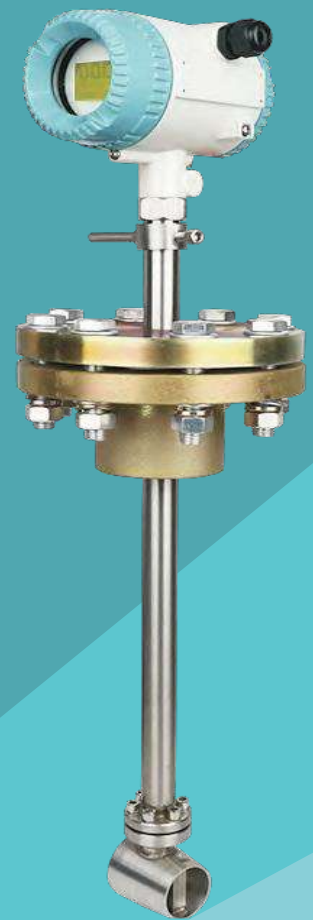




**NAGMAN FLOW-LEVEL SYSTEMS AND SOLUTIONS LLP**

**CHENNAI**

**CATALOGUE OF VORTEX FLOW METER**



# VORTEX FLOW METER



## Introduction

Vortex Flowmeter works on the Karman vortex street principle that swirls generated by a bluff body in the pipe. The number of swirls are proportional to the volumetric flow in the pipe. Vortex flowmeter widely used for gases, steam and liquid applications. It is ideal for measuring saturated and superheated steam in large facilities to improve steam production efficiency.

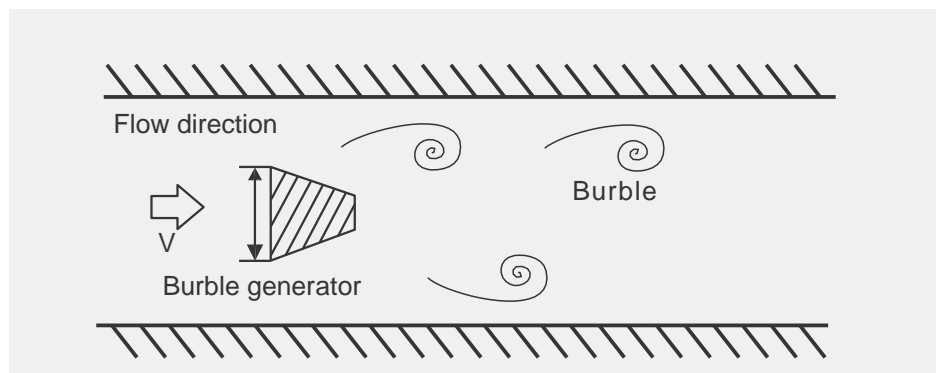


## Principle

When the fluid in the pipeline passes the burble generator(triangular prism),burble will generate due to the acceleration of partial flow rate. The burble will arise alternatively in two burble lines, which is called Karman vortex.

The releasing frequency of Karman vortex depends on the size of triangle prim and flow rate of fluid, while independent of the medium feature parameter, such as the temperature, pressure, it can be indicated by the following formulas:

| $F = sR \cdot v (1 - 1.27 \cdot d/D)$ | $Q = 3600 \cdot F/K$   | $M = Q \cdot P$ |
|---------------------------------------|--|-----------------|
| F                                     | The releasing frequency of Karman vortex (Hz)                |                 |
| Sr                                    | Strouhal number (unit: dimensionless)                        |                 |
| V                                     | Medium flow rate (m/s)                                       |                 |
| d                                     | The width of triangle prim                                   |                 |
| D                                     | Vortex meter inner diameter (m)                              |                 |
| Q                                     | Instantaneous volume flow rate (m <sup>3</sup> /h)           |                 |
| K                                     | Vortex meter coefficient (unit pulse number/m <sup>3</sup> ) |                 |
| M                                     | Instantaneous quality flow rate (kg/h)                       |                 |
| P                                     | Fluid density (kg/m <sup>3</sup> )                           |                 |



# VORTEX FLOW METER



## Application



## Features

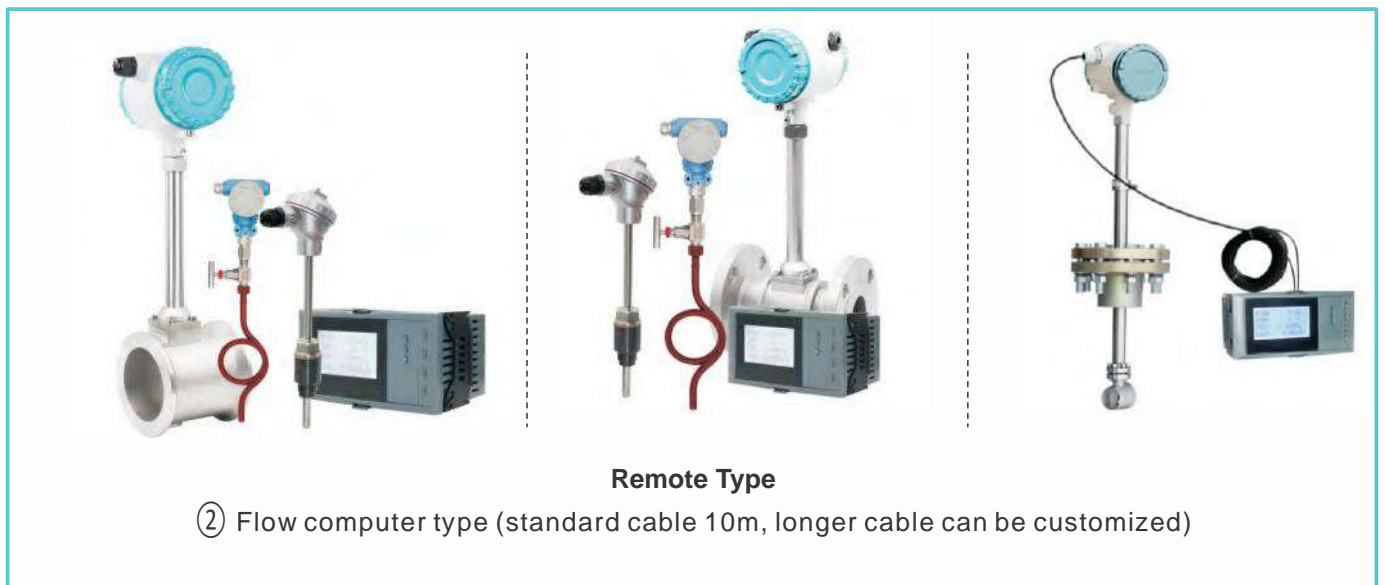
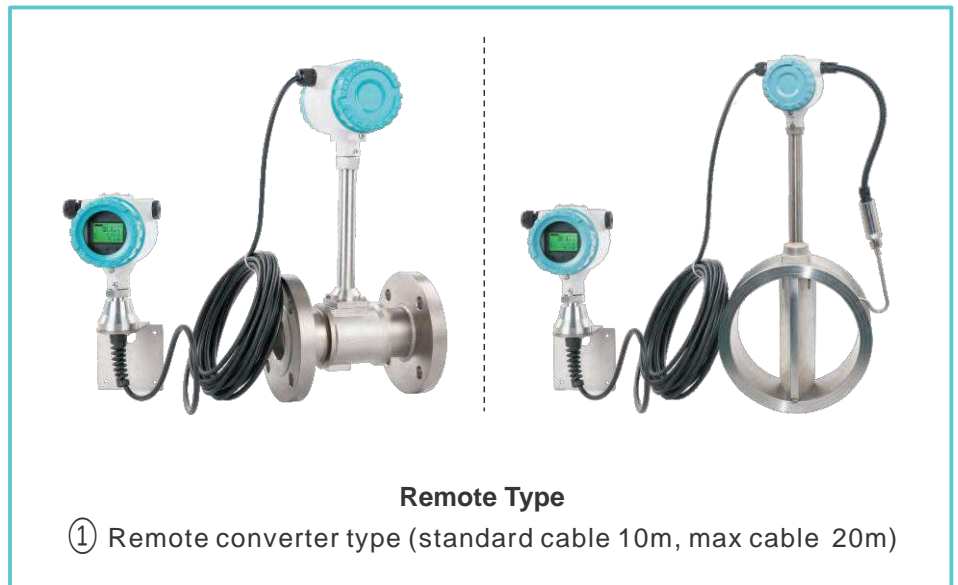


### ● Connection Type



# VORTEX FLOW METER

## • Compact Type and Remote Type



# VORTEX FLOW METER



## Parameters

|                                |   |   |
|--------------------------------|---|---|
| Measured Medium                | Liquid, Gas, Steam  |   |
| Medium Temp.                   | -40~+250°C; -40~+350°C (high temperature type)  |   |
| Pressure                       | Flange  | DIN PN10/PN16/PN25/PN40<br>JIS10K/20K/30K/40K<br>ANSI 150#/300# |
|                                | Wafer   | 40 Bar  |
|                                | Thread  | 16 Bar  |
|                                | Tri-clamp   | 16 Bar  |
|                                | Insertion   | 16 Bar  |
| Accuracy                       | ±1.0% (Flange/Wafer/Thread/Tri-clamp)<br>±1.5% (Insertion type)                                     |   |
| Flow Range                     | Liquid:0.4-7.0m/s;<br>Gas:4.0-60.0m/s;<br>Steam:5.0-70.0m/s   |   |
| Specifications                 | DN15-DN300 (flange/wafer type)<br>DN80-DN2000 (insertion type)<br>DN15-DN100 (thread/sanitary type) |   |
| Body Material                  | SS304 (standard)<br>SS316 (optional)  |   |
| Reynolds Number                | Normal $2 \times 10^4 \sim 7 \times 10^6$   |   |
| Resistance Coefficient         | $C_d \cong 2.6$   |   |
| Vibration Acceleration Allowed | $\cong 0.2g$  |   |
| Ambient Condition              | Ambient Temp.   | -40°C~65°C<br>-20°C~55°C  |
|                                | Relative Humidity   | $\cong 85\%$  |
|                                | Pressure  | 86-106kPa   |
| Power Supply                   | DC12-30V or 3.6V lithium battery powered  |   |
| Signal Output                  | 4-20mA, Pulse   |   |
| Communication                  | RS485 Modbus or HART  |   |

# VORTEX FLOW METER



## Flow Range

Table 1 Liquid and Air Flow Range Table (m<sup>3</sup>/h)

| Nominal DN(mm) | Liquid (m <sup>3</sup> /h) |                | Air (m <sup>3</sup> /h) |                |
|----------------|----------------------------|----------------|-------------------------|----------------|
|                | Standard Range             | Extended Range | Standard Range          | Extended Range |
| 15             | 0.8-6                      | 0.5-8          | 6-40                    | 5-50           |
| 20             | 1-8                        | 0.5-12         | 8-50                    | 6-60           |
| 25             | 1.5-12                     | 0.8-16         | 10-80                   | 8-120          |
| 32             | 2-20                       | 1.5-25         | 15-150                  | 10-200         |
| 40             | 2.5-30                     | 2-40           | 25-200                  | 20-300         |
| 50             | 3-50                       | 2.5-60         | 30-300                  | 25-500         |
| 65             | 5-80                       | 4-100          | 50-500                  | 40-800         |
| 80             | 8-120                      | 6-160          | 80-800                  | 60-1200        |
| 100            | 12-200                     | 8-250          | 120-1200                | 100-2000       |
| 125            | 20-300                     | 12-400         | 160-1600                | 150-3000       |
| 150            | 30-400                     | 18-600         | 250-2500                | 200-4000       |
| 200            | 50-800                     | 30-1200        | 400-4000                | 350-8000       |
| 250            | 80-1200                    | 40-1600        | 600-6000                | 500-12000      |
| 300            | 100-1600                   | 60-2500        | 1000-10000              | 600-16000      |
| 400            | 200-3000                   | 120-5000       | 1600-16000              | 1000-25000     |
| 500            | 300-5000                   | 200-8000       | 2500-25000              | 1600-40000     |
| 600            | 500-8000                   | 300-10000      | 4000-40000              | 2500-60000     |

# VORTEX FLOW METER

Table 2 Saturated Steam Mass Flow Range Table (kg/h)

| Absolute Pressure (MPa)      |      | 0.2    | 0.3    | 0.4    | 0.5    | 0.6    | 0.7     | 0.8    |
|------------------------------|------|--------|--------|--------|--------|--------|---------|--------|
| Temperature (°C)             |      | 120.2  | 133.5  | 143.62 | 151.84 | 158.94 | 164.96  | 170.41 |
| Density (kg/m <sup>3</sup> ) |      | 1.129  | 1.651  | 2.163  | 2.669  | 3.17   | 3.667   | 4.162  |
| DN15                         | Qmin | 5.645  | 8.255  | 10.815 | 13.345 | 15.85  | 18.335  | 20.81  |
|                              | Qmax | 56.45  | 82.55  | 108.15 | 133.45 | 158.5  | 183.35  | 208.1  |
| DN20                         | Qmin | 6.774  | 9.906  | 12.978 | 16.014 | 19.02  | 22.002  | 24.972 |
|                              | Qmax | 67.74  | 99.06  | 129.78 | 160.14 | 190.2  | 220.02  | 249.72 |
| DN25                         | Qmin | 9.032  | 13.208 | 17.304 | 21.352 | 25.36  | 29.336  | 33.296 |
|                              | Qmax | 135.48 | 198.12 | 259.56 | 320.28 | 380.4  | 440.04  | 499.44 |
| DN32                         | Qmin | 20.322 | 29.718 | 38.934 | 48.042 | 57.06  | 66.006  | 74.916 |
|                              | Qmax | 203.22 | 297.18 | 389.34 | 480.42 | 570.6  | 660.06  | 749.16 |
| DN40                         | Qmin | 22.58  | 33.02  | 43.26  | 53.38  | 63.4   | 73.34   | 83.24  |
|                              | Qmax | 338.7  | 495.3  | 648.9  | 800.7  | 951    | 1100.1  | 1248.6 |
| DN50                         | Qmin | 28.225 | 41.275 | 54.075 | 66.725 | 79.25  | 91.675  | 104.05 |
|                              | Qmax | 564.5  | 825.5  | 1081.5 | 1334.5 | 1585   | 1833.5  | 2081   |
| DN65                         | Qmin | 45.16  | 66.04  | 86.52  | 106.76 | 126.8  | 146.68  | 166.48 |
|                              | Qmax | 903.2  | 1320.8 | 1730.4 | 2135.2 | 2536   | 2933.6  | 3329.6 |
| DN80                         | Qmin | 67.74  | 99.06  | 129.78 | 160.14 | 190.2  | 220.02  | 249.72 |
|                              | Qmax | 1354.8 | 1981.2 | 2595.6 | 3202.8 | 3804   | 4400.4  | 4994.4 |
| DN100                        | Qmin | 112.9  | 165.1  | 216.3  | 266.9  | 317    | 366.7   | 416.2  |
|                              | Qmax | 2258   | 3302   | 4326   | 5338   | 6340   | 7334    | 8324   |
| DN125                        | Qmin | 169.35 | 247.65 | 324.45 | 400.35 | 475.5  | 550.05  | 624.3  |
|                              | Qmax | 3387   | 4953   | 6489   | 8007   | 9510   | 11001   | 12486  |
| DN150                        | Qmin | 225.8  | 330.2  | 432.6  | 533.8  | 634    | 733.4   | 832.4  |
|                              | Qmax | 4516   | 6604   | 8652   | 10676  | 12680  | 14668   | 16648  |
| DN200                        | Qmin | 395.15 | 577.85 | 757.05 | 934.15 | 1109.5 | 1283.45 | 1456.7 |
|                              | Qmax | 9032   | 13208  | 17304  | 21352  | 25360  | 29336   | 33296  |
| DN250                        | Qmin | 564.5  | 825.5  | 1081.5 | 1334.5 | 1585   | 1833.5  | 2081   |
|                              | Qmax | 13548  | 19812  | 25956  | 32028  | 38040  | 44004   | 49944  |
| DN300                        | Qmin | 677.4  | 990.6  | 1297.8 | 1601.4 | 1902   | 2200.2  | 2497.2 |
|                              | Qmax | 18064  | 26416  | 34608  | 42704  | 50720  | 58672   | 66592  |

# VORTEX FLOW METER

Table 2 Saturated Steam Mass Flow Range Table (kg/h)

| Absolute Pressure (MPa)      |      | 0.9     | 1.0     | 1.2     | 1.4     | 1.6     | 1.8     | 2.0    |
|------------------------------|------|---------|---------|---------|---------|---------|---------|--------|
| Temperature (°C)             |      | 175.36  | 179.68  | 187.96  | 195.04  | 201.37  | 207.11  | 212.37 |
| Density (kg/m <sup>3</sup> ) |      | 4.665   | 5.147   | 6.127   | 7.106   | 8.085   | 9.065   | 10.05  |
| DN15                         | Qmin | 23.325  | 25.735  | 30.635  | 35.53   | 440.425 | 45.325  | 50.25  |
|                              | Qmax | 233.25  | 257.35  | 306.35  | 355.3   | 404.25  | 453.25  | 502.5  |
| DN20                         | Qmin | 27.99   | 30.882  | 36.762  | 42.636  | 48.51   | 54.39   | 60.3   |
|                              | Qmax | 279.9   | 308.82  | 367.62  | 426.36  | 485.1   | 543.9   | 603    |
| DN25                         | Qmin | 37.32   | 41.176  | 49.016  | 56.848  | 64.68   | 72.52   | 80.4   |
|                              | Qmax | 559.8   | 617.64  | 735.24  | 852.72  | 970.2   | 1087.8  | 1206   |
| DN32                         | Qmin | 83.97   | 92.646  | 110.286 | 127.908 | 145.53  | 163.17  | 180.9  |
|                              | Qmax | 839.7   | 926.46  | 1102.86 | 1279.08 | 1455.3  | 1631.7  | 1809   |
| DN40                         | Qmin | 93.3    | 102.94  | 122.54  | 142.12  | 161.7   | 181.3   | 201    |
|                              | Qmax | 1399.5  | 1544.1  | 1838.1  | 2131.8  | 2425.5  | 2719.5  | 3015   |
| DN50                         | Qmin | 116.625 | 128.675 | 153.175 | 177.65  | 202.125 | 226.625 | 251.25 |
|                              | Qmax | 2332.5  | 2573.5  | 3063.5  | 3553    | 4042.5  | 4532.5  | 5025   |
| DN65                         | Qmin | 186.6   | 205.88  | 245.08  | 284.24  | 323.4   | 362.6   | 402    |
|                              | Qmax | 3732    | 4117.6  | 4901.6  | 5684.8  | 6468    | 7252    | 8040   |
| DN80                         | Qmin | 279.9   | 308.82  | 367.62  | 426.36  | 485.1   | 543.9   | 603    |
|                              | Qmax | 5598    | 6176.4  | 7352.4  | 8527.2  | 9702    | 10878   | 12060  |
| DN100                        | Qmin | 466.5   | 514.7   | 612.7   | 710.6   | 808.5   | 906.5   | 1005   |
|                              | Qmax | 9330    | 10294   | 12254   | 14212   | 16170   | 18130   | 20100  |
| DN125                        | Qmin | 699.75  | 772.05  | 919.05  | 1065.9  | 1212.75 | 1359.75 | 1507.5 |
|                              | Qmax | 13995   | 15441   | 18381   | 21318   | 24255   | 27195   | 30150  |
| DN150                        | Qmin | 933     | 1029.4  | 1225.4  | 1421.2  | 1617    | 1813    | 2010   |
|                              | Qmax | 18660   | 20588   | 24508   | 28424   | 32340   | 36260   | 40200  |
| DN200                        | Qmin | 1632.75 | 1801.45 | 2144.45 | 2487.1  | 2829.75 | 3172.75 | 3517.5 |
|                              | Qmax | 37320   | 41176   | 49016   | 56848   | 64680   | 72520   | 80400  |
| DN250                        | Qmin | 2332.5  | 2573.5  | 3063.5  | 3553    | 4042.5  | 4532.5  | 5025   |
|                              | Qmax | 55980   | 61764   | 73524   | 85272   | 97020   | 108780  | 120600 |
| DN300                        | Qmin | 2799    | 3088.2  | 3676.2  | 4263.6  | 4851    | 5439    | 6030   |
|                              | Qmax | 74640   | 82352   | 98032   | 113696  | 129360  | 145040  | 160800 |



## VORTEX FLOW METER

Table 3 Superheated Steam Density & Relative Temperature and Pressure (Kg/m<sup>3</sup>)

| Absolute Pressure (MPa) | Temperature ( °C ) |      |       |      |      |      |
|-------------------------|--------------------|------|-------|------|------|------|
|                         | 150                | 200  | 250   | 300  | 350  | 400  |
| 0.1                     | 0.52               | 0.46 | 0.42  | 0.38 |      |      |
| 0.15                    | 0.78               | 0.70 | 0.62  | 0.57 | 0.52 | 0.49 |
| 0.2                     | 1.04               | 0.93 | 0.83  | 0.76 | 0.69 | 0.65 |
| 0.25                    | 1.31               | 1.16 | 1.04  | 0.95 | 0.87 | 0.81 |
| 0.33                    | 1.58               | 1.39 | 1.25  | 1.14 | 1.05 | 0.97 |
| 0.35                    | 1.85               | 1.63 | 1.46  | 1.33 | 1.22 | 1.13 |
| 0.4                     | 2.12               | 1.87 | 1.68  | 1.52 | 1.40 | 1.29 |
| 0.5                     | -                  | 2.35 | 2.11  | 1.91 | 1.75 | 1.62 |
| 0.6                     | -                  | 2.84 | 2.54  | 2.30 | 2.11 | 1.95 |
| 0.7                     | -                  | 3.33 | 2.97  | 2.69 | 2.46 | 2.27 |
| 0.8                     | -                  | 3.83 | 3.41  | 3.08 | 2.82 | 2.60 |
| 1.0                     | -                  | 4.86 | 4.30  | 3.88 | 3.54 | 3.26 |
| 1.2                     | -                  | 5.91 | 5.20  | 4.67 | 4.26 | 3.92 |
| 1.5                     | -                  | 7.55 | 6.58  | 5.89 | 5.36 | 4.93 |
| 2.0                     | -                  | -    | 8.968 | 7.97 | 7.21 | 6.62 |
| 2.5                     | -                  | -    | 11.5  | 10.1 | 9.11 | 8.33 |
| 3.0                     | -                  | -    | 14.2  | 12.3 | 11.1 | 10.1 |
| 3.5                     | -                  | -    | 17.0  | 14.6 | 13.0 | 11.8 |
| 4.0                     | -                  | -    | -     | 17.0 | 15.1 | 13.6 |

# VORTEX FLOW METER



## Dimension

- Flange Connection Type (DIN PN16 as reference)

DIN PN16 Flange Connection Dimension

| Size  | L   | H   | d   | D1  | D2  | n-D3   |
|-------|-----|-----|-----|-----|-----|--------|
| DN15  | 170 | 440 | 15  | 65  | 95  | 4-φ14  |
| DN20  | 170 | 445 | 20  | 75  | 105 | 4-φ14  |
| DN25  | 170 | 450 | 26  | 85  | 115 | 4-φ14  |
| DN32  | 170 | 462 | 32  | 100 | 140 | 4-φ18  |
| DN40  | 190 | 465 | 38  | 110 | 150 | 4-φ18  |
| DN50  | 190 | 473 | 48  | 125 | 165 | 4-φ18  |
| DN65  | 220 | 487 | 62  | 145 | 185 | 4-φ18  |
| DN80  | 220 | 500 | 73  | 160 | 200 | 8-φ18  |
| DN100 | 240 | 533 | 95  | 180 | 220 | 8-φ18  |
| DN125 | 260 | 560 | 118 | 210 | 250 | 8-φ18  |
| DN150 | 280 | 608 | 140 | 240 | 285 | 8-φ22  |
| DN200 | 300 | 640 | 200 | 295 | 340 | 12-φ22 |
| DN250 | 360 | 705 | 250 | 355 | 405 | 12-φ26 |
| DN300 | 400 | 752 | 300 | 410 | 460 | 12-φ26 |

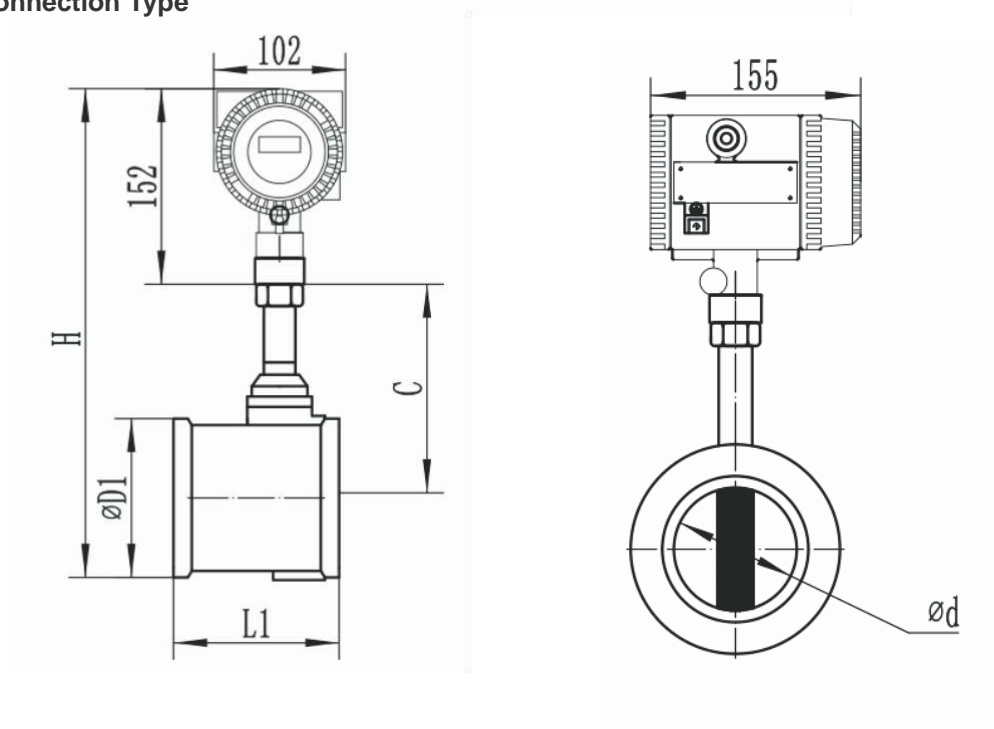
Noted: Above dimension as per flange DIN PN16.

# VORTEX FLOW METER



## Dimension

- Wafer Connection Type

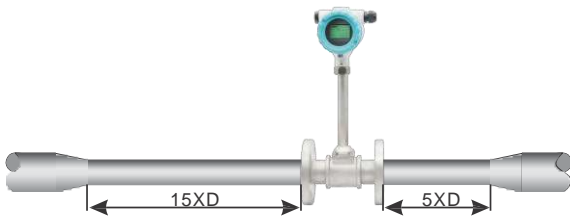


| Size  | L1  | D1  | d   | C     |
|-------|-----|-----|-----|-------|
| DN15  | 65  | 65  | 15  | 240.5 |
| DN20  | 65  | 65  | 20  | 240.5 |
| DN25  | 65  | 65  | 26  | 240.5 |
| DN32  | 65  | 65  | 32  | 240.5 |
| DN40  | 80  | 76  | 38  | 237   |
| DN50  | 80  | 88  | 48  | 237   |
| DN65  | 92  | 101 | 62  | 242.5 |
| DN80  | 100 | 112 | 73  | 247   |
| DN100 | 124 | 134 | 95  | 271   |
| DN125 | 145 | 158 | 118 | 284   |
| DN150 | 165 | 180 | 140 | 313   |
| DN200 | 195 | 247 | 200 | 319.5 |
| DN250 | 115 | 300 | 250 | 348   |
| DN300 | 130 | 347 | 300 | 369.5 |

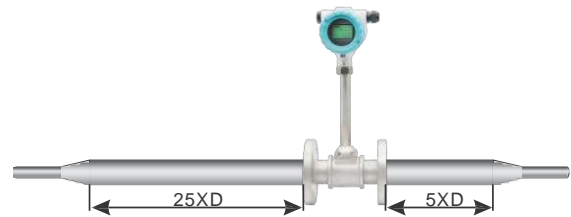
# VORTEX FLOW METER



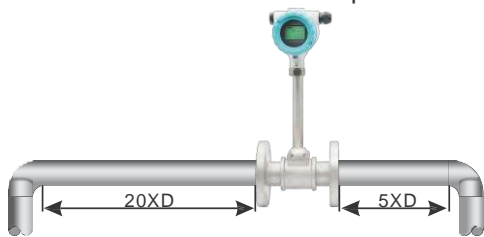
## Vortex Flow Meter Installation



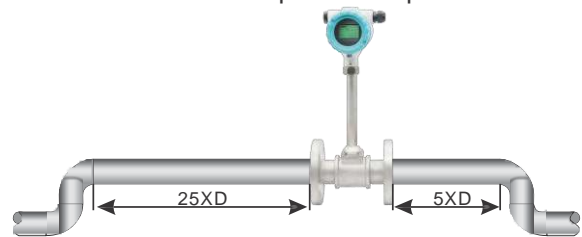
Concentric Reducers Pipeline



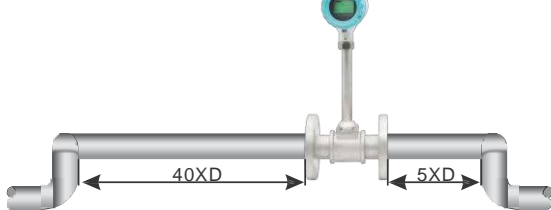
Concentric Expansion Pipeline



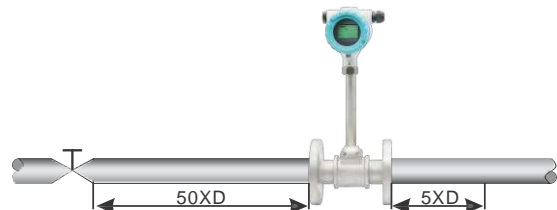
Single Square Bend



Two Square Bends At Same Plane



Two Square Bends At Different Plane



Regulating Valve, Half-open Gate Valve

