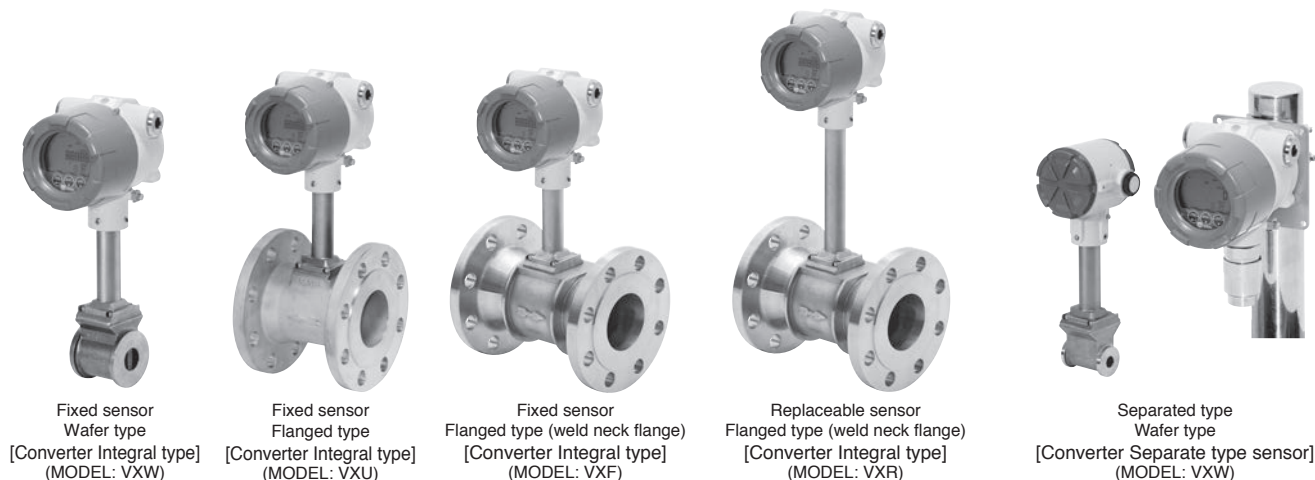




High performance standard type vortex flowmeter BATTERY POWERED EX DELTA II BATTERY POWERED EX DELTA II DIA PAF5 TYPE

GENERAL SPECIFICATION
GS.No.GBD662E-4



GENERAL

With a design to be more usable than ever before, the battery powered EX DELTA II and EX DELTA II DIA operate on an internal battery. In this series, the need of an external power source has been eliminated from the field proven EX DELTA II, that has enjoyed extensive use as a dedicated local monitor, thanks to its all-round characteristics of vortex flowmeter.

The display selects variables of the total flow and instantaneous flowrate with an external switch.

We also supply models with separately mountable flowmeter detector to be installed across the field - some located as far as 50 meters from the centralized monitor and control room.

FEATURES

1. Wide flow range with a high degree of meter accuracy.
2. Liquid service EX DELTA II DIA has our proprietary diamond-shaped vortex shedding bluff body combined with a separately-mounted sensor to reduce scale buildup to a minimum, justifying its use with consistent performance in "dirty" process fluid applications (patent applied for).
The sensor being isolated from the process material and a simple design with no moving parts contributes to long service life.
3. Battery powered, it requires no electrical installation from an external power source. [Uses five 3.6V lithium-metal battery packs. Good for 7 years on a 24 hours a day continuous operation (model integral with preamplifier), or 4 years (model with separately mounted preamplifier) basis.
4. Has multiple display functions such as simultaneous display of the total and the instantaneous flow rates, bargraph display of the instantaneous flow rate and alarm display functions including pre-announcement of low batteries.
5. Waterproof (IP66/67) and intrinsically safe explosionproof configuration (Exd IIB H₂T1, T4). Ideal to serve as a flow sensor dedicated to local monitoring.
6. Models with separately mounted preamplifier enables the operator to monitor multiple sensors at a central control room.

MODEL EXPLANATION

VXW: Fixed sensor Wafer type

VXU: Fixed sensor Flanged type

VXF: Fixed sensor Flanged type (weld neck flange)

VXT: Replaceable sensor Flanged type

VXR: Replaceable sensor Flanged type (weld neck flange)

BORE/CONNECTION STANDARDS CATEGORY FOR FLANGE TYPE

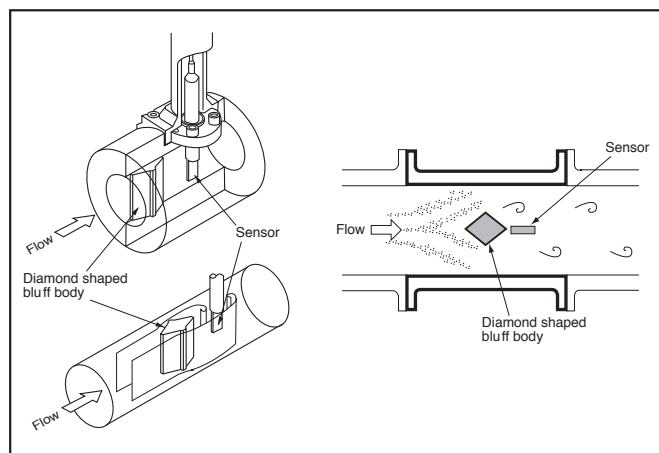
Nominal Size MODEL	10	15	25	40	50	80	100	150	200	250	300
VXU	—	—	—	○	○	○	○	○	—	—	—
VXF	◎	◎	◎	△	△	△	△	△	◎	◎	◎
VXT	—	—	—	○	○	○	○	○	—	—	—
VXR	◎	◎	◎	△	△	△	△	△	◎	◎	◎

◎ : JIS 10, 16, 20, 30K ASME/JPI 150, 300

○ : JIS 10K, ASME 150

△ : JIS 16, 20, 30K ASME 300 JPI 150, 300

EX DELTA II DIA CONSTRUCTION and PRINCIPLE



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■ GENERAL SPECIFICATIONS

● EX DELTA II Meter Body

Item	Description		
Sensor type	Fixed sensor	Fixed sensor	Replaceable sensor
Nominal size (mm)	10, 15, 25, 40, 50, 80, 100, 150	15, 25, 40, 50, 80, 100, 150, 200, 250, 300	15, 25, 40, 50, 80, 100, 150, 200, 250, 300
Connection type	Wafer type (※1)	Flanged type (RF is standard.)	Flanged type (RF is standard.)
Flange rating	JIS 10, 16, 20, 30K ASME/JPI 150, 300, 600 DIN PN10, 16, 25, 40		
Std. connecting pipe	Nominal wall thickness Sch 40 (※2)		
Applicable fluid	Liquids, gases and steam (※3)		
Flow range	See flow range table (P5, 6 and 7).		
Operating temp. range (※ 4, ※ 5)	Ambient temperature type : -30 to +120°C Standard type : -30 to +300°C	Standard type : -30 to +300°C High temp. type : -30 to +460°C	
Max. operating pressure	Depends on flange rating. Refer to the table on the bottom of this page. (Design pressure : 5.00MPa).		
Accuracy (※ 6)	Refer to the following table. If multiple choices are listed for accuracy, they indicate different flow range.		
	Applicable fluidNom. size (mm)	10	15, 25, 40, 50
	Liquids	±2% of full scale or better	±1% of reading or better ±1% of full scale or better
	Gases and steam (Max. flow velocity : 60m/s)	—	±1% of reading or better ±1% of full scale or better
	Gases and steam (Max. flow velocity : 80m/s)	—	— ±1.5% of reading or better ±1.5% of full scale or better
Repeatability	±0.2% or better		
Materials	Body	SCS14A	SUS316 or SCS14A (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 (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: For the nominal diameter of 10 mm, the connected pipe should have a nominal diameter of 15 mm as a standard if it complies with the ASME or JPI standards.

※2: If it differs from those of the standard nominal wall thickness, consult the factory.

※3: Measurement of gaseous steam is possible for nominal sizes of 15 mm and above.

※4: For nominal sizes between 200 and 300 mm with a flange material of SFVC2A, the allowable operating temperature covers a range above 0 °C due to temperature limitations by the flange material.

※5: For explosionproof use, Refer to page 3.

※6: If the instrument is to be used for gas or steam measurement in high pressure range (high Reynolds number: 2.8x10⁶ or above), contact OVAL.

● EX DELTA II DIA Meter Body

Item		Description		
Sensor type		Fixed sensor	Fixed sensor	Replaceable sensor
Nominal size (mm)		15, 25, 40, 50, 80	50, 80	50, 80
Connection		Wafer type	Flanged type (RF is standard.)	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 on use conditions (flow range). ① ±1% of reading or better (±0.1% of full scale is added in case of analog output.) ② ±1% of full scale or better		
Finish		Unpainted (stainless steel material)		

※1: Except for the items above, specifications remain the same as EX DELTA II basic body.

● Flange Rating and Max. Operating Pressure (MPa)

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

Flange Rating Operating Temp.	JIS10K	JIS16K	JIS20K	JIS30K	ASME/ JPI 150	ASME/ JPI 300	ASME/ JPI 600	DIN PN10	DIN PN16	DIN PN25	DIN PN40
Below 120°C	1.40	2.70	3.40	5.00	1.50	3.93	7.86	0.74	1.19	2.05	2.99
120 to 220°C	1.18	1.96	2.45	4.51	1.27	3.35	6.74	0.62	1.00	1.78	2.50
220 to 300°C	0.98	1.77	2.26	4.22	1.02	3.06	6.18	0.56	0.90	1.61	2.26
300 to 350°C	—	1.57	1.96	3.82	0.84	2.96	5.93	—	—	—	—
350 to 420°C	—	—	—	2.94	0.57	2.81	5.61	—	—	—	—
420 to 460°C	—	—	—	—	0.42	2.71	5.44	—	—	—	—

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

Flange Rating Operating Temp.	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
120 to 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
300 to 350°C	—	2.06	2.55	3.82	0.84	3.70
350 to 420°C	—	1.57	1.96	2.94	0.56	2.88

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

● Converter specifications (Standard)

Item	Description
Model	PAF5
Mounting	Flowmeter integral type Separated type (2B (50A) pipe stand), Distance between detector and converter: Max. 50 m
Directives and Standards	EMC EN 61326-1; FCC 47 CFR part 15 (applicable to integral type only) RoHS EN 50581
Explosionproof configuration	Flameproof configuration Meter integral type: detector for separated type: Ex d IIB + H ₂ T4 Converter for separated type (single): Ex d IIC T6 Gb
Waterproof configuration	JIS C 0920 (IEC IP66/67), Seal: silicon
Ambient Temperature	Explosionproof: -20 to +40 °C, 50 °C, 60 °C (see explosionproof specifications (integral and separated types)) Non-explosionproof: -40 to +70 °C
Ambient Humidity	5 to 100% RH. There should be no dew condensation in the housing.
Body Material	Aluminum die-cast
Housing Finish	Polyurethane coating (ISO 12944 compliance with category C4-M)
Finish	Body: Munsell 10B8/4, Cover (front and back): Munsell 2.5PB4/10
Display	Size: upper row 10.5 mm, lower row 7 mm, display rotation by an optical switch (1) Resettable counter in 8 digits, (7 digits for integers + decimal) (2) Totalizing counter in 8 digits (3) Instantaneous flow rate (selectable from /day, /h, /min, /sec) (4) Instantaneous flow rate bar graph Low battery alarm (), switch operation (), alarms, key lock (), with back light
Power Supply	Dedicated battery: 3.6 V lithium-metal battery TL-5930/F made by TADIRAN Converter integral type: 24h 7 years continuous Converter separated type: 24h 4 years continuous The battery life varies according to the setting, configuration and operating environment.
Dimensions	W112xH133xD148mm (excluding protrusions)
Data Protection	All settings are saved in EEPROM. For each total back up. Data retention: 10 years or more. Parameter settings can be saved with a password.
Weight	Approx. 1.9 kg (including pressure-proof packing: 2.0 kg)
Connection (For separated type only)	Wire connection port: M25 female screws Transmission distance: max. 50 m Cable: 1.25 mm ² or more, 3 core shielded wire, finished outer diameter: Non-explosionproof: φ13mm or less Explosionproof: φ8.5 to 11mm Connection terminal block: cross recessed machine screws M3 Pressure-tight packing: • Converter side: KXB-25, 16 ORES or ORE • Detector side: KXY-16 (common to PA25)

■ EXPLOSIONPROOF TEMPERATURE SPECIFICATIONS (INTEGRAL TYPE)

Product code	Ambient temperature Measured fluid temperature	Explosionproof configuratio	Sensor type
VXW VXF	-20°C to +50°C -196°C to +130°C	Ex d IIB+H ₂ T4	Fixed sensor T1 explosionproof
	-20°C to +40°C -196°C to +290°C	Ex d IIB+H ₂ T1	Fixed sensor T4 explosionproof
VXR	-20°C to +50°C -196°C to +420°C	Ex d IIB+H ₂ T1	Replaceable sensor T1 explosionproof
	-20°C to +50°C -196°C to +130°C	Ex d IIB+H ₂ T4 Gb	Replaceable sensor T4 explosionproof

■ EXPLOSIONPROOF TEMPERATURE SPECIFICATIONS (SEPARATED TYPE)

Product code	Ambient temperature Measured fluid temperature	Explosionproof configuratio	Sensor type
Converter for separated type	-20°C to +55°C —	Ex d IIC T6 Gb	Common to all sensors T6 explosionproof
VXW VXF	-20°C to +60°C -196°C to +420°C	Ex d IIB+H ₂ T1	Fixed sensor T1 explosionproof
	-20°C to +60°C -196°C to +130°C	Ex d IIB+H ₂ T4	Fixed sensor T4 explosionproof
VXR	-20°C to +60°C -196°C to +420°C	Ex d IIB+H ₂ T1	Replaceable sensor T1 explosionproof
	-20°C to +60°C -196°C to +130°C	Ex d IIB+H ₂ T4	Replaceable sensor T4 explosionproof

■ NOMINAL METER FACTOR

● EX DELTA II

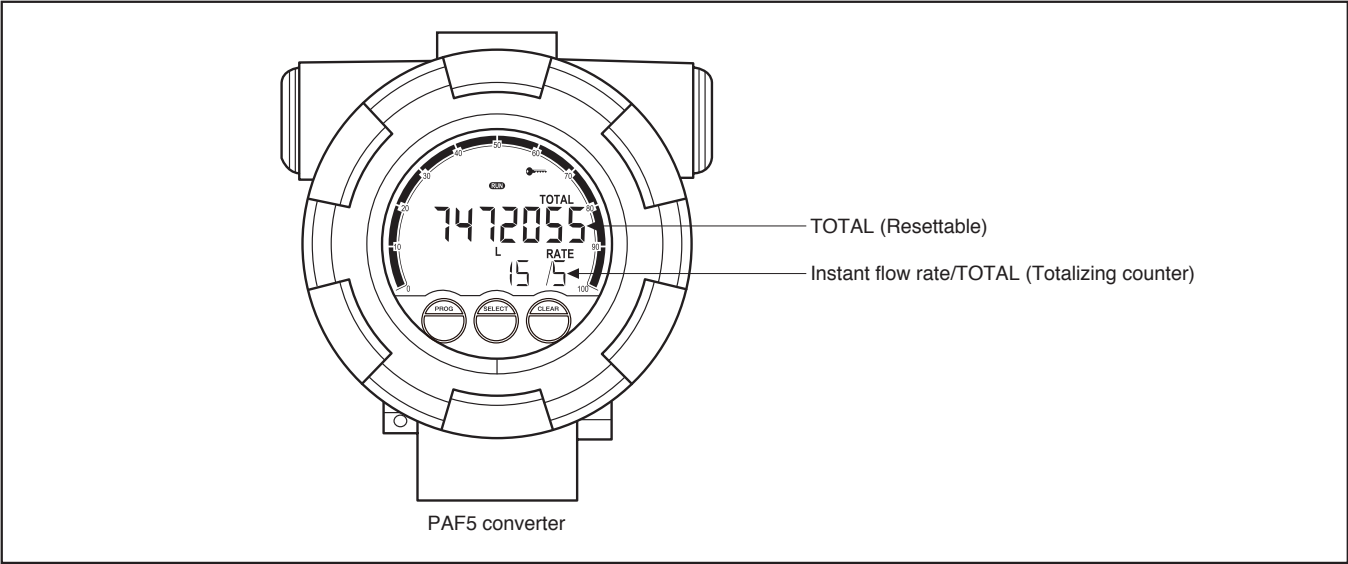
Applicable Fluids	Nominal size mm (inch)	Max. Flow rate m³/h	Nom. Meter Factor L/p
Liquids	10 (3/8)	2.8	0.001714
	15 (1/2)	6.0	0.005338
	25 (1)	20	0.01613
	40 (1-1/2)	48	0.04556
	50 (2)	79	0.1001
	80 (3)	172	0.3328
	100 (4)	296	0.7567
	150 (6)	645	2.422
	200 (8)	1130	7.021
	250 (10)	1750	13.54
	300 (12)	2510	23.24

Applicable Fluids	Nominal size mm (inch)	Max. Flow rate m³/h	Nom. Meter Factor L/p
Gases	15 (1/2)	33	0.005338
	25 (1)	130	0.01613
	40 (1-1/2)	290	0.04556
	50 (2)	490	0.1001
	80 (3)	1380	0.3328
	100 (4)	2370	0.7567
	150 (6)	5160	2.422
	200 (8)	9100	7.021
	250 (10)	14000	13.54
	300 (12)	20100	23.24

● EX DELTA II DIA

Applicable Fluids	Nominal size mm (inch)	Max. Flow rate m³/h	Nom. Meter Factor L/p
Liquids	15 (1/2)	6.0	0.005168
	25 (1)	20	0.01480
	40 (1-1/2)	48	0.05500
	50 (2)	79	0.1151
	80 (3)	172	0.3946

■ DISPLAY SCREEN



■ 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: m³/h

Nominal size mm	Sp. Gr.	Minimum flowrate							Max. 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
15		0.4	0.4	0.4	0.4	0.4	0.3	0.3	0.3
25		1.0	0.9	0.9	0.8	0.8	0.7	0.7	0.7
40		1.7	1.6	1.4	1.4	1.3	1.3	1.2	1.1
50		2.8	2.5	2.3	2.2	2.1	2.0	1.9	1.8
80		6.0	5.5	5.1	4.7	4.6	4.6	4.6	4.6
100		11	11	11	11	11	11	11	11
150		33	33	33	33	33	33	33	33
200		68	62	57	54	51	48	46	44
250		149	136	126	118	111	106	101	96
300		214	195	181	169	159	151	144	138

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

Unit: m³/h

Nominal size mm	Sp. Gr.	Minimum flowrate							Max. Rate
		0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2
15		0.6	0.6	0.5	0.5	0.5	0.4	0.4	0.4
25		1.4	1.3	1.2	1.1	1.1	1.0	1.0	0.9
40		2.4	2.2	2.0	1.9	1.8	1.7	1.6	1.5
50		3.8	3.5	3.2	3.0	2.9	2.7	2.6	2.5
80		8.4	7.6	7.1	6.6	6.2	5.9	5.7	5.4

Table B (based on viscosity)

Unit: m³/h

Nom. Size mm	Accuracy	Viscosity mm²/s	Minimum flowrate														
			1	2	3	5	10	15	20	25	30	40					
10	±2%FS			0.3	0.4	0.6	1.1	Unmeasurable regions									
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)

Liquid (Viscosity 1mPa·s)

Unit: m³/h

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

●Gas Service

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

Size mm			Minimum flowrate (m³/h)									Max. Flowrate (m³/h)	
Accuracy		Dens.kg/m³	0.38	0.7	1.2	2.0	3.6	6	11	19	34	(60)	
Table "C"	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	110	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	110(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 0.017mPa·s)			Measurable lower limit flow rate (detectable min. flowrate) (m³/h)										
	Size mm	Dens. kg/m³	0.38	0.7	1.2	2	3.6	6	11	19	34	60	
	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	
	Table "D"	Type of Gas	Dens. kg/Nm³	Gas pressure(MPa(gauge))at 20°C									
Acetylene		1.175	—	—	0	0.08	0.23	0.55	0.9	1.65	3	—	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 () is the max. rate at accuracy ±1.5% of readings.

How to Determine the Minimum Flowrate

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 flowrate where: Fluid:Air, Temperature:20°C, Pressure:0.5MPa (gauge) and nominal size: 80mm.

SOLUTION:Minimum flowrate 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:

$$Q_{\min} = 38 + \frac{0.85-0.5}{0.85-0.4} \times (47-38) \div 45\text{m}^3/\text{h}$$

It can also be determined by calculating the actual density. Actual density of air ρ at 20°C at 0.5MPa is

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

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 flowrate at a density of 7.15 therefore can be found in proportion to as follows:

$$Q_{\min} = 38 + \frac{11-7.15}{11-6} \times (47-38) \div 45\text{m}^3/\text{h}$$

EXAMPLE 2

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

SOLUTION:First,we find the actual max. flowrate 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:

$$Q_{\max} = 1800 \times \frac{273.15 + 30}{273.15} \times \frac{0.101325}{0.101325 + 0.8} \div 225\text{m}^3/\text{h}$$

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:

$$Q_{\min} = 8 + \frac{1.7-1.5}{1.7-0.95} \times (9-8) \div 8.3\text{m}^3/\text{h}$$

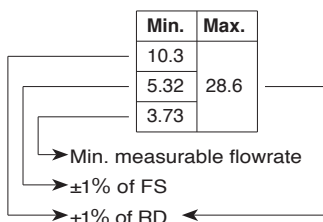
NOTE:In cases where obtained results of calculation are figures with decimal places, round off fraction below the decimal point in the maximum flow rate, or round out fractions to a round number in the minimum flow rate.

● Saturated Steam Service

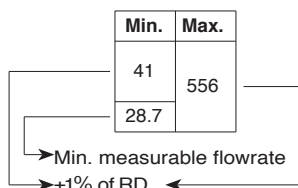
Pressure MPaG	Unit : kg/h								Unit : t/h											
	15mm (1/2")		25mm (1")		40mm (1 1/2")		50mm (2")		80mm (3")		100mm (4")		150mm (6")		200mm (8")		250mm (10")		300mm (12")	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
0.05	10.3		18.8		29.1		37.2		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	28.6	13.1	113	22	252	35.9	426												
	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		19.4		30		41		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	37.4	15	147	25.1	329		556												
	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		20.2		33		53.9		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	54.7	19.7	215		480		812												
	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		23.5		39.4		64.5		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	71.5		282		629		1060												
	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		27		45.3		74.2		0.17	2.94	0.28	4.94	0.61	11.1	1.07	18.7	2.37	28	3.39	40.1
	11	88.2		347		775		1310												
	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		30.3		50.8		83.2		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	104		412		920		1550												
			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		33.4		56		91.6		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	121		477		1060		1790												
			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		39.1		65.6		108		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	153		605		1350		2280												
			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		44.4		74.6		122		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	186		733		1630		2760												
			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		56.5		94.8		155		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	266		1050		2340		3960												
			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		67.4		114		185		0.41	11.5	0.7	19.4	1.52	44	2.67	73.7	5.89	110	8.83	158
	19.2	347		1370		3050		5160												
			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		77.5		131		213		0.47	14.3	0.81	24	1.75	54.3	3.3	91	6.78	136	10.9	195
	22.1	429		1690		3770		6370												
			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		87.1		147		240		0.53	17	0.91	28.6	1.97	64.8	3.93	108	7.62	162	13	232
	24.9	511		2010		4490		7590												
			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		106		177		290		0.64	22.6	1.09	38.1	2.38	86.1	5.22	144	10.1	216	17.3	309
	30.1	680		2670		5970		10100												
			73.7		124		203		0.45	28.4	0.77	48.8	1.67	106	3.66	187	70.3	288	12.1	414
5	50		123		206		337		0.74	28.4	1.27	47.9	2.83	108	6.56	181	12.7	271	21.7	388
	35	854		3360		7500		12600												
			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

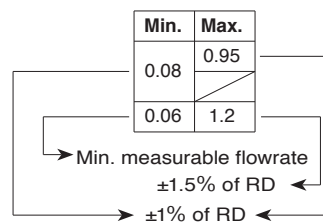
Less than 50mm



Less than 50mm

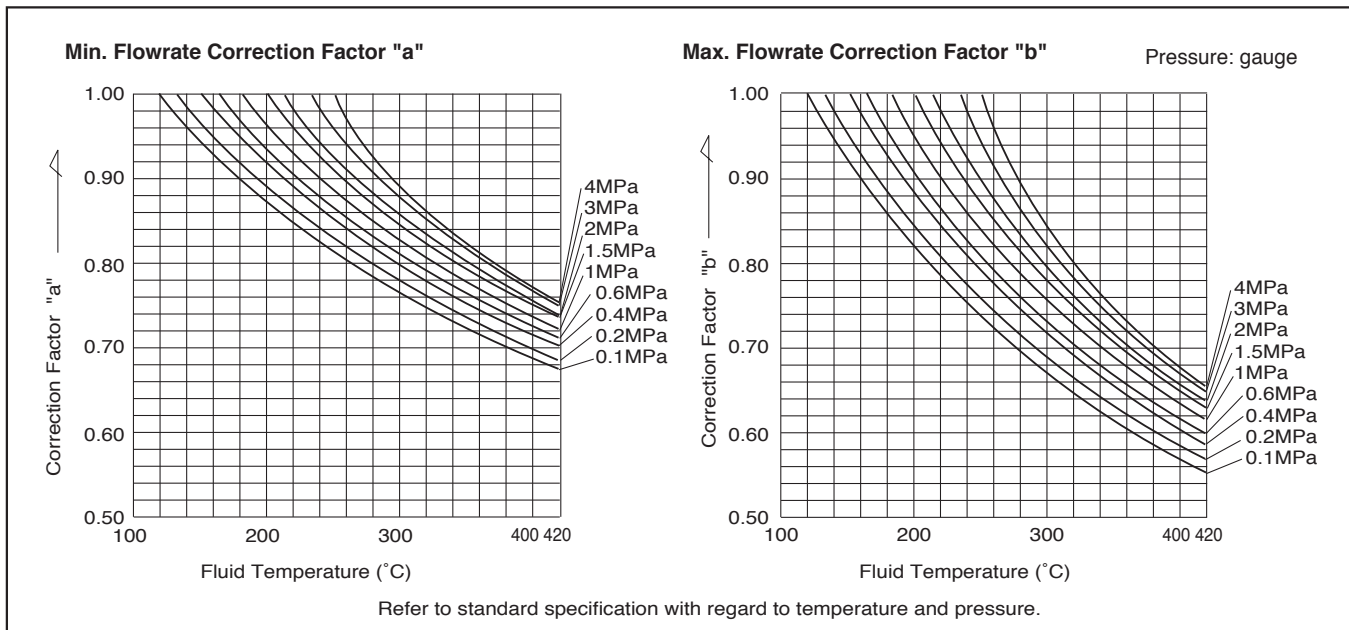


80mm and bigger



● 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 size and pressure readings in the saturated steam flow range table by these correction factors.



EXAMPLE : Find the flow range of superheated steam where Nominal size : 50mm, Pressure : 1MPa (gauge) and Temperature 250°C.

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

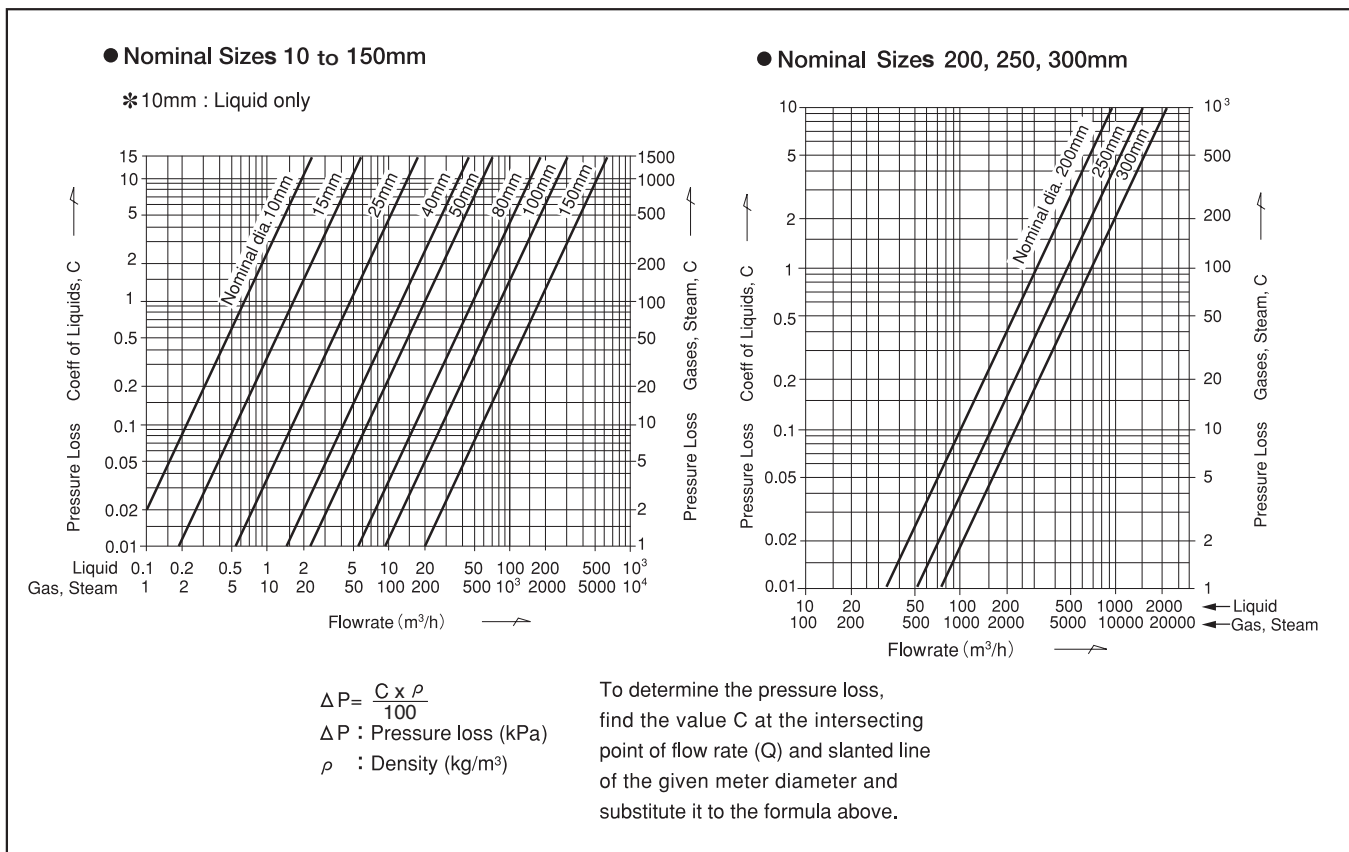
Min. flowrate $Q_{min} = 0.890 \times 122 = 109 \text{ kg/h}$

Max. flowrate $Q_{max} = 0.840 \times 2760 = 2320 \text{ kg/h}$

IMPORTANT: 1. In applications where flowrate momentarily exceeds the max. rate, hold that peak value within 1.6 times the max. rating.

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

■ PRESSURE LOSSES



■ INDICATED TOTAL UNITS OF MEASURE

The total flow reads in the same unit of measure as the flow unit.

Example : If it reads in “m³/h”, the total flow reads in “m³”.

■ TOTAL UNITS RESOLUTION

● EX DELTA II

● Liquid service

Nominal size (mm)	Reads in m ³
10	0.01
15	
25	
40	0.1
50	
80	
100	
150	1
200	
250	
300	

● Gas service

Nominal size (mm)	Reads in m ³
15	0.01
25	0.1
40	
50	
80	1
100	
150	
200	10
250	
300	

● EX DELTA II DIA

● Liquid service

Nominal size (mm)	Reads in m ³
15	0.01
25	
40	
50	0.1
80	

■ SCALED PULSE UNITS FOR FIXED CONVERSION

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

※ : Fixed conversion is done at certain conditions, i.e. pressure, temperature and density. Therefore, some error may occur when your service condition is different from the preset value.

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

● Case 1

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.(°C)

P=Operating press.(MPa[gauge])

Z_0 =Compressibility coefficient under standard conditions.

Z =Compressibility coefficient under operating conditions.

- 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, $0.999 \leq \text{③} < 9.99$
- In Table B, find the scaled pulse unit relative to the segment number.

Table A ● Conversion Factor — Segment Graph

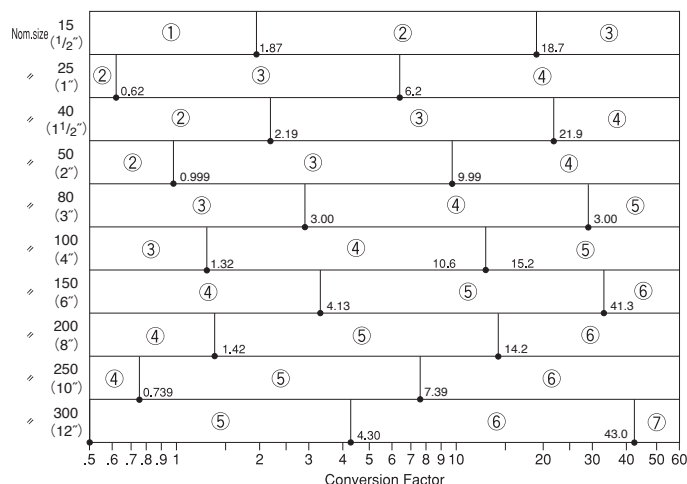


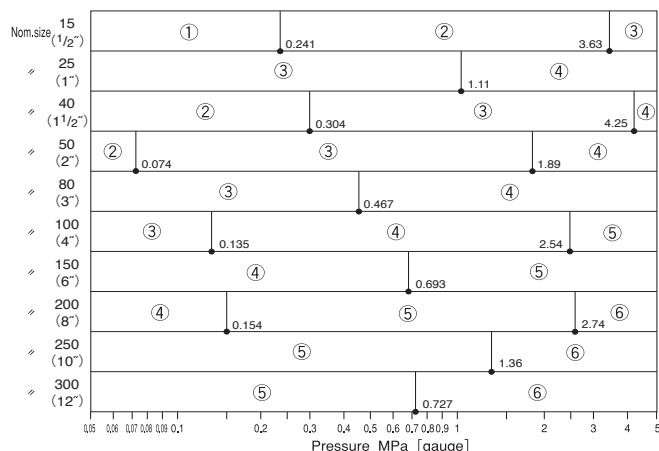
Table B ● Segment — Indicated Unit

Segment No.	Reads : m ³ [normal]
①	0.01
②	0.01
③	0.1
④	1
⑤	10
⑥	100
⑦	1000

● Case 2

- 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.

Table C ● Pressure (Gase Pressure) — Segment Graph



- In Table D, find the scaled pulse unit relative to the segment number.

Table D ● Segment — Indicated Unit

Segment No.	Reads : kg
①	0.01 (*)
②	0.01 (*)
③	0.1 (*)
④	1
⑤	10
⑥	100

In case of "Unit of display: t", "0.001t" is given as the minimum value.

● Case 3

- 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.

- In Table F, find the scaled pulse unit relative to the segment number.

Table E ● Density — Segment Graph

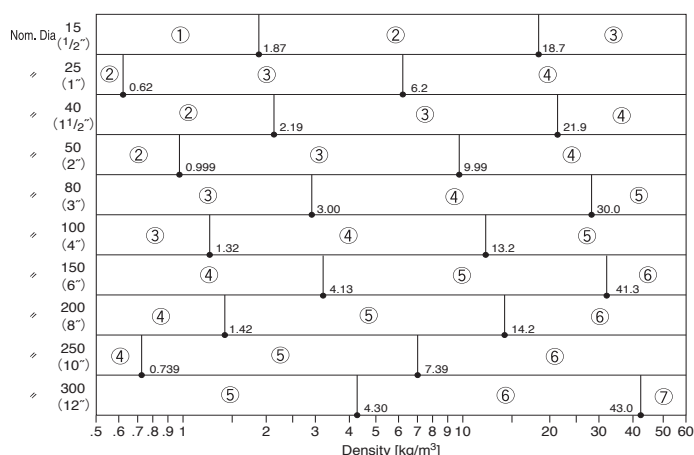


Table F ● Segment — Indicated Unit

Segment No.	Reads : kg
①	0.01 (*)
②	0.01 (*)
③	0.1 (*)
④	1
⑤	10
⑥	100

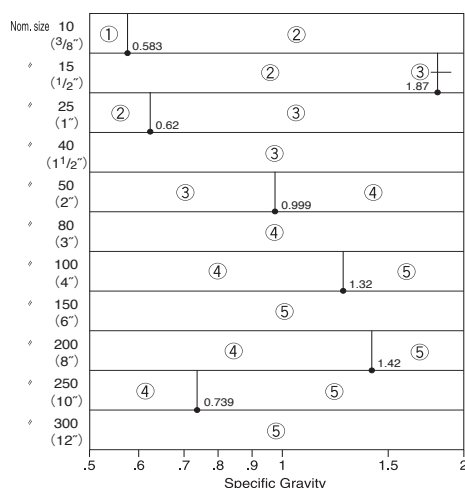
In case of "Unit of display: t", "0.001t" is given as the minimum value.

● Case 4

- 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.

- 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

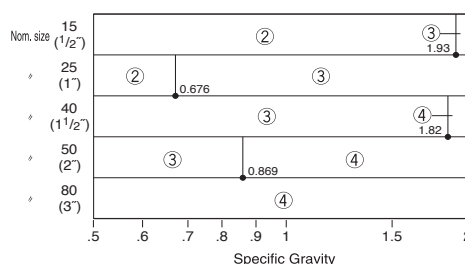


Table H

● Segment — Indicated Unit

Segment No.	Reads : kg
①	0.1 (*)
②	1
③	10
④	100
⑤	1000

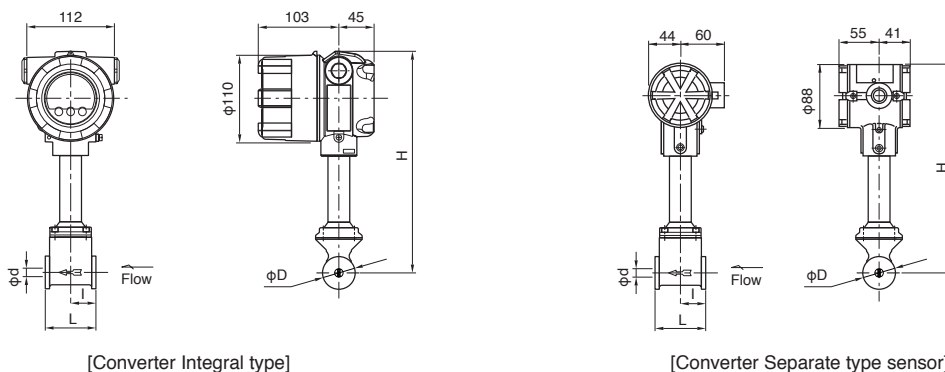
In case of "Unit of display: t", "0.001t" is given as the minimum value.

EX DELTA II OUTLINE DIMENSIONS [FIXED SENSOR TYPE] (Unit: mm)

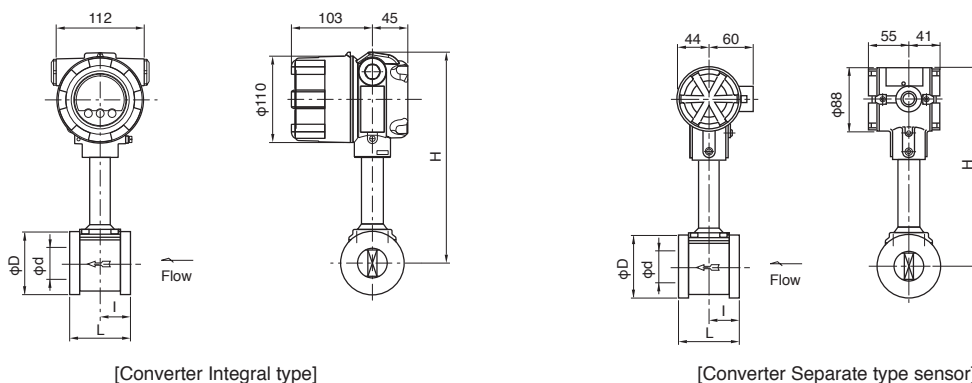
Fixed sensor/Wafer type (MODEL: VXW)

[Unit: mm]

● Nominal Sizes 10,15, 25mm



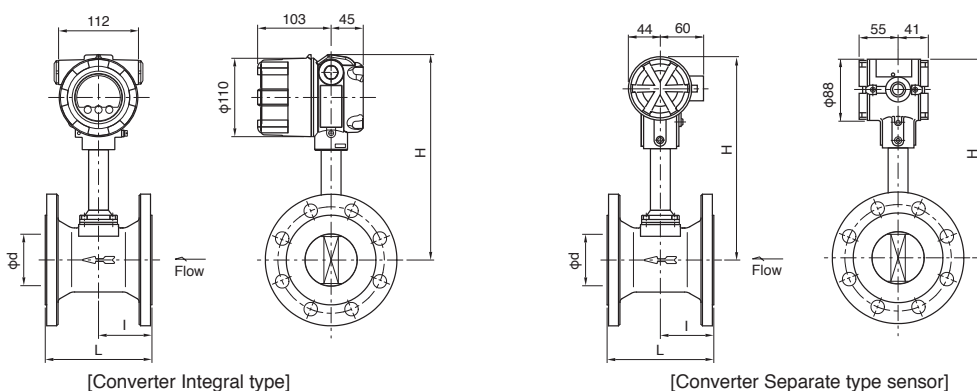
● Nominal Sizes 40 to 150mm



Nominal size mm (inch)	L	I	φd (Meter I.D.)	φD	H		Approx. Weight (kg)	
					Converter Integral type	Converter Separate type sensor	Converter Integral type	Converter Separate type sensor
10 (3/8")	65	32.5	10	40	299	276	3.3	2.4
15 (1/2")	65	32.5	14.5	40	299	276	3.3	2.4
25 (1")	65	32.5	26.6	67	299	276	3.9	3.0
40 (1-1/2")	80	40	37.6	81	284	261	4.6	3.7
50 (2")	80	40	48.5	91	288	265	4.7	3.8
80 (3")	100	40	72.4	126	304	281	7.5	6.6
100 (4")	125	48	95.2	156.2	324	301	11.2	10.3
150 (6")	165	54	140.3	214.9	354	331	21.1	20.2

Fixed sensor/Flange type (MODEL: VXU)

● Nominal Sizes 40 to 150mm



Nominal size mm (inch)	Flange rating	L	I	φd (Meter I.D.)	H		Approx. Weight (kg)	
					Converter Integral type	Converter Separate type sensor	Converter Integral type	Converter Separate type sensor
40 (1-1/2")	JIS 10K	130	65	37.6	284	261	6.9	6.0
	ASME 150	150	75				6.7	5.8
50 (2")	JIS 10K	130	65	48.5	288	265	8.0	7.1
	ASME 150	150	75				8.8	7.9
80 (3")	JIS 10K	150	75	72.4	304	281	11.3	10.4
	ASME 150	160	80				14.0	13.1
100 (4")	JIS 10K	160	80	95.2	324	301	14.4	13.5
	ASME 150	170	85				20.0	19.1
150 (6")	JIS 10K	220	110	140.3	354	331	28.9	28.0
	ASME 150	230	115				31.9	31.0

Note: Refer to model VXF for nominal diameters and flange standards other than listed above.

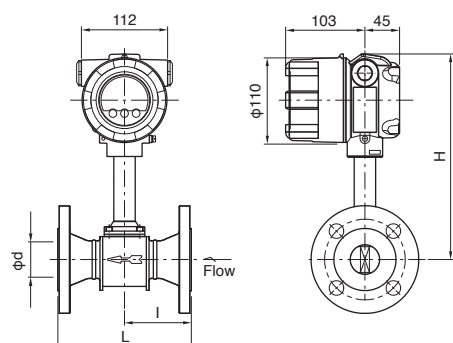
NOTE: Outline dimensions of special or law-compliant products may be different. Please refer to the approval drawing or delivery specification.

EX DELTA II OUTLINE DIMENSIONS [FIXED SENSOR TYPE] (Unit: mm)

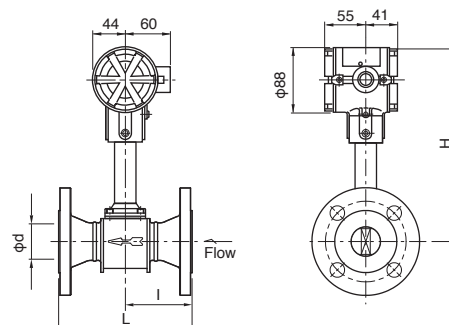
Fixed sensor/Flange type (MODEL: VXF)

[Unit: mm]

● Nominal Sizes 15 to 150mm

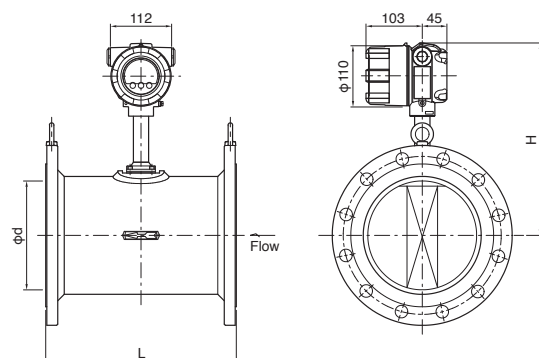


[Converter Integral type]

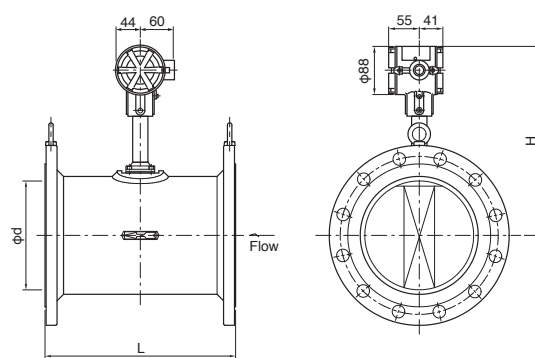


[Converter Separate type sensor]

● Nominal Sizes 200 to 300mm



[Converter Integral type]



[Converter Separate type sensor]

Nominal size mm (inch)	Flange rating	L	I	ϕd (Meter I.D.)	H		Approx. Weight (kg)	
					Converter Integral type	Converter Separate type sensor	Converter Integral type	Converter Separate type sensor
15 (1/2")	JIS 10K (16K)	142	71	14.5	299	276	4.6	3.7
	JIS 20K	142	71				6.0	5.1
	JIS 30K	152	76				4.2	3.3
	ASME 150	158	79				4.8	3.9
	JPI 150	167	83.5				5.1	4.2
	ASME 300	167	83.5					
	JPI 300	180	90					
	ASME 600	180	90					
25 (1")	JIS 10K (16K)	152	76	26.6	299	276	6.6	5.7
	JIS 20K	152	76				7.6	6.7
	JIS 30K	158	79				5.8	4.9
	ASME 150	174	87				7.0	6.1
	JPI 150	186	93				7.4	6.5
	ASME 300	186	93					
	JPI 300	199	99.5					
	ASME 600	199	99.5					
40 (1-1/2")	JIS 20K	175	87.5	37.6	284	261	9.1	8.2
	JIS 30K	185	92.5				11.2	10.3
	JPI 150	201	100.5				8.7	7.8
	ASME 300	213	106.5				11.1	10.2
	JPI 300	213	106.5				12.1	11.2
	ASME 600	229	114.5					
	JPI 600	229	114.5					
	ASME 600	229	114.5					
50 (2")	JIS 20K (16K)	181	90.5	48.5	288	265	9.9	9.0
	JIS 30K	191	95.5				12.0	11.1
	JPI 150	204	102				10.7	9.8
	ASME 300	217	108.5				12.5	11.6
	JPI 300	217	108.5				14.1	13.2
	ASME 600	236	118					
	JPI 600	236	118					
	ASME 600	236	118					
80 (3")	JIS 20K (16K)	233	106.5	72.4	304	281	18.6	17.7
	JIS 30K	243	111.5				22.6	21.7
	JPI 150	237	108.5				18.7	17.8
	ASME 300	255	117.5				23.2	22.3
	JPI 300	255	117.5				26.0	25.1
	ASME 600	275	127.5					
	JPI 600	275	127.5					
	ASME 600	275	127.5					

Nominal size mm (inch)	Flange rating	L	I	ϕd (Meter I.D.)	H		Approx. Weight (kg)	
					Converter Integral type	Converter Separate type sensor	Converter Integral type	Converter Separate type sensor
100 (4")	JIS 20K (16K)	264	117.5	95.2	324	301	25.9	25.0
	JIS 30K	274	122.5				32.5	31.6
	JPI 150	274	122.5				27.3	26.4
	ASME 300	294	132.5				36.7	35.8
	JPI 300	294	132.5				36.9	36.0
	ASME 600	338	154.5				48.5	47.6
	JPI 600	338	154.5					
	ASME 600	338	154.5					
150 (6")	JIS 20K (16K)	342	142.5	140.3	354	331	53.5	52.6
	JIS 30K	352	147.5				67.1	66.2
	JPI 150	340	141.5				47.3	46.4
	ASME 300	359	151				66.3	65.4
	JPI 300	359	151				66.7	65.8
	ASME 600	409	176				95.9	95.0
	JPI 600	409	176					
	ASME 600	409	176					
200 (8")	JIS 10K	350	—	199.9	369	346	39.5	38.6
	JIS 16K						48.1	47.2
	JIS 20K						50.3	49.4
	JIS 30K						68.5	67.6
	ASME 150						48.9	48
	JPI 150						73.7	72.8
	ASME 300						48.9	48
	JPI 300						73.7	72.8
250 (10")	JIS 10K	450	—	248.8	391	368	69.5	68.6
	JIS 16K						86.1	85.2
	JIS 20K						92.1	91.2
	JIS 30K						119.5	118.6
	ASME 150						81.1	80.2
	JPI 150						116.9	116
	ASME 300						81.1	80.2
	JPI 300						116.9	116
300 (12")	JIS 10K	500	—	297.9	413	390	89.5	88.6
	JIS 16K						112.9	112
	JIS 20K						118.7	117.8
	JIS 30K						162.5	161.6
	ASME 150						119.7	118.8
	JPI 150						166.3	165.4
	ASME 300						119.7	118.8
	JPI 300						166.3	165.4

Note: Refer to model VXU for nominal diameters and flange standards other than listed above.

Note: 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.

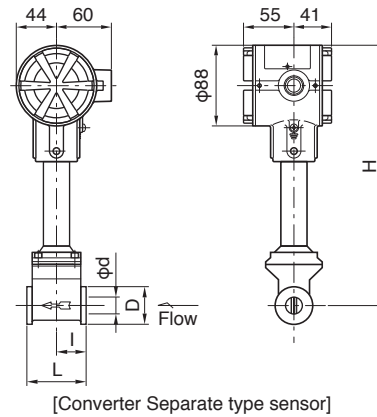
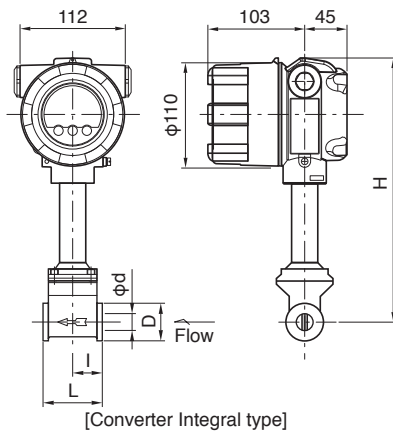
NOTE: Outline dimensions of special or law-compliant products may be different. Please refer to the approval drawing or delivery specification.

EX DELTA II DIA OUTLINE DIMENSIONS [FIXED SENSOR TYPE] (Unit: mm)

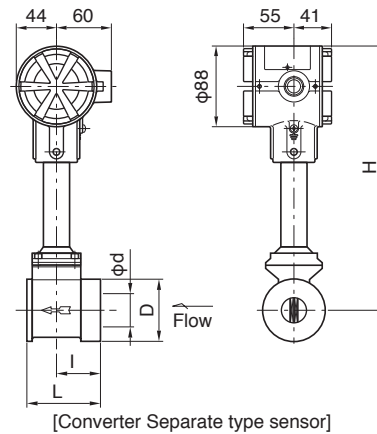
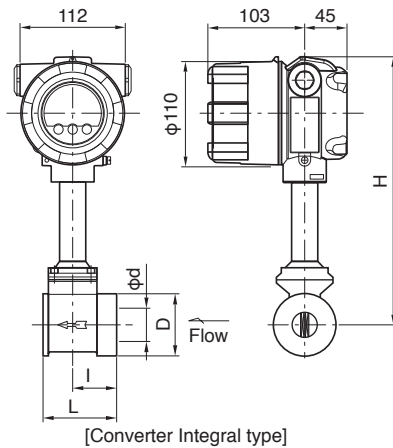
Fixed sensor/Wafer type (MODEL: VXJ)

[Unit: mm]

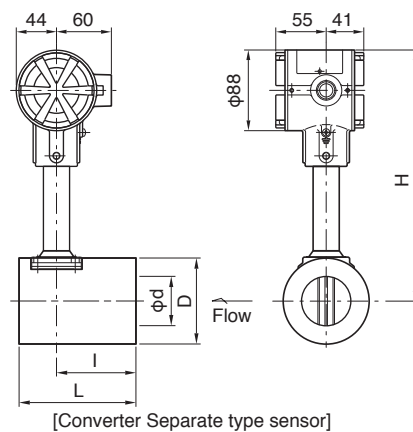
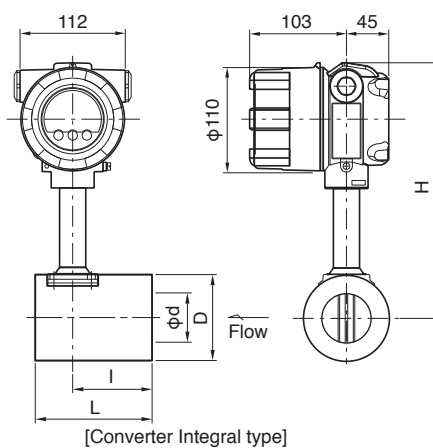
● Nominal Sizes 15mm



● Nominal Sizes 25mm



● Nominal Sizes 40 to 80mm



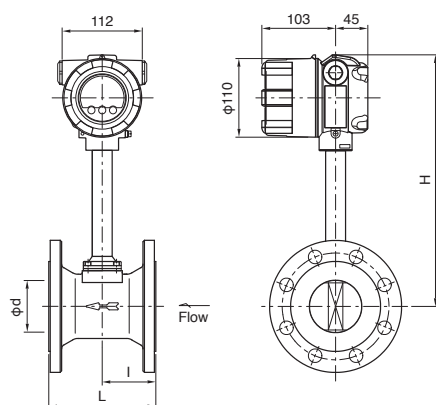
Nominal size mm (inch)	L	I	φd (Meter I.D.)	φD	H		Approx. Weight (kg)	
					Converter Integral type	Converter Separate type sensor	Converter Integral type	Converter Separate type sensor
15 (1/2")	65	32.5	14.5	40	299	276	3.3	2.4
25 (1")	80	47.5	26.6	67	299	276	3.9	3
40 (1-1/2")	100	67	41.2	82	284	261	4.6	3.7
50 (2")	125	85	52.7	92	288	265	4.7	3.8
80 (3")	125	85	78.1	127	304	281	7.5	6.6

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

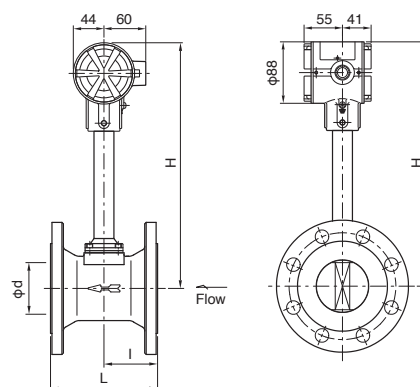
■ EX DELTA II OUTLINE DIMENSIONS [REPLACEABLE SENSOR TYPE] (Unit: mm)

Replaceable sensor/Flange type (MODEL: VXT)

[Unit: mm]



[Converter Integral type]



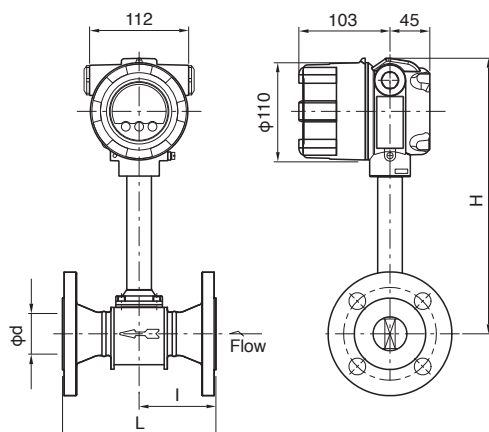
[Converter Separate type sensor]

Nominal size mm (inch)	Flange rating	L	I	φd (Meter I.D.)	H		Approx. Weight (kg)	
					Converter Integral type	Converter Separate type sensor	Converter Integral type	Converter Separate type sensor
40 (1-1/2")	JIS 10K	130	65	37.6	365	342	7.5	6.6
	ASME 150	150	75				7.3	6.4
50 (2")	JIS 10K	130	65	48.5	369	346	8.6	7.7
	ASME 150	150	75				9.4	8.5
80 (3")	JIS 10K	150	75	72.4	385	362	11.9	11.0
	ASME 150	160	80				14.6	13.7
100 (4")	JIS 10K	160	80	95.2	405	382	15.0	14.1
	ASME 150	170	85				20.6	19.7
150 (6")	JIS 10K	220	110	140.3	435	412	29.5	28.6
	ASME 150	230	115				32.5	31.6

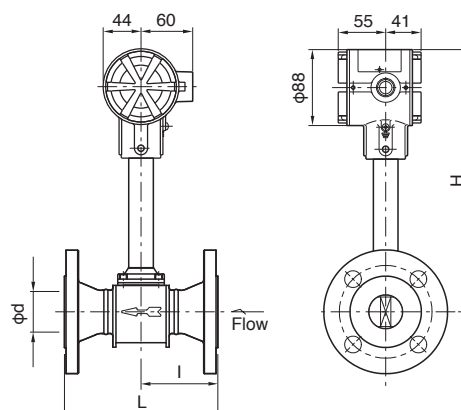
Note: Refer to model VXR for nominal diameters and flange standards other than listed above.

Replaceable sensor/Flange type (MODEL: VXR)

● Nominal Sizes 15 to 150mm

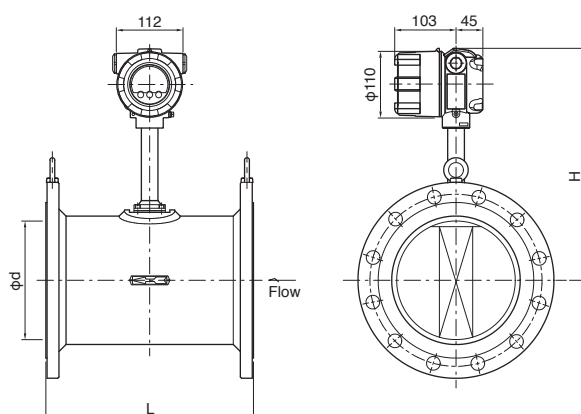


[Converter Integral type]

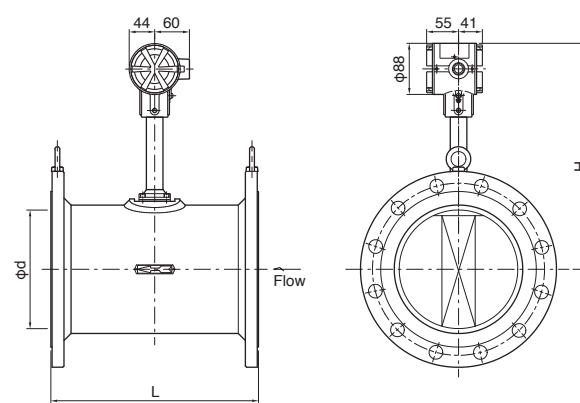


[Converter Separate type sensor]

● Nominal Sizes 200 to 300mm



[Converter Integral type]



[Converter Separate type sensor]

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

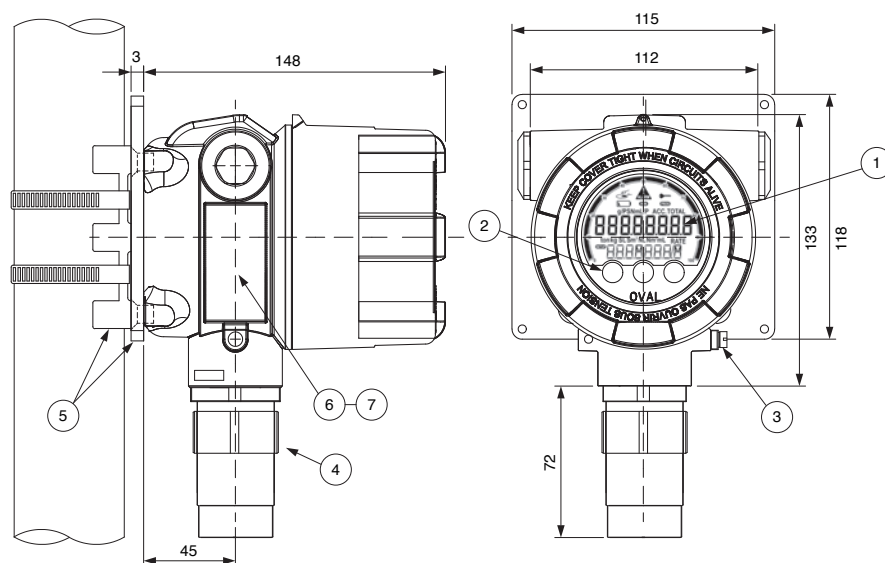
Nominal size mm (inch)	Flange rating	L	I	ϕ d (Meter I.D.)	H		Approx. Weight (kg)	
					Converter Integral type	Converter Separate type sensor	Converter Integral type	Converter Separate type sensor
15 (1/2")	JIS 10K (16K)	142	71	14.5	368	345	5.2	4.3
	JIS 20K	152	76				6.6	5.7
	JIS 30K	158	79				4.8	3.9
	ASME 150	167	83.5				5.4	4.5
	JPI 150	180	90				5.7	4.8
	ASME 300							
	JPI 300							
25 (1")	JIS 10K (16K)	152	76	26.6	368	345	7.3	5.7
	JIS 20K	158	79				8.3	6.7
	JIS 30K	174	87				6.5	4.9
	ASME 150	186	93				7.7	6.1
	JPI 150	199	99.5				8.1	6.5
	ASME 300							
	JPI 300							
40 (1-1/2")	JIS 16K	171	85.5	37.6	365	342	9.4	7.8
	JIS 20K	175	87.5				9.8	8.2
	JIS 30K	185	92.5				11.9	10.3
	JPI 150	201	100.5				9.4	7.8
	ASME 300	213	106.5				11.8	10.2
	JPI 300							
	ASME 600	229	114.5				12.8	11.2
50 (2")	JIS 20K (16K)	181	90.5	418.5	369	346	10.6	9.0
	JIS 30K	191	95.5				12.7	11.1
	JIS 150	204	102				11.4	9.8
	ASME 300	217	108.5				13.2	11.6
	JPI 300							
	ASME 600	236	118				14.8	13.2
	JPI 600							
80 (3")	JIS 20K (16K)	233	106.5	72.4	385	362	19.2	18.3
	JIS 30K	243	111.5				23.2	22.3
	JPI 150	237	108.5				19.3	18.4
	ASME 300	255	117.5				23.8	22.9
	JPI 300							
	ASME 600	275	127.5				26.6	25.7
	JPI 600							

Nominal size mm (inch)	Flange rating	L	I	ϕ d (Meter I.D.)	H		Approx. Weight (kg)	
					Converter Integral type	Converter Separate type sensor	Converter Integral type	Converter Separate type sensor
100 (4")	JIS 20K (16K)	264	117.5	95.2	405	382	26.5	25.6
	JIS 30K	274	122.5				33.1	32.2
	JPI 150	274	122.5				27.9	27.0
	ASME 300	294	132.5				37.3	36.4
	JPI 300						37.5	36.6
	ASME 600	338	154.5				49.1	48.2
	JPI 600							
150 (6")	JIS 20K (16K)	342	142.5	140.3	435	412	54.1	53.2
	JIS 30K	352	147.5				67.7	66.8
	JPI 150	340	141.5				47.9	47.0
	ASME 300	359	151				66.9	66.0
	JPI 300						67.3	66.4
	ASME 600	409	176				96.5	95.6
	JPI 600							
200 (8")	JIS 10K			199.9	450	427	40.1	39.2
	JIS 16K						48.7	47.8
	JIS 20K						50.9	50
	JIS 30K						69.1	68.2
	ASME 150						49.5	48.6
	JPI 150						74.3	73.4
	ASME 300						49.5	48.6
250 (10")	JIS 10K			248.8	472	449	70.1	69.2
	JIS 16K						86.7	85.8
	JIS 20K						92.7	91.8
	JIS 30K						120.1	119.2
	ASME 150						81.7	80.8
	JPI 150						117.5	116.6
	ASME 300						81.7	80.8
300 (12")	JIS 10K			297.9	494	471	117.5	116.6
	JIS 16K						90.1	89.2
	JIS 20K						113.5	112.6
	JIS 30K						119.3	118.4
	ASME 150						163.1	162.2
	JPI 150						120.3	119.4
	ASME 300						166.9	166
300 (12")	JPI 300						120.3	119.4
	JPI 600						166.9	166

Note: Refer to model VXT for nominal diameters and flange standards other than listed above.

Note: 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.

● Separate type converter



NO.	Name
1	LCD display
2	Optical switch
3	GND terminal M4 screw
4	M25 Pressure-tight packing *
5	Mounting bracket
6	Model code label
7	Explosionproof label (opposite side surface)

* In case of non-explosionproof option.

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

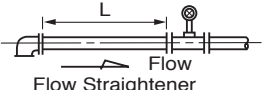
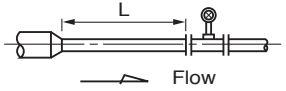
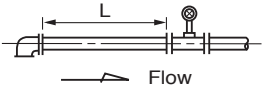
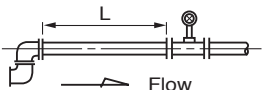
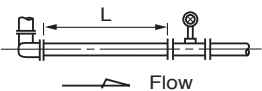
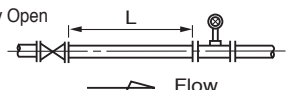
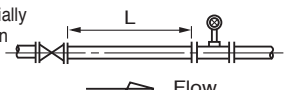
■ INSTALLATION CONDITIONS

1. TYPICAL PIPING INSTRUCTIONS

It is generally required that the flow pattern of a fluid flowing in and out of an vortex flowmeter be as uniform as possible for accurate metering performance.

For this, the standard piping instructions are shown in the following table.

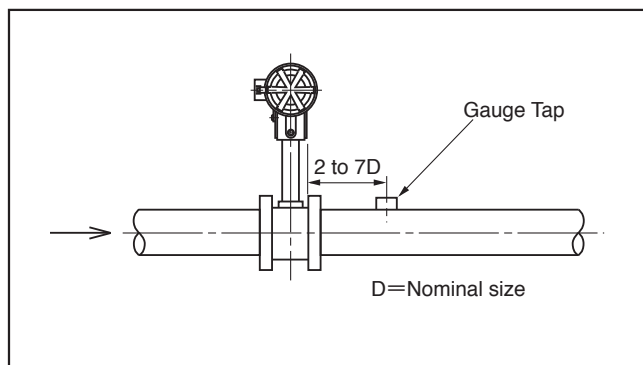
(1) Use an OVAL flow straightener or provide a specified straight pipe (ISO-5167 compliant).

No.	Piping Arrangement	Straight Pipe Length (L) D: nominal diameter	Remarks
1	OVAL's flow-straightener 	8D	Refer to Point 4 on P17.
	Flow Straightener 	12D	Refer to GS/GCF001.
2	Reducer 	15D Min.	A concentric reducer is installed upstream of meter.
3	Elbow 	23D Min.	An elbow is installed upstream of a meter.
		25D Min.	Two elbows are installed upstream of a meter.
		40D Min.	Two elbows are vertically installed upstream of a meter.
4	Fully open gate valve 	15D Min.	A full-open gate valve is installed 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 used for the flow straightener. Use Sch. 40 pipe for standard piping.

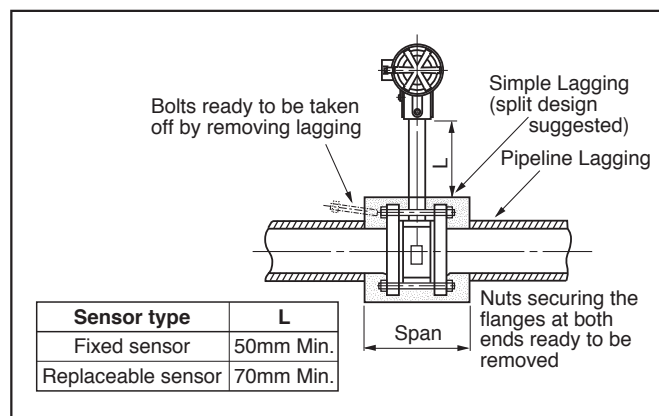
2: A short pipe section, 5D or longer, is provided downstream of the meter.

3: Taps for pressure gage and/or thermometer should be located downstream of the meter (Fig. below).



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.



* With high-temperature service, replaceable model, the required length is L=40mm min. from radiator fins.

* 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.

$$P \geq 2.60 \Delta P + 1.25P_o \text{ (MPa [absolute])}$$

where, P : Line pressure (MPa)

ΔP : Pressure loss (MPa)

P_o : 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.

$$N < 22 \rho V_2 \text{ (Pa)}$$

where, N : Fluctuation pressure (Pa)

ρ : Density (kg/m³)

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).

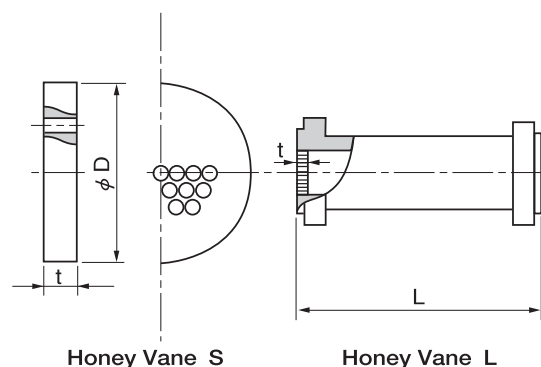
4. SPACE SAVING (Reduction of Meter run)

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 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 $\pm 2\%$ RD for liquid service. Consult OVAL for accuracy requirement.

● Honey Vane Outline Dimensions

Nom. size (mm)	ϕD * (mm)	Honey Vane S	Honey Vane L
		t (mm)	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

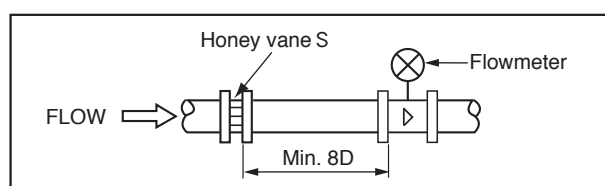
*1. JIS10K



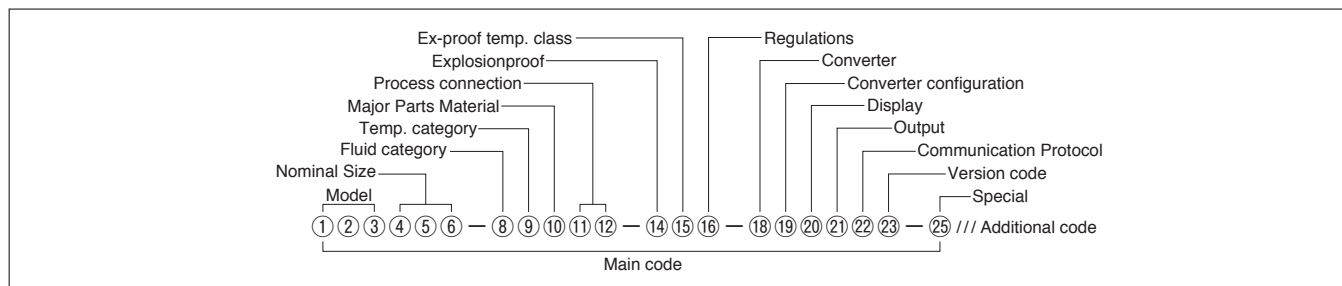
© Flange face to face span of EX DELTA II SS is the same as that of standard EX DELTA II. (Refer to P11,12)

● 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)

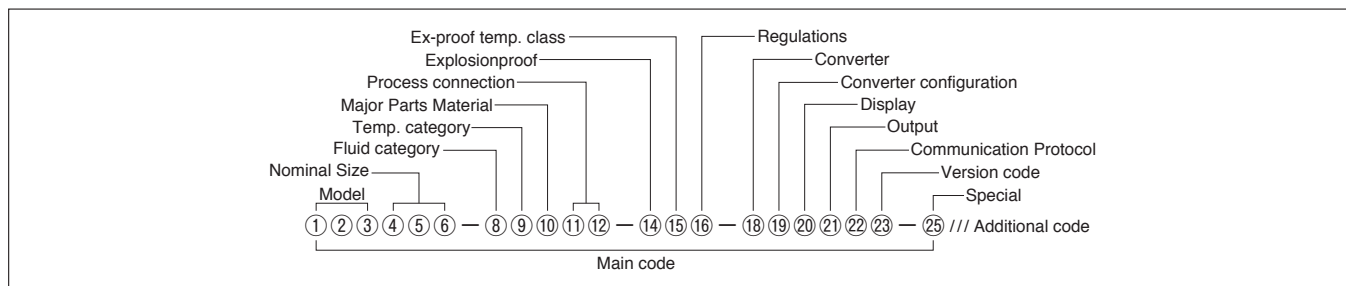
①	②	③	Model ※1
V	X	U	EX DELTA II Flanged type, Fixed sensor
V	X	T	EX DELTA II Flanged type, Replaceable sensor
④	⑤	⑥	Nominal Size
0	4	0	40mm (1-1/2")
0	5	0	50mm (2")
0	8	0	80mm (3")
1	0	0	100mm (4")
1	5	0	150mm (6")
⑦	—		
⑧	Fluid category		
L	Liquid		
G	Gas		
S	Saturated Steam		
K	Heating Steam		
⑨	Temp. 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	JIS 10K RF	
A	1	ASME 150	
Z	9	Special	
⑬	—		
⑭	Explosionproof		
0	Non-explosionproof		
1	Flameproof (TIIS)		

⑮	Ex-proof temp. class	
0	Non-explosionproof	
1	T1	
4	T4	
⑯	Regulations	
0	Standard	
F	w/Material test certificate	
⑰	—	
⑱	Converter	
F	PAF5 Battery drive, no output signal	
⑲	Converter configuration	
1	Integrally mounted	
2	Separately mounted ※2	
⑳	Display	
1	W/Totalizer · digital indicator	
㉑	Output	
N	No external output	
㉒	Communication interface	
N	Non	
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: Regardless of sensor specifications, the explosionproof symbol related to the converter is always Ex d IIC T6 Gb for the separated configuration.

■ PRODUCT CODE EXPLANATION



● Main code (MODEL: VXW, VXF and VXR)

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)
V	X	R	EX DELTA II Flanged type Replaceable sensor (Nominal Size 15mm and bigger, RF is standard)
④	⑤	⑥	Nominal Size
0	1	0	10mm (3/8") Only Liquid, Only Wafer
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 ※1		
S	Saturated Steam		
K	Heating Steam		
⑨	Temp. category		
0	120°C and lower		
1	220°C and lower		
2	300°C and lower		
3	350°C and lower		
4	420°C and lower		
5	460°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 ※3	
J	1	JIS 10K RF 300°C and lower, for wafer type FF is also available	
J	B	JIS 16K RF 350°C and lower, for wafer type FF is also available	
J	2	JIS 20K RF 350°C and lower, for wafer type FF is also available	
J	3	JIS 30K RF 420°C and lower, for wafer type FF is also available	
P	1	JPI 150 RF For wafer type FF is also available	
P	3	JPI 300 RF For wafer type FF is also available	
P	6	JPI 600 RF (Designed on PO issued)	
A	1	ASME 150 RF For wafer type FF is also available	
A	3	ASME 300 RF For wafer type FF is also available	
A	6	ASME 600 RF (Designed on PO issued)	
D	1	DIN 10 300°C and lower, only wafer type	
D	B	DIN 16 300°C and lower, only wafer type	
D	3	DIN 25 300°C and lower, only wafer type	
D	4	DIN 40 300°C and lower, only wafer type	
Z	9	Special	

※1: Gas and 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.

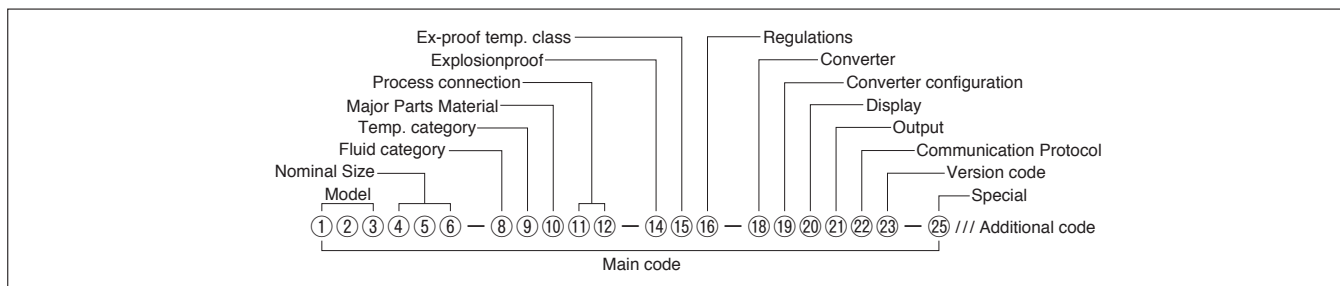
※3: Flange serration according to ASME standard complies with ASME B 16.5-2003.

DIN standard is applicable only to the body of wafer types.

※4: Regardless of sensor specifications, the explosionproof symbol related to the converter is always Ex d IIC T6 Gb for the separated configuration.

⑬	—	
⑭	Explosionproof	
0	Non-explosionproof	
1	Flameproof (TIIS)	
⑮	Ex-proof temp. class	
0	Non-explosionproof	
1	T1	
4	T4	
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)
J	High Pressure Gas Safety Act (Completion inspection)	※ w/Material test certificate
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	
F	PAF5 Battery drive, no output signal	
⑲	Converter configuration	
1	Integrally mounted	
2	Separately mounted ※4	
⑳	Display	
1	w/Totalizer · digital indicator	
㉑	Output	
N	No external output	
㉒	Communication interface	
N	Non	
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



● Main code (MODEL: VXJ, VXL and VXM)

①	②	③	Model ※1
V	X	J	EX DELTA II Diamond shaped bluff body Wafer type Fixed sensor
V	X	L	EX DELTA II Diamond shaped bluff body Flanged type Fixed sensor (Designed on PO issued)
V	X	M	EX DELTA II Diamond shaped bluff body Flanged type Replaceable 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	⑨	Fluid category
L			Liquid
⑩	⑪	⑫	Temp. category
0			120°C and lower
1			220°C and lower
2			300°C and lower
3			350°C and lower
4			420°C and lower
5			460°C and lower
⑬	⑭	⑮	Major Parts Material
C			SCS14A (SUS316) Allowed lowest temp.: -30°C
Z			Special
⑯	⑰	⑱	Process connection ※2
J	1		JIS 10K RF 300°C and lower, for wafer type FF is also available
J	B		JIS 16K RF 350°C and lower, for wafer type FF is also available
J	2		JIS 20K RF 350°C and lower, for wafer type FF is also available
J	3		JIS 30K RF 420°C and lower, for wafer type FF is also available
P	1		JPI 150 RF For wafer type FF is also available
P	3		JPI 300 RF For wafer type FF is also available
P	6		JPI 600 RF (Designed on PO issued)
A	1		ASME 150 RF For wafer type FF is also available
A	3		ASME 300 RF For wafer type FF is also available
A	6		ASME 600 RF (Designed on PO issued)
Z	9		Special
⑲	⑳	㉑	Explosionproof
0			Non-explosionproof
1			Flameproof (TIIS)

㉒	㉓	㉔	Ex-proof temp. class
0			Non-explosionproof
1			T1
4			T4
㉕	㉖	㉗	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)
J			High Pressure Gas Safety Act (Completion inspection) * w/Material test certificate
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
㉘	㉙	㉚	Converter
F			PAF5 Battery drive, no output signal
㉛	㉜	㉝	Converter configuration
1			Integrally mounted
2			Separately mounted ※3
㉞	㉟	㊱	Display
1			w/Totalizer · digital indicator
㊲	㊳	㊴	Output
N			No external output
㊵	㊶	㊷	Communication interface
N			Non
㊸	㊹	㊺	Version code
C			Version code: C
㊻	㊼	㊽	Special
0			Standard
Z			When "Special" or "Designed on PO issued" is chosen

※1: Applicable category

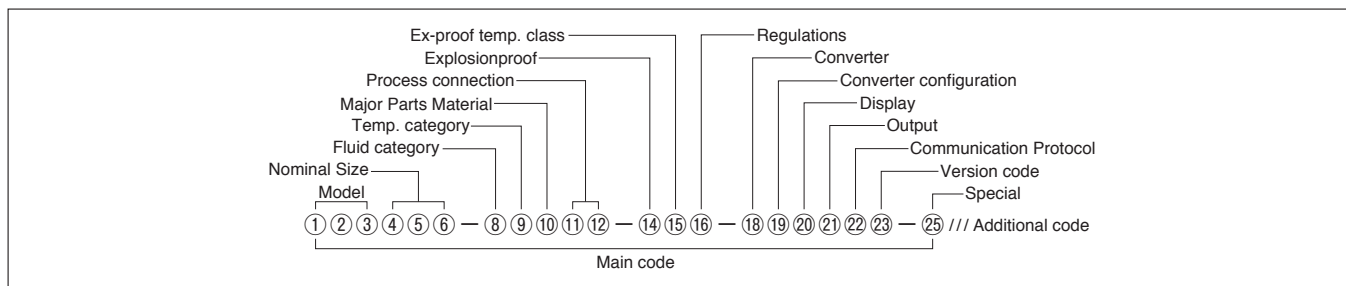
Nominal Size (mm)	15	25	40	50	80
Wafer type	○	○	○	○	○
Flanged type					Designed on PO issued

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

Din standard is applicable only to the body of wafer types.

※3: Regardless of sensor specifications, the explosionproof symbol related to the converter is always Ex d IIC T6 Gb for the separated configuration.

PRODUCT CODE EXPLANATION

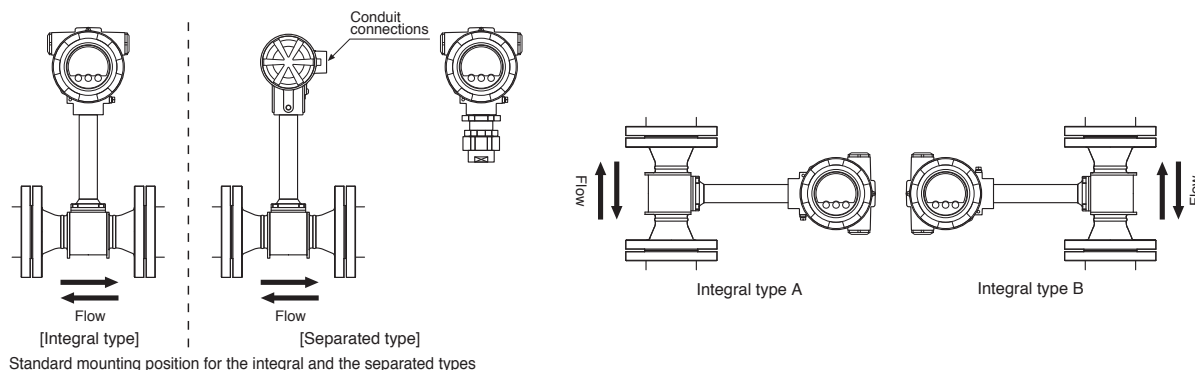


Additional code

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 1 0	±1.00% RD		
R 1 5	±1.50% RD	Only for gas and steam, size 80 to 300mm	
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 2	Dry calibration (Report)	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: LCD display type A (See the figure below)	Separate type: electric conduit at the bottom	
F D 0	B → T: LCD display type A (See the figure below)	Separate type: electric conduit at the bottom	
F U 1	T → B: LCD display type B (See the figure below)	Separate type: electric conduit at the top (dedicated for indoor use)	
F D 1	B → T: LCD display type B (See the figure below)	Separate type: electric conduit at the top (dedicated for indoor use)	
Pressure-tight packing gland *Must choose			
J F 0	Non		
J F 1	Cable O.D.: φ8.5 to 10.0		
J F 2	Cable O.D.: φ10.1 to 11.0		
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	
Designated special paint on transmitter			
S F 0	Corrosion proof	Special	
S D 0	Salinity tolerance		
S E 0	Acid tolerance	Special	
S X 0	Customer designated paint	Special	
S Z 9	Special	Special	
Cleansing			
T W 0	Non-oil and water treatment		
T W 1	Non-oil and water treatment equivalent		
T F 0	Food cleansing		

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
S P E	Penetrant test report (English)	Welded part of pressure resistant vessel
S M J	Magnetic particle inspection (Japanese)	Welded part of pressure resistant vessel
S M E	Magnetic particle inspection (English)	Welded part of pressure resistant vessel
S R J	Radiographic inspection (Japanese)	Welded part of pressure resistant vessel
S R E	Radiographic inspection (English)	Welded part of pressure resistant vessel
S U J	Ultrasonic inspection (Japanese)	Welded part of pressure resistant vessel
S U E	Ultrasonic inspection (English)	Welded part of pressure resistant vessel
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	

*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.



■ 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. Flow Range	Max._____ Normal_____ Min._____ ☐ m ³ /h [normal] ☐ m ³ /h [actual] ☐ kg/h
3. Temperature range	Max._____ Normal_____ Min._____ °C
4. Pressure range	Max._____ Normal_____ Min._____ ☐ MPa [gauge]
5. Density or Sp. Gr.	Density_____ ☐ kg/m ³ [normal] , ☐ kg/m ³ [actual] Sp. Gr._____
6. Viscosity	_____ ☐ mPa·s, ☐ mm ² /s at _____ °C
7. Connections	Nominal size _____ ☐ " ☐ mm, Flange rating JIS _____ K ASME/JPI _____ RF DIN PN _____
8. Flow straightening pipe	☐ Req'd (Flow straightener and downstream pipe) ☐ Not req'd (Prepare a straight pipe of specified length, I.D., Sch. No.)
9. Compensation	☐ Temperature/Pressure comp. ☐ Pressure comp. ☐ Temperature comp.
10. Compensation range	Temperature _____ to _____ °C , Pressure _____ to _____ ☐ MPa [gauge]
11. Compensation ref.	Ref. temp. _____ °C Press. ref. _____ ☐ MPa [gauge]
12. Compensation coeff. (gas measurement)	Z (service conditions)= _____ Zo (standard conditions)= _____
13. Accuracy test	☐ Req'd ☐ Not Req'd
14. Converter	Type: ☐ Integral configuration, ☐ Separate configuration Explosionproof configuration: ☐ Non-explosionproof, ☐ Flameproof
15. Miscellaneous	

The specification as of April, 2019 is stated in this GS Sheet. Specifications and design are subject to change without notice.

Sales Representative: