

Elbow Mounted Annubar Flowmeters: A Solution to Short Pipe Runs

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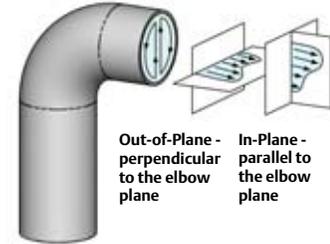


Figure 1: Velocity distortion following a single elbow

CHALLENGE

With today's typical piping configurations, finding the appropriate amount of straight run required to install most flowmeters can be difficult. Many flow measurement devices are installed with less than ideal straight run, which has a significant affect on performance.

The Rosemount 485 Annubar has been engineered and tested to deliver accurate and repeatable measurements in applications with minimal straight pipe run. This can be done even when an elbow is in the piping configuration.

SOLUTION

Piping Configurations Affect Flow Measurement

The key to the Annubar flow element accuracy is the prediction of the discharge coefficient, or K factor. When properly installed eight diameters downstream of a single elbow, the accuracy is $\pm 0.75\%$ of flow rate. This amount of straight pipe run allows the velocity flow profile to fully develop so a constant flow coefficient can be determined.

Normal plant piping configurations typically include a combination of pipefittings, reducers, expanders, strainers, and elbows, which all affect the flow profile. Although a pipe elbow distorts fully developed flow, it also acts as a flow conditioner and creates a more predictable flow profile immediately downstream of the discharge of the elbow.

Rosemount 485 Elbow-Mount Annubar

When the Annubar is installed two diameters downstream of the centerline of an elbow, the frontal slot design integrates the velocity flow profile and provides repeatable, accurate results. This mounting configuration delivers $\pm 3.0\%$ flow rate accuracy, and $\pm 0.1\%$ repeatability.

Due to the differences in the velocity flow profile created by the elbow, Rosemount used laboratory testing to empirically derive the Annubar K factor, when mounted two diameters downstream of both short and long radius configurations. Mounting the Annubar on either the plane of the inside radius or the outside radius will provide a suitable mounting location. However, the outside radius is preferred, to insure the fixed support is at the point of the higher velocity vectors in the flow stream.

The Rosemount 485 Annubar provides an accurate and repeatable insertion-type device when straight-run is not available, but flow measurement is required.

Guidelines for a Successful Elbow Mount Installation

1. The elbow must be welded or flanged, not threaded.
2. Refer to Table 1 to verify minimum diameters available for piping configuration.
3. Mount the 485 Annubar two inside pipe diameters from the center of the upstream pipe (Figure 2) in-plane with the elbow. (Inside or outside radius mounting are both acceptable, but the outside is preferred).
4. The Rosemount 485 Annubar cannot be located in a position that is between the radii.
5. The Annubar cannot be located in a position other than the two diameters downstream from the centerline of the elbow.

The Rosemount 485 Annubar has been engineered and tested to deliver accurate and repeatable measurements.

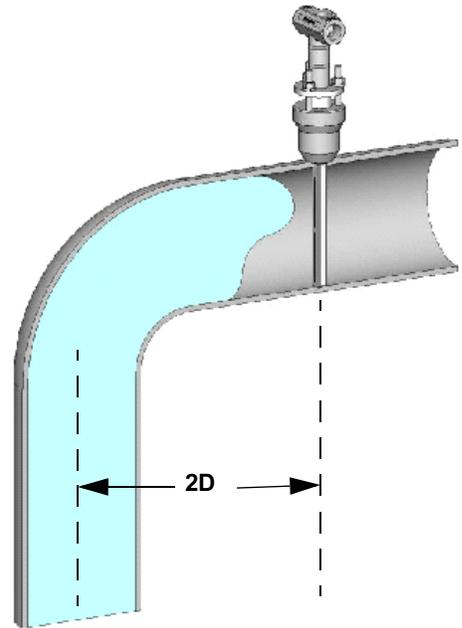


Figure 2: Annubar mounted 2D for an elbow

TABLE 1. Elbow Mount Annubar Piping Configuration

Piping Configuration	Mimimun Required Values	
	L1	L2
<p>ONE ELBOW - OUT OF PLANE</p>	4	2
<p>ELBOW/TEE, "U" CONFIGURATION</p>	5	2
<p>THROUGH VALVE - IN PLANE</p>	3	2
<p>BUTTERFLY VALVE - IN PLANE</p>	5	2

Piping Configuration	Mimimun Required Values	
	L1	L2
<p>SWIRL PRODUCING</p> <p>ELBOW TEE, "S" CONFIGURATION</p>	4	2
<p>TWO ELBOWS - OUT OF PLANE</p>	10	2
<p>THROUGH VALVE - OUT OF PLANE</p>	3	2
<p>BUTTERFLY VALVE - OUT OF PLANE</p>	5	2

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Emerson Process Management
 Rosemount Division
 8200 Market Boulevard
 Chanhassen, MN 55317 USA
 T (U.S.) 1-800-999-9307
 T (International) (952) 906-8888
 F (952) 949-7001
www.rosemount.com

Emerson Process Management
 Heath Place
 Bognor Regis
 West Sussex PO22 9SH
 England
 T 44 (0) 1243 863121
 F 44 (0) 1243 867554

Emerson Process Management
 Emerson Process Management Asia Pacific
 Private Limited
 1 Pandan Crescent
 Singapore 128461
 T (65) 6777 8211
 F (65) 6777 0947
Enquiries@AP.EmersonProcess.com



For more information:
www.rosemount.com

