OVAL

High Performance Inexpensive Vortex Flowmeter

DELTA FLOWPET-DX

(With / without pressure compensator)

GENERAL SPECIFICATION

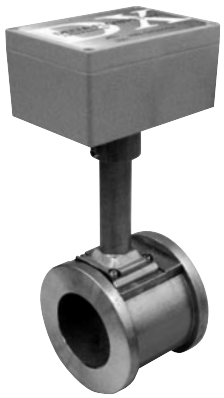
GS.No.GBD625E-5

■ GENERAL

DELTA FLOWPET-DX (pressure compensated) is a piezoelectric DELTA flowmeter combined with a built-in pressure sensor.
Designed for saturated steam, it measures mass flows corrected for pressure. Water, gas, and steam are also acceptable for volume flow measurement.

■ FEATURES

1. Incorporation of a pressure sensor and pressure correction circuitry reduces instrumentation cost and simplifies the system.
2. Both analog and factored pulse outputs are available at the same time.
3. Easy maintenance and maintenance cost reduction benefits result in increased safety.



Without pressure compensation function

With pressure compensation function

■ GENERAL SPECIFICATIONS

● Meter Body

Item		Description				
Applicable fluid		Saturated Steam	Gas	Steam	Gas (Other than steam)	Lquids
Compensation functions		With pressure compensation (※6)		Without pressure compensated		
		Mass flowrate	Normalized flowrate			
Nominal size		15, 25, 40, 50, 80, 100, 150mm				
Flow range		See flow range table (P2, 3)				
Connection		Wafer type				
Flange rating (※1)		JIS 10, 16, 20, 30K ASME/JPI 150, 300				
St'd. connecting pipe		Nominal wall thickness Sch. 40				
Operating temp. range		Max. +200˚C		−30 to +200˚C		
Max. operating pressure		1.0MPa		1.45MPa (※2)	5.0MPa (※3)	5.0MPa (※3)
Accuracy (※4)		± 2% of RD (※5)		± 1% of RD	± 1% of RD	± 1% of RD
Material	**Body**	SCS14A				
	Sensor	Nom. size 15 or 25mm: SUS316 Nom. size 40 to 150mm: XM19 (Super stainless steel)				
	Adapter	SCS13A				
	Coupling	SUS316		———		
	Valve	SUS304		———		
	Default setting	SUS316		———		
	Pressure sensor	Hastelloy C22		———		
Installation		No restrictions to cause loss of accuracy on physical orientation (Maintainability and waterproof work for cable entry should be taken into consideration) (※7)				

※1: Pressure compensator equipped models basically apply to JIS 10K, ASME 150, and JPI 150 only.
※2: With superheated steam, ensure that the temperature does not exceed 200˚C.
※3: Depends on the type of flange connection.
※4: With analog output, additional ±0.5% of full scale needs to be added.
※5: Accuracy at pressures above 0.25MPa. In a 0.06 to 0.25MPa range, ±3% of reading.
※6: With the pressure compensator equipped model, the temperature of normalized flowrate is a fixed value.
※7: Irrespective of the flow direction specified, the construction remains unchanged (due to the absence of display).

■ CONVERTER SPECIFICATIONS

Item	Description	
Mounting	Integrally mounted on the meter	
Power supply	24VDC ±10% Max. 50mA	
Ambient temperature range	−20 to +60°C	
Remote output	Analog output	"Flow output" or "pressure output (available only with pressure sensor equipped model)" 4 to 20mADC at 0 to FS Max. load resistance 500Ω
	Pulse output	Open collectot output, Allowable current: 20mA, Max. impressed voltage: 30V Pulse width: 1 to 240ms Any desired setting (st'd: 1ms)
Cable	4-conductor shielded cable (cable O.D. : 9 to 11mm)	
Transmission length	Max.1km (conductor area 1.25mm^2)	
Configuration	IP65 or equiv., Non-explosionproof configuration	
Material	Case: Alumimum die-casting Adapter: Stainless steel	
Backup	Parameters and variables are retained in an internal memory.	
Finish	Light gray	

■ FLOW RANGES

• Saturated Steam Service

Unit: kg/h

Nominal size / Pressure (MPa)	15mm	25mm	40mm	50mm	80mm	100mm	150mm
0.1	10.6 to 33.7	19.4 to 113	30.0 to 226	41.0 to 337	90.1 to 841	155 to 1450	337 to 3150
0.2	11.0 to 49.2	20.2 to 165	33.0 to 329	53.9 to 550	119 to 1220	204 to 2120	443 to 4600
0.3	11.4 to 64.4	23.5 to 216	39.4 to 431	64.5 to 720	142 to 1600	243 to 2770	530 to 6030
0.4	11.7 to 79.4	27.0 to 267	45.3 to 532	74.2 to 888	163 to 1980	280 to 3420	609 to 7430
0.5	12.4 to 94.3	30.3 to 317	50.8 to 631	83.2 to 1050	183 to 2350	314 to 4060	683 to 8820
0.6	13.6 to 109	33.4 to 367	56.0 to 730	91.6 to 1210	202 to 2720	346 to 4700	752 to 10200
0.7	14.8 to 123	36.3 to 416	60.9 to 829	99.7 to 1380	219 to 3080	376 to 5330	818 to 11500
0.8	16.0 to 138	39.1 to 466	65.6 to 927	108 to 1540	236 to 3450	405 to 5960	882 to 12900
0.9	17.1 to 153	41.8 to 515	70.2 to 1020	115 to 1710	252 to 3810	433 to 6590	942 to 14300
1.0	18.1 to 167	44.4 to 564	74.6 to 1120	122 to 1870	270 to 4180	460 to 7220	1010 to 15600

• Measurable flowrate (minimum detectable flowrate)

Saturated Steam Service

Unit: kg/h

Nominal size / Pressure (MPaG)	15mm	25mm	40mm	50mm	80mm	100mm	150mm
0.1	4.3	11	18	29	64	110	240
0.2	5.6	14	24	38	83	150	310
0.3	6.7	17	28	46	100	180	380
0.4	7.7	19	32	52	120	200	430
0.5	8.7	22	36	59	130	220	480
0.6	9.6	24	40	65	150	250	530
0.7	11	26	43	70	160	270	580
0.8	12	28	46	76	170	290	620
0.9	12	30	50	81	180	310	660
1.0	13	32	53	86	190	330	71

• Liquid Service

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

Table A (based on specific gravity)

Unit: m^3/h

Sp. Gr / Nominal size mm	Minimum Flowrate								Maximum Flowrate
	0.5	**0.6**	**0.7**	**0.8**	**0.9**	**1.0**	**1.1**	**1.2**	
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	13	13	13	13	13	13	13	33	645

Table B (based on viscosity) Unit: m^3/h

Viscosity mm^2/s / Nominal size mm	Minimum Flowrate									
	1	2	3	5	10	15	20	25	30	40
15	0.8	1.6	2.4	3.9		Unmeasurable				
25	1.6	3.1	4.6	7.6	16					
40	2.4	4.7	7.0	12	24	35				
50	3.0	6.0	9.0	15	30	45	60			
80		8.9	14	23	45	67	89	110	130	
100		12	18	29	58	87	120	150	180	230
150				43	86	130	170	220	260	340

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

● Measurable flowrate (detectable min. flowrate)

Liquid (Visocsity 1mPa·s) Unit: m^3/h

Sp. Gr. / Nominal size mm	Measurable flowrate							
	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2
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	3.1	3.0	2.9	2.7
100	7.2	6.6	6.1	5.7	5.4	5.1	4.9	4.7
150	16	15	14	13	13	11	11	11

● 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] condition and determine the flow range and the nominal diameter based on this table.

	Nom. size mm / 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	—	—	12	7.2	4.0	3.2	2.6	2.2	1.8	1.5	29.7
	25	68	37	22	13	10	8	7	6	5	4	100
	40	110	57	33	20	16	13	11	9	8	6	199
	50	134	73	43	31	26	22	18	15	12	10	332
	80	200	108	80	67	56	47	38	32	26	22	741
	100	260	174	140	115	95	80	66	55	45	37	1280
	150	520	380	300	260	210	180	150	120	110	110	2780
	Gas (Viscosity 0.017mPs · s) / Nom. size mm / Dens. kg/m^3	**Measurable flowrate (minimum detectable flowrate) (m^3/h)**										
		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	

	Type of Gas	Dens. kg/Nm^3	Gas pressure (MPa (gauge)) at 20°C										Gas viscosity
Table "D"	Argon	1.785	—	—	—	0.02	0.12	0.26	0.55	1.05	2	3.6	0.0209 (mPa·s)
	Air	1.293	—	—	—	0.07	0.20	0.4	0.85	1.5	2.7	—	0.017
	Oxygen	1.429	—	—	—	0.05	0.17	0.35	0.75	1.35	2.5	4.4	0.0192
	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

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:

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

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

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

From Table C, the minimum flow rate at a density of 6 and nominal size 80mm is $47m^3/h$; at a density of 11 is 38m3/h. The minimum flow rate at a density of 7.15 therefore can be found in proportion to as follows:

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

EXAMPLE 2

Find the minimum flowrate and applicable nominal size where:Fluid:Carbon dioxide, Temperature: 5 to 30°C, Pressure 0.8 to 1.5MPa, Max. flow rate:$1800m^3/h$(normal)

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

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

It follows that the nominal size is 40mm and the minimum flow rate is based on the low end in temperature and the high end in pressure.

From Tables D and C, the minimum flow rate at 40mm size and 0.95MPa pressure is 9m3/h, at 1.7MPa, it is 8m3/h. We then obtain the minimum flow rate in proportional way as:

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

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

■ PULSE UNIT

Saturated Steam
Superheated Steam

Nominal size mm (inch)	Default settings (kg/P)
15 (1/2)	0.001
25 (1)	
40 (11/2)	
50 (2)	0.01
80 (3)	
100 (4)	
150 (6)	

Gas（without pressure compensation）

Nominal size mm (inch)	Default settings (m^3/P)
15 (1/2)	0.01
25 (1)	
40 (11/2)	
50 (2)	
80 (3)	
100 (4)	
150 (6)	

Gas（Normalized flowrate）

Nominal size mm (inch)	Default settings (m^3 [nomal] /P)
15 (1/2)	0.1
25 (1)	
40 (11/2)	
50 (2)	
80 (3)	
100 (4)	
150 (6)	

Liquid

Nominal size mm (inch)	Default settings (m^3/P)
15 (1/2)	0.001
25 (1)	
40 (11/2)	
50 (2)	
80 (3)	
100 (4)	
150 (6)	

In mass units or normalized units, select a pulse unit that meets the requirements a and b below.

How to determine the factored pulse

a. Minimum pulse
The frequency at maximum flowrate must be held below 500Hz.

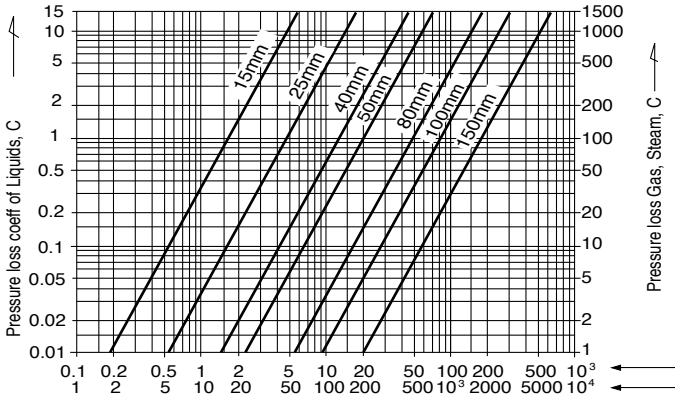
[Example]
80mm nominal size at 0.5MPa of saturated steam
Max. flowrate: 2350kg/h
Calculation of 2350kg/h ÷ 3600 ÷ 0.01kg/P = 65.3Hz
verifying that the setting is valid.

b. Pulse setting range
For the units of flow measurement, any setting is acceptable in a range from 0.001 to 100.000.

[Example]
In the case the flowmeter reads in kg/h.
Acceptable pulse settings:
0.001kg/P, 0.01kg/P, 0.1kg/P, 1kg/P, 10kg/P, 100kg/

■ PRESSURE LOSS

● Nominal size 10 to 150mm

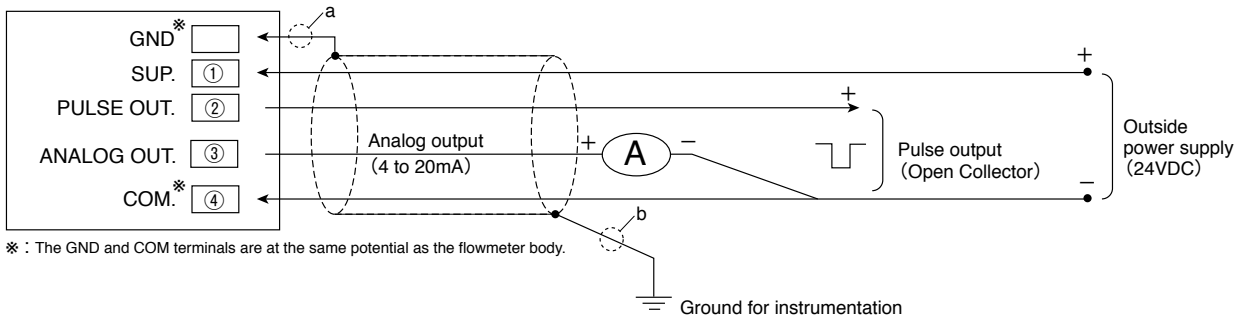


$$\Delta P = \frac{C \times \rho}{100}$$

ΔP: Pressure loss (kPa)
ρ : Density (kg/m^3)

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

■ WIRING DIAGRAM



※：The GND and COM terminals are at the same potential as the flowmeter body.

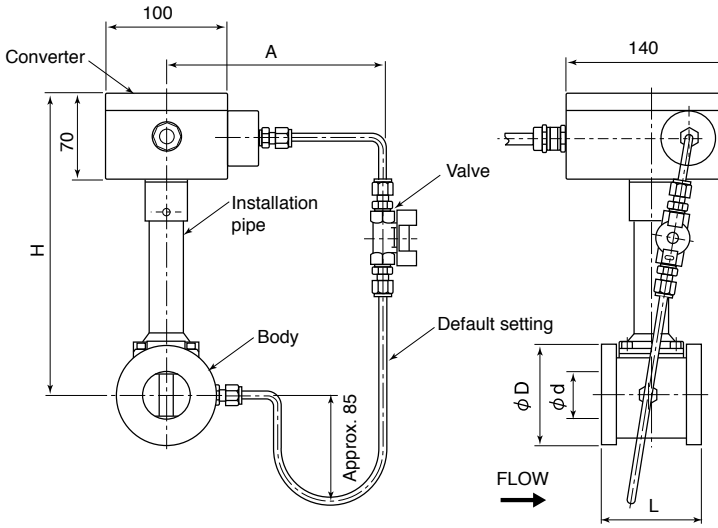
[Method for processing the shielded wire (Recommended)]
Using the following processing, you can expect improvement in nois resistance (shield effect) by shielded wire.

Status of flowmeter body grounding	Part a	Part b
When flowmeter body (piping) is grounded	Connected	Open
	or	
	Open	Connected
When flowmeter body (piping) is not grounded	Connected	Connected

(Note) The above is a method of processing shielded wire under ideal condition.
Note that the above treatment may not always be the best method depending on the site environment (grounding point itself is the source of noise or the like).

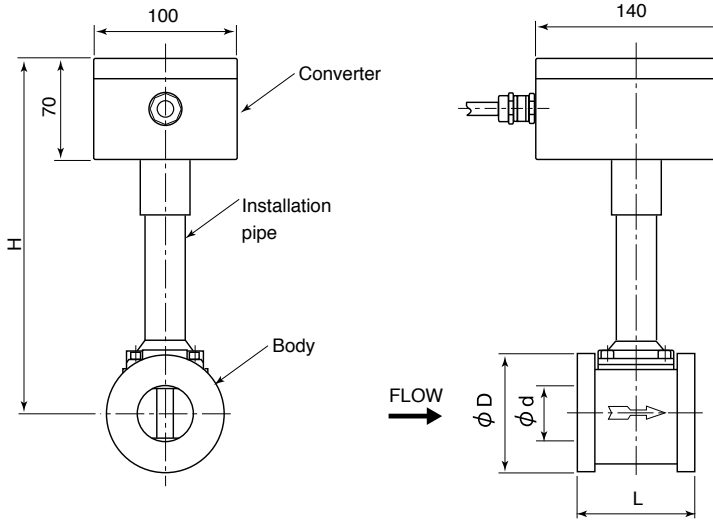
■ OUTLINE DIMENSIONS (Unit in mm)

● With pressure compensation function



Nominal size (mm)	Dimensions (mm)					Approx. Weight (kg)
	L	d	D	H	A	
15	65	14.5	40	262	172	3.5
25	65	26.6	67	262	185	4.2
40	80	37.6	81	247	192	4.8
50	80	48.5	91	251	198	5.1
80	100	72.4	126	267	241	7.7
100	125	95.2	156.2	287	250	11.4
150	165	140.3	214.9	317	275	21.3

● Without pressure compensation function



Nominal size (mm)	Dimensions (mm)				Approx. Weight (kg)
	L	d	D	H	
15	65	14.5	40	262	2.9
25	65	26.6	67	262	3.6
40	80	37.6	81	247	4.2
50	80	48.5	91	251	4.5
80	100	72.4	126	267	7.1
100	125	95.2	156.2	287	10.8
150	165	140.3	214.9	317	20.7

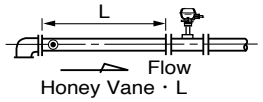
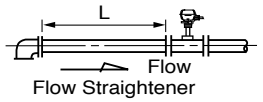
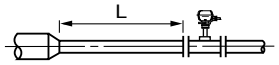
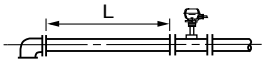
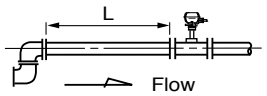
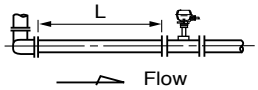
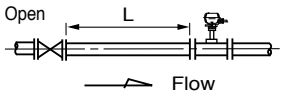
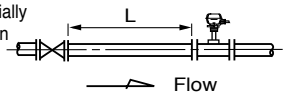
■ INSTALLATION CONDITIONS

1. TYPICAL PIPING INSTRUCTIONS

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

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

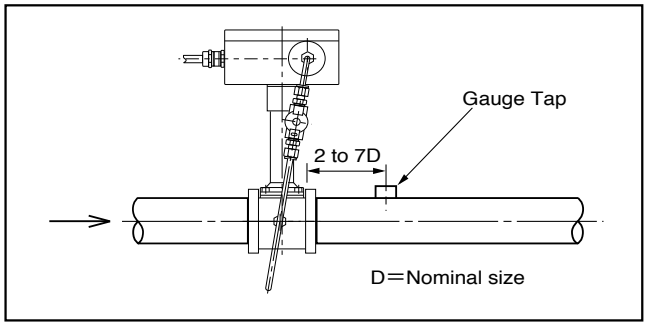
Use an OVAL flow straightener or install straight pipes conforming to established standards (ISO-5167).

No.	Piping Arrangement		Straightener Pipe Length (L)	Remark	
1	OVAL's Flow-Straightener		8D	Refer to Point, 4	Applicable to Nominal size, ＞25mm
			12D	Refer to GS/GCF001E	
2	Reducer		15D Min.	A concentric reducer is installed at the upstream of a meter.	
3	Elbow		23D Min.	An elbow is installed at the upstream of a meter.	
			25D Min.	Two elbows are installed at the upstream of a meter.	
			40D Min.	Two elbows are vertically installed at the upstream of a meter.	
4	Fully open gate valve		15D Min.	A full-open gate valve is installed at the upstream of a meter.	
5	Partially open gate valve		50D Min.	A partially open gate valve, sharp orifice or something that significantly disturbs the flow pattern is upsteam of a meter.	

※: Sch. 40 pipe is standard in the application above. Use Sch. 40 pipe for standard piping

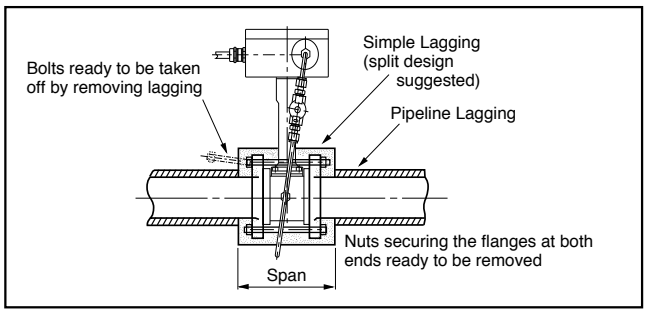
※: A short pipe section, 5D or longer shall be provided down steam of the meter.

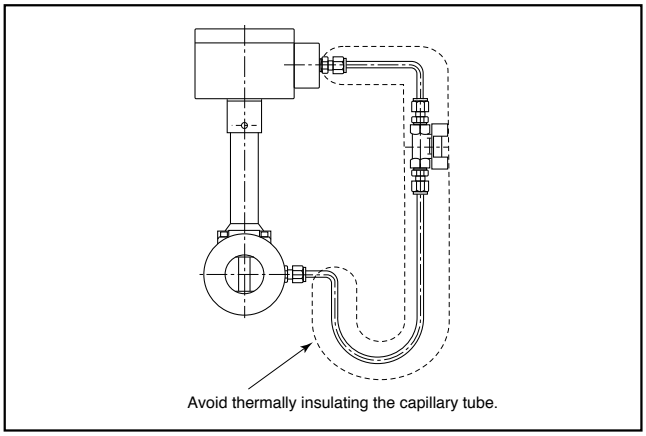
※: For pressure detection, provide the probe downstream of the flowmeter (see figure below). To avoid disturbances in the flow, temperature detection should be made downstream of the flowmeter and, at the same time, upstream of the control valve.



2. LAGGING WORK

When measuring steam, be sure to keep the flowmeter heated. 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.





3. ITEMS TO BE NOTED IN PROCESS CONDITION

(1) Prevention of Cavitation:

For liquid flow application, line pressure higher than a value calculated from the following equation shall be applied in order to prevent the flow from cavitation.

$P \geqq 2.60\Delta P + 1.25Po$ (MPa [absolute])

where, ΔP: Pressure loss (MPa)

Po: Vapor pressure of a liquid (MPa [absolute])

(2) 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.

$$N < \frac{22\,\rho\,V^2}{100}\ (\text{kPa})$$

where, N: Fluctuation pressure (kPa)

ρ : Density (kg/m^3)

V: Min. velocity (m/s)

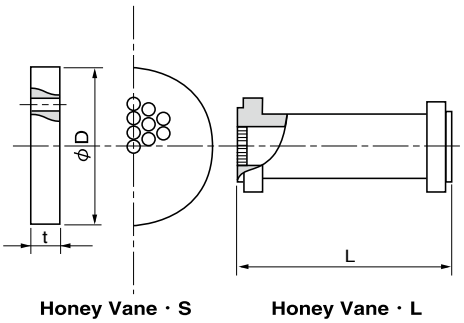
4. SPACE SAVING (Reducing of Meter run)

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.

● Honey Vane
Outline Dimensions

Nom.size (mm)	ϕD (mm) (※1)	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

※1: JIS10K

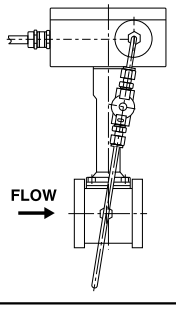


■ TYPICAL ORIENTATION

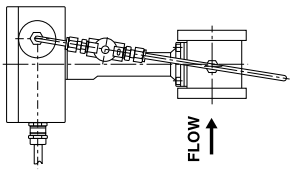
● Model with pressure compensator (Saturated Steam)

Install the meter in a condition that the capillary tube for pressure measurement holds drain water.

Horizontal Installation (Transmitter is at top.)



Vertical Installation (Bottom → Top)



● Model with pressure compensator (Gas) and without pressure compensator

No particular restrictions. (Take into consideration such factors as ease of maintenance and waterproofing at cable entry, however.)

■ EX DELTA PRODUCT CODE EXPLANATION

Item	Code No. ① ②	③	④	⑤ ⑥ ⑦	—	⑧	⑨	⑩	⑪	—	⑫	⑬	⑭	⑮	⑯	Description
Model	**V P**															DELTA FLOWPET-DX
Body style		**W**														Wafer type
Application			**1**													Standard
Nominal size				**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
Material						**N**										SCS14A
Flange rating							**1**									JIS 10K
							2									JIS 16K
							3									JIS 20K
							4									JIS 30K
							5									ASME 150
							6									ASME 300
							7									JPI 150
							8									JPI 300
Pressure compensation								**0**								Without pressure compensation function
								1								With pressure compensation function (※1)
Applicable fluid									**S**	—						Saturated Steam
									G	—						Gas・Superheated Steam
									L	—						Liquid
Converter configuration											**1**					Integral type
Explosionproof configuration												**0**				None (non-explosionproof)
Display													**0**			None
Output Signal														**1**		Scaled pulse + Analog (flow rate)
														2		Scaled pulse
														3		Analog (flow rate)
														4		Scaled pulse + Analog (pressure)
Version code															**B**	

※1: The meters with pressure compensation function are dedicated for saturated steam and gas.