

# BVT

# TECHbrief

Wyatt-Badger Venturi Tubes  
Cast Iron Primary Elements



## FEATURES:

- High Accuracy
- Reliable Operation
- Energy Efficient
- Different Options for a Variety of Applications

## Description

The Wyatt-Badger Venturi Tube is a differential-producing primary flow element that accurately and repeatably measures the flows of liquids or gases in closed, full-pipe conditions. The cast iron Wyatt BVT incorporates an efficient hydraulic shape with static pressure taps in the throat and inlet sections. The BVT can be provided with either 125 or 250 PSI flanges.

## Application

The cast iron series is often used in municipal water and wastewater applications. Known for longevity of service with minimal maintenance, BVT meters are ideal for metering potable water, sludge, slurries, as well as gases and clean fluids. The Model BVT-C is uniquely designed for rate-of-flow control applications, while the BVT-S is designed to prevent clogging of the pressure taps for applications with solids-bearing fluids.

## 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 Wyatt-Badger Venturi Tube is shown in Figure 1.

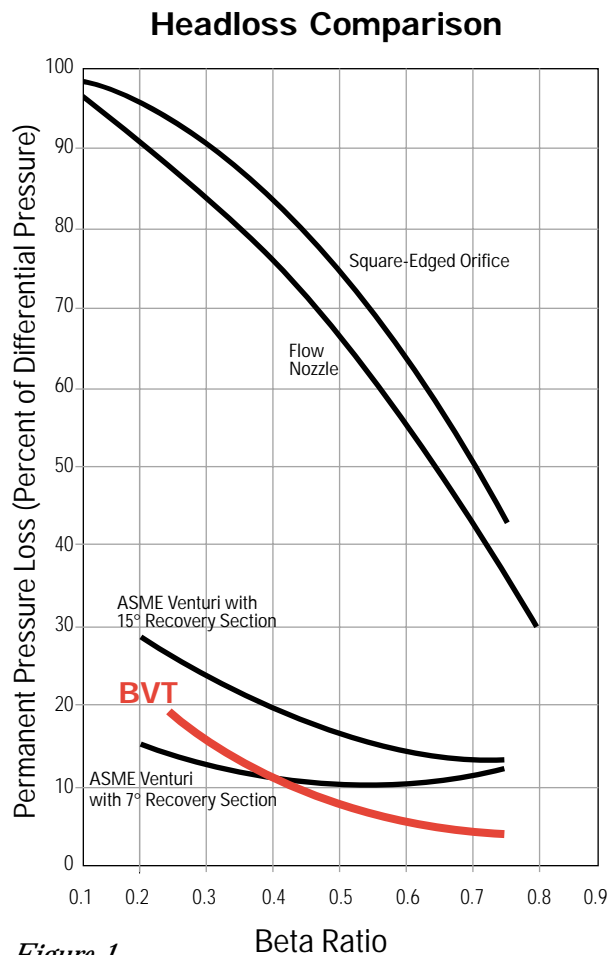


Figure 1

## Beta Ratio

Wyatt-Badger Venturi Tubes are available with a wide range of 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

Cast iron BVTs can handle process temperatures between -20 °F and +350 °F (-30 °C and +175 °C).

## Pressure Range/End Connections

Flanged end connections per ANSI B16.1 for 125 PSIG and 250 PSIG service are available. A variety of other end connections is also available including: Mechanical joint flanges per AWWA C110 or C111, as well as plain-end designs.

## 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 Technical Manual for the BVT.

## Energy Considerations

Figure 1 compares the headloss of the BVT design with that of other primary flow elements. The pressure recovery of the Wyatt-Badger Venturi Tube means reduced pumping costs. The Wyatt-Badger Venturi has a shorter laying length and exhibits better recovery than typical classical and modified venturi meters.

## Design Concepts

The Wyatt-Badger Venturi is designed to provide a high degree of accuracy with unquestionable and predictable performance. Key to this design is the following:

**Accuracy:** Static inlet and throat pressure sensation provides a highly accurate, stable, and predictable flow measurement signal for flow rates with pipe Reynolds numbers as low as 75 000.

**Reliability:** The Wyatt-Badger Venturi Tube is free of protrusions and sharp-edged, debris-collecting annuli. Static pressure taps reduce flow noise. The internal contour is designed to minimize the buildup of solids and deter erosion, corrosion, and scaling.

**Energy Savings:** Wyatt-Badger Venturi Tubes operate with minimal headloss. This results in less energy consumption, lower operational costs, and a lower cost of ownership.

# BVT Sizing Table



Inlet Diameter		Throat Diameter		Beta Ratio	Overall Length		Outlet Diameter		ΔP = Differential Pressure of 100" wc (24.864 kPa)						
									Water Flow at 60 F (16 C)					ΔH = Headloss	
(inches)	(mm)	(inches)	(mm)		(inches)	(mm)	(inches)	(mm)	US GPM	US MGD	LPS	m <sup>3</sup> /d	R <sub>D</sub> (10 <sup>-3</sup> )	in. wc	kPa
4.000	101.6	1.800	45.72	0.4500	13.25	337	2.90	74	186.30	0.268	11.75	1015.51	132	11.6	2.88
4.000	101.6	2.400	60.96	0.6000	13.00	330	3.41	87	348.00	0.501	21.96	1896.97	246	8.3	2.06
4.000	101.6	2.900	73.66	0.7250	11.50	292	3.66	93	557.71	0.803	35.19	3040.07	394	5.0	1.24
6.000	152.4	2.700	68.58	0.4500	17.50	445	4.18	106	419.17	0.604	26.45	2284.90	197	12.4	3.08
6.000	152.4	3.600	91.44	0.6000	17.00	432	4.94	125	783.01	1.128	49.40	4268.18	369	8.8	2.19
6.000	152.4	4.350	110.49	0.7250	16.00	406	5.42	138	1254.84	1.807	79.17	6840.15	591	5.0	1.24
8.000	203.2	3.600	91.44	0.4500	21.50	546	5.63	143	745.19	1.073	47.01	4062.04	263	11.7	2.91
8.000	203.2	4.800	121.92	0.6000	21.00	533	6.65	169	1392.02	2.005	87.82	7587.88	492	8.2	2.04
8.000	203.2	5.800	147.32	0.7250	19.00	483	7.17	182	2230.84	3.212	140.74	12160.27	788	5.0	1.24
10.000	254.0	4.800	121.92	0.4800	25.50	648	7.15	182	1333.49	1.920	84.13	7268.82	377	11.2	2.78
10.000	254.0	5.800	147.32	0.5800	25.00	635	8.00	203	2013.24	2.899	127.02	10974.17	569	8.9	2.21
10.000	254.0	7.250	184.15	0.7250	22.00	559	8.92	227	3485.68	5.019	219.91	19000.42	985	5.1	1.27
12.000	304.8	5.800	147.32	0.4833	30.50	775	8.69	221	1948.56	2.806	122.94	10621.59	459	10.7	2.66
12.000	304.8	7.250	184.15	0.6042	30.00	762	9.93	252	3182.44	4.583	200.78	17347.45	749	7.9	1.96
12.000	304.8	8.700	220.98	0.7250	26.00	660	10.67	271	5019.38	7.228	316.67	27360.60	1182	5.0	1.24
14.000	355.6	6.300	160.02	0.4500	34.50	876	9.63	245	2282.15	3.286	143.98	12440.00	461	11.7	2.91
14.000	355.6	8.700	220.98	0.6214	33.50	851	11.67	296	4625.86	6.661	291.85	25215.54	934	7.4	1.84
14.000	355.6	10.150	257.81	0.7250	30.00	762	12.41	315	6831.93	9.838	431.03	37240.82	1379	5.0	1.24
16.000	406.4	7.250	184.15	0.4531	40.50	1029	10.95	278	3024.19	4.355	190.80	16484.86	534	11.9	2.96
16.000	406.4	10.150	257.81	0.6344	37.00	940	13.42	341	6344.86	9.137	400.30	34585.79	1120	7.0	1.74
16.000	406.4	11.600	294.64	0.7250	34.00	864	14.19	360	8923.34	12.850	562.98	48641.07	1576	4.9	1.22
18.000	457.2	8.700	220.98	0.4833	45.50	1156	13.03	331	4384.26	6.313	276.60	23898.57	688	10.2	2.54
18.000	457.2	10.150	257.81	0.5639	43.50	1105	14.27	362	6123.38	8.818	386.32	33378.48	961	8.4	2.09
18.000	457.2	13.050	331.47	0.7250	39.00	991	15.94	405	11293.60	16.263	712.52	61561.35	1773	4.8	1.19
20.000	508.0	10.150	257.81	0.5075	48.00	1219	14.79	376	6005.93	8.649	378.92	32738.31	848	9.7	2.41
20.000	508.0	11.600	294.64	0.5800	47.50	1207	16.01	407	8052.97	11.596	508.06	43896.68	1138	8.2	2.04
20.000	508.0	14.500	368.30	0.7250	41.00	1041	17.65	448	13942.72	20.078	879.65	76001.67	1970	4.8	1.19
24.000	609.6	11.600	294.64	0.4833	59.00	1499	17.38	441	7794.24	11.224	491.74	42486.34	918	9.9	2.46
24.000	609.6	14.500	368.30	0.6042	57.00	1448	19.85	504	12729.75	18.331	803.12	69389.80	1499	7.3	1.81
24.000	609.6	17.400	441.96	0.7250	49.00	1245	21.15	537	20077.52	28.912	1266.69	109442.40	2364	4.6	1.14
30.000	762.0	13.050	331.47	0.4350	71.50	1816	20.17	512	9764.84	14.061	616.07	53228.08	920	11.4	2.83
30.000	762.0	17.400	441.96	0.5800	67.00	1702	23.36	593	18119.18	26.092	1143.14	98767.54	1706	8.5	2.11
30.000	762.0	21.750	552.45	0.7250	62.00	1575	26.57	675	31371.12	45.174	1979.21	171003.75	2954	4.5	1.12
36.000	914.4	17.400	441.96	0.4833	85.50	2172	25.72	653	17537.04	25.253	1106.42	95594.27	1376	9.6	2.39
36.000	914.4	21.750	552.45	0.6042	84.00	2134	29.43	748	28641.95	41.244	1807.03	156127.05	2248	7.2	1.79
36.000	914.4	26.100	662.94	0.7250	74.00	1880	31.82	808	45174.41	65.051	2850.06	246245.40	3545	4.4	1.09
42.000	1066.8	18.900	480.06	0.4500	99.50	2527	28.53	725	20539.37	29.577	1295.83	111959.96	1382	10.8	2.69
42.000	1066.8	26.100	662.94	0.6214	97.00	2464	34.67	881	41632.76	59.951	2626.62	226939.87	2801	6.7	1.67
42.000	1066.8	30.450	773.43	0.7250	87.00	2210	37.06	941	61487.39	88.542	3879.25	335167.35	4136	4.3	1.07
48.000	1219.2	21.750	552.45	0.4531	113.00	2870	32.85	834	27217.75	39.194	1717.17	148363.75	1602	10.5	2.61
48.000	1219.2	30.450	773.43	0.6344	110.00	2794	40.26	1023	57103.74	82.229	3602.69	311272.09	3361	6.1	1.52
48.000	1219.2	34.800	883.92	0.7250	98.00	2489	42.31	1075	80310.06	115.646	5066.78	437769.60	4727	4.3	1.07

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

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

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

$$Q_N = Q (\Delta P / 100)^{0.5}$$

### Examples:

For a 12.00" x 8.700" BVT, find

$$\Delta P \text{ at } 10\,000 \text{ US GPM}$$

$$\Delta H \text{ at } 10\,000 \text{ US GPM}$$

$$Q_N \text{ at } 750" \text{ wc}$$

### Solutions:

Found using the "Incompressible Flow Relationships"

$$\Delta P_N = 100 (10\,000 / 5\,019.38)^2 = 396.92" \text{ wc}$$

$$\Delta H_N = 5.0 (10\,000 / 5\,019.38)^{1.88} = 18.3" \text{ wc}$$

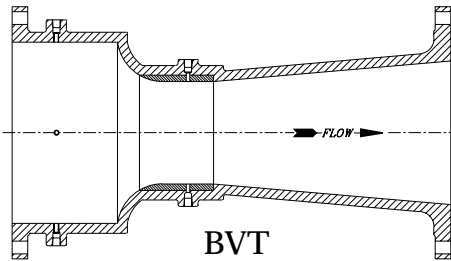
$$Q_N = 5\,019.38 (750 / 100)^{0.5} = 13\,746.14 \text{ US GPM}$$

# Available Options



The cast iron Wyatt-Badger Venturi Tube is available in four styles for specific applications.

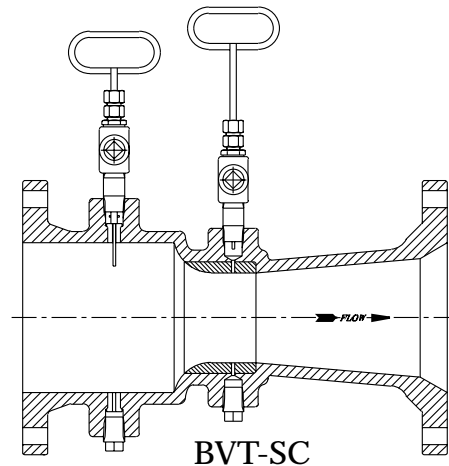
**Model BVT** is a flanged cast iron primary element designed for liquid and gas flow measurement. Typical throat materials are bronze and stainless steel. All valves, except butterfly valves, may be direct-coupled downstream for control purposes without loss of accuracy. The BVT can be supplied with flanges, mechanical joints, or plain ends. Typical throat materials are bronze or stainless steel.



**Model BVT-C** is a flanged cast iron primary element designed to utilize a butterfly valve for rate-of-flow control in liquid or gas service. The Wyatt-Badger Venturi tube is constructed to accept a butterfly valve bolted directly to the downstream flange allowing the BVT-C to be utilized as a rate-of-flow controller. The butterfly valve does not affect the accuracy of the primary element. The meter outlet can be modified to accommodate a valve one or more line sizes smaller than the main piping run.

**Model BVT-S** is a flanged primary element designed for wastewater, sludge, slurry, or other fluids with suspended solids. Static pressure taps assure stable measurement and minimize solids buildup at the tap. Manual vent cleaners are provided as a standard; automatic vent cleaners or a sealed diaphragm system are available as options. An inspection port and water purge systems, either continuous or timed, are also available.

**Model BVT-SC** is for rate-of-flow controllers used in applications where the line fluid contains suspended solids. The primary element is provided with vent cleaners, sealed diaphragms, or a purge system, and will accept a butterfly valve bolted directly to the downstream flange. This allows the BVT-SC to be used in many applications where other standard venturi or flow tubes cannot be used.



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



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