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Vortex Flow Meter – Wafer or Flange Connection

- Steam
- Liquid
- Gas

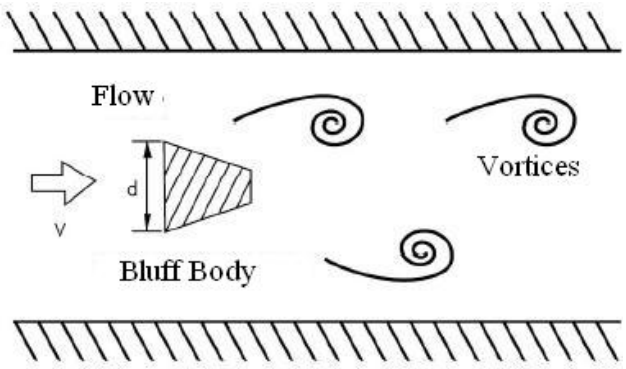
Working Principle & Circuit Diagram

- **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:

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

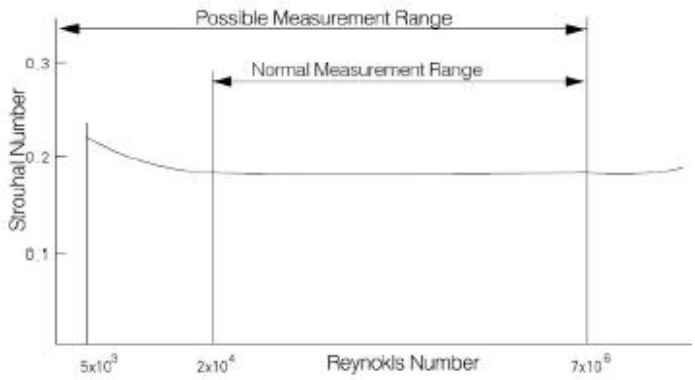
Thereinto f----frequency of Karman Vortex shedding
St----Strouhal number
v----velocity
d----width of column object



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

SPECIFICATIONS

Accuracy:

Liquid:	±1.0% of reading
Gas:	±1.5% of reading
Steam:	±1.5% of reading

Materials:

Housing:	SS316
Shedder Bar:	SS316

Converter housing and case cover: Aluminum Alloy

Output Signal: (Where applicable)

Sensor:	Pulse signal (Low Level: ≤1V; High Level: ≥6V)
Transmitter:	4 to 20 mA DC current signal

Signal Transmission Distance: ≤500 m

Electrical Connections: ISO M20×1.5 Female

Protection Level: IP65

Vibration: ≤1.0 g

OPERATION CONDITIONS

Ambient:

Temperature: -10C to +55°C
Relative Humidity: 5% to 90%

Power Supply:

Sensor: +12V DC (Optional: +24V DC)
Transmitter: +24V DC
Field Display Type: Integral 3.2V Lithium Battery or +24V DC or 230V AC

Fluid Temperature and Pressure:

Temperature: Standard: -20°C to +70°C
Optional: -20°C to +250°C; -20°C to +350°C
Pressure: Media pressure should be limited according to flange rating.

Measurable Flow Rate Range:

For general liquids and gas: (See table 1)

Table 1. Measurable Flow Rage Range for liquid and gas

Nominal Diameter		Liquid		Gas	
(mm)	(in.)	Flow (m^3/h)	Frequency(Hz)	Flow (m^3/h)	Frequency(Hz)
25	1	1.6 to 16	32 to 325	10 to 70	172 to 1420
40	1.5	2.5 to 25	13 to 130	22 to 220	115 to 1147
50	2	3.5 to 35	9 to 93	36 to 320	96 to 854
65	2.5	6.5 to 68	8 to 82	50 to 480	61 to 583
80	3	10 to 100	6 to 65	70 to 640	45 to 417
100	4	15 to 150	5 to 50	130 to 1100	43 to 367
125	5	27 to 275	5 to 47	200 to 1700	33 to 290
150	6	40 to 400	4 to 40	280 to 2240	27 to 221
200	8	80 to 800	3 to 33	580 to 4960	24 to 207
250	10	120 to 1200	3 to 26	970 to 8000	20 to 171
300	12	180 to 1800	2 to 22	1380 to 11000	17 to 136

Note: The flow range for gas in table 1 is defined at operating state.

For Saturated Steam: (See table 2)

Table 2. Measurable Flow Rage for Saturated Steam

Absolute pressure (MPa)		0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	.16	1.7	
Temperature (°C)		120	133	144	152	159	165	170	175	180	184	189	192	195	198	201	204	
Density (Kg/m^3)		1.13	1.66	2.18	2.67	3.17	3.67	4.16	4.66	5.15	5.65	6.13	6.62	7.11	7.60	8.09	8.58	
DN25	Q_{min}	9.6	14	18.5	22.7	27	31.2	35.3	39.6	43.7	48.0	52.0	56.2	60.4	64.6	68.7	72.9	
	Q_{max}	79.1	116	152	187	222	256	291	326	360	394	429	463	498	532	566.3	601	
DN40	Q_{min}	24.9	36.5	48	58.7	69.7	80.7	91.5	102	113	124	135	145	156	167	180	188	
	Q_{max}	249	365	480	587	697	807	915	1025	1130	1240	1350	1456	1564	1672	1800	1888	
DN50	Q_{min}	40.7	59.8	78.5	96	114	132	150	168	185	203	221	238	256	274	294	309	Flow Unit
	Q_{max}	362	531	698	854	1014	1174	1331	1491	1648	1805	1962	2118	2275	2432	2588	2746	
DN65	Q_{min}	56.5	83	109	133.5	158.5	183.5	208	233	257.5	282	306.5	331	355.5	380	405	429	
	Q_{max}	542	797	1046	1282	1522	1762	1997	2237	2472	2707	2942	3178	3413	3648	3883	4118	
DN80	Q_{min}	79	116	153	187	222	257	291	326	361	395	429	463	498	532	566	600	Kg/h
	Q_{max}	723	1062	1395	1709	2029	2349	2662	2982	3296	3610	3923	4237	4550	4864	5178	5491	
DN100	Q_{min}	147	216	283	347	412	477	541	606	670	733	797	861	924	988	1052	1115	
	Q_{max}	1243	1826	2398	2937	3487	4037	4576	5126	5665	6204	6743	7282	7821	8360	8899	9348	
DN125	Q_{min}	226	332	436	434	634	734	832	932	1030	1128	1226	1324	1422	1520	1618	1716	
	Q_{max}	1921	2822	3706	4539	5389	6239	7022	7922	8755	9588	10421	11254	12087	12920	13753	14586	
DN150	Q_{min}	316	465	610	748	888	1028	1165	1305	1442	1579	1716	1854	1991	2128	2265	2402	
	Q_{max}	2531	3718	4883	4981	7101	8221	9318	10438	11536	12634	13731	14829	14926	17024	18122	19209	
DN200	Q_{min}	655	963	1264	1549	1839	2129	2413	2703	2987	3271	3555	3840	4124	4408	4692	4976	
	Q_{max}	5605	8234	10813	13243	15723	18203	20634	23114	25544	27974	30405	32835	35266	37696	40126	42557	
DN250	Q_{min}	1096	1610	2115	2590	3075	3560	4035	4520	4996	5471	5946	6421	6683	7322	7847	8323	
	Q_{max}	9040	13280	17440	21360	25360	29360	33280	37280	41200	45120	49040	52960	56880	60800	64720	68640	
DN300	Q_{min}	1560	2290	3008	3684	4375	5056	5741	6431	7107	7783	8459	9136	9812	10488	11164	11840	
	Q_{max}	12430	18260	23980	29370	34870	40370	45760	51260	56650	62040	67430	72820	78210	83600	88990	93480	

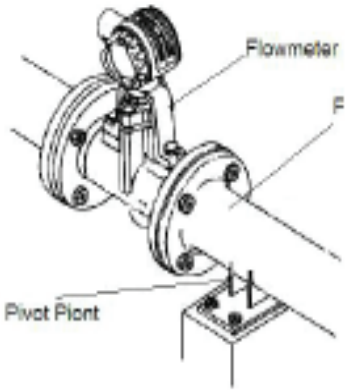
Model Selection (See Table 4)

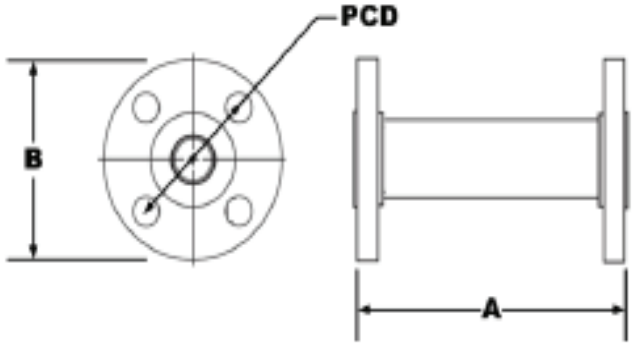
Table 4. Model Selection Guide

Model Suffix Code							Description
BFVM -	/□	/□	/□	/□	/□	/□	
Connection type	1						Flange connection
	2						Wafer Connection (between flanges)
Medium	Gas	1					
	Liquid	2					
	Steam	3					
Nominal Diameter (Code)							
			25				25mm
			40				40mm
			50				50mm
			65				65mm
			80				80mm
			100				100mm
			125				125mm
			150				150mm
			200				200mm
			250				250mm
			300				300mm
Display Option				Z			Integrated type (Optional: N; A; B; C; D)
				F			Remote type (Optional: N; C)
Function Type					N		Basic Type: +12V to +24V DC Power Supply; Pulse Output
					A		4 to 20 mA current output
					B		Battery Power Supply with filed Display
					C		Field Display and 4 to 20 mA current output
					C1		Field Display and RS485
					D		24V DC; Temperature & Pressure Compensation
EU Rating						N	Standard type

4.4.1 Flange Connection

Installation	Take care that flow sensor is always fully filled
	For detailed information see chapter "Cautions for Installation"
Flow direction	Forward
	Arrow on flow sensor indicates flow direction.
Inlet run	⩾ 10 DN
Outlet run	⩾ 5 DN





DIN Flange Meter Dimensions							
Size Code		A	DIN Flange Pressure Rating	Flange Diameter (B)	Bolt Hole Diameter	Bolt Circle Diameter (PCD)	Bolt Hole Quantity
(Inch)	(mm)	(mm)	Mpa	(mm)	(mm)	(mm)	
1/2"	15	180	1.6	95	14	65	4
3/4"	20	180	1.6	105	14	75	4
1"	25	180	1.6	115	14	85	4
1-1/4"	32	180	1.6	140	18	100	4
1-1/2"	40	180	1.6	150	18	110	4
2"	50	180	1.6	165	18	125	4
2-1/2"	65	200	1.6	185	18	145	4
3"	80	200	1.6	200	18	160	8
4"	100	200	1.6	220	18	180	8
5"	125	220	1.6	250	18	210	8
6"	150	220	1.6	285	22	240	8
8"	200	220	1.6	340	22	295	12
10"	250	250	1.6	405	26	355	12
12"	300	300	1.6	460	26	410	12

Note: For model with temperature and pressure compensation, the flowmeter length should be increased 50mm compared to the value (A) in table above.

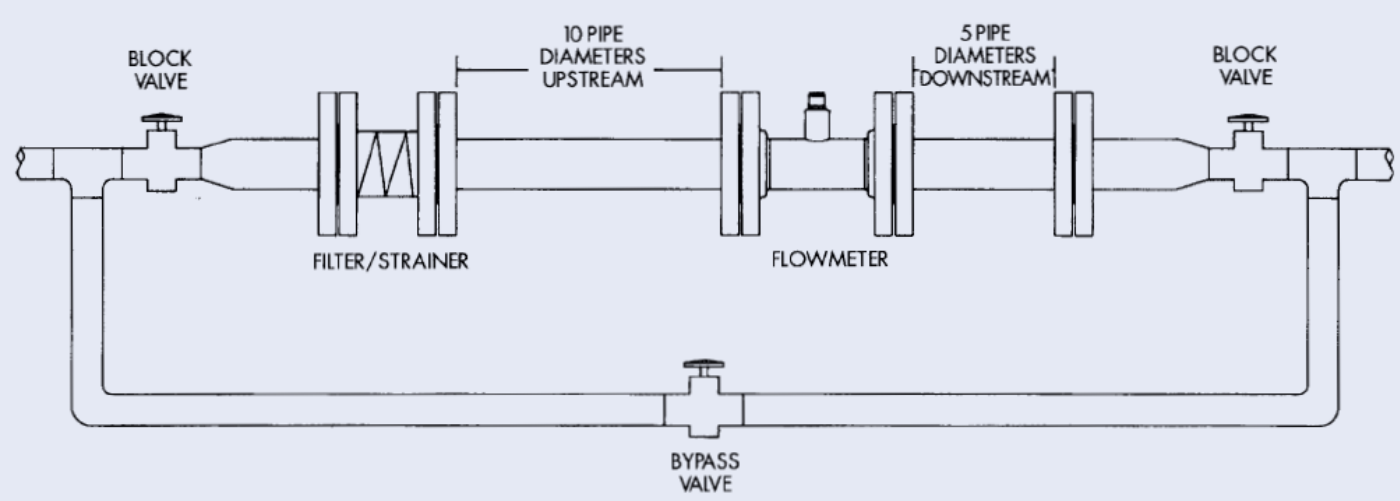
Mounting Orientation

All of our vortex flow meters are designed to measure flow in only one direction. See marking on body

Required Length of Straight pipe Runs

Flow profile altering items such as elbows, valves and reducers can affect accuracy. See diagram 1 for typical flow meter system installation.

Diagram 1. Typical Flow Meter System Installation



The recommended guidelines are given to enhance accuracy and maximize performance. Distances given here are minimum requirements .

- Upstream: allow a minimum straight pipe length of at least 10 times the internal diameter of the pipe. For example, with 50mm pipe, there should be 500mm of straight pipe immediately upstream. Ideal upstream straight pipe length is 1000mm.
- Downstream: allow a minimum straight pipe length of at least 5 times the internal diameter of the pipe. For example, with 50mm pipe, there should be 250mm of straight pipe immediately upstream. Ideal upstream straight pipe length is 500mm.

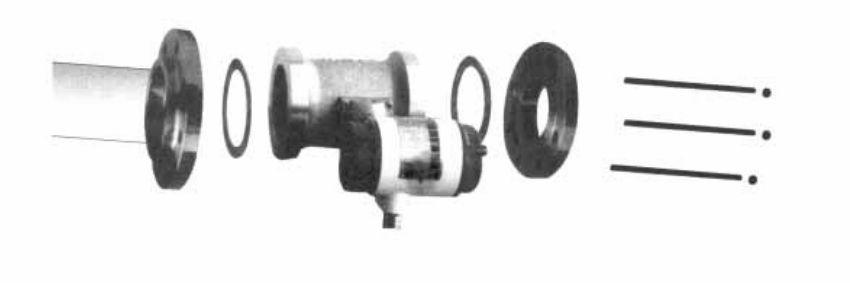
Transducer Installed in Vertical Pipe

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.

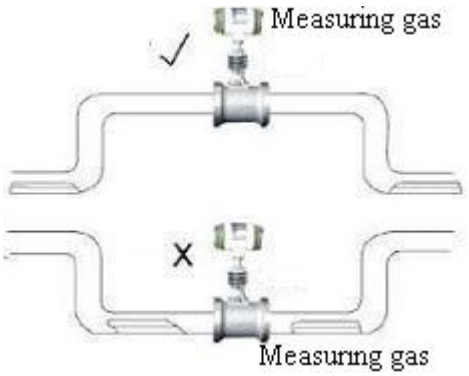
5. Requirement for Ambient Condition

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.

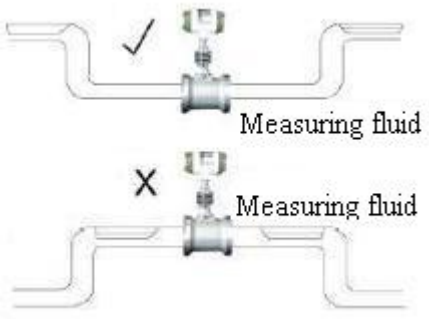
Transducer Installed in Horizontal Pipe

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.

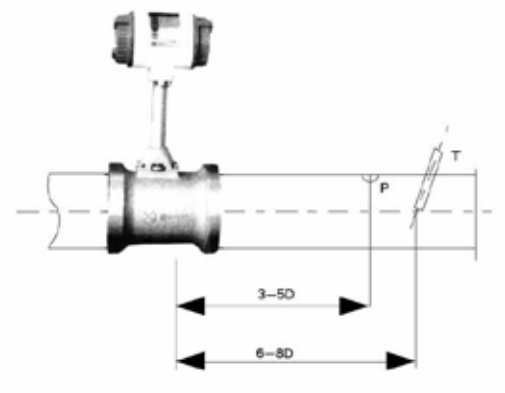


When used in liquid, transducer should be installed at the bottom of pipeline if the liquid contains little gas.



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.

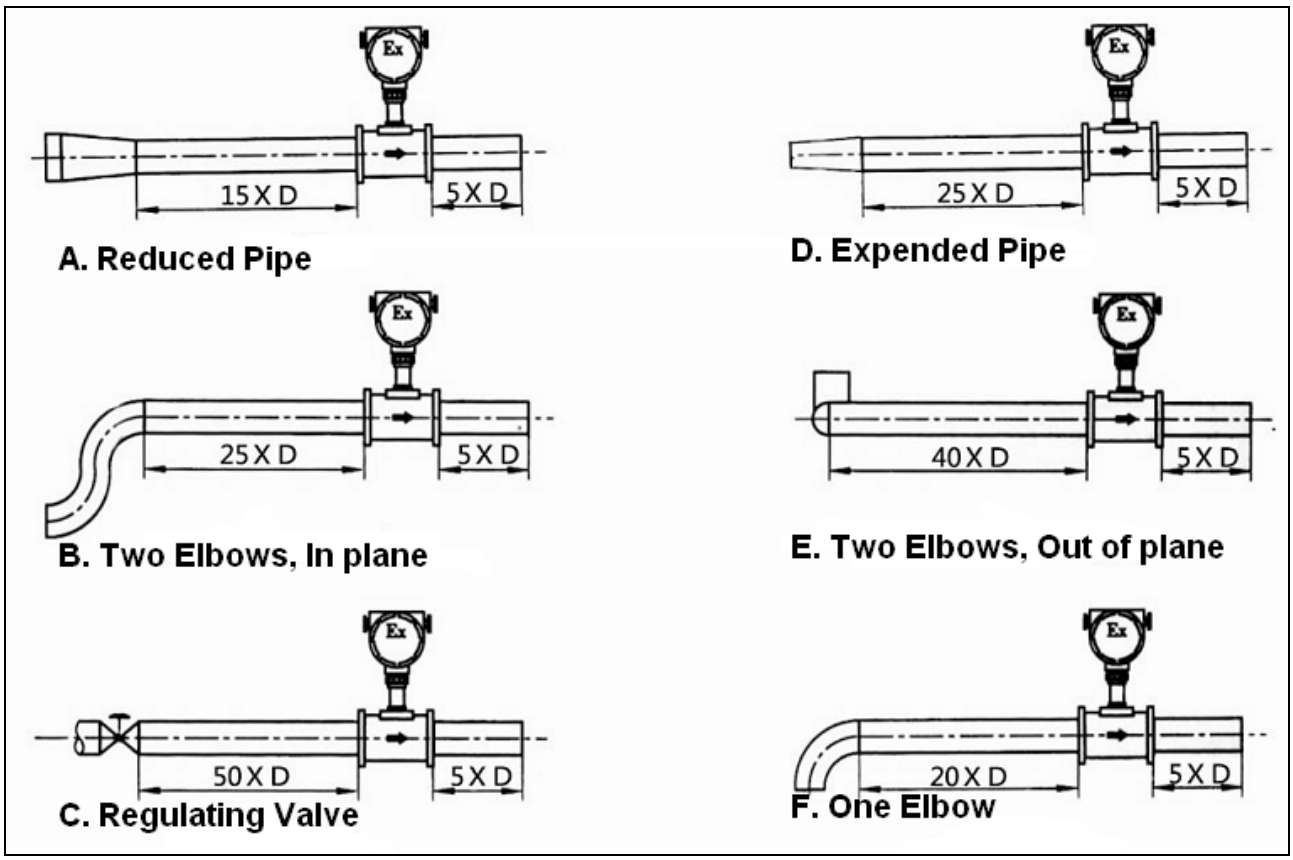


Preparation before Operation

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.

See diagram 2 for straight pipe length requirement when there is a flow profile altering item

Diagram 2. Number of Pipe Diameter (D=Diameter)



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