

# 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

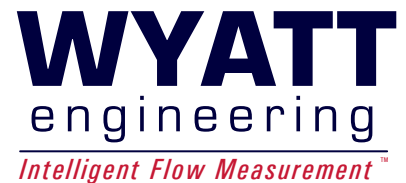
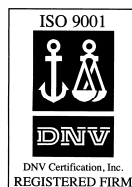
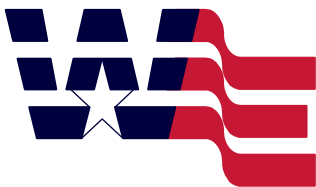
The Wyatt-Badger Lo-Loss® PMT-IF is a fabricated insert venturi flow element that offers repeatability and accuracy over a wide range of flow rates and has lower permanent pressure loss than orifice plates, flow nozzles, and any other venturi or flow tube on the market. The PMT-IF can be manufactured 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 combustion applications.

## Flow Measurement Accuracy

For pipe Reynolds numbers greater than 100 000 and with a normalized piping configuration, the Wyatt-Badger PMT-IF Lo-Loss® Tube 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 a normalized piping configuration, the Wyatt-Badger Lo-Loss® Meter provides a flow measurement uncertainty of:

- ± 1.00% for standard 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.

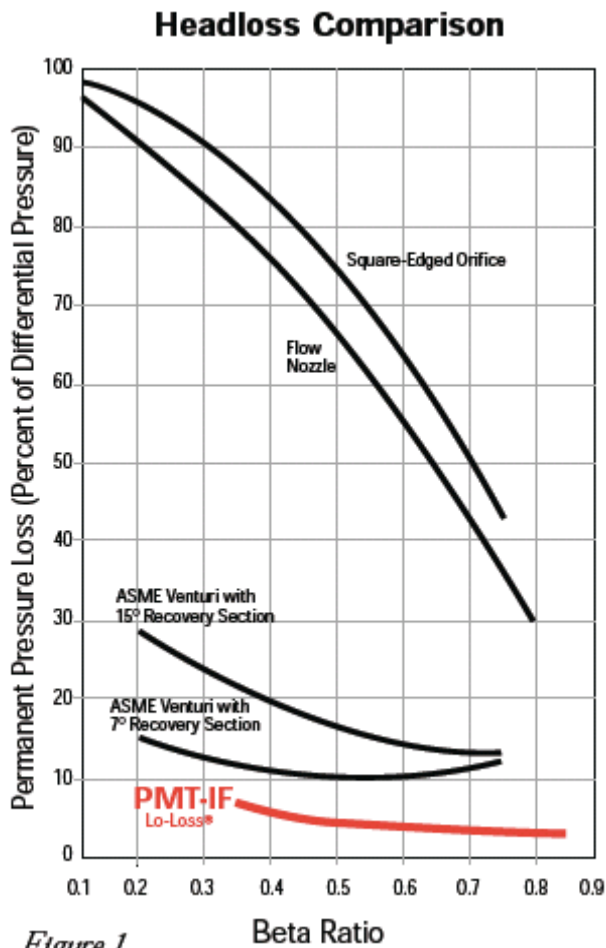


Figure 1

## Beta Ratio

Wyatt can furnish PMT-IF meters with a wide range 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

The fabricated series of the PMT-IF can operate over a fluid temperature range of -325 °F to +1200 °F (-200 °C to +650 °C).

## Pressure Range/Flange 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 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 40 years, engineers have given their clients the benefits of efficiency and accuracy by doing just that.

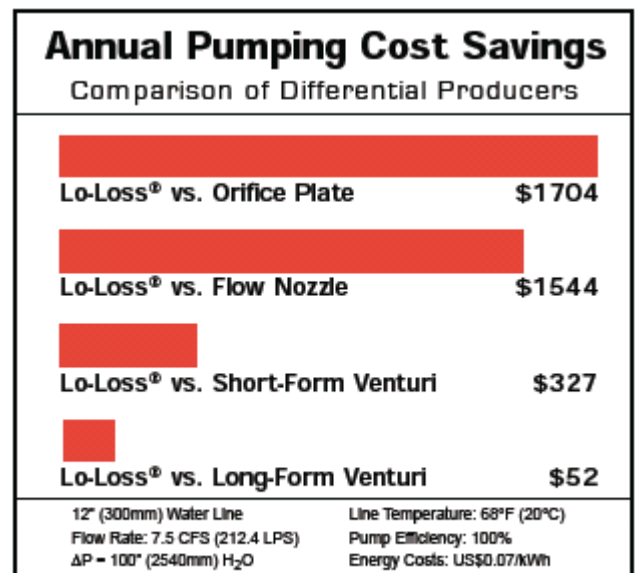


Figure 2

# PMT-IF 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 <sup>3</sup> /d	Ro(10 <sup>-3</sup> )	in. wc	kPa
3.00	76.2	1.500	38.10	0.5000	6.80	172.7	2.50	63.5	111.42	0.160	7.029	607.34	105	4.4	1.08
3.00	76.2	1.800	45.72	0.6000	5.70	144.8	2.60	66.0	160.52	0.231	10.13	875.00	151	3.7	0.92
3.00	76.2	2.100	53.34	0.7000	4.60	116.8	2.70	68.6	222.41	0.320	14.03	1212.3	209	3.1	0.77
4.00	101.6	2.000	50.80	0.5000	9.10	231.1	3.30	83.8	198.08	0.285	12.50	1079.7	140	4.4	1.08
4.00	101.6	2.400	60.96	0.6000	7.60	193.0	3.50	88.9	285.37	0.411	18.00	1555.6	202	3.7	0.92
4.00	101.6	2.800	71.12	0.7000	6.10	154.9	3.60	91.4	395.39	0.569	24.95	2155.3	279	3.1	0.77
6.00	152.4	3.000	76.20	0.5000	13.60	345.4	5.00	127.0	445.68	0.642	28.12	2429.4	210	4.4	1.08
6.00	152.4	3.600	91.44	0.6000	11.40	289.6	5.20	132.1	642.08	0.925	40.51	3500.0	302	3.7	0.92
6.00	152.4	4.200	106.7	0.7000	9.10	231.1	5.40	137.2	889.62	1.281	56.13	4849.3	419	3.1	0.77
8.00	203.2	4.000	101.6	0.5000	18.10	459.7	6.70	170.2	792.31	1.141	49.99	4318.9	280	4.4	1.08
8.00	203.2	4.800	121.9	0.6000	15.20	386.1	7.00	177.8	1141.5	1.644	72.02	6222.2	403	3.7	0.92
8.00	203.2	5.600	142.2	0.7000	12.10	307.3	7.20	182.9	1581.6	2.277	99.78	8621.0	559	3.1	0.77
10.00	254.0	5.000	127.0	0.5000	22.70	576.6	8.30	210.8	1238.0	1.783	78.10	6748.3	350	4.4	1.08
10.00	254.0	6.000	152.4	0.6000	18.90	480.1	8.70	221.0	1783.6	2.568	112.5	9722.2	504	3.7	0.92
10.00	254.0	7.000	177.8	0.7000	15.10	383.5	9.10	231.1	2471.2	3.558	155.9	13470.3	698	3.1	0.77
12.00	304.8	6.000	152.4	0.5000	27.20	690.9	10.00	254.0	1782.7	2.567	112.5	9717.5	420	4.4	1.08
12.00	304.8	7.200	182.9	0.6000	22.70	576.6	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	18.10	459.7	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	31.70	805.2	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	26.50	673.1	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	21.10	535.9	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	36.20	919.5	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	30.30	769.6	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	24.10	612.1	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	40.80	1036.3	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	34.00	863.6	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	27.10	688.3	16.30	414.0	8006.6	11.530	505.1	43643.9	1257	3.1	0.77
20.00	508.0	10.000	254.0	0.5000	45.30	1150.6	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	37.80	960.1	17.50	444.5	7134.3	10.273	450.1	38888.8	1008	3.7	0.92
20.00	508.0	14.000	355.6	0.7000	30.10	764.5	18.20	462.3	9884.7	14.234	623.6	53881.4	1396	3.1	0.77
24.00	609.6	12.000	304.8	0.5000	54.30	1379.2	20.10	510.5	7130.8	10.268	449.9	38870.0	839	4.4	1.08
24.00	609.6	14.400	365.8	0.6000	45.40	1153.2	21.00	533.4	10273.3	14.794	648.1	55999.8	1209	3.7	0.92
24.00	609.6	16.800	426.7	0.7000	36.20	919.5	21.80	553.7	14234.0	20.497	898.0	77589.2	1676	3.1	0.77
30.00	762.0	15.000	381.0	0.5000	67.90	1724.7	25.10	637.5	11141.9	16.044	702.9	60734.4	1049	4.4	1.08
30.00	762.0	18.000	457.2	0.6000	56.70	1440.2	26.20	665.5	16052.1	23.115	1012.7	87499.7	1512	3.7	0.92
30.00	762.0	21.000	533.4	0.7000	45.20	1148.1	27.30	693.4	22240.6	32.026	1403.2	121233.1	2095	3.1	0.77
36.00	914.4	18.000	457.2	0.5000	81.50	2070.1	30.10	764.5	16044.3	23.104	1012.2	87457.5	1259	4.4	1.08
36.00	914.4	21.600	548.6	0.6000	68.00	1727.2	31.50	800.1	23115.0	33.286	1458.3	125999.6	1814	3.7	0.92
36.00	914.4	25.200	640.1	0.7000	54.20	1376.7	32.70	830.6	32026.4	46.118	2020.6	174575.7	2513	3.1	0.77
42.00	1066.8	21.000	533.4	0.5000	95.10	2415.5	35.20	894.1	21838.1	31.447	1377.8	119039.4	1469	4.4	1.08
42.00	1066.8	25.200	640.1	0.6000	79.40	2016.8	36.70	932.2	31462.0	45.305	1984.9	171499.4	2116	3.7	0.92
42.00	1066.8	29.400	746.8	0.7000	63.30	1607.8	38.20	970.3	43591.5	62.772	2750.2	237616.9	2932	3.1	0.77
48.00	1219.2	24.000	609.6	0.5000	108.60	2758.4	40.20	1021	28523.2	41.073	1799.5	155480.0	1679	4.4	1.08
48.00	1219.2	28.800	731.5	0.6000	90.70	2303.8	42.00	1067	41093.3	59.174	2592.6	223999.2	2419	3.7	0.92
48.00	1219.2	33.600	853.4	0.7000	72.30	1836.4	43.70	1110	56935.8	81.988	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 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 20.00" x 14.000" PMT-IF, find  
 ΔP at 20 000 US GPM  
 ΔH at 20 000 US GPM  
 Q<sub>N</sub> at 750" wc

**Solutions:**

Found using the "Incompressible Flow Relationships"  
 $\Delta P_N = 100 (20\ 000 / 9\ 884.69)^2 = 409.39"$  wc  
 $\Delta H_N = 3.1 (20\ 000 / 9\ 884.69)^{1.88} = 11.7"$  wc  
 $Q_N = 9\ 884.69 (750 / 100)^{0.5} = 27\ 070.34$  US GPM

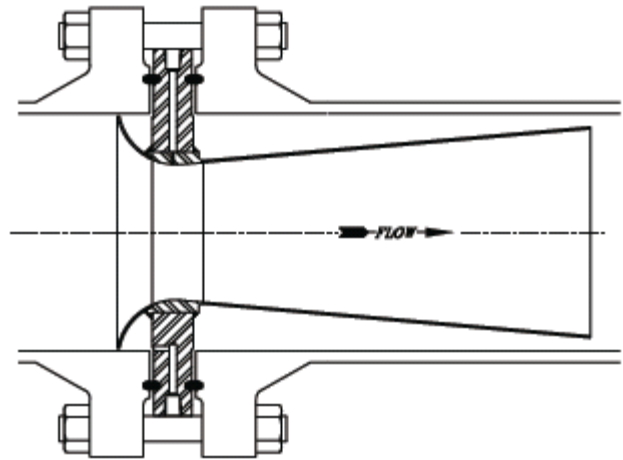
# Available Options



## 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
- 304 Stainless Steel
- 316 Stainless Steel
- Inconel
- Hastelloy B & C
- Monel
- Titanium
- Chrome Molybdenum
- Nickel
- Tantalum
- Zirconium



PMT-IF

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

