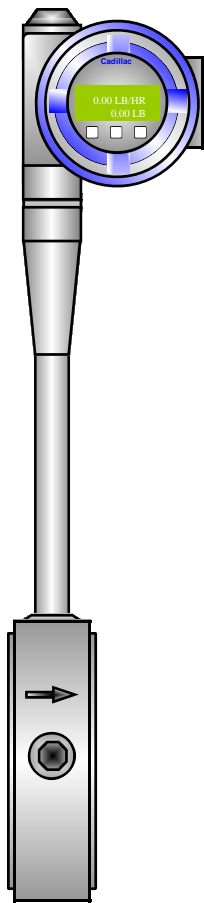


Cadillac[®] HS Vortex Meter

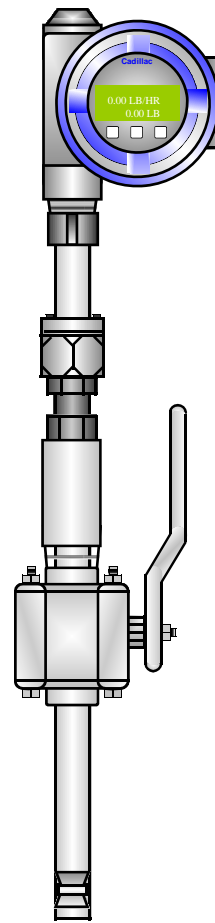
Central Station Steam Co.[®]

GENERAL INFORMATION

Wafer Design



Insertion Design



Central Station Steam Co.[®]

CADILLAC[®] METERS

15615 SW 74th Ave., Ste #150 Phone: 888-556-3913

Tigard, OR 97224

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www.cadillacmeter.com

THE STEAM METER OF CHOICE

The Cadillac® Vortex Meter is a rate and totalizing meter which is capable of measuring liquid, steam and gas. Due to its 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 meter & bluff body (shedder bar) and amplifier assembly. It detects velocity by measuring the frequency of the vortices, as they peel off the shedder bar 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

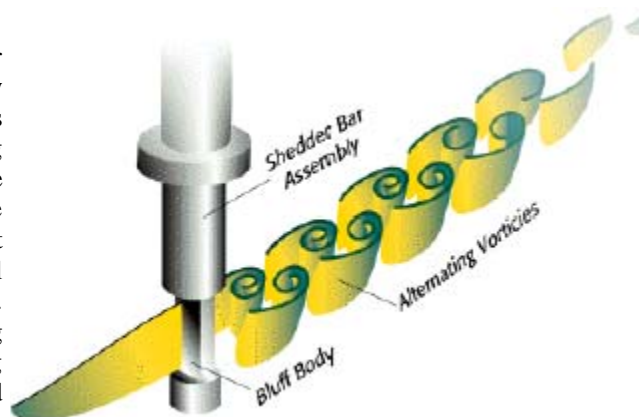
- Data Source for energy management system, DCS, district-wide systems.
- Energy-Customer Billing from accurately totalized flow measurements.
- Basis for internal cost distribution using campus-wide systems.
- Process monitoring from central control rooms.
- Direct Steam measurements at both Boiler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

FEATURES

- **ACCURACY:** +/-1.0% of the reading for liquids, gas, and steam.
- **RANGEABILITY.:** Typically 15 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 information highway
Meters are equipped with electronics capable of registering locally, remotely or interfacing 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 areas. 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, representing the increased frequency and intensity of these flag pole generated vortices as they pass



by. Wind velocity can thus be determined by measuring the frequency of that flutter.

The flow body of the Cadillac® Vortex Meter is machined from a solid piece of metal. Piezoelectric elements are placed against the side walls of the meter body and detect the vortices impacting the wall, thereby producing voltage spikes at the same frequency as the vortices being shed. By detecting and counting the frequency of these spikes, we can establish fluid velocity. Each vortex meter is tested to determine the relationship between velocity/flow rate and

(Continued on page 3)

(Continued from page 2)

vortex frequency, which results in a meter K-factor expressed in "Pulses/Gallon". This volumetric relationship can then be converted to other engineering units and the flow meter converter can then retransmit this information with a 4-20 mA current signal. An optional LCD Indicator/Totalizer can display and totalize in whatever engineering units you prefer. For compressible fluids such as gases or steam if the pressure and temperature are steady no other inputs are required to measure flow accurately. However, if pressure and temperature fluctuate both parameters must be measured externally and then all three inputs (Flow, Temperature, and Pressure) terminated into a flow computer, which is programmed with the Ideal gases and Steam table information to compensate and adjust for a MASS flow output.

METER INSTALLATION

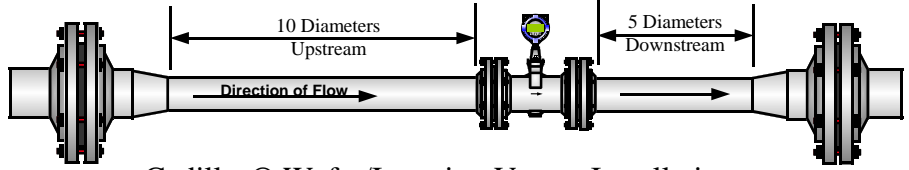
To ensure optimum performance and operation, Vortex meters should be sized to operate near or at the higher end of the operating range. This is due to the finite low end ability of the meter to generate and measure vortices. This is typically referred to as low flow cutoff. With other technologies on 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® Insertion/Wafer Vortex technology, sensitivity is dramatically increased by placing the sensors integral for the flow body, which results in a significant reduction in low flow cutoff values. Resulting in full or existing line size meters and the cost savings of not having to manufacture and install reducing spool pieces.

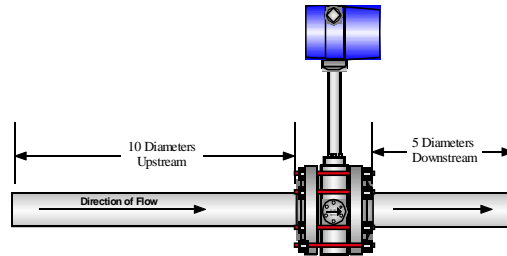
METER SIZING INFORMATION

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 250 ft/sec for gases and 25 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.

Typical Vortex Installation for highest turndown

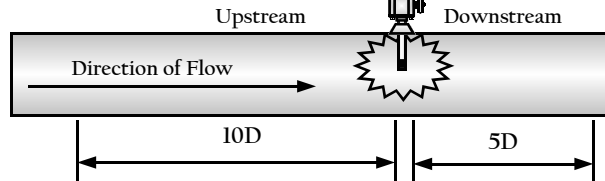


Cadillac® Wafer/Insertion Vortex Installation



Wafer style meters for 3/4" thru 6" line sizes

Insertion style meter for line sizes ranging from 2" to 48"

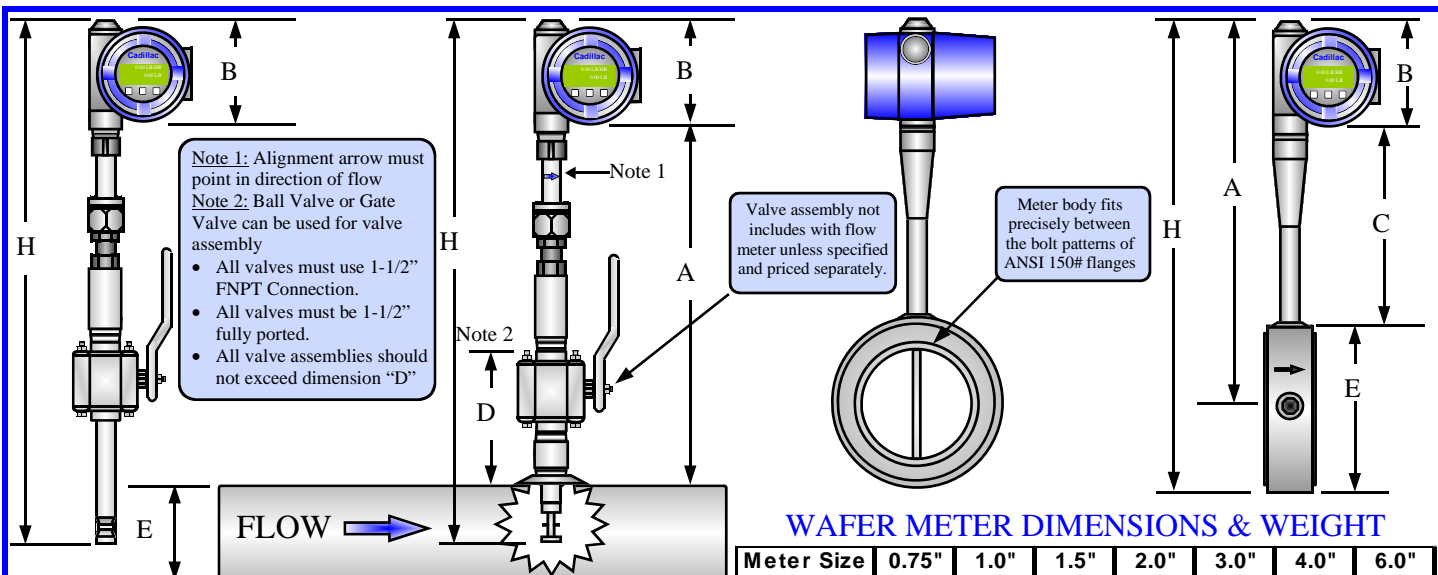


In addition, for line sizes of 2" to 48" the meter may be supplied as an insertion device which further reduces installation costs and fabrication.

D = nominal Vortex meter diameter

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

Meter Size	5 PSIG	10 PSIG	20 PSIG	50 PSIG	100 PSIG	150 PSIG
0.75"	8-132	11-204	14-280	16-410	23-702	29-980
1"	14-220	18-331	22-454	27-676	38-1158	48-1620
1.5"	31-537	42-780	51-1070	65-1616	92-2850	110-4000
2"	55-901	68-1287	84-1763	115-2775	170-4760	215-6670
3"	120-2005	150-2834	185-3884	255-6210	385-10650	480-15000
4"	215-3500	260-4881	320-6688	455-11000	670-18550	830-26000
6"	498-7920	588-11077	725-15179	1050-24500	1500-42000	1900-58900
8"	850-15200	1017-19181	1255-26280	1800-47000	2600-81000	3300-115000
10"	1372-23940	1603-30234	1980-41430	2915-74080	4175-126990	5235-178110
12"	1900-34000	2275-42915	2810-58805	4050-106000	5900-180000	7400-253000



WAFER METER DIMENSIONS & WEIGHT

Meter Size	0.75"	1.0"	1.5"	2.0"	3.0"	4.0"	6.0"
"W"	0.75"	0.75"	0.75"	0.75"	1.25"	1.50"	2.00"
"H"	12.75"	13.13"	14.00"	14.75"	16.00"	17.50"	19.50"
"E"	2.25"	2.63"	3.50"	4.25"	5.50"	7.00"	9.00"
"C"	5.50"	5.50"	5.50"	5.50"	5.50"	5.50"	5.50"
"B"	5.00"	5.00"	5.00"	5.00"	5.00"	5.00"	5.00"
"A"	11.63"	11.82"	12.25"	12.63"	13.25"	14.00"	15.00"
Weight	5 lbs	5 lbs	6 lbs	7 lbs	11 lbs	16 lbs	26 lbs

HT INSERTION METER DIMENSIONS & WEIGHT

"A"	27.75	26.75	25.75	24.75	23.75	22.75	21.75	20.75	19.75	18.75
"B"	7	7	7	7	7	7	7	7	7	7
"D"	10	10	10	10	10	10	10	10	10	10
"H"	36	36	36	36	36	36	36	36	36	36
"E"	2	4	6	8	10	12	14	16	18	20-24
Weight (Lbs)	25	25	25	25	25	25	25	25	25	25

Note: All dimensions are in inches

CADILLAC® VORTEX METER GENERAL SPECIFICATIONS

- Meter will consist of a Wafer style in-line or insertion type flow meter assembly with integral shedder bar.
- Meter available with local or remote indication or blind housings.
- Meter will provide analog (4-20 mADC) output.
- Instantaneous and totalized flow available at local indicator. Instantaneous flow available remotely through output.
- Meter measures flow using the Karman vortex shedding principle.
- Vortices shall be detected by piezoelectric crystals.
- Meter electronics shall be capable of direct MASS flow computation for saturated steam without external inputs.
- Input power shall be 14-36 VDC, analog output shall be 4-20 mADC, 2-Wire.
- Operating pressure/temperature of meter shall be (Vacuum to 900 psig)/(-40° to 650°F)

CADILLAC® VORTEX METER MODEL NUMBER STRUCTURE

CV	Cadillac Vortex Flow Meter
HS	High Sensitivity Wafer/Insertion
A	Size 0.75"
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"
K	Size 14"
L	Size 16"
N	Size 18" (For larger sizes please call factory)
S	Standard Electronics
M	Mass Electronics with integral RTD
II	Integral Converter with Indicator/Totalizer
IN	Integral Converter - Blind
RC	Remote Converter
W	Wafer Style Body (3/4" thru 4" only)
I	Insertion Style (2" to 48")
HT	Hot Tap Insertion Style (2" to 48")
150	ANSI Class 150 (Wafer style body only)
300	ANSI Class 300 (Wafer style body only)
900	900 psig testing (Insertion/HT style only)
FM	FM Approvals

CVC	Cadillac Vortex Converter
HS	HS remote electronics
I	Indicator/Totalizer
N	Blind
U	Universal Mounting Bracket
XXFT	Interconnecting Cable
FM	FM Approvals

** Maximum cable length between electronics and flow tube is 300 feet.

MASS COMPENSATION OPTION

For compressible fluids, such as gases or superheated steam, an external pressure compensation input will be required for the MASS electronics. Internally programmed Ideal Gas and Steam lookup tables will be referenced for online MASS computations. Integral RTD in shedder bar and lookup tables are provided through the MASS option. Terminations for pressure sensor are available for compressible fluids in electronics housing. For saturated steam no external inputs are required.