

Best Practices Engineering Guide

Installation Recommendations for FCI Single-Point, Thermal Dispersion Flow Meters

- **Straight-Run Situations and Recommendations**
- **Installation Orientation Options for Various Fluid Conditions**
- **Overcoming Limited Straight-Run and Flow Obstructions Using Flow Conditioners**
- **Optimizing Accuracy and Repeatability Performance**

Optimizing Flow Meter Installation Ensures Performance and Instrument Accuracy

All flow meter technologies have recommended installation and engineering practices to ensure they meet their published specifications and for optimal performance, accuracy and repeatability. Flow meter users are frequently challenged with wide variations in their actual field conditions and installation constraints that are much different from the ideal conditions under which their flow meter was calibrated. In fact, the most common installation constraint for most all flow meter installations is inadequate straight-run. Flow meter users expect their flow meter suppliers to provide engineering recommendations and solutions to overcome real world application conditions to obtain expected flow meter performance to specifications. This guide provides recommended engineering practices with diagrams and specifications

for straight-run, installation orientation and depths, as well as use of flow conditioners as an engineering solution for FCI single-point, thermal dispersion flow meters.

Use FCI's Free AVAL Tool for Proper Sizing and Instrument Selection

FCI's exclusive *AVAL* software tool is designed to make proper sizing and selection of thermal dispersion flow meters simple and effective. *AVAL* is always available and accessible by visiting FCI's website at www.fluidcomponents.com and clicking on the *AVAL* icon.



Since process parameters, fluid compositions and installation constraints can limit ideal performance, FCI *AVAL* software will ensure you are fully aware of process conditions that can potentially produce installed uncertainty. *AVAL* application evaluation software is a proprietary FCI service designed from years of fluid testing and installation experience. Using *AVAL* software, FCI models an installation with straight run variations and obstructions. When a complete evaluation is performed, an output report clearly defines expected "installed" accuracy or offers recommendations for improvement. FCI relates laboratory calibrations to true installed field performance. The configuration software matches specific process conditions and makes appropriate configuration recommendations for each flow meter application.

FCI Offers Multiple Solutions to Limited Straight-Run Conditions

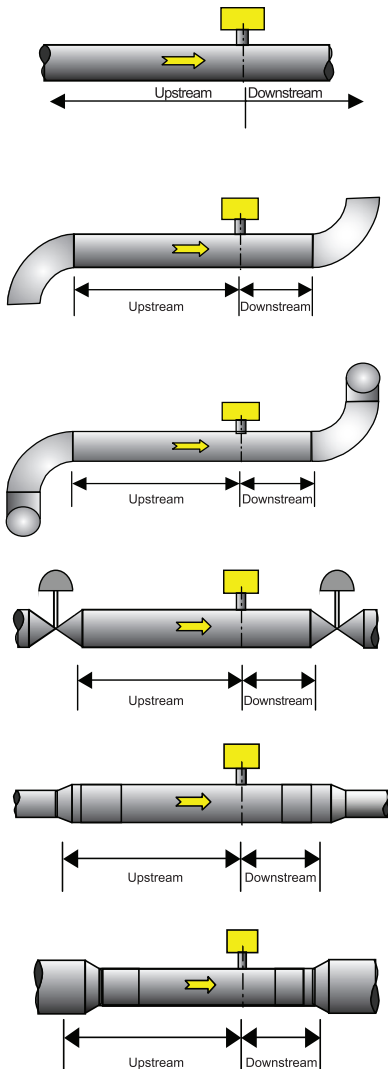
Straight-run is one of the most significant variables to consider in your flow meter installation to ensure accurate and repeatable flow measurement. Inadequate straight-run or the presence of flow disrupters are the most common real world constraints to proper flow meter installation.

Figure 1 provides recommendations and engineering practices for commonly found conditions and line sizes to ensure an installation supports the meter's published specifications. When possible, installing the flow meter within these recommendations will assure proper performance with the least installed cost. Figure 2 shows samples of the effects on flow meter accuracy of obstructions.

Recognizing the straight-runs specified in Figure 1 are not always possible, FCI offers four solutions which can be applied by themselves or in combination to overcome installation constraints.

- Vortab® Flow Conditioners to Develop Flow Profile and Negate Obstructions with up to 70% Reduction in Straight-Run Needed
- Customized Calibration Set-ups which Simulate the Actual Field Installation Conditions
- In-situ Field Calibration Service and Instrument Adjustment
- Multiple Sense Point Flow Meters

Figure 1: Straight Run Recommendations



Default Recommendation for Required Straight-runs with Undefined Obstructions

Pipe Size	Upstream	Downstream
< 6 inches [150 mm]	20 x Pipe ID	10 x Pipe ID
≥ 6 inches [150 mm]	15 x Pipe ID	7.5 x Pipe ID
with Vortab flow conditioner	6 x Pipe ID	2 x Pipe ID

Recommendation for 45° or 90° Elbows in Plane

Pipe Size	Upstream	Downstream
< 6 inches [150 mm]	15 x Pipe ID	7.5 x Pipe ID
≥ 6 inches [150 mm]	10 x Pipe ID	5 x Pipe ID
with Vortab flow conditioner	6 x Pipe ID	1 x Pipe ID

Recommendation for 45° or 90° Elbows OUT of Plane (Swirl Effect)

Pipe Size	Upstream	Downstream
< 6 inches [150 mm]	20 x Pipe ID	10 x Pipe ID
≥ 6 inches [150 mm]	15 x Pipe ID	5 x Pipe ID
with Vortab flow conditioner	6 x Pipe ID	2 x Pipe ID

Recommendation for Flow Controlling Valves Upstream or Downstream

Pipe Size	Upstream	Downstream
< 6 inches [150 mm]	20 x Pipe ID	10 x Pipe ID
≥ 6 inches [150 mm]	15 x Pipe ID	5 x Pipe ID
with Vortab flow conditioner	9 x Pipe ID	2 x Pipe ID

Recommendation for Pipe Adaptor Upstream or Downstream

Pipe Size	Upstream	Downstream
< 6 inches [150 mm]	20 x Pipe ID	10 x Pipe ID
≥ 6 inches [150 mm]	15 x Pipe ID	5 x Pipe ID
with Vortab flow conditioner	9 x Pipe ID	2 x Pipe ID

Recommendation for Pipe Reducers Upstream or Downstream

Pipe Size	Upstream	Downstream
< 6 inches [150 mm]	15 x Pipe ID	5 x Pipe ID
≥ 6 inches [150 mm]	10 x Pipe ID	3 x Pipe ID
with Vortab flow conditioner	6 x Pipe ID	1 x Pipe ID

Recommendations shown are for general reference only as actual application conditions can vary and multiple effects are possible. FCI flow meter performance guarantees are only available following completed AVAL software-based application evaluations. Contact your local FCI sales representative for a comprehensive evaluation.

Figure 2: Sample of Effects on Accuracy with Flow Obstructions Before and After Installation Point of Single-Point, Insertion Flow Meter

With Pipe ID < 6 inches [150 mm]

Distance From Flow Meter	19D	17D	15D	13D	11D	9D	7D	5D	3D	1D	FLOW METER	1D	3D	5D	7D	9D	
Obstruction Type:																	
90° Elbow	0%	0%	<1%	1%	1%	2%	3%	4%	5%	5%			4%	3%	2%	1%	0%
Two Elbows (with 4D between them)	1%	1%	2%	2%	2%	3%	4%	6%	8%	9%			5%	4%	3%	2%	1%
Gate Valve	1%	2%	3%	4%	5%	6%	8%	10%	17%	20%			15%	13%	8%	3%	1%

See Vortab discussions below on how to eliminate effect and improve accuracy.

With Pipe ID ≥ 6 inches [150 mm]

Distance From Flow Meter	19D	17D	15D	13D	11D	9D	7D	5D	3D	1D	FLOW METER	1D	3D	5D	7D	9D	
Obstruction Type:																	
90° Elbow	0%	0%	0%	0%	0%	<1%	2%	3%	4%	5%			4%	2%	<1%	0%	0%
Two Elbows (with 4D between them)	0%	0%	<1%	2%	2%	2%	4%	5%	6%	8%			4%	3%	<1%	0%	0%
Gate Valve	0%	0%	<1%	2%	3%	4%	6%	8%	15%	20%			15%	5%	<1%	0%	0%

See Vortab discussions below on how to eliminate effect and improve accuracy.

X% : Application not recommended.

Vortab Flow Conditioners Reduce Straight-Run

In installations with inadequate straight-run, Vortab flow conditioners provide a solution that will ensure flow meter performance in as little as just 7 diameters upstream. This patented technology is the flow conditioner most recommended by flow and process control experts to eliminate the flow swirl and profile distortions which adversely affect flow meter measuring accuracy. Further, because Vortab achieves results with the least pressure drop, it actually saves significantly on energy costs over alternate techniques. FCI is the only authorized supplier of Vortab flow conditioners for use with thermal dispersion technology flow meters. Vortab are available as a spool-piece meter run section, an insertable sleeve and as a field weldable kit to accommodate a variety of installation needs.

Figure 3: Vortab Flow Conditioning Removes Swirl and Creates Uniform Flow Profile

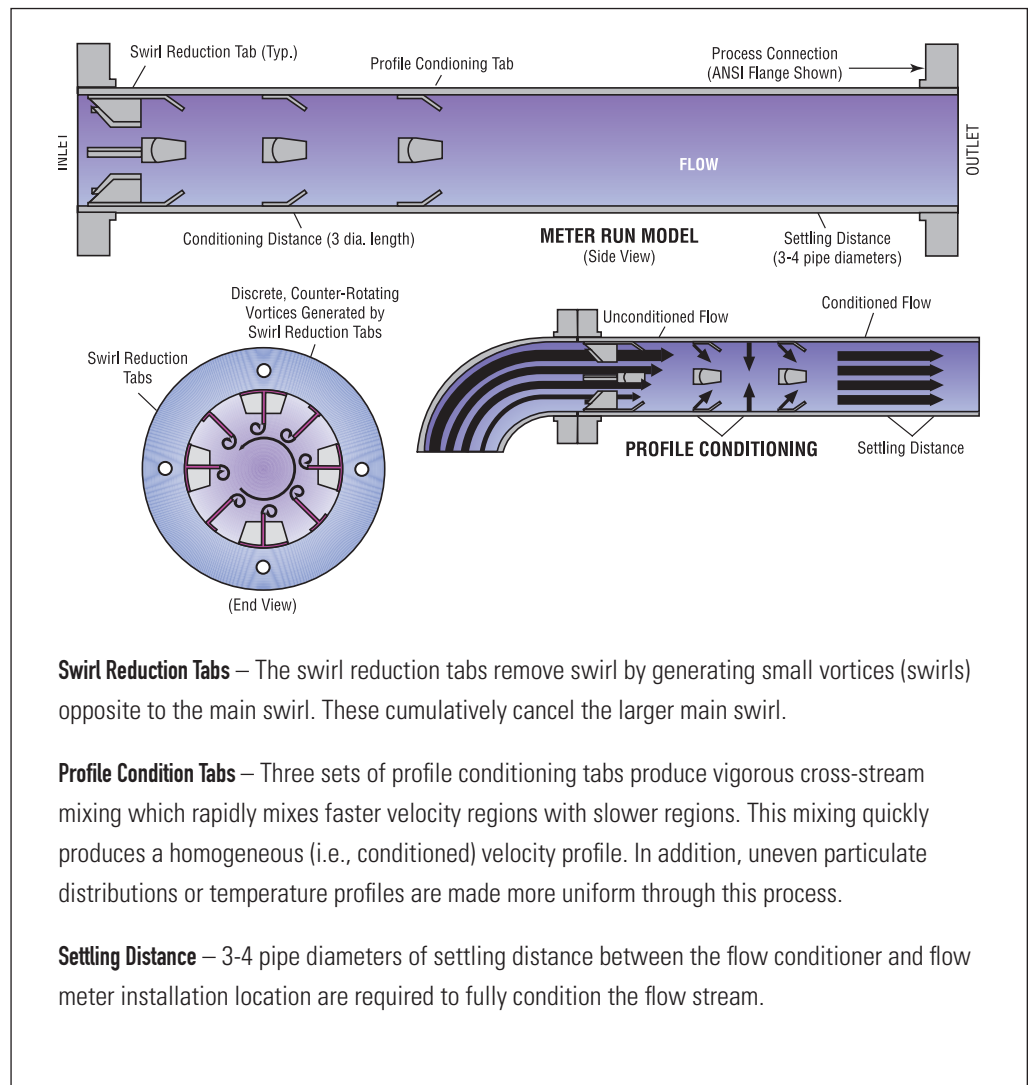
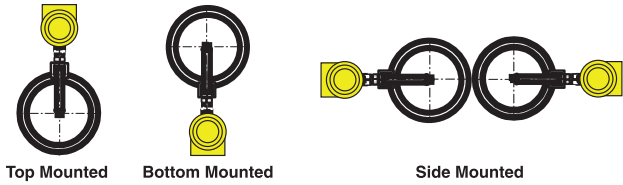
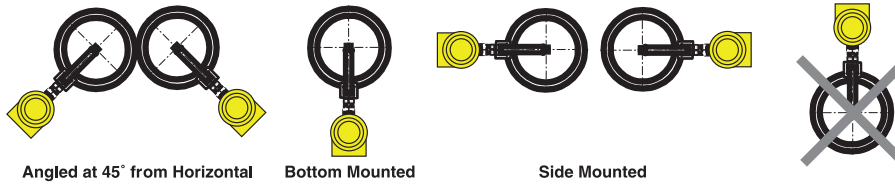


Figure 4: Pipe Installation Orientation Options for Insertion Style Flow Meters

Installation in Horizontal Pipe: For General Air/Gas Applications



Installation in Horizontal Pipe: High Humidity/Wet Gas Applications

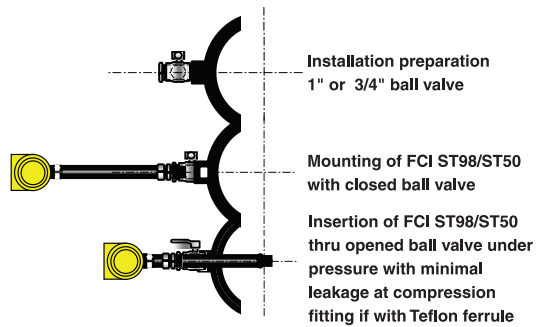


Installation in Vertical Pipe: For All Gas Applications



Installation thru Ball Valve for Easy Installation and Removal under Pressure

Type	Size Ball Valve
ST98	1" NPT
ST50	3/4" NPT



FLUID COMPONENTS INTERNATIONAL solves flow and level measurement applications for industrial process and plant applications using patented thermal dispersion flow measurement technologies. With more than 40 years experience and the world's largest installed base of thermal dispersion instruments, you can count on FCI to know your application and have proven solutions that will save you time and expense. From off-the-shelf products to custom engineered products and systems, FCI has the selection and an unequalled record of innovations to supply the optimal product for your application. From single-point to multi-point flow meters, from basic air flow to complex mixed, variable flare gas compositions, from water to the harshest of chemicals, FCI products will deliver superior accuracy, repeatability and long-term reliability at the lowest installed cost.



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