

LVM-IF

TECHbrief

Wyatt Engineering Liberty Venturi Meter
Insert-Type Primary Flow Element



FEATURES:

- High Accuracy
- Low Pressure Loss
- Low Installed Cost
- Custom Designed
- Long-Term Reliability

Description

The Wyatt **LVM-IF** is a fabricated insert-type flow element that offers high accuracy and repeatability over a wide range of flow rates and has lower permanent pressure loss than orifice plates, flow nozzles, or traditional (classical) venturis. These units can be manufactured from virtually any type of material to meet the specified requirements of your application. The **LVM-IF** is installed inside the pipeline and is secured by adjacent pipe flanges. These flow elements are characterized by longevity of service and flexibility in design.

Application

The fabricated insert **LVM-IF** is designed to measure the flow of gases and liquids that have low solids loading. The **LVM-IF** can operate over wide temperature and/or pressure ranges with highly corrosive fluids or gases. The **LVM-IF** has the distinct advantages of low weight, reduced cost, and short laying lengths. Typical applications range from potable and process water, cooling water, steam, compressed and combustion air, natural gas, and process gases.

Low Uncertainty

For pipe Reynolds numbers greater than 75,000, and with a normalized piping configuration, the **LVM-IF** provides a flowrate measurement accuracy of $\pm 0.50\%$ without flow calibration. With an independent flow calibration, the **LVM-IF** provides the user with $\pm 0.25\%$ accuracy.



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Accuracy

For pipe Reynolds numbers greater than 75,000 and normalized piping, the Wyatt **LVM-IF** venturi flow meter provides a measurement uncertainty of:

- ± 0.50% for standard QS9001 calibrated meters and
- ± 0.25% for flow calibrated meters.

Pressure Loss

The permanent pressure loss of Wyatt's Liberty Venturi Meter is shown in Figure 1.

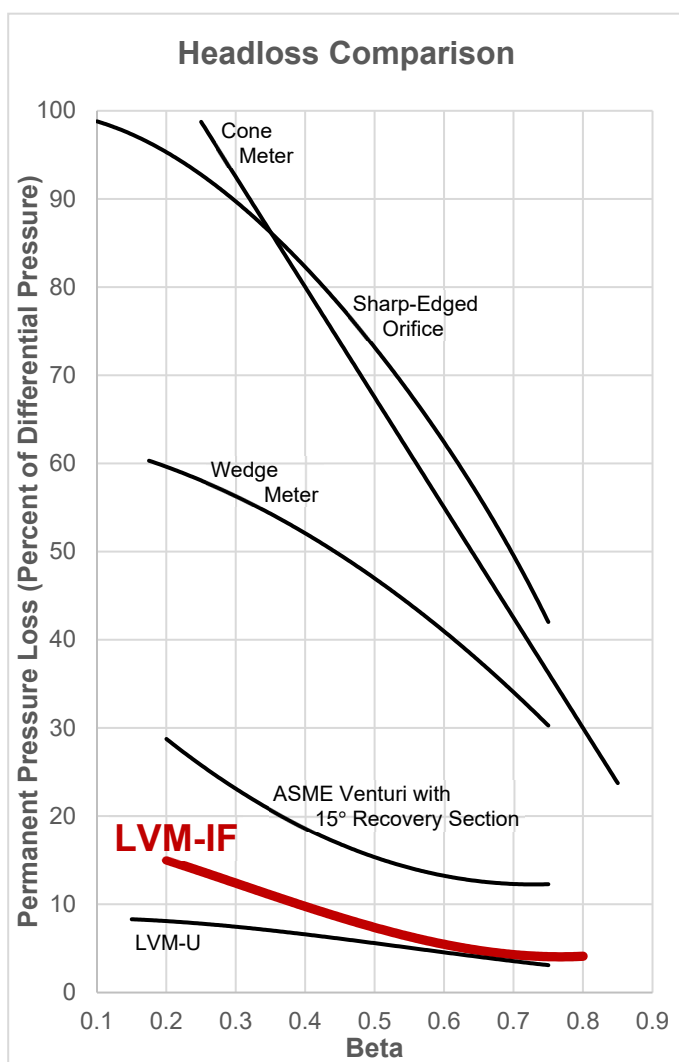


Figure 1

Beta Ratio

Wyatt Engineering custom designs every venturi to achieve the proper beta (ratio of throat-to-inlet diameter) for the application. This provides the most accurate measurement over a broad range of flow rates and a given line size.

Temperature and Pressure Range

With properly chosen materials, the **LVM-IF** can operate over a fluid temperature range of -425 °F to +1,200 °F (-250 °C to +650 °C) and pressures exceeding 10,000 psig.

Pipe Installation

The **LVM-IF** is designed for installation in between two adjacent flanges. Wyatt can accommodate virtually any flange type or pressure rating. As an alternative, we can design the flow element to be welded directly into your pipeline.

Piping Requirements

Designed for full-flowing pipelines, the **LVM-IF** flow element may be mounted horizontally, vertically or at an angle. For recommended upstream piping, please refer to Wyatt's TECHspec for the LVM design.

Energy Considerations

Figure 1 compares the headloss of the **LVM-IF** with that of other primary flow elements. The **LVM-IF** has a shorter laying length and exhibits better pressure recovery than classical ASME and ISO venturis and many other differential producing products. Higher pressure recovery leads to reduced pumping costs and more efficient operation.

Design Concepts

The LVM hydraulic design produces discharge coefficients that are highly predictable and independent of line size. The smooth transition section minimizes signal noise and lessens the effects of aging, corrosion, or erosion. Flow measurement of compressible fluids is performed accurately and reliably.

LVM-IF Sizing Table



Inlet Diameter		Throat Diameter		Beta Ratio	Overall Length		Outlet Diameter		ΔP = Differential Pressure of 100.00" wc (24.864 kPaD)						
									Water Flow at 60° F (16° C)					ΔH = Headloss	
(inches)	(mm)	(inches)	(mm)		(inches)	(mm)	(inches)	(mm)	US GPM	US MGD	LPS	m ³ /d	R _D (10 ³)	in. wc	kPa
3.068	78	1.500	38.10	0.4889	7.20	183	2.2	56	128.90	0.186	8.132	702.64	119	11.3	2.81
3.068	78	1.800	45.72	0.5867	6.30	160	2.4	61	189.48	0.273	11.95	1032.9	174	9.0	2.23
3.068	78	2.100	53.34	0.6845	5.80	147	2.6	66	266.77	0.384	16.83	1454.2	246	6.7	1.67
4.026	102	2.000	50.80	0.4968	9.10	231	3.0	76	229.58	0.331	14.48	1251.4	161	10.7	2.67
4.026	102	2.400	60.96	0.5961	8.30	211	3.2	81	338.23	0.487	21.34	1843.7	237	8.5	2.10
4.026	102	2.800	71.12	0.6955	7.50	191	3.5	89	478.25	0.689	30.17	2606.9	336	6.3	1.56
6.065	154	3.000	76.20	0.4946	13.80	351	4.5	114	516.44	0.744	32.58	2815.1	241	10.3	2.56
6.065	154	3.600	91.44	0.5936	12.50	318	4.9	124	760.70	1.095	47.99	4146.6	354	8.1	2.02
6.065	154	4.200	106.68	0.6925	11.40	290	5.3	135	1075.5	1.549	67.85	5862.3	501	6.0	1.50
7.981	203	4.000	101.60	0.5012	18.00	457	6.0	152	919.52	1.324	58.01	5012.3	326	9.8	2.44
7.981	203	4.800	121.92	0.6014	16.30	414	6.5	165	1356.9	1.954	85.61	7396.6	480	7.7	1.91
7.981	203	5.600	142.24	0.7017	14.90	378	7.0	178	1925.2	2.772	121.46	10494.4	682	5.6	1.40
10.02	255	5.000	127.00	0.4990	22.70	577	7.5	191	1436.5	2.069	90.63	7830.6	405	9.6	2.38
10.02	255	6.000	152.40	0.5988	20.60	523	8.1	206	2119.7	3.052	133.73	11554.3	598	7.5	1.87
10.02	255	7.000	177.80	0.6986	18.70	475	8.8	224	3007.8	4.331	189.76	16395.5	848	5.5	1.38
12.00	305	6.000	152.40	0.5000	27.20	691	9.0	229	2069.0	2.979	130.53	11278.0	487	9.4	2.33
12.00	305	7.200	182.88	0.6000	24.60	625	9.8	249	3053.5	4.397	192.64	16644.4	719	7.3	1.83
12.00	305	8.400	213.36	0.7000	22.40	569	10.6	269	4334.3	6.241	273.45	23626.5	1020	5.4	1.34
13.25	337	7.000	177.80	0.5283	29.20	742	10.2	259	2832.2	4.078	178.68	15438.2	604	8.7	2.16
13.25	337	8.400	213.36	0.6340	26.30	668	11.1	282	4207.3	6.059	265.44	22934.1	897	6.6	1.64
13.25	337	9.800	248.92	0.7396	23.90	607	12.1	307	6041.5	8.700	381.16	32932.3	1288	4.6	1.14
15.25	387	8.000	203.20	0.5246	33.70	856	11.7	297	3696.8	5.323	233.23	20151.0	685	8.6	2.14
15.25	387	9.600	243.84	0.6295	30.40	772	12.7	323	5487.8	7.902	346.23	29914.1	1017	6.6	1.63
15.25	387	11.200	284.48	0.7344	27.60	701	13.9	353	7872.4	11.34	496.67	42912.2	1458	4.6	1.14
17.25	438	9.000	228.60	0.5217	38.30	973	13.2	335	4676.4	6.734	295.03	25490.9	766	8.5	2.12
17.25	438	10.800	274.32	0.6261	34.60	879	14.4	366	6938.3	9.991	437.74	37820.7	1136	6.5	1.63
17.25	438	12.600	320.04	0.7304	31.40	798	15.6	396	9945.1	14.32	627.44	54210.8	1629	4.6	1.14
19.25	489	10.000	254.00	0.5195	42.70	1085	14.7	373	5769.1	8.307	363.97	31447.1	847	8.5	2.10
19.25	489	12.000	304.80	0.6234	38.60	980	16.0	406	8551.5	12.31	539.51	46614.0	1255	6.5	1.62
19.25	489	14.000	355.60	0.7273	35.10	892	17.4	442	12232	17.61	771.74	66678.3	1795	4.6	1.14
23.25	591	12.000	304.80	0.5161	51.80	1316	17.7	450	8303.3	11.96	523.86	45261.1	1009	8.3	2.07
23.25	591	14.400	365.76	0.6194	46.80	1189	19.3	490	12302	17.71	776.11	67055.5	1495	6.4	1.60
23.25	591	16.800	426.72	0.7226	42.60	1082	21.0	533	17585	25.32	1109.4	95854.8	2137	4.6	1.14
29.25	743	15.000	381.00	0.5128	65.40	1661	22.3	566	12965	18.67	817.95	70670.6	1252	8.2	2.03
29.25	743	18.000	457.20	0.6154	59.10	1501	24.2	615	19192	27.64	1210.8	104614	1854	6.3	1.57
29.25	743	21.000	533.40	0.7179	53.70	1364	26.3	668	27393	39.45	1728.2	149317	2646	4.5	1.13
35.25	895	18.000	457.20	0.5106	78.80	2002	26.8	681	18657	26.87	1177.1	101701	1495	8.0	2.00
35.25	895	21.600	548.64	0.6128	71.20	1808	29.1	739	27597	39.74	1741.1	150429	2212	6.2	1.55
35.25	895	25.200	640.08	0.7149	64.80	1646	31.6	803	39324	56.63	2480.9	214354	3152	4.5	1.12
41.25	1048	21.000	533.40	0.5091	92.50	2350	31.3	795	25391	36.56	1601.9	138407	1739	7.9	1.97
41.25	1048	25.200	640.08	0.6109	83.60	2123	34.0	864	37552	54.08	2369.2	204697	2572	6.1	1.53
41.25	1048	29.400	746.76	0.7127	76.10	1933	37.0	940	53509	77.05	3375.9	291680	3665	4.4	1.10
47.25	1200	24.000	609.60	0.5079	106.10	2695	35.9	912	33160	47.75	2092.1	180756	1983	7.8	1.94
47.25	1200	28.800	731.52	0.6095	96.00	2438	38.9	988	49038	70.61	3093.8	267304	2932	6.1	1.51
47.25	1200	33.600	853.44	0.7111	87.40	2220	42.3	1074	69873	100.6	4408.3	380879	4178	4.4	1.09

This sizing table can be used as a guide to aid the user in choosing the proper insert LVM-IF 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 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 19.25" x 14.000" LVM-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"

$$\Delta P_N = 100 (20,000 / 12,232)^2 = 267.34" \text{ wc}$$

$$\Delta H_N = 4.6 (20,000 / 12,232)^{1.88} = 11.6" \text{ wc}$$

$$Q_N = 12,232 (750 / 100)^{0.5} = 33,499 \text{ US GPM}$$

Available Options

WYATT

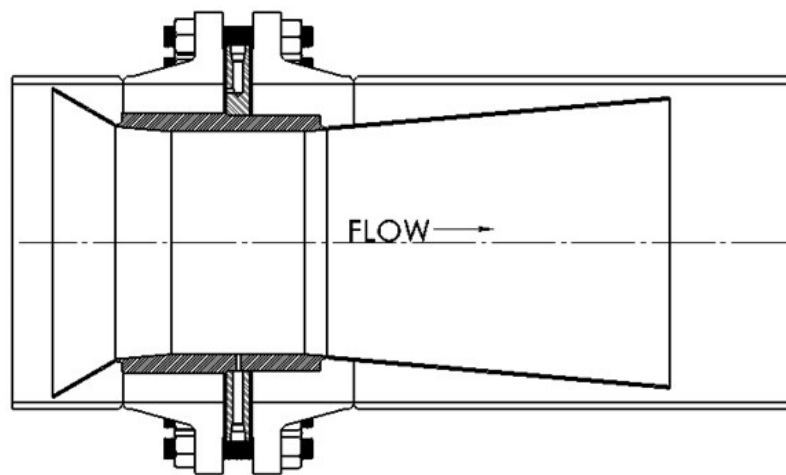
The Wyatt Fabricated Insert LVM-IF is available in several styles and many different materials specific for your application.

Materials of Construction

The nature of the insert-type design allows the flow element to be constructed from practically any material. The **LVM-IF** is constructed from all metallic components. An alternative style is the **LVM-IL**, which includes a metallic throat and mounting flange with a fiberglass or composite body. The **LVM-IP**, which is made entirely out of composite (or plastic) materials, is a third option.

Examples of some of the materials employed:

- Carbon Steel
- Stainless Steels
- Super Duplex
- Inconel
- Hastelloy B & C
- Monel
- Titanium
- Chrome Moly
- Tantalum
- Fiberglass
- Polyvinyl Chloride



LVM-IF

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

Our Products are Proudly Designed and Manufactured in the U.S.A.



ISO 9001:2015 Quality System
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