

**INTRA-AUTOMATION**

MESS- UND REGELINSTRUMENTE / MEASUREMENT AND CONTROL



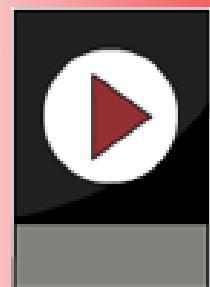
TÜVRheinland®  
**CERT**  
ISO 9001

# IntraVenturi Venturi Tube Type: IVT



## Technical Information

01/2011



FLOW

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**THE EXPERT IN LEVEL AND FLOW**

Intra-Automation  
Technical Information  
01/2011

Technical details subject to be changed without notice.

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# IntraVenturi Venturi Tube

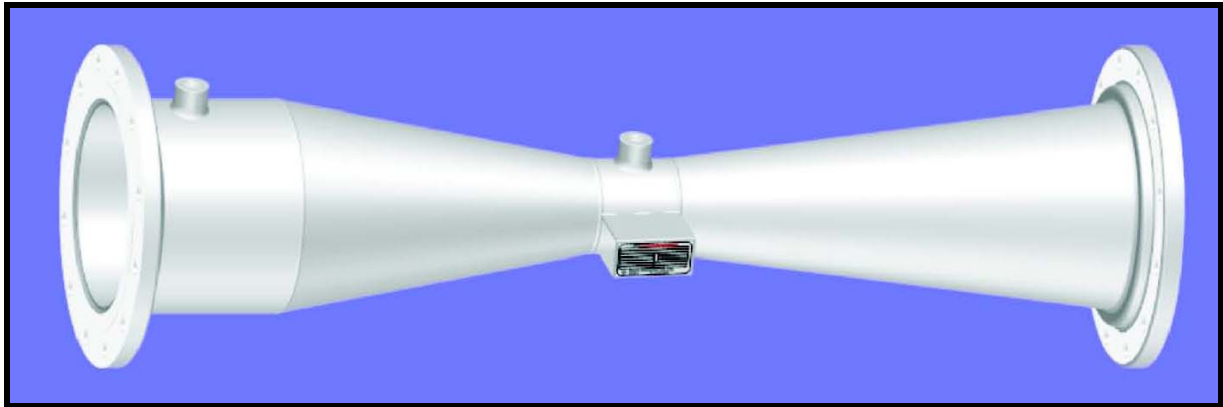
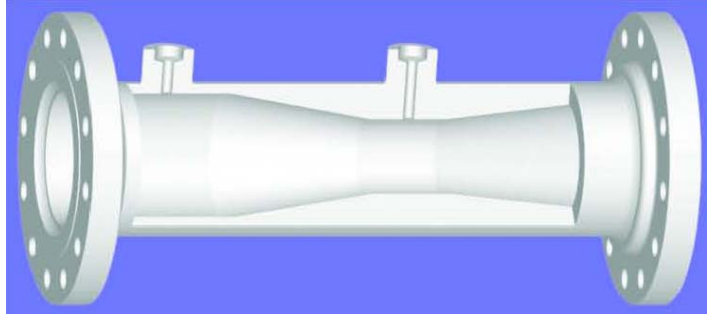
## Type: IVT

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## 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.



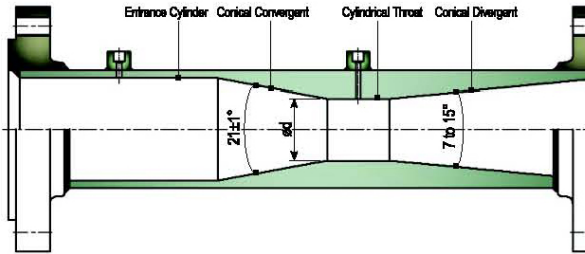
The Intra-Automation Venturi Tube IAVT is designed and manufactured in full compliance with ISO-5167 and ASME MFC-3M standards

## 2. Specifications

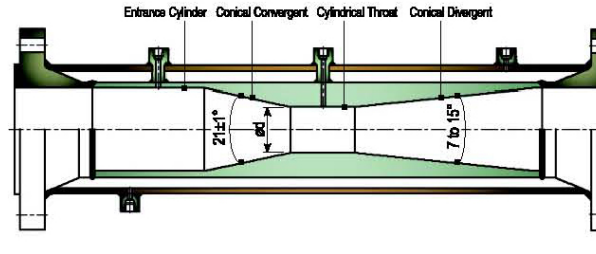
- |                             |   |
|-----------------------------|---|
| ◆ Venturi tube type:        | machined type<br>welded type<br>tetragon duct type  |
| ◆ End connection:           | butt-weld<br>flanged (slip-on & welding neck)   |
| ◆ $\beta$ -ratio-range:     | machined type: $\beta$ between 0,4 and 0,75 incl.<br>welded type: $\beta$ between 0,4 and 0,7 incl. |
| ◆ throat calculation codes: | ISO-5167<br>ASME MFC-3M<br>L.K.SPINK.<br>AGA NO.3.  |
| ◆ Options-1:                | Pressure tappings leading into piezometer ring  |
| ◆ Options-2:                | Full Jacket or Semi Jacket for Heating or Cooling   |

**3. Drawings**

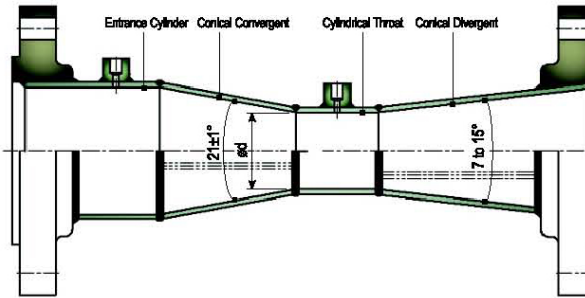
Generally, Venturi tube with a machined convergent can be used in pipes of size between 2" and 10". However, in the case that the machined type is of large size (8" or 10"), they have disadvantages because of required higher costs due to huge material consume.



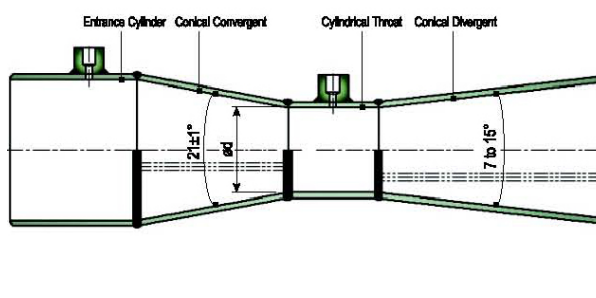
**Machined Type: Flanged End**



**Construction with jacket (model: SVT-J)**



**Welded Type: Flanged End**



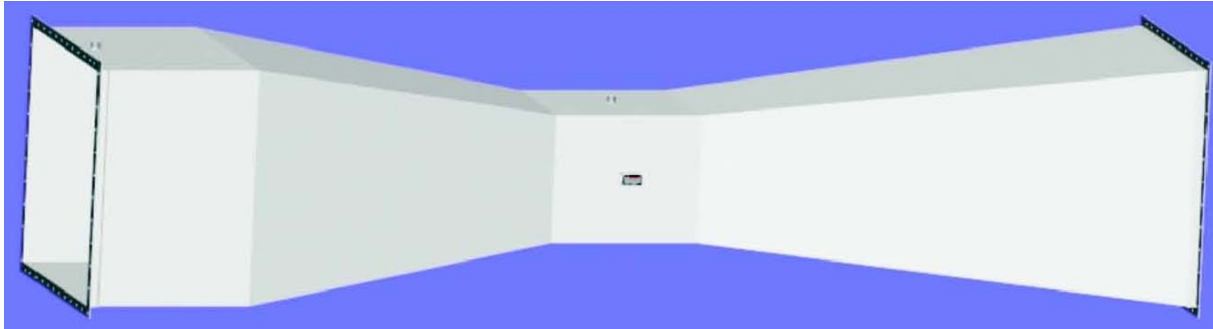
**Welded Type: Butt Welds End**

**4. Intra-Automation Design Standards**

- ◆ Conical Convergent Angle:  $21^\circ \pm 1^\circ$
- ◆ Conical Divergent Angle:  $14^\circ \pm 1^\circ$
- ◆ End connection: butt-welds  
flanged connection is available on request as welding-neck or slip-on-type
- ◆ Tapping adaptors:  $\frac{1}{2}$ " NPT  
Others are available on request (i.e.  $\frac{1}{2}$ " SW,  $\frac{3}{4}$ " 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 tapplings on request.

## 5. Tetragon Duct and Tapless type Venturi

### Tetragon Duct

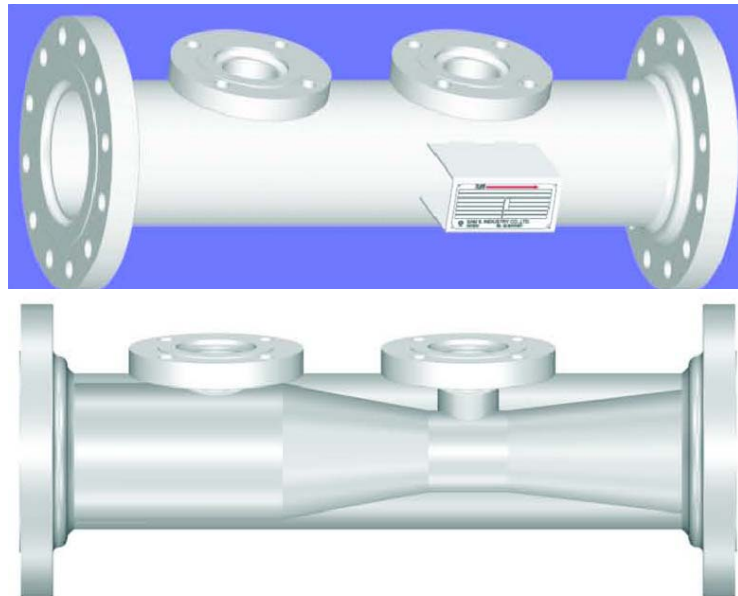


The tetragon is designed and manufactured in order to fit into tetragon duct type piping and the throat have the same area with its throat diameter calculated by ISO-5167, ASME MFC-3M or L.K.SPINK.-standards.

### 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 measurement of a slurry fluid, a fluid with suspensions, or a corrosive fluid. It can also 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:

$$\frac{w_1^2 \rho}{2} + p_1 + \rho g z_1 = \frac{w_2^2 \rho}{2} + p_2 + \rho g z_2$$

with

$$z_1 - z_2 = h$$

$$p_1 - p_2 = \Delta p$$

concludes into

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

based on mass conservation:

$$w_1 A_1 = w_2 A_2$$

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

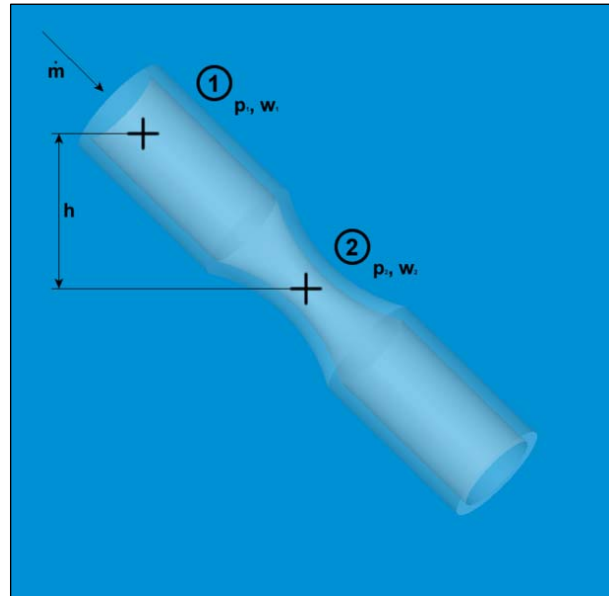
the following is additionally valid:

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


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

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**

 Intra-Automation GmbH	<b>VENTURI TUBES</b>				Sheet    of	
					Contract	Date
	No.	By	Date	Rev.	Quotation/Order-No.	
					By	Checked
<b>VENTURI TUBES</b> 1. Type: Weld-in <input type="checkbox"/> other: _____ 2. Std: ISO-5167 <input type="checkbox"/> other: _____ 3. Bore: max. rate <input type="checkbox"/> nearest 1/8° <input type="checkbox"/> 4. Mat.: 304SS <input type="checkbox"/> 316SS <input type="checkbox"/> other: _____ 5. ring mat. & type: _____ 6. type no. & mfr. _____ -				<b>FLANGES</b> 7. Taps: Troat <input type="checkbox"/> Tapless <input type="checkbox"/> other: _____ 8. Tap size: 1/2" SW <input type="checkbox"/> other: _____ 9. Type: weld neck <input type="checkbox"/> slip on <input type="checkbox"/> threaded <input type="checkbox"/> 10. Mat.: steel <input type="checkbox"/> other: _____ 11. Flange include <input type="checkbox"/> other: _____ 12. Flange rating: ANSI 150# RF other: _____		
<b>FLUID DATA</b>	★ 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. / Density at oper.				
	★ 24.	Super Comp. Factor [Z]				
	★ 25.	Mol.W.T.	C <sub>P</sub> / C <sub>V</sub>			
	★ 26.	Operating viscosity [cp]:				
	27.	Base press.:	Base Temp.:			
<b>METER</b>	★ 28.	Type of Meter:				
	★ 29.	Diff. Range [mm H <sub>2</sub> O]:				
		30. Static Pressure Range:				
	★ 31.	Full Scale Range [m³/h]:				
		32. Chart Multiplier:				
<b>VENTURI &amp; FLANGE OR PIPE</b>	★ 33.	Flange Rating:				
	★ 34.	Line Size:	Sch.:			
	★ 35.	Line material:				
	★ 36.	Pair[s] of Tapping:				
	★ 37.	End connection:				
		38. Divergent angle:				
<b>ACCESSORIES</b>		39. Nipple:				
		40. Block valve:				
<b>MANUF. DATA</b>		41. Type code:				
		42. Manufacturer:		INTRA	INTRA	INTRA
	★ 43.	Quantity:				
Remark: Lines marked with a "★" must be filled out by customer, if possible.						



**8. Order codes**

Code	Description
IVT	Venturi Tube
	<b>Pipe Size</b>
ID...	Inside diameter (in mm)
WT...	Wall thickness (in mm)
	<b>Design</b>
R	Round
D	Duct*
	<b>Design</b>
MT	Machined type (50...250 mm pipe ID)
MJ	Machined type with Jacket
WF	Welded type, flanged ends
WW	Welded type, welding ends
	<b>Process connection 1</b>
T000	Threaded connection
W000	Welding ends
XXXX	DIN flanges (see table 1)
XXXX	ANSI flanges (see table 2)
YYYY	Other standard flanges, please specify
	<b>Process connection 2</b>
	<b>Threaded connections</b>
NM	NPT male
NF	NPT female
GM	G male
GF	G female
RM	R male
RF	R female
	<b>Welding ends</b>
00	
	<b>ANSI flanges</b>
AF	FF
AR	RF
AJ	RTJ
	<b>DIN flanges</b>
DB	Form B
DC	Form C
DF	Form F
DN	Form N
	<b>Other standard flanges</b>
YY	Please specify
	<b>Pressure taps</b>
05N	1/2" NPT
75N	3/4" NPT
05S	1/2" SW
YYY	Others, please specify
	<b>Material of construction</b>
S	316SS
C	CS
Y	Others, please specify

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

**Table 1 DIN flanges\*:**

		Pressure ratings				
	Pipe size	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					

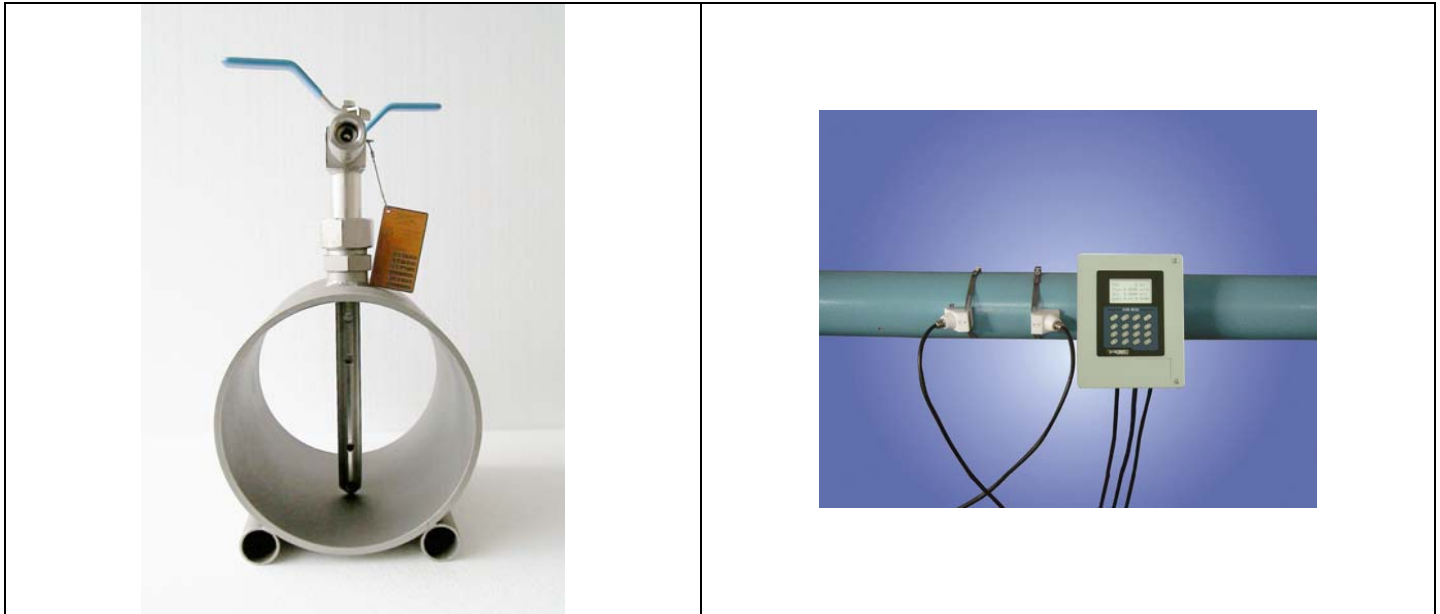
**Table 2 ANSI flanges\*:**

		Pressure ratings				
	Pipe size	150#	300#	600#	900#	2500#
Code 1	Code 2 →	1	2	3	4	5
A01	2"					
A02	2 1/2"					
A03	3"					
A04	3 1/2"					
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).

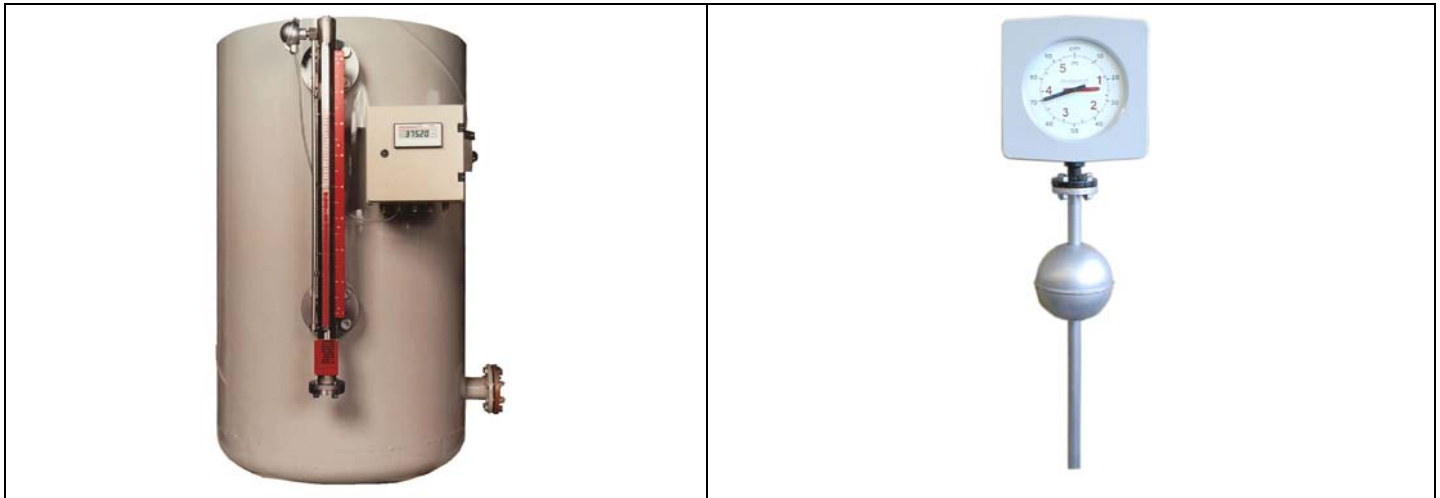
**Flow measurement**



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



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