

PMT-IF

TECHbrief

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



FEATURES:

- Lowest Pressure Loss
- Light Weight
- Low Cost of Ownership
- Custom Designed
- Short Laying Length
- Best Documented Flow Tube on the Market

Description

The Wyatt Engineering's Lo-Loss® **PMT-IF** is a fabricated insert Venturi flow element that offers repeatability and accuracy over a wide range of flow rates and has lower permanent pressure loss than orifice plates, flow nozzles, and most other differential producers on the market. The **PMT-IF** can be manufactured from virtually any material. It is designed for insertion within the interior of a pipeline and is secured by the adjacent pipe flanges. This unique design is characterized by longevity of service and flexibility in installation and application.

Application

The fabricated insert **PMT-IF** is designed to measure the flow of gases and liquids with low solids content. It can operate over extreme temperature and/or pressure ranges, and with highly corrosive fluids or gases. The Lo-Loss® fabricated insert has the distinct advantages of minimal weight, cost, and laying length. Typical applications include potable water, cooling water, process fluids, steam, air flow for aeration, and gas flow for process and combustion applications.

Flow Measurement Accuracy

For pipe Reynolds numbers greater than 100 000 and a normalized piping configuration, the Wyatt Badger PMT 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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Accuracy

For pipe Reynolds numbers greater than 100 000 and a normalized piping configuration, the Wyatt Lo-Loss[®] Meter provides a flow measurement uncertainty of:

- ± 1.00% for standard QS9001 calibrated meters and
- ± 0.25% for flow calibrated meters.

Pressure Loss

As shown in Figure 1, the permanent pressure loss of the **PMT-IF**, expressed as a percentage of differential pressure, is significantly lower than that of short-form and long-form Venturis as well.

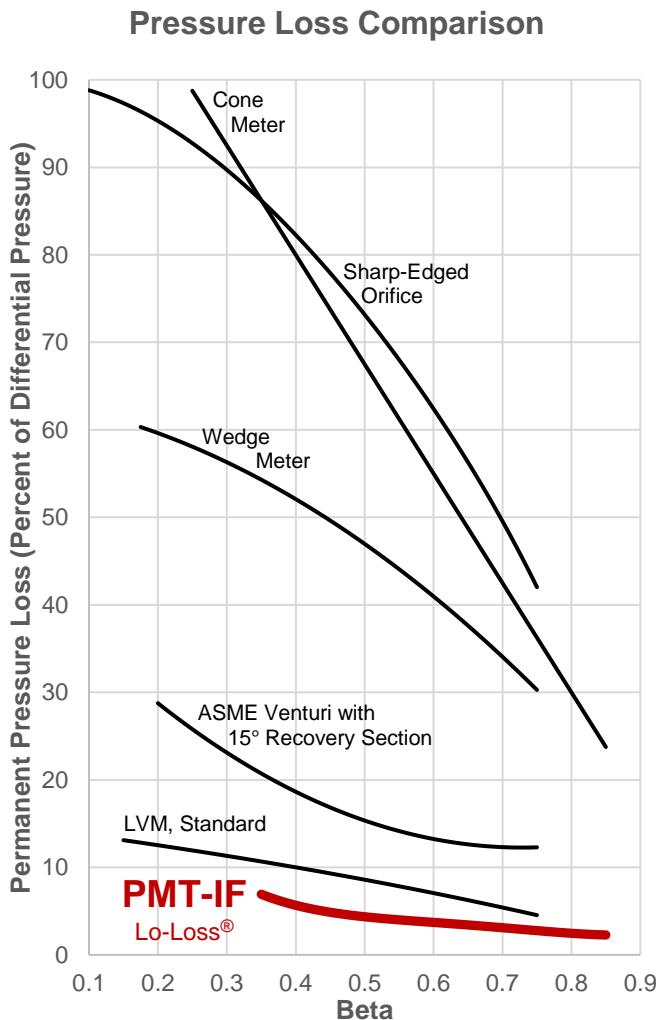


Figure 1

Beta Ratio

Wyatt can furnish **PMT-IF** Lo-Loss[®] meters 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

Depending on the materials of construction, insert **PMT-IF** Lo-Loss[®] meters can operate over a fluid temperature range of -325 °F and +1200 °F (-200 °C and +650 °C).

Pressure Range / End Connections

The allowable operating pressure for the **PMT-IF** is limited only to that of the adjacent pipe flanges. Pressures of 4000 PSIG to 6000 PSIG (27 500 kPaG to 41 350 kPaG) are not uncommon.

Piping Requirements

Designed for full-pipe flow, **PMT-IF** flow meters may be mounted either horizontally or vertically. For recommended upstream piping, refer to Wyatt Engineering Design Manual 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 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 standard 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 60 years, engineers have given their clients the benefits of efficiency and accuracy by doing just that.

Annual Pumping Cost Savings Comparison of Differential Producers

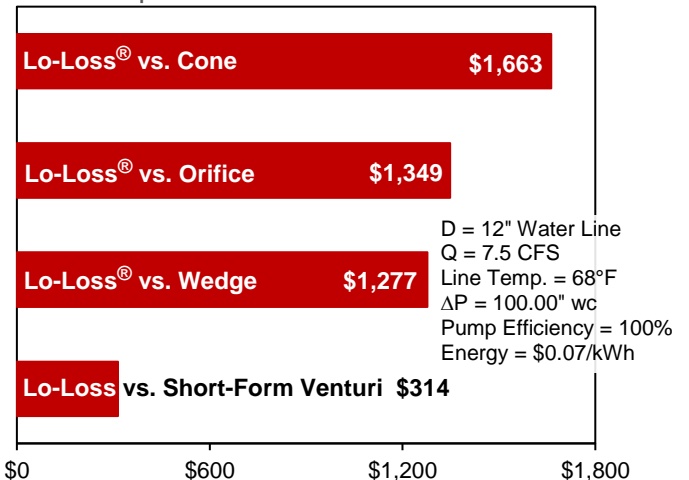


Figure 2, Using the Lo-Loss[®] Meter Saves in Pumping Costs

PMT-IF Sizing Table

Inlet Diameter		Throat Diameter		Beta Ratio	Overall Length		Outlet Diameter		ΔP = Differential Pressure of 100" 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	m³/d	R _b (10 ⁻³)	in. wc	kPa
3.068	77.9	1.500	38.10	0.4889	6.80	172.7	2.50	63.5	111.48	0.161	7.033	607.68	102	4.4	1.11
3.068	77.9	1.800	45.72	0.5867	5.70	144.8	2.60	66.0	160.35	0.231	10.117	874.07	147	3.8	0.94
3.068	77.9	2.100	53.34	0.6845	4.60	116.8	2.70	68.6	221.40	0.319	13.968	1206.9	203	3.2	0.80
4.026	102.3	2.000	50.80	0.4968	9.10	231.1	3.30	83.8	198.08	0.285	12.497	1079.7	139	4.4	1.09
4.026	102.3	2.400	60.96	0.5961	7.60	193.0	3.50	88.9	285.24	0.411	17.996	1554.8	200	3.7	0.93
4.026	102.3	2.800	71.12	0.6955	6.10	154.9	3.60	91.4	394.79	0.568	24.907	2152.0	276	3.1	0.78
6.065	154.1	3.000	76.20	0.4946	13.60	345.4	5.00	127.0	445.75	0.642	28.122	2429.8	207	4.4	1.09
6.065	154.1	3.600	91.44	0.5936	11.40	289.6	5.20	132.1	641.67	0.924	40.483	3497.7	298	3.7	0.93
6.065	154.1	4.200	106.68	0.6925	9.10	231.1	5.40	137.2	887.52	1.278	55.994	4837.8	412	3.1	0.78
7.981	202.7	4.000	101.60	0.5012	18.10	459.7	6.70	170.2	792.11	1.141	49.975	4317.8	280	4.3	1.08
7.981	202.7	4.800	121.92	0.6014	15.20	386.1	7.00	177.8	1141.4	1.644	72.011	6221.8	403	3.7	0.92
7.981	202.7	5.600	142.24	0.7017	12.10	307.3	7.20	182.9	1582.1	2.278	99.813	8623.9	559	3.1	0.77
10.02	254.5	5.000	127.00	0.4990	22.70	576.6	8.30	210.8	1237.8	1.782	78.096	6747.5	348	4.4	1.08
10.02	254.5	6.000	152.40	0.5988	18.90	480.1	8.70	221.0	1783.1	2.568	112.49	9719.5	502	3.7	0.92
10.02	254.5	7.000	177.80	0.6986	15.10	383.5	9.10	231.1	2469.7	3.556	155.81	13462.2	695	3.1	0.77
12.00	304.8	6.000	152.40	0.5000	27.20	690.9	10.00	254.0	1782.4	2.567	112.45	9715.7	419	4.4	1.08
12.00	304.8	7.200	182.88	0.6000	22.70	576.6	10.50	266.7	2567.9	3.698	162.01	13997.4	603	3.7	0.92
12.00	304.8	8.400	213.36	0.7000	18.10	459.7	10.90	276.9	3557.8	5.123	224.47	19393.8	836	3.1	0.77
13.25	336.6	7.000	177.80	0.5283	31.70	805.2	11.70	297.2	2423.1	3.489	152.87	13208.2	515	4.1	1.03
13.25	336.6	8.400	213.36	0.6340	26.50	673.1	12.20	309.9	3507.8	5.051	221.31	19121.2	746	3.5	0.87
13.25	336.6	9.800	248.92	0.7396	21.10	535.9	12.70	322.6	4915.1	7.078	310.09	26792.0	1046	2.8	0.71
15.25	387.4	8.000	203.20	0.5246	36.20	919.5	13.40	340.4	3165.2	4.558	199.69	17253.3	585	4.2	1.04
15.25	387.4	9.600	243.84	0.6295	30.30	769.6	14.00	355.6	4578.9	6.594	288.89	24959.7	846	3.5	0.88
15.25	387.4	11.200	284.48	0.7344	24.10	612.1	14.50	368.3	6404.9	9.223	404.09	34913.1	1184	2.9	0.71
17.25	438.2	9.000	228.60	0.5217	40.80	1036.3	15.00	381.0	4006.3	5.769	252.76	21838.1	655	4.2	1.04
17.25	438.2	10.800	274.32	0.6261	34.00	863.6	15.70	398.8	5792.7	8.342	365.46	31576.0	947	3.6	0.88
17.25	438.2	12.600	320.04	0.7304	27.10	688.3	16.30	414.0	8092.5	11.65	510.56	44112.3	1322	2.9	0.72
19.25	489.0	10.000	254.00	0.5195	45.30	1151	16.70	424.2	4946.4	7.123	312.07	26962.8	724	4.2	1.04
19.25	489.0	12.000	304.80	0.6234	37.80	960.1	17.50	444.5	7149.2	10.29	451.04	38970.0	1047	3.6	0.89
19.25	489.0	14.000	355.60	0.7273	30.10	764.5	18.20	462.3	9977.9	14.37	629.51	54389.4	1461	2.9	0.73
23.25	590.6	12.000	304.80	0.5161	54.30	1379	20.10	510.5	7123.7	10.26	449.44	38831.4	864	4.2	1.05
23.25	590.6	14.400	365.76	0.6194	45.40	1153	21.00	533.4	10290	14.82	649.20	56091.1	1248	3.6	0.89
23.25	590.6	16.800	426.72	0.7226	36.20	919.5	21.80	553.7	14342	20.65	904.82	78176.7	1739	3.0	0.73
29.25	743.0	15.000	381.00	0.5128	67.90	1725	25.10	637.5	11132	16.03	702.35	60682.6	1073	4.3	1.06
29.25	743.0	18.000	457.20	0.6154	56.70	1440	26.20	665.5	16071	23.14	1013.95	87605.1	1549	3.6	0.90
29.25	743.0	21.000	533.40	0.7179	45.20	1148	27.30	693.4	22370	32.21	1411.34	121940	2156	3.0	0.74
35.25	895.4	18.000	457.20	0.5106	81.50	2070	30.10	764.5	16032	23.09	1011.48	87391.7	1282	4.3	1.06
35.25	895.4	21.600	548.64	0.6128	68.00	1727	31.50	800.1	23137	33.32	1459.70	126118	1850	3.6	0.90
35.25	895.4	25.200	640.08	0.7149	54.20	1377	32.70	830.6	32178	46.34	2030.09	175400	2573	3.0	0.75
41.25	1047.8	21.000	533.40	0.5091	95.10	2416	35.20	894.1	21823	31.43	1376.84	118959	1491	4.3	1.06
41.25	1047.8	25.200	640.08	0.6109	79.40	2017	36.70	932.2	31486	45.34	1986.45	171630	2152	3.6	0.91
41.25	1047.8	29.400	746.76	0.7127	63.30	1608	38.20	970.3	43764	63.02	2761.09	238558	2990	3.0	0.75
47.25	1200.2	24.000	609.60	0.5079	108.60	2758	40.20	1021	28506	41.05	1798.42	155384	1700	4.3	1.07
47.25	1200.2	28.800	731.52	0.6095	90.70	2304	42.00	1067	41119	59.21	2594.21	224140	2453	3.7	0.91
47.25	1200.2	33.600	853.44	0.7111	72.30	1836	43.70	1110	57130	82.27	3604.31	311413	3408	3.0	0.75

This sizing table can be used as a guide in choosing the proper insert PMT for a given application and reflects the most commonly used sizes. Other sizes and special geometries are readily available, often at no additional cost. Depending on the application, a more appropriate selection, or a more accurate estimation of the performance, may be available. Wyatt Engineering encourages users to contact their local Wyatt representative, 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 19.25" x 14.000" PMT-IF, find
 ΔP at 20 000 US GPM
 ΔH at 20 000 US GPM
 Q_N at 750" wc

Solutions:

Found using the "Incompressible Flow Relationships"
 ΔP_N = 100 (20 000 / 9 977.9)² = 401.77" wc
 ΔH_N = 2.9 (20 000 / 9 977.9)^{1.88} = 10.7" wc
 Q_N = 9 977.9 (750 / 100)^{0.5} = 27 326 US GPM

Available Options

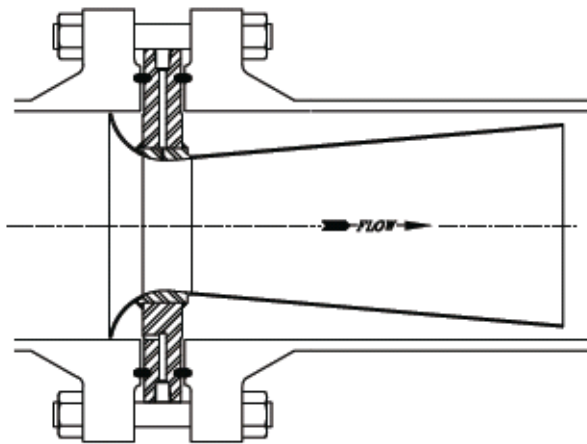
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The Wyatt Insert Fabrication PMT-IF Lo-Loss[®] is available in several styles and many different alloys for the specifics of your application.

Materials of Construction

The nature of the PMT-IF fabricated design allows the flow element to be constructed from practically any material. Examples of some of the alloys employed:

- Carbon Steel
- Stainless Steels
- Super Duplex
- Inconel
- Hastelloy B & C
- Monel
- Titanium
- Cr-Mo Alloys
- Nickel
- Tantalum
- Zirconium



PMT-IF

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



ISO 9001:2015 Quality System
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