**F-1500 Master Specification**

1. Products:
	* 1. Subject to compliance with requirements, for energy/BTU Meters in hydronic systems. American Made, Buy America Act FAR 52.225.1, ASHREA 62, field serviceable.
		2. Basis of Design: **ONICON Model F-1500** Series Insertion Turbine Flow Meter. Manufacturers approved to bid, subject to compliance with requirements include:
2. Description: Provide an insertion turbine flow meter complete with NIST traceable, wet calibrated flow-measuring element, remote transmitter, and calibration certificate. Flowmeter shall include integral density compensation to provide direct mass steam flow output. The flow meter shall calculate mass flow corrected for density with real time calculations based on temperature measured by an integral 1,000 ohm platinum RTD. Mass flow inferred from specified steam pressure or calculated externally to the flow meter will not be acceptable. Provide a flow straightener, if required to meet the manufacturer’s minimum upstream straight pipe run requirement. Provide lateral and horizontal supports as required to minimize vibration at the meter location. The flow meter shall be programmed by the manufacturer for each specific application and shall be ready to use upon delivery
3. **[Optional]** BTU Calculator: Total steam net or gross energy measurement system to be provided by a single manufacture.
4. Schedule: The following applications shall be provided with a btu meter where shown on the drawings:
	1. Saturated Steam Systems
	2. Superheated Steam Systems
	3. High Temperature Hot Water Systems
5. Sensing Technology: Axial mounted rotating turbine utilizing inductive sensing.

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1. Construction: Wetted components shall be constructed of 316L stainless steel with an attached tag indicating calibration information. Sensor technology shall have a NEMA4X enclosure display.
	1. Process Connections: Packing gland with 2” ANSI Class 150 or 300 Flanges.
	2. Fluid Temperature Rating: -330F to 500F
	3. Ambient Conditions Transmitter: -40F to 185F
	4. Pipe Size Range Available Options:3” - 16" nominal diameter
	5. Temperature Sensing: Integral 1,000 Ω platinum RTD provides instantaneous temperature
	6. Pressure Sensing: Integral pressure transducer (optional) provides instantaneous pressure
2. Flow Range: The flow meter shall be sized by the manufacturer for each specific application and installed according to the manufacturer’s recommendations
3. Accuracy: Flowmeter shall provide calibrated outputs directly from the integral transmitter, throughout the operating range with the accuracy stated as follows:
	1. Accuracy:
		* 1. ±1% of reading volumetric flow rate
			2. ±1.5% of reading mass flow rate
4. Calibration: Each flowmeter shall receive a wet calibration, within the expected operating range, against a primary volumetric standard that is traceable to NIST.
5. Local Display: Local display shall provide instantaneous flow rate information and totalized flow information and shall be factory configured to a specific configuration given by the contractor.
	1. Input Power:
		* 1. Loop Power: 12-36 VDC, 25 mA max
			2. External DC Power: 12-36 VDC, 300 mA max
			3. External AC Power: 100-240 VAC, 50/60 Hz, 5W max
			4. Power Over Ethernet
	2. I/O Signals: Transmitter should provide:.
		* 1. One (1) 2-Wire Analog Output. [Only when Loop Power input power is selected]
			2. Up to three (3) passive 2-wire, 4-20 mA outputs
			3. One (1) 2-wire scaled pulse output, 50 ms duration, 5 - 36 VDC @ 40 mA maximum
			4. Up to three (3) optocoupler relay alarm outputs
		1. Communication Protocols: BACnet MS/TP, BACnet UDP/IP, Modbus RTU, Modbus TCP/IP
		2. Mounting Option: Remote mount with the kit, up to 100ft.
		3. Display Size: 2-line, 16-character alphanumeric LCD with backlighting option.
		4. Programming Available Options: Password-protected menu-driven user interface via touchscreen.
6. Operating and Installation Instructions: Installation and operating instructions shall be provided for each flowmeter.
7. Warranty: Each flowmeter shall be covered by a 1-year no-fault warranty and a three-year manufacturing warranty.
8. Approvals
	1. FM/FMC:
		* 1. Class I, Division 1, Group B, C, D
			2. Class II, Division 1, Group E, F, G
			3. Type 4X and IP66, Ta = -40 to 60°C
	2. CRN APPROVAL
		* 1. All Providences, Class F - Instrumentation
9. Execution
	1. Installation: Meters shall be installed per the manufacturer’s recommendations.
	2. Connections:
		* 1. Install meters and transmitters/displays adjacent to machines and equipment to allow service and maintenance.
			2. This contractor shall be responsible for connecting all flow meter-system elements.
			3. This contractor shall be responsible for connecting flow meter transmitters to the sensor.
			4. This contractor shall be responsible for connecting thermal-energy meter transmitters to flow meters.
10. Commissioning:
	1. After installation, commission all meters according to the manufacturer's written instructions.
	2. Adjust the faces of meters and transmitters/displays to the proper angle for best visibility. Refer to the manufacturer's written instructions.