

Outline

VNT series Wafer-Cone® integrate VH Wafer-Cone® differential pressure flowmeter and high precision differential indicator. 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 guides 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 β ratio allows lower pressure loss than orifice plate with the same flow rate. It improves energy efficiency of the plant.
- Wide range-ability**
 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 connecting tube work required**
 The connecting tube work was required for the installation of the existing differential pressure flowmeter, but a compact differential transmitter has been directly mounted, resulting in saving the 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 back light 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.
- Available in all directions**
 Vertical type has been added to the line-up, namely Bottom to Top, Top to Bottom, Left to Right, & Right to Left.

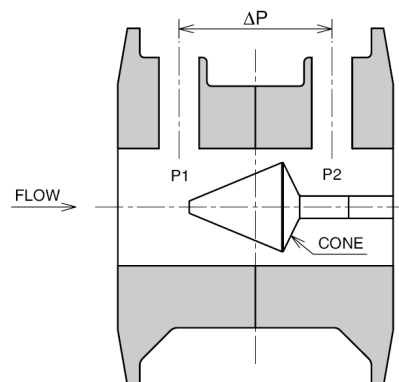
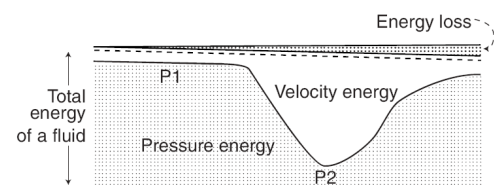


Measuring Principle

The principle of Wafer-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:

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

$$Q = K \sqrt{\Delta P}$$



[Fig 1]

VNT series integral type Wafer-Cone® Differential pressure flowmeter

Standard Specification

- Meter Size 25, 40, 50, 65, 80, 100 mm
- Connection Wafer type
- Rating JIS10/20K, ANSI Class 150/300
- Connection Size 25A (1"), 40A (1-1/2"), 50A (2"), 65A (2-1/2"), 80A (3"), 100A (4")
- Materials See Dimensions and Materials as described later
- Measuring fluids Liquids, Gases and 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)
- Protection class IP65 (JIS C 0920 Jet-proof type)
(When connection the compatible cable.)
- 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. Range-ability 14:1
Depends on differential pressure range.
- Accuracy of the reading ±1.5 to 2.5% of Full Scale
Depends on differential pressure range.
- *According to the flow calibration standard by Tokyo Keiso Thailand
- Flow direction Horizontal: Left to Right, Right to Left
Vertical: Bottom to Top, Top to Bottom
- Power Supply 24 VDC ±10%
- Wiring connection outlet Water-proof cable gland
Applicable cable outer diameter 9mmΦ to 14mmΦ

Required straight runs

| Measuring Fluid | Liquids general, Gases and Steam Re No < 200,000 | | Gases and Steam Re No > 200,000 | |
|--|--|------------------|---------------------------------|------------------|
| | Up-stream side | Down-stream side | Up-stream side | Down-stream side |
| 1 piece of 90° bend | 0D | 0D | 1D | 1D |
| 2 pieces of 90° bend | 0D | 0D | 1D | 1D |
| T joint | 0D | 0D | 1D | 1D |
| Butterfly valve (Flow control valve) | 3D | 3D | 10D | 5D |
| Butterfly valve (Fully open) | 3D | 0D | 5D | 3D |
| Gate valve (Fully open) | 0D | 0D | 1D | 1D |
| Expander (Diameter 0.67D expands to 1D, length 2.5D) | 1D | 1D | 2D | 2D |
| Reducer (Diameter 3D reduces to 1D, length 3.5D) | 1D | 1D | 1D | 1D |

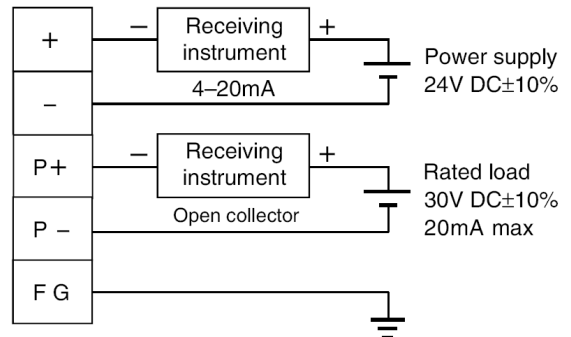
[Notes]

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 β 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
 - (Corresponding by decimal point flashing display up to six times of overflow.)
 - Indication cycle 500ms
 - 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)
 - Maximum load Max. 500 Ω
 - Output accuracy ±0.5% F.S. at 23°C (for the indicated value of instantaneous flow)
 - 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
 - Frequency 2Hz or less

Connection Diagram

[Terminal block]



Sizing

The differential pressure at the maximum flow is determined by the meter size, fluid properties and arbitrary drawing ratio (β ratio), and the differential pressure range of indicator is determined. The sizing can be easily made by the exclusive sizing program of Wafer-Cone®. Concerning the low pressure loss and high-accuracy specification etc., the product specification can be decided according to the application. Contact Tokyo Keiso Thailand for the details about Wafer-Cone® sizing program. Further, referring to the maximum flow range on the flowing age, it is the typical one which has been calculated, considering the range-ability as 14:1 or 10:1 in the guaranteed accuracy range. Depending on the operating conditions, the production can be made even if it is out of the range. It is recommended that the sizing program of Wafer-Cone® will be referred.

TG PVNT series integral type Wafer-Cone® Differential pressure flowmeter

Maximum Flow Range

- Maximum flow range when measuring 20°C water

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

- Maximum Flow Rate when measuring 0°C air with gage pressure

| Meter size /connection size | Fluid Pressure [MPa] | Maximum flow rate [m³/h(nor)] | | | | | | | | | | | |
|-----------------------------|----------------------|-------------------------------|------|------|------|------|------|------|------|------|------|-------|-----|
| | | 0.0 | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | 0.99 | |
| 25A (1") | Min. | (77) | 108 | 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") | 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") | 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") | 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") | Min. | (232) | 328 | 403 | 466 | 522 | 572 | 619 | 662 | 702 | 740 | 773 | |
| | Max. | 912 | 912 | 2424 | 3505 | 3956 | 4361 | 4732 | 5077 | 5400 | 5705 | 5966 | |
| 100A (4") | Min. | (308) | 308 | 701 | 811 | 908 | 996 | 1076 | 1151 | 1222 | 1288 | 1346 | |
| | Max. | 1587 | 1587 | 4742 | 6102 | 6886 | 7591 | 8238 | 8837 | 9400 | 9930 | 10385 | |

- Maximum Flow Rate when measuring saturated steam with gage pressure

| Meter size /connection size | Fluid Pressure [MPa] | Maximum flow rate [kg/h] | | | | | | | | | | |
|-----------------------------|----------------------|--------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| | | 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 |
| 25A (1") | 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") | Min. | 161 | 167 | 172 | 176 | 187 | 202 | 228 | 251 | 272 | 292 | 310 |
| | Max. | 384 | 635 | 836 | 937 | 1028 | 1112 | 1261 | 1393 | 1513 | 1625 | 1726 |
| 50A (2") | 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") | 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") | Min. | 407 | 497 | 572 | 637 | 695 | 749 | 846 | 935 | 1010 | 1083 | 1151 |
| | Max. | 1391 | 2231 | 2935 | 3292 | 3611 | 3905 | 4428 | 4892 | 5314 | 5705 | 6071 |
| 100A (4") | Min. | 708 | 865 | 995 | 1108 | 1210 | 304 | 1472 | 1621 | 1758 | 1884 | 2003 |
| | Max. | 2421 | 3952 | 5199 | 5831 | 6396 | 6918 | 7843 | 8665 | 9413 | 10106 | 10754 |

Model Code

| Model Code | | | | | | | Description | |
|--|---|---|----|-----|----|-----|-------------|-----------------|
| VNT | 1 | 3 | J1 | -45 | -1 | 10 | L | (Example) |
| Material | 1 | | | | | | | SCS14A/SUS316 |
| Meter size /Connection size | | 3 | | | | | | 25A (1") |
| | | 4 | | | | | | 40A (1-1/2") |
| | | 5 | | | | | | 50A (2") |
| | | 6 | | | | | | 65A (2-1/2") |
| | | 7 | | | | | | 80A (3") |
| | | 8 | | | | | | 100A (4") |
| Connection rating | | | J1 | | | | | JIS10K |
| | | | J2 | | | | | JIS20K |
| | | | A2 | | | | | ANSI Class 150 |
| | | | A5 | | | | | ANSI Class 300 |
| | | | Z | | | | | Other |
| 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 | | | | | -1 | | | Bottom to Top |
| | | | | | -6 | | | Left to Right |
| | | | | | -7 | | | Right to Left |
| | | | | | -8 | | | Top to Bottom |
| Differential pressure range of indicator | | | | | | -05 | | 5kPa |
| | | | | | | -10 | | 10kPa |
| | | | | | | -20 | | 20kPa |
| Measuring fluids | | | | | | | L | Liquids |
| | | | | | | | G | Gases |
| | | | | | | | S | Saturated steam |

The flow as described in each table is the maximum value of guaranteed accuracy in each diameter and each pressure. The minimum flow rate of guaranteed accuracy flow range is 1/14 or 1/10 of the maximum setup flow.

Note: Guaranteed accuracy range of maximum flow is 10:1.

<Example>

| Maximum flow [m³/h] | Flow range of guaranteed accuracy [m³/h] |
|---------------------|--|
| Minimum (13.42) | 1.3242 to 13.42 |
| Maximum 42.64 | 3.046 to 42.64 |

When requiring, by calculation, the flow range or the maximum differential pressure, the value for permanent pressure loss for other fluids or under other operating conditions than described in each table, the calculation is to be made in accordance with the exclusive sizing program of Wafer-Cone®.

Stud Bolt Size

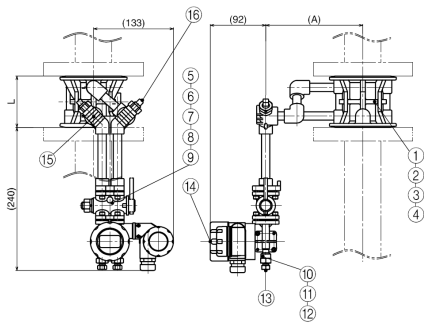
Following sizes of stud bolts for the mounting are recommended.

| Connection rating | JIS | | ANSI | |
|-------------------|-----------|-----------|------------------|------------------|
| | 10K (mm) | 20K (mm) | Class 150 (inch) | Class 300 (inch) |
| 25A (1") | M16 x 130 | M16 x 140 | 1/2 x 5 | 5/8 x 5-1/4 |
| 40A (1-1/2") | M16 x 160 | M16 x 160 | 1/2 x 6 | 3/4 x 6-3/4 |
| 50A (2") | M16 x 170 | M16 x 170 | 1/2 x 6-1/2 | 5/8 x 6-3/4 |
| 65A (2-1/2") | M16 x 190 | M16 x 190 | 5/8 x 7-1/2 | 3/4 x 8 |
| 80A (3") | M16 x 210 | M20 x 220 | 5/8 x 8-1/4 | 3/4 x 9 |
| 100A (4") | M16 x 240 | M20 x 260 | 5/8 x 9-1/2 | 3/4 x 10-1/2 |

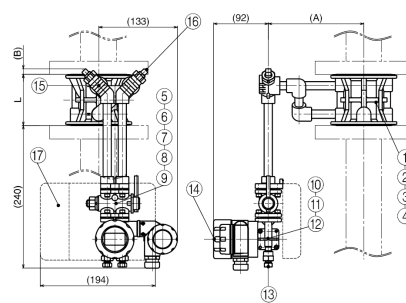
VNT series integral type Wafer-Cone® Differential pressure flowmeter

Dimensions and Material

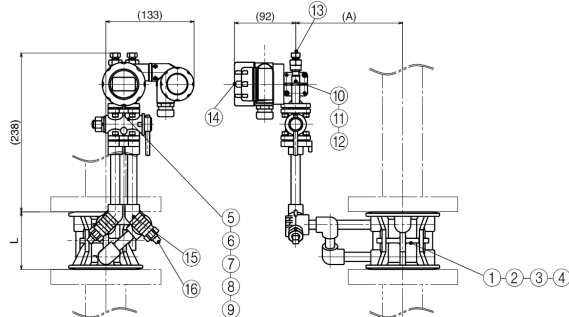
Vertical Type For Liquids



Vertical Type For Saturated Steam



Vertical Type For Gases

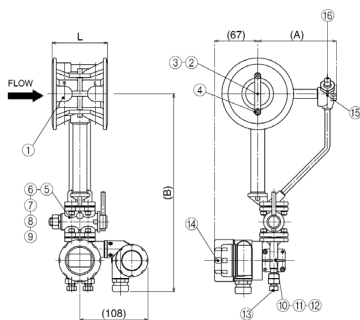


Dimensions (Vertical Type)

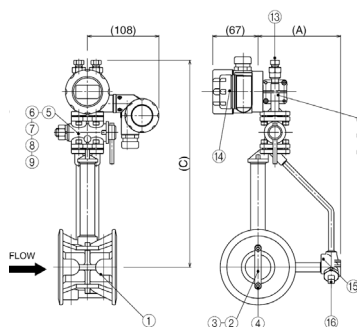
| Meter size (mm) | L (mm) | A (mm) | B (mm) | Weight (kg) |
|-----------------|--------|--------|--------|-------------|
| 25 | 57 | 140 | 16 | 3.5 |
| 40 | 76 | 156 | 12 | 4.5 |
| 50 | 86 | 161 | 10 | 5.0 |
| 65 | 102 | 173 | 8 | 7.0 |
| 80 | 121 | 183 | 3 | 9.0 |
| 100 | 152 | 206 | 0 | 14.5 |

- When attaching two or more sets to adjacent piping, secure the following piping pitch.
 Meter Size: 65mm or less : 250mm or more
 Meter Size: 80mm or less : 300mm or more

Horizontal Type For Liquids



Horizontal Type For Gases



Dimensions (Horizontal Type)

| 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 |

- When attaching two or more sets to adjacent piping, secure the following piping pitch.
 Meter Size: 65mm or less : 250mm or more
 Meter Size: 80mm or less : 300mm or more

Material List (Vertical / Horizontal Type)

| Item | Part name | Material | Item | Part name | Material |
|------|-----------------|-----------------|------|--|----------------------|
| 1 | Detector | Body | 10 | Diaphragm | SUS316L |
| 2 | | Cone | 11 | Body | SUS316/ SCS14A |
| 3 | | Support | 12 | O-ring | Fluoro-rubber |
| 4 | | Fastening bolts | 13 | Drain plug | SUS316 |
| 5 | 3-way Stop cock | Body | 14 | Housing | ADC12 |
| 6 | | Cock axis | 15 | Y-shaped fitting | SCS14A |
| 7 | | Gland | 16 | Drain plug | SUS316 |
| 8 | | Packing | 17 | <Vertical type only> Heat insulating plate (Accessory) | SUS304/Asbestos-free |
| 9 | O-ring | Fluoro-rubber | | | |

Item No. 17: The heat insulating plate is applicable only to the saturated steam.

- Wafer-Cone® is registered trademarks of McCROMETER, Inc.
- Specification is subject to change without notice.

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