

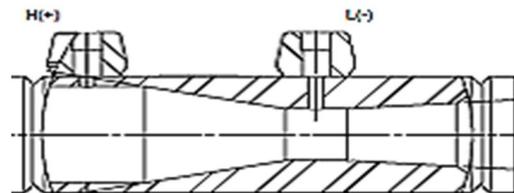
## Venturi Manual

### 1) INSTALLATION

#### Mounting Location

The Venturi Meter, as per ISO 5167 standard or equivalent, may be installed in any position suitable to the requirements of the application and piping.

1. Determine the location & orientation.
2. Sufficient upstream and downstream straight length of pipe must be respected without any restriction.
3. Depressurize the line.
4. If required; cut the portion of existing pipe/duct equal to the length of the venturi assembly and install necessary fittings.
5. Install the venturi with the flow direction as indicated on the instrument tag.
6. If venturi is equipped with multiple pairs of taps, the un-used pair(s) of taps must be plugged or closed with an isolation valve.



*Upstream piping should be as long as needed to provide as uniform a flow profile as is possible given the process Reynolds Number. Flow Conditioners (Straightening Vanes) can be used upstream to improve the flow profile.*

*Piping configuration downstream has no limitation except that a valve should be no closer than two diameters.*

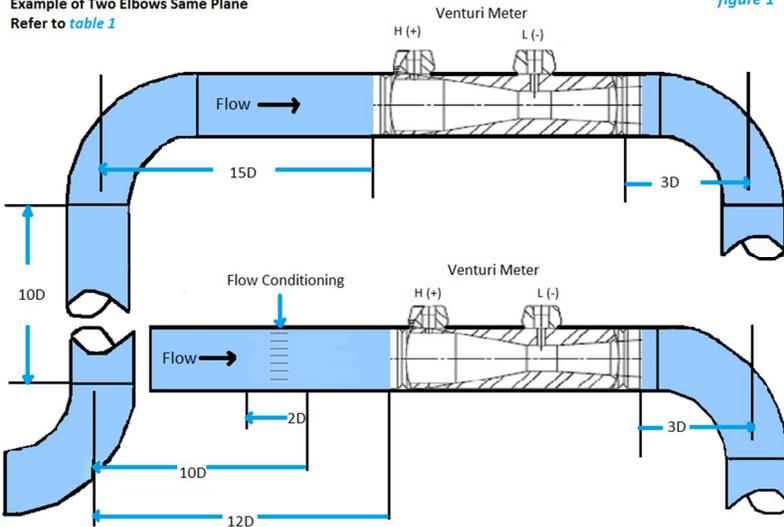
## Straight Pipe Run Requirements

For most piping configurations and obstructions, the required straight runs of pipe ID (inside diameter) measured from the inlet of the venturi tube upstream, depends on the beta ratio of the venturi (*table 1*) 3 pipe ID is recommended downstream (*figure 1 & 2*).

The use of a Flow Conditioner can reduce the required pipe run upstream (*figure 1 & 2*).

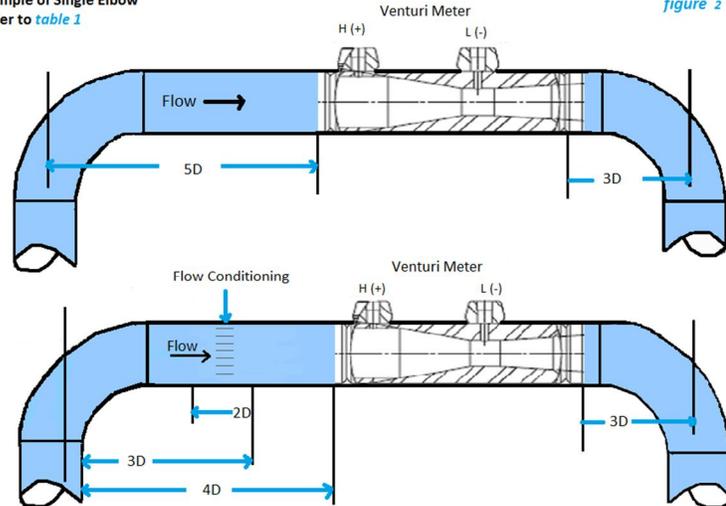
Example of Two Elbows Same Plane  
Refer to *table 1*

figure 1



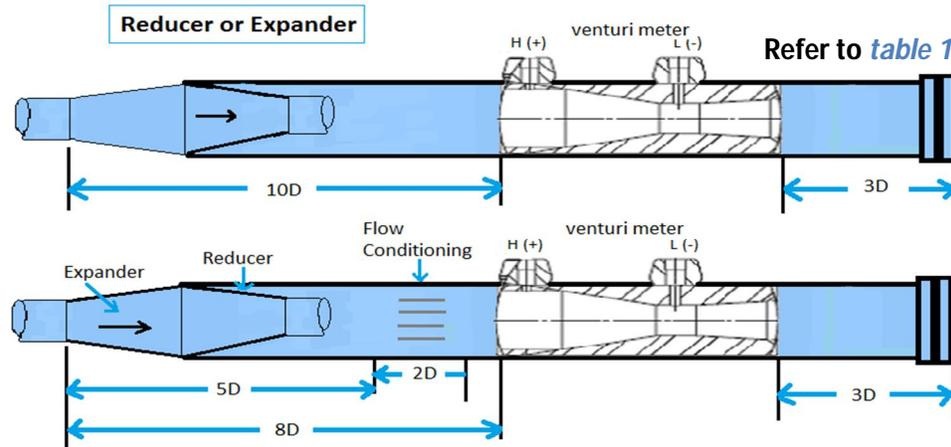
Example of Single Elbow  
Refer to *table 1*

figure 2



## Example of Reducer or Expander

Refer to *table 1*



**The minimum straight lengths** required are the straight lengths between various fittings located upstream of the Venturi tube and the Venturi tube itself. Straight lengths shall be measured from the downstream end of the curved portion of the nearest bend.

## Required Straight Lengths for Classical Venturi Tubes

Table 1

Most of the results are available for beta ratio 0.3 to 0.7.

Higher beta ratio needs longer straight length.  $\beta$  – Diameter (beta) ratio

Using ISO 5167 standard, the recommended minimum lengths are shown here.

Values Expressed as multiples of internal diameter D

The minimum straight lengths required are the lengths between various fittings located upstream of the classical Venturi tube and the classical Venturi tube itself. Straight lengths shall be measured from the downstream end of the curved portion of the nearest (or only) bend or the downstream end of the curved or conical portion of the reducer or expander to the upstream pressure tapping plane of the classical Venturi tube.

If temperature pockets or wells are installed upstream of the classical Venturi tube, they shall not exceed 0.13D in diameter and shall be located at least 4D upstream of the upstream tapping plane of the Venturi tube.

For downstream straight lengths, fittings or other disturbances (as indicated in this Table) or densitometer pockets situated at least four throat diameters downstream of the throat pressure tapping plane do not affect the accuracy of the measurement.

Column A for each fitting gives lengths corresponding to "zero additional uncertainty" values

Column B for each fitting gives lengths corresponding to "0.5% additional uncertainty" values

Diameter Ratio $\beta$	Single 90 degree Bend (1)		Two or More 90 deg Bends in Same or Different Planes (1)		Reducer 1.33D to D Over Length of 2.3D		Expander 0.67D to D Over Length of 2.5D		Reducer 3D to D over Length of 3.5D		Expander 0.75D to D Over Length of D		Full Bore Ball or Gate Valve Fully Open	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
	A (2)	B (3)	A (2)	B (3)	A (2)	B (3)	A (2)	B (3)	A (2)	B (3)	A (2)	B (3)	A (2)	B (3)
0.30	8	3	8	3	4	(4)	4	(4)	2.5	(4)	2.5	(4)	2.5	(4)
0.40	8	3	8	3	4	(4)	4	(4)	2.5	(4)	2.5	(4)	2.5	(4)
0.50	9	3	10	3	4	(4)	5	4	5.5	2.5	2.5	(4)	3.5	2.5
0.60	10	3	10	3	4	(4)	6	4	8.5	2.5	3.5	2.5	4.5	2.5
0.70	14	3	18	3	4	(4)	7	5	10.5	2.5	5.5	3.5	5.5	3.5
0.75	16	8	22	8	4	(4)	7	6	11.5	3.5	6.5	4.5	5.5	3.5

(1) The radius of curvature of bend shall be greater than or equal to the pipe diameter.

(2) Column A for each fitting gives length corresponding to "zero additional uncertainty" values.

(3) Column B for each fitting gives length corresponding to "0.5% additional uncertainty" values.

(4) The straight length in column A gives zero additional uncertainty; data are not available for shorter straight lengths which could be used to give the required straight lengths for column B.

**Prior to installation** ensure that the proper pressure and temperature ratings of the Venturi Meter are not exceeded by the application.

Prior to installation the Venturi Meter should be inspected for any damage that may have occurred during transport. If the meter is being re-installed then inspection should include a visual inspection of the interior of the meter for any signs of corrosion or erosion.

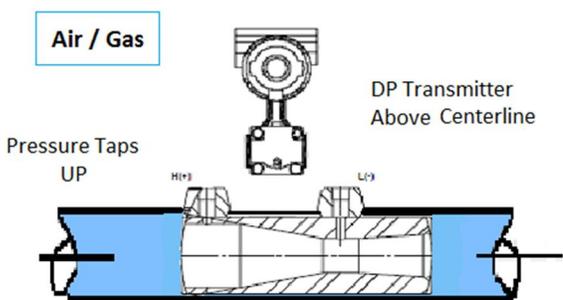
Installation of the Venturi Meter in the piping may be achieved through welded, threaded, or flanged process connections. Proper practices and regulations should be followed by the purchaser to ensure a safe and proper installation. Gaskets are required for flanged in process connections and care must be exercised to ensure that the gaskets are centered so as not to affect the flow profile entering the venturi tube. The process flanges are to be bolted in following the torque recommendations for the classification of the flanges. Gaskets and bolts are not supplied by **idSolutions** and it is the responsibility of the purchaser to properly select the gaskets and bolts for the application.

## For Remote Transmitter Mount

**The transmitter** should be properly located for maintenance accessibility and frequent checks.

Consider self-draining or blowdown of the impulse lines, venting, site adjustable zero and span of the transmitter, and other features when selecting the location.

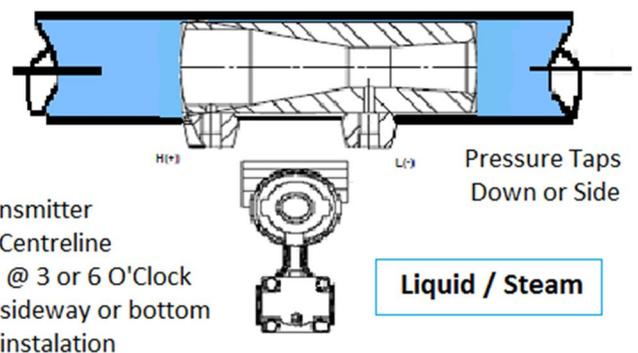
The distance between the pressure taps on the process line and the transmitter should be as short as possible. The site should be free from excessive vibrations. Ambient temperature around the transmitter should not exceed the specification of the transmitter. The venturi can be mounted in either vertical or horizontal positioned pipe, however any elevation difference between the tap locations must be compensated for.



### Air & Gas Flow Measurement

The pressure taps must be vertical or within 45 degrees either side of vertical.

The transmitter should be installed at the upper elevation of the primary element to prevent condensate collecting in the impulse piping.



### Liquid & Steam Flow Measurement

The pressure taps must be horizontal or below horizontal but not more than 45 degrees below horizontal. This prevents air pocket formation and reduces the chances of clogging of the impulse pipe due to deposits from the process fluid.

It is recommended that the transmitter be installed below the primary element.

## 2) Operation and Commissioning

### Checklist

Prior to commissioning the system, check the following:

- 1) No leakages in impulse piping.
- 2) Proper termination of the LP and HP lines to the Transmitter.
- 3) Orientation of the flow element tapping.
- 4) Routing of impulse lines, in particular the elevation of the two lines with respect to one another.
- 5) Proper termination of cables at both transmitter and instrument ends.

Procedure for commissioning:

- 1) Check 24 V DC supply to transmitter.
- 2) For DP transmitters with manifold valves:
  - Always perform a zero trim on the transmitter/manifold assembly after installation to eliminate any shift due to mounting effects.
  - In normal operation the two block valves between the process and instrument ports will be open and the equalizing valve will be closed.
  - To zero the DP transmitter (3 valve manifold), close the block valve to the low pressure (downstream) side of the transmitter first.
  - Open the center (equalize) valve to equalize the pressure on both sides of the transmitter. The manifold valves are now in the proper configuration for zeroing the transmitter.
  - After zeroing the transmitter, close the equalizing valve.
  - Open the block valve on the low pressure side of the transmitter to return the transmitter to service
- 3) For Steam applications:
  - After blowing down the lines, shut both the isolating valves and the drain valves. Open all the valves of the valve manifold. Unscrew the plugs of both the condensate pots and fill the impulse lines with water. Put on the plugs of the condensate pots.
  - Close the LP and HP valves of the manifold but keep the equalizing valve open.
  - Open both the isolating valves.
  - Ensure that the equalizing valve is open. Slowly open the LP valve. Let the pressure equalize in the transmitter. Adjust the zero if required. Open the HP valve of the manifold.
  - Slightly open the drain plugs on the transmitter and drain the condensate to remove any air pockets in the impulse lines. Re-tighten the drain plugs.
  - Shut the equalizing valve.
  - Check the output of transmitter.

### **3) MAINTENANCE**

The Venturi has no Moving Parts that require routine maintenance. There may be periodic verification or cleaning of the process lines due to the particular process conditions. The Venturi should be included in any scheduled piping inspections for the line in which it is installed.

Visual inspections should be made periodically for leakage at the process connections and at the instrument connections to the differential transmitter.

If the Venturi is taken out of the line all procedures for installation should be followed during re-installation.