

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).

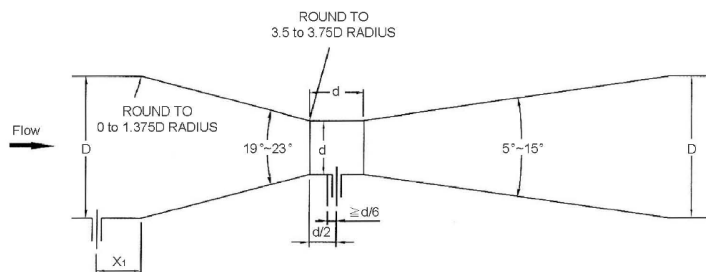
When measuring non-homogeneous liquids such as slurries, the piezometer rings are usually omitted so that the pressure tap holes can be purged efficiently. The venturi tube is considered the differential-pressure primary element best suited to measuring liquids with a high solids content.

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

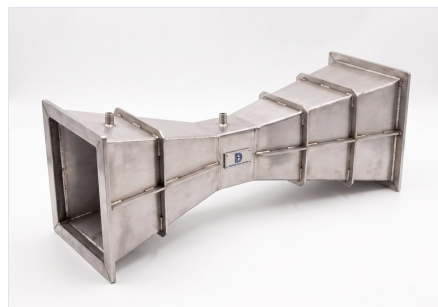


FIG 4 · DHOV-RE

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 $0 \sim 1.375D$ · convergent angle $19^\circ \sim 23^\circ$ · throat radius $3.5 \sim 3.75D$ · divergent angle $5^\circ \sim 15^\circ$ · 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)