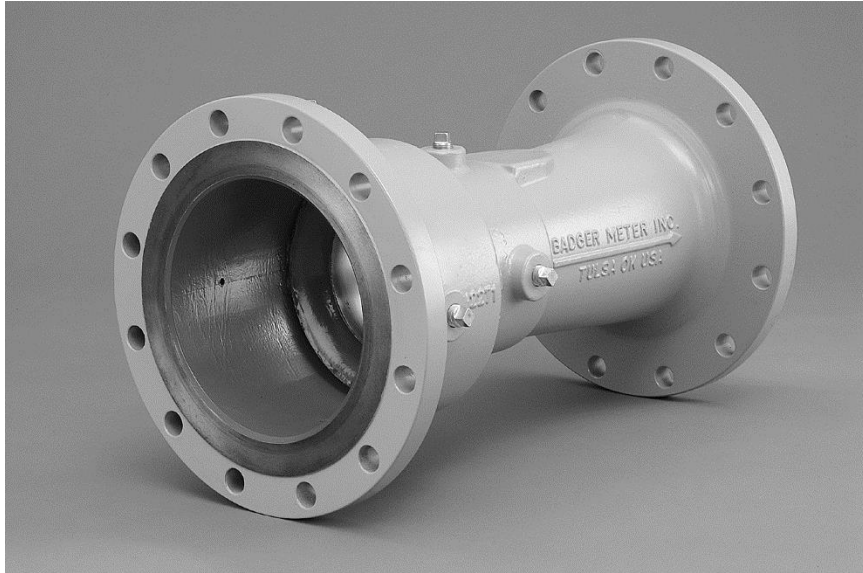


BVT-CI

TECHbrief

Wyatt Badger Venturi Tubes
Cast Iron Primary Elements



FEATURES:

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

Description

Wyatt Engineering's 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-CI** can be provided with 125-lb flanges. The ductile iron **BVT-DI** can be provided with either 125-lb or 250-lb flanges.

Application

The cast iron series is often used in municipal water and wastewater applications. Known for longevity of service with minimal maintenance, **BVT-CI** 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. The **BVT-SC** is a flow controller for use with contaminated fluids.

Low Uncertainty

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

- ± 0.50% for standard QS9001 calibrated meters and
- ± 0.25% for flow calibrated meters.

Pressure Loss

The permanent pressure loss of the Wyatt Engineering's Badger Venturi Tube is shown in Figure 1.

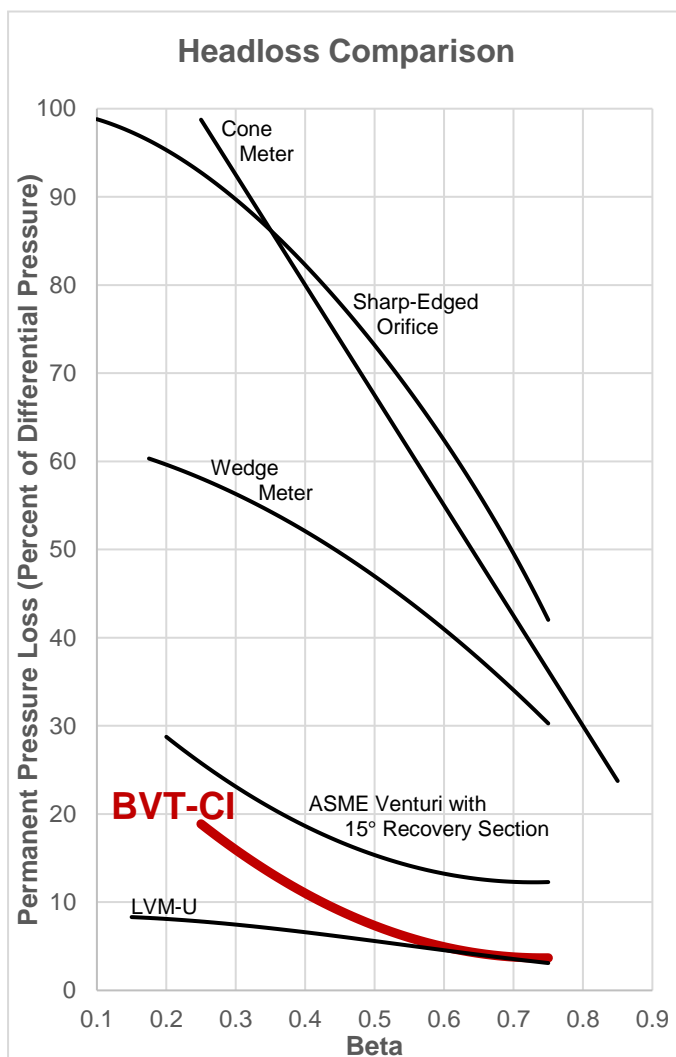


Figure 1

Beta Ratio

Wyatt's 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

Gray iron BVTs can handle process temperatures between -20 °F and +400 °F (-28 °C and +200 °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 are also available including: Mechanical joint flanges per AWWA C110 or C111, flexible joints, and plain-end designs. Inquire about other options and we will respond to your needs.

Piping Requirements

Designed for full-pipe flow, BVT flow meters may be mounted horizontally, at an angle, or vertically. For recommended upstream piping, refer to Wyatt Engineering's TECHspec 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 results in reduced pumping costs. Wyatt's Badger Venturi Tube 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: Sensation of static inlet and throat pressures provides an 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 very low headloss. This results in lower energy usage, lower operational costs, and a lower cost of ownership.

BVT-CI Sizing Table

Inlet Diameter		Throat Diameter		Beta Ratio	Overall Length		Outlet Diameter		ΔP = Differential Pressure of 100.00" wc (24.864 kPaD)						
(inches)	(mm)	(inches)	(mm)		(inches)	(mm)	(inches)	(mm)	Water Flow at 60° F (16° C)					ΔH = Headloss	
									US GPM	US MGD	LPS	m ³ /d	Ro(10 ⁻³)	in. wc	kPa
4.00	102	1.800	45.72	0.4500	13.25	337	2.90	74	186.30	0.268	11.754	1015.51	132	11.6	2.88
4.00	102	2.400	60.96	0.6000	13.00	330	3.41	87	348.00	0.501	21.956	1896.97	246	8.3	2.06
4.00	102	2.900	73.66	0.7250	11.50	292	3.66	93	557.71	0.803	35.186	3040.07	394	5.0	1.24
6.00	152	2.700	68.58	0.4500	17.50	445	4.18	106	419.17	0.604	26.446	2284.90	197	12.4	3.08
6.00	152	3.600	91.44	0.6000	17.00	432	4.94	125	783.01	1.128	49.400	4268.18	369	8.8	2.19
6.00	152	4.350	110.49	0.7250	16.00	406	5.42	138	1254.8	1.807	79.168	6840.15	591	5.0	1.24
8.00	203	3.600	91.44	0.4500	21.50	546	5.63	143	745.19	1.073	47.014	4062.04	263	11.7	2.91
8.00	203	4.800	121.92	0.6000	21.00	533	6.65	169	1392.0	2.005	87.823	7587.88	492	8.2	2.04
8.00	203	5.800	147.32	0.7250	19.00	483	7.17	182	2230.8	3.212	140.74	12160.3	788	5.0	1.24
10.00	254	4.800	121.92	0.4800	25.50	648	7.15	182	1333.5	1.920	84.130	7268.82	377	11.2	2.78
10.00	254	5.800	147.32	0.5800	25.00	635	8.00	203	2013.2	2.899	127.02	10974.2	569	8.9	2.21
10.00	254	7.250	184.15	0.7250	22.00	559	8.92	227	3485.7	5.019	219.91	19000.4	985	5.1	1.27
12.00	305	5.800	147.32	0.4833	30.50	775	8.69	221	1948.6	2.806	122.94	10621.6	459	10.7	2.66
12.00	305	7.250	184.15	0.6042	30.00	762	9.93	252	3182.4	4.583	200.78	17347.4	749	7.9	1.96
12.00	305	8.700	220.98	0.7250	26.00	660	10.67	271	5019.4	7.228	316.67	27360.6	1182	5.0	1.24
14.00	356	6.300	160.02	0.4500	34.50	876	9.63	245	2282.2	3.286	143.98	12440.0	461	11.7	2.91
14.00	356	8.700	220.98	0.6214	33.50	851	11.67	296	4625.9	6.661	291.85	25215.5	934	7.4	1.84
14.00	356	10.150	257.81	0.7250	30.00	762	12.41	315	6831.9	9.838	431.03	37240.8	1379	5.0	1.24
16.00	406	7.250	184.15	0.4531	40.50	1029	10.95	278	3024.2	4.355	190.80	16484.9	534	11.9	2.96
16.00	406	10.150	257.81	0.6344	37.00	940	13.42	341	6344.9	9.137	400.30	34585.8	1120	7.0	1.74
16.00	406	11.600	294.64	0.7250	34.00	864	14.19	360	8923.3	12.85	562.98	48641.1	1576	4.9	1.22
18.00	457	8.700	220.98	0.4833	45.50	1156	13.03	331	4384.3	6.313	276.60	23898.6	688	10.2	2.54
18.00	457	10.150	257.81	0.5639	43.50	1105	14.27	362	6123.4	8.818	386.32	33378.5	961	8.4	2.09
18.00	457	13.050	331.47	0.7250	39.00	991	15.94	405	11294	16.26	712.52	61561.3	1773	4.8	1.19
20.00	508	10.150	257.81	0.5075	48.00	1219	14.79	376	6005.9	8.649	378.92	32738.3	848	9.7	2.41
20.00	508	11.600	294.64	0.5800	47.50	1207	16.01	407	8053.0	11.60	508.06	43896.7	1138	8.2	2.04
20.00	508	14.500	368.30	0.7250	41.00	1041	17.65	448	13943	20.08	879.65	76001.7	1970	4.8	1.19
24.00	610	11.600	294.64	0.4833	59.00	1499	17.38	441	7794.2	11.22	491.74	42486.3	918	9.9	2.46
24.00	610	14.500	368.30	0.6042	57.00	1448	19.85	504	12730	18.33	803.12	69389.8	1499	7.3	1.81
24.00	610	17.400	441.96	0.7250	49.00	1245	21.15	537	20078	28.91	1266.69	109442	2364	4.6	1.14
30.00	762	13.050	331.47	0.4350	71.50	1816	20.17	512	9764.8	14.06	616.07	53228.1	920	11.4	2.83
30.00	762	17.400	441.96	0.5800	67.00	1702	23.36	593	18119	26.09	1143.14	98767.5	1706	8.5	2.11
30.00	762	21.750	552.45	0.7250	62.00	1575	26.57	675	31371	45.17	1979.21	171004	2954	4.5	1.12
36.00	914	17.400	441.96	0.4833	85.50	2172	25.72	653	17537	25.25	1106.42	95594.3	1376	9.6	2.39
36.00	914	21.750	552.45	0.6042	84.00	2134	29.43	748	28642	41.24	1807.03	156127	2248	7.2	1.79
36.00	914	26.100	662.94	0.7250	74.00	1880	31.82	808	45174	65.05	2850.06	246245	3545	4.4	1.09
42.00	1067	18.900	480.06	0.4500	99.50	2527	28.53	725	20539	29.58	1295.83	111960	1382	10.8	2.69
42.00	1067	26.100	662.94	0.6214	97.00	2464	34.67	881	41633	59.95	2626.62	226940	2801	6.7	1.67
42.00	1067	30.450	773.43	0.7250	87.00	2210	37.06	941	61487	88.54	3879.25	335167	4136	4.3	1.07
48.00	1219	21.750	552.45	0.4531	113.00	2870	32.85	834	27218	39.19	1717.17	148364	1602	10.5	2.61
48.00	1219	30.450	773.43	0.6344	110.00	2794	40.26	1023	57104	82.23	3602.69	311272	3361	6.1	1.52
48.00	1219	34.800	883.92	0.7250	98.00	2489	42.31	1075	80310	115.65	5066.78	437770	4727	4.3	1.07

This sizing table can be used as a guide to aid the user in choosing the proper BVT-CI 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 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-CI, find
 ΔP at 10 000 US GPM
 ΔH at 10 000 US GPM
 Q_N at 750" wc

Solutions:

Found using the "Incompressible Flow Relationships"
 $\Delta P_N = 100 (10\ 000 / 5\ 019.4)^2 = 396.91"$ wc
 $\Delta H_N = 5.0 (10\ 000 / 5\ 019.4)^{1.88} = 18.3"$ wc
 $Q_N = 5\ 019.4 (750 / 100)^{0.5} = 13\ 746.2$ US GPM

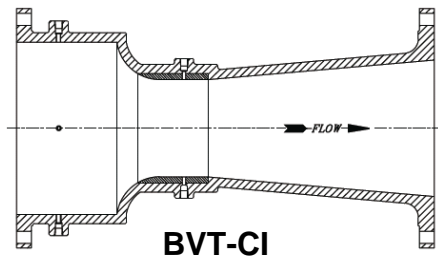
Available Options

WYATT

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

Model BVT-CI is a cast gray iron primary element designed for liquid and gas flow measurement. Typical throat materials are 304 and 316 stainless steel. Valves can be direct coupled downstream for control purposes without loss of accuracy, as can other common fittings.

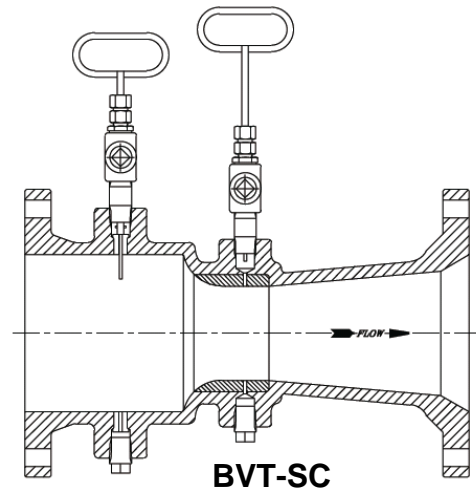
The BVT can be supplied with flanges, mechanical or flexible joints, or plain ends specific for your installation. For ductile iron, request our model **BVT-DI**.



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. Pressure tap locations 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 controller used in applications where the line fluid contains suspended solids. The primary element can be 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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