CATALOG

KBLU

Vortex Flowmeter

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Technical Features

- **No moving parts, high reliability and durability**
- **Convenient installation and maintenance**
- **Sensor not contact with the measured fluids directly, stable performance and long service life**
- **Output pulse signal is proportional to flowrate, high accuracy and no zero drift**
- **Wide measuring range, turndown ratio 10:1**
- **Low pressure loss, low cost**
- **In a specific range of Reynolds Number, frequency output not affected by the fluid change in physical character and composition, meter factor(K) only considers shape and dimensions of bluff body. Measurement of volumetric flow can get compensation once it needed. Then no re-calibration meter factor needed if damaged parts be exchanged**
- **Wide application for steam, gas, liquid**

Contents

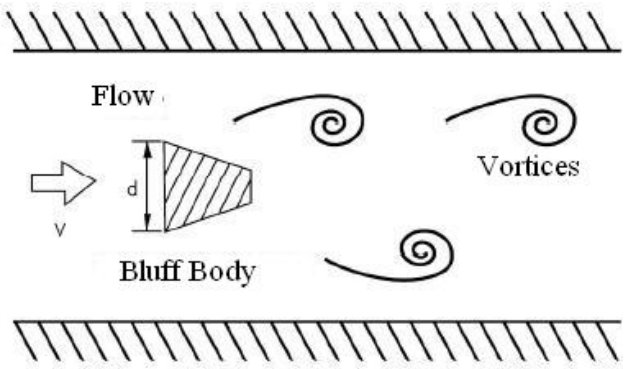
Working Principle & Circuit Diagram

- **Working Principle**

When a column body placed in flowing fluids in pipe, a series of vortices will be generated alternately on each side of the object as shown as below, these eddies known as “Karman Vortices”, the frequency of the vortex shedding is related to the velocity of the fluid and the width of the body. Expressed by formula as below:

$$f=St\ .v/d$$

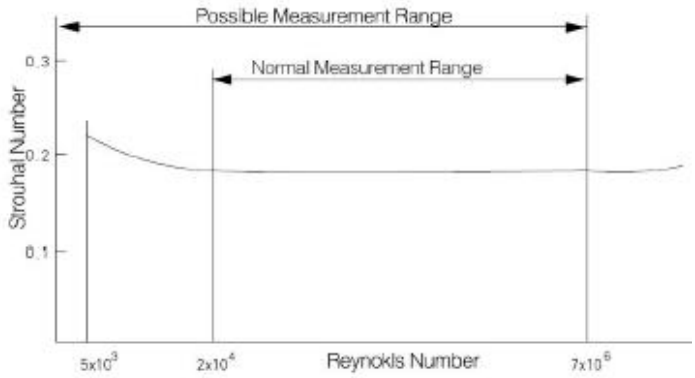
Thereinto f----frequency of Karman Vortex shedding
St----Strouhal number
v----velocity
d----width of column object



Because the frequency of the vortex shedding is proportional to the velocity, it can be used to calculate the instantaneous flowrate .

Strouhal number is a very important coefficient in the Vortex Flowmeter. In the range of straight line of St≈ 0.17 in curve, frequency of vortex shedding is proportional to the velocity, so as long as the frequency (f) be detected, the velocity (v) will be obtained, and volumetric flowrate will be got according to v.

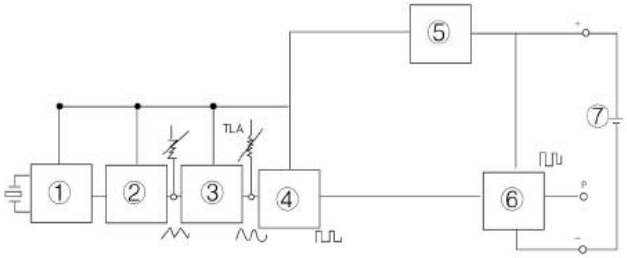
For KBLU Vortex Flowmeter, its frequency of the vortex shedding was detected by the stress force which exerted on the sensor (probe) using the piezoelectric unit which is built in sensor.



Strouhal Number Vs. Reynolds Number

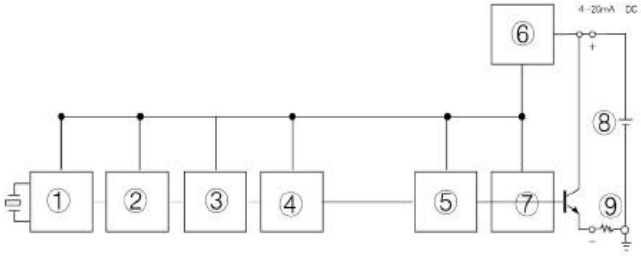
Circuit Diagram

1. Electric charge converter
2. Amplifier
3. Lowpass filter
4. Smith trigger
5. Stabilized voltage supply
6. Output amplifier
7. Power supply



Circuit block (pulse output)

1. Electric charge converter
2. Amplifier
3. Low-pass filter
4. Smith trigger
5. F/V converter
6. Stabilized voltage supply
7. V/I converter
8. Power supply
9. Load resistor



Circuit block (analog output)

- Electric charge converter
  Convert the alternating charge from piezoelectric unit into voltage, which is proportional to quantity of the charge.
- Alternating amplifier and low-pass filter
  Amplify signal and eliminate noise. When the velocity is low, high frequency noise produced from pipe vibration may be superposed on the output wave of charge converter to form a superposed wave. When high velocity, differential pulsed signal forms a wave involved low frequency swing. At low velocity (small output voltage), high frequency noise be eliminated by lowpass filter, and at high velocity (large output voltage), along with the lowpass feature be released and its feature of amplitude limit to appear, to prevent the signal from amplifying low frequency noise.
- Smith trigger
  Convert the detected voltage of the vortices frequency into pulse signal with a range of amplitude. Due to circuit of Smith trigger has a hysteretic function to input and output signal, therefore it can prevent oscillating caused by noises.
- F/V converter
  Convert pulse signal from Smith trigger output into analog vlotage that is proportional to frequency.
- V/I converter
  Convert analog output voltage into 4~20mA DC.
- Pulse output amplifier
  Amplify pulse frequency signal from Smith trigger.

How to Select Meter Model Correctly

It is very important to select meter model. Relevant information pointed out that most meter faults in application belong to improper meter model selection or meter installation.

- **For Mass Flowrate of Saturated Steam**

Flowrate measuring range (t/h)

DN(mm)	0.1MPa		0.2MPa		0.3MPa		0.4MPa		0.5MPa		0.6MPa	
15	5.8～31.7kg/h		7.0～46.4kg/h		8.1～60.8kg/h		8.8～75.0kg/h		9.7～89.0kg/h		10.4～103.0kg/h	
20	10.6～56.4kg/h		12.8～82.5kg/h		14.7～108.0kg/h		16.2～133.3kg/h		17.8～158.3kg/h		19.1～183.1kg/h	
25	13.4～88.1kg/h		16.2～128.8kg/h		18.2～168.8kg/h		20.5～208.2kg/h		22.4～247.3kg/h		24.1～286.1kg/h	
32	21.8～144.4kg/h		26.3～211.1kg/h		29.6～276.6kg/h		33.3～341.2kg/h		36.2～405.1kg/h		39.2～468.8kg/h	
40	26.5～225.7kg/h		32.0～329.8kg/h		36.1～432.2kg/h		40.6～533.1kg/h		44.1～633.0kg/h		47.7～732.5kg/h	
50	0.04	0.35	0.04	0.52	0.05	0.68	0.06	0.83	0.06	0.99	0.07	1.14
65	0.07	0.6	0.08	0.87	0.09	1.14	0.1	1.41	0.11	1.67	0.12	1.93
80	0.1	0.9	0.12	1.32	0.13	1.73	0.14	2.13	0.15	2.53	0.16	2.93
100	0.15	1.41	0.18	2.06	0.21	2.7	0.23	3.33	0.25	3.96	0.27	4.58
125	0.27	2.2	0.31	3.22	0.36	4.22	0.41	5.21	0.46	6.18	0.51	7.15
150	0.33	3.17	0.4	4.64	0.46	6.08	0.51	7.5	0.56	8.9	0.6	10.3
200	0.7	5.64	0.84	8.25	0.95	10.8	1.06	13.33	1.16	15.83	1.25	18.31
250	1.25	8.81	1.51	12.88	1.68	16.88	1.92	20.82	2.07	24.73	2.26	28.61
300	1.43	12.96	2.17	18.55	2.7	24.31	2.76	29.99	2.93	35.61	3.23	41.2
350	1.94	17.28	2.95	25.25	3.67	33.09	3.75	40.82	3.98	48.46	4.39	56.08
400	2.53	22.57	3.85	32.98	4.79	43.22	4.89	53.31	5.19	63.3	5.73	73.25
450	3.2	28.56	4.87	41.74	5.27	54.7	6.18	67.47	6.56	80.11	7.25	92.71
500	3.95	35.3	6.01	51.5	6.5	67.5	7.62	83.3	8.09	98.9	8.95	114.5

Continued

Flowrate measuring range (t/h)

DN(mm)	0.7MPa		0.8MPa		0.9MPa		1.0MPa		1.1MPa	
15	10.9～116.1kg/h		7.0～46.4kg/h		8.1～60.8kg/h		8.8～75.0kg/h		9.7～89.0kg/h	
20	20.2～206.4kg/h		12.8～82.5kg/h		14.7～108.0kg/h		16.2～133.3kg/h		17.8～158.3kg/h	
25	25.5～322.5kg/h		16.2～128.8kg/h		18.2～168.8kg/h		20.5～208.2kg/h		22.4～247.3kg/h	
32	41.6～528.4kg/h		26.3～211.1kg/h		29.6～276.6kg/h		33.3～341.2kg/h		36.2～405.1kg/h	
40	0.05	0.83	0.05	0.93	0.05	1.03	0.06	1.13	0.06	1.22
50	0.08	1.29	0.09	1.45	0.09	1.61	0.1	1.76	0.1	1.91
65	0.13	2.18	0.14	2.45	0.14	2.71	0.15	2.97	0.15	3.23
80	0.17	3.3	0.18	3.72	0.19	4.11	0.2	4.5	0.21	4.89
100	0.28	5.16	0.3	5.81	0.32	6.42	0.33	7	0.35	7.65
125	0.56	8.06	0.61	9.08	0.66	10.04	0.72	11	0.79	11.95
150	0.64	11.61	0.71	13.07	0.78	14.45	0.84	15.83	0.9	17.21
200	1.33	20.64	1.42	23.24	1.53	25.69	1.64	28.14	1.75	30.6
250	2.41	32.25	2.54	36.31	2.68	40.15	2.84	44	3.01	47.8
300	3.45	46.45	3.64	52.28	3.82	57.81	4.01	63.3	4.25	68.8
350	4.69	63.22	4.95	71.16	5.19	78.69	5.45	86.16	5.78	93.7
400	6.12	82.57	6.46	92.95	6.78	102.77	7.12	112.5	7.54	122.3
450	7.74	104.5	8.17	117.6	8.58	130.1	9.01	142.4	9.41	154.8
500	9.55	129	10	145.2	10.59	160.6	11.12	175.8	11.6	191.2

Continued

Flowrate measuring range (t/h)

DN(mm)	1.2MPa		1.3MPa		1.4MPa		1.5MPa		1.6MPa	
15	13.7～185.8kg/h		14.3～199.5kg/h		14.9～213.2kg/h		15.3～226.9kg/h		15.8～240.6kg/h	
20	26.1～330.3kg/h		27.3～354.8kg/h		28.2～379.1kg/h		29.3～403.4kg/h		30.4～427.8kg/h	
25	32.4～516.1kg/h		33.5～554.3kg/h		34.8～592.3kg/h		36～630.3kg/h		37.2～668.4kg/h	
32	0.05	0.85	0.05	0.91	0.05	0.97	0.06	1.03	0.06	1.1
40	0.06	1.32	0.06	1.42	0.06	1.52	0.07	1.61	0.07	1.71
50	0.11	2.06	0.11	2.22	0.12	2.37	0.12	2.52	0.13	2.67
65	0.15	3.49	0.16	3.75	0.16	4	0.17	4.26	0.18	4.52
80	0.22	5.28	0.23	5.68	0.24	6.07	0.25	6.45	0.26	6.84
100	0.37	8.26	0.38	8.87	0.39	9.48	0.4	10.08	0.41	10.69
125	0.85	12.9	0.9	13.86	0.97	14.81	1.02	15.76	1.07	16.71
150	1.08	18.58	1.17	19.95	1.25	21.32	1.32	22.69	1.39	24.06
200	1.87	33.03	2.01	35.48	2.13	37.91	2.26	40.34	2.39	42.78
250	3.23	51.61	3.37	55.43	3.51	59.23	3.65	63.03	3.79	66.84
300	4.49	74.31	4.74	79.82	4.98	85.29	5.23	90.76	5.46	96.25
350	6.11	101.2	6.45	108.6	6.78	116.1	7.11	123.5	7.39	131
400	7.98	132.1	8.42	141.9	8.85	151.6	9.28	161.4	9.65	171.1
450	10	167.2	10.6	179.6	11.2	191.9	11.7	204.2	12.2	216.6
500	12.3	206.4	13	221.7	13.9	236.9	14.4	225.1	15.06	267.4

Note: The pressure in Table above is gauge pressure

- **For Mass Flowrate of Superheated Steam**

Flowrate measuring range (t/h)

DN(mm)	Min. Flowrate(t/h)	Max. Flowrate(t/h)
15	$5.40\sqrt{\rho}$ kg/h	28.61 ρ kg/h
20	$9.88\sqrt{\rho}$ kg/h	50.87 ρ kg/h
25	$12.49\sqrt{\rho}$ kg/h	79.48 ρ kg/h
32	$20.35\sqrt{\rho}$ kg/h	130.22 ρ kg/h
40	$24.88\sqrt{\rho}$ kg/h	203.47 ρ kg/h
50	$37.10\sqrt{\rho}$ kg/h	317.93 ρ kg/h
65	$65.67\sqrt{\rho}$ kg/h	537.29 ρ kg/h
80	$99.66\sqrt{\rho}$ kg/h	813.89 ρ kg/h
100	$0.14\sqrt{\rho}$	1.27 ρ
125	$0.22\sqrt{\rho}$	2.0 ρ
150	$0.31\sqrt{\rho}$	2.86 ρ
200	$0.65\sqrt{\rho}$	5.07 ρ
250	$1.05\sqrt{\rho}$	7.95 ρ
300	$1.35\sqrt{\rho}$	11.45 ρ
350	$1.84\sqrt{\rho}$	15.58 ρ
400	$2.40\sqrt{\rho}$	20.35 ρ
450	$3.04\sqrt{\rho}$	25.75 ρ
500	$3.77\sqrt{\rho}$	31.79 ρ

Note: ρ---density of the superheated steam under operating condition (kg/m^3)

- **For Gas Volumetric Flowrate under Operating Condition**

Flowrate measuring range (m^3/min)

DN (mm)	Min. Flowrate (m^3/min)	Max. Flowrate (m^3/min)
15	$0.088/\sqrt{\rho}$	0.48
20	$0.156/\sqrt{\rho}$	0.85
25	$0.201/\sqrt{\rho}$	1.32
32	$0.328/\sqrt{\rho}$	2.17
40	$0.397/\sqrt{\rho}$	3.4
50	$0.658/\sqrt{\rho}$	5.3
65	$0.995/\sqrt{\rho}$	8.95
80	$1.51/\sqrt{\rho}$	13.56
100	$2.36/\sqrt{\rho}$	21.2
125	$3.68/\sqrt{\rho}$	33.12
150	$5.27/\sqrt{\rho}$	47.7
200	$9.42/\sqrt{\rho}$	84.8
250	$14.73/\sqrt{\rho}$	132.5
300	$21.2/\sqrt{\rho}$	190.8
350	$28.86/\sqrt{\rho}$	259.6
400	$37.7/\sqrt{\rho}$	339.1
450	$47.71/\sqrt{\rho}$	429.2
500	$58.9/\sqrt{\rho}$	529.9
600	$84.82/\sqrt{\rho}$	763
700	$115.4/\sqrt{\rho}$	1038.6
800	$150.8/\sqrt{\rho}$	1356.5
900	$190.8/\sqrt{\rho}$	1716.8
1000	$235.6/\sqrt{\rho}$	2119.5
1200	$339.3/\sqrt{\rho}$	3052.1

Notes:

1. ρ ----density of gas under operating condition (kg/m^3)
2. Formula:

   $\rho = (P+0.101325) \times 10.197 \times 10^4 / R(t+273.15)$

   Thereinto: ρ ----gauge pressure(MPa)

   t---- temperature (℃)

   R---- gas constant
3. The flowrate measuring range:

   DN15 ~ 500 for Piped Vortex Flowmeter,

   DN500 ~ 1200 (expandable to 1600mm) for Inserted Vortex Flowmeter.

- **For Gas Volumetric Flowrate under Standard Condition**

Flowrate measuring range (Nm^3/min)

DN (mm)	Min. Flowrate (Nm^3/min)	Max. Flowrate (Nm^3/min)
15	$0.088k/\sqrt{\rho}$	0.48k
20	$0.156k/\sqrt{\rho}$	0.85k
25	$0.201k/\sqrt{\rho}$	1.32k
32	$0.328k/\sqrt{\rho}$	2.17k
40	$0.397k/\sqrt{\rho}$	3.4k
50	$0.658k/\sqrt{\rho}$	5.3k
65	$0.995k/\sqrt{\rho}$	8.95k
80	$1.51k/\sqrt{\rho}$	13.56k
100	$2.36k/\sqrt{\rho}$	21.2k
125	$3.68k/\sqrt{\rho}$	33.12k
150	$5.27k/\sqrt{\rho}$	47.7k
200	$9.42k/\sqrt{\rho}$	84.8k
250	$14.73k/\sqrt{\rho}$	132.5k
300	$21.2k/\sqrt{\rho}$	190.8k
350	$28.86k/\sqrt{\rho}$	259.6k
400	$37.7k/\sqrt{\rho}$	339.1k
450	$47.71k/\sqrt{\rho}$	429.2k
500	$58.9k/\sqrt{\rho}$	529.9k
600	$84.82k/\sqrt{\rho}$	763k
700	$115.4k/\sqrt{\rho}$	1038.6k
700	$115.4k/\sqrt{\rho}$	1038.6k
800	$150.8k/\sqrt{\rho}$	1356.5k
900	$190.8k/\sqrt{\rho}$	1716.8k
1000	$235.6k/\sqrt{\rho}$	2119.5k
1200	$339.3k/\sqrt{\rho}$	3052.1k

Notes: 1. ρ ---- gas density under operating condition (kg/m^3)

2. $$k = \frac{p+0.101325}{0.101325} \times \frac{293.15}{t+273.15}$$

Thereinto: p----working pressure (gauge pressure) MPa

t---- temperature (℃)

3. Standard condition 20℃, 0.1MPa (absolute pressure), or under standard atmosphere at 20℃
4. The flowrate measuring range:

DN15 ~ 500 for Piped Vortex Flowmeter,

DN500 ~1200 (expandable to 1600mm) for Inserted Vortex Flowmeter.

- **For Volumetric Flowrate of Liquid**

Flowrate measuring range (m^3/h)

DN (mm)	Min. Flowrate (m^3/h)	Max. Flowrate (m^3/h)
15	$12.01/\sqrt{\rho}$	3.21
20	$21.18/\sqrt{\rho}$	5.65
25	$33.2/\sqrt{\rho}$	8.83
32	$106.6/\sqrt{\rho}$	14.47
40	$133.7/\sqrt{\rho}$	22.61
50	$167/\sqrt{\rho}$	35.33
65	$226.4/\sqrt{\rho}$	59.7
80	$343.1/\sqrt{\rho}$	90.43
100	$536/\sqrt{\rho}$	141.3
125	$837.7/\sqrt{\rho}$	220.8
150	$1206.4/\sqrt{\rho}$	317.9
200	$2144.8/\sqrt{\rho}$	565.2
250	$3351.3/\sqrt{\rho}$	883.1
300	$4825.9/\sqrt{\rho}$	1271.7
350	$6568.5/\sqrt{\rho}$	1730.93
400	$8576.7/\sqrt{\rho}$	2260.8
450	$10856.8/\sqrt{\rho}$	2861.3
500	$13405.8/\sqrt{\rho}$	3532.5
600	$19303.9/\sqrt{\rho}$	5086.8
700	$26274/\sqrt{\rho}$	6923.7
800	$34316.2/\sqrt{\rho}$	9043.2
900	$43433.7/\sqrt{\rho}$	11445.3
1000	$53623.3/\sqrt{\rho}$	14130
1200	$77215.6/\sqrt{\rho}$	20347.2

Notes: 1. ρ ----- liquid density under operating condition (kg/m^3)
Density of water under normal temperature and pressure is $1000kg/m^3$,
$\sqrt{\rho}=31.623Kg/m^3$

2. The flowrate measuring range:
DN15 ~ 500 for Piped Vortex Flowmeter,
DN500 ~ 1200 (expandable to 1600mm) for Inserted Vortex Flowmeter

Structure of Vortex Flowmeter

Vortex Flowmeter consists of converter (including internal amplifier board), bracket, assembly of vortex generator assembly (including triangular column body, sensor) and meter body as shown as below:

Parts:

1. Converter cover	2. Amplifier board	3. Converter
4. Mounting bolt for converter	5. Vortex generator	6. Mounting bolt for bracket
7. Bracket	8. Meter Body	

Fittings for installation including: concavo-convex flange, long-bolts and nuts etc, as shown as below:

Parts:

1. Nuts	2. Double-head bolt	3. Concavo-convex flange
4. Gasket	5. Welded seam	6. Process pipe

How to Select Right Installing Site

It is very important to select proper place for meter installation and install it correctly, otherwise it will affect meter accuracy or even damage meter. For convenient installation and maintenance, flexible pipe could be installed downstream flowmeter.

1. Requirement for straight pipe

This flowmeter requires specific straight pipe for upstream and downstream, or accuracy won't be exactly right.

The length of straight pipe ≥ 15D for upstream and ≥5D for downstream if converging pipe ＞15° is used in upstream of transducer installing site.

The length of straight pipe ≥ 18D for upstream and ≥5D for downstream if diverging pipe＞15° is used in upstream of transducer installing site.

The length of straight pipe ≥ 20D for upstream and ≥5D for downstream if 90° elbow or T joint is used in upstream of transducer installing site.

The length of straight pipe ≥ 25D for upstream and ≥5D for downstream if two 90° elbows on same plane in upstream.

The length of straight pipe ≥ 40D for upstream and ≥5D for downstream if two 90° elbows on different planes in upstream.

Flow or pressure control valve should be installed at least 5D far away from the meter in downstream as possible, if these valves must be installed in the

upstream, ensure ⩾50D for upstream at least and ⩾5D for downstream.

CAUTION:

- If there is a valve equipped near the site of meter installed in upstream, often open or close the valve will affect meter working life and even cause permanent meter damage.
- Avoid transducer installed in much long overhead pipe, otherwise leakage will happen between transducer and flange caused by transducer drooping. If can not avoid, fitting device for pipe must be used at the 2D on both side of meter.

2. Requirement for Companion Pipe

Straight pipe must be exactly required upstream and downstream of flowmeter installing site, or measuring accuracy will be affected.

- The inside diameter of companion pipe for upstream and downstream should be the same as nominal diameter of flowmeter, and should meet requirements as below:

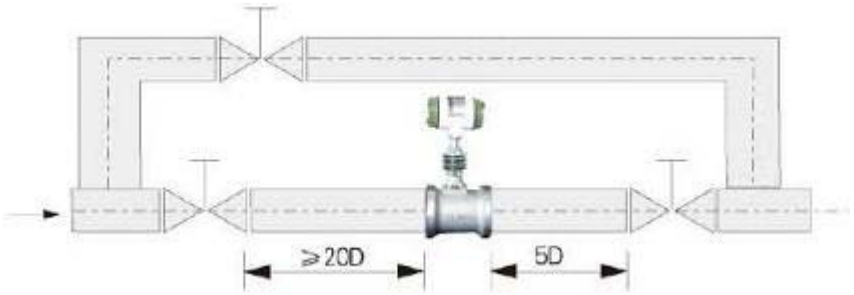
$$0.98DN \leqslant D \leqslant 1.05DN$$

Thereinto: DN----------nominal diameter of the flowmeter
D----------inside diameter of the companion pipe

- Companion pipe should be concentric to flowmeter, and coaxial offset should not be more than 0.05DN.
- Sealing gasket between flange and transducer cannot be protruded into the pipe, and its ID can be slightly bigger than that of transducer.

3. Requirement for By-pass Pipe

For convenient maintenance, it had better install a by-pass pipe for transducer. In addition, in pipeline needed cleaning or if the fluid in pipeline cannot be shut down for meter checking, the by-pass pipe must be mounted.



4. Requirement for Pipe Vibration

Avoid transducer being installed on the pipe with strong vibration, if you have to installed, vibration damping measures should be used. Install fitting device at 2D far away from the flowmeter on both side of upstream & downstream and vibration pad should be used too.

CAUTION: Transducer can not be installed at outlet of air compressor with strong vibration, and should be installed behind the gas container.

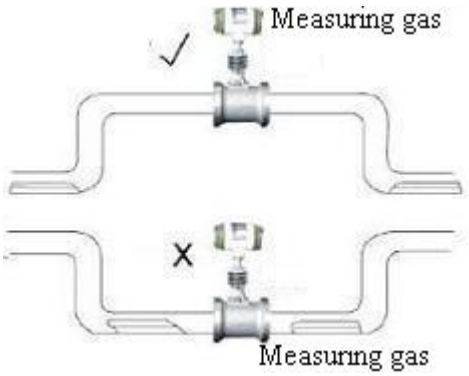
5. Requirement for Ambient Condition

1) Avoid transducer being installed in place where temperature changes greatly or heat radiation occurs. If it is necessary, take some measures to isolate thermal or ventilation.
2) Avoid transducer being installed in place where corrosive atmospheres surrounded. If it is necessary, take on some enforced ventilation measures.
3) It had better transducer be installed indoors. If sensor must be installed outdoors, bend the cable into U shape at the electrical port to avoid raining water into the box of amplifier along with the cable.
4) Sufficient space should be around transducer for convenient installation and regular maintenance.
5) Connection of transducer should be far away from electrical noise interference , such as big power transformer, electromotor and radio frequency interference etc.
6) There should be no frequency converter near transducer. Otherwise, normal performance will be affected by high frequency interference.
7) There should be no strong vibration source near transducer installing point. Damping measures should be taken once needed.

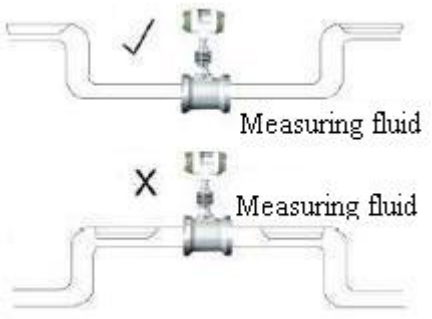
Transducer Installed in Horizontal Pipe

It is the most common way to install transducer in horizontal pipe.

When used in gas, transducer should be installed at the top of pipeline if the gas contains few liquid.



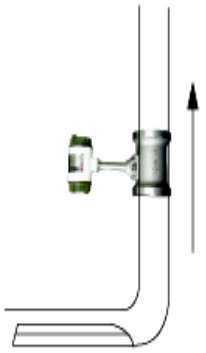
When used in liquid, transducer should be installed at the bottom of pipeline if the liquid contains little gas.



Transducer Installed in Vertical Pipe

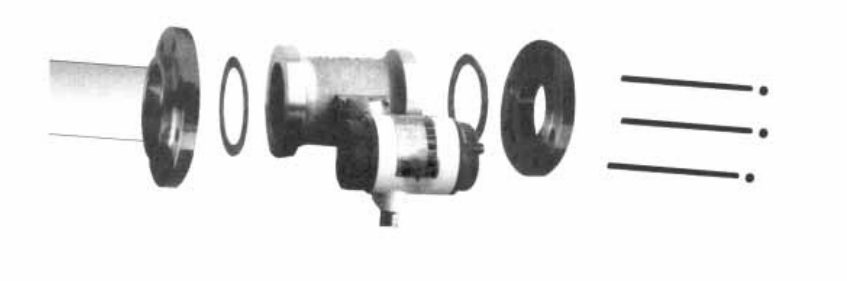
When used in gas, transducer could be installed in vertical pipe with no considering of flow direction, but for gas contains few liquid, the gas flow direction should be from bottom to top.

When used in liquid, flow direction should be from bottom to top, avoid extra weight of the liquid to exert on the probe.



Lateral Installation in Horizontal Pipe

Transducer can be installed laterally in horizontal pipe for all fluids. Particularly for superheated steam, saturated steam and cryogenic liquids, if allowed, transducer should be installed laterally to avoid amplifier from being affected greatly by temperature.



Inverse Installation in Horizontal Pipe

It is not suggested to install transducer inversely for normal gas or superheated steam, but it is suitable to saturated steam, high temperature liquid or the condition that dirty pipe needs cleaning frequently.

The flowmeter employs flange clamped (wafer type). Tighten long bolts and clamp transducer with two pieces of flange. Concave side connects with transducer and convex side connects with customer's pipe. Installing procedure in detail is as follows:

1. First calculate the size for meter installation;
2. Place the pipe to be mounted on sawing machine to cut-off and debur the kerf;
3. Connect flange with pipe, then fix and spot-weld, next weld all-around. Last check if perfect;
4. Repeat steps above, weld another flange;
5. Move the pipe with flange welded to installing site, mount the pipe with transducer, then install it on the pipeline;
6. Check if everything is OK, then open the valve slowly and check if leakage occurs.

Caution:

1. Flowing direction must be conformed with the arrow on the transducer.
2. During welding pipe or flange when install flowmeter, flowmeter should not be placed on the pipe to avoid damage the electronic amplifier unit.
3. Flanges on both side of transducer must be parallel, otherwise leakage will be caused easily.

Parts:

1. Nut
2. Double-head bolt
3. Concave-convex flange
4. Gasket
5. Transducer
6. Welding seam
7. Process pipe

Installation in Pipe with Insulating Layer

When measure high temperature steam, wrap pipe with heat insulating material to avoid heat dissipation. Pay attention not to cover bracket totally with heat insulating material, with height no more than 1/3 of bracket. Transducer body can be covered by heat insulating material.

Parts:

1. Bracket
2. Heat insulating material

Change Direction of Amplifier Box

The amplifier box can be changed to four directions for convenient wiring, reading (with LCD) etc. on site.
Just screw down 4 hex socket screws for fixing amplifier box(inner hexagon spanner attached), then slightly rotate amplifier box to desired direction(See figure on P10: structure).

Caution:
Do not lift amplifier box while rotate to avoid breaking the wire between amplifier and probe.

Wiring for Meter with Frequency Output Signal

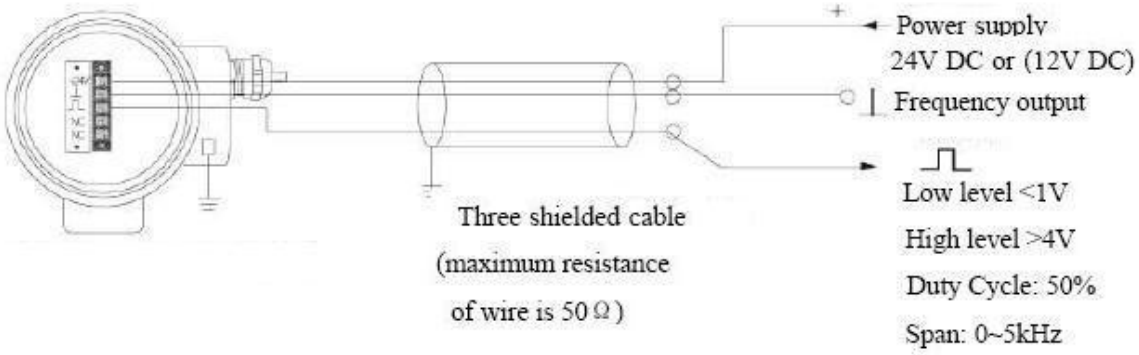
This meter uses three wires to transmit frequency output signal to other external equipments, with power supply 24V ±10%, the minimum load resistor of output circuit 10kΩ, the maximum capacitance 0.22μF, and resistance of shielded wire must be less than 50Ω.

Normally, a three cores shielded wire (RVVP3×0.5mm) is used as connecting wire. The outer shielded layer should be connected to the grounding screw in amplifier box reliably.

Appropriate shielded wire should be used to meet field temperature when meter used in high or low temperature ambient.

When the atmosphere surrounded the field contains oil, solvent or other corrosive gas and liquid, appropriate shielded wire should be used to meet this environment.

Connecting wire should not be parallel to the power cable, with distance between them more than 15cm at least. Place them into independent steel tube should be better. Fix connecting wire and can not be shaken.

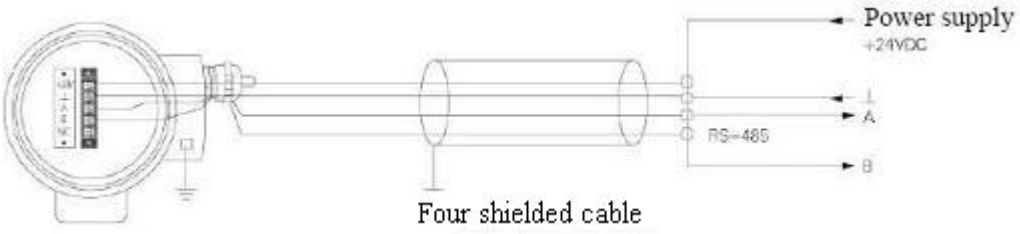


Wiring for RS-485 Communication

Four wires transmission is applied between vortex flowmeter with RS-485 output and other equipments. Power supply is 24V DC ±10%.

Normally, 600V PVC insulated wire or cable should be used as connecting wire. The two cores shielded wire (RVVP2×0.5mm) should be used where electrical noise occurs likely. The outer shielded layer should be connected to the grounding screw in amplifier box reliably. Appropriate shielded wire should be used to meet field temperature when meter used in high or low temperature ambient.

When the atmosphere surrounded the field contains oil, solvent or other corrosive gas and liquid, appropriate shielded wire should meet this environment.

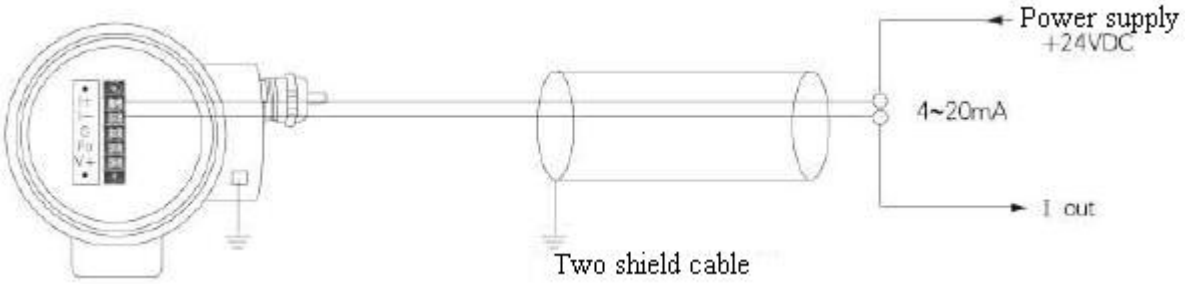


Wiring for Meter with Two Wires 4～20mA Output Signal

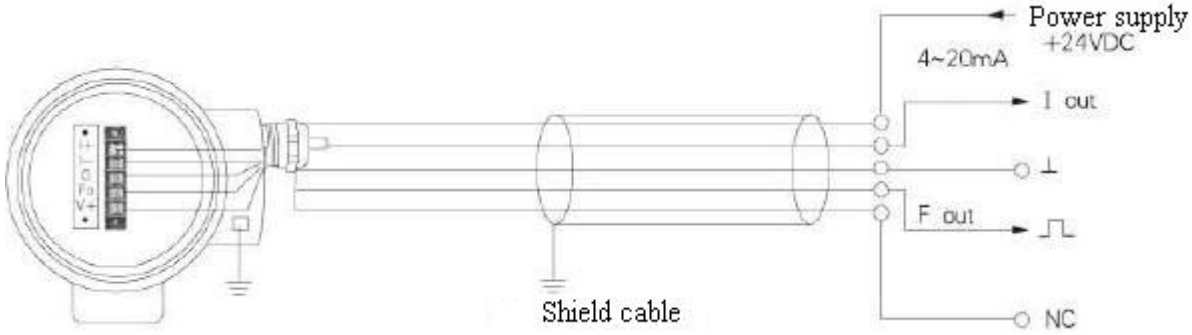
This meter uses two wires to transmit 4～20mA output signal to other equipments, with power supply 24V DC ±10%, the maximum load resistance for output circuit 600Ω (including resistance of cable).

Normally, 600V PVC insulated wire or cable should be used as connecting wire. The two cores shielded wire (RVVP2×0.5mm) should be used where electrical noise occurs likely. The outer shielded layer should be connected to the grounding screw in amplifier box reliably.

Appropriate shielded wire should be used to meet field temperature when meter used in high or low temperature ambient.

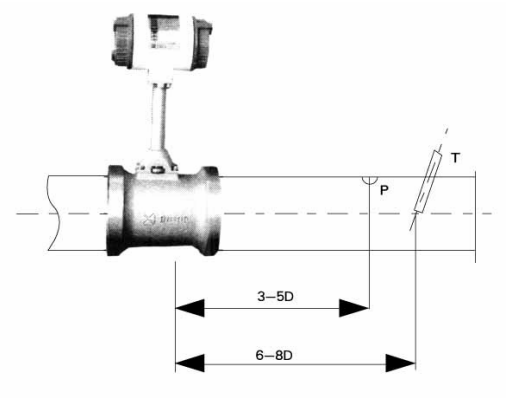


Wiring for 4~20mA and Frequency Signal Output at the Same Time



How to Select Pressure and Temperature Measuring Point

If you require measuring pressure or temperature near the flowmeter, pressure measuring point should be 3~5D at downstream of transducer and temperature measuring point should be 6~8D at downstream of transducer.



Preparation before Operation

1. Check the transducer mounting and wiring if it is correct;
2. Power on indicator and check if there is flow indication;
3. Open the valve slowly and stop once get a small pressure, then check if any leakage happens around the transducer or flow indication available in the indicator;
4. If condition is normal, open the valve fully and stabilize for a few minutes to check if it works properly.

Model Selection

Item	Code	Description
Factory Mark	KB	
Meter Type	L	Flowmeter
Working Principle	U	Karman Vortices
Meter Category	D	Standard Intelligent
	E	(with Communication Protocol)
Installing Type	-2	Flange Clamped
	3	Fixed Inserted
	4	Adjustable Inserted(with Ball Valve)
Fluid Measured	2	Liquid
	3	Gas
	4	Steam
Nominal Diameter	-15	15mm
	20	20mm
	2	25mm
	3	32mm
	4	40mm
	5	50mm
	6	65mm
	8	80mm
	10	100mm
	12	125mm
	15	150mm
	20	200mm
	25	250mm
	30	300mm
	35	350mm
	40	400mm
	45	450mm
	50	500mm
	Just for Inserted	DN×10
Indicator	D	With Digital Indicator (Only for Standard)
	N	No Indicator
Power Supply	-1	24VDC
	2	3.6V Lithium Battery
	3	Two Power Supplies (24V DC, 3.6V Lithium Battery)
Output Signal	0	No Output
	1	Pulse Output
	2	Two Wires: 4～20mA DC
	3	RS485
	4	Hart
	5	Modbus
Fluid Temperature	1	Standard -40～+250℃
	3	High Temperature: +100～+350℃
Rated Pressure	-1	16 Bar
	2	25 Bar
	3	40 Bar
	4	64 Bar
Explosion Proof	N	Non
	G	Flameproof
	B	Intrinsical Safe

For Flange Clamped

DN	15	20	25	32	40	50	65	80	100	125	150	200	250	300	350	400	450	500
Code	015	020	025	03	04	05	06	08	10	12	15	20	25	30	35	40	45	50

For Inserted

DN	300	350	400	450	500	600	650	700	800	900	1000	1100	1200	1400	1600
Code	30	35	40	45	50	60	65	70	80	90	100	110	120	140	160

Technical Specifications

BFS guarantees that the performance parameters for all products are not exceeded the error given hereafter. The data means the meter's average value obtained from a series homologous type meters.

Fluid---------- Saturated steam, superheated steam
----------Gas
---------- Liquid

Accuracy---------- ±1.0% for liquids; ±1.5% for gas
---------- ±2.5% for inserted

Repeatability---------- Pulse output ±0.33% for liquids; ±0.5% for gas
---------- ±0.83% for inserted

Rated Pressure----------1.6MPa (2.5 ~ 4.0MPa for special)

Fluid Temperature---------- -40 ~ +250℃(standard)
---------- +100 ~ +350℃ (high temperature)

Output Signal---------- Three wires voltage pulse, low level≤2V, high level≥6V
----------Two wires standard current, 4~20mA
----------RS-485 Communication

Power Supply---------- 24V DC, Lithium battery

Ambient Temperature---------- -35 ~ +60℃(no LCD display)
---------- -5 ~ +60℃ (with LCD display)

Humidity---------- 5 ~ 95%

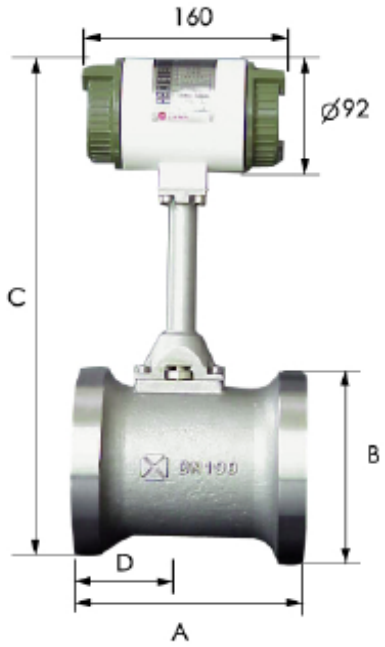
Protection Grade---------- IP65

Explosion Proof---------- Flameproof Exd Ⅱ BT4
---------- Intrinsical safe Exib Ⅱ CT4

Cable Port----------2×M20×1.5(with cable clip nut)

Body Material---------- 304SS

Dimension of Meter Outline

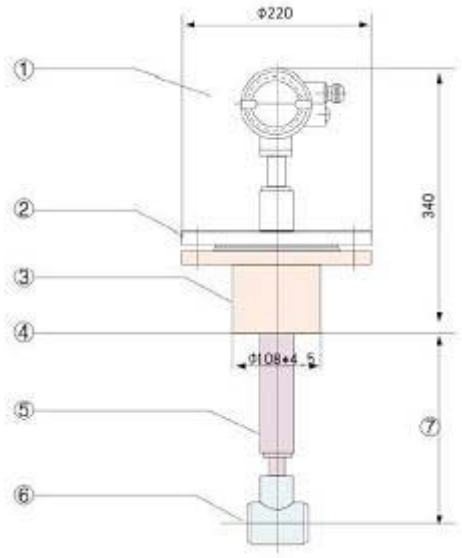


DN	A	B	C
15	100	Φ35	387.5
20	100	Φ45	390
25	100	Φ57	394
32	100	Φ65	396
40	100	Φ75	400
50	110	Φ87	405
65	110	Φ109	411
80	110	Φ120	417
100	120	Φ149	445
125	133	Φ175	475
150	160	Φ203	499
200	185	Φ259	555
250	210	Φ312	607
300	240	Φ363	659
350	260	Φ409	709
400	285	Φ460	761
450	310	Φ520	817
500	330	Φ575	882

Dimension for Fixed Inserted Vortex Flowmeter & Installation

Parts:

1. Vortex converter
2. Body flange
3. Short duct with flange
4. Outer wall of customer's pipe
5. Inserted rod
6. Measuring probe
7. 1/2 outer diameter of the pipe (ND≤500)
   1/5 outer diameter of the pipe (ND＞500)



DN	Outer Diameter × Thickness	Inner Diameter
300	Φ325×9	Φ307
350	Φ377×9	Φ359
400	Φ426×9	Φ408
450	Φ480×9	Φ462
500	Φ530×9	Φ512
550	Φ560×9	Φ542
600	Φ630×9	Φ612
650	Φ670×10	Φ650
700	Φ720×10	Φ700
800	Φ820×10	Φ800
900	Φ920×10	Φ900
1000	Φ1020×10	Φ1000
1100	Φ1120×10	Φ1100
1200	Φ1220×10	Φ1200
1400	Φ1420×10	Φ1400
1600	Φ1620×10	Φ1600

Installation Procedures:

1. Drill a hole in the customer's pipe by method of torch cutting, with diameter slightly less than Φ100, no burr at the edges of the hole to make the measuring probe inserted through it freely.
2. Weld a matched short-duct (supplied by us) on the hole on the pipe by spot welding, the axes line of the short-duct is perpendicular 90° to the one of the pipe, as well as its extending line is through the circle center of cross-section of the pipe, then welding all-around.

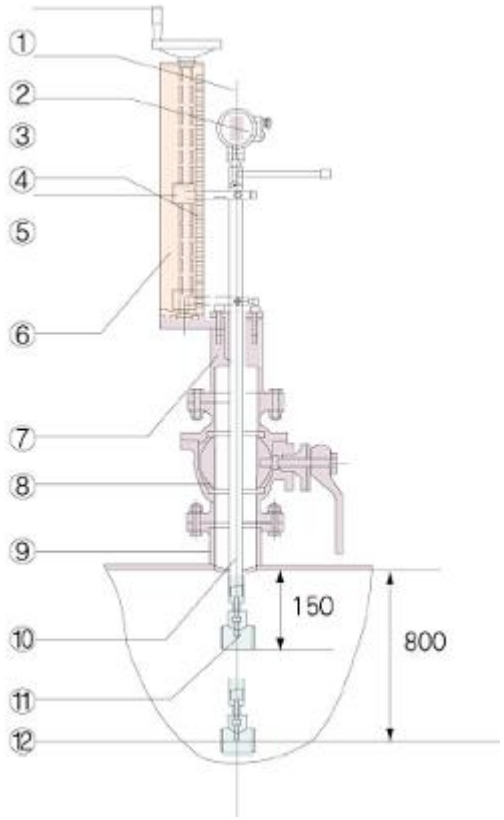
3. For fixed type

Put gasket of the duct flange, insert probe into the short-duct, then mount bolts and check if it is even around the flange, and the flow direction is conformed.

4. Check all if it is good, open valve slowly and check the leakage (care of personnel safety).

Caution:
1. Flow direction must be conformed with the flow arrow on the meter body;
2. When weld the flange and pipe, the converter should not be installed on the pipe to avoid any damage of the converter.

Dimension of Adjustable Inserted Meter & Installation (with Ball Valve)



Parts:

1. Hand handle
2. Convertor
3. Guide rod
4. Scale
5. Screw rod
6. Housing
7. Seat for inserted rod
8. Ball valve
9. Sleeve tube ø108*4. 5
10. Inserted rod
11. Probe
12. Center of measured tube

Installation Procedures:

1. Drill a hole in the customer's pipe by method of torch cutting, with diameter slightly less than Φ100, no burr at the edges of the hole to make the measuring probe inserted through it freely.
2. Weld a matched short-duct (supplied by us) on the hole on the pipe by spot welding, the axes line of the short-duct is perpendicular 90° to the one of the pipe, as well as its extending line is through the circle center of cross-section of the pipe, then welding all-around.

For adjustable type

3. First install ball-valve (Q41F-16R-32R, ID100mm, supplied by customer), then install converter on the valve.
4. The inserted deep is 0.5D, measuring the length of the short duct and ball valve, adjusting screw rod to make the inserted deep is conformed with the specification.
5. Check all if it is good, open valve slowly and check the leakage (care of personnel safety).

Caution:

1. Flow direction must be conformed with the flow arrow on the meter body;
2. When weld the flange and pipe, the converter should not be installed on the pipe to avoid any damage of the converter.

Installation of Pressure Transmitter & Thermal Resistor Pt100

1. Condensing flex tube (buffering ring)
2. Valve (DN20)
3. Vortex flowmeter
4. Pressure transmitter
5. Inner thread duct (M20×1.5)
6. Thermal resistor (Pt100)
7. Inner thread duct (M27×1.5)

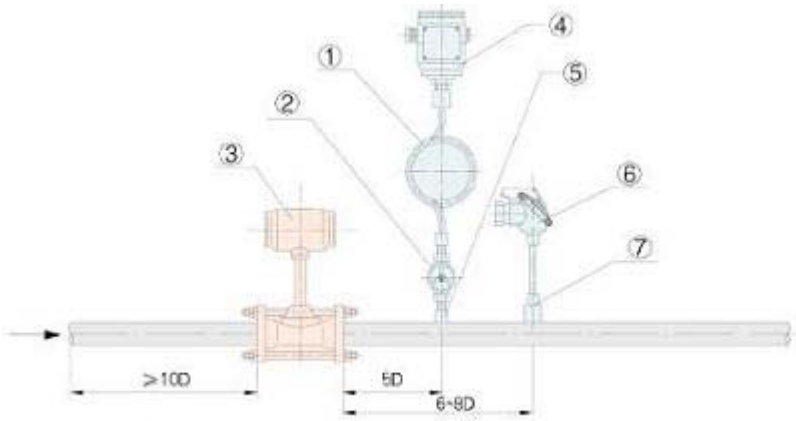


Figure 1. Pressure transmitter installed in horizontal pipe

1. Inner thread duct (M20×1.5)
2. Pressure transmitter
3. Condensing flex tube (buffering ring)
4. Valve (DN20)
5. L shape duct (DN20)

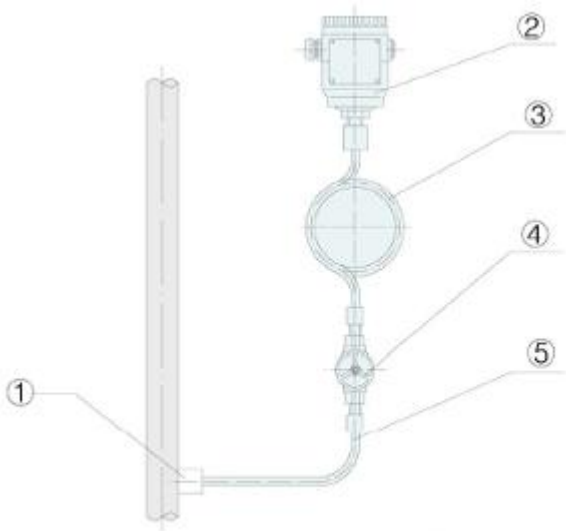


Figure 2. Pressure transmitter installed in vertical pipe

Installation Procedures

1. Drill a ø12 hole (its size no specified requirement) in the pipe;
2. Weld inner thread duct;
3. Screw valve (with ball valve), condensing flex tube in sequence;
4. Close valve, inject cold water into the flex tube, then screw pressure transmitter when it is used initially;
5. Open the valve under operation.

Production Standards

- **JJG198-1994**
- **JB/T9249-1999**
- **Q/SVEA 01-2005**
- **GB/T191-2000**
- **GB/T15464-1995**
- **GB3896.1/4-2000, 3896.2-2000**

Precaution for Selection and Usage of Explosion Proof Vortex Flowmeter:

- Divide category of hazardous area correctly; Select and install proper explosion proof vortex flowmeter; maintain and repair in time and correctly.
- Division of hazardous area, selection, installation and maintenance and so on must be conformed to safety standard system such as GB3836.14-2000, GB3836.15-2000, GB3836.13-1997 etc.
- Make sure that selection is conformed with design (including vortex flowmeter model and specification, power grade, protection grade, installation type, explosion proof mark, cable, thread etc.)
- Confirm installing site and leave sufficient space and path around flowmeter. Following factors should be considered: convenient usage, operation, running, repair& maintenance, disposal of urgent matters (urgent power off) etc. Avoid disadvantage factors such as stream, raining, thunder, moisture, thermal radiation, high temperature object, vibration etc.
- Groundng is one of the most important precautions in meter electrical technology. This connection is to transfer the static charge (static charge generated during fluid transmission, electromagnetic induction, electrostatic induction etc.) to ground.

Precaution for Intrinsical Safe Meter in Operation

This intrinsical safe meter is approved by National Supervision and Inspection Center for Explosion Protection and Safety of Instrumentation (NEPSI), according to National Standard GB3896.1/4-2000, mark of explosion proof is ExibIICT4, certificate No. GYB06179. It combined with safety barrier to make up an intrinsical safe explosion proof system, which can be used in relevant hazardous areas. You need to care of follows before installation:

a) There is grounding terminal in meter housing, you must ground the meter reliably;

b) This intrinsical safe meter must be combined with safety barrier which must be approved by Organization of Explosion Proof Inspection to make up intrinsical safe system;

c) The three cores shielded cable (core cross section is 0.5mm^2 , with insulating sheath) be used for connecting between meter to safety barrier, the shielded layer be single-end grounded in non-hazardous area. Cable layout should eliminate the electromagnetic interference as possible and make the cable distribution capacitance within 0.05F;

d) Ambient temperature range: −25 ～ +50℃. The relationship between temperature levels of explosion proof mark and inflame temperature as below:

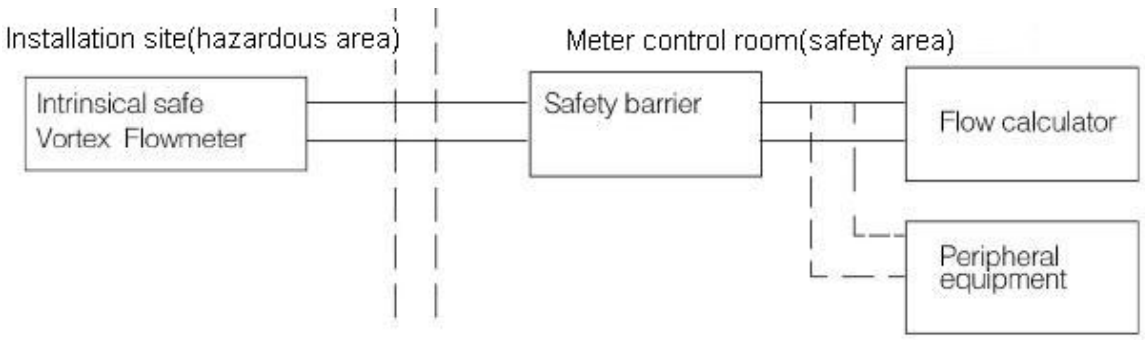
Temperature Level	T1	T2	T3	T4	T5	T6
Inflame Temperature	≤400℃	≤280℃	≤180℃	≤120℃	≤85℃	≤70℃

e) The safety barrier should be installed in non-hazardous areas and operation should be according to the operation instruction;

f) Customer should not change the electric elements by himself;

g) Must obey the regulations of National Standard GB50058-92 while installation and maintenance.

Configuration of Intrinsical Safe System



Safety barrier is zener or insulated type, please connect vortex flowmeter, flow calculator and safety barrier according to barrier instruction.

Precaution for Flameproof Meter in Operation

This flameproof flowmeter is approved by National Supervision and Inspection Center for Explosion Protection and Safety of Instrumentation (NEPSI), according to National Standard GB3896.1/4-2000, mark of flameproof is Exd II BT4, certificate No. GYB06239.

a) Avoid opening wiring box and inlet wire box of flameproof vortex flowmeter for daily maintenance. Cut off power before open. If open the flameproof housing, flameproof surface should be protected with no damage. Put flameproof surface upwards and can not touch the earth directly when check.

b) Non-flameproof meter and lamp fixture etc. are not allowed for maintenance on site. All tools should be flameproof.

c) Grounding terminal is available on housing. Meter should be grounded reliably while operation.

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