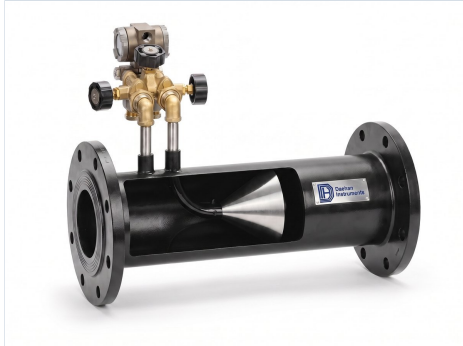


SPECIAL FLOW METER

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.

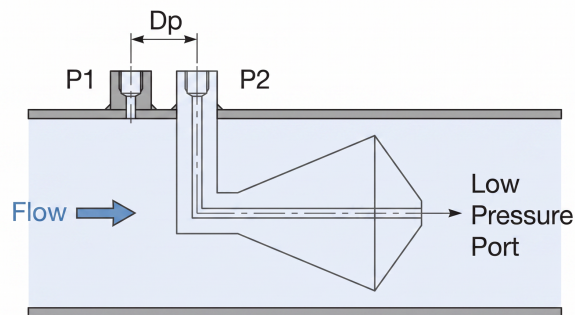
The difference between the static (line) pressure and the low pressure formed downstream of the cone is measured with two pressure taps. One tap is located slightly upstream of the cone, the other on the downstream face of the cone itself. This differential pressure is applied to the Bernoulli equation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

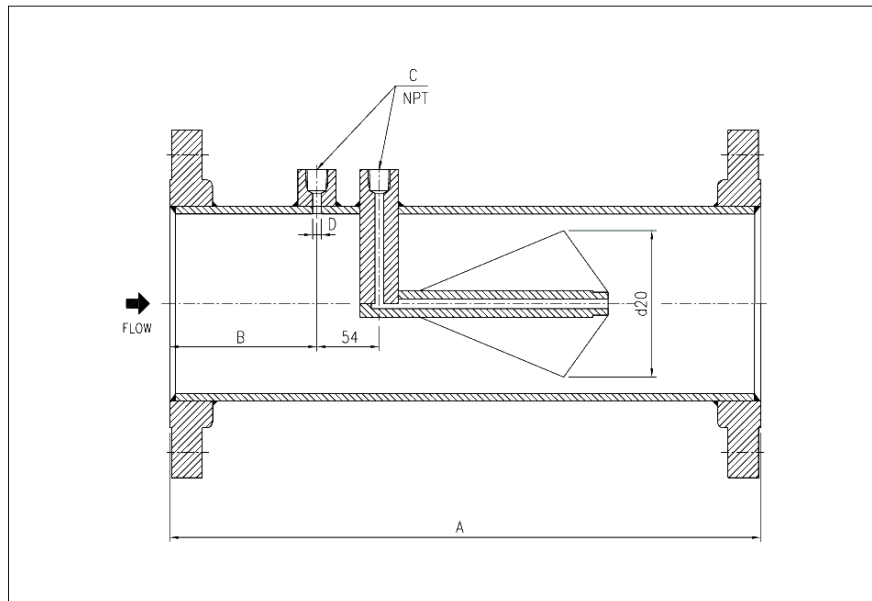
Item	Value
Accuracy	±0.5% of reading, primary element basis
Repeatability	+0.1% or better
Turndown	Typically 10:1 (higher is possible) · linear signal down to Re 8,000
Required straight run	Upstream 0 ~ 3D · downstream 0 ~ 1D ※ Performance tests installed directly downstream of a single 90° elbow and 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.

DHAV-CC01 standard dimensions (Flange version, mm)

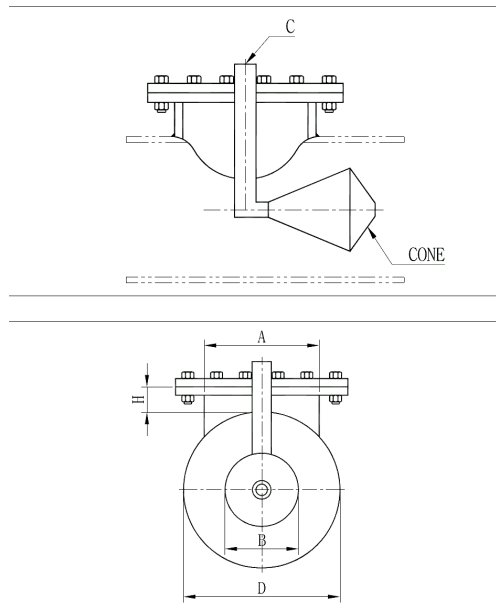


SIZE (mm)	A (mm)	B (mm)	C (PT)	C'	REMARKS
15	203	64	1/4	6	150#, 300# ANSI RF FLANGE
20	203	64	1/4	6	150#, 300# ANSI RF FLANGE
25	203	64	1/4	6	150#, 300# ANSI RF FLANGE
40	254	76	1/4	6	150#, 300# ANSI RF FLANGE
50	305	89	1/2	6	150#, 300# ANSI RF FLANGE
65	305	89	1/2	6	150#, 300# ANSI RF FLANGE
80	356	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#)