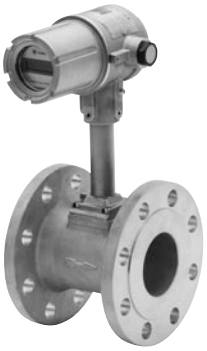
OVAL

# Excellent Vortex Flowmeter
# SMART TYPE EX DELTA Ⅱ
# SMART TYPE EX DELTA Ⅱ DIA
## (Stainless Steel Enclosure)

**GENERAL SPECIFICATION**

**GS.No.GBD643E-1N**

Fixed sensor
Wafer type
(MODEL: VXW)



Fixed sensor
Flanged type
(MODEL: VXU)

Fixed sensor
Flanged type (weld neck flange)
(MODEL: VXF)

Separate type sensor
Wafer type
(MODEL: VXW)

Separate type sensor
Flanged type
(MODEL: VXU)

Separate type sensor
Flanged type (weld neck flange)
(MODEL: VXF)

Separate type converter
(MODEL: PA25S)

## ■ GENERAL

The smart type EX DELTA II has been evolved with the smart functions of various conversion computing, intelligent functions of setting, changing, self-diagnosis and loop check with calling of range and every factor to be entered. Furthermore, additionally provided communication function utilizing a Smart Communication Unit (EL2310), can execute those operations such as setting and calling of each parameter and also communication with an upper ranked computer.

## ■ MODEL EXPLANATION

VXW: Fixed sensor Wafer type
VXU : Fixed sensor Flanged type
VXF : Fixed sensor Flanged type (weld neck flange)

## ■ FEATURES

1. Materialization of 2 wires transmission system for cost reduction and simplification of a system to be applied.
2. Ease to data setting.
3. Maintenance cost saving means increase of security operation.
4. Maintenance operation such as range and parameter setting, and calibration can be performed.

OVAL Corporation

http://www.oval.co.jp/english

Head Office (Tokyo): Tel. +81 3-3360-5121 Fax. +81 3-3365-8605
International Sales Division Email: SK10@oval.co.jp
Overseas Branch Offices: Beijing, Seoul, Singapore, Taipei

# ■ GENERAL SPECIFICATIONS

## ●EX DELTA Ⅱ Meter Body

| Item | Description | | |
|---|---|---|---|
| Sensor type | Fixed sensor | Fixed sensor | |
| Nominal size (mm) | 10,15, 25, 40, 50, 80, 100, 150 | 15, 25, 40, 50, 80, 100, 150, 200, 250, 300 | |
| Body style | Wafer type (※ 10) | Flanged type (RF is standard) | |
| Flange rating | JIS10, 16, 20, 30K ASME/JPI150, 300, 600<br>DIN PN10, 16, 25, 40 | | |
| St'd. connecting pipe | Nominal wall thickness Sch. 40 (※ 1) | | |
| Applicable fluid | Liquids, gases and steam (※ 2) | | |
| Flow range | See flow range table. Refer to page 4. (P5, 6, 7, 8) | | |
| Operating temp. range (※ 3) | Ambient temperature type : –30 to +120˚C<br>Standard type : –30 to +300˚C | | |
| Max. operating pressure | Depends on flange rating (Design pressure : 5.00MPa) | | |
| Accuracy (※10) | Refer to the following table. If multiple choices are available for accuracy, the flow range is different. | | |

| Nom. size (mm) / Applicable fluid | 10 | 15, 25, 40, 50 | 80, 100, 150, 200, 250, 300 |
|---|---|---|---|
| Liquids | ±2% of full scale or better (※4) | ・±1% of reading or better (※6)<br>・±1% of full scale or better (※5) (※7) | |
| Liquids (Applicable to high accuracy.) | — | ・±0.75% of reading or better (※6)<br>・±0.75% of full scale or better (※5) (※7) | |
| Gases (Standard) | ±2% of full scale or better (※4) | ・±1% of reading or better (※6)<br>・±1% of full scale or better (※5) (※7) | |
| Steam (Standard) | — | | |
| gases and steam (Max. flow velocity : 80m/s) | — | — | ・±1.5% of reading or better (※6)<br>・±1.5% of full scale or better (※5) (※7) |

| | | | |
|---|---|---|---|
| Repeatability | ±0.2% or better | | |
| Material | Body | SCS14A | SUS316 or SCS14A<br>(Nom. size 200 to 300mm…Flange material is SUS316 or SFVC2A.) |
| | Bluff body (Delta shaped) | SUS316 or SCS14A | |
| | Adapter | SUS304 or SCS13A | |
| Installation | No restrictions to cause loss of accuracy on physical orientation<br>(Maintainability and waterproof work for cable entry should be taken into consideration) | | |
| Finish | Nominal size 200 to 300mm :Phthalate resin finished Munsell 2.5G8/2 (SFVC2A only) | | |

※1: If different from piping of standard nominal wall thickness, consult the factory.
※2: With 15mm,steam is not measurable.
※3: With nominal size 200 to 300mm and flange material SFVC2A, the allowable operating temperature covers a range above 0°C due to temperature limitations by flange material.
※4: Rated maximum flow regardless of the meaning of full scale and output specification.
※5: Full scale means rated maximum flowrate in case of pulse and analog full scale setting in case of analog.
※6: ±0.1% of full scale is added in case of analog output.
※7: With analog output
If the maximum operating flowrate (full scale) ÷ Minimum flowrate is 4 or less even if the flow range is within ±1% of full scale, ±2% of full scale shall be adopted. However, the maximum operating flowrate (full scale) shall be greater than the lower limit ±1% of reading.
※8: Calibration under actual flow test is required.
※9: As nominal size 10mm is based on ASME and JPI standards, nominal size of the piping connected shall be 15mm for standard.
※10: If you want to use the instrument for gas and steam measurement in the region of high pressure (high Reynolds number: 2.8×10^6 or over), contact OVAL.

## ●EX DELTA Ⅱ・DIA Meter Body

| Item | Description | |
|---|---|---|
| Sensor type | Fixed sensor | Fixed sensor |
| Nominal size | 15, 25, 40, 50, 80mm | 50, 80mm |
| Body style | Wafer type | Flanged type (RF is standard.) |
| Flange rating | JIS 10, 16, 20, 30K ASME/JPI 150, 300 | |
| Applicable fluid | Liquids | |
| Materials | Body | SUS316 or SCS14A |
| | Bluff body (Diamond shaped) | SUS316 |
| | Adapter | SUS304 or SCS13A |
| Accuracy | Depends of use conditions (flow range). ① ±1% of reading or better (±0.1% of full scale is added in case of analog output.)<br>② ±1% of full scale or better (※ 2) (※ 3) | |
| Finish | Not painted (because of stainless steel material) | |

※1: Items other than above are common with that of EX DELTA Ⅱ bodies.
※2: Full scale means rated maximum flowrate in case of pulse and analog full scale setting in case of analog.
※3: With analog output
If the maximum operating flowrate (full scale) ÷ Minimum flowrate is 4 or less even if the flow range is within ±1% of full scale, ±2% of full scale shall be adopted. However, the maximum operating flowrate (full scale) shall be greater than the lower limit ±1% of reading.

## ■ CONVERTER SPECIFICATIONS

| Item | | Description |
|---|---|---|
| Model | | PA25S (w/Totalizer, Digital Indicator) |
| Mounting | | Select one of the following:<br>① Integral with flowmeter ② Separate type (installed on 2" pipe) |
| Waterproof configuration | | IP66-IEC/EN 60529, JIS C 0920 -- NEMA TYPE 4X |
| Explosionproof configuration | | Select one of the followings:<br>① Non-explosionproof configuration<br>② Flameproof configuration ITRI: Exd ⅡB+$H_2$T6 to T2<br>③ Flameproof configuration ATEX: Ⅱ2G Exd ⅡB+$H_2$T6 to T3<br>④ Flameproof configuration IECEx: Exd ⅡB+$H_2$T6 to T2 |
| Ambient temperature | | Non-explosionproof configuration: –20 to +60˚C<br>Explosionproof configuratio: –20 to +60˚C |
| Ambient humidity | | 5 to 100%RH without dew condensation |
| Material | | SCS14A |
| Housing finish | | Unpainted |
| Output (Choose any of the following. ) | Current signal | Current signal, 2-wire type (used in common with power line)<br>① Compensated pulse (factored pulse), Pulse level: [0]: 4mA, [1]: 20mA Pulse width: 10 to 1000ms (Standard 50ms)<br>② Uncompensated pulse (vortex synchronized pulse), Pulse level: [0]: 4mA, [1]: 20mA, Pulse width: 200ч s<br>③ Analog 4 to 20mADC at 0 to FS, Time constant: 0 to 100s (Standard: 2.5s) |
| | Open collector pulse | 3-wire type, NPN transistor output (Max. impressed voltage: 30VDC, Allowable current: 50mA, ON voltage: 1.5VDC or less)<br>① Compensated pulse (factored pulse), Pulse width: 10 to 1000ms (Standard 50ms)<br>② Uncompensated pulse (vortex synchronized pulse), Pulse width: 200ч s |
| Display | | Display: 7 segments LCD<br>Content: One of the following 4 displays is possible with switching over of an internal switch or a EL2310<br>① Totalizing flow throughput: 6 digits Unit of totalizing: Same as scaled pulse output<br>Unit of flow rate indication: Refer to (※3)<br>•Upon power interruption, Totalized counts are held by non-volatilized memory<br>•Totalized counts are resettable by an internal switch or EL2310<br>② Actual instantaneous flowrate: 7 digits (3 1/2 digits are effective) Unit of flow rate indication: Refer to (※3)<br>③% Instantaneous flowrate:<br>Unit of display: % FS Resolution on display: 0.1%<br>Full scale: Same as that of analog output<br>④ 8 scaled % Bar graph<br>Display: % FS<br>Full scale: Same as that of Analog output |
| Power supply (※1) | | 12 to 45V DC (See Load Resistance Range curve) |
| Cable entry | | G1/2 internal threads |
| Cable | | Converter to receiving instrument: 1.25mm² Min., 2-conductor shield cable (analog, voltage pulse type),<br>3-conductor shield cable (open collector pulse type)<br>Sensor to converter: 1.25mm² Min., 3-conductor shield cable (applicable to separate type)<br>Finished cable outside diameter: Non-explosionproof $\phi$ 13.5mm Max Flameproof $\phi$ 8.5 to $\phi$ 11mm |
| Transmission length | | Converter to receiving instrument: 1km Max<br>Sensor to converter: 200m Max (applicable to separate type) |
| Communication | | HART Protocol Communication (※2) |
| Computation | | •Actual flow rate computation (Liquid, Gas, Steam) •Temp./Press. correcting computation (Gas) |

| Unit of Indicated Flowrate<br>Top: Instantaneous flowrate units<br>Bottom: Total flow units | Calculation of actual flow | Calculation corrected for temp. and press. |
|---|---|---|
| L/min, L/h, m³/min, m³/h, kL/min, kL/h<br>L, m³, kL | ○ | × |
| L/min (normal), L/h (normal), m³/min (normal), m³/h (normal),<br>L (normal), m³ (normal) | × | ○ |
| g/min, g/h, kg/min, kg/h, t/min, t/h<br>g, kg, t | ○ | ○ |
| ton (US)/min, ton (US)/h<br>ton (US) | ○ | ○ |
| gal (US) /min, gal (US) /h<br>gal (US) | ○ | × |
| ft³/sec, ft³/min, ft³/h,<br>ft³ | ○ | × |
| SCFS (=ft³/sec [standard]), SCFM (=ft³/min [standard]), SCFH (=ft³/h [standard])<br>SCFT (=ft³ [standard]) | × | ○ |
| lb/min, lb/h<br>lb | ○ | ○ |

※1: If you connect OVAL communication unit EL2310, use power supply below 33V DC.
※2: In case a specification for Pulse output is given, Communication function is available only under the following conditions:
① During flow interruption
② Upon Power “ON” (Continuous communication is available if communication starts within 15 sec. after Power “ON” )
※3: Unit of indicated flow rate can be selected from the above table. For the unit of instantaneous flow rate, the units enclosed by thick lines can be combined.
● Guidelines to set the analog output and indicator full scale are given below:
3 times the minimum flowrate ≦ Full scale ≦ 1.3 times the max. flowrate. For minimum and maximum flowrates, refer to the section "Flow Ranges".
If you want to set up a full scale outside the range above, consult the factory.

## ■ CONFORMITY EN DIRECTIVES

| | |
|---|---|
| Applicable EU Directives | EMC: 2014/30/EU<br>ATEX: 94/9/EC |
| Applicable EN Standards | EMC: EN61326-1 : 2013 Class A<br>ATEX: EN60079-0 : 2006, EN60079-1, 2007 |

### ● Flange Rating and Max. Operating Pressure (MPa)

**Nominal size 10 to 300mm (with material SUS316 or SCS14A)**

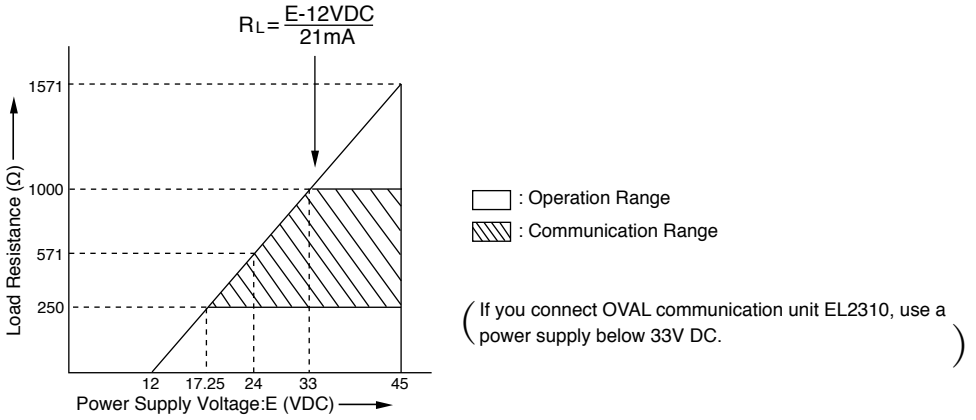
| Flange Rating / Operating Temperature | JIS10K | JIS16K | JIS20K | JIS30K | ASME/ JPI 150 | ASME/ JPI 300 | DIN PN10 | DIN PN16 | DIN PN25 | DIN PN40 |
|---|---|---|---|---|---|---|---|---|---|---|
| Below 120˚C | 1.40 | 2.70 | 3.40 | 5.00 | 1.50 | 3.93 | 0.74 | 1.19 | 2.05 | 2.99 |
| Below 220˚C | 1.18 | 1.96 | 2.45 | 4.51 | 1.27 | 3.35 | 0.62 | 1.00 | 1.78 | 2.50 |
| 220 to 300˚C | 0.98 | 1.77 | 2.26 | 4.22 | 1.02 | 3.06 | 0.56 | 0.90 | 1.61 | 2.26 |

**Nominal size 200 to 300mm (with flange material SFVC2A)**

| Flange Rating / Operating Temperature | JIS10K | JIS16K | JIS20K | JIS30K | ASME/JPI 150 | ASME/JPI 300 |
|---|---|---|---|---|---|---|
| Below 120˚C | 1.40 | 2.70 | 3.40 | 5.00 | 1.69 | 4.59 |
| Below 220˚C | 1.18 | 2.45 | 3.04 | 4.51 | 1.32 | 4.31 |
| 220 to 300˚C | 0.98 | 2.26 | 2.84 | 4.22 | 1.02 | 3.87 |

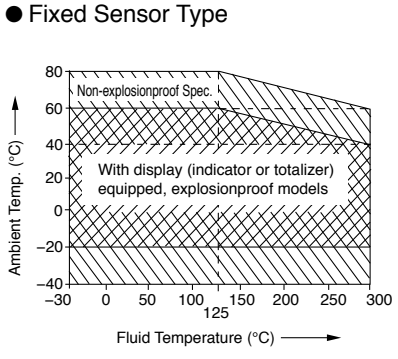
※ Contact us for the maximum allowable working pressure in case of exceeding 5MPa in ASME/JPI600.

### ● Acceptable Load Resistance Range




### ● Ambient Temperature Range

If the fluid temperature exceeds 125°C, allowable ambient temperature is reduced as shown in the diagram below.



## ■ SCALED PULSE UNITS AND TOTALIZRD INDICATED UNITS

The table below shows the scaled pulse units and totalized indicated units in volume flow rate. For fixed conversion into units other than volume flowrate, such as normal flow rate, determine it by referring to Tables A through H.

| Applicable Fluid | Nominal Size mm(inch) | Max. Rate $m^3/h$ (Unscaled pulse freq., Hz) | Nom. Meter Factor L/P (Nom. unscaled pulse unit) | Output Freq. (Hz) ※1 Q : Volume flow $m^3/h$ | Converter PA25 Scaled Pulse unit | | |
|---|---|---|---|---|---|---|---|
| | | | | | Min. | Standard | Max. |
| Liquids | 10 (3/8) | 2.8 (453.8) | 0.001714 | 162Q | 0.1 L/P | 1 L/P | 100 L/P |
| | 15 (1/2) | 6.0 (312.2) | 0.005338 | 52.0Q | 1 L/P | 10 L/P | 100 L/P |
| | 25 (1) | 20 (344.3) | 0.01613 | 17.2Q | 1 L/P | 10 L/P | 1 $m^3/P$ |
| | 40 (11/2) | 48 (292.7) | 0.04556 | 6.10Q | 10 L/P | 100 L/P | 1 $m^3/P$ |
| | 50 (2) | 79 (219.2) | 0.1001 | 2.78Q | 10 L/P | 100 L/P | 10 $m^3/P$ |
| | 80 (3) | 172 (143.6) | 0.3328 | 0.835Q | 10 L/P | 100 L/P | 10 $m^3/P$ |
| | 100 (4) | 296 (108.7) | 0.7567 | 0.367Q | 10 L/P | 100 L/P | 10 $m^3/P$ |
| | 150 (6) | 645 (74.0) | 2.422 | 0.115Q | 100 L/P | 1 $m^3/P$ | 100 $m^3/P$ |
| | 200 (8) | 1130 (44.7) | 7.021 | 0.0396Q | 100 L/P | 1 $m^3/P$ | 100 $m^3/P$ |
| | 250 (10) | 1750 (35.9) | 13.54 | 0.0205Q | 1 $m^3/P$ | 1 $m^3/P$ | 1000 $m^3/P$ |
| | 300 (12) | 2510 (30.0) | 23.24 | 0.012Q | 1 $m^3/P$ | 1 $m^3/P$ | 1000 $m^3/P$ |
| Gases | 10 (3/8) | 8.5 (1378) | 0.001714 | 162Q | 1 L/P | 10 L/P | 100 L/P |
| | 15 (1/2) | 33 (1717) | 0.005338 | 52.0Q | 1 L/P | 10 L/P | 100 L/P |
| | 25 (1) | 130 (2239) | 0.01613 | 17.2Q | 10 L/P | 100 L/P | 1 $m^3/P$ |
| | 40 (11/2) | 290 (1768) | 0.04556 | 6.10Q | 10 L/P | 100 L/P | 1 $m^3/P$ |
| | 50 (2) | 490 (1360) | 0.1001 | 2.78Q | 100 L/P | 1 $m^3/P$ | 10 $m^3/P$ |
| | 80 (3) | 1380 (1152) | 0.3328 | 0.835Q | 100 L/P | 1 $m^3/P$ | 10 $m^3/P$ |
| | 100 (4) | 2370 (870.0) | 0.7567 | 0.367Q | 100 L/P | 1 $m^3/P$ | 10 $m^3/P$ |
| | 150 (6) | 5160 (591.8) | 2.422 | 0.115Q | 1 $m^3/P$ | 10 $m^3/P$ | 100 $m^3/P$ |
| | 200 (8) | 9100 (360) | 7.021 | 0.0396Q | 1 $m^3/P$ | 10 $m^3/P$ | 100 $m^3/P$ |
| | 250 (10) | 14000 (287) | 13.54 | 0.0205Q | 1 $m^3/P$ | 10 $m^3/P$ | 1000 $m^3/P$ |
| | 300 (12) | 20100 (240) | 23.24 | 0.012Q | 1 $m^3/P$ | 10 $m^3/P$ | 1000 $m^3/P$ |

※1: Depending on specials and the meter factor after meter calibration, the selectable factored pulse output units may vary.

## ■ EX DELTA Ⅱ DIA FACTORED PULSE UNITS

| Nominal Size mm (inch) | Max. Rate $m^3/h$ (Unfactored pulse freq., Hz) | Nom. Meter Factor (L/P) | Scaled pulse unit ✻ | | |
|---|---|---|---|---|---|
| | | | Minimum | Standard | Maximum |
| 15 (1/2) | 6.0 (322.5) | 0.005168 | 1 L/P | 10 L/P | 100 L/P |
| 25 (1) | 20 (375.4) | 0.01480 | 1 L/P | 10 L/P | 1 $m^3/P$ |
| 40 (11/2) | 48 (242.4) | 0.05500 | 10 L/P | 100 L/P | 1 $m^3/P$ |
| 50 (2) | 79 (190.7) | 0.1151 | 10 L/P | 100 L/P | 10 $m^3/P$ |
| 80 (3) | 172 (121.1) | 0.3946 | 10 L/P | 100 L/P | 10 $m^3/P$ |

Note: Unit of a built-in totalizer is same as the scaled pulse unit.

## ■ FLOW RANGES

### ●Liquid Service

Select the minimum flow rate from Table A (based on Sp. Gr.) or Table B (based on viscosity), whichever is greater.

**Table A (based on specific gravity): EX DELTA Ⅱ**

Unit in m³/h

| Nominal size mm \ Sp. Gr. | Minimum flow rate | | | | | | | | Maximum Flow rate |
|---|---|---|---|---|---|---|---|---|---|
| | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | 1.0 | 1.1 | 1.2 | |
| 10 | 0.3 | 0.3 | 0.3 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 2.8 |
| 15 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.3 | 0.3 | 0.3 | 6 |
| 25 | 1.0 | 0.9 | 0.9 | 0.8 | 0.8 | 0.7 | 0.7 | 0.7 | 20 |
| 40 | 1.7 | 1.6 | 1.4 | 1.4 | 1.3 | 1.3 | 1.2 | 1.1 | 48 |
| 50 | 2.8 | 2.5 | 2.3 | 2.2 | 2.1 | 2.0 | 1.9 | 1.8 | 79 |
| 80 | 6.0 | 5.5 | 5.1 | 4.7 | 4.6 | 4.6 | 4.6 | 4.6 | 172 |
| 100 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 296 |
| 150 | 33 | 33 | 33 | 33 | 33 | 33 | 33 | 33 | 645 |
| 200 | 68 | 62 | 57 | 54 | 51 | 48 | 46 | 44 | 1130 |
| 250 | 149 | 136 | 126 | 118 | 111 | 106 | 101 | 96 | 1750 |
| 300 | 214 | 195 | 181 | 169 | 159 | 151 | 144 | 138 | 2510 |

**Table A (based on specific gravity): EX DELTA Ⅱ DIA**

Unit in m³/h

| Nominal size mm \ Sp. Gr. | Minimum flow rate | | | | | | | | Maximum Flow rate |
|---|---|---|---|---|---|---|---|---|---|
| | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | 1.0 | 1.1 | 1.2 | |
| 15 | 0.6 | 0.6 | 7.5 | 0.5 | 0.5 | 0.4 | 0.4 | 0.4 | 6 |
| 25 | 1.4 | 1.3 | 1.2 | 1.1 | 1.1 | 1.0 | 1.0 | 0.9 | 20 |
| 40 | 2.4 | 2.2 | 2.0 | 1.9 | 1.8 | 1.7 | 1.6 | 1.5 | 48 |
| 50 | 3.8 | 3.5 | 3.2 | 3.0 | 2.9 | 2.7 | 2.6 | 2.5 | 79 |
| 80 | 8.4 | 7.6 | 7.1 | 6.6 | 6.2 | 5.9 | 5.7 | 5.4 | 172 |

**Table B (based on viscosity)**

**Table B (based on viscosity)** Unit in m³/h

Unit in m³/h

| Size mm | Viscosity mm²/s \ Accuracy | Minimum flow rate | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 5 | 10 | 15 | 20 | 25 | 30 | 40 |
| 10 | ± 2%FS | | 0.3 | 0.4 | 0.6 | 1.1 | Beyond Measurement | | | | |
| 15 | ± 1%RD | 0.8 | 1.6 | 2.4 | 3.9 | | | | | | |
| | ± 1%FS | 0.4 | 1.2 | 1.8 | 2.9 | | | | | | |
| 25 | ± 1%RD | 1.6 | 3.1 | 4.6 | 7.6 | 16 | | | | | |
| | ± 1%FS | | | | 1.8 | 5.9 | 11 | 15 | 19 | | |
| 40 | ± 1%RD | 2.4 | 4.7 | 7.0 | 12 | 24 | 35 | | | | |
| | ± 1%FS | | | | 2.8 | 6.5 | 14 | 22 | 29 | 35 | |
| 50 | ± 1%RD | 3.0 | 6.0 | 9.0 | 15 | 30 | 45 | 60 | | | |
| | ± 1%FS | | | | 3.6 | 7.1 | 15 | 24 | 34 | 42 | 59 |
| 80 | ± 1%RD | | 8.9 | 14 | 23 | 45 | 67 | 89 | 110 | 130 | |
| | ± 1%FS | | | | | 11 | 16 | 26 | 38 | 53 | 82 |
| 100 | ± 1%RD | | 12 | 18 | 29 | 58 | 87 | 120 | 150 | 180 | 230 |
| | ± 1%FS | | | | | 14 | 21 | 28 | 45 | 55 | 96 |
| 150 | ± 1%RD | | | | 43 | 86 | 130 | 170 | 220 | 260 | 340 |
| | ± 1%FS | | | | | | | 41 | 51 | 61 | 100 |
| 200 | ± 1%RD | | | | | 113 | 170 | 230 | 280 | 340 | 450 |
| | ± 1%FS | | | | | | | | 68 | 81 | 110 |
| 250 | ± 1%RD | | | | | 140 | 210 | 280 | 350 | 420 | 560 |
| | ± 1%FS | | | | | | | | | | 140 |
| 300 | ± 1%RD | | | | | 170 | 250 | 340 | 420 | 500 | 680 |
| | ± 1%FS | | | | | | | | | 180 | 230 |

- In the shadowed area ▭, determine on the basis of specific gravity (Table A).
- RD : Reading, FS : Full Scale

### ●Minimum measurable flowrate (minimum detectable flowrate)

**Fluid (Viscosity 1mPa·s)**

Unit in m³/h

| Nominal size mm \ Sp. Gr. | Measurable flowrate | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | 1.0 | 1.1 | 1.2 |
| **10** | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.1 | 0.1 | 0.1 |
| **15** | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.2 | 0.2 | 0.2 |
| **25** | 0.7 | 0.7 | 0.6 | 0.6 | 0.6 | 0.5 | 0.5 | 0.5 |
| **40** | 1.2 | 1.1 | 1.0 | 1.0 | 0.9 | 0.9 | 0.8 | 0.8 |
| **50** | 1.9 | 1.8 | 1.6 | 1.5 | 1.5 | 1.4 | 1.3 | 1.3 |
| **80** | 4.2 | 3.8 | 3.6 | 3.3 | 3.3 | 3.3 | 3.3 | 3.3 |
| **100** | 7.7 | 7.7 | 7.7 | 7.7 | 7.7 | 7.7 | 7.7 | 7.7 |
| **150** | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 |
| **200** | 48 | 43 | 40 | 38 | 36 | 34 | 32 | 31 |
| **250** | 105 | 95 | 88 | 83 | 78 | 74 | 71 | 68 |
| **300** | 150 | 137 | 127 | 118 | 112 | 106 | 101 | 97 |

## ●Gas Service

In this table, flow rates are specified in [actual] base. Therefore, in case of [normal] base, make sure to convert the flow rate to the [actual] and determine the flow range and the nominal diameter based on this table.

| | size mm / Accuracy / Dens.kg/m³ | | Minimum flow rate (m³/h) 0.38 | 0.7 | 1.2 | 2.0 | 3.6 | 6 | 11 | 19 | 34 | (60) | Max. flow rate (m³/h) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Table "C" | 10 | ± 2% of Full scale | 4.8 | 3.3 | 2.6 | 2.2 | 1.8 | 1.5 | 1.3 | 1.1 | 0.9 | 0.7 | 8.5 |
| | 15 | ± 1% of Reading | — | — | 12 | 7.2 | 4.0 | 3.2 | 2.6 | 2.2 | 1.8 | 1.5 | 33 |
| | | ± 1% of Full scale | 9.4 ◎ | 6.9 ◎ | 5.4 ◎ | 4.6 | 3.8 | 3.2 | 2.6 | 2.2 | 1.8 | 1.5 | |
| | 25 | ± 1% of Reading | 68 | 37 | 22 | 13 | 10 | 8 | 7 | 6 | 5 | 4 | 130 |
| | | ± 1% of Full scale | 23 | 17 | 13 | 12 | 10 | 8 | 7 | 6 | 5 | 4 | |
| | 40 | ± 1% of Reading | 110 | 57 | 33 | 20 | 16 | 13 | 11 | 9 | 8 | 6 | 290 |
| | | ± 1% of Full scale | 39 | 29 | 23 | 19 | 16 | 13 | 11 | 9 | 8 | 6 | |
| | 50 | ± 1% of Reading | 134 | 73 | 43 | 31 | 26 | 22 | 18 | 15 | 12 | 10 | 490 |
| | | ± 1% of Full scale | 63 | 46 | 37 | 31 | 26 | 22 | 18 | 15 | 12 | 10 | |
| | 80 | ± 1% of Reading | 200 | 108 | 80 | 67 | 56 | 47 | 38 | 32 | 26 | 22 | 1100( 1380) |
| | | ± 1% of Full scale | 140 | 101 | 80 | 67 | 56 | 47 | 38 | 32 | 26 | 22 | |
| | 100 | ± 1% of Reading | 260 | 174 | 140 | 115 | 95 | 80 | 66 | 55 | 45 | 37 | 1850( 2370) |
| | | ± 1% of Full scale | 240 | 174 | 140 | 115 | 95 | 80 | 66 | 55 | 45 | 37 | |
| | 150 | ± 1% of Reading | 520 | 380 | 300 | 260 | 210 | 180 | 150 | 120 | 110 | 110 | 4180( 5160) |
| | 200 | ± 1% of Reading | 900 | 670 | 520 | 440 | 370 | 310 | 250 | 250 | 250 | 250 | 7000( 9100) |
| | 250 | ± 1% of Reading | 2000 | 1470 | 1120 | 980 | 800 | 680 | 560 | 490 | 490 | 490 | 10500(14000) |
| | 300 | ± 1% of Reading | 2900 | 2100 | 1600 | 1400 | 1150 | 970 | 840 | 840 | 840 | 840 | 15000(20100) |

| | Gas (Viscosity 0.017mPs·s) / Size mm / Dens. kg/m³ | Measurable lower limit flow rate (detectable min. flowrate) (m³/h) 0.38 | 0.7 | 1.2 | 2 | 3.6 | 6 | 11 | 19 | 34 | 60 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 10 | 3.1 | 2.3 | 1.8 | 1.6 | 1.3 | 1.1 | 0.9 | 0.8 | 0.6 | 0.5 |
| | 15 | 6.5 | 4.8 | 3.7 | 3.2 | 2.7 | 2.2 | 1.8 | 1.5 | 1.3 | 1.1 |
| | 25 | 16 | 12 | 9.0 | 7.8 | 6.4 | 5.4 | 4.5 | 3.7 | 3.1 | 2.6 |
| | 40 | 27 | 20 | 16 | 14 | 11 | 9.1 | 7.4 | 6.2 | 5.1 | 4.3 |
| | 50 | 44 | 33 | 25 | 22 | 18 | 15 | 13 | 11 | 8.4 | 6.9 |
| | 80 | 96 | 71 | 54 | 47 | 39 | 33 | 27 | 23 | 19 | 16 |
| | 100 | 165 | 122 | 93 | 81 | 67 | 56 | 46 | 39 | 32 | 26 |
| | 150 | 359 | 265 | 202 | 176 | 145 | 122 | 100 | 83 | 69 | 57 |
| | 200 | 629 | 464 | 354 | 308 | 253 | 214 | 175 | 146 | 120 | 99 |
| | 250 | 1400 | 1030 | 738 | 681 | 560 | 472 | 386 | 322 | 265 | 220 |
| | 300 | 2000 | 1470 | 1130 | 976 | 803 | 677 | 553 | 461 | 380 | 315 |

| | Type of Gas | Dens. kg/Nm³ | Gas pressure (MPa〔gauge〕) at 20°C 0 | 0.08 | 0.23 | 0.55 | 0.9 | 1.65 | 3 | — | Gas viscosity |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Table "D" | Acetylene | 1.175 | — | — | | | | | | | 0.00943 (mPa·s) |
| | Argon | 1.785 | — | — | — | 0.02 | 0.12 | 0.26 | 0.55 | 1.05 | 2 | 3.6 | 0.0209 |
| | Ammonia | 0.771 | — | 0 | 0.07 | 0.21 | 0.42 | 0.75 | 1.45 | 2.55 | 4.6 | — | 0.0092 |
| | Carbon Monoxide | 1.250 | — | — | 0 | 0.07 | 0.21 | 0.42 | 0.85 | 1.55 | 2.8 | — | 0.0166 |
| | Ethane | 1.357 | — | — | 0 | 0.06 | 0.18 | 0.37 | 0.8 | 1.4 | 2.6 | — | 0.0085 |
| | Ethylene | 1.264 | — | — | 0 | 0.07 | 0.21 | 0.42 | 0.85 | 1.55 | 2.8 | — | 0.0097 |
| | Air | 1.293 | — | — | 0 | 0.07 | 0.20 | 0.4 | 0.85 | 1.5 | 2.7 | — | 0.017 |
| | Oxygen | 1.429 | — | — | 0 | 0.05 | 0.17 | 0.35 | 0.75 | 1.35 | 2.5 | 4.4 | 0.0192 |
| | Hydrogen | 0.0899 | 0.35 | 0.73 | 1.33 | 2.3 | 4.2 | — | — | — | — | — | 0.0084 |
| | Carbon Dioxide | 1.977 | — | — | — | 0.01 | 0.1 | 0.23 | 0.5 | 0.95 | 1.7 | 3.3 | 0.0138 |
| | Nitrogen | 1.251 | — | — | — | 0.07 | 0.21 | 0.42 | 0.85 | 1.55 | 2.8 | — | 0.0166 |
| | City Gas | 0.802 | — | 0 | 0.06 | 0.17 | 0.38 | 0.7 | 1.4 | 2.45 | 4.5 | — | 0.01 |
| | Natural Gas | 0.828 | — | 0 | 0.06 | 0.16 | 0.37 | 0.68 | 1.35 | 2.4 | 4.3 | — | 0.0107 |
| | Freon-12 | 5.533 | — | — | — | — | 0 | 0.02 | 0.12 | 0.27 | 0.56 | 1.1 | 0.0127 |
| | Propane | 2.020 | — | — | — | 0.01 | 0.09 | 0.22 | 0.49 | 0.9 | 1.7 | 3.2 | 0.0075 |
| | Butane | 2.703 | — | — | — | 0 | 0.04 | 0.14 | 0.34 | 0.65 | 1.2 | 2.4 | 0.0069 |
| | Methane | 0.717 | — | 0 | 0.08 | 0.2 | 0.44 | 0.8 | 1.55 | 2.8 | — | — | 0.0103 |

Note: In nominal size 15mm, figures marked ◎ indicate ±2% of Full scale. Figures in brackets ( ) in the max. rate indicate with ±1.5% of readings. Accuracy of 10mm in nom. size is ±2% or better with respect to the max. rated flow rate.

### How to Determine the Minimum Flow rate

Find a value nearest (lower side) to the applicable gas pressure in Table D, follow the same column upwards and find a value intersecting the desired nominal size in Table C for the minimum flow rate. If it is desired to determine the minimum flow rate more accurately, calculate it as follows:

**EXAMPLE 1**

Find the minimum flow rate where: Fluid:Air, Temperature:20℃, Pressure:0.5MPa (gauge) and nominal size: 80mm.

SOLUTION:Minimum flow rate at 0.4MPa and 0.85MPa of air with respect to nominal diameter 80mm in Table D are 47m³/h and 38m³/h, respectively, from Table C. The minimum flow rate at 0.5MPa is therefore determined in proportion to as follows:

$$Qmin = 38 + \frac{0.85 - 0.5}{0.85 - 0.4} \times (47 - 38) \fallingdotseq 45 m^3/h$$

It can also be determined by calculating the actual density. Actual density of air $\rho$ at 20℃ at 0.5MPa is

$$\rho = 1.293 \times \frac{273.15}{273.15 + 20} \times \frac{0.101325 + 0.5}{0.101325} \fallingdotseq 7.15 kg/m^3$$

From Table C, the minimum flow rate at a density of 6 and nominal size 80mm is 47m³/h; at a density of 11 is 38m³/h. The minimum flow rate at a density of 7.15 therefore can be found in proportion to as follows:

$$Qmin = 38 + \frac{11 - 7.15}{11 - 6} \times (47 - 38) \fallingdotseq 45 m^3/h$$

**EXAMPLE 2**

Find the minimum flow rate and applicable nominal size where: Fluid:Carbon dioxide, Temperature: 5 to 30℃, Pressure 0.8 to 1.5MPa, Max. flow rate:1800m³/h(normal)

SOLUTION:First,we find the actual max. flow rate and determine the nominal diameter. If there is some latitude in temperature and pressure, the maximum flow rate should be calculated on the basis of the high end in temperature and the low end in pressure. The actual maximum flow rate is therefore computed as follows:

$$QMax. = 1800 \times \frac{273.15 + 30}{273.15} \times \frac{0.101325}{0.101325 + 0.8} \fallingdotseq 225 m^3/h$$

It follows that the nominal size is 40mm and the minimum flow rate is based on the low end in temperature and the high end in pressure. From Tables D and C, the minimum flow rate at 40mm size and 0.95MPa pressure is 9m³/h, at 1.7MPa, it is 8m³/h. We then obtain the minimum flow rate in proportional way as:

$$Qmin = 8 + \frac{1.7 - 1.5}{1.7 - 0.95} \times (9 - 8) \fallingdotseq 8.3 m^3/h$$

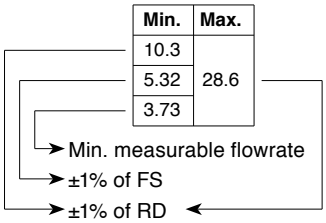
NOTE:In cases where obtained results of calculation are figures with decimal places, round off fraction below the decimal point in the maximum flow rate, or round out fractions to a round number in the minimum flow rate.

## ● Saturated Steam Service

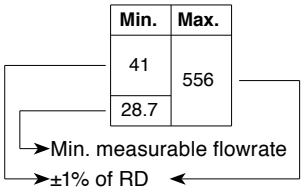
| | Unit: kg/h | | | | | | | | Unit: t/h | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Pressure** | **15mm (1/2″)** | | **25mm (1″)** | | **40mm (1·1/2″)** | | **50mm (2″)** | | **80mm (3″)** | | **100mm (4″)** | | **150mm (6″)** | | **200mm (8″)** | | **250mm (10″)** | | **300mm (12″)** | |
| **MPaG** | **Min.** | **Max.** | **Min.** | **Max.** | **Min.** | **Max.** | **Min.** | **Max.** | **Min.** | **Max.** | **Min.** | **Max.** | **Min.** | **Max.** | **Min.** | **Max.** | **Min.** | **Max.** | **Min.** | **Max.** |
| **0.05** | 10.3 | 28.6 | 18.8 | 113 | 29.1 | 252 | 37.2 | 426 | 0.08 | 0.95 | 0.14 | 1.6 | 0.3 | 3.63 | 0.52 | 6.08 | 1.15 | 9.13 | 1.64 | 13 |
| | 5.32 | | 13.1 | | 22 | | 35.9 | | | | | | | | | | | | | |
| | 3.73 | | 9.15 | | 15.4 | | 25.2 | | 0.06 | 1.2 | 0.1 | 2.06 | 0.21 | 4.48 | 0.37 | 7.91 | 0.8 | 12.1 | 1.15 | 17.4 |
| **0.1** | 10.6 | 37.4 | 19.4 | 147 | 30 | 329 | 41 | 556 | 0.1 | 1.24 | 0.16 | 2.1 | 0.34 | 4.74 | 0.59 | 7.95 | 1.31 | 11.9 | 1.88 | 17 |
| | 6.08 | | 15 | | 25.1 | | | | | | | | | | | | | | | |
| | 4.26 | | 10.5 | | 17.6 | | 28.7 | | 0.07 | 1.56 | 0.11 | 2.69 | 0.24 | 5.86 | 0.42 | 10.3 | 0.914 | 15.9 | 1.32 | 22.8 |
| **0.2** | 11 | 54.7 | 20.2 | 215 | 33 | 480 | 53.9 | 812 | 0.12 | 1.82 | 0.21 | 3.06 | 0.45 | 6.92 | 0.78 | 11.6 | 1.72 | 17.4 | 2.46 | 24.8 |
| | 7.99 | | 19.7 | | | | | | | | | | | | | | | | | |
| | 5.6 | | 13.8 | | 23.1 | | 37.8 | | 0.09 | 2.28 | 0.15 | 3.92 | 0.31 | 8.55 | 0.55 | 15 | 1.21 | 23.2 | 1.73 | 33.3 |
| **0.3** | 11.4 | 71.5 | 23.5 | 282 | 39.4 | 629 | 64.5 | 1060 | 0.15 | 2.38 | 0.25 | 4.01 | 0.53 | 9.06 | 0.93 | 15.1 | 2.06 | 22.7 | 2.95 | 32.5 |
| | 9.56 | | | | | | | | | | | | | | | | | | | |
| | 6.7 | | 16.5 | | 27.6 | | 45.2 | | 0.1 | 2.99 | 0.18 | 5.14 | 0.38 | 11.1 | 0.65 | 19.7 | 1.44 | 30.3 | 2.07 | 43.6 |
| **0.4** | 11.7 | 88.2 | 27 | 347 | 45.3 | 775 | 74.2 | 1310 | 0.17 | 2.94 | 0.28 | 4.94 | 0.61 | 11.1 | 1.07 | 18.7 | 2.37 | 28 | 3.39 | 40.1 |
| | 11 | | | | | | | | | | | | | | | | | | | |
| | 7.7 | | 18.9 | | 31.8 | | 51.9 | | 0.12 | 3.69 | 0.2 | 6.33 | 0.43 | 13.8 | 0.75 | 24.3 | 1.66 | 37.4 | 2.37 | 53.7 |
| **0.5** | 12.4 | 104 | 30.3 | 412 | 50.8 | 920 | 83.2 | 1550 | 0.19 | 3.49 | 0.32 | 5.87 | 0.69 | 13.2 | 1.2 | 22.2 | 2.65 | 33.3 | 3.8 | 47.6 |
| | 8.63 | | 21.2 | | 35.6 | | 58.2 | | 0.13 | 4.38 | 0.22 | 7.52 | 0.48 | 16.3 | 0.84 | 28.8 | 1.86 | 44.4 | 2.66 | 63.8 |
| **0.6** | 13.6 | 121 | 33.4 | 477 | 56 | 1060 | 91.6 | 1790 | 0.21 | 4.04 | 0.35 | 6.79 | 0.76 | 15.3 | 1.32 | 25.7 | 2.92 | 38.5 | 4.19 | 55 |
| | 9.51 | | 23.4 | | 39.2 | | 64.1 | | 0.15 | 5.06 | 0.25 | 8.7 | 0.53 | 18.9 | 0.93 | 33.4 | 2.05 | 51.4 | 2.93 | 73.8 |
| **0.8** | 16 | 153 | 39.1 | 605 | 65.6 | 1350 | 108 | 2280 | 0.24 | 5.12 | 0.41 | 8.62 | 0.89 | 19.4 | 1.55 | 32.6 | 3.42 | 48.9 | 4.91 | 69.9 |
| | 11.2 | | 27.4 | | 46 | | 75.2 | | 0.17 | 6.43 | 0.29 | 11 | 0.62 | 24 | 1.09 | 42.4 | 2.4 | 65.2 | 3.44 | 93.6 |
| **1** | 18.1 | 186 | 44.4 | 733 | 74.6 | 1630 | 122 | 2760 | 0.27 | 6.2 | 0.46 | 10.4 | 1.01 | 23.5 | 1.76 | 39.4 | 3.89 | 59.2 | 5.57 | 84.6 |
| | 12.7 | | 31.1 | | 52.2 | | 85.4 | | 0.19 | 7.78 | 0.33 | 13.3 | 0.71 | 29.1 | 1.23 | 51.3 | 2.72 | 78.9 | 3.9 | 113 |
| **1.5** | 23 | 266 | 56.5 | 1050 | 94.8 | 2340 | 155 | 3960 | 0.35 | 8.89 | 0.59 | 14.9 | 1.28 | 33.8 | 2.24 | 56.6 | 4.94 | 84.9 | 7.08 | 121 |
| | 16.1 | | 39.5 | | 66.4 | | 109 | | 0.24 | 11.1 | 0.41 | 19.1 | 0.9 | 41.7 | 1.57 | 73.6 | 3.46 | 113 | 4.96 | 162 |
| **2** | 27.5 | 347 | 67.4 | 1370 | 114 | 3050 | 185 | 5160 | 0.41 | 11.5 | 0.7 | 19.4 | 1.52 | 44 | 2.67 | 73.7 | 5.89 | 110 | 8.83 | 158 |
| | 19.2 | | 47.2 | | 79.2 | | 130 | | 0.29 | 14.5 | 0.49 | 24.9 | 1.07 | 54.3 | 1.87 | 95.9 | 4.13 | 147 | 6.18 | 211 |
| **2.5** | 31.6 | 429 | 77.5 | 1690 | 131 | 3770 | 213 | 6370 | 0.47 | 14.3 | 0.81 | 24 | 1.75 | 54.3 | 3.3 | 91 | 6.78 | 136 | 10.9 | 195 |
| | 22.1 | | 54.3 | | 91.1 | | 149 | | 0.33 | 17.9 | 0.57 | 30.8 | 1.23 | 67.1 | 2.31 | 118 | 4.75 | 182 | 7.63 | 261 |
| **3** | 35.5 | 511 | 87.1 | 2010 | 147 | 4490 | 240 | 7590 | 0.53 | 17 | 0.91 | 28.6 | 1.97 | 64.8 | 3.93 | 108 | 7.62 | 162 | 13 | 232 |
| | 24.9 | | 61 | | 103 | | 168 | | 0.37 | 21.4 | 0.64 | 36.7 | 1.38 | 80 | 2.75 | 141 | 5.34 | 217 | 9.09 | 311 |
| **4** | 42.9 | 680 | 106 | 2670 | 177 | 5970 | 290 | 10100 | 0.64 | 22.6 | 1.09 | 38.1 | 2.38 | 86.1 | 5.22 | 144 | 10.1 | 216 | 17.3 | 309 |
| | 30.1 | | 73.7 | | 124 | | 203 | | 0.45 | 28.4 | 0.77 | 48.8 | 1.67 | 106 | 3.66 | 187 | 7.03 | 288 | 12.1 | 414 |
| **5** | 50 | 854 | 123 | 3360 | 206 | 7500 | 337 | 12600 | 0.74 | 28.4 | 1.27 | 47.9 | 2.83 | 108 | 6.56 | 181 | 12.7 | 271 | 21.7 | 388 |
| | 35 | | 85.8 | | 145 | | 236 | | 0.52 | 35.7 | 0.89 | 61.3 | 1.98 | 133 | 4.59 | 235 | 8.83 | 362 | 15.2 | 520 |

## ● Explanation of tables

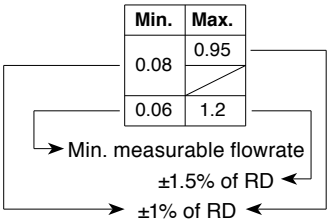
**Less than 50mm**




**Less than 50mm**

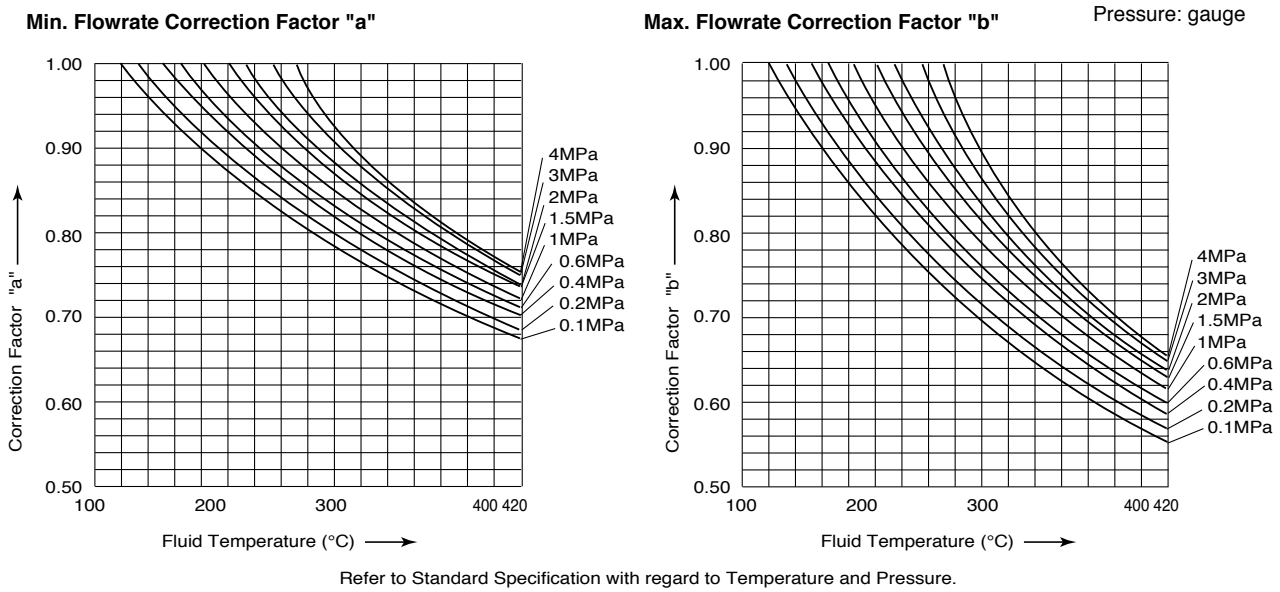



**More than 80mm**



## ● Superheated Steam Service

The superheated steam flow range is determined by first finding the correction factors "a" and "b" for the min. rate and max. rate, respectively, from the curves below and then multiplying the applicable nominal diameter and pressure readings in the saturated steam flow range table by these correction factors.




Refer to Standard Specification with regard to Temperature and Pressure.

EXAMPLE : Find the flow range of superheated steam where Nominal diameter : 50mm, Pressure : 1MPa (gauge) and Temperature 250℃

SOLUTION : From the curves, correction factors are : a = 0.890, b = 0.840. So we obtain

Min. flowrate Qmin = 0.890 × 122 = 109kg/h
Max. flowrate Qmax = 0.840 × 2760 = 2320kg/h

IMPORTANT: 1. In applications where flow rate momentarily exceeds the max. rate for both of gas and steam, hold that peak value within 1.6 times the max. rating.

2. In a ± 1% of full scale specification, if the flow range is $\frac{\text{Full scale flowrate}}{\text{Min. flowrate}} < 4$, then a ± 2% of full scale is applied.

## ■ SCALED PULSE UNIT FOR FIXED CONVERSION

When it is required that a volume flow rate(flow rate in terms of volume) be reduced to the equivalent flow rate under standard conditions (normal flow rate) or to the mass flow rate in a fixed conversion by multiplying a conversion factor, the scaled pulse unit is determined by the unit selector graphs given below.

| Case | Fluid Type | Type of Conversion | Reference |
|---|---|---|---|
| 1 | Gases | Conversion under standard conditions (normal flowrate) | Tables A, B |
| 2 | Saturated Steam | Conversion to mass flowrate | Tables C, D |
| 3 | Gases, Super-heated steam | Conversion to mass flowrate | Tables E, F |
| 4 | Liquids | Conversion to mass flowrate | Tables G, H |

※: Available factored pulse units may vary depending on nonstandard models and on the meter factor after meter calibration.
※: Fixed converted data is corrected under certain conditions (pressure, temperature, density). Therefore, some error may occur when your service condition is different from the preset value.

### ●Factored Pulse Units for Fixed Conversion into Standard State (normal flowrate)

1. "Conversion factor" is calculated by the following equation;

$$\text{Conversion factor} = \frac{273.15}{T+273.15} \times \frac{P+0.101325}{0.101325} \times \frac{Z_0}{Z}$$

(Except where significant influence is anticipated, it is assumed that $Z_0 / Z = 1$)

where T = Operating temp. (℃)
P = Operating press. (MPa〔gauge〕)
$Z_0$ = Compressibility coefficient under standard conditions.
Z = Compressibility coefficient under operating conditions.

2. Follow your way to the right in the nominal bore size column of the given meter in Table A and find the segment number (①, ②, etc.) that agrees with the conversion factor you have just computed. Example:Nom. size 50mm, 0.735 ≦⑥< 0.999
3. In Table B, find the scaled pulse unit relative to the segment number.

**Table A ● Conversion Factor − Segment Graph**

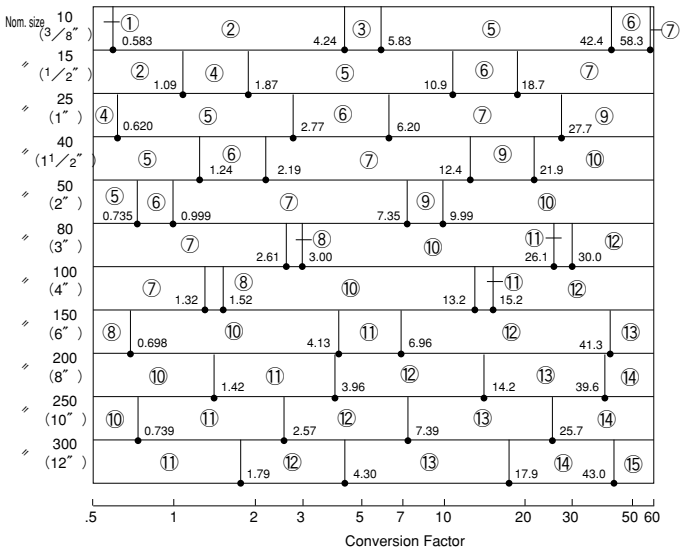



**Table B ● Segment − Scaled Pulse Output**

| Segment No. | Scaled pulse output unit : 〔normal〕 | | |
|---|---|---|---|
| | Minimum | Standard | Maximum |
| ① | 1 L/P | 1 L/P | 10 L/P |
| ② | | 10 L/P | 100 L/P |
| ③ | 10 L/P | | 100 L/P |
| ④ | | 100 L/P | 100 L/P |
| ⑤ | | | 1 m³/P |
| ⑥ | 100 L/P | 1 m³/P | 1 m³/P |
| ⑦ | | | 10 m³/P |
| ⑧ | | | 100 m³/P |
| ⑨ | 1 m³/P | 10 m³/P | 10 m³/P |
| ⑩ | | | 100 m³/P |
| ⑪ | | | 1000 m³/P |
| ⑫ | 10 m³/P | 100 m³/P | 1000 m³/P |
| ⑬ | | | 10000 m³/P |
| ⑭ | 100 m³/P | 1000 m³/P | 10000 m³/P |
| ⑮ | | | 100000 m³/P |

### ●Factored Pulse Units for Saturated Steam Measurement

1. Follow your way to the right in the nominal size column of the given meter in Table C and find the segment number (①, ②, etc.) that agrees with the saturated steam pressure.
2. In Table D, find the scaled pulse unit relative to the segment number.

**Table C ● Pressure (Gas Pressure) − Segment Graph**

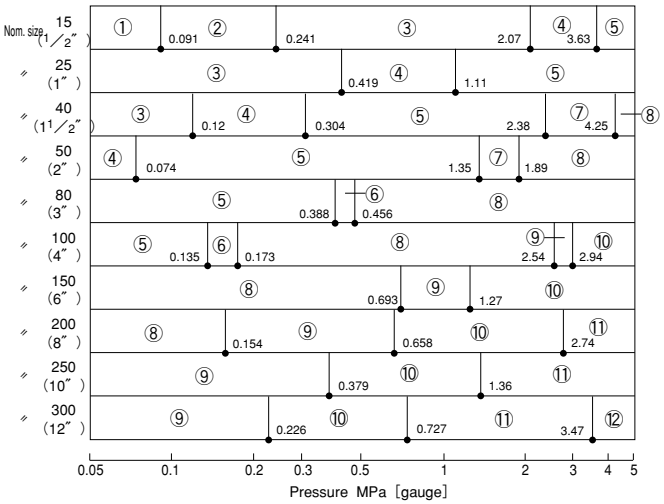



**Table D ● Segment − Scaled Pulse Output**

| Segment No. | Scaled pulse output unit : 〔normal〕 | | |
|---|---|---|---|
| | Minimum | Standard | Maximum |
| ① | 1 g/P | 10 g/P | 100 g/P |
| ② | 10 g/P | 100 g/P | 100 g/P |
| ③ | | | 1 kg/P |
| ④ | 100 g/P | 1 kg/P | 1 kg/P |
| ⑤ | | | 10 kg/P |
| ⑥ | | | 100 kg/P |
| ⑦ | 1 kg/P | 10 kg/P | 10 kg/P |
| ⑧ | | | 100 kg/P |
| ⑨ | | | 1 t/P |
| ⑩ | 10 kg/P | 100 kg/P | 1 t/p |
| ⑪ | | | 10 t/P |
| ⑫ | 100 kg/P | 1 t/P | 10 t/P |

## ● Factored Pulse Units for Fixed Conversion into Mass Flowrate (Superheated steam and gas)

1. Follow your way to the right in the nominal size column of the given meter in Table E and find the segment Number (①, ② etc.) that agrees with the density when in use.
2. In Table E, find the scaled pulse unit relative to the segment number.

**Table E ● Density — Segment Graph**

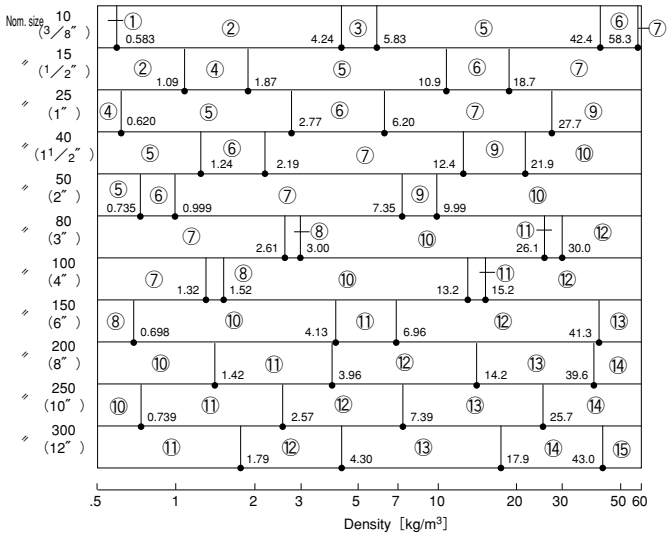



**Table F ● Segment — Scaled Pulse Output**

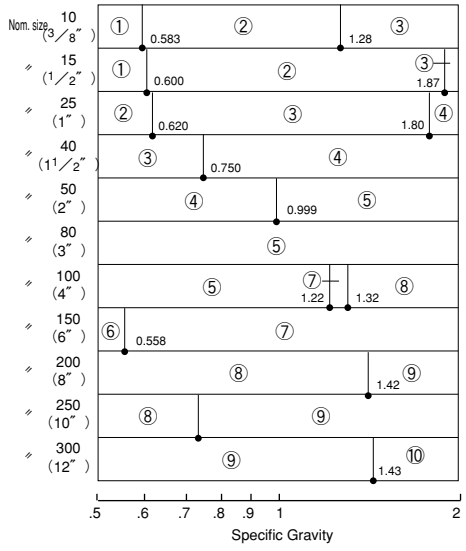
| Segment No. | Scaled pulse output unit : [normal] | | |
|---|---|---|---|
| | Minimum | Standard | Maximum |
| ① | 1 g/P | 1 g/P | 10 g/P |
| ② | | 10 g/P | 100 g/P |
| ③ | 10 g/P | | 100 g/P |
| ④ | | 100 g/P | 100 g/P |
| ⑤ | | | 1 kg/P |
| ⑥ | 100 g/P | 1 kg/P | 1 kg/P |
| ⑦ | | | 10 kg/P |
| ⑧ | | | 100 kg/P |
| ⑨ | 1 kg/P | 10 kg/P | 10 kg/P |
| ⑩ | | | 100 kg/P |
| ⑪ | | | 1 t/P |
| ⑫ | 10 kg/P | 100 kg/P | 1 t/P |
| ⑬ | | | 10 t/P |
| ⑭ | 100 kg/P | 1 t/P | 10 t/P |
| ⑮ | | | 100 t/P |

## ● Factored Pulse Units for Fixed Conversion into Mass Flowrate (Liquids)

1. Follow your way to the right in the nominal size column of the given meter in Table G and find the segment Number (①, ② etc.) that agrees with the density when in use.
2. In Table H, find the scaled pulse unit relative to the segment number.

**Table G ● Specific Gravity — Segment Graph**

**● EX DELTA Ⅱ**




**● EX DELTA Ⅱ DIA**

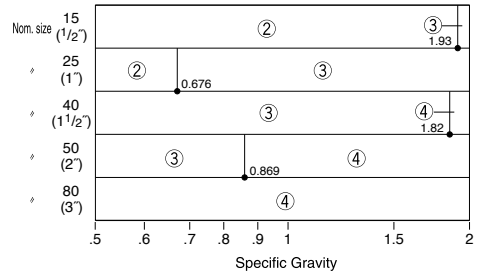
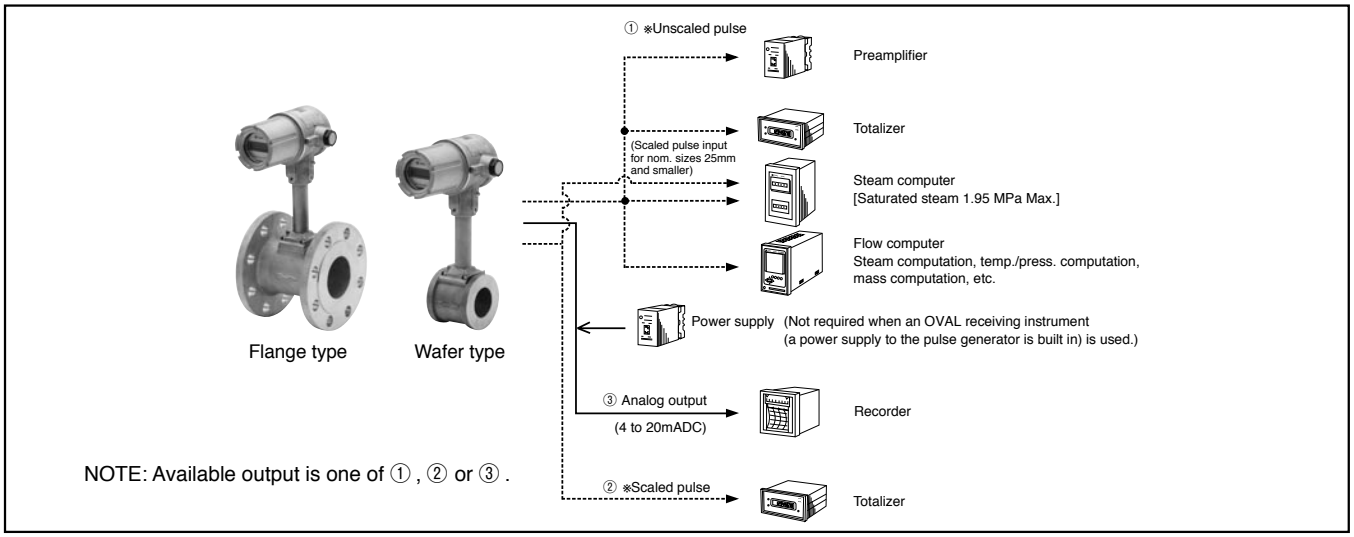



**Table H ● Segment — Scaled Pulse Output**

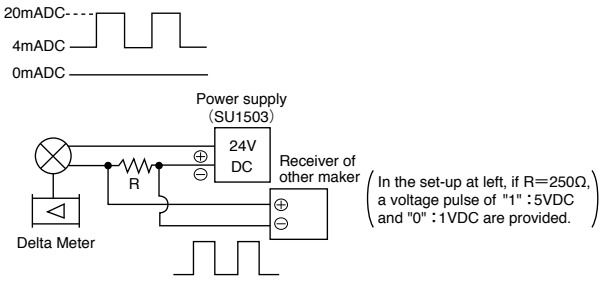
| Segment No. | Scaled Pulse Output Unit : [normal] | | |
|---|---|---|---|
| | Minimum | Standard | Maximum |
| ① | 100 g/P | 1 kg/P | 10 kg/P |
| ② | 1 kg/P | 10 kg/P | 100 kg/P |
| ③ | 1 kg/P | 10 kg/P | 1 t/P |
| ④ | 10 kg/P | 100 kg/P | 1 t/P |
| ⑤ | 10 kg/P | 100 kg/P | 10 t/P |
| ⑥ | 10 kg/P | 100 kg/P | 100 t/P |
| ⑦ | 100 kg/P | 1 t/P | 10 t/P |
| ⑧ | 100 kg/P | 1 t/P | 100 t/P |
| ⑨ | 100 kg/P | 1 t/P | 1000 t/P |
| ⑩ | 1 t/P | 10 t/P | 1000 t/P |

## ■ HOOK-UP WITH RECEIVING INSTRUMENTS



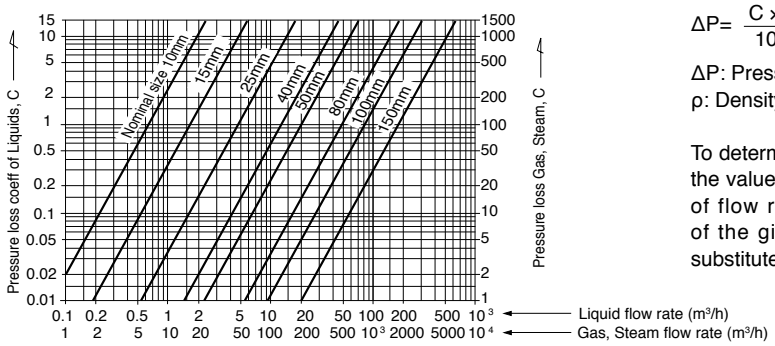

- Shown above are typical examples. Depending on individual applications and specifications, hookup with many other electrical instruments are acceptable.
- For any arrangement with an electrical instrument, indicator, etc. other than those supplied by OVAL, an external power supply is required. Use OVAL Model SU1503 power supply.
- As to individual receiving instruments, see respective General Specification sheets.

※ The unfactored and factored pulse output levels are "1": 20mADC and "0": 4mADC, respectively, as illustrated below. Therefore, if you plan to use any instrument designed to accept a voltage pulse signal, couple a resistor in series as shown. The resistance value of load resistor is given in the Acceptance Load Resistance Range on Page 4.




## ■ PRESSURE LOSS

● Nominal size 10 to 150mm

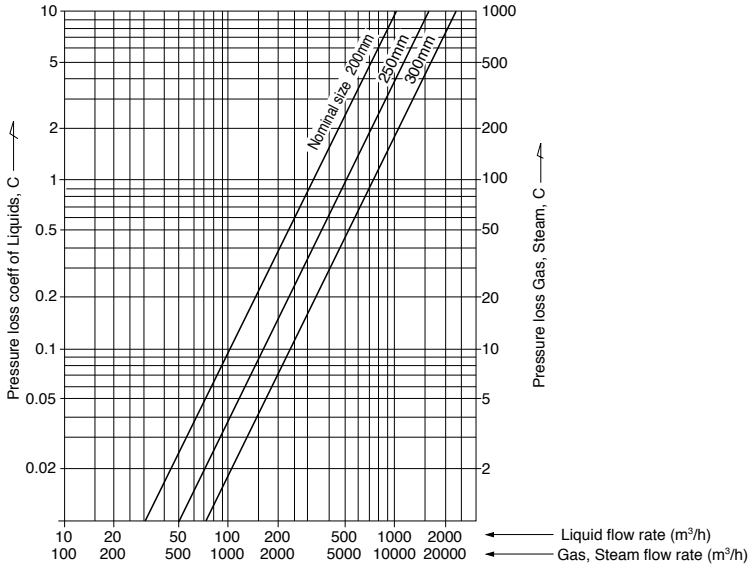



$$\Delta P = \frac{C \times \rho}{100}$$

ΔP: Pressure loss (kPa)
ρ: Density (kg/m³)

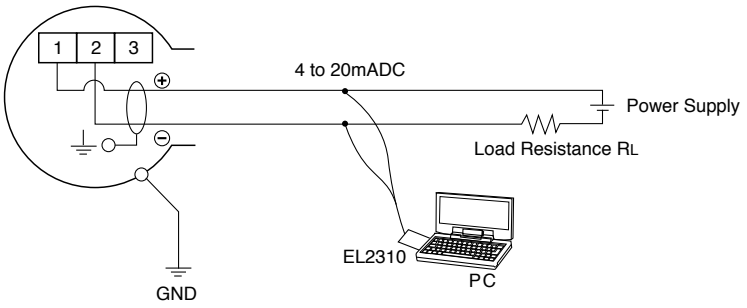
To determine the pressure loss, find the value C at the intersecting point of flow rate (Q) and slanted line of the given meter diameter and substitute it to the formula above.

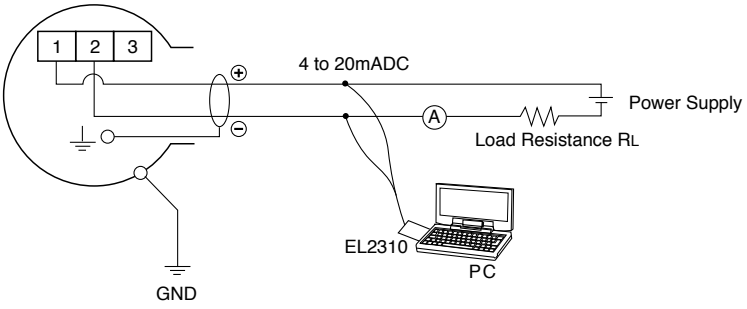
● Nominal size 200, 250, 300mm



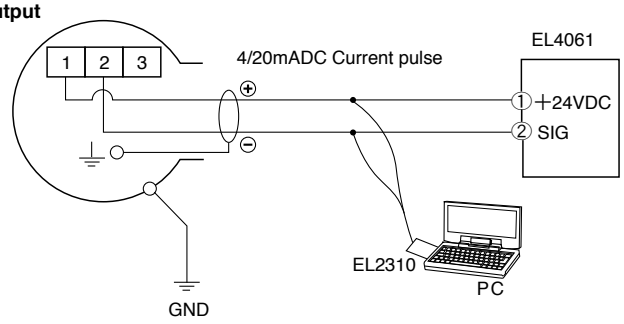
## ■ WIRING CONNECTIONS（an example）

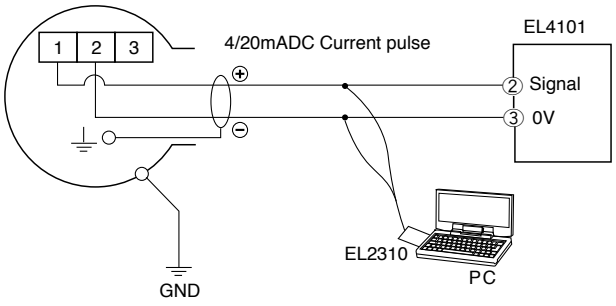
**Analog Output**



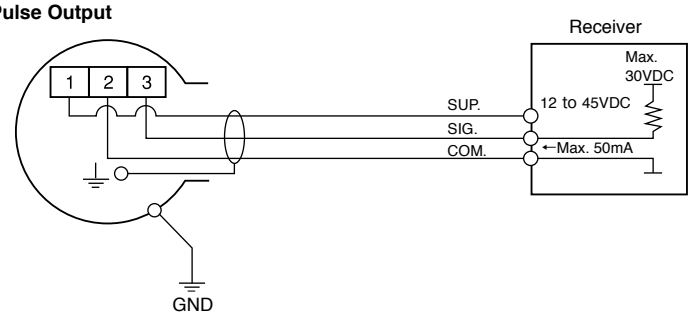




**Voltage Pulse Output**




**Open collector Pulse Output**



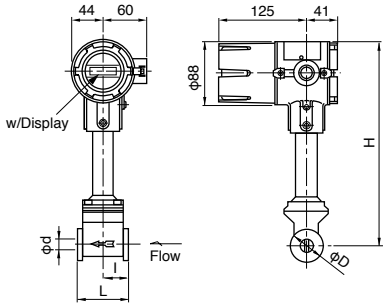

※For EL2310 : Smart Communication Unit. Refer to GS No.GEL104E.

# ■ EX DELTA Ⅱ OUTLINE DIMENSIONS [FIXED SENSOR TYPE] (Unit in mm)

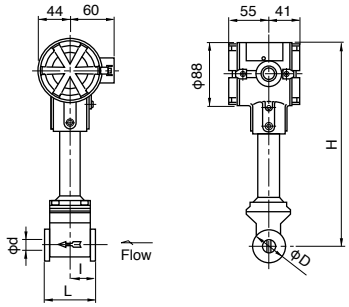
## Fixed sensor/Wafer type (MODEL: VXW)

[Unit in mm]

- Nominal size: 10, 15 and 25mm

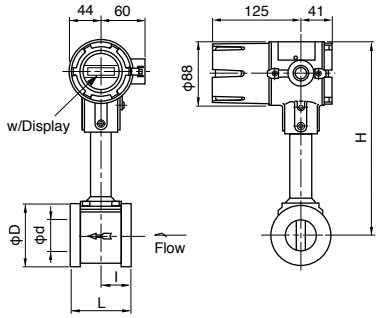



[Converter Integral type]

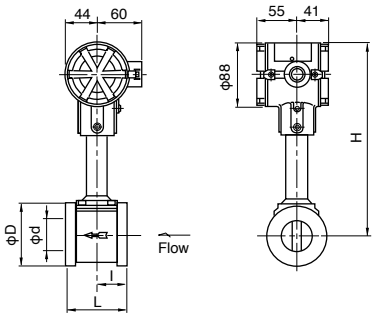



[Converter Separate type sensor]

- Nominal size: 40 to 150mm




[Converter Integral type]

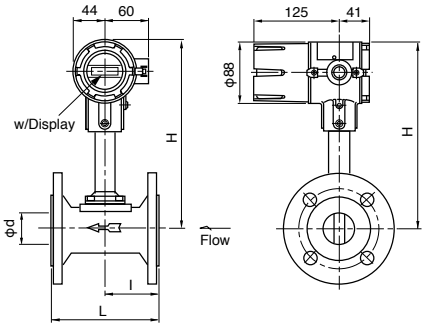



[Converter Separate type sensor]

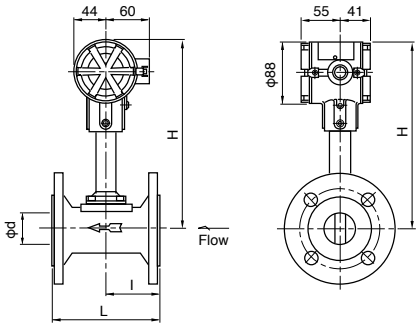
| Nominal size mm (inch) | L | l | φd (Meter I.D) | φD | H | Approx. Weight (kg) | |
|---|---|---|---|---|---|---|---|
| | | | | | | Converter Integral type | Converter Separete type sensor |
| 10 (3/8") | 65 | 32.5 | 10 | 40 | 276 | 4.0 | 3.5 |
| 15 (1/2") | 65 | 32.5 | 14.5 | 40 | 276 | 4.0 | 3.5 |
| 25 (1") | 65 | 32.5 | 26.6 | 67 | 276 | 4.6 | 4.1 |
| 40 (1-1/2") | 80 | 40 | 37.6 | 81 | 261 | 5.3 | 4.8 |
| 50 (2") | 80 | 40 | 48.5 | 91 | 265 | 5.4 | 4.9 |
| 80 (3") | 100 | 40 | 72.4 | 126 | 281 | 8.2 | 7.7 |
| 100 (4") | 125 | 48 | 95.2 | 156.2 | 301 | 11.9 | 11.4 |
| 150 (6") | 165 | 54 | 140.3 | 214.9 | 331 | 21.8 | 21.3 |

## Fixed sensor/Flange type (MODEL: VXU)

- Nominal size: 40 to 150mm




[Converter Integral type]




[Converter Separate type sensor]

| Nominal size mm (inch) | Flange rating | L | l | φd (Meter I.D) | H | Approx. Weight (kg) | |
|---|---|---|---|---|---|---|---|
| | | | | | | Converter Integral type | Converter Separete type sensor |
| 40 (1-1/2") | JIS 10K (16K) | 130 | 65 | 37.6 | 261 | 7.6 | 7.1 |
| | ASME150 | 150 | 75 | | | 7.4 | 6.9 |
| 50 (2") | JIS 10K | 130 | 65 | 48.5 | 265 | 8.7 | 8.2 |
| | ASME150 | 150 | 75 | | | 9.5 | 9.0 |
| 80 (3") | JIS 10K | 150 | 75 | 72.4 | 281 | 12.0 | 11.5 |
| | ASME150 | 160 | 80 | | | 14.7 | 14.2 |
| 100 (4") | JIS 10K | 160 | 80 | 95.2 | 301 | 15.1 | 14.6 |
| | ASME150 | 170 | 85 | | | 20.7 | 20.2 |
| 150 (6") | JIS 10K | 220 | 110 | 140.3 | 331 | 29.6 | 29.1 |
| | ASME150 | 230 | 115 | | | 32.6 | 32.1 |

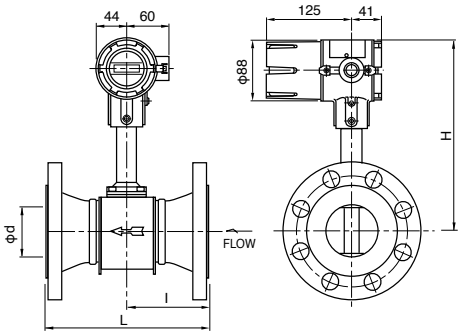
Note: Figures in the brackets show the dimensions with built-in display.
Note: Dim. φD is the I.D. of bluff body.
※: Irrespective of flange rating, a flange thickness having a higher rating is selected as long as the flange O.D. and bolt holes remain the same.

NOTE: Outline dimensions of special or regulation-compliant products may be different. Please refer to the approval drawing or delivery specification.

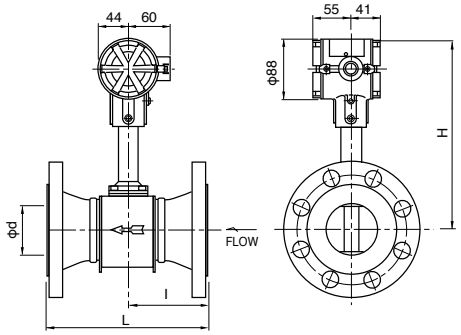
[Unit in mm]

## Fixed sensor/Flange type (MODEL: VXF)

● Nominal size: 15 to 150mm

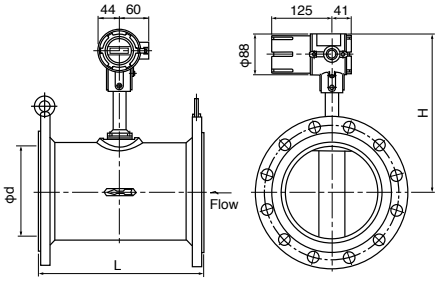



[Converter Integral type]

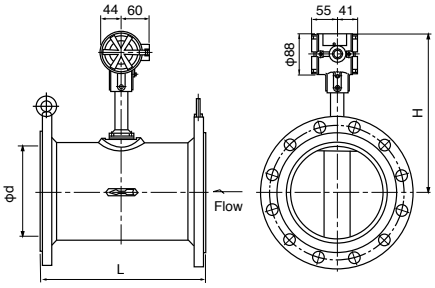



[Converter Separate type sensor]

● Nominal size: 200 to 300mm




[Converter Integral type]




[Converter Separate type sensor]

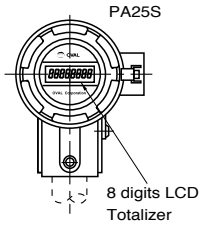
| Nominal size mm (inch) | Flange rating | L | l | ϕd (Meter I.D) | H | Approx. Weight (kg) | |
|---|---|---|---|---|---|---|---|
| | | | | | | Converter Integral type | Converter Separete type sensor |
| 15 (1/2″) | JIS 10K (16K) | 142 | 71 | 14.5 | 276 | 5.3 | 4.8 |
| | JIS 20K | | | | | | |
| | JIS 30K | 152 | 76 | | | 6.7 | 6.2 |
| | ASME 150 | 158 | 79 | | | 4.9 | 4.4 |
| | JPI 150 | | | | | | |
| | ASME 300 | 167 | 83.5 | | | 5.5 | 5.0 |
| | JPI 300 | | | | | | |
| | ASME 600 | 180 | 90 | | | 5.8 | 5.3 |
| | JPI 600 | | | | | | |
| 25 (1″) | JIS 10K (16K) | 152 | 76 | 26.6 | 276 | 7.3 | 6.8 |
| | JIS 20K | | | | | | |
| | JIS 30K | 158 | 79 | | | 8.3 | 7.8 |
| | ASME 150 | 174 | 87 | | | 6.5 | 6.0 |
| | JPI 150 | | | | | | |
| | ASME 300 | 186 | 93 | | | 7.7 | 7.2 |
| | JPI 300 | | | | | | |
| | ASME 600 | 199 | 99.5 | | | 8.1 | 7.6 |
| | JPI 600 | | | | | | |
| 40 (1-1/2″) | JIS 10K (16K) | 171 | 85.5 | 37.6 | 261 | 9.4 | 8.9 |
| | JIS 20K | 175 | 87.5 | | | 9.8 | 9.3 |
| | JIS 30K | 185 | 92.5 | | | 11.9 | 11.4 |
| | ASME 150 | 201 | 100.5 | | | 9.4 | 8.9 |
| | JPI 150 | | | | | 9.4 | 8.9 |
| | ASME 300 | 213 | 106.5 | | | 11.8 | 11.3 |
| | JPI 300 | | | | | | |
| | ASME 600 | 229 | 114.5 | | | 12.8 | 12.3 |
| | JPI 600 | | | | | | |
| 50 (2″) | JIS 10K | 173 | 86.5 | 48.5 | 265 | 10.4 | 9.9 |
| | JIS 20K (16K) | 181 | 90.5 | | | 10.6 | 10.1 |
| | JIS 30K | 191 | 95.5 | | | 12.7 | 11.2 |
| | ASME 150 | 204 | 102 | | | 11.3 | 10.8 |
| | JPI 150 | | | | | 11.4 | 10.9 |
| | ASME 300 | 217 | 108.5 | | | 13.2 | 12.7 |
| | JPI 300 | | | | | | |
| | ASME 600 | 236 | 118 | | | 14.8 | 14.3 |
| | JPI 600 | | | | | | |

| Nominal size mm (inch) | Flange rating | L | l | ϕd (Meter I.D) | H | Approx. Weight (kg) | |
|---|---|---|---|---|---|---|---|
| | | | | | | Converter Integral type | Converter Separete type sensor |
| 80 (3″) | JIS 10K | 219 | 99.5 | 72.4 | 281 | 16.6 | 16.1 |
| | JIS 20K (16K) | 233 | 106.5 | | | 19.3 | 18.8 |
| | JIS 30K | 243 | 111.5 | | | 23.3 | 22.8 |
| | ASME 150 | 237 | 108.5 | | | 19.4 | 18.9 |
| | JPI 150 | | | | | | |
| | ASME 300 | 255 | 117.5 | | | 23.9 | 23.4 |
| | JPI 300 | | | | | | |
| | ASME 600 | 275 | 127.5 | | | 26.7 | 26.2 |
| | JPI 600 | | | | | | |
| 100 (4″) | JIS 10K | 250 | 110.5 | 95.2 | 301 | 22.6 | 22.1 |
| | JIS 20K (16K) | 264 | 117.5 | | | 26.6 | 26.1 |
| | JIS 30K | 274 | 122.5 | | | 33.2 | 32.7 |
| | ASME 150 | 274 | 122.5 | | | 27.9 | 27.4 |
| | JPI 150 | | | | | 28.0 | 27.5 |
| | ASME 300 | 294 | 132.5 | | | 37.4 | 36.9 |
| | JPI 300 | | | | | 37.6 | 37.1 |
| | ASME 600 | 338 | 154.5 | | | 49.2 | 48.7 |
| | JPI 600 | | | | | | |
| 150 (6″) | JIS 10K | 322 | 132.5 | 140.3 | 331 | 45.1 | 44.6 |
| | JIS 20K (16K) | 342 | 142.5 | | | 54.2 | 53.7 |
| | JIS 30K | 352 | 147.5 | | | 67.8 | 67.3 |
| | ASME 150 | 340 | 141.5 | | | 47.9 | 47.4 |
| | JPI 150 | | | | | 48.0 | 47.4 |
| | ASME 300 | 359 | 151 | | | 67.0 | 66.5 |
| | JPI 300 | | | | | 67.4 | 66.9 |
| | ASME 600 | 409 | 176 | | | 96.6 | 96.1 |
| | JPI 600 | | | | | | |
| 200 (8″) | JIS 10K | 350 | — | 199.9 | 346 | 40.2 | 39.7 |
| 250 (10″) | JIS 10K | 450 | — | 248.8 | 368 | 70.2 | 69.7 |
| 300 (12″) | JIS 10K | 500 | — | 297.9 | 390 | 90.2 | 89.7 |

Note: Figures in the brackets show the dimensions with built-in display.
Note: Dim. ϕD is the I.D. of bluff body.

※: Irrespective of flange rating, a flange thickness having a higher rating is selected as long as the flange O.D. and bolt holes remain the same.

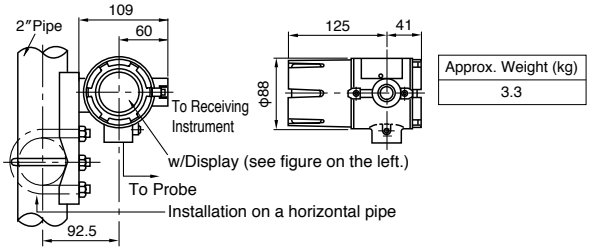
● Converter (w/Totalizer & Digital Indicator)




(1) Direction of mounting of the converter is changeable with 90° step being rotated around the center of a mounting bracket.

(2) Direction of a display is also changeable with 90°step being rotated within the converter.

● Separate type converter




| Approx. Weight (kg) |
|---|
| 3.3 |

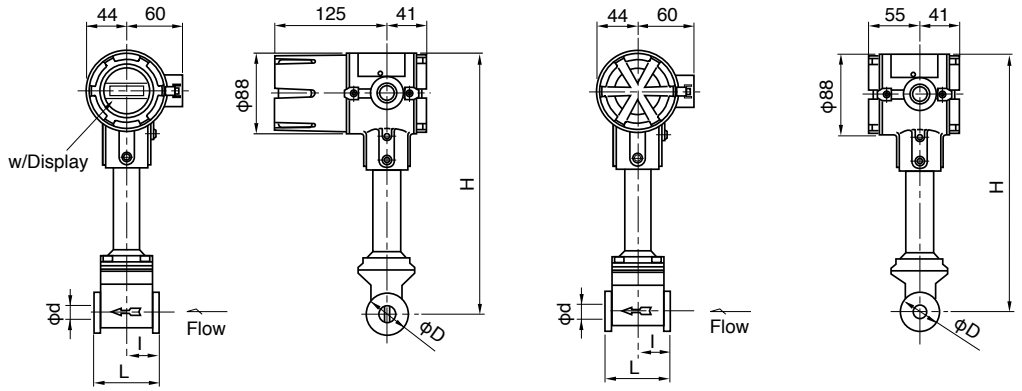
NOTE: Outline dimensions of special or regulation-compliant products may be different. Please refer to the approval drawing or delivery specification.

## ■ EX DELTA Ⅱ･DIA OUTLINE DIMENSIONS [FIXED SENSOR TYPE] (Unit in mm)

**Fixed sensor/Wafer type (MODEL: VXW)**

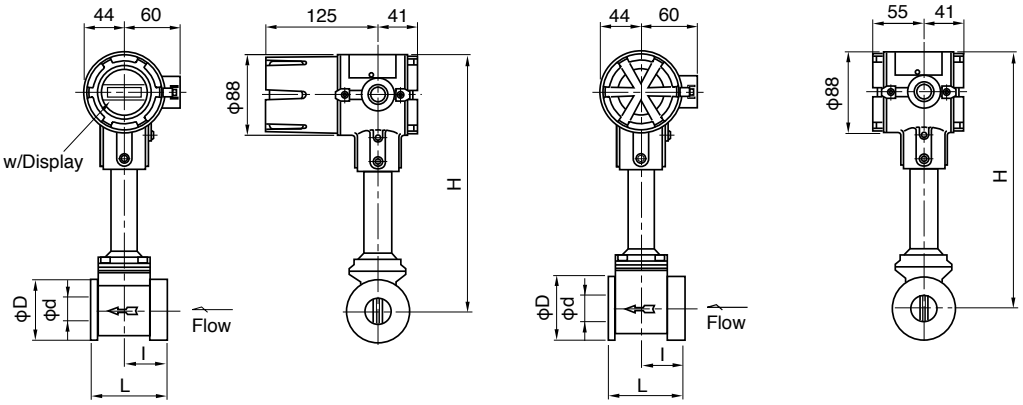
[Unit in mm]

● Nominal size: 15mm



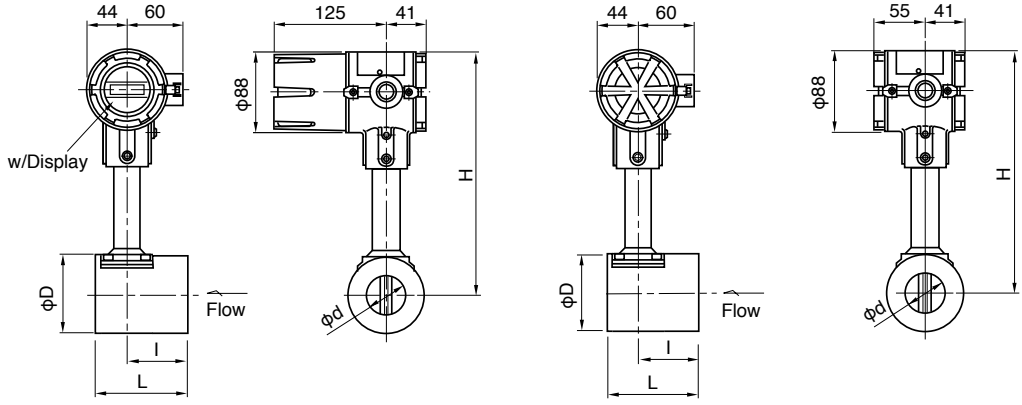

[Converter Integral type] [Converter Separate type sensor]

● Nominal size: 25mm




[Converter Integral type] [Converter Separate type sensor]

● Nominal size: 40 to 80mm




[Converter Integral type] [Converter Separate type sensor]

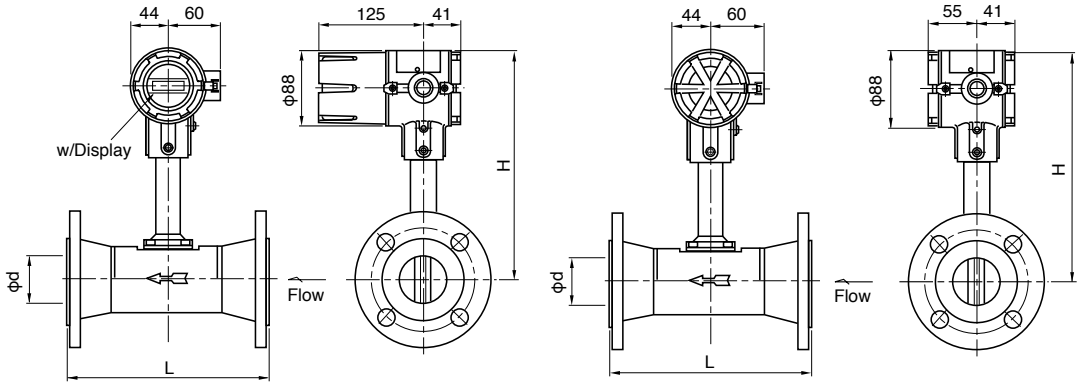
| Nominal size mm (inch) | L | l | φd (Meter I.D) | φ D | H | Approx. Weight (kg) | |
|---|---|---|---|---|---|---|---|
| | | | | | | Converter Integral type | Converter Separete type sensor |
| 15 (1/2″) | 65 | 32.5 | 14.5 | 40 | 276 | 4.0 | 3.5 |
| 25 (1″) | 80 | 47.5 | 26.6 | 67 | 276 | 4.6 | 4.1 |
| 40 (1-1/2″) | 100 | 67 | 41.2 | 82 | 261 | 5.3 | 4.8 |
| 50 (2″) | 125 | 85 | 52.7 | 92 | 265 | 5.4 | 4.9 |
| 80 (3″) | 125 | 85 | 78.1 | 127 | 281 | 8.2 | 7.7 |

NOTE: Outline dimensions of special or regulation-compliant products may be different. Please refer to the approval drawing or delivery specification.

## Fixed sensor/Flange type (MODEL: VXF)

[Unit in mm]

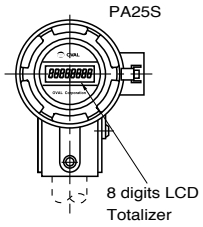
● Nominal size: 50, 80mm




[Converter Integral type] [Converter Separate type sensor]

| Nominal size mm (inch) | L | ϕd (Meter I.D) | H |
|---|---|---|---|
| 50 (2″) | 229 | 52.7 | 265 |
| 80 (3″) | 254 | 78.1 | 281 |

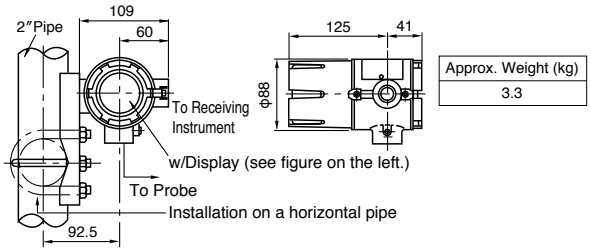
● Converter (w/Totalizer & Digital Indicator)




(1) Direction of mounting of the converter is changeable with 90° step being rotated around the center of a mounting bracket.

(2) Direction of a display is also changeable with 90°step being rotated within the converter.

● Separate type converter




| Approx. Weight (kg) |
|---|
| 3.3 |

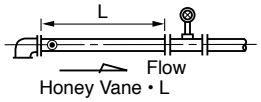
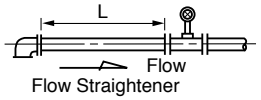
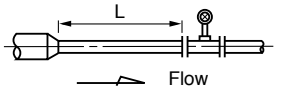
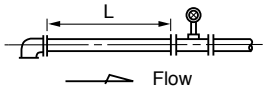
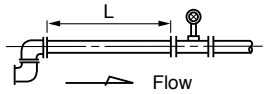
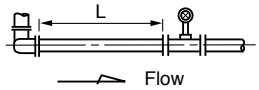
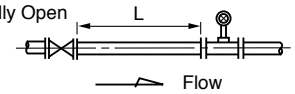
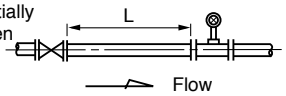
NOTE: Outline dimensions of special or regulation-compliant products may be different. Please refer to the approval drawing or delivery specification.

# ■ INSTALLATION CONDITIONS

## 1. TYPICAL PIPING INSTRUCTIONS

It is generally required that the flow pattern of a fluid flowing in and out of an inferential type flow meter be as uniform as possible for higher accurate metering performance. All account of this, proper flow straightening measures have to be applied for piping installation of EX DELTA II. The standard piping instructions are shown in the following table.

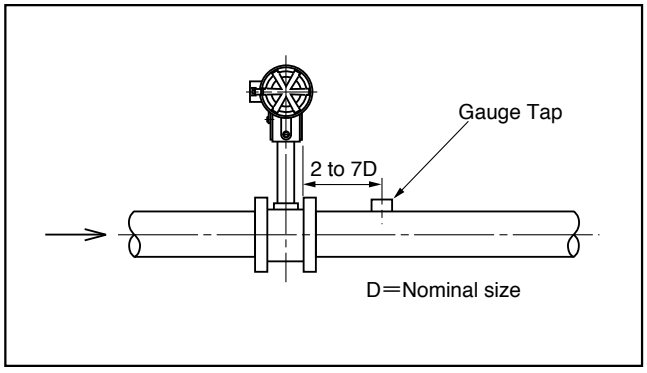
**（1） Use an OVAL flow straightener or provide a specified straight pipe (ISO-5167 compliant).**

| No. | Piping Arrangement | | Straight Pipe Length (L) | Remark | |
|---|---|---|---|---|---|
| 1 | OVAL's Flow Straightener |  | 8D | Refer to Point 4 on P21. | Applicable to Nominal size, >25mm |
| | |  | 12D | GS/GCF001 Refer to | |
| 2 | Reducer |  | 15D Min. | A concentric reducer is installed at the upstream of a meter. | |
| 3 | Elbow |  | 23D Min. | An elbow is installed at the upstream of a meter. | |
| | |  | 25D Min. | Two elbows are installed at the upstream of a meter. | |
| | |  | 40D Min. | Two elbows are vertically installed at the upstream of a meter. | |
| 4 | Fully open gate valve |  | 15D Min. | A full-open gate valve is installed at the upstream of a meter. | |
| 5 | Partially open gate valve |  | 50D Min. | A partially open gate valve, sharp orifice or something that markedly disturbs the flow pattern is upstream of a meter. | |

Note 1:Sch. 40 pipe is standard in the application above. Use Sch. 40 pipe for standard piping. If you plan to use pipes different in nominal pipe thickness, consult the factory.

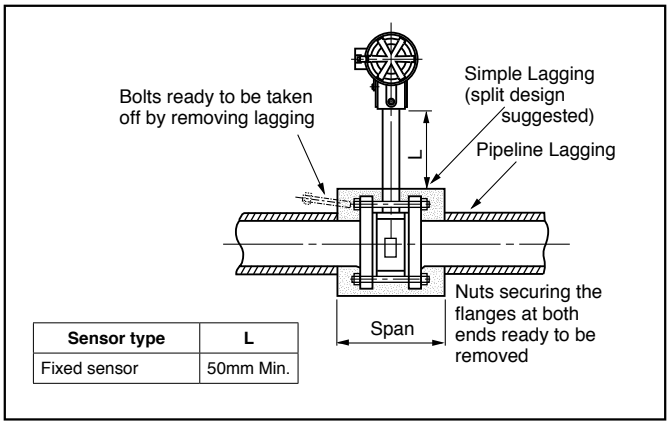
2:A short pipe section, 5D or longer shall be provided down stream of the meter.

3:For pressure detection, provide the probe downstream of the flowmeter (see figure below). To avoid disturbances in the flow, temperature detection should be made downstream of the flowmeter and, at the same time, upstream of the control valve.




## 2. LAGGING WORK

If it is desired to thermally insulate the pipeline, simple lagging (without mortar finish) is suggested to facilitate servicing. This arrangement will permit taking off the flowmeter connecting bolts without destroying the lagging.




| Sensor type | L |
|---|---|
| Fixed sensor | 50mm Min. |

※ If heat retention is required, lagging should be made no more than dim. “L”below the neck of preamplifier.

## 3. ITEMS TO BE NOTED IN PROCESS CONDITION

(1) Prevention of Cavitation:
For liquid flow application, line pressure higher than a value calculated from the following equation shall be applied in order to prevent the flow from cavitation.

$P \geqq 2.60\Delta P + 1.25Po$ (MPa [absolute])
where, P: Line pressure (MPa)
ΔP: Pressure loss (MPa)
Po: Vapor pressure of a liquid (MPa [absolute])

(2) Pressure fluctuation:
In case EX DELTA II is installed in the line where blower such as a roots blower and compressor those can generate fluctuated pressure, performance of the flowmeter can be affected by flow fluctuation.
Allowable fluctuation pressure is calculated from the following equation.

$N < 22\ \rho\ V^2$ (Pa)
where, N: Fluctuation pressure (Pa)
$\rho$: Density (kg/m$^3$)
V: Min. Velocity (m/s)

Even at shutdown, pressure pulsation in the process fluid can produce a false output. If pressure pulsation is excessive, take the following measures:
① Locate the source of flow fluctuation downstream of the flowmeter.
② Install a pulsation attenuator.
③ At shutdown of the flow, shut off valves upstream and downstream of the flowmeter.
④ Provide a digital filter (to prevent false pulse output at shutdown).

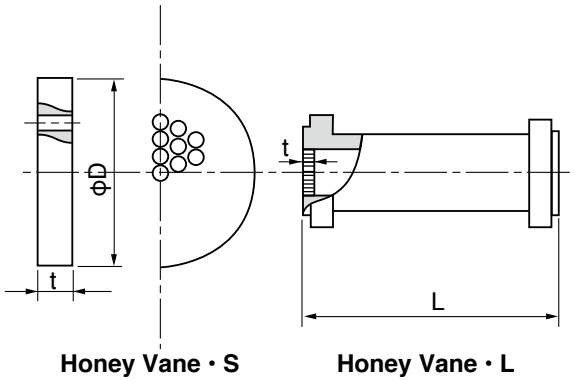
## 4. SPACE SAVING (Reduction of Meter run)

In case span of the meter run is limited due to limit of installation space and a specified straight pipe can not be secured, combination of Honey vane・S and a short length pipe composing Honey vane・L is useful for reduction of total length of the upstream straight pipe.
EX DELTA II・SS providing a built-in Honey vane is available with accuracy ±2% RD for liquid service. Consult the factory for accuracy requirement.

### ●Honey Vane Outline Dimensions

| Nom.size (mm) | φD ＊ (mm) | Honey Vane.S t (mm) | Honey Vane.L L (mm) |
|---|---|---|---|
| 25 | 75 | 3.5 | 200 |
| 40 | 90 | 5.4 | 320 |
| 50 | 105 | 6.9 | 400 |
| 80 | 134 | 10.2 | 640 |
| 100 | 159 | 13.3 | 800 |
| 150 | 220 | 19.6 | 1200 |
| 200 | 268 | 26 | 1600 |
| 250 | 331 | 32.3 | 2000 |
| 300 | 376 | 38.7 | 2400 |

＊: JIS10K

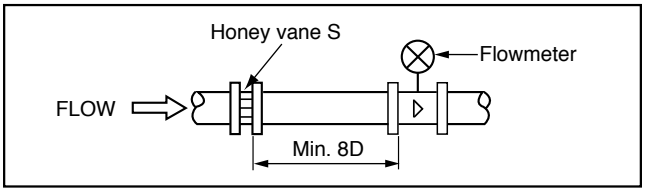



**Honey Vane・S** **Honey Vane・L**

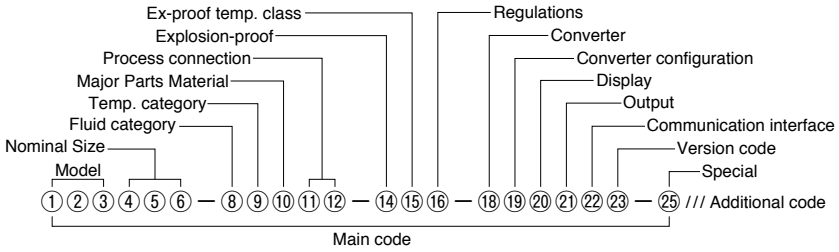
◎ Flange face to face span of EX DELTA II・SS is the same as that of standard EX DELTAII. (Refer to P14,15)

### ●Installation of Honey Vane S

① Locate the Honey Vane S upstream of the flowmeter.
② Provide a short pipe (8D or longer) between Honey Vane S and flowmeter.
③ Regarding the bolts and nuts used for connecting JPI flange, adopt unified screw threads. If you want to use metric screw threads, contact OVAL.



# ■ PRODUCT CODE EXPLANATION




**●Main code (MODEL: VXU, VXT)**

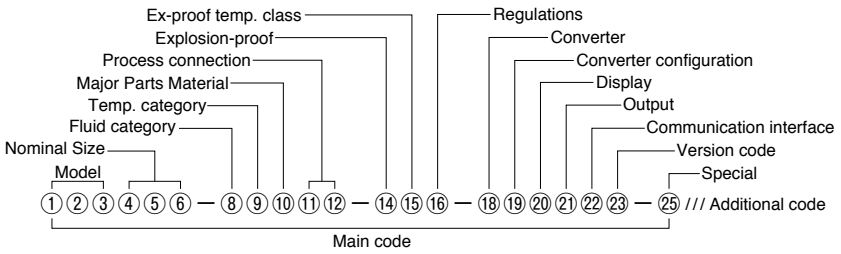
| ① | ② | ③ | **Model ※1** |
|---|---|---|---|
| V | X | U | EX DELTA II Flanged type, Short F to F Dimension, Fixed sensor |
| **④** | **⑤** | **⑥** | **Nominal Size** |
| 0 | 4 | 0 | 40mm (1·1/2″) |
| 0 | 5 | 0 | 50mm (2″) |
| 0 | 8 | 0 | 80mm (3″) |
| 1 | 0 | 0 | 100mm (4″) |
| 1 | 5 | 0 | 150mm (6″) |
| **⑦** | — | | |
| **⑧** | **Fluid category** | | |
| L | Liquid | | |
| G | Gas | | |
| S | Saturated Steam | | |
| K | Heating Steam | | |
| **⑨** | **Temp. category** | | |
| 0 | 120°C and lower | | |
| 1 | 220°C and lower | | |
| 2 | 300°C and lower | | |
| **⑩** | **Major Parts Material** | | |
| C | SCS14A | | Allowed lowest temp.: –30°C |
| **⑪** | **⑫** | **Process connection** | |
| J | 1 | JIS10K RF | |
| A | 1 | ASME150 RF | |
| Z | 9 | Special | |
| **⑬** | — | | |
| **⑭** | **Explosion-proof** | | |
| 0 | Non-explosionproof | | |
| 2 | Flameproof (ATEX, IECEx) | | T2 to T6 |
| T | Flameproof (ITRI) | | T2 to T6 |

| **⑮** | **Ex-proof temp. class** |
|---|---|
| 0 | Non-explosionproof |
| 8 | T2 to T6 |
| **⑯** | **Regulations** |
| 0 | Standard |
| F | w/Material test certificate |
| **⑰** | — |
| **⑱** | **Converter** |
| 4 | PA25 External power supply: 12 to 45 VDC (Stainless steel enclosure) |
| 9 | Special |
| **⑲** | **Converter configuration** |
| 1 | Integrally mounted |
| 2 | Separately mounted (2″ pipe mounting) |
| **⑳** | **Display** |
| 1 | W/Totalizer · digital indicator ※2 |
| **㉑** | **Output** |
| A | Analog output |
| D | Current pulse output |
| G | Open collector pulse output |
| Z | Special |
| **㉒** | **Communication interface** |
| H | HART |
| **㉓** | **Version code** |
| C | Version code: C |
| **㉔** | — |
| **㉕** | **Special** |
| 0 | Standard |

※1: Inapplicable to (the Japan) law and regulations such as High Pressure Gas Safety Act.

※2: By using the internal switch or EL2310, any of ① 6 digits total flow, ② instantaneous flow rate, ③ % instantaneous flow rate, and ④ 8 divided % bar graph can be displayed by switching.

# ■ PRODUCT CODE EXPLANATION



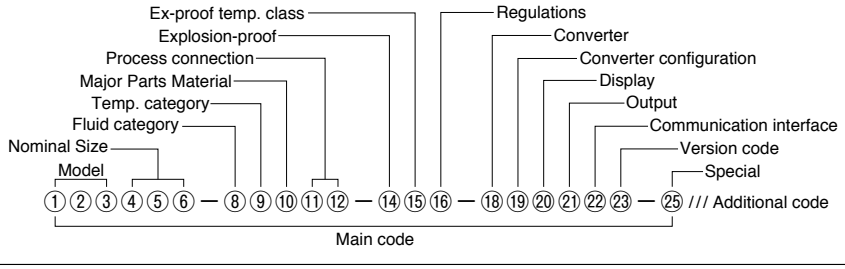

**●Main code (MODEL: VXW, VXF)**

| ① | ② | ③ | **Model** | |
|---|---|---|---|---|
| V | X | W | EX DELTA II Wafer type Fixed sensor (Nominal Size 10 to 150mm) | |
| V | X | F | EX DELTA II Flanged type Fixed sensor (Nominal Size 15mm and bigger, RF is standard) | |
| ④ | ⑤ | ⑥ | **Nominal Size** | |
| 0 | 1 | 0 | 10mm (3/8″) Only for Liquid · Gas | |
| 0 | 1 | 5 | 15mm (1/2″) | |
| 0 | 2 | 5 | 25mm (1″) | |
| 0 | 4 | 0 | 40mm (1·1/2″) | |
| 0 | 5 | 0 | 50mm (2″) | |
| 0 | 8 | 0 | 80mm (3″) | |
| 1 | 0 | 0 | 100mm (4″) | |
| 1 | 5 | 0 | 150mm (6″) | |
| 2 | 0 | 0 | 200mm (8″) | |
| 2 | 5 | 0 | 250mm (10″) | |
| 3 | 0 | 0 | 300mm (12″) | |
| ⑦ | — | | | |
| ⑧ | **Fluid category** | | | |
| L | Liquid | | | |
| G | Gas | | | |
| S | Saturated Steam | | | |
| K | Heating Steam | | | |
| ⑨ | **Temp. category** | | | |
| 0 | 120°C and lower | | | |
| 1 | 220°C and lower | | | |
| 2 | 300°C and lower | | | |
| ⑩ | **Major Parts Material** | | | |
| C | SCS14A (SUS316) | | (Nominal Size 10 to 300mm), allowed lowest temp.: –30°C | |
| J | SUS316 + flange SFVC2A ※2 | | (Nominal Size 200 to 300mm), allowed lowest temp.: 0°C | |
| Z | Special | | | |
| ⑪ | ⑫ | **Process connection** | | |
| J | 1 | JIS10K RF | 300°C and lower | |
| J | B | JIS16K RF | 350°C and lower, for wafer type FF is also available | |
| J | 2 | JIS20K RF | 350°C and lower, for wafer type FF is also available | |
| J | 3 | JIS30K RF | 420°C and lower, for wafer type FF is also available | |
| P | 1 | JPI150 RF | For wafer type FF is also available | |
| P | 3 | JPI300 RF | For wafer type FF is also available | |
| P | 6 | JPI600 RF | For wafer type FF is also available | |
| A | 1 | ASME150 RF | For wafer type FF is also available | |
| A | 3 | ASME300 RF | For wafer type FF is also available | |
| A | 6 | ASME600 RF | For wafer type FF is also available | |
| D | 1 | DIN10 | 300°C and lower, only wafer type | |
| D | B | DIN16 | 300°C and lower, only wafer type | |
| D | 3 | DIN25 | 300°C and lower, only wafer type | |
| D | 4 | DIN40 | 300°C and lower, only wafer type | |
| Z | 9 | Special | | |

| ⑬ | — | |
|---|---|---|
| ⑭ | **Explosion-proof** | |
| 0 | Non-explosion-proof | |
| 2 | Flameproof (ATEX, IECEx) T2 to T6 | |
| T | Flameproof (ITRI) T2 to T6 | |
| ⑮ | **Ex-proof temp. class** | |
| 0 | Non-explosionproof | |
| 8 | T2 to T6 | |
| ⑯ | **Regulations** | |
| 0 | Standard | |
| G | High Pressure Gas Safety Act (Approved product) | ※ w/Material test certificate |
| H | High Pressure Gas Safety Act (Individual test) | ※ w/Material test certificate (Designed on PO issued) |
| L | Gas Business Act (Approved product) | ※ w/Material test certificate (Designed on PO issued) |
| M | Gas Business Act | ※ w/Material test certificate (Designed on PO issued) |
| Q | Electricity Business Act (Certificate required) | ※ w/Material test certificate (Designed on PO issued) |
| R | Electricity Business Act | ※ w/Material test certificate (Designed on PO issued) |
| T | Fire Service Act | ※ w/Material test certificate (Designed on PO issued) |
| F | w/Material test certificate | |
| ⑰ | — | |
| ⑱ | **Converter** | |
| 4 | PA25 External power supply: 12 to 45 VDC (Stainless steel enclosure) | |
| 9 | Special | |
| ⑲ | **Converter configuration** | |
| 1 | Integrally mounted | |
| 2 | Separately mounted (2″ pipe mounting) | |
| ⑳ | **Display** | |
| 1 | w/Totalizer · digital indicator ※4 | |
| ㉑ | **Output** | |
| A | Analog output | |
| D | Current pulse output | |
| G | Open collector pulse output | |
| Z | Special | |
| ㉒ | **Communication interface** | |
| H | HART | |
| ㉓ | **Version code** | |
| C | Version code: C | |
| ㉔ | — | |
| ㉕ | **Special** | |
| 0 | Standard | |
| Z | When "Special" or "Designed on PO issued" is choosen | |

※1: Steam flow measurement is possible with only 15mm and bigger.
※2: Pipe material is SUS316 and flange material is SFVC2A.
Inapplicable to (the Japan) law and regulations such as High Pressure Gas Safety Act.
※3: Flange serration according to ASME standard complies with ASME B 16.5–2003.
DIN standard is applicable only to the body of wafer types body.
※4: By using the internal switch or EL2310, any of ① 6 digits total flow, ② instantaneous flow rate, ③ % instantaneous flow rate, and ④ 8 divided % bar graph can be displayed by switching.

# ■ PRODUCT CODE EXPLANATION




**● Main code (MODEL: VXJ, VXL)**

| ① | ② | ③ | **Model ※1** |
|---|---|---|---|
| V | X | J | EX DELTA II Diamond shaped bluff body Wafer type Fixed sensor (Nominal Size 15 to 80mm) |
| V | X | L | EX DELTA II Diamond shaped bluff body Flanged type Fixed sensor (Designed on PO issued) |
| ④ | ⑤ | ⑥ | **Nominal Size** |
| 0 | 1 | 5 | 15mm (1/2″) |
| 0 | 2 | 5 | 25mm (1″) |
| 0 | 4 | 0 | 40mm (1·1/2″) |
| 0 | 5 | 0 | 50mm (2″) |
| 0 | 8 | 0 | 80mm (3″) |
| ⑦ | — | | |
| ⑧ | **Fluid category** | | |
| L | Liquid | | |
| ⑨ | **Temp. category** | | |
| 0 | 120°C and lower | | |
| 1 | 220°C and lower | | |
| 2 | 300°C and lower | | |
| ⑩ | **Major Parts Material** | | |
| C | SCS14A (SUS316) | Allowed lowest temp.: –30°C | |
| Z | Special | | |
| ⑪ | ⑫ | **Process connection ※2** | |
| J | 1 | JIS10K RF | 300°C and lower |
| J | B | JIS16K RF | 350°C and lower, for wafer type FF is also available |
| J | 2 | JIS20K RF | 350°C and lower, for wafer type FF is also available |
| J | 3 | JIS30K RF | 420°C and lower, for wafer type FF is also available |
| P | 1 | JPI150 RF | For wafer type FF is also available |
| P | 3 | JPI300 RF | For wafer type FF is also available |
| P | 6 | JPI600 RF | (Designed on PO issued) |
| A | 1 | ASME150 RF | For wafer type FF is also available |
| A | 3 | ASME300 RF | For wafer type FF is also available |
| A | 6 | ASME600 RF | (Designed on PO issued) |
| Z | 9 | Special | |
| ⑬ | — | | |

※1: Applicable category

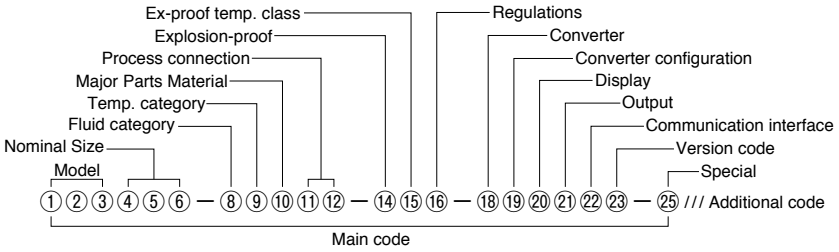
| Nominal Size (mm) | 15 | 25 | 40 | 50 | 80 |
|---|---|---|---|---|---|
| Wafer type | ○ | ○ | ○ | ○ | ○ |
| Flanged type | Designed on PO issued | | | | |

※2: Flange serration according to ASME standard complies with ASME B 16.5–2003.

※3: By using the internal switch or EL2310, any of ① 6 digits total flow, ② instantaneous flow rate, ③ % instantaneous flow rate, and ④ 8 divided % bar graph can be displayed by switching.

| ⑭ | **Explosion-proof** | |
|---|---|---|
| 0 | Non-explosionproof | |
| 2 | Flameproof (ATEX, IECEx) | T2 to T6 |
| T | Flameproof (ITRI) | T2 to T6 |
| ⑮ | **Ex-proof temp. class** | |
| 0 | Non-explosionproof | |
| 8 | T2 to T6 | |
| ⑯ | **Regulations** | |
| 0 | Standard | |
| G | High Pressure Gas Safety Act (Approved product) | ※ w/Material test certificate |
| H | High Pressure Gas Safety Act (Individual test) | ※ w/Material test certificate (Designed on PO issued) |
| L | Gas Business Act (Approved product) | ※ w/Material test certificate (Designed on PO issued) |
| M | Gas Business Act | ※ w/Material test certificate (Designed on PO issued) |
| Q | Electricity Business Act (Certificate required) | ※ w/Material test certificate (Designed on PO issued) |
| R | Electricity Business Act | ※ w/Material test certificate (Designed on PO issued) |
| T | Fire Service Act | ※ w/Material test certificate (Designed on PO issued) |
| F | w/Material test certificate | |
| ⑰ | — | |
| ⑱ | **Converter** | |
| 4 | PA25 External power supply: 12 to 45 VDC (Stainless steel enclosure) | |
| 9 | Special | |
| ⑲ | **Converter configuration** | |
| 1 | Integrally mounted | |
| 2 | Separately mounted (2″ pipe mounting) | |
| ⑳ | **Display** | |
| 1 | w/Totalizer · digital indicator ※3 | |
| ㉑ | **Output** | |
| A | Analog output | |
| D | Current pulse output | |
| G | Open collector pulse output | |
| Z | Special | |
| ㉒ | **Communication interface** | |
| H | HART | |
| ㉓ | **Version code** | |
| C | Version code: C | |
| ㉔ | — | |
| ㉕ | **Special** | |
| 0 | Standard | |
| Z | When "Special" or "Designed on PO issued" is choosen | |

# ■ PRODUCT CODE EXPLANATION




**● Additional code**

| Category of High Pressure Gas ※Must choose | | | | |
|---|---|---|---|---|
| H | P | 0 | Other than High Pressure Gas | |
| H | P | 1 | Toxic gas and flammable gas | |
| H | P | 2 | Toxic gas | |
| H | P | 3 | Flammable gas | |
| H | P | 4 | Other than toxic or flammable gas | |
| **Accuracy ※Must choose** | | | | |
| R | 0 | 7 | ±0.75% RD | High accuracy (applicable only for liquid with actual flow test) |
| R | 1 | 0 | ±1.00% RD | |
| R | 1 | 5 | ±1.50% RD | Only for gas and steam, size 80 to 300mm |
| F | 0 | 7 | ±0.75% FS | High accuracy (applicable only for liquid with actual flow test) |
| F | 1 | 0 | ±1.00% FS | |
| F | 1 | 5 | ±1.50% RD | Only for gas and steam, size 80 to 300mm |
| F | 2 | 0 | ±2.00% FS | Applicable when size is 10mm |
| R | 9 | 9 | Special | |
| **Special test (instrumental error) ※Must choose** | | | | |
| A | 0 | 1 | Dry calibration (w/Certificate) | Witnessed accuracy test not applicable |
| A | 0 | 3 | Actual flow test | |
| A | 2 | 0 | By certified measurer | |
| A | 9 | 9 | Designation of instrumental error test method | Designation of test point and/or addition, etc. |
| **Flow direction ※Must choose** | | | | |
| F | R | 0 | R → L | |
| F | L | 0 | L → R | |
| F | U | 0 | T → B: electric conduit at the bottom | |
| F | D | 0 | B → T: electric conduit at the bottom | |
| F | U | 1 | T → B: electric conduit at the top | Dedicated for indoor use |
| F | D | 1 | B → T: electric conduit at the top | Dedicated for indoor use |
| **Designated special paint on body** | | | | |
| B | C | 0 | Corrosion proof | |
| B | A | 0 | Salinity and acid tolerance | Limited to 120°C and lower |
| B | X | 0 | Customer designation | Special |
| **Cleansing** | | | | |
| T | W | 0 | Non-oil and non-water treatment | |
| T | W | 1 | Non-oil and non-water treatment equivalent | |
| T | F | 0 | Food cleansing | |

※1: Need not choose the item when required to implement in Japan law and regulation. Only for items other than the legal requirement, customer can choose as special requirement.

| Document | | | | |
|---|---|---|---|---|
| D | S | J | DWG and specifications for approval (Japanese) | |
| D | S | E | DWG and specifications for approval (English) | |
| D | R | 0 | Re-submission of DWG with specifications | |
| D | C | J | Final DWG (Japanese) | |
| D | C | E | Final DWG (English) | |
| D | P | J | Calculation sheet (Japanese) | |
| D | P | E | Calculation sheet (English) | Unavailable for the Japan law compliant |
| S | E | J | Instrumental error test report (Japanese) | |
| S | E | E | Instrumental error test report (English) | |
| S | T | J | Pressure test report (Japanese) | |
| S | T | E | Pressure test report (English) | |
| S | A | J | Airtight test report (Japanese) | |
| S | A | E | Airtight test report (English) | |
| D | D | J | Dimensional check record (Japanese) | |
| D | D | E | Dimensional check record (English) | |
| S | P | J | Penetrant test report (Japanese) | Welded part of pressure resistant vessel ※1 |
| S | P | E | Penetrant test report (English) | Welded part of pressure resistant vessel ※1 |
| S | M | J | Magnetic particle inspection (Japanese) | Welded part of pressure resistant vessel ※1 |
| S | M | E | Magnetic particle inspection (English) | Welded part of pressure resistant vessel ※1 |
| S | R | J | Radiographic inspection (Japanese) | Welded part of pressure resistant vessel ※1 |
| S | R | E | Radiographic inspection (English) | Welded part of pressure resistant vessel ※1 |
| S | U | J | Ultrasonic inspection (Japanese) | Welded part of pressure resistant vessel ※1 |
| S | U | E | Ultrasonic inspection (English) | Welded part of pressure resistant vessel ※1 |
| S | X | J | PMI test report (Japanese) | ※1 |
| S | X | E | PMI test report (English) | ※1 |
| S | S | J | Impact test report (Japanese) | ※1 |
| S | S | E | Impact test report (English) | ※1 |
| D | Y | J | WPS/PQR (Japanese) | |
| D | Y | E | WPS/PQR (English) | |
| D | 9 | J | Photo (Japanese) | |
| D | 9 | E | Photo (English) | |
| D | T | J | Inspection procedure (Japanese) | |
| D | T | E | Inspection procedure (English) | |
| C | A | J | Inspection certificate: A set | Only Japanese |
| C | B | J | Inspection certificate: B set | Only Japanese |
| C | C | J | Inspection certificate: C set | Only Japanese |
| C | D | J | Inspection certificate: D set | Only Japanese |
| **Witnessed by customer** | | | | |
| V | 1 | 0 | Required | |

## ■ PLEASE SUPPLY THE FOLLOWING INFORMATION WHEN YOU INQUIRE.

Fill in the blanks. Tick the boxes ☐ that apply.

| Item | Description |
|---|---|
| **1. Fluid to be metered** | |
| **2. Model** | Model:_____ |
| **3. Flow range** | Max._____ Normal_____ Min._____ ☐ $m^3$/h [normal] ☐ $m^3$/h [actual] ☐ kg/h |
| **4. Temperature range** | Max._____ Normal_____ Min._____°C |
| **5. Pressure range** | Max._____ Normal_____ Min._____ ☐ MPa [gauge] |
| **6. Density or Sp. Gr.** | Density_____ ☐ kg/$m^3$ [normal] , ☐ kg/$m^3$ [actual] ☐ kg/h Sp. Gr._____ |
| **7. Viscosity** | _____ ☐ mPa•s, ☐ $mm^2$/s at _____°C |
| **8. Connections** | Nominal size_____ ☐″ , ☐ mm, Flange rating JIS_____K ASME/JPI_____RF DIN PN_____ |
| **9. Flow straightening pipe** | ☐ Req'd (Flow straightener and downstream pipe)<br>☐ Not req'd (Prepare a straight pipe of specified length, I.D., Sch. No.) |
| **10. Compensation** | ☐ Temperature/Pressure comp. ☐ Pressure comp. ☐ Temperature comp. |
| **11. Compensation range** | Temperature_____ to _____°C , Pressure_____ to _____ ☐ MPa [gauge] |
| **12. Compensation ref.** | Ref. temp._____ °C Press. ref._____ ☐ MPa [gauge] |
| **13. Compensation coeff. (gas measurement)** | Z (service conditions)= Zo (standard conditions)= |
| **14. Accuracy test** | ☐ Req'd ☐ Not Req'd |
| **15. Converter** | Type: ☐ Integral configuration, ☐ Separate configuration<br>Explosionproof configuration: ☐ Non-explosionproof, ☐ Flameproof |
| **16. Output** | ☐ Unscaled pulse, ☐ Scaled pulse, Pulse unit _____ /P<br>☐ Analog output, Full scale _____ to _____ _____ /h |
| **17. Receiving instrument** | ☐ Separate-mount LCD counter ☐ Remotely located receiver (Specify model and spec.) |
| **18. Miscellaneous** | |



**Sales Representative:**

GS.No.GBD643E

| 初版 | 改訂 | 印刷 |
|---|---|---|
| 17.07 | | |