aobo

instrument

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PRODUCT
INTRODUCTION

VORTEX FLOWMETER

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Summary

The LUGB series vortex flow sensor is a fluid vibration flow detection instrument made of piezoelectric ceramics as the sensitive elements according to the principle of Karman vortex and uses the stress detection method.

The sensor is simple and motion-free. It has high stability and reliability. It has unique medium versatility and its instrument coefficient is universal for different medium.

The flow measurement system composed of the sensor is simple, easy to install and maintain, small pressure loss, large measurement range and good economy. In the environment with inflammability and explosive gas, explosion-proof products should be selected, explosion-proof grade :ExdIICT6Gb, explosion-proof number: SYEx19.12246.

The LUGB series of vortex flow sensors produced by our company strictly implement national and industrial standards, and conduct real flow calibration stage by stage. The core component —— detection probe adopts seismic design, which effectively improves the seismic performance; the test part external sensor, sensitive element on the surface, and the temperature of measurable fluid medium reaches 350°C.

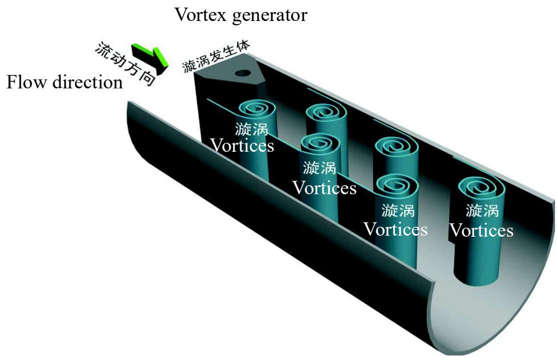
LUGB series vortex flow meters are widely used in petroleum, chemical, metallurgy, thermal, textile, paper and other industries, suitable for the measurement and detection control of over thermal steam, saturated steam, compressed air and general gas (oxygen, nitrogen, hydrogen, natural gas, gas, etc.), liquid (water, gasoline, alcohol, benzene, etc.).

Measurement Instrument Type Standard Certificate No.: PA2018F 291-37; Product Execution Standard: JB / T 9249-2015 Vortex Flow meter

Product Implementation Code: JJG 1029-2007 Code for Verification of Vortex Flow

meter

Part 1: Working Principle and Main Technical Indicators



1. Working principle

The vortex flow sensor is a fluid vibration instrument developed based on the principle of "Karman vortex (Karman)". The non-streamlined vortex generator is placed in the fluid, separating the vortex alternately and releasing two columns of regular staggered rows.

Within a certain flow velocity range, the vortex separation frequency is directly proportional to the flow. This frequency is detected by the piezoelectric ceramic detection element, converted into the transaction substation signal, amplified, filtered and shaped to output a voltage pulse signal directly proportional to the flow or (4 ~ 20) mA standard current signal.

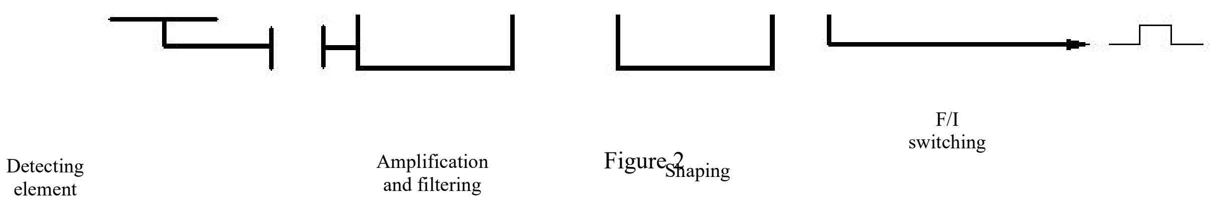


Figure 2

2. **Main technical indicators of commonly used sensors**

(1) Accuracy: 1.0; 1.5; insert type: 2.5;

(2) Repeatability error: ≤1/3 accuracy grade value;

(3) Pressure drop coefficient：Cd≤2.4；

(4) Measurement range：8:1～20:1；

(5) Nominal pressure (MPa): 1.6; 2.5; (2.5 above order indicated)；

(6) Measurement medium temperature（℃）：－40～120；250；300；350；

(7) Power supply: 12VDC (24VDC made alone), lithium battery power supply 3.6VDC (lithium battery is not allowed for intrinsic safety type products, rated voltage 12V);

(8) Output signal：

① Voltage pulse: low level ≤0.5V, high level ≥6V;

② Standard signal：(4～20)mA；

(9) Service environment：

①Temperature: -40℃ ~55℃ (explosion-proof type and field display type is-20℃ ~40℃);

② Relative humidity：5%RH～95%RH；

③Atmospheric pressure：86KPa～106KPa；

(10) Levels of protection：IP65；

(11) explosion-proof grade :ExdIICT6Gb, explosion-proof number: SYEx19.12246.

3. Major technical indicators of digital intelligence type product

(1) Flow input signal: a piezoelectric sensor

(2) Temperature input signal (compensation signal): Pt100 or Pt1000 platinum resistance;

(3) Pressure input signal (compensation signal): the pressure transmitter（4～20） mA;

(4) Output signal:

① Three-line system voltage pulse:V_{oL}<1.8v， V_{oH}>4.5V;

② Two-line system current pulse:l_{oL}<4mA， l_{oH}>20mA;

③ Two-line system current simulation quantity(4～20) mA;

④ HART@(4～20) mA;

⑤ RS485 Modbus

(5) Measurement accuracy: the simulation quantity is better than 0.2% and the frequency is better than 0.1%;

(6) Operation accuracy: IEEE754 double-precision floating-point operation；

(7) Communication function:

① HART@(4～20)mA;

② RS485 Modbus lightning protection;

(8) Display function

Double-line liquid crystal display can display cumulative flow, instantaneous flow, frequency and temperature;

(9) Data protection function

Using the latest generation of storage technology, the results of the machine and user set data are recorded at any time and will not be lost when power failure.

(10)Working power supply :

(12.0-24)VDC(Voltage pulse output)；

(16.5-24)VDC((4～20)mA@HART)；

3.6V DC (Battery power supply field display type).

Part 2: Instrument Type Selection

1. Flow measurement range

Table 1

Nominal diameter (DN) (mm)	Liquid: normal temperature water, p=998.2kg/m^3 U=1.006x$10^{-6}m^2/s$		Gas: normal temperature and pressure air (20℃), 101325Pa P=1.205kg/m^3, U=15x$10^{-6}m^2/s$	
	Standard (m^3/h)	Extended (m^3/h)	Standard (m^3/h)	Extended (m^3/h)
12.5	0.42-2.5		3.2-16	
15	0.4-4		4.0-25	
20	0.6-6	0.4-10	5.0-50	
25	0.8-8	0.6-14	8-80	
32	1.5-15	1-20	15-150	10-150
40	2.0-20	1.5-30	20-200	16-240
50	3.0-30	2-50	30-300	26-380
65	5.0-50	3-90	50-500	50-600
80	8.0-80	6-130	80-800	70-900
100	12-120	8-200	120-1200	100-1500
125	20-200	15-300	200-2000	160-2400
150	30-300	20-400	300-3000	240-3800
200	50-500	40-800	400-4000	350-6000
250	80-800	50-1400	800-8000	600-9000

300	100-1000	70-1800	1000-10000	900-12000
350	160-1600		1500-15000	
400	200-2000		2000-20000	
450	250-2500		2500-25000	
500	300-3000		3000-30000	

1.1 Reference medium flow range (see Table 1)

Descriptions:

1. The general maximum diameter of the full pipe type is DN300 and the special requirements can reach DN500;

2. The diameter range for the insert type product is generally DN (250~1600).

1.2 Range of saturated water steam flow (see Table 2)

Table 2

Absolute pressure (MPa)		0.2	0.3	0.4	0.5	0.6	0.7	0.8	1.0	1.2	1.4	Flow unit
Temperature (˚C)		120	134	144	152	159	165	170	180	188	195	
Density (kg^3/m)		1.13	1.65	2.16	2.67	3.17	3.67	4.16	5.15	6.13	7.11	
DN20	Qmin	10	12	15	17	19	21	23	26	30	33	Kg/h
	Qmink	6.2	7.6	9.1	10	12	13	14	16	18	20	
	Qmax	68	99	130	160	190	220	250	300	360	420	
DN25	Qmin	18	23	28	31	35	38	42	48	54	59	
	Qmink	7.5	9.2	11	12	14	15	17	19	21	23	
	Qmax	140	200	260	320	380	440	500	610	740	850	
DN32	Qmin	20	25	30	35	38	42	45	52	60	65	
	Qmink	16	20	24	28	30	34	38	42	48	54	
	Qmax	200	300	400	500	600	700	800	1000	1200	1400	

DN40	Qmin	30	37	45	50	57	65	70	80	90	100	
	Qmink	18	23	28	31	35	38	42	48	55	60	
	Qmax	360	520	690	850	1000	1200	1300	1600	1900	2300	
DN50	Qmin	50	63	76	80	95	100	110	130	150	160	
	Qmink	30	38	45	50	57	65	70	80	90	100	
	Qmax	560	820	1100	1300	1600	1800	2100	2600	3100	3600	
DN65	Qmin	0.08	0.09	0.10	0.11	0.12	0.13	0.14	0.16	0.18	0.20	
	Qmink	0.06	0.07	0.08	0.09	0.10	0.11	0.13	0.15	0.16	0.18	
	Qmax	1.00	1.30	1.70	2.10	2.50	2.90	3.30	4.10	5.00	5.80	
DN80	Qmin	0.12	0.15	0.18	0.21	0.23	0.25	0.28	0.32	0.36	0.40	
	Qmink	0.08	0.09	0.11	0.12	0.14	0.15	0.17	0.19	0.21	0.24	
	Qmax	1.40	2.10	2.70	3.40	4.00	4.60	5.20	6.50	7.70	9.00	
DN100	Qmin	0.20	0.24	0.28	0.32	0.38	0.42	0.46	0.52	0.58	0.63	
	Qmink	0.10	0.12	0.14	0.16	0.18	0.20	0.22	0.25	0.30	0.32	
	Qmax	2.2	3.3	4.3	5.3	6.3	7.3	8.3	10	12	14	
DN125	Qmin	0.22	0.28	0.36	0.42	0.48	0.56	0.64	0.72	0.80	0.88	t/h
	Qmink	0.18	0.23	0.28	0.33	0.35	0.40	0.45	0.50	0.55	0.60	
	Qmax	3.5	5.0	6.5	8.0	9.5	11	13	16	18	21	
DN150	Qmin	0.42	0.51	0.60	0.70	0.79	0.85	0.90	1.1	1.2	1.4	
	Qmink	0.26	0.32	0.38	0.44	0.50	0.56	0.62	0.68	0.76	0.85	
	Qmax	5.0	7.3	9.6	12	14	16	18	23	27	32	
DN200	Qmin	0.65	0.8	0.95	1.1	1.2	1.3	1.5	1.7	1.9	2.1	
	Qmink	0.45	0.53	0.60	0.70	0.80	0.80	0.90	1.0	1.2	1.3	
	Qmax	9.0	13	17	21	25	29	33	41	49	57	

Table 2 continued

Absolute pressure (Mpa）		0.2	0.3	0.4	0.5	0.6	0.7	0.8	1.0	1.2	1.4	Flow unit
Temperature (℃)		120	134	144	152	159	165	170	180	188	195	
Density (kg³/m)		1.13	1.65	2.16	2.67	3.17	3.67	4.16	5.15	6.13	7.11	
DN250	Qmin	1.0	1.2	1.4	1.6	1.8	2.0	2.2	2.5	2.9	3.2	t/h
	Qmink	0.6	0.75	0.9	1.0	1.1	1.2	1.3	1.4	1.6	1.8	
	Qmax	14	20	26	33	39	45	51	63	75	87	
DN300	Qmin	1.2	1.5	1.8	2.1	2.3	2.5	2.8	3.2	3.6	3.9	
	Qmink	0.75	0.9	1.1	1.2	1.4	1.6	1.8	2.1	2.4	2.7	
	Qmax	20	29	38	47	56	65	74	92	110	120	
DN350	Qmin	1.8	2.3	2.8	3.3	3.8	4.4	5.0	5.6	6.2	6.8	
	Qmink	1.5	1.8	2.1	2.4	2.7	3.0	3.4	3.8	4.2	4.6	
	Qmax	30	40	54	70	80	90	110	130	150	180	
DN400	Qmin	2.4	3.0	3.6	4.2	4.7	5.2	5.7	6.5	7.2	8.0	
	Qmink	1.8	2.3	2.8	3.2	3.5	3.9	4.2	4.7	5.2	5.8	
	Qmax	34	50	65	80	100	110	130	150	180	210	
DN450	Qmin	3.2	3.8	4.5	5.3	5.9	6.5	7.0	8.0	9.0	10	
	Qmink	2.4	3.0	3.6	4.2	4.7	5.2	5.7	6.5	7.4	8.1	
	Qmax	45	66	90	110	130	150	170	200	250	280	
DN500	Qmin	3.8	4.6	5.4	6.3	7.0	7.8	8.5	10	11	12	
	Qmink	3.2	3.8	4.5	5.3	5.9	6.5	7.0	8.0	9.0	10	
	Qmax	60	80	110	130	160	180	210	260	310	360	

1.3 Overheated steam density table (see Table 3)

Table 3

Absolute pressure (Mpa)		0.5	0.6	0.7	0.8	1.0	1.2	1.5	2.0	2.5	3.0
Temperature (℃)	180	2.47	2.99	3.51	4.05	5.14					
	200	2.35	2.84	3.33	3.83	4.86	5.91	7.55			
	250	2.11	2.54	2.97	3.41	4.30	5.20	6.58	8.98	11.5	14.2
	300	1.91	2.30	2.69	3.08	3.88	4.67	5.89	7.97	10.1	12.3
	350	1.75	2.11	2.46	2.82	3.54	4.26	5.36	7.21	9.11	11.1
	400	1.62	1.95	2.27	2.60	3.26	3.92	4.93	6.62	8.33	10.1

2. Specifications and models

2.1 Specifications and marks

2.1.1 Sensor nominal diameter mark (see Table 4)

Table 4

Nominal	20	25	32	40	50	65	80	100	125	150	200	250
Tag	20	25	32	40	50	65	80	100	125	150	200	250
Nominal	300	350	400	450	500							
Tag	300	350	400	450	500							

2.1.2 Mark of the measured medium (see Table 5)

Table 5

Measured medium	Liquid	Gas (steam)
Tagged number	2	3

2.1.3 Connection mode mark (see Table 6)

Table 6

Connection	Flange connection	Clamp-on type	Insert type
Tagged	1	2	3

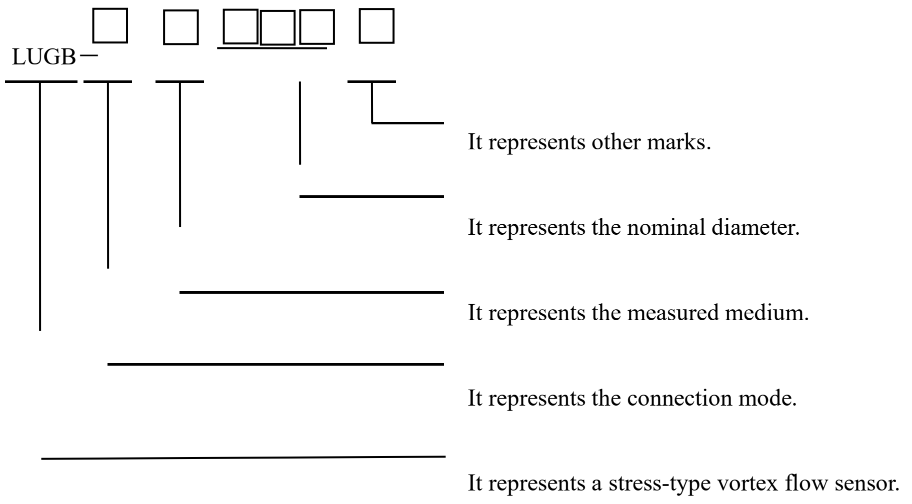
2.1.4 Other marks (see Table 7)

Table 7

General≤180℃	High temperature ≤350℃	External type of test piece	Intrinsic safety explosion-proof type	Imitation output	Wide-range	Explosion suppression type	Field display	Anti-corrosion
No	G	W	B	M	K	b	X	F

2.2 Sensor model

2.2.1 Model composition and significance



3. Type selection description and examples

3.1 The selection of the vortex flow sensor is crucial, and the correct selection has a great impact on the normal operation of the instrument. Therefore, the correct selection must be conducted and the selection method can refer to (3.2 to 3.5).

3.2 According to the size of the circulating pipeline diameter of the tested medium, refer to Table 1 (Table 2), if the flow range of the tested pipeline medium is listed in Table 1 (Table 2), the same sensor as the pipe diameter can be selected.

3.3 If the fluid flow range of the measured pipeline conforms to 3.2, but the medium density of the measured medium varies greatly from the reference medium density listed in Table 1, the minimum flow rate shall be determined in the following method.

$$Qmin=Q\sqrt[3]{\rho_0/\rho} \quad (m^3/h)$$

In the formula：

Q——Minimum lower limit flow given in Table 1（m^3/h）

ρ_0——The density of the reference medium（kg/m^3 ）see Table 1.

ρ——Actual working condition density of the measured medium（kg/m^3）

Qmin－The actual minimum flow measured by the latus rectum sensor shall be less than the actual minimum flow of the pipe（m^3/h）

3.4 The flow rate detected by the vortex flow sensor refers to the volume flow in the working state. When only the mass flow or standard volume flow of the measured medium should be known, and then according to the given flow range in Table 1 (the saturated water vapor can be looked directly out in Table 2).

3.4.1 The volume flow rate under the mass flow conversion condition is converted as follows：

$Qv=Qm/\rho(m^3/h)$

In the formula：Qv-Volume flow rate under working conditions（m^3/h）

Qm-Mass flow rate under working conditions（kg/h）

ρ-Medium density under working conditions（kg/m^3）

3.4.2 The volume flow under the standard state (20℃, 101325Pa) is converted to the volume flow under the working conditions, as per formula:

$$Qv=\frac{QN(273.15+t)}{2893(0.101325+P)}(m^3/h)$$

In the formula：QN-Gas volume flow rate under known standard conditions(Nm^3/h)

t-Temperature of the gas in the operating state（℃）

Qv-Volume flow of the gas in the operating state(m^3/h)

3.5 When the measured medium is liquid, in order to prevent cavitation, the medium pressure passing through the sensor shall meet the requirements of the following formula: $P \geq 2.7\triangle P+1.3Ps(Pa)$

In the formula: △P-Pressure loss of the medium through the sensor (Pa)is calculated by the following equation:

$$P=1.2V^2\rho$$

In the formula:

ρ-Density of the measured medium(kg/m^3)

V-Mean flow rate of the measured medium(m/s)

Ps-The saturated steam pressure value corresponding to the operating temperature of the measured medium(Pa)

3.6 Example

3.6.1 A workshop provides steam from a 10-ton saturated steam boiler, with a steam supply pressure of 0.7MPa and a pipe diameter of 150mm. The vortex flow sensor model is tentatively selected.

The steam supply pressure of 0.7MPa shall be gauge pressure, which shall be converted into absolute pressure of 0.8MPa. According to table 2, the flow range of saturated steam with nominal diameter DN150 for absolute pressure of 0.8MPa is (0.9 ~ 18) t / h (standard type), so the sensor with the same nominal diameter as the pipeline can be selected.

Note: If the overheated steam is found, the corresponding steam density can be found according to Table 3, and then check the flow range under the similar density in Table 2.

3.6.2 An air station has two 40m^3 / min air compressor and four 20m^3 / min air compressor with an operating pressure of 0.8MPa for compressed air at the working site.Its gas supply pressure is also 0.8MPa, (surface pressure), and the compressed air temperature is 50℃.At peak gas consumption, open two 40m^3 / min and three 20m^3 / min air compressors, only one 40m^3 / min or two 20m^3 / min air compressor for less gas consumption, and try to select the vortex flow sensor for the main pipeline of the air pressure station.

Calculation: a. Maximum gas volume flow rate in the operating state is:

$$Qvrmax = \frac{QN(273.15+t)}{2893(0.101325+P)} \ (m^3/h)$$

$$= \frac{(40\times2+20\times3)\times60\times(273.15+50)}{2893\times(0.101325+0.8)} = 1041 m^3/h$$

b.The minimum gas volume flow rate in the operating state is:

$$Qvmin=\frac{QN(273.15+t)}{2893(0.101325+P)}=\frac{(40\times60)\times(273.15+50)}{2893\times(0.101325+0.8)}=297m^3/h$$

c.As shown in Table 1, the nominal diameter of DN80, DN100 and DN125 all meet the requirements of the air pressure station. Considering the pipeline pressure loss, DN125 caliber is well selected.

d.Through the above calculation and analysis, the LUGB-23125 vortex flow sensor should be selected.

Part 3: Outline Dimension and Installation

1. Structural form and installation dimensions

1.1 Common structure form of vortex instrument

The sensor is composed of two parts of the detection meter and the detection amplifier and the connecting rod (see Figure 3). The meter and its components and connecting rod are made of 1Cr18Ni9Ti stainless steel material, with the advantages of anti-corrosion and durability, and gas protection and self-melting welding between the internal vortex generator and the meter, which is solid and durable.The external placement of the piezoelectric detection probe in the external surface can not only improve the operating temperature of the sensor and replace the probe without gas stop.

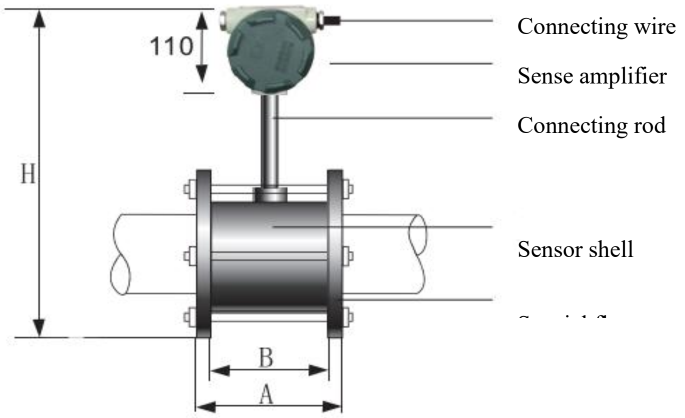


Figure 3. Overall Dimensions of Sensor

1.2 Installation and structural dimensions (see Figure 3 and Table 8)

Table 8

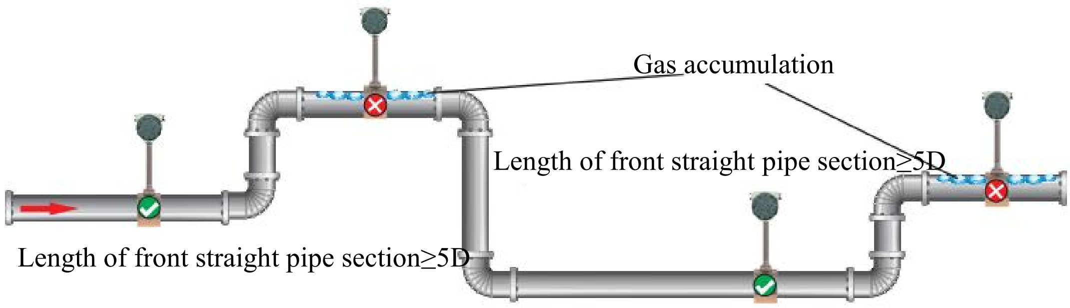
DN (mm)	H (mm)	A (mm)	B (mm)
12.5-25	445 (345)	95	65
40	455	109	75
50	466	109	75
65	482	117	75
80	495	126	84
100	529	132	90
125	549	146	100
150	579	170	120
200	631	200	150
250	693	214	160
300	743	224	170
350	870	274	200
400	925	292	220
450	975	324	240
500	1035	330	240

2.Installation

2.1 Environment and conditions for installation

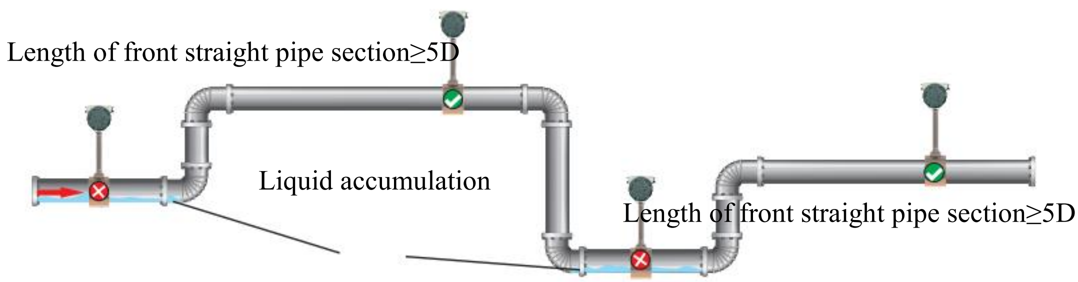
2.1.1 The sensor can be installed indoors and outdoors and the environmental conditions should meet the requirements of Item 2.9 of Part I.

2.1.2 The sensor can be mounted on vertical, inclined, horizontal pipes, but must be filled with medium as measured.For gas (vapor) medium and fluid medium flow, vertical pipe must be bottom-up (see Figure 4). For gas (vapor) medium, the sensor should be installed higher in the pipeline to avoid the impact of fluid accumulation (see Figure 5). For liquid medium sensors, horizontal piping shall be installed lower in the pipeline to avoid the effects of air bubbles (see Figure 4).



When measuring the liquid, the sensor shall be installed at the lower part of the pipeline.

(Figure 4) Liquid Measurement



When measuring gas (steam) flow, the flowmeter shall be installed in the higher part of the pipeline.

(Figure 5) Gas Measurement

2.1.3 The sensor shall be installed on the pipe without mechanical vibration as far as possible. When the vibration is unavoidable, it shall be considered to add a fixed support frame 2D from the front and rear of the sensor or connect it with hose (if the soft connection is rubber, the meter shall be grounded).

2.1.4 Sensors shall be avoided with strong electromagnetic magnetic field interference, small space, high temperature and inconvenient maintenance.

2.1.5 When installing the sensor, the pipe inner diameter must be the same as the sensor inner diameter.If it is not identical, use the pipeline with a 3% difference from the sensor diameter size, and no more than 5mm.

2.1.6 There shall be sufficient straight pipe sections on the upstream and downstream sides of the sensor. Please install them as required in Table 9 and Figure 6. (The adjustment valve shall be installed downstream of the sensor as far as possible).

2.1.7 When the measured fluid contains more impurities, the filter shall be added beyond the straight pipe section upstream length of the sensor.

The upstream pipeline condition of the sensor	The length of the front	The length of the rear straight
Concentric diameter	≥15D	5D
Concentric expansion	≥30D	
A 90^0 bend	≥20D	
Two 90^0 bends in the same plane	≥25D	
Two 90^0 bends in the different planes	≥40D	
Adjustment valve or the semi-open valve	≥50D	

Table 9

D is the instrument nominal diameter, unit：mm

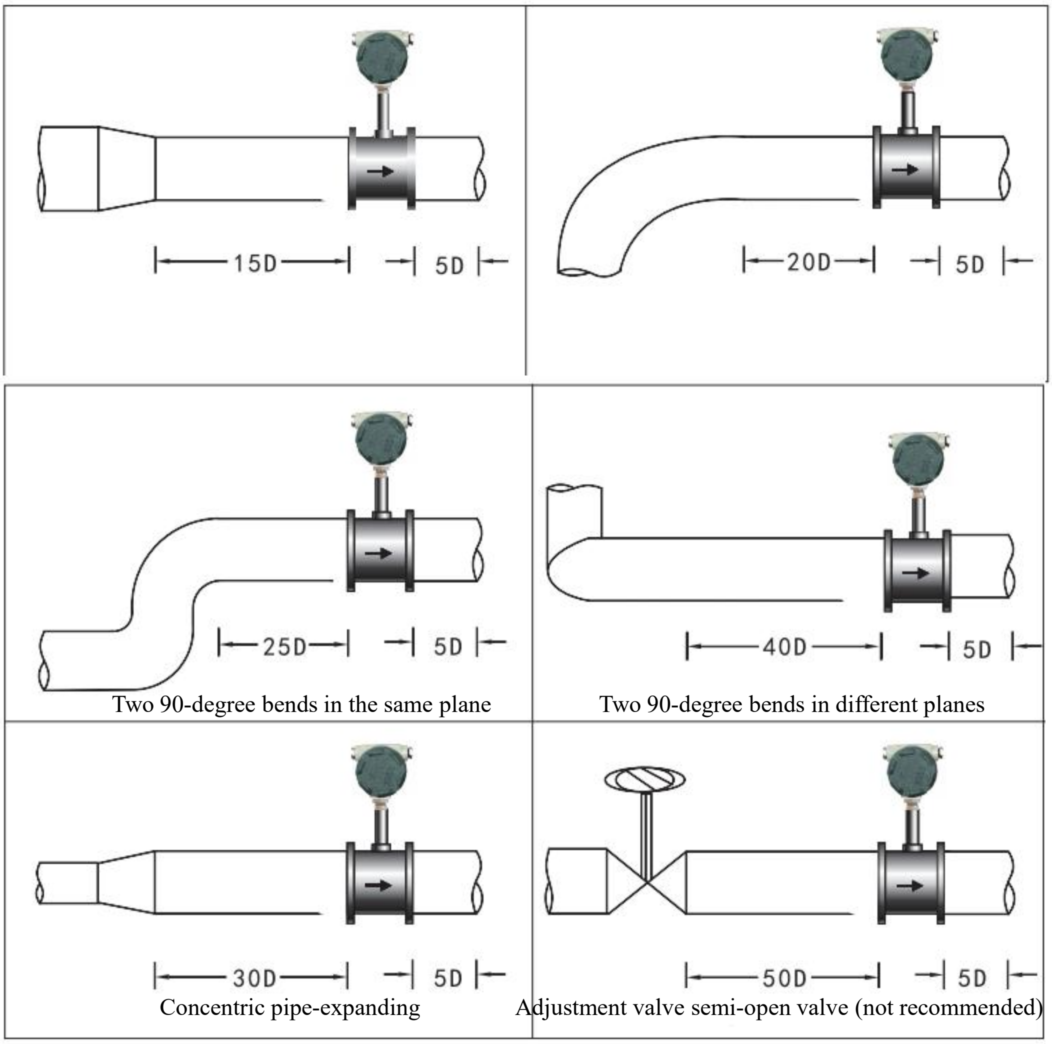


Figure 6: Reserved Straight Section Diagram

2.2 Installation steps

2.2.1 The equipped special flange shall be welded to the upper and downstream straight pipe sections respectively, so that the inner diameter of the special flange and straight pipe sections is strictly vertical and concentric.

2.2.2 Attach the sensor on the upper and downstream straight pipe sections welded with special flange and bolt the upstream and downstream sections coaxial with the sensor.

2.2.3 Assemble the upper and downstream straight pipe sections of the sensor to the pipe.

2.3 Installation precautions

2.3.1 The sensor shall be removed before welding between the special flange and the straight pipe sections and cannot be welded with the sensor.Cross-meter welding is strictly prohibited!

2.3.2 When temperature and pressure compensation is required, the pressure measurement point shall be at the downstream side of the sensor (3-5) D, and the temperature measurement point is a

Flowmeter Installation Diagram

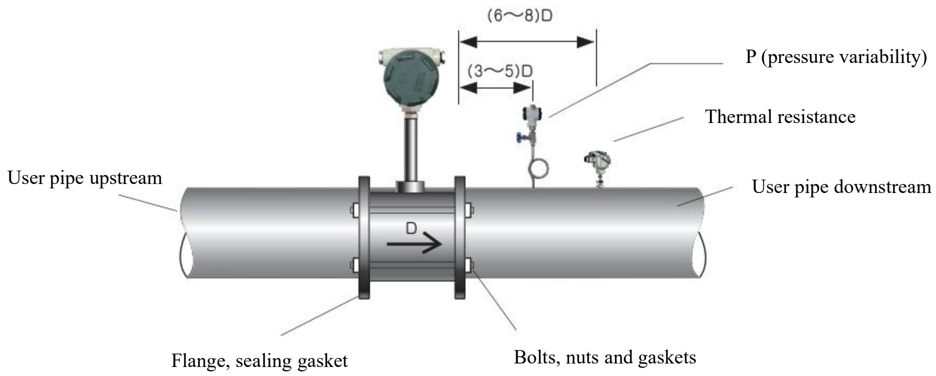


Figure 7. Outline Drawing of Clamp-on

2.3.3 The seals on both sides of the sensor shall be concentric with the sensor and not protruding into the pipe. The inner diameter shall be slightly greater than the inner diameter.

2.3.4 Impact of sensor shall be avoided during installation.

2.3.5 The sensor flow sign shall be directed in the same fluid direction during installation.

2.3.6 The high temperature fluid piping sensor shall be mounted horizontally or tilted down (with the amplifier pointing).

3. Insert type vortex flow sensor installation

The insert type vortex flow sensor is a sensor that inserts a special DN50 vortex measuring head into a specific part of the large-caliber pipe to measure the local flow velocity in the pipe and calculate the pipe flow.It has the advantages of small size, light weight, convenient installation and disassembly, small pressure loss.A standard sensor can be suitable for a variety of pipe diameter.It can be dismantled and installed under continuous flow.

The sensor is composed of vortex measuring head, drive rod, mounting seat, sealing assembly, watch head assembly, etc.Continuous flow disassembly, drive rod with thread, but also need to be equipped with a DN100, PN1.6 ball valve.

Table 10

DN (mm)	Detachable type without water cut-off		Detachable type with water cut-off	
	H_1	H	H_1	H
250-600	$0.5D_D$	1100	$0.5D_D$	820
7600-1200	$0.5D_D$	1400	$0.5D_D$	1120
1200-6000	$0.5D_D$	1600	$0.5D_D$	1320

3.1 Structural form and installation dimension

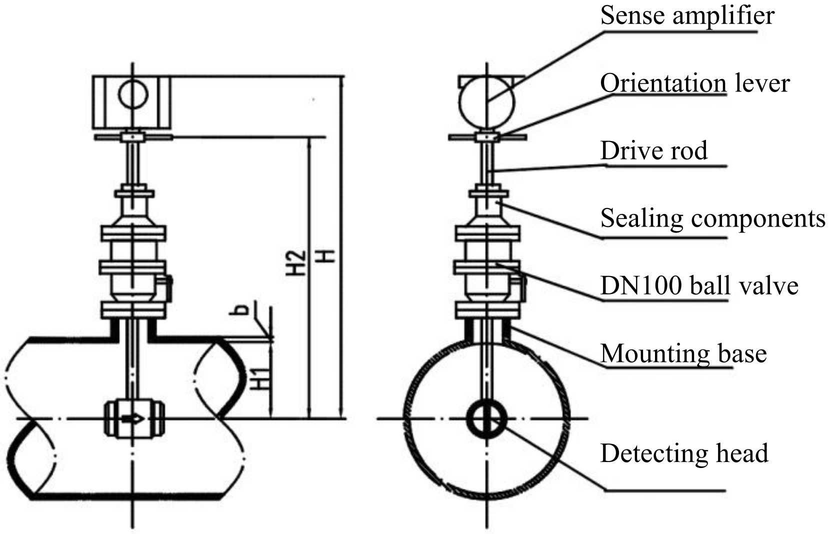


Figure 8. Installation Diagram of Insert Type Vortex Flowmeter Without Water Cut-Off

Part 4 Wiring and Commissioning

1. Wiring and commissioning of common sensor

1.1 Located on the other side of the detection amplifier, the spin cover is visible, as shown in Figure 9: Two terminals:

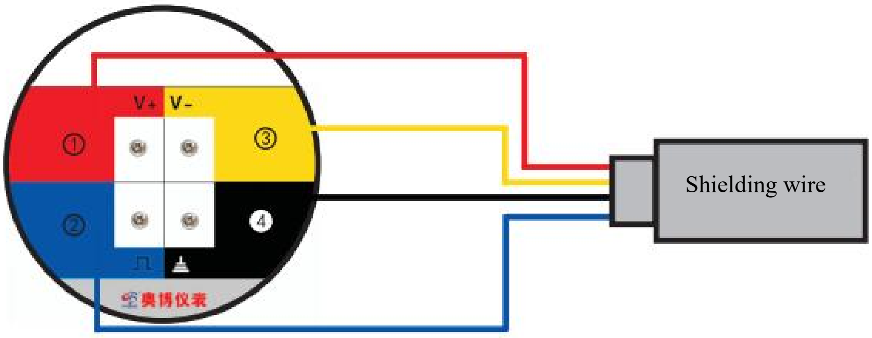


Figure 9

①Power supply cathode, red line. ②Output pulse end, blue line.③Power supply negative pole, yellow line.

④The shield layer is grounded.

1.2 Our sensors randomly with 10 meters RVVP3×0.5 three-core shielding cable, among which: red line is power line, connected to V + terminal.Blue line is signal line, connected to " ⎍ " terminal.Yellow line is zero line, connected to V-terminal and shielding layer is grounded;

1.3 The sensor shall be well grounded, with a ground resistance of less than 10 Ω;

1.4 The sensor has been debugged and verified before leaving the factory, and correctly installed according to the instructions. After wiring, when the power is on,it can work normally.Commissioning is performed in the secondary instrument.

2. LUGB-K wiring and debugging of intelligent vortex converter

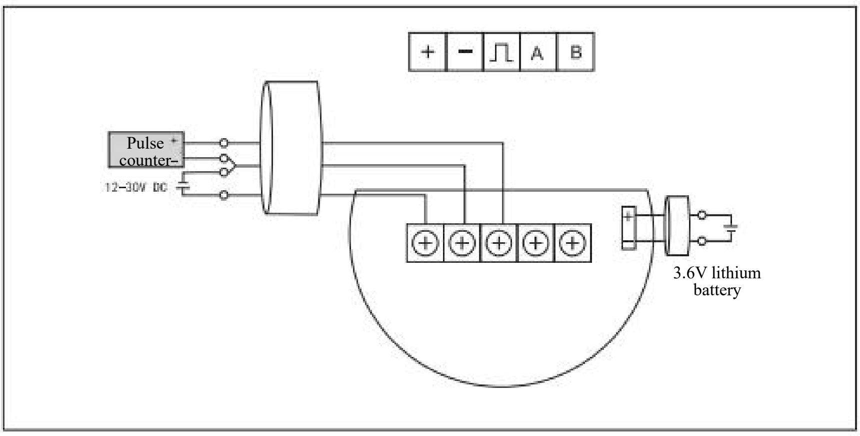


Figure 10

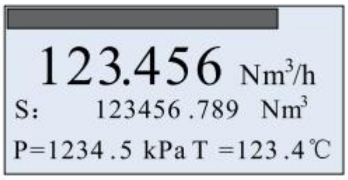
2.1 Display

The LCD was displayed by using a 128 * 64 dot array, supporting a multivariate display.This instrument supports two display modes:

2.1.1 Three lines display mode

When opening the third line display, the display is as shown in the figure below:

Figure 11



In a progress bar, display the current percentage showing the instantaneous stream.

Set it to display the cumulative traffic.

It can be set to display the frequency density, pressure temperature, current, or percentage value.

In the normal display state, the display frequency, pressure, temperature, density, current, and percentage can be set in the third line by long pressing the M key.

The third line shows the variable prompts as follows:

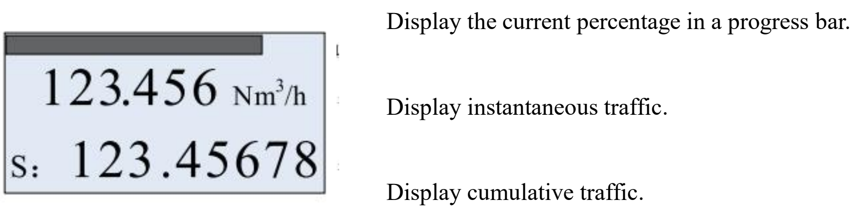
Table11

DOS prompt	F	Den:	P:	T:	Curr :	Per:	P = T=
Display the	Frequency	Density	Pressure	Temperature	Current	Percentage	Pressure and

2.1.2 Two-line display mode

When the third line display is closed, the second line display is fixed, as shown in the figure below:

Figure 12

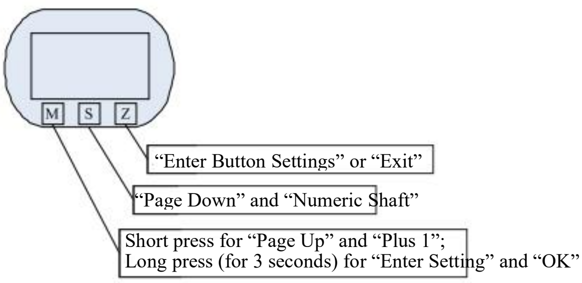


2.2 Detailed description of the field button function

2.2.1Button basic function description

This product supports the "three-button" operation mode.The basic functions of the three buttons are as follows:

Figure 13



2.2.2 Enter the field configuration

In the Normal Display state, press Z to enter Field Configuration.The Field

Configuration parameters can be set with the Direct Digital Import and Menu Selection methods.

2.2.3 Exit from the field configuration

In the Field Configuration status, press Z to exit the Field Configuration and enter the Display status.

2.4 Data setting method

The field setting parameters are divided into two types: Menu Selection and Direct Digital Input.

2.4.1 The Menu Selection setting method

Long press M and move underline to the second line.It means you can change your settings.Press M short, flip the option up, or press S, and flip the option down.

During the data settings, long press M to save the settings.When it is saved, the underline automatically moves to the first line;

2.4.2 The Direct Digital Input setting method

Long press M and move underline to the second line.It means you can change your settings.Press M briefly to switch the symbols.

Press S key to move right and move underline to the first digit, indicating modifiable, short press M key, and add one digit.

Press S again to set the number in the same way as the first one.During data setting, press M to save the setting data, or press Z to exit the setting.

2.5 Field configuration function

2.5.1Basic features (password-free)

Table12

Set the change	English prompt	Chinese prompt	Setup method	Note
Contrast	Contrast	Contrast	Menu selection	Level 1~5, the larger, the darker the font.Generally, 3
Write-protect	Protection	Write-protect	Switch by long	Open(Write Disable) Close(Write Enable)
Low alarm setting	Min AIarm(%)	Low alarm setting (%)	Direct digital input	Unit：%
High alarm setting	Max AIarm(%)	High alarm setting (%)	Direct digital input	Unit：%
The diameter of vortex[52]	MeterSize	Caliber	Read only	When you are not entering a password, you can view
Flow mode	Flow Mode	Flow mode	Menu selection	Liquid volume (Liquid Qv) Liquid quality(Liquid Qm) Gas volume(Gas Qv)
Transient flow unit	Unit_Qv Unit_Qm	Flow volume unit Flow quality unit	Menu selection	Volume unit support: Nm^3/h, Nm^3/m, Nm^3/s, l/s, l/m, 1/h, m^3/s, m^3/m, m^3/h, m^3/d, Scf/s, Scf/m, Scf/h,
Scale upper limit	Range 100%	Scale upper limit	Direct digital input	
Density	Density (kg/m^3)	Density(kg/m^3)	Direct digital input	Gas density (unit: kg / m 3)
Gas pressure (gauge pressure)	Gauge Pre. (Kpa)	Gas gauge pressure (Kpa)	Direct digital input	Unit: kpa,it is not available when measuring the
Gas temperature (degrees C)	Temperature(℃)	Gas temperature(℃)	Direct digital input	Unit: ℃, which is not available when measuring the
Small flow resection	PV Cutoff (%)	Small flow resection(%)	Direct digital input	Range：0%～20%
Damp	Damping (S)	Damp（S）	Direct digital input	Range：0～64S
Number of decimal points of	Disp. Point	The decimal point digits	Menu selection	Range：0, 1, 2, 3
Display mode	Display Mode	Display mode	Menu selection	Two lines display (2 _ line Display): display only

Cumulative flow zero	Total Reset	Cumulative flow zero	Menu selection	(Yes),Maximize the zero clearance of the cumulative
Accumulated flow spill-over	Total Overflow	Accumulated flow	Read only	Cumulative flow is greater than 9999999, overflow
Meter factor (K value) [57]	K-Factor	Meter factor (K)	Read only	Check the instrument coefficient, without entering a

2.5.2 Advanced features (manufacturer use, require different password)

Enter different passwords and you can enter different special functions.

Table13

OC	Code	Password	Substantive	Enter * * * * 50 to enter set items 51 to 59.
Signal monitoring [51]	Signal Monitor	Signal monitoring	Read only	LCD display example： 450.00 CH 2
The diameter of vortex [52]	MeterSize	Caliber	Menu selection	Option：20mm, 25mm, 32mm, 40mm, 50mm, 65mm, 80mm, 100mm, 125mm, 150mm, 200mm, 250mm, 300mm, 350mm, 400mm, 450mm, 500mm, 600mm;
Medium[53]	Fluid Type	Medium	Menu selection	（Gas） （Liquid） Note: After changing the medium, you must reset the lower
Low Flow Limit [54]	Low Flow Limit	Low Flow Limit	Direct digital input	Determined by the caliber and measuring medium. [The unit is fixed to m^3 / h (working condition), and the lower
High Flow Limit[55]	High Flow Limit	High Flow Limit	Direct digital input	The upper flow automatically defaults to 10 times the lower flow, and the upper limit of the actual measurement is 2.5 times
Magnification [56]	Max AMP.	Set the	Direct digital	Recommended range is between 200 and 1000.Usually at

OC	Code	Password	Direct input	Enter * * * * 50 to enter set items 51 to 59.
Instrument coefficient	K-Factor	Instrument	Direct digital	Determined by the caliber and measuring medium.Unit is fixed
Pulse coefficient	Pulse Factor	Pulse coefficient	Menu selection	Supported units are: m^3, N m, t, kg, Scf, cf, USG (US gallon),
Output pulse	Pulse Factor	Output pulse	Direct digital	Enter the corresponding number of output pulses under 1 "pulse

Special explanation:

After modifying the "vortex diameter", the "lower limit flow", "maximum magnification "and" instrument coefficient K " must be reset according to the gauge and measurement medium, otherwise the instrument may work abnormally.[If you change the caliber through the configuration software, these parameters automatically transfer the default values]

The setting of the lower limit flow, CH selection and magnification is significantly related to the good working relationship of the vortex. Please set it carefully according to the actual application situation.

The magnification setting range is: 20 ~ 2,000 times, which can be adjusted according to the field signal, noise, vibration, etc.

2.6 Description of the flow mode setting of the vortex

2.6.1 Gas Qv

A．Measure the operating condition volume and set as follows:

Density: Set to density at 20℃ (Do not participate in operations.)

Pressure:0.0KPa

Temperature:20℃

B. Measure the standard volume as follows:

Density: Standard condition density (Do not participate in operations.)

Pressure: Current pressure (gauge pressure KPa)

Temperature: Current temperature (°C)

2.6.2 Gas Q_m

A. The current density is known and set as follows: (The state conversion coefficient is 1)

Density: It is set to the current actual density.

Pressure:0.0KPa

Temperature:20°C

B. Known standard density is set as follows: (Internal state conversion is according to temperature and pressure).

Density: Standard condition density (density at 20°C)

Pressure: Current pressure (gauge pressure KPa)

Temperature: Current temperature (°C)

2.6.3 Liquid Q_v

A. Measure the volume, as set below:

Density: 1.0 or the current density (not involved in the operation)

2.6.4 Liquid Q_m

A. Set the current density, as set below:

Density: It is set to the current actual density.

2.6.5 Steam Q_v

Density: 1.0 or the current density (not involved in the operation)

Pressure: 0.0KPa (not involved in the operation)

Temperature: 20℃ ((not involved in the operation)

2.6.6 Steam quality flow

A.Superheated steam quality(PT)(Steam(P/T)):

If the external temperature or pressure sensor fails (or the temperature or pressure sensor), the steam density is calculated at the input temperature or pressure input:

Pressure: Current gauge pressure KPa

Temperature: Current temperature℃

B.Saturating steam quality(T)(Sat_Steam(T)):

If the external temperature sensor fails (or has no temperature sensor), the steam density is calculated at the input temperature:

Temperature: Current temperature℃

C.Saturating steam quality(P)(Sat_Steam(P)):

If the external pressure sensor fails (or fails to handle the pressure sensor), the steam density is calculated according to the input pressure:

Pressure: Current gauge pressure KPa

Part 5: Maintenance

1. The vortex flow sensor has no motor parts, and it is generally not regularly maintained under normal use, but when the measured medium has dirt, the internal surface shall be cleaned regularly.When washing, the vortex generator and detection probe should be effectively protected, and shall not touch its surface, edges, etc.

2. This intrinsic safety type explosion-proof system shall be equipped with a special grounding wire and it can not share a connection site with other circuits.

3. The connection cable between the flow meter and the safety gate shall be selected with three-core shield cable of RVVP30.5, cable length generally <100 meters, or cable length shall be calculated according to the Co and Lo parameters of the safety gate:

Cable distribution capacitance<0.8 Co

Cable distribution inductance<0.8 Lo

4. Intrinsic safe cables must be laid in the steel pipe or wire sink; the intrinsic safe cables shall not be laid in the same cable pipes, and the intrinsic safe cables shall be kept away from the AC cables.

5. Do not arbitrarily remove the parts of the sensor without the consent of the manufacturer, otherwise it shall be responsible.

6. After maintenance, the sensor amplifier end cover shall be tightened and carefully checked without any debris.

7. If the fault of the sensor occurs, first check whether the sensor power supply is normal and whether the pipe flow changes. Generally, refer to Table 14. If the fault cannot be eliminated, please contact the manufacturer to solve the problem.

Table 14

Fault phenomenon	Causes	Elimination methods
The sensor has no output signal after connecting with the power supply.	1.The sensor power supply is not normal. 2.No fluid flow exists in the tube.	1.Check the power supply and grounding shielding. 2.Ensure the normal fluid flow in the pipe.

There is no medium flow in the tube, but the sensor has an output signal.	1.Poor grounding, and introduce interference. 2.The vibration of the pipeline is large.	1.Check the grounding line. 2.Take vibration reduction measures. 3.Reduce gain
Small flow signal is unstable and increase the flow stability.	1.The flow rate is too small, below the lower limit of the sensor operation	1.Increase the flow or switch to small-caliber sensors.
After the sensor is used for a period of time,the measurement accuracy decreases, or even no flow.	1.The measurement medium is dirty, with a foreign body, the sensor scale or wrapped by a foreign body	1.Remove the sensor for cleaning. 2.Return to the factory for maintenance.

Part 6: Pre-Sale and After-Sales Services

1.Provide free technical consultation and help users choose the type.

2.Free delivery to the door, on-site installation and commissioning; one year within the warranty period.The "Three guarantees" shall be implemented within the warranty period and one free maintenance verification; beyond the warranty period, the lifetime service.

Attached: Vortex Flow Sensor Order Consultation Form

Order unit		Postal address			Tel Zip code	
Use unit		Postal address			Tel Zip code	
Pipeline	The outer diameter X the wall	Medium			Density	kg/m^3
Medium	Gas state□ Liquid state □	Saturated vapour □		Superheated vapor□		

<table>
<tr><td>Flow range</td><td colspan="3">Lowest（ ）Highest（ ）Common use （ ）t/h□ m^3/h□ operating mode□</td></tr>
<tr><td>Fluid</td><td colspan="3">Lowest（ ） Highest（ ） Common use（ ） MPa Gage pressure□</td></tr>
<tr><td>Fluid temperature</td><td>Lowest（ ） Highest（ ） Common use（ ）℃</td><td>Installation environment</td><td>High temperature□ Damp□ Explosive□</td></tr>
<tr><td>Installation</td><td colspan="3">Indoor installation □ Outdoor installation□ Elevated installation□</td></tr>
<tr><td colspan="4">Select model：LUGB－（ ） Quantity（ ）set</td></tr>
<tr><td colspan="4">Supporting instrument：
MC51－( )intelligent traffic integrating instrument （ ）set
The YBY-type diffusive silicon pressure transmitter（ ）set Pt100 hot resistance ( )pcs</td></tr>
<tr><td colspan="4">Note descriptions：</td></tr>
<tr><td colspan="2">1.Please fill in this form carefully and click√ in the □.
2.This form is made in duplicate. Please fill in and seal and send it back to the company together with the contract (please leave one copy).</td><td colspan="2">The user filling personnel：
Date：
Supplier reviewer：
Date：</td></tr>
</table>