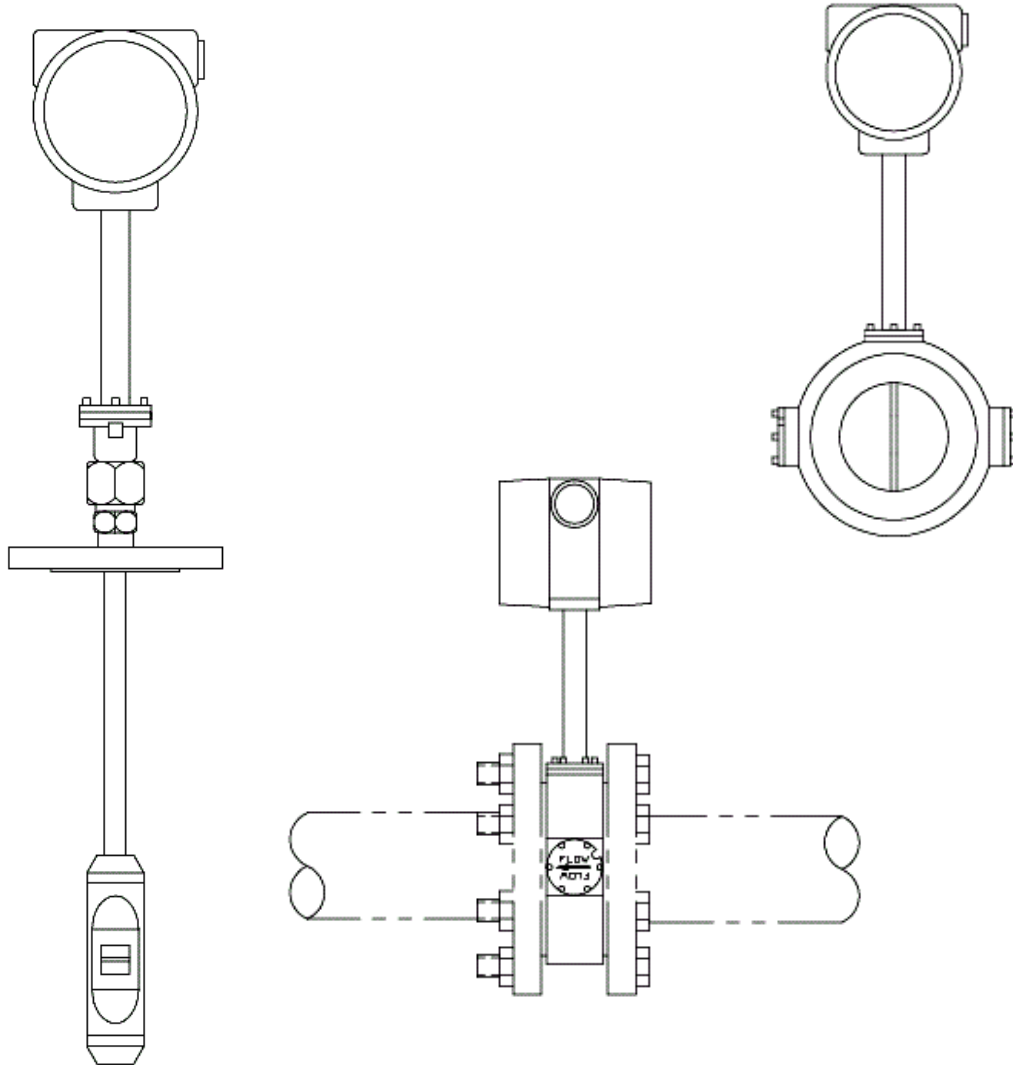


Cadillac[®] Vortex Meter

Central Station Steam Co.[®]

GENERAL INFORMATION



Central Station Steam Co.[®]

CADILLAC[®] METERS

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THE STEAM METER OF CHOICE

The Cadillac® Vortex Meter is a rate, totalizing, and Mass flow meter which is capable of measuring liquid, steam and gas. Due to it's rugged design it is particularly suitable for direct steam measurement. In any steam system, the Cadillac® Vortex Meter is the number one technology choice due to Cadillac®'s accuracy, linearity, reliability and rangeability.

Like many other flow meters, the Cadillac® Vortex Meter is a velocity measuring device which computes flow by multiplying the effective cross sectional area of the flow meter with the detected fluid velocity. The meter has no moving parts and consists of a small vortex strut, embedded transmitting and receiving ultrasonic transducers, and amplifier assembly. It detects velocity by measuring the frequency of the vortices, as they peel off the vortex strut of the flowmeter. The frequency of these "Karman" vortices is directly proportional to the velocity of the moving fluid, whether this is a gas or liquid.

THE NEW INDUSTRY STANDARD

Since the late 1970's, the Vortex direct steam flow meters have been acknowledged as the industry standard. Customers choose the Cadillac® Vortex Meter because of proven:

- **ACCURACY, DEPENDABILITY, CONSISTENCY, LOW MAINTENANCE, RANGEABILITY.**

APPLICATIONS

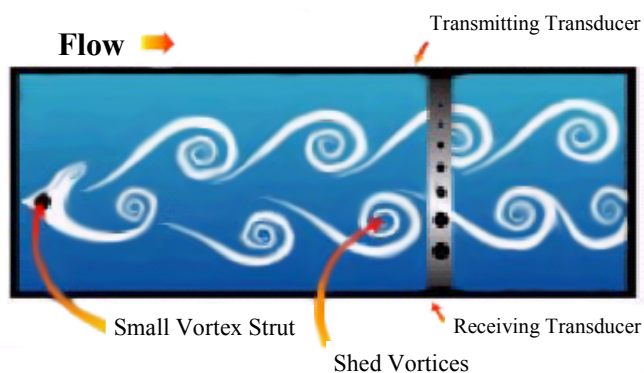
- Data Source for energy management system, DCS, district-wide systems.
- Energy-Customer Billing from accurately totalized flow measurements.
- Basis for internal cost distribution using campus-wide systems.
- Process monitoring from central control rooms.
- Direct Steam measurements at both Boiler and point of use locations.
- Natural Gas measurements for Boiler fuel flow.

FEATURES

- **ACCURACY: +/-1.0% of the reading for liquids, gas and steam.**
High accuracy, linear throughout the entire dynamic measuring range. (See Flow Range table on next page)
- **RANGEABILITY: Typically 25 to 1 turndown or better.**
With seasonal steam load variation, the need for a large turndown is essential. Cadillac® Vortex Meters will accurately measure all load requirements with proper sizing.
- **LONGEVITY: Mean time between failure (MTBF) of 50 years.**
With no moving parts and through simple robust design the MTBF of the shedder bar is 50 years. With proper system maintenance Cadillac® Vortex Meters will provide reliable, accurate service beyond all flow technologies.
- **MODERN ELECTRONICS: Meeting the challenges of the next millennium**
Meters are equipped with electronics capable of mass flow computation for varying steam loads/pressure. Electronics will register locally, remotely or interface with an energy management system. Built to withstand the toughest conditions.

PRINCIPLE OF OPERATION

The "Karman" vortex meter principle is clearly illustrated by a flag waving in the wind. As the air passes across the flag pole, vortices peel off and the flag is shaped by these pressure area's. You will notice that, at low wind velocity, the flag will move slowly from side to side. As the wind increases, the flag will start to flutter and ripple, representing the increased frequency and intensity of these flag pole generated vortices as they pass. Wind velocity can thus be determined by measuring the frequency of that flutter.



The small vortex strut of the Cadillac Vortex Meter sheds the vortices, which then pass through an ultrasonic beam, generated by flush mounted transducers (see illustration), where they are detected and counted. The frequency of these vortices is directly proportional to the fluid velocity and exact volumetric flow rate is computed knowing the internal cross sectional area. Each vortex meter is tested to determine the relationship between velocity/flow rate and vortex

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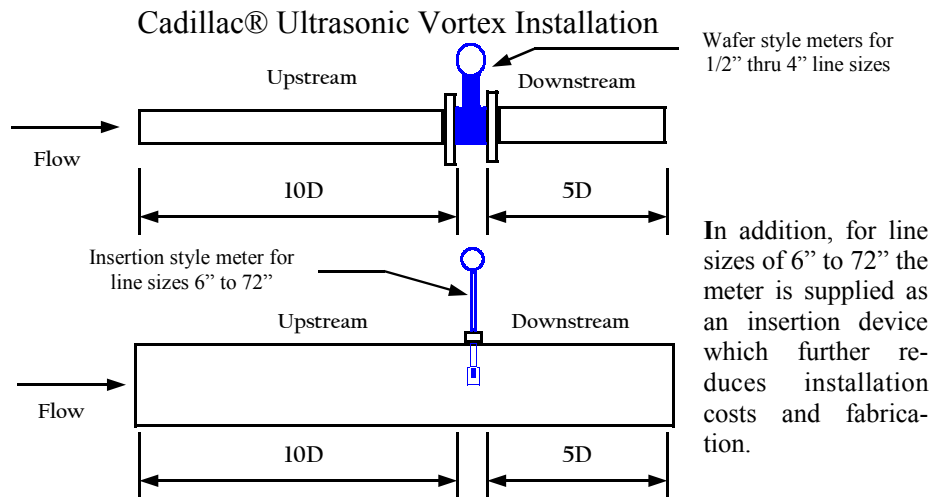
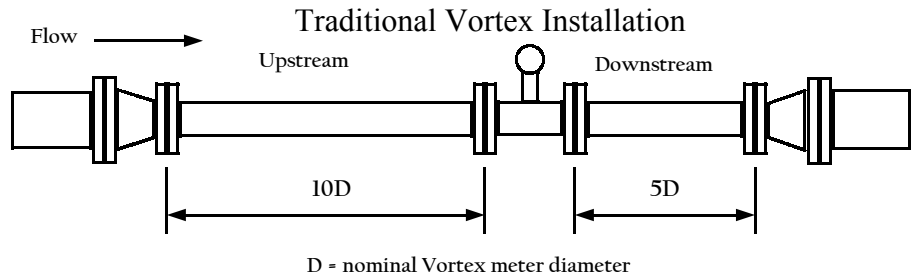
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frequency, which results in a meter K-factor expressed in “Pulses/Gallon”. This volumetric relationship is then converted to relative engineering units, which the flow meter converter can then retransmit via a 4-20 mADC current signal or conditioned pulse. An optional LCD Indicator/Totalizer can display and totalize in engineering units of the users choice. For compressible mediums, such as steam or gases, the meter amplifier can correct for temperature (internally mounted in strut) and pressure to provide a compensated or mass flow output(s) and display.

METER INSTALLATION

To ensure optimum performance and operation, Vortex meters should be sized to operate near or at the higher end of the operating range. This is due to the finite low end ability of the meter to generate and measure vortices. This is typically referred to as low flow cutoff. With other technologies on the market this low flow cutoff value is relatively high, thus requiring piping reductions as illustrated to bring the meter within a reasonable range for operation. In a typical steam heating system this is typically 1-2 pipe diameters.

However, with the Cadillac® Ultrasonic Vortex technology, sensitivity is dramatically increased, which results in a significant reduction in low flow cutoff values. Resulting in line size meters and the cost savings of not having to manufacture reducing spool pieces.

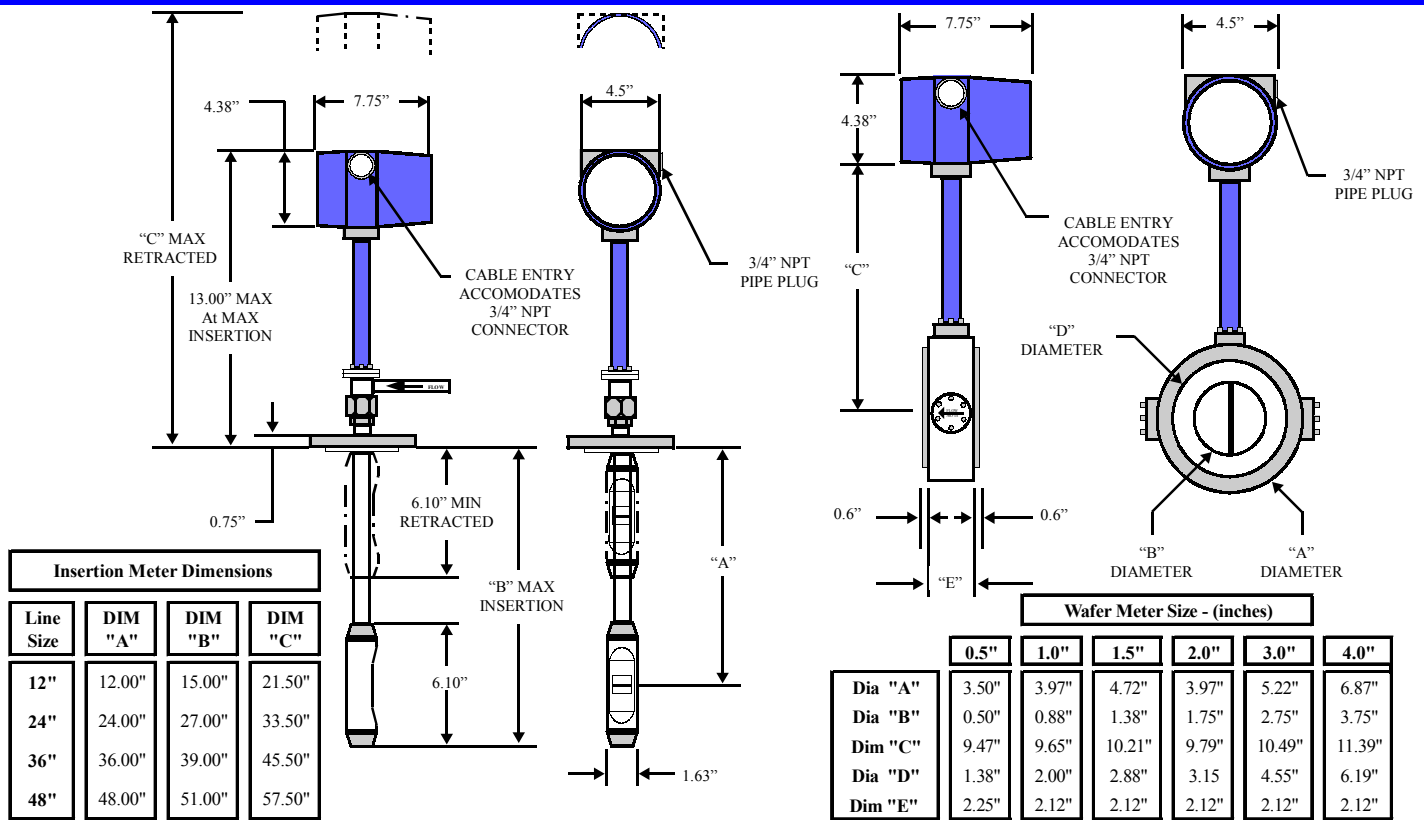


METER SIZING INFORMATION

The low-end performance of the meter is a function of the fluid’s ability to generate a vortex, which using ultrasonic technology is at the very threshold of when vortices for a given fluid are shed. This threshold is dependent on fluid velocity, density and Reynolds number. The high end of the flow meter is amplitude limited, which ultimately impacts the electronics ability to distinguish one vortex from another. In most cases, this represents 125 ft/sec for gases and 20 ft/sec for liquids. To guarantee satisfactory performance, we will check every vortex meter application for suitability and will require process medium, pressure, temperature and expected minimum and maximum flow rates. For easy reference, we are providing you with a table (see below) for saturated steam at various pressures. The tables list the minimum and maximum flow capability, between which a flow measurement can be made at stated accuracy. Outside those limits, the accuracy will deteriorate somewhat, the extent of which will depend on the quality of the installation.

Saturated Steam Flow Range Table. (Steam Flow in lbs/hr)

Pipe/Meter Size	25 PSIG	50 PSIG	75 PSIG	100 PSIG	150 PSIG	200 PSIG	250 PSIG
0.5"	2-57	4-90	5-122	6-154	9-217	11-281	14-344
1.0"	7-199	11-315	15-428	19-540	27-762	35-983	43-1204
1.5"	14-568	22-899	31-1222	39-1542	54-2176	70-2808	86-3441
2.0"	28-908	45-1438	61-1955	77-2467	109-3482	140-4492	172-5506
3.0"	57-1816	90-2876	122-3910	154-4934	218-6964	281-8985	344-11013
4.0"	113-2723	180-4314	244-5865	308-7400	435-10446	562-13477	688-16519
6.0"	309-8355	489-16765	665-25190	839-31785	1184-44870	1527-57889	1872-70952
8.0"	549-14853	869-29805	1181-44782	1491-56507	2104-79768	2715-102913	3328-126138
10"	857-23208	1358-46571	1846-69973	2329-88292	3288-124638	4242-160802	5199-197090
12"	1234-33419	1955-67062	2658-100760	3354-127140	4735-179478	6109-231554	7487-283809



CADILLAC® VORTEX METER GENERAL SPECIFICATIONS

- Meter will consist of an in-line or insertion type flow meter assembly with remote or integral electronics.
- Meter available with local or remote indication or blind housings.
- Meter available with pulsed DC or analog (4-20 mADC) outputs.
- Instantaneous and totalized flow available at local indicator or remotely through outputs.
- Meter measures flow using the Karman vortex shedding principle.
- Vortices shall be detected with an ultrasonic receiver.
- Meter electronics shall be capable of direct mass flow computation for saturated steam without external inputs.
- Input power shall be 15-48 VDC, analog output shall be 4-20 mADC, 2-Wire HART Protocol.
- Operating pressure/temperature of meter shall be (-5 to 250 psig)/(-40° to 400°F)

CADILLAC® VORTEX METER MODEL NUMBER STRUCTURE

CV	Cadillac Vortex Flowmeter
A	Size 0.5"
B	Size 1"
C	Size 1.5"
D	Size 2"
E	Size 3"
F	Size 4"
G	Size 6"
H	Size 8"
I	Size 10"
J	Size 12" *
S	Standard Electronics
M	Smart Mass Electronics and Integral RTD
II	Integral Converter with Indicator/Totalizer
IN	Integral Converter - Blind
RC	Remote Converter
W	Wafer Style (1/2" to 4")
I	Insertion Style (6" to 72") *
150	ANSI Class 150
300	ANSI Class 300
FM	FM Approvals

CVC	Cadillac Vortex Converter
R	Remote Mounting
I	Indicator/Totalizer
N	Blind
U	Universal Mounting Bracket
XXFT	Interconnecting Cable 10/25/50ft**
FM	FM Approvals

* For line sizes greater than 12" please contact Factory for pricing.
 ** Maximum cable length between electronics and flow tube is 50 feet.

MASS FLOW COMPENSATION FOR GASES AND SUPERHEATED STEAM

For compressible fluids, such as gases or super heated steam, an external pressure input (4-20 mADC) into the meter electronics is required to provide mass flow computation. Mass Flow computation available for all gases except Helium and Hydrogen. **Central Station Steam Company** also offers a complete line of Pressure elements.