TECHNICAL GUIDANCE

SIMPLE, BUT RELIABLE
BEST COST PERFORMANCE

R-100 Series

GLASS TUBE FLOWMETER

GENERAL

R-100 is a glass tube type variable area flowmeter. The flow rate is indicated by the position of float and the graduation engraved on the glass tube.
Although it has a very simple construction, it is widely used for measurement of flow rate of liquids and gases in various applications thanks to its high reliability and easy handling capability.
R-700 series having alarm contact are also available. (Refer to separate TECHNICAL GUIDANCE for details.)

FEATURES

❑ DIRECT OBSERVATION OF FLUID
In addition to flow rate measurement, direct observation of fluid can be done through glass tube. This is effective for quality control of process line.

❑ COST EFFECTIVENESS
This is the most cost effective device for local flow measurement. Very widely used for various applications.

❑ EASY INSTALLATION
No adjustment is required after installation. No straight run for upstream and downstream is needed. This results easy piping design.

❑ EASY MAINTENANCE
Very simple construction offers almost "NO MAINTENANCE LOAD".

❑ PURE MECHANICAL CONSTRUCTION
Flow rate is measured by pure mechanical action and no utility supply such as electric, air...required.

MODEL CODE

R-10		-		Description
Flow Direction	1			BOTTOM→TOP
	2			BOTTOM→TOP SIDE
	3			BOTTOM SIDE→TOP SIDE
	4			BOTTOM SIDE→TOP
	5			BOTTOM REAR→TOP REAR
Options			R	RIBBED TAPERED TUBE
			V	FLOW ADJUSTING VALVE

TOKYO KEISO CO.,LTD.

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STANDARD MATERIAL PRODUCTS

OUTLINE

In STANDARD MATERIAL PRODUCTS, the fluid contacting body material is cast iron and stainless steel. They are widely used for measurement of water, air and other "Not-so-corrosive" fluids.

STANDARD SPECIFICATION

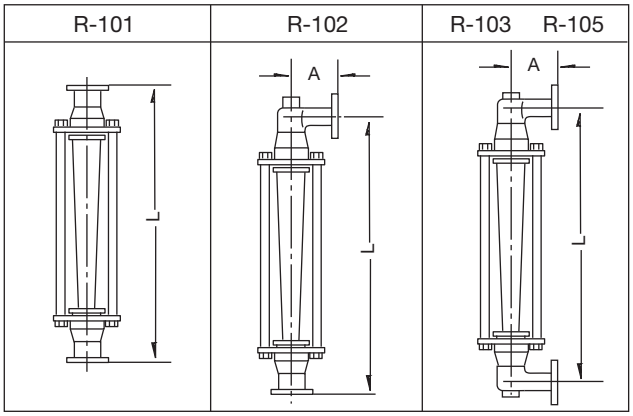
- Measuring fluid: All kinds of liquids and gases
  (Not suitable for steam measurement. AM series Metal Tube Flowmenters are recommended.)
- Available size (Meter size): 10 to 100
- Process connection
  Standard: JIS 10K flange
  Option: ANSI, JPI, other flanges
  Rc, NPT (up to 25mm)

Fluid pressure

Meter size	Max. Fluid press. (MPa)	Meter size	Max. Fluid press. (MPa)
10	1.2	50	0.6
15	1.0	65	0.6
20	0.8	80	0.4
25	0.8	100	0.4
40	0.6		

- Max. thermal shock: 80°C
- Indication accuracy: Stainless steel float ±1.5%F.S.
  Resin float ±2.5%F.S.
- Range ability: 10:1
  (±3% F.S. for liquids with Q_W of 50 L/h or lower, and gases with Q_A of 1.5 m^3/h (nor) or lower)
- Available material
  Fittings: SCS14, SUS304, SUS316
  Tapered tube: Heat-resistant glass (Acryl tapered tube is available on request.)
  Float: For liquids
  SUS304, SUS316, SUS316L, PVC, Others
  For gases
  Aluminium, PVC, PTFE, SUS304, Others
  Float rod: SUS304, SUS316, SUS316L, Others
  (The meters for gases with 20 or more in meter size and ones for liquids with 40 or more have the float rods)
  Packing: NBR, FPM, Others
- Paint: Not painted
- Fluid temp: Select the temperature for the material in the following table in the operating temperature limit.

DIMENSION



Meter size	Dimension	
	L (mm)	A (mm)
10	420	75
15	420	75
20	430	100
25	500	100
40(B)*	500	100
40(A)*	500	120
50	530	120
65	530	140
80	570	140
100	590	160

*Refer to the flow rating by size in the next page.

PRODUCT MASS

Meter size	Mass (approx.) kg	Meter size	Mass (approx.) kg
10	3	50	18
15	4	65	22
20	5	80	29
25	8	100	41
40	14		

Above table shows the approximate mass of R-101 made of metal.

		Operating temperature limit (℃)					
Parts name	Material	0	50	60	70	80	120
Tapered tube	Heat-resistant glass						
	Acrylic						
Float	Metal						
	PTFE						
	PVC						
Packing	NBR						
	EPDM						

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

CAPACITY RATING

❑ For liquid measurement

Meter size	Water flow [L/h]			
	Glass tapered tube		Acryl tapered tube	
	Stainless steel float	PVC, PTFE float	Stainless steel float	PVC, PTFE float
10	9 to 120	30 to 55	70 to 120	30 to 55
15	410	230	400	230
20	1040	700	1000	700
25	1750	1100	1600	1100
40 (B)	2500	1650	2500	1650
40 (A)	4400	3000	4200	3000
50	9100	6400	9000	6400
65	12100	9200	12000	9200
80	21000	15300	Not available	Not available
100	52000	42800	Not available	Not available

❑ For gas measurement

Meter size	Air flow [m^3/h (nor)]				
	Glass tapered tube			Acryl tapered tube	
	Stainless steel float	Aluminum float	PTFE float	Stainless steel float	Aluminum float
10	Not available	0.16 to 1.6	0.15 to 1.4	Not available	1.2 to 1.6
15	Not available	6	5.4	Not available	6
20	9.7 to 30	18	15	9.7 to 30	18
25	51	30	24	51	30
40 (B)	71	41	43	71	41
40 (A)	130	78	86	130	78
50	270	160	150	270	160
65	350	220	180	350	220
80	Not available	360	340	Not available	Not available
100	Not available	820	980	Not available	Not available

Flowmeters with stainless steel floats may suffer from hunting at fluid pressures below 0.1 MPa.

FLOW RATE COMPENSATION CALCULATION

In this TECHNICAL GUIDANCE flow rate tables are indicated by flow rate of water (Density 1.0g/cm^3, Viscosity 1.0mPa·s) and by flow rate of air (0° C, 1 atm). Thus, in case the actual operating condition differs from them, the following compensation calculation is required to obtain flow rate in such condition and then, tables are referred for size selection.

❑ Liquid measurement applicarions

$$Q_W = Q \times \sqrt{\frac{\rho\ (\rho_f - 1)}{(\rho_f - \rho)}}$$

Q_W : Conversion coefficient
Q : Density of liquid to be measured [g/cm^3]
ρ : Density of water [g/cm^3]
ρ_f : Density of float [g/cm^3] (Refer to Float density table below)

SUS 304,316	7.9	MA-B (Equivalent to Hastelloy C)	9.24
MA276 (Equivalent to Hastelloy C)	8.94	Titanium	4.5

Calculation example
Density of liquid 1.4g/cm^3
SUS316 float (7.9g/cm^3)
Full scale 1000 L/h

$$Q_W = 1000 \times \sqrt{\frac{\rho\ (\rho_f - 1)}{(\rho_f - \rho)}}$$
$$= 1000 \times \sqrt{\frac{1.4 \times (7.9 - 1)}{(7.9 - 1.4)}}$$
$$= 1000 \times 1.219 = 1219\ \text{L/h}$$

❑ Gas measurement application

$$Q_A = Q \times 0.0169 \times \sqrt{\frac{p\ (273 + t)}{0.1013 + p}}$$

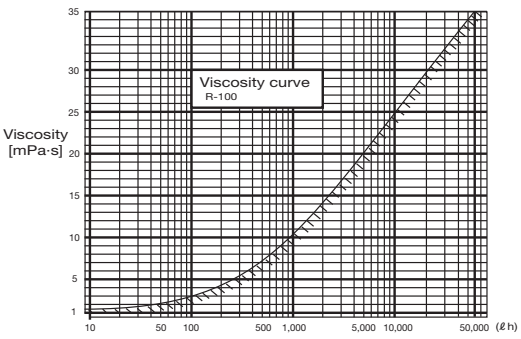
Q_A : Air converted flow rate [m^3/h (nor)]
Q : Flow rate of actual gas [m^3/h (nor)]
ρ : Density of actual gas [kg/m^3 (nor)]
p : Operating pressure [MPa]
t : Operating temperature [°C]

Calculation example
CO_2 gas 1.977kg/m^3 (nor), Op.press. 0.5MPa, Op.temp. 40° C,
Full scale 100m^3/h (nor)

$$Q_A = 100 \times 0.0169 \times \sqrt{\frac{1.977 \times (273 + 40)}{0.1013 + 0.5}}$$
$$= 100 \times 0.0169 \times 32.08$$
$$= 54.22\ \text{m}^3\text{/h (nor)}$$

LIMITATION OF FLUID VISCOSITY

Refer to the following figure in case of measurement of high viscosity liquid. If the viscosity of liquids is lower than the viscosity curve on the viscosity vs. flow rate graph below, flowmeters are manufactured as a standard procedure. The flow rate tables in this TECHNICAL GUIDANCE can be referred to only by density compensation. If the viscosity is above the curve, contact Tokyo Keiso for detailed investigation by our factory computer.



PROCESS CONNECTIONS FOR EACH SIZE

Meter size	JIS 10K Flange								
	10A	15A	20A	25A	40A	50A	65A	80A	100A
10	○	○	○	○					
15	○	○	○	○					
20	○	○	○	○					
25		○	○	○					
40			○	○	○				
50					○	○			
65						○	○		
80							○	○	
100								○	○

Meter size	JIS 5K Flange								
	10A	15A	20A	25A	40A	50A	65A	80A	100A
10	○	○	○	○					
15	○	○	○	○					
20		○	○	○					
25			○	○	○				
40			○*1	○*1	○	○			
50					○	○	○		
65						○	○		
80							○	○	
100									○

Meter size	Rc				
	1/4	3/8	1/2	3/4	1
10		○	○		
15			○	○	
20				○	○
25					○

*1 20A and 25A are not available for meter size 40mm (2).

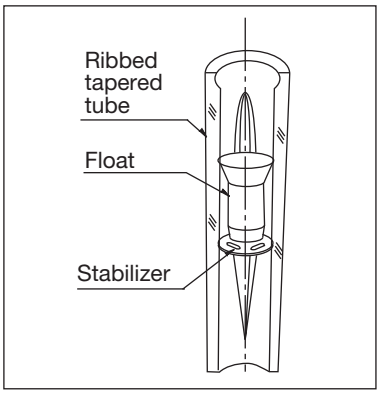
SPECIAL MATERIAL, CONSTRUCTION PRODUCTS

RIBBED TAPERED TUBE VERSION

❑ OUTLINE

Float is guided by rib construction inside of glass tapered tube. No float rod is provided and they are suitable for measurement of liquids with certain solids. Also, the distance from inner surface to float is stable and relatively close, and observation of float is easier than that of standard flat tapered tubes.

RIBBED TAPERED TUBE



❑ STANDARD SPECIFICATION

- Available size (Meter size) : 10, 15, 20, 25, 40(B), 40(A) and 50

Other specification is equal to that of STANDARD MATERIAL PRODUCTS.
Lined material also available.

❑ CAPACITY RATING

Meter size	Flow rate*	
	Water (L/h)	Air [m³/h (nor)]
10	60 to 150	0.9 to 1.7
15	390	5.8
20	950	15
25	1650	23
40 (B)	2500	Not available
40 (A)	4200	58
50	7500	115

* : Flow rates in the Water and Air columns are for stainless steel floats and aluminum floats, respectively.

POLYSULFON TAPERED TUBE VERSION (R-101-SU)

❑ OUTLINE

R-101-SU employs Polysulfone made tapered tube which is durable and suitable for strong alkalines such as caustic soda. This is very much suitable for caustic soda measurement application where glass tube is not suitable due to anti-corrosion capability against fluid. And also suitable for saturated brine lines.

❑ STANDARD SPECIFICATION

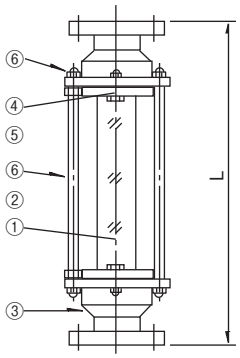
- Measuring fluid : Transparent liquids (Suitable for caustic soda and brine)
- Available size (Meter size) : 25, 40, 50 and 80
- Process connection : JIS10K flanges (Other flanged on request)
- Flow direction : Bottom to Top
- Fluid press. : Max. 0.5MPa
- Fluid temp. : Max. 100°C
- Indication Accuracy : ±3% F.S.

Material availability

No.	Parts name	Material
1	Tapered tube	Polysulfone
2	Float	PTFE, Titanium, Stainless steel, Others
3	Body	PP, PTFE lined, Stainless steel
4	Packing	EPDM, FPM
5	Packing follower	SUS304
6	Column	SS400 (SUS304)

Options : ① Normal flow rate indication pointer
② Optical alarm unit

❑ DIMENSION



Meter size	Dimension L (mm)	Mass (Approx.) kg
25	330	6
40	360	7
50	360	9
80	400	12

❑ CAPACITY RATING

Meter size	Water flow rate (m³/h)			Connection size
	Stainless steel, float	Titanium float	PTFE float	
25	0.7 to 1.25	0.6 to 1.1	0.5 to 0.95	20, 25, 40mm
40	4.5	4	3.5	25, 40, 50mm
50	9	8	7	40, 50, 65mm
80	24	24	15	65, 80, 100mm

R-105-RK and R-105-RKS PANEL MOUNT, FOR GASES

❑ OUTLINE

R-105-RK and R-105-RKS are panel mount type glass tube flowmeter for gas measurement and very much suitable for monitoring of injection gas flow rate into furnaces. Ribbed tapered tube is used for stable indication even for low pressure gas supply line. Also, the pressure drop is designed low to meet the requirement in such applications.

R-105-RK • R-105-RKS Basic Model Code

Series		Meter size	Connection size	Standard		Float material	Packing material		Alarm output		Pointer		Oil preventive treatment	Special item
R-105-RKS	-	A	A	R	-	A	N	-	0	-	0	-	0	0
												-	0: Not treated	0: w/o special item
													1: Treated	Z: w/special item
										-	With or without pointer		0: Not provided	
													1: With 1 point	
													2: With 2 points	
								-	Alarm output		O : With alarm			
											L : Lower limit alarm - 1 point			
											H : Upper limit alarm- 1 point			
											HL : Upper and lower limit alarm			
											LL : Lower limit alarm - 2 points			
											HH : Upper limit alarm - 2 points			
							Packing material	N : NBR						
								F : FPM						
								E : EPDM						
								Z : Others						
R-105-RK and R-105-RKS	-					Float material	A : Aluminum		Standard material: Aluminum					
							4 : SUS304							
							6 : SUS316							
							Z : Others							
				Standard	R : Rc		Rc connection is our standard. Corresponding with adapter (Male & Female) for other connection sizes							
					N : NPT									
					Z : Others									
			Connection size	A: 3/8		Same diameter as meter size is standard. Corresponding with accessories like adapter (male and female) in case of different connection size from meter size								
				B: 1/2										
				C: 3/4										
				D: 1										
				E: 1-1/2										
				F: 2										
		Meter size	A : 10	Materials Body : SCS14 (R-105-RKS) Aluminum (R-105-RK) Tapered tube : Heat-resistant glass with ribs										
			B : 15											
			C : 20											
			D : 25											
			E : 40											
			F : 50											

MATERIAL	Model code	
Parts name	R-105-RK	R-105-RKS
Body	Aluminum	SCS14
Tapered tube with ribs	Heat-resistant glass	
Float	Aluminum	
O-ring	NBR	
Cover	SPCC	
Fixtures	SPCC	
Cap	SUS304	

❑ STANDARD SPECIFICATION

- Measuring fluid : Gases such as air, nitrogen, propane and butane
- Available size (Meter size) : 10, 15, 20, 25, 40 and 50
- Installation : Panel mount
- Process connection : Rc
- Flow direction : Bottom rear to Top rear
- Fluid press : Max. 0.3MPa
- Fluid temp. range : 0 to 120°C
- Max. thermal shock : 80°C
- Indication accuracy : ±2% F.S. (A pointer indicating normal flow rate can be installed on request)
- Alarm contact : Available on request, 1 or 2 points
  - Contact: SPST, selfe-holding Reed switch
  - Setting accuracy: ±2% F.S. Adjustable (Against flow calibration)
  - Reset span: Max.15% F.S. (Against flow calibration)
  - Enclosure: Water tight
  - Wiring: Direct connection to reed wire
- Paint : Metallic silver

Capacity rating and approximate pressure drop for local indicator with aluminum float

Meter size	Flow rate {Air, m³/h(nor}	Pressure drop (kPa)
10	0.9 to 1.7	0.8
15	1.8 to 5.8	1.0
20	3.6 to 15	1.2
25	11 to 23	1.2
40	23 to 58	1.2
50	55 to 115	1.8

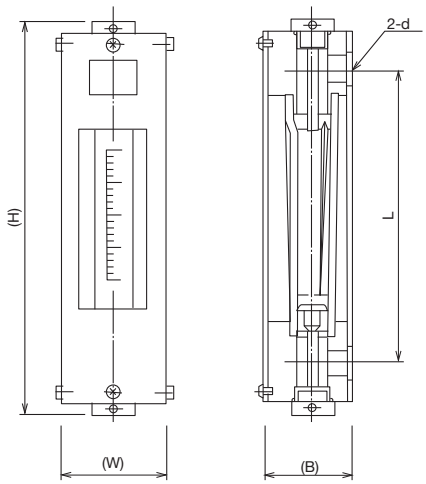
Capacity rating and approximate pressure drop for alarm type with aluminum float

Meter size	Flow rate {Air, m³/h (nor)}	Pressure drop (kPa)
10	Not available	
15	5 to 7.5	1.6
20	7.3 to 17	2.4
25	14 to 28	2.5
40	34 to 85	2.0
50	57 to 130	2.0

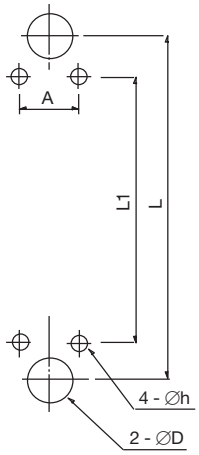
Full scale can be specified within the range of flow rates of each size shown in above table with the rangeability 10:1.

DIMENSION

Body



Panel cut



MODEL R-105-RK

Meter size	Dimension (mm)				Panel cut (mm)				Mass (approx.) kg
	(H)	(W)	(B)	L	D	h	A	L1	
10	452	53	50	380	20	6	24	350	2.2
15	462	73	65	390	25	6	40	370	3.5
20	476	83	75	400	31	8	40	360	4.5
25	558	93	85	460	38	8	45	430	6.5
40	616	103	95	490	53	10	50	435	8.5
50	670	143	135	520	65	10	60	440	16

MODEL R-105-RKS

Meter size	Dimension (mm)				Panel cut (mm)				Mass (approx.) kg
	(H)	(W)	(B)	L	D	h	A	L1	
10	446	38	47	380	20	8	20	320	1.8
15	446	48	54	380	25	8	30	320	2.2
20	468	53	62	390	31	8	30	320	2.8
25	548	63	67	460	38	10	30	380	4
40	600	73	82	480	53	10	40	380	7
50	620	83	97	490	65	10	40	380	9.2

OPTIONAL PARTS

❑ PROTECTION COVER

Transparent PVC and steel plate are ready to protect tapered tube. Specify if required.

❑ FLOW ADJUSTING VALVE

A valve for flow adjustment will be assembled onto flowmeter on request.

ORDERING INFORMATION

Notify the following for order/inqury

Model R-10☐ - ☐

Fluid name _____

Density _____

Viscosity _____

Press. _____

Temp. _____

Full scale _____

Connection size _____ ☐mm ☐inch

Connection rating ☐JIS10RF ☐Rc ☐ _____

Material ☐Cast iron ☐SUS304 ☐SUS316

☐Other special (_____)

Special instruction, 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.

1. Liquid services subject to impulse pressure in the process.
2. 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
3. Gas handling process where breakage of glass might result in gas leakage or scattering of glass fragments.
4. The installation places of the flowmeters where breakage of glass might be caused by the accidents from the surrounding piping or equipment.
5. 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.
6. Services where the heat shock by abrupt change of temperature is expected.

* Specification is subject to change without notice.

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