

Description

Vortex flow meter is one kind of velocity type flow meter, it's based on Karman vortex theory and adopts piezoelectric crystal to detect the burble frequency of the fluid caused by flowing through the triangular prism in the pipeline and then measure the flow of fluid. It is widely used in petrol, chemical industry, light industry and power heat supply and so on.

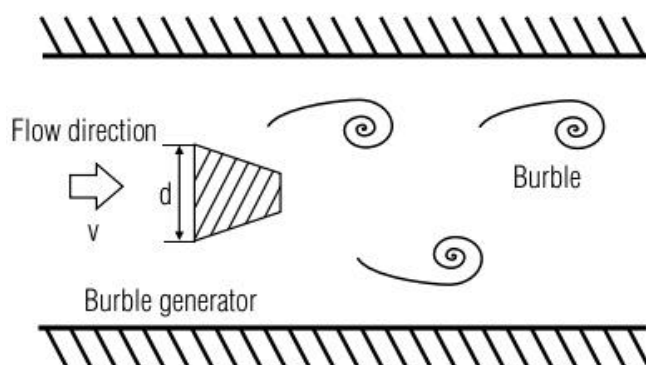
Working Principle

When the fluid in the pipeline passes the burble generator(triangular prism),burble will generate due to the acceleration of partial flow rate. The burble will arise alternatively in two burble lines, which is called Karman vortex.

The releasing frequency of Karman vortex depends on the size of triangle prim and flow rate of fluid, while independent of the medium feature parameter, such as the temperature, pressure, it can be indicated by the following formulas:

$$F=sR*v \ (1-1.27*d/D) \quad Q=3600*F/K \quad M=Q*P$$

- F.....The releasing frequency of Karman vortex (Hz)
- Sr.....Strouhal number (unit: dimensionless)
- V.....Medium flow rate (m/s)
- d.....The width of triangle prim
- D.....Vortex meter inner diameter (m)
- Q.....Instantaneous volume flow rate (m³/h)
- K.....Vortex meter coefficient (unit pulse number/m³)
- M.....Instantaneous quality flow rate (kg/h)
- P.....Fluid density (kg/m³)

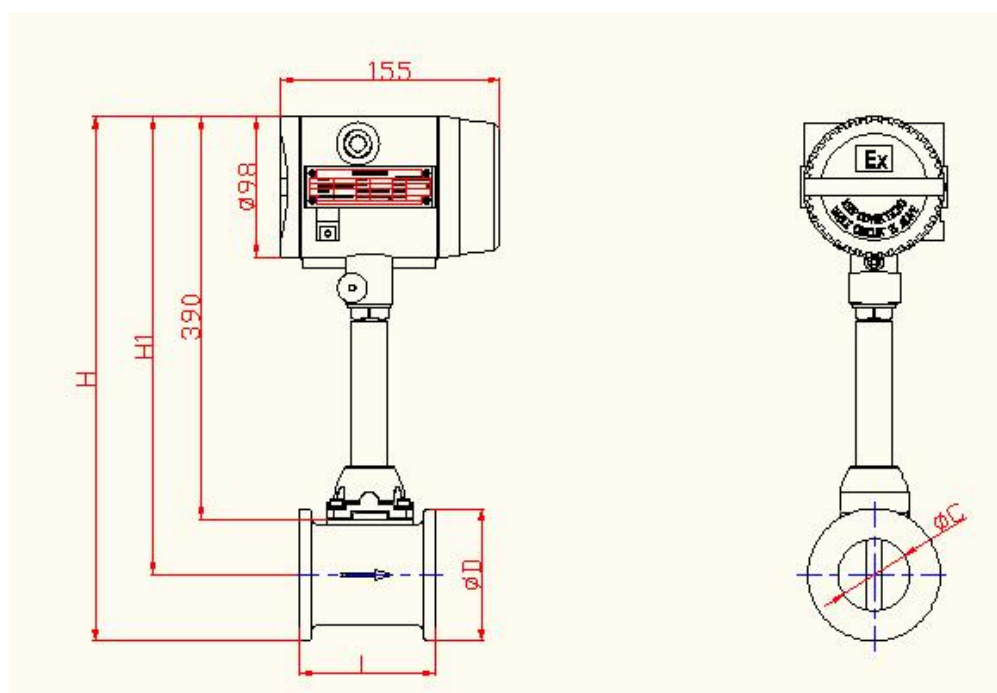


Benefit

- ◆ Integrated pressure and temperature compensation.
- ◆ 4-20mA, pulse with HART; Optional pulse with RS485
- ◆ Wide temperature range up to highest temperature 350℃
- ◆ Adopt Japan OVAL technology and design
- ◆ Embedded sensor, 4 piezo-electric crystal encapsulated inside the sensor.
- ◆ No moving parts, no abrasion, non-wearing parts inside, fully welded SS304 body (Optional SS316)

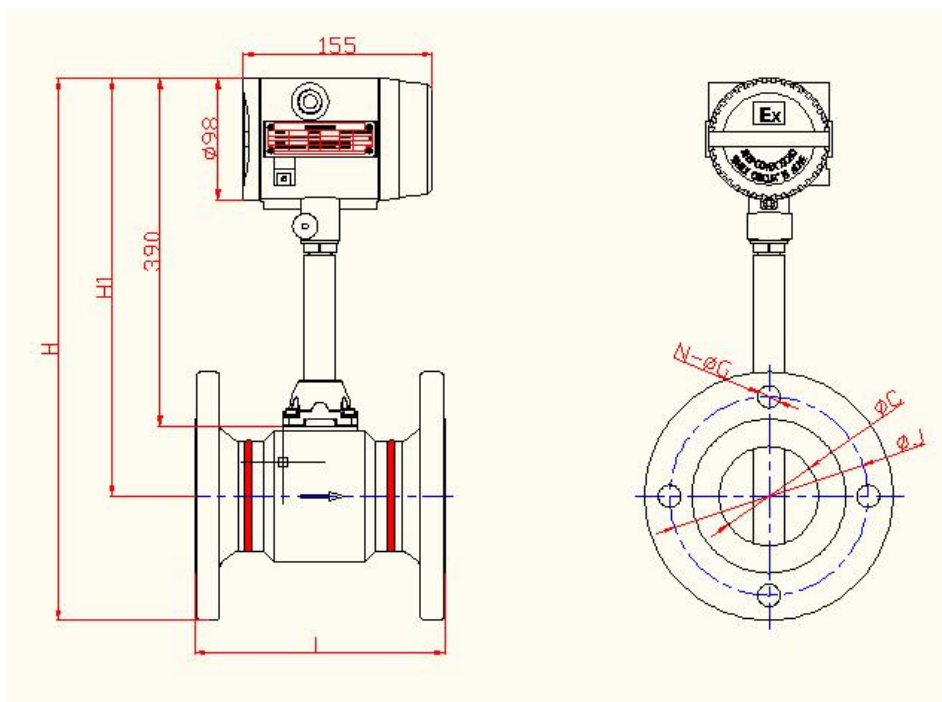
Standard Specification

- | | | | |
|--------------------|--------------------------------------|----------------------------|--|
| • Size | : DN15-DN300mm | • Relative Humidity | : ≤85% |
| • Accuracy | : ± 1.5%(standard), ± 1.0%(optional) | • Explosion-proof | : Exia IIC T6 Gb |
| • Power Supply | : 12VDC, 24VDC | • Ambient Temperature | : -40℃~55℃ (Non Ex-proof Place)
-20℃~55℃ (Non Ex-proof Place) |
| • Communication | : RS485/Modbus, Hart, Profitbus | • Nominal Pressure | : 1.6 MPa, 2.5 MPa, 4.0 MPa |
| • Flange Standard | : EN1092-1 | • Protection Grade | : IP65 |
| | PN10,PN16,PN25,PN40 | • Velocity | : 0.4~7.0 m/s liquid
4.0~60 m/s gas
5.0~70 m/s steam |
| | ANSI BS16.5 Class 150,300,600 | • Body Material | : SS304(Standard),SS316(Optional) |
| | JIS2220 10K,20K,40 | • Resistance Coefficient | : Cd ≤2.6 |
| | AS2129 Table D,Table E | • Oscillatory Acceleration | : ≤0.2g |
| | AS4087 PN16,PN21,PN35 | • Reynolds Number | : 2x10 ⁴ ~7x10 ⁶ |
| • Straight Pipe | : Inlet Path ≥ 12D,Outlet Path ≥ 5D | | |
| • Signal Output | : 4~20 mA,pulse | | |
| • Frequency Output | : 2~3000 Hz | | |



Wafer type

Pipe size	H1	H	L	D	C
15	431	448	70	35.1	15
220	431	452	70	43	20
25	431	456	70	50.8	25
32	431	463	70	64	32
40	428	464	70	73	40
50	431	477	75	92	50
65	440	492	75	105	65
80	448	511	100	127	80
100	459	537	120	157.2	100
125	471	564	103	186	125
150	484	592	120	216	150
200	504	624	98	240	200
250	535	684	114	298	250
300	560	734	130	348	300



Flange type

Pipe size	L	H1	China GB 1.6MPa			ANSI 150RF			ANSI 300RF			C
			H	J	N- ϕG	H	J	N- ϕG	H	J	N- ϕG	
15	170	431	478	65	4- $\phi 14$	/			/			15
20	170	431	483	75	4- $\phi 14$	480	70	4- $\phi 15$	489	82.5	4- $\phi 19$	20
25	170	431	488	85	4- $\phi 14$	485	79.5	4- $\phi 15$	493	89	4- $\phi 19$	25
32	170	431	501	100	4- $\phi 18$	490	89	4- $\phi 15$	497	98.4	4- $\phi 19$	32
40	170	428	503	110	4- $\phi 18$	491	98.5	4- $\phi 15$	506	114.5	4- $\phi 23$	40
50	170	431	513	125	4- $\phi 18$	507	120.5	4- $\phi 19$	513	127	8- $\phi 19$	50
65	170	440	532	145	4- $\phi 18$	529	139.5	4- $\phi 19$	535	149	8- $\phi 23$	65
80	200	448	548	160	8- $\phi 18$	543	152.5	4- $\phi 19$	553	168	8- $\phi 23$	80
100	220	459	569	180	8- $\phi 18$	573	190.5	8- $\phi 19$	586	200	8- $\phi 23$	100
125	220	471	596	210	8- $\phi 18$	598	216	8- $\phi 23$	610	235	8- $\phi 23$	125
150	270	484	626	240	8- $\phi 22$	623	241.5	8- $\phi 23$	643	270	12- $\phi 23$	150
200	310	504	674	295	12- $\phi 22$	675	298.5	8- $\phi 23$	694	330	12- $\phi 25$	200
250	370	535	737	355	12- $\phi 26$	738	362	12- $\phi 25$	757	387.5	16- $\phi 30$	250
300	400	560	790	410	12- $\phi 26$	801	432	12- $\phi 25$	820	451	16- $\phi 33$	300

Flange Type Vortex Flow Meter Dimensions

Table 2: Superheated Steam Density & Relative Temperature and Pressure (Kg/m³)

Absolute Pressure (MPa)	Temperature (°C)					
	150	200	250	300	350	400
0.1	0.52	0.4	0.42	0.38		
0.15	0.78	0.7	0.62	0.57	0.52	0.49
0.2	1.04	0.9	0.83	0.76	0.69	0.65
0.25	1.31	1.1	1.04	0.95	0.87	0.81
0.33	1.58	1.3	1.25	1.14	1.05	0.97
0.35	1.85	1.6	1.46	1.33	1.22	1.13
0.4	2.12	1.8	1.68	1.52	1.40	1.29
0.5	-	2.3	2.11	1.91	1.75	1.62
0.6	-	2.8	2.54	2.30	2.11	1.95
0.7	-	3.3	2.97	2.69	2.46	2.27
0.8	-	3.8	3.41	3.08	2.82	2.60
1.0	-	4.8	4.30	3.88	3.54	3.26
1.2	-	5.9	5.20	4.67	4.26	3.92
1.5	-	7.5	6.58	5.89	5.36	4.93
2.0	-	-	8.96	7.97	7.21	6.62
2.5	-	-	11.5	10.1	9.11	8.33
3.0	-	-	14.2	12.3	11.1	10.1
3.5	-	-	17.0	14.6	13.0	11.8
4.0	-	-	-	17.0	15.1	13.6

Table 3: Flow Range

Caliber (mm)	Liquid (m³/h)	Gas (m³/h)
15	0.8~6	6~40
20	1~8	8~50
25	1.3~15	8~100
32	1.5~16	14~350
40	3~33	18~450
50	4~44	30~750
65	6~66	50~1250
80	13~140	70~1750
100	20~220	100~2500
125	36~400	200~5000
150	50~600	400~10000
200	100~1200	600~15000
250	150~1800	1000~25000
300	200~2400	-
400	300~3600	-
500	400~4800	-
600	500~6000	-

The Choice for Measured Medium

The choice for gas flow range

The upper limit of vortex flowmeter does not influenced by the temperature and pressure of medium. Flow range is depended on the medium's density and viscosity at working condition. Thus, the confirmation of flow range is calculation the available lower limit flow.

Calculation 1: First of all, using Q_p formula to calculate the working condition lower limit flow, which is determined by viscosity

In the formula $Q_p = Q_0 \times$

Q_p : Medium's lower limit flow at working condition density

Q_0 : Lower limit flow of flowmeter at reference condition

ρ_0 : Reference the air density, $\rho_0 = 1.205 \text{ kg/m}^3$

ρ : Working condition density of medium to be measured

Calculation 2 Q_v formula for calculation the lower flow limit by kinematic viscosity

In the formula: $Q_v = Q_0 \times V/V_0$ (m³/h)

Q_v : Lower limit flow of the medium

Q_0 : Low flow limit at reference condition

V_0 : Reference viscosity, 15 kgm/S^2

V : The working condition viscosity of medium (kgm/S²)

Compare Q_0 and Q_v , the larger flow as the real low flow limit of gas.

The choice for liquid flow range

As shown on flow range table 3

The choice of steam flow range

Saturated steam: Reference to table 1 to choose

Superheated steam: Through table 2 to get the pressure, temperature and corresponding density, taking the similar density's flow range from table six to confirm the flow range of superheated steam.

Selection Table Vortex Flow Meter

Model	LUGB									
Caliber	DN15-DN300									
Structure	Integrated	I								
	Seperated	S								
Nominal	1.6 MPa		P1							
	2.5 MPa		P2							
	4.0 MPa		P3							
Connection	Flange		C1							
	Wafer		C2							
	Tri-clamp		C3							
	Thread		C4							
Medium	Liquid		M1							
	Common Gas		M2							
	Saturated Steam		M3							
	Superheated Steam		M4							
Shell Material	Stainless steel 304		K2							
	Stainless steel 316		K3							
Flange Standard	ANSI 150#, 300#, 600#		F1							
	JIS 10K, 20K, 40K		F2							
	DIN PN10,PN16,PN25,PN40		F3							
Power Supply	24V		D1							
	3.6V Lithium		D2							
Signal Output	4~20 mA,HART		G1							
	Pulse,RS485		G2							
Special Mark	Standard signal output		B1							
	Intrinsically safe ex-proof		B2							
	On site display		B3							
	Temperature compensation		B4							
	Pressure compensation		B5							
	Temperature and pressure compensation		B6							
	High Temperature 350℃		B7							



Installation Straight Length Requirement

Upstream Straight pipe form	The Straight length of upstream	The Straight length of downstream
Concentric tube fully open valve	$\geq 12 \text{ DN}$	$\geq 5 \text{ DN}$
Concentric contraction fully open valve	$\geq 15 \text{ DN}$	
Single quarter bend	$\geq 20 \text{ DN}$	
Two quarter bends on the same surface	$\geq 25 \text{ DN}$	
Two quarter bends on the different surface	$\geq 40 \text{ DN}$	
Regulating valve、Half-open gate valve	$\geq 50 \text{ DN}$	