

PMT

TECHbrief

Wyatt-Badger Lo-Loss® Flow Tubes
Cast Iron Primary Elements



FEATURES:

- Lowest Pressure Loss
- Short Laying Length
- Economical Design
- Best Documented Flow Tube on the Market

Description

The cast iron Wyatt-Badger Lo-Loss® meter is a differential-producing flow tube that maintains its accuracy over a wide range of flow rates. The hydraulic shape of the PMT Lo-Loss® meter incurs a lower permanent pressure loss than any other differential producing flow device. The PMT can be provided with either 125 or 250 PSIG flanges.

Application

The cast iron PMT series of Lo-Loss® meters is designed to accurately and reliably measure the flow rates of water, wastewater, sludge, slurries, clean fluids, and gases in full pipe conditions. The PMT series of meters is ideally suited to applications where permanent pressure loss must be kept to a minimum, such as in gravity-fed systems, or where a savings due to lower pumping costs can be realized. The Model PMT-C is designed for rate-of-flow control applications, while the PMT-S incorporates a rugged design for cleaning the pressure taps for solid-bearing fluids.

Flow Measurement Accuracy

For pipe Reynolds numbers greater than 100 000 and in a normalized piping configuration, the Wyatt-Badger PMT Lo-Loss® provides a flow measurement accuracy of $\pm 0.25\%$ with independent flow calibration and $\pm 1.00\%$ without flow calibration.

Lo-Loss® is a registered trademark of Wyatt Engineering.



WYATT
engineering

Intelligent Flow Measurement™

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Technical Specifications

Accuracy

Within the specified pipe Reynolds number range and a normalized piping configuration, the Lo-Loss® flow meter provides flow measurement uncertainties of:

- ± 1.00% for standard meters and
- ± 0.25% for flow calibrated meters.

Pressure Loss

The permanent pressure loss of the Lo-Loss® meter expressed as a percentage of the differential produced is shown in Figure 1 and is the lowest of any differential-producing primary element.

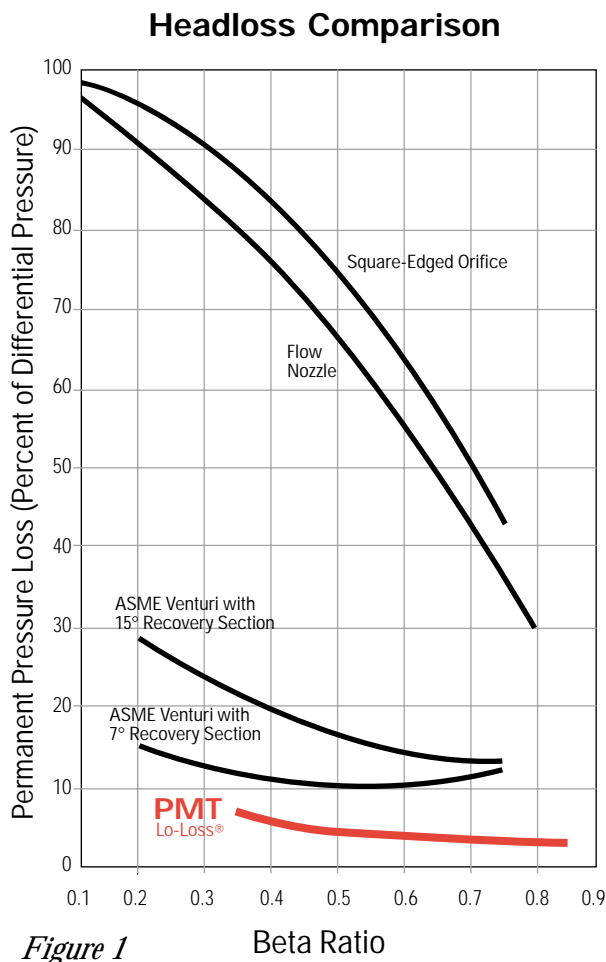


Figure 1

Beta Ratio

Wyatt Engineering offers Lo-Loss® meters with a wider range of diameter ratios (d/D) than any other manufacturer. By custom designing a Lo-Loss® meter to your application's flow conditions, Wyatt-Badger can provide an accurate and reliable primary element with the lowest permanent pressure loss.

Temperature Range

Cast iron Lo-Loss® meters 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. Various other end connections are also available, including: Mechanical joint flanges, per AWWA C110 and C111, and plain-end designs.

Piping Requirements

Designed for full-pipe flow, Lo-Loss® flow meters can be mounted horizontally, vertically, or on an angle. Refer to Wyatt Engineering Technical Manual for the Lo-Loss® Meter for recommended upstream piping.

Energy Considerations

Figure 1 compares the permanent pressure loss of the insert Lo-Loss® design with that of other primary flow elements. Figure 2 illustrates the substantial savings that are realized when a Lo-Loss® meter is used in a typical application. The pressure recovery of the Wyatt-Badger Lo-Loss® Meter means reduced pumping costs. High beta ratio Lo-Loss® meters will recover up to 97.5% of the differential pressure produced. This is two to four times better than typical classical venturi devices, as well as most modified venturi meters.

Using venturi tubes instead of orifice plates can yield significant savings, and using the Lo-Loss® meter instead of venturi tubes can realize further savings. For over 40 years, engineers have given their clients the benefits of efficiency and accuracy by doing just that.

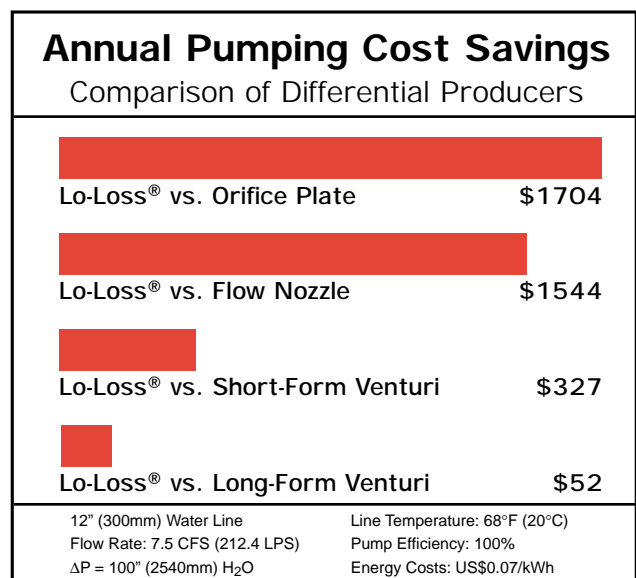


Figure 2

PMT Sizing Table



Inlet 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	7.35	187	2.50	64	128.02	0.184	8.08	697.86	121	4.1	1.02
3.000	76.2	1.798	45.7	0.5993	6.65	169	2.55	65	160.16	0.231	10.10	873.01	151	3.7	0.92
3.000	76.2	2.171	55.1	0.7237	5.25	133	2.70	69	239.64	0.345	15.12	1306.29	226	2.9	0.73
4.000	101.6	1.750	44.5	0.4375	11.35	288	3.30	84	152.57	0.220	9.63	831.68	108	5.0	1.25
4.000	101.6	2.203	56.0	0.5508	9.15	232	3.35	85	239.98	0.346	15.14	1308.12	170	4.0	0.99
4.000	101.6	2.814	71.5	0.7035	6.80	173	3.60	91	399.78	0.576	25.22	2179.22	282	3.1	0.76
6.000	152.4	2.529	64.2	0.4215	16.25	413	4.85	123	319.37	0.460	20.15	1740.86	150	5.3	1.31
6.000	152.4	3.114	79.1	0.5190	14.00	356	5.00	127	479.75	0.691	30.27	2615.10	226	4.2	1.05
6.000	152.4	4.000	101.6	0.6667	9.75	248	5.20	132	800.08	1.152	50.48	4361.26	377	3.3	0.82
6.000	152.4	4.428	112.5	0.7380	9.25	235	5.60	142	1002.89	1.444	63.27	5466.74	472	2.8	0.71
8.000	203.2	3.466	88.0	0.4333	21.00	533	4.85	123	598.84	0.862	37.78	3264.27	211	5.1	1.27
8.000	203.2	4.018	102.1	0.5023	19.00	483	5.00	127	799.35	1.151	50.43	4357.27	282	4.3	1.08
8.000	203.2	4.919	124.9	0.6149	15.50	394	5.20	132	1200.38	1.729	75.73	6543.25	424	3.6	0.90
8.000	203.2	5.978	151.8	0.7473	11.60	295	5.60	142	1835.83	2.644	115.82	10007.10	648	2.8	0.69
10.000	254.0	3.991	101.4	0.3991	27.50	699	8.00	203	798.27	1.150	50.36	4351.38	226	5.7	1.41
10.000	254.0	4.919	124.9	0.4919	24.00	610	8.35	212	1198.83	1.726	75.63	6534.83	339	4.4	1.10
10.000	254.0	6.343	161.1	0.6343	17.00	432	8.65	220	2000.64	2.881	126.22	10905.48	565	3.5	0.87
10.000	254.0	6.907	175.4	0.6907	13.75	349	18.65	474	2399.48	3.455	151.38	13079.57	678	3.2	0.79
12.000	304.8	4.892	124.3	0.4077	32.00	813	9.70	246	1197.62	1.725	75.56	6528.24	282	5.5	1.37
12.000	304.8	6.966	176.9	0.5805	24.50	622	10.50	267	2401.22	3.458	151.49	13089.04	565	3.8	0.95
12.000	304.8	8.000	203.2	0.6667	18.75	476	10.80	274	3200.34	4.608	201.91	17445.02	753	3.3	0.82
14.000	355.6	4.900	124.5	0.3500	40.50	1029	11.00	279	1215.55	1.750	76.69	6625.95	245	6.9	1.72
14.000	355.6	5.600	142.2	0.4000	38.00	965	11.25	286	1571.43	2.263	99.14	8565.86	317	5.7	1.41
14.000	355.6	6.958	176.7	0.4970	31.50	800	11.55	293	2397.87	3.453	151.28	13070.78	484	4.4	1.09
14.000	355.6	8.044	204.3	0.5746	28.50	724	12.15	309	3201.12	4.610	201.96	17449.26	646	3.9	0.96
14.000	355.6	9.757	247.8	0.6969	24.00	610	13.80	351	4796.68	6.907	302.62	26146.69	968	3.1	0.78
14.000	355.6	10.328	262.3	0.7377	20.00	508	13.00	330	5455.25	7.856	344.17	29736.52	1101	2.8	0.71
16.000	406.4	6.932	176.1	0.4333	40.90	1039	13.10	333	2395.36	3.449	151.12	13057.09	423	5.1	1.27
16.000	406.4	8.036	204.1	0.5023	37.00	940	13.50	343	3197.41	4.604	201.73	17429.08	565	4.3	1.08
16.000	406.4	9.838	249.9	0.6149	25.90	658	13.35	339	4801.51	6.914	302.93	26173.02	848	3.6	0.90
16.000	406.4	11.255	285.9	0.7034	22.90	582	14.30	363	6395.28	9.209	403.48	34860.64	1129	3.1	0.77
18.000	457.2	8.011	203.5	0.4451	45.00	1143	14.80	376	3194.15	4.600	201.52	17411.30	501	4.9	1.23
18.000	457.2	8.984	228.2	0.4991	41.65	1058	15.15	385	3997.05	5.756	252.17	21787.88	627	4.4	1.08
18.000	457.2	9.849	250.2	0.5472	38.30	973	15.50	394	4796.52	6.907	302.61	26145.79	753	4.0	1.00
18.000	457.2	11.35	288.3	0.6306	27.40	696	15.35	390	6402.53	9.220	403.94	34900.14	1005	3.5	0.88
18.000	457.2	12.592	319.8	0.6996	28.50	724	16.50	419	7995.36	11.513	504.43	43582.66	1255	3.1	0.77
18.000	457.2	12.618	320.5	0.7010	28.35	720	16.50	419	8031.95	11.566	506.74	43782.08	1261	3.1	0.77
20.000	508.0	7.000	177.8	0.3500	57.00	1448	15.75	400	2480.80	3.572	156.51	13522.81	350	6.9	1.72
20.000	508.0	8.959	227.6	0.4480	49.95	1269	16.50	419	3993.44	5.751	251.95	21768.23	564	4.9	1.22
20.000	508.0	9.839	249.9	0.4920	46.70	1186	16.80	427	4796.26	6.907	302.60	26144.36	678	4.4	1.10
20.000	508.0	11.377	289.0	0.5689	40.90	1039	17.35	441	6402.11	9.219	403.91	34897.88	904	3.9	0.97
20.000	508.0	13.813	350.9	0.6907	31.70	805	18.20	462	9596.26	13.819	605.43	52309.16	1356	3.2	0.79
24.000	609.6	9.783	248.5	0.4076	62.90	1598	19.45	494	4789.55	6.897	302.17	26107.81	564	5.5	1.37
24.000	609.6	11.349	288.3	0.4729	57.65	1464	20.35	517	6391.31	9.203	403.23	34838.97	752	4.6	1.14
24.000	609.6	13.931	353.8	0.5805	45.50	1156	20.45	519	9603.49	13.829	605.89	52348.54	1131	3.8	0.95
24.000	609.6	16.000	406.4	0.6667	33.50	851	20.55	522	12801.35	18.434	807.64	69780.09	1507	3.3	0.82
24.000	609.6	17.677	449.0	0.7365	33.50	851	20.25	514	15972.51	23.000	1007.71	87066.06	1880	2.9	0.71
30.000	762.0	11.265	286.1	0.3755	82.30	2090	23.90	607	6388.62	9.200	403.06	34824.32	602	6.2	1.54
30.000	762.0	12.645	321.2	0.4215	77.30	1963	24.40	620	7984.15	11.497	503.72	43521.56	752	5.3	1.31
30.000	762.0	16.086	408.6	0.5362	64.60	1641	25.70	653	12796.05	18.426	807.31	69751.20	1205	4.1	1.02
30.000	762.0	17.975	456.6	0.5992	57.60	1463	26.35	669	16006.49	23.049	1009.85	87251.26	1507	3.7	0.92
30.000	762.0	21.711	551.5	0.7237	43.20	1097	27.75	705	23966.72	34.512	1512.07	130642.44	2257	2.9	0.73
36.000	914.4	13.806	350.7	0.3835	96.00	2438	28.70	729	9580.44	13.796	604.43	52222.91	752	6.0	1.50
36.000	914.4	16.022	407.0	0.4451	89.50	2273	29.65	753	12776.60	18.398	806.08	69645.18	1003	4.9	1.23
36.000	914.4	19.705	500.5	0.5474	75.90	1928	31.00	787	19199.71	27.648	1211.31	104657.48	1507	4.0	1.00
36.000	914.4	22.004	558.9	0.6112	67.20	1707	31.85	809	24011.01	34.576	1514.86	130883.85	1884	3.6	0.91
36.000	914.4	25.183	639.6	0.6995	55.10	1400	33.00	838	31978.64	46.049	2017.54	174315.31	2510	3.1	0.77
42.000	1066.8	22.023	559.4	0.5244	91.90	2334	35.85	911	23991.09	34.547	1513.60	130775.25	1614	4.2	1.04
42.000	1066.8	25.414	645.5	0.6051	79.40	2017	37.05	941	32011.92	46.097	2019.64	174496.77	2153	3.7	0.91
42.000	1066.8	30.664	778.9	0.7301	59.00	1499	38.95	989	47931.20	69.021	3023.99	261272.64	3224	2.9	0.72
48.000	1219.2	19.567	497.0	0.4076	125.50	3188	38.85	987	19160.10	27.591	1208.81	104441.57	1128	5.5	1.37
48.000	1219.2	25.437	646.1	0.5299	103.90	2639	41.05	1043	32001.03	46.081	2018.95	174437.38	1884	4.1	1.03
48.000	1219.2	31.045	788.5	0.6468	82.90	2106	43.05	1093	48015.77	69.143	3029.32	261733.63	2826	3.4	0.85
48.000	1219.2	35.353	898.0	0.7365	69.50	1765	45.00	1143	63885.85	91.996	4030.57	348241.34	3760	2.9	0.71

This sizing table can be used as a guide to aid the user in choosing the proper PMT 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 30.00" x 21.711" PMT, find

$$\Delta P \text{ at 50 000 US GPM}$$
$$\Delta H \text{ at 50 000 US GPM}$$
$$Q_N \text{ at 750" wc}$$

Solutions:

Found using the "Incompressible Flow Relationships"

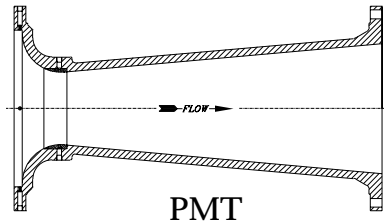
$$\Delta P_N = 100 (50\ 000 / 23\ 966.72)^2 = 435.23" \text{ wc}$$
$$\Delta H_N = 2.9 (50\ 000 / 23\ 966.72)^{1.88} = 11.6" \text{ wc}$$
$$Q_N = 23\ 966.72 (750 / 100)^{0.5} = 65\ 635.57 \text{ US GPM}$$

Available Options



The cast iron Lo-Loss® is designed to measure the flow of gases, water, wastewater, sludge, and slurry flows in full pipes. The iron Lo-Loss® design is furnished in four models, depending on the application.

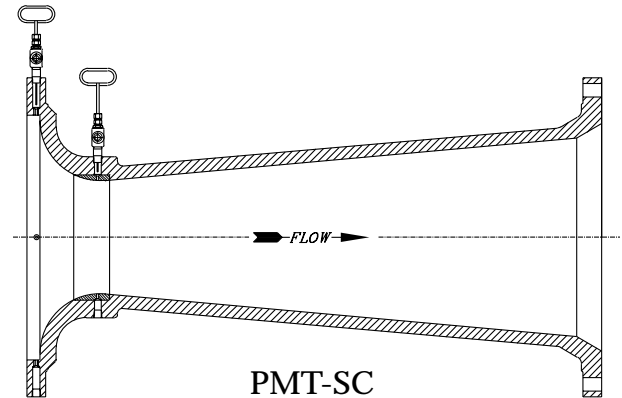
Model PMT is a flanged cast iron Lo-Loss® meter designed for liquid and gas flow measurement. Available throat materials are bronze and stainless steel. All valves, except butterfly valves, may be direct-coupled downstream for control purposes without loss of accuracy. The Lo-Loss® can be supplied with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



Model PMT-C is a flanged cast iron primary element designed to utilize a direct-coupled butterfly valve in a rate-of-flow controller for liquid or gas service. The direct-coupling of the butterfly valve will not affect the discharge coefficient 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 PMT-S is a flanged primary element designed for wastewater, sludge, slurry, or other fluids with suspended solids. Manual vent cleaners are provided as 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 PMT-SC is a rate-of-flow controller designed for use in applications where the line fluid contains suspended solids. The primary element is provided with vent cleaners or a purge system and will accept a butterfly valve bolted directly to the downstream flange. This allows the PMT-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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Intelligent Flow Measurement™