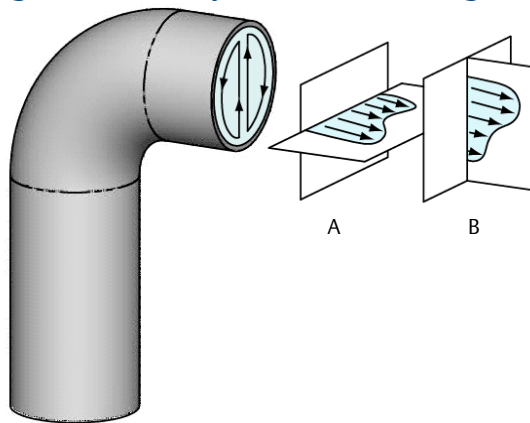


Elbow Mounted Annubar™ Flow Meters: A Solution to Short Pipe Runs

1.0 Contents

- Piping configurations affect flow measurement
- Rosemount™ 485 Elbow-mount Annubar
- Guidelines for a successful elbow mount installation
- Elbow mount annubar piping configuration

Figure 1-1. Velocity Distortion Following a Single Elbow



A. Out-of-plane – perpendicular to the elbow plane
B. In-Plane – parallel to the elbow plane

2.0 Challenge

With today's typical piping configurations, finding the appropriate amount of straight run required to install most flow meters 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.

3.0 Solution

3.1 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 ± 0.75 percent 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, all of which 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 elbow discharge.

3.2 Rosemount 485 Elbow-Mount Annubar

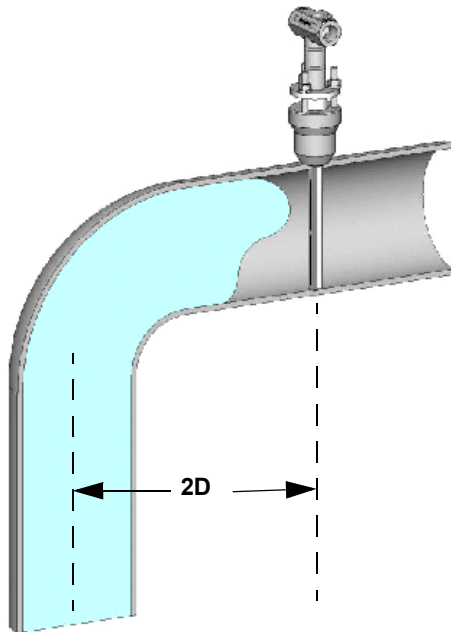
When the Annubar is installed two diameters downstream of the centerline of an elbow, the frontal slot design integrates the velocity flow profile and provides repeatable, accurate results. This mounting configuration delivers ± 3.0 percent flow rate accuracy, and ± 0.1 percent repeatability.

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 is suitable.

However, the outside radius is preferred, to ensure 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.

Figure 1-2. Annubar Mounted 2D for Elbow



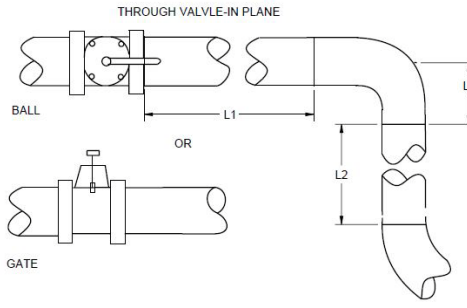
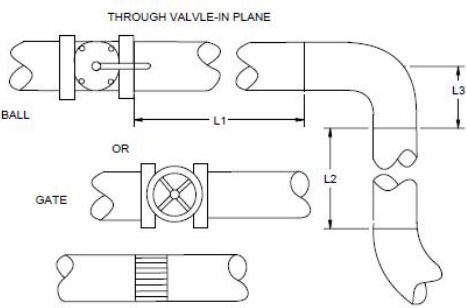
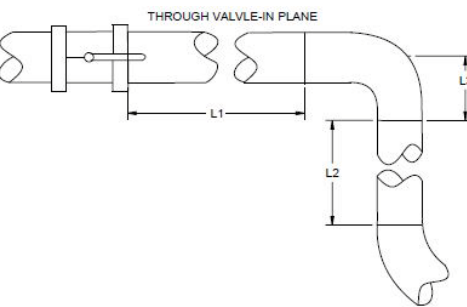
4.0 Guidelines for a successful elbow mount installation

1. The elbow must be welded or flanged, not threaded.
2. Refer to [Table 1-1](#) to verify minimum diameters available for piping configuration.
3. Mount the 485 Annubar two inside pipe diameters from the center of the upstream pipe 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.

Table 1-1. Elbow Mount Annubar Piping Configuration

Piping configuration	Minimum required values		Piping configuration	Minimum required values	
	L1	L2		L1	L2
<p>Non-swirl producing</p>	4	2	<p>Non-swirl producing</p>	4	2
<p>ELBOWTEE, "U" CONFIGURATION</p>	5	2		10	2

Table 1-1. Elbow Mount Annubar Piping Configuration

Piping configuration	Minimum required values		Piping configuration	Minimum required values	
	3	2		3	2
			5		

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