IntraVenturi
Venturi Tube

Type: IVT

Technical Information

01/2011

FLOW

THE EXPERT IN LEVEL AND FLOW

Venturi Tube
IVT
        Technical Information
        Intra-Automation

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Technical details subject to be changed without notice.

For comments regarding this brochure, please contact:
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List of Contents:

1. General Description

Comparing with orifices and flow nozzles, the Venturi tube generally is of a little more complicated structure, requires more material and costs and tends to be larger in size. However, Venturi tubes offer advantages including an extremely low pressure loss, a higher durability and a lower chance of catching a sludge media and sediment than other throttle elements.
The Venturi tube is mostly used for measurements of flow wherever a minimal loss of pressure is important.
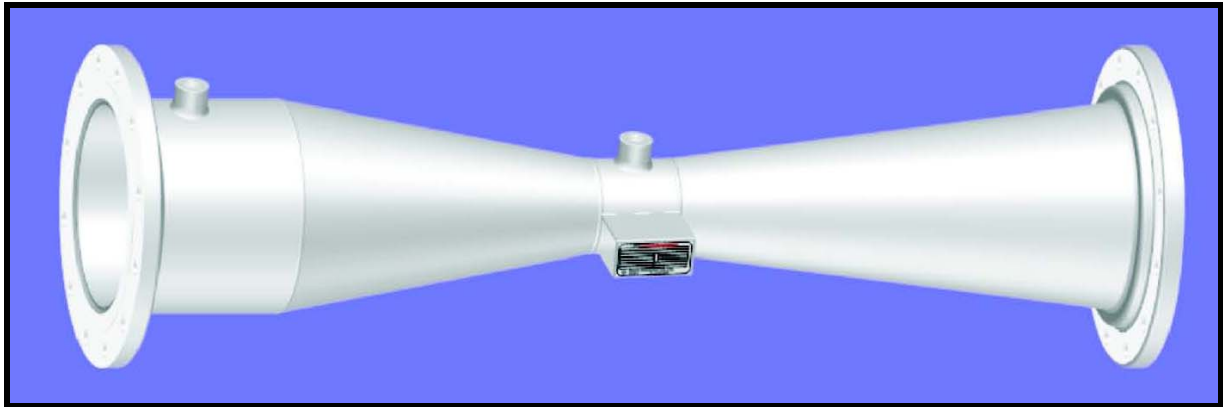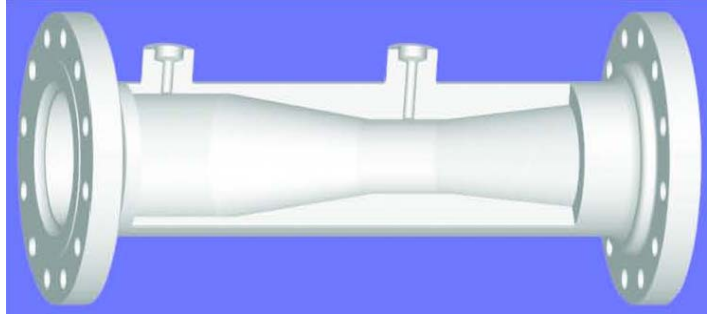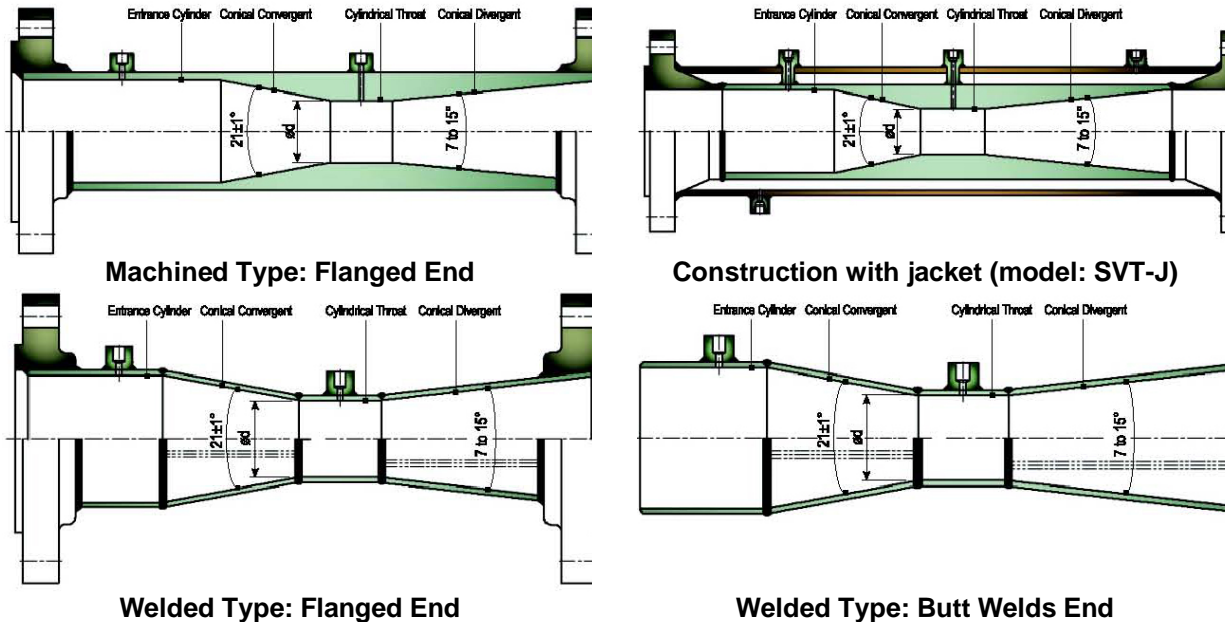

The Intra-Automation Venturi Tube IAVT is designed and manufactured in full compliance with ISO-5167 and ASME MFC-3M standards

2. Specifications

♦ Venturi tube type: machined type
                                             welded type
                                             tetragon duct type

♦ End connection: butt-weld
                                             flanged (slip-on & welding neck)

♦ β-ratio-range: machined type: β between 0,4 and 0,75 incl.
                                             welded type: β between 0,4 and 0,7 incl.

♦ throat calculation codes: ISO-5167
                                             ASME MFC-3M
                                             L.K.SPINK.
                                             AGA NO.3.

♦ Options-1:   Pressure tappings leading into piezometer ring
♦ Options-2:   Full Jacket or Semi Jacket for Heating or Cooling

3. Drawings

Generally, Venturi tube with a machined convergent can be used in pipes of size between 2" and 10". However, in the case that the machined type is of large size (8" or 10"), they have disadvantages because of required higher costs due to huge material consume.

Machined Type: Flanged End   **Construction with jacket (model: SVT-J)**

Welded Type: Flanged End   **Welded Type: Butt Welds End**

4. Intra-Automation Design Standards

- ♦ Conical Convergent Angle: 21° ± 1°

- ♦ Conical Divergent Angle: 14° ± 1°

- ♦ End connection: butt-welds
  flanged connection is available on request as welding-neck or slip-on-type

- ♦ Tapping adaptors: ½" NPT
  Others are available on request (i.e. ½" SW, ¾" NPT or SW, etc)

- ♦ Tapping Nos: 1 (one) upstream pressure tapping and 1(one) downstream pressure Tapping
  There may be used with several sets of pressure tappings on request.

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5. Tetragon Duct and Tapless type Venturi

Tetragon Duct
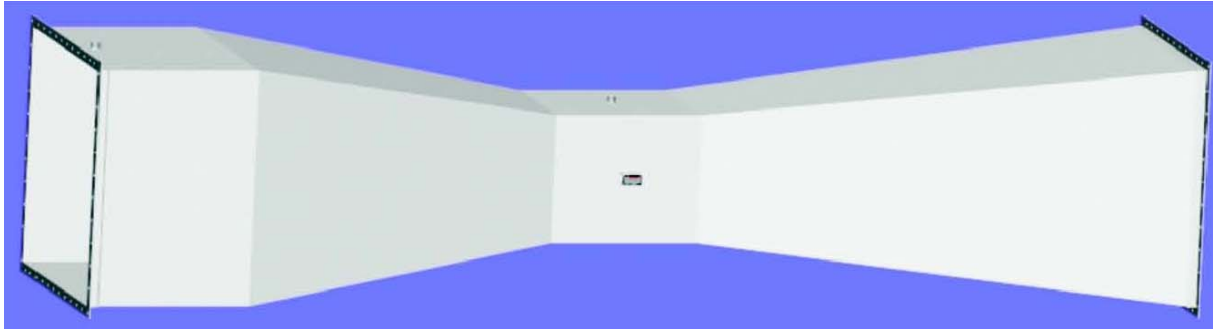
The tetragon is designed and manufactured in order to fit into tetragon duct type piping and the throat have the same area with its throat diameter calculated by ISO-5167, ASME MFC-3M or L.K.SPINK.- standards.

Tapless

The tapless Venturi tube, which has no need of pressure tappings for differential pressure measurement, can be effectively used (with less pressure drop) for flow measurem. of a slurry fluid, a fluid with suspensions, or a corrosive fluid. It can alsoj measure a liquid which solidifies at low temperatures, or a liquid which vaporizes at high temperatures.

♦ max. temperature: -40…+280 °C

♦ pressure rating: up to JIS 20K RF
                    up to ANSI 300 lb
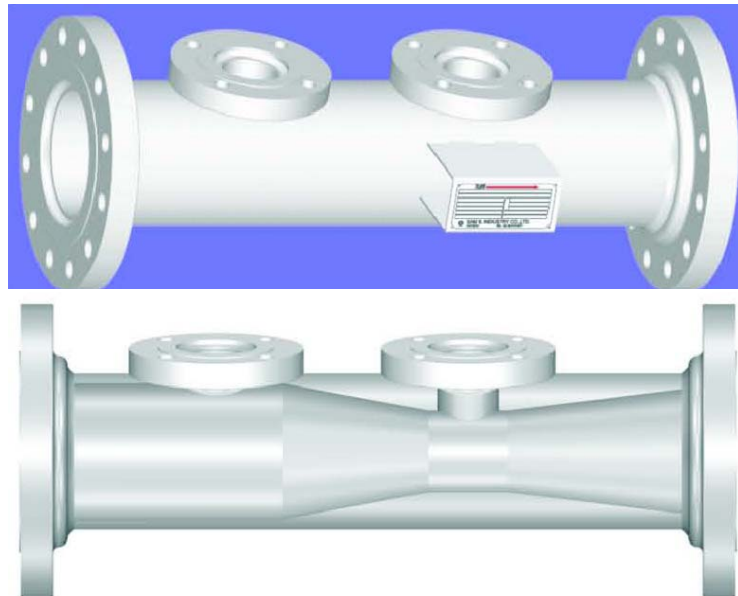
6. Equations

Equations describing the Venturi-principle:

From the Bernoulli-Equation:

$$\frac{w_1^2 \rho}{2} + p_1 + \rho g z = \frac{w_2^2 \rho}{2} + p_2 + \rho g z_2$$

with

$$z_1 - z_2 = h$$

$$p_1 - p_2 = \Delta p$$

concludes into

$$\Delta p + \rho g h = \frac{1}{2} \rho \left(w_2^2 - w_1^2\right) = \frac{1}{2} \rho w_2^2 \left(1 - \frac{w_1^2}{w_2^2}\right)$$

based on mass conservation:

$$w_1 A_1 = w_2 A_2$$

$$w_1 = \frac{A_2}{A_1} w_2$$

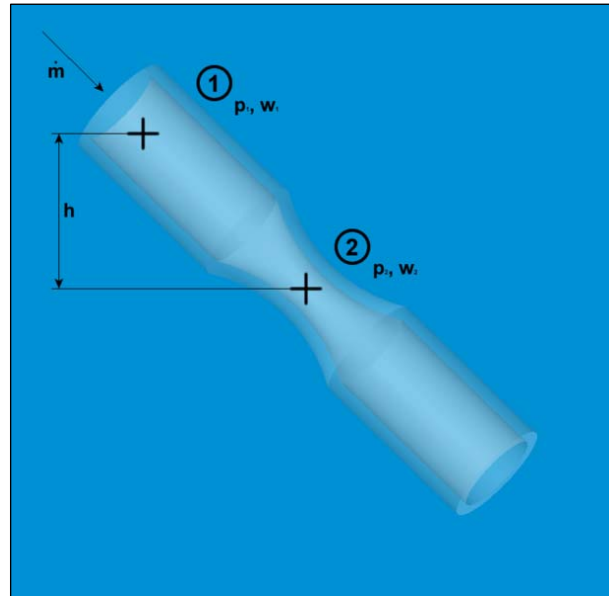the following is additionally valid:

$$\Delta p + \rho g h = \frac{1}{2} \rho w_2^2 \left(1 - \left[\frac{A_2}{A_1}\right]^2\right)$$

$$w_2 = \sqrt{\frac{2(\Delta p + \rho g h)}{\rho \left(1 - \left[\frac{A_2}{A_1}\right]^2\right)}}$$

So the mass flow in a Venturi pipe is as follows:

$$m = \rho A_2 w_2 = \rho \frac{A_2}{\sqrt{1 - \left(\frac{A_2}{A_1}\right)^2}} \sqrt{\frac{2}{\rho}(\Delta p + \rho g h)}$$

7. Specification Questionnaire for Venturi Tubes

I A Intra-Automation GmbH	**VENTURI TUBES**				Sheet of		
					Contract	Date	
	No.	By	Date	Rev.	Quotation/Order-No.		
					By	Checked	Approved

VENTURI TUBES		**FLANGES**	
1. Type: Weld-in ☐ other:_____		7. Taps: Troat ☐ Tapless ☐ other:_____	
2. Std: ISO-5167 ☐ other:_____		8. Tap size: ½" SW ☐ other:_____	
3. Bore: max. rate ☐ nearest 1/8° ☐		9. Type: weld neck ☐ slip on ☐ threaded ☐	
4. Mat.: 304SS ☐ 316SS ☐ other:_____		10. Mat.: steel ☐ other:_____	
5. ring mat. & type: _____		11. Flange include ☐ other:_____	
6. type no. & mfr. _____ -		12. Flange rating: ANSI 150# RF other:_____	

FLUID DATA	★	13.	TAG-No.				
		14.	Service				
		15.	Line No.				
	★	16.	Fluid name				
	★	17.	Fluid state				
	★	18.	max. Flow [m³/h]				
	★	19.	normal Flow [m³/h]				
	★	20.	pressure @ max. / norm.				
	★	21.	temp. @ max. / norm.				
	★	22.	Sp.Gr. / Density at base				
	★	23.	Sp.Gr. / Denstiy at oper.				
	★	24	Super Comp. Factor [Z]				
	★	25.	Mol.W.T. C_P / C_V				
	★	26.	Operating viscosity [cp]:				
		27.	Base press.: Base Temp.:				
METER	★	28.	Type of Meter:				
	★	29.	Diff. Range [mm H_2O]:				
		30.	Static Pressure Range:				
	★	31.	Full Scale Range [m³/h]:				
		32.	Chart Multiplier:				
VETURI & FLANGE OR PIPE	★	33.	Flange Rating:				
	★	34.	Line Size: Sch.:				
	★	35.	Line material:				
	★	36.	Pair[s] of Tapping:				
	★	37.	End connection:				
		38.	Divergent angle:				
ACCESS-ORIES		39.	Nipple:				
		40.	Block valve:				
MANUF. DATA		41.	Type code:				
		42.	Manufacturer:	INTRA	INTRA	INTRA	INTRA
	★	43.	Quantity:				

Remark: Lines marked with a "★" must be filled our by customer, if possible.

8. Order codes

Code	Description									
IVT	Venturi Tube									
	Pipe Size									
	ID…	Inside diameter (in mm)								
		WT…	Wall thickness (in mm)							
			Design							
			R	Round						
			D	Duct*						
				Design						
				MT	Machined type (50…250 mm pipe ID)					
				MJ	Machined type with Jacket					
				WF	Welded type, flanged ends					
				WW	Welded type, welding ends					
					Process connection 1					
					T000	Threaded connection				
					W000	Welding ends				
					XXXX	DIN flanges (see table 1)				
					XXXX	ANSI flanges (see table 2)				
					YYYY	Other standard flanges, please specify				
						Process connection 2				
						Threaded connections				
						NM	NPT male			
						NF	NPT female			
						GM	G male			
						GF	G female			
						RM	R male			
						RF	R female			
						Welding ends				
						00				
						ANSI flanges				
						AF	FF			
						AR	RF			
						AJ	RTJ			
						DIN flanges				
						DB	Form B			
						DC	Form C			
						DF	Form F			
						DN	Form N			
						Other standard flanges				
						YY	Please specify			
							Pressure taps			
							05N	½" NPT		
							75N	¾" NPT		
							05S	½" SW		
							YYY	Others, please specify		
								Material of construction		
								S	316SS	
								C	CS	
								Y	Others, please specify	

IVT									

*Please specify the lengths of the sides under "Inside diameter" (e.g. ID1000x1200).

Table 1 DIN flanges*:

Code 1	Pipe size	Pressure ratings				
		PN40	PN64	PN100	PN160	PN200
Code 1	**Code 2 ➜**	**1**	**2**	**3**	**4**	**5**
D01	DN50					
D02	DN80					
D03	DN100					
D04	DN150					
D05	DN200					
D06	DN250					
D07	DN300					
D08	DN350					
D09	DN400					
D10	DN450					
D11	DN500					
D12	DN550					
D13	DN600					

Table 2 ANSI flanges*:

Code 1	Pipe size	Pressure ratings				
		150#	300#	600#	900#	2500#
Code 1	**Code 2 ➜**	**1**	**2**	**3**	**4**	**5**
A01	2”					
A02	2 ½”					
A03	3”					
A04	3 ½”					
A05	4”					
A06	5”					
A07	6”					
A08	8”					
A09	10”					
A10	12”					
A11	14”					
A12	16”					
A13	18”					
A14	20”					
A15	22”					
A16	24”					

*Other sizes and pressure ratings on request.

Besides the products covered by this brochure, Intra-Automation GmbH also manufactures other high-quality and high precision instruments for industrial measurement tasks. For more information, please contact us (contact details on the backside of this brochure).
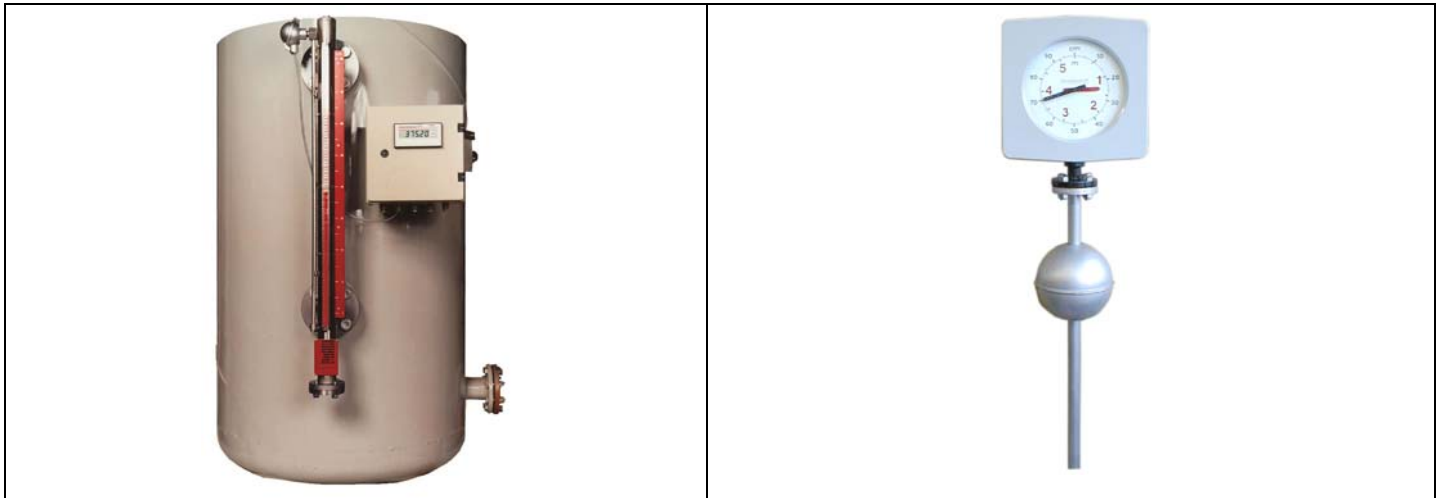
Flow measurement
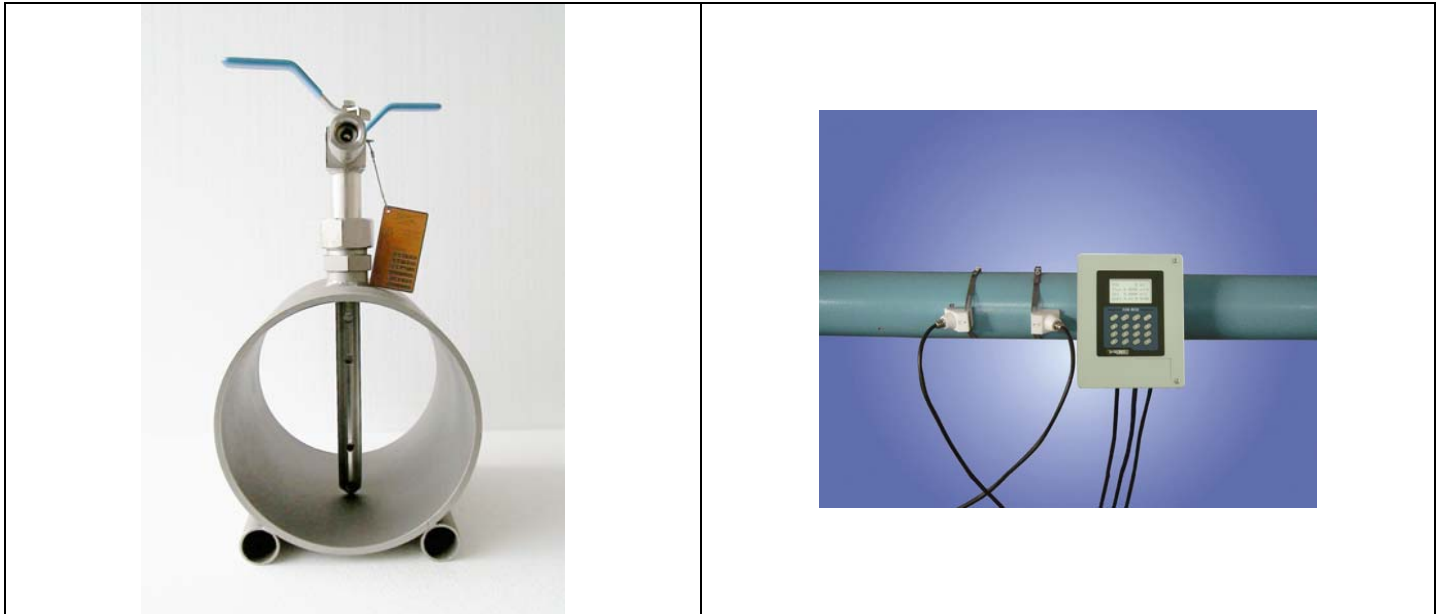
Itabar®-Flow Sensor

IntraSonic IS210 Ultrasonic Flow Meter

Level measurement

ITA-mag. Level Gauge

MAGLINK Level Indicator

Other Measurement Tasks:

DigiFlow Flow and Level Computers

IntraCon Digital Controllers

IntraDigit Digital Indicators / Meters

INTRA-AUTOMATION IA

MESS- UND REGELINSTRUMENTE / MEASUREMENT AND CONTROL

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