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V-CONE PRIMARY ELEMENT SPECIFICATION FOR STEAM

PREPARED BY:

[ENTER COMPANY AND CONTACT INFORMATION HERE]
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[ENTER CITY, STATE & ZIP]

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PART 1 - GENERAL

1.1 SYSTEM DESCRIPTION

The Contractor shall furnish and install a McCrometer V-Cone brand flow meter, model [ENTER MODEL], based on the principles of differential pressure flow measurement, or equal for [ENTER METER APPLICATION]. Each V-Cone flowmeter system shall consist of a differential pressure primary flow measuring element, a differential pressure transmitter, and a flow monitor/computer.

Note: Refer to the appropriate McCrometer V-Cone Configuration Sheet for a detailed description of and configuration options for this meter.

A. A complete system shall include a close coupled 3-way valve isolation manifold connected by close nipples attached to the V-Cone primary flow element to isolate the sensing line from the differential pressure transmitter. The isolation manifold shall be a 316 Stainless Steel Block Type. In addition, the system shall include three valve manifold equalizer lines, two block valves, two condensate legs, and two vent and drain valves. No integral pulsation damper will be required.

B. The V-Cone flow meter shall consist of a V-Cone conical type element as manufactured by McCrometer, Inc., positioned in the center of the flow tube to reshape the upstream fluid velocity profile, reducing upstream/downstream piping requirements, allowing greater turndown (rangeability), and creating a region of low pressure downstream of the cone.

C. Primary elements with rotating and/or moving parts, and/or sudden constrictions, are not acceptable.

D. The pressure difference between the static line pressure upstream of the cone and the low pressure area created after the cone shall be measured via two (2) pressure taps that will resist plugging. Low pressure will be sensed through the cone in the center of the line. The pressure taps shall be positioned upstream of the cone element, and spaced an appropriate distance apart to properly ensure orderly connection with the 3-way valve isolation manifold via pressure sensing tubing.

E. The flow tube shall be rotated around the x-axis during installation so that the pressure sensing ports will resist air entrapment and sediment build-up. At zero flow conditions the static pressure of the high and low pressure ports will be equal.

1.2 DESIGN REQUIREMENTS

Primary Flow Element: The primary flow element shall be designed to re-profile and flatten the fluid velocity profile from any turbulent flows, minimize permanent head loss, reduce upstream and downstream straight meter run requirements, and minimize wear of the conical element.

- A. The nominal size of the meter shall be [ENTER LINE SIZE] inches.
- B. The piping system shall have a minimum straight run of pipe upstream of the meter of zero to two (0-2) diameters, and a minimum straight run of pipe downstream of the meter of one to five (1-5) pipe diameters.
- C. The primary flow element shall be manufactured by McCrometer, Inc.
- D. The primary flow element shall be essentially "maintenance free" and corrosion resistant so that no primary element no recalibration over the life of the meter is required.
- E. The permanent pressure (head) loss shall be kept at a minimum in relation to the maximum differential created for a given flow rate. Maximum acceptable head loss is [ENTER MAXIMUM HEADLOSS] psi.
- F. Primary flow element accuracy shall be up to +/- 0.5 % of actual flow rate (of reading).
- G. Primary flow element repeatability shall be +/- 0.1% for all calibrated units.
- H. The flow meter system shall have a typical turndown 10:1 with a single DP transmitter and up to 50:1 with multiple DP transmitters in series including a calibration curve fit. The turndown for this application shall be [ENTER TURNDOWN] to 1.

Application Parameters:

- A. Fluid Type: Steam.
- B. Temperature (Flowing) Range: minimum - [ENTER MINIMUM TEMPERATURE], typical - [ENTER TYPICAL TEMPERATURE], and maximum - [ENTER MAXIMUM TEMPERATURE] degrees F.
- C. Static Line Pressure Range: minimum - [ENTER MINIMUM PRESSURE], typical - [ENTER AVERAGE PRESSURE], and maximum - [ENTER MAXIMUM PRESSURE] [ENTER PRESSURE UNITS OF MEASURE].
- D. Flow Rates: minimum - [ENTER MINIMUM FLOW RATE], typical - [ENTER AVERAGE FLOW RATE], and maximum - [ENTER MAXIMUM FLOW RATE] [ENTER FLOW RATE UNITS OF MEASURE].
- E. Flowing Viscosity at Average Temperature and Pressure: [ENTER VISCOSITY] centiPoise.
- F. Flowing Density at Average Temperature and Pressure: [ENTER DENSITY] pounds per cubic foot.
- G. Steam Quality at Average Temperature and Pressure: [ENTER STEAM QUALITY]%.

Secondary Element - Differential Pressure Transmitter: The transmitter shall sense the pressure difference generated by the primary element and generate a signal directly related to the rate of flow. The transmitter shall provide either a linear output or a square root output according to the purchaser's specifications. Differential pressure ranges, and units of measure, are determined by the end user per the transmitter manufacturer's options.

Tertiary Element - Flow Monitor/Computer: The flow monitor or computer shall provide rate of flow and totalization data from the fluid flowing through the primary element. It may also provide temperature and/or pressure inputs. This information is based on the 4-20 mA signal generated from the transmitter. Flow monitors/computers shall have high/low alarms, and at least 6 digit capacity rate of flow indication. Output shall be available for connection with a SCADA system, chart recorder, or other local instrumentation.

Secondary and tertiary elements are selected at the sole discretion of the customer or end user.

1.3 SUBMITTALS

Submittals shall be as follows:

- A. General Drawings in accordance with any General Provisions.
- B. McCrometer V-Cone Configuration Sheet, or equivalent, which consists of manufacturer's data and descriptive literature for the equipment, including Materials of Construction by ASTM reference and grade, coating(s) specifications, and dimensional drawings.
- C. McCrometer Certified Test Record, if applicable, or and approved flow calibration laboratory NIST traceable certified test report for each flowmeter.
- D. McCrometer V-Cone Sizing Sheet, or equivalent, which includes critical dimensional characteristics of the meter, key fluid parameters, and the maximum and minimum flow rates (and corresponding differential pressure produced by the meter) of the application.
- E. McCrometer V-Cone Installation and Operation Manual or equivalent.
- F. McCrometer Warranty Statement or equivalent.

PART 2 - PRODUCT CONFIGURATION

2.1 METER BODY

- A. The meter shall be either a precision meter tube style to top plate style. The precision tube style meter shall be comprised of a cylindrical section, containing a high pressure tap, and include a conical shaped primary flow element incorporating the low pressure tap. The top plate style meter shall be comprised of a top plate on which a conical shaped primary flow element is positioned and shall incorporate both the high pressure and low pressure taps.
- B. Where specified, the meter body, cone element, and pressure taps shall be 304 or 316 stainless steel, epoxy coated carbon steel flow tube with a 304 stainless steel cone, or other material as specified by the end user/engineer/contractor.
- C. End Connections shall be flanged, or otherwise as specified. Flanges shall be as specified, nominally ANSI B16.5, Class 150 or 300, or AWWA "D", etc.

PART 3 - EXECUTION

3.1 CALIBRATION

Where appropriate, the primary flow element shall be tested for accuracy in an NIST traceable flow test facility, capable of +/-0.25% calibration. Documentation of tests shall be provided by the manufacturer. Tests are open for witnessing.

Tests will be performed for:

- A. Accuracy of flow indication at each test point over a range of minimum flow to maximum flow. A minimum of three test points will be selected.
- B. Flow Coefficient over an approximate Reynolds Number range corresponding to the aforementioned minimum and maximum flows.

If the Manufacturer has previously tested identical sizes and models of the primary flow element, under closely similar (or exact) process conditions and/or fluid properties, then copies of such reports may be substituted, or used to substantiate performance claims, for the actual tests specified, at the sole discretion of the End User/Engineer/Contractor/Purchaser.

3.2 FLOW COEFFICIENT

The data that determines the flow coefficient shall be generated from equations derived from Bernoulli's Equation. The flow coefficient may be calculated by the factory authorized sizing programs (both paper and computer versions) for the V-Cone primary element. The data used to calculate the coefficient takes into consideration the effect of up and downstream piping configurations, the head loss associated with the aforementioned, and the beta ratio of the conical element within the pipe. The calculations will provide data indicating the independence of the coefficient from the flow rate within the specified rangeability of the primary element. The meter's flow coefficient shall not vary more than +/-0.5 percent throughout the entire specified turndown range.

3.3 INSTALLATION

A. Install in accordance with manufacturer's written instructions and approved submittals.

B. The primary flow element shall be installed with zero (0) to two (2) pipe diameters downstream from tees and elbows in the piping configuration. Additional pipe diameters required for the proper performance of the primary flow element are not acceptable.

C. The primary flow element shall be installed with zero (0) to three (3) pipe diameters downstream from valves and other valve fittings, depending upon the angle of the valve opening and the beta ratio of the flowmeter. Additional pipe diameters required for the proper performance of the primary flow element are not acceptable.