

BVT-IP

TECHbrief

Wyatt-Badger Venturi Tubes
Insert-Type Composite Primary Elements



FEATURES:

- High Accuracy
- Economical Design
- Low Pressure Loss
- Reliable Performance

Description

The Wyatt-Badger BVT insert venturi is available in two configurations: The standard BVT-IP, made entirely of engineered materials, and the BVT-IL, which uses a metallic throat and mounting flange and a fiberglass reinforced body. The BVT-IP and BVT-IL are designed for insertion within the interior of a pipeline and are secured by adjacent pipe flanges. Wyatt-Badger insert venturis are low-weight and cost-effective alternatives to other meter geometries and designs.

Application

The BVT insert venturi design provides higher accuracy over a wider range of flow rates, and lower permanent pressure loss than orifice plates, flow nozzles, or conventional venturi meters. Designed to measure clean liquids and gases in full pipes, the insert BVT can be manufactured to fit virtually any pipe size. In applications where solids contaminate the line fluid, an auxiliary high pressure tap can be provided for installation in the upstream pipe.

Flow Measurement Accuracy

For pipe Reynolds numbers greater than 75 000 and with a normalized piping configuration, the Wyatt-Badger BVT-IP and BVT-IL provide a flow measurement accuracy of $\pm 0.25\%$ with independent flow calibration. Without independent flow calibration, the Wyatt-Badger BVT-IP and BVT-IL provide a flow measurement accuracy of $\pm 0.50\%$.



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Technical Specifications

Accuracy

For pipe Reynolds numbers greater than 75 000 and a normalized piping configuration, the Wyatt-Badger BVT-IP and BVT-IL provide flow measurement uncertainties of:

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

Pressure Loss

The permanent pressure loss of Wyatt-Badger insert meters is considerably lower than that of short-form venturis, and for most beta ratios, lower than that of long-form venturis as well. (See Figure 1)

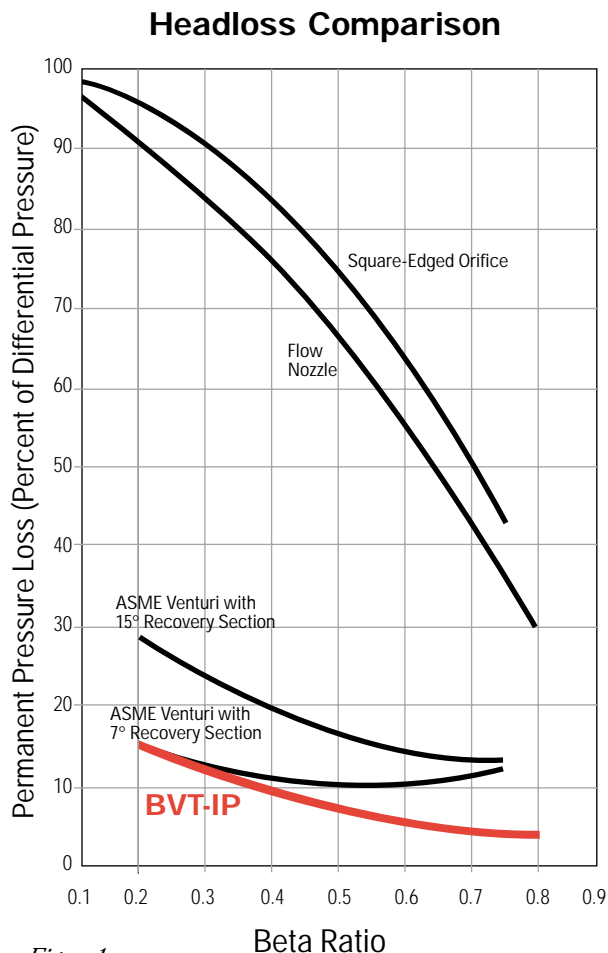


Figure 1

Beta Ratio

Wyatt-Badger insert meters can be furnished in a wide range of beta ratios (d/D), providing accurate and reliable primary elements with low permanent pressure loss.

Temperature Range

The composite design insert BVT series of primary devices is designed to operate within process temperature range of 0 °F to +300 °F (-18 °C to +150 °C).

Pressure Range/Flange Connections

Depending on process conditions, the standard design BVT-IP can operate at pressures up to 750 PSIG (5175 kPaG). The BVT-IL, due to its metallic mounting flange, operates at pressures up to 4000 PSIG (27 500 kPaG).

Piping Requirements

Designed for full-pipe flow, BVT-IP and BVT-IL insert meters can be installed in horizontal or vertical lines. For recommended upstream piping, refer to Wyatt Engineering Technical Manual for the BVT.

Design Concepts

The hydraulic design produces discharge coefficients that are highly predictable and independent of line size. The Wyatt-Badger 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 Wyatt-Badger 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-IP Sizing Table



Pipe Inside Diameter		Throat Diameter		Beta Ratio	Overall Length		Outlet Diameter		ΔP = Differential Pressure of 100" wc (24.864 kPa)						
(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	R _D (10 ⁻³)	in. wc	kPa	
3.000	76.2	1.609	40.9	0.5363	7.12	180.8	2.50	63.5	149.41	0.215	9.43	814.44	141	8.5	2.12
3.000	76.2	1.798	45.7	0.5993	6.53	165.8	2.60	66.0	189.51	0.273	11.96	1033.03	178	6.7	1.68
3.000	76.2	2.171	55.1	0.7237	5.36	136.2	2.70	68.6	289.10	0.416	18.24	1575.88	272	3.8	0.96
4.000	101.6	1.800	45.7	0.4500	10.57	268.5	3.30	83.8	184.47	0.266	11.64	1005.52	130	10.5	2.62
4.000	101.6	2.203	56.0	0.5508	9.31	236.5	3.40	86.4	280.96	0.405	17.73	1531.53	198	7.8	1.95
4.000	101.6	2.814	71.5	0.7035	7.40	188.0	3.60	91.4	481.79	0.694	30.40	2626.25	340	4.0	1.00
6.000	152.4	2.529	64.2	0.4215	16.50	419.1	4.90	124.5	363.10	0.523	22.91	1979.25	171	10.9	2.70
6.000	152.4	3.114	79.1	0.5190	14.65	372.1	5.10	129.5	557.74	0.803	35.19	3040.24	263	8.3	2.05
6.000	152.4	4.000	101.6	0.6667	10.65	270.5	5.20	132.1	959.47	1.382	60.53	5230.04	452	4.5	1.13
6.000	152.4	4.428	112.5	0.7380	10.45	265.4	5.60	142.2	1209.34	1.741	76.30	6592.11	569	3.4	0.84
8.000	203.2	3.466	88.0	0.4333	21.75	552.5	6.50	165.1	682.75	0.983	43.07	3721.67	241	10.2	2.52
8.000	203.2	4.018	102.1	0.5023	20.00	508.0	6.70	170.2	925.84	1.333	58.41	5046.76	327	8.4	2.08
8.000	203.2	4.919	124.9	0.6149	17.00	431.8	7.10	180.3	1425.11	2.052	89.91	7768.29	503	5.6	1.39
8.000	203.2	5.978	151.8	0.7473	13.40	340.4	7.40	188.0	2211.58	3.185	139.53	12055.31	781	3.2	0.80
10.000	254.0	3.991	101.4	0.3991	28.25	717.6	8.00	203.2	902.64	1.300	56.95	4920.29	255	11.0	2.73
10.000	254.0	4.919	124.9	0.4919	25.30	642.6	8.40	213.4	1385.32	1.995	87.40	7551.37	391	8.4	2.09
10.000	254.0	6.343	161.1	0.6343	19.00	482.6	8.50	215.9	2384.72	3.434	150.45	12999.11	674	5.0	1.24
10.000	254.0	6.907	175.4	0.6907	15.90	403.9	8.65	219.7	2887.75	4.158	182.19	15741.09	816	3.8	0.95
12.000	304.8	4.892	124.3	0.4077	33.60	853.4	9.70	246.4	1357.07	1.954	85.62	7397.37	320	10.4	2.60
12.000	304.8	5.675	144.1	0.4729	31.15	791.2	10.00	254.0	1838.80	2.648	116.01	10023.31	433	8.7	2.15
12.000	304.8	6.966	176.9	0.5805	26.90	683.3	10.35	262.9	2829.77	4.075	178.53	15425.05	666	6.2	1.53
12.000	304.8	8.000	203.2	0.6667	21.10	535.9	10.50	266.7	3837.87	5.527	242.13	20920.18	904	4.2	1.04
14.000	355.6	5.600	142.2	0.4000	39.50	1003.3	10.30	261.6	1777.28	2.559	112.13	9687.93	359	10.5	2.61
14.000	355.6	6.958	176.7	0.4970	33.80	858.5	10.45	265.4	2774.05	3.995	175.02	15121.33	560	8.0	1.98
14.000	355.6	8.044	204.3	0.5746	27.90	708.7	10.60	269.2	3767.53	5.425	237.69	20536.76	760	6.2	1.54
14.000	355.6	9.757	247.8	0.6969	27.30	693.4	12.10	307.3	5776.92	8.319	364.47	31489.92	1166	3.6	0.88
16.000	406.4	6.932	176.1	0.4333	43.35	1101.1	13.10	332.7	2731.00	3.933	172.30	14886.66	482	9.3	2.32
16.000	406.4	8.036	204.1	0.5023	38.90	988.1	13.20	335.3	3703.37	5.333	233.65	20187.06	654	7.7	1.92
16.000	406.4	9.838	249.9	0.6149	29.15	740.4	13.30	337.8	5700.46	8.209	359.64	31073.16	1007	5.2	1.28
16.000	406.4	11.255	285.9	0.7034	26.60	675.6	13.40	340.4	7707.13	11.098	486.24	42011.50	1361	3.4	0.85
18.000	457.2	8.011	203.5	0.4451	48.00	1219.2	14.80	375.9	3651.51	5.259	230.39	19905.97	573	8.9	2.22
18.000	457.2	9.984	228.2	0.4991	44.15	1121.4	14.90	378.5	4626.29	6.662	291.87	25217.88	726	7.7	1.91
18.000	457.2	9.849	250.2	0.5472	39.50	1003.3	15.00	381.0	5611.24	8.080	354.01	30586.85	881	6.6	1.65
18.000	457.2	11.350	288.3	0.6306	31.25	793.8	15.10	383.5	7625.92	10.981	481.12	41568.85	1197	4.7	1.18
18.000	457.2	12.592	319.8	0.6996	37.00	939.8	15.80	401.3	9631.89	13.870	607.68	52503.38	1512	3.4	0.85
20.000	508.0	8.959	227.6	0.4480	53.25	1352.6	16.50	419.1	4568.69	6.579	288.24	24903.88	645	8.7	2.17
20.000	508.0	9.839	249.9	0.4920	50.35	1278.9	16.70	424.2	5542.45	7.981	349.67	30211.87	783	7.7	1.92
20.000	508.0	11.377	289.0	0.5689	42.30	1074.4	16.80	426.7	7525.57	10.837	474.79	41021.83	1063	6.1	1.51
20.000	508.0	13.813	350.9	0.6907	36.50	927.1	16.90	429.3	11549.08	16.631	728.63	62953.98	1631	3.5	0.87
24.000	609.6	9.783	248.5	0.4076	66.80	1696.7	19.50	495.3	5427.15	7.815	342.40	29583.35	639	9.6	2.39
24.000	609.6	11.349	288.3	0.4729	61.90	1572.3	20.10	510.5	7353.88	10.590	463.96	40085.94	866	8.0	1.98
24.000	609.6	13.931	353.8	0.5805	50.65	1286.5	20.40	518.2	11317.32	16.297	714.01	61690.64	1332	5.7	1.41
24.000	609.6	16.000	406.4	0.6667	39.25	997.0	20.50	520.7	15351.46	22.106	968.53	83680.72	1807	3.8	0.96
30.000	762.0	11.265	286.1	0.3755	86.50	2197.1	24.00	609.6	7180.65	10.340	453.03	39141.67	676	10.4	2.60
30.000	762.0	12.645	321.2	0.4215	82.15	2086.6	24.50	622.3	9077.49	13.072	572.70	49481.36	855	9.0	2.23
30.000	762.0	16.086	408.6	0.5362	71.30	1811.0	25.80	655.3	14933.27	21.504	942.14	81401.13	1406	6.5	1.61
30.000	762.0	17.975	456.6	0.5992	65.15	1654.8	26.50	673.1	18939.76	27.273	1194.91	103240.47	1784	5.1	1.27
30.000	762.0	21.711	551.5	0.7237	50.40	1280.2	27.50	698.5	28913.00	41.635	1824.13	157604.55	2723	2.9	0.73
36.000	914.4	16.022	407.0	0.4451	92.20	2341.9	29.10	739.1	14607.23	21.034	921.57	79623.88	1146	8.2	2.04
36.000	914.4	19.705	500.5	0.5474	80.50	2044.7	30.40	772.2	22461.89	32.345	1417.13	122439.63	1763	6.1	1.51
36.000	914.4	22.004	558.9	0.6112	73.00	1854.2	31.30	795.0	28484.40	41.018	1797.09	155268.26	2235	4.8	1.18
36.000	914.4	25.183	639.6	0.6995	62.45	1586.2	32.40	823.0	38524.08	55.475	2430.49	209994.49	3023	3.1	0.78
42.000	1066.8	17.889	454.4	0.4259	114.15	2899.3	29.60	751.8	18174.99	26.172	1146.66	99071.74	1223	8.5	2.11
42.000	1066.8	19.653	499.2	0.4679	108.63	2759.3	31.40	797.6	22038.12	31.735	1390.39	120129.65	1482	7.6	1.88
42.000	1066.8	22.023	559.4	0.5244	101.23	2571.3	33.70	856.0	27924.64	40.211	1761.77	152217.00	1878	6.4	1.60
42.000	1066.8	25.414	645.5	0.6051	90.64	2302.2	37.10	942.3	37926.46	54.614	2392.79	206736.86	2551	4.8	1.19
42.000	1066.8	30.664	778.9	0.7301	74.23	1885.6	41.60	1057	57820.33	83.261	3647.90	315178.21	3889	2.7	0.68
48.000	1219.2	19.567	497.0	0.4076	133.19	3383.1	32.90	835.7	21710.85	31.264	1369.74	118345.68	1278	8.8	2.20
48.000	1219.2	21.957	557.7	0.4574	125.73	3193.5	35.30	896.6	27472.23	39.560	1733.23	149750.94	1617	7.7	1.90
48.000	1219.2	25.437	646.1	0.5299	114.86	2917.3	38.80	985.5	37294.05	53.703	2352.89	203289.62	2195	6.2	1.55
48.000	1219.2	31.045	788.5	0.6468	97.33	2472.3	44.40	1128	57374.04	82.619	3619.74	312745.47	3377	3.9	0.97
48.000	1219.2	35.353	898.0	0.7365	83.88	2130.4	47.60	1209.0	77045.00	110.945	4860.78	419971.77	4535	2.7	0.66

This sizing table can be used as a guide to aid the user in choosing the proper insert BVT for a given application and reflects the most commonly-used sizes. Other sizes and special geometries are available, often at no additional cost. Depending on the details of your 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 20.00" x 13.813" BVT-IP or BVT-IL, find
 ΔP at 20 000 US GPM
 ΔH at 20 000 US GPM
 Q_N at 750" wc

Found using the "Incompressible Flow Relationships"

$$\Delta P_N = 100 (20\ 000 / 11\ 549.08)^2 = 299.89" \text{ wc}$$

$$\Delta H_N = 3.3 (20\ 000 / 11\ 549.08)^{1.88} = 9.3" \text{ wc}$$

$$Q_N = 11\ 549.08 (750 / 100)^{0.5} = 31\ 628.46 \text{ US GPM}$$

Available Options

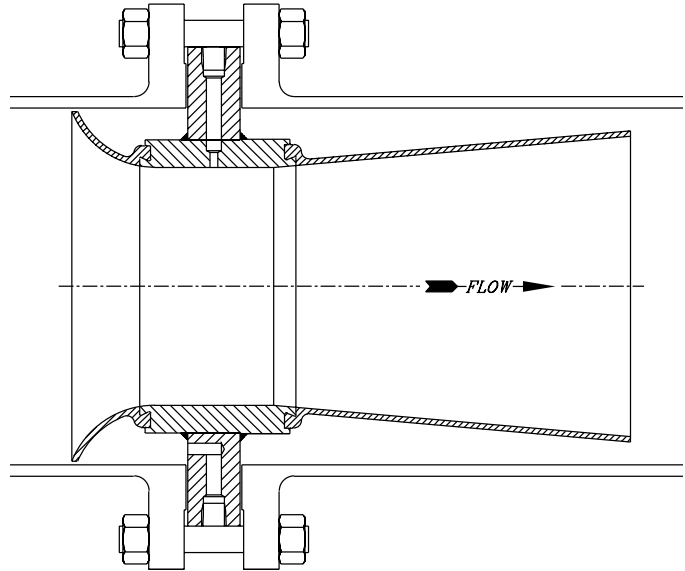


Materials of Construction

The Wyatt-Badger insert series of flow meters can be constructed of virtually any composite material, such as vinyl ester or isophthalic resin, reinforced with fiberglass or carbon fiber. Consult Wyatt Engineering for available materials.

Model BVT-IP: In the BVT-IP series, the body is typically constructed of vinyl ester resin reinforced with fiberglass (40% by weight). The throat can be constructed of polyvinyl chloride, FRP, or almost any other synthetic material.

Model BVT-IL: Like the BVT-IP, the meter body of the BVT-IL is generally constructed of vinyl ester resin reinforced with fiberglass (40% by weight). The BVT-IL typically incorporates a bronze, 304 stainless steel, or 316 stainless steel throat. Consult Wyatt Engineering for other available throat materials.



BVT-IL

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



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