



Vortex Flowmeter BATTERY POWERED EX DELTA•DIA MODEL VX Series

GENERAL SPECIFICATION
GS.No.GBD660E-12

■ GENERAL

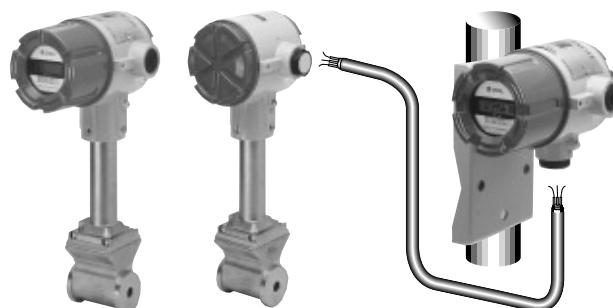
With a design to be more usable than ever before, the battery powered EX DELTA and EX DELTA • DIA operate on an internal battery. In this series, the need of an external power source has been eliminated from its big brother, the field proven EX DELTA that has enjoyed extensive use as a dedicated local 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 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.
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 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
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		
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)		-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		Select one from the following two ranges according to the given operating conditions: 1: ±1% of indicated reading or better 2: ±1% of full scale or better (※4)		
Repeatability		±0.2% or better		
Materials	Body	SCS14A Nom. size 10mm ••• SCS14A+SUS316	SUS316 or SCS14A (Nom. size 200 to 300mm ••• Flange material is SUS316 or SFVC2A.)	
	Bluff body (delta or dia. 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 (measuring pipe)	Nominal sizes 10 to 300mm : Remains unfinished (because of stainless steel material) Nominal sizes 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. ※1 : 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.

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● EX DELTA•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	
Installation	No restrictions to cause loss of accuracy on physical orientation (Maintainability and waterproof work for cable entry should be taken into consideration.)		
Finish (Measuring Pipe)	Remains unfinished (because of stainless steel material)		

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

●Flange Rating and Max. Operating Pressure (MPa)

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

Flange Rating Operating Temperature	JIS10K	JIS16K	JIS20K	JIS30K	ASME/JPI 150	ASME/JPI 300
Below 220°C	1.18	1.96	2.45	4.51	1.27	3.35
220 to 300°C	0.98	1.77	2.26	4.22	1.02	3.06
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 Temperature	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

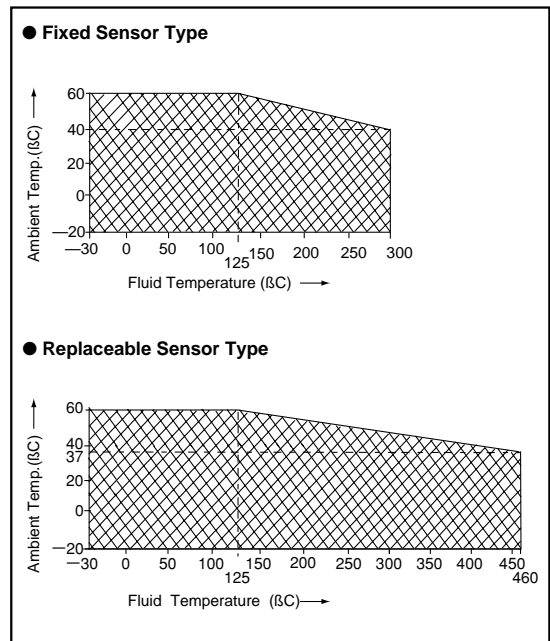
■ CONVERTER SPECIFICATIONS

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 (Exiall CT4)
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 2.5G8/2 (Cover: Munsell 2.5BG5/6)
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)

※1 : distance between the meter and converter: Max. 200m.

●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

Applicable Fluids	Nom. size mm (inch)	Max. Flowrate m ³ /h	Nom. Meter Factor L/p	Applicable Fluids	Nom. size mm (inch)	Max. Flowrate m ³ /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•DIA

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

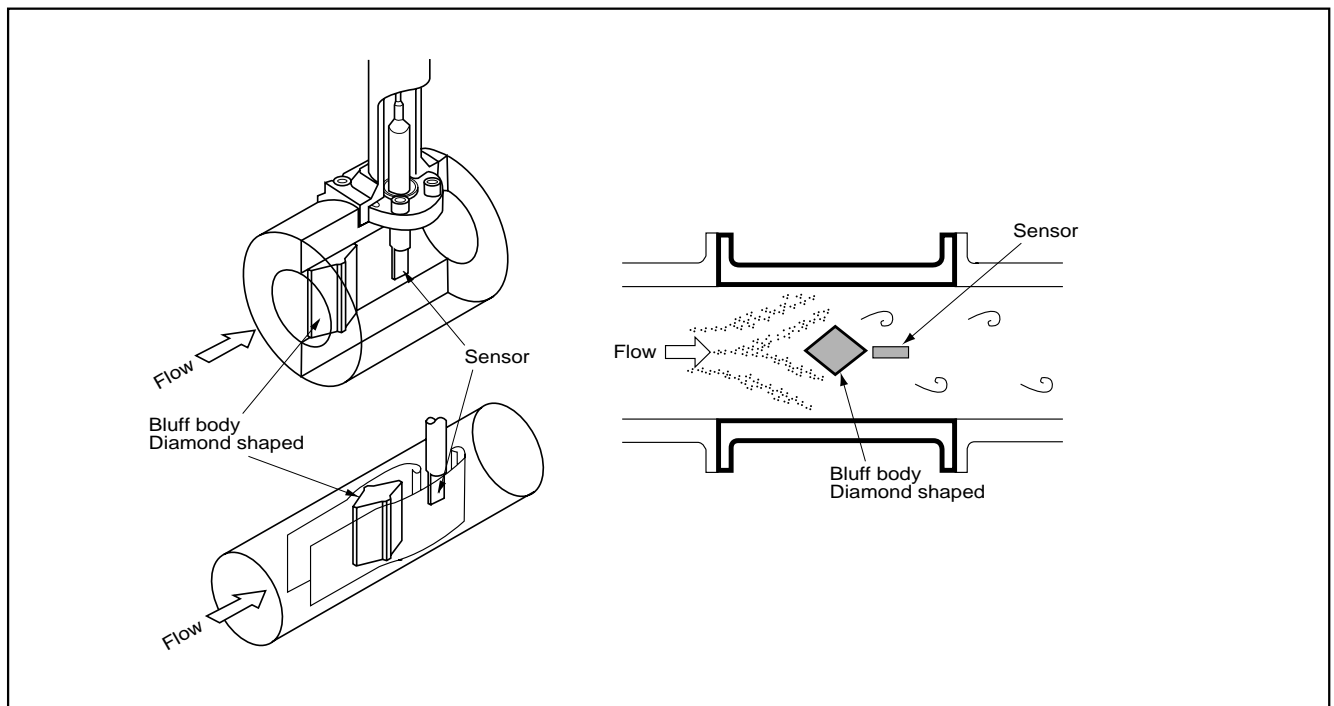
Mode Select Pushbutton Switch

Display

- 1: Accumulated total flow 12345678
m³
- 2: Instantaneous flow rate (b1) b1 1200
m³/h
- 3: Instantaneous flow rate (b2) b2 2000
m³/min
- 4: Resettable total flow C 1234567
m³

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

■ EX DELTA•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

Unit in 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	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•DIA

Unit in m³/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 m³/h

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

● In the shadowed area , determine on the basis of specific gravity (Table A).

● RD : Reading, FS : Full Scale

● Minimum measurable flowrate (minimum detectable flowrate)

Fluid (Viscosity 1mPa•s)

Unit in m³/h

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

● Gas Service

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

Size mm	Accuracy	Dens.kg/m ³	Minimum flowrate (m ³ /h)										Max. Flowrate (m ³ /h)
			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)			Minimum flow rate (m ³ /h)										
Size mm	Dens. kg/m ³	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/Nm ³	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	0.007
	Ammonia	0.771	—	0	0.07	0.21	0.42	0.75	1.45	2.55	4.6	—	0.0092
	Carbon Monoxide	1.250	—	—	0	0.07	0.21	0.42	0.85	1.55	2.8	—	0.0166
	Ethane	1.357	—	—	0	0.06	0.18	0.37	0.8	1.4	2.6	—	0.0085
	Ethylene	1.264	—	—	0	0.07	0.21	0.42	0.85	1.55	2.8	—	0.0097
	Air	1.293	—	—	0	0.07	0.20	0.4	0.85	1.5	2.7	—	0.017
	Oxygen	1.429	—	—	0	0.05	0.17	0.35	0.75	1.35	2.5	4.4	0.0192
	Hydrogen	0.0899	0.35	0.73	1.33	2.3	4.2	—	—	—	—	—	0.0084
	Carbon Dioxide	1.977	—	—	—	0.01	0.1	0.23	0.5	0.95	1.7	3.3	0.0138
	Nitrogen	1.251	—	—	—	0.07	0.21	0.42	0.85	1.55	2.8	—	0.0166
	City Gas	0.802	—	0	0.06	0.17	0.38	0.7	1.4	2.45	4.5	—	0.01
	Natural Gas	0.828	—	0	0.06	0.16	0.37	0.68	1.35	2.4	4.3	—	0.0107
	Freon-12	5.533	—	—	—	—	0	0.02	0.12	0.27	0.56	1.1	0.0127
	Propane	2.020	—	—	—	0.01	0.09	0.22	0.49	0.9	1.7	3.2	0.0075
Butane	2.703	—	—	—	0	0.04	0.14	0.34	0.65	1.2	2.4	0.0069	
Methane	0.717	—	0	0.08	0.2	0.44	0.8	1.55	2.8	—	—	0.0103	

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

How to Determine the Minimum Flow Rate

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

EXAMPLE 1

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

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

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

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 47m³/h; at a density of 11 is 38m³/h. The minimum flow rate 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 flow rate 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. flow rate and determine the nominal diameter. If there is some latitude in temperature and pressure, the maximum flow rate should be calculated on the basis of the high end in temperature and the low end in pressure. The actual maximum flow rate is therefore computed as follows:

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

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 9m³/h, at 1.7MPa, it is 8m³/h. We then obtain the minimum flow rate in proportional way as:

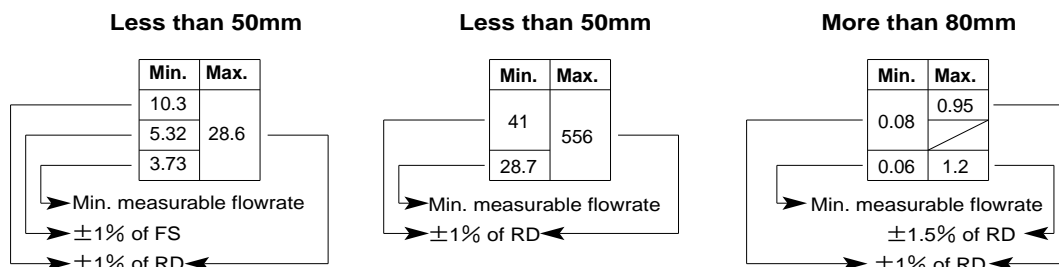
$$Q_{min} = 8 + \frac{1.7 - 1.5}{1.7 - 0.95} \times (9 - 8) \approx 8.3m^3/h$$

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	28.6	18.8	113	29.1	252	37.2	426	0.08	0.95	0.14	1.6	0.3	3.63	0.52	6.08	1.15	9.13	1.64	13
	5.32		13.1		22		35.9		0.06	1.2	0.1	2.06	0.21	4.48	0.37	7.91	0.8	12.1	1.15	17.4
	3.73		9.15		15.4		25.2		0.06	1.2	0.1	2.06	0.21	4.48	0.37	7.91	0.8	12.1	1.15	17.4
0.1	10.6	37.4	19.4	147	30	329	41	556	0.1	1.24	0.16	2.1	0.34	4.74	0.59	7.95	1.31	11.9	1.88	17
	6.08		15		25.1		35.9		0.07	1.56	0.11	2.69	0.24	5.86	0.42	10.3	0.914	15.9	1.32	22.8
	4.26		10.5		17.6		28.7		0.07	1.56	0.11	2.69	0.24	5.86	0.42	10.3	0.914	15.9	1.32	22.8
0.2	11	54.7	20.2	215	33	480	53.9	812	0.12	1.82	0.21	3.06	0.45	6.92	0.78	11.6	1.72	17.4	2.46	24.8
	7.99		19.7		25		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
	5.6		13.8		23.1		37.8		0.09	2.28	0.15	3.92	0.31	8.55	0.55	15	1.21	23.2	1.73	33.3
0.3	11.4	71.5	23.5	282	39.4	629	64.5	1060	0.15	2.38	0.25	4.01	0.53	9.06	0.93	15.1	2.06	22.7	2.95	32.5
	9.56		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
	6.7		16.5		27.6		45.2		0.1	2.99	0.18	5.14	0.38	11.1	0.65	19.7	1.44	30.3	2.07	43.6
0.4	11.7	88.2	27	347	45.3	775	74.2	1310	0.17	2.94	0.28	4.94	0.61	11.1	1.07	18.7	2.37	28	3.39	40.1
	11		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
	7.7		18.9		31.8		51.9		0.12	3.69	0.2	6.33	0.43	13.8	0.75	24.3	1.66	37.4	2.37	53.7
0.5	12.4	104	30.3	412	50.8	920	83.2	1550	0.19	3.49	0.32	5.87	0.69	13.2	1.2	22.2	2.65	33.3	3.8	47.6
	8.63		21.2		35.6		58.2		0.13	4.38	0.22	7.52	0.48	16.3	0.84	28.8	1.86	44.4	2.66	63.8
	8.63		21.2		35.6		58.2		0.13	4.38	0.22	7.52	0.48	16.3	0.84	28.8	1.86	44.4	2.66	63.8
0.6	13.6	121	33.4	477	56	1060	91.6	1790	0.21	4.04	0.35	6.79	0.76	15.3	1.32	25.7	2.92	38.5	4.19	55
	9.51		23.4		39.2		64.1		0.15	5.06	0.25	8.7	0.53	18.9	0.93	33.4	2.05	51.4	2.93	73.8
	9.51		23.4		39.2		64.1		0.15	5.06	0.25	8.7	0.53	18.9	0.93	33.4	2.05	51.4	2.93	73.8
0.8	16	153	39.1	605	65.6	1350	108	2280	0.24	5.12	0.41	8.62	0.89	19.4	1.55	32.6	3.42	48.9	4.91	69.9
	11.2		27.4		46		75.2		0.17	6.43	0.29	11	0.62	24	1.09	42.4	2.4	65.2	3.44	93.6
	11.2		27.4		46		75.2		0.17	6.43	0.29	11	0.62	24	1.09	42.4	2.4	65.2	3.44	93.6
1	18.1	186	44.4	733	74.6	1630	122	2760	0.27	6.2	0.46	10.4	1.01	23.5	1.76	39.4	3.89	59.2	5.57	84.6
	12.7		31.1		52.2		85.4		0.19	7.78	0.33	13.3	0.71	29.1	1.23	51.3	2.72	78.9	3.9	113
	12.7		31.1		52.2		85.4		0.19	7.78	0.33	13.3	0.71	29.1	1.23	51.3	2.72	78.9	3.9	113
1.5	23	266	56.5	1050	94.8	2340	155	3960	0.35	8.89	0.59	14.9	1.28	33.8	2.24	56.6	4.94	84.9	7.08	121
	16.1		39.5		66.4		109		0.24	11.1	0.41	19.1	0.9	41.7	1.57	73.6	3.46	113	4.96	162
	16.1		39.5		66.4		109		0.24	11.1	0.41	19.1	0.9	41.7	1.57	73.6	3.46	113	4.96	162
2	27.5	347	67.4	1370	114	3050	185	5160	0.41	11.5	0.7	19.4	1.52	44	2.67	73.7	5.89	110	8.83	158
	19.2		47.2		79.2		130		0.29	14.5	0.49	24.9	1.07	54.3	1.87	95.9	4.13	147	6.18	211
	19.2		47.2		79.2		130		0.29	14.5	0.49	24.9	1.07	54.3	1.87	95.9	4.13	147	6.18	211
2.5	31.6	429	77.5	1690	131	3770	213	6370	0.47	14.3	0.81	24	1.75	54.3	3.3	91	6.78	136	10.9	195
	22.1		54.3		91.1		149		0.33	17.9	0.57	30.8	1.23	67.1	2.31	118	4.75	182	7.63	261
	22.1		54.3		91.1		149		0.33	17.9	0.57	30.8	1.23	67.1	2.31	118	4.75	182	7.63	261
3	35.5	511	87.1	2010	147	4490	240	7590	0.53	17	0.91	28.6	1.97	64.8	3.93	108	7.62	162	13	232
	24.9		61		103		168		0.37	21.4	0.64	36.7	1.38	80	2.75	141	5.34	217	9.09	311
	24.9		61		103		168		0.37	21.4	0.64	36.7	1.38	80	2.75	141	5.34	217	9.09	311
4	42.9	680	106	2670	177	5970	290	10100	0.64	22.6	1.09	38.1	2.38	86.1	5.22	144	10.1	216	17.3	309
	30.1		73.7		124		203		0.45	28.4	0.77	48.8	1.67	106	3.66	187	70.3	288	12.1	414
	30.1		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	854	123	3360	206	7500	337	12600	0.74	28.4	1.27	47.9	2.83	108	6.56	181	12.7	271	21.7	388
	35		85.8		145		236		0.52	35.7	0.89	61.3	1.98	133	4.59	235	8.83	362	15.2	520
	35		85.8		145		236		0.52	35.7	0.89	61.3	1.98	133	4.59	235	8.83	362	15.2	520

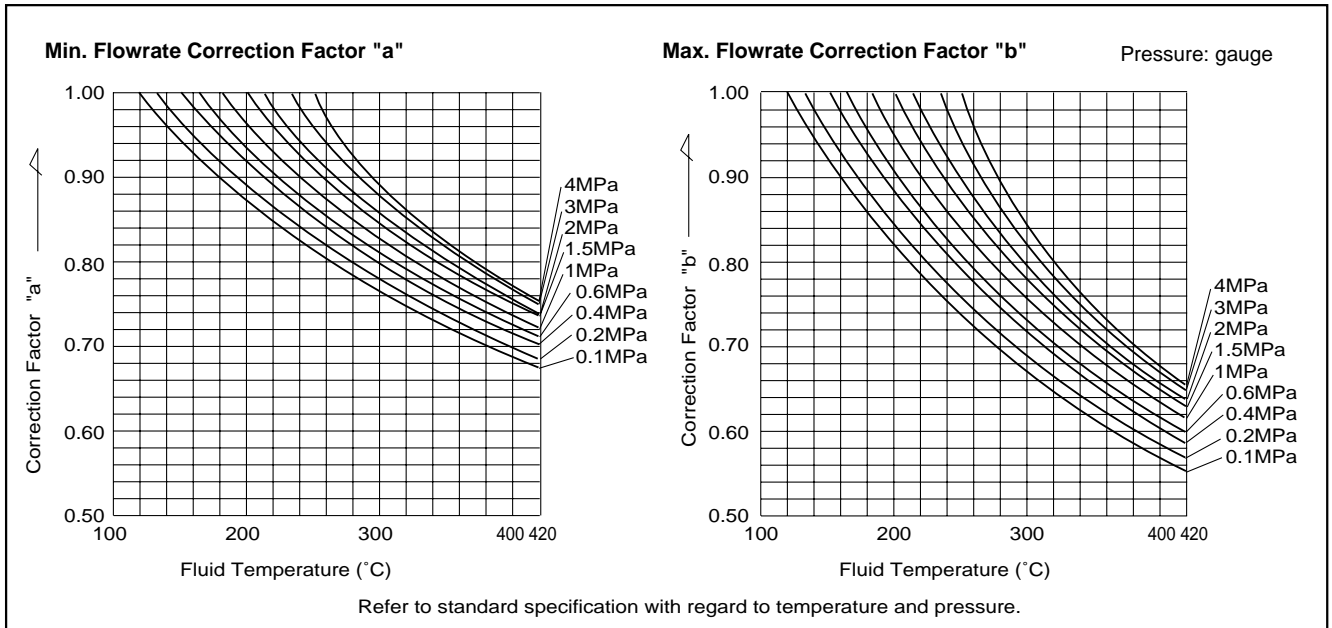
● Explanation of tables



● 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.

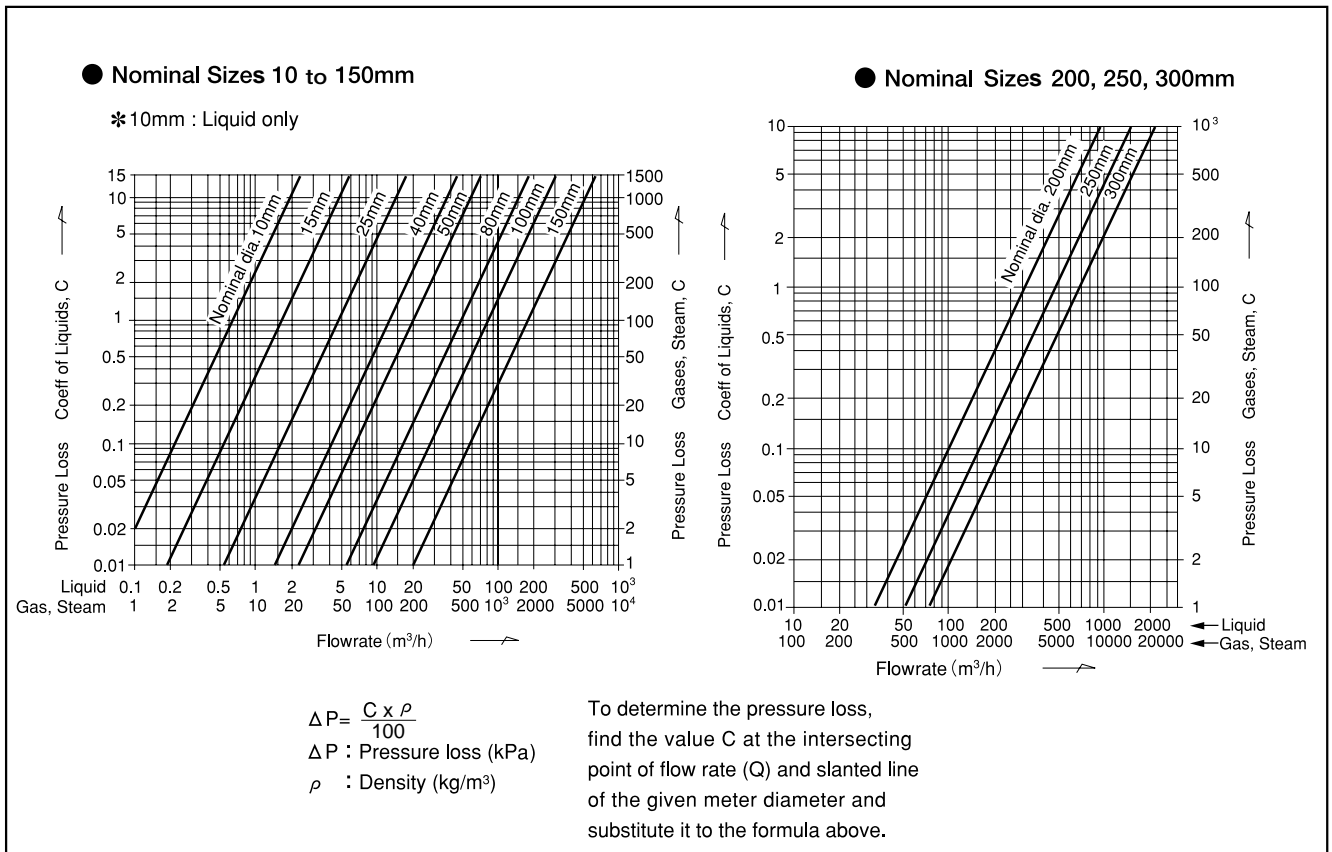
SOLUTION : From the curves, correction factors are : a= 0.890, b= 0.840. So we obtain

Min. flowrate $Q_{min} = 0.890 \times 130 = 115.7 \text{ kg/h}$
 Max. flowrate $Q_{max} = 0.840 \times 2720 = 2285 \text{ kg/h}$

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 “m³/h”, the total flow reads in “m³/h”.

TOTAL UNITS RESOLUTION

EX DELTA

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 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.

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 Z₀/Z=1.)

where T=Operating temp.(°C)

P=Operating press.(MPa[gauge])

Z₀=Compressibility coefficient under standard conditions.

Z=Compressibility coefficient under operating conditions.

2. Follow your way to the right in the nominal bore size column of the given meter in Table A and find the segment number (①,②,etc.) that agrees with the conversion factor you have just computed. Example: Nom. size 50mm, 0.999≤③<9.99

3. In Table B, find the scaled pulse unit relative to the segment number.

Table A • Conversion Factor — Segment Graph

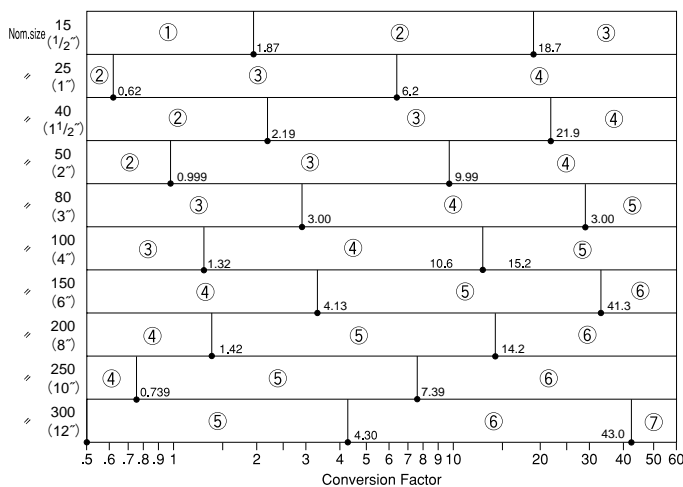


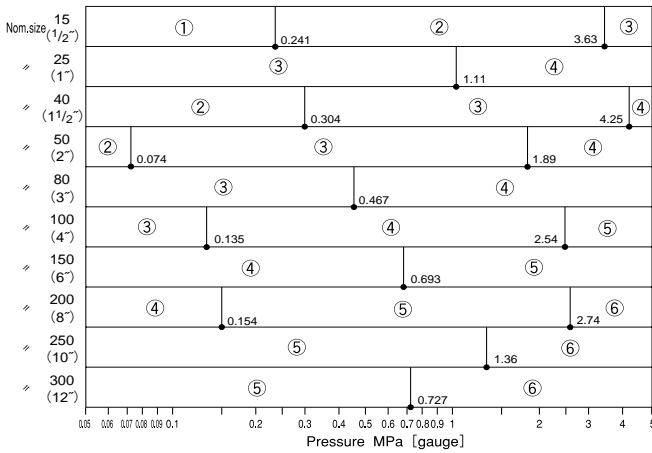
Table B • Segment — Indicated Unit

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

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



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

● 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.

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

Table E ● Density — Segment Graph

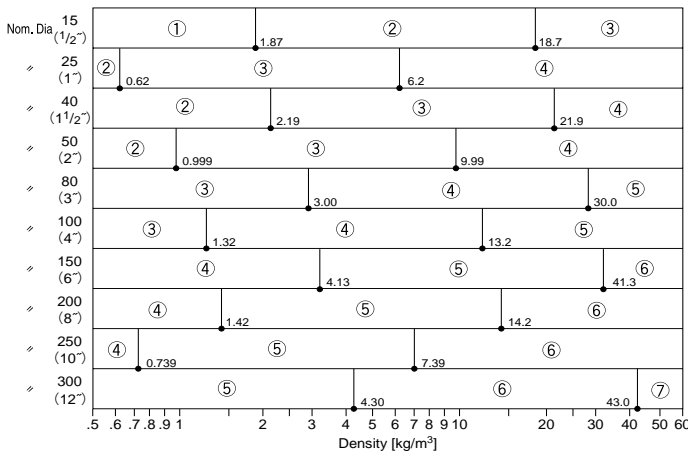


Table F ● Segment — Indicated Unit

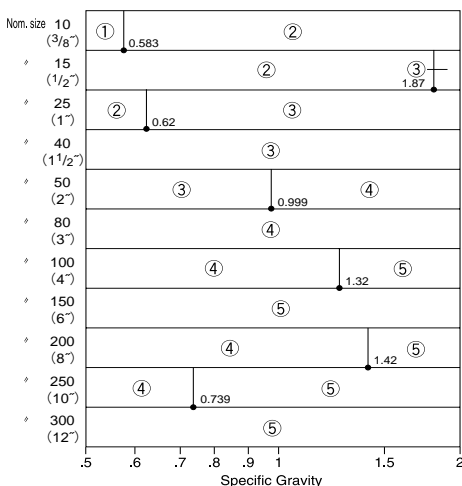
Segment No.	Reads : kg
①	0.01
②	0.01
③	0.1
④	1
⑤	10
⑥	100
⑦	1000

● 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.

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

Table G ● Specific Gravity — Segment Graph
● EX DELTA



● EX DELTA • DIA

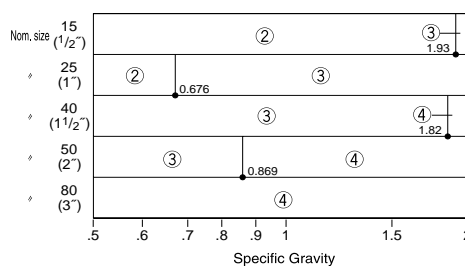


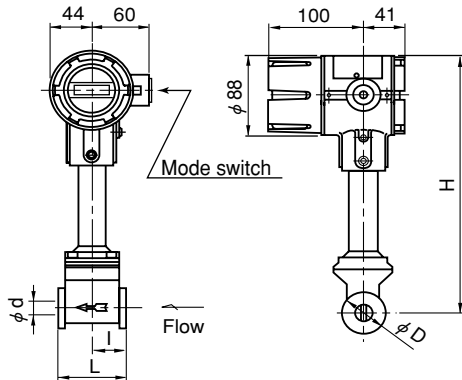
Table H ● Segment — Indicated Unit

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

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

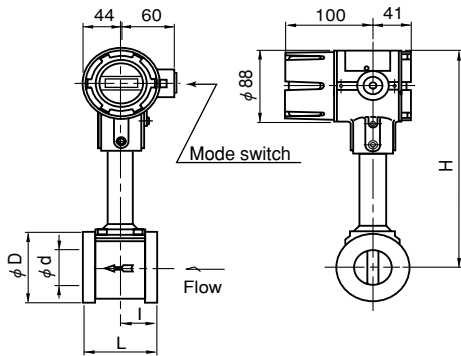
Wafer Type

- Nominal Sizes 10,15, 25mm



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 sizes 40 to 150mm

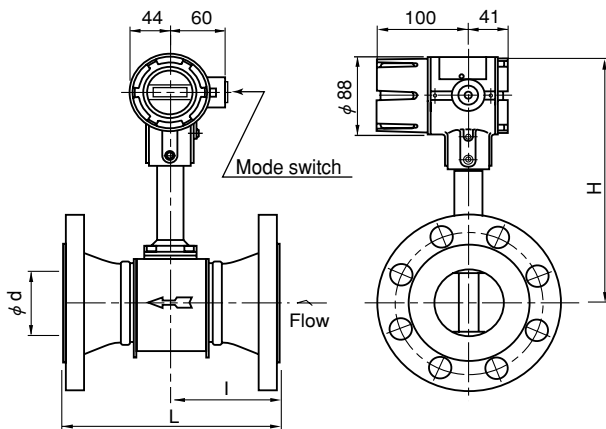


Nominal size (mm)	Flange Rating	L	I	φ d (Meter I.D)	H	Approx. Weight (kg)
15 (1/2")	JIS 10K(16K)	142	71	14.5	276	3.9
	JIS 20K	142	71			5.3
	JIS 30K	152	76			3.5
	ASME 150	158	79			4.1
	JPI 150	167	83.5			
25 (1")	JIS 10K(16K)	152	76	26.6	276	5.9
	JIS 20K	152	76			6.9
	JIS 30K	158	79			5.1
	ASME 150	174	87			6.3
	JPI 150	186	93			
40 (1-1/2")	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	201	100.5			8.0
	ASME 300	213	106.5			10.4
50 (2")	JIS 10K	173	86.5	48.5	265	9.0
	JIS 20K(16K)	181	90.5			9.2
	JIS 30K	191	95.5			11.3
	ASME 150	204	102			9.9
	JPI 150	204	102			10.0
	ASME 300	217	108.5			11.8
80 (3")	JIS 10K	219	99.5	72.4	281	15.2
	JIS 20K(16K)	233	106.5			17.9
	JIS 30K	243	111.5			21.9
	ASME 150	237	108.5			18.0
	JPI 150	237	108.5			18.0
	ASME 300	255	117.5			22.5
100 (4")	JIS 10K	250	110.5	95.2	301	21.2
	JIS 20K(16K)	264	117.5			25.2
	JIS 30K	274	122.5			31.8
	ASME 150	274	122.5			26.5
	JPI 150	274	122.5			26.6
	ASME 300	294	132.5			36.0
150 (6")	JIS 10K	322	132.5	140.3	331	43.7
	JIS 20K(16K)	342	142.5			52.8
	JIS 30K	352	147.5			66.4
	ASME 150	340	141.5			46.5
	JPI 150	340	141.5			46.6
	ASME 300	359	151			65.6
200 (8")	—	350	—	199.9	346	38.3
250 (10")	—	450	—	248.8	368	68.8
300 (12")	—	550	—	297.9	390	88.6

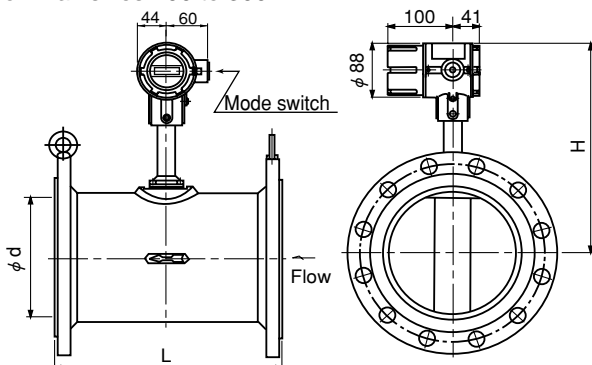
Flanged Type

- Fixed Sensor Type

- Nominal sizes 15 to 150mm



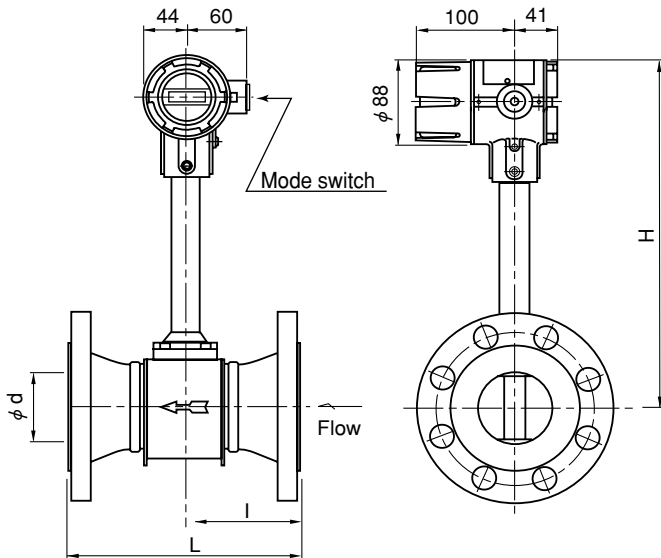
- Nominal sizes 200 to 300mm



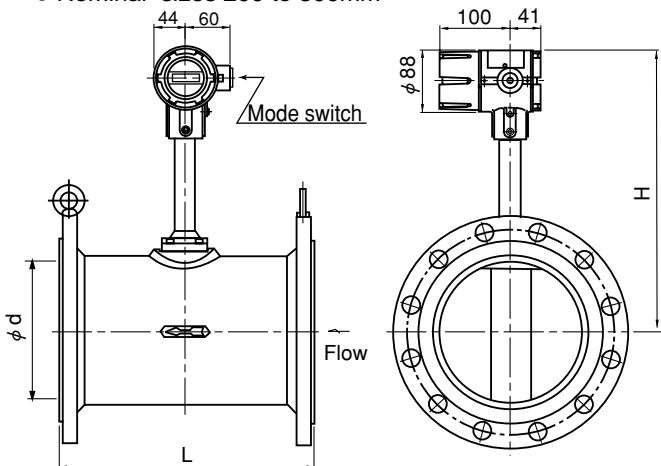
※ : Irrespective of flange rating, a flange thickness having a higher rating is selected as long as the flange O.D. and bolt holes remain the same.

■ Replaceable Sensor Type

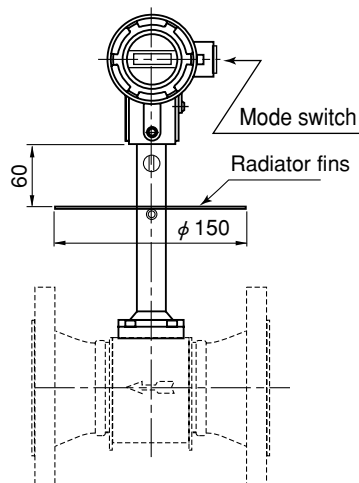
● Nominal sizes 15 to 150mm



● Nominal sizes 200 to 300mm



■ High-temperature service Replaceable Sensor Type



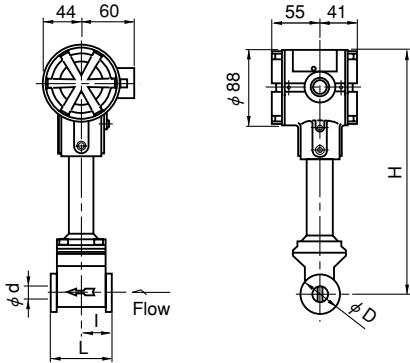
Nominal size (mm)	Flange Rating	L	I	ϕ d (Meter I.D)	H	Approx. Weight (kg)
15 (1/2")	JIS 10K(16K)	142	71	14.5	356	4.5
	JIS 20K					5.9
	JIS 30K	152	76			4.1
	ASME 150	158	79			
	JPI 150					
	ASME 300	167	83.5			4.7
25 (1")	JIS 10K(16K)	152	76	26.6	356	6.5
	JIS 20K					7.5
	JIS 30K	158	79			5.7
	ASME 150	174	87			
	JPI 150					
	ASME 300	186	93			6.9
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
	ASME 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
	ASME 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					
	ASME 300	255	117.5			23.1
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
	ASME 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
	ASME 300	359	151			66.2
200 (8")	—	350	—	199.9	427	39.4
250 (10")	—	450	—	248.8	449	69.4
300 (12")	—	550	—	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.

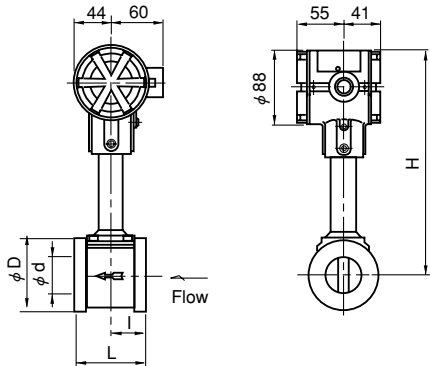
■ EX DELTA OUTLINE DIMENSIONS [SEPARATE TYPE] (Unit in mm)

Wafer Type

● Nominal Sizes 10,15, 25mm



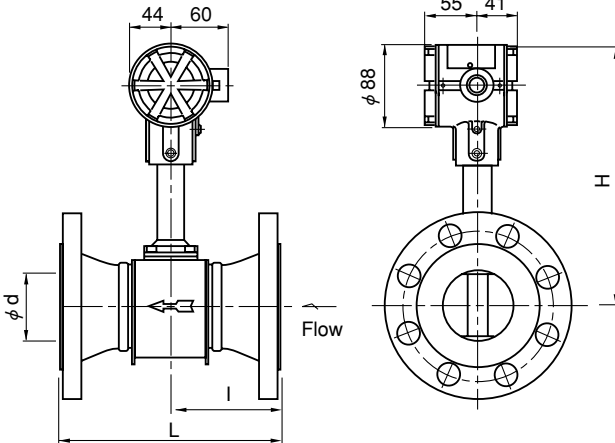
● Nominal sizes 40 to 150mm



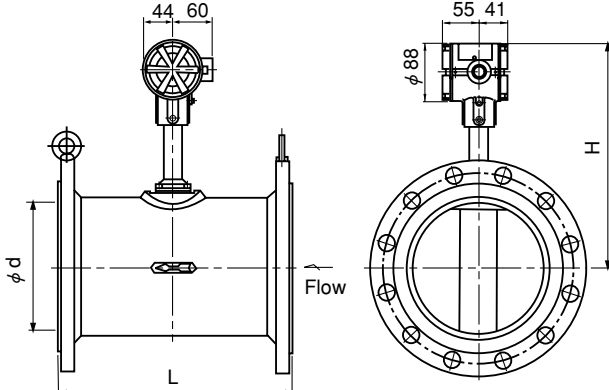
Flanged Type

■ Fixed Sensor Type

● Nominal sizes 15 to 150mm



● Nominal sizes 200 to 300mm



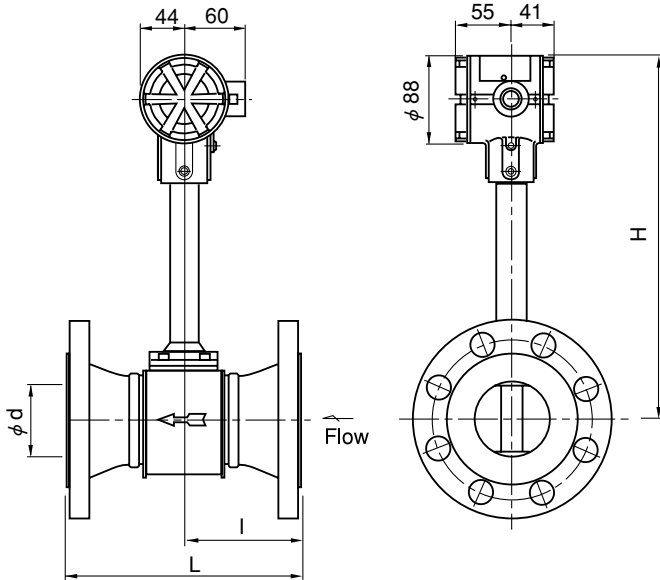
Nominal size (mm)	L	I	φ d (Meter I.D)	φ D	H	Approx. Weight (kg)
10 (3/8")	65	32.5	10	40	276	2.4
15 (1/2")	65	32.5	14.5	40	276	2.4
25 (1")	65	32.5	26.6	67	276	3.0
40 (1-1/2")	80	40	37.6	81	261	3.7
50 (2")	80	40	48.5	91	265	3.8
80 (3")	100	40	72.4	126	281	6.6
100 (4")	125	48	95.2	156.2	301	10.3
150 (6")	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					5.1
	JIS 30K	152	76			3.3
	ASME 150	158	79			
	JPI 150					3.9
	ASME 300	167	83.5			
25 (1")	JIS 10K(16K)	152	76	26.6	276	5.7
	JIS 20K					6.7
	JIS 30K	158	79			4.9
	ASME 150	174	87			
	JPI 150					6.1
	ASME 300	186	93			
40 (1-1/2")	JIS 10K(16K)	171	85.5	37.6	261	7.8
	JIS 20K	175	87.5			8.2
	JIS 30K	185	92.5			10.3
	ASME 150	201	100.5			7.8
	JPI 150					7.8
	ASME 300	213	106.5			10.2
50 (2")	JIS 10K	173	86.5	48.5	265	8.8
	JIS 20K(16K)	181	90.5			9.0
	JIS 30K	191	95.5			11.1
	ASME 150	204	102			9.7
	JPI 150					9.8
	ASME 300	217	108.5			11.6
80 (3")	JIS 10K	219	99.5	72.4	281	15.0
	JIS 20K(16K)	233	106.5			17.7
	JIS 30K	243	111.5			21.7
	ASME 150	237	108.5			17.8
	JPI 150					
	ASME 300	255	117.5			22.3
100 (4")	JIS 10K	250	110.5	95.2	301	21.0
	JIS 20K(16K)	264	117.5			25.0
	JIS 30K	274	122.5			31.6
	ASME 150	274	122.5			26.3
	JPI 150					26.4
	ASME 300	294	132.5			35.8
150 (6")	JIS 10K	322	132.5	140.3	331	36.0
	JIS 20K(16K)	342	142.5			43.5
	JIS 30K	352	147.5			52.6
	ASME 150	340	141.5			66.2
	JPI 150					46.3
	ASME 300	359	151			46.4
200 (8")	---	350	---	199.9	346	65.8
250 (10")	---	450	---	248.8	368	38.6
300 (12")	---	550	---	297.9	390	68.6
						88.6

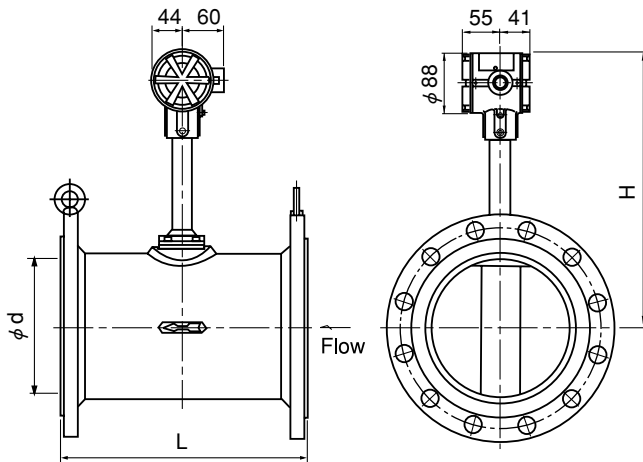
※ : Irrespective of flange rating, a flange thickness having a higher rating is selected as long as the flange O.D. and bolt holes remain the same.

■ Replaceable Sensor Type

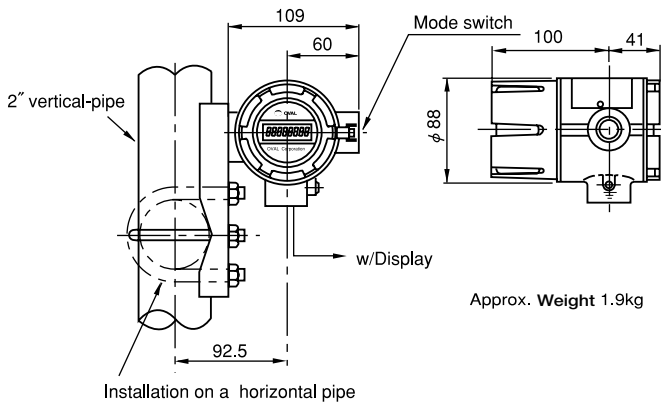
● Nominal sizes 15 to 150mm



● Nominal sizes 200 to 300mm



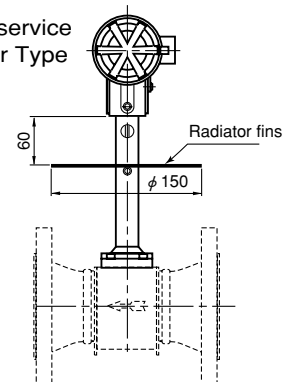
SEPARATE TYPE CONVERTER



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			3.9
	ASME 150	158	79			
	JPI 150					4.5
	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			5.5
	ASME 150	174	87			
	JPI 150					6.7
	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")	—	550	—	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

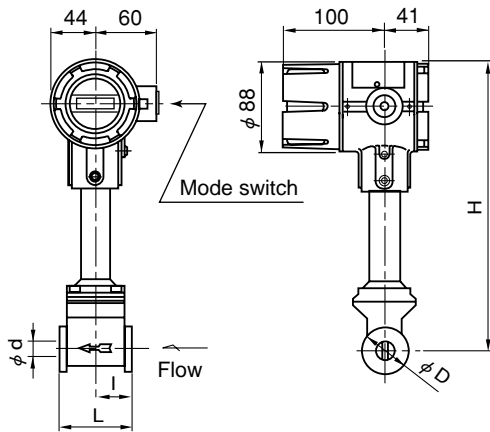


■ EX DELTA • DIA OUTLINE DIMENSIONS (Unit in mm)

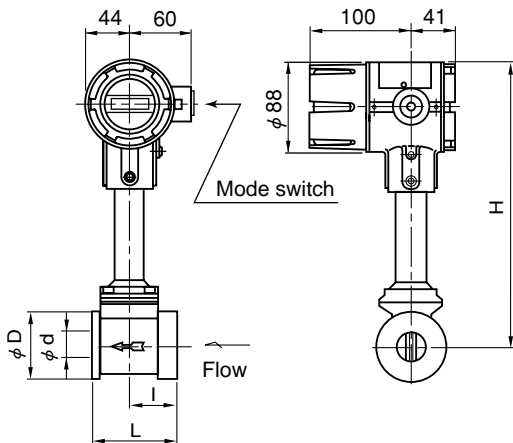
[INTEGRAL PREAMP TYPE]

Wafer Type

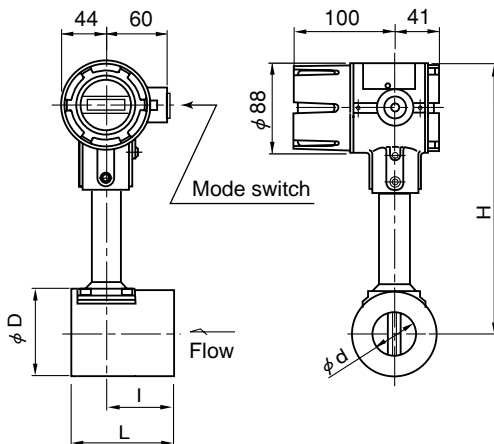
- Nominal size 15mm



- Nominal size 25mm



- Nominal sizes 40 to 80mm

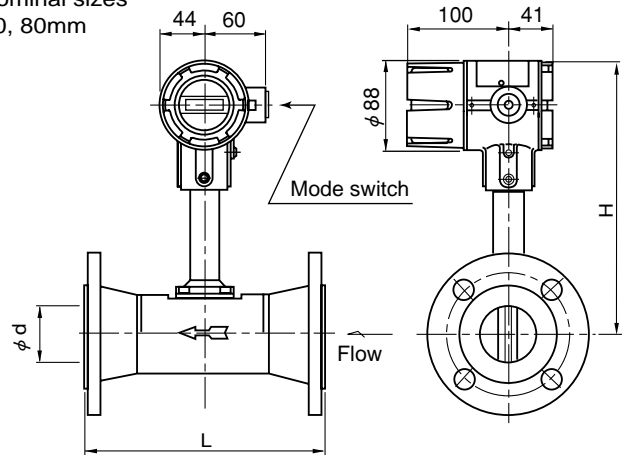


Nominal size (mm)	L	I	φd (Meter i.D.)	φD	H	Approx. Weight (kg)	
						No Display	w/Display
15 (1/2")	65	32.5	14.5	40	276	2.6	2.9
25 (1")	80	47.5	26.6	67	276	3.2	3.5
40 (1 1/2")	100	67	41.2	82	261	3.9	4.2
50 (2")	125	85	52.7	92	265	4.0	4.3
80 (3")	125	85	78.1	127	281	6.8	7.1

Flanged Type

- Fixed Sensor Type

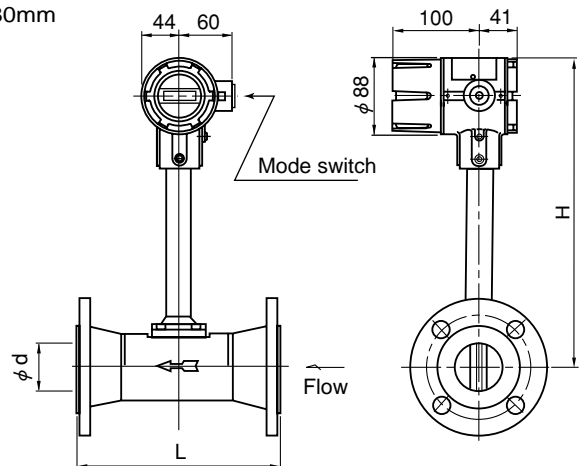
- Nominal sizes 50, 80mm



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

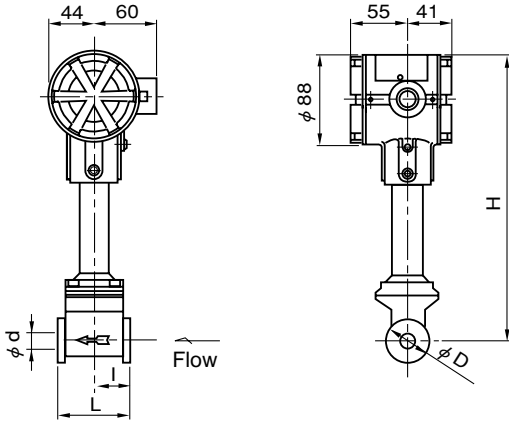
High-temperature service, replaceable model is provided with radiator fins on the adapter. (See P11)

※ : 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.

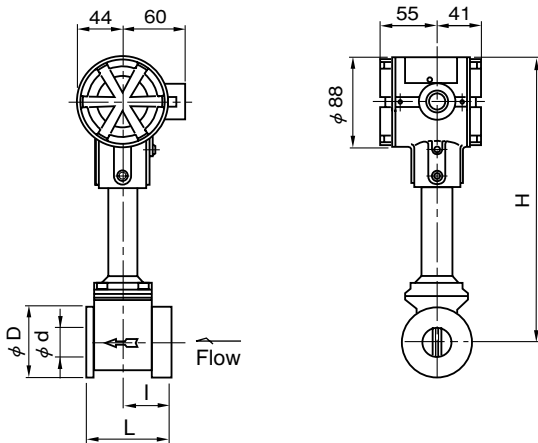
[SEPARATE-MOUNT PREAMP TYPE]

Wafer Type

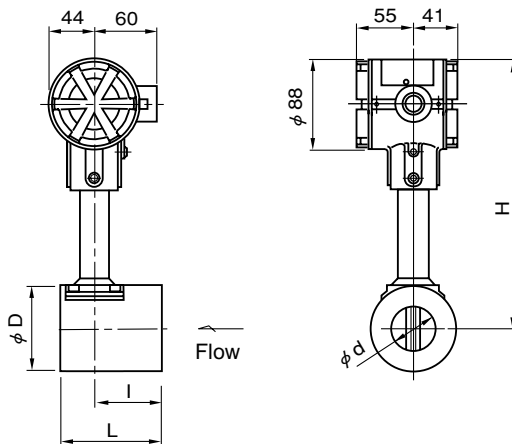
- Nominal size 15mm



- Nominal size 25mm



- Nominal sizes 40 to 80mm

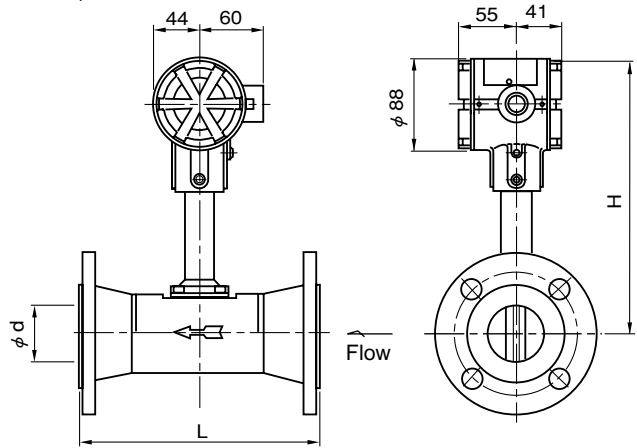


Nominal size (mm)	L	I	φd (Meter i.D.)	φD	H	Approx. Weight (kg)
15 (1/2")	65	32.5	14.5	40	276	2.4
25 (1")	80	47.5	26.6	67	276	3.0
40 (1 1/2")	100	67	41.2	82	261	3.7
50 (2")	125	85	52.7	92	265	3.8
80 (3")	125	85	78.1	127	281	6.6

Flanged Type

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

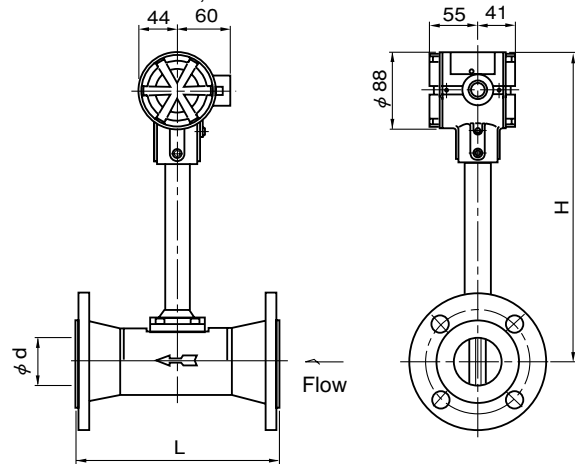
- Fixed Sensor Type
- Nominal sizes 50, 80mm



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

- Replaceable Sensor Type

- Nominal sizes 50, 80mm

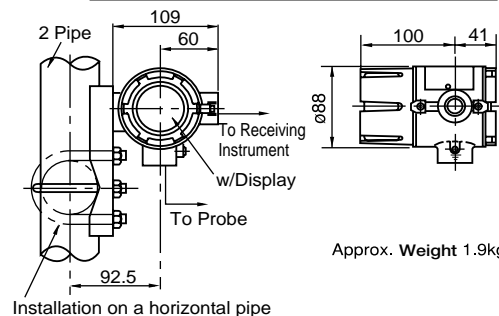


Nominal size (mm)	L	φd (Meter i.D.)	H
50 (2")	229	52.7	346
80 (3")	254	78.1	362

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



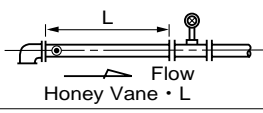
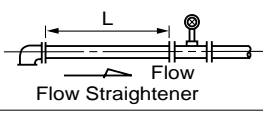
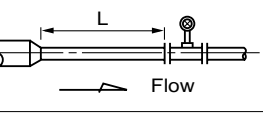
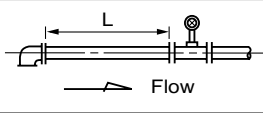
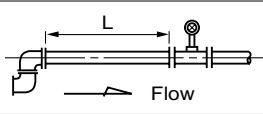
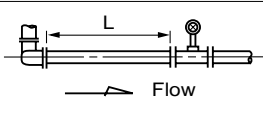
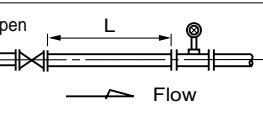
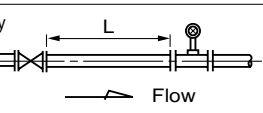
■ INSTALLATION CONDITIONS

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.

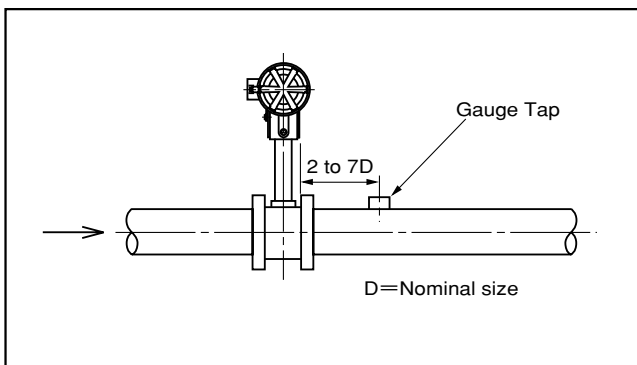
All account of this, proper flow straightening measures have to be applied for piping installation of EX DELTA. The standard piping instructions are shown in the following table.

(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 Honey Vane • L	8D	Refer to Point 4 on P17. Applicable to meter 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.
		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.

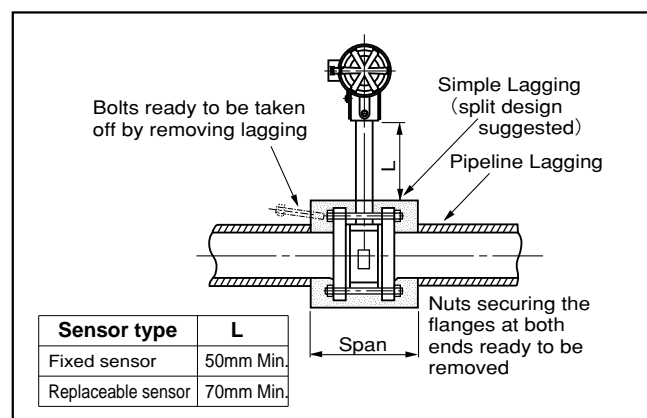
Note 1: Sch.40 pipe is used for the flow straightener. Use Sch. 40 pipe for standard piping.

- 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.

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

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 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 composing Honey vane · L is useful for reduction of total length of the upstream straight pipe.

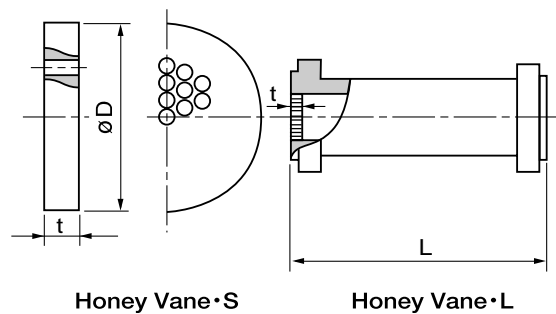
EX DELTA · SS providing a built-in Honey vane is available with accuracy $\pm 2\%$ RD for liquid service. Consult the factory for accuracy requirement.

●Honey Vane

Outline Dimensions

Nom.size (mm)	$\phi D \times 1$ (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

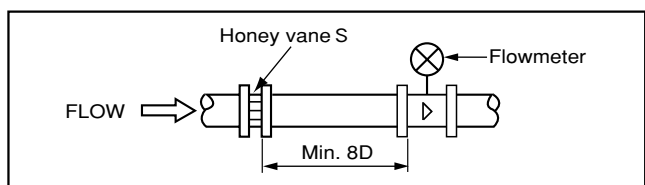
*1. JIS10K



©Flange face to face span of EX DELTA · SS is the same as that of standard EX DELTA. (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.



■ EX DELTA PRODUCT CODE EXPLANATION

Item	Product Code															Description			
	①	②	③	④	⑤	⑥	⑦	—	⑧	⑨	⑩	⑪	—	⑫	⑬		⑭	⑮	
Model	V	X																EX DELTA	
Body Style	W																	Wafer type (Nom. sizes: 10 to 150mm)	Fixed sensor type
	F																	Flanged type (Nom. sizes: 15 to 300mm) RF is Std.	
	R																		Flanged type (Nom. sizes: 15 to 300mm) RF is Std.
Application	1																	Standard (Delta shaped vortex shedding bluff body)	
Nominal Bore Size	0	1	0	—														10mm (Liquids only)	
	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	
Major Parts Material																		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)
Flange Rating																		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
																		9	Others
Sensor configuration																		1	Nominal size > 40mm (Integral sensor type)
																		2	Nominal size = 10, 15, 25mm (Separate sensor type)
Fluids to be Metered																		G	Gas, Steam (<300°C)
																		L	Liquid (<300°C)
																		S	High temp. application for gas, steam (over 300°C and <460°C)
																		H	High temp. application for liquid (over 300°C and <460°C)
Converter configuration																		1	Integral type
																		2	Separate type
Explosionproof Configuration																		0	Non-explosionproof
																		3	Intrinsic safety (TIIS)
Display																		1	W/Totalizer & Digital indicator (※3)
Output signal																		0	Non output (battery powered type)

※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—1996.

※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 • DIA PRODUCT CODE EXPLANATION

Item	Product Code															Description				
	①	②	③	④	⑤	⑥	⑦	—	⑧	⑨	⑩	⑪	—	⑫	⑬			⑭	⑮	
Model	V	X																EX DELTA		
Body style			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.	Replaceable sensor type
Application			2															Diamond shaped bluff body		
Nominal size			0	1	5	—												15mm		
			0	2	5	—												25mm		
			0	4	0	—												40mm		
			0	5	0	—													50mm	
			0	8	0	—													80mm	
Material							N											SCS14A (Nominal sizes 15, 25 wafer type)		
							C											SUS316		
							Z											Special (other than above)		
Flange rating							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	
							9												Other	
Sensor construction							2											Separate sensor type		
Applicable fluid							L	—										Liquid (300°C or lower)		
							H	—										High temp. application for liquid (Over 300°C and <460°C)(Flanged replaceable sensor type)		
Converter configuration							1											Integral type		
							2											Separate type		
Explosionproof configuration							0											Non-explosionproof		
							3											Intrinsic safety (TIIS)		
Display																		1	W/Totalizer & Digital indicator (※2)	
Output signal																		0	Non output (battery powered type)	

※1 : Flange serration for ASME standard : ASME 1316.5-1996.

※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	O	O	O	O	O
Flanged type	△	△	△	O	O

O : Standard △ : Option

■ When making inquiries, please specify the following:

Fill in the blanks or tick in .

Item	Description
1. Fluid to be Metered	
2. Flow Range	Max. _____ Normal _____ Min. _____ <input type="checkbox"/> m ³ /h[normal] <input type="checkbox"/> m ³ /h[actual] <input type="checkbox"/> kg/h
3. Temp. Range	Max. _____ Normal _____ Min _____ °C
4. Press. Range	Max. _____ Normal _____ Min. _____ <input type="checkbox"/> MPa[gauge]
5. Density or Sp. Gr.	Density _____ <input type="checkbox"/> kg/m ³ [normal], <input type="checkbox"/> kg/m ³ [actual] Sp. Gr. _____
6. Viscosity	_____ <input type="checkbox"/> mPa·s, <input type="checkbox"/> mm ² /s at _____ °C
7. Connections	Nom. Size _____ <input type="checkbox"/> mm, <input type="checkbox"/> ", Flange rating <input type="checkbox"/> JIS _____ KRF <input type="checkbox"/> ASME/JRL _____ RF
8. Flow Straightening Pipe	<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.)
9. Compensation	<input type="checkbox"/> Temp./Press. comp. <input type="checkbox"/> Pressure comp. <input type="checkbox"/> Temp. comp.
10. Compensation Range	Temp. _____ to _____ °C, Pressure _____ to _____ <input type="checkbox"/> MPa [gauge]
11. Compensation Ref.	Ref. temp. _____ °C Press. ref. _____ <input type="checkbox"/> MPa [gauge]
12. Compensation Coeff. (gas measurement)	Z (service conditions) = _____ Zo (standard conditions) = _____
13. Accuracy Test	<input type="checkbox"/> Req'd <input type="checkbox"/> Not req'd
14. Converter	Type : <input type="checkbox"/> Integral configuration <input type="checkbox"/> Separate configuration Explosionproof configuration : <input type="checkbox"/> Non-explosionproof <input type="checkbox"/> Intrinsic safety
15. Miscellaneous	

The specification as of Dec., 2010 is stated in this GS Sheet. Specifications and design are subject to change without notice.



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