

### OUTLINE

VH series Wafer-Cone<sup>®</sup> differential pressure flowmeter and high precision differential pressure transmitter are integrated into one flowmeter. It can measure liquids, gases and saturated steam including all high temperature fluids. It serves flow measurement for wide range of application such as air conditioning pipe lines, water treatment facilities and various chemical plants.

### FEATURES

- Simple installation  
Wafer connection makes installation simple. Flowmeter body flanges designed to match the pipe flanges guide to the pipe center line.
- Short straight runs  
The required straight runs are less than 1/5 of those required for orifice and vortex flowmeters. The narrow installation space allows simple and flexible piping arrangement plan. It leads to space and cost saving.
- Low pressure loss  
A proper selection of  $\beta$  ratio allows lower pressure loss than orifice plate with the same flow rate. It improves energy efficiency of the plant.
- Wide rangeability  
Since the differential pressure created by the meter is stable at low flow rate, it can measure the flow rate in the range of the turn down ratio 14:1 to cover the wide flow range with one flowmeter. This flowmeter is best suited for the measurement of saturated steam line for air conditioning system whose flow rate is fluctuated at every change-over of cooling and heating.
- Wear and adhesion resistant  
V shape cone has durable structure against wear or adhesion. It can measure challenging slurry or flue-gas process lines that ordinary orifice could not deal with.
- No impulse piping work required  
Direct mounting of a compact differential transmitter requires no impulse piping to save installation cost.
- 3-way stopcock installed  
With only one-touch operation, a newly developed 3-way stopcock (Patent is pending) works better than three way manifold. This stopcock prevents mechanically such wrong operations as running off seal liquid in the impulse piping and over-pressurizing to the one side of differential transmitter which might occur with the traditional three way manifold.
- Indicator and highly functional transmitter combined  
The LCD indicator with backlight LED allows easy reading as LED indicator at dark place, even at night. The instantaneous flow rate and integrating flow quantity alternately are indicated manually or automatically. The transmitter transmits the totalizing flow pulse signal (Open collector signal) in addition to the 4 to 20mA output with 2-wire system.



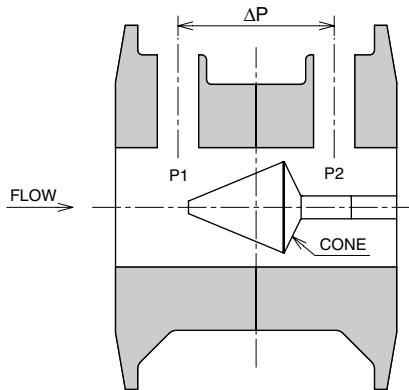
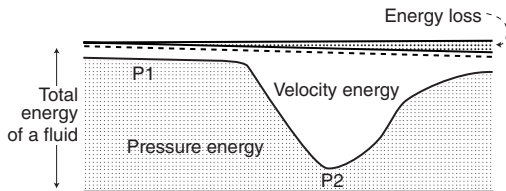
## MEASUREMENT PRINCIPLE

The principle of V-Cone flowmeter is the same as that of a common differential pressure type flowmeter, and it is based on the Bernoulli's theorem of the conservation of a fluid energy.

As shown in Fig.1, the pressure P1 at the approaching point to V-Cone decreases to P2 at the edge point with increasing fluid velocity by throttling the flow path along the contoured shape of V-Cone.

P1 and P2 are measured from the pressure taps and the difference of the two pressures is given as:

$$\Delta P = P1 - P2 \quad \Delta P \text{ is differential pressure output.}$$



[Fig 1]

## STANDARD SPECIFICATION

- Meter size 25, 40, 50, 65, 80, 100 mm  
1, 1-1/2, 2, 2-1/2, 3, 4 inch
- Connection Wafer type
- Rating JIS10K, 20K  
ANSI Class150, 300  
DIN PN16, 40  
GB PN1.6, 4.0
- Connection size Same as meter size
- Materials See Dimensions and Materials as described later.
- Measuring fluid Liquids, Gases, Saturated steam
- Fluid pressure and temperature

Fluids	Liquids	Gases	Saturated steam
Pressure	2 MPa or less	Less than 1 MPa	1.6 MPa or less
Temperature	Max.120°C	Max.120°C	Max.204.3°C

- Ambient temperature -20°C to 60°C
- Humidity 35% to 85% RH (No condensate, No freezing)
- Measuring range\*
  - Liquids: 0 to 10 m/s
  - Gases: 0 to 80 m/s
  - Saturated steam: 0 to 80 m/s
- \* Where low cut is set as 0%. As standard the low cut is set as 7%.
- Guaranteed accuracy range Max. Rangeability 14:1  
Depends on differential pressure range.
- Accuracy of the reading ±1.0 to 1.5% of Full Scale  
Depends on differential pressure range.
- Flow direction Horizontal (left to right or right to left)
- Power supply 24 V DC ±10%
- Wiring connection outlet Water-proof cable gland  
Applicable cable outer diameter 9 mm Ø to 14 mm Ø

● Required straight runs

[Measuring fluid : Liquids general, both Gases and Saturated steam with Reynolds No. < 200,000]

Type of joints	Upstream side	Downstream side
1 piece of 90° bend	0D	0D
2 pieces of 90° bend	0D	0D
T joint	0D	0D
Butterfly valve (Flow control valve)	3D	3D
Butterfly valve (Fully open)	3D	0D
Gate valve (Fully open)	0D	0D
Expander (Diameter 0.67D expands to 1D, length 2.5D)	1D	1D
Reducer (Diameter 3D reduces to 1D, length 3.5D)	1D	1D

[Measuring fluid :Both Gases and Saturated steam with Reynolds No. >200,000]

Type of joints	Upstream side	Downstream side
1 piece of 90° bend	1D	1D
2 pieces of 90° bend	1D	1D
T joint	1D	1D
Butterfly valve (Flow control valve)	10D	5D
Butterfly valve (Fully open)	5D	3D
Gate valve (Fully open)	1D	1D
Expander (Diameter 0.67D expands to 1D, length 2.5D)	2D	2D
Reducer (Diameter 3D reduces to 1D, length 3.5D)	1D	1D

[Notes]

- D shows the nominal size of Wafer-Cone flowmeter.
- The required straight runs are the distance from the flange faces of Wafer-Cone flowmeter.
- Add 1D to the above mentioned figures for the service  $\beta$  ratio is 0.65 or more.

● Indication

- Indication part 6 digits LCD (Character height 10mm) with LED backlight
- Instantaneous flow rate indication Max. 4 digits, indication range 0 to 3000
- Totalizing flow quantity indication Max. 6 digits, indication range 0 to 999999
- Indication cycle 500 msec.
- Filter Selectable from 0, 2, 4, 8, 16 sec.
- Indication change-over Selectable from instantaneous flow rate and totalizing flow quantity
- Change-over setting Manual or Automatic (1 to 10 sec. interval)

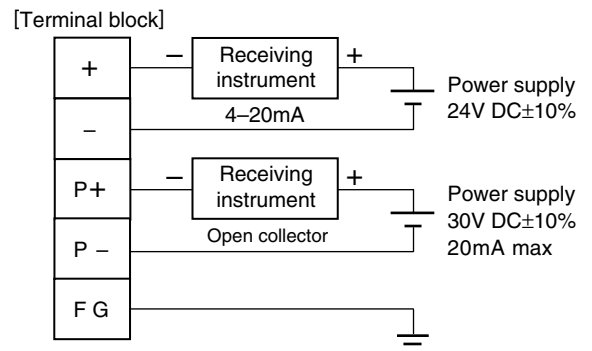
● Current output (to output instantaneous flow rate)

- Output signal 4–20mA DC (2 wire system)
- Maximum load Max. 500  $\Omega$
- Output accuracy  $\pm 0.5\%$  F.S. at 23°C
- Response 200ms with filter set as 0
- Resolution 0.1% Full Scale

● Pulse output (to synchronize with totalizing flow quantity)

- Output contact signal Open collector (independent common type)
- Maximum load Max. 30V DC, Max.20mA DC
- Pulse width 100 msec.
- Frequency 2Hz or less

CONNECTION DIAGRAM



SIZING

Based on a selected Wafer-Cone  $\beta$  ratio, the differential pressure at maximum flow range is determined by the meter size and fluid properties. The maximum differential pressure corresponds to the maximum flow range of indicator. The maximum differential pressure can be selected as required by designating a Wafer-Cone  $\beta$  ratio and a flow range if meter size and fluid properties are given.

The Wafer-Cone® sizing program presents a solution to meet your requirements such as low pressure loss measurement or more precise flow measurement.

Please contact TOKYO KEISO for further information of the Wafer-Cone® sizing program.

## MAXIMUM FLOW RANGE

● Maximum flow range when measuring 20°C water

Meter size /connection size			Maximum flow rate [m³/h]	
25A	1"	DN25	Min.	(5.51)
			Max.	(7.50)
40A	1-1/2"	DN40	Min.	(8.62)
			Max.	19.03
50A	2"	DN50	Min.	(11.24)
			Max.	31.10
65A	2-1/2"	DN65	Min.	(13.42)
			Max.	42.64
80A	3"	DN80	Min.	(16.71)
			Max.	68.79
100A	4"	DN100	Min.	(22.15)
			Max.	119.73

· The accuracy is guaranteed up to the maximum flow rate in the list at the written size and fluid pressure. The minimum flow rate at which the accuracy is guaranteed is 1/14 or 1/10 of the maximum flow rate. The maximum flow rate in parenthesis in the list guarantees the accuracy within 1:10 of the maximum flow rate.

· You can find following calculation results by using the Wafer-Cone® sizing program: Fluids other than ones in the list, Flow range at operating conditions, Maximum differential pressure, Permanent pressure loss

· When pressure and temperature compensation is required for gas measurement and saturated steam, calculate maximum flow rate using the Wafer-Cone® sizing program.

● Maximum flow range when measuring 0°C air with gage pressure

Meter size /connection size			Maximum flow rate [m³/h (nor)]											
			Fluid pressure [MPa]	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	0.99
25A	1"	DN25	Min.	(77)	108	108	108	108	108	108	108	108	108	108
			Max.	(99)	198	296	381	430	475	515	553	588	621	649
40A	1-1/2"	DN40	Min.	(120)	168	168	168	181	169	168	178	189	200	208
			Max.	252	502	753	969	1094	1206	1309	1404	1493	1578	1650
50A	2"	DN50	Min.	(155)	217	217	217	230	252	272	291	309	326	340
			Max.	412	821	1231	1585	1788	1971	2139	2295	2441	2579	2697
65A	2-1/2"	DN65	Min.	(186)	261	260	301	337	369	399	427	453	478	499
			Max.	565	1126	1688	2173	2452	2703	2933	3147	3347	3536	3698
80A	3"	DN80	Min.	(232)	328	403	466	522	572	619	662	702	740	773
			Max.	912	1818	2724	3505	3956	4361	4732	5077	5400	5705	5966
100A	4"	DN100	Min.	(308)	570	701	811	908	996	1076	1151	1222	1288	1346
			Max.	1587	3164	4742	6102	6886	7591	8238	8837	9400	9930	10385

● Maximum flow range when measuring saturated steam with gage pressure

Meter size /connection size			Maximum flow rate [kg/h]											
			Fluid pressure [MPa]	0.1	0.2	0.3	0.4	0.5	0.6	0.8	1.0	1.2	1.4	1.6
			Density [kg/m³]	1.136	1.658	2.170	2.676	3.176	3.674	4.662	5.644	6.623	7.602	8.581
25A	1"	DN25	Min.	103	107	110	112	114	116	120	122	126	127	128
			Max.	151	250	329	369	404	437	496	548	595	639	680
40A	1-1/2"	DN40	Min.	161	167	172	176	187	202	228	251	272	292	310
			Max.	384	635	836	937	1028	1112	1261	1393	1513	1625	1729
50A	2"	DN50	Min.	223	219	252	280	306	330	372	410	444	476	506
			Max.	628	1027	1351	1515	1662	1798	2038	2252	2446	2626	2794
65A	2-1/2"	DN65	Min.	263	321	369	411	449	484	546	601	652	699	743
			Max.	862	1359	1788	2005	2199	2379	2697	2979	3237	3475	3698
80A	3"	DN80	Min.	407	497	572	637	695	749	846	932	1010	1083	1151
			Max.	1391	2231	2935	3292	3611	3905	4428	4892	5314	5705	6071
100A	4"	DN100	Min.	708	865	995	1108	1210	1304	1472	1621	1758	1884	2003
			Max.	2421	3952	5199	5831	6396	6918	7843	8665	9413	10106	10754

## MODEL CODES

MODEL CODES								CONTENTS		
VNT	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
Materials of detector	1							SCS14A/SUS316		
Meter size /Connection size	3							25A	1"	DN25
	4							40A	1-1/2"	DN40
	5							50A	2"	DN50
	6							65A	2-1/2"	DN65
	7							80A	3"	DN80
	8							100A	4"	DN100
Connection rating	J1							JIS10K		
	J2							JIS20K		
	A2							ANSI Class 150		
	A5							ANSI Class 300		
	G1							GB PN1.6		
	G4							GB PN4.0		
	D1							DIN PN16		
	D4							DIN PN40		
V-Cone β ratio				-45				0.45		
				-50				0.50		
				-55				0.55		
				-60				0.60		
				-65				0.65		
				-70				0.70		
				-75				0.75		
				-80				0.80		
Flow direction				-6				Left to right		
				-7				Right to left		
Differential pressure range of indicator						05		5kPa		
						10		10kPa		
						20		20kPa		
Measuring fluids							L	Liquids		
							G	Gases		
							S	Saturated steam		

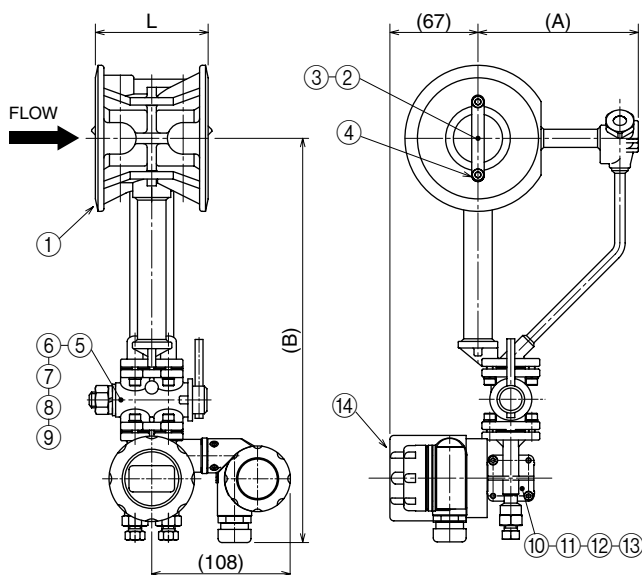
## STUD BOLT SIZE

Following size of stud bolts for the mounting are recommended.

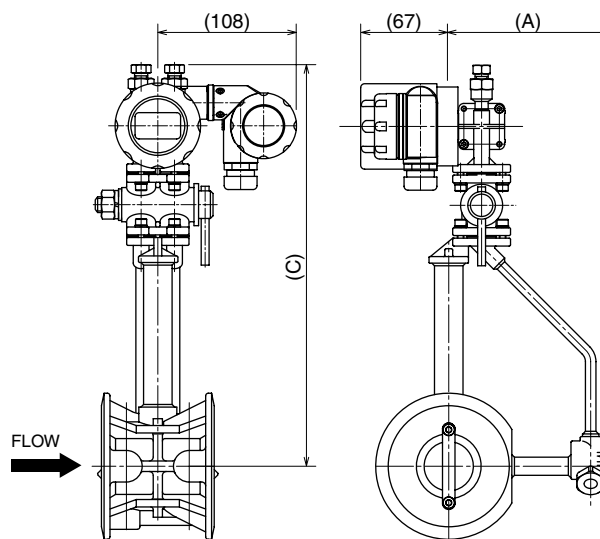
Connection rating Meter size			JIS		ANSI		DIN		GB	
			10K (mm)	20K (mm)	Class150 (inch)	Class300 (inch)	PN16 (mm)	PN40 (mm)	PN1.6 (mm)	PN4.0 (mm)
25A	1"	DN25	M16×130	M16×140	1/2×5	5/8×5-1/4	M12×130	M12×130	M12×130	M12×130
40A	1-1/2"	DN40	M16×160	M16×160	1/2×6	3/4×6-3/4	M16×160	M16×160	M16×160	M16×160
50A	2"	DN50	M16×170	M16×170	1/2×6-1/2	5/8×6-3/4	M16×170	M16×170	M16×170	M16×170
65A	2-1/2"	DN65	M16×190	M16×190	5/8×7-1/2	3/4×8	M16×190	M16×190	M16×190	M16×190
80A	3"	DN80	M16×210	M20×220	5/8×8-1/4	3/4×9	M16×210	M16×220	M16×210	M16×220
100A	4"	DN100	M16×240	M20×260	5/8×9-1/2	3/4×10-1/2	M16×240	M20×260	M16×240	M20×260

## DIMENSIONS

● For liquids and saturated steam



● For gases



● Materials

Part No	Part name	Materials
1	Detector	Body
2		Cone
3		Support
4		Fastening bolts
5	3way stopcock	Body
6		Cock axis
7		Gland
8		Packing
9		O-ring
10	Indication part	Diaphragm
11		Body
12		O-ring
13		Drain plug
14	Indicator housing	ADC12

● Dimension list

Meter size (mm)	L (mm)	A (mm)	B (mm)	C (mm)	Weight (kg)
25	57	107	283	281	3.0
40	76	117	291	289	4.0
50	86	122	307	305	4.5
65	102	134	314	312	6.5
80	121	149	333	331	8.5
100	152	167	348	346	14

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\* Specification is subject to change without notice.

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