

## LUGB VORTEX FLOW METER

### Summary

LUGB type vortex flow meter is a kind of velocity flow meter, which is widely used in petroleum, chemical, electric power, light industry, power heating industry. The production and implementation standards of our company's vortex flow meter are vortex flow sensor (JB/T9249-2015) and verification regulations for vortex flow meter (JJG10299-2007).

### Technical Parameters

The vortex flow meter is composed of a vortex generator, a detection probe and corresponding electronic circuits. When the fluid flows through the vortex generator, two alternating rows of vortices are formed on both sides of it. This vortex is called the Karman vortex street. On the basis of the Karman vortex street theory, Strohma proposed that the frequency of the Karman vortex street is proportional to the flow velocity of the fluid, and gives the relationship between frequency and flow velocity

$$f = St \times V/d$$

Formula:

- f Vortex generation frequency (Hz)
- V Average flow velocity on both sides of the vortex generator (m/s)
- St Strohal coefficient (constant over a range of Reynolds numbers)
- d Width of front face of vortex generator (m)

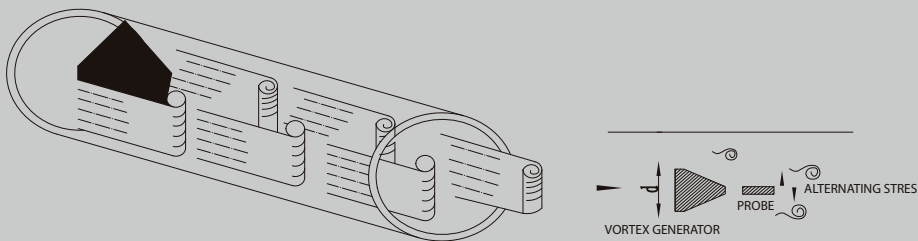


Figure 1 Vortex Flow Meter Working Principle Diagram

These alternating vortices form a series of alternating fluid lift forces. The lift force acts on the detection probe based on the piezoelectric effect to generate a series of alternating charge signals, which are converted, shaped and amplified by the preamplifier. Output a pulse signal with the same frequency as the vortex shedding and proportional to the flow velocity.

### Instrument Features and Applications

#### Features

- No moving parts, long term stability, simple structure for easy installation and maintenance.
- The output of sensor is pulse frequency, and its frequency is linear with the actual flow of the fluid being measured. Zero point has no drift and performance is very stable. The structure is diverse, including pipeline and plug-in flow sensors.
- High accuracy, usually the measurement accuracy of liquid is  $\pm 1.0\%$ ; the measurement accuracy of gas is  $\pm 1.5\%$ .
- Wide measuring range, up to 1:20 within the Reynolds number of  $2 \times 10^4 \sim 7 \times 10^6$ .
- The pressure loss is small (about  $1/4 \sim 1/2$  of the orifice flow meter), which is an energy-saving flow meter.
- The installation method is flexible, according to the different process pipelines on site, it can be installed horizontally, vertically and inclined at different angles.
- It adopts noise cancellation circuit and anti-vibration sensor, which has certain anti-environmental vibration performance.

- Using ultra-low power consumption single-chip microcomputer technology, one 3V10AH lithium battery can be used for more than 5 years.
- Correction of non-linearity of instrument coefficients by software to improve measurement accuracy.
- Use EEPROM to protect the accumulated flow from power failure, and the protection time is more than 10 years.

### **Application**

The instrument can be widely used in large, medium and small pipeline water supply and drainage, industrial circulation, sewage treatment, oil and chemical reagents and compressed air, saturated and superheated steam, natural gas and various medium flow measurements.

### **Technical Parameters**

**Table 1 Technical Parameters**

|   |   |                        |                             |
|---|---|------------------------|-----------------------------|
| <b>Measured medium</b>                          | Medium and high velocity media such as steam, compressed air, coal gas, liquid, etc.  |                        |                             |
| <b>Implementation standards</b>                 | Vortex flow sensor ( JB/T9249-2015 )  |                        |                             |
| <b>Inspection procedures</b>                    | Vortex flow meter ( JJG10299-2007 )   |                        |                             |
| <b>Instrument size (mm) and connection type</b> | Flange connection type  | DN15-DN300             |                             |
|   | Clamp connection type   | DN15-DN300             |                             |
| <b>Accuracy</b>                                 | Liquid measurement: $\pm 1\%$   |                        |                             |
|   | Gas or vapor measurement: $\pm 1\%$ 、 $\pm 1.5\%$   |                        |                             |
| <b>Range ability</b>                            | 1:10; 1:15; 1; 20   |                        |                             |
| <b>Sensor material</b>                          | SS304, SS316 etc  |                        |                             |
| <b>Working condition</b>                        | Medium temperature: $-40 \sim +70^{\circ}\text{C}$ ; $-40 \sim +250^{\circ}\text{C}$ ; $-40 \sim +350^{\circ}\text{C}$<br>Ambient temperature: $-20 \sim +60^{\circ}\text{C}$<br>Relative humidity: 5% ~ 90%<br>Atmospheric pressure: 86 ~ 106kPa       |                        |                             |
| <b>Output signal</b>                            | Pulse signal, 4 ~ 20mA signal   |                        |                             |
| <b>Communication output function</b>            | RS485 communication, HART protocol  |                        |                             |
| <b>Power supply</b>                             | A. External power supply: $+24\text{VDC} \pm 15\%$ , ripple $\leq \pm 15\%$ , suitable for 4-20mA output, pulse output, RS485, etc.<br>B. Internal power supply: 1 set of 3.0V10AH lithium battery, the battery voltage can work normally at 2.0V~3.0V. |                        |                             |
| <b>Flange standard</b>                          | Normal standard   | GB/T 9113-2000         |                             |
| <b>Flange standard</b>                          | Other standard  | International standard | For example: DIN, ANSI, JIS |
| <b>Flange standard</b>                          |   | China standard         | For example: HG, JB         |
| <b>Signal line interface</b>                    | M20×1.5 female thread ( NPT thread needs to be customized )   |                        |                             |
| <b>Explosion-proof</b>                          | ExdIICT6 Gb   |                        |                             |
| <b>Ingress protection</b>                       | IP65 or higher ( can be customized )  |                        |                             |

## Model Selection Table

1. Flow ranges for General Liquids and Gases (see table 2)

**Table 2 Flow ranges for general gases and liquids**

| Instrument size ( mm ) | Liquid measurement range (m <sup>3</sup> /h) | Gas measurement range (m <sup>3</sup> /h) | Connection type                   | Pressure rating |
|------------------------|--|---|-----------------------------------|-----------------|
| 15                     | 1.2~6.2                                      | 5~25                                      | Flange clamping/flange connection | 2.5/1.6         |
| 20                     | 1.5~10                                       | 8~50                                      | Flange clamping/flange connection | 2.5/1.6         |
| 25                     | 1.6~16                                       | 10~70                                     | Flange clamping/flange connection | 2.5/1.6         |
| 32                     | 1.9~19                                       | 15~150                                    | Flange clamping/flange connection | 2.5/1.6         |
| 40                     | 2.5~26                                       | 22~220                                    | Flange clamping/flange connection | 2.5/1.6         |
| 50                     | 3.5~38                                       | 36~320                                    | Flange clamping/flange connection | 2.5/1.6         |
| 65                     | 6.2~65                                       | 50~480                                    | Flange clamping/flange connection | 1.6/1.6         |
| 80                     | 10~100                                       | 70~640                                    | Flange clamping/flange connection | 1.6/1.6         |
| 100                    | 15~150                                       | 130~1100                                  | Flange clamping/flange connection | 1.6/1.6         |
| 125                    | 25~250                                       | 200~1700                                  | Flange clamping/flange connection | 1.6/1.6         |
| 150                    | 36~380                                       | 280~2240                                  | Flange clamping/flange connection | 1.6/1.6         |
| 200                    | 62~650                                       | 580~4960                                  | Flange clamping/flange connection | 1.6/1.6         |
| 250                    | 140~1400                                     | 970~8000                                  | Flange clamping/flange connection | 1.6/1.6         |
| 300                    | 200~2000                                     | 1380~11000                                | Flange clamping/flange connection | 1.6/1.6         |

2. Volumetric flow rate for known standard conditions converted to operating conditions

The unit of measurement for common gases is the standard state volume unit of measurement, i.e. standard cubic meters per hour (Nm<sup>3</sup>/h), referred to as "standard side". The standard state volume flow rate is converted to the operating state volume flow rate by the following formula, i.e. cubic meter/hour (m<sup>3</sup>/h), and then compared with the applicable flow range in Table 2.

$$Q_w = Q_s \times \frac{0.10325 \times (T_w + 273.15)}{293.15 \times (P_w + 0.101325)}$$

Formula:

- Q(w): The volume flow of the measured medium under working conditions. (M3/h)
- Q(s): The volume flow of the measured medium under standard conditions. (Nm3/h, 20 °C, 0.1013MPa absolute pressure)
- T<sub>w</sub>: The temperature of the medium under the working condition
- P<sub>w</sub>: The pressure of the medium under the working condition, gauge pressure. (MPa)

3. For saturated steam, it can be selected according to the mass flow range given in Table.

4. For superheated steam, first check the density value of the corresponding temperature and pressure (take absolute pressure: gauge pressure + 1) against the superheated steam table (table 4), and then calculate the corresponding value according to the given mass flow through the following formula The volume flow rate is compared with the steam flow rate of the corresponding caliber (Table 2)

$$Q(\text{m}^3/\text{h}) = \frac{G(\text{kg}/\text{h})}{\rho(\text{kg}/\text{m}^3)}$$

Formula:

G: Mass flow

ρ : Medium density

**Table 3: Flow range of saturated steam**

(Unit: kg/h )

| Absolute pressure Mpa     |      | 0.2   | 0.3   | 0.4   | 0.5   | 0.6   | 0.7   | 0.8   | 0.9   | 1     | 1.1   | 1.2   | 1.3   |
|---------------------------|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Temperature °C            |      | 120   | 133   | 144   | 152   | 159   | 165   | 170   | 175   | 180   | 184   | 189   | 192   |
| Density Kg/m <sup>3</sup> |      | 1.13  | 1.65  | 2.16  | 2.67  | 3.17  | 3.67  | 4.16  | 4.65  | 5.15  | 5.64  | 6.13  | 6.61  |
| DN15                      | Qmin | 6     | 8     | 11    | 13    | 16    | 18    | 21    | 23    | 26    | 28    | 31    | 33    |
|                           | Qmax | 28    | 41    | 54    | 67    | 79    | 92    | 104   | 116   | 129   | 141   | 153   | 165   |
| DN20                      | Qmin | 9     | 13    | 17    | 21    | 25    | 29    | 33    | 37    | 41    | 45    | 49    | 53    |
|                           | Qmax | 57    | 83    | 108   | 134   | 159   | 184   | 208   | 233   | 258   | 282   | 307   | 331   |
| DN25                      | Qmin | 11    | 17    | 22    | 27    | 32    | 37    | 42    | 47    | 52    | 56    | 61    | 66    |
|                           | Qmax | 79    | 116   | 151   | 187   | 222   | 257   | 291   | 326   | 361   | 395   | 429   | 463   |
| DN32                      | Qmin | 17    | 25    | 32    | 40    | 48    | 55    | 62    | 70    | 77    | 85    | 92    | 99    |
|                           | Qmax | 170   | 248   | 324   | 401   | 476   | 551   | 624   | 698   | 773   | 846   | 920   | 992   |
| DN40                      | Qmin | 25    | 36    | 48    | 59    | 70    | 81    | 92    | 102   | 113   | 124   | 135   | 145   |
|                           | Qmax | 249   | 363   | 475   | 587   | 697   | 807   | 915   | 1023  | 1133  | 1241  | 1349  | 1454  |
| DN50                      | Qmin | 41    | 59    | 78    | 96    | 114   | 132   | 150   | 167   | 185   | 203   | 221   | 238   |
|                           | Qmax | 362   | 528   | 691   | 854   | 1014  | 1174  | 1331  | 1488  | 1648  | 1805  | 1962  | 2115  |
| DN65                      | Qmin | 57    | 83    | 108   | 134   | 159   | 184   | 208   | 233   | 258   | 282   | 307   | 331   |
|                           | Qmax | 542   | 792   | 1037  | 1282  | 1522  | 1762  | 1997  | 2232  | 2472  | 2707  | 2942  | 3173  |
| DN80                      | Qmin | 79    | 116   | 151   | 187   | 222   | 257   | 291   | 326   | 361   | 395   | 429   | 463   |
|                           | Qmax | 723   | 1056  | 1382  | 1709  | 2029  | 2349  | 2662  | 2976  | 3296  | 3610  | 3923  | 4230  |
| DN100                     | Qmin | 147   | 215   | 281   | 347   | 412   | 477   | 541   | 605   | 670   | 733   | 797   | 859   |
|                           | Qmax | 1243  | 1815  | 2376  | 2937  | 3487  | 4037  | 4576  | 5115  | 5665  | 6204  | 6743  | 7271  |
| DN125                     | Qmin | 226   | 330   | 432   | 534   | 634   | 734   | 832   | 930   | 1030  | 1128  | 1226  | 1322  |
|                           | Qmax | 1921  | 2805  | 3672  | 4539  | 5389  | 6239  | 7072  | 7905  | 8755  | 9588  | 10421 | 11237 |
| DN150                     | Qmin | 316   | 462   | 605   | 748   | 888   | 1028  | 1165  | 1302  | 1442  | 1579  | 1716  | 1851  |
|                           | Qmax | 2543  | 3713  | 4860  | 6008  | 7133  | 8258  | 9360  | 10463 | 11588 | 12690 | 13793 | 14873 |
| DN200                     | Qmin | 655   | 957   | 1253  | 1549  | 1839  | 2129  | 2413  | 2697  | 2987  | 3271  | 3555  | 3834  |
|                           | Qmax | 5605  | 8184  | 10714 | 13243 | 15723 | 18203 | 20634 | 23064 | 25544 | 27974 | 30405 | 32786 |
| DN250                     | Qmin | 1096  | 1601  | 2095  | 2590  | 3075  | 3560  | 4035  | 4511  | 4996  | 5471  | 5946  | 6412  |
|                           | Qmax | 9040  | 13200 | 17280 | 21360 | 25360 | 29360 | 33280 | 37200 | 41200 | 45120 | 49040 | 52880 |
| DN300                     | Qmin | 1559  | 2277  | 2981  | 3685  | 4375  | 5065  | 5741  | 6417  | 7107  | 7783  | 8459  | 9122  |
|                           | Qmax | 12430 | 18150 | 23760 | 29370 | 34870 | 40370 | 45760 | 51150 | 56650 | 62040 | 67430 | 72710 |

**Table 3 Flow range of saturated steam**

(Unit: kg/h)

| Absolute pressure Mpa     |      | 1.4   | 1.5   | 1.6   | 1.7   | 1.8   | 1.9    | 2      | 2.1    | 2.2    | 2.3    | 2.4    | 2.5    |
|---------------------------|------|-------|-------|-------|-------|-------|--------|--------|--------|--------|--------|--------|--------|
| Temperature °C            |      | 195   | 198   | 201   | 204   | 207   | 209.8  | 212    | 214.8  | 217.2  | 219.5  | 221.8  | 223.9  |
| Density Kg/m <sup>3</sup> |      | 7.1   | 7.59  | 8.08  | 8.57  | 9.06  | 9.55   | 10.04  | 10.54  | 11.03  | 11.52  | 12.02  | 12.51  |
| DN15                      | Qmin | 36    | 38    | 40    | 43    | 45    | 48     | 50     | 53     | 55     | 58     | 60     | 63     |
|                           | Qmax | 178   | 190   | 202   | 214   | 227   | 239    | 250    | 263    | 275    | 288    | 300    | 313    |
| DN20                      | Qmin | 57    | 61    | 65    | 69    | 72    | 76     | 80     | 84     | 88     | 92     | 96     | 100    |
|                           | Qmax | 355   | 380   | 404   | 429   | 453   | 478    | 500    | 525    | 550    | 575    | 600    | 625    |
| DN25                      | Qmin | 71    | 76    | 81    | 86    | 91    | 96     | 100    | 105    | 110    | 115    | 120    | 125    |
|                           | Qmax | 497   | 531   | 566   | 600   | 634   | 669    | 700    | 735    | 770    | 805    | 840    | 875    |
| DN32                      | Qmin | 107   | 114   | 121   | 129   | 136   | 143    | 150    | 158    | 165    | 173    | 180    | 188    |
|                           | Qmax | 1065  | 1139  | 1212  | 1286  | 1359  | 1433   | 1500   | 1575   | 1650   | 1725   | 1800   | 1875   |
| DN40                      | Qmin | 156   | 167   | 178   | 189   | 199   | 210    | 220    | 231    | 242    | 253    | 264    | 275    |
|                           | Qmax | 1562  | 1670  | 1778  | 1885  | 1993  | 2101   | 2200   | 2310   | 2420   | 2530   | 2640   | 2750   |
| DN50                      | Qmin | 256   | 273   | 291   | 309   | 326   | 344    | 360    | 378    | 396    | 414    | 432    | 450    |
|                           | Qmax | 2272  | 2429  | 2586  | 2742  | 2899  | 3056   | 3200   | 3360   | 3520   | 3680   | 3840   | 4000   |
| DN65                      | Qmin | 355   | 380   | 404   | 429   | 453   | 478    | 500    | 525    | 550    | 575    | 600    | 625    |
|                           | Qmax | 3408  | 3643  | 3878  | 4114  | 4349  | 4584   | 4800   | 5040   | 5280   | 5520   | 5760   | 6000   |
| DN80                      | Qmin | 497   | 531   | 566   | 600   | 634   | 669    | 700    | 735    | 770    | 805    | 840    | 875    |
|                           | Qmax | 4544  | 4858  | 5171  | 5485  | 5798  | 6112   | 6400   | 6720   | 7040   | 7360   | 7680   | 8000   |
| DN100                     | Qmin | 923   | 987   | 1050  | 1114  | 1178  | 1242   | 1300   | 1365   | 1430   | 1495   | 1560   | 1625   |
|                           | Qmax | 7810  | 8349  | 8888  | 9427  | 9966  | 10505  | 11000  | 11550  | 12100  | 12650  | 13200  | 13750  |
| DN125                     | Qmin | 1420  | 1518  | 1616  | 1714  | 1812  | 1910   | 2000   | 2100   | 2200   | 2300   | 2400   | 2500   |
|                           | Qmax | 12070 | 12903 | 13736 | 14569 | 15402 | 16235  | 17000  | 17850  | 18700  | 19550  | 20400  | 21250  |
| DN150                     | Qmin | 1988  | 2125  | 2262  | 2400  | 2537  | 2674   | 2800   | 2940   | 3080   | 3220   | 3360   | 3500   |
|                           | Qmax | 15975 | 17078 | 18180 | 19283 | 20385 | 21488  | 22500  | 23625  | 24750  | 25875  | 27000  | 28125  |
| DN200                     | Qmin | 4118  | 4402  | 4686  | 4971  | 5255  | 5539   | 5800   | 6090   | 6380   | 6670   | 6960   | 7250   |
|                           | Qmax | 35216 | 37646 | 40077 | 42507 | 44938 | 47368  | 49600  | 52080  | 54560  | 57040  | 59520  | 62000  |
| DN250                     | Qmin | 6887  | 7362  | 7838  | 8313  | 8788  | 9264   | 9700   | 10185  | 10670  | 11155  | 11640  | 12125  |
|                           | Qmax | 56800 | 60720 | 64640 | 68560 | 72480 | 76400  | 80000  | 84000  | 88000  | 92000  | 96000  | 100000 |
| DN300                     | Qmin | 9798  | 10474 | 11150 | 11827 | 12503 | 13179  | 13800  | 14490  | 15180  | 15870  | 16560  | 17250  |
|                           | Qmax | 78100 | 83490 | 88880 | 94270 | 99660 | 105050 | 110000 | 115500 | 121000 | 126500 | 132000 | 137500 |

**Table 4 Density of superheated steam**

| Absolute Pressure (Mpa) \ Temperature | 150   | 170   | 190   | 210   | 230   | 250   | 270   | 290   | 310   | 330   | 350   | 370   |
|---------------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 0.1                                   | 0.52  | 0.49  | 0.47  | 0.45  | 0.43  | 0.42  | 0.4   | 0.39  | 0.37  | 0.36  | 0.35  | 0.34  |
| 0.15                                  | 0.78  | 0.74  | 0.71  | 0.68  | 0.65  | 0.62  | 0.6   | 0.58  | 0.56  | 0.54  | 0.52  | 0.51  |
| 0.2                                   | 1.04  | 0.99  | 0.95  | 0.91  | 0.87  | 0.83  | 0.8   | 0.77  | 0.75  | 0.72  | 0.7   | 0.68  |
| 0.25                                  | 1.31  | 1.24  | 1.19  | 1.13  | 1.08  | 1.04  | 1     | 0.97  | 0.93  | 0.9   | 0.87  | 0.85  |
| 0.3                                   | 1.58  | 1.5   | 1.43  | 1.37  | 1.31  | 1.25  | 1.21  | 1.16  | 1.12  | 1.08  | 1.05  | 1.02  |
| 0.4                                   | 2.12  | 2.01  | 1.92  | 1.83  | 1.75  | 1.65  | 1.62  | 1.56  | 1.5   | 1.47  | 1.4   | 1.36  |
| 0.5                                   | 2.67  | 2.54  | 2.41  | 2.3   | 2.2   | 2.11  | 2.03  | 1.95  | 1.88  | 1.81  | 1.75  | 1.7   |
| 0.8                                   | 4.4   | 4.17  | 3.94  | 3.74  | 3.57  | 3.41  | 3.27  | 3.15  | 3.03  | 2.92  | 2.82  | 2.73  |
| 1.1                                   | 6.13  | 5.83  | 5.53  | 5.24  | 4.97  | 4.75  | 4.54  | 4.36  | 4.19  | 4.04  | 3.9   | 3.77  |
| 1.4                                   | 7.88  | 7.52  | 7.15  | 6.79  | 6.43  | 6.11  | 5.84  | 5.6   | 5.38  | 5.18  | 4.99  | 4.83  |
| 1.7                                   | 9.85  | 9.37  | 9.25  | 8.41  | 7.94  | 7.52  | 7.17  | 6.86  | 6.58  | 6.33  | 6.1   | 5.78  |
| 2                                     | 11.63 | 11.1  | 10.57 | 10.04 | 9.51  | 8.97  | 8.54  | 8.14  | 7.81  | 7.5   | 7.22  | 6.96  |
| 2.5                                   | 15.19 | 14.45 | 13.72 | 12.98 | 12.24 | 11.5  | 10.88 | 10.35 | 9.89  | 9.48  | 9.11  | 8.78  |
| 3                                     | 18.42 | 17.57 | 16.72 | 15.88 | 15.04 | 14.18 | 13.34 | 12.64 | 12    | 11.51 | 11.05 | 10.63 |
| 3.5                                   | 22.7  | 21.57 | 20.44 | 19.31 | 18.23 | 17.05 | 15.92 | 15.02 | 14.26 | 13.85 | 13.03 | 12.62 |
| 4                                     | 27.16 | 25.75 | 24.33 | 22.91 | 21.5  | 20.08 | 18.66 | 17.5  | 16.55 | 15.75 | 15.05 | 14.44 |
| 4.5                                   | 30.39 | 28.92 | 27.45 | 25.98 | 24.51 | 23.04 | 21.57 | 20.1  | 18.93 | 17.96 | 17.13 | 16.4  |
| 5                                     | 35.42 | 33.63 | 31.83 | 30.04 | 28.24 | 26.45 | 24.65 | 22.86 | 21.42 | 20.25 | 19.26 | 18.41 |
| 6                                     | 43.9  | 41.75 | 39.6  | 37.45 | 35.3  | 33.15 | 31.01 | 28.86 | 26.71 | 25.05 | 23.7  | 22.56 |

**Table 4 Density of superheated steam**

| Absolute Pressure (Mpa) \ Temperature | 390   | 410   | 430   | 450   | 470   | 490   | 510   | 530   | 550   | 570   | 590   |
|---------------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 0.1                                   | 0.33  | 0.32  | 0.31  | 0.3   | 0.29  | 0.28  | 0.28  | 0.27  | 0.26  | 0.26  | 0.25  |
| 0.15                                  | 0.49  | 0.48  | 0.46  | 0.45  | 0.44  | 0.43  | 0.42  | 0.41  | 0.4   | 0.39  | 0.38  |
| 0.2                                   | 0.66  | 0.64  | 0.62  | 0.6   | 0.58  | 0.57  | 0.55  | 0.54  | 0.53  | 0.51  | 0.5   |
| 0.25                                  | 0.82  | 0.8   | 0.77  | 0.75  | 0.73  | 0.71  | 0.69  | 0.68  | 0.66  | 0.76  | 0.63  |
| 0.3                                   | 0.98  | 0.96  | 0.93  | 0.9   | 0.89  | 0.85  | 0.83  | 0.81  | 0.79  | 0.77  | 0.75  |
| 0.4                                   | 1.31  | 1.28  | 1.24  | 1.2   | 1.17  | 1.14  | 1.11  | 1.08  | 1.06  | 1.03  | 1.01  |
| 0.5                                   | 1.65  | 1.6   | 1.55  | 1.51  | 1.46  | 1.43  | 1.39  | 1.35  | 1.32  | 1.29  | 1.26  |
| 0.8                                   | 2.64  | 2.56  | 2.49  | 2.42  | 2.35  | 2.29  | 2.23  | 2.17  | 2.12  | 2.07  | 2.02  |
| 1.1                                   | 3.65  | 3.54  | 3.43  | 3.33  | 3.24  | 3.15  | 3.07  | 2.99  | 2.92  | 2.84  | 2.78  |
| 1.4                                   | 4.67  | 4.52  | 4.39  | 4.26  | 4.35  | 4.23  | 3.92  | 3.81  | 3.72  | 3.63  | 3.54  |
| 1.7                                   | 5.69  | 5.51  | 5.34  | 5.19  | 5.04  | 4.9   | 4.77  | 4.64  | 4.52  | 4.41  | 4.31  |
| 2                                     | 6.73  | 6.51  | 6.31  | 6.12  | 5.94  | 5.78  | 5.62  | 5.47  | 5.33  | 5.2   | 5.07  |
| 2.5                                   | 8.48  | 8.19  | 7.93  | 7.69  | 7.46  | 7.25  | 7.05  | 6.86  | 6.69  | 6.52  | 6.36  |
| 3                                     | 10.25 | 9.9   | 9.58  | 9.28  | 9     | 8.74  | 8.49  | 8.27  | 8.05  | 7.84  | 7.65  |
| 3.5                                   | 12.05 | 11.63 | 11.24 | 10.88 | 10.55 | 10.24 | 9.95  | 9.68  | 9.42  | 9.18  | 8.95  |
| 4                                     | 13.89 | 13.31 | 13    | 12.51 | 12.18 | 11.75 | 11.42 | 11.1  | 10.8  | 10.52 | 10.25 |
| 4.5                                   | 15.75 | 14.76 | 14.67 | 14.15 | 13.7  | 13.28 | 12.9  | 12.53 | 12.19 | 11.87 | 11.57 |
| 5                                     | 17.66 | 16.98 | 16.37 | 15.81 | 15.3  | 14.82 | 14.39 | 13.97 | 13.59 | 13.23 | 12.89 |
| 6                                     | 21.56 | 20.69 | 19.91 | 19.2  | 18.55 | 17.95 | 17.4  | 16.89 | 16.41 | 15.97 | 15.54 |

5. Calculation of pressure loss

Calculate whether the pressure loss has an impact on the process pipeline, calculated by the following formula:

$$\Delta P = 1.2 \rho \cdot V^2 (\text{Pa})$$

In the formula:

- $\Delta P$ : Pressure loss(Pa)
- $\rho$  : Density
- V: Average flow velocity in pipe (m/s)

6. When the medium to be measured is a liquid, to prevent cavitation and cavitation, the liquid pressure of the sensor shall be in accordance with the following formula:

$$P \geq 2.6 \Delta P + 1.25 P_1 \text{ (Pa Absolute pressure)}$$

In the formula:

- $\Delta P$ : Pressure loss value (Pa)
- $P_1$  : Vapor pressure of the fluid (Pa absolute pressure)

7. Model Selection Table (Table 5)

**Model Selection Table**

Table 5

| Model             | Code                     |                          |                          |                          |                          |                          |                          | Content  |
|-------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--|
| LUGB-             | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |  |
| Connection Method | 1                        |                          |                          |                          |                          |                          |                          | Flange connection  |
|                   | 2                        |                          |                          |                          |                          |                          |                          | Flange clamping  |
| Probe Temperature | 1                        |                          |                          |                          |                          |                          |                          | Low temperature probe ( $\leq 70^\circ\text{C}$ )  |
|                   | 2                        |                          |                          |                          |                          |                          |                          | Medium temperature probe ( $\leq 250^\circ\text{C}$ )  |
|                   | 3                        |                          |                          |                          |                          |                          |                          | High temperature probe ( $\leq 350^\circ\text{C}$ )  |
| Nominal Diameter  |                          |                          | 15                       |                          |                          |                          |                          | DN15   |
|                   |                          |                          | 20                       |                          |                          |                          |                          | DN20   |
|                   |                          |                          | 25                       |                          |                          |                          |                          | DN25   |
|                   |                          |                          | 32                       |                          |                          |                          |                          | DN32   |
|                   |                          |                          | 40                       |                          |                          |                          |                          | DN40   |
|                   |                          |                          | 50                       |                          |                          |                          |                          | DN50   |
|                   |                          |                          | 65                       |                          |                          |                          |                          | DN65   |
|                   |                          |                          | 80                       |                          |                          |                          |                          | DN80   |
|                   |                          |                          | 100                      |                          |                          |                          |                          | DN100  |
|                   |                          |                          | 125                      |                          |                          |                          |                          | DN125  |
|                   |                          |                          | 150                      |                          |                          |                          |                          | DN150  |
|                   |                          |                          | 200                      |                          |                          |                          |                          | DN200  |
|                   |                          | 250                      |                          |                          |                          |                          | DN250                    |  |
|                   |                          | 300                      |                          |                          |                          |                          | DN300                    |  |
| Structure         |                          |                          |                          | Z                        |                          |                          |                          |  |
|                   |                          |                          |                          | F                        |                          |                          |                          | Split type   |
| Instrument Type   |                          |                          |                          |                          | N                        |                          |                          | No display, 24V/12V power supply, pulse output   |
|                   |                          |                          |                          |                          | A                        |                          |                          | No display, 24V power supply, 4 ~ 20mA output  |
|                   |                          |                          |                          |                          | V                        |                          |                          | Local display, external power supply, 4 ~ 20mA/RS485/pulse output                              |
|                   |                          |                          |                          |                          | D                        |                          |                          | Temperature and pressure compensation, external power supply, 4 ~ 20mA/RS485/Pulse output/HART |
| Accuracy          |                          |                          |                          |                          |                          | N                        |                          | ExdIICT6 Gb  |
|                   |                          |                          |                          |                          |                          | E                        |                          | Non explosion-proof  |
| Pressure rating   |                          |                          |                          |                          |                          |                          | N                        | Regular  |
|                   |                          |                          |                          |                          |                          |                          | H(X)                     | High pressure (Negotiated)   |

### Outline Drawing and Installation

Regular type / digital intelligent vortex flow meter

#### 1. Flange connection type size

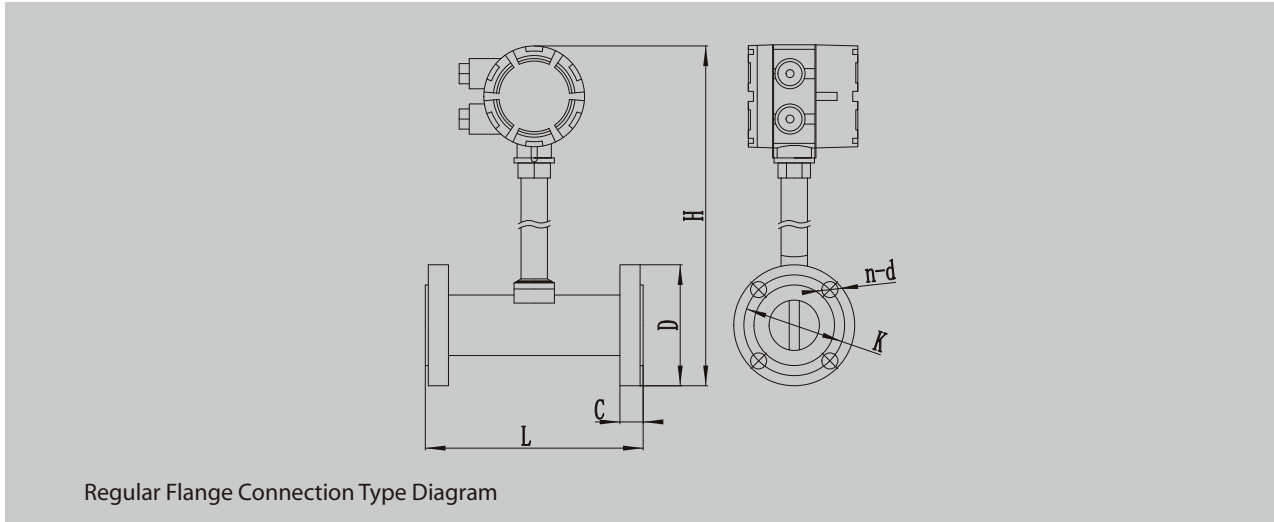


Table 6 flange connection type size comparison table

| Instrument Size<br>( mm ) | L (mm) | D<br>(mm) | K<br>(mm) | H ( mm )          |                  | d<br>(mm) | n<br>(Number of Holes) | Bolt Specifications | Standard Pressure Resistance |
|---------------------------|--------|-----------|-----------|-------------------|------------------|-----------|------------------------|---------------------|------------------------------|
|                           |        |           |           | Pulse Output Type | Intelligent Type |           |                        |                     |                              |
| 15                        | 180    | 95        | 65        | 415               | 440              | 14        | 4                      | M12x60              | Φ 18x1.5                     |
| 20                        | 180    | 105       | 75        | 420               | 445              | 14        | 4                      | M12x60              | Φ 25x2.5                     |
| 25                        | 180    | 115       | 85        | 425               | 450              | 14        | 4                      | M12x60              | Φ 32x3.5                     |
| 32                        | 180    | 140       | 100       | 435               | 460              | 18        | 4                      | M16x70              | Φ 39x3.5                     |
| 40                        | 180    | 150       | 110       | 435               | 455              | 18        | 4                      | M16x70              | Φ 48x4                       |
| 50                        | 180    | 165       | 125       | 460               | 480              | 18        | 4                      | M16x70              | Φ 59x4.5                     |
| 65                        | 200    | 185       | 145       | 470               | 500              | 18        | 4                      | M16x70              | Φ 74x4.5                     |
| 80                        | 200    | 200       | 160       | 490               | 520              | 18        | 8                      | M16x70              | Φ 89x4.5                     |
| 100                       | 200    | 220       | 180       | 515               | 545              | 18        | 8                      | M16x70              | Φ 109x4.5                    |
| 125                       | 220    | 250       | 210       | 535               | 560              | 18        | 8                      | M16x70              | Φ 134x4.5                    |
| 150                       | 220    | 285       | 240       | 570               | 595              | 22        | 8                      | M16x90              | Φ 159x4.5                    |
| 200                       | 220    | 340       | 295       | 625               | 650              | 22        | 12                     | M16x90              | Φ 219x9                      |
| 250                       | 250    | 405       | 355       | 685               | 710              | 26        | 12                     | M24x110             | Φ 273x11                     |
| 300                       | 300    | 460       | 410       | 710               | 735              | 26        | 12                     | M24x110             | Φ 325x12                     |

#### Note:

- ① The above parameters are applicable to flanged vortex flowmeter with pressure rating of 1.6 MPa.
- ② Flanged vortex flowmeters are not equipped with pipe flanges and bolts when they leave the factory. Users need to purchase them separately. The standard for connecting flanges is GB/TB9113-2000 raised panel flat-welded steel pipe flanges.



## 2. Clamping connection type size

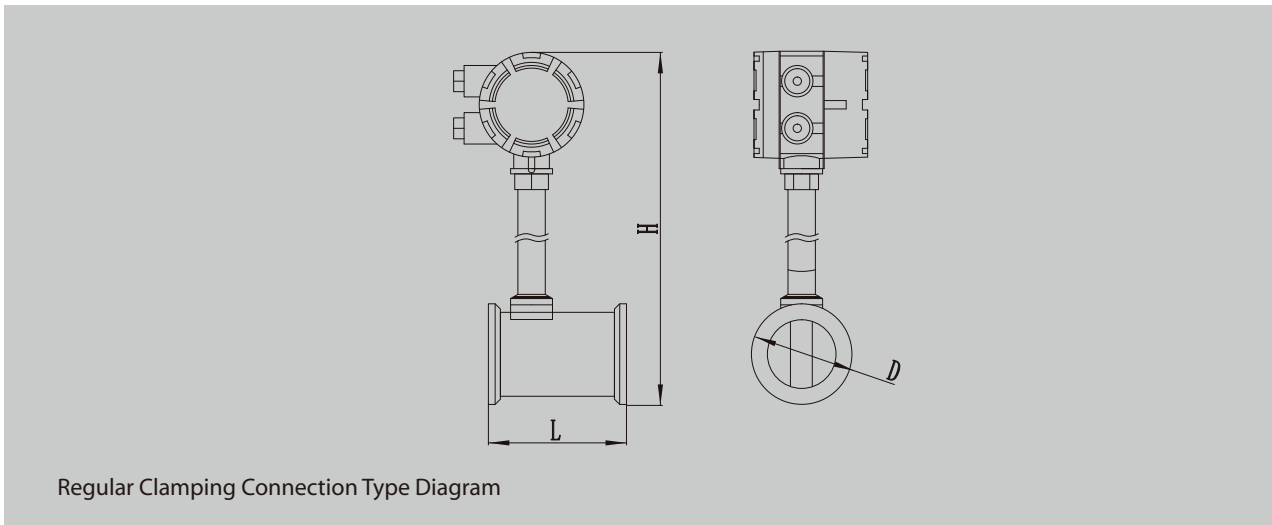


Table 7 Size comparison table of clamp connection type

| Instrument Size<br>( mm ) | L<br>(mm) | Lo*<br>(mm) | D<br>( mm ) | H ( mm )             |                             | Piping Specifications<br>(Outer Diameter * Thickness) |
|---------------------------|-----------|-------------|-------------|----------------------|-----------------------------|---|
|                           |           |             |             | Pulse Output<br>type | Digital Intelligent<br>Type |   |
| 15                        | 65        | 105         | 66          | 405                  | 425                         | Φ 18x1.5  |
| 20                        | 65        | 100         | 80          | 320                  | 340                         | Φ 25x2.5  |
| 25                        | 65        | 100         | 80          | 320                  | 340                         | Φ 32x3.5  |
| 32                        | 65        | 100         | 80          | 320                  | 340                         | Φ 39x3.5  |
| 40                        | 65        | 100         | 80          | 320                  | 340                         | Φ 49x4.5  |
| 50                        | 65        | 105         | 90          | 330                  | 350                         | Φ 59x4.5  |
| 65                        | 65        | 105         | 105         | 330                  | 350                         | Φ 74x4.5  |
| 80                        | 65        | 105         | 120         | 360                  | 380                         | Φ 89x4.5  |
| 100                       | 65        | 110         | 140         | 380                  | 400                         | Φ 109x4.5   |
| 125                       | 65        | 110         | 165         | 405                  | 425                         | Φ 134x4.5   |
| 150                       | 65        | 115         | 190         | 430                  | 450                         | Φ 159x4.5   |
| 200                       | 100       | 150         | 240         | 480                  | 500                         | Φ 219x9   |
| 250                       | 150       | 200         | 290         | 520                  | 550                         | Φ 273x11  |
| 300                       | 160       | 255         | 340         | 580                  | 600                         | Φ 325x12  |

### Note:

- ① The above parameters are all applicable to flange clamping type vortex flowmeters with a pressure rating of 1.6MPa.
- ② Installation length L. Increase the length of the mating flange. The mounting flange is a special flange, which has been equipped before leaving the factory. The standard of the mounting flange is the corporate standard and is recommended.
- ③ The structure of pipe butt welding type, threaded connection type, clamp connection type, fixed plug-in type, ball valve plug-in type and the external dimensions of the high temperature type are subject to confirmation at the time of delivery or ordering.
- ④ Flowmeter installation flange adopts enterprise standard, or other national department or industry standard or other national standard (American standard, German standard, Japanese standard, etc.) if you need special standard, please specify at the time of ordering.

**Temperature and pressure compensation type vortex flowmeter**

3. Flange connection size

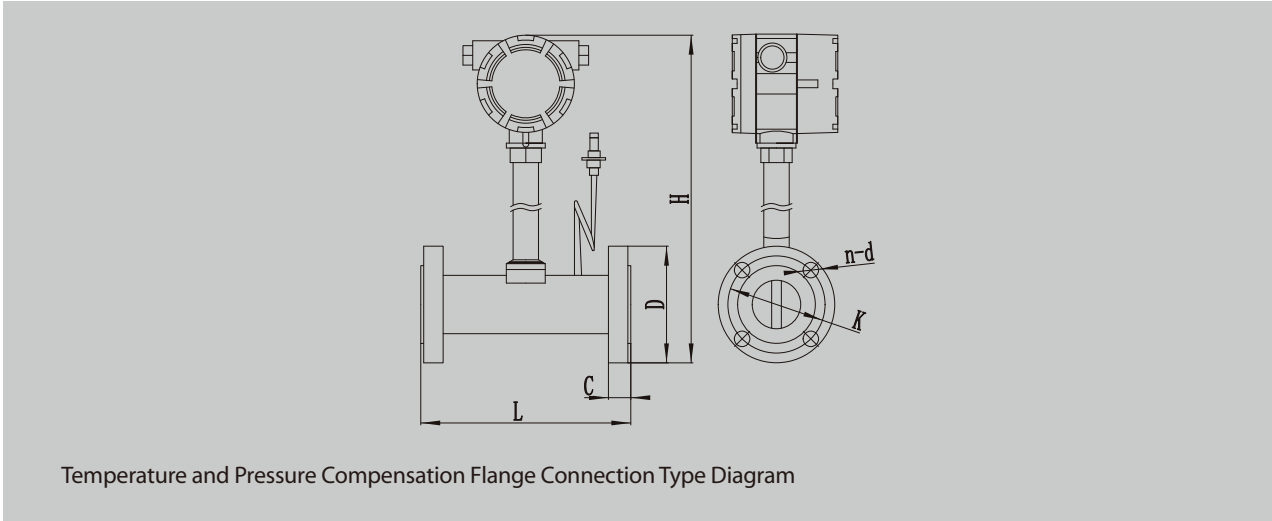


Table 8 flange connection type size comparison table

| Instrument Size<br>( mm ) | L (mm) | D(mm) | K    | H      | d    | n                 | Bolt specifications | Piping Specifications<br>(Outer Diameter*Thickness) |
|---------------------------|--------|-------|------|--------|------|-------------------|---------------------|---|
|                           |        |       | (mm) | ( mm ) | (mm) | (Number of holes) |                     |   |
| 15                        | 180    | 95    | 65   | 435    | 14   | 4                 | M12x60              | Φ 18x1.5  |
| 20                        | 180    | 105   | 75   | 440    | 14   | 4                 | M12x60              | Φ 25x2.5  |
| 25                        | 180    | 115   | 85   | 445    | 14   | 4                 | M12x60              | Φ 32x3.5  |
| 32                        | 180    | 140   | 100  | 455    | 18   | 4                 | M16x70              | Φ 39x3.5  |
| 40                        | 180    | 150   | 110  | 450    | 18   | 4                 | M16x70              | Φ 48x4  |
| 50                        | 180    | 165   | 125  | 475    | 18   | 4                 | M16x70              | Φ 59x4.5  |
| 65                        | 200    | 185   | 145  | 495    | 18   | 4                 | M16x70              | Φ 74x4.5  |
| 80                        | 200    | 200   | 160  | 515    | 18   | 8                 | M16x70              | Φ 89x4.5  |
| 100                       | 200    | 220   | 180  | 540    | 18   | 8                 | M16x70              | Φ 109x4.5   |
| 125                       | 220    | 250   | 210  | 555    | 18   | 8                 | M16x70              | Φ 134x4.5   |
| 150                       | 220    | 285   | 240  | 590    | 22   | 8                 | M16x90              | Φ 159x4.5   |
| 200                       | 220    | 340   | 295  | 645    | 22   | 12                | M16x90              | Φ 219x9   |
| 250                       | 250    | 405   | 355  | 705    | 26   | 12                | M24x110             | Φ 273x11  |
| 300                       | 300    | 460   | 410  | 730    | 26   | 12                | M24x110             | Φ 325x12  |

**Note:**

- ① The above parameters are applicable to flanged connection type vortex flowmeter with pressure rating of 1.6 MPa.
- ② Flanged vortex flowmeters are not equipped with pipe flanges and bolts when they leave the factory. Users need to purchase them separately. The standard for connecting flanges is GB/T9113-2000 raised-face flat-welded steel pipe flanges.

#### 4. Clamping connection type size

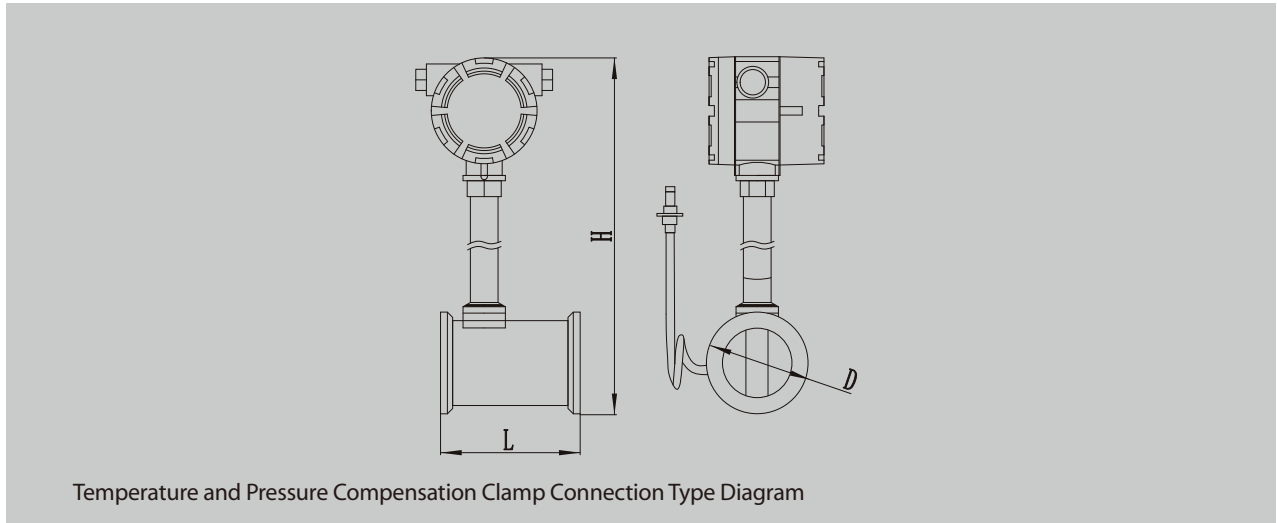


Table 9 Size comparison table of clamp connection type

| Instrument Size (mm) | L (mm) | L <sub>o</sub> (mm) | D (mm) | H (mm) | Piping specifications (outer diameter x thickness) |
|----------------------|--------|---------------------|--------|--------|--|
| 15                   | 66     | 94                  | 66     | 420    | Φ 18 x 1.5   |
| 20                   | 66     | 94                  | 66     | 420    | Φ 25 x 2.5   |
| 25                   | 66     | 94                  | 66     | 420    | Φ 32 x 3.5   |
| 32                   | 66     | 94                  | 66     | 420    | Φ 39 x 3.5   |
| 40                   | 80     | 112                 | 77     | 425    | Φ 49 x 4.5   |
| 50                   | 80     | 120                 | 89     | 430    | Φ 59 x 4.5   |
| 65                   | 93     | 137                 | 102    | 445    | Φ 74 x 4.5   |
| 80                   | 100    | 144                 | 113    | 455    | Φ 89 x 4.5   |
| 100                  | 125    | 173                 | 135    | 489    | Φ 109 x 4.5  |
| 125                  | 145    | 197                 | 158    | 515    | Φ 134 x 4.5  |
| 150                  | 165    | 217                 | 181    | 540    | Φ 159 x 4.5  |
| 200                  | 196    | 252                 | 248    | 595    | Φ 219 x 9  |
| 250                  | 120    | 166                 | 300    | 620    | Φ 273 x 11   |
| 300                  | 135    | 185                 | 350    | 670    | Φ 325 x 12   |

**Note:**

- ① The above parameters are all applicable to flange clamping vortex flowmeters with a pressure rating of 1.6MPa.
- ② Installation length L. Increase the length of the mating flange. The mounting flange is a special flange, which is already equipped at the factory. The standard of the mounting flange is the corporate standard, and it is recommended.
- ③ The above dimensions are for reference only when designing and selecting. The actual dimensions are subject to confirmation at the time of delivery or ordering.
- ④ Pipeline butt-welding type, threaded connection type, clamp connection type, fixed plug-in type, ball valve plug-in type structure and external dimensions, and high temperature type, temperature type external dimensions are subject to confirmation at the time of delivery or order.
- ⑤ The flowmeter mounting flange adopts corporate standards, and can also adopt other national department or industry standards according to user needs, or adopt other national standards (American Standard, German Standard, Japanese Standard, etc.). If you need special standards, please indicate when ordering.

5. Installation of flow meter and pipeline

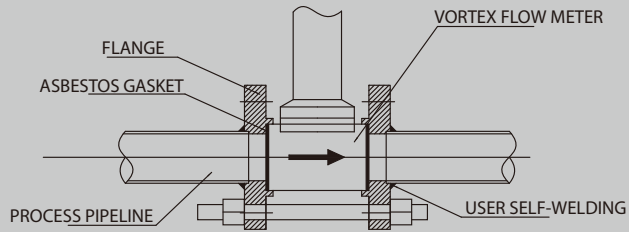


Figure 1 Clamping Flange Type Installation

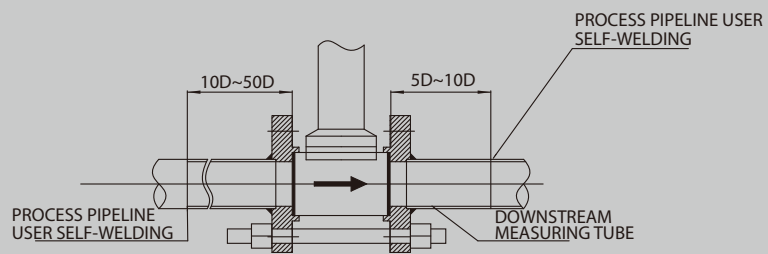


Figure 2 T-type Measuring Tube Installation

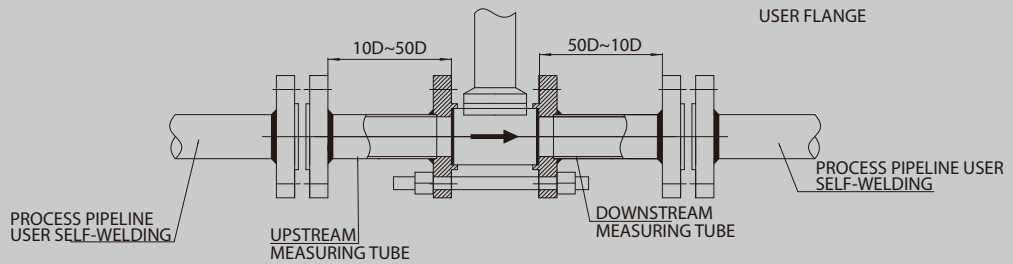


Figure 3 I-type Measuring Tube Installation

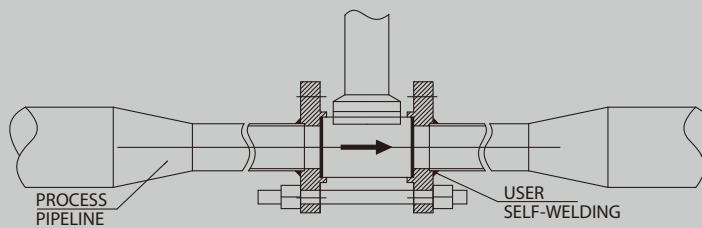


Figure 4 Pipe Diameter Reduced Type Installation

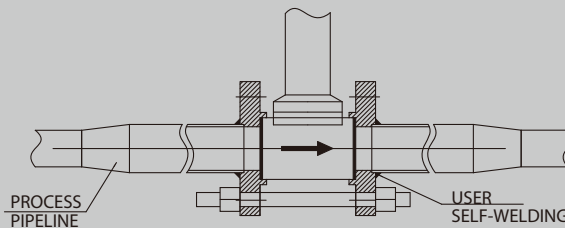
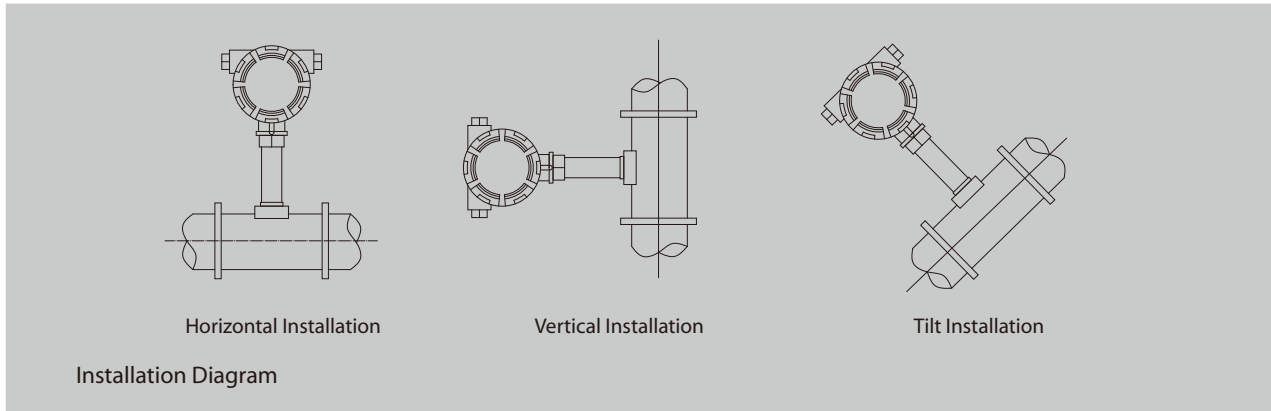


Figure 5 Pipe Diameter Expanded Type Installation

## **Installation Requirements**

### **1. Flowmeter Installation**



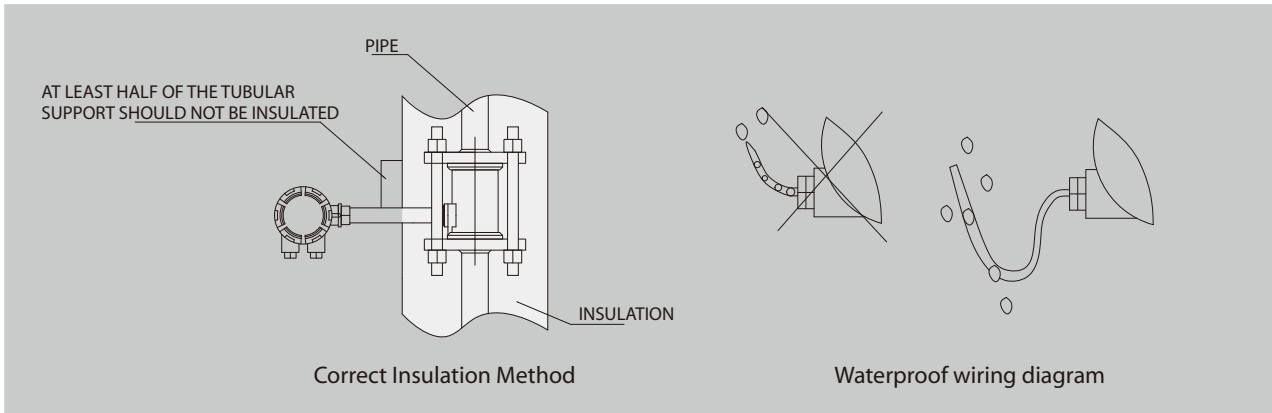
- Make openings in the pipe as required by the opening size and position the openings to meet the requirements of the straight pipe section.
- Place the flanged flowmeter set into the open pipe.
- Spot weld positioning of the flange and pipe.
- Remove the flowmeter, weld the flange as required, and clean all protrusions in the pipe.

Install the sealing gasket with the same diameter as the pipeline in the inner groove of the flange, and install the flowmeter into the flange. The flow direction of the flowmeter should be the same as the direction of the fluid, and then tighten the bolts.

### **2. Installation Notes**

- The flowmeter is best installed indoors. If it needs to be installed outdoors, measures should be taken to avoid direct sunlight and prevent rain.
- The flowmeter should be installed in places with strong magnetic interference, small space and inconvenient maintenance.
- The flowmeter should not be installed in places with high temperature, heat radiation from equipment, or corrosive gas. If installation is required, heat insulation and ventilation measures must be taken.
- The flowmeter should not be installed on the pipeline with mechanical vibration. If installation is necessary, shock absorption measures must be taken. A hose transition can be installed, or a fixed pipe support point and anti-vibration pad should be installed at the 2DN upstream and downstream of the flowmeter.
- The flowmeter should be removed after the flange and pipe spot welding position, and the flowmeter should not be welded with it.
- Vortex flowmeter can measure liquid, gas and steam, but is not common between different media. The same medium is divided into three specifications: low temperature, high temperature and extra high temperature, and is not common between different temperatures.
- When measuring liquids, it is important to ensure that the piping is filled with liquid so that the media flow direction is from the bottom up.
- The flow meter can be installed at any 360 degree vertical direction along the pipe axis. Optimal installation: low-temperature dielectric rod installed vertically on the ground; high-temperature dielectric rod installed parallel to the ground.
- The flowmeter should be mounted on a long overhead pipe as far as possible, as the sagging pipe is likely to cause seal leakage between the flowmeter and the flange. If installation is necessary, pipe support points must be provided at 2D upstream and downstream of the meter.
- In piping used to measure steam, the instrument connecting rod should be uninsulated at least halfway through to prevent excessive converter temperatures (as shown in Figure 7-2).
- In order to facilitate observation and wiring, the meter head can be rotated 360 degrees in the original position, after adjusting the position, tighten the lock nut. To prevent moisture from entering the housing from the lock nut, the lock nut should be wrapped with waterproof tape to seal it if necessary.

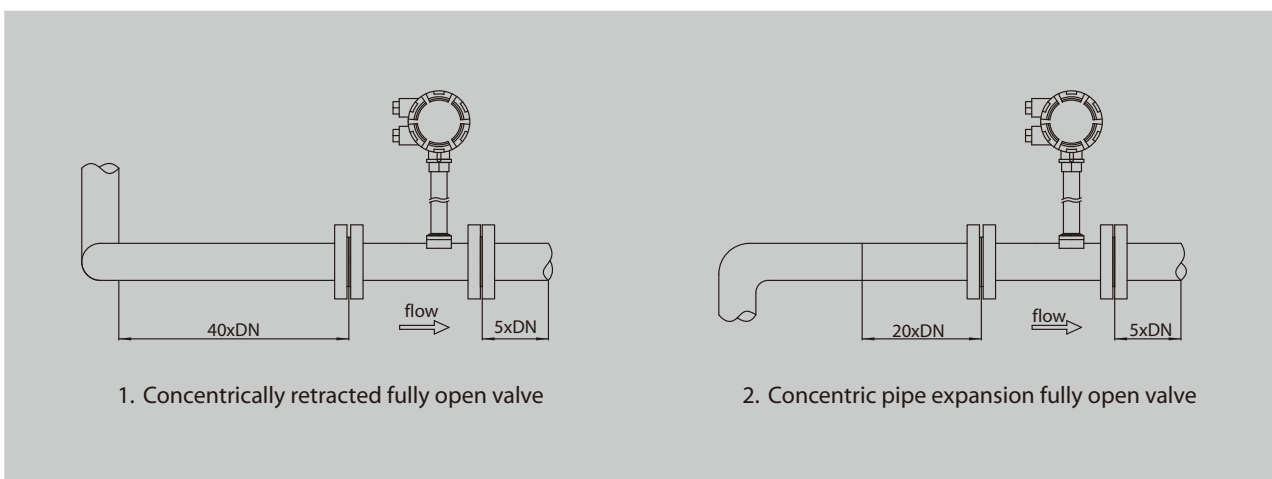
- The shielded cable connected to the flow meter should be routed away from strong electromagnetic field interference and should never be laid together with the high-voltage cable. The shielded cable should be as short as possible and not coiled to reduce the distribution inductance, and the maximum length should not exceed 500 m. The shielded cable should be as short as possible and not coiled to reduce the distribution inductance.
- When wiring, first unscrew the case back cover and feed the signal wire through the waterproof connector. Follow the wiring diagram for proper wiring. Tighten the waterproof connector and ensure that the cable must be bent downward before entering the waterproof connector to ensure that water does not enter the housing through the cable (as shown below).

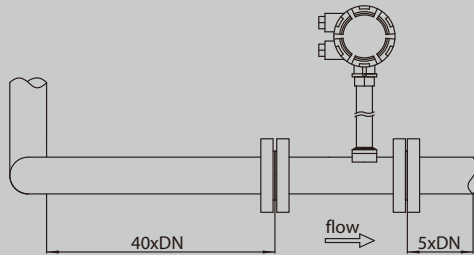


### **3. Requirements for Straight Pipe Sections**

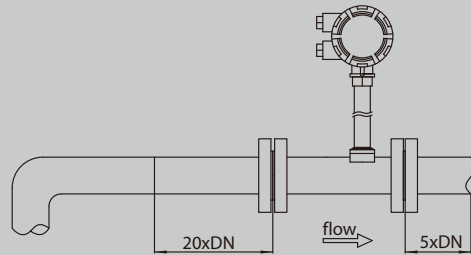
In order to ensure accurate measurement, the upstream of the flowmeter must have a sufficiently long straight pipe section, the upstream flow distribution is as undisturbed as possible, if there is a control and throttling device is best installed in the downstream. The minimum upstream and downstream requirements are as follows: upstream: 10DN (10 times the diameter); downstream: 5DN (5 times the diameter).

If there are elbows' shrinkage' expansion' valves, etc. upstream of the flowmeter, a longer straight section of pipe is required, as shown in Figure 7-4.





3. Two 90° elbows different planes



4. One 90° elbows

**Note:**

Requirements for piping: The inner diameter of the piping upstream and downstream of the installation point of the flowmeter shall be the same as the inner diameter of the flowmeter, which shall meet the requirements of the following formula.

$$0.98D < DN < 1.05D$$

In the formula:

- D inside diameter of flowmeter;
- DN inside diameter of pipeline

The pipeline should be concentric with the flowmeter, coaxial deviation should not be greater than 0.05 DN.

**Ordering Information**

- ▶ Vortex flow meter models
- ▶ The name of the fluid medium and its physical parameters
- ▶ Maximum working pressure      Maximum working temperature      Minimum working temperature
- ▶ Common flow rate      Maximum flow rate      Minimum flow rate