

■ GENERAL

O Series ORIFLO METER is a By-pass Orifice type flowmeter. Small sized variable flowmeter is installed onto measuring tube part in which an orifice plate for by-pass flow is integrated. Three different process connections, i.e., "SCREW", "FLANGE" and "WAFER", are available for Selection. An isolation valve is available between measuring tube and indicator for indicator maintenance work even during process operation. This eliminates the necessity of by-pass piping for maintenance purpose and saves total piping cost. In addition to standard material of STEEL version, Stainless steel and PVC versions to cover corrosive fluids are available. Alarm contacts are available as option. (O-780 Series) See quick delivery model details on page 7.

■ FEATURES

- ❑ LOW COST / HIGH PERFORMANCE
Thanks to unique orifice by-pass system, total instrumentation cost can be saved especially for medium and large sized piping measurement.
- ❑ COMPACT DESIGN
Small sized indicator saves space in plants.
- ❑ EASY INSTALLATION
"SCREW", "FLANGE" and "WAFER" are ready to meet field requirements.
By-pass piping for maintenance purpose can be skipped by using isolation valve.
- ❑ FOR ALL FLOW DIRECTIONS
BOTTOM TO TOP, TOP TO BOTTOM, LEFT TO RIGHT, RIGHT TO LEFT.
ORIFLO is applicable for all possible flow directions. Change of such flow direction is possible in field even after installation.
- ❑ ALARM CONTACT
Besides local flow rate indication, alarm contact (s) are available. ORIFLO can be used as FLOWSWITCH.
- ❑ EASY MAINTENANCE
Simple design and limited number of parts saves maintenance work.
- ❑ HIGH ANTI CORROSIVE CAPABILITY VERSION
Stainless steel and PVC versions are available for corrosive fluid application.



■ MAIN APPLICATIONS

- ❑ Hot and cool water as well as air flow measurement at Air conditioning
- ❑ Medium and large line measurement at General process
- ❑ Cooling water lines
- ❑ Water treatment process
- ❑ Pure and Ultra pure water production facilities process
- ❑ Testing of Fire fighting pumps
- ❑ Testing of blowers
- ❑ Others

■ OPERATION PRINCIPLE

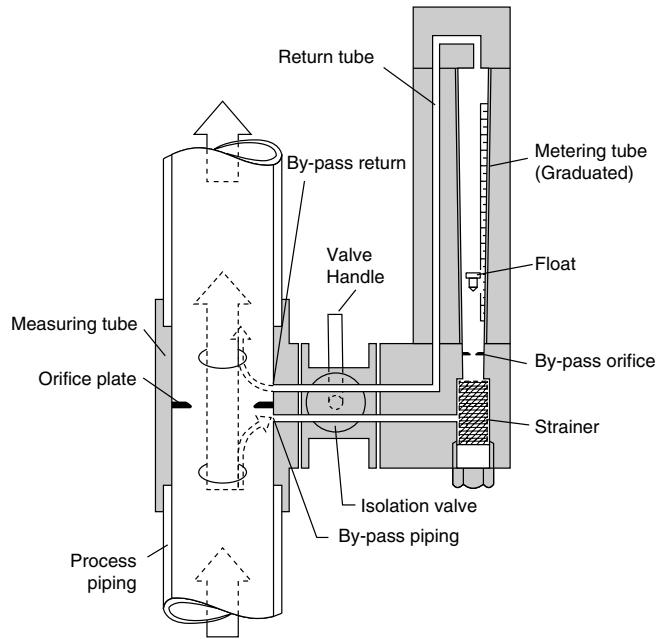
As shown in the figure, differential pressure is produced across the Main orifice plate by flow velocity which corresponds to flow rate.

A small sized flowmeter (Variable area flowmeter) is mounted onto this differential pressure production unit. By this arrangement, the flow rate through the flowmeter corresponds to the flow rate through the Process piping.

Thus, scale range for Process piping can be engraved onto the small sized flowmeter and the flow rate through the Process piping is indicated by the position of float of the flowmeter.

Normally, an isolation valve is provided between the measuring tube and the indicator for the purpose of indicator maintenance with no interference of process operation. (This valve is for maintenance/ isolation purpose and not for flow control purpose.)

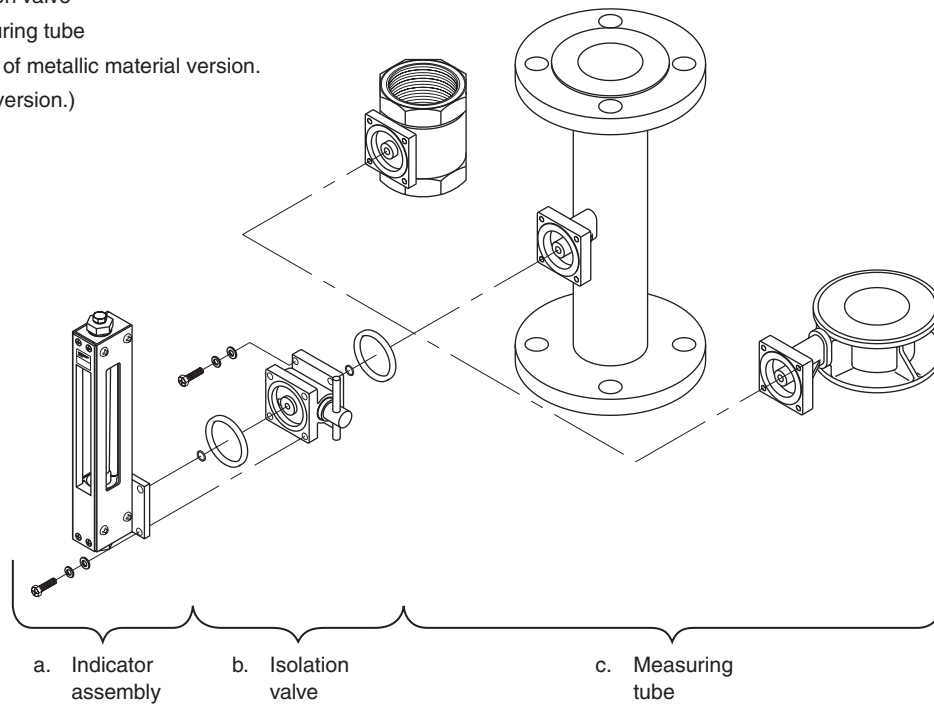
A magnet piece is buried into the float for Alarm version which attracts reed switch for alarm contact output. The setting point of alarm is adjustable by shifting the location of reed switch.



■ CONSTRUCTION

- ORIFLO consists of :
- a. Indicator
 - b. Isolation valve
 - c. Measuring tube

The figure is an extended view of metallic material version.
(It would differ in case of PVC version.)



MATERIAL CONSTRUCTION

Different materials are available for measuring tube, isolation valve, indicator and sealings to cover various fluids as per the following table ;

Part name		Material Class 1	Material Class 2	Material Class 3	Material Class 4	Material Class 5
Measuring tube	Screw connection	SCS14	SCS14	SCS14	PVC	HT-PVC
	Flange connection	SS400/SGP	SUS304	SUS316	PVC	HT-PVC
		SUS304*1				
	Wafer connection	SS400	SUS304	SUS316	PVC	HT-PVC
SCS14*2		SCS14*2	SCS14*2			
Orifice plate		SUS304	SUS304	SUS316	PVC	HT-PVC
Isolation valve body / shaft		SCS14/SUS316	SCS14/SUS316	SCS14/SUS316	HT-PVC/PP	HT-PVC/PP
Indicator body		SCS14	SCS14	SCS14	HT-PVC	HT-PVC
Metering tube		Heat-resistant glass	Heat-resistant glass	Heat-resistant glass	Heat-resistant glass*3	Heat-resistant glass
Float	For liquids	SUS316	SUS316	SUS316	PVC	HT-PVC
	For gases	Glass	Glass	Glass	Glass	Glass
Cover, scale		SUS304/ABS Polycarbonate	SUS304/ABS Polycarbonate	SUS304/ABS Polycarbonate	Polycarbonate	Polycarbonate
Packing		NBR	NBR	NBR	NBR	NBR
		FPM	FPM	FPM	FPM	FPM
		EPDM	EPDM	EPDM	EPDM	EPDM

*1 SUS304 for 10 mm to 40 mm.

*2 SCS14 for 10 mm to 200 mm (JIS 10K).

*3 PVC tapered tubes (max. pressure of 0.6MPa and max. temperature of 40°C) are also available on request.

Abbreviation of material

PP : Polypropylene

NBR : Nitrile Butadiene Rubber

FPM : Fluoro rubber

EPDM : Ethylene-propylene rubber

HT-PVC : High temp. PVC

ABS : Acrylonitrile Butadiene Styrene

MODEL CODE

MODEL CODE										DESCRIPTION		
O	-											
FUNCTION *1	1	8										LOCAL INDICATION ONLY
	7	8										LOCAL INDICATION + ALARM CONTACT
	6	8										LOCAL INDICATION + OPTICAL ALARM UNIT (OLD MODEL O-76□)
FLOW DIRECTION	1											BOTTOM→TOP
	6											LEFT→RIGHT
	7											RIGHT→LEFT
	8											TOP→BOTTOM
PROCESS CONNECTION	-	S										SCREW CONNECTION
	-	F										FLANGE CONNECTION
	-	W										WAFER CONNECTION
ISOLATION VALVE *2			N									NOT PROVIDED
			C									PROVIDED
			B									INDICATOR SEPARATION VERSION
MAIN PIPE SIZE	-	0	1	0								10mm
	-	0	1	5								15mm
	-	0	2	0								20mm
	-	0	2	5								25mm
	-	0	3	2								32mm
	-		∫									∫
	-	4	5	0								450mm
-	5	0	0								500mm	
MATERIAL CODE	-	1										MATERIAL CLASS 1 (Steel)
	-	2										MATERIAL CLASS 2 (SUS304)
	-	3										MATERIAL CLASS 3 (SUS316)
	-	4										MATERIAL CLASS 4 (PVC)
	-	5										MATERIAL CLASS 5 (HT-PVC)
PACKING MATERIAL			N									NBR
			F									FPM
			E									EPDM
			Z									SPECIAL
TERMINAL BOX *3	-	T										Yes
	-	N										No

*1 ; O-190 Dial indication version available.

Refer to page 13 for details.

*2 ; Ball valves are provided for indicator separation version (O-□8□-□B).

Refer to page 11 for details.

*3 ; Select when using O-780 series.

■ STANDARD SPECIFICATION

● Measuring fluid :

Liquids (upto 3 mPa·s viscosity)

Gases

(Not suitable for opaque liquids, slurries and steam)

● Main pipe sizes :

Std. 10mm to 300mm

Option 350mm to 500mm

Special Larger than above on request
(For details, contact us.)

For meters with the main pipe of ø350 mm, pressure tests are conducted only for the indicator and the isolation valve, not for the measuring tube.

● Process connection:

Screw connection: Rc and NPT

Size availability:

10 mm to 100 mm

(10 mm to 50 mm for PVC, 10 mm to 40 mm for HT-PVC versions)

Flange connection: JIS10KFF/RF, ANSI/JPI CLASS

150, and others

Size availability: More than 10 mm

Wafer connection: JIS10K, ANSI/JPI CLASS 150, and others

Size availability: More than 10 mm

● Fluid temp

Material	Maximum fluid temp.
Metallic indicators (Glass tapered tube)	120°C
PVC indicators	60°C
HT-PVC indicators	80°C
NBR packing	80°C
FPM packing	120°C
Stainless steel valve shaft	120°C

It is general data, and the maximum temperature may change by terms of use and environment.

● Fluid press. : Max. 1.0MPa (Metallic versions, Material class 1,2,3)

Max. 0.6MPa (PVC, HT-PVC versions, Material class 4,5)

● Range ability : Std. 10:2

Different range ability applicable for special design products.

● Indication accuracy : ±3% F.S.

● Standard Differential pressure :

Function	Indicator material	DP (kPa)		Range ability	
		For liquids	For gases	For liquids	For gases
Local indication	Metallic material (Glass tapered tube) ₁ 0-18□-□□-□□□- ₂ ₃	15	5	10:2	10:2
	PVC, HT-PVC 0-18□-□□-□□□- ₄ ₅	15	5	10:2	10:2
Local indication + Alarm	Metallic material (Glass tapered tube) ₁ 0-78□-□□-□□□- ₂ ₃	20	20	10:2	10:2
	PVC, HT-PVC 0-78□-□□-□□□- ₄ ₅	20	20	10:2	10:3

Other special Differential pressure design available on request. Consult factory for details.

Optical alarm type (O-68□) has the same diff. pressure as local indication type.

● Standard painting : Munsel 7.5G4/1.5 (only for measuring tube)

PVC part will not be painted.

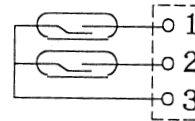
Stainless steel is not painted.

● Alarm function : 1 or 2 point alarm can be additionally provided.

● Type of contact : Reed switch (SPST)(Self-preservation)

● Termination : M3.5 screw terminal

Terminal connection :



(SELF RETENTIONING TYPE)

1 point alarm : ①-③

2 point alarm : ①-③, ②-③

● Contact capacity :

10 VA AC

(Max. voltage 125 V AC, Max. current 0.5A)

10 W DC

(Max. voltage 100 V DC, Max. current 0.5A)

Use RD-1000 type Relay Driver if larger contact capacity is required.

(Separate TECHNICAL GUIDANCE available on request)

In case of lamp load, inductive load and electric motor load, the surge current may be induced. Provide the suitable protection such as CR, surge suppression, relays etc.

● Reset Span : Max. 20% F.S. (Against flow calibration)

● Special treatment : Water free and oil free treatment are available on request.

■ MAX FLOW SIZE BY MAIN PIPE SIZE

FOR LIQUID MEASUREMENT

MAIN PIPE SIZE	Flow rate Water m ³ /h (Density 1.0g/cm ³ , Viscosity: 1.0 mPa.s)					
	DP 10kPa *1		DP 15kPa *2		DP 50kPa *3	
10mm	0.14	to 0.5	0.15	to 0.6	0.3	to 1
15mm	0.18	to 1	0.2	to 1.2	0.4	to 2
20mm	0.3	to 2.4	0.35	to 2.5	0.65	to 5
25mm	0.45	to 4	0.5	to 4.5	0.9	to 8.5
32mm	0.7	to 6.5	0.8	to 8	1.5	to 14
40mm	1	to 9	1.2	to 10	2.5	to 20
50mm	1.8	to 12	2	to 15	4	to 30
65mm	3.5	to 20	4	to 25	8	to 50
80mm	4.2	to 32	5	to 40	10	to 70
100mm	7	to 55	8	to 70	15	to 120
125mm	12	to 80	15	to 100	30	to 180
150mm	16	to 120	20	to 150	40	to 250
200mm	35	to 200	40	to 250	80	to 450
250mm	50	to 300	60	to 400	100	to 700
300mm	65	to 450	80	to 550	140	to 1000
350mm	85	to 550	100	to 700	180	to 1300
400mm	120	to 700	150	to 900	250	to 1600
450mm	160	to 950	200	to 1200	350	to 2200
500mm	350	to 1200	400	to 1500	700	to 2600

*1: Range ability 10 : 2.5

*2: Range ability 10 : 2

*3: Range ability 10 : 2 (10 : 1.5 on request)

Consult factory for other main pipe sizes and scale ranges, if required.

Above table is indicated based on water flow measurement (Density 1.0g/cm³ Viscosity 1.0mPa.s). When the fluid Specific gravity is other than 1.0, conduct conversion calculation by the following formula, and refer to the table :

$$Q_w = Q \times \sqrt{\frac{\gamma_o (\gamma_f - 1)}{(\gamma_f - \gamma_o)}}$$

Example: The flow rate converted to water, of alcohol 50m³/h (Density: 0.8g/cm³) can be calculated as follows. The flowmeter to be used is to be stainless (local indication only).

$$Q_w = 50 \times \sqrt{\frac{0.8 \times (7.9 - 1)}{(7.9 - 0.8)}}$$

$$= 44.1 \text{ (m}^3\text{/h)}$$

From the above table, select the main pipe size (100mm, 125mm etc.) in which 44.1m³/h is included.

Q_w : Water converted range
 Q : Flow range for actual liquid
 γ_o : Density of actual Liquid
 γ_f : Density of float

Float material	Density of float
Stainless steel (Local indicator)	7.9 g/cm ³
Stainless steel (With alarm)	7.3 g/cm ³
PVC (Local indicator)	2.8 g/cm ³
PVC (With alarm)	3.0 g/cm ³

The calculation of figures in the above flow range table 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. In case of main pipes other than SGP, multiply the above liquid quantity by (the inner diameter of a main pipe used ÷ the inner diameter of a SGP pipe)².

For the measuring pipe of Material Class 4 and Class 5, it means the inner diameter of VP (Rigid Polyvinyl Chloride pipes). Depending on the main pipe size, but multiply the above flow range by 0.75 to 1.

Inner diameter of a SGP pipe

MAIN PIPE SIZE	Inner diameter [mm]
10mm	12.7
15mm	16.1
20mm	21.6
25mm	27.6
32mm	35.7
40mm	41.6
50mm	52.9
65mm	67.9
80mm	80.7
100mm	105.3
125mm	130.8
150mm	155.2
200mm	204.7
250mm	254.2
300mm	304.7

FOR GAS MEASUREMENT

ORIFLO for gas flow measurement will be calibrated and graduated according to customers' individual operating conditions such as density, pressure and temperature. Refer to ORDERING INFORMATION on Page 15 and specify the operating conditions. The following table shows the air flow range at 0°C and 1atm for each main pipe size. Conversion calculation is required in case the actual operating conditions differ from this.

MAIN PIPE SIZE	Flow rate AIR m ³ /h (nor) (0°C, 1 atm)					
	DP 5kPa *1		DP 10kPa *2		DP 20kPa *2	
10mm	2.3	to 9	3.5	to 12	4.5	to 18
15mm	3.2	to 20	4.5	to 28	6	to 38
20mm	5	to 45	7.5	to 65	10	to 85
25mm	8	to 75	11	to 100	15	to 140
32mm	12	to 120	18	to 150	25	to 240
40mm	16	to 170	22	to 240	32	to 320
50mm	25	to 280	35	to 350	50	to 500
65mm	45	to 460	65	to 600	90	to 850
80mm	60	to 640	85	to 850	120	to 1200
100mm	100	to 1100	140	to 1500	200	to 2000
125mm	150	to 1650	220	to 2300	300	to 3200
150mm	210	to 2300	300	to 3300	400	to 4500
200mm	380	to 4100	500	to 5500	750	to 7500
250mm	550	to 6400	800	to 8500	1100	to 12000
300mm	900	to 9000	1200	to 12000	1700	to 17000
350mm	1100	to 11000	1600	to 15000	2200	to 21000
400mm	1500	to 15000	2100	to 20000	2800	to 28000
450mm	1800	to 19000	2600	to 26000	3500	to 36000
500mm	2200	to 23000	3200	to 33000	4200	to 45000

*1: Range ability 10 : 2

*2: Range ability 10 : 2 (10 : 1.5 on request)

Consult factory for other scale ranges, if required.

Gas measurement versions are all custom made. Figures in above table shows the flow rate based on air at 0°C, 1 atm. Conduct conversion calculation and refer to the table.

Conversion calculation

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

Q_A : Converted Air flow

Q : Flow rate of Actual Gas

$$C_\gamma = \sqrt{\gamma / 1.293} \quad [\gamma = \text{density of gas in kg/m}^3 \text{ (nor)}]$$

$$C_t = \sqrt{(273+t)/273} \quad (t = \text{operating temp., } ^\circ\text{C})$$

$$C_p = \sqrt{0.1013/(0.1013+p)} \quad (p = \text{operating press. MPa})$$

Taking, nitrogen gas, density; 1.251kg/m³ (nor), pressure; 0.6MPa, and temperature; 20°C for example, the flow rate of 300m³/h (nor) converted to air can be calculated as follows:-

$$Q_A = 300 \times \sqrt{\frac{1.251}{1.293}} \times \sqrt{\frac{273+20}{273}} \times \sqrt{\frac{0.1013}{0.1013+0.6}}$$

$$= 116.2\text{m}^3/\text{h (nor)}$$

From the above table, select the main pipe size (32mm, 40mm etc.) in which 116.2m³/h (nor) is included.

The calculation of figures in the above flow range table 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. In case of main pipes other than SGP, multiply the above liquid quantity by (the inner diameter of a main pipe used ÷ the inner diameter of a SGP pipe)².

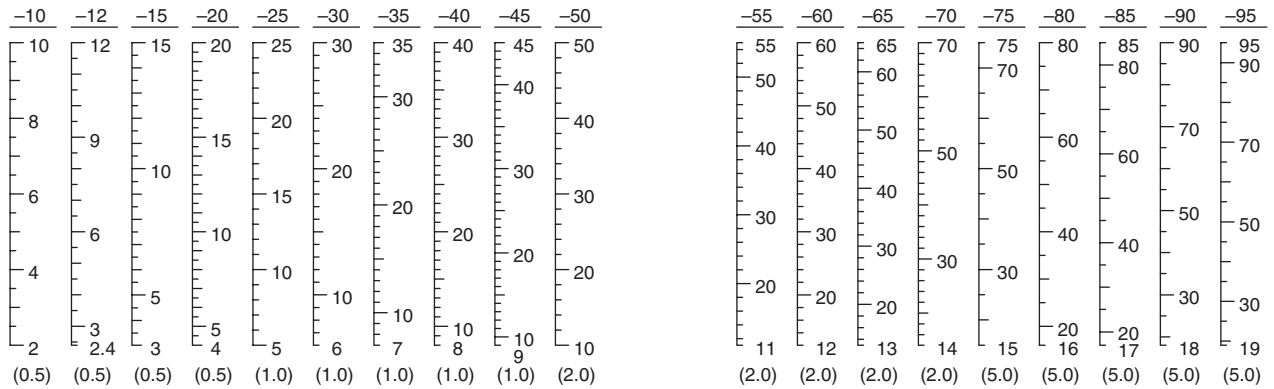
For the measuring pipe of Material Class 4 and Class 5, it means the inner diameter of VP (Rigid Polyvinyl Chloride pipes). Depending on the main pipe size, but multiply the above flow range by 0.75 to 1.

Inner diameter of a SGP pipe

MAIN PIPE SIZE	Inner diameter [mm]
10mm	12.7
15mm	16.1
20mm	21.6
25mm	27.6
32mm	35.7
40mm	41.6
50mm	52.9
65mm	67.9
80mm	80.7
100mm	105.3
125mm	130.8
150mm	155.2
200mm	204.7
250mm	254.2
300mm	304.7

●Scale graduation

Standard scale division is set as per following figure. Select a desirable scale graduation from the figures below.



The figures in () shows minimum graduation of scale. These figures may change according to the differential pressure.

■ Series for quick delivery O-180-□□-□□□-2F

Appoint “model code” when ordering. Parts such as indicator, isolation valve and measuring tube shall be delivered disassembled. Put them together in accordance with the required flow direction.

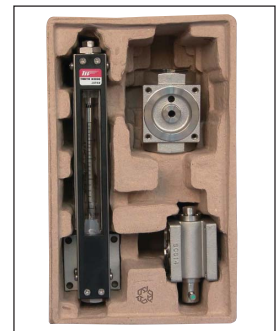
●SPECIFICATION

- LIQUID : Water (Double scale of m³/h and L/min)
- DENSITY : 1.0 g/cm³
- VISCOSITY : 1.0 mPa·s
- MAX. PRESSURE : 15 kPa (Screw connection)
20 kPa (Wafer connection)

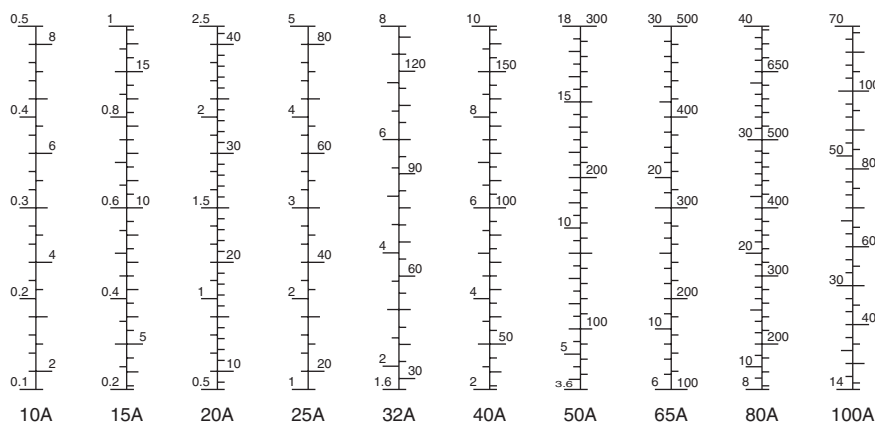
MAIN PIPE SIZE	FLOW SCALE		MODEL CODE	
			SCREW CONNECTION (Rc)	WAFER CONNECTION (JIS-10K)
10A	0.1 to 0.5	m ³ /h	O-180-SC-010-2F	—
	(1.7 to 8.3)	L/min		
15A	0.2 to 1	m ³ /h	O-180-SC-015-2F	—
	(3.3 to 16.7)	L/min		
20A	0.5 to 2.5	m ³ /h	O-180-SC-020-2F	—
	(8.3 to 41.7)	L/min		
25A	1 to 5	m ³ /h	O-180-SC-025-2F	O-180-WC-025-2F
	(17 to 83)	L/min		
32A	1.6 to 8	m ³ /h	O-180-SC-032-2F	—
	(26.7 to 133)	L/min		
40A	2 to 10	m ³ /h	O-180-SC-040-2F	O-180-WC-040-2F
	(33 to 167)	L/min		
50A	3.6 to 18	m ³ /h	O-180-SC-050-2F	O-180-WC-050-2F
	60 to 300	L/min		
65A	6 to 30	m ³ /h	O-180-SC-065-2F	O-180-WC-065-2F
	100 to 500	L/min		
80A	8 to 40	m ³ /h	O-180-SC-080-2F	O-180-WC-080-2F
	(133 to 667)	L/min		
100A	14 to 70	m ³ /h	O-180-SC-100-2F	O-180-WC-100-2F
	(233 to 1167)	L/min		

●Packing method when delivered

The 3 parts of indicator, isolation valve, and measuring tube are packed as per picture. (It can be assembled at factory if desired. Advise us of required flow direction.)



●Scale graduation

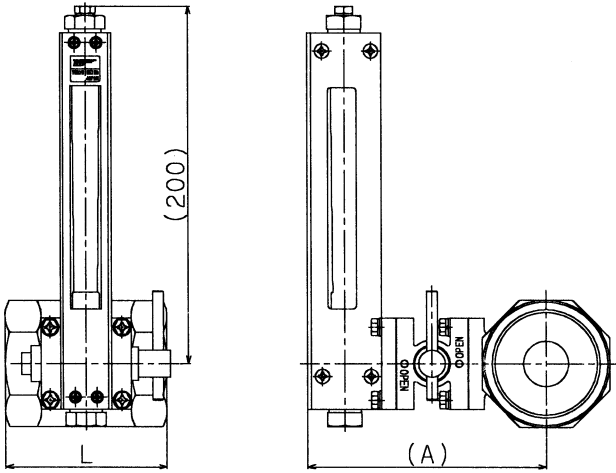


Note: The unit of L/min for 100A is ×10L/min.

EXTERNAL DIMENSION

● SCREW CONNECTION TYPE O-18 □ -SC- □ □ □ - □ □

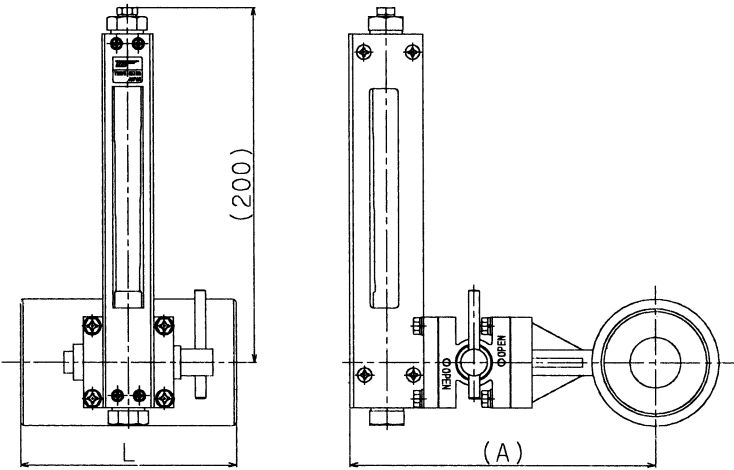
① MATERIAL CLASS 1, 2, 3 (SCS14) 10 mm to 50 mm



MAIN PIPE SIZE	L	*(A)	Mass (Approx.) (kg)
10mm	70	104	1.5
15mm		106	1.6
20mm		108	1.7
25mm		112	1.8
32mm	74	120	2.0
40mm	85	123	2.1
50mm	90	131	2.6

* A is reduced by 40mm in case Isolation valve is not provided.
Mass of Isolation valve is approximately 0.4 kg.

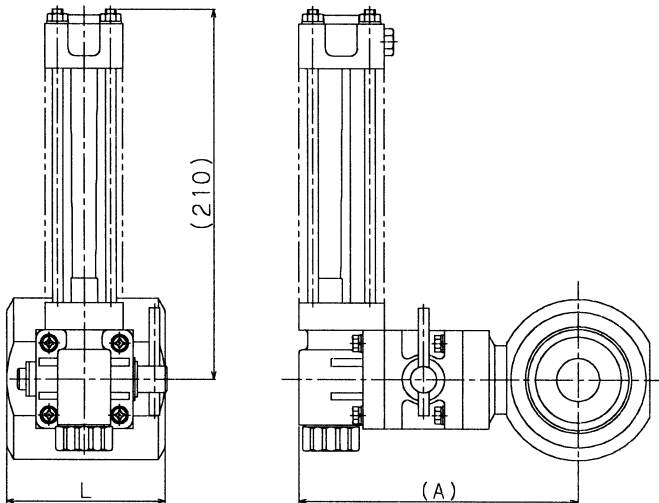
② MATERIAL CLASS 1, 2, 3 (SCS14) 65mm to 100mm



MAIN PIPE SIZE	L	*(A)	Mass (Approx.) (kg)
65mm	120	176	4.0
80mm		183	4.3
100mm	160	198	7.5

* A is reduced by 40mm in case Isolation valve is not provided.
Mass of Isolation valve is approximately 0.4 kg.

③ MATERIAL CLASS 4 (PVC) 10 mm to 50 mm
MATERIAL CLASS 5 (HT-PVC) 10 mm to 40 mm

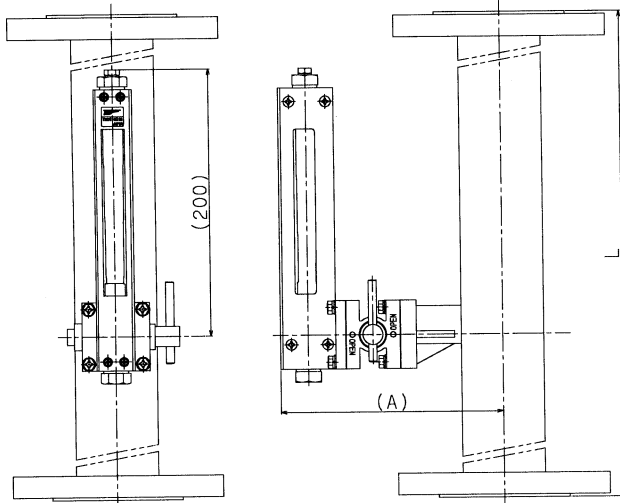


MAIN PIPE SIZE	L	*(A)	Mass (Approx.) (kg)
10mm	75	146	1.1
15mm		146	1.1
20mm		146	1.1
25mm		146	1.1
32mm	85	153	1.2
40mm		158	1.2
50mm	90	163	1.2

* A is reduced by 44mm in case Isolation valve is not provided.
Mass of Isolation valve is approximately 0.2 kg.

●FLANGE CONNECTION TYPE O-18 □-FC-□□□-□□□

MATERIAL CLASS 1, 2, 3 (SGP, SUS304, SUS316)

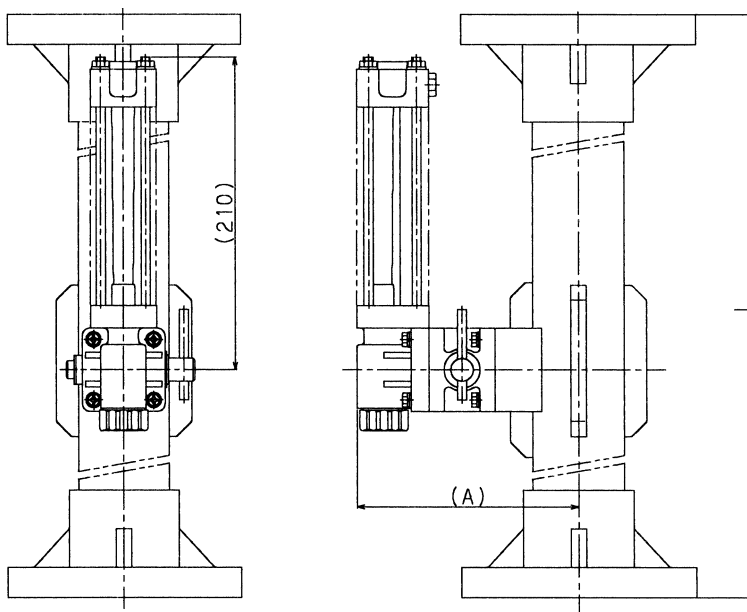


Special design with L dimension of 200mm (10mm to 80mm) and 300mm (100mm to 500mm) available on request, Contact Tokyo Keiso for details.

MAIN PIPE SIZE	Measuring tube ^{[1], [2], [3]} (SGP, SUS304, SUS316)		
	L	*1(A)	Mass (Approx.) (kg) ^{*2}
10mm	540	142	3.2
15mm		144	3.6
20mm		147	4.2
25mm		150	5.4
32mm		154	6.7
40mm		157	7.1
50mm		163	8.5
65mm		171	11.4
80mm		178	12
100mm		190	15.5
125mm		203	20
150mm		216	27
200mm		241	35
250mm		267	50
300mm		292	61
350mm		311	74
400mm		336	93
450mm		362	115
500mm		387	130

*1: A is reduced by 40mm in case Isolation valve is not provided.
 *2: In case flange rating JIS10K Mass of the isolation valve is approximately 0.4 kg.

MATERIAL CLASS 4, 5 (PVC, HT-PVC)

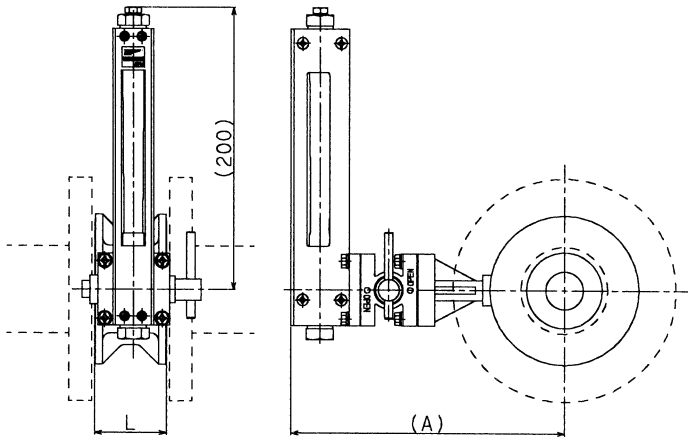


MAIN PIPE SIZE	Measuring tube ^{[4], [5]} (PVC, HT-PVC)		
	L	*1(A)	*2 Mass (Approx.) (kg)
10mm	540	127	1.1
15mm		129	1.2
20mm		131	1.3
25mm		134	1.5
32mm		137	1.7
40mm		142	1.9
50mm		148	2.3
65mm		156	2.7
80mm		162	3.1
100mm		175	4.1
125mm		208	5.5
150mm		220	8.0
200mm		246	9.5
250mm		271	14.5
300mm		297	20

*1: A is reduced by 44mm in case Isolation valve is not provided.
 *2: In case flange rating JIS10K Mass of the isolation valve is approximately 0.2 kg.

● **WAFER CONNECTION TYPE** O-18□-W□-□□□-□□

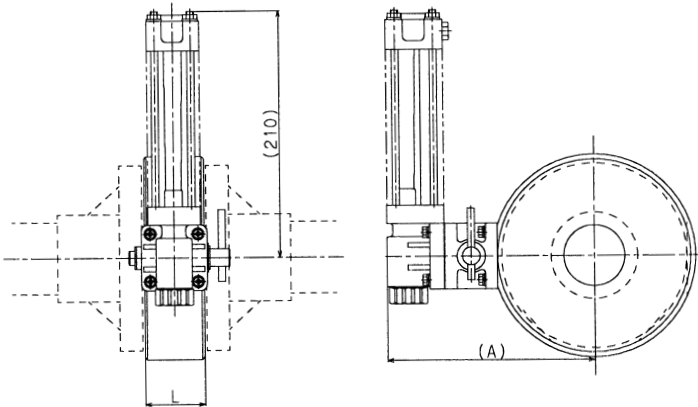
① MATERIAL CLASS 1, 2, 3 (SS400, SUS304, SUS316, SCS14)



MAIN PIPE SIZE	L	*(A)	*Mass (Approx.) (kg)
10mm	50	160	2.5
15mm		162	2.7
20mm		165	2.8
25mm		173	2.0
32mm		175	3.6
40mm		181	2.5
50mm		188	2.8
65mm		198	3.1
80mm		203	3.3
100mm		216	3.8
125mm		231	8.2
150mm		246	10
200mm		268	13
250mm		300	18
300mm	322	20	
350mm	65	345	25
400mm		376	34
450mm		404	40
500mm		431	47

* Size A and mass (approx.) are for JIS10K flange installation and is reduced by 40mm in case Isolation valve is not provided. Mass of Isolation valve is approximately 0.4 kg.

② MATERIAL CLASS 4, 5 (PVC, HT-PVC)

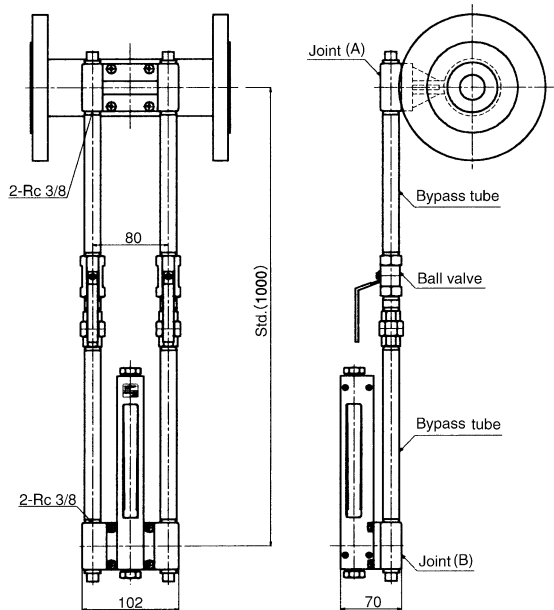


MAIN PIPE SIZE	L	*(A)	*Mass (Approx.) (kg)
10mm	50	139	1.3
15mm		141	1.3
20mm		144	1.4
25mm		158	1.7
32mm		163	1.9
40mm		166	1.9
50mm		174	2.2
65mm		184	2.4
80mm		189	2.6
100mm		202	3.0
125mm		223	3.8
150mm		238	4.5
200mm		263	5.5
250mm		298	7.5
300mm		321	8.5
350mm		344	9
400mm	379	12	
450mm	409	14	
500mm	437	16	

* Size A and mass (approx.) are for JIS10K flange installation and is reduced by 44mm in case Isolation valve is not provided. Mass of Isolation valve is approximately 0.2 kg.

●INDICATOR SEPARATION VERSION O-18□-□B-□□□□-□□

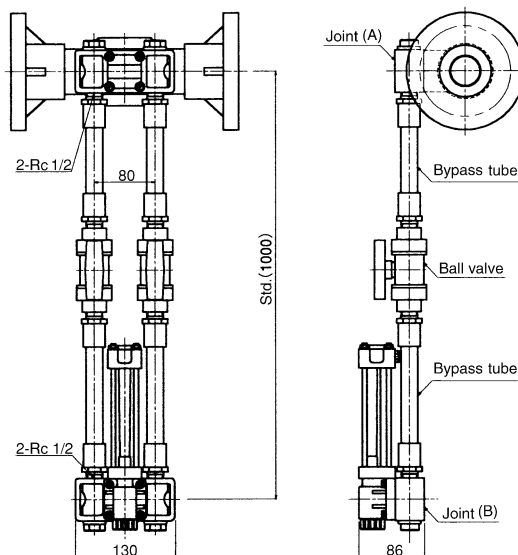
Indicator can be located separately from process by using by-pass piping for easy observation of indication. Ball valves are provided for indicator maintenance purpose. Different materials are available as shown in below table. Special design for bypass piping is available on request.



Metallic (Material 1~3)

Part name	Material
Joint A, B	SCS14
Bypass tube	SGP (White), SUS304, SUS316
Ball valve	C3771BE, SCS13A, SCS14A

Bypass tube size will be 10mm for metal.



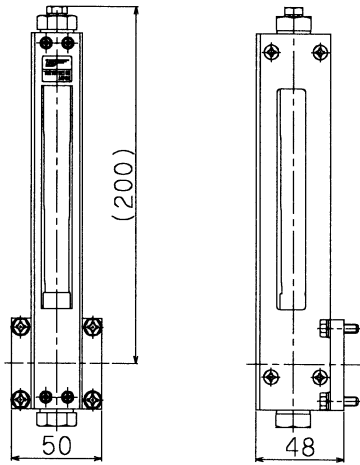
PVC-HT-PVC (Material 4, 5)

Part name	Material
Joint A, B	HT-PVC
Bypass tube	PVC, HT-PVC
Ball valve	PVC, HT-PVC

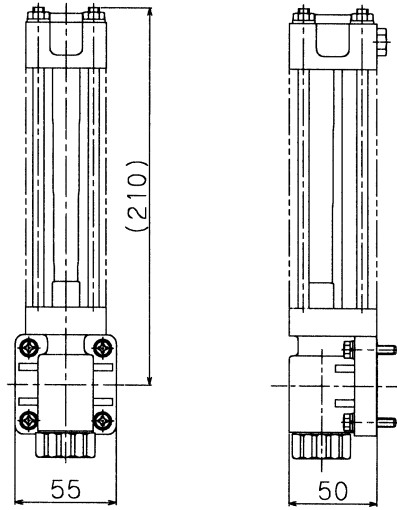
Bypass tube size will be 15mm for PVC.

●INDICATOR

① LOCAL INDICATION ONLY O-18 □

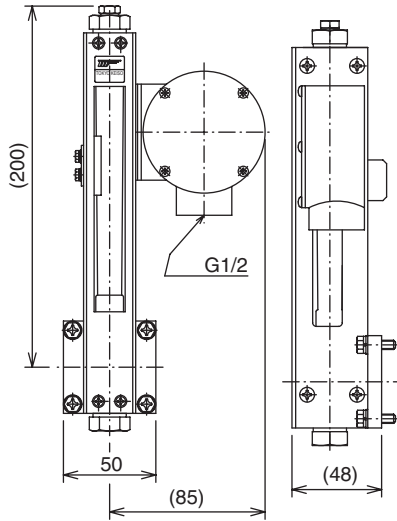


MATERIAL (SCS14)

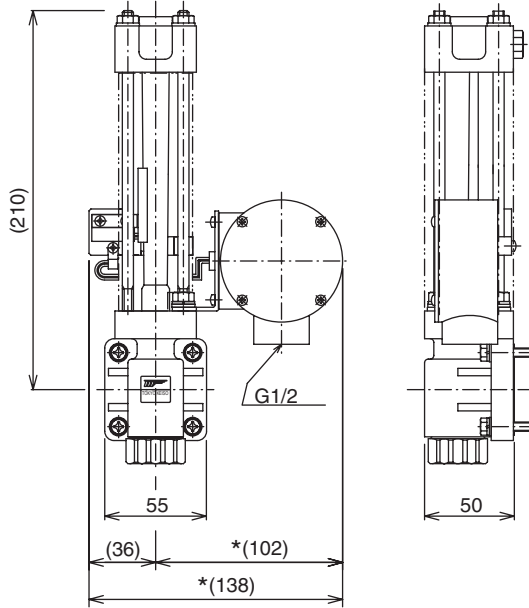


MATERIAL (PVC, HT-PVC)

② LOCAL INDICATION WITH ALARM CONTACT O-78 □



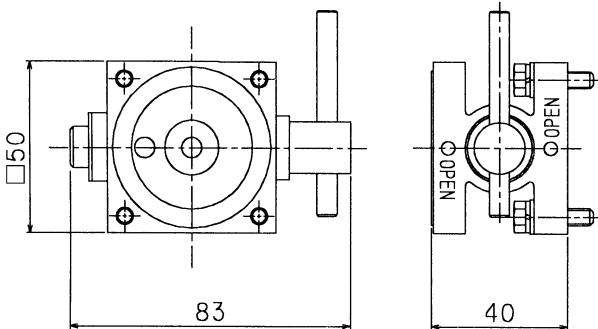
MATERIAL (SCS14)



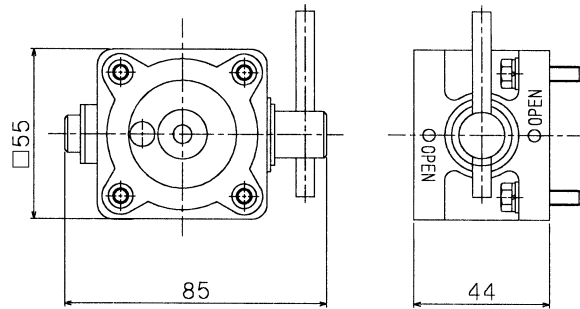
* This dimension becomes longer by 15mm for 2-point alarm.

MATERIAL (PVC, HT-PVC)

●ISOLATION VALVE



MATERIAL (SCS14)



MATERIAL (HT-PVC)

■ O-190 SERIES DIAL INDICATOR TYPE

In addition to standard O-180 with Glass tube flowmeter indication, O-190 series Dial indication type is available. Consult factory for details.

A. Integrated Dial Indication type O-190-DG



O-190-DG indicators flowrate by pressure gauges. 3 way manifold valve is provided.

B. O-190-B □ separate indication series

Different types of pressure indicators can be used for indication of flow rate. They can be installed separately away from orifice piping for better observation.

<p style="text-align: center;">a. Manometer indication</p>	<p style="text-align: center;">b. U shaped Manometer indication</p>
<p style="text-align: center;">c. Dial indication</p>	<p style="text-align: center;">d. Indication in protection housing</p>

■ SUGGESTIONS

(1) Upper/lower straight tube length

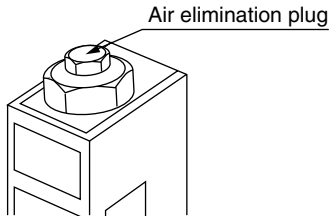
To obtain measurements with the predetermined accuracy, straight runs of pipes are required on both the upstream and downstream sides of the flowmeter. The required length varies depending on the piping condition and the diameter ratio; the following table shows the required length as a reference.

	Elbows and Tees	Valve (fully-opened gate valve)
Length of straight run of pipe (Upstream)	6D	8D
Length of straight run of pipe (Downstream)	3D	3D

- 'D' indicates the inside diameter of the pipe.
- The length of straight run of pipe is measured from the upstream face of the orifice plate.
- Refer to JIS Z 8762-2: 2007 for details of the straight run of pipe.

(2) Air bubble elimination and draining

Air bubble in the indicator may cause measurement error. Eliminate the air in the indicator through Air elimination plug at the top of indicator for the start-up.



Ball valves are available for air eliminator and drain out as option as follows ;

MATERIAL CONSTRUCTION

OPTION

	Ball valve/ Cock	Nipple	Shape	Method to install
Material Class 1	ASTM A351-CF8M (Equiv. to SCS14A)	SGP		Upper and lower parts: Embedded in cap
Material Class 2		SUS304		
Material Class 3		SUS316		
Material Class 4	PVC	—		Upper body and lower part embedded in cap
Material Class 5	Not applicable			

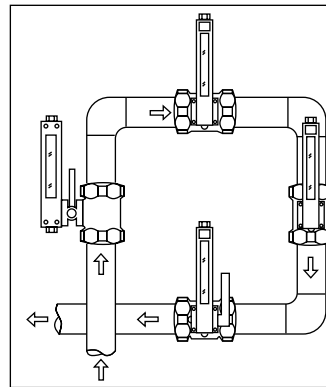
(3) Reading of flow rate

The flow rate is to be read by the position of float and engraved graduation. Refer to the following :

Gas application	Liquid application for local indicator
center →	top →
Alarm versions (Metallic material)	Alarm versions (PVC, HT.PVC)
top →	top →

(4) Flow direction

By changing the direction of indicator, ORIFLO may be used for any flow direction of bottom to top, left to right, right to left and top to bottom. This change can be conducted in the field as well.



■ ACCESSORIES

(1) COUNTER FLANGES

Counter flanges are available on request. Supply scope is as follows :

Part name	Q'ty	Material
Flange	2	SS400, SUS304, SUS316
Bolt and nuts	As required	SS400, SUS304
Gaskets	2	Non-asbestos, NBR, FPM, EPDM, Others

(2) TS FLANGES

TS socket welding flanges are also available on request :

Part name	Q'ty	Material
TS Socket welding flange	2	PVC, HT-PVC
Bolt and nuts	As required	SS400, SUS304
Gaskets	2	NBR, EPDM, Others



■ ORDERING INFORMATION

Specify the following for order or inquiry ;

MODEL O-□8□-□□-□□□-□□

Fluid name _____

Density _____ g/cm³ kg/m³(nor) _____

Viscosity _____ mPa·s _____

Pressure Nor. _____ Max. _____ MPa _____

Temperature Nor. _____ Max. _____ °C _____

Process connection Rc Other thread (_____)
 JIS10KFF JIS10KRF Other flange (_____)
 Wafer for JIS10K flange Wafer for other flange (_____)

Inner diameter of process piping SGP _____ mm

Full scale _____ m³/h m³/h(nor) _____

Packing material NBR FPM EPDM Others (_____)

In case of alarm version

Number of point 1 2

Setting 1 H L at _____ m³/h m³/h(nor) _____

Setting 2 H L at _____ m³/h m³/h(nor) _____

Installation accessories Counter flanges Material ()

TS flanges Material ()

Other special instructions, if any ; _____

Cautions on the use of glass tube variable area flowmeters

CAUTION

Avoid the use of glass tube variable area flowmeters for the following services.

- Liquid services subject to impulse pressure in the process.
- Secondary accidents might occur due to the breakage of glass in such services :
 - Toxic fluids such as poisons, stimulant and narcotics
 - Flammable fluids
 - Explosive fluids
- Gas handling process where breakage of glass might result in gas leakage or scattering of glass fragments.
- The installation places of the flowmeters where breakage of glass might be caused by the accidents from the surrounding piping or equipment.
- On-off operation where breakage of glass might be caused by the collision of the float inside meter due to the abrupt change of flow.
- Services where the heat shock by abrupt change of temperature is expected.

**DIGITAL FLOW
INDICATION**

DIFFERENTIAL PRESSURE FLOWMETER *with* **HDT 1000 SERIES ORIFLO METER**

HDT 1000 Series oriflo meter works as one flowmeter by the integration of orifice and multi-digital differential pressure indicator. It indicates flow rate by measuring directly the differential pressure generated across the orifice inside pipe.



FEATURES

- For liquids and gases
- Compact indicators save the space
- Screw (up to 100mm), flange and wafer connection. From 15mm to 300mm including both are available.
- Wide rangeability 10 to 100% and accuracy $\pm 3\%$ Full Scale.

For details see Technical Guidance of HDT 1000.

* Specification is subject to change without notice.

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