**SECTION 40 71 13.13**

**Inline Microwave Total Solids Measurement**

***PART 1- GENERAL***

* 1. **SUMMARY**

1. Microwave Total Solids meters shall utilize High Frequency low power microwave antennas to measure the attenuation and time to determine permittivity of the fluid. The meter must be adjusted in the field to align with lab values prior to completion of startup activities. Because this meter does not measure flow, there are no velocity or straight pipe run requirements.

**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. 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 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 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 Proline Teqwave MW 300/500

**2.02 MANUFACTURED UNITS**

1. The total solids meter shall be a wafer-style sensor and include a transmitter which may be mounted integral (compact) to the sensor or remote with interconnecting cables up to 650 feet in length.
2. The system shall be microprocessor-based and possess a non-volatile memory to store the sensor calibration and transmitter setup information.
3. The sensor shall be the proper size to ensure the full measuring range is fulfilled and the Maximum conductivity is not reached as meter performance will be affected
4. The sensor shall consist of a Cast stainless meter body with a Cl 150 ASME B16.5 (2020), Material Group 2.2 rating

1. All sizes have a limit of maximum conductivity:
   1. 2” : 0-100 mS/cm
   2. 3” : 0-85 mS/cm
   3. 4” : 0-50 mS/cm
   4. 6” : 0-20 mS/cm
   5. 8”, 10”, 12” : 0-14.5 mS/cm
2. The sensor tube shall be made of Cast Stainless, CF3M per ASME A351, Ceramic Antennas, and a Stainless Steel Antenna Bracket made from 316L .
3. The sensor shall house two antennas and an additional built in temperature measurement probe made from 316L Stainless Steel
4. No Straight pipe run is required for this device to perform within specification
5. No Velocity requirement is needed for this device to perform within specification.
6. Upon Installation, a Commissioning Wizard and an Adjustment Wizard should be in place to aid in the startup and adjustment to the device.
7. The transmitter shall be a three-stage microprocessor controller mounted integrally or remotely as specified in the instrument schedule. The transmitter shall incorporate a universal 100-240 VAC/18-30 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 local programming that can be operated through the enclosure window without opening the electrical enclosure.

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 with a minimum requirement of dual passwords according to data sensitivity.

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

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

b. Modbus RS-485

5. The transmitter output(s) shall be integral to the Total Solids meter transmitter electronics and using an external third party signal converter is unacceptable.

6. There shall be no limitation of transmitter operational capability or diagnostic dependency between integral and compact mounting orientation.

8. 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 Ethernet port or a WLAN (Wireless Local Area Network) connection as specified.

9. 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.

10. The transmitter 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.

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

12. The transmitter shall provide access to service and monitoring parameters designed to identify transient or permanent process influences.

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

a. The system shall be traceable to factory calibration using a third party, attested onboard system pursuant to ISO standards.

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

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

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

e. f. The verification report shall be compliant to common quality systems such as ISO 9001 7.6.a to prove reliability of the meter specified accuracy.

**2.03 ACCESSORIES**

* + 1. Stainless steel tag - labeled to match the contract documents.
    2. Provide sun shield for outdoor installations as required per the instrument schedule.

**2.04 SOURCE QUALITY CONTROL & CALIBRATION**

1. Adjustment report for each Total Solids meter should be made available and be traceable back to National or International Standards (NIST).
2. Evidence of accreditation shall originate from a national verification agency such as A2LA.
3. The manufacturer shall provide complete documentation covering the traceability of all calibration instruments.
4. 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 edition.

B. All devices shall be certified for use in hazardous areas: Class 1, Div. 2, Groups B/C; temperature rating T3 (200 deg. C)

C. 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.

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

E. Non-intrinsically safe electrical equipment shall be approved by a Nationally Recognized Testing Laboratory (NRTL) such as FM, UL, 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 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.

3.03 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