

# BVT-IF

# TECHbrief

Wyatt-Badger Venturi Tubes  
Insert-Type Fabricated Primary Elements



## FEATURES:

- Low Pressure Loss
- High Accuracy
- Low Installed Cost
- Custom Designed
- Short Laying Length

## Description

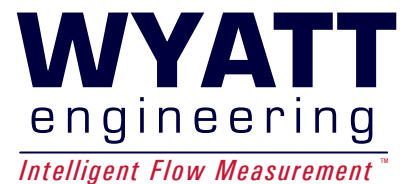
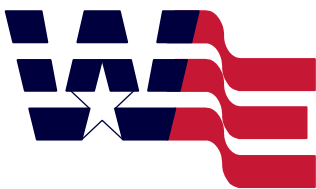
The Wyatt-Badger BVT-IF is a fabricated insert venturi flow element that offers repeatability and accuracy over a greater range of flow rates and has lower permanent pressure loss than orifice plates, flow nozzles, or traditional venturi meters. These units can be manufactured from virtually any material to address the needs of your applications. The BVT-IF is designed for insertion within the interior of a pipeline and is secured by the adjacent pipe flanges. These venturi elements are characterized by longevity of service and flexibility in design.

## Application

The fabricated insert BVT-IF is designed to measure the flow of gases and liquids that have low solids loading. The BVT-IF can operate over extreme temperature and/or pressure ranges with highly corrosive fluids or gases. The BVT-IF has the distinct advantages of minimal weight, cost, and laying length. Typical applications range from potable water, cooling water, process water, steam, air flow for fine bubble aeration, combustion air, and natural and process gases.

## Flow Measurement Accuracy

For pipe Reynolds numbers greater than 75 000 and with a normalized piping configuration, the Wyatt-Badger Venturi Tube provides a flow measurement accuracy of  $\pm 0.50\%$  without flow calibration. With independent flow calibration, Wyatt-Badger's BVTs provide the user with  $\pm 0.25\%$  accuracy.



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# Technical Specifications

## Accuracy

For pipe Reynolds numbers greater than 75 000 and a normalized piping configuration, the Wyatt-Badger Venturi Tube provides a flow measurement uncertainty of:

- ± 0.50% for standard meters and
- ± 0.25% for flow calibrated meters.

## Pressure Loss

The permanent pressure loss of the BVT-IF is significantly lower than that of short-form venturis, and for most beta ratios, lower than that of long-form venturis as well (See Figure 1).

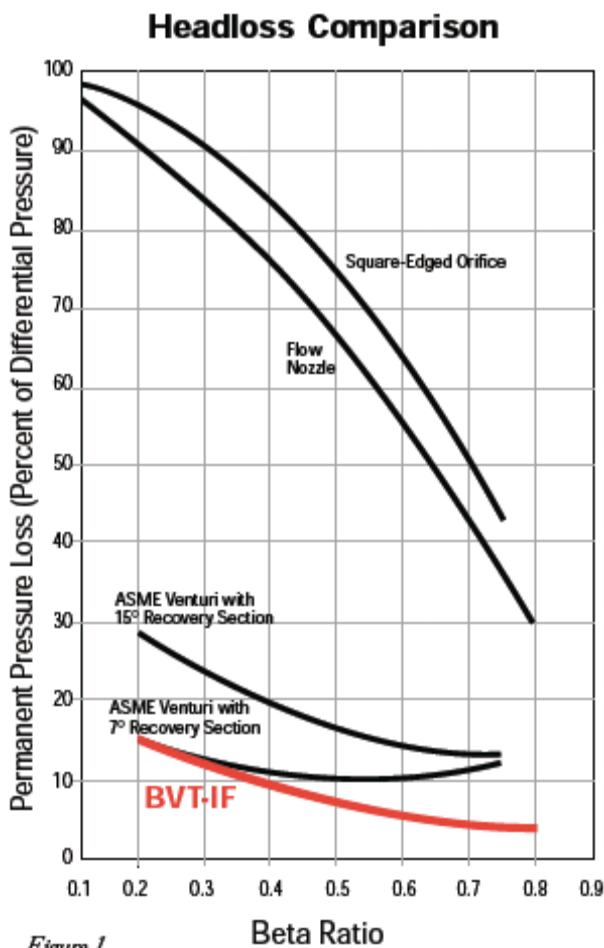


Figure 1

## Beta Ratio

Wyatt can furnish BVT-IF meters with a wide range diameter ratios (d/D). This provides users with accurate flow measurement over a broad range of flow rates for a given line size.

## Temperature Range

The fabricated series of the BVT-IF can operate over a fluid temperature range of -325 °F to +1200 °F (-200 °C to +650 °C).

## Pressure Range/End Connections

The BVT-IF is designed to operate within the pressure boundary of 4000 PSIG (27 500 kPaG) and can be manufactured to interface with any flange geometry.

## Piping Requirements

Designed for full-pipe flow, BVT flow meters may be mounted either horizontally or vertically. For recommended upstream piping, refer to Wyatt Engineering TechSpec for the BVT design.

## Design Concepts

The hydraulic design produces discharge coefficients that are highly predictable and independent of line size. The BVT-IF design allows accurate calculation of expansibility factors that are necessary for compressible fluid flow measurement. The smooth transition section minimizes flow noise and erosion.

## Signal-to-Noise Ratio

Within the specified flow range and piping conditions, the BVT-IF will produce signal-to-noise ratios greater than 98%. This level of performance is essential for sensitive process control and reactive rate-of-flow control applications.

# BVT-IF Sizing Table



Inlet Diameter		Throat Diameter		Beta Ratio	Overall Length		Outlet Diameter		$\Delta P = \text{Differential Pressure of } 100'' \text{ wc (24.864 kPa)}$						
									Water Flow at 60 F (16 C)					$\Delta H = \text{Headloss}$	
(inches)	(mm)	(inches)	(mm)		(inches)	(mm)	(inches)	(mm)	US GPM	US MGD	LPS	m <sup>3</sup> /d	Rd(10 <sup>-3</sup> )	in. wc	kPa
4.00	101.6	2.000	50.80	0.5000	10.10	257	3.00	76	229.31	0.330	14.47	1249.95	162	9.2	2.28
4.00	101.6	2.400	60.96	0.6000	10.20	259	3.40	86	337.73	0.486	21.31	1840.94	239	6.5	1.62
4.00	101.6	2.800	71.12	0.7000	10.30	262	3.80	97	476.34	0.686	30.05	2596.52	336	4.1	1.01
6.00	152.4	3.000	76.20	0.5000	15.20	386	4.60	117	515.94	0.743	32.55	2812.38	243	8.7	2.17
6.00	152.4	3.600	91.44	0.6000	15.30	389	5.20	132	759.88	1.094	47.94	4142.12	358	6.2	1.54
6.00	152.4	4.200	106.68	0.7000	15.40	391	5.70	145	1071.76	1.543	67.62	5842.17	505	3.9	0.96
8.00	203.2	4.000	101.60	0.5000	20.20	513	6.10	155	917.23	1.321	57.87	4999.79	324	8.4	2.10
8.00	203.2	4.800	121.92	0.6000	20.40	518	6.90	175	1350.9	1.945	85.23	7363.77	477	6.0	1.49
8.00	203.2	5.600	142.24	0.7000	20.60	523	7.60	193	1905.4	2.744	120.21	10386.1	673	3.7	0.93
10.00	254.0	5.000	127.00	0.5000	25.20	640	7.70	196	1433.2	2.064	90.42	7812.18	405	8.2	2.04
10.00	254.0	6.000	152.40	0.6000	25.50	648	8.70	221	2110.8	3.040	133.17	11505.9	596	5.8	1.45
10.00	254.0	7.000	177.80	0.7000	25.70	653	9.50	241	2977.1	4.287	187.83	16228.2	841	3.7	0.91
12.00	304.8	6.000	152.40	0.5000	30.30	770	9.20	234	2063.8	2.972	130.20	11249.5	486	8.0	2.00
12.00	304.8	7.200	182.88	0.6000	30.60	777	10.40	264	3039.5	4.377	191.76	16568.5	716	5.7	1.42
12.00	304.8	8.400	213.36	0.7000	30.80	782	11.40	290	4287.0	6.173	270.47	23368.7	1009	3.6	0.89
14.00	355.6	7.000	177.80	0.5000	35.30	897	10.80	274	2809.0	4.045	177.22	15311.9	567	7.9	1.96
14.00	355.6	8.400	213.36	0.6000	35.70	907	12.10	307	4137.1	5.957	261.01	22551.5	835	5.6	1.39
14.00	355.6	9.800	248.92	0.7000	36.00	914	13.30	338	5835.2	8.403	368.14	31807.4	1178	3.5	0.87
16.00	406.4	8.000	203.20	0.5000	40.30	1024	12.30	312	3668.9	5.283	231.47	19999.2	648	7.8	1.93
16.00	406.4	9.600	243.84	0.6000	40.80	1036	13.90	353	5403.6	7.781	340.92	29455.1	954	5.5	1.37
16.00	406.4	11.200	284.48	0.7000	41.10	1044	15.30	389	7621.4	10.975	480.84	41544.3	1346	3.5	0.86
18.00	457.2	9.000	228.60	0.5000	45.40	1153	13.80	351	4643.5	6.687	292.96	25311.5	729	7.7	1.90
18.00	457.2	10.800	274.32	0.6000	45.90	1166	15.60	396	6839.0	9.848	431.47	37279.1	1073	5.4	1.35
18.00	457.2	12.600	320.04	0.7000	46.20	1173	17.20	437	9645.9	13.890	608.56	52579.5	1514	3.4	0.85
20.00	508.0	10.000	254.00	0.5000	50.40	1280	15.40	391	5732.7	8.255	361.67	31248.7	810	7.6	1.88
20.00	508.0	12.000	304.80	0.6000	51.00	1295	17.40	442	8443.2	12.158	532.68	46023.6	1193	5.4	1.33
20.00	508.0	14.000	355.60	0.7000	51.30	1303	19.10	485	11908.5	17.148	751.31	64913.0	1682	3.4	0.84
24.00	609.6	12.000	304.80	0.5000	60.50	1537	18.50	470	8255.0	11.887	520.81	44998.1	972	7.4	1.84
24.00	609.6	14.400	365.76	0.6000	61.20	1554	20.90	531	12158.1	17.508	767.06	66273.9	1431	5.2	1.30
24.00	609.6	16.800	426.72	0.7000	61.60	1565	22.90	582	17148.2	24.693	1081.88	93474.7	2019	3.3	0.82
30.00	762.0	15.000	381.00	0.5000	75.60	1920	23.10	587	12898.5	18.574	813.77	70309.6	1215	7.2	1.79
30.00	762.0	18.000	457.20	0.6000	76.50	1943	26.10	663	18997.1	27.356	1198.53	103553.0	1789	5.1	1.27
30.00	762.0	21.000	533.40	0.7000	77.00	1956	28.70	729	26794.1	38.583	1690.44	146054	2523	3.2	0.80
36.00	914.4	18.000	457.20	0.5000	90.70	2304	27.70	704	18573.8	26.746	1171.83	101245.8	1458	7.0	1.75
36.00	914.4	21.600	548.64	0.6000	91.80	2332	31.30	795	27355.8	39.392	1725.88	149116	2147	5.0	1.24
36.00	914.4	25.200	640.08	0.7000	92.40	2347	34.40	874	38583.4	55.560	2434.24	210318	3028	3.1	0.78
42.00	1066.8	21.000	533.40	0.5000	105.80	2687	32.40	823	25281.0	36.405	1594.99	137807	1701	6.9	1.72
42.00	1066.8	25.200	640.08	0.6000	107.10	2720	36.50	927	37234.3	53.617	2349.12	202964	2505	4.9	1.22
42.00	1066.8	29.400	746.76	0.7000	107.80	2738	40.10	1019	52516.4	75.624	3313.27	286266	3533	3.1	0.76
48.00	1219.2	24.000	609.60	0.5000	120.90	3071	37.00	940	33020.1	47.549	2083.25	179993	1944	6.8	1.69
48.00	1219.2	28.800	731.52	0.6000	122.40	3109	41.80	1062	48632.5	70.031	3068.24	265096	2863	4.8	1.20
48.00	1219.2	33.600	853.44	0.7000	123.10	3127	45.90	1166	68592.8	98.774	4327.53	373899	4037	3.0	0.75

This sizing table can be used as a guide to aid the user in choosing the proper BVT for a given application. Depending on the details of that application, a more appropriate selection, or a more accurate estimation of the performance of a given selection, may be available. Wyatt Engineering encourages users to contact their local Wyatt-Badger representatives, or call us directly, for definitive sizing information.

### Incompressible Flow Relationships:

$$\Delta P_N = 100 (Q_N / Q)^2$$

$$\Delta H_N = DH (Q_N / Q)^{1.88}$$

$$Q_N = Q (DP / 100)^{0.5}$$

### Examples:

20.00" x 14.000" BVT-IF, find

$\Delta P$  at 20 000 US GPM

$\Delta H$  at 20 000 US GPM

$Q_N$  at 750" wc

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### Solutions:

Found using the "Incompressible Flow Relationships"

$$\Delta P_N = 100 (20\,000 / 11\,908.47)^2 = 282.06'' \text{ wc}$$

$$\Delta H_N = 3.4 (20\,000 / 11\,908.47)^{1.88} = 9.0'' \text{ wc}$$

$$Q_N = 11\,908.47 (750 / 100)^{0.5} = 32\,612.69 \text{ US GPM}$$

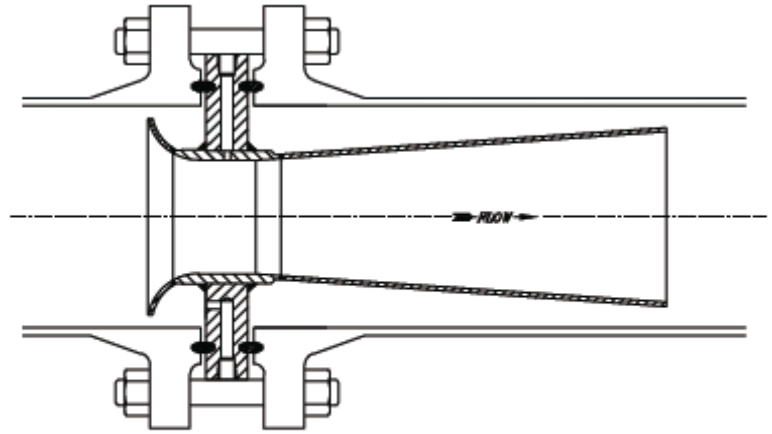
# Available Options



## Materials of Construction

The nature of the BVT-IF fabricated design allows the flow element to be constructed from practically any material. Examples of some of the alloys employed:

- Carbon Steel
- 304 Stainless Steel
- 316 Stainless Steel
- Inconel
- Hastelloy B & C
- Monel
- Titanium
- Chrome Molybdenum
- Nickel
- Tantalum
- Zirconium



BVT-IF

Consult your local representative or Wyatt Engineering for information on other materials of construction.

