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Introduction

Tek-DP 1620A Cone Flow Meter is a differential pressure instrument ideal for flow rate measurement of liquids, steams and gases in harsh conditions. The instrument easily fits into confined or restricted places and provides precise, repeatable and reliable results.

The device is extremely useful in accurate flow rate measurement of fluids where straight, long run pipelines are impractical. The advanced design features of the range of cone flow meters result in the most cost effective solution for functioning in rough environmental conditions. It provides optimized measurement for wide range upstream and downstream applications, for a variety of fluids.

Measuring Principle

Cone Flow Meter works on the principle of differential pressure measurement. It is based on Bernoulli's theory of conservation of mass and energy in a closed pipe. According to this principle, the obstruction to the flow of fluid leads to increase in flow velocity (i.e. V2 > V1), thereby creating a pressure drop. The flow rate can be determined by measuring the static pressures at upstream and downstream, minimum cross-sectional area and temperature. The flow rate of the fluid is calculated by applying the law of conservation of mass and energy.



Bernoulli described this relation between the differential pressure and flow rate by equation,

$\Delta p \alpha Q_m^2$

The differential pressure generated, Δp , is proportional to the square of mass flow rate, Q_m . In simple terms, for a given size of restriction, higher the Δp , higher is the flow rate.



Operation

The Cone Flow Meter mainly comprises of 3 elements, namely, a meter body or tube, a cone assembly and a pair of pressure taps.



Working of Cone Flow Meter

The flow tube holds a cone hanging at the center that acts as an obstruction to the flow. The cone is responsible for varying the cross-sectional area of the fluid passing through the tube. As the fluid passes through the pipe, the area of cross-section reduces at the cone, which increases the velocity of fluid. This creates a low-pressure zone at downstream. The fluid enters the flow meter at pressure P1 and it drops to pressure P2 as it reaches the confined area of cone. The static pressures P1 and P2 are measured at the flow meter's taps by using pressure transducers and the differential pressure is calculated. The differential pressure varies exponentially with the flow velocity. As the area of cross-section reduces, the differential pressure increases for the same flow rates. The cone fitted in the flow path regulates the uneven velocity of the incoming fluid by creating controlled disturbance. This results in a steady differential pressure, which is sensed at the downstream tap.

The beta ratio of a Cone Flow Meter is defined such that a cone and an orifice with equal beta ratios will have equal opening areas. The beta ratio is calculated as the flow area at the largest cross-section of cone divided by the inside diameter of the flow meter. It is given as,

Beta ratio=
$$\frac{(D^2-d^2)}{D}^{0.5}$$

Where, d is the cone diameter and D is the inside diameter of the pipe. With this design, the beta ratio can exceed 0.75.

The cone is designed to function in an extensive variety of mild, moderate and harsh environments. The unique geometry of the cone, which acts as a restriction in the fluid flow minimizes the accuracy degradation due to wear. It offers high repeatability, wide operating range and minimal maintenance making it an excellent choice for high velocity flows and erosive/corrosive applications.

Tek-DP 1620A Cone Flow Meter is suitable for pipes with nominal diameter ranging from 3" to 48". They provide flanged end connection. The cone is available in all standard materials. DP Cone meters are calibrated to offer discharge coefficient performance of up to ± 0.5 %.



Features

- Low pressure loss
- Abrasion resistant
- Excellent repeatability
- Long term stability
- High accuracy
- Signal stability
- No moving parts
- Low installation and maintenance cost

Application

- Water treatment plants
- Oil and Gas custody transfer
- Chemical processing
- Paper and pulp industry
- Effluent treatment plants
- Wastewater and sewage systems
- Food and dairy processing

Dimension Drawing



nch)	#0009	2.13	2.13	2.13	2.13	2.76	2.76	2.76	2.76	2.76	2.76	2.76	2.76	2.76	2.76	2.76	2.76	2.76	2.76
F (Ir	3000#			2.13	2.13	2.13	2.13	2.13	2.13	2.13	2.13	2.13	2.13	2.13	2.13	2.13	2.13	2.13	2.13
ch)	#0009			Ø1.18	Ø1.18	Ø1.50													
E (In	3000#			Ø0.87	Ø0.87	Ø1.18													
) (lnch)			0.98	0.98	1.54	1.54	1.54	1.54	1.54	1.54	1.54	1.54	1.54	1.54	1.54	1.54	1.54	1.54
U	(TqN)	1/4	1/4	1/4	1/4	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2
	(Inch)	γ_8	1/8 1/8	1/4	1/4	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8
#0	A (Inch)	3.74	3.94	5.12	5.51	6.30	6.30												
1500	(lnch)	9.45	9.84	12.60	13.39	15.75	15.75												
+++	A (Inch)	3.74	3.94	5.12	5.51	6.30	6.30	6.30	6.69	7.09	7.87	8.66	9.45	10.24	11.81	12.20	12.60	13.39	15.35
006	L (Inch)	9.45	9.84	12.60	13.39	15.75	15.75	16.93	18.50	24.80	25.69	29.53	32.28	35.04	42.52	45.28	49.21	52.76	61.81
0#	A (Inch)	3.54	3.74	4.72	5.12	5.12	5.51	5.51	6.30	6.69	6.69	7.48	8.27	8.27	9.84	10.63	10.63	11.02	11.42
60	L (Inch)	9.06	9.45	11.81	12.60	13.39	14.17	16.14	18.11	24.41	24.41	28.35	31.10	33.07	39.37	42.91	46.06	50.39	57.87
0#	A (Inch)	3.15	3.35	2.76	3.15	3.54	3.54	3.94	4.33	4.72	4.72	5.51	5.91	5.91	7.09	7.87	8.66	8.66	8.66
30	L (Inch)	8.27	8.66	8.07	10.43	11.81	11.81	14.57	16.14	22.44	22.44	26.38	28.74	30.71	32.28	36.22	40.16	44.09	53.94
0#	A (Inch)	3.15	3.35	2.56	2.95	3.54	3.54	3.54	3.94	4.33	4.33	5.12	5.12	5.12	6.30	7.09	7.87	7.87	7.87
15	L (Inch)	8.27	8.66	7.87	10.24	11.81	11.81	14.17	15.75	22.05	22.05	25.98	27.95	29.92	31.50	35.43	39.37	43.31	53.15
A	Size	1/2"	3/4"	-,	11/2"	2"	21/2"	"	4	5"	6"		10"	12"	14"	16"	18"	20"	24"

Class ANSI B16.5 Raised-Face Slip-on Flange, B31.3 Body





Specification

Pipe Size	3" to 48" for any pipe schedule (larger sizes on request)
Flanged End Connection	ANSI Class #150 - #2500 (any specific connection on request)
Materials	All standard materials available
Process Products	Liquid, gas
Length	Standard Cone meter is approximately 7D long
DP Transmitters	Tek-Bar 3100
Calibration Requirements	Cone meters are supplied calibrated
Discharge Co-efficient performance	±0.5%
Turndown Ratio	10:1 without stacking transmitters

Installation

Meter Installation Factors

Meter Orientation: Cone Meters can be installed in a horizontal or vertical orientation. Typically, the horizontal orientation is standard, however the vertical position may prove to be the best where space is limited.

Pipe Orientation: Pipe orientation depends on the meter position, fluid type and fluid flow direction. In case of vertical position, special care has to be taken while pipe positioning to avoid fluid being trapped in the assembly.

Condensate Chamber (optional): It is a collection vessel or a drip pot that collects condensed gas or liquid droplets in liquid instrument tubing. It should be mounted at the highest point between the cone meter and the DP transmeter.

• For Liquid

Horizontal Installation

In horizontal installation, the pressure taps must be located 30° to 60° below the horizontal centerline. Taps at the bottom may get plugged with the solids from the liquid whereas taps above the centerline may accumulate air or non-condensing gases affecting the measurement accuracy.





Vertical Installation

In most process applications, certain level of gas or vapor exists in a liquid service, even if the liquid is water. Therefore, the piping configuration must be allow gas to rise back into the flow stream.



• For Gas

Horizontal Installation

The process taps in gas service must be positioned between the horizontal center line and the top of the pipe.







Vertical Installation

When the meter is installed in a vertical position, special care must be taken to ensure that no trap is formed in the downstream tap such that gas being trapped in a liquid or liquid is trapped in a gas.





Model Chart

Example	Tek-DP 1620A	0050	A	01	Α	01	A	03	A	03	A	01	A	MTR	Tek-DP 1620A-0050-A-01-A-01-A-03-A-03-A-01-A-MTR
Series	Tek-DP 1620A														Cone Flow Meter
Size		0015 0020 0025 0040 0050 0065 0080 0150 0200 0250 0300 0350 0400 0450 0500 0450 0500 0600 0700 0800 0900 1200													½" ¾" 1" 1½" 2" 2½" 3" 4" 6" 8" 10" 12" 14" 16" 18" 20" 24" 28" 32" 36" 48"
Meter Body			A B C D E F G H X												Carbon Steel (Standard) Low Temp CS 304L SS 316L SS Duplex 2205 Duplex 2507 Chromemoly CrMo P11 Chromemoly CrMo P22 Special
Pipe Schedule				01 02 03 04 05 06 07 08 09 10 11 12 13 XX											STD (Standard Pipe SCH) 105 10 20 30 405 40 805 80 120 160 XS XXS Special
Process Connection					A B C D E F G H I W X										Raised Face Slip On Raised Face Weld Neck RTJ Slip On RTJ Weld Neck Hubs API Beveled End Socket NPTF (Upto 3" Only) Wafer Style (Upto 4" Only) Special
Pressure Rating						01 02 03 04 05 06 07 08 09 XX									150# 300# 600# 900# 1500# 2500# NPT (3000#) Socket Beveled End Special



Example	Tek-DP 1620A	0050	А	01	Α	01	А	03	A	03	Α	01	A	MTR	Tek-DP 1620A-0050-A-01-A-01-A-03-A-03-A-01-A-MTR
Cone Material of Construction							A B C D E F G H X								Carbon Steel Low Temp CS 304L SS (Standard Option) 316L SS Duplex 2205 Duplex 2507 Chromemoly CrMo P11 Chromemoly CrMo P22 Special
Pressure Taps Size								01 02 03 04 05 XX							14" 3/8" 1⁄2" 34" 1" Special
Pressure Tap Style									A B C D F H V X						3000psi NPT 6000psi NPT 3000psi Socket 6000psi Socket Flanged Hubs Valves Special
Beta										01 02 03 04 05 06 07 XX					0.45 0.50 0.55 0.60 0.65 0.70 0.75 Special
Additional Meter Taps (D/S)											A B C X				None Temperature Tap (3D) Validation/Diagnostic Tap (6D) Special
Flow Transmitters/ Computers												01 02 03 04 05 06 XX			None (Customer Supplied) Tek-Bar 3110 (Liquids) - Smart DP Tek-Bar 3800 (MVT Steam & Compressed Gases) Tek-FC 8000 (Natural Gas - Flow Computer) TekValsys DPRO (Insitu Flow Validation) TekValsys DPRO WFGM (Wet Gas) Special
Calibration													A B C D X		Dry (ISO 5167) Water Air Multiphase Special
Options														MTR MC PMI COC HYD XRT DPT MPT O2C TAG UMR DMR FMR CDE MRB DFT CPC	Material Test Report EN3.1 Material Cert EN2.1 Poistive Material Identification (NDE) Certificate of Conformity Hydro Test X-Ray Dye Penetrant Magnetic Particle Testing O2 Cleaned SS TAG PLATE Upstream Meter Run - 1PC Downstream Meter Run - 1PC Meter Run with Flow Contioner Plates - 2PC Certified Drawing Electronic (As Built) Manufacturing Record Book Dry Film Thickness - Custom Paint Spec Custom Product Code

Customer Service & Support



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