

Model YF100

Vortex Flow-meter

Series of vortices will be shed alternatively from both sides of the shedder (that is a cylindrical or triangular bar) when it is inserted in the fluids. Under certain conditions, the frequency of shed vortices should be proportional to volume flow rate. Based on this principle, the flow measurement could be carried out through measuring frequency of vortices by means of vortex flow-meters.

Two versions are available: one has a built-in (integral) converter, and the other is used with a remote converter.

The process technology and bottleneck equipment of vortex flow meter have been introduced from Yokogawa Electric Corporation in Japan. Its features are as follows:

- Wide application-liquids, gases and steam can all be measured;
- High accuracy and wide flow range;
- Simple structure does not contain any moving parts, and its measuring sensor can not come into contact with fluid. This feature ensures high reliability and easy maintenance;
- Indicator with wide angle (TBL) or digital totalizer (TBT、TBS) could be attached.

Standard of this product: Q/YXBM 369-1999;

Inspecting regulation: JJG 198-94



□Principal Specifications

| | |
|--------------------------------|---|
| Fluids to be measured: | Liquid, gas or steam |
| Measurable range: | Reynolds Number within 5×10^3 to 7×10^6 |
| Normal Operating Range: | Reynolds number within 2×10^4 to 7×10^6 (for nominal sizes 25A to 100A) 4×10^4 to 7×10^6 (for nominal sizes 150A、200A) |

Note: In addition to Reynolds Number, there should be a limit for fluid velocity during measurement; the maximum velocity for liquid is 7m/s, while maximum velocity for gas or steam is 75m/s; besides, minimum velocity is related to density and viscosity of fluids (see "Sizing" section).

Accuracy: (within normal operating range)

| | |
|---------------|---|
| Liquid | ±1.0 % of reading |
| Gas | ±1.0 % of reading (velocity 35 m/s or less) |
| Steam | ±1.5 % of reading (velocity 35 m/s to 75 m/s) |

Note: This table shows the accuracy of Pulse Output version. In case of Analog Output, add up $\pm 0.1\%$ of full scale to the values shown above.

| | |
|-----------------------|--|
| Repeatability: | ±0.2 % of reading. |
| Span Setting: | For analog output, a screw-type span adjustment allows span to be adjusted in the following ranges: |
| Liquid: | 0-1.1 m/s to 0-7 m/s (for nominal sizes 25A to 100A) 0-1.5 m/s to 0-7 m/s (for nominal sizes 150A、200A) |
| Gas or Steam: | 0-11m/s to 0-75m/s (for nominal sizes 25A to 100A) 0-15 m/s to 0-75 m/s (for nominal sizes 150A、200A) |
| Time Constant: | 5 s (with analog output converter). |

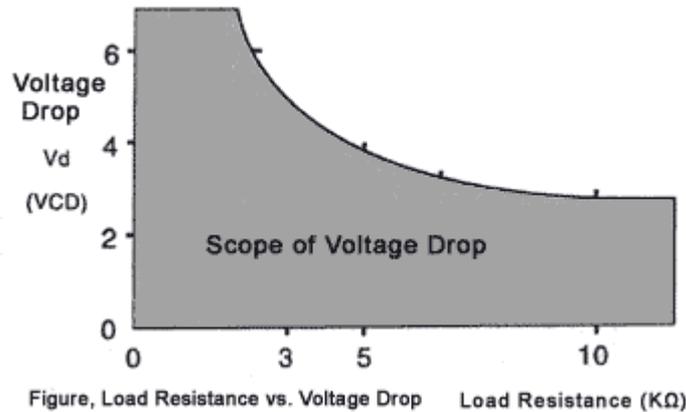
Output Signal: Analog: 4 to 20 mA DC, (2 wire system). Pulse: Voltage pulse, (3 wire system).

Low level: 0~2V

High level: $V_s - V_d$ (V_d is related to load resistance. Refer to the figure below.)

(V_s : Input power supply voltage, V_d : Voltage drop)

Duty cycles: Approx. 50%



Nominal pulse rate and K-Factor

| Nominal Size | Internal Diameter (mm) | Nominal K-Factor (Pulse/liter) | Nominal Pulse Rate | |
|--------------|------------------------|--------------------------------|--------------------|----------------------|
| | | | Hz/m/s | Hz/m ³ /h |
| 25A | 25.7 | 68.6 | 35.5 | 19.1 |
| 40A | 39.7 | 18.7 | 23.1 | 5.19 |
| 50A | 51.1 | 8.95 | 18.3 | 2.49 |
| 80A | 71.0 | 3.33 | 13.2 | 0.924 |
| 100A | 93.8 | 1.43 | 9.88 | 0.397 |
| 150A | 138.8 | 0.441 | 6.67 | 0.123 |
| 200A | 185.6 | 0.185 | 5.00 | 0.0514 |

Power supply Voltage: Analog Output: 12 to 45 V DC

Pulse Output: 12 to 30 V DC

Process Temperature Limit: -40~300°C

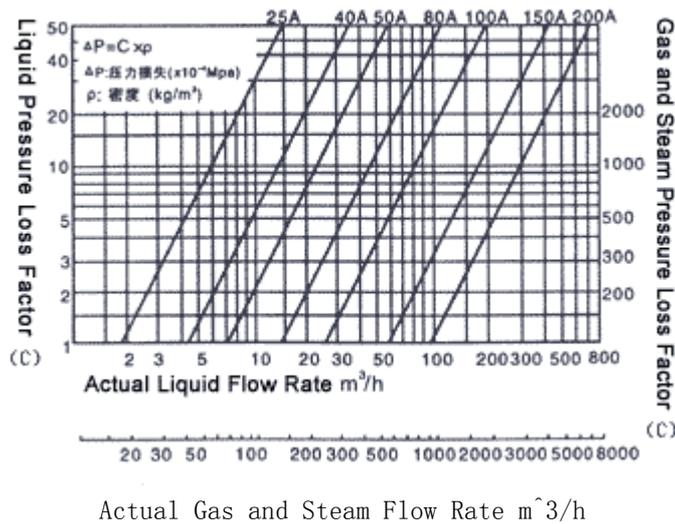
Process Pressure Limit: -0.1Mpa to flange ratings

Pressure Loss:

At velocity of 7m/s by water, $\Delta P = 0.054$ Mpa

At velocity of 75m/s by atmospheric air, $\Delta P = 8.1$ kPa

(For the relationship between pressure loss and actual flow rate, refer to the figure below.)



| | |
|-----------------------------------|---|
| Ambient Temperature Limit: | -40 to 80°C -20 to 60°C (Explosion-proof type or with indicator) -10 to 60°C (With totalizer) |
| Ambient Humidity: | 5% to 95% relative humidity |
| Material: | Body: SCS14 stainless steel Shedder Bar: SUS329J1 Duplex stainless steel Converter Case: AC3A-F aluminum alloy |
| Enclosure Classification: | IPX6 |
| Explosion-proof Structure: | dIIBT4 Explosion Isolation Type |
| Signal Cable: | Model YF011 cable, used to connect remote detector and converter with its maximum length no more than 20m, and durable temperature within -40 to 150°C |
| Electrical Connection: | G1/2" cylindrical pipe thread |
| Option Specifications: | 1) Built-in indicator: Only suitable for analog output; 0 to 100% linear division with scale length about 130 mm; 250° wide angle indication with its accuracy being 1.5%; Weight: 0.8 kg additional; Code: /TBL. 2) Built-in totalizer: Suitable for both analog and pulse output versions; Six digit LCD display for accumulative flow; Totalizer value being protected by built-in battery in case of power failure; Weight: 0.5 kg additional; Code: /TBT. 3) Built-in Totalizer: with built-in power supply battery; Without retransmission output; Weight: 0.6 kg; Code: /TBT-G; 4) Built-in Display: Suitable for both analog and pulse output versions; Simultaneously displaying instantaneous flow rate and total flow; (For detailed features and wiring connections, see YF/TBS sheet.) |

□ **Model and its Suffix Code**

YF100 Vortex Flow-meter

| Model | Suffix Code | description |
|---------------|----------------------------------|---|
| YF102 | | Nominal Size 25A (without flange) |
| YF104 | | Nominal Size 40A (without flange) |
| YF105 | | Nominal Size 50A (without flange) |
| YF108 | | Nominal Size 80A (without flange) |
| YF110 | | Nominal Size 100A (without flange) |
| YF115 | | Nominal Size 150A (with flange) |
| YF120 | | Nominal Size 200A (with flange) |
| Converter | -AL..... -AG..... -NN..... | Integral type (Liquid) Integral type (Gas or steam) Remote converter type |
| Output signal | S..... P..... N..... | 4 to 20 mA DC output (Integral type) Pulse output (Integral type) Remote converter type |

| | | |
|---|--------------------|--------------------------|
| Process Connections comply with GB113RF and GB119RF | C1..... C2..... | PN1. 6MPa PN4. 0MPa |
| Style Code | -CD..... | Style CD |
| Explosion-proof structure | /JSF | Explosion Isolation type |

※ Optional components should be specially ordered.

YFA11 Vortex Flow Converter (Remote type)

| Model | Suffix Code | description |
|---------------------------|--|--|
| YFA11 | | Vortex Flow Converter |
| Measured Fluid | -L -G | Liquid Gas or Steam |
| Output Signal | S..... P..... | 4 to 20 mA DCPulse |
| Flow-meter Nominal Size | -02..... -04..... -05..... -08..... -10..... -15..... -20..... | Nominal size 25A (without flange) Nominal size 40A (without flange) Nominal size 50A (without flange) Nominal size 80A (without flange) Nominal size 100A (without flange) Nominal size 150A (with flange) Nominal size 200A (with flange) |
| Style Code | -CD..... | Style CD |
| Explosion-proof structure | /JSF | Explosion Isolation type |

※ Optional components should be specially ordered.

YF011 Signal Cable (Remote type)

| Model | Suffix Code | description |
|--------------|--|-------------------------------------|
| YF011 | | Signal Cable |
| Cable End | -0 -1 | Without end finish※ With end finish |
| Cable Length | -05..... -10..... -15..... -20..... | 5m 10m 15m 20m |
| Style Code | -CD..... | Style CD |

□ Typical Measuring Range

·Water Flow Rate

| Nominal Size | Measurable Flow Rate (m ³ /h) | Normal Operating Flow Rate (m ³ /h) |
|--------------|--|--|
| 25A | 0.75~13 | 1.7~13 |
| 40A | 1.6~31 | 2.6~31 |
| 50A | 2.6~51 | 3.3~51 |
| 80A | 5.0~99 | 5.0~99 |
| 100A | 8.8~170 | 8.8~170 |
| 150A | 19~380 | 19~380 |

| | | |
|------|--------|--------|
| 200A | 39~680 | 39~680 |
|------|--------|--------|

Note: This table is based on standard conditions of 20°C and 1000 kg/m³ as its density (γ). Measurable flow rate is calculated from the velocity (0.35 to 7 m/s, and 0.4 to 7 m/s in case of 25A or 200A).

• Air Flow Rate at selected Pressures

| Nominal Size | Flow Rate Limit | Minimum and Maximum Measurable Flow Rate (Nm ³ /h) | | | | | | | | | |
|--------------|-----------------|---|------------|--------|--------|--------|--------|--------|--------|--------|--------|
| | | Atm. | 0.1MPa | 0.2MPa | 0.4MPa | 0.6MPa | 0.8MPa | 1.0MPa | 1.5MPa | 2.0MPa | 2.5MPa |
| 25A | Minimum | 12.9(19.4) | 18.1(19.4) | 22.1 | 28.4 | 33.6 | 38.1 | 42.1 | 55.8 | 69.3 | 82.2 |
| | Maximum | 140 | 275 | 411 | 682 | 953 | 1220 | 1490 | 2170 | 2560 | 3520 |
| 40A | Minimum | 26.3(29.9) | 36.9 | 45.1 | 62.6 | 81.0 | 100 | 118 | 159 | 197 | 234 |
| | Maximum | 334 | 657 | 980 | 1620 | 2270 | 2920 | 3560 | 5180 | 6800 | 8410 |
| 50A | Minimum | 43.6 | 61.1 | 74.6 | 96.1 | 114 | 129 | 143 | 182 | 226 | 268 |
| | Maximum | 553 | 1080 | 1620 | 2690 | 3760 | 4830 | 5910 | 8580 | 11200 | 13400 |
| 80A | Minimum | 84.1 | 118 | 114 | 186 | 220 | 269 | 316 | 426 | 529 | 628 |
| | Maximum | 1060 | 2100 | 3130 | 5200 | 7270 | 9340 | 11400 | 16500 | 18700 | 18700 |
| 100A | Minimum | 147 | 206 | 252 | 350 | 457 | 558 | 655 | 884 | 1100 | 1310 |
| | Maximum | 1860 | 3660 | 5470 | 9080 | 12600 | 16300 | 19900 | 24700 | 24700 | 24700 |
| 150A | Minimum | 322 | 470 | 647 | 970 | 1270 | 1550 | 1820 | 2450 | 3050 | 3610 |
| | Maximum | 4080 | 8030 | 11900 | 19800 | 27700 | 35700 | 36500 | 36500 | 36500 | 36500 |
| 200A | Minimum | 670 | 1065 | 1465 | 2195 | 2870 | 3505 | 4115 | 5550 | 6895 | 8175 |
| | Maximum | 7310 | 14300 | 21500 | 35600 | 49200 | 49200 | 49200 | 49200 | 49200 | 49200 |

Note: 1) All listed pressures are gauge pressures at process temperature of 0°C.

2) All listed flow rates have been converted to standard conditions STP (0°C, 1 atm.)

3) Maximum flow rate is the lower of values obtained from 75 m/s or Reynolds number.

4) The values in parentheses show minimum linear flow rates (Re=20000 or 40000), which are higher than the minimum measurable flow rates; while the others are the same as the minimum linear flow rates within the normal operating range.

• Saturated Steam Flow Rate at Selected Process Pressure

| Nominal Size | Flow Rate Limit | Minimum and Maximum Measurable Flow Rate (kg/h) | | | | | | | | | |
|--------------|-----------------|---|------------|--------|--------|--------|--------|--------|--------|--------|-------|
| | | 0.1MPa | 0.2MPa | 0.4MPa | 0.6MPa | 0.8MPa | 1.0MPa | 1.5MPa | 2.0MPa | 2.5MPa | 3MPa |
| 25A | Minimum | 15.6(18.8) | 19.0(19.8) | 24.2 | 28.3 | 31.9 | 35.1 | 42.0 | 48.0 | 53.3 | 59.0 |
| | Maximum | 159 | 232 | 375 | 514 | 652 | 790 | 1130 | 1470 | 1810 | 2170 |
| 40A | Minimum | 32.0 | 38.3 | 49.3 | 57.8 | 65.1 | 74.4 | 99.4 | 123 | 146 | 167 |
| | Maximum | 379 | 554 | 894 | 1220 | 1560 | 1880 | 2700 | 3510 | 4340 | 5180 |
| 50A | Minimum | 53.0 | 64.2 | 81.6 | 95.7 | 108 | 119 | 143 | 163 | 180 | 199 |
| | Maximum | 628 | 917 | 1470 | 2030 | 2570 | 3120 | 4480 | 5830 | 7200 | 8580 |
| 80A | Minimum | 103 | 125 | 158 | 185 | 209 | 230 | 275 | 330 | 392 | 450 |
| | Maximum | 1210 | 1770 | 2850 | 3920 | 4970 | 6030 | 8640 | 11200 | 13800 | 16500 |
| 100A | Minimum | 178 | 217 | 275 | 323 | 363 | 416 | 555 | 686 | 812 | 934 |
| | Maximum | 2120 | 3090 | 4980 | 6850 | 8690 | 10500 | 15000 | 19600 | 24200 | 28900 |
| 150A | Minimum | 391 | 474 | 633 | 816 | 990 | 1160 | 1540 | 1910 | 2250 | 2590 |
| | Maximum | 4630 | 6760 | 10800 | 14990 | 19000 | 23000 | 32900 | 43000 | 48000 | 49000 |
| 200A | Minimum | 814 | 986 | 1210 | 1560 | 1870 | 2180 | 2920 | 3580 | 4230 | 5870 |
| | Maximum | 8290 | 12000 | 19500 | 26900 | 34000 | 41300 | 56400 | 58300 | 60100 | 61600 |

Note: 1) Maximum flow rate is the lower of values obtained from 75 m/s or Reynolds number.

2) The values in parentheses show the minimum linear flow rates (Re=20000 or 40000),

which are higher than the minimum measurable flow rates; while the others might be the same as the minimum linear flow rates within the normal operating range.

□Sizing

Sizing could be done with the help of "Technical Information" and "work sheet". Based on actual fluid conditions, the measurable range and the accuracy guaranteed range could be calculated. After that, the most suitable size can be determined.

Measurable minimum flow velocity: Reynolds number must be 5000 or more. Select the larger value of flow velocity obtained from Figure-a (relationship between minimum flow velocity and density) and Figure-b (relationship between velocity and kinematic viscosity).

Accuracy guaranteed minimum flow velocity: Reynolds number must be 20000 or more (40000 or more for 150A and 200A). In the same way, select the larger value of flow velocity obtained from Figure-a or Figure-b. But Figure-b shows the curve of Reynolds number 5000. For Reynolds number 20000 (40000 at 150A and 200A), relevant value should be four times (eight times) the flow velocity obtained from figure-b.

The method of calculating the measurable range and the linear range are shown in the tables below.

•Range of Measurable Flow Velocity

| Medium | Minimum flow velocity | Maximum flow velocity |
|------------|---|---|
| Liquid | Larger value of flow velocity obtained from Fig.-a and Fig.-b | 7m/s |
| Gas, Steam | Value obtained from Fig.-a | Smaller value between 75m/s and the velocity obtained from Fig.-c |

•Range of Accuracy Guaranteed Flow Velocity

| Medium | Minimum flow velocity | Maximum flow velocity |
|------------|---|--|
| Liquid | Larger value of velocities obtained from Fig.-a or Fig.-b times 4 (For 150A and 200A, Fig.-b times 8) | 7m/s |
| Gas, Steam | | Smaller value between 75 m/s and the velocity obtained from Fig.-c |

$$Q_r = \frac{v \times D^2}{353.7} \text{ or } Q_r = 3600 \times v \times s$$

式中: Q_r — Volume flow rate at operating conditions (m³/h)

v — Flow velocity (m/s)

D — Internal diameter of flow-meter body (mm)

s — Sectional area of flow-meter body (m²)

$$25A: v = \sqrt[5]{\frac{530}{\rho}} \text{ (14.6kg/m}^3\text{以上)}$$

$$40A, 100A: v = \sqrt[5]{\frac{1260}{\rho}} \text{ (4.9kg/m}^3\text{以上)}$$

$$50A: v = \sqrt[5]{\frac{200}{\rho}} \text{ (16.7kg/m}^3\text{以上)}$$

$$80A: v = \sqrt[5]{\frac{530}{\rho}} \text{ (8.7kg/m}^3\text{以上)}$$

$$150A: v = \sqrt[5]{\frac{4100}{\rho}} \text{ (2.2kg/m}^3\text{以上)}$$

$$200A: v = \sqrt[5]{\frac{13500}{\rho}} \text{ (1.68kg/m}^3\text{以上)}$$

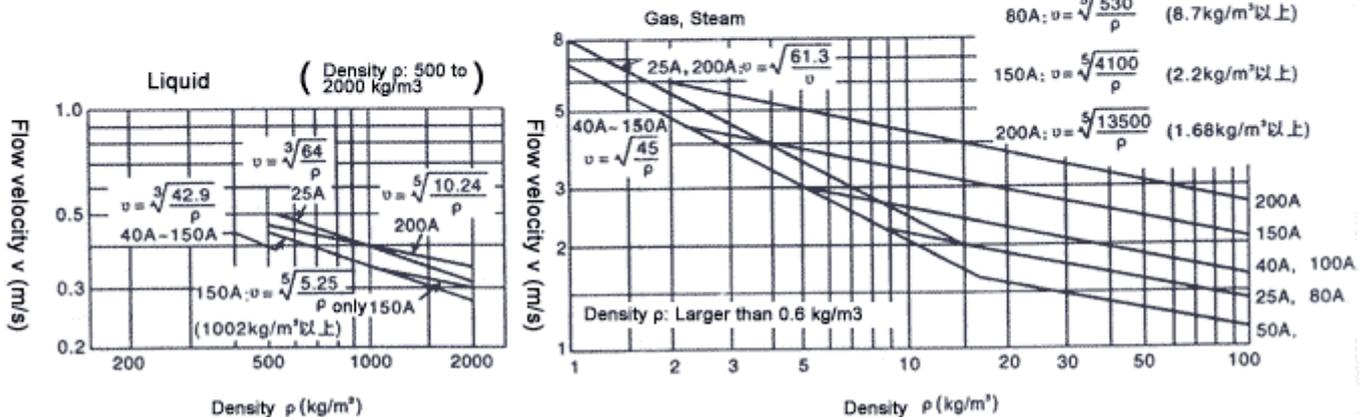


Fig.-a: Relationship between Minimum Velocity and Density

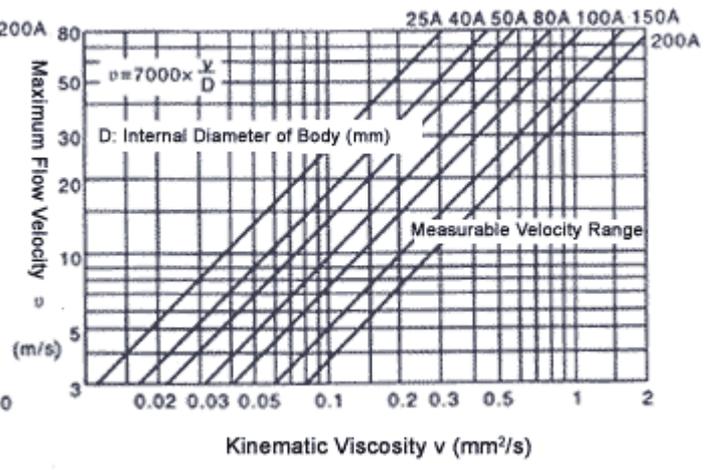
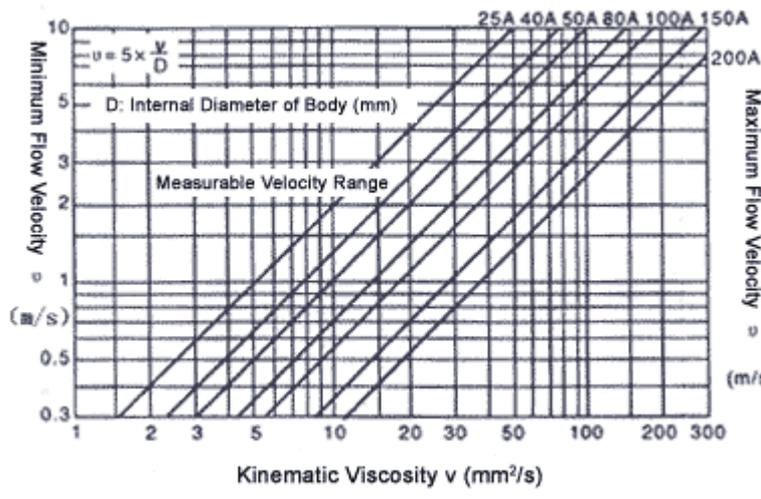
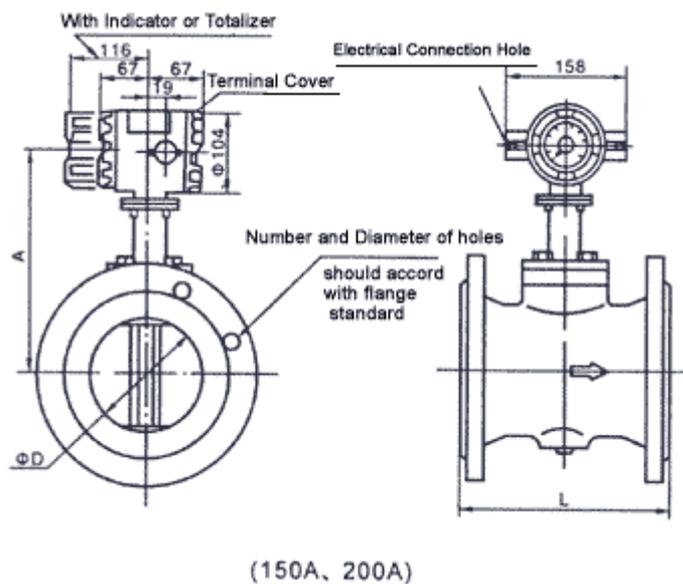
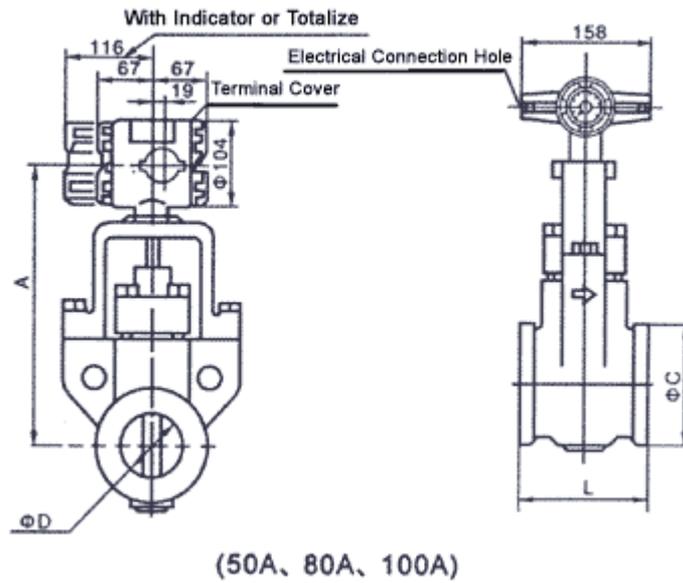
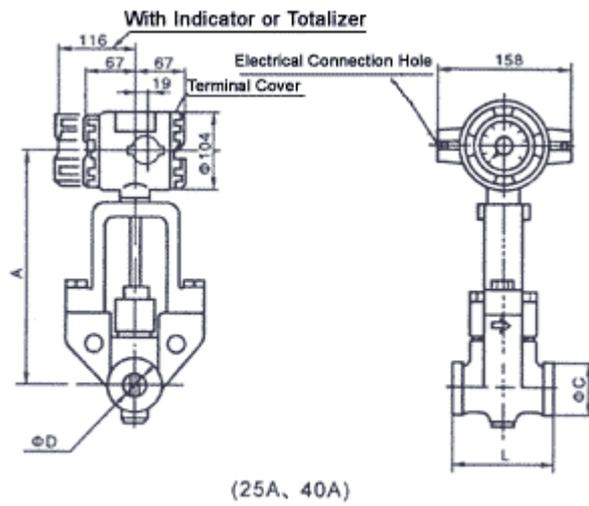


Fig.-b: Relationship between Velocity and Kinematic Viscosity (Re=5,000)

Fig.-c: Relationship between Velocity and Kinematic Viscosity (Re=7,000,000)

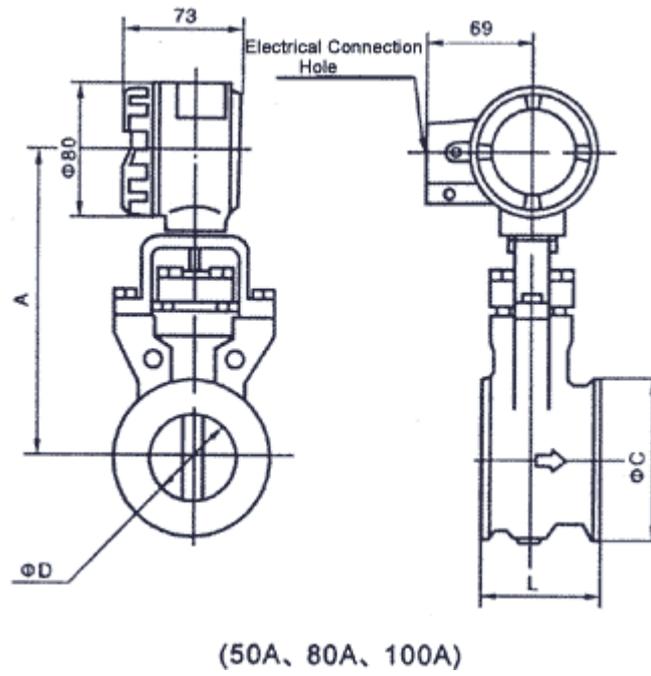
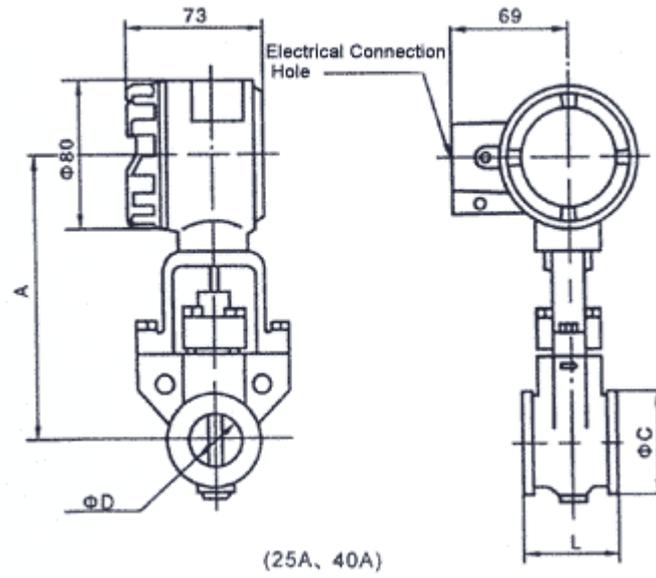
□EXTERNAL DIMENSIONS

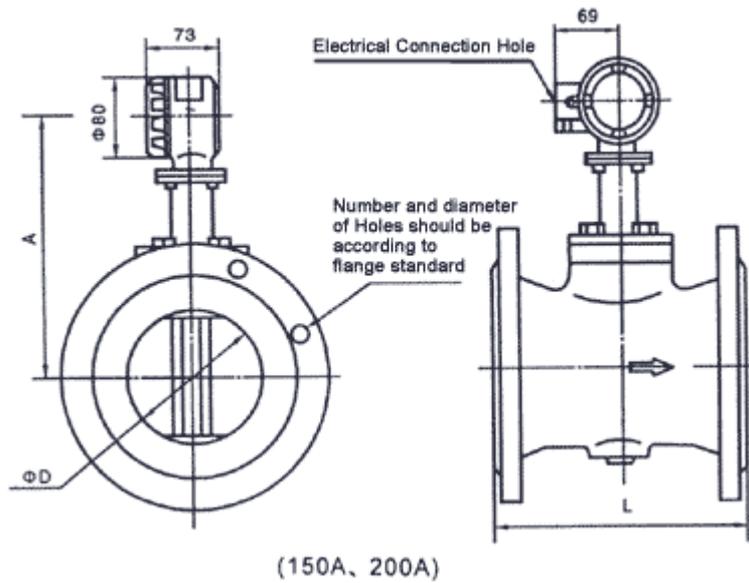
- Integral Type



| Nominal Size | A | ΦD | ΦC | L | Weight (kg) |
|--------------|-----|-------|-------|-----|-------------|
| 25A | 192 | 25.7 | 50.8 | 70 | 4.3 |
| 40A | 199 | 39.7 | 73 | 70 | 4.9 |
| 50A | 221 | 51.1 | 92 | 75 | 6.6 |
| 80A | 238 | 71.0 | 127 | 100 | 10 |
| 100A | 253 | 93.8 | 157.2 | 120 | 13.4 |
| 150A | 272 | 138.8 | | 270 | 44 |
| 200A | 304 | 185.6 | | 310 | 58 |

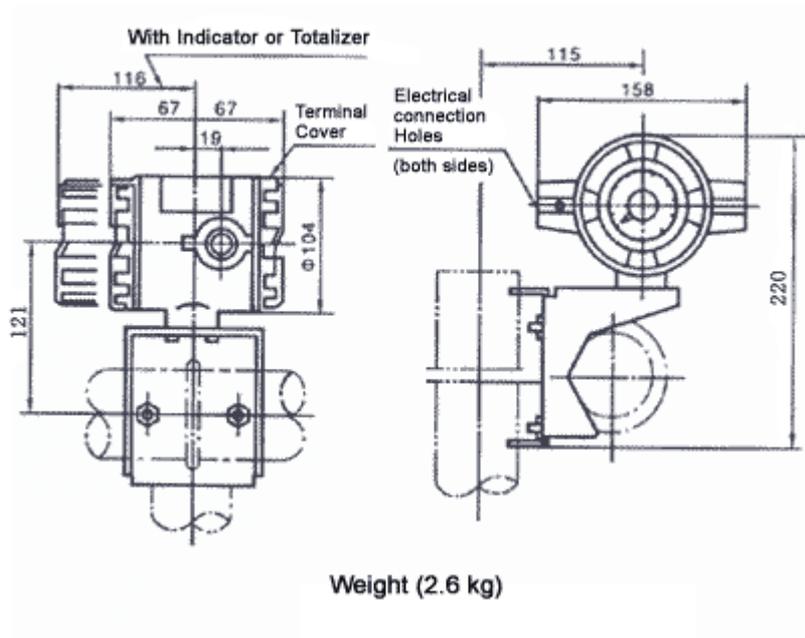
• Remote Type





| Nominal Size | A | ΦD | ΦC | L | Weight(kg) |
|--------------|-----|-------|-------|-----|------------|
| 25A | 180 | 25.7 | 50.8 | 70 | 3.3 |
| 40A | 187 | 39.7 | 73 | 70 | 3.9 |
| 50A | 209 | 51.1 | 92 | 75 | 5.6 |
| 80A | 226 | 71.0 | 127 | 100 | 9.0 |
| 100A | 241 | 93.8 | 157.2 | 120 | 12.4 |
| 150A | 260 | 138.8 | | 270 | 43 |
| 200A | 292 | 185.6 | | 310 | 57 |

- Converter of Vortex Flow-meter



□ Related Instruments

- Digital Flow totalizers

| Model | Function description |
|------------|--|
| XSJ-39A(I) | Simultaneously displaying momentary flow rate and total flow; 4 to 20 mA |

| | |
|------------|--|
| K) | output; flow control for fixed displacement is feasible. |
| XSJ-39B(I) | Total flow and flow rate display; 4 to 20 mA output; with error less than $\pm 0.1\%$; compact structure; LED or LCD display selectable; power-off protection durable over five years. |
| XSF-40A | Accumulating total flow and indicating momentary flow rate; 0 to 10 mA or 4 to 20 mA output. |
| SXP-3113 | Modular design; compensating for temperature, pressure as desired; displaying total amount, momentary rate and its percentage of mass or volume flow; 0 to 10 mA or 4 to 20 mA output; also usable for accumulating and indicating gas flow. |
| XSK-10B | Digital flow controller for fixed displacement, used for proportional bottling; displaying flow rate and total flow of liquid. |

□ Ordering Instructions

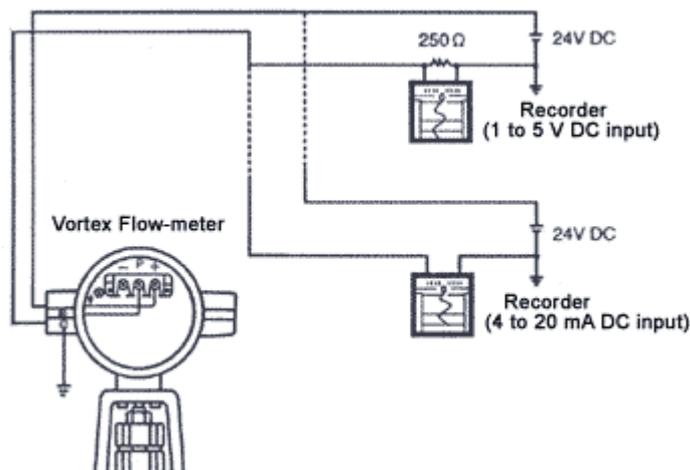
Please specify the following items when ordering:

- Model, suffix codes and options.
- Flow conditions:
 - a. Fluid name, or gas composition
 - b. Maximum scale reading, normal flow rate and minimum flow rate.
 - c. Maximum and normal operating temperature.
 - d. Maximum and normal operating pressure.
 - e. Density at normal operating conditions.
 - f. Viscosity at normal operating conditions.
 - g. Relative humidity at normal operating conditions (wet gas only).
 - h. Deviation factor
- K. (only for gas, omission not allowed).

□ Terminal Configuration and Terminal Wiring Diagrams

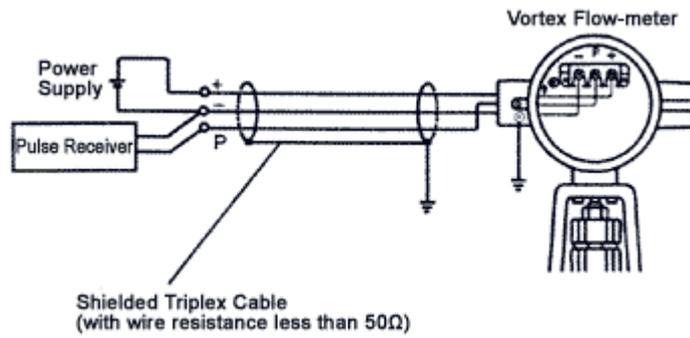
1. Wiring of Integral Type

- Wiring for Analog Output Type



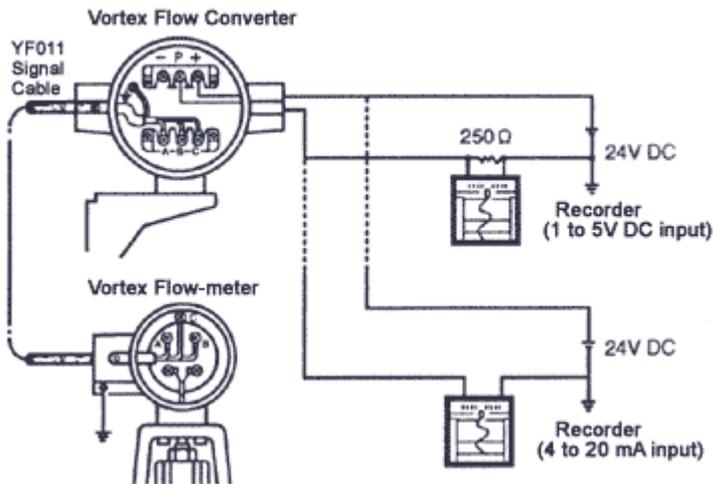
Note: If customer selects the flow meter of analog output type, and temporarily uses only local display with current signals not in use, a load resistance of 250~300 Ω should be connected between the terminals "p" and "-".

- Wiring for Pulse Output Type



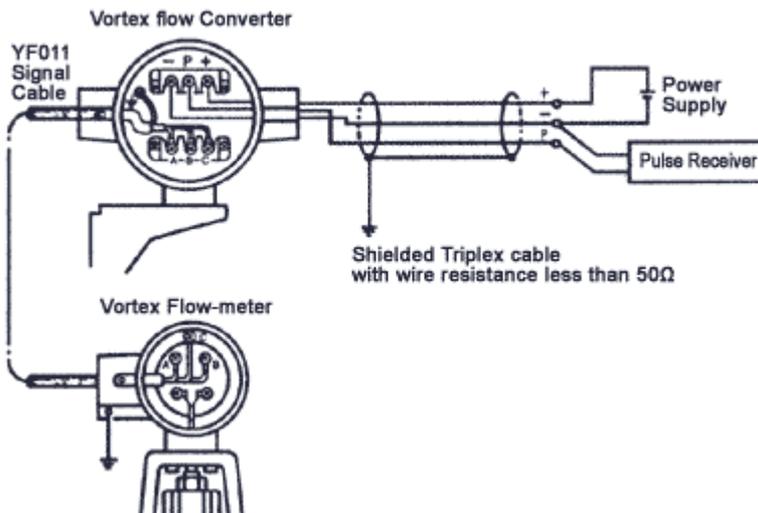
2. Wiring of Remote Type

- Wiring for Analog Output Type



Note: If customer selects the flow-meter of analog output type, and temporarily uses only local display with current signals not in use, a load resistance of 250~300Ω should be connected between the terminals "p" and "-".

- Wiring for Pulse Output type



Note: After the signal cable has been connected, the shield cover must be mounted on, so as to guard against outside interference.