CHONGQING CHUANYI AUTOMATION CO.,LTD.



VORTEX FLOWMETER

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QR code of Chuanyi Flowmeter

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ФИЛИАЛ ПО ПРОИЗВОДСТВУ РАСХОДОМЕРОВ ПРИ ОАО ЧУНЦИНСКОЙ КОРПОРАЦИИ АВТОМАТИЗАЦИИ «ЧУАНЬИ»

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Working Principle of Vortex Flowmeter

Vortex flowmeter is a fluid oscillation type flowmeter made according to the Karman vortex principle. When a cylinder with a non-streamlined cross section is inserted into a flowing fluid, two rows of staggered vortices are generated on both sides of the back of the cylinder. (Fig. 1)



Fig. 1 Staggered Vortices

The vortex shedding frequency f is directly proportional to the average flow velocity v on both sides of the cylinder and inversely proportional to the cylinder width d:

f = St×v/d Formula (1)

Where,

f: vortex shedding frequency

St: dimensionless constant (Strouhal)

v: average flow velocity on both sides of the cylinder

d: width of flow-facing surface of the cylinder

The fluid flow velocity and instantaneous flow can be measured by measuring the vortex shedding frequency. The Strouhal number St is a dimensionless constant that can be determined by tests. The linear part of the functional relationship between the Strouhal number St and the Reynolds number Re is the linear measurement range of the vortex flowmeter. The velocity of the fluid in the pipe can be obtained by measuring the frequency f, and then the volume flow can be obtained from the flow velocity. The ratio of the number of pulses output in a period of time to the volume of the fluid (corresponding number of pulses that flow through a unit volume of fluid) is called the meter coefficient (coefficient K).

K= N/Q Formula (2)

where:

K: meter coefficient (pulse/m^3)

N: number of pulses

Q: fluid volume (m^3)

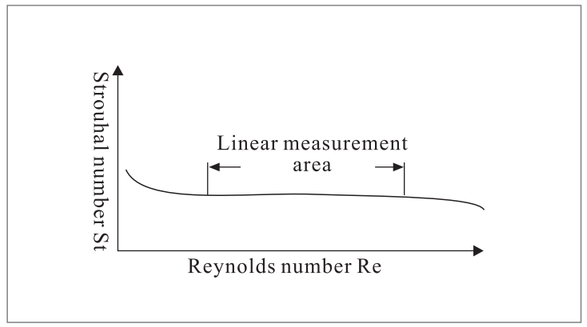


Fig. 2 Variation Relationship between Strouhal Number St and Reynolds Number Re

Product Feature Comparison

VFD vibration-resistant type vortex flowmeter

Advanced FFT spectrum analysis signal processing technology

The most advanced FFT technology in the world is used to analyze and process the vortex flow signal, and able to accurately detect the vortex model in the small flow area, greatly expanding the measurable flow range of the meter.

High stability and vibration resistance

The international advanced dual-probe sensor technology is adopted. One probe detects fluid flow and pipeline vibration signal, and the other one detects the pipeline vibration signal. In case of pipeline vibration intensity up to 1g, the meter is still able to accurately detect the effective vortex signal in strong interference to achieve accurate measurement, representing high stability and super vibration resistance.

High reliability

The reverse protection and purification technology is adopted for power supply, and the isolation technology is adopted for vortex signal processing, with super anti-EMI capability.

Low flow

The lower limit flow velocity of measurable liquid of the meter is as low as 0.2 m/s.

(temperature: 20°C; water density: 1000 kg/m3)

Wide range

The turndown ratio of measurable flow is up to 1:30.

(t= 20°C; P=0.1 MPa; caliber ≥ 32 mm)

VFE intelligent type vortex flowmeter

Advanced FFT spectrum analysis signal processing technology

The advanced FFT technology is used to analyze and process the vortex flow signal, and able to accurately detect the vortex signal in the area with small signal and low flow, which makes the meter also have super stability and reliability in the low flow area, and greatly expands the measurable flow range of the meter, with a turndown ratio of up to 1:30.

High reliability

The reverse protection and purification technology is adopted for power supply, and the isolation technology is adopted for vortex signal processing, with super anti-EMI capability.

Intelligent automatic zero setting

When it is confirmed that there is no flow in the pipeline, this function can be used to effectively remove the inherent interference signal.

Low-power consumption design

The working current of the meter is less than 4 mA, and the total power consumption is less than 100 mW.

Real-time temperature and pressure compensation

The built-in temperature sensor and pressure sensor of the meter are able to measure the temperature and pressure of the fluid in real time, and the mass flow or flow under standard conditions can be measured through real-time temperature and pressure compensation. The temperature error is ±1°C, and the pressure accuracy is ±0.5%FS

VFT enhanced vortex flowmeter

Advanced FFT spectrum analysis signal processing technology

The advanced FFT technology is used to analyze and process the vortex flow signal, and able to accurately detect the vortex signal in the area with small signal and low flow, which makes the meter also have super stability and reliability in the low flow area, and greatly expands the measurable flow range of the meter, with a turndown ratio of up to 1:40.

Strong anti-interference ability and high signal-to-noise ratio

The device features a shielded signal chain design with built-in surge protection. Through optimized anti-vibration algorithms, it achieves enhanced anti-interference ability, resulting in a high signal-to-noise ratio.

Wide range

A lifting cantilever beam tail wing optimization design is adopted by the detection body to increase the turndown ratio.

Probe online replacement

The probe is not wetted. The online replacement function of the probe is realized

Low-power consumption design

New analog switch control, time-sharing multiplexing of temperature and pressure. Reduce power consumption.

Wide measurement temperature range

The probe is isolated from the medium by air and mechanical parts, making the probe temperature close to room temperature, effectively extending the use temperature range

*The warranty period of vortex flowmeter is one year (since the delivery date of the product)

Overview of VFD Vibration-resistant Type Vortex Flowmeter

1. Application scope

The VFD vibration-resistant vortex flowmeter is a high-performance flowmeter product introduced by the Company. The VFD vibration-resistant vortex flowmeter adopts the international leading digital signal processing technology, completely breaks the traditional vortex flow mode, is a new revolution of the vortex flowmeter, and brings the vortex flowmeter products to a new level. This meter is still able to measure accurately when the vibration intensity of the pipeline is as high as 1g and the flow velocity is as low as 0.2 m/s. The VFD vibration-resistant vortex flowmeter has super stability and vibration resistance, and is specially used in the worst working environment.

2. Product features

●Advanced FFT spectrum analysis signal processing technology

The international most advanced FFT technology is used to analyze and process the vortex flow signal, and able to accurately detect the vortex signal in the area with small signal and low flow, which makes the meter also have super stability and reliability in the low flow area, and greatly expands the measurable flow range of the meter, with an accuracy range of up to 1:20.

●High stability and vibration resistance

The international advanced dual-probe sensor technology is adopted. One probe detects fluid flow, and the other one detects the pipeline vibration. In case of pipeline vibration intensity up to 1g, the meter is able to automatically analyze the fluid condition in the pipeline and the vibration of the pipeline itself, and accurately detect the effective vortex signal in strong interference to achieve accurate measurement, representing high stability and super vibration resistance.

●High reliability

The reverse protection and purification technology is adopted for power supply, and the isolation technology is adopted for vortex signal processing, with super anti-EMI capability.

●Low flow

The lower limit flow velocity of measurable liquid of the meter is as low as 0.2 m/s. (temperature: 20°C; water density: 1000 kg/m3)

●Wide range

Accuracy range: up to 1:20.

●Low-power consumption design

The working current of the meter is less than 4 mA, and the total power consumption is less than 100 mW.

●Simple parameter setting

The frequently used parameter combinations are put in one module, reducing the parameter setting time.

●Concise and clear display

The instantaneous flow, cumulative flow, percentage flow (expressed in %) and self-diagnosis information can be displayed simultaneously.

●High accuracy

±0.5% of reading (the highest for liquid)

±1.0% of reading (gas\steam)

●Wide temperature range

General type: (-40~200)°C

High temperature type: (-40~400)°C

●Analog/pulse output

4-20 mA current signal and pulse signal can be output simultaneously

●Alarm output

In case of out-of-range, EEPROM error, etc., an alarm is output and displayed.

●Data protection in case of power loss

Data (parameters, accumulated values, etc.) are saved in EEPROM, and no spare battery is required.

The meter error can be compensated by 5 approximate polylines (by setting 5 compensation coefficients).

●Interchangeability

The converter can be used with sensors of various calibers.

●Intrinsically safe explosion-proof design:

The explosion-proof mark is:

Ex iaIICT1～T6Ga,Ex ia IIIC T 80°CDa

Ex dbIIC T1～T6Gb, Ex tb IIIC T80°CDb

●Blockage-free design

The whole sensor is made of stainless steel, with simple and firm structure and without moving parts, avoiding holes, gaps and washers that are prone to failure as much as possible.

●Mechanical anti-vibration treatment

In the aspect of sensor, the vortex generator and probe are installed separately, and the probe adopts two main sampling piezoelectric wafers and two auxiliary sampling piezoelectric wafers. The signal detected by the probe is not affected by the mechanical vibration of the vortex generator.

●Simple fault handling

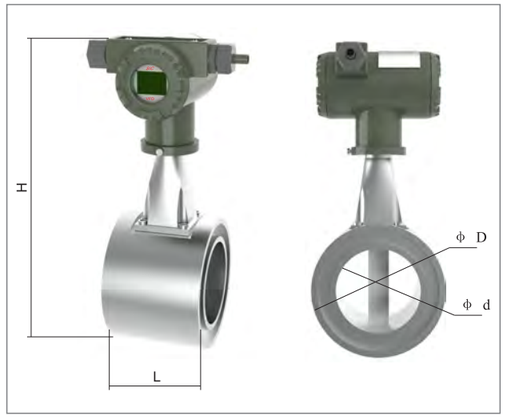
The sensor is easy to install, and the meter coefficient is constant. Thanks to high data repeatability, the converter and sensor have good interchangeability, and the maintenance process is convenient and fast.

VFD anti-vibration vortex flowmeter		
	Clamp-on type (DN15-300)	Flange type
Accuracy level	1.0 (gas); 0.5 (the highest for liquid)	
Caliber	DN15、DN20、DN25、DN32、DN40、DN50、DN65、DN80、DN100、DN125、DN150、 DN200、DN250、DN300、DN350、DN400、DN450、DN500、DN600	
Pressure grade	1.0MPa, 1.6MPa, 2.5MPa, 4.0MPa, ANSI150, ANSI300 (other pressures shall be determined as per agreement)	
Material of wetted part of sensor	304, 316L, Hastelloy C (other materials shall be determined as per agreement)	
IP grade	IP65、IP66、IP67	
Explosion-proof grade	Intrinsically safe type: ExiaIICT1~T6Ga; Integrated flameproof type: ExdbIICT1~T6Gb;Split flameproof type: ExdbebIICT1~T6Gb Intrinsically safe dust: Ex ia IIICT200 80°CDa; flameproof dust ExtbIIICT80°CDb"	
Medium temperature range	-40°C~+200°C (general type), -40°C~+400°C (high temperature type)	
Ambient Temperature	-30°C~70°C	
Repeatability	±0,3%	
Turndown ratio	1:20 (up to 1:30)	
Flow velocity range	Liquid: 0.3~7, gas: 3~60, steam: 2.5~60 Unit: (m/s)	
Outgoing line seal	Gl/2", NPT1/2", M20X1.5	
Power supply voltage	External power supply, voltage range of 16.5~42 VDC, (with HART communication; minimum load of 250Ω and power supply of 21.5 VDC are required); with Modbus, and required voltage range of 21.6~26.4 VDC; FF required voltage range: 9~32 VDC	
Output signal	Analog output 4~-20mA, pulse output	
Communication protocol	HART Modbus(RS485), FF	

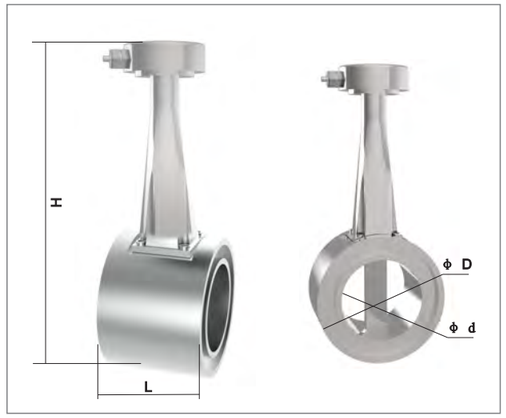
Note: The products with specifications not included in the above table can be ordered by agreements with the Company.

Overall Dimensions of VFD Vibration-resistant Type Vortex Flowmeter

1. Overall dimensions of clamp-on type vortex flowmeter



Integrated Type



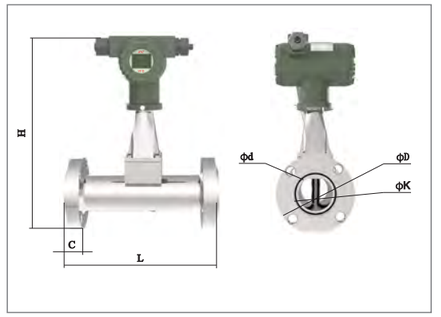
Split Type (Sensor)

Unit: (mm)

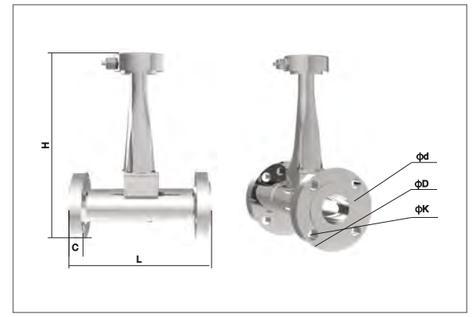
Nominal Caliber	Length of Meter Body L	ID of Meter Body d	OD of Meter Body D	Height of Meter Body H		Weight KG
				Integrated type	Split type	
15	65	15	55	260	290	3.2
20	65	20	55	260	290	3.2
25	65	25	55	260	290	3.1
32	65	32	60	290	320	3.2
40	65	40	70	290	320	3.5
50	65	50	80	300	330	3.7
65	75	65	130	320	350	6.9
80	65	80	130	330	360	6.1
100	65	100	150	350	380	7.2
125	65	125	175	375	405	8.7
150	65	150	200	400	430	10.4
200	100	200	250	455	485	19.6
250	100	250	300	505	535	26.5
300	120	300	350	555	585	39.3

●Note: The clamp-on type vortex flowmeter is provided with matching flanges, bolts and gaskets in case of delivery from factory.

2. Overall dimensions of flange type vortex flowmeter



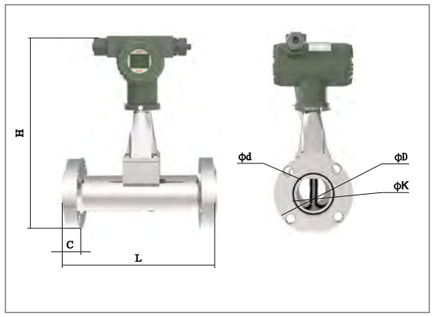
Integrated Type



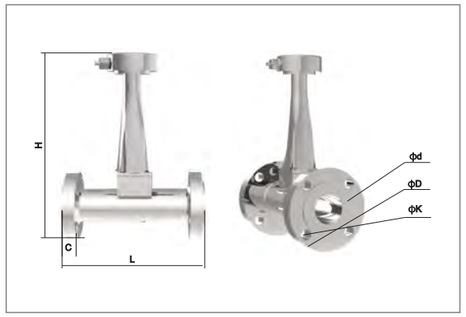
Split Type (Sensor)

Ед.изм.: мм

Nominal Pressure	Nominal Caliber	Meter Length L	Height of Meter Body H		ID of Meter Body d	OD of Flange D	Central Pitch K	Bolt Hole Diameter d2	Bolt Number N	Flange Thickness C
			Integrated type	Split type						
1.0MPa	15	200	305	335	15	95	65	14	4	14
	20	200	310	340	20	105	75	14	4	16
	25	200	315	345	25	115	85	14	4	16
	32	200	325	355	32	140	100	18	4	18
	40	200	330	360	40	150	110	18	4	18
	50	200	345	375	50	165	125	18	4	20
	65	200	365	395	65	185	145	18	8	20
	80	200	375	405	80	200	160	18	8	20
	100	250	398	428	100	220	180	18	8	22
	125	250	420	450	125	250	210	18	8	22
	150	300	453	483	150	285	240	22	8	24
	200	350	510	540	200	340	295	22	8	24
	250	450	560	590	250	395	350	22	12	26
	300	500	610	640	300	445	400	22	12	26
	350	500	670	700	350	505	460	22	16	28
	400	600	723	753	400	565	515	26	16	32
	500	600	830	860	500	670	620	26	20	38
	600	600	938	968	600	780	725	30	20	42



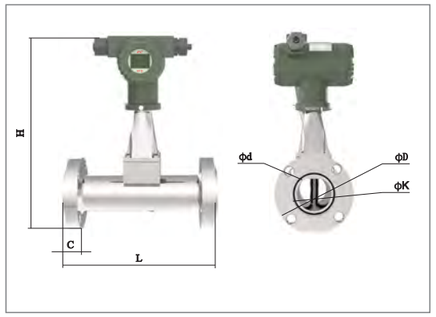
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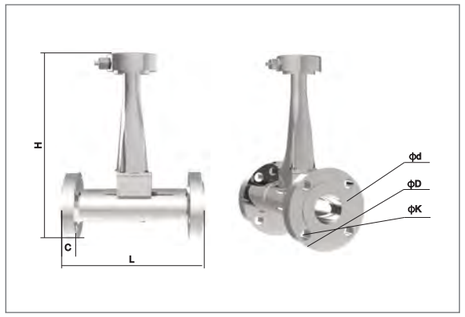
Split Type (Sensor)

Unit: (mm)

Nominal Pressure	Nominal Caliber	Meter Length L	Height of Meter Body H		ID of Meter Body d	OD of Flange D	Central Pitch K	Bolt Hole Diameter d2	Bolt Number N	Flange Thickness C
			Integrated type	Split type						
1.6MPa	15	200	305	335	15	95	65	14	4	14
	20	200	310	340	20	105	75	14	4	16
	25	200	315	345	25	115	85	14	4	16
	32	200	325	355	32	140	100	18	4	18
	40	200	330	360	40	150	110	18	4	18
	50	200	345	375	50	165	125	18	4	20
	65	200	365	395	65	185	145	18	8	20
	80	200	375	405	80	200	160	18	8	20
	100	250	398	428	100	220	180	18	8	22
	125	250	420	450	125	250	210	18	8	22
	150	300	453	483	150	285	240	22	8	24
	200	350	510	540	200	340	295	22	12	26
	250	450	565	595	250	405	355	26	12	29
	300	500	618	648	300	460	410	26	12	32
	350	500	678	708	350	520	470	26	16	35
	400	600	730	760	400	580	525	30	16	38
	500	600	853	883	500	715	650	33	20	46
	600	600	968	998	600	840	770	33	20	52



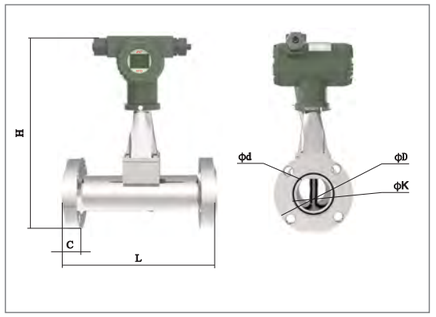
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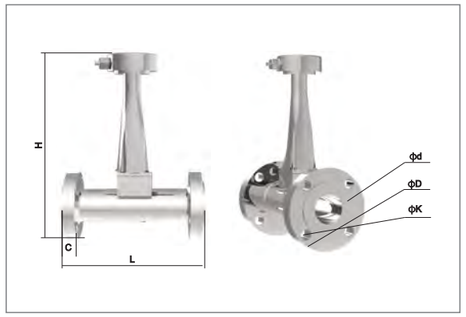
Split Type (Sensor)

Unit: (mm)

Nominal Pressure	Nominal Caliber	Meter Length L	Height of Meter Body H		ID of Meter Body d	OD of Flange D	Central Pitch K	Bolt Hole Diameter d2	Bolt Number N	Flange Thickness C
			Integrated type	Split type						
2.5MPa	15	200	305	335	15	95	65	14	4	14
	20	200	310	340	20	105	75	14	4	16
	25	200	315	345	25	115	85	14	4	16
	32	200	325	355	32	140	100	18	4	18
	40	200	330	360	40	150	110	18	4	18
	50	200	345	375	50	165	125	18	4	20
	65	200	365	395	65	185	145	18	8	22
	80	200	375	405	80	200	160	18	8	24
	100	250	405	435	100	235	190	22	8	26
	125	250	430	460	125	270	220	26	8	28
	150	300	460	490	150	300	250	26	8	30
	200	350	520	550	200	360	310	26	12	32
	250	450	575	605	250	425	370	30	12	35
	300	500	630	660	300	485	430	30	16	38
	350	500	695	725	350	555	490	33	16	42
	400	600	750	780	400	620	550	36	16	46
	500	600	860	890	500	730	660	36	20	56
	600	600	970	1000	600	845	770	39	20	68



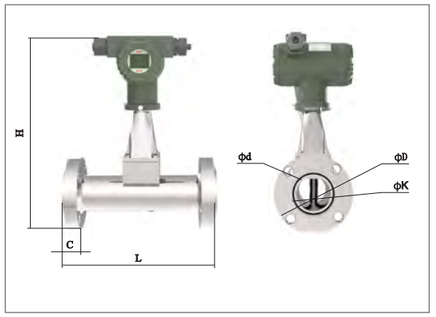
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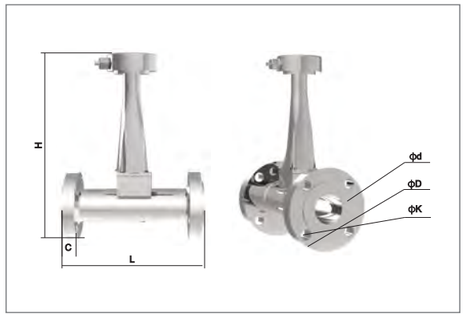
Split Type (Sensor)

Unit: (mm)

Nominal Pressure	Nominal Caliber	Meter Length L	Height of Meter Body H		ID of Meter Body d	OD of Flange D	Central Pitch K	Bolt Hole Diameter d2	Bolt Number N	Flange Thickness C
			Integrated type	Split type						
4.0MPa	15	200	305	335	15	95	65	14	4	14
	20	200	310	340	20	105	75	14	4	16
	25	200	315	345	25	115	85	14	4	16
	32	200	325	355	32	140	100	18	4	18
	40	200	330	360	40	150	110	18	4	18
	50	200	345	375	50	165	125	18	4	20
	65	200	365	395	65	185	145	18	8	22
	80	200	375	405	80	200	160	18	8	24
	100	250	405	435	100	235	190	22	8	26
	125	250	430	460	125	270	220	26	8	28
	150	300	460	490	150	300	250	26	8	30
	200	350	528	558	200	375	320	30	12	36
	250	450	589	618	250	450	385	33	12	42
	300	500	645	675	300	515	450	33	16	48
	350	500	708	738	350	580	510	36	16	54
	400	600	770	800	400	660	585	39	16	60
	500	600	873	903	500	755	670	42	20	72
	600	600	993	1023	600	890	795	48	20	84



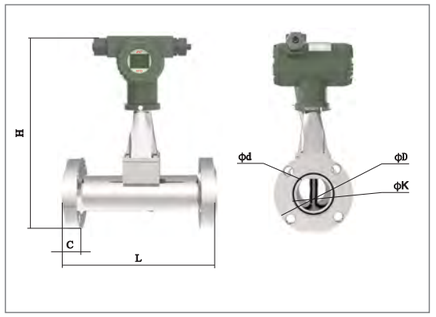
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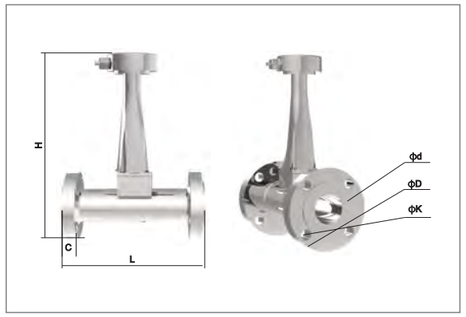
Split Type (Sensor)

Unit: (mm)

Nominal Pressure	Nominal Caliber	Meter Length L	Height of Meter Body H		ID of Meter Body d	OD of Flange D	Central Pitch K	Bolt Hole Diameter d2	Bolt Number N	Flange Thickness C
			Integrated type	Split type						
ANSI 150	15	200	303	333	15	90	60.3	16	4	11.6
	20	200	308	338	20	100	69.9	16	4	13.2
	25	200	313	343	25	110	79.4	16	4	14.7
	32	200	313	343	32	115	88.9	16	4	16.3
	40	200	318	348	40	125	98.4	16	4	18
	50	200	338	368	50	150	120.7	18	4	19.5
	65	200	363	393	65	180	139.7	18	4	22.7
	80	200	370	400	80	190	152.4	18	4	24.3
	100	250	403	433	100	230	190.5	18	8	24.3
	125	250	423	453	125	255	215.9	22	8	24.3
	150	300	450	480	150	280	241.3	22	8	26
	200	350	513	543	200	345	298.5	22	8	29
	250	450	565	595	250	405	362	26	12	30.6
	300	500	630	660	300	485	431.8	26	12	32.2
	350	500	685	715	350	535	476.3	30	12	35.4
	400	600	738	768	400	595	539.8	30	16	37
	500	600	845	875	500	700	635	33	20	43.3
	600	600	955	985	600	815	749.3	36	20	48.1



Integrated Type



Split Type (Sensor)

Unit: (mm)

Nominal Pressure	Nominal Caliber	Meter Length L	Height of Meter Body H		ID of Meter Body d	OD of Flange D	Central Pitch K	Bolt Hole Diameter d2	Bolt Number N	Flange Thickness C
			Integrated type	Split type						
ANSI 300	15	200	305	335	15	95	66.7	16	4	14.7
	20	200	315	345	20	115	82.6	18	4	16.3
	25	200	320	350	25	125	88.9	18	4	18
	32	200	323	353	32	135	98.4	18	4	19.5
	40	200	333	363	40	155	114.3	22	4	21.1
	50	200	345	375	50	165	127	18	8	22.7
	65	200	368	398	65	190	149.2	22	8	26
	80	200	380	410	80	210	168.3	22	8	29
	100	250	415	445	100	255	200	22	8	32.2
	125	250	435	465	125	280	235	22	8	35.4
	150	300	470	500	150	320	269.9	22	12	37
	200	350	530	560	200	380	330.2	26	12	41.7
	250	450	585	615	250	445	387.4	30	16	48.1
	300	500	648	678	300	520	450.8	33	16	51.3
	350	500	710	740	350	585	514.4	33	20	54.4
	400	600	765	795	400	650	571.5	36	20	57.6
	500	600	883	913	500	775	685.8	36	24	64
	600	600	1005	1035	600	915	812.8	42	24	70.3

Note: The dimensions in the above table are all conventional contract dimensions. In case of any special dimension requirements, please make an order with the Company.

Selection of VFD Vibration-resistant Type Vortex Flowmeter Sensor

1. Caliber selection

The basic technical parameters are listed as follows.

In case of selection, the caliber can be determined as per look-up table method (water, steam, air), calculation method or selection software.

(1) Minimum measurable flow velocity

Diameter (mm)	Liquid		Gas, steam	
	Integrated type (m/s)	Split type (m/s)	Integrated type (m/s)	Split type (m/s)
15	$\sqrt{250/\rho}$	—	$\sqrt{22.5/\rho or 3}$	I
25	$\sqrt{122.5/\rho}$	$\sqrt{490/\rho}$	$\sqrt{15.5/\rho or 3}$	$\sqrt{43/\rho or 3}$
40	$\sqrt{90/\rho}$	$\sqrt{490/\rho}$	$\sqrt{10.8/\rho or 3}$	$\sqrt{43/\rho or 3}$
50	$\sqrt{90/\rho}$	$\sqrt{160/\rho}$	$\sqrt{10.8/\rho or 3}$	$\sqrt{21.1/\rho or 3}$
80	$\sqrt{90/\rho}$	$\sqrt{160/\rho}$	$\sqrt{10.8/\rho or 3}$	$\sqrt{21.1/\rho or 3}$
100	$\sqrt{90/\rho}$	$\sqrt{160/\rho}$	$\sqrt{10.8/\rho or 3}$	$\sqrt{21.1/\rho or 3}$
150	$\sqrt{90/\rho}$	$\sqrt{160/\rho}$	$\sqrt{10.8/\rho or 3}$	$\sqrt{21.1/\rho or 3}$
200	$\sqrt{122.5/\rho}$	$\sqrt{202.5/\rho}$	$\sqrt{15.5/\rho or 3}$	$\sqrt{27/\rho or 3}$
250	$\sqrt{160/\rho}$	—	$\sqrt{21.1/\rho or 3}$	—
300	$\sqrt{160/\rho}$	—	$\sqrt{21.1/\rho or 3}$	—

ρ: density of steam in operating state (kg/m^3)
Density of liquid: (400~2000) kg/m^3
Density of gas and steam: ≥0.5 kg/m^3

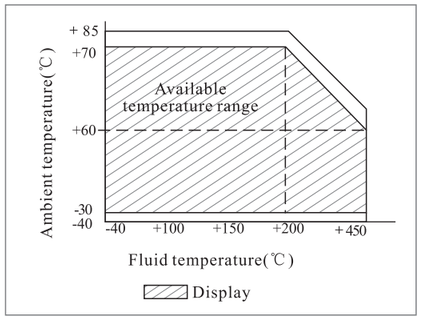


Fig.3 Temperature Range of High Temperature Fluid

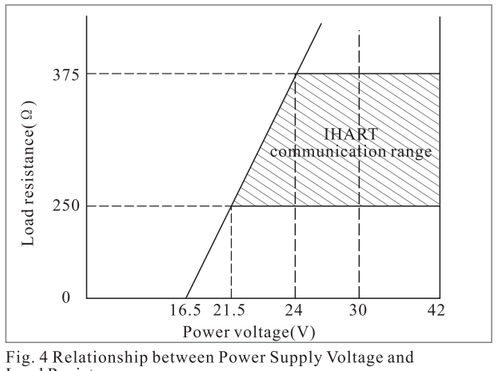


Fig. 4 Relationship between Power Supply Voltage and Load Resistance

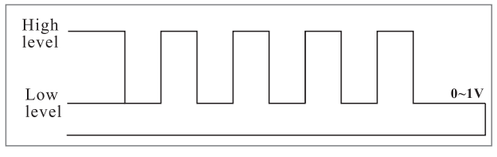


Fig. 5 High Level and Low Level (Transistor Contact Output)

(2) Measurable flow range of gas

The measurement range depends on the nominal caliber, fluid and environmental conditions. The flow range listed below is the maximum allowable flow measurement range (Q_{min} ~ Q_{max}) corresponding to each nominal caliber. The measurement range may be limited depending on the fluid properties and environmental conditions. Additional restrictions are applied to accommodate the lower and upper range limits.

Table (I) VFD/VFE Vortex Flowmeter Air Measurable Flow Range

Caliber (mm)	Calibration Flow Range m^3/h	Calibration Output Frequency Range Hz	Measurable Flow Range m^3/h	Measurable Output Frequency Range Hz
15	5-20	458-1830	5-20	458-1830
20	8-40	290-1448	5-45	181-1631
25	12-60	264-1320	8-80	176-1760
32	12-116	110-1068	12-145	110-1338
40	18-181	90-905	18-249	90-1245
50	28-283	75-758	28-424	75-1131
65	48-478	60-598	48-717	60-896
80	72-724	41-412	72-1086	41-627
100	113-1131	35-350	113-1696	35-522
125	177-1767	26-259	177-2651	26-398
150	254-2545	23-230	254-3817	23-341
200	452-4100	15-150	452-6780	15-231
250	707-7069	12-120	707-10593	12-186
300	1018-10179	9-90	1018-15254	9-142
350	1385-13854	7.5-75	1385-20762	7.5-114
400	1810-15000	7.1-71	1810-27118	7.1-106
450	2290-22902	6.4-64	2290-34322	6.4-97
500	2827-28274	5.6-56	2827-42372	5.6-84.8
600	4072-40715	4.9-49	4072-61016	4.9-73.3

•Note:

(1) The gas is calibrated according to the calibration flow range by default when leaving the factory, and the nameplate is engraved according to the calibration flow. If it is necessary to calibrate the flow according to other flow rates, the supply needs to be negotiated.

(2) For the above gas measurement flow range, the VFD type vortex flowmeter covers a caliber range of DN15-DN600, and the VFE type vortex flowmeter covers a caliber range of DN15-DN300. If the VFE exceeds the DN300 caliber, it needs to be negotiated for supply.

The above table refers to the air at normal temperature and pressure

Reference conditions: t=20℃, P_0=0.1 MPa (absolute pressure), ρ_0=1.205 kg/m^3, V=15^{-6}m^2/s×10^{-6}m^2/s flow range

The lower limit flow of vortex flowmeter depends on the density under working condition and kinematic viscosity of medium

The upper limit flow of vortex flowmeter is generally not affected by the pressure and temperature of the medium

Therefore, determining the flow range is actually to determine the actually available lower limit flow

The calculation method for the suitable flow range of the meter for gases at non-normal temperature and pressure is as follows:

Step 1 According to Formula (3), calculate the lower limit flow Q_ρ determined by the density under working condition. When the medium density is large, the measurable lower limit flow of the flowmeter is low.

$$Q_\rho = Q_0 \sqrt{(\rho_0 / \rho)} \quad \text{Formula (3)}$$

Where,

Q_ρ: measurable lower limit flow determined by medium density under working condition

Q_0: lower limit flow at air reference density specified in Table (I) (found in Table (I))

ρ_o: air reference density specified in Table (I),

ρ_o =1. 205kg/m^3

ρ: density under working condition of measured medium

Step 2 According to Formula (4), calculate the lower limit flow Q_v determined by the kinematic viscosity of the medium under working condition

When the kinematic viscosity of the medium is small, the linear lower limit flow of the flowmeter is low.

$Q_v = Q_0 \times v / v_0$< Formula (4)

Where,

Q_v: linear lower limit flow of flowmeter when used in this medium

Q_0: lower limit flow at reference medium viscosity specified in Table (I) (found in Table (I))

v_0: air reference viscosity specified in Table (I), 15 mm^2/s

v: viscosity of measured medium under working condition

Step 3 Compare Q_V and Q_ρ to determine the available lower limit flow and linear lower limit flow.

In case of $Q_v \geq Q_\rho$, the measurable flow range is Q_ρ~Q_{max}

The linear flow range is Q_v~Q_{max}

In case of $Q_v < Q_\rho$, the measurable flow range and linear flow range are all Q_ρ~Q_{max}

Q_{max}: upper limit flow specified in Table (I).

●Important notes:

For gases with low density or high viscosity at normal temperature and pressure (e.g. hydrogen), the available lower limit flow of the flowmeter is very high. If the required use flow is low, the vortex flowmeter is probably not suitable. The vortex flowmeter is suitable for such gas only under the conditions of high pressure and large flow, and the available flow range must be strictly calculated according to the steps above.

Example of selection calculation

■ **Example 1** When the density and viscosity of a gas are known, measure a certain gas with density ρ = 1.668kg/m^3 and viscosity V=13 × 10^{-6}m^2/s

Try to calculate the flow under minimum working condition that can be measured by DN100 flowmeter.

Step 1 Calculate the lower limit flow under working condition determined by density

According to Table (I), the lower limit flow of DN100 gas is 113^3/h, which is substituted into Formula (3):

$$Q_\rho = Q_0 \times \sqrt{\rho_0 / \rho}$$
$$= 113 \times \sqrt{1.205/1.668}$$
$$= 113 \times 0.85$$
$$= 96$$

The minimum measurable flow of gas measured by DN100 flowmeter is 96 m^3/h

Step 2 Calculate the linear lower limit flow determined by kinematic viscosity

$$Q_V = Q_0 \times v / v_0$$
$$= 113 \times 13/15$$
$$= 98$$

The linear lower limit flow of gas measured by DN100 flowmeter is 98 m^3/h

Step 3 Compare Q_v and Q_ρ

Since $Q_v > Q_\rho$, the available lower limit flow is:

Q_ρ=96m^3/h The linear lower limit flow is: 98m^3/h

Conclusion: When the DN100 flowmeter is used for this gas, the lower limit flow is 98 m^3/h, and the flow range is (98-1696) m^3/h.

■ **Example 2** When the pressure, temperature, and flow under standard condition of the gas are known

At this time, the flow under standard condition must be converted into the flow under working condition, and then look up the table for calculation.

For a certain compressed air, in case of Qn under standard condition = (10-60) Nm^3/min, pressure under working condition P=0.7 Mpa and temperature t=30℃, determine the flow caliber.

●**Important notes:**

At this time, first convert the flow under standard condition into the flow under working condition, and then look up the table for calculation

Step 1 Calculate the flow under working conditions

First convert the given flow per minute to flow per hour

Q_n =(10〜60)m^3/min=(600〜3600) Nm^3/h

Convert the flow under standard condition into flow under working condition according to ideal gas state equation:

$Q=Q_n[P_n/(P_n+P)]\times[(T_n+T)/T_n]$ Formula (5)

P_n: atmospheric pressure under standard condition (0.101325 MPa)

P: medium pressure under working condition = (MPa)

T_n: temperature under standard condition (273.15K)

T: medium temperature under working condition (℃)

Convert the minimum flow

$Q=600\times[0.101325/(0.7+0.101325)]\times[(273.15+30)/273.15]$
$=600\times0.1264\times1.1098$
$=84(m^3/h)$

Then the minimum flow used under working condition is 84 (m^3/h)

The maximum flow under converted maximum flow condition is Q=84×(3600/600)=504 (m^3/h)

Step 2 According to flow range under service condition, i.e. (84-504) m^3/h, by looking up Table (I), the measurable flow range under working condition of DN80 flowmeter is (72-1086) m^3/h, which is close to the use flow range, and the DN80 flowmeter is selected primarily; however, the lower limit flow of the DN80 flowmeter under the service conditions of the medium shall be further calculated.

Examine and calculate the lower limit flow of DN80 flowmeter under this working condition:

$$Q\rho = Q_0\times\sqrt{(\rho_0/\rho)}$$
$$= Q_0\times\sqrt{[0.101325\times(273.15+t)]/[(P+0.101325)/273.15]}$$
$$=72\times\sqrt{0.101325\times303.15/0.801325/273.15}$$
$$=72\times0.3746$$
$$=27\,(m^3/h)$$

That is, the theoretical lower limit flow of the flowmeter under this working condition is max(27,72)m^3/h=72m^3/h, which is far less than the required lower limit flow of 84m3/h. It is determined to use a DN80 flowmeter with a flow range of (72~1086)m^3/h.

●Note: The kinematic viscosity of 0.7MPa compressed air is 1/8 of that of normal temperature and pressure air. The reduced gas viscosity is more conducive to the lower limit flow test

(3) Liquid measurement flow range

Table (II) Liquid Measurable Flow Range of VFD/VFE Vortex Flowmeter

Caliber (mm)	Calibration Flow Range m^3/h	Calibration Output Frequency Range Hz	Measurable Flow Range m^3/h	Measurable Output Frequency Range Hz
15	0.32-3.2	57-576	0.2-5.1	36-900
20	0.56-5.6	19-192	0.35-9	12-299
25	0.9-9	16-158	0.53-15.8	9.3-280
32	1.5-15	13.3-133	0.9-26	8-230
40	2.3-23	9.2-92	1.4-40	5.6-160
50	3-30	7.1-71	2.1-63.5	5-153
65	6-60	7.5-75	3.6-107	4.5-134
80	9-90	4.8-48	5.4-162.7	2.9-87
100	14-140	3.9-39.5	8.5-254	2.4-72.6
125	22-220	3.6-35.5	13-397	2.1-64.5
150	45-320	3.4-24	32-572	2.4-43
200	79-560	2.6-16	56-1017	1.6-29
250	124-880	2.1-14.9	106-1588	1.8-27
300	178-1280	1.9-13.7	178-2288	1.9-24
350	242-1750	1.4-10.1	242-3114	1.4-18.7
400	317-2250	1.2-8.7	317-4068	1.2-16
450	401-2850	1.1-8.1	401-5148	1.1-14.5
500	495-3500	0.96-6.8	495-6356	0.96-12.7
600	700-5100	0.69-5	700-9152	0.69-9.2

Note:

1) The liquid in the table refers to normal temperature water t=20°C, ρo =1000kg/m^3, V0=1×10^{-6} m^2/s

2) If the measured liquid is not water and the liquid density is known, the flow range can be calculated according to Formula (3).

3) When calculating the measurable lowest limit flow of liquids under different densities, ρ0 shall be taken as 1000 kg/m^3

4) The maximum flow velocity of liquid shall generally be <9 m/s.

Flow range under actual service conditions

When the liquid used is not normal temperature water, it is necessary to calculate the actual measurable operating flow range.

Measurable operating flow range.

The lower limit flow of vortex flowmeter depends on the density under working condition and kinematic viscosity of medium. Determining the flow range is actually to determine the actually available lower limit flow.

(5) The liquid is calibrated according to the calibration flow range by default when leaving the factory, and the nameplate is engraved according to the calibration flow. If it is necessary to calibrate the flow according to other flow rates, the supply needs to be negotiated.

(6) The above liquid measurement flow range is applicable to VFD type vortex flowmeter. If it is necessary to use VFE type vortex flowmeter to measure liquid, the supply needs to be negotiated.

Determine the actually available lower limit flow

Step 1 According to Formula (3), calculate the lower limit flow determined by the medium density. When the medium density is large, the measurable lower limit flow of the flowmeter is low.

$$Q\rho = Q_0 \times \sqrt{(\rho_0 / \rho)}$$

where:

Q_ρ: measurable lower limit flow determined by medium density under working condition

Q_0: lower limit flow of water under normal temperature specified in Table (II) (found in Table (II))

ρ_o: reference density of water under normal temperature specified in Table (II),

$\rho_o = 1000 kg/m^3$

P: density under working condition of measured medium

Step 2 According to Formula (4), calculate the lower limit flow Q_v determined by the kinematic viscosity of the medium under working condition

$$Q_v = Q_0 \times V / V_0$$

Where,

Q_v: linear lower limit flow of flowmeter when used in this medium

Q_0: lower limit flow at reference medium viscosity specified in Table (II) (found in Table (II))

V_0: kinematic viscosity of water at normal temperature specified in Table (II), $10^{-6} m^2/s$

V: density under working condition of measured medium

Step 3 Compare Q_v and Q_ρ to determine the available lower limit flow and linear lower limit flow.

In case of $Q_v \geq Q_\rho$, the measurable flow range is Qρ~Qmax, and the linear flow range is Q_v~Q_{max}

In case of $Q_v < Q_\rho$, the measurable flow range and linear flow range are all Q_ρ-Q_{max}

Qmax: upper limit flow specified in Table (II).

●Important notes:

For most industrial liquids, e.g. refinery products and chemical liquids, the main reason affecting their lower limit flow is density, and the lower limit flow determined by density can only be examined and calculated according to Step (1). For some media with a density similar to that of the water, the lower limit flow specified in Table (II) can even be directly adopted without calculation. For high-viscosity liquids, e.g. heavy oil, the lower limit flow determined by viscosity is mainly examined and calculated according to Step (2). The heavy oil and other high-viscosity liquids shall be heated to an appropriate temperature, and the viscosity shall be reduced to a certain value before the vortex flowmeter can be used.

Example of selection calculation:

■ **Example 1:** Density and viscosity of known liquids

The density 0.75T/m^3 dynamic viscosity of #0 diesel is 5 centipoises. Determine the flow range of DN80 flowmeter for 0# diesel.

Step 1 According to Table (II), the normal temperature water flow range of DN80 flowmeter is (5.4~163)m^3/h

Step 2 According to Formula (3), calculate the lower limit flow Qρ determined by the density of the medium used

$$Q\rho = Q_0 \times \sqrt{\rho_0 / \rho}$$
$$= 5.4 \times \sqrt{(1000/750)}$$
$$= 6.24 (m^3/h)$$

Note: 0.75T/m^3=750kg/m^3

Step 3 According to Formula (4), calculate the lower limit flow Qv determined by the density of the medium used

Firstly, calculate the kinematic viscosity according to the dynamic viscosity:

$$Q_v = m/\rho = 5/0.75 = 6.7 \times 10^{-6} m^2/s$$
$$Q_v = Q_0 \times V/V_0 = 5.4 \times 6.7/1 = 36.2 (m^3/h)$$

Step 4 $Q_v > Q_\rho$, available flow range: 6.24~160(m^3/h)

Linear flow range: 36.2~160(m^3/h)

●Important notes:

For high-viscosity oil, the linear lower limit flow of a flowmeter is much higher than water.

(4) Measurable flow range of steam

When the measured medium is steam, the common unit of measurement is mass flow, that is, t/hr or kg/h. Because the density of steam (superheated steam and saturated steam) is different at different temperatures and pressures, the steam flow range varies with pressure and temperature, which can be calculated by Formula (6).

The calculation is as follows:

Step 1 Find out the air flow range of the corresponding caliber flowmeter from Table (I)

Step 2 According to the pressure and temperature parameters of steam, check relevant data to obtain the density of steam

Step 3 Calculate the lower limit flow of the flowmeter according to Formula (6)

$$Q = 1.5 Q_0 \times \rho \times 10^{-3} \times \sqrt{\rho_0 / \rho} \qquad \text{Formula (6)}$$

ρ, Q: density and flow of measured steam

ρ_o, Q_0: density and flow of reference air

Step 4 The upper limit flow velocity of steam for determining the upper limit flow shall be controlled below 70 m/s.

Selection calculation example (saturated steam)

■ **Example 2:** When the pressure of saturated steam is known

Calculate the flow range of 0.8MPa saturated steam with DN100 flowmeter.

Step 1 Check the air flow range of DN100 flowmeter from Table (I), (113~1696)m^3/h

Step 2 Check the density at 0.8MPa from quick check table of mass flow range of saturated steam (Table (III), see the next page), ρ=4.162kg/m^3

Step 3 Calculate lower limit flow according to Formula (6)

$$Q = 1.5 \times 113 \times 4.162 \times 10^{-3} \times \sqrt{(1.205/4.162)}$$
$$= 0.38 (t/h)$$

Step 4 Check upper limit flow. The upper limit flow velocity shall not exceed 70m/s

The available steam flow ranges of flowmeters of different calibers are listed in Table III (see the next page), which can be found out by steam reference calculation.

Selection calculation example (superheated steam)

★Example 3: When the pressure and temperature of superheated steam are known

Try to calculate the flow range of DN80 flowmeter for superheated steam with a pressure of 1.0MPa and a temperature of 300°C.

Step 1 Check the flow range of DN80 flowmeter from Table (I), (72~1086)m^3/h

Step 2 Check the density of 1.0MPa/300°C superheated steam from Density Table (IV) of Superheated Steam, ρ =4.191kg/m^3

Step 3 Calculate the flow according to Formula (6)

$$Q = 1.5 \times 72 \times 4.191 \times 10^{-3} \times \sqrt{(1.205/4.191)}$$
$$= 0.243 (t/h)$$

Step 4 Check upper limit flow. The upper limit flow velocity shall not exceed 70m/s

Table (V) is shown on the next page, which is a superheated steam quick calculation table. Users can substitute the steam density into Table (V) to calculate the flow range.

●Important notes:

When measuring steam, to measure the mass flow of steam, the vortex flowmeter must be combined with temperature and (or) pressure measuring elements to form a mass flow measurement system; for the measurement of saturated steam, temperature compensation or pressure compensation (one of them) shall be added; for the measurement of superheated steam, temperature compensation and pressure compensation (both) shall be added.

Table (IV) Standard Flow Range for Saturated Steam Measurement

Unit: (kg/h)

Absolute pressure (Mpa)	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.2	1.5	2.0
Temperature (°C)	133.5	143.6	151.8	158.9	165	170.7	175.4	179.9	188	198	212.4
Density (Kg/m^3)	1.651	2.163	2.669	3.170	3.667	4.162	4.655	5.147	6.127	7.6	10.05
DN15 standard lower limit	8	11	13	16	18	21	23	26	31	38	50
DN15 standard upper limit	33	43	53	63	73	83	93	103	123	152	201
DN20 standard lower limit	13	17	21	25	29	33	37	41	49	61	80
DN20 standard upper limit	66	87	107	127	147	166	186	206	245	304	402
DN25 standard lower limit	20	26	32	38	44	50	56	62	74	91	121
DN25 standard upper limit	99	130	160	190	220	250	279	309	368	456	603
DN32 standard lower limit	20	26	32	38	44	50	56	62	74	91	121
DN32 standard upper limit	192	251	310	368	425	483	540	597	711	882	1166
DN40 standard lower limit	30	39	48	57	66	75	84	93	110	137	181
DN40 standard upper limit	299	392	483	574	664	753	843	932	1109	1376	1819
DN50 standard lower limit	46	61	75	89	103	117	130	144	172	213	281
DN50 standard upper limit	467	612	755	897	1038	1178	1317	1457	1734	2151	2844
DN65 standard lower limit	79	104	128	152	176	200	223	247	294	365	482
DN65 standard upper limit	789	1034	1276	1515	1753	1989	2225	2460	2929	3634	4804

Note: The above flow is the reference flow of saturated steam. The specific flow shall be subject to the calculation sheet.

Table (IV) Standard Flow Range for Saturated Steam Measurement (continued)

Unit: (kg/h)

Absolute pressure (Mpa)	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.2	1.5	2.0
Temperature (°C)	133.5	143.6	151.8	158.9	165	170.7	175.4	179.9	188	198	212.4
Density (Kg/m^3)	1.651	2.163	2.669	3.170	3.667	4.162	4.655	5.147	6.127	7.6	10.05
DN80 standard lower limit	119	156	192	228	264	300	335	371	441	547	724
DN80 standard upper limit	1195	1566	1932	2295	2655	3013	3370	3726	4436	5504	7276
DN100 standard lower limit	187	244	302	358	414	470	526	582	692	859	1136
DN100 standard upper limit	1867	2446	3019	3585	4147	4707	5265	5821	6930	8598	11367
DN125 standard lower limit	292	383	472	561	649	737	824	911	1084	1346	1779
DN125 standard upper limit	2917	3822	4716	5601	6480	7354	8225	9095	10826	13433	17758
DN150 standard lower limit	419	549	678	805	931	1057	1182	1307	1556	1931	2553
DN150 standard upper limit	4202	5505	6793	8068	9333	10592	11847	13099	15593	19347	25577
DN200 standard lower limit	746	978	1206	1433	1657	1881	2104	2326	2769	3436	4543
DN200 standard upper limit	6769	8868	10943	12997	15035	17064	19086	21103	25121	31168	41205
DN250 standard lower limit	1167	1529	1887	2241	2593	2943	3291	3639	4332	5375	7105
DN250 standard upper limit	11671	15290	18867	22409	25922	29421	32906	36384	43312	53739	71043
DN300 standard lower limit	1681	2202	2717	3227	3733	4237	4739	5240	6237	7739	10231
DN300 standard upper limit	16806	22017	27168	32267	37326	42365	47383	52391	62367	77381	102299

Note: The above flow is the reference flow of saturated steam. The specific flow shall be subject to the calculation sheet.

Table (V) Superheated Steam Density

Gauge Pressure p MPa	Temperature t (°C)								
	170	180	190	200	210	220	230	240	250
0.1	0.9718	0.9497	0.9276	0.9076	0.8888	0.8696	0.8518	0.8344	0.8174
0.2	1.469	1.433	1.400	1.368	1.388	1.310	1.282	1.256	1.231
0.3	1.978	1.952	1.878	1.835	1.793	1.754	1.717	1.682	1.647
0.4	2.485	2.421	2.362	2.306	2.253	2.203	2.155	2.110	2.006
0.45	2.744	2.673	2.606	2.544	2.484	2.428	2.375	2.325	2.277
0.5	3.007	2.926	2.852	2.783	2.717	2.655	2.597	2.541	2.488
0.55	3.271	3.182	3.100	3.022	2.951	2.883	2.820	2.759	2.701
0.6	3.537	3.440	3.349	3.266	3.187	3.113	3.044	2.978	2.914
0.66	3.807	3.700	3.601	3.510	3.425	3.344	3.268	3.196	3.128
0.7	4.078	3.962	3.855	3.756	3.663	3.575	3.493	3.415	3.343
0.75	—	4.226	4.110	4.002	3.902	3.808	3.720	3.635	3.559
0.8	—	4.494	4.367	4.250	4.142	4.042	3.948	3.857	3.775
0.86	—	5.764	4.625	4.500	4.385	4.275	4.157	4.080	3.990
0.9	—	5.035	4.888	4.753	4.630	4.515	4.407	4.306	4.210
1.0	—	—	5.417	5.263	4.123	4.992	4.871	4.757	4.649
1.1	—	—	5.963	5.784	5.621	5.473	5.339	5.211	5.092
1.2	—	—	—	6.317	6.125	5.963	5.810	5.699	5.537
1.3	—	—	—	6.842	6.640	6.465	6.289	6.135	5.988
1.4	—	—	—	7.391	7.163	6.959	6.775	6.605	6.443
1.5	—	—	—	—	7.692	7.468	7.267	7.077	6.909
1.6	—	—	—	—	8.237	7.987	7.770	7.553	7.372
1.7	—	—	—	—	8.787	8.511	8.276	8.038	7.839
1.8	—	—	—	—	9.345	9.042	8.786	8.530	8.039
1.9	—	—	—	—	—	9.578	9.298	9.024	8.783
2.0	—	—	—	—	—	10.13	9.813	9.524	9.256
2.1	—	—	—	—	—	10.69	10.33	10.02	9.764
2.2	—	—	—	—	—	11.25	10.87	10.54	10.24
2.3	—	—	—	—	—	—	11.42	11.06	10.74
2.4	—	—	—	—	—	—	11.97	11.68	11.24
2.5	—	—	—	—	—	—	12.53	12.12	11.75
2.6	—	—	—	—	—	—	13.10	12.66	12.26
2.7	—	—	—	—	—	—	13.68	13.21	12.79
2.8	—	—	—	—	—	—	—	13.77	13.31
2.9	—	—	—	—	—	—	—	14.33	13.85
3.0	—	—	—	—	—	—	—	14.91	14.39
3.1	—	—	—	—	—	—	—	15.49	14.94
3.2	—	—	—	—	—	—	—	16.08	15.50
3.3	—	—	—	—	—	—	—	16.68	16.07
3.4	—	—	—	—	—	—	—	—	16.64
3.5	—	—	—	—	—	—	—	—	17.22
3.6	—	—	—	—	—	—	—	—	17.82
3.7	—	—	—	—	—	—	—	—	18.42
3.8	—	—	—	—	—	—	—	—	19.02
3.9	—	—	—	—	—	—	—	—	19.65

Table (V) Superheated Steam Density (continued)

Gauge Pressure p MPa	Temperature t (°C)								
	260	270	280	290	300	310	320	330	340
0.1	0.8027	0.7879	0.7725	0.7587	0.7453	0.7321	0.7194	0.7076	0.6959
0.2	1.027	1.184	1.162	1.141	1.121	1.101	1.082	1.063	1.045
0.3	1.615	1.584	1.554	1.525	1.497	1.471	1.445	1.420	1.397
0.4	2.025	1.986	1.948	1.911	1.876	1.843	1.810	1.779	1.749
0.45	2.231	2.187	2.145	2.105	2.066	2.029	1.994	1.959	1.926
0.5	2.438	2.390	2.344	2.300	2.257	2.216	2.177	2.139	2.103
0.55	2.646	2.593	2.543	2.495	2.448	2.404	2.361	2.320	2.280
0.6	2.855	2.797	2.743	2.690	2.640	2.592	2.546	2.501	2.458
0.66	3.064	3.002	2.943	2.886	2.832	2.780	2.730	2.682	2.636
0.7	3.274	3.207	3.144	3.083	3.025	2.969	2.915	2.864	2.814
0.75	3.484	3.413	3.346	3.281	3.218	3.158	3.101	3.046	2.993
0.8	3.695	3.620	3.548	3.479	3.412	3.348	3.287	3.229	3.173
0.85	3.907	3.827	3.750	3.676	3.606	3.538	3.473	3.412	3.352
0.9	4.120	4.034	3.952	3.874	3.799	3.728	3.660	3.594	3.531
1.0	4.548	4.452	4.361	4.274	4.191	4.112	4.036	3.962	3.892
1.1	4.980	4.873	4.771	4.675	4.583	4.496	4.413	4.333	4.255
1.2	5.414	5.297	5.187	5.081	4.980	4.883	4.792	4.704	4.619
1.3	5.851	5.724	5.602	5.485	5.376	5.271	5.171	5.076	4.984
1.4	6.293	6.154	6.020	5.893	5.774	5.695	5.555	5.450	5.350
1.5	6.738	6.588	6.443	6.305	6.177	6.053	5.938	5.824	5.718
1.6	7.188	7.022	6.868	6.720	6.582	6.447	6.324	6.203	6.086
1.7	7.639	7.436	7.294	7.138	6.988	6.845	6.714	6.583	6.457
1.8	8.097	7.905	7.728	7.558	7.396	7.245	7.104	6.964	6.831
1.9	8.560	8.354	8.163	7.981	7.806	7.645	7.494	7.348	7.025
2.0	9.025	8.803	8.598	8.403	8.228	8.052	7.886	7.732	7.582
2.1	9.497	9.259	9.048	8.834	8.636	8.453	8.281	8.117	7.960
2.2	9.970	9.718	9.479	9.266	9.058	8.864	8.681	8.503	8.338
2.3	10.45	10.18	9.930	9.698	9.479	9.276	9.081	8.893	8.718
2.4	10.93	10.64	10.38	10.13	9.901	9.680	9.482	9.285	9.099
2.5	11.42	11.11	10.83	10.57	10.33	10.10	9.881	9.677	9.484
2.6	11.91	11.59	11.29	11.01	10.76	10.52	10.29	10.07	9.872
2.7	12.41	12.06	11.75	11.46	11.19	10.94	10.70	10.47	10.26
2.8	12.91	12.55	12.22	11.91	11.62	11.36	11.11	10.87	10.65
2.9	13.42	13.04	12.69	12.36	12.06	11.80	11.52	11.27	11.04
3.0	13.94	13.53	13.16	12.82	12.50	12.21	11.94	11.68	11.44
3.1	14.46	14.03	13.64	13.28	12.95	12.64	12.35	12.08	11.83
3.2	14.99	14.53	14.12	13.74	13.40	13.08	12.78	12.50	12.23
3.3	15.52	15.04	14.60	14.21	13.85	13.51	13.20	12.90	12.63
3.4	16.06	15.55	15.09	14.68	14.30	13.95	13.62	13.32	13.03
3.5	16.61	16.07	15.59	15.16	14.76	14.39	14.05	13.73	13.43
3.6	17.61	16.60	16.09	15.63	15.22	14.83	14.48	14.15	13.84
3.7	17.73	17.13	16.60	16.12	15.68	15.28	14.91	14.57	14.24
3.8	18.29	17.66	17.10	16.60	16.15	15.79	15.35	14.99	14.65
3.9	18.88	18.21	17.62	17.10	16.62	16.19	15.78	15.41	15.06
4.0	19.47	18.76	18.14	17.59	17.10	16.65	16.23	15.84	15.48

Superheated Steam Density (continued)

Gauge Pressure p MPa	Temperature t (°C)								
	350	360	370	380	390	400	410	420	430
0.1	0.6845	0.7879	0.7725	0.7587	0.7453	0.7321	—	—	—
0.2	1.028	1.012	0.9960	0.9804	0.9652	0.9506	—	—	—
0.3	1.374	1.351	1.330	1.309	1.289	1.269	—	—	—
0.4	1.720	1.692	1.665	1.639	1.613	1.589	—	—	0.6959
0.45	1.894	1.863	1.833	1.804	1.776	1.749	1.723	1.697	1.672
0.5	2.068	2.034	2.001	1.969	1.939	1.909	1.880	1.852	1.825
0.55	2.242	2.205	2.170	2.135	2.102	2.070	2.038	2.008	1.979
0.6	2.417	2.377	2.338	2.301	2.265	2.230	2.195	2.164	2.132
0.66	2.592	2.549	2.057	2.467	2.428	2.391	2.352	2.230	2.286
0.7	2.767	2.721	2.677	2.634	2.592	2.552	2.511	2.476	2.439
0.75	2.943	2.894	2.846	2.800	2.756	2.714	2.671	2.632	2.593
0.8	3.119	3.066	3.016	2.967	2.920	2.875	2.831	2.789	2.747
0.85	3.295	3.239	3.186	3.134	3.084	3.037	2.990	2.946	2.902
0.9	3.471	3.413	3.356	3.301	3.249	3.199	3.150	3.103	3.056
1.0	3.826	3.761	3.968	3.638	3.579	3.524	3.469	3.416	3.365
1.1	4.181	4.108	4.040	3.974	3.911	3.849	3.789	3.731	3.675
1.2	4.537	4.458	4.383	4.312	4.243	4.175	4.110	4.047	3.986
1.3	4.895	4.810	4.728	4.651	4.574	4.502	4.413	4.363	4.297
1.4	5.255	5.163	5.076	4.990	4.909	4.831	4.755	4.682	4.610
1.5	5.615	5.517	5.423	5.330	5.244	5.160	5.079	5.000	4.924
1.6	5.977	5.872	5.770	5.672	5.580	5.490	5.403	5.319	5.236
1.7	6.341	6.227	6.120	6.017	5.917	5.820	5.727	5.637	5.559
1.8	6.707	6.582	6.471	6.369	6.254	6.150	6.053	5.956	5.865
1.9	7.072	6.942	6.821	6.714	6.592	6.482	6.379	6.277	6.180
2.0	7.440	7.302	7.174	7.059	6.930	6.817	6.707	6.601	6.498
2.1	7.812	7.664	7.530	7.407	7.270	7.153	7.037	6.925	6.816
2.2	8.183	8.030	7.886	7.755	7.613	7.489	7.367	7.250	7.133
2.3	8.554	8.396	8.242	8.104	7.955	7.825	7.698	7.574	7.452
2.4	8.928	8.760	8.598	8.453	8.299	8.163	8.029	7.899	7.770
2.5	9.302	9.131	8.960	8.803	8.643	8.503	8.361	8.224	8.090
2.6	9.680	9.502	9.320	9.154	8.988	8.843	8.693	8.551	8.410
2.7	10.06	9.872	9.680	9.506	9.337	9.183	9.027	8.878	8.734
2.8	10.44	10.24	10.05	9.861	9.690	9.524	9.363	9.205	9.058
2.9	10.82	10.61	10.41	10.22	10.04	9.866	9.699	9.533	9.384
3.0	11.20	10.99	10.78	10.58	10.39	10.21	10.03	9.862	9.709
3.1	11.59	11.36	11.14	10.94	10.74	10.55	10.37	10.20	10.03
3.2	11.98	11.74	11.51	11.30	11.09	10.90	10.71	10.53	10.36
3.3	12.36	12.12	11.88	11.66	11.45	11.24	11.05	10.86	10.68
3.4	13.76	12.50	12.25	12.02	11.80	11.59	11.39	11.20	11.01
3.5	13.15	12.88	12.63	12.39	12.16	11.94	11.73	11.53	11.34
3.6	13.54	13.27	13.00	12.76	12.52	12.29	12.07	11.87	11.67
3.7	13.94	13.65	13.38	13.12	12.87	12.64	12.42	12.20	12.00
3.8	14.34	14.04	13.76	13.49	12.23	12.99	12.76	12.54	12.33
3.9	14.74	14.43	14.14	13.86	13.60	13.34	13.11	12.88	12.66
4.0	15.14	14.82	14.52	14.23	13.96	13.70	13.54	13.22	12.99

Table (VI) Quick Calculation Table of Mass Flow Range of Superheated Steam

Nominal Diameter (mm)	Lower Limit Flow	Upper Limit Flow
15	$6.12\times\sqrt{\rho}$	$73.4\times\sqrt{\rho}$
20	$7.44\times\sqrt{\rho}$	$119\times\sqrt{\rho}$
25	$9.84\times\sqrt{\rho}$	$157\times\sqrt{\rho}$
32	$17.1\times\sqrt{\rho}$	$273\times\sqrt{\rho}$
40	$19.75\times\sqrt{\rho}$	$395\times\sqrt{\rho}$
50	$36.70\times\sqrt{\rho}$	$734\times\sqrt{\rho}$
65	$61.17\times\sqrt{\rho}$	$1223\times\sqrt{\rho}$
80	$85.65\times\sqrt{\rho}$	$1713\times\sqrt{\rho}$
100	$121.8\times\sqrt{\rho}$	$2437\times\sqrt{\rho}$
125	$184.5\times\sqrt{\rho}$	$3691\times\sqrt{\rho}$
150	$246.7\times\sqrt{\rho}$	$4934\times\sqrt{\rho}$
200	$493.4\times\sqrt{\rho}$	$9868\times\sqrt{\rho}$
250	$744\times\sqrt{\rho}$	$14880\times\sqrt{\rho}$
300	$1233\times\sqrt{\rho}$	$24670\times\sqrt{\rho}$
350	$1845\times\sqrt{\rho}$	$36910\times\sqrt{\rho}$
400	$2222\times\sqrt{\rho}$	$44450\times\sqrt{\rho}$
450	$2589\times\sqrt{\rho}$	$51790\times\sqrt{\rho}$
500	$3094\times\sqrt{\rho}$	$61880\times\sqrt{\rho}$
600	$3935\times\sqrt{\rho}$	$78700\times\sqrt{\rho}$

Note: ρ represents the steam density in operating status

(5) The caliber of the selected sensor is the same as that of the connected process pipeline

This option is convenient for installation

(6) The caliber of the selected sensor is different from that of the connected process pipeline

This option is applicable in the following situations:

A. The flow velocity in the pipeline is low, and the process flow is relatively stable. In order to meet the requirements of the meter for the flow velocity range, the caliber of the sensor can be selected to be smaller than that of the process pipeline, and a reducer can be added in front of and behind the sensor.

B. Considering the price, for large-caliber vortex flowmeter, the larger the caliber, the higher the price. When the flow velocity in the pipeline is low and the process parameters are stable, the sensor with smaller caliber can be selected, which can not only make the instrument run in better working conditions, but also reduce the investment cost of the instrument.

(7) Precautions for installing reducer

In order not to affect the distribution of flow field too much and the measurement accuracy of the meter, the central cone angle α of the reducer shall not be greater than 15°, so that the reducer can be regarded as a part of the straight pipe section.

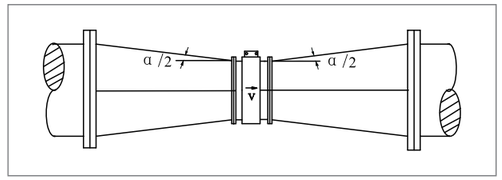


Fig. 6 Installation of Meter on Reducer

(8) Selection of caliber code

The expression of the caliber of VFD series vortex flowmeter is three digits: the first and second digits of DN and the number of zeros following the first two digits (unit: mm). For example: code 150 means the caliber is 15mm; code 151 means the caliber is 150mm; DN125 is special, indicating that the code is 121.

(9) Pressure loss

Water speed is 10m/s, △ρ =108kPa

When the air speed under atmospheric pressure is 80m/s, Δp=9kPa

Pressure loss can be obtained from the following formula:

$$\triangle P=108\times10^{-5}\cdot p_f\cdot v^2 \quad \cdots\cdots\cdots\cdots\cdots\cdots (1)$$

or

$$\triangle P=135\times p_f\cdot \frac{Q_f^2}{D^4} \quad \cdots\cdots\cdots\cdots\cdots\cdots (2)$$

Where,

ΔP: Pressure loss (kPa)

p_f: density in operating status (kg/m^3)

v: flow velocity (m/s)

Q_f: actual flow (m^3/s)

D: inner diameter

The following figure shows the curve of the relationship between pressure loss and actual flow.

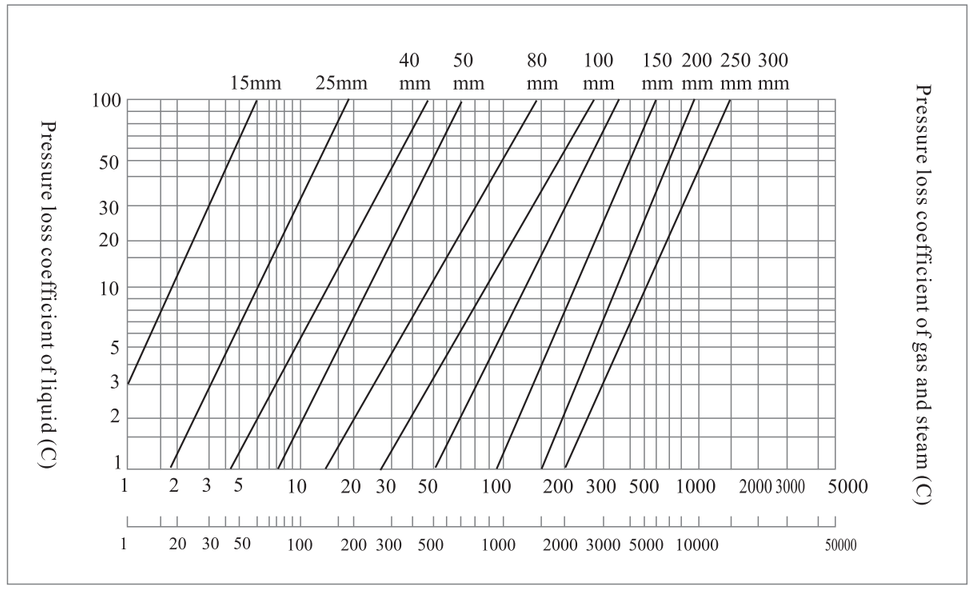


Fig. 7 Actual Flow of Gas and Steam m^3/h

Example of pressure loss calculation:

With diameter of 50mm, water with temperature of 80°C, and flow of 30m^3/h, the pressure loss is:

① The water density at 80°C is 972kg/m^3. Put the value into Formula (2).

$$\triangle P=135\times972\times\frac{30^2}{51.1^4}=17.3kPa$$

② Calculate pressure loss with Formula (1). When the flow is 30m^3/h, calculate the flow velocity with the following formula:

$$v=\frac{354\times Q_f}{D^2}=\frac{354\times30}{51.1^2}=4.07m/s$$

Therefore, put the value into Formula (1):

$$\triangle P=108\times10^{-5}\times972\times4.07^2=17.3kPa$$

③ Check the table to obtain pressure loss. The liquid pressure loss coefficient is 18.5, and the formula $\Delta P = C\times P\times10^{-5}$

Where, ΔP: pressure loss (kg/cm^2) p: density: (kg/m^3)

So $\Delta P=98.1\times18.5\times972\times10^{-5}=17.6kPa$

(10) Cavitation (minimum back pressure, liquid only)

In liquid measurement, when the liquid pressure in the pipeline is very low and the flow velocity is very high, cavitation will be generated to affect the correct measurement of flow. To prevent errors in flow measurement, the following minimum pipe pressure can be used:

$$P=2.7\cdot\triangle P+1.3\cdot p_0 \quad \cdots\cdots\cdots\cdots\cdots (3)$$

Where,

P: pipe pressure with downstream side 2~7D from the end face of the flowmeter (kpabs)

△P: pressure loss (kPa), similarly as above.

P_o: saturated steam pressure of liquid in operating status (kPabs)

■ **Example:** Confirm whether there is cavitation

It is only necessary to confirm the maximum flow (when the pressure loss is the greatest). In the example, the pipeline pressure is 120kPabs and the measuring range is 0~30m^3/h.

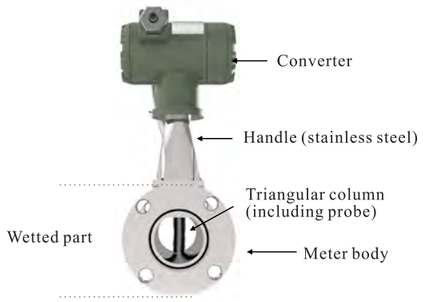
From Example 1, the pressure loss is 17.3kpa, and from the saturated steam table, the saturated steam pressure of water at 80°C is:

P0=47.74kPabs

Put the above value into Formula (3):

P=2.7×17.3 + 1.3v×47.4=108.3kPabs

Because the operating pressure of 120kPabs is greater than that of 108.3kPabs, cavitation is not produced.



Clamp-on Type

2. Material selection and dimensions of the wetted part

According to the different media measured by users, two different materials for wetted part are provided, 304 stainless steel and 316L stainless steel. For special material requirements, please contact the Company for special orders.

(1) Sensor of clamp-on type vortex flowmeter

Wetted part includes the following parts:

①. Triangular column (vortex generator)

②. Probe (vortex detection body)

③. Probe base

④. Meter body

Note: To select different materials for the wetted part, please ensure that ③ is consistent with ④.

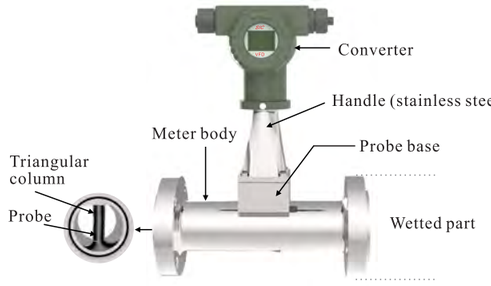
Clamped sensor DN15~DN25 is provided with probe base.

(2) Sensor of flange type vortex flowmeter

Wetted part includes the following parts:

①. Triangular column (vortex generator) ②. Probe (vortex detection body) ③. Probe base ④. Meter body ⑤. Flange

Note: To select different materials for the wetted part, please ensure that ③, ④ and ⑤ are consistent with each other.



Flange Type

3. Selection of IP grade

According to the national standard GB4208, the housing IP grade of meters can be divided into the following categories:

IP65: Water spraying type allows the faucet to spray water on the meter from any direction, with the water spraying pressure of 30kPa, the water output of 12.5L/Min and the nozzle distance of 3m from the meter.

IP66: Violent water spraying type strongly sprays water to the housing in all directions without harmful effect, the water output is 100L/min, and the duration is 3 min.

IP67: Immersed meter can be completely immersed in water (1m underwater) in a short time, with duration of 30 min.

4. Selection of cable

The connecting cable between the sensor and the converter is dedicated. The length of the cable in the model specification table refers to this cable section, and its length generally does not exceed 30m (if the required length is longer than 30m, please consult with the manufacturer). The connecting cable between the sensor and the converter generally requires iron pipe for protection when it is installed on site.

5. Selection of sealing washer

When used in general workplaces, flexible graphite sealing washers can be selected;

When used in hazardous workplaces, PTFE sealing washers can be selected when measuring explosive gases such as oxygen.

6. Selection of flange

The companion flange for clamp-on type vortex flowmeter is a standard part of the Company, and is made of carbon steel.

The companion flange for flange type vortex flowmeter is an optional part of the Company. To place an order, please provide the dimension and material requirements of the meter connecting pipe.

If there are no special material requirements, the flange of the Company will be made of carbon steel. For special materials and other standard flanges, please contact the Company confirmation before placing an order.

The standard for companion flanges is HG/T 20592-2009. For common flange specifications, please refer to the flange dimension table of flange introduction part of this sample.

7. Determination of working environment

Working environment refers to the environment around the meter, which can be divided into general workplaces and hazardous workplaces.

General workplace refers to a safe place without combustible gases and explosive substances. The working ambient temperature is below (-40~70)°C. The upper limit of medium temperature is divided into 200°C and 350°C. The meter is optional between integrated type or split type. Hazardous workplace refers to the workplace with combustible gases and explosive substances. The operating environment temperature is (-20~60)°C, and the medium temperature shall not be higher than 250°C.

8. Selection of explosion -proof accessories

The vortex flowmeter is intrinsically safe and explosion-proof, and the product must be matched with the isolated safety barrier, otherwise the intrinsically safe explosion-proof performance of the vortex flowmeter can not be guaranteed.

Isolated safety barrier is optional. If explosion-proof products need this accessory, please explain when ordering.

9. Reducing type solution

(1) Advantages of measurement lower limit:

The minimum lower limit of liquid measurement can reach 0.1m/s

The minimum lower limit of gas measurement can reach 1m/s

Both ends of the sensor meter body are equipped with internal reducing pipe/internal expanding pipe for low flow measurement.

Up to 2 smaller sizes of diameter reduction can be selected



Same flange spacing



Standard Type Reducing Type

(2) Advantages of interchangeability:

The safety of the reducing type is the same as that of the standard type, and there is no leakage point. The flange dimensions and spacing of the reducing type are the same as those of the standard type, so it is more convenient to replace.

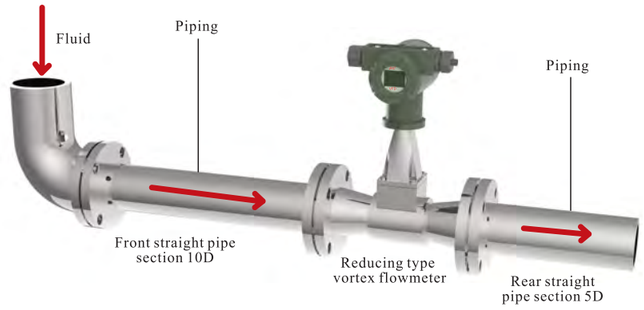
(3) Advantages of low cost

It is unnecessary to install internal reducing pipe/internal expanding pipe and short pipe, as well as matching pipe flanges.

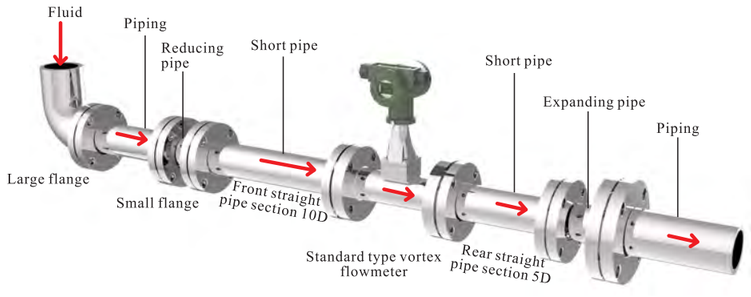
Reduce on-site installation space, lower installation cost and improve safety!

Installation solution

New solution of installation of reducing type



Solution of conventional type



10. Solution of water hammer

(1) Introduction to water hammer

Water hammer effect is a kind of visual statement, which refers to a serious water hammer caused by the water impact on the pipeline when the feed pump is started and stopped. Because in the pipe, the inner wall of the pipe is smooth, the water flows freely. When an open valve is suddenly closed or the feed pump is stopped, the water flow produces a pressure on the valve and the pipe wall, mainly the valve or pump. Because the pipe wall is smooth, the subsequent water flow reaches the maximum force quickly under the action of inertia, and has a destructive effect, which is the "water hammer effect" in hydraulics, that is, positive water hammer. On the contrary, when a closed valve is suddenly opened or the feed pump is started, a water hammer is also produced, which is called negative water hammer, but not as large as the former. Of course, the water hammer will occur not only in the water system, but also in the steam system. When it occurs in a steam system, a water hammer is sometimes called a "steam hammer".

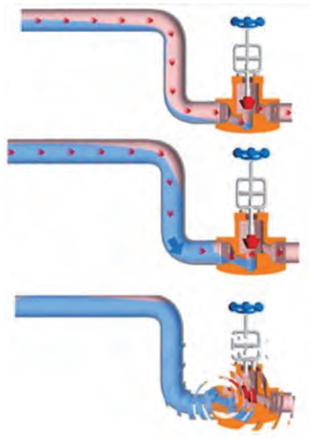
(2) Hazard of water hammer

When the steam is assigned to the steam line or enters the equipment, you will hear the metal "bang, bang, bang" sound, and a similar situation will happen to many steam users. When a water hammer occurs, it will instantly produce more than 10MPa pressure in the pipe.

This will cause serious impact on the pipe, equipment or equipment room, which may cause damage to the detection body of the flowmeter in serious conditions.

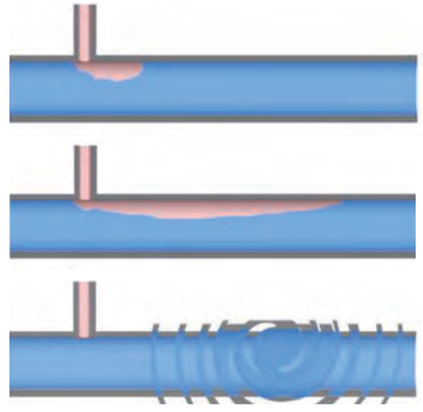
(3) Causes to water hammer

High-speed condensate produces a water hammer



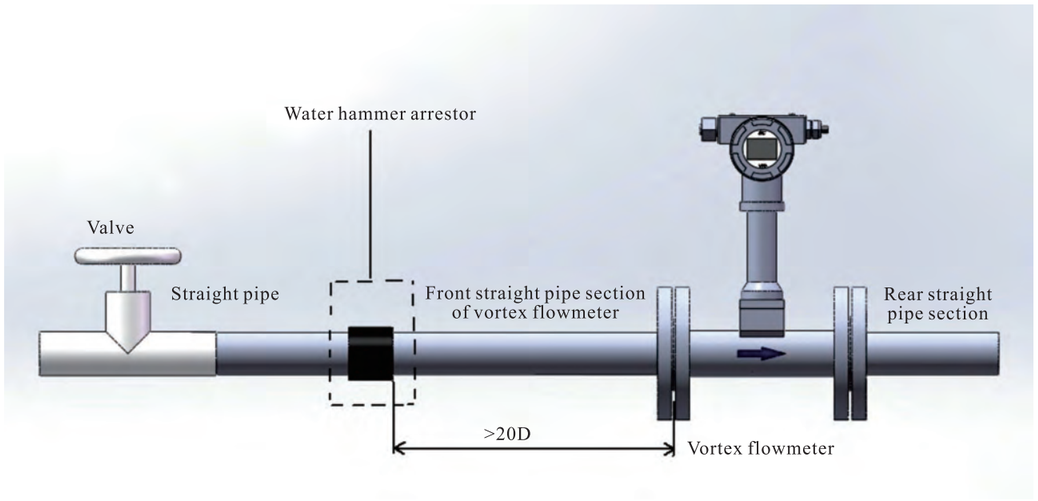
The collision of high-speed condensed water in the pipe produces a water hammer

The sudden condensation of steam produces a water hammer



Quick condensation and collision of steam produces a water hammer.

(4) Solution of water hammer



(5) Important tips (in case of the following process, it is recommended to add a water hammer arrestor to protect the flowmeter from damage)

1. Rapid opening or closing of the valve;

2. Sudden shutdown or startup of the water pump unit;

3. Single-pipe water conveyance to a high place (with water supply elevation difference of above 20m)

4. High water pump total head (or operating pressure);

5. Too high water flow rate in water delivery pipe;

6. Too long water delivery pipe, and great terrain change.

Converter Selection of VFD Vibration-resistant Type Vortex Flowmeter

1. Introduction to converter performance

●Advanced FFT spectrum analysis signal processing circuit module

The converter adopts advanced FFT spectrum analysis signal processing circuit module, which can accurately detect the vortex information in a small signal and low flow area, so that the meter has super high stability and reliability in the low flow area, and the measurable flow range of the meter is greatly expanded. Besides, the fluid situation in the pipe can be analyzed, and the best judgment and adjustment can be made according to the analyzed data, reflecting high stability, intelligence and vibration resistance.

●Intelligent automatic zero setting. When it is confirmed that there is no flow in the pipe, this function can be used to effectively remove the inherent interference signal.

Output

Analog and pulse output modes, which can be set by the keys.

Analog output: 4~20mA DC, two-wire pulse output: low level ≤ 1V DC, high level ≥ 5V DC (standard: low level: 1V DC, high level 5V DC);

Maximum pulse frequency: 3kHz; duty cycle: about 50%;

HART communication

Communication signal: HART communication signal (1200Hz and 2200Hz analog signals are superimposed on 4~20mA DC signal);

Communication load resistance: 250Ω;

Communication distance: up to 1km with multi-stranded cable. The communication distance varies according to the type of cable used.

Self-diagnosis and alarm output

In case of an alarm (out of range, EEPROM error and other abnormalities), an alarm output signal is generated and displayed.

Data protection function in case of power loss

Data (parameters, accumulated flow, etc.) are saved in EEPROM, and no spare battery is required.

Damping time

Damping time is 0.5s~200s, which can be set by keypad, and the minimum delay time is 0.5s

Linear compensation function

Meter polyline correction: 5 approximate polylines can be used to correct and compensate the linear error of the meter.

Reynolds number compensation: The output error when the Reynolds number is less than 10,000 can be compensated by 5 approximate polylines.

Interchangeability

The converter can be used with sensors of various calibers.

Display

The low-power consumption 128x64 full-dot-matrix LCD is adopted, with clear and intuitive display;

Instantaneous flow, cumulative flow and percentage flow (expressed in %) can be displayed at the same time; short message of self-diagnosis can be displayed, and output current, pulse and other information can be displayed by keypad.

Explosion-proof performance (please refer to GB 3836.1, GB 3836.4 and GB 3836.2 for detailed explosion-proof parameters)

Explosion-proof grade: ExiaIICT6 or ExdIICT6;

Or Ex ia IIIC T 80°C Da or Ex tb IIIC T80°C Db;

Ex indicates that the electrical equipment conforms to the regulations on explosion-proof type;

ia: intrinsically safe type category a d: Flameproof type;

IIC: electrical equipment for other explosive gas environment except coal mine;

IIIC Conductive dust

T6: temperature group.

Small signal excision

When the flow is lower than the set low flow value, the output is 4 mA or 0 pulse.

Selection Table of VFD Vibration-resistant Type Vortex Flowmeter

Sensor | Sensor

VFD | XXX | X | X | X | X | X | X | XX | X | XX | X | X | X | X | X | X | X

Main Name

Caliber DN15~DN600
Expressed by three digits: The first two digits represent the significant figures of the caliber, and the third digit indicates the number of trailing zeros (unit: mm).

Nominal pressure
1:1.6MPa 2:2.5MPa 3:1.0MPa 4:ANSI150
5:4.0MPa 6:ANSI 300 7:ANSI600 8:6.3MPa
9: Others A:10.0MPa

Structure Material
Material combination sequence: body - generator - probe
2:HC -HC -HC 3:304-304-316L
4:304-316L-316L 5:316L-316L-HC
6:316L-316L-316L 9: Others
A:2205-2205-2205 B:Ti2-Ti2-Ti2
Note: If 2 is selected, it is for the clamp-on type flowmeter ≤DN80 only

Measuring medium
1: Liquid 3: Steam 2: Gas

Working environment
General places: ambient temperature: (-40~70)°C
Hazardous places: ambient temperature: (-20~60)°C
1: Medium temperature: (-40~120)°C
2: Medium temperature: (-40~200)°C
3: Medium temperature: (-40~400)°C

Connection method
1: Clamp-on type 3: Flange connection type 4: Reducing type (one-level)
5: Reducing type (two-level)) 6: Dual sensor (clamp-on type) 7: Dual sensor (flange type)
8: Clamp connection type
Note: The reducing type is limited to flange connection type; the clamp connection type is limited to DN15-DN50

Accuracy level
A: Class 1.0 B: Class 0.75 (liquid) E: Special

Cable length
Split type: 10m/20m/30m (10m by default) Integrated type: 00
Note: If there are special requirements, they must be stated when ordering.
The length of the special cable is expressed as an actual number, and the total cable length is ≤30m

Outgoing line seal
1: G1/2" external thread 2: 1/2" NPT internal thread 3: M20×1.5

Type
VH: Integrated type VR: Split type

Power supply
1: 24V DC

Display assembly
2: With display

Output signal
1: 4~20mA.DC output, two-wire system 2: 4~20mA. DC output and pulse output
3: with pulse output, no 4-20mA. DC output
Note: 4-20mA.DC output and 485 communication cannot be selected at the same time; 4-20mA.DC output and FF communication cannot be selected at the same time. For converters with 485 communication or FF communication, 3 must be selected.

Explosion-proof requirements
1: Non-explosion-proof 2: Intrinsically safe 3: Flameproof 4: Intrinsically safe dust 5: Flameproof dust
6: Combined explosion-proof Note: The explosion-proof grade of the combined explosion-proof needs to be noted in the contract.

Display orientation
1: Standard direction

Language
1: English

Communication protocol
0: None 1: HART 2: Modbus (RS485) 3: FF

Note:
1. When measuring flammable and explosive gases such as oxygen and natural gas, the sensor must be degreased first to avoid accidents.
2. The connecting flange is provided with a flexible graphite gasket. Flange connection type vortex flowmeter is not provided with pipe flanges and bolts in delivery, which can be processed by users themselves or purchased directly from us (please state the requirement when ordering)
3. The temperature compensation sensor and pressure compensation transmitter used for integrator, gas and steam measurement are non-standard factory accessories, and we can provide them on behalf of users according to their needs. Please explain when ordering.
4. The probe is provided with a graphite gasket.
5. IP grade is IP65 by default.
6. When the medium temperature is ≥280°C, the split type must be selected.
7. Additional options (/XX, see the additional option table)

Overview of VFE Intelligent Type Vortex Flowmeter

1. Applicable scope of product

The VFE intelligent type vortex flowmeter is a new generation of product with integrated real-time temperature and pressure compensation. The VFE intelligent type vortex flowmeter is equipped with temperature sensor and pressure sensor, which can measure fluid temperature and pressure in real time. In addition, the parameters such as operating flow, temperature and pressure can be converted into medium flow or standard flow, which can be settled easily. The VFE intelligent type vortex flowmeter has the characteristics of VFD vibration-resistant type vortex flowmeter, which can measure accurately even when the pipe vibration intensity is as high as 1g and the flow velocity is as low as 0.2m/s. The VFE intelligent type vortex flowmeter has high stability and vibration resistance, and can be used in harsh working environment.

2. Product characteristics

●Advanced FFT spectrum analysis signal processing technology

The advanced FFT technology is used to analyze and process the vortex flow signal, and able to accurately detect the vortex information in the area with small signal and low flow, which makes the meter also have super stability and reliability in the low flow area, and greatly expands the measurable flow range of the meter, with a turndown ratio of up to 1:30.

●High stability and vibration resistance

The independent double sensor technology is adopted, one sensor detects the fluid flow information, and the other sensor detects the pipe vibration information. In case of pipeline vibration intensity up to 1g, the meter is able to automatically analyze the fluid flow condition in the pipeline and the vibration of the pipeline itself, and accurately detect the effective vortex signal in strong interference to achieve accurate measurement, representing high stability and super vibration resistance.

●High reliability

The reverse protection and purification technology is adopted for power supply, and the isolation technology is adopted for vortex signal processing, with super EMI immunity.

●Low flow

The measurable lower limit flow velocity of the meter is as low as 0.2m/s (liquid)

●Wide range

The turndown ratio of measurable flow is up to 1:30

●Low-power consumption design

The operating current of the meter is less than 4mA, and the total power consumption is less than 100mW.

●Real-time temperature and pressure compensation

The built-in temperature sensor and pressure sensor of the meter can measure the temperature and pressure of fluid in real time, and the mass flow or standard flow can be measured through real-time temperature and pressure compensation, which can be used for trade settlement.

Temperature error: ±1°C, pressure accuracy: ±0. 5% FS

●Simple parameter setting

The frequently used parameter combinations are put in one module, reducing the parameter setting time.

●Concise and clear display

The instantaneous flow, cumulative flow, percentage flow (expressed in %) and self-diagnosis information can be displayed simultaneously.

●High accuracy

±0.5% of reading (the highest for liquid)

±1% of reading (gas and liquid) analog output

4~20mA current output mode, which can be set by key.

●Data protection in case of power loss

Data (parameters. accumulated values, etc.) are saved in EEPROM, and no spare battery is required

●Meter error compensation

The meter error can be compensated by 5 approximate polylines (by setting 5 compensation coefficients).

●Interchangeability

The converter can be used with sensors of various calibers.

●Explosion-proof design

Explosion-proof standard:

Exia IICT6 or Exd IICT6 (NEPSI certified).

Ex ia IIIC T200 80°C Da or

Ex tb IIIC T80°C Db(CMExC)

●Blockage-free design

The whole sensor is made of stainless steel, with simple and firm structure and without moving parts, avoiding holes, gaps and washers that are prone to failure as much as possible.

●Mechanical anti-vibration treatment

In the aspect of sensor, the vortex generator and probe are installed separately, and the probe adopts two main sampling piezoelectric wafers and two auxiliary sampling piezoelectric wafers. The signal detected by the probe is not affected by the mechanical vibration of the vortex generator.

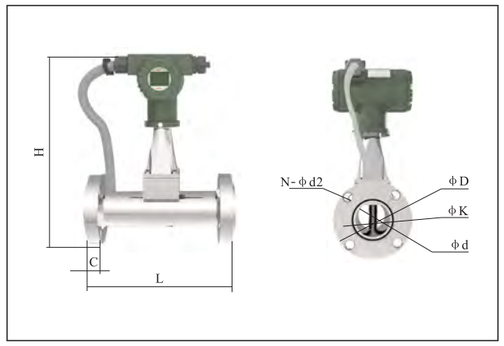
●Simple fault handling

The sensor is easy to install, and the meter coefficient is constant. Thanks to high data repeatability, the converter and sensor have good interchangeability, and the maintenance process is convenient and fast.

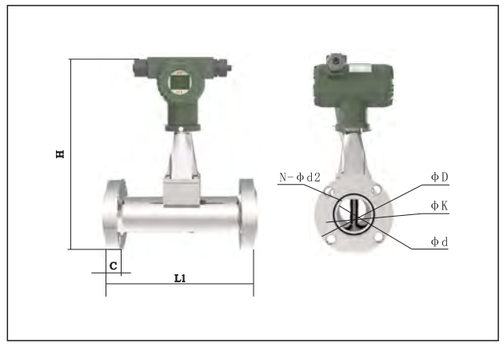
VFE Intelligent Vortex flowmeter	
	Flange type
Accuracy level	1.0 (gas/steam)
Caliber	DN15、DN20、DN25、DN32、DN40、DN50、DN65、DN80、DN100、DN125、DN150、 DN200、DN250、DN300
Pressure grade	1.0MPa、1.6 MPa、2.5 MPa 、ANSI150、ANSI300
Material of wetted part of sensor	304, 316L
IP grade	IP65, IP66, IP67
Explosion-proof grade	Intrinsically safe type: ExiaIICT6; flameproof type: ExdIICT6 Intrinsically safe dust: ExiaIIICT 80°CDa, flameproof dust ExtbIIICT80°CDb
Medium temperature range	-40°C~+120°C (general type), -40°C~+350°C(high temperature type)
Ambient Temperature	-30°C~+70°C
Repeatability	±0,3%
Turndown ratio	1:20 (up to 1:30)
Flow velocity range	Liquid: 0.3~7, gas: 3~60, steam: 2.5~60 Unit: (m/s)
Outgoing line seal	G1⁄2"、NPT1/2"、M20×1.5
Power supply voltage	External power supply, voltage range of 16.5~42 VDC, (with HART communication; minimum load of 250Ω and power supply of 21.5 VDC are required); with Modbus, and required voltage range of 21.6~26.4 VDC; with FF required voltage range: 9~-32 VDC
Output signal	Analog output (4~20)mA, pulse output)
Communication protocol	HART, Modbus(RS485), FF
Temperature error	±1°C
Pressure accuracy	± 0,5%FS

Note: The products with specifications not included in the above table can be ordered by agreements with the Company

Overall Dimensions of Flange Type Vortex Flowmeter



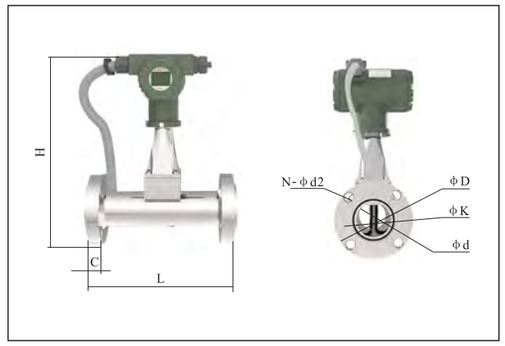
Temperature and Pressure Compensation



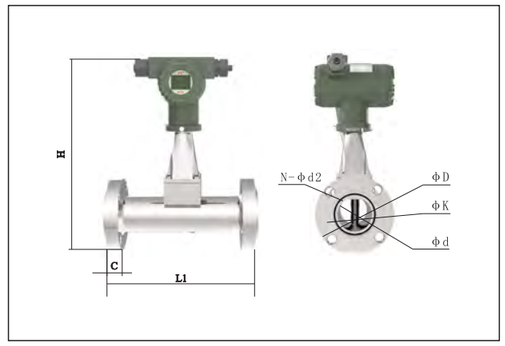
Temperature Compensation

Unit: (mm)

Nominal Pressure	Nominal Caliber	Meter Length L	Meter Length L1	Meter Height H	ID of Meter Body d	OD of Flange D	Central Pitch K	Bolt Aperture d2	Bolt Number N	Flange Thickness C
1.0MPa	15	250	200	435	15	95	65	14	4	14
	20	250	200	440	20	105	75	14	4	16
	25	250	200	445	25	115	85	14	4	16
	32	250	200	455	32	140	100	18	4	18
	40	200	200	460	40	150	110	18	4	18
	50	200	200	475	50	165	125	18	4	19
	65	200	200	495	65	185	145	18	8	20
	80	200	200	505	80	200	160	18	8	20
	100	250	250	528	100	220	180	18	8	22
	125	250	250	550	125	250	210	18	8	22
	150	300	300	583	150	285	240	22	8	24
	200	350	350	640	200	340	295	22	8	24
	250	450	450	690	250	395	350	22	12	26
	300	500	500	710	300	445	400	22	12	26



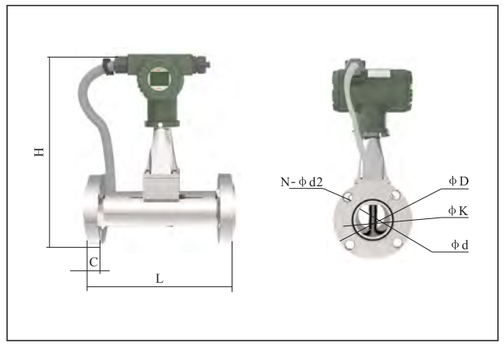
Temperature and Pressure Compensation



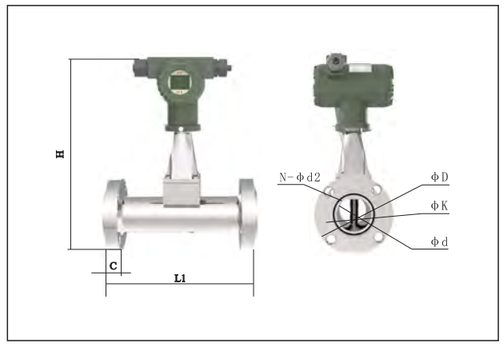
Temperature Compensation

Unit: (mm)

Nominal Pressure	Nominal Caliber	Meter Length L	Meter Length L1	Meter Height H	ID of Meter Body d	OD of Flange D	Central Pitch K	Bolt Aperture d2	Bolt Number N	Flange Thickness C
1.6MPa	15	250	200	435	15	95	65	14	4	14
	20	250	200	440	20	105	75	14	4	16
	25	250	200	445	25	115	85	14	4	16
	32	250	200	455	32	140	100	18	4	18
	40	200	200	460	40	150	110	18	4	18
	50	200	200	475	50	165	125	18	4	19
	65	200	200	495	65	185	145	18	8	20
	80	200	200	505	80	200	160	18	8	20
	100	250	250	528	100	220	180	18	8	22
	125	250	250	550	125	250	210	18	8	22
	150	300	300	583	150	285	240	22	8	24
	200	350	350	640	200	340	295	22	12	26
	250	450	450	695	250	405	355	26	12	29
	300	500	500	718	300	460	410	26	12	32



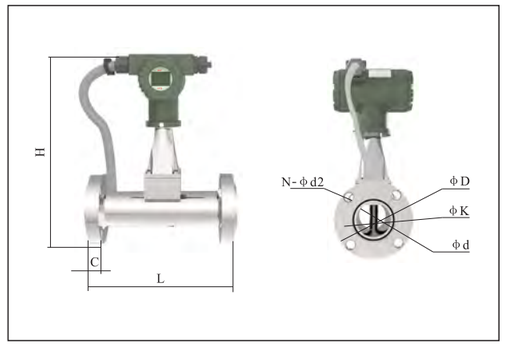
Temperature and Pressure Compensation



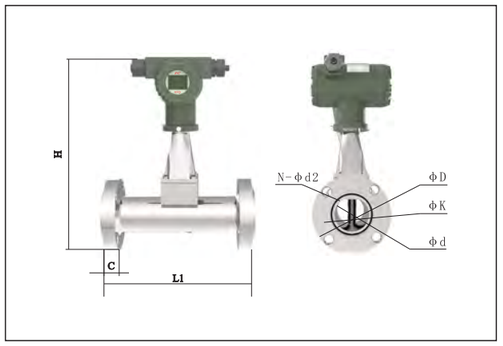
Temperature Compensation

Unit: (mm)

Nominal Pressure	Nominal Caliber	Meter Length L	Meter Length L1	Meter Height H	ID of Meter Body d	OD of Flange D	Central Pitch K	Bolt Aperture d2	Bolt Number N	Flange Thickness C
2.5MPa	15	250	200	435	15	95	65	14	4	14
	20	250	200	440	20	105	75	14	4	16
	25	250	200	445	25	115	85	14	4	16
	32	250	200	455	32	140	100	18	4	18
	40	200	200	460	40	150	110	18	4	18
	50	200	200	475	50	165	125	18	4	20
	65	200	200	495	65	185	145	18	8	22
	80	250	200	505	80	200	160	18	8	24
	100	250	250	535	100	235	190	22	8	26
	125	250	250	560	125	270	220	26	8	28
	150	300	300	590	150	300	250	26	8	30
	200	350	350	650	200	360	310	26	12	32
	250	450	450	705	250	425	370	30	12	35
	300	500	500	730	300	485	430	30	16	38



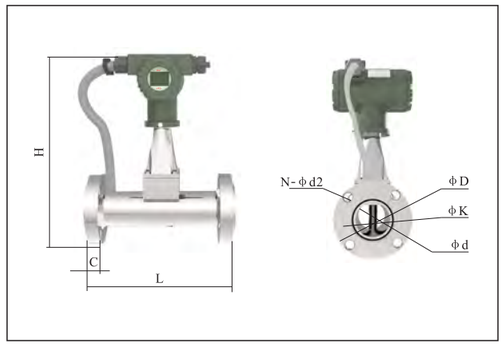
Temperature and Pressure Compensation



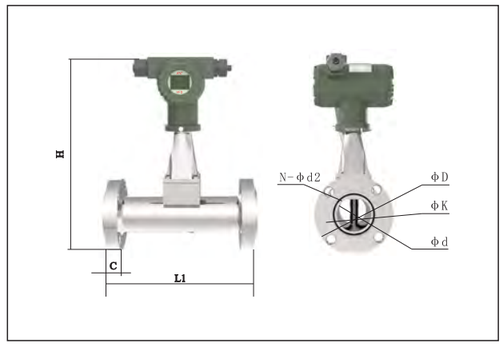
Temperature Compensation

Unit: (mm)

Nominal Pressure	Nominal Caliber	Meter Length L	Meter Length L1	Meter Height H	ID of Meter Body d	OD of Flange D	Central Pitch K	Bolt Aperture d2	Bolt Number N	Flange Thickness C
4.0MPa	15	250	200	435	15	95	65	14	4	14
	20	250	200	440	20	105	75	14	4	16
	25	250	200	445	25	115	85	14	4	16
	32	250	200	455	32	140	100	18	18	4
	40	200	200	460	40	150	110	18	4	18
	50	200	200	475	50	165	125	18	4	20
	65	200	200	495	65	185	145	18	8	22
	80	250	200	505	80	200	160	18	8	24
	100	250	250	535	100	235	190	22	8	26
	125	250	250	560	125	270	220	26	8	28
	150	300	300	590	150	300	250	26	8	30
	200	350	350	658	200	375	320	30	12	36
	250	450	450	718	250	450	385	33	12	42
	300	500	500	745	300	515	450	33	16	48



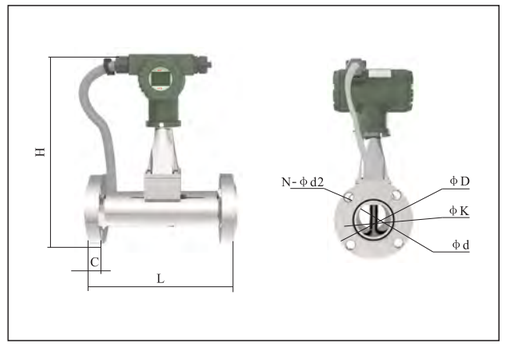
Temperature and Pressure Compensation



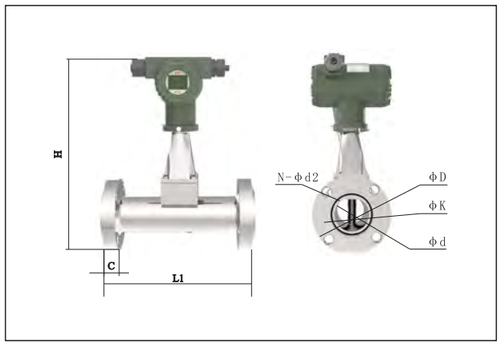
Temperature Compensation

Unit: (mm)

Nominal Pressure	Nominal Caliber	Meter Length L	Meter Length L1	Meter Height H	ID of Meter Body d	OD of Flange D	Central Pitch K	Bolt Aperture d2	Bolt Number N	Flange Thickness C
ANSI 150	15	250	200	433	15	90	60.3	16	4	11.6
	20	250	200	438	20	100	69.9	16	4	13.2
	25	250	200	443	25	110	79.4	16	4	14.7
	32	250	200	443	32	115	88.9	16	4	16.3
	40	200	200	448	40	125	98.4	16	4	17.9
	50	200	200	468	50	150	120.7	18	4	19.5
	65	200	200	493	65	180	139.7	18	4	22.7
	80	250	250	500	80	190	152.4	18	4	24.3
	100	250	250	533	100	230	190.5	18	8	24.3
	125	250	250	553	125	255	215.9	22	8	24.3
	150	300	300	580	150	280	241.3	22	8	25.9
	200	350	350	643	200	345	298.5	22	8	29
	250	450	450	695	250	405	362	26	12	30.6
	300	500	500	730	300	485	431.8	26	12	32.2



Temperature and Pressure Compensation



Temperature Compensation

Unit: (mm)

Nominal Pressure	Nominal Caliber	Meter Length L	Meter Length L1	Meter Height H	ID of Meter Body d	OD of Flange D	Central Pitch K	Bolt Aperture d2	Bolt Number N	Flange Thickness C
ANSI 300	15	250	200	435	15	95	66.7	16	4	14.7
	20	250	200	445	20	115	82.6	18	4	16.3
	25	250	200	450	25	125	88.9	18	4	18
	32	250	200	453	32	135	98.4	18	4	19.5
	40	200	200	463	40	155	114.3	22	4	21.1
	50	250	200	475	50	165	127	18	8	22.7
	65	250	250	498	65	190	149.2	22	8	26
	80	250	250	510	80	210	168.3	22	8	29
	100	250	250	545	100	255	200	22	8	32.2
	125	250	250	565	125	280	235	22	8	35.4
	150	300	300	600	150	320	269.9	22	12	37
	200	350	350	660	200	380	330.2	26	12	41.7
	250	450	450	715	250	445	387.4	30	16	48.1
	300	500	500	748	300	520	450.8	33	16	51.3

Note: The dimensions in the above table are all conventional contract dimensions. In case of any special dimension requirements, please make an order with the Company.

Converter Selection of VFE Intelligent Type Vortex Flowmeter

1. Introduction to converter performance

●Advanced FFT spectrum analysis signal processing circuit

The converter adopts advanced FFT spectrum analysis signal processing circuit module, which can accurately detect the vortex information in a small signal and low flow area, so that the meter has super high stability and reliability in the low flow area, and the measurable flow range of the meter is greatly expanded. Besides, the fluid situation in the pipe can be analyzed, and the best judgment and adjustment can be made according to the analyzed data, reflecting high stability, intelligence and vibration resistance.

●Real-time temperature and pressure compensation function

The temperature, pressure and operating flow of the medium can be measured in real time, and these parameters can be converted into standard flow or mass flow of the medium.

●Intelligent automatic zero setting

When it is confirmed that there is no flow in the pipeline, this function can be used to effectively remove the inherent interference signal.

●HART communication

Communication signal: HART communication signal (1200Hz and 2200Hz analog signals are superimposed on (4~20)mA DC signal);

Communication load resistance: 250Ω

Communication distance: up to 1km with multi-stranded cable. The communication distance varies according to the type of cable used.

●Self-diagnosis and alarm output

In case of an alarm (out of range, EEPROM error and other abnormalities), an alarm output signal is generated and displayed.

●Data protection function in case of power loss

Data (parameters, accumulated flow, etc.) are saved in EEPROM, and no spare battery is required.

●Damping time

Damping time is 0.5s-200s, which can be set by the keys;

The minimum delay time is 0.5s;

●Linear compensation function

Meter polyline correction: 5 approximate polylines can be used to correct and compensate the linear error of the meter.

Reynolds number compensation: The output error when the Reynolds number is less than 10,000 can be compensated by 5 approximate polylines.

●Interchangeability

The converter can be used with sensors of various calibers.

●Display

The low-power consumption 128x64 full-dot-matrix LCD is adopted, with clear and intuitive display;

Instantaneous flow, cumulative flow and percentage flow (expressed in %) can be displayed at the same time; short message of self-diagnosis can be displayed, and output current, pulse and other information can be displayed by keypad.

●Explosion-proof performance (please refer to GB 3836.1, GB 3836.4 and GB 3836.2 for detailed explosion-proof parameters)

Explosion-proof grade: Exia IIC T6, Exd IIC T6;

EX indicates that the electrical equipment conforms to the regulations on explosion-proof type;

ia: intrinsically safe type category a;

d: Flameproof type;

IIC: electrical equipment for other explosive gas environment except coal mine;

T6: temperature group;

●Small signal excision

When the flow is lower than the set low flow value, the output is 4 mA or 0 pulse.

2. Selection Table of VFE Intelligent Type Vortex Flowmeter

Sensor | Converter

VFE | XXX | X | X | X | X | X | X | XX | X | XX | X | X | X | X | X | X | X | X

Main Name

Caliber DN15~DN300
Expressed by three digits: The first two digits represent the significant figures of the caliber, and the third digit indicates the number of trailing zeros (unit: mm).
Note: DN125 is special and is indicated as 121.

Nominal pressure
1:1.6MPa 2:2.5MPa 3:1.0MPa
4:ANSI150 5:4.0MPa 6:ANSI 300

Structure Material
Material combination sequence: body - generator - probe
3: 304-304-316L 4: 304-316L-316L
5: 316L-316L-HC 6: 316L-316L-316L
9: Others

Measuring medium
1: Liquid 3: Steam 2: Gas

Working environment
General places: ambient temperature: (-40~70)°C
Hazardous places: ambient temperature: (-20~60)°C
1: Medium temperature: (-40~120)°C
2: Medium temperature: (-40~200)°C
3: Medium temperature: (-40~350)°C

Connection method
3: Flange connection type 7: Dual sensor (flange type)

Accuracy level
A: Class 1.0 E: Special

Pressure sensor
00: Her 01:1.6MPa 02: 4. 0MPa

Outgoing line seal
1: G1/2" external thread 2: 1/2" NPT internal thread 3: M20×1.5

Type
VH: Integrated type

Power supply
1:24V DC

Display assembly
2: With display

Output signal
1: 4~20mA.DC output, two-wire system 2: 4~20mA. DC output and pulse output
3: with pulse output, no 4-20mA. DC output
Note: 4-20mA.DC output and 485 communication cannot be selected at the same time; 4-20mA.DC output and FF communication cannot be selected at the same time. For converters with 485 communication or FF communication, 3 must be selected.

Explosion-proof requirements
1: Non-explosion-proof 2: Intrinsically safe 3: Flameproof
4: Intrinsically safe dust 5: Flameproof dust 6: Combined explosion-proof
Note: The explosion-proof grade of the combined explosion-proof needs to be noted in the contract.

Display orientation
1: Standard direction

Language
1: English

Communication protoco
0: None 1: HART 2: Modbus (RS485) 3: FF

Compensation mode
T: temperature compensation L: low-temperature temperature and pressure compensation (-40~120)°C
H: high-temperature temperature and pressure compensation (-40~350)°C

Note:
1. When measuring flammable and explosive gases such as oxygen and natural gas, the sensor must be degreased first to avoid accidents. 2. The connecting flange is provided with a flexible graphite gasket. Flange connection type vortex flowmeter is not provided with pipe flanges and bolts in delivery, which can be processed by users themselves or purchased directly from us (please state the requirement when ordering)
3. The probe is provided with a graphite gasket. 4. IP grade is IP65 by default. 5. The operating pressure of VFE vortex flowmeter shall be less than the allowable value of pressure sensor. 6. Additional options / XX (See the additional option table)

Overview of VFT Enhanced Vortex Flowmeter

1. Application scope of product

The VFT enhanced vortex flowmeter is a high-performance flowmeter product introduced by the Company. The detection body of the VFT enhanced vortex flowmeter adopts a lifting cantilever beam tail wing structure. The probe is not wetted, which can realize the online replacement function of the probe. It is a new revolution in vortex flowmeters and brings vortex flowmeter products to a new level. This meter is still able to measure accurately when the vibration intensity of the pipeline is as high as 1.5g and the liquid flow velocity is as low as 0.3 m/s (3 m/s for gas). The VFT enhanced vortex flowmeter has super stability and vibration resistance, and is specially used in the worst working environment.

2. Product features

●Advanced FFT spectrum analysis signal processing technology

The international most advanced FFT technology is used to analyze and process the vortex flow signal, and able to accurately detect the vortex signal in the area with small signal and low flow, which makes the meter also have super stability and reliability in the low flow area, and greatly expands the measurable flow range of the meter, with an accuracy range of up to 1:40.

●High stability and vibration resistance

A lifting cantilever beam tail wing structure is adopted by the detection body. The probe is not wetted. It not only realizes the online replacement function of the probe, but also optimizes the mass balance and anti-vibration algorithm of the sensor to achieve meter measurement reliability under strong vibration. In case of pipeline vibration intensity up to 1.5g, the meter is able to automatically analyze the fluid condition in the pipeline and the vibration of the pipeline itself, and accurately detect the effective vortex signal in strong interference to achieve accurate measurement, representing high stability and super vibration resistance.

●High reliability

The reverse protection and purification technology is adopted for power supply, and the isolation technology is adopted for vortex signal processing, with super anti-EMI capability.

●Low flow

The lower limit flow velocity of measurable liquid of the meter is as low as 0.3m/s. (temperature: 20°C; water density: 1000 kg/m^3)

●Wide range

The accuracy range can reach up to 1:40.

●Low-power consumption design

The working current of the meter is less than 4 mA, and the total power consumption is less than 100 mW.

●Simple parameter setting

The frequently used parameter combinations are put in one module, reducing the parameter setting time.

●Concise and clear display

The instantaneous flow, cumulative flow, percentage flow (expressed in %) and self-diagnosis information can be displayed simultaneously.

●High accuracy

±0.75% of reading (the highest for liquid)

±1.0% of reading (liquid, gas, steam)

●Wide temperature range

General type: (-40~260)°C

High temperature type: (-40~400)°C

●Analog/pulse output

4-20 mA current signal and pulse signal can be output simultaneously

●Alarm output

In case of out-of-range, EEPROM error, etc., an alarm is output and displayed.

●Data protection in case of power loss

Data (parameters, accumulated values, etc.) are stored in EEPROM, and no spare battery is required.

●Meter error compensation

The meter error can be compensated by 5 approximate polylines (by setting 5 compensation coefficients).

●Interchangeability

The converter can be used with sensors of various calibers.

●Explosion-proof design

The explosion-proof mark is:

Intrinsically safe: Ex ia IIC T6Ga/Ex ia IIIC T20080°CDa

Flameproof: Ex db IIC T6Gb/Ex tb IIIC T80°CDb

●Blockage-free design

The whole sensor is made of stainless steel, with simple and firm structure and without moving parts, avoiding holes, gaps and washers that are prone to failure as much as possible.

●Mechanical anti-vibration treatment

In the aspect of sensor, the vortex generator and probe are installed separately, and the probe adopts two main sampling piezoelectric wafers and two auxiliary sampling piezoelectric wafers. The signal detected by the probe is not affected by the mechanical vibration of the vortex generator.

●Simple fault handling

The sensor is easy to install, and the meter coefficient is constant. Thanks to high data repeatability, the converter and sensor have good interchangeability, and the maintenance process is convenient and fast.

●Temperature and pressure compensation

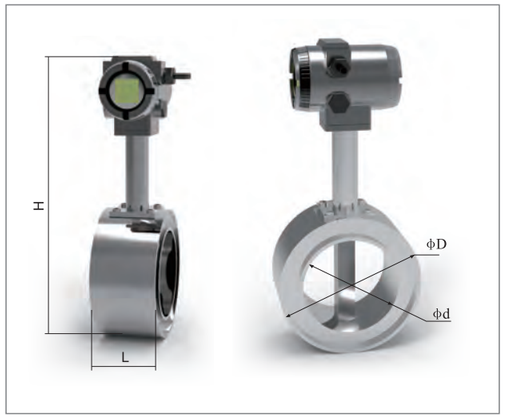
Temperature and pressure time-sharing multiplexing effectively reduces power consumption, supports integrated temperature and pressure acquisition function and preset temperature and pressure function, and realizes flow compensation integration under working conditions.

3 Main technical indicators

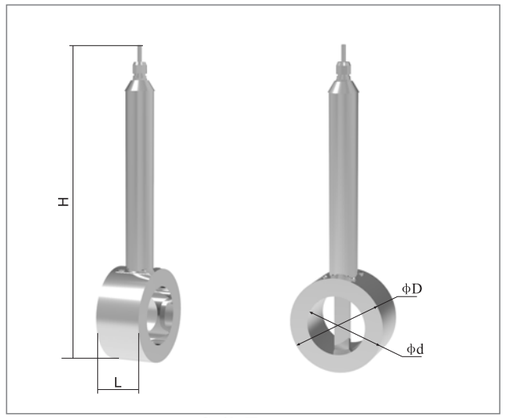
VFT enhanced vortex flowmeter		
	Clamp-on type	Flange type
Accuracy level	1.0 (gas); 1.0 (liquid); 0.75 (highest for liquid, other accuracies shall be determined as per agreement)	
Caliber	DN15, DN20, DN25, DN32, DN40, DN50, DN65, DN80, DN100, DN125, DN150, DN200, DN250 and DN300 (other calibers shall be determined as per agreement)	
Pressure grade	1.0MPa, 1.6MPa, 2.5MPa, 4.0MPa, ANSI150, ANSI300 (other pressures shall be determined as per agreement)	
Material of wetted part of sensor	304, 316L, Hastelloy C (other materials shall be determined as per agreement)	
IP grade	IP65、IP66、IP67	
Explosion-proof grade	Intrinsically safe: Ex ia IIC T6Ga/Ex ia IIIC T 80°C Da Flameproof: Ex db IICT6Gb/Ex tb IIIC T80°CDb	
Medium temperature range	-40°C~+260°C (general type); -40°C~+400°C (high temperature type); (other medium temperatures shall be determined as per agreement)	
Ambient Temperature	Integrated type: (-40~70)°C; split sensor: (-52~70)°C; split converter: (-40~70)°C;	
Repeatability	1/3 of accuracy level	
Turndown ratio	1:20 (maximum 1:40)	
Flow velocity range	Reference range: liquid: 0.3~7, gas: 3~75, steam: 2.5~75 units (m/s)	
Outgoing line seal	G1/2"、1/2"NPT、M20×1.5	
Power supply voltage	External power supply: no communication. Power supply voltage range: 16.5~42VDC; With HART communication; minimum load of 250Ω and power supply of 21.5 VDC are required; FF bus power supply voltage range is 9~32VDC; with Modbus, the required voltage range is 21.6~26.4VDC	
Output signal	Analog output 4~-20mA, pulse output	
Communication protocol	HART, Modbus(RS485), FF	

Overall Dimensions of VFT Vibration-resistant Type Vortex Flowmeter

1. Overall dimensions of VFT clamp-on type vortex flowmeter



Integrated Type



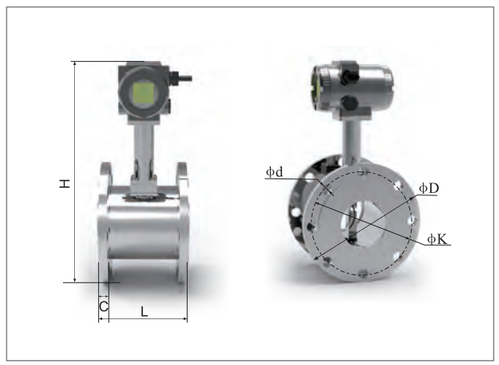
Split Type

Unit: (mm)

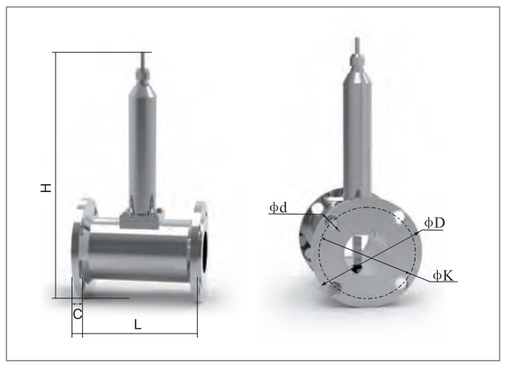
Nominal Caliber	Length of Meter Body L	ID of Meter Body d	OD of Meter Body D	Height of Meter Body H		Weight KG
				Integrated type (VH type)	Split type (VR type)	
15	65	15	55*56 square steel	370	280	4.9
20	75	20	55*56 square steel	370	280	5.0
25	75	25	58*57 square steel	370	280	5.0
32	75	32	76	373	308	5.6
40	75	40	88	387	322	6.3
50	75	50	95	386	321	6.5
65	75	65	103	402	337	6.6
80	85	80	125	423	358	8.6
100	90	100	150	445	380	11.0
125	100	125	175	475	410	13.8
150	110	150	206	508	443	18.5
200	125	200	248	548	483	24.3
250	140	250	298	598	533	33.9
300	160	300	358	658	593	55.0

Note: The clamp-on type vortex flowmeter is provided with matching flanges, bolts and gaskets in case of delivery from factory.

2. Overall dimensions of VFT flange type vortex flowmeter (1.0MPa)



Integrated Type

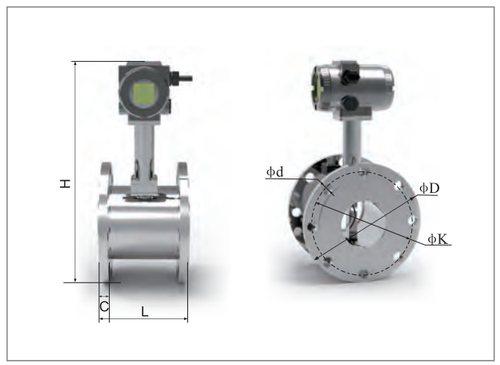


Split Type

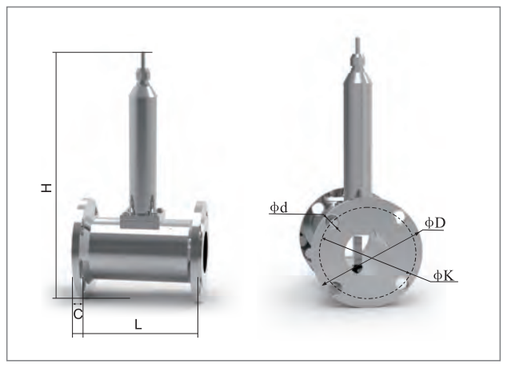
Unit: (mm)

Nominal Pressure	Nominal Diameter	Meter Length L	Meter Height H		ID of Meter Body d	OD of Flange D	Central Pitch K	Bolt Hole Diameter d2	Bolt Number N	Flange Thickness C	Weight (Kg)
			Integrated type	Split type							
1.0MPa	15	160	381	316	15	95	65	14	4	14	5.4
	20	160	386	321	20	105	75	14	4	16	5.8
	25	160	392	327	25	115	85	14	4	16	5.9
	32	170	408	343	32	140	100	18	4	18	7.3
	40	170	418	353	40	150	110	18	4	18	7.2
	50	180	430	365	50	165	125	18	4	20	8.7
	65	180	438	373	65	185	145	18	8	20	10.3
	80	200	462	397	80	200	160	18	8	20	12.9
	100	220	483	418	100	220	180	18	8	22	18.1
	125	220	510	445	125	250	210	18	8	22	23.4
	150	240	541	476	150	285	240	22	8	24	30.3
	200	280	600	535	200	340	295	22	8	24	42.5
	250	300	658	593	250	395	350	22	12	26	68.0
	300	320	712	647	300	445	400	22	12	26	92.2

3. Overall dimensions of VFT flange type vortex flowmeter (1.6MPa)



Integrated Type

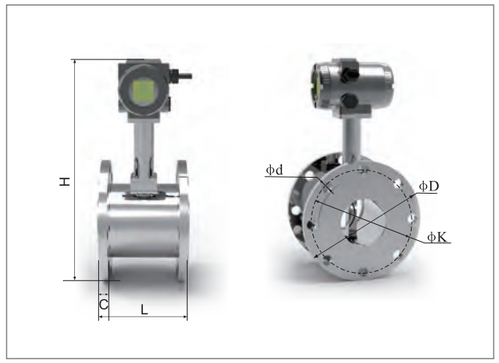


Split Type

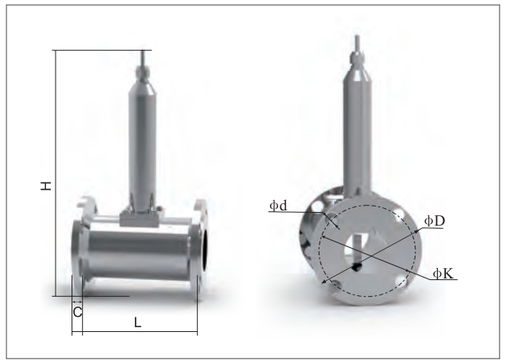
Unit: (mm)

Nominal Pressure	Nominal Caliber	Meter Length L	Height of Meter Body H		ID of Meter Body d	Flange Outer Diameter D	Central Pitch K	Bolt Hole Diameter d2	Bolt Number N	Flange Thickness C	Weight (Kg)
			Integrated type	Split type							
1.6MPa	15	160	381	316	15	95	65	14	4	14	5.9
	20	160	386	321	20	105	75	14	4	16	6.3
	25	160	392	327	25	115	85	14	4	16	6.3
	32	170	408	343	32	140	100	18	4	18	7.9
	40	170	418	353	40	150	110	18	4	18	7.8
	50	180	430	365	50	165	125	18	4	20	9.4
	65	180	438	373	65	185	145	18	8	20	11.1
	80	200	462	397	80	200	160	18	8	20	14.0
	100	220	483	418	100	220	180	18	8	22	19.6
	125	220	510	445	125	250	210	18	8	22	25.3
	150	240	541	476	150	285	240	22	8	24	32.8
	200	280	600	535	200	340	295	22	12	24	46.0
	250	300	658	593	250	405	355	26	12	29	73.6
	300	320	712	647	300	460	410	26	12	32	99.8

4. Overall dimensions of VFT flange type vortex flowmeter (2.5MPa)



Integrated Type

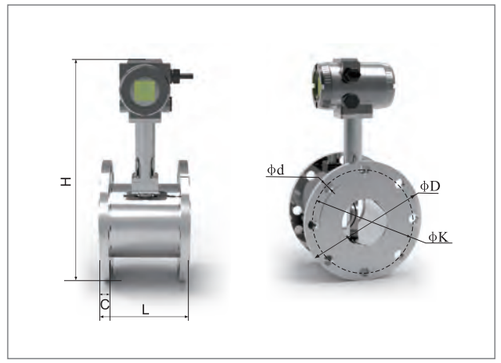


Split Type

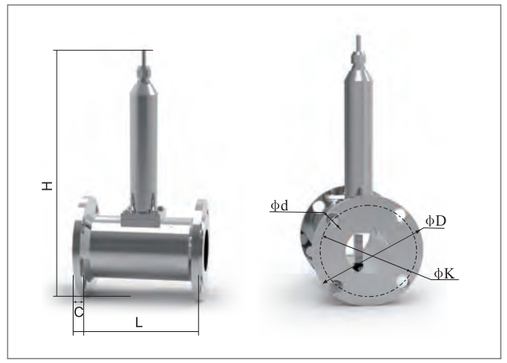
Unit: (mm)

Nominal Pressure	Nominal Caliber	Meter Length L	Height of Meter Body H		ID of Meter Body d	Flange Outer Diameter D	Central Pitch K	Bolt Hole Diameter d2	Bolt Number N	Flange Thickness C	Weight (Kg)
			Integrated type	Split type							
2.5MPa	15	160	381	316	15	95	65	14	4	14	6.4
	20	160	386	321	20	105	75	14	4	16	6.8
	25	160	392	327	25	115	85	14	4	16	6.9
	32	170	408	343	32	140	100	18	4	18	8.6
	40	170	418	353	40	150	110	18	4	18	8.5
	50	180	430	365	50	165	125	18	4	20	10.2
	65	180	438	373	65	185	145	18	8	22	12.1
	80	200	462	397	80	200	160	18	8	24	15.2
	100	220	490	425	100	235	190	22	8	26	21.3
	125	220	520	455	125	270	220	26	8	28	27.5
	150	240	549	484	150	300	250	26	8	30	35.7
	200	280	610	545	200	360	310	26	12	32	50
	250	300	669	604	250	425	370	30	12	35	80
	300	320	725	660	300	485	430	30	16	38	108.5

5. Overall dimensions of VFT flange type vortex flowmeter (4.0MPa)



Integrated Type

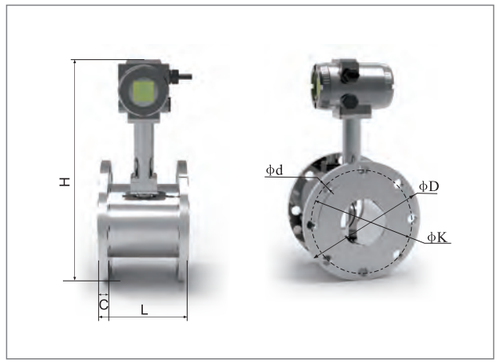


Split Type

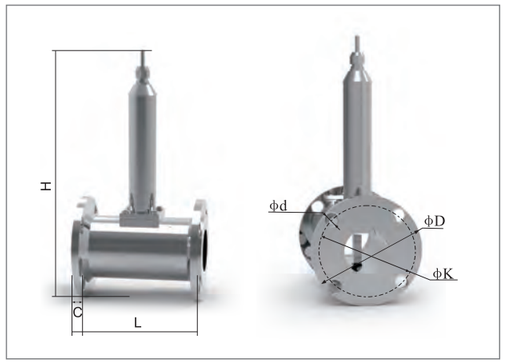
Unit: (mm)

Nominal Pressure	Nominal Caliber	Meter Length L	Height of Meter Body H		ID of Meter Body d	Flange Outer Diameter D	Central Pitch K	Bolt Hole Diameter d2	Bolt Number N	Flange Thickness C	Weight (Kg)
			Integrated type	Split type							
4.0MPa	15	160	381	316	15	95	65	14	4	14	6.9
	20	160	386	321	20	105	75	14	4	16	7.3
	25	160	392	327	25	115	85	14	4	16	7.5
	32	170	408	343	32	140	100	18	4	18	9.3
	40	170	418	353	40	150	110	18	4	18	9.2
	50	180	430	365	50	165	125	18	4	20	11.0
	65	180	438	373	65	185	145	18	8	22	13.1
	80	200	462	397	80	200	160	18	8	24	16.4
	100	220	490	425	100	235	190	22	8	26	23.0
	125	220	520	455	125	270	220	26	8	28	29.7
	150	240	549	484	150	300	250	26	8	30	38.6
	200	280	618	553	200	375	320	30	12	36	54.0
	250	300	682	617	250	450	385	33	12	42	86.4
	300	320	740	675	300	515	450	33	16	48	117.2

6. Overall dimensions of VFT flange type vortex flowmeter (ANSI150)



Integrated Type

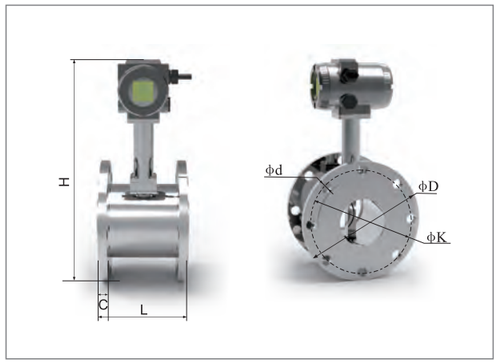


Split Type

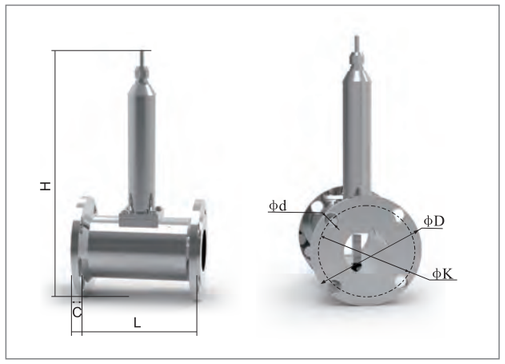
Unit: (mm)

Nominal Pressure	Nominal Caliber	Meter Length L	Height of Meter Body H		ID of Meter Body d	Flange Outer Diameter D	Central Pitch K	Bolt Hole Diameter d2	Bolt Number N	Flange Thickness C	Weight (Kg)
			Integrated type	Split type							
ANSI 150	15	160	378	313	15	90	60.3	16	4	11.6	6.7
	20	160	383	318	20	100	69.9	16	4	13.2	7.1
	25	160	389	324	25	110	79.4	16	4	14.7	7.2
	32	170	396	331	32	120	88.9	16	4	16.3	9.0
	40	170	405	340	40	130	98.4	16	4	17.9	8.9
	50	180	423	358	50	150	120.7	18	4	19.5	10.7
	65	180	445	380	65	180	139.7	18	4	22.7	12.7
	80	200	457	392	80	190	152.4	18	4	24.3	16.0
	100	220	488	423	100	230	190.5	18	8	24.3	22.4
	125	220	513	448	125	255	215.9	22	8	24.3	28.9
	150	240	539	474	150	280	241.3	22	8	26	37.5
	200	280	601	536	200	345	298.5	22	8	29	52.5
	250	300	659	594	250	405	362	26	12	30.6	84.0
	300	320	725	660	300	485	431.8	26	12	32.2	113.9

7. Overall dimensions of VFT flange type vortex flowmeter (ANSI300)



Integrated Type



Split Type

Unit: (mm)

Nominal Pressure	Nominal Caliber	Meter Length L	Height of Meter Body H		ID of Meter Body d	Flange Outer Diameter D	Central Pitch K	Bolt Hole Diameter d2	Bolt Number N	Flange Thickness C	Weight (Kg)
			Integrated type	Split type							
ANSI 300	15	160	386	321	15	95	66.7	16	4	14.7	7.2
	20	160	391	326	20	115	82.6	18	4	16.3	7.6
	25	160	397	332	25	125	88.9	18	4	18	7.7
	32	170	405	340	32	135	98.4	18	4	19.5	9.6
	40	170	420	355	40	155	114.3	22	4	21.1	9.5
	50	180	430	365	50	165	127	18	8	22.7	11.4
	65	180	450	385	65	190	149.2	22	8	26	13.6
	80	200	467	402	80	210	168.3	22	8	29	17.0
	100	220	500	435	100	255	200	22	8	32.2	23.9
	125	220	525	460	125	280	235	22	8	35.4	30.8
	150	240	559	494	150	320	269.9	22	12	37	40.0
	200	280	619	554	200	380	330.2	26	12	41.7	56.0
	250	300	680	615	250	445	387.4	30	16	48.1	89.6
	300	320	745	680	300	520	450.8	33	16	51.3	121.5

Note: The dimensions in the above table are all conventional contract dimensions. In case of any special dimension requirements, please make an order with the Company.

Selection of VFT Enhanced Vortex Flowmeter Sensor

1. Application scope of product

(1) Minimum and maximum measurable flow velocities

Category	Medium	Caliber	General type, low temperature type (detection body material: 316L)	High temperature type, high corrosion type (detection body material: HC)
Minimum measurable flow velocity (take the maximum of the two)	Gas	DN15	$\sqrt{32.5/\rho}$ Or 5 (m/s)	$\sqrt{52/\rho}$ Or 6.3 (m/s)
		DN20-300	$\sqrt{22/\rho}$ Or 4 (m/s)	$\sqrt{40/\rho}$ Or 5 (m/s)
	Liquid	DN15	$\sqrt{250/\rho}$ Or 0.5 (m/s)	$\sqrt{490/\rho}$ Or 0.7 (m/s)
		DN20-125	$\sqrt{160/\rho}$ Or 0.4 (m/s)	$\sqrt{250/\rho}$ Or 0.5 (m/s)
		DN150-200	$\sqrt{360/\rho}$ Or 0.6 (m/s)	$\sqrt{490/\rho}$ Or 0.7 (m/s)
		DN250-300	$\sqrt{490/\rho}$ Or 0.7 (m/s)	$\sqrt{640/\rho}$ Or 0.8 (m/s)
Maximum measurable flow velocity (take the minimum of the two)	Gas	DN15	$\sqrt{40000/\rho}$ Or 40 (m/s)	
		DN20	$\sqrt{40000/\rho}$ Or 50 (m/s)	
		DN25	$\sqrt{56000/\rho}$ Or 60 (m/s)	
		DN32	$\sqrt{76000/\rho}$ Or 70 (m/s)	
		DN40-300	$\sqrt{100000/\rho}$ Or 80 (m/s)	
	Liquid	DN15-300	$\sqrt{100000/\rho}$ Or 9 (m/s)	

Where ρ is the density of the process medium in a flowing state, in kg/m^3. Generally, for gas and steam, ρ≥0.5kg/m^3; for liquids, 400≤ρ≤2000kg/m^3.

(2) VFT gas/steam measurement flow range

Caliber (mm)	Calibration Flow Range m³/h	Calibration Output Frequency Range Hz	Measurable Flow Range m³/h	Reference range of measurable output frequency Hz
15	5-20	458-1830	3.2-26	323-2515
20	8-40	290-1448	4.5-56	201-2255
25	12-60	264-1320	7-106	178-2168
32	12-116	110-1068	11.3-202	104-2056
40	18-181	90-905	18-360	90-1980
50	28-283	75-758	28-560	75-1507
65	48-478	60-598	48-960	60-1195
80	72-724	41-412	72-1440	41-836
100	113-1131	35-350	113-2260	35-697
125	177-1767	26-259	177-3540	26-531
150	254-2545	23-230	254-5080	23-454
200	452-4100	15-150	452-9040	15-308
250	707-7069	12-120	707-14125	12-249
300	1018-10179	9-90	1018-20340	9-190

•Note: The gas is calibrated according to the calibration flow range by default when leaving the factory, and the nameplate is engraved according to the calibration flow. If it is necessary to calibrate the flow according to other flow rates, the supply needs to be negotiated.

(3) VFT liquid measurement flow range

Caliber (mm)	Calibration Flow Range m³/h	Calibration Output Frequency Range Hz	Measurable Flow Range m³/h	Reference range of measurable output frequency Hz
15	0.32-3.2	57.6-576	0.3-5.7	54-993
20	0.56-5.6	19.2-192	0.34-10.1	12-338
25	0.9-9	15.8-158	0.53-15.8	9.3-280
32	1.5-15	13.3-133	0.9-26	8-230
40	2.3-23	9.2-92	1.4-40.7	5.6-160
50	3-30	7.1-71	2.1-63.5	5-153
65	6-60	7.5-75	3.6-107	4.5-134
80	9-90	4.8-48	7.2-162.7	3.9-87
100	14-140	3.9-395.3	11.3-254	3.2-72.6
125	22-220	3.6-355	17.7-397	2.9-64.5
150	45-320	3.4-24	38-572	2.9-43
200	79-560	2.6-16	56-1017	1.6-29
250	124-880	2.1-14.9	106-1588	1.8-27
300	178-1280	1.9-13.7	153-2290	1.7-24

•Note: The liquid is calibrated according to the calibration flow range by default when leaving the factory, and the nameplate is engraved according to the calibration flow. If it is necessary to calibrate the flow according to other flow rates, the supply needs to be negotiated.

(4) Saturated Steam Mass Flow Range Table

Unit: (kg/h)

Absolute pressure (MPa)	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.2	1.5	2.0
Temperature (°C)	133.5	143.6	151.8	158.9	165.0	170.7	175.4	179.9	187.9	198.0	212.4
Density (Kg/m^3)	1.651	2.163	2.669	3.170	3.667	4.162	4.655	5.147	6.127	7.602	10.050
DN15 standard lower limit	8	11	13	16	18	21	23	26	31	38	50
DN15 standard upper limit	33	43	53	63	73	83	93	103	123	152	201
DN20 standard lower limit	13	17	21	25	29	33	37	41	49	61	80
DN20 standard upper limit	66	87	107	127	147	166	186	206	245	304	402
DN25 standard lower limit	20	26	32	38	44	50	56	62	74	91	121
DN25 standard upper limit	99	130	160	190	220	250	279	309	368	456	603
DN32 standard lower limit	20	26	32	38	44	50	56	62	74	91	121
DN32 standard upper limit	192	251	310	368	425	483	540	597	711	882	1166
DN40 standard lower limit	30	39	48	57	66	75	84	93	110	137	181
DN40 standard upper limit	299	392	483	574	664	753	843	932	1109	1376	1819
DN50 standard lower limit	46	61	75	89	103	117	130	144	172	213	281
DN50 standard upper limit	467	612	755	897	1038	1178	1317	1457	1734	2151	2844
DN65 standard lower limit	79	104	128	152	176	200	223	247	294	365	482
DN65 standard upper limit	789	1034	1276	1515	1753	1989	2225	2460	2929	3634	4804
DN80 standard lower limit	119	156	192	228	264	300	335	371	441	547	724
DN80 standard upper limit	1195	1566	1932	2295	2655	3013	3370	3726	4436	5504	7276
DN100 standard lower limit	187	244	302	358	414	470	526	582	692	859	1136
DN100 standard upper limit	1867	2446	3019	3585	4147	4707	5265	5821	6930	8598	11367
DN125 standard lower limit	292	383	472	561	649	737	824	911	1084	1346	1779
DN125 standard upper limit	2917	3822	4716	5601	6480	7354	8225	9095	10826	13433	17758
DN150 standard lower limit	419	549	678	805	931	1057	1182	1307	1556	1931	2553
DN150 standard upper limit	4202	5505	6793	8068	9333	10592	11847	13099	15593	19347	25577
DN200 standard lower limit	746	978	1206	1433	1657	1881	2104	2326	2769	3436	4543
DN200 standard upper limit	6769	8868	10943	12997	15035	17064	19086	21103	25121	31168	41205
DN250 standard lower limit	1167	1529	1887	2241	2593	2943	3291	3639	4332	5375	7105
DN250 standard upper limit	11671	15290	18867	22409	25922	29421	32906	36384	43312	53739	71043
DN300 standard lower limit	1681	2202	2717	3227	3733	4237	4739	5240	6237	7739	10231
DN300 standard upper limit	16806	22017	27168	32267	37326	42365	47383	52391	62367	77381	102299

Note: The above flow is the reference flow of saturated steam. The specific flow shall be subject to the calculation sheet

(5) The caliber of the selected sensor is the same as that of the connected process pipeline

This option is convenient for installation

(6) The caliber of the selected sensor is different from that of the connected process pipeline

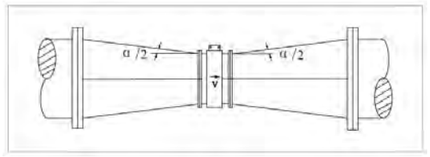
This option is applicable in the following situations:

A. The flow velocity in the pipeline is low, and the process flow is relatively stable. In order to meet the requirements of the meter for the flow velocity range, the caliber of the sensor can be selected to be smaller than that of the process pipeline, and a reducer can be added in front of and behind the sensor.

B. Considering the price, for large-caliber vortex flowmeter, the larger the caliber, the higher the price. When the flow velocity in the pipeline is low and the process parameters are stable, the sensor with smaller caliber can be selected, which can not only make the instrument run in better working conditions, but also reduce the investment cost of the instrument.

(7) Precautions for installing reducer

In order not to affect the distribution of flow velocity field too much and the measurement accuracy of the meter, the central cone angle a of the reducer shall not be greater than 15°, so that the reducer can be regarded as a part of the straight pipe section.



Installation of Meter on Reducer

(8) Selection of caliber code

The expression of the caliber of VFT series vortex flowmeter is three digits: the first and second digits of DN and the number of zeros following the first two digits (unit: mm). For example: code 150 means the caliber is 15mm; code 151 means the caliber is 150mm; 152 means the caliber is 1500mm. DN125 is special, indicating that the code is 121.

(9) Long-term pressure drop

The approximate long-term pressure drop (△P) of the vortex flowmeter can be determined from the following formula:

$$\Delta P = A \times \rho_f \times \frac{Q_f^2}{D^4}$$

Where △P is the long-term pressure drop (KPa), **ρ**f is the density under working conditions (kg/m3), Qf is the actual flow (m3/h), and D is the flow diameter (mm).

A is a constant, which is determined according to the model and medium as shown in the following table.

Determine the parameter A of long-term pressure drop △P

Model of flowmeter	A
VFD, VFE and conventional type of VFT	135
VFD and VFT reducing type (one-level)	155
VFD and VFT reducing type (two-level)	242

(10) Minimum back pressure (cavitation, liquid only)

In liquid measurement, when the liquid pressure in the pipeline is very low and the flow velocity is very high, cavitation will be generated to affect the correct measurement of flow. To prevent cavitation, liquid vaporization shall be avoided. For liquid applications, the working pressure of the pipeline must be greater than the minimum back pressure to prevent cavitation. In general, the treatment plan shall consider installing a back pressure valve downstream of the meter. Calculation formula of minimum back pressure:

$$P = 2.7\Delta P + 1.3\ P_0$$

Where, P is the pipeline pressure at 2~7D downstream of the flowmeter, i.e. the minimum back pressure; △P is the long-term pressure drop (KPa), and P0 is the saturated steam pressure KPa(A) of liquid under working conditions.

2. Material selection of wetted part

According to the different media measured by users, two different materials for wetted part are provided, 304 stainless steel and 316L stainless steel. For special material requirements, please contact the Company for special orders.

Component	Part	Whether it is wetted	Material	Remarks
Sensor	Sensor meter body	Wetted	304/316L/HC/Special	/
	Generator	Wetted	304/316L/HC/Special	/
	Probe	Wetted	316L/HC/Special	VFD/VFE only; when selecting HC material, the meter body and generator must be both HC
	Detection body	Wetted	3 1 6L/HC	VFT only; When selecting HC material, the meter body and generator must be both HC
	Lever	Not wetted	304	/
	Flange sealing gasket	Not wetted	Graphite (default) / PTFE / 316L (RJ face sealing ring)	/

Note: The VFT probe is not wetted. The materials are mainly stainless steel and nickel-based alloy.

3. Selection of IP grade

According to the national standard GB4208, the housing IP grade of meters can be divided into the following categories:

IP65: Water spraying type allows the faucet to spray water on the meter from any direction, with the water spraying pressure of 30kPa, the water output of 12.5L/min and the nozzle distance of 3m from the meter.

IP66: Violent water spraying type strongly sprays water to the housing in all directions without harmful effect, the water output is 100L/min, and the duration is 3 min.

IP67: Immersed meter can be completely immersed in water (1m underwater) in a short time, with duration of 30 min

4. Selection of cable

The connecting cable between the sensor and the converter is dedicated. The length of the cable in the model specification table refers to this cable section, and its length generally does not exceed 30m (if the required length is longer than 30m, please consult with the manufacturer). The connecting cable between the sensor and the converter generally requires iron pipe for protection when it is installed on site.

5. Selection of sealing washer

When used in general workplaces, flexible graphite sealing washers can be selected;

When used in hazardous workplaces, PTFE sealing washers can be selected when measuring explosive gases such as oxygen.

6. Selection of flange

The companion flange for clamp-on type vortex flowmeter is a standard part of the Company, and is made of carbon steel.

The companion flange for flange type vortex flowmeter is an optional part of the Company. To place an order, please provide the dimension and material requirements of the meter connecting pipe.

If there are no special material requirements, the flange of the Company will be made of carbon steel. For special materials and other standard flanges, please contact the Company confirmation before placing an order.

The standard for companion flanges is HG/T 20592-2009. For common flange specifications, please refer to the flange dimension table of flange introduction part of this sample.

7. Determination of working environment

Working environment refers to the environment around the meter, which can be divided into general workplaces and hazardous workplaces. General workplace refers to a safe place without combustible gases and explosive substances. The working ambient temperature is below (-40~70)°C. The upper limit of medium temperature is divided into 260°C and 400°C. The meter is optional between integrated type or split type. Hazardous workplace refers to the workplace with combustible gases and explosive substances. The working ambient temperature is (-40~60)°C, and the medium temperature shall not be higher than 400°C.

8. Selection of explosion-proof accessories

The vortex flowmeter is intrinsically safe and explosion-proof, and the product must be matched with the isolated safety barrier, otherwise the intrinsically safe explosion-proof performance of the vortex flowmeter can not be guaranteed.

Isolated safety barrier is optional. If explosion-proof products need this accessory, please explain when ordering.

9. Reducing type solution

Refer to the reducing type solution of VFD.

10. Solution of water hammer

Refer to the water hammer solution of VFD.

Converter Selection of VFT Enhanced Vortex Flowmeter

1. Introduction to converter performance

●Advanced FFT spectrum analysis signal processing circuit module

The converter adopts advanced FFT spectrum analysis signal processing circuit module, which can accurately detect the vortex information in a small signal and low flow area, so that the meter has super high stability and reliability in the low flow area, and the measurable flow range of the meter is greatly expanded. Besides, the fluid situation in the pipe can be analyzed, and the best judgment and adjustment can be made according to the analyzed data, reflecting high stability, intelligence and vibration resistance.

●Intelligent automatic zero setting. When it is confirmed that there is no flow in the pipe, this function can be used to effectively remove the inherent interference signal.

Output

Analog and pulse output modes, which can be set by the keys.

Analog output: (4-20) mADC, two-wire system

Pulse output; 4~20mA DC, two-wire pulse output: low level ≤ 1V DC, high level ≥ 5V DC (standard: low level: 1V DC, high level 5V DC);

Maximum pulse frequency: 5kHz; duty cycle: about 50%;

HART communication

Communication signal: HART communication signal (1200HZ and 2200Hz analog signals are superimposed on 4~20mA DC signal);

Communication load resistance: 250**Ω**;

Communication distance: up to 1km with multi-stranded cable. The communication distance varies according to the type of cable used.

Self-diagnosis and alarm output

In case of an alarm (out of range, EEPROM error and other abnormalities), an alarm output signal is generated and displayed

Data protection function in case of power loss

Data (parameters, accumulated flow, etc.) are saved in EEPROM, and no spare battery is required.

Damping time

Damping time is 0.5s~200s, which can be set by the keys. The minimum delay time is 0.5s

Linear compensation function

Meter polyline correction: 5 approximate polylines can be used to correct and compensate the linear error of the meter.

Reynolds number compensation: The output error when the Reynolds number is less than 10000 can be compensated by 5 approximate polylines.

Interchangeability

The converter can be used with sensors of various calibers.

Display

The low-power consumption 128x64 full-dot-matrix LCD is adopted, with clear and intuitive display;

The instantaneous flow, cumulative flow, percentage flow (expressed in %) can be displayed at the same time;

A short message of self-diagnosis can be displayed, and information such as output current and pulse can be displayed through key settings.

Explosion-proof performance (please refer to GB 3836.1, GB 3836.4 and GB 3836.2 for detailed explosion-proof parameters)

Explosion-proof grade: Exia II CT6 or Exd II Ct6;

Or Ex ia IIIC T 80°CDa or Ex tb IIIC T80°CDb;

Ex indicates that the electrical equipment conforms to the regulations on explosion-proof type;

ia: intrinsically safe type category a d: Flameproof type;

IIC: electrical equipment for other explosive gas environment except coal mine;

IIIC Conductive dust

T6: temperature group.

Small signal excision

When the flow is lower than the set low flow value, the output is 4mA or 0 pulse.

2. Selection Table of VFT Type Vortex Flowmeter

Sensor									Converter								
VFT	XXX	X	X	X	X	X	X	X	X	XX	X	X	X	X	X	X	X

Main Name

Caliber DN15 ~ DN300

Expressed by three digits: The first two digits represent the significant figures of the caliber, and the third digit indicates the number of trailing zeros (unit: mm).
Note: DN125 is special and is indicated as 121.

Nominal pressure

1: 1.6MPa 2: 2.5MPa 3: 1.0MPa
4: ANSI150 5: 4.0MPa 6: ANSI300
Note: The maximum nominal pressure for temperature and pressure measurement is 4.0MPa

Structure Material

Material combination sequence: body - generator - probe
3: 304-304-316L4: 304-316L-316L
5: 316L-316L-HC 6: 316L-316L-316L 9: Others
A:2205-2205-2205 B:Ti2-Ti2-Ti2
Note: Option "A" is only applicable to medium temperatures within 260°C

Measuring medium

1: Liquid 3: Steam 2: Gas

Working environment

1: General places: -40°C ≤ ambient temperature ≤ 70°C, -40°C ≤ medium temperature ≤ 260°C
2: General places: -40°C ≤ ambient temperature ≤ 70°C, -40°C ≤ medium temperature ≤ 400°C
3: Explosion-proof place: -40°C≤ambient temperature ≤60°C, -40°C≤medium temperature ≤260°C
4: Explosion-proof place: -40°C≤ambient temperature ≤60°C, -40°C≤medium temperature ≤400°C

Connection method

1: Clamp-on type 3: Flange type
4: Reducing type (one-level) (limited to non-temperature and pressure compensation flange connection)
7: Dual sensor (flange connection ≥ DN50 only) 8: Clamp type (DN15-DN50 only)

Accuracy level

A: Class 1.0 B: Class 0.75 (liquid only) E: Special

Temperature and pressure compensation

0: None 1: 1.6MPa pressure + PT100 temperature 2: 4.0MPa pressure + PT100 temperature
Note: Only for flange type with temperature and pressure compensation, the temperature and pressure selection pressure shall be ≥ the nominal pressure of the meter, among which the split type can only select 0

Electrical Interface

1: G1/2" external thread 2: 1/2" NPT internal thread 3: M20×1.5

Type

VH: Integrated type
VR: Split type (cable length defaults to 10m, other lengths must be selected in additional options)

Power supply

1:24V DC

Display assembly

2: With display

Output signal

1: Two-wire system, 4~20mA.DC output 2: Pulse output + 4~20mA.DC output
3: Pulse output + 4~20mA.DC output + HART communication 4: Pulse output + Modbus RS-485 communication
5: Pulse output + FF communication
Note: Modbus RS-485 communication or FF communication is not compatible with 4-20mA.DC output

Explosion-proof requirements

1: Non-explosion-proof 2. Intrinsically safe 3: Flameproof 4: Intrinsically safe dust 5: Flameproof dust 6: Combined explosion-proof
Note: The explosion-proof grade of the combined explosion-proof needs to be noted in the contract.

Display orientation

1: Standard direction 2: 90° counterclockwise 3: 90° clockwise 4: 180° clockwise

Language

1: English

IP grade

0: IP55 1: IP65 2: IP66 3: IP67

Note:

1. When measuring flammable and explosive gases such as oxygen and natural gas, the sensor must first be degreased without oil to avoid accidents.
2. The connecting flange is provided with a flexible graphite gasket. The flange type vortex flowmeter is not provided with pipe flanges and bolts in delivery, which can be processed by users themselves or purchased directly from us (please state the requirement when ordering).
3. The temperature compensation sensor and pressure compensation transmitter used for integrator, gas and steam measurement are non-standard factory accessories, and we can provide them on behalf of users according to their needs. Please explain when ordering.
4. IP grade is IP65 by default.
5. Only gas or steam can be compensated for temperature and pressure. Saturated steam defaults to temperature compensation when leaving the factory, and gas and superheated steam default to temperature and pressure compensation when leaving the factory.
6. Additional options: /XX (see the additional option table)
7. When the temperature of the selected medium is lower than 260°C, the flowmeter has no valve for pressure measurement. If you need to perform online maintenance on the pressure sensor by closing the valve, please select the additional option /P9. When the temperature of the selected medium is higher than 260°C, the flowmeter is equipped with a pressure tapping valve as standard, and there is no need to select the additional option /P9.

Accessories

Our company provides a variety of meter accessories to meet the needs of different users. Accessories can be ordered with the meter or separately. Detailed ordering information for accessories can be obtained through local sales outlets, or by contacting our company through the ordering information.

Special accessories for equipment

<table>
<tr><th>Item</th><th colspan="4">Manifestations</th><th>Code</th><th>Remarks</th></tr>
<tr><td rowspan="5">Matching flange</td><td>Material</td><td>Flange type</td><td>Sealing surface</td><td>Series</td><td rowspan="5">Example: F0002 (expressed as 304 steel PL slip-on-welding plate RF surface 2 series matching flange)</td><td rowspan="5">1) Only the RF surface can be selected for PL plate-type flat welding;
2) FF full plane is limited to pressure grade 1.0MPa/1.6MPa/ANSI150;
3) It is recommended to select FM surface for the matching flange of MFM surface, and the default meter sealing surface is M surface;
4) The RJ ring connection surface can only be used for WN welding neck;</td></tr>
<tr><td>0: 304 steel</td><td>0: PL plate-type flat welding (standard)</td><td>0: RF raised surface (standard)</td><td>0: Series I</td></tr>
<tr><td>1: 316L steel</td><td>1: SO Split-on welding</td><td>1: FF (Flat face)</td><td>1: Series II (standard)</td></tr>
<tr><td>2: Carbon steel</td><td>2: WN (Welding neck)</td><td>2: FM concave</td><td></td></tr>
<tr><td>S: Others</td><td>3: SW socket welding</td><td>3: M convex</td><td></td></tr>
<tr><td></td><td></td><td>4: RJ (Ring joint face)</td><td></td></tr>
<tr><td rowspan="8">Surface treatment</td><td colspan="3">0: Copper-zinc content of wetted materials ≤0.1%</td><td>S0</td><td>Limited to non-TS products</td></tr>
<tr><td colspan="3">1: Copper-zinc content of wetted materials ≤0.5%</td><td>S1</td><td>For sensors</td></tr>
<tr><td colspan="3">2: Copper-zinc content of wetted materials ≤1%</td><td>S2</td><td></td></tr>
<tr><td colspan="3">3: Wetted material finish Ra0.8</td><td>S3</td><td></td></tr>
<tr><td colspan="3">4: Wetted material finish Ra1.6</td><td>S4</td><td></td></tr>
<tr><td colspan="3">5: C3 anti-salt spray paint</td><td>S5</td><td>For converters</td></tr>
<tr><td colspan="3">6: C5 heavy protective paint</td><td>S6</td><td>For converters</td></tr>
<tr><td colspan="3">7: No oil and degreasing</td><td>S7</td><td></td></tr>
<tr><td rowspan="2">Cable</td><td colspan="3">1: 20 m</td><td>D1</td><td rowspan="2">VFT type only</td></tr>
<tr><td colspan="3">2: 30 m</td><td>D2</td></tr>
</table>

Temperature sensor	0: External ordinary temperature sensor	N0	Standard 304 stainless steel mounting base
	1: External intrinsically safe temperature sensor	N1	
	2: External flameproof temperature sensor	N2	
Pressure transmitter	0: External ordinary pressure transmitter	C0	Standard 304 stainless steel mounting base
	1: External intrinsically safe pressure transmitter	C1	
	2: External flameproof pressure transmitter	C2	
	3: External dust flameproof pressure transmitter	C3	
Integrator	0: Integrator CMF1 (220VAC power supply)	Y0	Input: flow 4~20mA or pulse, temperature PT100, pressure 4~20mA; Output: 4~20mA; power supply 100~240VAC;
	1: Integrator CMF1 (24VDC power supply)	Y1	Input: flow 4~20mA or pulse, temperature PT100, pressure 4~20mA; Output: 4~20mA; power supply 12~30VDC;
	2: Integrator CMF4 (220VAC power supply)	Y2	Input: flow 4~20mA or pulse, temperature PT100, pressure 4~20mA; Output: 4~20mA, RS485; power supply 100~240VAC;
	3: Integrator CMF4 (24VDC power supply)	Y3	Input: flow 4~20mA or pulse, temperature PT100, pressure 4~20mA; Output: 4~20mA, RS485; power supply 12~30VDC;
	4: Other integrators	Y4	
Product Accessories	1: 316L Tag No. plate	P1	
	2: Customized nameplate	P2	
	3: 316L converter housing	P3	
	4: Wireless RTU-4G	P4	The meter itself must have RS485 communication
	5: Surge protector	P5	
	6: Metal graphite spiral wound gasket	P6	
	7: PTFE gasket	P7	Only for nominal pressure ≤1.6MPa or ANSI150, and the medium temperature is (-40~100)°C
	8: Metal PTFE spiral wound gasket	P8	Only for temperature ≤150°C
	9: Pressure tapping valve	P9	VFT type only
	10:304 blind plug	PA	
	11: Concentric reducer of carbon steel (one pair)	PB	"It is necessary to determine the specific size of the on-site process pipeline. Outer diameter × wall thickness"
	12:304 concentric reducer (one pair)	PC	
	13: 316L concentric reducer (one pair)	PD	
	14: Carbon steel matching straight pipe section assembly (front 15D and rear 5D long straight pipes, with flanges and concentric reducers)	PE	
	15: 304 matching straight pipe section assembly (front 15D and rear 5D long straight pipes, with flanges and reducers)	PF	
	16: 316L matching straight pipe section assembly (front 15D and rear 5D long straight pipes, with flanges and reducers)	PG	
	17: Converter sunshade	PH	VFT type only
Rectifier	0: 304 Rectifier	Z0	Caliber ≤DN100
	1: 316L rectifier	Z1	
	2: HC rectifier	Z2	

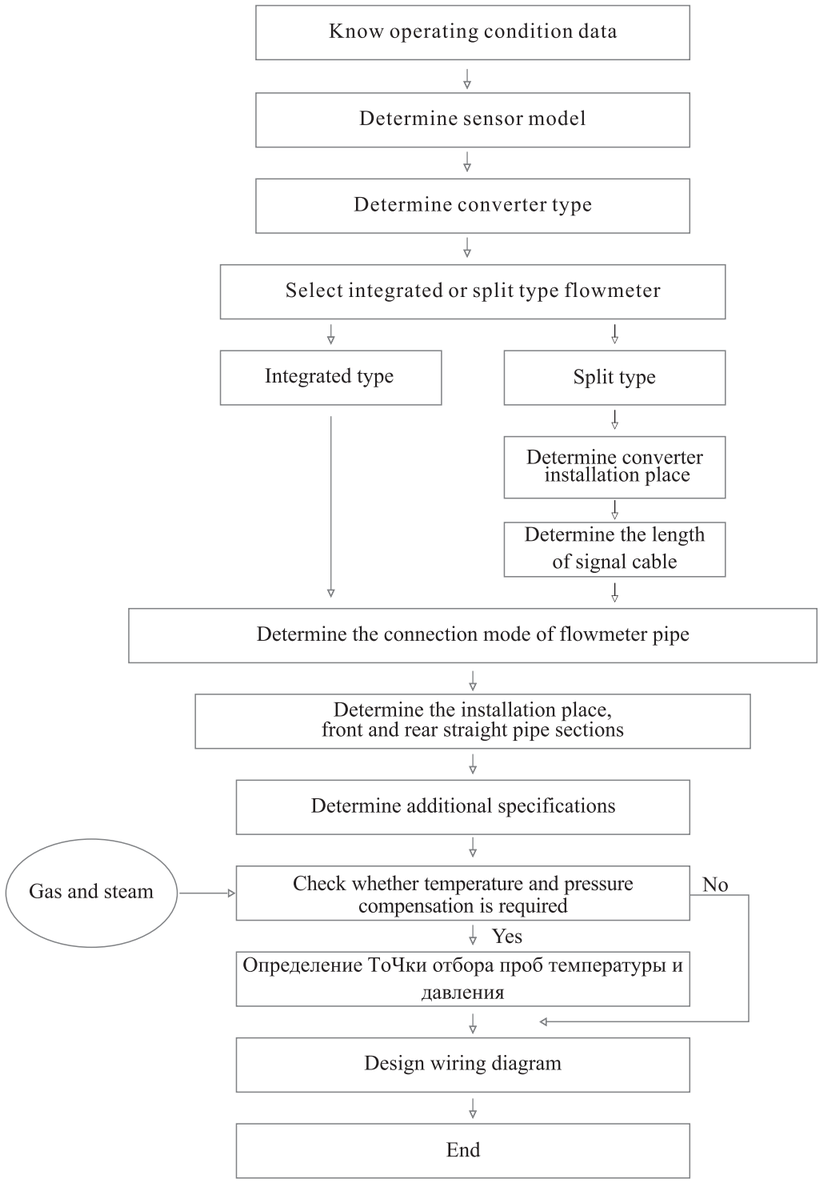
Explosion-proof cable gland	0: 304 Explosion-proof cable gland	E0	The default material of explosion-proof cable gland is nickel plated brass
	1: 316L explosion-proof cable gland	E1	
Product Certification	0: Verification certificate (in the name of customer)	A0	VFT series is not supported yet A5, A6, A7, A8, A9, AA
	1: Verification certificate (in the name of Chuanyi)	A1	
	2: Calibration certificate (in the name of customer)	A2	
	3: Calibration certificate (in the name of Chuanyi)	A3	
	4: TS certification	A4	
	5: PAC certification	A5	
	6: EAC certification (CU-TR 012 explosion-proof)	A6	
	7: EAC certification (CU-TR 020 electromagnetic compatibility)	A7	
	8: EAC certification (CU-TR 032 pressure)	A8	
	9: CE certification	A9	
	10:SIL3	AA	
Handover data	0: Calibration certificates, qualification certificates and nameplates in Chinese and English, with instructions in Chinese as standard configuration		
	1: Calibration certificates, qualification certificates and nameplates in Russian, with instructions in Russian as standard configuration	H1	
	2: Calibration certificates, qualification certificates and nameplates in English, with instructions in English as standard configuration	H2	
	3: National standard wetted material report (meter body)	H3	
	4: National standard wetted material report (meter body + generator)	H4	
	5: National standard wetted material report (meter body + generator + flange)	H5	
	6: National standard wetted material report (meter body + generator + flange + probe base)	H6	
	7: National standard wetted material report (meter body + generator + flange + probe base + pressure tapping pipe)	H7	
	8: EN10204-3.1 wetted material report (meter body)	H8	
	9: EN10204-3.1 wetted material report (meter body + generator)	H9	
	10: EN10204-3.1 wetted material report (meter body + generator + flange)	HA	
	11: EN10204-3.1 wetted material report (meter body + generator + flange + probe base)	HB	
	12: EN10204-3.1 wetted material report (meter body + generator + flange + probe base + pressure tapping pipe)	HC	

Handover data	13: Pressure test report	HD	
	14: Technical passport	HE	Standard English and Russian bilingual
	15: PVC first inspection certificate	HF	
	16: Weld penetrant flaw detection report	HG	
	17: Product test report	HH	
	18: Two-dimensional Overall Dimension	HI	
	19: Three-dimensional Overall Dimension	HJ	
Current alarm	The output signal rises when a fault occurs in accordance with NAMUR NE43 (output signal ≥ 21.6mA when an alarm occurs)	GA	VFT type only
Quality assurance level	0:QA1	Q1	
	1:QA2	Q2	
	2:QA3	Q3	
	3:QNC	Q4	
Export packing	0: Plywood export packing	B0	
	1: Fumigated wooden box export packing	B1	
	2: Carton export packing	B2	
	3: Unmarked export packing	B3	

When there is a need to purchase only parts or additional items, the main product model must be indicated in front of the part or additional item. Example:
Only VFT flange type sensors with DN100 caliber, 1.6MPa, 304 material and liquid measurement are purchased. The model is: VFT10113123A00;
Only VFT converters with M20×1.5 outgoing line seal, 4~20mA.DC output, non-explosion-proof and IP65 IP grade are purchased. The model is: VFT3VH1211111; only 1 set of 20m long VFT cable (additional item), The model is: VFT/D1

Guide for Selection of Vortex Flowmeter

1. Selection design steps



1. Selection design steps

(1) Which operating condition data shall be known when selecting flowmeter?

Data:

Medium	Main data to be known	Other data
Liquid	Medium name, temperature, pressure, flow range, output signal, explosion-proof requirements, original pipe dimension.	Viscosity (cSt) density
Steam		Saturated or superheated
Gas		Density (Kg/Nm丨)

(2) How to determine nominal diameter of the flowmeter?

Because the improvement of efficiency and the reduction of pressure loss are taken into consideration in fluid transmission, the pipe is generally selected with a large diameter and a low flow velocity, but when the flowmeter is in normal service, there are certain requirements for lower limit of flow velocity, and the diameter of the flowmeter shall be generally selected according to the flow and medium density and viscosity rather than the inner diameter of the original pipe. For specific selection, please refer to our flowmeter selection sample and provide parameters for selection and production by us.

(3) How to determine the type of the converter?

The converter shall be selected according to explosion-proof requirements and fluid output mode.

(4) How to determine the vortex flowmeter as integrated type or split type?

The vortex flowmeter can be divided into two parts in structure: flowmeter sensor (body part) and flowmeter converter (electronic part). The integrated type is to combine the two parts together, and the split type is to place the two parts separately and connect them through the special cable supplied by Chongqing Chuanyi Automation Co., Ltd. Flowmeter Branch.The integrated type has a simple structure and is suitable for situations with easy installation and low medium temperature (< 120°C). Example of integrated type model:

VFD20113211A002VH1211110

It represents the integrated type intelligent clamped vortex flowmeter with a diameter of 200mm.

The split type is suitable for high medium temperature (> 200°C), or for easy observation of the display on the converter. The model specification of the split type flowmeter consists of three parts, such as:

VFD50013211A102VR1211110

It represents a split type flowmeter with a diameter of 50mm

Where: VR1211110

Represents the converter of the flowmeter (with display header)

A10

Represents the special cable length of 10m

(5) Installation Diagram of Vortex Flowmeter

The clamped type of the nominal diameter DN15-DN300 of the vortex flowmeter produced by us is clamped and fixed by external flanges and long bolts on the pipe. See Fig. 6 below.

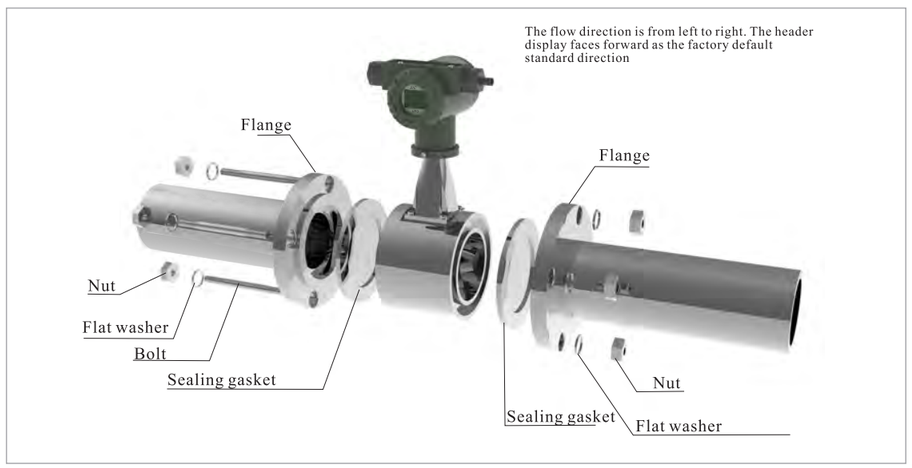


Fig. 6 Installation Mode of Clamped Flowmeter

The flowmeter with nominal diameter DN15-DN600 is of flange type, as shown in Fig. 7 below.

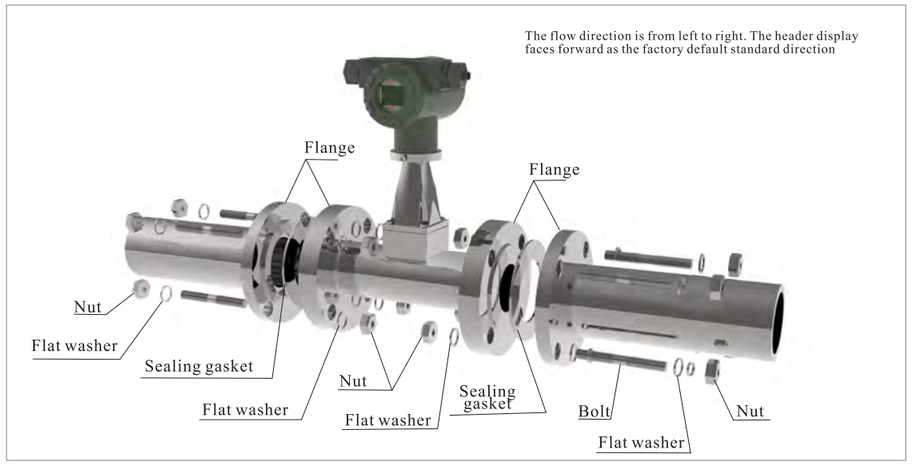


Fig. 7 Installation Mode of Flange Flowmeter

(6) Overall dimensions of vortex converter (mm)

·VFD/VFE converter

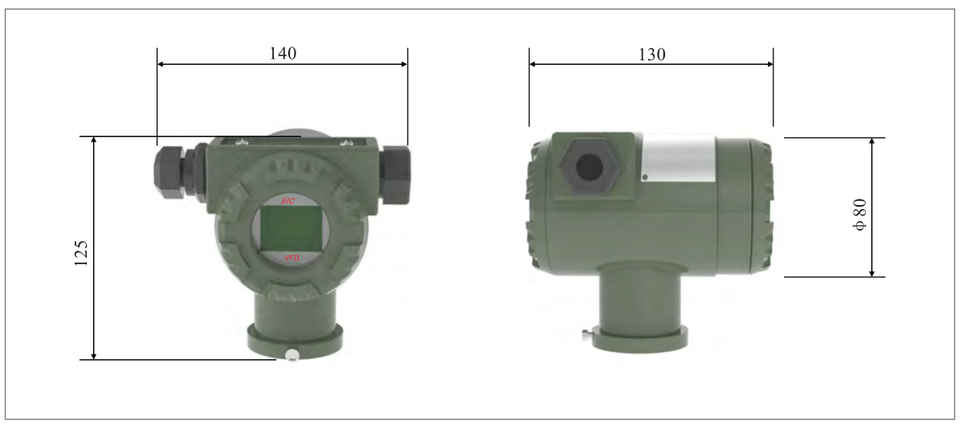


Fig. 8 Integrated Converter

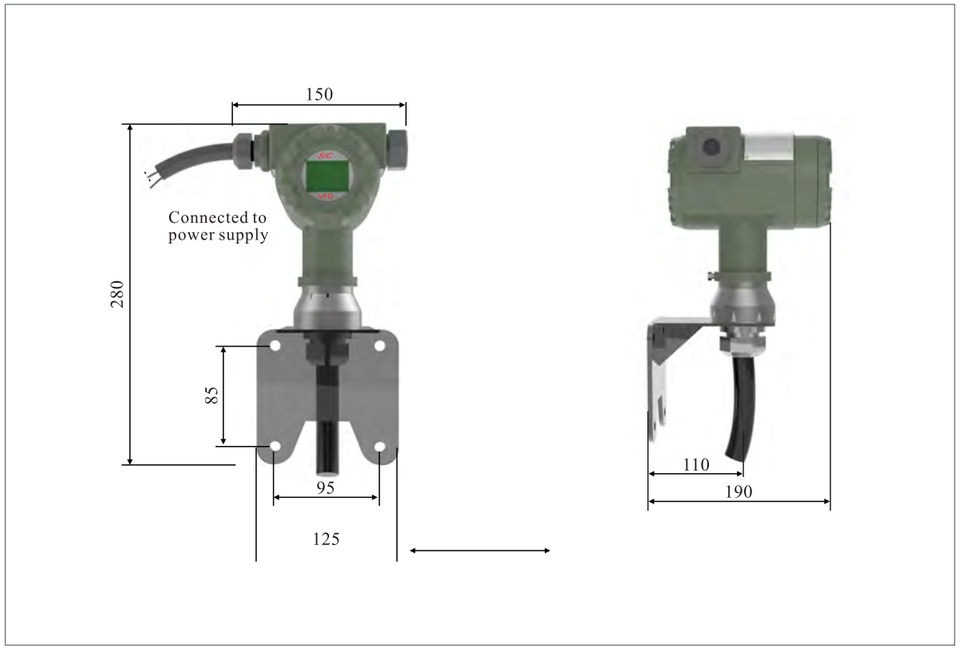
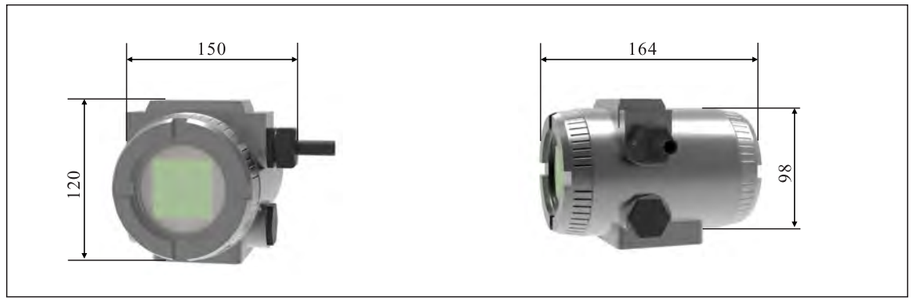
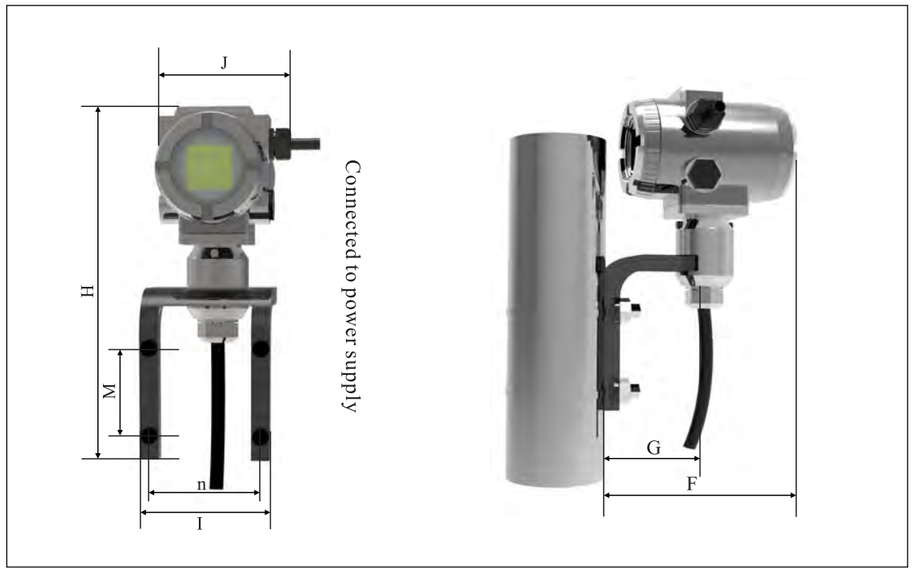


Fig. 9 Split Converter

VFT converter



VFT Integrated Type Converter



VFT Split Type Converter

Unit: (mm)

Total Height H	Total Length J	Vertical Hole Spacing m	Horizontal Hole Spacing n	Bracket Width I	Wall Spacing G	Total Width F	Weight M Kg
329	150	85	95	111	112	175	5.5

(7) Flange size

For the convenience of design, flange data of the most commonly used connection methods are now provided according to HG/T 20592-20615

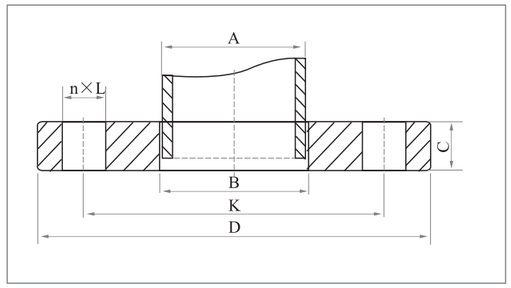


Fig. 10 Plate-type Flat Welding Steel Pipe Flanges with Raised Face (RF)

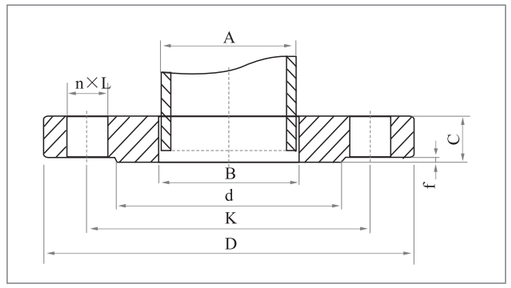


Fig. 11 Slip-on-welding Steel Pipe Flanges with Raised Face (RF)

Unit: mmPlate-type Flat Welding Steel Pipe Flange (1.0MPa-4.0MPa)

Unit: mm

Pressure Grade	Nominal Diameter	Connection Dimension						Sealing Surface		Flange Thickness C	Inner Diameter of Flange B
		Outer Diameter of Steel Pipe A	Flange Outer Diameter D	Diameter of Center of Bolt Hole	Bolt Hole Diameter L	Bolt		d	f		
						Quantity n	Thread Specification				
PN1.0MPa	15	21.3	95	65	14	4	M12	45	2	14	22
	20	26.9	105	75	14	4	M12	58	2	16	27.5
	25	33.7	115	85	14	4	M12	68	2	16	34.5
	32	42.4	140	100	18	4	M16	78	2	18	43.5
	40	48.3	150	110	18	4	M16	88	2	18	49.5
	50	60.3	165	125	18	4	M16	102	2	20	61.5
	65	76.1	185	145	18	8	M16	122	2	20	77.5
	80	88.9	200	160	18	8	M16	138	2	20	90.5
	100	114.3	220	180	18	8	M16	158	2	22	116
	125	139.7	250	210	18	8	M16	188	2	22	141.5
	150	168.3	285	240	22	8	M20	212	2	24	170.5
	200	219.1	340	295	22	8	M20	268	2	24	221.5
	250	273	395	350	22	12	M20	320	2	26	276.5
	300	323.9	455	400	22	12	M20	370	2	28	327.5
	350	355.6	505	460	22	16	M20	430	2	30	359.5
	400	406.4	565	515	26	16	M24	482	2	32	411
	450	457	615	565	26	20	M24	532	2	35	462
	500	508	670	620	26	20	M24	585	2	38	513.5
	600	610	780	725	30	20	M27	685	2	42	616.5

Unit: mm

Pressure Grade	Nominal Diameter	Connection Dimension						Sealing Surface		Flange Thickness C	Inner Diameter of Flange B
		Outer Diameter of Steel Pipe A	Flange Outer Diameter D	Diameter of Center of Bolt Hole	Bolt Hole Diameter L	Bolt		d	f		
						Quantity n	Thread Specification				
PN1.6MPa	15	21.3	95	65	14	4	M12	45	2	14	22
	20	26.9	105	75	14	4	M12	58	2	16	27.5
	25	33.7	115	85	14	4	M12	68	2	16	34.5
	32	42.4	140	100	18	4	M16	78	2	18	43.5
	40	48.3	150	110	18	4	M16	88	2	18	49.5
	50	60.3	165	125	18	4	M16	102	2	20	61.5
	65	76.1	185	145	18	8	M16	122	2	20	77.5
	80	88.9	200	160	18	8	M16	138	2	20	90.5
	100	114.3	220	180	18	8	M16	158	2	22	116
	125	139.7	250	210	18	8	M16	188	2	22	141.5
	150	168.3	285	240	22	8	M20	212	2	24	170.5
	200	219.1	340	295	22	12	M20	268	2	26	221.5
	250	273	405	355	26	12	M24	320	2	28	276.5
	300	323.9	460	410	26	12	M24	378	2	32	327.5
	350	355.6	520	470	26	16	M24	428	2	35	359.5
	400	406.4	580	525	30	16	M27	490	2	38	411
	450	457	640	585	30	20	M27	550	2	42	462
	500	508	715	650	33	20	M30	610	2	46	513.5
	600	610	840	770	36	20	M33	725	2	52	616.5
PN2.5MPa	15	21.3	95	65	14	4	M12	45	2	14	22
	20	26.9	105	75	14	4	M12	58	2	16	27.5
	25	33.7	115	85	14	4	M12	68	2	16	34.5
	32	42.4	140	100	18	4	M16	78	2	18	43.5
	40	48.3	150	110	18	4	M16	88	2	18	49.5
	50	60.3	165	125	18	4	M16	102	2	20	61.5
	65	76.1	185	145	18	8	M16	122	2	22	77.5
	80	88.9	200	160	18	8	M16	138	2	24	90.5
	100	114.3	235	190	22	8	M20	162	2	26	116
	125	139.7	270	220	26	8	M24	188	2	28	141.5
	150	168.3	300	250	26	8	M24	218	2	30	170.5
	200	219.1	360	310	26	12	M24	278	2	32	221.5
	250	273	425	370	30	12	M27	335	2	35	276.5
	300	323.9	485	430	30	16	M27	395	2	38	327.5
	350	355.6	555	490	33	16	M30	450	2	42	359.5
	400	406.4	620	550	36	16	M33	505	2	46	411
	450	457	670	600	36	20	M33	555	2	50	462
	500	508	730	660	36	20	M33	615	2	56	513.5
	600	610	845	770	39	20	M36	720	2	68	616.5

Unit: mm

Pressure Grade	Nominal Diameter	Connection Dimension						Sealing Surface		Flange Thickness C	Inner Diameter of Flange B
		Outer Diameter of Steel Pipe A	Flange Outer Diameter D	Diameter of Center of Bolt Hole	Bolt Hole Diameter L	Bolt		d	f		
						Quantity n	Thread Specification				
PN4.0MPa	15	21.3	95	65	14	44	M12	45	2	14	22
	20	26.9	105	75	14	4	M12	58	2	16	27.5
	25	33.7	115	85	14	4	M12	68	2	16	34.5
	32	42.4	140	100	18	4	M16	78	2	18	43.5
	40	48.3	150	110	18	4	M16	88	2	18	49.5
	50	60.3	165	125	18	4	M16	102	2	20	61.5
	65	76.1	185	145	18	8	M16	122	2	22	77.5
	80	88.9	200	160	18	8	M16	138	2	24	90.5
	100	114.3	235	190	22	8	M20	162	2	26	116
	125	139.7	270	220	26	8	M24	188	2	28	141.5
	150	168.3	300	250	26	8	M24	218	2	30	170.5
	200	219.1	375	320	30	12	M27	285	2	36	221.5
	250	273	450	385	33	12	M30	345	2	42	276.5
	300	323.9	515	450	33	16	M30	410	2	48	327.5
	350	355.6	580	510	36	16	M33	465	2	55	359.5
	400	406.4	660	585	39	16	M36	535	2	60	411
	450	457	685	610	39	20	M36	560	2	66	462
	500	508	755	670	42	20	M39	615	2	72	513.5
	600	610	890	795	48	20	M45	735	2	94	616.5

Slip-on-welding Steel Pipe Flanges (ANSI150-ANSI300)

Unit: mm

Pressure Grade	Nominal diameter	Connection Dimension						Sealing Surface		Flange Thickness C	Inner Diameter of Flange B	Flange Height H
		Outer Diameter of Steel Pipe A	Flange Outer Diameter D	Center Circle Diameter of Bolt Hole K	Bolt Hole Diameter L	Bolt		d	f			
						Quantity n	Thread Specification					
ANSI150	15	21.3	90	60.3	16	4	M14	34.9	2	11.6	15.5	14
	20	26.9	100	69.9	16	4	M14	42.9	2	13.2	21	14
	25	33.7	110	79.4	16	4	M14	50.8	2	14.7	27	16
	32	42.4	115	88.9	16	4	M14	63.5	2	16.3	35	19
	40	48.3	125	98.4	16	4	M14	73.0	2	17.9	41	21
	50	60.3	150	120.7	18	4	M16	92.1	2	19.5	52	24
	65	76.1	180	139.7	18	4	M16	104.8	2	22.7	66	27
	80	88.9	190	152.4	18	4	M16	127.0	2	24.3	77.5	29
	100	114.3	230	190.5	18	8	M16	157.2	2	24.3	101.5	32
	125	139.7	255	215.9	22	8	M20	185.7	2	24.3	127	35
	150	168.3	280	241.3	22	8	M20	215.9	2	25.9	154	38
	200	219.1	345	298.5	22	8	M20	269.9	2	29	203	43
	250	273	405	362	26	12	M24	323.8	2	30.6	255	48
	300	323.9	485	431.8	26	12	M24	381.0	2	32.2	303.5	54
	350	355.6	535	476.3	30	12	M27	412.8	2	35.4	/	56
	400	406.4	595	539.8	30	16	M27	469.9	2	37	/	62
	450	457	635	577.9	33	16	M30	533.4	2	40.1	/	67
	500	508	700	635	33	20	M30	584.2	2	43.3	/	71
	600	610	815	749.3	36	20	M33	692.2	2	48.1	/	81
ANSI300	15	21.3	95	66.7	16	4	M14	34.9	2	14.7	15.5	21
	20	26.9	115	82.6	18	4	M16	42.9	2	16.3	21	24
	25	33.7	125	88.9	18	4	M16	50.8	2	17.9	27	25
	32	42.4	135	98.4	18	4	M16	63.5	2	19.5	35	25
	40	48.3	155	114.3	22	4	M20	73.0	2	21.1	41	29
	50	60.3	165	127.0	18	4	M16	92.1	2	22.7	52	32
	65	76.1	190	149.2	22	4	M20	104.8	2	25.9	66	37
	80	88.9	210	168.3	22	4	M20	127.0	2	29	77.5	41
	100	114.3	255	200.0	22	8	M20	157.2	2	32.2	101.5	46
	125	139.7	280	235.0	22	8	M20	185.7	2	35.4	127	49
	150	168.3	320	269.9	22	8	M20	215.9	2	37	154	51
	200	219.1	380	330.2	26	8	M24	269.9	2	41.7	203	60
	250	273	445	387.4	30	12	M27	323.8	2	48.1	255	65
	300	323.9	520	450.8	33	12	M30	381.0	2	51.3	303.5	71
	350	355.6	585	514.4	33	12	M30	412.8	2	54.4	/	75
	400	406.4	650	571.5	36	16	M30	469.9	2	57.6	/	81
	450	457	710	628.6	36	16	M33	533.4	2	60.8	/	87
	500	508	775	685.8	36	20	M33	584.2	2	64	/	94
	600	610	915	812.8	42	20	M39×3	692.2	2	70.3	/	105

Note: For the detailed dimensions of other flange specifications, please refer to the national standard HG/T 20592~20615. Our company can provide customized flanges, bolts, nuts and sealing gaskets according to user requirements. Please indicate them when ordering.

Vortex Flowmeter

Unit: mm

Caliber	Clamp-on type	Flange type					
	Weight (kg)	Weight (kg)					
		1.0MPa	1.6MPa	2.5MPa	4.0MPa	ANSI150	ANSI300
DN15	3.2	5.7	5.7	5.7	5.7	5.2	5.66
DN20	3.2	6	6	6	6	5.36	6.28
DN25	3.1	6.1	6.1	6.1	6.1	5.92	6.82
DN32	3.2	7.8	7.8	7.8	7.8	6.08	7.88
DN40	3.5	7.7	7.7	7.7	7.7	6.42	9.6
DN50	3.7	9.4	9.4	9.4	9.4	8.76	10.76
DN65	6.9	11	11	11.3	11.3	11.9	13.38
DN80	6.1	13	13	14.4	14.4	14.02	17.2
DN100	7.2	17	17	20.5	20.5	19.26	29.84
DN125	8.7	21	21	26.7	26.7	23.48	37.04
DN150	10.4	28.6	28.6	34.9	34.9	30.4	46.58
DN200	19.6	39.3	40.2	49.2	55.6	47	70.44
DN250	26.5	63.1	66.9	79.7	97.5	74.1	108.42
DN300	39.3	83.9	92.5	107.7	137.5	109.88	157.1

(8) How to determine the installation place, front and rear straight pipe sections of the flowmeter?

The flowmeter shall be installed in the place with minor vibration rather than beside vibration sources such as water pump and motor.

The front straight pipe section shall be generally 15D (D is nominal diameter, unit mm). The rear straight pipe section shall be generally 5D.

If a gate valve is installed upstream of the flowmeter, the front straight pipe section shall be greater than 35D.

If a reducing pipe is installed upstream of the flowmeter, the front straight pipe section can be 15D.

Refer to the installation data of the vortex flowmeter for details.

(9) What is temperature and pressure compensation?

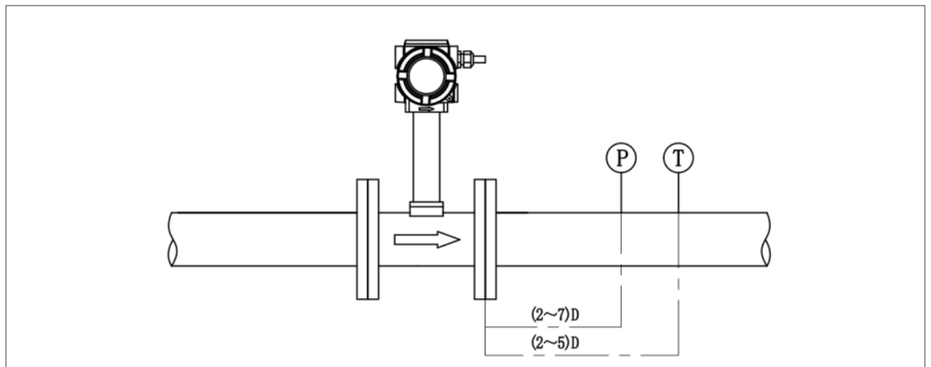
Generally, temperature and pressure compensation is for steam or gas.

Because the vortex flowmeter is a speed flowmeter, the measured flow is the operating volume flow Q_f, while the mass flow Q_m is generally adopted for steam trade settlement, and the relationship between the two is: $Q_m = Q_f \cdot \rho = Q_r$. Where, ρ represents the steam density, and for superheated steam ρ, it varies with pressure and temperature. For saturated steam, because there is a certain relationship between pressure and temperature, ρ varies with temperature or pressure.

When the pressure or temperature of the measured steam has little change, an average density ρ (check the steam table) can be obtained by taking the average pressure and average temperature. When the pressure or temperature of the measured steam changes greatly and the measurement accuracy requirement is high, Leli temperature sampling shall be adopted, and then through the secondary meter, the density ρ can be calculated from the pressure and temperature, and the mass flow Q_m can be obtained from $Q_m = Q_r \cdot \rho$, which is called temperature and pressure compensation.

Generally, the saturated steam can be measured by temperature compensation, superheated steam shall be measured by temperature and pressure compensation.

Sometimes only pressure or temperature compensation can be adopted to save costs.



P-pressure measuring meter T-temperature measuring meter

Note:
Pressure compensation can generally be adopted for gases to save platinum resistor.
Temperature compensation can generally be adopted for saturated steam to save pressure transmitter.
Temperature and pressure compensation can generally be adopted for superheated steam.
Temperature compensation can be adopted for liquid if necessary.

Selection of Vortex Flowmeter and Precautions for Use

Because the vortex flowmeter has low fault rate in normal use, the proportion of the vortex flowmeter is gradually increasing. To make better use of the flowmeter, the following precautions shall be noticed:

Correct selection of flowmeter diameter

Generally, the flowmeter diameter shall not be selected according to the inner diameter of the pipe, but shall be selected according to the minimum flow, the maximum flow, the common flow and the medium parameters (such as temperature, pressure, density and viscosity). Generally, the common flow shall be more than 20% of the measurable range.

Correct selection of flowmeter installation point

The flowmeter shall not be installed in places with intense vibration to avoid vibrating objects such as motors and water pumps. If necessary, a support fixture shall be installed at the pipe where the flowmeter is installed.

Grounding of split type vortex flowmeter

To improve the working stability of the split type vortex flowmeter, the grounding terminal of the flowmeter sensor, the grounding terminal of the converter and the cable shielding wire shall be connected to the earth in a uniform manner.

The fluid shall not contain too many particles, impurities and filaments

To ensure stable generator signal, the measuring medium shall not contain too many particles, impurities and filaments

Temperature and pressure compensation in steam and gas measurement

The measured value of the vortex flowmeter is only the volume flow under the working conditions. For the medium with little change in temperature and pressure, the average temperature, pressure and density can be set. The measured flow value of the flowmeter can be made to be mass flow or standard flow to meet the requirements of trade calculation. However, if the temperature and pressure fluctuates greatly, it is necessary to measure them in real time and compensate them for temperature and pressure. Otherwise, major error will be caused. For example, for saturated steam at 0.6MPa, the measurement error will reach 13% without compensation.

Accurate parameter setting

As there are many internal parameters of the vortex flowmeter, the parameters are set according to the parameters during user ordering. However, because the parameters in actual use are often inconsistent with those in the original design, the parameters need to be adjusted according to the actual situation to achieve the expected measurement effect.

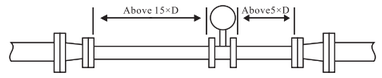
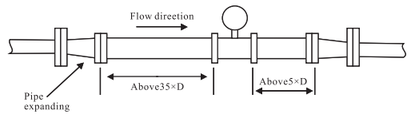
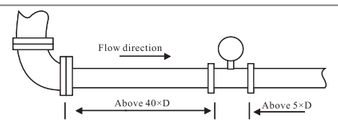
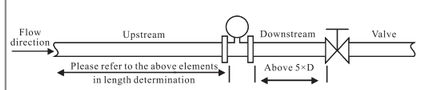
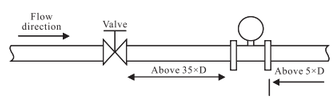
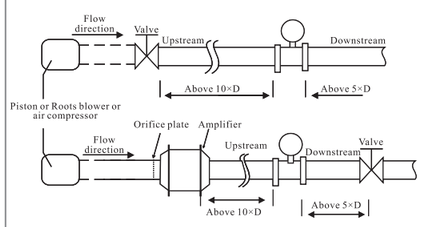
Process pipe and installation mode

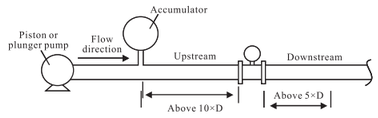
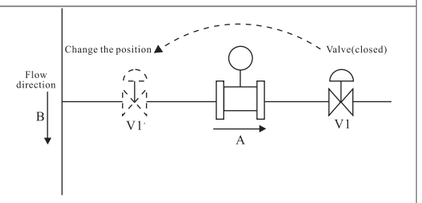
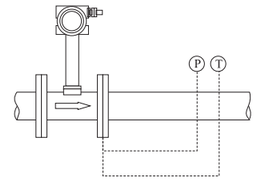
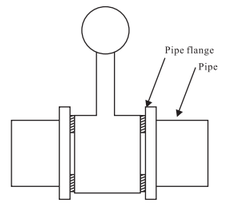
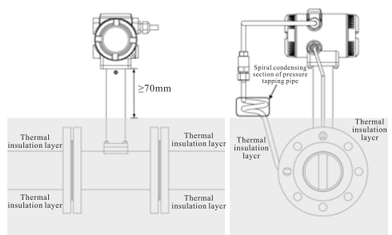
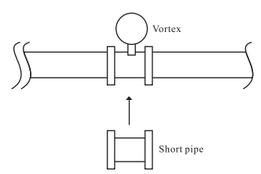
There shall be a straight pipe section in front of and behind the flowmeter. The inner diameter of the straight pipe section shall be the same as or slightly larger than that of the flowmeter. The center of the flowmeter shall be kept consistent with that of the pipe during installation. The sealing washers on both sides of the flowmeter shall not be protruded in the pipe to avoid measurement errors and measurement fluctuations.

Gas parameters

When users provide the flow range of gas measurement, they often confuse the operating flow (m^3/h) with the standard flow (Nm^3/h), resulting in wrong selection. The operating flow refers to the flow under the pressure and temperature in actual use. While the standard flow refers to the flow value with the operating flow converted to the standard condition (0°C, 1atm). The difference between the two is often several times.

Installation of Vortex Flowmeter on Pipeline

Description	Illustration
The vortex flowmeter can be installed indoors or outdoors. Please install the flowmeter in a place with minor vibration. In case of intense pipe vibration, the pipeline shall be provided with supports. If the pipe is always filled with liquid, the pipe can be installed vertically or at any angle. The inner diameter of the connecting pipe must be slightly larger than the inner diameter of the vortex flowmeter, within (1-10mm).	
Pipe reducing: For the pipe shrinking, the length of the straight pipe section on the upstream side should be at least 15D, and that on the downstream side should be at least 5D (D: Nominal inner diameter of vortex flowmeter)	
Pipe expanding: For the pipe expanding, the length of the straight pipe section on the upstream side should be at least 35D, and that on the downstream side should be at least 5D	
Elbow: For the pipe bending, the length of the straight pipe section on the upstream side should be at least 40D, and that on the downstream side should be at least 5D.	
Valve position and length of straight pipe section: 1. The valve shall be installed downstream of the flowmeter. The length of the upstream straight pipe section depends on the upstream pipeline conditions (such as pipe expanding, pipe reducing and elbow), as shown above. The length of the straight pipe section on the downstream side shall be at least 5D. 2. If the valve must be installed upstream of the flowmeter, the length of the upstream straight pipe section shall be at least 35D, and the length of the downstream straight pipe section shall be at least 5D.	 
Impact of pulsating flow: The fluid may vibrate on the gas pipeline using piston or Roots blower or air compressor or on the high-pressure liquid pipeline using piston or plunger pump. Generally, the valve shall be installed downstream of the flowmeter. When necessary to install the flowmeter upstream of the valve, a pulsating flow attenuator, such as throttle plate or expansion section, can be installed upstream of the flowmeter.	

Description	Illustration
Piston or plunger pump: An energy accumulator can be installed upstream of the vortex flowmeter to mitigate liquid vibration.	
Valve position (pulsating pressure caused by T-tube) When using a T-tube, a valve can be installed upstream of the flowmeter to avoid the impact of pulsating pressure. For example, as shown in the right figure, when valve V1 is closed, the fluid flows in direction B, and the flow through the flowmeter is zero. However, due to the detected pulsating pressure, the zero point of the meter fluctuates. To avoid this, change the installation position of the valve to V1.	
Pressure measuring hole and temperature measuring hole When the fluid pressure flowing through the vortex flowmeter needs to be measured, if there is no special requirement, the pressure measuring hole shall be set at a place (2~7)D downstream of the vortex flowmeter. When it is necessary to measure the temperature of the fluid flowing through the vortex flowmeter, if there are no special requirements, the temperature measuring hole shall be set at a place (2~5)D downstream from the vortex flowmeter. (D is nominal inner diameter of vortex flowmeter)	 P-Pressure measuring hole T-Temperature measuring hole
Sealing gasket Do not protrude the sealing gasket into the pipe, otherwise the reading will have error. A gasket with bolts shall also be used for a clamped vortex flowmeter. The spiral sealing gasket (without bolt holes) shall be customized in the factory where sealing gasket is made, because the standard dimensions may not be available for the flanges of some specifications.	
Heat insulation When the integrated type vortex flowmeter or split type sensor installed on the pipeline transporting high-temperature fluids is wrapped with surface insulation materials, the installation position of the thermal insulation layer at the handle shall be installed according to the height shown in the figure, and the distance from the lower end face of the converter shall be ≥70mm to prevent overheating or overcooling of electronic components. For temperature-pressure vortex flowmeters with a medium temperature exceeding +260°C, in order to prevent the pressure sensor from overheating and damage, the thermal insulation layer must be installed below the spiral condensing section of pressure tapping pipe.	
Pipe cleaning Newly installed or repaired pipes shall be cleaned before operation. The rust, scale, residue and sludge in the pipe shall be flushed. During flushing, the water shall flow to the bypass pipe to avoid damage to the flowmeter. If there is no bypass pipe, a short pipe shall be temporarily installed to replace the flowmeter.	

Order Consultation Sheet

Customer:		Date:		
Name:		Department:		
Tel:		Email:		
Output signal type of meter:				
Measuring medium:	Steam □	Gas □	Liquid □	
Medium composition:				
Flow	Unit: m^3/h□	kg/h□	t/h□	Standard state □
Maximum:				Working state □
Minimum:				
Operating point:				
Density	Unit: kg/m^3			Standard state □
Maximum:				Working state □
Minimum:				
Operating point:				
Viscosity	Unit: cst			
Maximum:				
Minimum:				
Operating point:				
Medium temperature	Unit: °C			
Maximum:				
Minimum:				
Operating point:				
Ambient temperature:	Unit: °C			
Medium pressure	Unit: MPa			Absolute pressure □
Maximum:				Gauge pressure □
Minimum:				
Operating point:				
Explosion-proof requirements:	Intrinsically safe □	Flameproof □	Intrinsically safe dust □	Flameproof dust □
Temperature and pressure compensation:	Temperature compensation □	Pressure compensation □	Temperature and pressure compensation □	Not required □
Actual inner diameter of pipe:	mm			
Actual outer diameter of pipe:	mm			
Other requirements:				