SECTION 23 00 00

VN2000 Hot Tap Vortex Meter
Insert-style Vortex Flow Meter, Liquid and Steam, Single-Channel

PART 1 - GENERAL

* 1. SCOPE
1. This section describes the requirements for a flow meter.
2. Under this item, the contractor shall furnish and install flow measurement equipment and accessories as indicated on the plans and as herein specified.
	1. SUBMITTALS
3. The following information shall be included in the submittal for this section:
4. Customer connection and power wiring diagrams
5. Data sheets and sizing sheets for microprocessor-based flow sensor
6. Installation and operations manual
7. List of spare parts
8. Complete technical product description including a complete list of options provided
9. Any portions of this specification not met must be clearly indicated or the supplier and contractor shall be liable to provide all additional components required to meet this specification

SYSTEM DESCRIPTION

1. VN2000 hot tap flow meter measures volumetric or mass flow rate of liquid or steam in closed pipe systems. Responds to changes in flow rate and is also suitable for flow control and heat energy applications. The vortex element is machined out of stainless steel and does not require custom calibration, has minimal pressure loss, and is resistant to clogging.. The sensor probe is press fitted and welded to vortex element to eliminate gaskets and o-rings that might leak in steam applications. Dual sensor technology produces two independent flow signals and improves noise immunity over conventional vortex meters. The meter probe can include an optional RTD, eliminating a tap for temperature compensation. The meter includes a programmable transmitter that displays the rate and total. A single meter can fit multiple pipe diameters within a specified range. Two o-rings in the sealing assembly allow the height to be adjusted for pipes with different diameters. The meter is designed for use with a user supplied hot tap insertion point and can be removed or reinstalled without shutting down the flow system. An optional tool aids in inserting and extracting the meter while the line is pressurized. The insertion/extraction tool is removable and reusable on multiple VN2000 hot tap meters.
	1. DEFINITIONS
2. Direct Insert – This is a type of flow sensor that is meant for direct installation in a pipeline that has been shut down.
3. Ethylene Propylene – A synthetic elastomer that exhibits good chemical stability and is resistant to heat and oxidation.
4. Flow Monitor – Peripheral device which remotely displays various flow conditions (e.g. total volume, flow rate) using a potential variety of inputs.
5. Hot Tap – This is a type of flow sensor that is meant for installation into a pipeline that is in service or under pressure. A valve to isolate the sensor during the installation process is not included.
6. LCD – (Liquid Crystal Display) An electronic visual display that uses the light-modulating properties of liquid crystals. LCD screens have low electrical power consumption that makes them preferable for battery-powered electronic equipment.
7. NPT – (National Pipe Thread) A U.S. standard for tapered threads used on threaded pipes and fittings. In contrast to straight threads that are found on a bolt, a taper thread will pull tight and therefore make a fluid-tight seal.
8. RTD – (Resistance Temperature Detectors) A sensor used to measure temperature by detecting the resistance in the sensor and correlating that resistance to temperature.

PART 2 – PRODUCTS

* 1. APPROVED MANUFACTURERS
		+ - 1. Basis-of-Design Product: Subject to compliance with specifications, provide flow measurement technology by one of the following:

Badger Meter

* 1. OPERATING CONDITIONS
1. System Components
2. Vortex Flow Sensor
3. Measures flows regardless of conductivity or turbidity of liquid and delivers flow measurement signals to a transmitter.
4. Transmitter Electronics
5. Electronic hardware that calculates the flow based on the low level signals from the vortex flow sensor. The transmitter includes a display and keypad and either a 4-20 mA/pulse output or Modbus RTU EIA-485 port. If the transmitter is remotely mounted, a cable is included.
6. (Optional) Insertion/Extraction Tool
	1. Removable tool to aid in the insertion and extraction of the probe while the line is under pressure.
7. Operational Requirements
8. Vortex Flow Meter
9. Flow Sensor
10. Stainless steel, machined vortex element in a stainless steel probe with a safety stop and without gaskets.
11. The system shall operate with pipe size ranges 2 to 48'' [5 to 120 cm].
12. Tap size shall be 1 1/2'' NPT or ANSI 150# flange over a 1 1/2” opening.
13. Sensor can be installed in horizontal or vertical piping
14. Sensor material shall be constructed from 304L stainless steel.
15. Sensor shall have a continuous operating temperature of -250° to 400°F [-120° to 204°C].
16. Maximum pressure ratings shall be 1000 psi (68.9 bar).

NOTE TO SPECIFIER: Select either volumetric flow, mass flow with temperature compensation or BTU/energy section respectively.

1. Volumetric flow detection technology: Dual piezo-electric sensors in the vortex element.
2. Mass flow detection: Dual piezo-electric sensors and RTD in the vortex element.
3. BTU/energy flow detection: Dual piezo-electric sensors and RTD in the vortex element. Secondary external direct insertion RTD.
4. Transmitter Electronics
5. Operating temperature shall be 32° to 140° F [0° to 60° C] for electronics.
6. Outputs:

NOTE TO SPECIFIER: Select either 4-20mA/pulse or Modbus RTU section respectively.

* 1. 4-20 mA/Pulse
1. Pulse output: maximum output frequency 12.5 Hz, 5-24V DC, negative or positive going pulse, pulse width from 40-120 ms.
2. Analog 4-20mA: 10-36V DC maximum load.
3. Modbus RTU
4. EIA-485 port at 9600 baud.

 NOTE TO SPECIFIER: Select power section based on either 4-20mA/pulse or Modbus RTU output selection.

1. Powering
	1. For Modbus RTU, the meter is available with a 14…36 VDC power input.
	2. For analog output, the meter is available with a two-wire loop powered 4-20 mA output.
2. Control and Programming
	1. All electronic transmitters are programmed through the display and four membrane button interface.
	2. All information is stored in non-volatile memory in the flow meter.
3. Mounting
	1. Electronic transmitter can be mounted locally on the sensor or remotely.
	2. Remotely mounted electronic transmitter can be mounted in any orientation.
4. Indication
	1. Display type shall be local LCD on transmitter.
	2. Display shall be a 2x16 character, monochrome LCD.
	3. Display shall be rotatable within the transmitter enclosure.
5. Sensor Performance
6. Measuring range shall be 1.32 to 32 FPS [.402 to 9 MPS] for liquids.
7. Measuring range shall be cube root of 140/density ft/s to 300 ft/sec (91 m/sec)
8. Accuracy shall be ±1% of range.
9. Repeatability shall be 0.25%.
10. Related Equipment
11. Tools
12. (Optional) Insertion/Extraction Tool
13. Tool to aid in inserting and extracting the meter probe shall be removable from the meter.
14. Spare Parts
15. O-ring kit

PART 3 - EXECUTION

* 1. INSTALLATION
1. Follow manufacturer’s recommendation for installation and conform to the guidelines provided by the Installation & Operation Manual.
2. All VN2000 hot tap insertion sensors are mounted on the pipe with a user supplied 1 1/2” tap over 1 1/2” opening.
3. Straight pipe requirement shall be 10 diameters upstream and 5 downstream. Pipe bends, valves, other fittings, pipe enlargements and reductions should not be present in this length of pipe.
4. The sensor shall be vertically upright in horizontal installations, not more than 85° from top dead center; any circumferential orientation in vertical installations is acceptable.
5. Insertion depth must conform to the recommended position for accurate measurement.
6. Hot tap versions shall be installed in piping configurations that are in service or under pressure. Sensor is mounted in the pipe under pressure by attaching the sensor to the isolation valve connected to the pipe and the sensor probe is extended into the pipeline to measure flow.
	1. MANUFACTURER’S WARRANTY
7. Terms
8. The manufacturer of the above specified equipment shall guarantee for twelve (12) months from date of installation; or one (1) year and six (6) months after the data of shipment that the equipment shall be free from defects in design, workmanship or materials.

END OF SECTION