

PMT-IP

TECHbrief

Wyatt-Badger Lo-Loss® Flow Tubes
Insert-Type Composite Primary Elements



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FEATURES:

- **Lowest Pressure Loss**
- **Light Weight**
- **Cost Effective**
- **Short Laying Length**
- **Best Documented Flow Tube on the Market**

Description

The Wyatt-Badger Lo-Loss® insert series of differential producers is designed for installation within a pipe, and is secured in place by the adjacent pipe flanges. Lo-Loss® insert venturi meters are available in two configurations: PMT-IP and PMT-IL. The standard PMT-IP is made entirely of engineered materials such as FRP, PVC, and other thermoplastic compounds. The PMT-IL employs similar construction, but offers a metallic throat section and mounting flange. Their permanent pressure loss, expressed as a percent of differential pressure, is lower than any other venturi or flow tube on the market.

Application

The PMT-IP and PMT-IL Lo-Loss® Meters can accommodate a wide range of flow rates, line fluids, and process conditions. They are designed to measure full-pipe, clean fluids and gases in 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. The Lo-Loss® insert meters have the advantages of minimal weight, low cost, and a short laying length.

Flow Measurement Accuracy

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

Technical Specifications

Accuracy

For pipe Reynolds numbers greater than 100 000 and a normalized piping configuration, the Lo-Loss® PMT-IP and PMT-IL provide 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 and differential producing primary element.

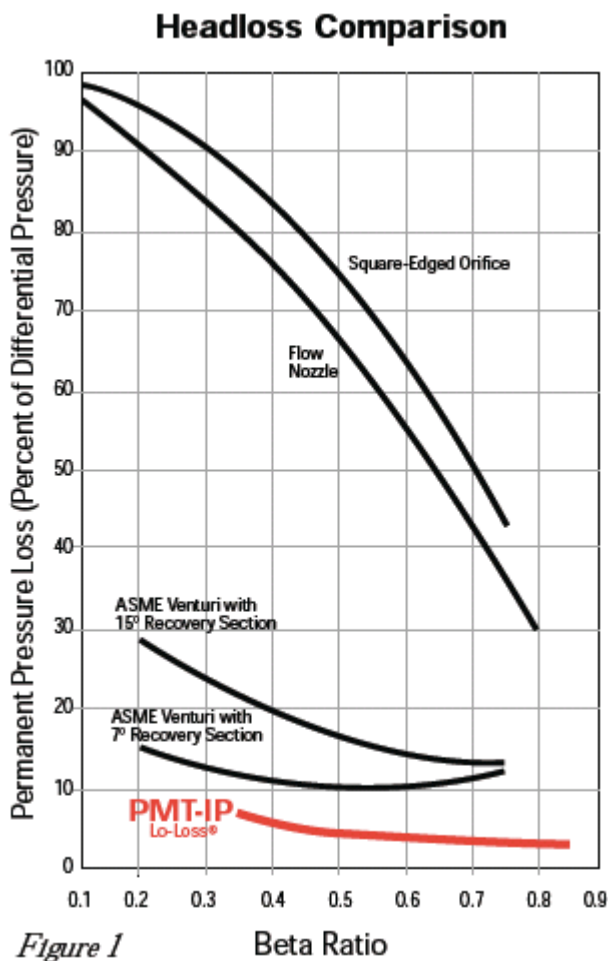


Figure 1

Beta Ratio

Wyatt Engineering offers Lo-Loss® insert 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

The insert series of Lo-Loss® primary devices is designed to operate within a 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 Lo-Loss® PMT-IP can operate at pressures up to 750 PSIG (5175 kPaG). The PMT-IL, due to its metallic mounting flange, operates at pressures up to 4000 PSIG (27 500 kPaG).

Piping Requirements

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

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 reduced pumping costs that are realized when using a Lo-Loss® Meter in a typical example. 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 50 years, engineers have given their clients the benefits of efficiency and accuracy by doing just that.

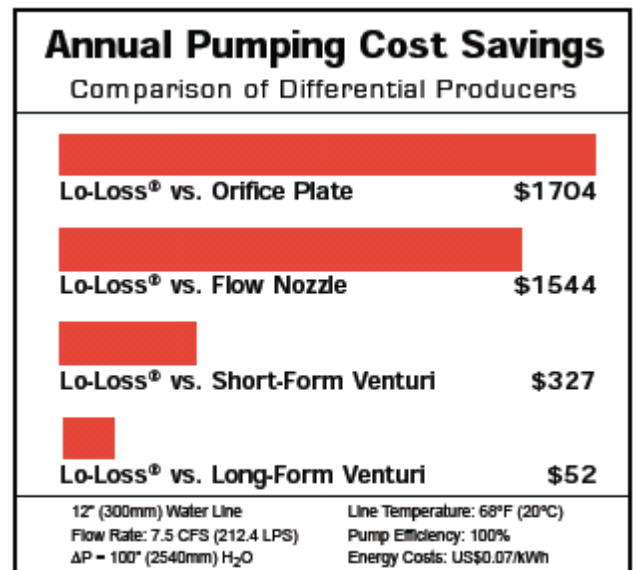


Figure 2

PMT-IP 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= H _{loss}	
									USGPM	USMGD	LPS	m ³ /d	R ₀ (10 ³)	in wc	kPa
3.0000	76.2	1.609	40.87	0.5363	6.30	160.0	2.50	63.5	128.02	0.184	8.08	697.86	121	4.1	1.02
3.0000	76.2	1.798	45.67	0.5993	5.55	140.97	2.60	66.0	160.16	0.231	10.10	873.01	151	3.7	0.92
3.0000	76.2	2.171	55.14	0.7237	4.05	102.9	2.70	68.6	239.64	0.345	15.12	1306.29	226	2.9	0.73
4.0000	101.6	1.800	45.72	0.4500	9.80	248.9	3.30	83.8	161.16	0.232	10.17	878.50	114	4.9	1.21
4.0000	101.6	2.203	55.96	0.5508	8.20	208.3	3.40	86.4	239.98	0.346	15.14	1308.12	170	4.0	0.99
4.0000	101.6	2.814	71.48	0.7035	5.75	146.1	3.60	91.4	399.78	0.576	25.22	2179.22	282	3.1	0.76
6.0000	152.4	3.114	79.10	0.5190	13.10	332.7	5.10	129.5	479.75	0.691	30.27	2615.10	226	4.2	1.05
6.0000	152.4	4.000	101.60	0.6667	8.70	221.0	5.20	132.1	800.08	1.152	50.48	4361.26	377	3.3	0.82
6.0000	152.4	4.428	112.47	0.7380	7.60	193.0	5.50	139.7	1002.89	1.444	63.27	5466.74	472	2.8	0.71
8.0000	203.2	3.466	88.04	0.4333	20.00	508.0	6.50	165.1	598.84	0.862	37.78	3264.27	211	5.1	1.27
8.0000	203.2	4.018	102.06	0.5023	18.00	457.2	6.70	170.2	799.35	1.151	50.43	4357.27	282	4.3	1.08
8.0000	203.2	4.919	124.94	0.6149	14.60	370.8	7.05	179.1	1200.38	1.729	75.73	6543.25	424	3.6	0.90
8.0000	203.2	5.978	151.84	0.7473	10.50	266.7	7.40	188.0	1835.83	2.644	115.82	10007.1	648	2.8	0.69
10.0000	254.0	3.991	101.37	0.3991	26.25	666.8	8.00	203.2	798.27	1.150	50.36	4351.38	226	5.7	1.41
10.0000	254.0	4.919	124.94	0.4919	22.85	580.4	8.40	213.4	1198.8	1.726	75.63	6534.83	339	4.4	1.10
10.0000	254.0	6.343	161.11	0.6343	15.90	403.9	8.55	217.2	2000.6	2.881	126.22	10905.5	565	3.5	0.87
10.0000	254.0	6.907	175.44	0.6907	12.50	317.5	8.60	218.4	2399.5	3.455	151.38	13079.6	678	3.2	0.79
12.0000	304.8	4.892	124.26	0.4077	31.15	791.2	9.70	246.4	1197.6	1.725	75.56	6528.24	282	5.5	1.37
12.0000	304.8	5.675	144.15	0.4729	28.30	718.8	10.00	254.0	1598.1	2.301	100.82	8711.24	376	4.6	1.14
12.0000	304.8	6.966	176.94	0.5805	23.45	595.6	10.35	262.9	2401.2	3.458	151.49	13089.0	565	3.8	0.95
12.0000	304.8	8.000	203.20	0.6667	17.25	438.2	10.40	264.2	3200.3	4.608	201.91	17445.0	753	3.3	0.82
14.0000	355.6	5.600	142.24	0.4000	36.65	930.9	11.30	287.0	1571.4	2.263	99.14	8565.86	317	5.7	1.41
14.0000	355.6	6.958	176.73	0.4970	30.35	770.9	11.45	290.8	2397.9	3.453	151.28	13070.8	484	4.4	1.09
14.0000	355.6	8.044	204.32	0.5746	24.00	609.6	11.50	292.1	3201.1	4.610	201.96	17449.3	646	3.9	0.96
14.0000	355.6	9.757	247.83	0.6969	22.45	570.2	12.00	304.8	4796.7	6.907	302.62	26146.7	968	3.1	0.78
16.0000	406.4	6.932	176.07	0.4333	40.00	1016.0	13.10	332.7	2395.4	3.449	151.12	13057.1	423	5.1	1.27
16.0000	406.4	8.036	204.11	0.5023	35.10	891.5	13.25	336.6	3197.4	4.604	201.73	17429.1	565	4.3	1.08
16.0000	406.4	9.838	249.89	0.6149	24.40	619.8	13.30	337.8	4801.5	6.914	302.93	26173.0	848	3.6	0.90
16.0000	406.4	11.255	285.88	0.7034	21.15	537.2	13.35	339.1	6395.3	9.209	403.48	34860.6	1129	3.1	0.77
18.0000	457.2	8.984	228.19	0.4991	39.80	1010.9	15.00	381.0	3997.0	5.756	252.17	21787.9	627	4.4	1.08
18.0000	457.2	9.849	250.16	0.5472	34.75	882.7	15.05	382.3	4796.5	6.907	302.61	26145.8	753	4.0	1.00
18.0000	457.2	11.350	288.29	0.6306	25.80	655.3	15.10	383.5	6402.5	9.220	403.94	34900.1	1005	3.5	0.88
18.0000	457.2	12.592	319.84	0.6996	30.85	783.6	15.80	401.3	7995.4	11.513	504.43	43582.7	1255	3.1	0.77
20.0000	508.0	8.959	227.56	0.4480	48.90	1242.1	16.50	419.1	3993.4	5.751	251.95	21768.2	564	4.9	1.22
20.0000	508.0	9.839	249.91	0.4920	45.60	1158.2	16.75	425.5	4796.3	6.907	302.60	26144.4	678	4.4	1.10
20.0000	508.0	11.377	288.98	0.5689	36.80	934.7	16.80	426.7	6402.1	9.219	403.91	34897.9	904	3.9	0.97
20.0000	508.0	13.813	350.85	0.6907	29.80	756.9	16.85	428.0	9596.3	13.819	605.43	52309.2	1356	3.2	0.79
24.0000	609.6	9.783	248.49	0.4076	62.10	1577.3	19.40	492.8	4789.6	6.897	302.17	26107.8	564	5.5	1.37
24.0000	609.6	11.349	288.26	0.4729	56.40	1432.6	20.00	508.0	6391.3	9.203	403.23	34839.0	752	4.6	1.14
24.0000	609.6	13.931	353.85	0.5805	43.90	1115.1	20.50	520.7	9603.5	13.829	605.89	52348.5	1131	3.8	0.95
24.0000	609.6	16.000	406.40	0.6667	31.50	800.1	20.60	523.2	12801.4	18.434	807.64	69780.1	1507	3.3	0.82
30.0000	762.0	12.645	321.18	0.4215	76.65	1946.9	24.40	619.8	7984.2	11.497	503.72	43521.6	752	5.3	1.31
30.0000	762.0	16.086	408.58	0.5362	64.05	1626.9	25.70	652.8	12796.1	18.426	807.31	69751.2	1205	4.1	1.02
30.0000	762.0	17.975	456.57	0.5992	57.00	1447.8	26.40	670.6	16006.5	23.049	1009.85	87251.3	1507	3.7	0.92
30.0000	762.0	21.711	551.46	0.7237	40.40	1026.2	27.40	696.0	23966.7	34.512	1512.07	130642	2257	2.9	0.73
36.0000	914.4	16.022	406.96	0.4451	85.00	2159.0	29.00	736.6	12776.6	18.398	806.08	69645.2	1003	4.9	1.23
36.0000	914.4	19.705	500.51	0.5474	71.50	1816.1	30.35	770.9	19199.7	27.648	1211.31	104657	1507	4.0	1.00
36.0000	914.4	22.004	558.90	0.6112	62.90	1597.7	31.20	792.5	24011.0	34.576	1514.86	130884	1884	3.6	0.91
36.0000	914.4	25.183	639.65	0.6995	50.70	1287.8	32.40	823.0	31978.6	46.049	2017.54	174315	2510	3.1	0.77
42.0000	1066.8	19.653	499.19	0.4679	96.25	2444.8	34.30	871.2	19175.0	27.612	1209.76	104523	1290	4.7	1.16
42.0000	1066.8	22.023	559.38	0.5244	87.50	2222.5	35.20	894.1	23991.1	34.547	1513.60	130775	1614	4.2	1.04
42.0000	1066.8	25.414	645.52	0.6051	74.90	1902.5	36.40	924.6	32011.9	46.097	2019.64	174497	2153	3.7	0.91
42.0000	1066.8	30.664	778.87	0.7301	54.70	1389.4	38.35	974.1	47931.2	69.021	3023.99	261273	3224	2.9	0.72
48.0000	1219.2	21.957	557.71	0.4574	113.10	2872.7	39.25	997.0	23960.6	34.503	1511.68	130609	1410	4.8	1.19
48.0000	1219.2	25.437	646.10	0.5299	100.50	2552.7	40.50	1028.7	32001.0	46.081	2018.95	174437	1884	4.1	1.03
48.0000	1219.2	31.045	788.54	0.6468	79.40	2016.8	42.55	1080.8	48015.8	69.143	3029.32	261734	2826	3.4	0.85
48.0000	1219.2	35.353	897.97	0.7365	62.80	1595.1	44.20	1122.7	63885.9	91.996	4030.57	348241	3760	2.9	0.71

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

$$\Delta P \text{ at } 50,000 \text{ USGPM}$$

$$\Delta H \text{ at } 50,000 \text{ USGPM}$$

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

Solutions:

Found using the "Incompressible Flow Relationships"

$$\Delta P_N = 100 (50,000 / 23,966.72)^2 = 435.24" \text{ wc}$$

$$\Delta H_N = 2.9 (50,000 / 23,966.72)^{1.88} = 11.6" \text{ wc}$$

$$Q_N = 23,966.72 (750 / 100)^{0.5} = 65,635.57 \text{ USGPM}$$

Available Options

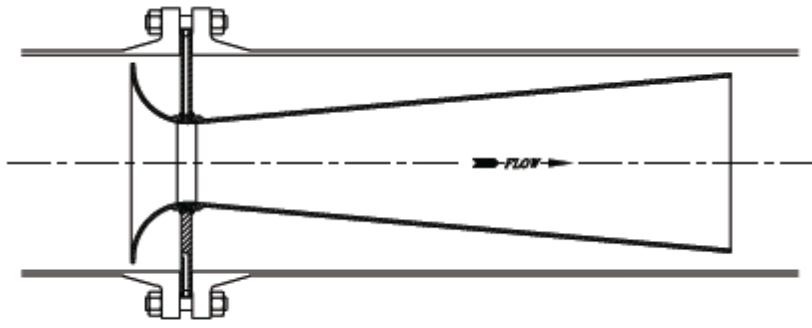
Materials of Construction

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 PMT-IP: In the PMT-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 PMT-IL: The meter body of the PMT-IL is generally constructed of vinyl ester resin reinforced with fiberglass, much like the PMT-IP. The PMT-IL incorporates a metallic throat (common materials are bronze or stainless steel) and, typically, an epoxy-coated, carbon steel mounting flange. Stainless steel and other materials are also available for the mounting flange.



PMT-IL

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



ISO 9001:2015 Quality System
CERTIFIED

2014 / 68 / EU

Pressure Equipment Directive