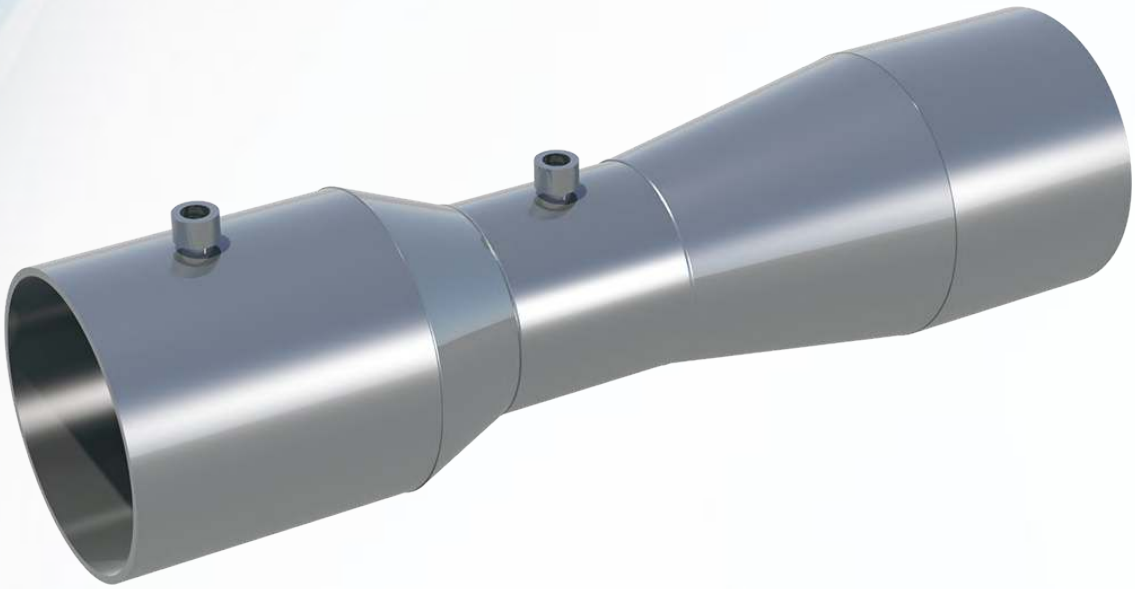
TEKTROL
Technology Solutions

TEK-DP 1640A

Venturi Tube

FLOW



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Introduction

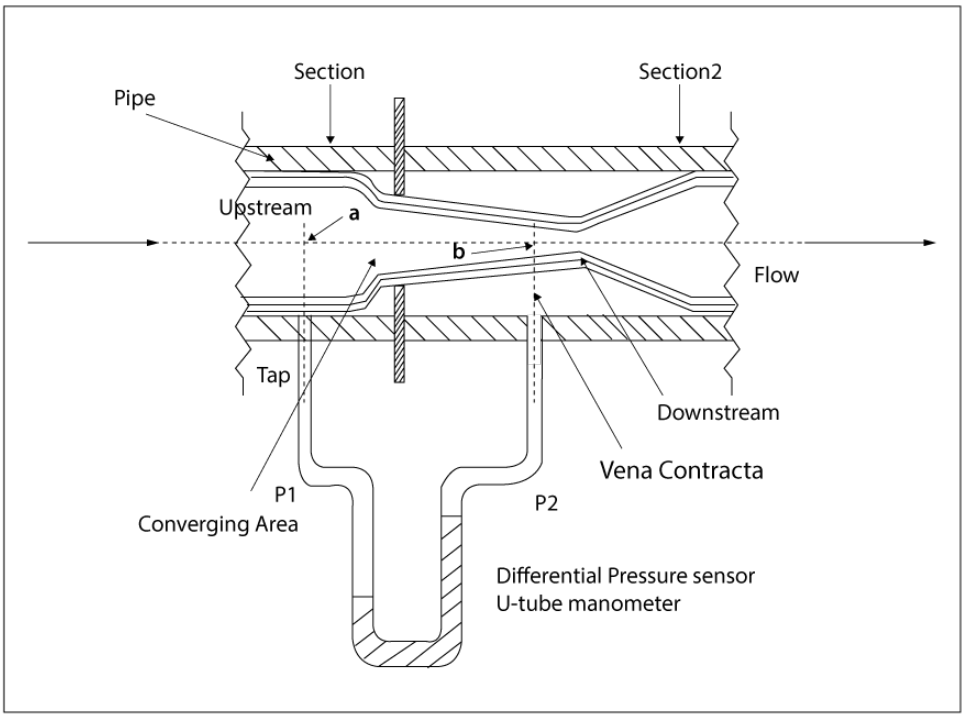
Venturi tubes are differential pressure flow measurement devices particularly designed for the measurement of non-viscous, clean liquids and gases. The prominent features of Venturi tubes include maximum pressure recovery and minimal upstream and downstream pipe length requirement.

Venturi tubes contain no moving parts. They consist of a gradually decreasing nozzle at upstream and a gradually increasing diffuser section at downstream. Due this characteristic design, they have the capability to regain the major part of the output pressure unlike other primary flow elements. The minimal pressure loss makes venture tubes ideal for the systems with low pressure differential.

Tek-DP 1640A Venturi tubes are available in various models for normal liquid applications and wet gas applications. Tek-dp 1640A series provides consistent accuracy, maximum pressure recovery, and sustained performance for a variety of applications where permanent pressure loss is intolerable.

Measuring Principle

Venturi Tubes work 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, obstruction to the flow of fluid leads to increase in the 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,

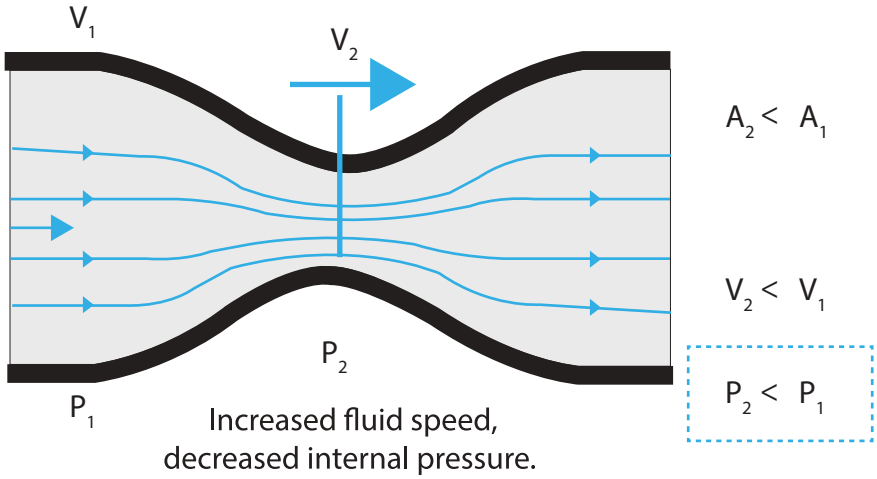
$$\Delta p \; \alpha \; Q^2_m$$

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

A venturi tube is nothing but a tubular section with a constriction in it. It has a convergent nozzle at upstream and a divergent diffuser section at downstream which is responsible for creating a venturi effect in the flowing fluid.

The venturi tube is placed inside the pipe or is positioned between the two flanges. It is ensured that the pipeline is completely filled with a fluid while operating the device. A differential pressure sensor is attached between the two points, 1 & 2, for determining the differential pressure of a fluid.



As the fluid enters the upstream part of the venturi tube, the flow contracts and is accelerated due to the gradual decrease in cross-sectional area, creating a pressure loss.

The pressure drop varies with the fluid flow rate. The DP sensor measures the pressures of the upstream and downstream flow. The differential pressure (P_1-P_2) is proportional to the flow rate and can be determined by mathematical equations and appropriate calibration.

At the downstream, the flow regains its volume before leaving the venturi tube due to the diffusing section. This way, the venturi tube ensures maximum pressure recovery.

Tek-DP 1640A Series Venturi Tubes

Tek-DP 1640A series Venturi Tubes are available in following designs.

• Classical Venturi

The convergent inlet is like a truncated cone.

The Classical Venturi is used in gas and fluid flow applications, where low pressure loss is a primary requirement. Classical Venturi tubes prevent sediment clogging.

• Venturi Nozzle

The convergent inlet matches with the structure of a flow nozzle.

The Venturi nozzles are suitable in the measurement of superheated fluid, steam and gas where the pressure gradient is below critical and the flow pattern is steady.

Features

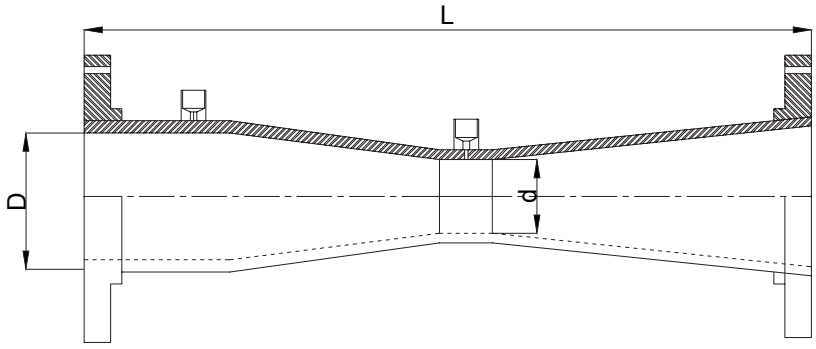
- Durable and optimized design, simple configuration
- Suitable for high-pressure, high-velocity, non-viscous, erosive process media
- Leakage-proof, spillage-proof assembly
- Shortest laying pipe-length
- Reduced piping cost
- Highest pressure recovery or lowest permanent pressure loss
- Accuracy ≤ ± 0.5 % of the actual flow rate
- Repeatability 0.1 %
- Available in all pipe sizes and a wide range of materials

Applications

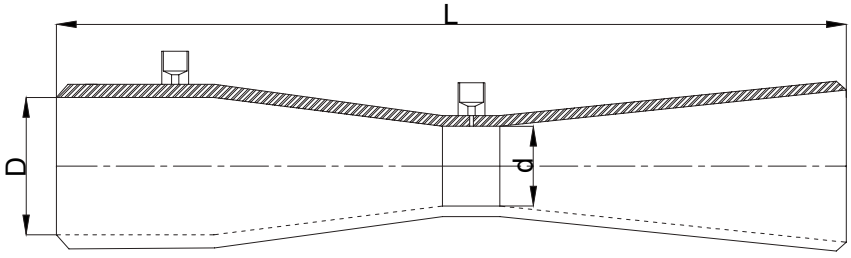
- Water and sewage plants
- Slurry flows in mining, chemical plants
- Oil refineries and gas plants
- Power Generation
- Compressor suction pipelines
- Coolant flow rate measurement in cryogenic facilities
- Carburetors of vehicle engines

Dimensional Drawing

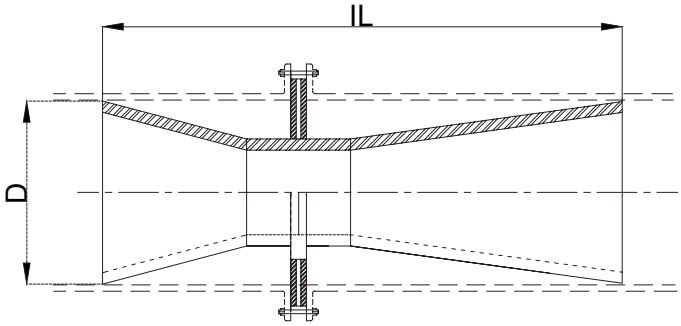
Flanged Type



Weld-in Type



Insertion Type



NOM. Line Size	Beta Ratio Note 1	Throat Dia. d Note 1	STD Pipe Dia. D Note 1	Length Note 2		Approx. WT. LB: Note 3	Flow Rates In GPM Of Water @ 60° F. ΔP In Inches Of w.c.			
				L (VTF)	IL (VTI)		20°	50°	100°	200°
3	0.50	1.534	3.068	14		48	60	95	135	190
	0.60	1.841		12		42	90	143	202	286
	0.75	2.301		10		37	160	250	355	500
4	0.50	2.013	4.026	17		88	105	165	232	330
	0.60	2.416		15		79	156	245	347	491
	0.75	3.020		12		66	274	433	612	865
6	0.50	3.033	6.065	24	19	221	235	370	525	740
	0.60	3.639		21	16	192	351	553	785	1110
	0.75	4.549		17	12	155	620	985	1390	1970
8	0.50	3.991	7.961	40	22	132	410	645	915	1290
	0.60	4.789		35	18	127	613	964	1370	1930
	0.75	5.986		30	13	123	1075	1700	2405	3400
10	0.50	5.010	10.020	50	28	213	645	1020	1440	2040
	0.60	6.012		45	24	208	964	1525	2155	3050
	0.75	7.515		35	17	189	1695	2680	3790	5360
12	0.50	6.000	12.000	60	34	315	925	1460	2065	2920
	0.60	7.200		50	29	290	1385	2185	3085	4365
	0.75	9.000		40	20	271	2435	3845	5440	7690
14	0.50	6.625	13.250	65	38	401	1125	1780	2520	3560
	0.60	7.950		55	32	376	1680	2660	3766	5320
	0.75	9.938		45	23	358	2965	4690	6630	9380
16	0.50	7.625	15.250	70	44	461	1490	2360	3335	4720
	0.60	9.150		65	37	464	2230	3530	4984	7055
	0.75	11.440		50	27	421	3930	6215	8790	12430
18	0.50	8.625	17.250	80	50	603	1910	3020	4270	6040
	0.60	10.350		70	42	580	2855	4515	6380	9030
	0.75	12.940		55	30	537	5025	7950	11240	15900
20	0.50	9.625	19.250	90	56	701	2375	3755	5310	7510
	0.60	11.550		75	47	705	3550	5615	7940	11220
	0.75	14.440		60	34	665	6260	9900	14000	19800
24	0.50	11.625	23.250	105	69	1035	3465	5480	7750	10960
	0.60	13.950		90	58	980	5180	8190	11580	16380
	0.75	17.550		70	42	906	9125	14470	20420	28940
30	0.50	14.625	29.250	130	56	1546	5485	8675	12270	17350
	0.60	17.550		110	47	1448	8200	12965	18330	25920
	0.75	21.940		85	34	1333	14455	22860	32320	45720
36	0.50	17.625	35.250	150	56	2203	7970	12600	17820	25200
	0.60	21.150		130	47	2113	11910	18830	26620	37660
	0.75	26.440		100	34	1948	20995	33200	46950	66390
42	0.50	20.625	41.250	175	56	3050	10910	17265	24400	34510
	0.60	24.750		150	47	2905	16305	25790	36460	51570
	0.75	30.940		115	34	2680	28750	45465	64290	90930
48	0.50	23.625	47.250	200	142	3907	14315	22640	32010	45260
	0.60	28.350		170	120	3690	21400	33830	47840	67650
	0.75	35.440		130	87	3400	37720	59650	84350	119300

Specifications

Venturi Meter for normal liquids

Venturi Material	All standard materials available
Tap Connections	Two ½" NPT per side standard
Venturi Tube Sizes	3" to 48", Custom size available on order
Flanges	#150 - #2500
Operating Temperature	Standard at -20° to 100° F, optional -40° to 1200° F
Operating Position	Vertical, horizontal, or any angle in between
Process products	Liquids, liquid hydrocarbons
Assembly Type	Flange, Weld in, Insertion type
End Connection	Flanged end, socket welded, butt welded
DP Transmitter	Tek-Bar 3110A

Venturi Meters for wet gases

Material	All standard materials available
Tap Connections	Two ½" NPT per side standard
Venturi Tube Sizes	3" to 24", Custom size available on order
Flanges	#150 - #2500
Operating Temperature	Standard at -20° to 100° F, optional -40° to 1200° F
Operating Position	Vertical, horizontal, or any angle in between
Process products	Gases
Assembly Type	Flange, Weld in, Insertion type
End Connection	Flanged end, socket welded, butt welded
DP Transmitter	Tek-Bar 3110A

Installation

- Make sure that the operating staff handling the instrument is professionally trained and alert while operating.
- Venturi tube is a piping component that is installed between the upstream and downstream meter run sections. Place the device in line with the two flange taps or insert in the pipeline positioning the instruction plate facing upward.
- Ensure that the flow direction arrow on the outer surface of the venturi tube agrees with the direction of flow.
- Do not use the device as a flow pipe support, do not subject the device to shocks and vibrations
- Ensure that the pressure taps are positioned below the horizontal centerline
- While filling the pipeline, do not over-pressurize the flowmeter.
- Verify the connections before starting the operation. Ensure that the assembly is leakage-free.
- For maximum accuracy, ensure that the fluid enters the venturi tube with a fully developed velocity profile.
- If the venturi tube has to be removed from the line for any reason, depressurize the line and drain it completely.

Customer Service and Support

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