

# Vortex Flowmeter WBZ 08



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Reliability in gas supply-  
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# Vortex Flowmeter

## WBZ 08

### The Principle

A bluff body in a fluid stream sheds downstream vortices. This "vortex street" was discovered by Kármán as early as in 1878.

Vortex shedding in a fluid following around a body is periodic. The frequency at which the vortices are shed is, in certain range, proportional to the fluid velocity. Accounting for the cross-sectional area of the conduit, the number of vortices is a very exact measure of the flow rate and the volume passed through the meter.

Vortex frequency is a function of the fluid velocity, the geometry of the bluff body and the ratio between the bluff body size and the diameter of the conduit. The geometric data determine a meter factor (pulse/volume) which is independent of pressure and temperature, density and viscosity.

The vortices produced by the bluff body in the meter are the cause of velocity and pressure oscillations. These oscillations are picked up by a thermistor sensor whose resistance varies in response to the pressure oscillations.

The measurement is duplicated for high accuracy for custody transfer metering.

### The Applications

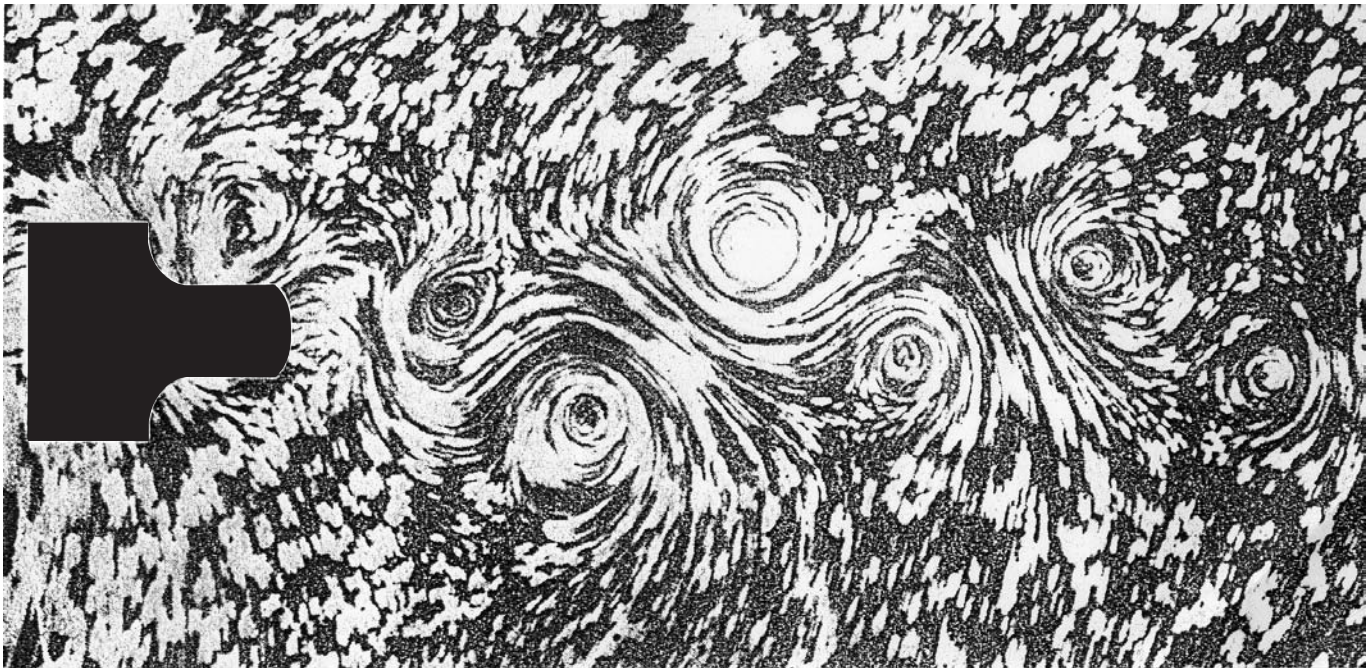
Vortex flow meters are used for fluid resp. gas flow measurement. Gas flow at reference conditions is calculated from flow at operating conditions pressure and temperature or flow at operating conditions and density data.

The vortex meter consists of a meter body, a bluff body and a meter head with thermistor sensors and an amplifier.

The accuracy of the vortex meter is dependent on the length and the condition of the meter run. Upstream flow disturbances such as swirl or an asymmetric velocity profile are eliminated by a flow straightener.

The thermistor sensors are accommodated in meter head tubings above the bluff body protecting them against direct exposure to flow and the accumulation of condensate. This arrangement also allows an inspection of the sensors without taking the meters out of service.

The arrangement creates ideal conditions for signal generation. A downstream amplifier stabilizes the signals which can be processed by RMG model series ERZ 9000 and ERZ 2200 flow computers or the CS 900 counter system.



Kármán Vortex Street

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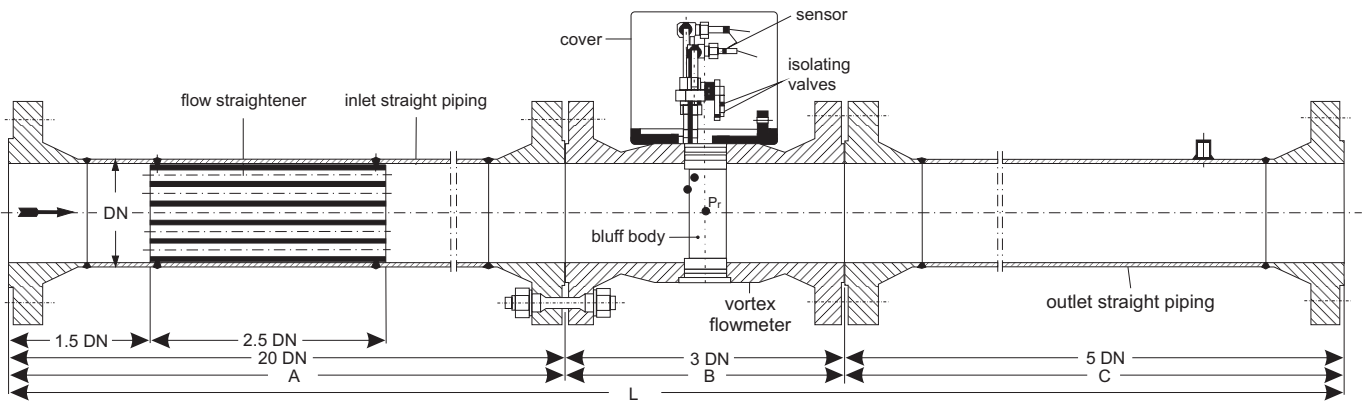
## Properties

- wide range
- high accuracy
- insensibility to high loads
- no influence of meter position
- insensibility to vibrations
- high reproducibility
- twin signal generation
- maintenance without taking meter out of service
- insensibility to dirt
- explosionproofed

## Technical Data

- DN 40 to DN 600
- PN 10 to PN 100 / PN 160 / PN 250
- ANSI 150 to ANSI 600 / ANSI 900 / ANSI 1500
- range for custody transfer metering
  - calibration at atmospheric pressure 1 : 10/20
  - calibration at high pressure 1 : 50
- linearity ± 0,5 %
- reproducibility ± 0,1 %
- accuracy ± 0,5 %
- standard design for natural gas and all non-corrosive gases (other gases upon request)

## Dimensions (meter run for custody transfer metering)



DN	A	B	C*	L*	C**	L**
40 1 1/2"	800	120	630	1550	—	—
50 2"	1000	150	800	1950	1250	2400
80 3"	1600	240	560	2400	1350	3190
100 4"	2000	300	600	2900	1450	3750
150 6"	3000	450	750	4200	1200	4650
200 8"	4000	600	1000	5600	1400	6000
250 10"	5000	750	1250	7000	1550	7300
300 12"	6000	900	1500	8400	1700	8600
400 16"	8000	1200	2000	11200	2000	11200
500 20"	10000	1500	2500	14000	2500	14000
600 24"	12000	1800	3000	16800	3000	16800

A = length of upstream straight piping  
 B = length of meter  
 C = length of downstream straight piping  
 L = length of meter run

\*) Two pockets for densitometer and drier or G 3/4 taps for PT 100 resistance thermometer (taps spaced at 230 mm)  
 \*\*) Four densitometer and drier pockets or more than 5 taps



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### Diameters and Ranges

DN mm / inch	size	range (for custody transfer) [m <sup>3</sup> /h]			meter factor K (pulses/m <sup>3</sup> )	max. frequency f <sub>max</sub> (Hz) (for q <sub>flmax</sub> )
		q <sub>nmin</sub>	q <sub>flmin</sub>	q <sub>flmax</sub>		
40 1½"	G 40 G 65	40	3/ 5/ 10 3/ 5/ 10	65 100	16700	400
50 2"	G 65 G 100	40	5/ 10/ 10 5/ 10/ 10	100 160	8000	365
80 3"	G *250	80	8/ 13/ 20	400	2400	350
100 4"	G 400 G *650	80	20	650 1000	1100	370
150 6"	G 1000 G *1600	130	50	1600 2500	310	220
200 8"	G 1600 G *2500	160	80	2500 4000	140	260
250 10"	G 2500 G *4000	200	130	4000 6500	70	130
300 12"	G 4000 G *6500	320	200	6500 10000	40	110
400 16"	G 6500 G *10000	320	320	10000 16000	20	90
500 20"	G 10000 G *16000	500	500	16000 25000	10	70
600 24"	G 16000 G *25000	800	800	25000 40000	5	60

Physics require the following minimum flow for the vortex meter:

$$q_{flmin} = \frac{q_{nmin} \cdot p_n}{p_{fl}} \quad [\text{m}^3/\text{h}]$$

**To maintain the range for custody transfer, flow should never drop below the minimum flow  $q_{flmin}$  tabulated above.**

The maximum flow range of 1:50 is only feasible for meter sizes marked with an asterisk (\*).

**Pressure loss** of total meter run:

$$\Delta p = 2000 \cdot \rho_{fl} \cdot \frac{Q_{fl}^2}{DN^4}$$

q<sub>fl min</sub> : minimum flow at flowing conditions

q<sub>n min</sub> : minimum flow at normal conditions

p<sub>fl</sub> : minimum operating pressure [bar (absolute)]

f : signal frequency [Hz] (f<sub>max</sub> at q<sub>flmax</sub>)

K : meter factor [pulses/m<sup>3</sup>]

$$q_{fl} = \frac{f}{K} \cdot 3600 \quad [\text{m}^3/\text{h}]$$

Δp : pressure loss (mbar)

DN : nominal size (mm)

ρ<sub>fl</sub> : density at flowing conditions (kg/m<sup>3</sup>)

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