

PMT-U

TECHbrief

Wyatt-Badger Lo-Loss® Flow Tubes
Fabricated Primary Elements



FEATURES:

- Low Installed Cost
- Short Laying Length
- Low Pressure Loss
- Cost Effective
- Best Documented Flow Tube on the Market

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Description

Wyatt-Badger fabricated PMT Lo-Loss® meters are differential producers that maintain their accuracy over a wide range of flow rates, and incur lower permanent pressure loss than any other differential producing flow device. These units can be made from virtually any material to address the different requirements of your applications. Lo-Loss® flow tubes are characterized by longevity of service and flexibility in design.

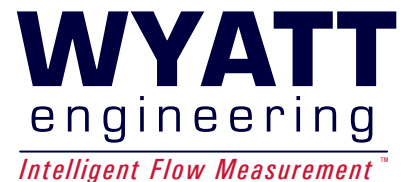
Application

The fabricated series of Lo-Loss® meters are often used in industrial applications where the flow stream demands intelligent decisions regarding materials of construction. This is due to extremes of pressure, temperature, or the aggressive nature of the fluid being metered. A short list of Lo-Loss® installations include:

Power Plants
Refineries
Petrochemical Plants
Chemical Processing
Natural Gas Custody Transfer

Flow Measurement Accuracy

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



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Technical Specifications

Accuracy

For pipe Reynolds numbers greater than 100 000 and with a normalized piping configuration, the Lo-Loss® flow meters provide a flow measurement uncertainty of:

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

Pressure Loss

The permanent pressure loss of the Lo-Loss®, expressed as a percentage of the differential pressure, is the lowest of any differential producing primary element.

Headloss Comparison

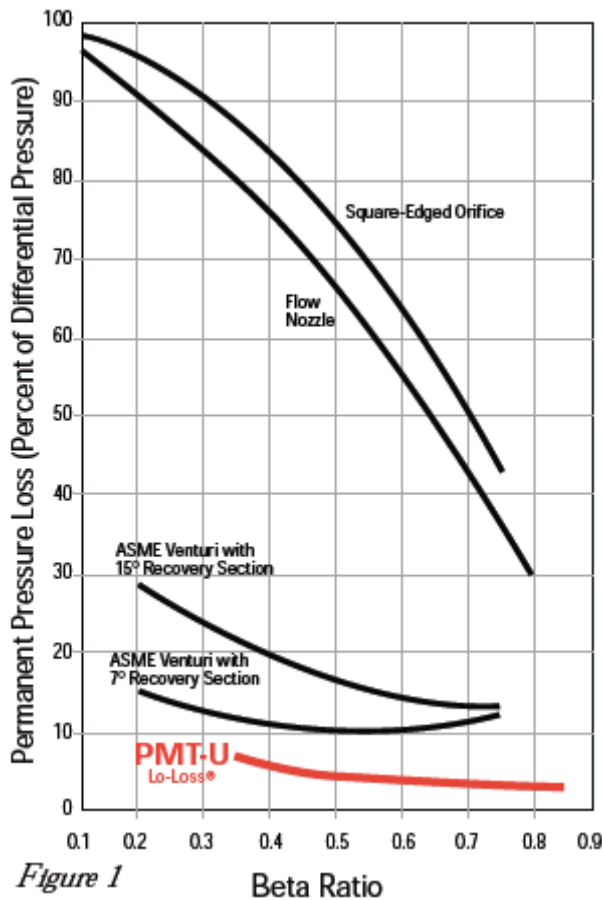


Figure 1

Beta Ratio

Wyatt Engineering can furnish the Lo-Loss® meter with a wide range of diameter ratios (d/D). By custom designing a Lo-Loss® meter for your application's flow conditions, Wyatt-Badger can provide an accurate and reliable primary element with the low permanent pressure loss.

Temperature Range

The fabricated series of Lo-Loss® meters can operate over the fluid temperature range of -425 °F to +1200 °F (-250 °C to +650 °C).

Pressure Range/End Connections

The Lo-Loss® PMT-U is available with flanged end connections, per ANSI B16.5 for 150 PSIG through 2500 PSIG service. Various end connections are also available, including plate, slip-on, weld neck, Van Stone, RTJ, or beveled ends (for butt-welding).

Piping Requirements

Designed for full-pipe flow, PMT 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.

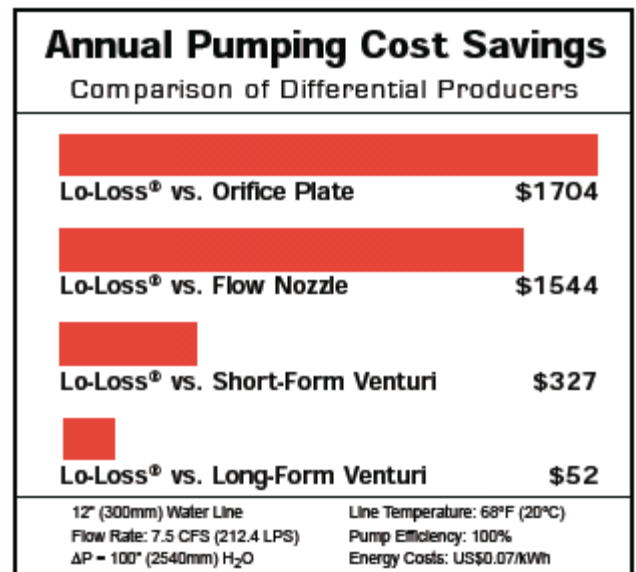


Figure 2

PMT-U 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	Ro(10 ⁻³)	in. wc	kPa
3.00	76.2	1.500	38.1	0.5000	10.00	254.0	2.50	63.5	111.42	0.160	7.029	607.34	105	4.4	1.08
3.00	76.2	1.800	45.7	0.6000	9.00	228.6	2.60	66.0	160.52	0.231	10.13	875.00	151	3.7	0.92
3.00	76.2	2.100	53.3	0.7000	7.80	198.1	2.70	68.6	222.41	0.320	14.03	1212.33	209	3.1	0.77
4.00	101.6	2.000	50.8	0.5000	13.40	340.4	3.30	83.8	198.08	0.285	12.50	1079.72	140	4.4	1.08
4.00	101.6	2.400	61.0	0.6000	12.00	304.8	3.50	88.9	285.37	0.411	18.00	1555.55	202	3.7	0.92
4.00	101.6	2.800	71.1	0.7000	10.40	264.2	3.60	91.4	395.39	0.569	24.95	2155.26	279	3.1	0.77
6.00	152.4	3.000	76.2	0.5000	20.00	508.0	5.00	127.0	445.68	0.642	28.12	2429.38	210	4.4	1.08
6.00	152.4	3.600	91.4	0.6000	17.90	454.7	5.20	132.1	642.08	0.925	40.51	3499.99	302	3.7	0.92
6.00	152.4	4.200	106.7	0.7000	15.60	396.2	5.40	137.2	889.62	1.281	56.13	4849.33	419	3.1	0.77
8.00	203.2	4.000	101.6	0.5000	23.10	586.7	6.70	170.2	792.31	1.141	49.99	4318.89	280	4.4	1.08
8.00	203.2	4.800	121.9	0.6000	20.10	510.5	7.00	177.8	1141.5	1.644	72.02	6222.20	403	3.7	0.92
8.00	203.2	5.600	142.2	0.7000	17.00	431.8	7.20	182.9	1581.6	2.277	99.78	8621.02	559	3.1	0.77
10.00	254.0	5.000	127.0	0.5000	28.80	731.5	8.30	210.8	1238.0	1.783	78.10	6748.26	350	4.4	1.08
10.00	254.0	6.000	152.4	0.6000	25.10	637.5	8.70	221.0	1783.6	2.568	112.5	9722.19	504	3.7	0.92
10.00	254.0	7.000	177.8	0.7000	21.30	541.0	9.10	231.1	2471.2	3.558	155.9	13470.35	698	3.1	0.77
12.00	304.8	6.000	152.4	0.5000	34.60	878.8	10.00	254.0	1782.7	2.567	112.5	9717.50	420	4.4	1.08
12.00	304.8	7.200	182.9	0.6000	30.10	764.5	10.50	266.7	2568.3	3.698	162.0	14000.0	605	3.7	0.92
12.00	304.8	8.400	213.4	0.7000	25.50	647.7	10.90	276.9	3558.5	5.124	224.5	19397.3	838	3.1	0.77
14.00	355.6	7.000	177.8	0.5000	40.30	1023.6	11.70	297.2	2426.5	3.494	153.1	13226.6	490	4.4	1.08
14.00	355.6	8.400	213.4	0.6000	35.10	891.5	12.20	309.9	3495.8	5.034	220.5	19055.5	705	3.7	0.92
14.00	355.6	9.800	248.9	0.7000	29.70	754.4	12.70	322.6	4843.5	6.975	305.6	26401.9	977	3.1	0.77
16.00	406.4	8.000	203.2	0.5000	46.10	1170.9	13.40	340.4	3169.2	4.564	199.9	17275.6	560	4.4	1.08
16.00	406.4	9.600	243.8	0.6000	40.10	1018.5	14.00	355.6	4565.9	6.575	288.1	24888.8	806	3.7	0.92
16.00	406.4	11.200	284.5	0.7000	34.00	863.6	14.50	368.3	6326.2	9.110	399.1	34484.1	1117	3.1	0.77
18.00	457.2	9.000	228.6	0.5000	51.90	1318.3	15.00	381.0	4011.1	5.776	253.1	21864.4	630	4.4	1.08
18.00	457.2	10.800	274.3	0.6000	45.10	1145.5	15.70	398.8	5778.7	8.321	364.6	31499.9	907	3.7	0.92
18.00	457.2	12.600	320.0	0.7000	38.20	970.3	16.30	414.0	8006.6	11.53	505.1	43643.9	1257	3.1	0.77
20.00	508.0	10.000	254.0	0.5000	57.60	1463.0	16.70	424.2	4952.0	7.131	312.4	26993.1	700	4.4	1.08
20.00	508.0	12.000	304.8	0.6000	50.10	1272.5	17.50	444.5	7134.3	10.27	450.1	38888.8	1008	3.7	0.92
20.00	508.0	14.000	355.6	0.7000	42.50	1079.5	18.20	462.3	9884.7	14.23	623.6	53881.4	1396	3.1	0.77
24.00	609.6	12.000	304.8	0.5000	69.10	1755.1	20.10	510.5	7130.8	10.27	449.9	38870.0	839	4.4	1.08
24.00	609.6	14.400	365.8	0.6000	60.20	1529.1	21.00	533.4	10273.3	14.79	648.1	55999.8	1209	3.7	0.92
24.00	609.6	16.800	426.7	0.7000	51.00	1295.4	21.80	553.7	14234.0	20.50	898.0	77589.2	1676	3.1	0.77
30.00	762.0	15.000	381.0	0.5000	86.40	2194.6	25.10	637.5	11141.9	16.04	702.9	60734.4	1049	4.4	1.08
30.00	762.0	18.000	457.2	0.6000	75.20	1910.1	26.20	665.5	16052.1	23.11	1012.7	87499.7	1512	3.7	0.92
30.00	762.0	21.000	533.4	0.7000	63.70	1618.0	27.30	693.4	22240.6	32.03	1403.2	121233.1	2095	3.1	0.77
36.00	914.4	18.000	457.2	0.5000	103.70	2634.0	30.10	764.5	16044.3	23.10	1012.2	87457.5	1259	4.4	1.08
36.00	914.4	21.600	548.6	0.6000	90.20	2291.1	31.50	800.1	23115.0	33.29	1458.3	125999.6	1814	3.7	0.92
36.00	914.4	25.200	640.1	0.7000	76.40	1940.6	32.70	830.6	32026.4	46.12	2020.6	174575.7	2513	3.1	0.77
42.00	1066.8	21.000	533.4	0.5000	120.90	3070.9	35.20	894.1	21838.1	31.45	1377.8	119039.4	1469	4.4	1.08
42.00	1066.8	25.200	640.1	0.6000	105.30	2674.6	36.70	932.2	31462.0	45.31	1984.9	171499.4	2116	3.7	0.92
42.00	1066.8	29.400	746.8	0.7000	89.10	2263.1	38.20	970	43591.5	62.77	2750.2	237616.9	2932	3.1	0.77
48.00	1219.2	24.000	609.6	0.5000	138.20	3510.3	40.20	1021.1	28523.2	41.07	1799.5	155480.0	1679	4.4	1.08
48.00	1219.2	28.800	731.5	0.6000	120.30	3055.6	42.00	1067	41093.3	59.17	2592.6	223999.2	2419	3.7	0.92
48.00	1219.2	33.600	853.4	0.7000	101.90	2588.3	43.70	1110.0	56935.8	81.99	3592.1	310356.8	3351	3.1	0.77

This sizing table can be used as a guide to aid the user in choosing the proper PMT-U 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 12.00" x 7.200" PMT-U, find

ΔP at 5 000 US GPM

ΔH at 5 000 US GPM

Q_N at 5000" wc

Solutions:

Found using the "Incompressible Flow Relationships"

$$\Delta P_N = 100 (5\ 000 / 2\ 568.33)^2 = 379.00'' \text{ wc}$$

$$\Delta H_N = 3.7 (5\ 000 / 2\ 568.33)^{1.88} = 12.9'' \text{ wc}$$

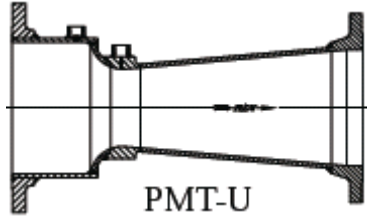
$$Q_N = 2\ 568.33 (500 / 100)^{0.5} = 5\ 742.96 \text{ US GPM}$$

Available Options

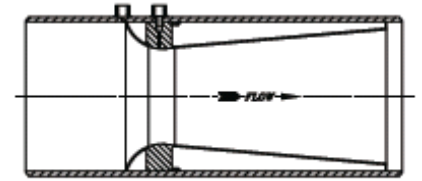


Fabricated PMT units are available in four styles:

Model PMT-U is designed to the ASME Boiler and Pressure Vessel Code. It is typically used at operating pressures less than 400 PSIG (2 750 kPaG) and temperatures less than +500 °F (+260 °C). The unique construction of the Lo-Loss® PMT-U allows for custom designs. For example, the throat can be manufactured from a specific alloy for maximum abrasion resistance, while the cone can be constructed with a different alloy for corrosion resistance. For flexibility, multiple pressure connections are available.



Model PMT-F is used for more demanding process temperatures and pressures. Its pipe shell design can be constructed and certified to meet the requirements of B31.1 and B31.3. The PMT-F is available in flanged and plain-end designs.



Model PMT-IF is designed for insertion within the interior of a pipeline and can be secured by companion flanges or welded directly into your pipeline. For more information on fabricated insert PMT Lo-Loss® meters, see the Wyatt Engineering PMT-IF TechBrief.

Model PMT-B is designed for service in which demanding process conditions require a uniquely rugged design. Machined from forged bar material, it is ideally suited for applications in which extreme temperature cycling and/or pressure cycling is encountered, such as the power industry. While the most common sizes are 6 inches (150mm) and less, the Wyatt-Badger bar stock design has been made from 27" (685 mm) diameter bar stock material.

Materials of Construction

The versatile PMT can be constructed from almost any material, including:

Carbon Steel
300-Series Stainless Steel
400-Series Stainless Steel
Duplex and Superduplex

Inconel
Hastelloy B & C
Monel
Titanium

Cr-Mo Alloy
Nickel
Tantalum
Zirconium

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

