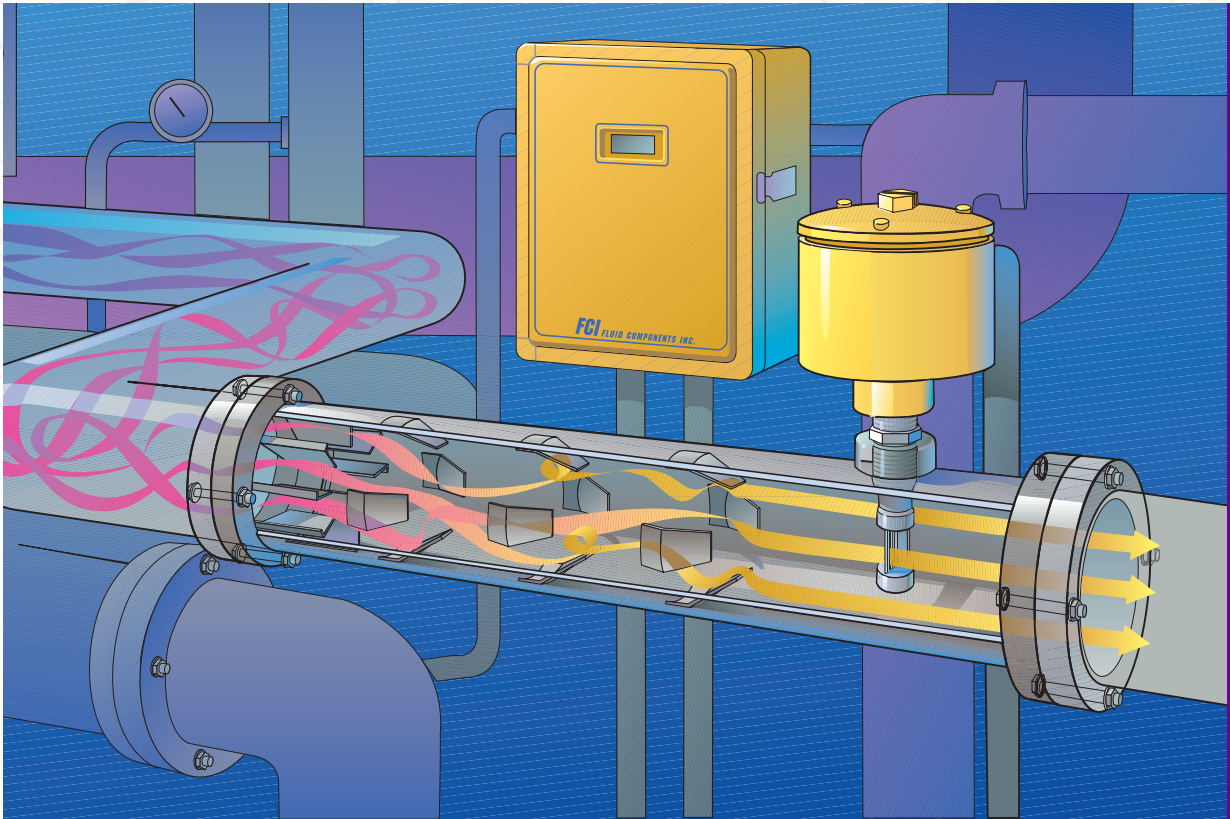


**FCI and VORTAB®:**

**Proven Partners**

**for Accurate**



**Gas Mass Flow**

**Measurement.**

**FCI** FLUID COMPONENTS INTERNATIONAL LLC

Fluid Components Intl and VORTAB® Corporation have formed an exclusive partnership to provide a lower cost, reliable, high performance solution for accurate mass flowmetering in gas applications. The new FCI/VORTAB Flowmetering System combines FCI's field-proven thermal gas mass flowmeters with VORTAB's patented low pressure loss flow conditioners.

**FCI Flowmeters** Since 1964, FCI has provided high performance thermal flow sensing for tough applications in the processing, nuclear and fossil fuel power, wastewater treatment and aerospace industries. All FCI Flowmeters feature FCI's Thermal Dispersion operating principle providing stable performance, high reliability and low flow sensitivity. FCI's no-moving parts design ensures dependable, virtually maintenance-free performance in harsh, dirty and explosive gas mass flowmetering applications. Microprocessor-based electronics add increased flexibility to FCI's Mass Flowmeters permitting user-friendly operations and maintenance, easy in-field adjustment of zero, span and display units, and built-in testing and self-diagnostics.

**VORTAB® Flow Conditioners** VORTAB Flow Conditioners provide a low pressure loss solution to flow profile irregularities produced by elbows, valves, blowers, compressors, and other disruptions that commonly occur in pipe and duct runs. By eliminating flow profile irregularities and temperature or media stratification, they ensure accurate, repeatable gas flow measurement and are the efficient alternative to long lengths of straight piping or ducting upstream from a flowmeter. VORTAB Flow Conditioners provide the most thorough conditioning, in a shorter distance, with a fraction of the pressure loss of any other flow straightener or conditioner available today.

**Performance from Teamwork** By teaming FCI's proven Thermal Dispersion Mass Flowmetering experience and products with VORTAB Flow Conditioners, FCI now provides unequalled gas mass flowmetering performance in applications previously considered too difficult or impractical to meter.

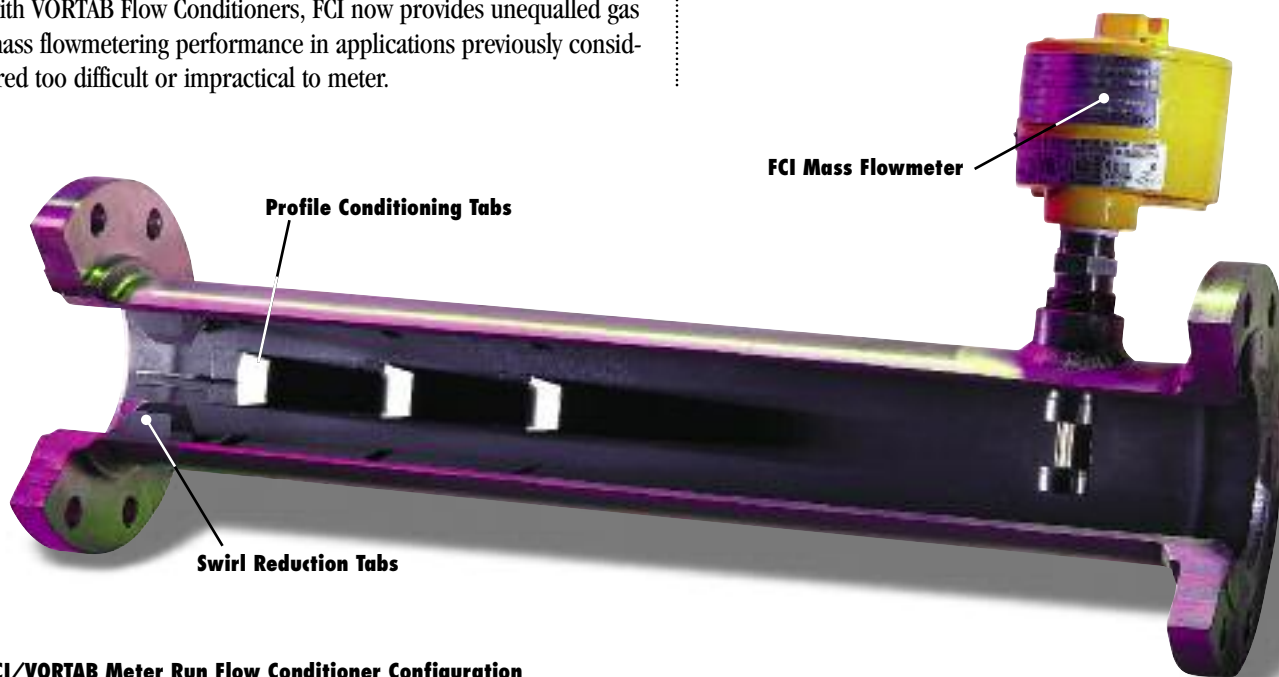
The VORTAB Flow Conditioner, located just three (3) diameters upstream of the FCI Flowmeter installation, virtually eliminates gas flow swirl and velocity profile distortions as well as temperature and media stratification produced by process equipment obstructions and/or inadequate straight run of pipe and ducting. This results in tremendous flowmetering accuracy and repeatability improvements. The FCI/VORTAB team provides the ideal solution for industry's toughest, most critical gas mass flowmetering applications.

**Proven Flow Conditioning Technology** VORTAB Flow Conditioners uniquely combine proven swirl removal technology with the patented VORTAB mixing process to achieve the most thorough and efficient flow conditioning available. Each of the three available flow conditioner configurations consists of a short section of swirl reduction tabs combined with three (3) arrays of VORTAB profile conditioning tabs. This design produces: > rapid cross-stream mixing > minimizes swirl and velocity profile distortions > produces flow profile repeatability across a broad flow range.

Equally important, VORTAB Flow Conditioners feature a patented low pressure loss design. Non-recoverable pressure loss can reduce maximum flow capability in process lines, creating process inefficiencies and requiring greater energy expenditures to move process gases. Perforated plates, tube bundles, screens and other flow conditioning technologies produce a much greater pressure loss than VORTAB Flow Conditioners and, unlike VORTAB Flow Conditioners, are subject to clogging or fouling in industrial applications.

The patented VORTAB® technology provides unmatched performance with little pressure loss and swirl-free, conditioned flow profile. It is the ideal partner for FCI's low pressure loss, centerline mounted single-point and equal area multi-point sensor technology.

**Economic, Flexible Installation** To meet industry's demand for installation flexibility, ease and economy, the FCI/VORTAB



**FCI/VORTAB Meter Run Flow Conditioner Configuration**

Flow Conditioning System is available in three configurations (see the outline dimension drawings on the back page):

**1.) Meter Run Configuration.** The Meter Run Configuration (VMR) offers a complete, simple pipe section replacement for new and existing piping systems. The VORTAB Flow Conditioner is precisely located three (3) diameters upstream of the FCI flowmeter port in a seven (7) (eight (8) with 2" pipe) diameters long built-in pipe section: A variety of end connections and pipe sizes from 2 to 12 inches (51 to 305 mm) are available.

**2.) Insertion Sleeve Configuration.** The Insertion Sleeve Configuration (VIS) allows for direct mounting in existing or specially sized pipe sections. The swirl and conditioning tabs are connected to a mounting sleeve that slides into the process piping. Attachment methods include welded-in-place or captured flange designs.

**3.) Field Kit Configuration.** The Field Kit Configuration (VFK) is designed for use in very large ducts and piping, square ducts and irregular shaped installations. The kit comes complete with separate profile conditioning and swirl reduction tabs that have been sized for the specific application. Complete instructions are included to permit easy, permanent field installation.

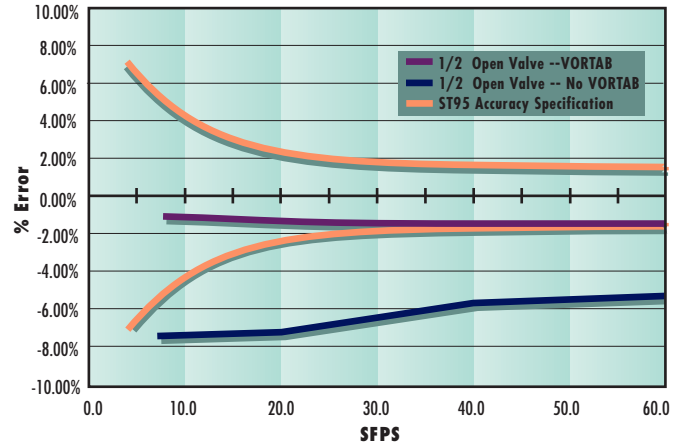
**Performance Improvement Highlights | 50% Gate Valve Closure Seven (7) Diameters Upstream of Metering Location.** Considered to be among the most difficult installation locations, a 50% gate valve closure produces severe flow profile distortions that vary in intensity throughout the flow range of the installation. Such flow profile distortions can produce severe flowmeter accuracy degradation. However, a highly accurate and reliable mass flow rate measurement can be achieved in this application with the installation of an FCI/VORTAB Flowmetering System.

The installation of a VORTAB Flow Conditioner downstream of the gate valve and three diameters upstream of the FCI Flowmeter as shown in Graph A, provides a virtually ideal flow profile for the FCI Flowmeter. Consequently, FCI's Thermal Mass Flowmeter is able to provide flow rate accuracy and repeatability approaching the performance characteristics associated with ideal installations that typically require up to four times more straight run.

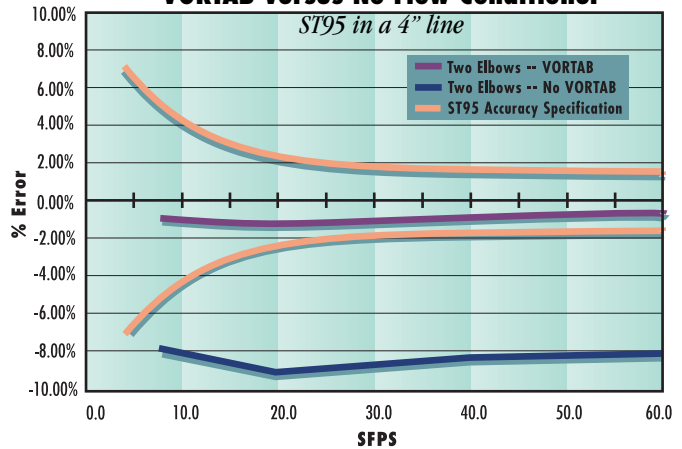
**Standard Elbow Seven (7) Diameters Upstream of Metering Location.** Frequently encountered in flowmeter installations, elbows and double elbows (either in-plane or out-of-plane) can produce flow profile irregularities that limit flowmeter accuracy and repeatability. As demonstrated in Graph B, a VORTAB Flow Conditioner used in conjunction with an FCI Mass Flowmeter revolutionizes flowmeter performance for this difficult installation. The result is exceptional instrument accuracy, repeatability and reliability.

For tough applications with flow profile distortions ranging from subtle to severe, depend on the teamwork of proven industry leaders FCI and VORTAB -- a smart partnership built for industry leadership.

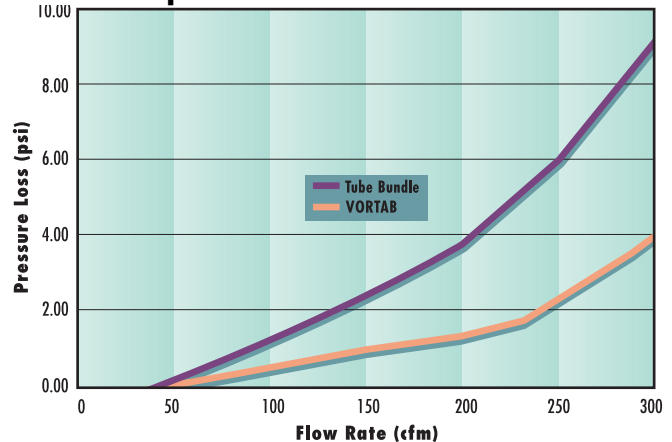
**Graph A: 1/2 Open Disturbance -- VORTAB Versus No Flow Conditioner**  
ST95 in a 4" line



**Graph B: Two Elbow Disturbance -- VORTAB Versus No Flow Conditioner**  
ST95 in a 4" line



**Graph C: Pressure Loss Versus Flow Rate**



**$\Delta P$  Equation** for Air at Standard Conditions (60°F, 0 psig):

$$\Delta P = 6.8 \times 10^{-5} \times \frac{Q^2}{D^4} \text{ or } 3.36 \times 10^{-6} \times \frac{M^2}{D^4}$$

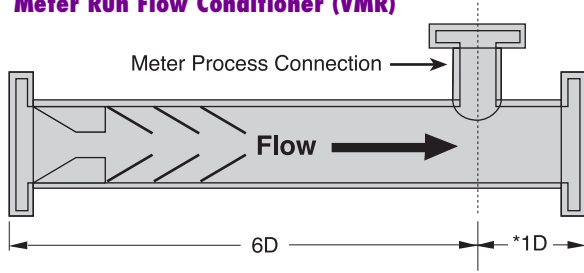
**$\Delta P$  Equation** for Water:

$$\Delta P = 5.66 \times 10^{-2} \times \frac{Q^2}{D^4} \text{ or } 4.04 \times 10^{-9} \times \frac{M^2}{D^4} \text{ or } 1.01 \times 10^{-3} \times \frac{G^2}{D^4}$$

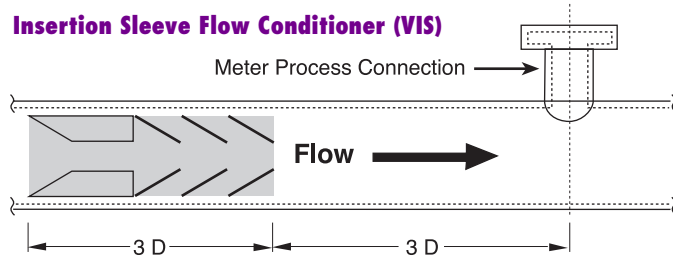
Where  $\Delta P$  is in pounds per square inch (psi);  $Q$  is the volumetric flow rate in cubic feet per minute (cfm);  $M$  is the mass flow rate in pounds per hour (lb<sub>m</sub>/hr);  $G$  is the flow rate in gallons per minute (gpm);  $D$  is the inside pipe diameter in inches.

## FCI/VORTAB Flow Conditioner Specifications

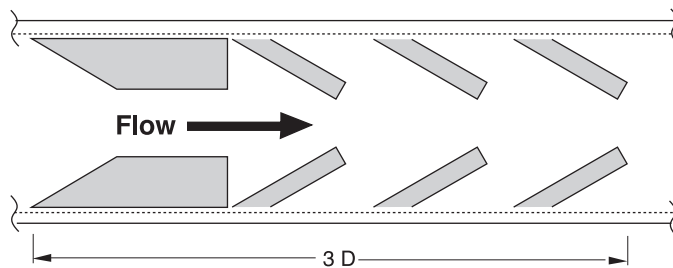
### Meter Run Flow Conditioner (VMR)



### Insertion Sleeve Flow Conditioner (VIS)



### Field Kit Flow Conditioner (VFK)



D = Nominal Pipe Diameter

\*2D used for 2" size with flanged meter process connection.

### Application:

High accuracy air and gas flow measurement in applications with irregular flow profiles and minimum upstream runs of piping or ducting.

**Meter Run Flow Conditioner (VMR):** A pipe section replacement (spool piece) that includes an FCI flowmeter mounting connection.

**Insertion Sleeve Flow Conditioner (VIS):** An assembly that slides into existing or specially sized pipe sections.

**Field Kit Flow Conditioner (VFK):** A set of swirl reduction and profile conditioning tabs.

**Material of Construction (for all models):** 316L stainless steel, carbon steel, Hastelloy C-276, or other materials of construction available.

### Maximum Flow Velocity:

> Air: 300 ft/sec [91 m/sec]

> Water: 30 ft/sec [9.1 m/sec]

(Consult factory for applications that exceed these limits.)

### Meter Run Flow Conditioner:

**Pipe Size:** Standard sizes of 2, 3, 4, 6, 8, 10 and 12 inch diameter configurations. Larger sizes are available.

**Pipe Schedule:** Schedule 40 or 80 are standard, not limitations.

**Process Connections:** Weld preparation, NPT through 4 inch sizes, or flanged (Customer supplied or ANSI 150#, 300#, or 600# serrated with raised faces).

**Flowmeter Connection:** Female threaded (3/4, 1, or 1-1/4 inch NPT), 1-1/4 inch male threaded NPT, or flanged (1-1/2 inch ANSI 150#, 300#, or contact manufacturer for special flange sizes).

**Meter Run Length:** 7 pipe diameters (except the 2 inch size with flanged meter process connection, which is 8 pipe diameters).

### Insertion Sleeve Flow Conditioner:

**Pipe Diameter:** Customer specified from 0.87 to 48 inches [22 to 1220 mm].

**Attachment Method:** Welded-in-place or captured flange.

**Flow Conditioner Length:** 3 pipe diameters.

### Field Kit Flow Conditioner:

**Nominal Pipe/Duct Size:** 36 inch [914 mm] and larger.

**Attachment Method:** Welded-in-place.

**Flow Conditioner Length:** 3 pipe diameters.

**Note:** Contact FCI for custom configurations.

## FCI's Instrument User's Protection Plan

**Guaranteed Performance.** FCI guarantees performance of its entire product line -- including the FCI/VORTAB Flowmetering System, mass flowmeters, flow switch/monitors, and liquid level and interface controllers -- in accepted applications or your money back.

**1-Year Warranty.** FCI warrants its products against faulty

materials or workmanship for one full year from the date of delivery to the buyer. (Ask for a copy of our complete warranty.)

**Customer Service.** FCI commits itself to providing prompt, 24 hour customer service including expedited field service and repair support, and toll-free factory service.



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FCI is ISO 9001:2000 and AS9100 certified