System Scope and General Requirements
   2. Powered Instruments, General

**1.02 FURNISHED INSTRUMENTATION**

1. The Contractor shall provide magnetic BTU flow meters for measuring flow and BTU energy of conductive fluids. The meters shall utilize bipolar pulse DC coil excitation to measure voltage induced by the flow of conductive fluids through a magnetic flux.
2. The voltage shall be linearly proportional to flow velocity from 0.3 to 30 feet per second. Standard accuracy of the pulse output shall be ± 0.5% of rate (from .3 to 30 ft/sec) for all meters.
3. As described in this specification, the flow meters shall have the operating features and include the appurtenant equipment listed below. The Manufacturer shall supply any equipment necessary to place the meter in working order.

**1.03 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.

**1.04 QUALITY ASSURANCE**

1. Manufactured instruments 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.
2. Factory Calibration*:*
   1. Magnetic flow meters shall be factory calibrated on an approved test stand with certified accuracy traceable to NIST, compliant with the ISO 17025 standard.

**1.05 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.

**1.06 PROJECT OR SITE CONDITIONS**

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

**1.07 CALIBRATION AND WARRANTY**

1. The magnetic BTU flow meters shall be factory calibrated on an approved test stand with certified accuracy traceable to NIST, compliant with the ISO 17025 standard. Each meter shall ship with a certificate of a 3-point calibration report exceeding stated accuracy of 0.5%.
2. Each manufactured unit- magnetic BTU flow tube, temperature sensors and flow transmitter as specified in Part 2 below, shall be factory tested and calibrated as an integrated system prior to shipment, per tag number in the instrument schedule. The manufacturer shall clearly identify, and the Contractor shall install, the components of each manufactured unit as an integrated system, in accordance with the manufacturer’s installation instructions.
3. The magnetic BTU flow meter shall continuously monitor performance with data stored in the microprocessor allowing for field verification of the meter parameters at any time in the service life.
4. The magnetic BTU flow meter shall as be warranted against manufacturing defects for twenty four (24) months from the date of shipment.
5. In the event of dissatisfaction with the meter performance, the manufacturer shall accept return of the meter within thirty (30) days of delivery free of charge, freight charges exclusive.

**PART 2 PRODUCTS**

**2.01 MANUFACTURED UNITS**

1. The electromagnetic BTU flow metering system shall consist of a flanged flow metering tube, a flow transmitter which shall be mounted remotely with interconnecting cables up to 90 feet in length, and two (2) Pt1000 temperature sensors, all from a single manufacturer, factory tested and calibrated prior to shipment, with test documentation provided at the time of delivery.
2. The flow metering system shall be microprocessor based and both the sensor and transmitter shall have microchips to store and process data.
3. The flow tube shall be of the proper size to measure the design flow rate of the piping and shall be noted in the instrument schedule.
4. The flow tube shall consist of a stainless steel sleeve, two magnetic coils, PTFE liner and three electrodes chosen to be compatible with the process fluid. All fluids require a minimum conductivity of 20µS/cm. Flanges shall be Cl 150 ANSI carbon steel. The sleeve, coil assemblies and internal wiring shall be fully enclosed in aluminum housing, and the full exterior of the housing shall be painted with high quality epoxy paint.
5. The flow tubes shall be lined with PTFE and shall have ISO standard flange to flange lay lengths. Unless noted otherwise in the instrument schedule, the flanges shall be ANSI B16.1 Class 150.
6. There shall be two measuring electrodes, and one grounding electrode. The electrodes shall be of 316L material. The electrode circuit shall have a minimum impedance of 1012 ohms.
7. The flow tube shall be furnished with two (2) independent external Pt1000 temperature sensors. The contractor shall install and wire the temperature sensors in strict accordance with the manufacturer’s instructions. Temperature sensors sourced from other than the flow meter manufacturer shall not be acceptable.
8. The contractor shall procure and install the manufacturer’s grounding rings when installing the flow tube in plastic piping systems.
9. The flow tube shall be rated for NEMA 4X service.
10. The transmitter shall be a three stage microprocessor controller mounted remotely as specified in the instrument schedule. The power supply to the transmitter shall be 85 - 260 VAC. Transmitter housing shall be powder coated cast aluminum with NEMA 4X rating.
11. The flow transmitter shall have the capability to calculate volumetric flow and the BTU energy per standard EN 1434 thermal energy metering, without the need for a separate BTU calculator. Systems requiring a separate module to calculate BTU energy shall not be acceptable. The flow transmitter shall have touch control programming that can be operated through a 4x 4 tactile feedback membrane keypad capable of displaying instantaneous flow rates in GPM, accumulated flow rate in Gal, energy in BTU, GJ and kWh without opening the electrical enclosure. The flowmeter shall have a 2-line x 20 character backlit liquid crystal display in user-selectable engineering units, and readout of diagnostic error messages. The flowmeter shall have the following built-in totalizers: energy totalizer, POS flow totalizer, NEG flow totalizer, NET flow totalizer, Daily totalizer and Monthly totalizer.
12. The microprocessor shall safeguard against entering of invalid data for the particular meter size, and all programming parameters shall be access-code protected. The electronics shall include infinitely adjustable low flow cutoff.
13. Upon any power failure, the unit shall retain all setup parameters and accumulated measurements internally in non-volatile memory. All units shall be protected against voltage spikes from the power source with internal transient protection. Power consumption shall be no more than 16 VA, independent of meter size.
14. The flow transmitter shall output a 4-20 mA DC directly proportional to flow velocity or energy rate plus a scaled 24 VDC pulse or open collector frequency output. The frequency shall be freely adjustable to 0-5,000 Hz.
15. The flow transmitter shall incorporate inputs of the two (2) external PT1000 temperature elements. The error in the temperature differential between the two temperature channels should be 0.18°F (0.1°C) or less. The flow transmitter menu shall incorporate temperature calibration allowing for field calibration when necessary. The temperature calibration shall be accomplished using two precision resistors, one corresponding to 122.0°F (50.0°C), another corresponding to 184.1°F 84.5°C. The temperature sensors shall be factory calibrated with NIST traceable calibration certificate provided prior to installation.
16. The flow transmitter shall also be equipped with any one of the following interfaces when specified by the engineer: RS485/Modbus, BACnet, Ethernet, RF 433MHz, RF 868MHz, RF 915MHz, or GPRS wireless

**2.03 ACCESSORIES**

* + 1. Stainless steel tag - labeled to match the Contract Documents.
    2. Provide grounding rings, as per manufacture’s recommendations.

**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. The Contractor shall install the BTU flow meters as shown on installation details and mechanical Drawings.
2. The Contractor shall install the BTU flow meters in strict accordance with the manufacturer’s installation and operation manual.
3. Specific attention should be given to the following technical requirements:
   * 1. Where required, verify ground rings have been installed according to the manufacturer’s recommendations.
     2. Temperature sensors have been installed according to the manufacturer’s recommendation.

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. Manufacturer’s Field Services:

1. The contractor shall engage the manufacturer’s authorized field service technician to inspect the final installation and provide initial programming of the magnetic BTU flow meter(s). Failure to

2. Manufacturer’s authorized field service technician shall inspect and verify installation of all installed flow tubes, temperature sensors and transmitters. The manufacturer’s authorized field service technician shall provide a written report of each inspection per tag number.

3. Notify the ENGINEER in writing of any problems or discrepancies and proposed solutions.

4. Failure to engage the manufacturer’s authorized field service technician as described under this section may void the warranty.

3.04 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.