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Measuring & Beyond

CE

MIAL INSTRUMENTS PVT. LTD.

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MVF 300
VORTEX FLOW METER

MIAL MVF 300/Vortex Flow MeterDN15-DN300mm

Description

Vortex flow meter is one kind of speed 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.

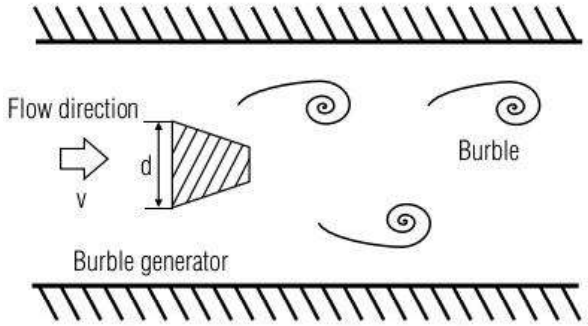
Working Principle

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:

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

- 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 (m^3/h)
- K.....Vortex meter coefficient (unit pulse number/m^3)
- M.....Instantaneous quality flow rate (kg/h)
- P.....Fluid density (kg/m^3)



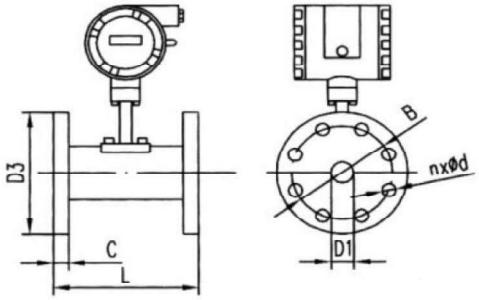
Benefit

- Integrated pressure and temperature compensation.
- 4-20mA, pulse with HART or pulse with RS485 are selectable
- 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 (SS316 selectable)

Standard Specification

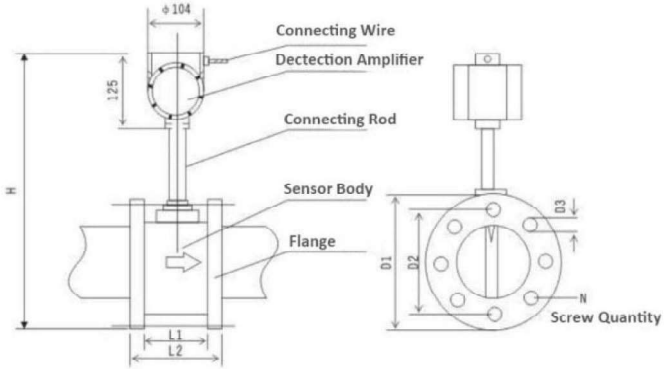
- Size : DN15-DN300mm
- Accuracy : ±1.0%
- Power Supply : 24VDC, 3.6V lithium battery-powered
- Communication : RS485,Hart
- Flange Standard : EN1092-1
  PN10,PN16,PN25,PN40
  ANSI BS16.5 Class 150,300,600
  JIS2220 10K,20K,40
  AS2129 Table D,Table E
  AS4087 PN16,PN21,PN35
- Straight Pipe : Inlet Path ≥ 12D,Outlet Path ≥ 5D
- Signal Output : 4~20 mA,pulse
- Frequency Output : 2~3000 Hz
- Relative Humidity : ≤85%
- Explosion-proof : Exia IIC T6 Gb
- Ambient Temperature :-40℃~55℃ (Non Ex-proof Place)
  -20℃~55℃ (Non Ex-proof Place)
- Nominal Pressure : 1.6 MPa,2.5 MPa,4.0 MPa
- Protection Grade : IP65
- Velocity : 0.4~7.0 m/s liquid
  4.0~60 m/s gas
  5.0~70 m/s steam
- Body Material : SS304(Standard),SS316(Optional)
- Resistance Coefficient : Cd ≤2.6
- Oscillatory Acceleration: ≤0.2g
- Reynolds Number : $2x10^4$~$7x10^6$

Flange Type Vortex Flow Meter Dimensions



Caliber (mm)	Inner D1 (mm)	Length L (mm)	Flange Outer D3 (mm)	Central Dia of Bolts Hole B (mm)	Flange Thickness C (mm)	Bolt Hole Diameter D(mm)	Hole No.(N)
25	25	170	125	90	14	19	4
32	32	170	135	100	16	19	4
40	40	190	140	105	16	19	4
50	50	190	155	120	16	19	4
65	65	220	175	140	18	19	4
80	80	220	185	150	18	19	8
100	100	240	210	175	18	19	8
125	125	260	250	210	20	23	8
150	150	280	280	240	22	23	8
200	200	300	330	290	22	23	12
250	250	360	400	355	24	25	12

Flange Type Vortex Flow Meter Dimensions



Caliber	L1	L2	D1	D2	H	D3	N	Caliber	L1	L2	D1	D2	H	D3	N
20	65	95	125	100	460	13	4	100	90	132	230	190	544	17	8
25	65	95	125	100	460	13	4	125	100	146	245	210	564	17	8
40	75	109	145	110	470	13	4	150	120	170	280	240	594	21	8
50	75	109	160	125	481	17	4	200	150	200	335	295	646	21	12
65	75	117	180	145	497	17	6	250	160	214	405	355	708	21	12
80	80	122	195	160	510	17	6	300	170	324	460	410	760	21	12

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Tabel 1: Saturated Steam Mass Flow Range Table (kg/h)

Absolute Pressure Mpa		0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.2	1.4	1.6	1.8	2.0
Temperature (℃)		120.2	133.5	143.62	151.84	164.96	164.96	170.41	175.36	179.68	187.96	195.04	201.37	207.11	212.37
Density (kg/m^3)		1.129	1.651	2.163	2.669	3.667	3.667	4.162	4.665	5.147	6.127	7.106	8.085	9.065	10.05
DN20	Qmax	80	102	130	160	190	220	250	279	309	368	426	485	544	603
	Qmin	9	11	12	13	15	16	17	18	19	20	22	24	25	26
DN25	Qmax	136	198	260	320	380	440	499	559	618	735	853	970	1088	1206
	Qmin	14	17	19	21	23	25	27	28	30	33	35	37	39	42
DN40	Qmax	400	498	649	801	951	1100	1249	1397	1544	1838	2132	2426	2720	3015
	Qmin	32	38	44	48	53	57	60	64	67	73	79	84	89	94
DN50	Qmax	667	826	1080	1335	1585	1834	2081	2328	2574	3054	3553	4043	4533	5025
	Qmin	52	64	73	81	88	95	100	107	112	122	132	140	149	157
DN65	Qmax	933	1320	1730	2135	2536	2934	3330	3724	4118	4902	5685	6468	7252	8040
	Qmin	88	106	121	135	147	158	168	178	187	204	220	234	248	261
DN80	Qmax	1400	1980	2596	3240	4015	4644	5270	5896	6520	7760	9000	10240	11480	12730
	Qmin	105	127	1445	161	176	189	201	213	224	345	263	280	298	313
DN100	Qmax	2332	3300	4320	5400	6430	7320	8320	9310	10300	12260	14200	16160	19120	20100
	Qmin	175	212	242	269	293	315	336	335	374	408	439	468	496	522
DN125	Qmax	3500	4950	6490	8000	9510	11000	12500	14000	15440	18400	21300	24260	27200	30200
	Qmin	262	317	363	404	440	473	504	533	560	611	658	702	744	783
DN150	Qmax	4666	6600	8650	10680	12680	14670	16650	18620	20590	24500	28420	32340	36260	40200
	Qmin	350	423	484	538	586	631	672	711	747	815	878	936	990	1044
DN200	Qmax	9330	13200	17300	21360	25360	29340	33300	37240	41180	47000	56850	64680	72520	80400
	Qmin	610	740	848	942	1026	1104	1176	1243	1308	1427	1536	1638	1735	1827
DN250	Qmax	13997	19810	25960	32030	38040	44000	49940	55860	61760	73520	85270	97000	108780	120600
	Qmin	875	1056	1210	1345	1466	1577	1680	1776	1868	2038	2195	2340	2480	2610
DN300	Qmax	20995	29720	38930	48040	57050	66000	74900	83800	92650	110300	127900	145530	163200	180900
	Qmin	1050	1270	1453	1614	1759	1892	2016	2132	2241	2446	2634	2808	2975	3132

Flange Type Vortex Flow Meter Dimensions

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

Absolute Pressure (MPa)	Temperature (℃)					
	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 (m^3/h)	Gas (m^3/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 $Q_P=Q_{0X}$

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

Qo: Lower limit flow of flowmeter at reference condition

ρ_o: Reference the air density, $\rho_o=1.205kg/m^3$

ρ : Working condition density of medium to be measured

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

In the formula: $Q_V=Q_O \times V/V_O$ (m^3/h)

Qv : Lower limit flow of the medium

Qo: Low flow limit at reference condition

Vo: Reference viscosity,15kgm/S²

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

Compare Qo and Qv, 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.

MVF 300

Selection Table Vortex Flow Meter

MVF300	DN150-S1-P1-L1-E1-K1-F1-D1-G1-C1-F1								
Caliber	DN15-DN3000								
Structure	Integrated	S1							
	Seperated	S2							
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

Swirler

Available Flow Totalizer

Installation Straight Length Requirement

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

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