



Daehan Instruments

Product Catalog — Differential-pressure flow meters · Temperature sensors · Accessories

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VENTURI · NOZZLE

Flow Nozzle

Flow Nozzle (ISO 5167 Long Radius)

MODEL : DHON-BW / DHON-HR / DHON-FL



DHON-BW

DHON-HR

DHON-FL

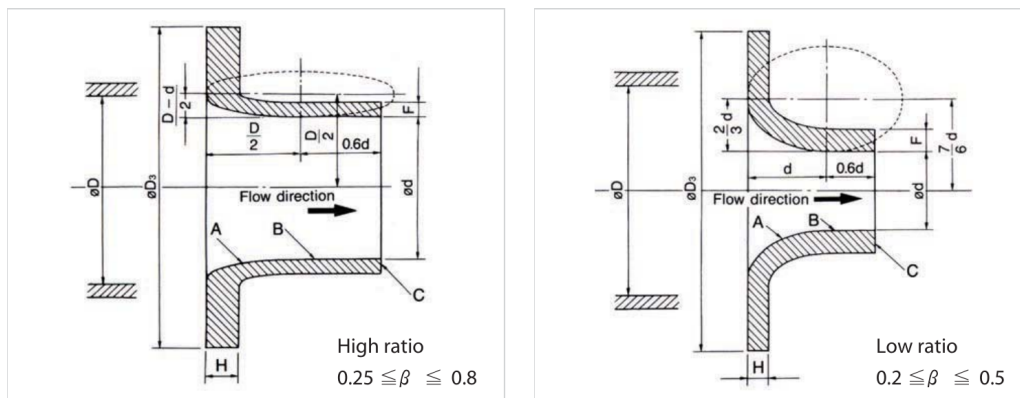
Although a flow nozzle costs more than an orifice because of its construction, it is suitable for measuring the flow of fluids at high temperature and high pressure.

Under the same measuring conditions, a flow nozzle has higher mechanical strength, can pass more than 60% more flow than an orifice of the same bore, and measures fluids containing solid particles with less disturbance than an orifice. It is therefore also suitable for high-velocity fluids.

Supplied not only as a nozzle alone but also as a meter run with short pipe sections welded on both the upstream and downstream sides.

2B ~ 24B (50A ~ 600A) β 0.2 ~ 0.8 Accuracy $\pm 2.0\%$ 1D - 1/2D taps

Measurement principle



Long radius nozzle

Long radius nozzle shape — High ratio ($0.25 \leq \beta \leq 0.8$) · Low ratio ($0.2 \leq \beta \leq 0.5$)

The long radius nozzle consists of an elliptical (quarter-ellipse) convergent section and a cylindrical throat of length $0.6d$, with differential pressure sensed at taps located $1D$ upstream and $1/2D$ downstream ($1D$ - $1/2D$ taps).

Depending on β ($= d/D$), nozzles are classified as high ratio ($0.25 \leq \beta \leq 0.8$) or low ratio ($0.2 \leq \beta \leq 0.5$), and their shapes differ.

Types · model configuration



FIG 1 · DHON-BW

Cutaway rendering for illustration

Weld-in type — nozzle welded directly into the pipe, cutaway image

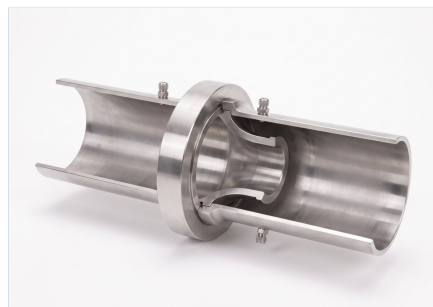


FIG 2 · DHON-HR

Cutaway rendering for illustration

Holding-ring type — nozzle held by a ring inside the meter run, cutaway image



FIG 3 · DHON-FL

Cutaway rendering for illustration

Flange type — nozzle clamped between flanges, cutaway image

The three images are cutaway renderings with the pipe cut lengthwise to show the installation method; the actual products are closed pipe / meter-run sections.

Item	DHON-BW Weld-in type (Weld in)	DHON-HR Holding ring type (Holding Ring)	DHON-FL Flanged type
Features	Butt welding mounting type (Weld in type, FIG 1)	Holding ring mounting type (Holding Ring type, FIG 2)	Flange mounting type (Flange type, FIG 3)
Turndown	6:1	6:1	6:1
Materials	Carbon Steel, STS304, STS316, Inconel, Monel, Hastelloy	Carbon Steel, STS304, STS316, Inconel, Monel, Hastelloy	Carbon Steel, STS304, STS316, Inconel, Monel, Hastelloy
Connection	Butt Weld	Butt Weld	Flange 150#, 300#, 600#, 900#, 1500#, 2500#
Applicable piping	2B ~ 24B (50A ~ 600A) Pipe	2B ~ 24B (50A ~ 600A) Pipe	2B ~ 24B (50A ~ 600A) Pipe
Standards	ISO5167-3	ISO5167-3	ISO5167-3
Accuracy	±2.0%	±2.0%	±2.0%

Technical Specifications

Item	Value
Accuracy	±2.0%
Turndown	6:1
Mounting type	ISO 5167 Long Radius — Weld in type (FIG 1) · Holding Ring type (FIG 2) · Flange type (FIG 3)
Flow calculation standard	ISO5167, JIS Z 8762, ASME, KS A 0612
Pressure taps	1D - 1/2D taps
Applicable pipe sizes	2 to 24B (50A to 600A)
β range	$0.2 \leq \beta \leq 0.8$ — Low beta long radius nozzle $0.2 \leq \beta \leq 0.5$ · High beta long radius nozzle $0.25 \leq \beta \leq 0.8$
Nozzle material	Carbon Steel · 304SS, 304L SS, 316SS, 316L SS · Ni, Cr, Mo Alloy Steel (A182 F11 to 91)
Meter run material	A53 Gr B · A106 Gr B · A335 P11 · A335 P22 · A335 P51 · A335 P91
Flange rating	150#, 300#, 600#, 900#, 1500#, 2500# (DHON-FL)
DP tap connection	NPT 1/2 · NPT 3/4 · SW 1/2 · SW 3/4
Holding ring type meter run	Upstream 4D (MIN.) · downstream 2D (MIN.) · reducer angle 30° Max · splice weld required to maintain the minimum downstream length per A.S.M.E. Fluid Meters
Weld-in type note	For sizes under 3", the downstream connection weld may overlap the nozzle/pipe weld

Standards · ISO 5167-3 · ISO 5167 · JIS Z 8762 · ASME · KS A 0612

Installation requirements

- The taps are located 1D upstream and 1/2D downstream of the upstream face of the nozzle (1D-1/2D taps).
- The holding ring type (DHON-HR) is manufactured as a meter run including at least 4D upstream and 2D downstream of straight pipe, with a connecting reducer angle of 30° or less.
- For weld-in type (DHON-BW) sizes under 3", the downstream connection weld may overlap the nozzle/pipe weld.
- Whether a meter run is included is specified by the ordering code Meter Run (N: nozzle only / Y: meter run included).

Ordering information (How to Order)

1 Model (DHON-)
BW Weld in type
HR Holding Ring type
FL Flange type

2 Meter Run
N Element Only (nozzle only)
Y Meter run Include (meter run included)

3 Nominal Pipe Size
Pipe size in inch or mm (nominal pipe size, inch or mm)

4 Nozzle Material
A1 A105
4S A182 F304
4L A182 F304L
6S A182 F316
6L A182 F316L
11 A182 F11
22 A182 F22
51 A182 F51
91 A182 F91
OP Option

5 Meter Run Material
A5 A 53 Gr B
10 A 106 Gr B
P1 A 335 P11
P2 A 335 P22
P5 A 335 P51
P9 A 335 P91
00 Option

6 Diff' Taps
1 NPT 1/2
2 NPT 3/4
3 SW 1/2
4 SW 3/4

7 Flange Type
000 Flange Rating (specify flange rating)

8 Option
Options (by separate agreement)

VENTURI · NOZZLE

Venturi Nozzle

Venturi Nozzle

MODEL : DHOV-N-TM / DHOV-N-TF / DHOV-N-BW / DHOV-N-FL



DHOV-N-TM

DHOV-N-TF

DHOV-N-BW

DHOV-N-FL

The venturi nozzle is axisymmetric in profile and consists of a convergent section with a rounded profile, a cylindrical throat (throat) and a divergent section. The upstream face is identical to the ISA 1932 nozzle. The throat consists of a section E of length $0.3d$, the same as the ISA 1932 nozzle, and a section E' of length $0.4d \sim 0.45d$.

The throat diameter d is the mean of at least four diameter measurements distributed at approximately equal angles in axial planes. The throat must be cylindrical, and no diameter in any cross-section may deviate from the mean diameter by more than 0.05%. The divergent section joins section E of the throat without rounding, but burrs (burr) are removed.

The included angle Φ of the divergent section is 30° or less, and the venturi nozzle may be truncated (truncate) in the same way as the classical venturi tube.

0.5B ~ 120B (15A ~ 3000A) ANSI 150 ~ 1500LB Accuracy $\pm 2.0\%$ ISO 5167-3

Measurement principle

The venturi nozzle consists of a convergent section with a rounded profile (upstream face identical to the ISA 1932 nozzle) → a cylindrical throat (E: $0.3d$, E': $0.4d \sim 0.45d$) → a divergent section with an included angle of 30° or less.

Flow is obtained from the differential pressure between the high pressure upstream of the convergent section and the low pressure at the throat; because pressure is recovered in the divergent section, the permanent pressure loss is smaller than that of a plain nozzle of the same β .

Types · model configuration

Item	DHOV-N-TM Male threaded connection	DHOV-N-TF Female threaded connection	DHOV-N-BW Butt weld connection	DHOV-N-FL Flanged connection
Features	Male screw mounting type (Threaded type, FIG 5)	Female screw mounting type (Threaded type, FIG 5)	Butt welding mounting type (Butt weld type, FIG 6)	Flange mounting type (Flanged type, FIG 7)
Turndown	6:1	6:1	6:1	6:1
Materials	Carbon Steel, STS304, STS316, Inconel, Monel, Hastelloy	Carbon Steel, STS304, STS316, Inconel, Monel, Hastelloy	Carbon Steel, STS304, STS316, Inconel, Monel, Hastelloy	Carbon Steel, STS304, STS316, Inconel, Monel, Hastelloy
Connection	Screw 1/2B ~ 2B (15A ~ 50A)	Screw 1/2B ~ 2B (15A ~ 50A)	Butt Weld	Flange 150#, 300#, 600#, 900#, 1500#, 2500#
Applicable piping	1/2B ~ 2B (15A ~ 50A) Pipe	1/2B ~ 2B (15A ~ 50A) Pipe	2B ~ 120B (50A ~ 3000A) Pipe	2B ~ 120B (50A ~ 3000A) Pipe
Standards	ISO5167-3	ISO5167-3	ISO5167-3	ISO5167-3
Accuracy	$\pm 2.0\%$	$\pm 2.0\%$	$\pm 2.0\%$	$\pm 2.0\%$

Technical Specifications

Item	Value
Accuracy	$\pm 2.0\%$

Item	Value
Turndown	6:1
Connection type	Threaded type (FIG 5) · Butt weld type (FIG 6) · Flanged type (FIG 7)
Flow calculation standard	ISO5167, JIS Z 8762, ASME, KS A 0612
Flange rating	ANSI 150, 300, 600, 900, 1500LB
Applicable pipe sizes	0.5 to 120B (15A to 3000A)
Materials	Carbon Steel · 304SS, 304L SS, 316SS, 316L SS · Ni, Cr, Mo Alloy Steel (A182 F11 to 91)
Profile	Upstream face identical to the ISA 1932 nozzle · throat E 0.3d + E' 0.4d ~ 0.45d · throat diameter deviation ≤ 0.05% · divergent section included angle $\Phi \leq 30^{\circ}$ · may be truncated (truncate)
DP tap connection	NPT 1/4 · NPT 1/2 · NPT 3/4 · SW 1/2 · SW 3/4

Standards · ISO 5167-3 · ISO 5167 · JIS Z 8762 · ASME · KS A 0612

Dimensions · drawings

Unit: mm. Actual manufacturing dimensions are based on the approved drawing.

Venturi nozzle required straight run (multiples of D)

β	2. Single 90° bend or tee (flow from one branch only)	3. Two or more 90° bends in the same plane	4. Two or more 90° bends in different planes	5. Reducer 2D to D over 2 length of 1.5D to 3D	6. Expander 0.5D to D over a length of D to 2D	7. Globe valve full open	8. Full bore ball or gate valve fully open	9. Abrupt symmetrical reduction (diameter ratio ≥ 0.5)	10. Thermometer pocket or well ($\leq 0.03D$)	11. Thermometer pocket or well (0.03D ~ 0.13D)	12. Downstream fittings (columns 2 to 8)
0.20	10 (6)	14 (7)	34 (17)	5	16 (8)	18 (9)	12 (6)				4 (2)
0.25	10 (6)	14 (7)	34 (17)	5	16 (8)	18 (9)	12 (6)				4 (2)
0.30	10 (6)	16 (8)	34 (17)	5	16 (8)	18 (9)	12 (6)				5 (2.5)
0.35	12 (6)	16 (8)	36 (18)	5	16 (8)	18 (9)	12 (6)				5 (2.5)
0.40	14 (7)	18 (9)	36 (18)	5	16 (8)	20 (10)	12 (6)				6 (3)
0.45	14 (7)	18 (9)	38 (17)	5	17 (9)	20 (10)	12 (6)				6 (3)
0.50	14 (7)	20 (10)	40 (20)	6 (5)	18 (9)	22 (11)	12 (6)	30 (15)	5 (3)	20 (10)	6 (3)
0.55	16 (8)	22 (11)	44 (22)	8 (5)	20 (10)	24 (12)	14 (7)				6 (3)
0.60	18 (9)	26 (13)	48 (24)	9 (5)	22 (11)	26 (13)	14 (7)				7 (3.5)
0.65	22 (11)	32 (16)	54 (27)	11 (6)	25 (13)	28 (14)	16 (8)				7 (3.5)
0.70	28 (14)	36 (18)	62 (31)	14 (7)	30 (15)	32 (16)	20 (10)				7 (3.5)
0.75	36 (18)	42 (21)	70 (35)	22 (11)	38 (19)	36 (18)	24 (12)				8 (4)
0.80	46 (23)	50 (25)	80 (40)	30 (15)	54 (27)	44 (22)	30 (15)				8 (4)

Columns 2 ~ 11 are the upstream (inlet) side and column 12 is the downstream (outlet) side straight run. Values without parentheses are 'zero additional uncertainty' values; values in parentheses are '0.5% additional uncertainty' values. The minimum required straight run is the length between each upstream/downstream fitting and the primary element, and all straight lengths are measured from the upstream face of the primary element. The installation of thermometer pockets or wells does not alter the minimum upstream straight run required for other fittings.

Installation requirements

- The required straight run follows the table above according to β and the type of upstream fitting, and all straight lengths are measured from the upstream face of the primary element.
 - The installation of thermometer pockets or wells does not alter the minimum upstream straight run required for other fittings.
- Small sizes (1/2B ~ 2B) are supplied with threaded connections (TM/TF); 2B and above as butt weld (BW) or flanged (FL) type.

Ordering information (How to Order)

1 Model (DHOV-N-)	
TM	Threaded Male type
TF	Threaded Female type
BW	Butt weld type
FL	Flanged type

2 Nominal Pipe Size	
	Pipe size in inch or mm (nominal pipe size, inch or mm)

3 Material	
CS	Carbon Steel
4S	304SS
4L	304L SS
6S	316SS
6L	316L SS
11	A182 F11
12	A182 F12
51	A182 F51
91	A182 F91
OP	Option

4 Flange Connection	
015	ANSI Class 150 LB
030	ANSI Class 300 LB
060	ANSI Class 600 LB
090	ANSI Class 900 LB
150	ANSI Class 1500 LB
NPT	Threaded (threaded connection)
000	Option

5 Diff' Taps	
0	NPT 1/4
1	NPT 1/2
2	NPT 3/4
3	SW 1/2
4	SW 3/4

6 Option	
	Options (by separate agreement)

VENTURI · NOZZLE

Venturi Tube

Venturi Tube

MODEL : DHOV-FF / DHOV-FW / DHOV-MF / DHOV-MW / DHOV-RE



DHOV-FF

DHOV-FW

DHOV-MF

DHOV-MW

DHOV-RE

The venturi tube has a streamlined inlet and outlet. The standard design is fitted with piezometer rings (several tap holes around the circumference of the inlet and throat, enclosed by an annular ring).

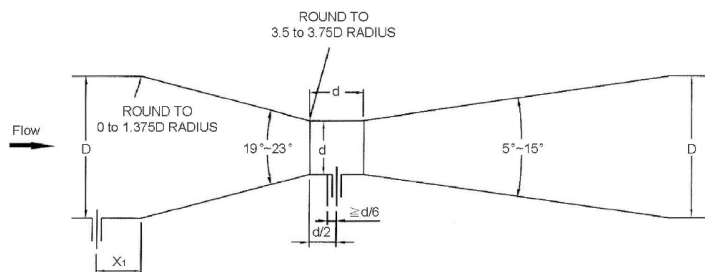
When measuring non-homogeneous liquids such as slurries, the piezometer rings are usually omitted so that the pressure tap holes can be purged efficiently. The venturi tube is considered the differential-pressure primary element best suited to measuring liquids with a high solids content.

As a standard means of measurement for acceptance tests of pumps and similar equipment, an individually calibrated venturi tube has the advantage — like a calibrated orifice meter run — that the effects of tap characteristics are included in the calibration.

The standard deviation of test data for classical venturi tubes with piezometer rings at the inlet and throat is 0.3 ~ 0.4%, and properly manufactured and installed venturi tubes of this type agree with the data within $\pm 0.75\%$ in 95% of installations up to a pipe Reynolds number of 200,000.

4B ~ 72B (100A ~ 1800A) ANSI 150 ~ 1500LB Accuracy $\pm 2.0\%$ / $\pm 1.0\%$ ISO 5167-4

Measurement principle



The Critical Dimensions of Classical Venturi Tube

Principal dimensions of the classical venturi tube

The classical venturi tube consists of an inlet cylinder → convergent section ($19^\circ \sim 23^\circ$) → cylindrical throat (throat, diameter d) → divergent section ($5^\circ \sim 15^\circ$). The junction between the inlet cylinder and the convergent section is rounded with a radius of $0 \sim 1.375D$, and that between the convergent section and the throat with a radius of $3.5 \sim 3.75D$.

The high-pressure tap is located in the inlet cylinder (position X_1) and the low-pressure tap at $d/2$ from the start of the throat; flow is obtained from the differential pressure between the two taps.

Types · model configuration



FIG 1 · DHOV-FF / MF

Fabricated flange type — 4B (100A) and larger



FIG 2 · DHOV-FW / MW

Fabricated weld-on type — 4B (100A) and larger, welded directly to the pipe



FIG 3 · Machined type

Machined flange type — 2B (50A) and larger, small bore

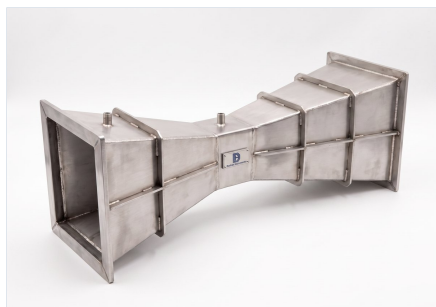


FIG 4 · DHOV-RE

Rectangular type — 6B (150A) and larger, for ducts

Photographic examples by type (produced from the drawings). Actual dimensions and flange ratings follow the order specification.

Item	DHOV-FF Fabricated from welded plate · flanged connection	DHOV-FW Fabricated from welded plate · welded connection	DHOV-MF Machined · flanged connection	DHOV-MW Machined · welded connection	DHOV-RE Welded steel plate · rectangular duct type
Features	Welding sheet plate type, Flange mounting type (Fabricated flange type, FIG 1 · 4" and above)	Welding sheet plate type, Welding mounting type (Fabricated weld-on type, FIG 2 · 4" and above)	Machinery processing type, Flange mounting type (Machined flange type, FIG 3 · 2" and above)	Machinery processing type, Welding mounting type (Machined weld-on type)	Welding steel plate type, Rectangle (Rectangular type, FIG 4 · 6" and above)
Turndown	6:1	6:1	6:1	6:1	6:1
Materials	Carbon Steel, STS304, STS316, Inconel, Monel, Hastelloy	Carbon Steel, STS304, STS316, Inconel, Monel, Hastelloy	Carbon Steel, STS304, STS316, Inconel, Monel, Hastelloy	Carbon Steel, STS304, STS316, Inconel, Monel, Hastelloy	Carbon Steel, STS304, STS316, Inconel, Monel, Hastelloy
Connection	Flange 150#, 300#	Flange 150#, 300#	Flange 150#, 300#, 600#, 900#, 1500#, 2500#	Flange 150#, 300#, 600#, 900#, 1500#, 2500#	Duct
Applicable piping	4B and above (100A and above) Pipe & Duct	4B and above (100A and above) Pipe & Duct	2B ~ 14B (50A ~ 300A) Pipe	2B ~ 14B (50A ~ 300A) Pipe	6B and above (150A and above) Duct
Standards	ISO5167-4	ISO5167-4	ISO5167-4	ISO5167-4	ISO5167-4
Accuracy	±2.0%	±2.0%	±1.0%	±1.0%	±2.0%

Technical Specifications

Item	Value
Accuracy	±2.0% (DHOV-FF / FW / RE) · ±1.0% (DHOV-MF / MW)
Turndown	6:1
Venturi tube types	Fabricated flange type (FIG 1) · Fabricated weld-on type (FIG 2) · Machined flange type (FIG 3) · Rectangular type (FIG 4)

Item	Value
Minimum size by type	Fabricated flange / weld-on: 4" and above · Machined flange: 2" and above · Rectangular: 6" and above
Flow calculation standard	ISO5167, JIS Z 8762, ASME, KS A 0612
Flange rating	ANSI 150, 300, 600, 900, 1500LB
Applicable pipe sizes	4 to 72B (100A to 1800A)
Materials	Carbon Steel · 304SS, 304L SS, 316SS, 316L SS · Ni, Cr, Mo Alloy Steel (A182 F11 to 91)
Pressure tap construction	Standard: piezometer rings (multiple taps around the inlet and throat + annular ring) · slurries and non-homogeneous liquids: rings omitted (easy tap purging)
DP tap connection	NPT 1/2 · NPT 3/4 · SW 1/2 · SW 3/4
Principal profile dimensions	Inlet radius 0 ~ 1.375D · convergent angle 19° ~ 23° · throat radius 3.5 ~ 3.75D · divergent angle 5° ~ 15° · throat tap position d/2

Standards · ISO 5167-4 · ISO 5167 · JIS Z 8762 · ASME · KS A 0612

Dimensions · drawings

Unit: mm. Actual manufacturing dimensions are based on the approved drawing.

Classical venturi tube required straight run (multiples of D)

β	Single 90° bend *)	Two or more 90° bends in the same plane *)	Two or more 90° bends in different planes *) **)	Reducer 3D to D over a length of 3.5D	Expander 0.75D to D over a length of D	Full bore ball or gate valve fully open
0.30	0.5 ***)	1.5 (0.5)	(0.5)	0.5 ***)	1.5 (0.5)	1.5 (0.5)
0.35	0.5 ***)	1.5 (0.5)	(0.5)	1.5 (0.5)	1.5 (0.5)	2.5 (0.5)
0.40	0.5 ***)	1.5 (0.5)	(0.5)	2.5 (0.5)	1.5 (0.5)	2.5 (1.5)
0.45	1.0 (0.5)	1.5 (0.5)	(0.5)	4.5 (0.5)	2.5 (1)	3.5 (1.5)
0.50	1.5 (0.5)	2.5 (1.5)	(8.5)	5.5 (0.5)	2.5 (1.5)	3.5 (1.5)
0.55	2.5 (0.5)	2.5 (1.5)	(12.5)	6.5 (0.5)	3.5 (1.5)	4.5 (2.5)
0.60	3.0 (1.0)	3.5 (2.5)	(17.5)	8.5 (0.5)	3.5 (1.5)	4.5 (2.5)
0.65	4.0 (1.5)	4.5 (2.5)	(23.5)	9.5 (1.5)	4.5 (2.5)	4.5 (2.5)
0.70	4.0 (2.0)	4.5 (2.5)	(27.5)	10.5 (2.5)	5.5 (3.5)	5.5 (3.5)
0.75	4.5 (3.0)	4.5 (3.5)	(29.5)	11.5 (3.5)	6.5 (4.5)	5.5 (3.5)

Values without parentheses are 'zero additional uncertainty' values; values in parentheses are '0.5% additional uncertainty' values. *) The radius of curvature of the bend must be at least the pipe diameter. **) Since the effect may remain even beyond 40D, no value without parentheses is given. ***) Since no fitting may be placed within 0.5D of the venturi upstream pressure tap, only the 'zero additional uncertainty' value applies. Straight runs are measured from the plane of the venturi upstream pressure tap, and over lengths beyond those stated in the table the pipe roughness must not exceed that of commercially available smooth pipe ($k/D \leq 10^{-3}$). On the downstream side, fittings and disturbances located at least 4 throat diameters from the plane of the throat pressure tap do not affect measurement accuracy.

Installation requirements

- The required straight run follows the table above according to β and the type of upstream fitting, and all straight lengths are measured from the plane of the venturi tube's upstream pressure tap.
- Over lengths beyond those stated in the table, the pipe roughness must not exceed that of commercially available smooth pipe (approx. $k/D \leq 10^{-3}$).
- On the downstream side, fittings and disturbances located at least 4 throat diameters from the plane of the throat pressure tap do not affect measurement accuracy.
- For slurries and non-homogeneous liquids, a specification with the piezometer rings omitted is applied so that the pressure taps can be purged easily.

Ordering information (How to Order)

1 Model (DHOV-)	
FF	Fabricated flange type (fabricated from plate · flanged)
FW	Fabricated weld-on type (fabricated from plate · welded)
MF	Machined flange type (machined · flanged)
MW	Machined weld-on type (machined · welded)
RE	Rectangular type (rectangular duct)

2 Nominal Pipe Size	
	Pipe size in inch or mm (nominal pipe size, inch or mm)

3 Material	
CS	Carbon Steel
4S	304SS
4L	304L SS
6S	316SS
6L	316L SS
11	A182 F11
22	A182 F22
51	A182 F51
91	A182 F91
OP	Option

4 Flange Rating	
015	ANSI Class 150 LB
030	ANSI Class 300 LB
060	ANSI Class 600 LB
090	ANSI Class 900 LB
150	ANSI Class 1500 LB
250	ANSI Class 2500 LB
000	Option

5 Diff' Taps	
1	NPT 1/2
2	NPT 3/4
3	SW 1/2
4	SW 3/4

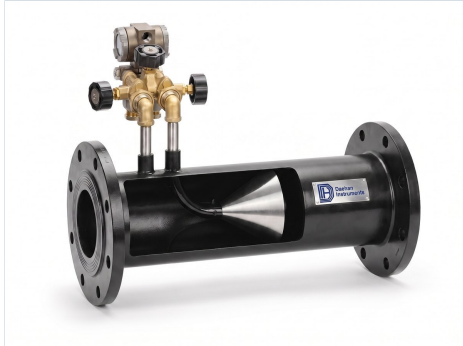
6 Option	
	Options (by separate agreement)

SPECIAL FLOW METER

Annular Venturi Meter

Annular Venturi Meter

MODEL : DHAV-CC01 / DHAV-CC02



DHAV-CC01

DHAV-CC02

The annular venturi meter is a patented technology that accurately measures flow over a wide range of Reynolds numbers, for a variety of conditions and fluids. It operates on the same physical principle as other differential-pressure flow meters in that it uses the principle of conservation of energy in the fluid flow within the pipe.

Its outstanding performance characteristics, however, come from its unique design. The cone positioned at the center of the tube interacts with the fluid, reshaping the velocity profile and creating a low-pressure region immediately downstream of the cone.

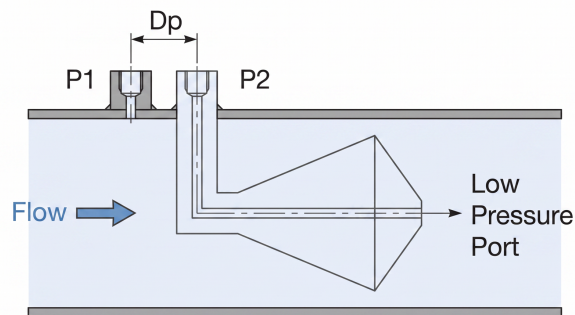
The difference between the static (line) pressure and the low pressure formed downstream of the cone is measured with two pressure taps. One tap is located slightly upstream of the cone, the other on the downstream face of the cone itself. This differential pressure is applied to the Bernoulli equation to obtain the flow rate.

Because the cone is positioned at the center of the line, the velocity profile at the measuring point is optimized, allowing accurate and reliable flow measurement regardless of upstream flow conditions.

1/2B ~ 72B Turndown 10:1 Accuracy $\pm 0.5\%$ (calibrated)

Straight run 0~3D upstream · 0~1D downstream

Measurement principle



High- and low-pressure port arrangement

The annular venturi meter is a differential-pressure flow meter. According to Bernoulli's theorem on the conservation of energy in a closed pipe, at a constant flow rate the pressure in the pipe is inversely proportional to the square of the velocity. That is, as the velocity increases, the pressure decreases.

If the pressure of the fluid approaching the meter is P_1 , the pressure drops to P_2 as the velocity increases in the cross-section narrowed by the cone (Figure 1). P_1 and P_2 are measured at the meter taps with a differential-pressure transmitter, and the differential pressure generated rises and falls exponentially with velocity. The more of the pipe cross-section the cone occupies, the greater the differential pressure generated at the same flow rate.

The β ratio is the flow area at the largest cross-section of the cone (converted to an equivalent diameter) divided by the inside diameter of the meter.

The cone interacts directly with the 'high-velocity core' at the center of the pipe, mixing it with the slower flow near the wall. As a result, even flow disturbed by elbows, valves, reducers and the like is flattened toward a well-developed velocity profile as it approaches the cone, forming a predictable velocity profile even under non-ideal conditions.

Types · model configuration



DHAV-CC01

Precision tube type (Figure 7) — integral flanged spool with the cone fixed inside



DHAV-CC02

Insertion top-plate type (Figure 8) — inserted into large pipes through a top plate

Photographic examples by type (produced from the drawings). Actual dimensions and flange ratings follow the order specification.

Item	DHAV-CC01 Standard type · precision tube (flanged)	DHAV-CC02 Welded type · insertion top-plate
Features	Unnecessary direct-connecting-pipe & low pressure loss (no straight run required · low pressure loss)	Unnecessary direct-connecting-pipe & low pressure loss (no straight run required · low pressure loss)
Type	Precision Tube Annular Venturi Meter (Figure 7) · Flange version	Insertion Top-plate Annular Venturi Meter (Figure 8) · Welded type
Turndown	10:1	10:1
Materials	Cone: STS304, STS316, Inconel, Monel, Hastelloy / Body: C.S, STS304, STS316, Inconel, Monel, Hastelloy	Cone: STS304, STS316, Inconel, Monel, Hastelloy / Body: C.S, STS304, STS316, Inconel, Monel, Hastelloy
Connection	Flange 150#, 300#, 600#	Pipe side (top-plate welded to the pipe)
Applicable piping	1/2B ~ 72B Pipe & Duct	20B ~ 72B Pipe & Duct
Accuracy	±0.5% (Calibration)	±0.5% (Calibration)

Technical Specifications

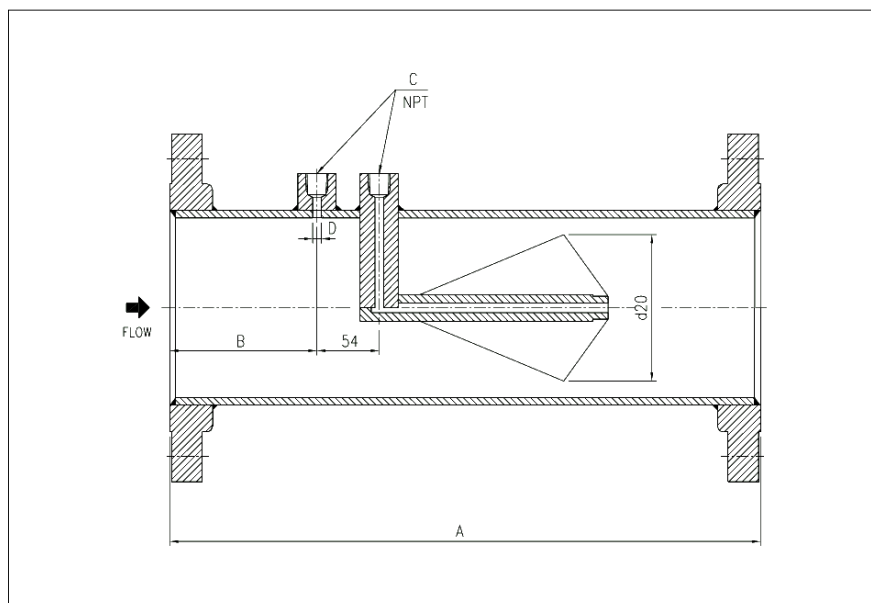
Item	Value
Accuracy	±0.5% of reading, primary element basis
Repeatability	+0.1% or better
Turndown	Typically 10:1 (higher is possible) · linear signal down to Re 8,000
Required straight run	Upstream 0 ~ 3D · downstream 0 ~ 1D ※ Performance tests installed directly downstream of a single 90° elbow and of close-coupled double elbows (out of plane) showed that the meter can be installed adjacent to elbows without loss of accuracy
Standard β ratios	0.45, 0.55, 0.65, 0.75, 0.85
Applicable pipe sizes	Precision tube type 15A ~ 600A and larger · insertion top-plate type 150A ~ 1800A and larger
Materials	Cone: STS304, STS316, Inconel, Monel, Hastelloy / Body: C.S, STS304, STS316, Inconel, Monel, Hastelloy
Connection	DHAV-CC01: Flange 150#, 300#, 600# · DHAV-CC02: Pipe side
DP tap connection	DHAV-CC01: PT 1/4 (15 ~ 40mm) · PT 1/2 (50mm and larger) / DHAV-CC02: NPT 1/2
Long-term performance	The streamlined shape of the cone does not force the fluid to impact an abrupt face, and the boundary layer pushes the fluid away from the β edge, so wear from contaminated fluids is low and the β ratio and calibration are maintained for a long time

Item	Value
Signal stability	Short vortices form as the fluid passes the cone, producing a stable signal of low amplitude and high frequency (an orifice produces long vortices → high amplitude, low frequency)
Permanent pressure loss	Lower than a conventional orifice plate because there is no impact against an abrupt face · the stable signal allows the recommended full-scale differential pressure to be set lower
Other characteristics	No stagnant zones (swept-through design prevents accumulation of debris, condensate and particles) · mixing effect from the short vortices downstream of the cone (also applied as a static mixer)

Dimensions · drawings

Unit: mm. Actual manufacturing dimensions are based on the approved drawing.

DHAHV-CC01 standard dimensions (Flange version, mm)

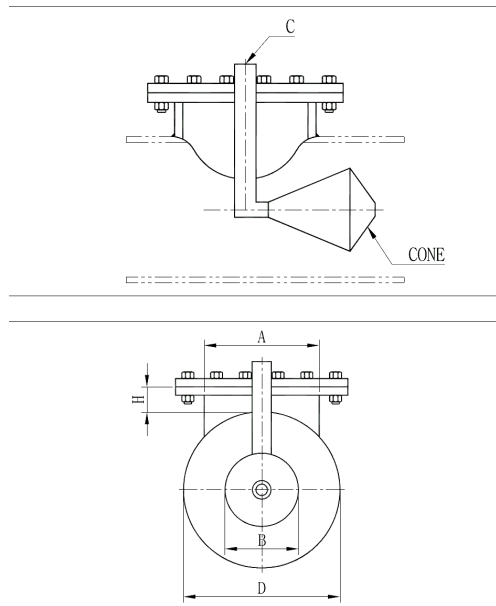


SIZE (mm)	A (mm)	B (mm)	C (PT)	C'	REMARKS
15	203	64	1/4	6	150#, 300# ANSI RF FLANGE
20	203	64	1/4	6	150#, 300# ANSI RF FLANGE
25	203	64	1/4	6	150#, 300# ANSI RF FLANGE
40	254	76	1/4	6	150#, 300# ANSI RF FLANGE
50	305	89	1/2	6	150#, 300# ANSI RF FLANGE
65	305	89	1/2	6	150#, 300# ANSI RF FLANGE
80	356	89	1/2	6	150#, 300# ANSI RF FLANGE
100	406	102	1/2	8	150#, 300# ANSI RF FLANGE
150	559	108	1/2	8	150#, 300# ANSI RF FLANGE
200	660	127	1/2	8	150#, 300# ANSI RF FLANGE
250	711	127	1/2	8	150#, 300# ANSI RF FLANGE

SIZE (mm)	A (mm)	B (mm)	C (PT)	C'	REMARKS
300	762	133	1/2	8	150#, 300# ANSI RF FLANGE
350	762	152	1/2	8	150#, 300# ANSI RF FLANGE
400	762	152	1/2	8	150#, 300# ANSI RF FLANGE
500	914	152	1/2	8	150#, 300# ANSI RF FLANGE
600	1219	254	1/2	8	150#, 300# ANSI RF FLANGE
1800	4000	254	1/2	12	150#, 300# ANSI RF FLANGE

A: flange face-to-face distance, B: distance from inlet flange face to high-pressure tap, C: tap thread size (PT), C': tap hole diameter (φ). Tap spacing 54mm; the low-pressure tap connects to the downstream face of the cone through an internal passage in the cone (see drawing). Larger sizes on special order (LARGER ANNULAR VENTURI METER ON SPECIAL ORDER).

DHAV-CC02 welded type dimensions (Welded type, mm)



A · TOP PLATE SIZE (mm)	sch.	B · CON SIZE (mm)	D · LINE SIZE (mm)	H 150# (mm)	H 300# (mm)	C (NPT)	REMARKS
150	40	~140	150 ~ 350	125	150	1/2	ANSI RF FLANGE
200	40	~190	200 ~ 500	125	150	1/2	ANSI RF FLANGE
250	40	~241	250 ~ 600	125	150	1/2	ANSI RF FLANGE
300	40	~292	300 ~ 750	125	150	1/2	ANSI RF FLANGE
350	40	~324	350 ~ 750	125	150	1/2	ANSI RF FLANGE
400	40	~375	400 ~ 900	125	150	1/2	ANSI RF FLANGE
450	std	~425	450 ~ 1000	175	200	1/2	ANSI RF FLANGE
500	std	~476	500 ~ 1200	175	200	1/2	ANSI RF FLANGE
600	std	~578	600 ~ 1400	175	200	1/2	ANSI RF FLANGE
750	std	~730	750 ~ 1700	175	200	1/2	ANSI RF FLANGE
900	std	~883	900 ~ 2250	175	200	1/2	ANSI RF FLANGE

A: top plate (flange) size, B: maximum cone diameter, D: applicable pipe size range, H: top plate height (by flange rating), C: DP tap NPT.

Installation requirements

- The recommended straight run is 0 ~ 3D upstream and 0 ~ 1D downstream. Because the cone flattens the velocity profile, the meter can be installed much closer to upstream disturbances than other differential-pressure flow meters.
- Performance tests directly downstream of a single 90° elbow and of close-coupled double elbows (out of plane) showed that the meter can be installed adjacent to elbows without loss of accuracy (Figures 4, 5).
- The welded type (DHAV-CC02) is applied to large-bore piping: a top-plate is welded to the top of the pipe and the cone assembly is inserted.
- Information required for special orders: fluid name (FLUID NAME), flow rate (kg/hr, m³/hr), pressure (kPa), material (304SS, 316SS, etc.), line size (e.g. 3B sch20, sch40, etc.).

Ordering information (How to Order)

1 Model	
DHAV-CC01	Standard type (standard · precision tube · flanged)
DHAV-CC02	Welded type (welded · insertion top-plate)
2 Line Size (DHAV-CC01)	
015A ~ 900A	15, 20, 25, 40, 50, 65, 80, 100, 150, 200, 250, 300, 350, 400, 500, 600, 750, 900 (mm)
3 Line Size (DHAV-CC02)	
0400A ~ 1800A	400, 450, 500, 600, 750, 900, 1000, 1200, 1500, 1800 (mm)
4 Material (Cone / Pipe / Flange)	
Z	SS316 / SS316 / SS316
Y	SS304 / SS304 / SS304
X	SS304 / CS / CS
W	Option / Option / Option

5 Pipe Schedule	
A	10
B	20
C	40 Bored (15A ~ 150A)
D	std (400A ~)
E	40 (200A ~ 350A)
F	80
G	160
6 Flange Class	
M	ANSI 150# RF/SO
N	ANSI 300# RF/SO
O	ANSI 600# RF/SO
P	ANSI 900# RF/SO

Ordering example: **DHAV-CC01-100AYCM**

DHAV-CC01, 100A, material Y (SS304 / SS304 / SS304), schedule C (40 Bored), flange M (ANSI 150# RF/SO) · welded type example: DHAV-CC02-0600AXDM (600A, material X, schedule D (std), ANSI 150#)

SPECIAL FLOW METER

Averaging Pitot Tube

Average Pitot Tube

MODEL : 301 TYPE / 302 TYPE / 303 TYPE / 304 TYPE



301 TYPE

302 TYPE

303 TYPE

304 TYPE

Daehan Instruments developed a new pitot tube that resolves several problems of conventional pitot tubes — low differential pressure, the need for precise installation position, and the difficulty of measuring the average velocity in the pipe.

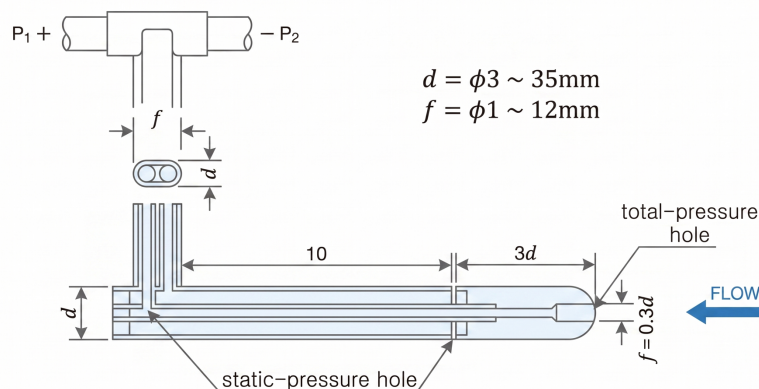
With six months of technical support from the Korea Institute of Industrial Technology starting in 1994, the new pitot tube was successfully developed.

A conventional pitot tube has the advantages of a simple structure and the ability to measure velocity over a relatively small area regardless of pipe size, but it also has the disadvantages of low differential pressure, demanding precision in installation position and orientation, and difficulty in measuring the average velocity in the pipe.

The Daehan pitot tube detects a differential pressure about 2 ~ 3 times greater than a conventional pitot tube, and obtains the average velocity by sensing pressure at 4 ~ 8 points inside the pipe. It saves 5 ~ 8% energy compared with an orifice meter, and its simple construction reduces installation and maintenance costs.

3B ~ 16B / 10B ~ 120B Accuracy $\pm 1.5\%$ STS316 · Inconel · Monel · Hastelloy
Screw & Flange

Measurement principle



Pitot tube structure — total pressure holes and static pressure holes ($d = \phi 3 \sim 35\text{mm}$, $f = \phi 1 \sim 12\text{mm}$)

The velocity of an incompressible fluid is obtained from the Bernoulli equation. $Q = A \cdot V = A \cdot \sqrt{(2g(P_1 - P_2)/r)}$... Eq. (1). P_1 : total pressure, P_2 : static pressure, V : velocity, A : pipe cross-sectional area, r : specific gravity.

In practice, the velocity/pressure coefficient C obtained from experimental data is applied, and the flow is calculated as $Q = A \cdot V = A \cdot C \cdot \sqrt{(2g(P_1 - P_2)/r)}$... Eq. (2).

Taking the velocity profile in the pipe (Figure 2) into account, the sensing holes are placed at the equal-area division positions r_i/R .
 $n = 2$: 0.5, 0.866 / $n = 3$: 0.408, 0.707, 0.912 / $n = 4$: 0.354, 0.612, 0.790, 0.936.

Types · model configuration

**301 TYPE**

Single support type — for low pressure (10K or less) and ducts, two needle valves, 3B ~ 16B

**302 TYPE**

Double support type — for high pressure (10 ~ 20K), large diameter (10 ~ 120B) and high velocity, two ball valves

**303 TYPE**

Isolation valve type — prevents fluid escaping from the pipe during maintenance

**304 TYPE**

Isolation valve · rod type — insertion/retraction structure preventing leakage under high pressure

Photographic images by type. Connection sizes, materials and other details follow the ordering code.

Item	301 TYPE Single support type (Single support)	302 TYPE Double support type (Double support)	303 TYPE Isolation valve type	304 TYPE Isolation valve & Rod type
Features	Easy to install	Suitable for large caliber (suitable for large pipe sizes)	Shut-off fluid after remove element on maintenance (fluid is shut off after removing the element for maintenance)	Installation & maintenance can be done in operation (installation and maintenance possible during operation)
Type	Single support type — suitable for low pressure (10K or less) and ducts, simple construction, applicable sizes 3B ~ 16B	Double support type — suitable for high pressure (10 ~ 20K) and large pipe sizes (10 ~ 120B), handles high velocities	Isolation Valve type — fitted with an isolation valve to prevent liquid overflow from the tube during maintenance and repair	Isolation valve & Rod type — overflow prevention system for maintenance and repair under high-pressure conditions (insertion rod · packing gland · cage nipple)
Applicable piping	3B ~ 16B Pipe & Duct	10B ~ 120B Pipe & Duct	3B ~ 16B Pipe & Duct	3B ~ 16B Pipe & Duct
Materials	STS316, Inconel, Monel, Hastelloy	STS316, Inconel, Monel, Hastelloy	STS316, Inconel, Monel, Hastelloy	STS316, Inconel, Monel, Hastelloy
Connection	Screw & Flange	Screw & Flange	Screw & Flange	Screw & Flange
Measured fluid	Liquid & Gas not included sludge (not for high-viscosity fluids)	Liquid & Gas not included sludge (not for high-viscosity fluids)	Liquid & Gas not included sludge (not for high-viscosity fluids)	Liquid & Gas not included sludge (not for high-viscosity fluids)
Accuracy	±1.5%	±1.5%	±1.5%	±1.5%

Technical Specifications

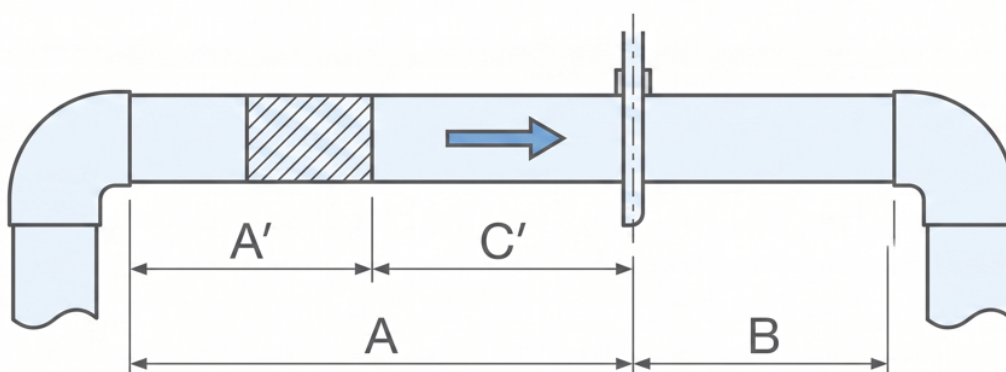
Item	Value
Accuracy	±1.5%
Measured fluid	Liquids and gases not containing sludge (not for high-viscosity fluids)

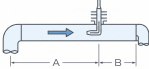
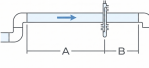
Item	Value
Applicable pipe sizes	301 / 303 / 304 TYPE: 3B ~ 16B · 302 TYPE: 10B ~ 120B (Pipe & Duct)
Pressure classes	Single support type (301): low pressure (10K or less) and ducts · double support type (302): high pressure (10 ~ 20K), high velocity
Sensor material	STS316, Inconel, Monel, Hastelloy
Mounting connection	Screw & Flange ※ Ordering codes: PT1", PT1-1/2, PT2" · JIS 10K / 20K 40A · 50A · 80A · ANSI 150# / 300# 1-1/2B · 2B · 3B
DP (D/P) connection	PT 1/2 · PT 3/8 · PT 1/4
Differential-pressure characteristics	About 2 ~ 3 times the differential pressure of a conventional pitot tube · pressure sensed at 4 ~ 8 points inside the pipe
Energy	5 ~ 8% better than an orifice meter
Isolation valve material (Body / Ball)	SCPH2/316 · SCPH13/316 · 304/316 · 316/316 · Option (303, 304 TYPE)
Packing · cage nipple · insertion rod material	Packing: Rubber, Teflon, Graphite / Cage Nipple: Carbon steel, Stainless steel / Insertion Rods: Carbon steel, Stainless steel (304 TYPE)
Installation angle tolerance	Tilt within the pipe cross-section $\pm 3^\circ$ · tilt along the pipe axis $\pm 5^\circ$ · sensing hole orientation $\pm 3^\circ$

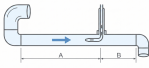
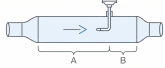
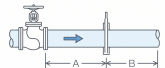
Dimensions · drawings

Unit: mm. Actual manufacturing dimensions are based on the approved drawing.

Required straight run (Table 4, multiples of D)



Upstream piping condition	Without conditioner			With conditioner		Downstream
Piping condition	A (same plane)	A (different planes)	A'	A	C'	B
 Single 90° elbow	7	9	6	3	3	3
 Two 90° elbows (same plane)	9	14	8	4	4	3

Upstream piping condition	Without conditioner			With conditioner		Downstream
Piping condition	A (same plane)	A (different planes)	A'	A	C'	B
 Two 90° elbows (different planes)	19	24	9	4	5	4
 Reducer	8	8	8	4	4	3
 Expander	8	8	8	4	4	3
 Valve	24	24	9	4	5	4

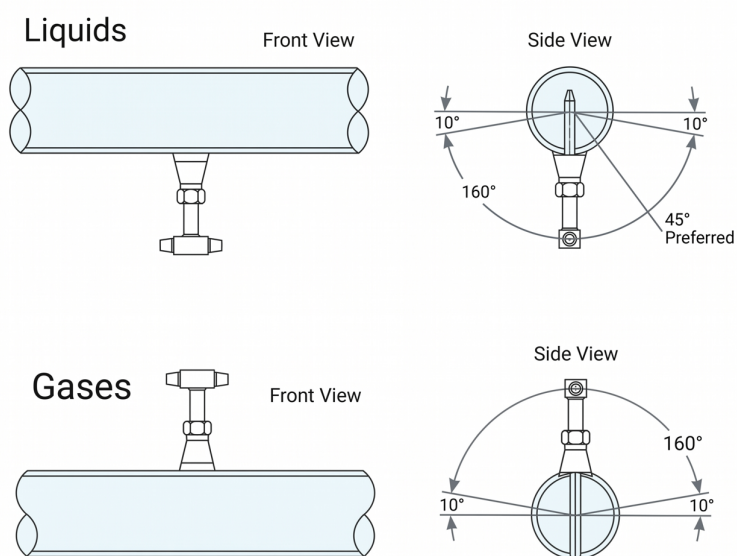
A: upstream straight run, B: downstream straight run, A' / C': with a flow conditioner, upstream of the conditioner / conditioner to pitot tube. Figures: A = upstream straight run, B = downstream straight run, A' = elbow to flow conditioner, C' = conditioner to pitot tube (unit: multiples of pipe inner diameter D).

Equal-area division positions r_i/R (Figure 2 velocity profile)

n	r_1	r_2	r_3	r_4	r_5
2	0.5	0.866	–	–	–
3	0.408	0.707	0.912	–	–
4	0.354	0.612	0.790	0.936	–

n: number of radial divisions, r_i/R : ratio of the sensing point position to the pipe radius.

Installation orientation in horizontal piping (Figures 6, 7)



Fluid	Installation position	Allowable range (side view)
Liquids	Inserted from the bottom of the pipe	Within 10° either side of vertical (excluding the 160° range), 45° preferred (Preferred)
Gases	Inserted from the top of the pipe	Within 10° either side of vertical (excluding the 160° range)

The diagrams in Pitot Tube catalog p.5 Figure 6 (Liquids) and Figure 7 (Gases), arranged as a table.

Installation requirements

- In vertical piping, the pitot tube is installed at a position in the horizontal plane (Figure 5).
- In horizontal piping, the installation method is chosen according to the type of fluid. For liquids it is installed at the bottom of the pipe (Figure 6), for gases at the top (Figure 7).
- The required straight run follows Table 4 according to the upstream piping condition and whether a flow conditioner is installed.
- The installation angle tolerances are $\pm 3^\circ$ within the pipe cross-section, $\pm 5^\circ$ along the pipe axis and $\pm 3^\circ$ in sensing hole orientation (Figure 8).
- Precautions: avoid locations with heavy dust (if the sensing holes become blocked by dust, this can be cleared by blowing high-pressure air). Not suitable for turbulent flow. Do not use for high-pressure steam or in locations subject to vibration.

Ordering information (How to Order)

1 Series	
301	Single support type
302	Double support type
303	Isolation Valve type
304	Isolation valve & Rod type (Isolation valve & Rod type)

2 Code 1 · D/P Connection	
2	PT 1/2
8	PT 3/8
4	PT 1/4

3 Code 2 · Mounting connection	
1	PT 1"
2	PT 1-1/2
3	PT 2"
4	10K 40A
5	10K 50A
6	10K 80A
7	20K 40A
8	20K 50A
9	20K 80A
10	150# 1-1/2B
11	150# 2B
12	150# 3B
13	300# 1-1/2B
14	300# 2B
15	300# 3B
0	Option

4 Code 3 · Insulation T	
☐ ☐ ☐	Insulation thickness (T) + 50mm (301, 302 series)

5 Code 4 · Line size & SCH	
☐ ☐ ☐	Pipe size & SCH or pipe inside diameter (original: Line size & SCH or Line India)

6 Code 5 · Sensor material	
5	STS304 (standard)
6	STS316
7	STS316L
8	Inconel
9	Hastelloy
0	Option

7 Code 6 · Isolation Valve mat'l Body / Ball (303, 304)	
1	SCPH2 / 316
2	SCPH13 / 316
3	304 / 316
4	316 / 316
5	Option

8 Code 7 · Packing Gland & Cage Nipple mat'l (304)	
R	Packing: Rubber
T	Packing: Teflon
G	Packing: Graphite
O	Packing: Option
C	Cage Nipple: Carbon steel
S	Cage Nipple: Stainless steel
O	Cage Nipple: Option

9 Code 8 · Insertion Rods mat'l (304)	
C	Carbon steel
S	Stainless steel

10 Option	
★	e.g. Handle (304 TYPE)

Ordering example: 301 - PT1/4 - PT1 - 150 - STPG38 8B SCH40 (or 203.5) - STS304

301 series, D/P connection PT1/4, mounting PT1, insulation thickness + 50mm = 150, pipe STPG38 8B SCH40 (I.D. 203.5), sensor STS304 · other examples from the catalog: 302 - PT1/2 - PT1-1/2 - 150 - STPT 20B SCH40 (or 508.0) - STS304 / 303 - PT1/2 - 10K50A RF or PT1-1/2 - 100 - 10B SCH40 - STS316 - SCPH2/STS316 / 304 - PT1/2 - PT1-1/2 or 10K50A RF - 50 - 6B SCH80 - STS316 - SCS13/SUS316 - Graphite/SUS304 - STS - Handle

SPECIAL FLOW METER

Wedge Meter

Wedge Meter

MODEL : DHWM-F / DHWM-BW / DHWM-T



※ Cutaway image for illustration — the pipe wall is cut away to show the internal V-wedge; the actual product is a closed pipe spool.

DHWM-F

DHWM-BW

DHWM-T

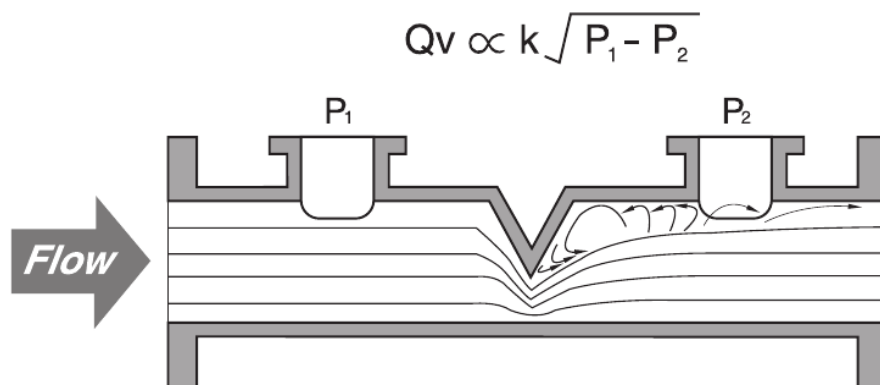
The DHWM-F / DHWM-BW / DHWM-T series wedge meters are flow meters for measuring flow under harsh conditions.

The DHWM-F series can measure the flow of liquids, gases and steam as well as fluids containing sludge, and is particularly suitable for measuring high-viscosity fluids.

Bidirectional (forward and reverse) flow measurement is possible.

25A ~ 600A Flange 150# ~ 1500# H/D 0.2 ~ 0.5 Up to 538 °C

Measurement principle



Principle of differential pressure generation across the wedge

The DHWM series installs a V-shaped wedge inside the pipe.

Flow is measured from the pressure difference across the wedge ($P_1 - P_2$). $Qv \propto k \cdot \sqrt{(P_1 - P_2)}$

Types · model configuration



DHWM-F Cutaway rendering for illustration

Flanged type — cutaway image showing the internal V-wedge



DHWM-BW

Cutaway rendering for illustration

Butt-weld type — cutaway image showing the internal V-wedge



DHWM-T

Chemical Tee remote-seal type — actual product

The DHWM-F and DHWM-BW images are cutaway renderings with the pipe wall removed to show the internal wedge; the actual product is a closed pipe spool.

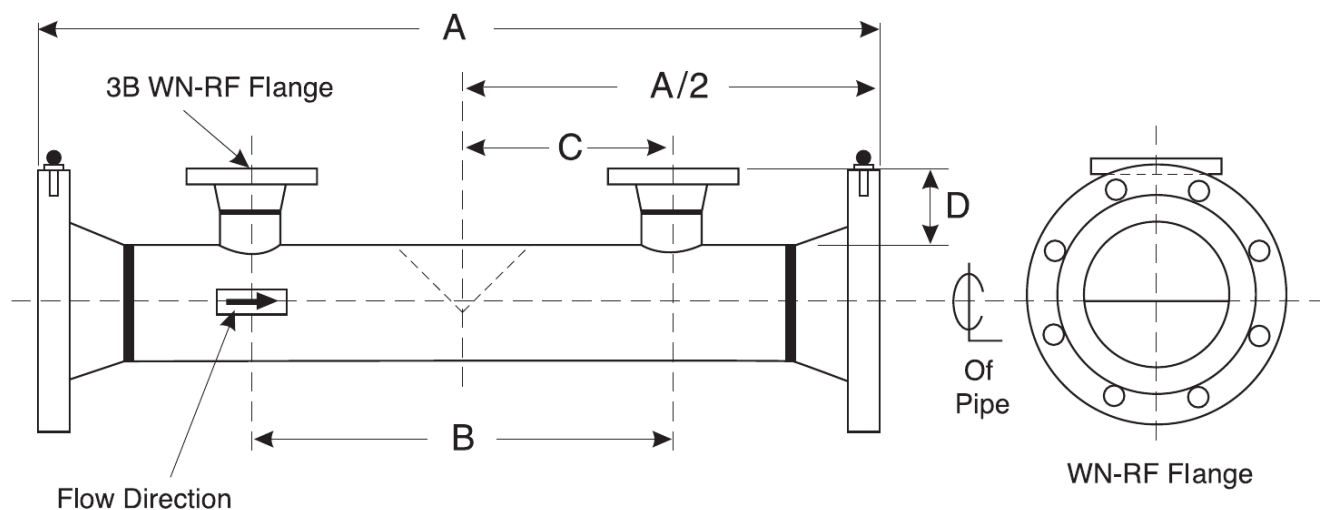
Item	DHWM-F Flanged connection	DHWM-BW Welded connection (Butt Weld)	DHWM-T Chemical Tee remote seal type
Features	Suitable for high-viscosity liquids and liquids containing sludge · Remote Seal Type D/P Transmitter	Suitable for high-viscosity liquids and liquids containing sludge · welded directly to the piping	Suitable for high-viscosity liquids and liquids containing sludge · Remote Seal Chemical Tee Type D/P Transmitter
Turndown	6:1	6:1	6:1
Materials	Carbon Steel, STS304, STS316, Inconel, Monel, Hastelloy, Tungsten carbide coating	Carbon Steel, STS304, STS316, Inconel, Monel, Hastelloy, Tungsten carbide coating	Carbon Steel, STS304, STS316, Inconel, Monel, Hastelloy, Tungsten carbide coating
Connection	Flange 150#, 300#, 600#, 900#, 1500#	Butt Weld	Flange 150#, 300#, 600#, 900#, 1500#
Applicable piping	2B ~ 24B (50A ~ 600A) Pipe	2B ~ 24B (50A ~ 600A) Pipe	2B ~ 24B (50A ~ 600A) Pipe
Standards	DHQ1023 (in-house standard)	DHQ1023 (in-house standard)	DHQ1023 (in-house standard)
Accuracy	±2.0% (±0.5% when calibrated)	±2.0% (±0.5% when calibrated)	±2.0% (±0.5% when calibrated)

Technical Specifications

Item	Value
Accuracy	±0.5% of reading after calibration (±3% before calibration)
Repeatability	±0.2
Maximum operating temperature	538 °C
Measuring range (Range)	10:1
H/D ratio (wedge height / pipe diameter)	0.2 ~ 0.5
Applicable pipe sizes	25A ~ 600A
Required straight run	Upstream 6 ~ 10D / downstream 3D
Materials	Carbon Steel, STS304, STS316, Inconel, Monel, Hastelloy, Tungsten carbide coating
Flange rating	ANSI 150#, 300#, 600#, 900#, 1500# (SORF / WNRF / RTJ)
DP tap connection	Chemical Tee / ANSI 2B / ANSI 3B / ANSI 4B

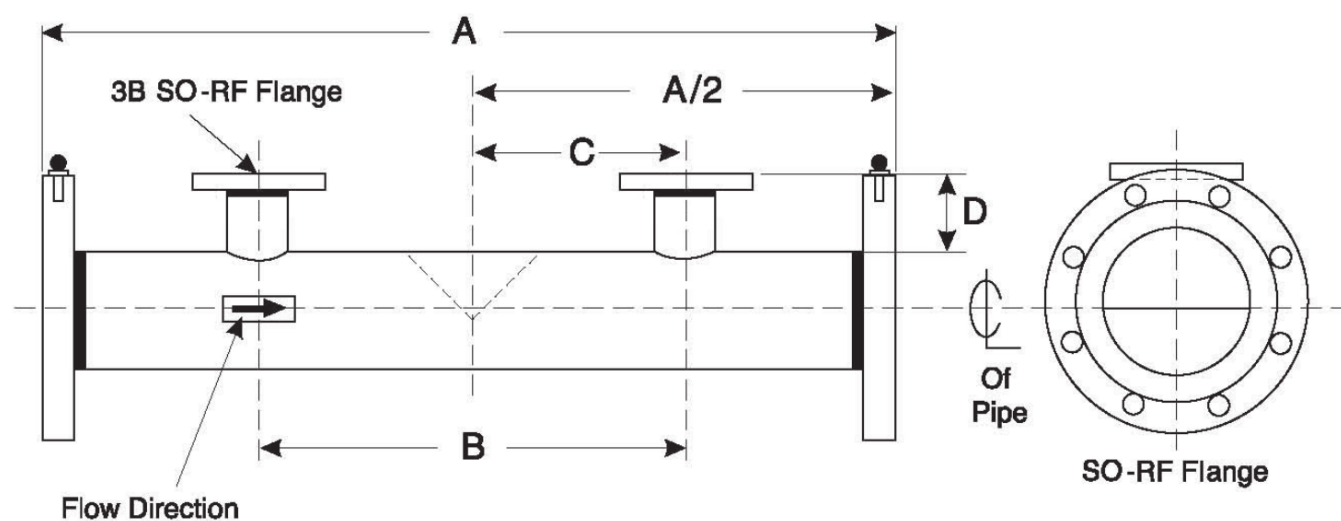
Dimensions · drawings

Unit: mm. Actual manufacturing dimensions are based on the approved drawing.

WN-RF type dimensions (mm)

Pipe Size	A (150#)	A (300#)	A (600#)	B	C	D (150#)	D (300#)	D (600#)
40A	530	543	559	292	146	208	214	213
50A	546	559	578	292	146	216	222	232
80A	622	641	660	311	156	156	167	175
100A	902	921	965	381	191	114	125	133
125A	965	972	1005	419	210	114	125	133
150A	1029	1048	1099	457	229	114	125	133
200A	1092	1111	1168	521	260	114	125	133
250A	1143	1175	1257	597	298	114	125	133
300A	1321	1353	1416	673	337	114	125	133
350A	1397	1429	1486	711	356	114	125	133
400A	1473	1511	1588	775	387	114	125	133
450A	1575	1613	1676	851	425	114	125	133
500A	1686	1721	1791	940	470	114	125	133
600A	1854	1886	1969	1067	533	114	125	133

A: face-to-face length (by flange rating), B: DP tap spacing, C: center-to-tap distance, D: tap flange height. Tap flanges are 3B WN-RF.

SO-RF type dimensions (mm)

Pipe Size	A	B	C	D (150#)	D (300#)	D (600#)
25A	495	272	136	208	214	214
40A	529	292	146	208	214	214
50A	546	292	146	216	222	232
65A	580	300	150	216	222	232
80A	622	311	156	156	167	175
100A	762	381	191	114	125	133
125A	813	419	210	114	125	133
150A	864	457	229	114	125	133
200A	914	521	260	114	125	133
250A	965	597	298	114	125	133
300A	1118	673	337	114	125	133
350A	1168	711	356	114	125	133
400A	1245	775	387	114	125	133
450A	1321	851	425	114	125	133
500A	1422	940	470	114	125	133
600A	1575	1067	533	114	125	133

Tap flanges are 3B SO-RF.

Installation requirements

- Provide a straight run of 6 ~ 10D upstream and at least 3D downstream.
- For slurries and viscous fluids, a Remote Seal type (DHWM-F) or Chemical Tee type (DHWM-T) DP transmitter is recommended.
- Selecting the Jacket model allows use with fluids that require insulation or heating.

Ordering information (How to Order)

1 Series	
DHWM-F	Flanged connection
DHWM-BW	Welded connection
DHWM-T	Chemical Tee remote seal type

2 Pipe Size	
025A ~ 600A	25, 40, 50, 65, 80, 100, 125, 150, 200, 250, 300, 350, 400, 450, 500, 600 (mm)

3 Material (Wedge / Pipe / Flange)	
Z	SS316 / SS316 / SS316
Y	SS304 / SS304 / SS304
V	SS316 / C.S / C.S
X	SS304 / C.S / C.S
W	Other (etc.)

4 Process Connection	
MS	ANSI 150# SORF
MW	ANSI 150# WNRF
NS	ANSI 300# SORF
NW	ANSI 300# WNRF
OS	ANSI 600# SORF
OW	ANSI 600# WNRF
PS	ANSI 900# SORF
PW	ANSI 900# WNRF
QS	ANSI 600# SORTJ
QW	ANSI 600# WNRTJ
RS	ANSI 900# SORTJ
RW	ANSI 900# WNRTJ
S	Other

5 D/P Connection	
1	Chemical Tee
2	ANSI 2B
3	ANSI 3B
4	ANSI 4B
5	Other

6 Option	
0	Non Jacket Model
1	Jacket Model

Ordering example: **DHWM-F-350AZMS30**

DHWM-F, 350A, all SS316 (Z), ANSI 150# SORF (MS), D/P connection ANSI 3B (3), no jacket (0)

ACCESSORIES

Condensate Pot

Condensate Pot

MODEL : DHCP

**DHCP**

The CONDENSATE POT is used for measuring steam or highly condensable gases as follows.

1) For steam, since the steam temperature exceeds 200 °C, it is used when the steam must be condensed to a liquid before measurement. The condensate is therefore sealed in between the POT and the instrument in advance. However, if the steam temperature is below 200 °C, a TEE and PLUG alone are sufficient when the transmitter is a diaphragm-type force-balance differential-pressure gauge.

The feature item in the General Catalog is summarized as "Protect the gauge from steam".

2B ~ 4B 1/2 · 3/4 SW / PT / NPT C.S · STS304 · STS316 · A182 Pipe Sch 10 ~ 160

Technical Specifications

Item	Value
Features	Protects the gauge from steam (Protect the gauge from steam)
Materials	C.S, STS304, STS316, Inconel, Monel, Hastelloy, A182 F11, F22, F51
Size	2B, 2-1/2B, 3B, 4B
Connection (Mounting)	1/2SW, 1/2 PT or NPT, 3/4SW, 3/4 PT or NPT
Pipe schedule (Pipe sch)	10, 20, 40, 80, 160
Ordering material codes	STPG, STPT, 304(L)SS, 316(L)SS
Plug / vent plug	Plug (P), Vent Plug (V)

Installation requirements

- The CONDENSATE POT is used lying horizontally so as to ease condensation of the measured medium and minimize volume changes in the wetted part of the instrument, thereby enlarging the contact area of the condensate.
- The CONDENSATE POT is mounted within 45° above horizontal from the tapping nozzle so that condensate above a certain level returns to the main pipe, with the high- and low-pressure sides at the same level.

Ordering information (How to Order)

1 Model / Size	
4	DHCP 4B
3	DHCP 3B
2.5	DHCP 2-1/2B
2	DHCP 2B

2 Pipe sch	
01	Sch 10
02	Sch 20
04	Sch 40
08	Sch 80
16	Sch 160

3 Material	
SG	STPG
ST	STPT
4(L)S	304(L)SS
6(L)S	316(L)SS

4 Connection	
P1	PT 1/2
P3	PT 3/4
N1	NPT 1/2
N3	NPT 3/4
S1	S.W 1/2
S3	S.W 3/4

5 Plug & Vent Plug	
P	Plug
V	Vent Plug

6 Option	
/□□□	Options (by separate agreement)

FLOW INSTRUMENTS

Flow Computer

Flow Computer

MODEL : SKE-3300



SKE-3300

The SKE-3300 flow computer supplies 2-wire DC 24V power to steam and gas flow meters, and is a computing unit that displays, totalizes and prints the flow meter output signals (digital, analog, pulse), temperature and atmospheric pressure in digital form.

It is panel-mounted, operates on AC 110 ~ 220 V 50/60 Hz power, and provides 4~20mA · RS485 · pulse outputs.

- Panel Mount AC 110 ~ 220 V 50/60 Hz 4~20mA · RS485 · Pulse
- DC 24V 2-wire power supply

Technical Specifications

Item	Value
Features	Supplies 2-wire DC 24V to steam and gas flow meters · digitally displays, totalizes and prints output signals (digital, analog, pulse), temperature and atmospheric pressure
Mounting (Mount)	Panel
Power supply	AC110~220V 50/60Hz
Output	4~20mA, RS485, Pulse

ACCESSORIES

Flow Conditioner (Flow Straightener)

Flow Conditioner

MODEL : DH19-TB

**DH19-TB**

The DH19-TB flow conditioner arranges 19 tubes in parallel inside the pipe to stabilize the flow.

The material is selected from STS304, STS316, Inconel, Monel and Hastelloy, and it is mounted between flanges of 150# ~ 2500#.

The applicable standard is ISO 5167-1.

19-Tube Bundle Flange 150# ~ 2500# ISO 5167-1
STS304 / STS316 · Inconel · Monel · Hastelloy

Technical Specifications

Item	Value
Features	19 tubes arranged in parallel inside the pipe to stabilize the flow
Materials	STS304, STS316, Inconel, Monel, Hastelloy
Connection (Mounting)	Flange 150#, 300#, 600#, 900#, 1500#, 2500#
Standards	ISO 5167-1

Standards · ISO 5167-1

ENVIRONMENTAL INSTRUMENTS (TMS)

Flow Velocity Meter

Flow Velocity Meter

MODEL : DHF-300



DHF-300

The DHF-300 flow velocity meter is a type-approved (Type approval) product for stack emission gas measurement.

The measuring range is selected from 0~5, 6, 7, 8 m/s and 0~10, 12, 15, 18, 20, 25, 30, 35, 40 m/s, and the power supply is AC110~220V.

The catalog photos show two types — a panel-type display unit and an outdoor enclosure type (FLOW VELOCITY METER) — together with an S-type pitot tube sensing element.

0 ~ 5 ... 0 ~ 40 m/s AC 110 ~ 220 V NIER type approval Stack emission gas (TMS)

Technical Specifications

Item	Value
Features	Type-approved product for stack emission gas measurement
Measuring range	0~5, 6, 7, 8 m/s / 0~10, 12, 15, 18, 20, 25, 30, 35, 40 m/s
Power supply	AC110~220V
Type approval	NIER (National Institute of Environmental Research)

FLOW INSTRUMENTS

Gas Flow Meter & Switch

Gas Flow Meter & Switch

MODEL : DPDT / DPLT / DSDT / DSLT



DPDT

DPLT

DSDT

DSLT

DPDT / DPLT / DSDT / DSLT gas flow meters & Switch is for measuring the flow of non-corrosive gases that do not contain sludge.

DPDT · DPLT have an LCD display and DC24V power; DSDT · DSLT have an LED display, AC100~220V 50/60Hz power and are explosion-proof (Explosion proof type).

The material is STS304 or STS316, the connection is 150# · 300# flange, the applicable piping is 3/8B ~ 24B (10A ~ 600A), and the turndown is 6:1.

The output is 4~20mA or 1~5V DC plus a contact (Contact) output, and the accuracy is $\pm 1.5\%$.

3/8B ~ 24B (10A ~ 600A) Turndown 6:1 $\pm 1.5\%$ Explosion-proof type (DSDT / DSLT)

Types · model configuration

Item	DPDT LCD · DC24V	DPLT LCD · DC24V	DSDT LED · AC · explosion-proof	DSLT LED · AC · explosion-proof
Features	For non-corrosive gases free of sludge	For non-corrosive gases free of sludge	For non-corrosive gases free of sludge · explosion-proof	For non-corrosive gases free of sludge · explosion-proof
Turndown	6:1	6:1	6:1	6:1
Materials	STS304, STS316	STS304, STS316	STS304, STS316	STS304, STS316
Connection	Flange 150#, 300#	Flange 150#, 300#	Flange 150#, 300#	Flange 150#, 300#
Applicable piping	3/8B~24B (10A~600A) Pipe	3/8B~24B (10A~600A) Pipe	3/8B~24B (10A~600A) Pipe	3/8B~24B (10A~600A) Pipe
Display	LCD	LCD	LED	LED
Power supply	DC24V	DC24V	AC100~220V 50/60Hz	AC100~220V 50/60Hz
Output	4~20mA or 1~5V DC, Contact	4~20mA or 1~5V DC, Contact	4~20mA or 1~5V DC, Contact	–
Accuracy	$\pm 1.5\%$	$\pm 1.5\%$	$\pm 1.5\%$	–

Technical Specifications

Item	Value
Fluids	Non-corrosive gases not containing sludge
Turndown	6:1
Materials	STS304, STS316
Connection (Mounting)	Flange 150#, 300#
Applicable piping	3/8B~24B (10A~600A) Pipe
Display	LCD (DPDT, DPLT) / LED (DSDT, DSLT)
Power supply	DC24V (DPDT, DPLT) / AC100~220V 50/60Hz (DSDT, DSLT)
Output	4~20mA or 1~5V DC, Contact

Item	Value
Accuracy	$\pm 1.5\%$ ※ Based on DPDT, DPLT, DSDT
Explosion-proof	Explosion proof type (DSDT, DSLT)

ORIFICE FLOW METERS

High Accuracy Orifice (Meter Run Assembly)

High Accuracy Orifice

MODEL : DHOF-H



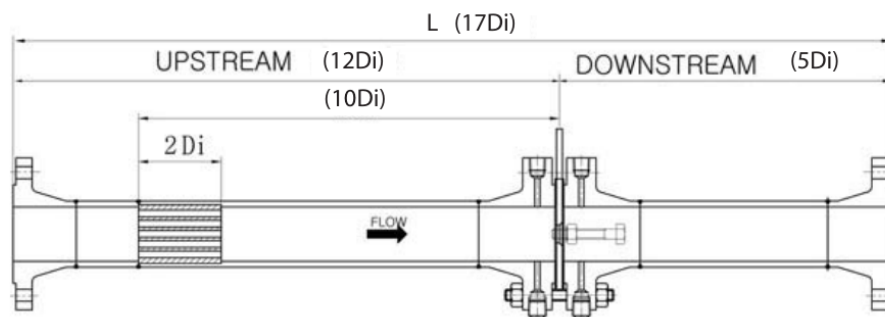
DHOF-H

The high accuracy orifice assembly (DHOF-H) is an assembly comprising orifice flanges, a meter run tube and a flow straightener.

Model DHOF-H□: used with the DHOF-H□ orifice plate, complete with Weld Neck flanges, meter run tube and flow straightener. As a meter run tube type, the DHOF-H□ is supplied only as an assembly (Assembly).

Accuracy 0.25% / 0.3% Meter run L = 17Di 1B ~ 32B (25A ~ 800A) ASME B16.36

Measurement principle



Meter run configuration: upstream 12Di (straightener 2Di @ 10Di) · downstream 5Di · L = 17Di

The total meter run length L is 17Di (Di: pipe inside diameter), made up of 12Di upstream and 5Di downstream.

In the upstream section, a flow straightener of length 2Di (selected from Tube Bundle, Etoile, AMCA, K-Lab and NEL) is installed 10Di from the orifice to condition the flow entering the orifice.

The differential pressure taken from the orifice flange taps is measured by a transmitter (integral or separate), with an output of 4~20mA or 1~5V.

Types · model configuration

Item	DHOF-H High accuracy orifice meter run assembly
Features	High accuracy
Turndown	4:1
Materials	Plate: STS304, STS316, Inconel, Monel, Hastelloy, Teflon · Flange: C.S, STS304, STS316, Inconel, Monel, Hastelloy, A182 F11, F22, F51
Connection	Flange 300#, 600#, 900#, 1500#
Applicable piping	2B ~ 24B (50A ~ 600A) Pipe & Duct
Standards	ISO5167-2
Accuracy	Within $\pm 0.3\%$ on calibration (In less than $\pm 0.3\%$ calibration)

Technical Specifications

Item	Value
Accuracy (1B ~ 20B, 40A ~ 500A)	0.25%
Accuracy (22B ~ 32B, 550A ~ 800A)	0.3%
Turndown (Turndown Range)	4:1
Nominal pipe size	1B ~ 32B (25A ~ 800A)
Meter run length	L = 17Di (12Di upstream, 5Di downstream) · flow straightener length 2Di, located 10Di upstream of the orifice
Flange rating (Flange Rating)	ASME(ANSI) 300#, 600#, 900# · Standard: ASME B 16.36
Flow calculation standard	ISO5167-2003, ASME PTC, AGA3, JIS Z 8762, KS A 0612
Applicable standards (Regulations)	ISO5167-2
Flange material	Carbon steel · 304(L)SS, 316(L)SS · Ni, Cr, Mo Alloy steel (A182 F11 to 91)
Plate material	304(L)SS, 316(L)SS · Ni, Cr, Mo Alloy steel (A182 F11 to 91) · Inconel, Hastelloy, Monel etc
Meter run tube material	A106 · 304(L)SS, 316(L)SS · Ni, Cr, Mo Alloy steel (A335 F11 to 91)
Tap connection 1 (threaded directly into flange)	1/2NPTF, 3/4NPTF, 1/2SW, 3/4SW
Tap connection 2 (nipple connection)	1/2NPTM, 3/4NPTM, socket weld, butt weld or flange
Flow straightener	Tube Bundle, Etoile, AMCA, K-Lab, NEL
Transmitter	One Body (integral) / Separation Type (separate)
Output	4 ~ 20mA / 1 ~ 5V / etc

Standards · ISO 5167-2 (2003) · ASME B16.36 · ASME PTC · AGA 3 · JIS Z 8762 · KS A 0612

Installation requirements

- The meter run assembly (upstream 12Di + downstream 5Di = 17Di) is connected to the piping by flanges at both ends.
- The DP taps are either threaded directly into the flange (1/2 · 3/4 NPT F, 1/2 · 3/4 SW) or connected by nipple (1/2 · 3/4 NPT M, socket weld · butt weld · flange).
- The transmitter can be ordered as integral (One Body) or separate (Separation Type).

Ordering information (How to Order)

1 Model
DHOF-H High Accuracy Orifice Assembly

2 Nominal Pipe Size
(size) Pipe size in inch or mm

3 Flange Rating
30 300#
60 600#
90 900#
O1 Option

4 Plate Material
4(L)S 304(L)SS
6(L)S 316(L)SS
I6 Inconel 600
HS Hastelloy-C 276
O2 Option

5 Flange Material
CS Carbon Steel
4S 304(L)SS
6S 316(L)SS
11 A182 F11
12 A182 F12
22 A182 F22
51 A182 F51
91 A182 F91
O3 Option

6 Meter Run Tube Material
CS Carbon Steel
4S 304(L)SS
6S 316(L)SS
11 A335 P11
12 A335 P12
22 A335 P22
51 A335 P51
91 A335 P91
O4 Option

7 Diff' Pressure Taps
0 MFR STD
1 NPT 1/2
2 NPT 3/4
3 SW 1/2
4 SW 3/4
O5 Option

8 Flow Straightener
T Tube Bundle
E Etoile
A AMCA
K K-Lab
N NEL
O6 Option

9 Transmitter
O One Body
S Separation Type
O7 Option

10 Output
A 4 ~ 20mA
V 1 ~ 5V
R etc

ORIFICE FLOW METERS

High Pressure RTJ Orifice

High Pressure Orifice

MODEL : DHOF-RTJP / DHOF-RTJF



DHOF-RTJP

DHOF-RTJF

These flanges include the Weld Neck type used with an orifice plate or a ring-mounted orifice plate, and are supplied in the following types.

Model DHOF-RTJ□: used with the DHOF-RTJ□ orifice fitted with a holding ring (Holding Ring) for flange taps. Supplied only as Weld Neck type, with ring joint (Ring-Joint) type flange faces.

The DHOF-RTJF has two taps per flange, located at the flange tap positions specified in ISO5167.

RTJ Oval / Octagonal ANSI 600 ~ 2500LB 1-1/2B ~ 24B (40A ~ 600A) Weld Neck only

Types · model configuration

Item	DHOF-RTJP Plate only (Plate Only)	DHOF-RTJF With flanges (Flange Include)
Features	For high pressure (For High pressure)	For high pressure (For High pressure)
Turndown	4:1	4:1
Materials	Plate: STS304, STS316, Inconel, Monel, Hastelloy	Plate: STS304, STS316, Inconel, Monel, Hastelloy · Flange: C.S, STS304, STS316, Inconel, Monel, Hastelloy, A182 F11, F22, F51
Connection	Flange 900#, 1500#, 2500#	Flange 900#, 1500#, 2500#
Applicable piping	2B ~ 24B (50A ~ 600A) Pipe	2B ~ 24B (50A ~ 600A) Pipe
Standards	ISO5167-2	ISO5167-2
Accuracy	±1.5%	±1.5%

Technical Specifications

Item	Value
Accuracy	±1.5%
Turndown (Turndown Range)	4:1
Applicable standards (Regulations)	ISO5167-2
Nominal pipe size	1-1/2B ~ 24B (40A ~ 600A)
Flange rating (Flange Rating)	ANSI 600, 900, 1500, 2500LB RTJ Oval Type or Octagonal Type
Flange type	Weld Neck only · Ring-Joint type flange face
Tap configuration	Two per flange (DHOF-RTJF) · ISO5167 flange tap positions
Flow calculation standard	ISO5167, JIS Z 8762, ASME, KS A 0612
Materials	Carbon Steel · 304SS, 304L SS, 316SS, 316L SS · Ni, Cr, Mo Alloy Steel (A182 F11 to 91)
Tap connection 1 (threaded directly into flange)	1/2NPT F, 3/4NPT F, 1/2 S.W, 3/4 S.W

Item	Value
Tap connection 2 (nipple connection)	1/2NPT M, 3/4NPT M, socket weld, butt weld or flange
Bolts	Stud · A193 Gr B7
Nuts	Hex · A194 2H

Standards · ISO 5167-2 · ISO 5167 · JIS Z 8762 · ASME · KS A 0612 · ASTM A193 B7 / A194 2H

Installation requirements

- The Weld Neck flanges are butt-welded to the piping, and the orifice plate with holding ring is assembled between the flanges together with the RTJ gasket ring.
- The DP taps are either threaded directly into the flange (1/2 · 3/4 NPT F, 1/2 · 3/4 S.W) or connected by nipple (1/2 · 3/4 NPT M, socket weld · butt weld · flange).
- Bolting uses A193 Gr B7 studs and A194 2H hex nuts.

Ordering information (How to Order)

1 Model	
DHOF-RTJ P	Plate Only
DHOF-RTJ F	Flange Include
2 Nominal Pipe Size	
(size)	Pipe size in inch or mm
3 Material	
CS	Carbon Steel
4S	304SS
4L	304L SS
6S	316SS
6L	316L SS
11	A182 F11
12	A182 F12
51	A182 F51
91	A182 F91
OP	Option

4 Mounting Connection	
060	ANSI Class 600 LB
090	ANSI Class 900 LB
150	ANSI Class 1500 LB
250	ANSI Class 2500 LB
000	Option

5 Diff' Taps	
1	NPT 1/2
2	NPT 3/4
3	SW 1/2
4	SW 3/4

ORIFICE FLOW METERS

Integral Orifice (One-Piece DP Flow Meter)

Integral Orifice

MODEL : DHIO-FM / DHIO-BN / DHIO-BY



DHIO-FM

DHIO-BN

DHIO-BY

The integral orifice is a one-piece (One-Piece) differential-pressure flow meter. Although it is an orifice-based flow meter, its different design greatly simplifies installation and commissioning.

The integral orifice is a self-contained orifice flow meter with all of the following:
 an integral 3-valve manifold · integral connection between the carrier taps and the manifold · a DP transmitter factory-mounted on the manifold and pre-configured for the application · fully leak-tested and configured.

Features: combines the primary element and DP transmitter into a single flow meter assembly. As a one-piece flow meter pressure-tested as an assembly, there are no leak points to trace or repair, improving reliability. With an integral multivariable transmitter and RTD, mass flow (liquids, steam) and corrected volumetric flow (gases) are measured integrally in a single unit. The integral impulse connection eliminates impulse piping and provides a repeatable DP connection regardless of installation position. Installation cost is reduced because there is only one component to install and no separate manifold to supply and connect. The entire flow meter is specified with a single ordering code, and with only two orifice ratios (Ratio), specification is simple.

DHIO-FM: the integral orifice is a flow element that can be close-coupled (Close-coupled) with a DP transmitter to form a complete flow meter, allowing easy installation and low-cost measurement of the low flows frequently encountered in plant metering and research work. It can be ordered with internal NPT threads or with flanged piping (meter run) welded upstream and downstream of the flow restriction, and the orifice assembly can be mounted directly on the transmitter or remotely with the optional adapter kit (155S711).

DHIO-BN / DHIO-BY: the integral orifice block type is a compact flow meter providing integral measurement of liquids and steam in mass units, and gas flow in corrected volumetric units.

15A ~ 200A (1/2" ~ 8") ASME B16.5 150 ~ 1500# Process temperature -40 ~ 121 °C

Integral 3-valve manifold

Types · model configuration

Item	DHIO-FM Flange & Meter run included	DHIO-BN Block type · without meter run	DHIO-BY Block type · with meter run
Features	Transmitter · meter run integral (All-in-one)	Transmitter · block integral (All-in-one)	Transmitter · meter run integral (All-in-one)
Turndown	4:1	4:1	4:1
Materials	Plate: STS304, STS316, Inconel, Monel, Hastelloy · Flange & Meter Run: C.S, STS304, STS316, Inconel, Monel, Hastelloy, A182 F11, F22, F51	STS304, STS316, Inconel, Monel, Hastelloy	Plate: STS304, STS316, Inconel, Monel, Hastelloy · Flange & Meter Run: C.S, STS304, STS316, Inconel, Monel, Hastelloy, A182 F11, F22, F51
Connection	Flange 150#, 300#	Flange 150#, 300#, 600#, 900#, 1500#	Flange 150#, 300#, 600#, 900#, 1500#
Applicable piping	1/2B ~ 2-1/2B (15A ~ 65A) Pipe	1/2B ~ 8B (15A ~ 200A) Pipe	1/2B ~ 8B (15A ~ 200A) Pipe

Item	DHIO-FM Flange & Meter run included	DHIO-BN Block type · without meter run	DHIO-BY Block type · with meter run
Standards	ISO5167-2	ISO5167-2	ISO5167-2
Accuracy	±1.5%	±1.5%	±1.5%

Technical Specifications

Item	Value
Accuracy	±1.5%
Turndown (Turndown Range)	4:1
Applicable standards (Regulations)	ISO5167-2
Fluids	Liquids, gases and saturated steam
Line size	15A, 25A, 40A, 50A, 80A, 100A, 150A, 200A (1/2", 1", 1-1/2", 2", 3", 4", 6", 8")
Process connection	Wafer body — installed between ASME B16.5 (ANSI) Class 150, 300, 600, 900, 1500# flange drilling
Material (orifice assembly · stem · manifold)	316L
Material (orifice body)	304 SS, 304L SS, 316 SS, 316L SS
Process temperature	−40 ~ 121 °C (−4 ~ 250 °F)
Ambient temperature	−40 ~ 70 °C (−4 ~ 158 °F)
Components	Integral 3-valve manifold · integral carrier tap–manifold connection · factory-mounted and pre-configured DP transmitter · leak-tested
Measurement output (Indicator)	Volumetric / Mass
Output signal	4 ~ 20mA / 1 ~ 5V
Transmitter mounting	Direct mounting or remote mounting with the optional adapter kit (155S711) (DHIO-FM)
DHIO-FM piping connection	Internal NPT threads or flanged meter run welded upstream and downstream of the flow restriction
Orifice ratio (Ratio)	Two (Only two orifice ratios)

Standards · ISO 5167-2 · ASME B16.5

Installation requirements

- The wafer body is installed between ASME B16.5 Class 150 ~ 1500# flanges. The DHIO-FM / DHIO-BY are supplied with upstream and downstream meter runs and are connected to the piping by flanges at both ends.
- No impulse piping or separate manifold is required; the transmitter is mounted on the manifold and configured at the factory before shipment.
- Used within a process temperature of −40 ~ 121 °C and an ambient temperature of −40 ~ 70 °C. For conditions outside these ranges, consider the separate transmitter arrangement (DHIO-FM remote mounting) or similar.

Ordering information (How to Order)

1 Model	
DHIO-FM	Flange & Meter Run Included
DHIO-BN	Block Type, Meter Run Excluded
DHIO-BY	Block Type, Meter Run Included

2 Nominal Pipe Size	
(size)	Pipe size in inch or mm

3 Material : Plate or Block / Meter Run	
CS	Carbon Steel
4S	304SS
4L	304L SS
6S	316SS
6L	316L SS
OP	Option

4 Mounting Connection	
015	ASME(ANSI) Class 150 LB
030	ASME(ANSI) Class 300 LB
060	ASME(ANSI) Class 600 LB
090	ASME(ANSI) Class 900 LB
150	ASME(ANSI) Class 1500 LB
000	Option

5 Indicator	
V	Volumetric
M	Mass

6 Output	
A	4 ~ 20mA
V	1 ~ 5V

ORIFICE FLOW METERS

Standard Orifice Plate

Orifice Plate & Flange

MODEL : DHOP / DHOF-W



DHOP

DHOE-W

Because an orifice plate can be installed directly in the pipe flanges, it measures flow more economically than an orifice plate with rings and is generally suitable for large-bore piping. For large-bore piping of 500mm and above, several DP tap holes are drilled around the pipe circumference and connected by a loop-type equalizing pipe to measure the average pressure.

Daehan Instruments' paddle-type orifice plates are used with orifice flange unions. The outside diameter of the plate is fully machined into a uniform disc, giving high concentricity between the orifice bore and the plate outside diameter. The handle is then welded on and the plate is ground to the specified surface finish on dedicated equipment. Blank plates and plates with commonly requested bore sizes are kept in stock at all times, and the handle of each plate is stamped with the pipe size, flange rating, orifice bore and plate material. Standard thicknesses of 304 and 316 stainless steel are stocked; other sizes and materials are manufactured on request.

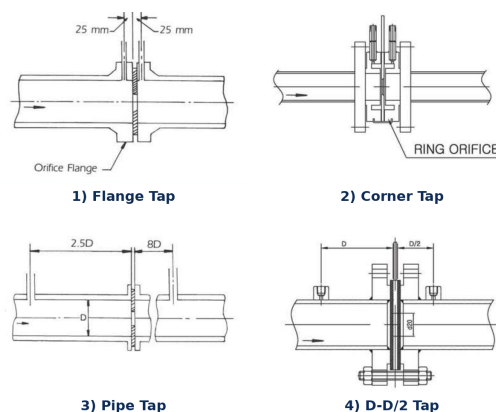
The bevel of a concentric (Concentric) bore, which serves to limit the plate edge thickness, is machined at 45°. Unless otherwise specified, the bevel is machined to the smaller of 1/50 of the pipe inside diameter or 1/8 of the orifice bore.

An eccentric (Eccentric) bore plate has the orifice offset from the center; the bore is normally inscribed in a circle of 98% of the pipe diameter so that solids or slurry can pass through. It is used in many industries including heavy and light chemicals, steelmaking, paper, nuclear power and petrochemicals.

A segmental (Segmental) bore plate is used for measurement where solids are entrained in gas or liquid flow. The arc of the bore is normally inscribed in a circle of 98% of the pipe diameter, and the segmental opening can be placed at the top or bottom of the pipe. It is used in sewage treatment, steelmaking, chemicals, water treatment, paper and petrochemicals.

Accuracy $\pm 1.5\%$ Turndown 4:1 25mm(1") ~ 3000mm(120") ISO 5167-2

Measurement principle



DP tapping positions by tap type

Flange Tap, Corner Tap or D-D/2 Tap is selected according to the position (tap type) at which differential pressure is taken across the orifice plate (ordering codes F / C / D).

Flange Tap: both upstream and downstream taps are located 25mm from the orifice plate; applied to relatively small-bore piping.

Corner Tap: differential pressure is taken immediately before and after the orifice; mainly used for small-bore piping of 2" and under (ring type orifice).

D-D/2 Tap: the upstream tap is located one pipe diameter (D) from the orifice, and the downstream tap at half the pipe diameter (D/2).

Types · model configuration



Concentric

Concentric orifice — bore at the plate center; the most common standard type



Eccentric

Eccentric orifice — bore offset toward the bottom of the pipe so solids and condensate pass easily



Segmental

Segmental orifice — segment-shaped (D-shaped) opening for slurries and fluids containing solids

Photographic examples by bore type (produced from the drawings). Actual bore size and β ratio are determined by the flow calculation.

Item	DHOP Orifice plate (Plate Only)	DHOF-W Orifice Plate & Flange assembly (including Bolt, Nut, Gasket)
Features	Low installation and maintenance cost	Low installation and maintenance cost
Turndown	4:1	4:1
Materials	STS304, STS316, Inconel, Monel, Hastelloy, Teflon	Plate: STS304, STS316, Inconel, Monel, Hastelloy, Teflon · Flange: C.S, STS304, STS316, Inconel, Monel, Hastelloy, A182 F11, F22, F51
Connection	Flange 150#, 300#, 600#, 900#	Flange 300#, 600#, 900#
Applicable piping	2B ~ 92B (50A ~ 2300A) Pipe & Duct	2B ~ 24B (50A ~ 600A) Pipe & Duct
Standards	ISO5167-2	ISO5167-2
Accuracy	±1.5%	±1.5%

Technical Specifications

Item	Value
Accuracy	±1.5%
Turndown (Turndown Range)	4:1
Applicable standards (Regulations)	ISO5167-2
Flow calculation standard	ISO5167, JIS Z 8762, ASME, KS A 0612
Nominal diameters (Nominal Diameters)	25mm (1inch) ~ 3000mm (120inch)
Orifice bore types	Concentric Square Edge Type, Eccentric Type, Segmental Type, Quadrant Edge Type
Tap types (Taps Type)	Flange Taps Type, Corner Taps Type, D-D/2 Taps Type
Orifice flange types	Weld Neck Type, Socket Weld Type, Slip On Type
Flange rating (Flange Rating)	ANSI 150, 300, KS, JIS 10K 20K, AWWA
Plate material	304SS, 304L SS, 316SS, 316L SS, Monel, Hastelloy, Inconel, Cu-Ni, PTFE, Glass, Ni·Cr·Mo Alloy Steel (A182 F11 to 91)
Flange material	A105, A182 F304, A182 F316, A182 F11, A182 F22, A182 F51, A350 LF2, etc

Item	Value
Orifice flange material	Forged steel A.S.T.M. A-105 (other materials by special order, delivery to be advised)
Concentric bore bevel	Machined at 45°. Unless otherwise specified, the smaller of 1/50 of the pipe inside diameter or 1/8 of the orifice bore
Eccentric · segmental bores	Bore (arc) inscribed in a circle of 98% of the pipe diameter
Standard stock	Type 304 · 316 stainless steel in standard thicknesses (blank plates and commonly requested bore sizes always in stock)
Handle stamping	Pipe size, flange rating, orifice bore, plate material
DP tap connection (Diff' Taps)	NPT 1/2, NPT 3/4, SW 1/2, SW 3/4
DHOF-W assembly contents	Orifice flanges + plate + Bolt, Nut, Gasket (meter run optional)

Standards · ISO 5167-2 · ISO 5167 · JIS Z 8762 · ASME · KS A 0612

Dimensions · drawings

Unit: mm. Actual manufacturing dimensions are based on the approved drawing.

Diameters of holes in paddle plate handles (Diameters of holes in paddle Plate Handles)

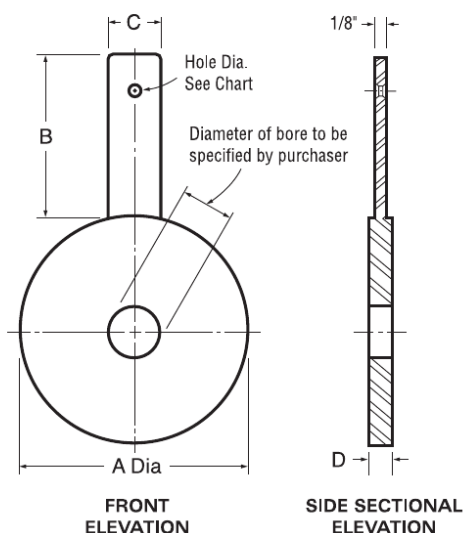


Plate Size	Hole Diameter
1/2" thru 2"	1/4"
1-1/2" thru 12"	3/8"
14" thru 24"	1/2"
26" and larger	3/4"

In the drawing, A (plate outside diameter) · B (handle height) · C (handle width) · D (thickness) are determined by the flange rating and pipe size, and the bore diameter is specified by the customer.

Installation requirements

- The orifice plate is installed directly between the pipe flanges (orifice flanges). With Flange Taps, the upstream and downstream taps are located 25mm from the plate.
- For large-bore piping of 500mm and above, several DP taps are placed around the pipe circumference and connected by a loop-type equalizing pipe to measure the average pressure.
- For fluids containing solids or slurry, an eccentric (Eccentric) or segmental (Segmental) bore is applied. The segmental opening can be placed at the top or bottom of the pipe.
- The upstream/downstream straight run lengths for orifices, flow nozzles and venturi tubes and the impulse piping configuration (steam · liquid · gas) are determined according to the β ratio on the basis of ISO 5167, as described on the 'Orifice Tap Types · Installation Piping Requirements' page.

Ordering information (How to Order)

1 Model	
DHOP	Plate Only
DHOF-W	Flange Assembly (including Bolt, Nut, Gasket)

2 Tap Type	
D	D-D/2 Taps
F	Flange Taps
C	Corner Taps

3 Nominal Pipe Size	
(size)	Pipe size in inch or mm

4 Material : Plate / Flange	
CS	Carbon Steel
4S	304SS
4L	304L SS
6S	316SS
6L	316L SS
11	A182 F11
12	A182 F12
51	A182 F51
91	A182 F91
OP	Option

5 Mounting Connection	
015	ASME(ANSI) Class 150 LB
030	ASME(ANSI) Class 300 LB
010	KS(JIS) Class 10K
020	KS(JIS) Class 20K
000	Option

6 Diff' Taps	
1	NPT 1/2
2	NPT 3/4
3	SW 1/2
4	SW 3/4

7 Meter Run	
N	None
Y	Include

Ordering example: **DHOF-W-D-1800-6S/CS-PN10-1-N**

DHOF-W flange assembly, D-D/2 tap (D), 1800A, plate 316SS (6S) / flange Carbon Steel (CS), PN10 flange (optional rating), DP tap 1 (1/2 tap), no meter run (N) — ordering example based on the orifice approved drawing

ORIFICE FLOW METERS

Orifice Flange Assembly

Orifice Plate & Flange Assembly

MODEL : DHOF-W

**DHOF-W**

Orifice flanges are one of the most economical means of measuring flow, and Daehan Instruments' orifice flanges are manufactured specifically for accurate measurement. Automatic machine tools are used to meet the strict tolerances and recommendations required for the flanges, with close attention to tap position, bore surface condition, and machining of the bolt and flange faces.

Orifice flanges are manufactured from forged steel A.S.T.M. A-105. Other materials are manufactured by special order with extended delivery.

The DHOF-W assembly includes a pair of orifice flanges, an orifice plate, and bolts, nuts and gasket (per the ordering code table), and can be supplied with a meter run (Meter Run) if required.

Bolt · Nut · Gasket included WN / SW / SO flanges Taps NPT · SW 1/2 · 3/4
Accuracy $\pm 1.5\%$

Types · model configuration

Item	DHOF-W Orifice Plate & Flange assembly
Features	Low installation and maintenance cost
Turndown	4:1
Materials	Plate: STS304, STS316, Inconel, Monel, Hastelloy, Teflon · Flange: C.S, STS304, STS316, Inconel, Monel, Hastelloy, A182 F11, F22, F51
Connection	Flange 300#, 600#, 900#
Applicable piping	2B ~ 24B (50A ~ 600A) Pipe & Duct
Standards	ISO5167-2
Accuracy	$\pm 1.5\%$

Technical Specifications

Item	Value
Orifice flange types	Weld Neck Type, Socket Weld Type, Slip On Type
Flange material	Forged steel A.S.T.M. A-105 (other materials by special order)
Flange material (options)	A105, A182 F304, A182 F316, A182 F11, A182 F22, A182 F51, A350 LF2, etc
Flange rating (Flange Rating)	ANSI 150, 300, KS, JIS 10K 20K, AWWA
Tap type	Flange Taps, Corner Taps, D-D/2 Taps
DP tap connection (Diff' Taps)	NPT 1/2, NPT 3/4, SW 1/2, SW 3/4
Flange Tap position	25mm from the orifice plate, both upstream and downstream
Assembly section drawing notes	1/2" N.P.T. pressure taps, 1/16" thick gasket, 37½° weld bevel (Weld Neck)
Assembly contents	Orifice flanges + plate + Bolt, Nut, Gasket (Meter Run optional)

Item	Value
Assembly drawing parts list (example)	Flange A105 · Plate SUS316 · Gasket (MAX 350 °C) · Boss A105 PT 1/2 · Bolt & Nut A193 B7 Stud · Pipe C/S (user scope) ※ Example approved drawing of an 1800A PN10 D-D/2 tap assembly; specifications vary by project
Plate material	304SS, 304L SS, 316SS, 316L SS, Monel, Hastelloy, Inconel, Cu-Ni, PTFE, Glass, Ni · Cr · Mo Alloy Steel (A182 F11 to 91)
Accuracy / turndown / applicable standards	±1.5% / 4:1 / ISO5167-2

Standards · ISO 5167-2 · ISO 5167 · JIS Z 8762 · ASME · KS A 0612 · ASTM A105

Installation requirements

- The Weld Neck type is butt-welded to the pipe, the Socket Weld type is socket-welded, and the Slip On type is slipped over the pipe and welded. The flange rating is selected to match the process piping.
- With Flange Taps, the upstream and downstream taps are located 25mm from the plate. The tap connection is selected from NPT 1/2 · 3/4 or SW 1/2 · 3/4.
- Impulse piping (steam · liquid · gas service) and straight run lengths are determined according to the β ratio on the basis of ISO 5167, as described on the 'Orifice Tap Types · Installation Piping Requirements' page.

Ordering information (How to Order)

1 Model	
DHOF-W	Flange Assembly (including Bolt, Nut, Gasket)
DHOP	Plate Only

2 Tap Type	
D	D-D/2 Taps
F	Flange Taps
C	Corner Taps

3 Nominal Pipe Size	
(size)	Pipe size in inch or mm

4 Material : Plate / Flange	
CS	Carbon Steel
4S	304SS
4L	304L SS
6S	316SS
6L	316L SS
11	A182 F11
12	A182 F12
51	A182 F51
91	A182 F91
OP	Option

5 Mounting Connection	
015	ASME(ANSI) Class 150 LB
030	ASME(ANSI) Class 300 LB
010	KS(JIS) Class 10K
020	KS(JIS) Class 20K
000	Option

6 Diff' Taps	
1	NPT 1/2
2	NPT 3/4
3	SW 1/2
4	SW 3/4

7 Meter Run	
N	None
Y	Include

Ordering example: **DHOF-W-D-1800-6S/CS-PN10-1-N**

DHOF-W flange assembly, D-D/2 tap (D), 1800A, plate 316SS (6S) / flange Carbon Steel (CS), PN10 flange (optional rating), DP tap 1 (1/2 tap), no meter run (N) — ordering example based on the orifice approved drawing

ORIFICE FLOW METERS · TECHNICAL REFERENCE

Orifice Tap Types · Installation Piping Requirements

Orifice Type / Installation & Piping Requirements

MODEL : Flange Tap / Corner Tap / Pipe Tap / D-D/2 Tap



Flange Tap

Corner Tap

Pipe Tap

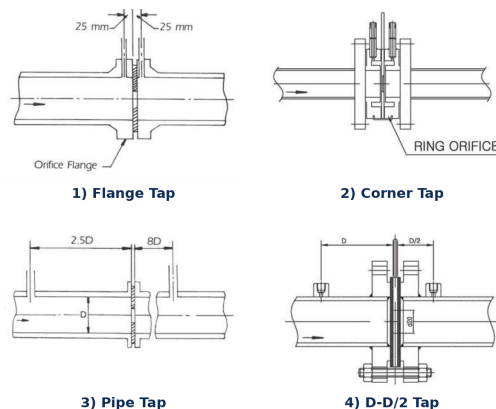
D-D/2 Tap

- 1) Flange Tap: both the upstream and downstream taps are located 25mm from the orifice plate. This type can be applied to relatively small-bore piping.
- 2) Corner Tap: differential pressure is taken immediately before and after the orifice. Mainly used for small-bore piping (2" and under); the ring orifice (Ring Orifice) uses this type.
- 3) Pipe Tap: taken at 2.5D upstream and 8D downstream. The differential pressure is small and this type is not widely used.
- 4) D-D/2 Tap: the upstream tap is located one pipe diameter (D) from the orifice, and the downstream tap at half the pipe diameter (D/2).

Flange Tap: 25 mm before and after Corner Tap: small bore, 2" and under

Pipe Tap: 2.5D / 8D D-D/2 Tap: D / D/2

Measurement principle



DP tapping positions of the four tap types

Since an orifice flow meter measures the pressure difference across the plate, the position of the taps (pressure take-offs) determines the flow coefficient and the conditions for applying the calculation standard (ISO 5167, etc.).

In the ordering codes for Daehan Instruments orifice products, the tap type is specified as D (D-D/2 Taps), F (Flange Taps) or C (Corner Taps). The ring type orifice (DHOF-RING) is corner tap only.

The figure is the tap type diagram from Orifice catalog p.11.

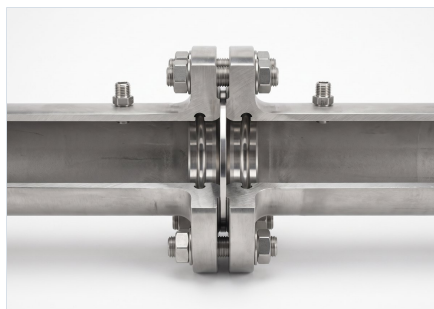
Types · model configuration



Flange Tap

Cutaway rendering for illustration

Flange taps — drilled in the flange body 25 mm on each side of the plate (most common), cutaway image



Corner Tap

Cutaway rendering for illustration

Corner taps — pressure taken at the corner between the plate face and pipe wall (ring orifice), cutaway image



Pipe Tap

Cutaway rendering for illustration

Pipe taps — pipe-wall taps 2.5D upstream and 8D downstream, cutaway image



D-D/2 Tap Cutaway rendering for illustration

D and D/2 taps (radius taps) — pipe-wall taps 1D upstream and D/2 downstream, cutaway image

The four images are cutaway renderings with the pipe cut lengthwise to show the tap locations; the actual products are closed pipe and flange assemblies.

Item	Flange Tap Flange tap	Corner Tap Corner tap	Pipe Tap Pipe tap	D-D/2 Tap D-D/2 tap (Radius Tap)
Tap position	25mm from the plate, both upstream and downstream	Immediately before and after the orifice	Upstream 2.5D · downstream 8D	Upstream D · downstream D/2
Application	Applied to relatively small-bore piping	Mainly small-bore piping (2" and under) · ring orifice	Small differential pressure · not widely used	Taps installed directly in the pipe (no orifice flanges required)
Applicable products	DHOP / DHOF-W (code F), DHOF-RTJ, DHOF-H	DHOF-RING, DHOP / DHOF-W (code C)	—	DHOP / DHOF-W (code D)

Technical Specifications

Item	Value
Flange Tap position	Upstream 25mm / downstream 25mm (from the plate)
Corner Tap position	Immediately before and after the orifice (mainly 2" and under)
Pipe Tap position	Upstream 2.5D / downstream 8D
D-D/2 Tap position	Upstream D / downstream D/2
Impulse piping — steam service	Plugged tee (for steam service or sealing fluid), blocking valves, sufficient pipe length for condensation, 3-valve manifold, blowdown valves, vent/drain valves (transmitter installed below the taps)
Impulse piping — liquid service	3-valve manifold, vent/drain valves (side-mounting option), transmitter installed below the taps
Impulse piping — gas service	3-valve manifold, vent/drain valves, transmitter installed above the taps
Straight run requirement charts	Required straight run length (in pipe diameters) as a function of diameter ratio β (0 ~ 0.8), presented in eight charts (A)~(H) by piping condition

Standards · ISO 5167 · JIS Z 8762 · ASME · KS A 0612

Dimensions · drawings

Unit: mm. Actual manufacturing dimensions are based on the approved drawing.

Straight run requirement charts — Piping Requirements for Orifices, Flow Nozzles and Venturi Tubes

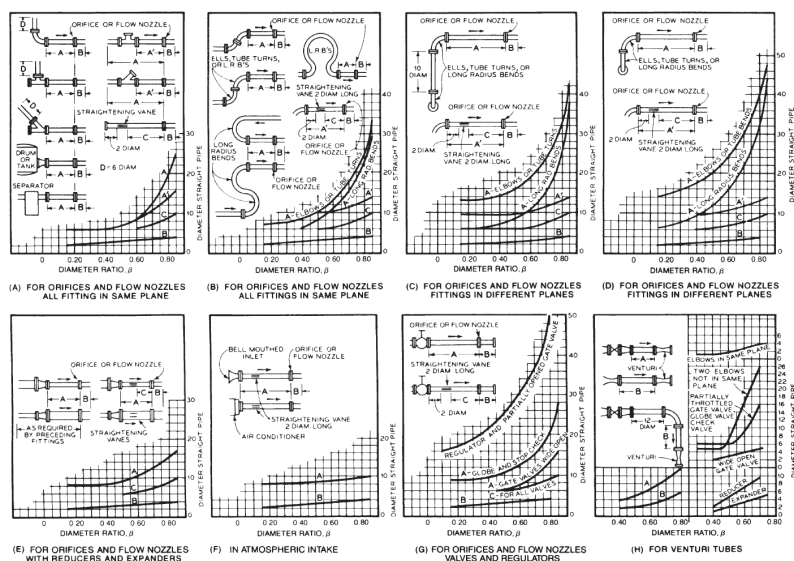


Chart	Application conditions	Curves
(A)	Orifices · flow nozzles — all fittings in the same plane (upstream elements such as elbows, tees, drums/tanks, separators)	A, A', C, B
(B)	Orifices · flow nozzles — all fittings in the same plane (two or more elbows · tube turns · long radius bends)	A (elbows/tube turns), A' (long radius bends), C, B
(C)	Orifices · flow nozzles — fittings in different planes (10D apart)	A (elbows/tube turns), A' (long radius bends), C, B
(D)	Orifices · flow nozzles — fittings in different planes	A (elbows/tube turns), A' (long radius bends), C, B
(E)	Orifices · flow nozzles — with reducers · expanders	A, C, B
(F)	Atmospheric intake (bell-mouth inlet · air conditioner)	A, B
(G)	Orifices · flow nozzles — valves · regulators (partially open gate valves, globe · stop check, fully open gate valves)	Regulators/partially open, A (globe · stop check), A' (gate fully open), C (all valves)
(H)	Venturi tubes — elbows in the same plane, two elbows in different planes, partially open gate/globe/check valves, fully open gate valves, reducers · expanders	A, B

Horizontal axis: diameter ratio β (Diameter Ratio), vertical axis: required straight run length (Diameter Straight Pipe, in pipe diameters). A = upstream straight run (without straightening vane), A' = upstream of a long radius bend, C = upstream when a 2D-long straightening vane (Straightening Vane) is used, B = downstream straight run.

Installation requirements

- Steam service: provide enough impulse piping length for adequate condensation at the taps, and arrange blocking valves, blowdown valves, a 3-valve manifold and vent/drain valves. The transmitter is installed below the taps.
- Gas service: arrange a 3-valve manifold and vent/drain valves, with the transmitter installed above the taps.
- Liquid service: arrange a 3-valve manifold and vent/drain valves (side-mounting option), with the transmitter installed below the taps.

- Straight run: read the upstream (A/A'/C) and downstream (B) straight run lengths from charts (A)~(H) according to the type of upstream fitting (elbow, bend, reducer, valve, etc.), its plane arrangement and the diameter ratio β . When the straight run is insufficient, 2D-long straightening vanes (flow conditioner) can be used to reduce the upstream straight run (curve C).

TEMPERATURE INSTRUMENTS

Resistance Temperature Detector (RTD)

Resistance Temperature Detector

MODEL : DRB



DRB

The DRB RTD is a temperature sensor with a temperature-sensing resistance element built in sheath pipe (protection tube) form.

The measuring range is -200~600 °C, and the element is PT100 or PT1000 Ω.

The sheath material is selected from STS304, STS316, STS310, STS446, Inconel600 and Hastelloy, with threaded (Screw) or flanged (Flange) mounting. The applicable standards are DIN 43760 and IEC 751 : 1983.

-200 ~ 600 °C PT100 / PT1000 Ω Screw & Flange DIN 43760 · IEC 751

Technical Specifications

Item	Value
Features	RTD in sheath pipe (protection tube) form
Connection (Mounting)	Screw & Flange
Measuring range	-200~600 °C
Element	PT100, PT1000 ohm
Sheath material	STS304, STS316, STS310, STS446, Inconel600, Hastelloy
Standards	DIN 43760, IEC 751 : 1983

Standards · DIN 43760 · IEC 751 : 1983

ORIFICE FLOW METERS

Restriction Orifice (Pressure-Reducing Orifice)

Restriction Orifice

MODEL : DHRO-SH / DHRO-MH / DHRO-MS



DHRO-SH

DHRO-MH

DHRO-MS

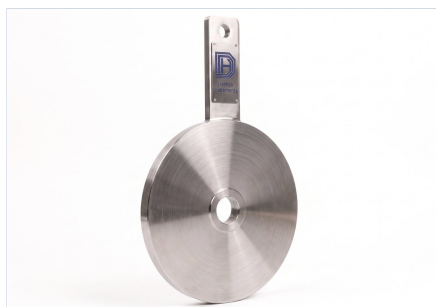
Restriction orifices are used to reduce fluid pressure and are designed somewhat differently from orifice plates for flow measurement.

Restriction orifices come in several types: a plate with a single hole, a multi-hole plate with several distributed holes, and a multi-stage orifice (Multistage Orifice) with several orifice plates welded together for high-pressure, high-temperature fluids.

The bore edge of a restriction orifice can be surface-hardened by Stellite (Stellite) welding or nitriding (Nitriding).

Single / Multi Hole / Multi Stage 1/2B ~ 24B (15A ~ 600A) ANSI 150 ~ 2500LB RTJ
Stellite · nitride hardening

Types · model configuration



DHRO-SH

Single hole — one bore at the center of a thick plate



DHRO-MH

Multi hole — several small bores to reduce noise and vibration



DHRO-MS Cutaway rendering for illustration

Multi stage — stacked plates inside a spool, cutaway image

The DHRO-MS image is a cutaway rendering to show the multi-stage plates inside the spool; the actual product is a closed flanged spool.

Item	DHRO-SH Single hole (Single Hole)	DHRO-MH Multi-hole (Multi Hole)	DHRO-MS Multi-stage (Multi Stage)
Features	Single-hole plate for pressure reduction	Multi-hole plate for pressure reduction (ordering code table: Multi Hole)	Multi-stage plate that resolves the long pressure recovery zone that occurs when a single-hole plate is used for pressure reduction
Materials	STS304, STS316, Inconel, Monel, Hastelloy, Teflon	STS304, STS316, Inconel, Monel, Hastelloy, Teflon	STS304, STS316, Inconel, Monel, Hastelloy
Connection	Flange 150#, 300#, 600#, 900#, 1500#, 2500#	Flange 150#, 300#, 600#, 900#, 1500#, 2500#	Flange 150#, 300#, 600#, 900#, 1500#, 2500#
Applicable piping	1/2B ~ 36B (15A ~ 900A) Pipe	1/2B ~ 36B (15A ~ 900A) Pipe	1/2B ~ 36B (15A ~ 900A) Pipe

Technical Specifications

Item	Value
Type	Single Hole (DHRO-SH), Multi Hole (DHRO-MH), Multi Stage (DHRO-MS)
Connection (Mounting)	Flange, Union, Butt Weld etc
Nominal pipe size	1/2B ~ 24B (15A ~ 600A)

Item	Value
Flow calculation standard	ISO5167, JIS Z 8762, ASME, KS A 0612
Flange rating (Flange Rating)	ANSI 150, 300, 600, 900, 1500, 2500LB RTJ Oval Type or Octagonal Type
Materials	Carbon Steel · 304SS, 304L SS, 316SS, 316L SS · Ni, Cr, Mo Alloy Steel (A182 F11 to 91) · Monel, Hastelloy, Inconel etc
Material codes (special alloys)	I5 Inconel 625 · M0 Monel 400 · HC Hastelloy-C276
Bore edge surface hardening	Stellite welding or nitriding (Nitrification)
Multi-stage orifice application	High-pressure, high-temperature fluids (set of several orifice plates welded together)
With / without flanges	F: Flange Include / N: Flange Exclude

Standards · ISO 5167 · JIS Z 8762 · ASME · KS A 0612

Installation requirements

- The connection method — between flanges, union, butt weld, etc. — is selected to suit the piping conditions. It can be ordered with flanges (F) or without (N).
- If the downstream pressure recovery zone becomes long when reducing pressure with a single-hole plate, consider the multi-stage (DHRO-MS) type.
- For high-pressure, high-temperature fluids or where wear is a concern, bore edge surface hardening (Stellite welding · nitriding) can be included in the specification.

Ordering information (How to Order)

1 Model	
DHRO-SH	Single Hole
DHRO-MH	Multi Hole
DHRO-MS	Multi Stage

2 Type	
F	Flange Include
N	Flange Exclude

3 Nominal Pipe Size	
(size)	Pipe size in inch or mm

4 Material : Plate / Flange	
CS	Carbon Steel
4S	304SS
4L	304L SS
6S	316SS
6L	316L SS
11	A182 F11
22	A182 F22
51	A182 F51
91	A182 F91
I5	Inconel 625
M0	Monel 400
HC	Hastelloy-C276
OP	Option

5 Mounting Connection	
015	ASME(ANSI) Class 150 LB
030	ASME(ANSI) Class 300 LB
060	ASME(ANSI) Class 600 LB
090	ASME(ANSI) Class 900 LB
150	ASME(ANSI) Class 1500 LB
250	ASME(ANSI) Class 2500 LB
000	Option

ORIFICE FLOW METERS

Ring Type Orifice

Ring Type Orifice

MODEL : DHOF-RING



DHOF-RING

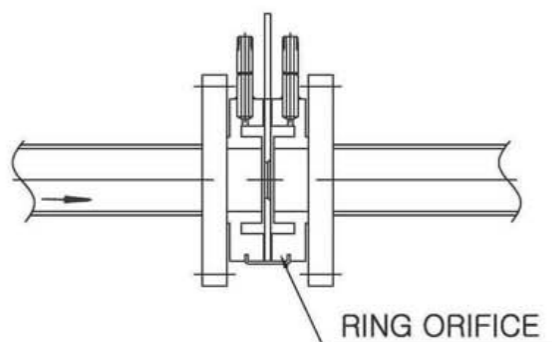
Orifice ring assemblies are used for flow measurement in small- and medium-bore piping at relatively low pressure. Each assembly consists of one orifice plate and two orifice rings, with differential pressure taken by the corner tap (Corner Tap) method.

An orifice block (Orifice Block) of unit construction (Unit-construction), providing a higher pressure rating than the orifice ring assembly, is also available; differential pressure is likewise taken by the corner tap method.

Corner Tap 2B ~ 36B (50A ~ 900A) ANSI 150# · 300# / JIS 5 ~ 30 kg/cm²

Accuracy ±1.5%

Measurement principle



Ring orifice with corner taps

The corner tap (Corner Tap) takes differential pressure immediately before and after the orifice, and is mainly used for small-bore piping (2" and under).

The ring type orifice has annular pressure chambers inside the rings on both sides of the plate and takes the differential pressure through pressure tap nipples, so no tapping of the pipe flanges is required.

Types · model configuration

Item	DHOF-RING Ring Type Orifice (Corner Tap Plate & Ring)
Features	Low installation and maintenance cost · Corner-tap type
Turndown	4:1
Materials	Plate: STS304, STS316, Inconel, Monel, Hastelloy, Teflon · Ring: C.S, STS304, STS316, Inconel, Monel, Hastelloy, Teflon
Connection	Flange 150#, 300#
Applicable piping	2B ~ 36B (50A ~ 900A) Pipe & Duct
Standards	ISO5167-2
Accuracy	±1.5%

Technical Specifications

Item	Value
Accuracy	±1.5%
Turndown (Turndown Range)	4:1
Applicable piping	2B ~ 36B (50A ~ 900A) Pipe & Duct
Applicable standards (Regulations)	ISO5167-2
Flow calculation standard	ISO5167, JIS Z 8762, ASME, KS A 0612
DP tapping method	Corner Tap (one plate + two rings)
Orifice bore types	Concentric Square Edged Orifices, Quadrant Edged Orifices
Quadrant Edge minimum conditions	Minimum orifice diameter 4.5mm, minimum edge radius 0.5mm
Flange rating (Flange Rating)	JIS 5, 10, 20, 30 kg/cm ² , ANSI 150#, 300#
Ring · pressure tap nipple material	C.S, 304SS, 316SS
Plate material	304SS, 316SS, 316L, Monel, other
Tab handle material	304SS, 316SS
Tap connection (Tap Connection)	PT 1/2 or 1/2 NPT male · Socket weld, butt weld or flange (flange rating same as the process piping)
Gasket material	Asbestos, Non-Asbestos, Teflon
Gasket thickness	1.5mm, 2.0mm, 3.0mm
Tap valve option (Taps Valve)	Ball Valve / Globe Valve / None
Orifice block	Unit construction with a higher pressure rating than the ring assembly (Corner Tap)

Standards · ISO 5167-2 · ISO 5167 · JIS Z 8762 · ASME · KS A 0612

Installation requirements

- The ring assembly (plate + two rings) is installed between the process pipe flanges together with gaskets. It can be ordered with flanges (F) or without (N).
- The tap connection is selected from PT 1/2 · 1/2 NPT male nipple, socket weld, butt weld or flange; for flanged connections the rating is the same as the process piping.
- Tap valves (ball valve or globe valve) can be included if required.

Ordering information (How to Order)

1 Model
DHOF-RING Corner Taps Plate & Ring

2 Flange
F Flange Include
N Flange Exclude

3 Nominal Pipe Size
(size) Pipe size in inch or mm

4 Material : Plate / Flange
CS Carbon Steel
4S 304SS
4L 304L SS
6S 316SS
6L 316L SS
11 A182 F11
12 A182 F12
51 A182 F51
91 A182 F91
OP Option

5 Mounting Connection
015 ASME(ANSI) Class 150 LB
030 ASME(ANSI) Class 300 LB
010 KS(JIS) Class 10K
020 KS(JIS) Class 20K
000 Option

6 Diff' Taps
1 NPT 1/2
2 NPT 3/4
3 SW 1/2
4 SW 3/4
0 Option

7 Taps Valve
B Ball Valve
G Globe Valve
N None
O Option

TEMPERATURE INSTRUMENTS

Sheathed RTD

Sheath Resistance Temperature Detector

MODEL : DSR



DSR

The DSR sheathed RTD is a temperature sensor with a temperature-sensing resistance element built in MI cable (Mineral Insulated Cable) form.

The measuring range is -200~600 °C, and the element is PT100 or PT1000 Ω.

The sheath material is selected from STS304, STS316, STS310, STS446, Inconel600 and Hastelloy, with threaded (Screw) or flanged (Flange) mounting. The applicable standards are DIN 43760 and IEC 751 : 1983.

-200 ~ 600 °C PT100 / PT1000 Ω MI Cable DIN 43760 · IEC 751

Technical Specifications

Item	Value
Features	RTD in MI cable (mineral insulated cable) form
Connection (Mounting)	Screw & Flange
Measuring range	-200~600 °C
Element	PT100, PT1000 ohm
Sheath material	STS304, STS316, STS310, STS446, Inconel600, Hastelloy
Standards	DIN 43760, IEC 751 : 1983

Standards · DIN 43760 · IEC 751 : 1983

TEMPERATURE INSTRUMENTS

Sheathed Thermocouple

Sheath Thermocouple

MODEL : DST



DST

The DST sheathed thermocouple is a thermocouple built in MI cable (Mineral Insulated Cable) form.

The measuring range is 0~1200 °C for type K and 600~1600 °C for type R; types J, T, E, N, B and S are also manufactured.

The sheath material is selected from STS316, STS310, STS446, Inconel600 and Hastelloy, with threaded (Screw) or flanged (Flange) mounting. The applicable standard is ASTM E230.

K: 0 ~ 1200 °C R: 600 ~ 1600 °C MI Cable ASTM E230

Technical Specifications

Item	Value
Features	Thermocouple in MI cable (mineral insulated cable) form
Connection (Mounting)	Screw & Flange
Measuring range	K = 0~1200 °C / R = 600~1600 °C / others = J, T, E, N, B, S
Sheath material	STS316, STS310, STS446, Inconel600, Hastelloy
Standards	ASTM E230

Standards · ASTM E230

FLOW INSTRUMENTS

Steady Flow Meter

Steady Flow Meter

MODEL : SFM300 / SFM305



SFM300

SFM305

The SFM300 steady flow meter is a flow meter with a built-in (Built-in type) flow straightening function to counter the effects of turbulent flow (turbulent flow) during measurement, designed to prevent measurement error.

The SFM305 is a model that combines a flow straightener (commutator) and a flow element in a single insertion-type (Insertion type) product for large-bore ducts and pipes, providing stable measurement while reducing cost.

Both models have a turndown of 6:1, and the material is selected from Carbon Steel, STS304, STS316, Inconel, Monel and Hastelloy.

Turndown 6:1 SFM300: 4B (100A) and above

SFM305: 20B (500A) and above, insertion type Flange 150# / 300# · Duct

Types · model configuration

Item	SFM300 Built-in type (Built-in)	SFM305 Insertion type (Insertion)
Features	Built-in flow straightening to prevent measurement error due to turbulence	For large-bore ducts and pipes · insertion type integrating straightener + flow element · cost saving and stable measurement
Turndown	6:1	6:1
Materials	Carbon Steel, STS304, STS316, Inconel, Monel, Hastelloy	Carbon Steel, STS304, STS316, Inconel, Monel, Hastelloy
Connection	Flange 150#, 300#, Ducts	Insertion Flange 150#, 300#, Ducts
Applicable piping	More 4B (more 100A) Pipe & Duct	More 20B (more 500A) Pipe & Duct
Accuracy	±2.0% (±0.5% when calibrated)	±2.0% (±0.5% when calibrated)

Technical Specifications

Item	Value
Turndown	6:1
Materials	Carbon Steel, STS304, STS316, Inconel, Monel, Hastelloy
Connection (Mounting)	SFM300: Flange 150#, 300#, Ducts / SFM305: Insertion Flange 150#, 300#, Ducts
Applicable piping	SFM300: 4B (100A) and above Pipe & Duct / SFM305: 20B (500A) and above Pipe & Duct
Accuracy	±2.0%

TEMPERATURE INSTRUMENTS

Temperature Transmitter

Temperature Transmitter

MODEL : DHRT / DHTC



DHRT

DHTC

The DHRT temperature transmitter has a built-in PT100 Ω RTD, with a measuring range of $-200 \sim 600$ $^{\circ}\text{C}$.

The DHTC temperature transmitter has a built-in thermocouple, with a measuring range of $0 \sim 1200$ $^{\circ}\text{C}$.

For both models, the sheath material is selected from STS304, STS316 and Inconel600, mounting is threaded (Screw) or flanged (Flange), and the output is 4-20mA 2-wire (2-Wire) on DC24V power.

DHRT: $-200 \sim 600$ $^{\circ}\text{C}$ (PT100 Ω) DHTC: $0 \sim 1200$ $^{\circ}\text{C}$ (thermocouple)

DC 24V · 4-20mA 2-Wire Screw & Flange

Types · model configuration

Item	DHRT Built-in RTD	DHTC Built-in thermocouple
Features	Transmitter with built-in PT100 Ω RTD	Transmitter with built-in thermocouple
Connection	Screw & Flange	Screw & Flange
Measuring range	$-200 \sim 600$ $^{\circ}\text{C}$	$0 \sim 1200$ $^{\circ}\text{C}$
Sheath material	STS304, STS316, Inconel600	STS304, STS316, Inconel600
Power supply	DC24V	DC24V
Output	4-20mA 2-Wire	4-20mA 2-Wire

Technical Specifications

Item	Value
Features	DHRT: built-in PT100 Ω RTD / DHTC: built-in thermocouple
Connection (Mounting)	Screw & Flange
Measuring range	DHRT: $-200 \sim 600$ $^{\circ}\text{C}$ / DHTC: $0 \sim 1200$ $^{\circ}\text{C}$
Sheath material	STS304, STS316, Inconel600
Power supply	DC24V
Output	4-20mA 2-Wire

TEMPERATURE INSTRUMENTS

Thermocouple

Thermocouple

MODEL : DTC



DTC

The DTC thermocouple is a thermocouple built in sheath pipe (protection tube) form.

The measuring range is 0~1200 °C for type K and 600~1600 °C for type R; types J, T, E, N, B and S are also manufactured.

The sheath material is selected from STS304, STS316, STS310, STS446, Inconel600 and Hastelloy, with threaded (Screw) or flanged (Flange) mounting. The applicable standard is ASTM E230.

K: 0 ~ 1200 °C R: 600 ~ 1600 °C Screw & Flange ASTM E230

Technical Specifications

Item	Value
Features	Thermocouple in sheath pipe (protection tube) form
Connection (Mounting)	Screw & Flange
Measuring range	K = 0~1200 °C / R = 600~1600 °C / others = J, T, E, N, B, S
Sheath material	STS304, STS316, STS310, STS446, Inconel600, Hastelloy
Standards	ASTM E230

Standards · ASTM E230