TECHNICAL GUIDANCE

MOST COST EFFECTIVE FLOW MEASUREMENT

O-1000 Series

ORIFLOMETER®

■ GENERAL

O-1000 series ORIFLO METER is a flow meter consisting of an orifice plate and a metal tube variable area flow meter. Since the flow rate is measured with a "small sized" flow meter set to a bypass pipes, the flow measurement even for "large sized" lines can be economically conducted. In addition to the local indication type, different types of outputs such as pneumatic and electric ones alarm contact as well as integration function are all available to meet various requirements.

■ STANDARD SPECIFICATIONS

Detection type : Bypassed orifice type
Measuring fluids : Liquids (viscosity: up to 3mPa•s) and Gases (Not suitable for slurry and steam)
Available tapping and sizes :
1) 1D • 1/2D taps (□□-O-1□□□-□P) 100mm to 500mm
2) Corner taps (with Orifice ring) (□□-O-1□□□-□C) 50mm to 500mm
3) Flange taps (□□-O-1□□□-□F) 50mm to 500mm
4) Vena contracta taps (□□-O-1□□□-□V) 200mm to 500mm

Note:550mm or more of can be supplied on request.
Process connection : JIS5K/10K/20K, ANSI/JPI CLASS 150/300 and Other
Fluid temperature : -20 to +200°C
Fluid pressure :
"Standard" ,
In case of liquid temperature of 120°C or less : 1.37MPa
In case of liquid temperature of more than 120°C to 200°C : 1.18MPa
Max. diff. press. : For liquids, 40kPa or 60kPa
For gases, 40kPa or 60kPa
Indication accuracy : ± 3%(F.S.)
Rangeability : 10 : 2.5 for 40kPa
10 : 2 for 60kPa

■ TYPES AND FUNCITON

1) Local Indication only
O-140□-□□ type
2) Local Indication+Pneumatic output
O-13□-□□ type
Air supply : 0.14 ± 0.01MPa
Outputs : Standard 20~100kPa (with output gauge)
Air consumption : 14L/min(nor)
Connection : Standard Rc 1/4
On request NPT 1/4
Output accuracy : ±1.0%F.S.
Construction : Weather proof (Equ. to IP54)
Ambient Temp : –20~80°C
Provide heat insulation if required.
Accessory : Air set (On request)
3) Local indication+Electric output
□□-O-152□-□□ type
Power supply voltage : Weather proof and flame proof 12~30V DC
Output : 4~20mA DC

Max load : Weather proof and flame proof 600Ω (24V DC)
Cable entry : Weather proof : 2xG1/2 or 2xNPT1/2
Flame proof : 2xG1/2 or 2xNPT1/2
Option : Packing type cable gland
Specified cable gland (Type SXC-16B Shimada Electric Co.) to be used for flame proof construction work.
Output accuracy : ±1.0%F.S. (Against flow calibration)
Construction : Weather proof ; Equ. to IP54
Flame proof ; Exd II BT4
On request ; Exd II CT4
Ambient Temp : Weather proof ; –30 ~ +70°C
Flame proof ExdIIBT4 ; –20 ~ +55°C
ExdIICT4 ; –20 ~ +55°C
4) Local indication+integration+Scaled pulse output
□□-O-169□-□□ type
Integration : 6 digit with reset
Count rate : 50~2000c/h
Pulse output : Open collector output
Pulse width 100ms, Rating 35V DC, 50mA
(Signal circuit and power supply circuit are isolated.)
Integration accuracy : ±2.0%F.S. (Against flow calibration)
Power supply : 100V AC, 50/60Hz as standard. 110V AC, 50/60Hz is also available on your request except flame proof version.
A separate transformer is required for other voltage.
Power consumption : Max. 5VA
Cable entry :
Standard : G1/2 with female screw
Cable gland with flameproof gasket available on request
On request : NPT1/2
Enclosure : Weather proof (Equ. to IP54)
Flame proof (JISd2G4)
Ambient temp : –20~80°C for Weather proof
–10~60°C for Flame proof
Provide heat insulation if required

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5) Local Indication+Alarm contact
□□-O-174□-□□ type

Alarm point : 1 point high alarm or
1 point low alarm or
2 points high and low

Switch : Micro switch SPDT

Rating :

Standard : 125/250V AC, 5A

On request : 30VDC, 0.1A

Setting accuracy : ±1.5% F.S. (against flow calibration)
Note: The indication of flow rates except for the alarm setting value may be less accurate just after turning on the switch.

Reset span : Weather proof and Intrinsically safe within 20% (F.S.) (Against flow calibration)
Flame proof within 30% (F.S.)

Cable entry :

Standard : G1/2 with female screw
Conduit connection is standard.
Packing type cable gland is also available.

On request : NPT 1/2

Enclosure : Weather proof (Equ. to IP54)
Flame proof (JISd2G4)
Intrinsically safe (ExiaIICT6) *
* Supplied with safety barrier

Ambient temp : –25~80°C for Weather proof
–10~60°C for Flame proof
Intrinsically safe
Provide heat insulation if required

Material : Refer to ■ Material and Scope of supply.

■ MODEL CODE

											DESCRIPTION
			-	O-1				-			
Enclosure											Water tight
	E	P									Flameproof *1
	I	S									Intrinsically safe *2
Function					4	0					Local Indication only
					3	1					Local Indication + Pneumatic output
					5	2					Local Indication + Electric output
					6	9					Local Indication + Local totalizing + Scale pulse output
					7	4					Local Indication + Alarm contact output
Flow directions of main pipes							1	-			Bottom to Top
							6	-			Left to right
							7	-			Right to Left
							8	-			Top to bottom
Position of indicator									A		Above main pipes
									B		Below main pipes
Type of tapping *3										P	D · D/2 taps
										C	Corner taps (with orifice ring) *4
										F	Flange taps
										V	Vena contracta taps

*1: Flameproof types:
The followings are available.
EP-O-152□-□□
EP-O-169□-□□
EP-O-174□-□□

*2: Intrinsically safe explosion proof type:
The following is available.
IS-O-174□-□□

*3: Refer to STANDARD SPECIFICATIONS for the available sizes corresponding each tap.

*4: The orifice ring is delivered as an standard accessory unless otherwise specified.

■ CAPACITY OF EACH LINE SIZE

Main pipe size (mm)	Flow rate Water m³/h (Density 1.0g/cm³, Viscosity 1.0mPa·S)						Flow rate Air m³/h (nor) (0°C, 1atm)					
	DP 40kPa			DP 60kPa			DP 40kPa			DP 60kPa		
50	3	to	25	4	to	35	80	to	710	90	to	900
65	4	to	45	4	to	50	90	to	1200	110	to	1400
80	5	to	60	6	to	80	120	to	1700	140	to	2100
100	8	to	100	9	to	120	200	to	3000	230	to	3500
125	12	to	160	15	to	200	290	to	4600	350	to	5400
150	15	to	200	20	to	300	410	to	6000	490	to	7200
200	30	to	400	35	to	500	730	to	10000	850	to	13000
250	40	to	600	50	to	800	1100	to	17000	1400	to	20000
300	60	to	900	70	to	1000	1600	to	24000	1900	to	29000
350	80	to	1000	90	to	1200	2000	to	30000	2300	to	36000
400	100	to	1500	120	to	1600	2600	to	40000	3100	to	48000
450	120	to	1600	150	to	2000	3200	to	52000	3900	to	60000
500	150	to	2000	200	to	3000	4000	to	60000	4900	to	72000

The maximum flow rate of flow meters can be set within scopes for each size.
Range abilities are, in case of the maximum differential pressure 40kPa, 10: 2.5 and, in case of the maximum differential pressure 60kPa, 10: 2.

Notes:

1. The calculation of figures in the above flow range list has been made on the premises that SGP, a JIS code name for a carbon steel pipe for ordinary piping, had been used for main pipes. For main pipes other than SGP, multiply the above liquid quantity by (the inner diameter of the main pipe used ÷ the inner diameter of a SGP pipe) ^{2}.
2. The water flow value means the maximum flow range that can be measured in case of density : 1.0g/cm³ and viscosity: 1.0mPa·s
   When measuring liquid whose density is not 1.0g/cm³, refer to the above table after calculating flow rate converted to air by the following formula.

$$Q_w = Q \times \sqrt{\gamma_o \times 6.9/(7.9-\gamma_o)}$$

Qw : Flow rate converted to water
Q : Flow rate of actual fluid
γ_o : Density of actual fluid

3. Airflow indicates the maximum measurable flow range based on 0℃, 1 atm. When operating conditions are different, refer to the above table after calculating flow rate converted to air by the following formula.

$$Q_A = Q \times C_\gamma \times C_t \times C_p$$

Q_A : Flow rate converted to air
Q : Flow rate of actual fluid
C_γ : Density conversion factor

$$C_\gamma = \sqrt{\gamma}/1.293$$

γ : Gaseous density [kg/m³(nor)]

C_t : Temperature conversion factor

$$C_t = \sqrt{(273+t)/273}$$

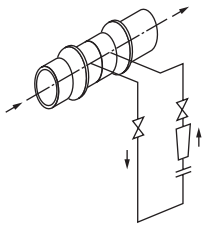
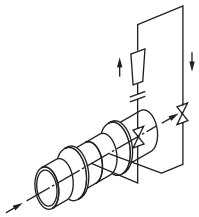
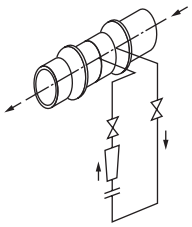
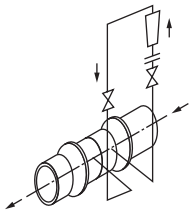
t : Temperature for actual fluid [℃]

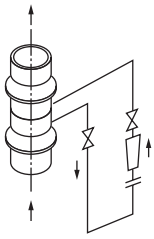
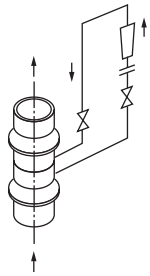
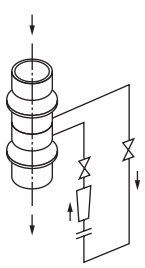
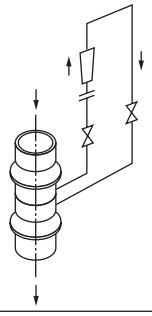
C_p : Pressure conversion factor

$$C_p = \sqrt{0.1013/(0.1013+p)}$$

p : Pressure for actual fluid [MPa]

■ DIRECTION OF FLOW AND BYPASS PIPING

O−1□□6−BC	O−1□□6−AC	O−1□□7−BC	O−1□□7−AC
			

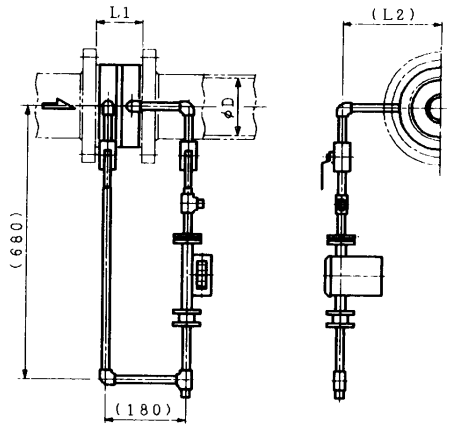
O−1□□1−BC	O−1□□1−AC	O−1□□8−BC	O−1□□8−AC
			

Above drawings show the case of comer tapping. The same piping configurations are applied also for other types of tappings.

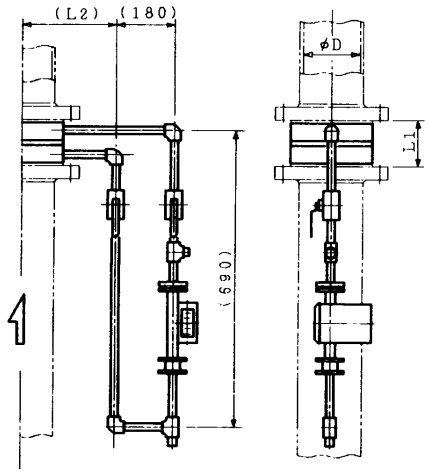
■ STANDARD SIZES OF BYPASS PIPING (In case of Flange rating JIS10K)

(1) Comer taps

・Horizontal piping



・Vertical piping (bottom to top)



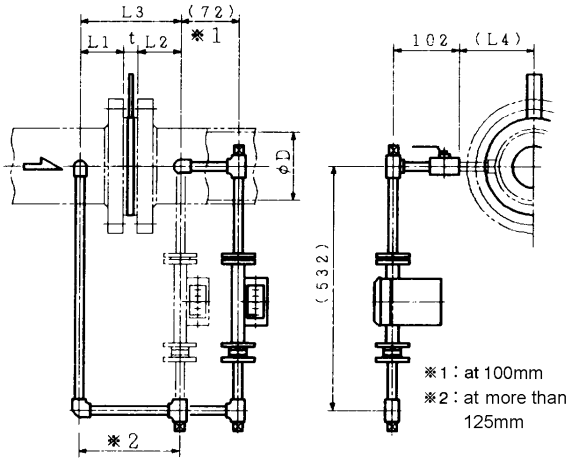
Main connection size	L1	L2
50mm	68	125
65mm	68	135
80mm	68	140
100mm	71	150
125mm	71	165
150mm	71	180
200mm	71	205
250mm	71	245
300mm	71	265
350mm	71	290
400mm	71	325
450mm	71	355
500mm	71	380

unit : mm

The dimensions L1 include gasket thickness: t1.5mm × 2pcs for 50mm, 65mm, 80mm and t3mm × 2pcs for 100 mm.

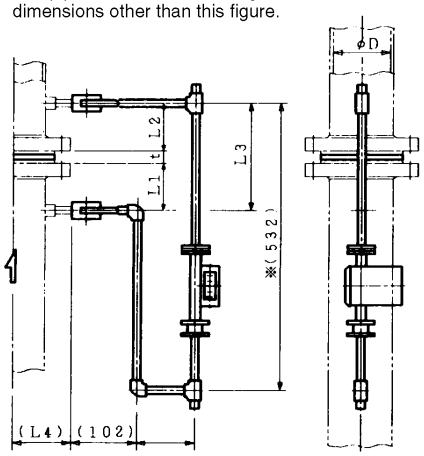
(1) D・D/2 taps

・Horizontal piping



・Vertical piping (bottom to top)

※The pipes with 300 mm or larger in diameter have different dimensions other than this figure.



Main connection size	L1	L2	t	L3	L4
50mm					
65mm					
80mm					
100mm	102	47	9	158	110
125mm	128	59	9	196	130
150mm	152	71	10	233	150
200mm	202	95	10	307	170
250mm	251	119	11	381	210
300mm	302	144	11	457	230
350mm	337	162	11	510	250
400mm	388	186	12	586	280
450mm	438	212	12	662	310
500mm	489	237	12	738	350

unit : mm

Figures for "t" include sizes of gaskets. (t3mm × 2pcs)
L1 includes thickness pf gaskets. t3 × 2pcs
L1 and L2 are for SGP piping.
For other piping material; L1=1D - 3, L2=1/2D - (t-3) where D=Pipe inside dimeter

■ SUGGESTIONS FOR INSTALLATION ;

1. Upper/lower straight tube length
   In order to make measurement in the predetermined accuracy, the straight run of tube is required. The required straight run of tube varies, depending on the diameter ratio of contraction device and the piping shape. Refer to JIS Z 8762-2: 2007.
2. Since the pressure loss within the bypass pipe is pre-calculated, do a specified bypass piping in accordance with the related approval drawing.
3. If you need bypass pipes of which sizes are different from those of standard ones due to a piping design in your factory, please contact us.

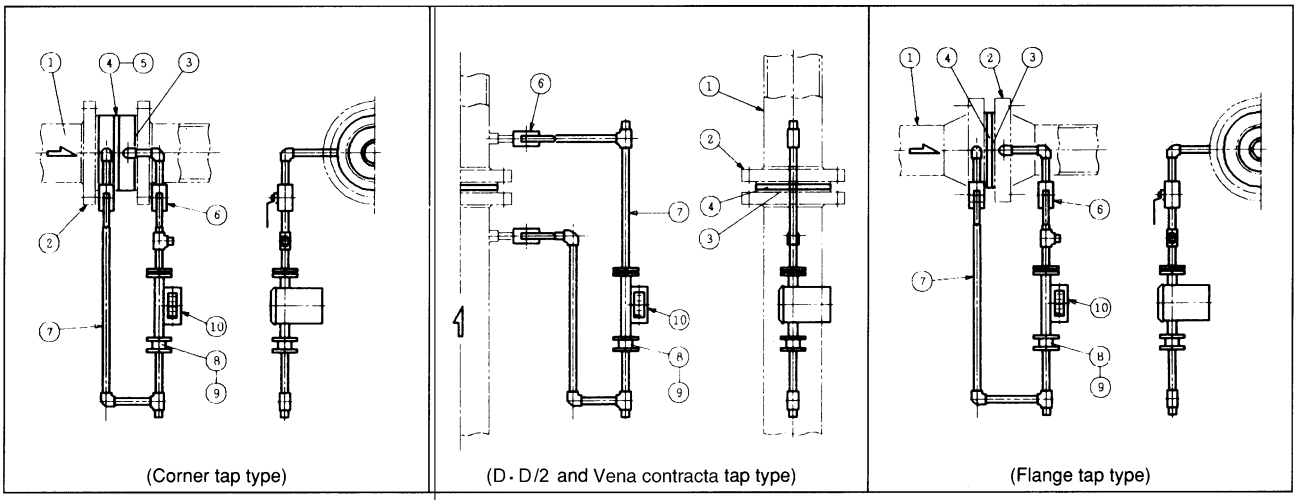
The straight run of pipe varies, depending on the piping condition and the contraction ratio of diameter, and the following is just the outline.

[Reference]

	Elbow・Tees	Valve (Gate valve fully opened)
Straight run of pipe (Upstream)	10D	12D
Straight run of pipe (Downstream)	4D	4D

• 'D' stands for the inside diameter of pipe
• Straight run of pipe means the length from the upstream face of orifice plate.

■ MATERIAL AND SCOPE OF SUPPLY



(Corner tap type) (D・D/2 and Vena contracta tap type) (Flange tap type)

Prat No.	Names of parts		Material Class 1	Material Class 2	Material Class 3
1	Main pipe		Customer's scope		
2	Orifice flange	Except flange taps	Customer's scope (Available as an optional accessary)		
		Flange taps	S25C or SFVC2A	SUS 304	SUS 316
3	Flange gasket		Customer's scope (Available as an optional accessary)		
4	Main pipe orifice		SUS 304	SUS 304	SUS 316
5	Orifice ring		SS 400	SUS 304	SUS 316
6	Ball valve		C3771BE	SCS 14A	SCS 14A
7	Bypass pipe		SGP (W) (STPG)	SUS 304	SUS 316
8	Bypass orifice		SUS 304	SUS 304	SUS 316
9	Gasket		For liquids: Non-asbestos/ For gases: NBR or fluoric rubber		
10	Flow meter		SS400/SUS 304	SUS 304	SUS 316

■ MATERIAL AND SCOPE OF SUPPLY

Common	Model		□□-O-1□□□-□□			
	Name of fluid					
	Density					
	Viscosity					
	Pressure					
	Temperature					
	Scale range					
	Material class		☐ Material class 1 ☐ Material class 2 ☐ Material class 3 ☐ Special ( )			
	Main Pipe	Size	_____mm Process connection _____			
		Material	☐ SGP pipe ☐ STPG and STPT pipes sch No. ___ ☐ Stainless steel pipe sch No. ___ ☐ Lining pipe (inner diameter ___mm) Others (outer diameter ___mm and inner diameter ___mm) ☐ Hard PVC pipe (VP VU) ☐ STPY pipe (thickness ___mm)			
Trandmitter specifications			with Pnuematic taransmitter O-131□	with Electric taransmitter O-152□	with Integrator O-169□	with Alarm contct O-174□
	Connection		☐ Standard Rc 1/4 ☐	☐ Standard G 1/2	☐ Standard G 1/2 ☐	☐ Standard G 1/2 ☐
	Enclosure		☐ Dust and Weather proof only	☐ Dust and Weather proof ☐ Flameproof	☐ Dust and Weather proof only ☐ Flameproof	☐ Dust and Weather proof only ☐ Flameproof ☐ Intrinsically safe (Including barrier)
	Power supply		—	Standard: 24 V DC	V AC Hz	—
	Alarm point		—	—	—	☐ 1 ☐ 2
	Setting point		—	—	—	☐ Upper limit ☐ Lower limit
	Pulse per hour (At full scale)		—	—	c/h	—
Accessaries			with air set	☐ with flameproof packing adaptor	☐ with flameproof packing adaptor	☐ with flameproof packing adaptor ☐ Intrinsically safe relay

* Specification is subject to change without notice.

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