



**Vortex Flowmeter**  
**BATTERY POWERED EX DELTA II DIA**  
**MODEL VX Series**

**GENERAL SPECIFICATION**  
**GS.No.GBD661E-2**

**■ GENERAL**

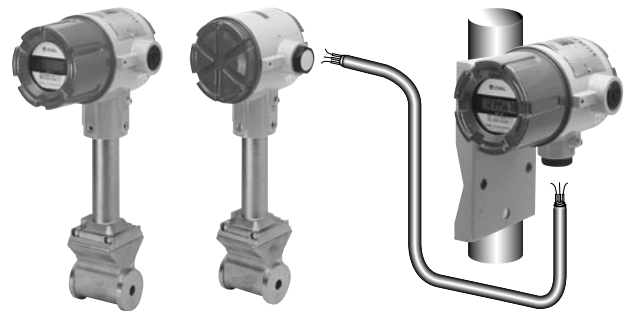
With a design to be more usable than ever before, the battery powered EX DELTA II and EX DELTA II DIA operate on an internal battery. In this series, the need of an external power source has been eliminated from the field proven EX DELTA II, that has enjoyed extensive use as a dedicated local monitor, 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 sensors to be installed across the field - some located as far as 200 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 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 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. Can monitor the total flow (accumulated total and resettable total) and instantaneous flowrate on the digital display.
5. Waterproof (IP65) and intrinsically safe explosionproof configuration (Exia II CT4). 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. Max. transmission length is 200 meters.

**■ 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	Flanged type (RF is standard.)	Flanged type (RF is standard.)
Flange rating	JIS 10, 16, 20, 30K ASME/JPI 150, 300 DIN PN10, 16, 25, 40		
Std. connecting pipe	Nominal wall thickness Sch 40 (*1)		
Applicable fluid	Liquids, gases and steam (*2)		
Flow range	See flow range table (P4, 5, 6 and 7).		
Operating temp. range (*3)	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 (Design pressure : 5.00MPa).		
Accuracy (*5)	Applicable fluid \ Nom. 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 : If different from piping of standard nominal wall thickness, consult the factory.  
 \*2 : 10mm is dedicated for liquid measurement only.  
 \*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 : Accuracy of 10mm in nom. size is ±2% or better with respect to the max. rated flowrate.  
 \*5 : Meaning of full scale : rated maximum flow

● EX DELTA II DIA Meter Body

Item		Description		
Sensor type		Fixed sensor	Fixed sensor	Replaceable sensor
Nominal size		15, 25, 40, 50, 80mm	50, 80mm	50, 80mm
Body style		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 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.

\*2: Meaning of full scale : rated maximum flow

● 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	DIN PN10	DIN PN16	DIN PN25	DIN PN40
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
300 to 350°C	—	1.57	1.96	3.82	0.84	2.96	—	—	—	—
350 to 420°C	—	—	—	2.94	0.57	2.81	—	—	—	—
420 to 460°C	—	—	—	—	0.42	2.71	—	—	—	—

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

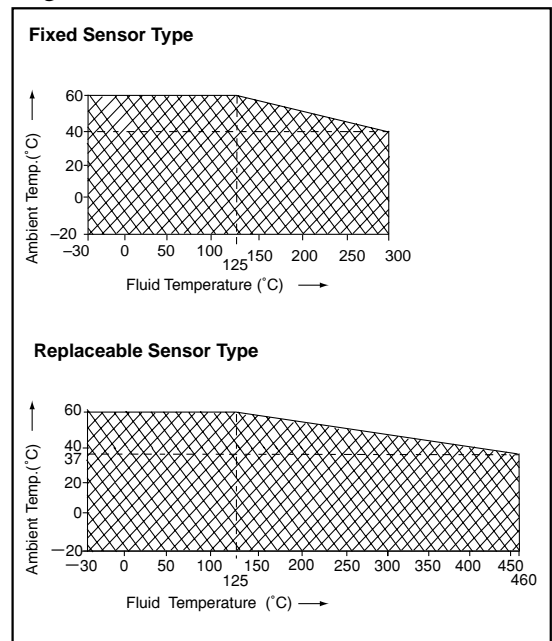
Flange Rating Operating Temp.	JIS10K	JIS16K	JIS20K	JIS30K	ASME / JPI 150	ASME / JPI 300
Below 220°C	1.18	2.45	3.04	4.51	1.32	4.31
220 to 300°C	0.98	2.26	2.84	4.22	1.02	3.87
300 to 350°C	—	2.06	2.55	3.82	0.84	3.70
350 to 420°C	—	1.57	1.96	2.94	0.56	2.88

■ CONVERTER SPECIFICATIONS

Item	Description
Model	PA35
Mounting	Select any one of the following types: 1. Integral with meter itself 2. Separated type with 2" pipe stand (*1)
Waterproof configuration	JIS C 0920 weathertight (IEC IP65)
Explosionproof configuration	Intrinsically safe (Exia IIC T4)
Operating Temperature	Ambient -20 to +60°C
Ambient Humidity	5 to 100% R.H (without dew condensation)
Housing Material	Aluminum alloy
Housing Finish	Finished in baked melamine Finish Munsell 10B8/4 (Cover: Munsell 2.5PB4/10)
Display	LCD : Indication of totalizer, instantaneous flowrate 1: Totalizing Counter, 8 digits 2: Resettable Counter, 7 digits :C 3: Instant. Flowrate (/ h) :b1 4: Instant. Flowrate (/ min) :b2 1, 2, 3, 4 : Select by a external switch. Orientation adjustable for max. readability. Low battery alarm with flickering  mark.
Power Supply	3.6V lithium battery packs Life: 24h 7 years continuous (for Integral type) 24h 4 years continuous (for separate type)

● Ambient Temperature Range

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



**■ NOMINAL METER FACTOR**


**● EX DELTA II**

Applicable Fluids	Nom. size mm (inch)	Max. Flowrate m <sup>3</sup> /h	Nom. Meter Factor L/p	Applicable Fluids	Nom. size mm (inch)	Max. Flowrate m <sup>3</sup> /h	Nom. Meter Factor L/p	
Liquids	10(3/8)	2.8	0.001714	Gases	15(1/2)	33	0.005338	
	15(1/2)	6.0	0.005338		25(1)	130	0.01613	
	25(1)	20	0.01613		40(1 1/2)	290	0.04556	
	40(1 1/2)	48	0.04556		50(2)	490	0.1001	
	50(2)	79	0.1001		80(3)	1380	0.3328	
	80(3)	172	0.3328		100(4)	2370	0.7567	
	100(4)	296	0.7567		150(6)	5160	2.422	
	150(6)	645	2.422		200(8)	9100	7.021	
	200(8)	1130	7.021		250(10)	14000	13.54	
	250(10)	1750	13.54		300(12)	20100	23.24	
	300(12)	2510	23.24					

**● EX DELTA II DIA**

Applicable Fluids	Nom. size mm (inch)	Max. Flowrate m <sup>3</sup> /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

**■ MODE SELECT PUSHBUTTON SWITCH**



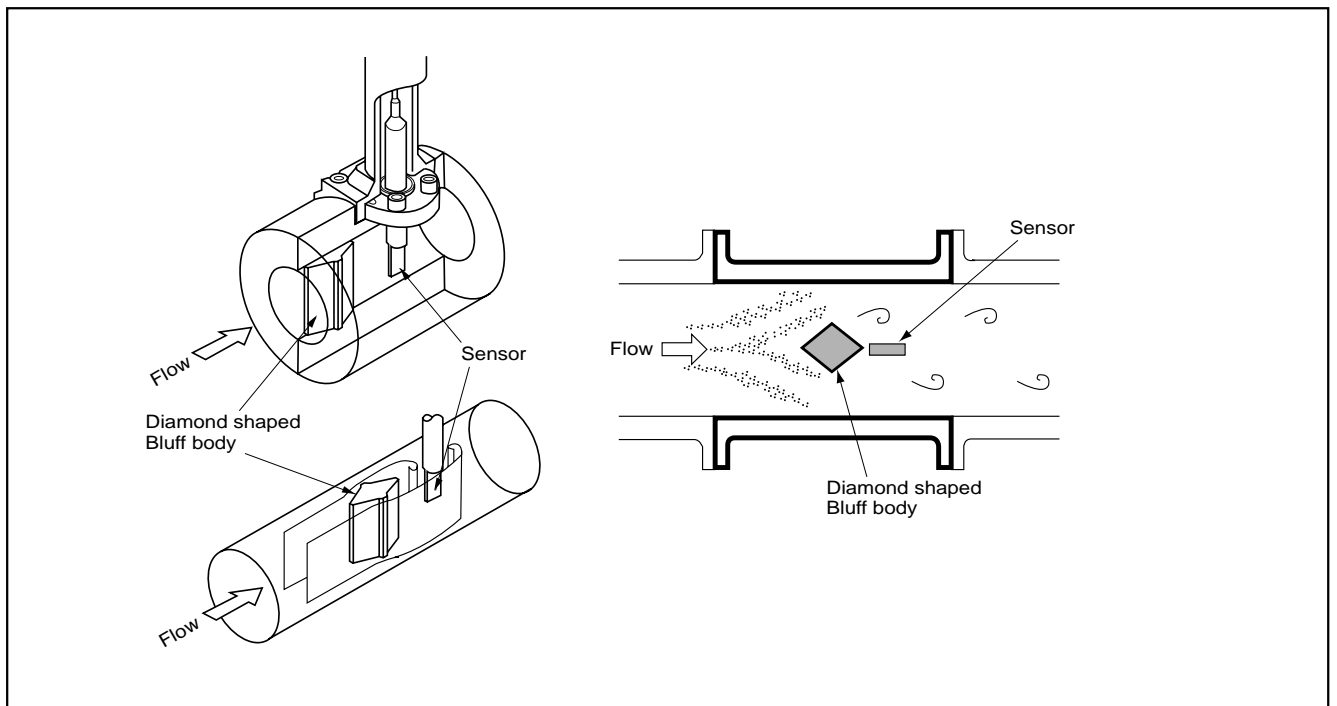
Mode Select Pushbutton Switch

Display

- 1: Accumulated total flow 12345678  
m<sup>3</sup>
- 2: Instantaneous flowrate (b1) b1 1200  
m<sup>3</sup>/h
- 3: Instantaneous flowrate (b2) b2 2000  
m<sup>3</sup>/min
- 4: Resettable total flow [ 1234567  
m<sup>3</sup>

\*: To reset the counter, hold the display mode select switch depressed for 5 seconds.

**■ EX DELTA II DIA CONSTRUCTION and PRINCIPLE**



**■ 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 m<sup>3</sup>/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	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 m<sup>3</sup>/h

Nominal size	Sp. Gr.	Minimum flowrate							Maximum Flowrate	
		0.5	0.6	0.7	0.8	0.9	1.0	1.1		1.2
15 (1/2)		0.6	0.6	0.5	0.5	0.5	0.4	0.4	0.4	6
25 (1)		1.4	1.3	1.2	1.1	1.1	1.0	1.0	0.9	20
40 (1-1/2)		2.4	2.2	2.0	1.9	1.8	1.7	1.6	1.5	48
50 (2)		3.8	3.5	3.2	3.0	2.9	2.7	2.6	2.5	79
80 (3)		8.4	7.6	7.1	6.6	6.2	5.9	5.7	5.4	172

**Table B (based on viscosity)**

Unit in m<sup>3</sup>/h

Size mm	Viscosity mm <sup>2</sup> /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	Unmeasurable regions						
	± 1% FS	0.4	1.2	1.8	2.9	Unmeasurable regions						
25	± 1% RD	1.6	3.1	4.6	7.6	16	Unmeasurable regions					
	± 1% FS				1.8	5.9	11	15	19	Unmeasurable regions		
40	± 1% RD	2.4	4.7	7.0	12	24	35	Unmeasurable regions				
	± 1% FS				2.8	6.5	14	22	29	35		
50	± 1% RD	3.0	6.0	9.0	15	30	45	60	Unmeasurable regions			
	± 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 m<sup>3</sup>/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 flowrate to [actual] conditions and determine the flow range and the nominal diameter based on this table.

Size mm		Accuracy	Dens.kg/m <sup>3</sup>	Minimum flowrate (m <sup>3</sup> /h)									Max. Flowrate (m <sup>3</sup> /h)
				0.38	0.7	1.2	2.0	3.6	6	11	19	34	
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 0.017mPs·s)				Minimum flow rate (m <sup>3</sup> /h)									
Size mm	Dens. kg/m <sup>3</sup>	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			
Type of Gas		Dens. kg/Nm <sup>3</sup>	Gas pressure(MPa(gauge))at 20°C									Gas viscosity	
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. Accuracy of 10mm in nom. size is ±2% or better with respect to the max. rated flowrate.

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 47m<sup>3</sup>/h and 38m<sup>3</sup>/h, respectively, from Table C. The minimum flow rate at 0.5MPa is therefore determined in proportion to as follows:

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

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

$$\rho = 1.293 \times \frac{273.15}{273.15 + 20} \times \frac{0.1013 + 0.5}{0.1013} \approx 7.04kg/m^3$$

From Table C, the minimum flow rate at a density of 6 and nominal size 80mm is 47m<sup>3</sup>/h; at a density of 11 is 38m<sup>3</sup>/h. The minimum flowrate at a density of 7.04 therefore can be found in proportion to as follows:

$$Q_{min} = 38 + \frac{11 - 7.04}{11 - 6} \times (47 - 38) \approx 45m^3/h$$

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:1800m<sup>3</sup>/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:

$$Q_{Max} = 1800 \times \frac{273.15 + 30}{273.15} \times \frac{0.1013}{0.1013 + 0.8} \approx 228m^3/h$$

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 9m<sup>3</sup>/h, at 1.7MPa, it is 8m<sup>3</sup>/h. We then obtain the minimum flow rate in proportional way as:

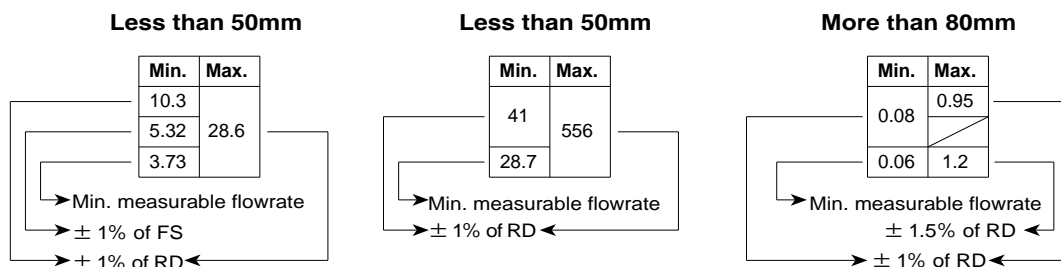
$$Q_{min} = 8 + \frac{1.7 - 1.5}{1.7 - 0.95} \times (9 - 8) \approx 8.3m^3/h$$

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

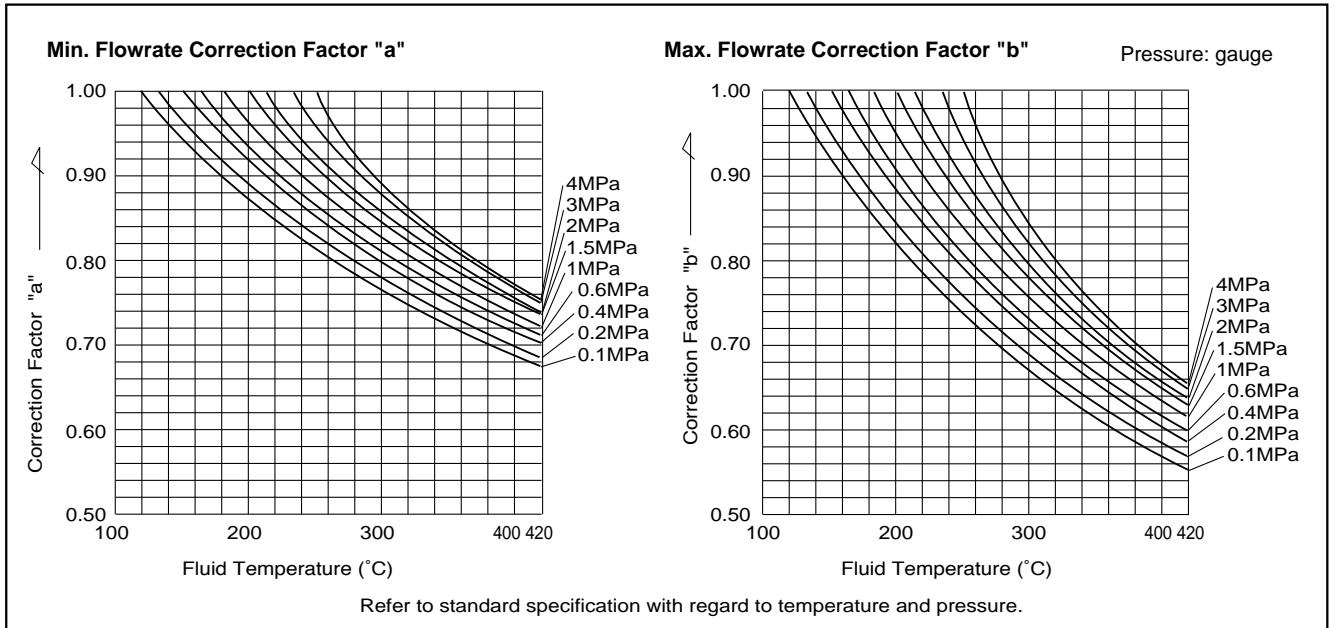
Pressure MPaG	Unit : kg/h								Unit : t/h											
	15mm (1/2")		25mm (1")		40mm (1 1/2")		50mm (2")		80mm (3")		100mm (4")		150mm (6")		200mm (8")		250mm (10")		300mm (12")	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
0.05	10.3		18.8		29.1		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	28.7	556												
	4.26		10.5		17.6		25.2		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	23.1	480	37.8	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	16.5	282	27.6	629	45.2	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	18.9	347	31.8	775	51.9	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	21.2	412	35.6	920	58.2	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	23.4	477	39.2	1060	64.1	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	27.4	605	46	1350	75.2	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	31.1	733	52.2	1630	85.4	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	39.5	1050	66.4	2340	109	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	47.2	1370	79.2	3050	130	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	54.3	1690	91.1	3770	149	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	61	2010	103	4490	168	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	73.7	2670	124	5970	203	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	85.8	3360	145	7500	236	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



● 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.

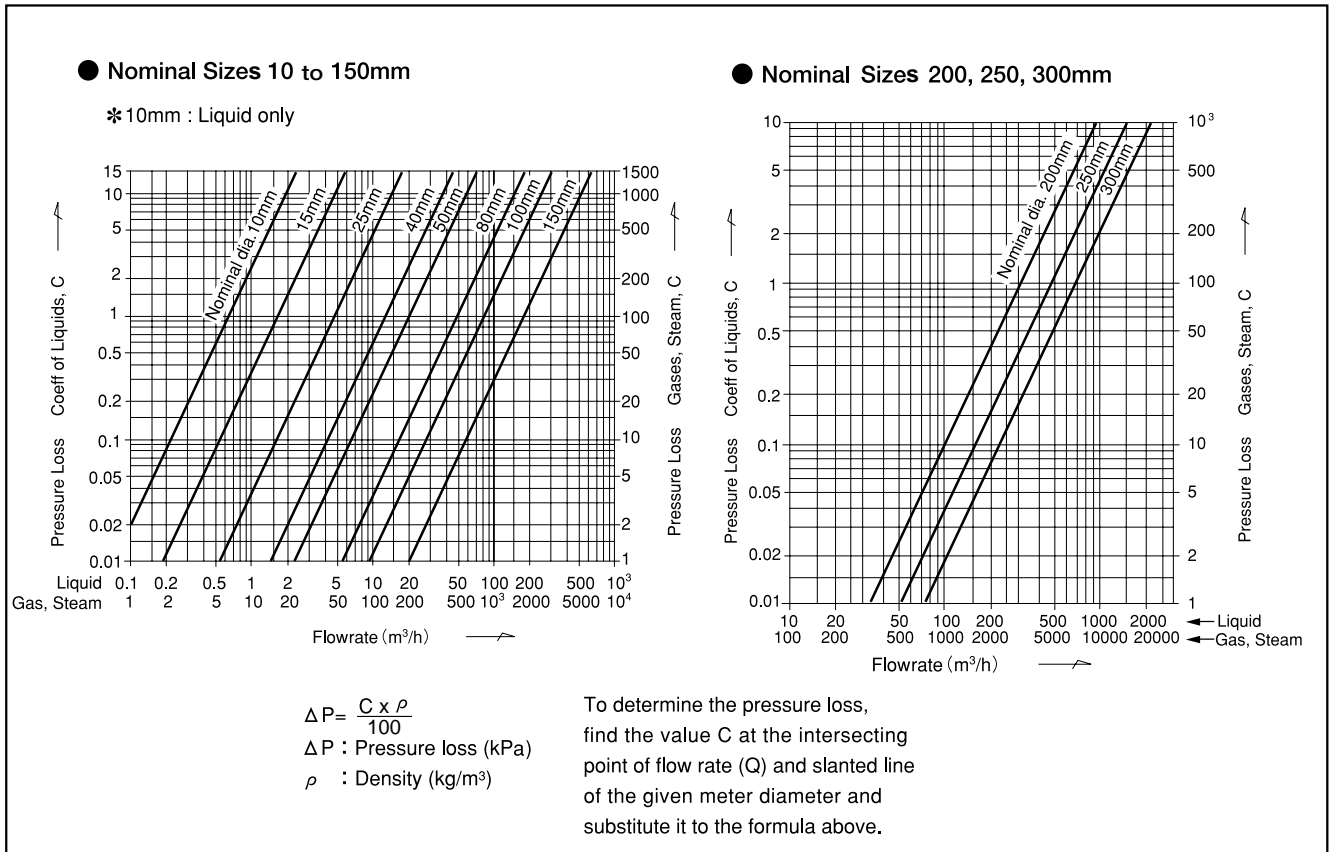
SOLUTION : From the curves, correction factors are : a=0.890, b=0.840. So we obtain

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 ±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.

■ 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 “m<sup>3</sup>/h”, the total flow reads in “m<sup>3</sup>/h”.

**TOTAL UNITS RESOLUTION**

**EX DELTA II**

**Liquid service**

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

**Gas service**

Nominal size(mm)	Reads in m <sup>3</sup>
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 <sup>3</sup>
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:

$$\text{Conversion factor} = \frac{273.15}{T+273.15} \times \frac{P+0.1013}{0.1013} \times \frac{Z_0}{Z}$$

(Except where significant influence is anticipated, it is assumed that Z<sub>0</sub>/Z=1.)

where T=Operating temp.(°C)

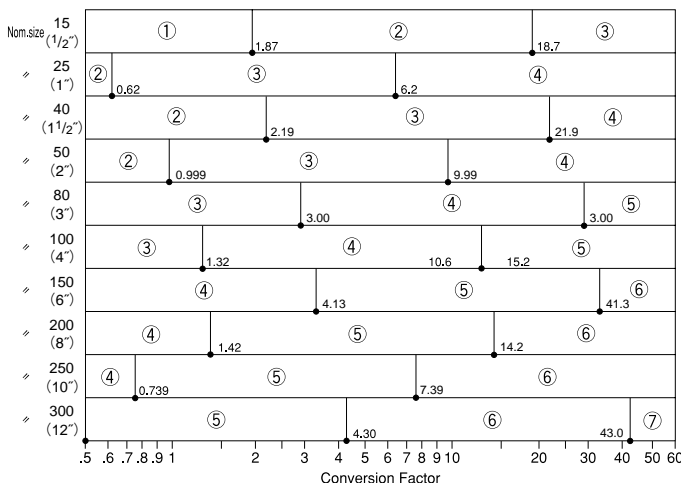
P=Operating press.(MPa[gauge])

Z<sub>0</sub>=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 ≤ 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**

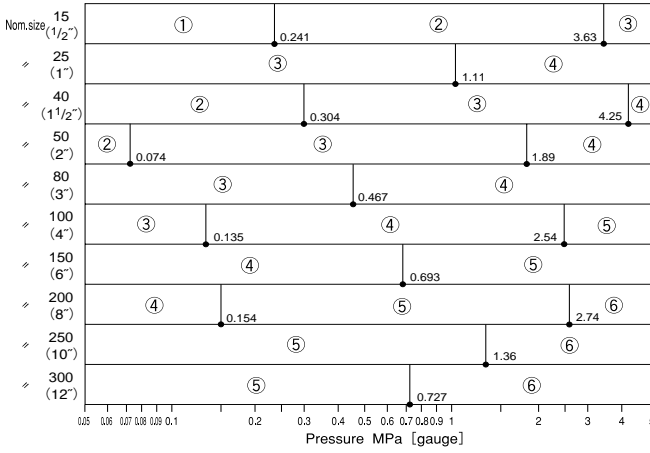
Segment No.	Reads : m <sup>3</sup> [normal]
①	0.01
②	0.01
③	0.1
④	1
⑤	10
⑥	100
⑦	1000



● **Case 2**

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.

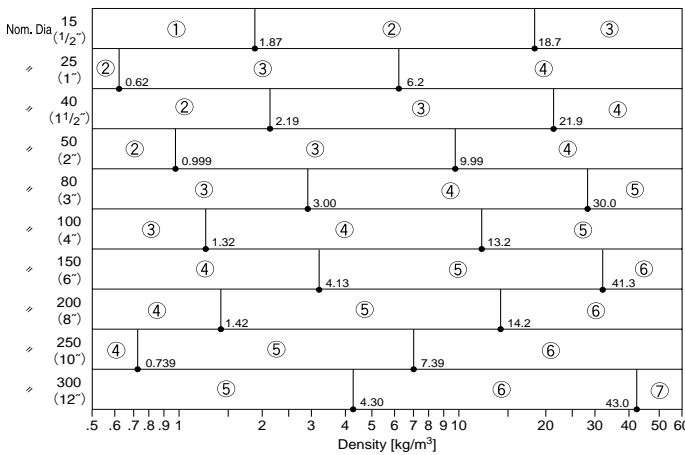
**Table C ● Pressure (Gase Pressure)— Segment Graph**



● **Case 3**

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.

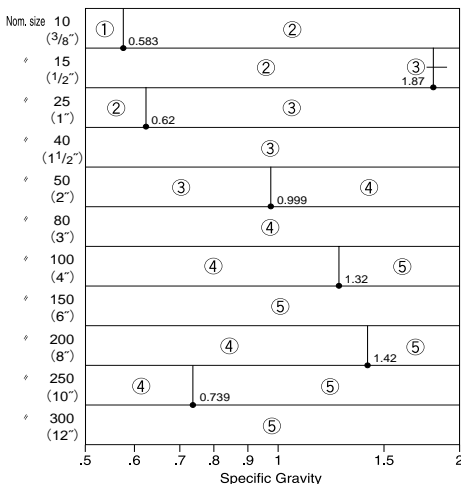
**Table E ● Density — Segment Graph**



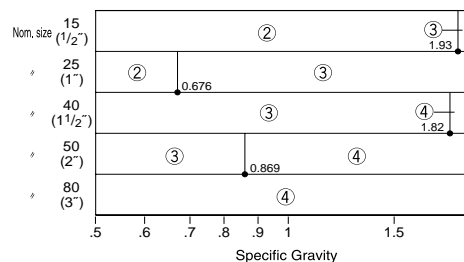
● **Case 4**

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.

**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.

2. 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.

2. In Table E, find the scaled pulse unit relative to the segment number.

**Table F ● Segment — Indicated Unit**

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

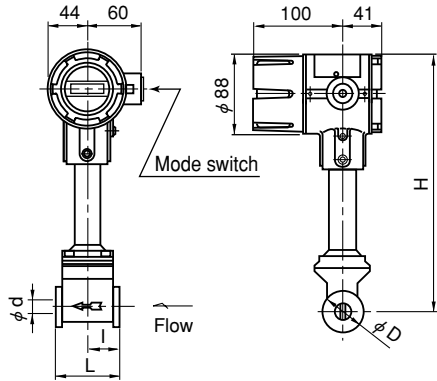
In case of "Unit of display: t", "0.001t" is given as the minimum value.

2. In Table H, find the scaled pulse unit relative to the segment number.

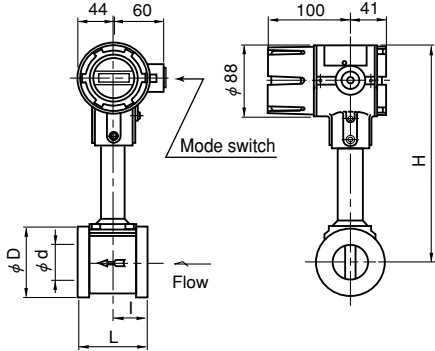
**EX DELTA II OUTLINE DIMENSIONS [INTEGRAL TYPE] (Unit in mm)**

**Wafer Type**

- Nominal Sizes 10, 15, 25mm



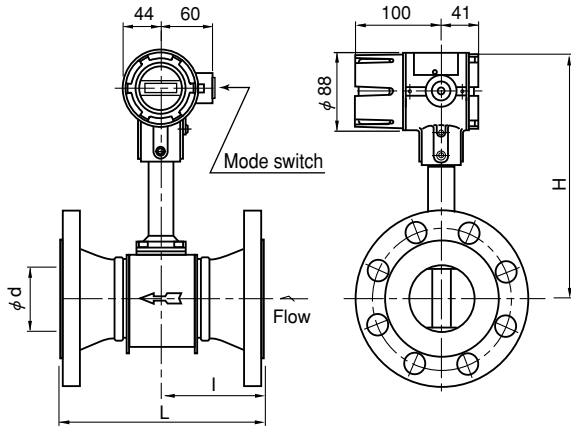
- Nominal sizes 40 to 150mm



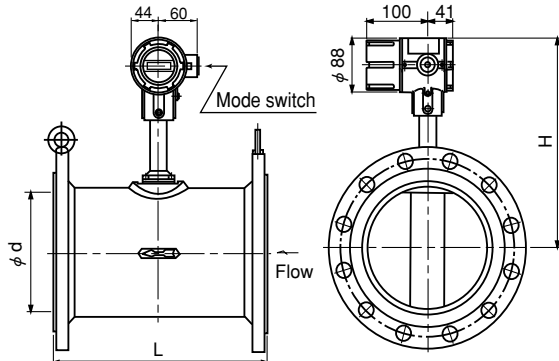
**Flanged Type**

- Fixed Sensor Type

- Nominal sizes 15 to 150mm



- Nominal sizes 200 to 300mm



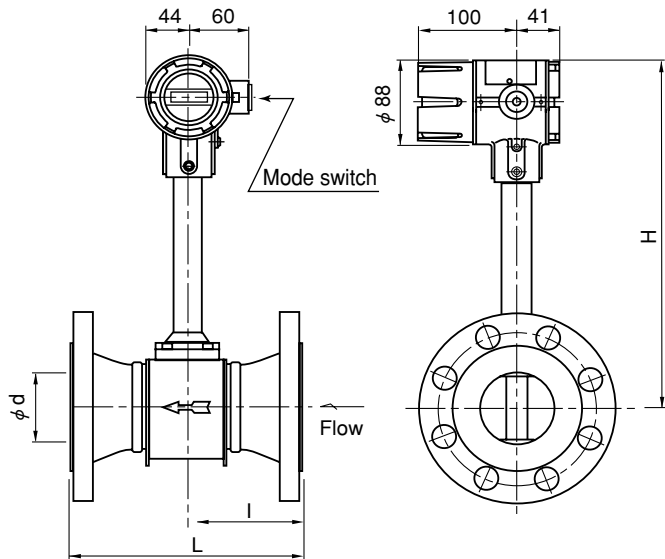
Nominal size (mm)	L	I	φ d (Meter I.D)	φ D	H	Approx. Weight (kg)
10 (3/8")	65	32.5	10	40	276	2.6
15 (1/2")	65	32.5	14.5	40	276	2.6
25 (1")	65	32.5	26.6	67	276	3.2
40 (1-1/2")	80	40	37.6	81	261	3.9
50 (2")	80	40	48.5	91	265	4.0
80 (3")	100	40	72.4	126	281	6.8
100 (4")	125	48	95.2	156.2	301	10.5
150 (6")	165	54	140.3	214.9	331	20.4

Nominal size (mm)	Flange Rating	L	I	φ d (Meter I.D)	H	Approx. Weight (kg)			
15 (1/2")	JIS 10K(16K)	142	71	14.5	276	3.9			
	JIS 20K	152	76			5.3			
	JIS 30K					3.5			
	ASME 150					4.1			
	JPI 150					158	79	26.6	276
ASME 300	167	83.5	6.9						
JPI 300	174	87	5.1						
ASME 150	186	93	6.3						
25 (1")	JIS 10K(16K)	171	85.5	37.6	261	8.0			
	JIS 20K	175	87.5			8.4			
	JIS 30K	185	92.5			10.5			
	ASME 150	201	100.5			8.0			
	JPI 150	213	106.5			8.0			
	ASME 300					10.4			
	JPI 300					9.0			
40 (1-1/2")	JIS 10K	173	86.5	48.5	265	9.2			
	JIS 20K(16K)	181	90.5			11.3			
	JIS 30K	191	95.5			9.9			
	ASME 150	204	102			10.0			
	JPI 150	217	108.5			11.8			
	ASME 300					15.2			
50 (2")	JIS 10K	219	99.5	72.4	281	17.9			
	JIS 20K(16K)	233	106.5			21.9			
	JIS 30K	243	111.5			18.0			
	ASME 150	237	108.5			22.5			
	JPI 150					21.2			
	ASME 300					25.2			
	80 (3")	JIS 10K	250			110.5	95.2	301	31.8
		JIS 20K(16K)	264			117.5			26.5
JIS 30K		274	122.5	26.6					
ASME 150		274	122.5	36.0					
JPI 150				36.2					
ASME 300				43.7					
100 (4")		JIS 10K	322	132.5	140.3	331			52.8
	JIS 20K(16K)	342	142.5	66.4					
	JIS 30K	352	147.5	46.5					
	ASME 150	340	141.5	46.6					
	JPI 150			65.6					
	ASME 300			66.0					
150 (6")	JPI 300	359	151	199.9	346	38.3			
	200 (8")	—	—			248.8	368	68.8	
	250 (10")	—	—			297.9	390	88.6	
300 (12")	—	—	—	—	—	—			

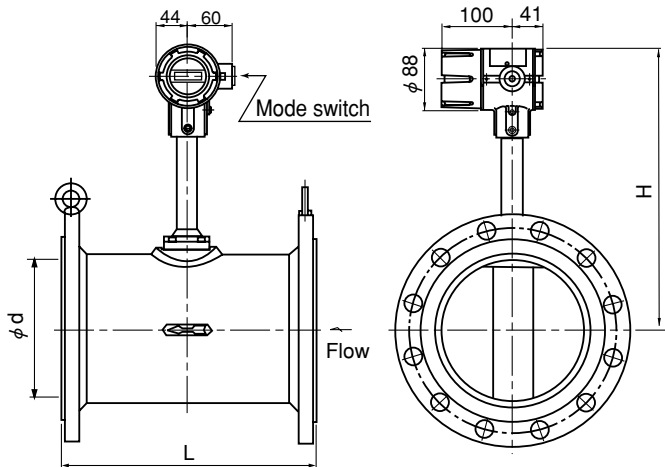
※ : Irrespective of flange rating, a flange thickness having a higher rating is selected as long as the flange O.D. and bolt holes remain the same.

■ Replaceable Sensor Type

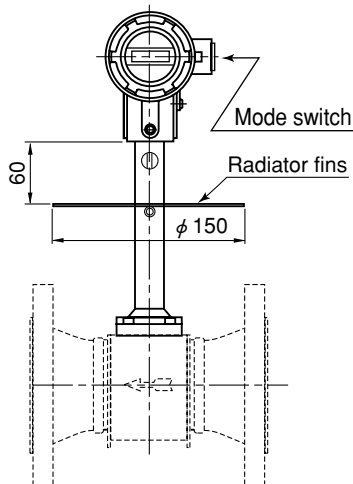
● Nominal sizes 15 to 150mm



● Nominal sizes 200 to 300mm



■ High-temperature service Replaceable Sensor Type



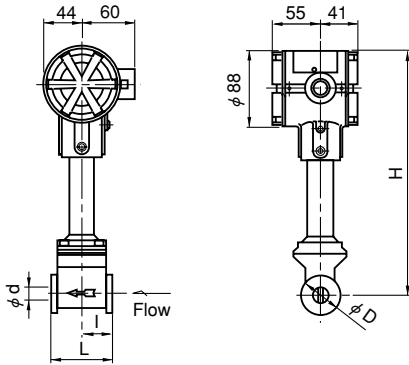
Nominal size (mm)	Flange Rating	L	I	$\phi$ d (Meter I.D.)	H	Approx. Weight (kg)
15 (1/2")	JIS 10K(16K)	142	71	14.5	356	4.5
	JIS 20K					5.9
	JIS 30K	152	76			4.1
	ASME 150	158	79			4.7
	JPI 150	167	83.5			
	JPI 300					
25 (1")	JIS 10K(16K)	152	76	26.6	356	6.5
	JIS 20K					7.5
	JIS 30K	158	79			5.7
	ASME 150	174	87			6.9
	JPI 150	186	93			
	JPI 300					
40 (1-1/2")	JIS 10K(16K)	171	85.5	37.6	342	8.6
	JIS 20K	175	87.5			9.0
	JIS 30K	185	92.5			11.1
	ASME 150	201	100.5			8.6
	JPI 150					8.6
	JPI 300	213	106.5			11.0
50 (2")	JIS 10K	173	86.5	48.5	346	9.6
	JIS 20K(16K)	181	90.5			9.8
	JIS 30K	191	95.5			11.9
	ASME 150	204	102			10.5
	JPI 150					10.6
	JPI 300	217	108.5			12.4
80 (3")	JIS 10K	219	99.5	72.4	362	15.8
	JIS 20K(16K)	233	106.5			18.5
	JIS 30K	243	111.5			22.5
	ASME 150	237	108.5			18.6
	JPI 150					23.1
	JPI 300	255	117.5			
100 (4")	JIS 10K	250	110.5	95.2	382	21.8
	JIS 20K(16K)	264	117.5			25.8
	JIS 30K	274	122.5			32.4
	ASME 150	274	122.5			27.1
	JPI 150					27.2
	JPI 300	294	132.5			36.6
150 (6")	JIS 10K	322	132.5	140.3	412	44.3
	JIS 20K(16K)	342	142.5			53.4
	JIS 30K	352	147.5			67.0
	ASME 150	340	141.5			47.1
	JPI 150					47.2
	JPI 300	359	151			66.2
200 (8")	—	350	—	199.9	427	39.4
250 (10")	—	450	—	248.8	449	69.4
300 (12")	—	500	—	297.9	471	89.4

※ : 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.

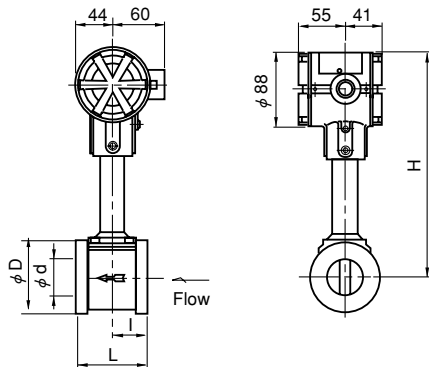
**EX DELTA II OUTLINE DIMENSIONS [SEPARATE TYPE] (Unit in mm)**

**Wafer Type**

● Nominal Sizes 10,15, 25mm



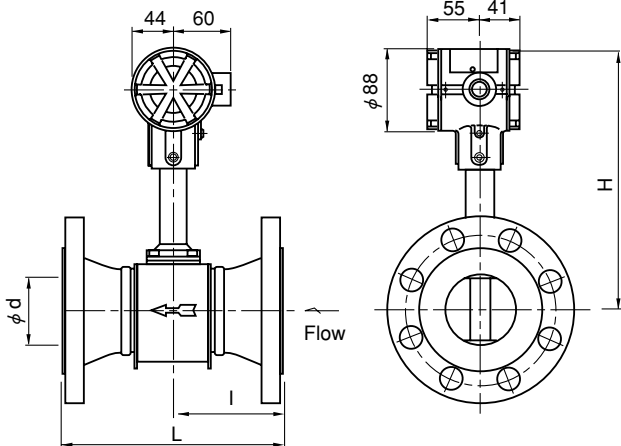
● Nominal sizes 40 to 150mm



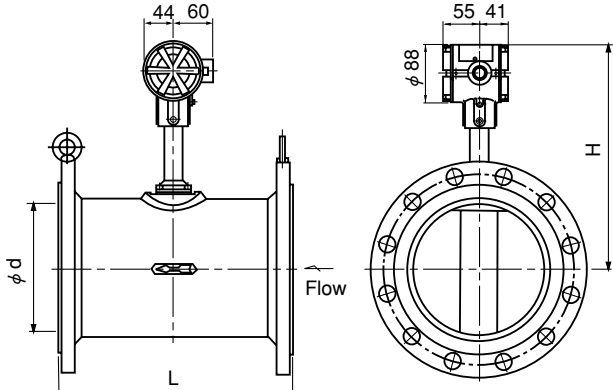
**Flanged Type**

■ Fixed Sensor Type

● Nominal sizes 15 to 150mm



● Nominal sizes 200 to 300mm

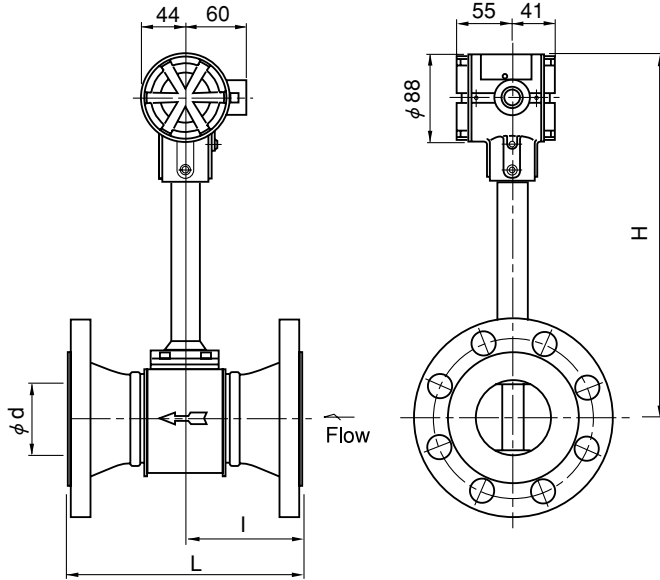


Nominal size (mm)	L	I	φ d (Meter I.D)	φ D	H	Approx. Weight (kg)
10 (3/8")	65	32.5	10	40	276	2.4
15 (1/2")	65	32.5	14.5	40	276	2.4
25(1")	65	32.5	26.6	67	276	3.0
40 (1-1/2")	80	40	37.6	81	261	3.7
50 (2")	80	40	48.5	91	265	3.8
80 (3")	100	40	72.4	126	281	6.6
100 (4")	125	48	95.2	156.2	301	10.3
150 (6")	165	54	140.3	214.9	331	20.2

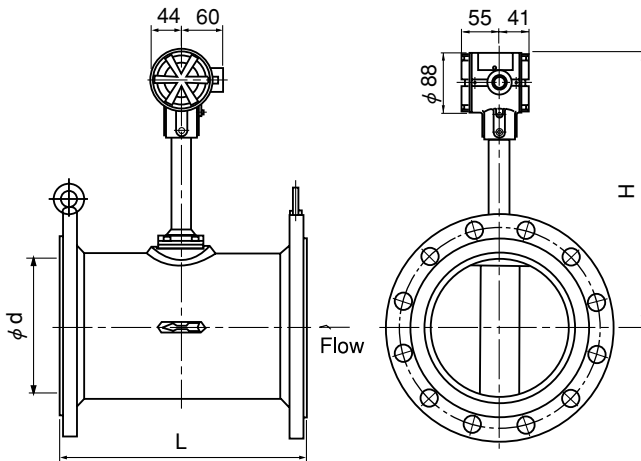
Nominal size (mm)	Flange Rating	L	I	φ d (Meter I.D)	H	Approx. Weight (kg)	
15 (1/2")	JIS 10K(16K)	142	71	14.5	276	3.7	
	JIS 20K						
	JIS 30K						
	ASME 150	158	79				3.3
	JPI 150						
	ASME 300						
JPI 300	167	83.5	3.9				
JIS 10K(16K)							
JIS 20K							
JIS 30K							
ASME 150				174	87	4.9	
JPI 150							
ASME 300							
JPI 300	186	93	6.1				
JIS 10K(16K)							
JIS 20K							
JIS 30K							
ASME 150				171	85.5	7.8	
JIS 20K							
JIS 30K							
ASME 150	185	92.5	10.3				
JPI 150							
ASME 300							
JPI 300	213	106.5		10.2			
JIS 10K							
JIS 20K(16K)							
JIS 30K							
ASME 150			204		102	9.7	
JPI 150							
ASME 300							
JPI 300	217	108.5	11.6				
JIS 10K							
JIS 20K(16K)							
JIS 30K							
ASME 150				237	108.5	17.8	
JPI 150							
ASME 300							
JPI 300	255	117.5	22.3				
JIS 10K							
JIS 20K(16K)							
JIS 30K							
ASME 150				274	122.5	26.3	
JPI 150							
ASME 300							
JPI 300	294	132.5	36.0				
JIS 10K							
JIS 20K(16K)							
JIS 30K							
ASME 150				340	141.5	46.3	
JPI 150							
ASME 300							
JPI 300	359	151	65.8				
JIS 10K							
JIS 20K(16K)							
JIS 30K							
ASME 150				359	151	65.8	
JPI 150							
ASME 300							
JPI 300	359	151	65.8				
JIS 10K							
JIS 20K(16K)							
JIS 30K							
ASME 150				359	151	65.8	
JPI 150							
ASME 300							
JPI 300	359	151	65.8				
JIS 10K							
JIS 20K(16K)							
JIS 30K							
ASME 150				359	151	65.8	
JPI 150							
ASME 300							
JPI 300	359	151	65.8				
JIS 10K							
JIS 20K(16K)							
JIS 30K							
ASME 150				359	151	65.8	
JPI 150							
ASME 300							
JPI 300	359	151	65.8				
JIS 10K							
JIS 20K(16K)							
JIS 30K							
ASME 150				359	151	65.8	
JPI 150							
ASME 300							
JPI 300	359	151	65.8				
JIS 10K							
JIS 20K(16K)							
JIS 30K							
ASME 150				359	151	65.8	
JPI 150							
ASME 300							
JPI 300	359	151	65.8				
JIS 10K							
JIS 20K(16K)							
JIS 30K							
ASME 150				359	151	65.8	
JPI 150							
ASME 300							
JPI 300	359	151	65.8				
JIS 10K							
JIS 20K(16K)							
JIS 30K							
ASME 150				359	151	65.8	
JPI 150							
ASME 300							
JPI 300	359	151	65.8				
JIS 10K							
JIS 20K(16K)							
JIS 30K							
ASME 150				359	151	65.8	
JPI 150							
ASME 300							
JPI 300	359	151	65.8				
JIS 10K							
JIS 20K(16K)							
JIS 30K							
ASME 150				359	151	65.8	
JPI 150							
ASME 300							
JPI 300	359	151	65.8				
JIS 10K							
JIS 20K(16K)							
JIS 30K							
ASME 150				359	151	65.8	
JPI 150							
ASME 300							
JPI 300	359	151	65.8				
JIS 10K							
JIS 20K(16K)							
JIS 30K							
ASME 150				359	151	65.8	
JPI 150							
ASME 300							
JPI 300	359	151	65.8				
JIS 10K							
JIS 20K(16K)							
JIS 30K							
ASME 150				359	151	65.8	
JPI 150							
ASME 300							
JPI 300	359	151	65.8				
JIS 10K							
JIS 20K(16K)							
JIS 30K							
ASME 150				359	151	65.8	
JPI 150							
ASME 300							
JPI 300	359	151	65.8				
JIS 10K							
JIS 20K(16K)							
JIS 30K							
ASME 150				359	151	65.8	
JPI 150							
ASME 300							
JPI 300	359	151	65.8				
JIS 10K							
JIS 20K(16K)							
JIS 30K							
ASME 150				359	151	65.8	
JPI 150							
ASME 300							
JPI 300	359	151	65.8				
JIS 10K							
JIS 20K(16K)							
JIS 30K							
ASME 150				359	151	65.8	
JPI 150							
ASME 300							
JPI 300	359	151	65.8				
JIS 10K							
JIS 20K(16K)							
JIS 30K							
ASME 150				359	151	65.8	
JPI 150							
ASME 300							
JPI 300	359	151	65.8				
JIS 10K							
JIS 20K(16K)							
JIS 30K							
ASME 150				359	151	65.8	
JPI 150							
ASME 300							
JPI 300	359	151	65.8				
JIS 10K							
JIS 20K(16K)							
JIS 30K							
ASME 150				359	151	65.8	
JPI 150							
ASME 300							
JPI 300	359	151	65.8				
JIS 10K							
JIS 20K(16K)							
JIS 30K							
ASME 150				359	151	65.8	
JPI 150							
ASME 300							
JPI 300	359	151	65.8				
JIS 10K							
JIS 20K(16K)							
JIS 30K							
ASME 150				359	151	65.8	
JPI 150							
ASME 300							
JPI 300	359	151	65.8				
JIS 10K							
JIS 20K(16K)							
JIS 30K							
ASME 150				359	151	65.8	
JPI 150							
ASME 300							
JPI 300	359	151	65.8				
JIS 10K							
JIS 20K(16K)							
JIS 30K							
ASME 150				359	151	65.8	
JPI 150							
ASME 300							
JPI 300	359	151	65.8				
JIS 10K							
JIS 20K(16K)							
JIS 30K							
ASME 150				359	151	65.8	
JPI 150							
ASME 300							
JPI 300	359	151	65.8				
JIS 10K							
JIS 20K(16K)							
JIS 30K							
ASME 150				359	151	65.8	
JPI 150							
ASME 300							
JPI 300	359	151	65.8				
JIS 10K							
JIS 20K(16K)							
JIS 30K							
ASME 150				359	151	65.8	
JPI 150							
ASME 300							
JPI 300	359	151	65.8				
JIS 10K							
JIS 20K(16K)							
JIS 30K							
ASME 150				359	151	65.8	
JPI 150							
ASME 300							
JPI 300	359	151	65.8				
JIS 10K							
JIS 20K(16K)							
JIS 30K							
ASME 150				359	151	65.8	
JPI 150							
ASME 300							
JPI 300	359	151	65.8				
JIS 10K							
JIS 20K(16K)							
JIS 30K							
ASME 150				359	151	65.8	
JPI 150							
ASME 300							
JPI 300	359	151	65.8				
JIS 10K							
JIS 20K(16K)							
JIS 30K							
ASME 150				359	151	65.8	
JPI 150							
ASME 300							
JPI 300	359	151	65.8				
JIS 10K							
JIS 20K(16K)							
JIS 30K							
ASME 150				359	151	65.8	
JPI 150							
ASME 300							
JPI 300	359	151	65.8				
JIS 10K							
JIS 20K(16K)							
JIS 30K							
ASME 150				359	151	65.8	
JPI 150							
ASME 300							
JPI 300	359	151	65.8				
JIS 10K							
JIS 20K(16K)							
JIS 30K							
ASME 150				359	151	65.8	
JPI 150							
ASME 300							
JPI 300	359	151	65.8				
JIS 10K							
JIS 20K(16K)							
JIS 30K							
ASME 150				359	151	65.8	
JPI 150							
ASME 300							
JPI 300	359	151	65.8				
JIS 10K							
JIS 20K(16K)							
JIS 30K							
ASME 150				359	151	65.8	
JPI 150							
ASME 300							
JPI 300	359	151	65.8				
JIS 10K							
JIS 20K(16K)							
JIS 30K							
ASME 150				359	151	65.8	
JPI 150							
ASME 300							
JPI 300	359	151	65.8				
JIS 10K							
JIS 20K(16K)							
JIS 30K							
ASME 150				359	151	65.8	
JPI 150							
ASME 300							
JPI 300	359	151	65.8				
JIS 10K							
JIS 20K(16K)							
JIS 30K							
ASME 150				359	151	65.8	
JPI 150							
ASME 300							
JPI 300	359	151	65.8				
JIS 10K							
JIS 20K(16K)							
JIS 30K							
ASME 150				359	151	65.8	
JPI 150							
ASME 300							
JPI 300	359	151	65.8				
JIS 10K							
JIS 20K(16K)							
JIS 30K							
ASME 150				359	151	65.8	
JPI 150							
ASME 300							
JPI 300	359	151	65.8				
JIS 10K							
JIS 20K(16K)							
JIS 30K							
ASME 150				359	151	65.8	
JPI 150							
ASME 300							
JPI 300	359	151	65.8				
JIS 10K							
JIS 20K(16K)							
JIS 30K							
ASME 150				359	151	65.8	
JPI 150							
ASME 300							
JPI 300	359	151	65.8				
JIS 10K							
JIS 20K(16K)							
JIS 30K							

■ Replaceable Sensor Type

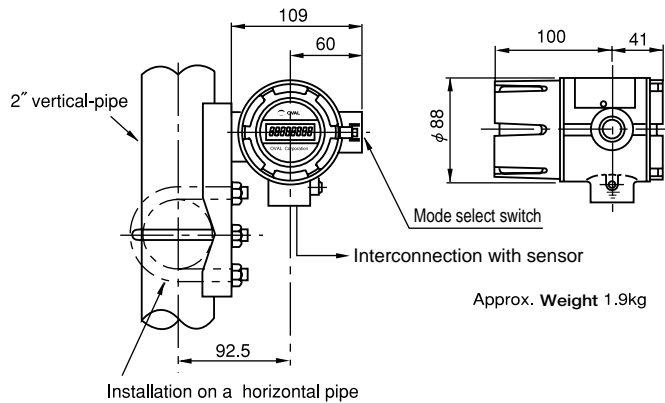
● Nominal sizes 15 to 150mm



● Nominal sizes 200 to 300mm



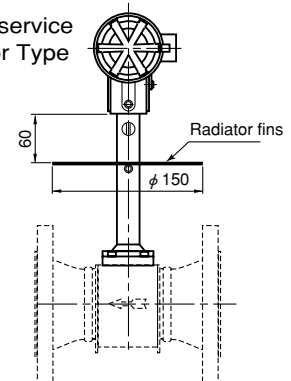
SEPARATE TYPE CONVERTER



Nominal size (mm)	Flange Rating	L	I	φ d (Meter I.D.)	H	Approx. Weight (kg)
15 (1/2")	JIS 10K(16K)	142	71	14.5	356	4.3
	JIS 20K					5.7
	JIS 30K	152	76			
	ASME 150	158	79			
	JPI 150					
	ASME 300	167	83.5			
25 (1")	JIS 10K(16K)	152	76	26.6	356	6.3
	JIS 20K					7.3
	JIS 30K	158	79			
	ASME 150	174	87			
	JPI 150					
	ASME 300	186	93			
40 (1-1/2")	JIS 10K(16K)	171	85.5	37.6	342	8.4
	JIS 20K	175	87.5			8.8
	JIS 30K	185	92.5			10.9
	ASME 150	201	100.5			8.4
	JPI 150					8.4
	ASME 300	213	106.5			10.8
50 (2")	JIS 10K	173	86.5	48.5	346	9.4
	JIS 20K(16K)	181	90.5			9.6
	JIS 30K	191	95.5			11.7
	ASME 150	204	102			10.3
	JPI 150					10.4
	ASME 300	217	108.5			12.2
80 (3")	JIS 10K	219	99.5	72.4	362	15.6
	JIS 20K(16K)	233	106.5			18.3
	JIS 30K	243	111.5			22.3
	ASME 150	237	108.5			18.4
	JPI 150					
	ASME 300	255	117.5			22.9
100 (4")	JIS 10K	250	110.5	95.2	382	21.6
	JIS 20K(16K)	264	117.5			25.6
	JIS 30K	274	122.5			32.2
	ASME 150	274	122.5			26.9
	JPI 150					27.0
	ASME 300	294	132.5			36.4
150 (6")	JIS 10K	322	132.5	140.3	412	44.1
	JIS 20K(16K)	342	142.5			53.2
	JIS 30K	352	147.5			66.8
	ASME 150	340	141.5			46.9
	JPI 150					47.0
	ASME 300	359	151			66.0
200 (8")	—	350	—	199.9	427	39.4
250 (10")	—	450	—	248.8	449	69.4
300 (12")	—	500	—	297.9	471	89.4

※ : 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.

■ High-temperature service Replaceable Sensor Type

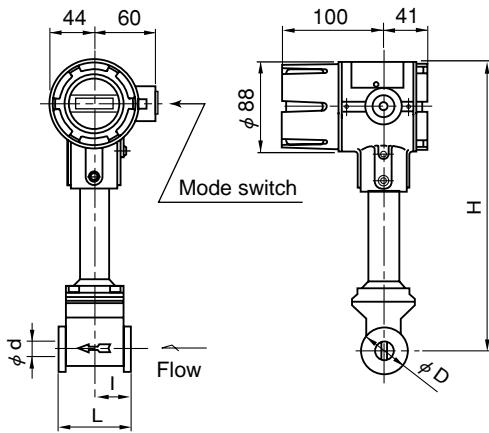


**EX DELTA II • DIA OUTLINE DIMENSIONS (Unit in mm)**

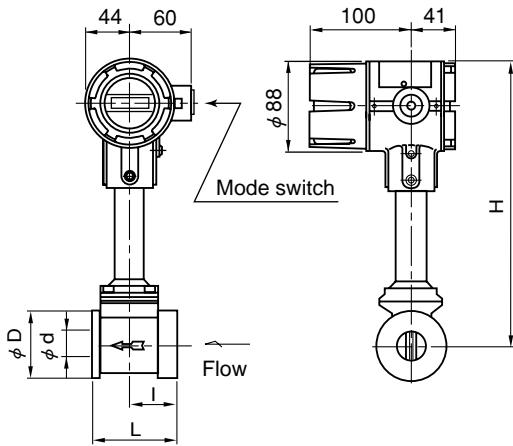
**[INTEGRAL PREAMP TYPE]**

**Wafer Type**

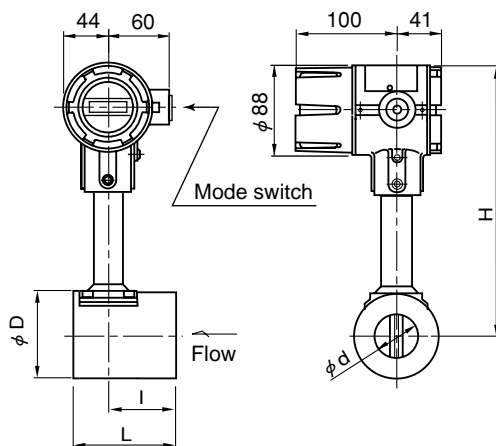
● Nominal size 15mm



● Nominal size 25mm



● Nominal sizes 40 to 80mm

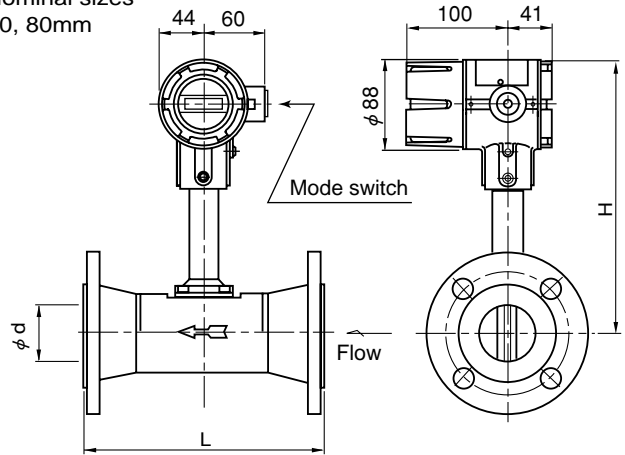


Nominal size (mm)	L	I	φ d (Meter i.D.)	φ D	H	Approx. Weight (kg)	
						No Display	w/Display
15 (1/2")	65	32.5	14.5	40	276	2.6	2.9
25 (1")	80	47.5	26.6	67	276	3.2	3.5
40 (1 1/2")	100	67	41.2	82	261	3.9	4.2
50 (2")	125	85	52.7	92	265	4.0	4.3
80 (3")	125	85	78.1	127	281	6.8	7.1

**Flanged Type**

■ Fixed Sensor Type

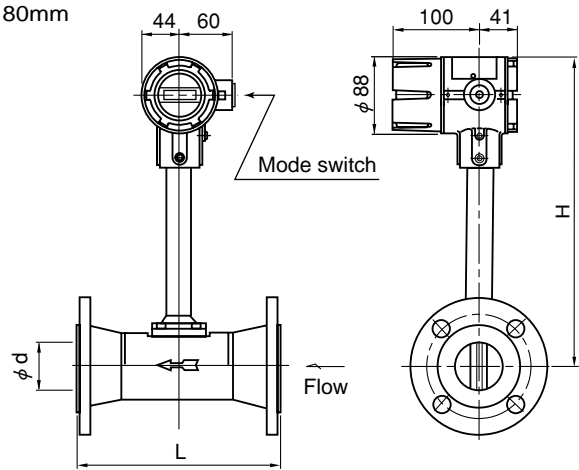
● Nominal sizes 50, 80mm



Nominal size (mm)	L	φ d (Meter i.D.)	H
50 (2")	229	52.7	265
80 (3")	254	78.1	281

■ Replaceable Sensor Type

● Nominal sizes 50, 80mm



Nominal size (mm)	L	φ d (Meter i.D.)	H
50 (2")	229	52.7	346
80 (3")	254	78.1	362

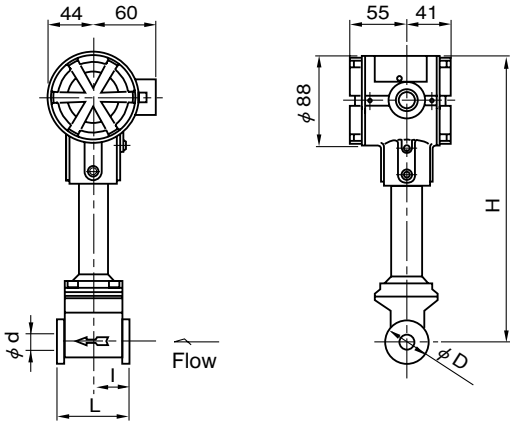
High-temperature service, replaceable model is provided with radiator fins on the adapter. (See P11)

※: 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.

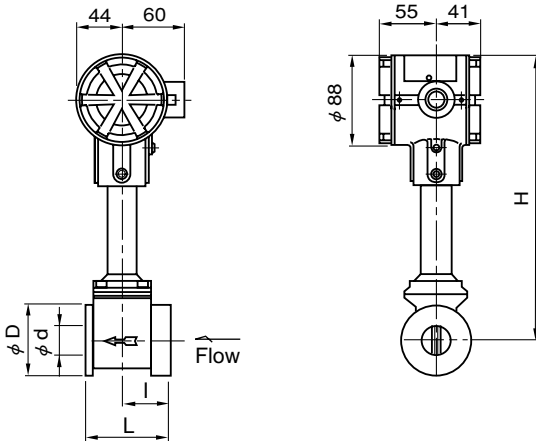
**[SEPARATE-MOUNT PREAMP TYPE]**

**Wafer Type**

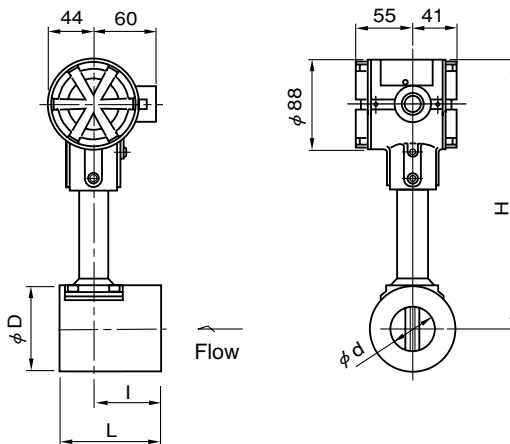
● Nominal size 15mm



● Nominal size 25mm



● Nominal sizes 40 to 80mm

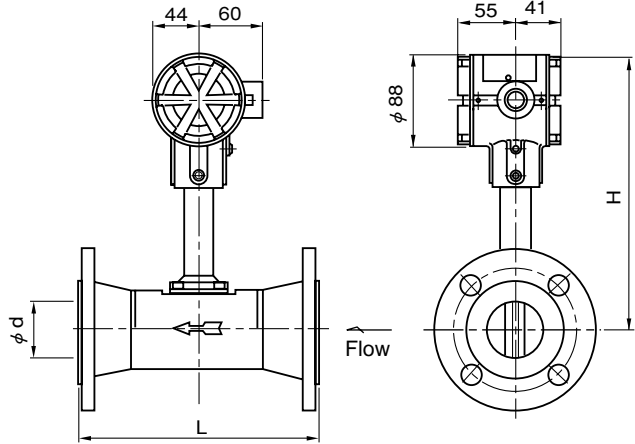


Nominal size (mm)	L	I	φ d (Meter i.D.)	φ D	H	Approx. Weight (kg)
15 (1/2")	65	32.5	14.5	40	276	2.4
25 (1")	80	47.5	26.6	67	276	3.0
40 (1 1/2")	100	67	41.2	82	261	3.7
50 (2")	125	85	52.7	92	265	3.8
80 (3")	125	85	78.1	127	281	6.6

**Flanged Type**

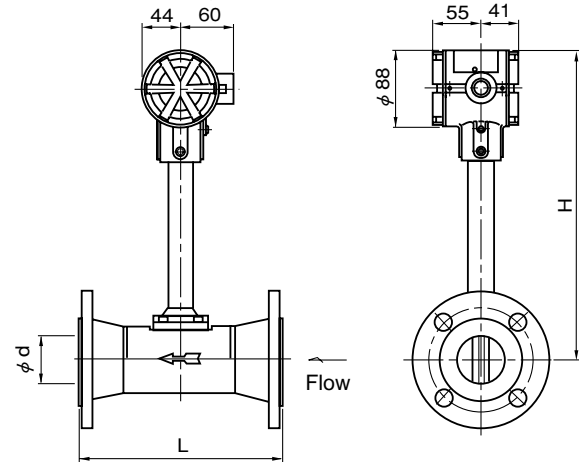
Note: Figures in the brackets show the dimensions with built-in display.

■ Fixed Sensor Type  
● Nominal sizes 50, 80mm



Nominal size (mm)	L	φ d (Meter i.D.)	H
50 (2")	229	52.7	265
80 (3")	254	78.1	281

■ Replaceable Sensor Type  
● Nominal sizes 50, 80mm

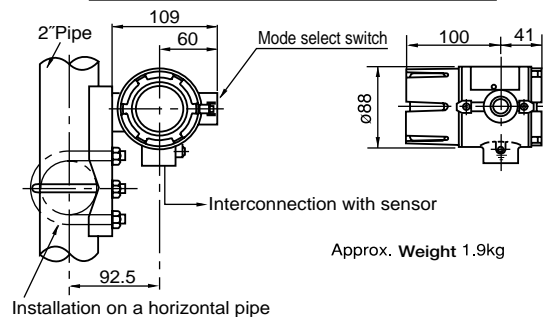


Nominal size (mm)	L	φ d (Meter i.D.)	H
50 (2")	229	52.7	346
80 (3")	254	78.1	362

High-temperature service, replaceable model is provided with radiator fins on the adapter. (See P13)

\*: 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-MOUNT PREAMP**

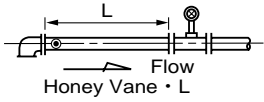
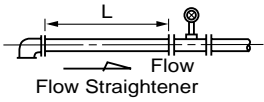
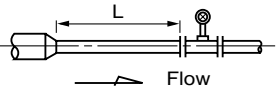
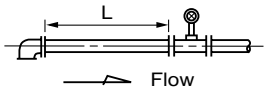
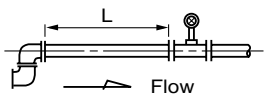
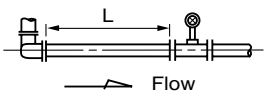
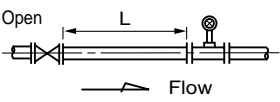
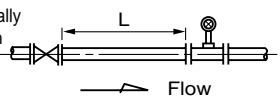


## ■ INSTALLATION CONDITIONS

### 1. TYPICAL PIPING INSTRUCTIONS

It is generally required that the flow pattern of a fluid flowing in and out of an inferential type flowmeter be as uniform as possible for 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.

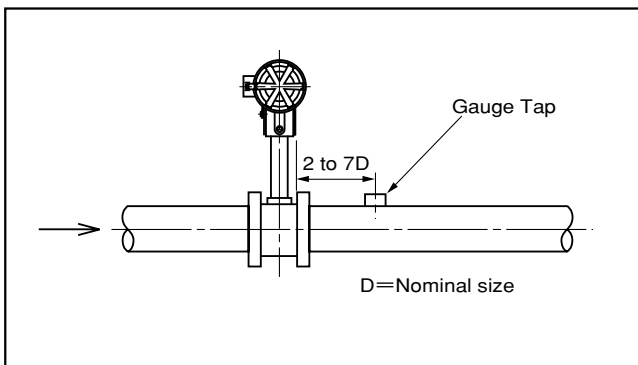
(1) Use an OVAL flow straightener or provide a specified straight pipe (ISO-5167 compliant).

No.	Piping Arrangement	Straight Pipe Length (L)	Remarks
1	 OVAL's flow-straightener	8D	Refer to Point 4 on P17.  Applicable to nominal size >25mm
	 Flow Straightener	12D	
2	 Reducer	15D Min.	A concentric reducer is installed upstream of meter.
3	 Elbow	23D Min.	An elbow is installed upstream of a meter.
	 Elbow	25D Min.	Two elbows are installed upstream of a meter.
	 Elbow	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.

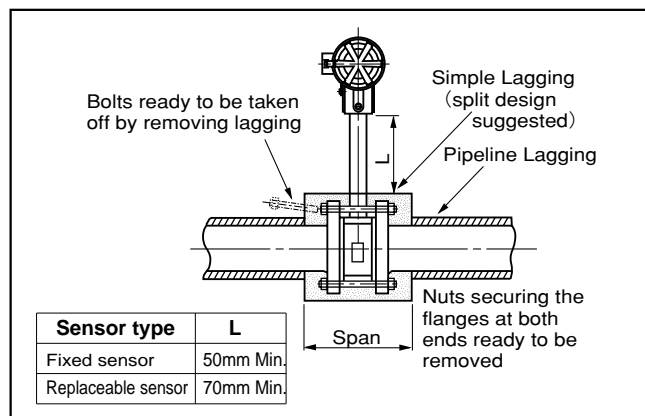
2: A short pipe section, 5D or longer, is provided downstream of the meter.

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)

$\Delta P$  : 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)

$\rho$  : Density (kg/m<sup>3</sup>)

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).

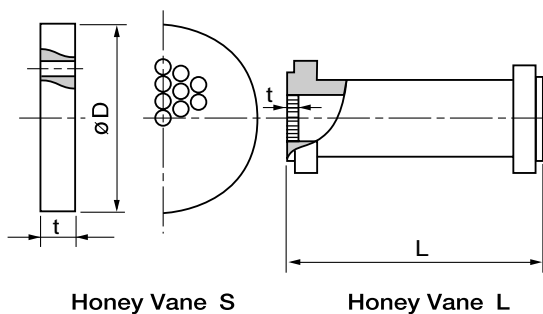
**4. SPACE SAVING (Reduction of Meter run)**

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

**●Honey Vane Outline Dimensions**

Nom.size (mm)	øD *1 (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

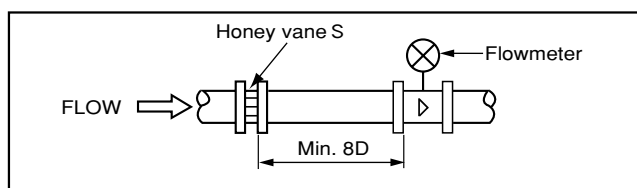
\*1. JIS10K



© Flange face to face span of EX DELTA II SS is the same as that of standard EX DELTA II . (Refer to P10,11)

**● 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.



**■ EX DELTA II PRODUCT CODE EXPLANATION**

Item	Product Code																Description			
	①	②	③	④	⑤	⑥	⑦	-	⑧	⑨	⑩	⑪	-	⑫	⑬	⑭		⑮	⑯	
<b>Model</b>	V	X																	EX DELTA II	
<b>Body style</b>		W																	Wafer type (Nominal sizes: 10 to 150mm)	Fixed sensor type
		F																	Flanged type (sizes: 15 to 300mm) RF is std.	
		R																		Flanged type (sizes: 15 to 300mm) RF is std.
<b>Application</b>			1																Standard (Delta shaped vortex shedding bluff body)	
<b>Nominal size</b>				0	1	5	-												15mm	
				0	2	5	-												25mm	
				0	4	0	-												40mm	
				0	5	0	-												50mm	
				0	8	0	-												80mm	
				1	0	0	-												100mm	
				1	5	0	-												150mm	
				2	0	0	-												200mm	
				2	5	0	-												250mm	
			3	0	0	-												300mm		
<b>Material</b>								N											SCS14A (Nominal sizes 10 to 150mm)	
																			SUS316 (Nominal sizes 200 to 300mm)	
								C											SUS316+SFVC2A (Nominal sizes 200 to 300mm)	(※1)
								Z											Special (other than above)	
<b>Flange rating</b>									1										JIS 10K	
									2										JIS 16K	
									3										JIS 20K	
									4										JIS 30K	
									5										ASME 150	(※2)
									6										ASME 300	(※2)
									7										JPI 150	
									8										JPI 300	
									A										DIN PN10	
									B										DIN PN16	
								C										DIN PN25		
								D										DIN PN40		
								9										Other		
<b>Sensor configuration</b>									1										Nominal size > 40mm (Integral sensor type)	
									2										Nominal size = 10,15, 25mm (Separate sensor type)	
<b>Applicable fluid</b>									K	-									Gas (<120°C) (Fixed sensor)	
									E	-									Liquid ( < 120°C) (Fixed sensor)	
									G	-									Gas, Steam (<300°C)	
									L	-									Liquid ( < 300°C)	
									S	-									High temp. application for gas, steam (<460°C) (Replaceable sensor)	
									H	-									High temp. application for liquid ( < 460°C) (Replaceable sensor)	
<b>Converter configuration</b>									1										Integral type	
									2										Separate type	
<b>Explosionproof configuration</b>										0									Non-explosionproof	
										3									Intrinsic safety (TIIS)	
<b>Display</b>											1								W/Totalizer & Digital indicator	(※3)
<b>Output Signal</b>												0							Non output (battery powered type)	
<b>Version code</b>																			B	

\* 1: Body material for meters 200mm to 300mm in nominal size is SUS316 pipe + SFVC2A flanges. Meters approved to comply with high pressure gas safety regulations are not applicable, however.

\* 2: Flange serration for ASME standard : ASME B 16.5—2003.

\* 3: The following variables are selectable with an external switch for the display:

- ① Totalizing counter
- ② Instantaneous flowrate(/h)
- ③ Instantaneous flowrate(/min)
- ④ Resettable counter

**EX DELTA II PRODUCT CODE EXPLANATION**

Item	Product Code																Description			
	①	②	③	④	⑤	⑥	⑦	-	⑧	⑨	⑩	⑪	-	⑫	⑬	⑭		⑮	⑯	
<b>Model</b>	V	X																	EX DELTA II	
<b>Body style</b>	W																		Wafer type (Nominal sizes: 15 to 80mm)	Fixed sensor type (*3)
	F																		Flanged type (sizes: 50, 80mm) RF is std.	
	R																			Flanged type (sizes: 50, 80mm) RF is std.
<b>Application</b>			2																Diamond shaped bluff body	
<b>Nominal size</b>			0	1	5	-													15mm	
			0	2	5	-													25mm	
			0	4	0	-													40mm	
			0	5	0	-													50mm	
			0	8	0	-													80mm	
<b>Material</b>							N												SCS14A (Nominal sizes 15, 25 wafer type)	
							C												SUS316	
							Z												Special (other than above)	
<b>Flange rating</b>							1												JIS 10K	
							2												JIS 16K	
							3												JIS 20K	
							4												JIS 30K	
							5												ASME 150 (*1)	
							6												ASME 300 (*1)	
							7												JPI 150	
							8												JPI 300	
							A												DIN PN10	
							B												DIN PN16	
						C												DIN PN25		
						D												DIN PN40		
						9												Other		
<b>Sensor configuration</b>							2											Separate sensor type		
<b>Applicable fluid</b>							E	-										Liquid (< 120°C) (Fixed sensor)		
							L	-										Liquid (< 300°C)		
							H	-										High temp. application for liquid (< 460°C) (Replaceable sensor)		
<b>Converter configuration</b>																		1	Integral type	
																		2	Separate type (secured to a 2" pipe stanchion)	
<b>Explosionproof configuration</b>																		0	None (non-explosionproof)	
																		3	Intrinsic safety (TIIS)	
<b>Display</b>																		1	W/Totalizer & Digital indicator (*2)	
<b>Output Signal</b>																		0	Non output (battery powered type)	
<b>Version code</b>																		B		

- \* 1: Flange serration for ASME standard : ASME 1316.5-2003.
- \* 2: The following variables are selectable with an external switch for the display:
  - ① Totalizing counter
  - ② Instantaneous flowrate (/h)
  - ③ Instantaneous flowrate (/min)
  - ④ Resettable counter
- \* 3: Applicable item.

Nominal size (mm)	15	25	40	50	80
Wafer type	○	○	○	○	○
Flanged type	△	△	△	○	○

○ : Standard △ : Option

■ **When making inquiries, please specify the following:**

Fill in the blanks or tick in .

Item	Description
<b>1. Fluid to be Metered</b>	
<b>2. Flow Range</b>	Max. _____ Normal _____ Min. _____ <input type="checkbox"/> m <sup>3</sup> /h[normal] <input type="checkbox"/> m <sup>3</sup> /h[actual] <input type="checkbox"/> kg/h
<b>3. Temp. Range</b>	Max. _____ Normal _____ Min. _____ °C
<b>4. Press. Range</b>	Max. _____ Normal _____ Min. _____ <input type="checkbox"/> MPa[gauge]
<b>5. Density or Sp. Gr.</b>	Density _____ <input type="checkbox"/> kg/m <sup>3</sup> [normal], <input type="checkbox"/> kg/m <sup>3</sup> [actual] Sp. Gr. _____
<b>6. Viscosity</b>	_____ <input type="checkbox"/> mPa·s, <input type="checkbox"/> mm <sup>2</sup> /s at _____ °C
<b>7. Connections</b>	Nom. Size _____ <input type="checkbox"/> mm, <input type="checkbox"/> ", Flange rating <input type="checkbox"/> JIS _____ KRF <input type="checkbox"/> ASME/JPI _____ RF <input type="checkbox"/> DIN PN _____
<b>8. Flow Straightening Pipe</b>	<input type="checkbox"/> Req'd (Flow straightener and downstream pipe) <input type="checkbox"/> Not req'd (Prepare a straight pipe of specified length, I.D., Sch. No.)
<b>9. Compensation</b>	<input type="checkbox"/> Temp./Press. comp. <input type="checkbox"/> Pressure comp. <input type="checkbox"/> Temp. comp.
<b>10. Compensation Range</b>	Temp. _____ to _____ °C, Pressure _____ to _____ <input type="checkbox"/> MPa [gauge]
<b>11. Compensation Ref.</b>	Ref. temp. _____ °C Press. ref. _____ <input type="checkbox"/> MPa [gauge]
<b>12. Compensation Coeff.</b> (gas measurement)	Z (service conditions) = _____ Zo (standard conditions) = _____
<b>13. Accuracy Test</b>	<input type="checkbox"/> Req'd <input type="checkbox"/> Not req'd
<b>14. Converter</b>	Type : <input type="checkbox"/> Integral configuration <input type="checkbox"/> Separate configuration Explosionproof configuration : <input type="checkbox"/> Non-explosionproof <input type="checkbox"/> Intrinsic safety
<b>15. Miscellaneous</b>	

The specification as of Sep., 2013 is stated in this GS Sheet. Specifications and design are subject to change without notice.

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