

# LVM-CI

# TECHbrief

Liberty Venturi Meter  
Cast Iron Primary Elements



## FEATURES:

- High Accuracy
- Reliable Operation
- Energy Efficient
- Flexible Design for a Variety of Applications

## Description

Wyatt Engineering's Liberty Venturi Meter is a differential-producing primary flow element that accurately and repeatably measures the flows of liquids or gases in closed, full-pipe conditions. The cast iron Wyatt LVM incorporates an efficient hydraulic shape with static pressure taps in the throat and inlet sections. The **LVM-CI** can be provided with 125-lb flanges. The ductile iron **LVM-DI** can be provided with either 125-lb or 250-lb flanges.

## Application

The cast iron series is often used in municipal water and wastewater applications. Known for longevity of service with minimal maintenance, **LVM-CI** and **LVM-DI** meters are ideal for metering potable water, sludge, slurries, as well as gases and clean fluids. The Model **LVM-C** is uniquely designed for rate-of-flow control applications, while the **LVM-S** is designed to prevent clogging of the pressure taps for applications with solids-bearing fluids. The **LVM-SC** is a flow controller for use with contaminated fluids.

## Low Uncertainty

For pipe Reynolds numbers greater than 75 000 and with a normalized piping configuration, the Liberty Venturi Meter provides a flow measurement accuracy of  $\pm 0.50\%$  without flow calibration. With independent flow calibration, Wyatt's LVMs provide the user with  $\pm 0.25\%$  accuracy.

L  
V  
M  
C  
I  
  
0  
6  
/  
2  
0  
1  
9  
  
2  
M



Oklahoma • Rhode Island • Virginia  
[www.wyattflow.com](http://www.wyattflow.com)

6 Blackstone Valley Place  
Suite 401  
Lincoln, RI 02865-1162  
tel +1.401.334.1170  
fax +1.401.334.1173  
[solutions@wyattflow.com](mailto:solutions@wyattflow.com)

# Technical Specifications

## Accuracy

For pipe Reynolds numbers greater than 75 000 and normalized piping, the Liberty Venturi Meter provides a flow 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.

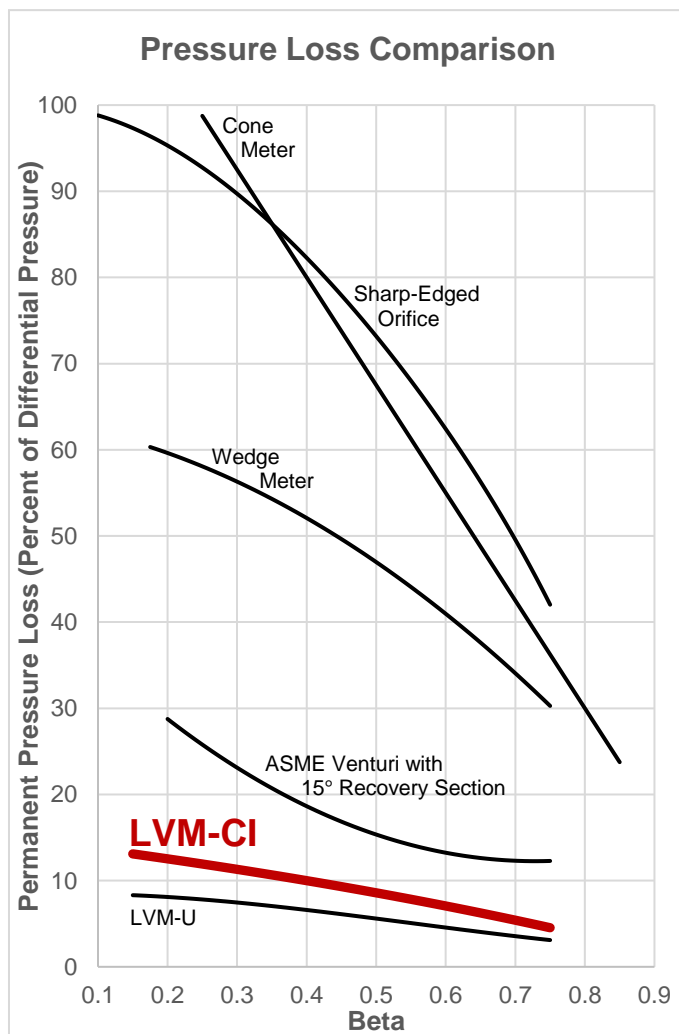


Figure 1

## Beta Ratio

Liberty Venturi Meters are available 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

Cast iron LVMS can handle process temperatures between -20 °F and +400 °F (-28 °C and +200 °C).

## Pressure Range/End Connections

Flanged end connections per ANSI B16.1 for 125 PSIG and 250 PSIG service are available. A variety of other end connections is also available including: Mechanical joint flanges per AWWA C110 or C111, flexible joints, and plain-end designs. Inquire about other options to meet your needs.

## Piping Requirements

Designed for full-pipe flow, LVM flow meters may be mounted horizontally, vertically, or at an angle. For recommended upstream piping, refer to Wyatt Engineering TECHspec for the LVM.

## Energy Considerations

Figure 1 compares the headloss of the LVM-CI design with that of other primary flow elements. The pressure recovery of the Liberty Venturi Meter means reduced pumping costs. The Wyatt Engineering Liberty Venturi has a shorter laying length and exhibits better recovery than standard classical and modified Venturi meters.

## Design Concepts

The Liberty Venturi is designed to provide a high degree of accuracy with unquestionable and predictable performance. Key to this design is the following:

**Accuracy:** Static inlet and throat pressure sensation provides a highly accurate, stable, and predictable flow measurement signal for flow rates with pipe Reynolds numbers as low as 75 000.

**Reliability:** The Liberty Venturi Meter is free of protrusions and sharp-edged, debris-collecting annuli. Static pressure taps reduce flow noise. The internal contour is designed to minimize the buildup of solids and deter erosion, corrosion, and scaling.

**Energy Savings:** Liberty Venturi Meters operate with minimal headloss. This results in less energy consumption, lower operational costs, and a lower cost of ownership.

# LVM-CI Sizing Table

Inlet Diameter		Throat Diameter		Beta Ratio	Overall Length		Outlet Diameter		ΔP = Differential Pressure of 100" wc (24.864 kPaD)						
									Water Flow at 60 °F (16 °C)				ΔH = Headloss		
(inches)	(mm)	(inches)	(mm)		(inches)	(mm)	(inches)	(mm)	US GPM	US CFS	LPM	m <sup>3</sup> /d	R <sub>D</sub> (10 <sup>-3</sup> )	in. wc	kPa
3.00	76	1.500	38.10	0.5000	11.85	301	2.25	57	130.62	0.291	494.46	712.03	123	10.9	2.70
3.00	76	1.800	45.72	0.6000	11.85	301	2.55	65	195.21	0.435	738.96	1064.1	184	8.3	2.07
3.00	76	2.100	53.34	0.7000	11.85	301	2.85	72	284.37	0.634	1076.5	1550.1	268	5.1	1.28
4.00	102	2.100	53.34	0.5250	14.00	356	3.05	77	257.88	0.575	976.18	1405.7	182	9.9	2.47
4.00	102	2.400	60.96	0.6000	14.00	356	3.35	85	347.04	0.773	1313.7	1891.7	245	8.6	2.14
4.00	102	2.800	71.12	0.7000	14.00	356	3.70	94	505.55	1.126	1913.7	2755.7	357	5.1	1.27
6.00	152	3.000	76.20	0.5000	22.00	559	4.50	114	522.49	1.164	1977.8	2848.1	246	10.0	2.49
6.00	152	3.600	91.44	0.6000	22.00	559	5.05	128	780.85	1.740	2955.8	4256.4	368	8.2	2.04
6.00	152	4.200	106.68	0.7000	22.00	559	5.60	142	1137.5	2.534	4305.8	6200.4	536	4.8	1.20
8.00	203	4.200	106.68	0.5250	26.00	660	6.15	156	1031.5	2.298	3904.7	5622.8	364	9.1	2.27
8.00	203	4.800	121.92	0.6000	26.00	660	6.70	170	1388.2	3.093	5254.8	7567.0	490	7.9	1.97
8.00	203	5.600	142.24	0.7000	26.00	660	7.45	189	2022.2	4.505	7654.8	11023	714	4.7	1.17
10.00	254	4.800	121.92	0.4800	31.75	806	7.40	188	1330.9	2.965	5038.1	7254.8	376	9.8	2.44
10.00	254	5.800	147.32	0.5800	31.75	806	8.50	216	2008.0	4.474	7601.0	10945	567	8.0	1.99
10.00	254	7.000	177.80	0.7000	31.75	806	9.45	240	3159.7	7.040	11961	17223	893	4.2	1.05
12.00	305	6.000	152.40	0.5000	36.50	927	9.05	230	2090.0	4.656	7911.4	11392	492	9.2	2.29
12.00	305	7.000	177.80	0.5833	36.50	927	10.15	258	2929.1	6.526	11088	15967	690	7.6	1.89
12.00	305	8.400	213.36	0.7000	36.50	927	11.25	286	4549.9	10.137	17223	24802	1071	4.4	1.10
14.00	356	7.000	177.80	0.5000	41.55	1055	10.55	268	2844.7	6.338	10768	15506	574	9.0	2.25
14.00	356	8.400	213.36	0.6000	39.25	997	11.45	291	4251.3	9.472	16093	23174	858	7.1	1.76
14.00	356	9.800	248.92	0.7000	37.30	947	12.40	315	6192.9	13.798	23443	33758	1250	5.2	1.29
16.00	406	8.000	203.20	0.5000	46.65	1185	12.05	306	3715.5	8.278	14065	20253	656	8.9	2.21
16.00	406	9.600	243.84	0.6000	44.00	1118	13.10	333	5552.7	12.372	21019	30268	980	7.0	1.73
16.00	406	11.200	284.48	0.7000	41.75	1060	14.20	361	8088.7	18.022	30619	44092	1428	5.1	1.27
18.00	457	9.000	228.60	0.5000	51.70	1313	13.55	344	4702.4	10.477	17801	25633	738	8.8	2.18
18.00	457	10.800	274.32	0.6000	48.75	1238	14.70	373	7027.7	15.658	26603	38308	1103	6.9	1.71
18.00	457	12.600	320.04	0.7000	46.25	1175	15.95	405	10237	22.809	38752	55803	1607	5.0	1.25
20.00	508	10.000	254.00	0.5000	56.80	1443	15.10	384	5805.5	12.935	21976	31646	820	8.7	2.15
20.00	508	12.000	304.80	0.6000	53.50	1359	16.35	415	8676.1	19.330	32843	47293	1226	6.8	1.69
20.00	508	14.000	355.60	0.7000	50.70	1288	17.75	451	12639	28.159	47842	68893	1785	5.0	1.23
24.00	610	12.000	304.80	0.5000	66.95	1701	18.10	460	8359.9	18.626	31646	45570	984	8.5	2.10
24.00	610	14.400	365.76	0.6000	63.00	1600	19.65	499	12494	27.836	47293	68103	1471	6.6	1.65
24.00	610	16.800	426.72	0.7000	59.65	1515	21.30	541	18200	40.549	68893	99206	2142	4.9	1.21
30.00	762	15.000	381.00	0.5000	84.15	2137	22.65	575	13062	29.103	49446	71203	1230	8.2	2.05
30.00	762	18.000	457.20	0.6000	79.25	2013	24.55	624	19521	43.494	73896	106410	1838	6.5	1.61
30.00	762	21.000	533.40	0.7000	75.05	1906	26.60	676	28437	63.358	107646	155010	2678	4.7	1.18
36.00	914	18.000	457.20	0.5000	99.40	2525	27.15	690	18810	41.908	71203	102532	1476	8.1	2.00
36.00	914	21.600	548.64	0.6000	93.50	2375	29.45	748	28111	62.631	106410	153231	2206	6.3	1.57
36.00	914	25.200	640.08	0.7000	88.45	2247	31.95	812	40949	91.235	155010	223214	3214	4.6	1.15
42.00	1067	21.000	533.40	0.5000	114.65	2912	31.70	805	25602	57.042	96915	139557	1722	7.9	1.97
42.00	1067	25.200	640.08	0.6000	107.70	2736	34.35	872	38262	85.247	144836	208564	2574	6.2	1.54
42.00	1067	29.400	746.76	0.7000	101.85	2587	37.25	946	55736	124.18	210985	303819	3749	4.5	1.13
48.00	1219	24.000	609.60	0.5000	129.85	3298	36.25	921	33439	74.503	126582	182278	1968	7.8	1.94
48.00	1219	28.800	731.52	0.6000	121.95	3098	39.30	998	49974	111.34	189174	272411	2941	6.1	1.52
48.00	1219	33.600	853.44	0.7000	115.25	2927	42.60	1082	72799	162.2	275573	396825	4285	4.5	1.11

This sizing table can be used as a guide to aid the user in choosing the proper LVM-CI 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 20.00" x 14.000" LVM-CI, 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"  
 ΔP<sub>N</sub> = 100 (20 000 / 12 639)<sup>2</sup> = 250.40" wc  
 ΔH<sub>N</sub> = 5.0 (20 000 / 12 639)<sup>1.88</sup> = 11.8" wc  
 Q<sub>N</sub> = 12 639 (750 / 100)<sup>0.5</sup> = 34 613 US GPM

# Available Options

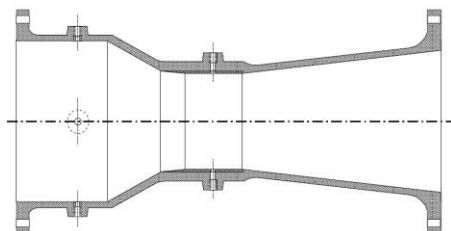
WYATT

## The cast iron Liberty Venturi Meter is available in four styles for your specific application.

**Model LVM-CI** is a flanged cast iron primary element designed for liquid and gas flow measurement. Typical throat materials are bronze and 300-series stainless steel.

All valves, except butterfly valves, may be direct-coupled downstream for control purposes without loss of accuracy.

The LVM can be supplied with flanges, mechanical joints, or plain ends. For ductile iron, reference our model **LVM-DI**.

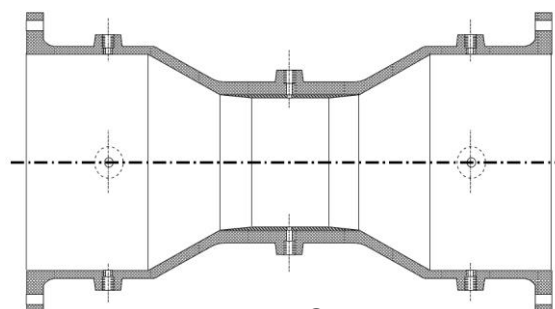


**LVM-CI**

**Model LVM-C** is a flanged cast iron primary element designed to utilize a butterfly valve for rate-of-flow control in liquid or gas service. The Liberty Venturi Meter is constructed to accept a butterfly valve bolted directly to the downstream flange allowing the **LVM-C** to be utilized as a rate-of-flow controller. The butterfly valve does not affect the accuracy of the primary element. The meter outlet can be modified to accommodate a valve one or more line sizes smaller than the main piping run.

**Model LVM-S** is a flanged primary element designed for wastewater, sludge, slurry, or other fluids with suspended solids. Static pressure taps assure stable measurement and minimize solids buildup at the tap. Manual vent cleaners are provided as a standard; automatic vent cleaners or a sealed diaphragm system are available as options. An inspection port and water purge systems, either continuous or timed, are also available.

**Model LVM-CB** is for applications where the flow can reverse direction due to upset or as directed. The cast iron bidirectional Liberty Venturi Meter is provided with tap sets for monitoring the flow rate in both directions and can be provided instrumentation to determine the flow direction. The **LVM-CB** is field-verifiable and can be used in many applications where standard differential producers, or other metering technologies, cannot be used.



**LVM-CB**

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



Oklahoma • Rhode Island • Virginia  
[www.wyattflow.com](http://www.wyattflow.com)

6 Blackstone Valley Place  
Suite 401  
Lincoln, RI 02865-1162  
tel +1.401.334.1170  
fax +1.401.334.1173  
[solutions@wyattflow.com](mailto:solutions@wyattflow.com)