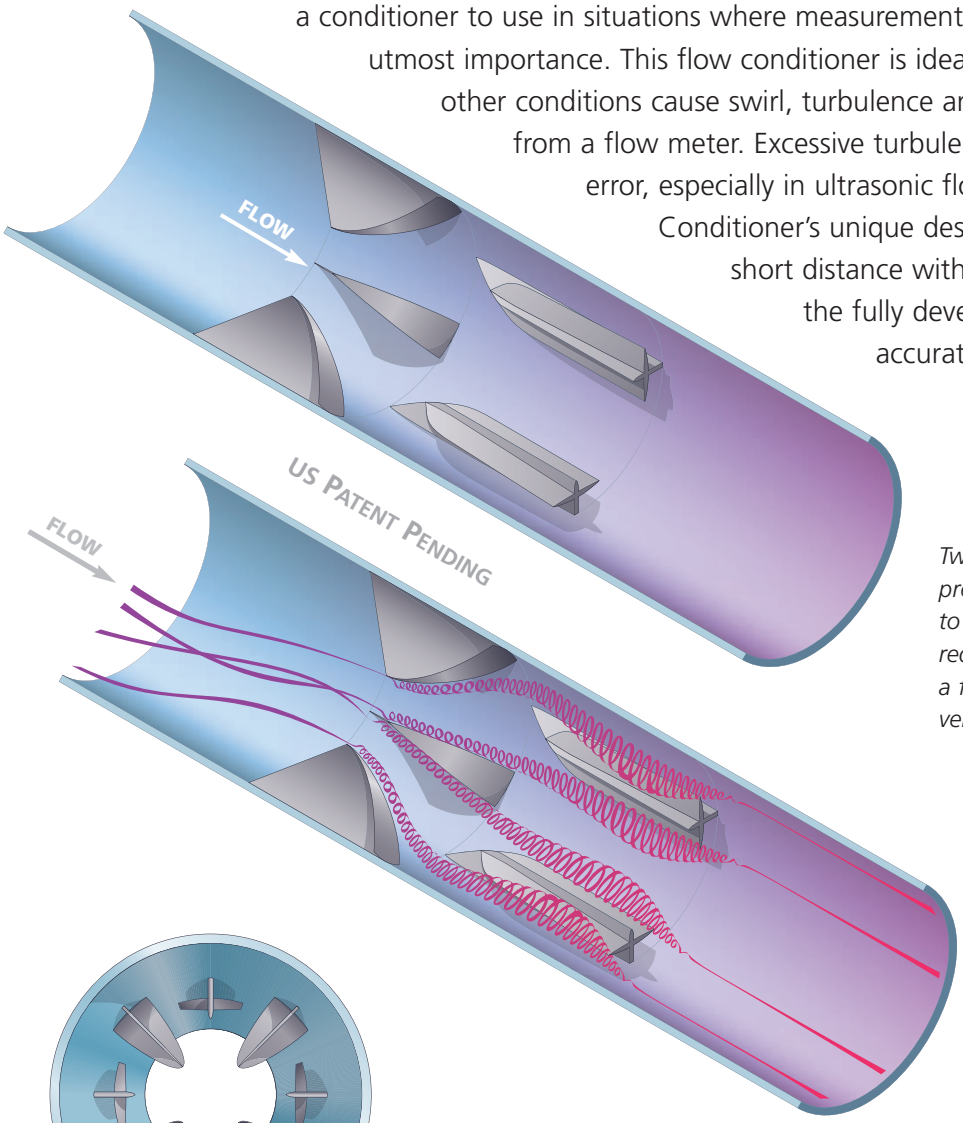
WESTFALL

Model 3000
Flow Conditioner

● US Patent Pending

Achieve Fully Developed Velocity Profile with Minimal Headloss

Westfall developed the Model 3000 Flow Conditioner in response to a customer's request for a conditioner to use in situations where measurement accuracy and low headloss were of utmost importance. This flow conditioner is ideal for situations where pipe bends or other conditions cause swirl, turbulence and mal-distribution of flow upstream from a flow meter. Excessive turbulence can be a cause for measurement error, especially in ultrasonic flow meters. The Westfall 3000 Flow Conditioner's unique design straightens out the flow over a short distance without significant headloss, creating the fully developed velocity profile necessary for accurate measurement.



Two sets of tapered and curved vanes with precisely designed geometry are positioned to eliminate swirl and turbulence without reducing the high velocity core essential to a fully developed velocity profile – all with very little headloss.

Westfall's Flow Conditioner Model 3000 conditions turbulent flow quickly for improved flow meter accuracy. It addresses mal-distribution by inducing a small amount of pressure loss, and turning the flow "inside-out" so that momentum is fully exchanged across the flow stream.

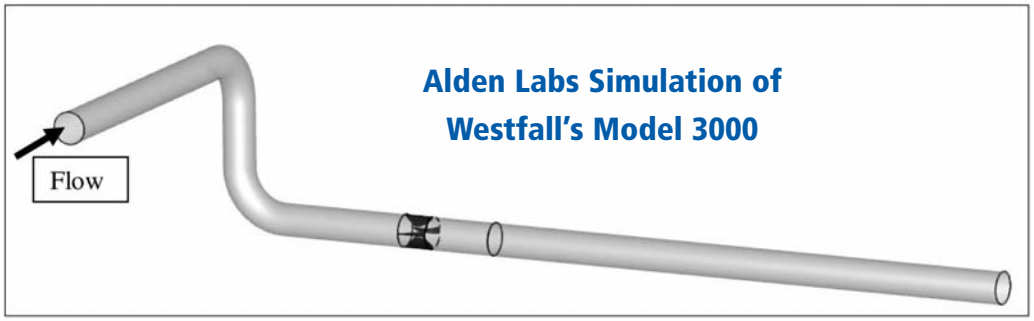
Cross section of Westfall 3000 Flow Conditioner

Jet Fighter Planes Inspired the Design

The design was inspired by the aerodynamics of jet fighter planes, whose geometry has to control turbulence to keep the planes aloft, straight and fast. The conditioner employs two kinds of vanes to do the work. The first vanes create vortices that mix the flow by turning it "inside-out," and suppress swirl. The second set of vanes, shaped like airplanes, condition the vortices from the first set of vanes for a fully developed, non-swirling flow.

Advantages

- Creates ideal conditions for accurate flow measurement, reducing flow meter error
- Provides fully developed velocity profile within 6 diameters
- Creates minimal headloss – $^{2}/_{3}$ less than other conditioners
- Eliminates swirl induced by out-of-plane pipe bends
- Minimizes turbulence regardless of flow conditions or mal-distribution upstream
- Saves space with short installed length
- Can be fabricated from PVC, FRP, 316 Stainless Steel, with or without Teflon coating, and any other engineering materials to meet industry needs.
- Is available in pipe diameters from $^{1}/_{2}$" to 120"
- Low cost, easy installation
- Long service life and low maintenance requirements



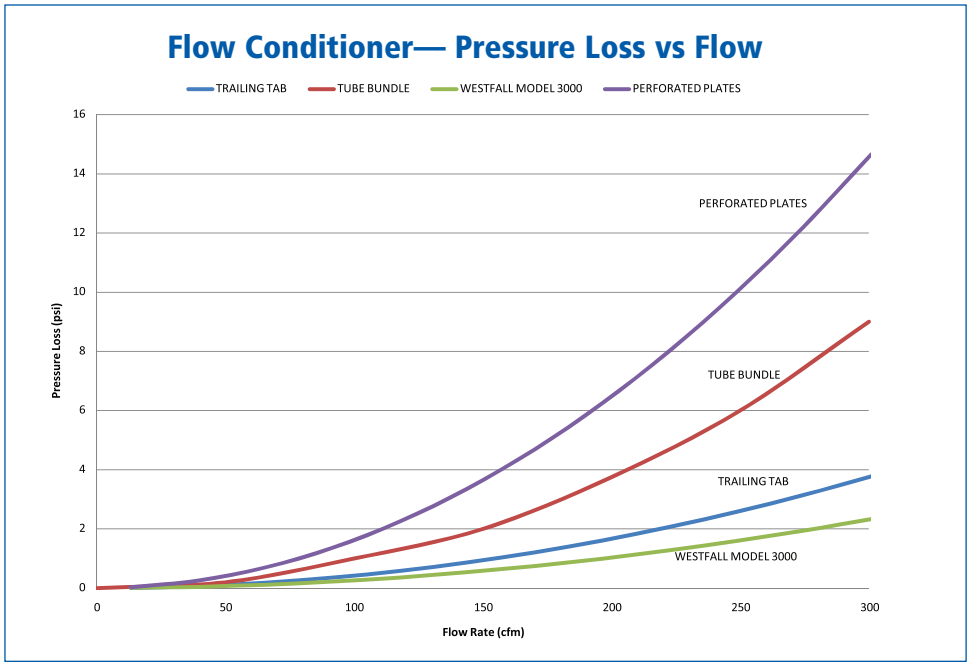
Air flow in a 6-in Sch40. steel pipe, after two out-of-plane 90° bends. The flow conditioner is installed 4D downstream of the second bend.

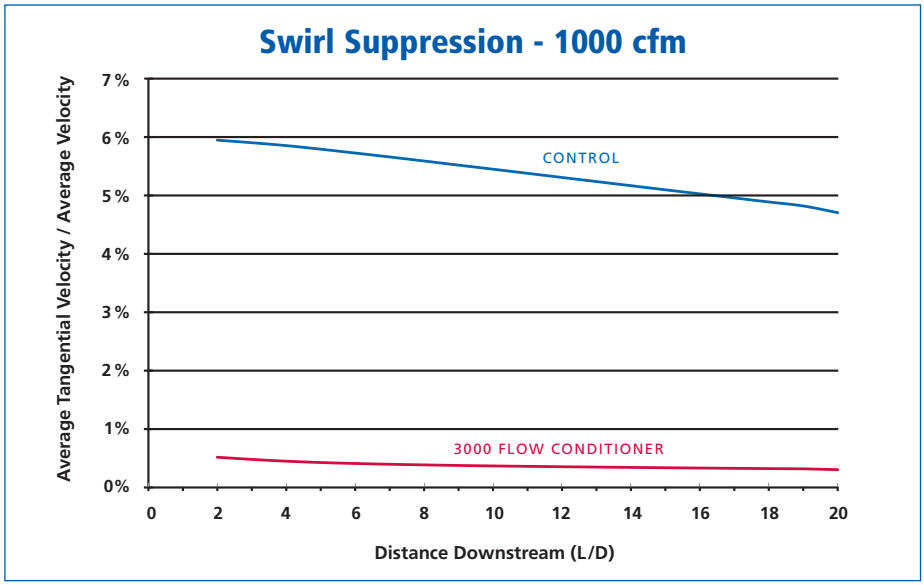
Westfall Innovates Others Imitate

VALUE K= .579

Headloss 2/3 Less Than Others

Pressure loss vs. flow rate of the Westfall 3000 Flow Conditioner compared to other devices. The Model 3000 offers significantly less pressure loss than its competition.





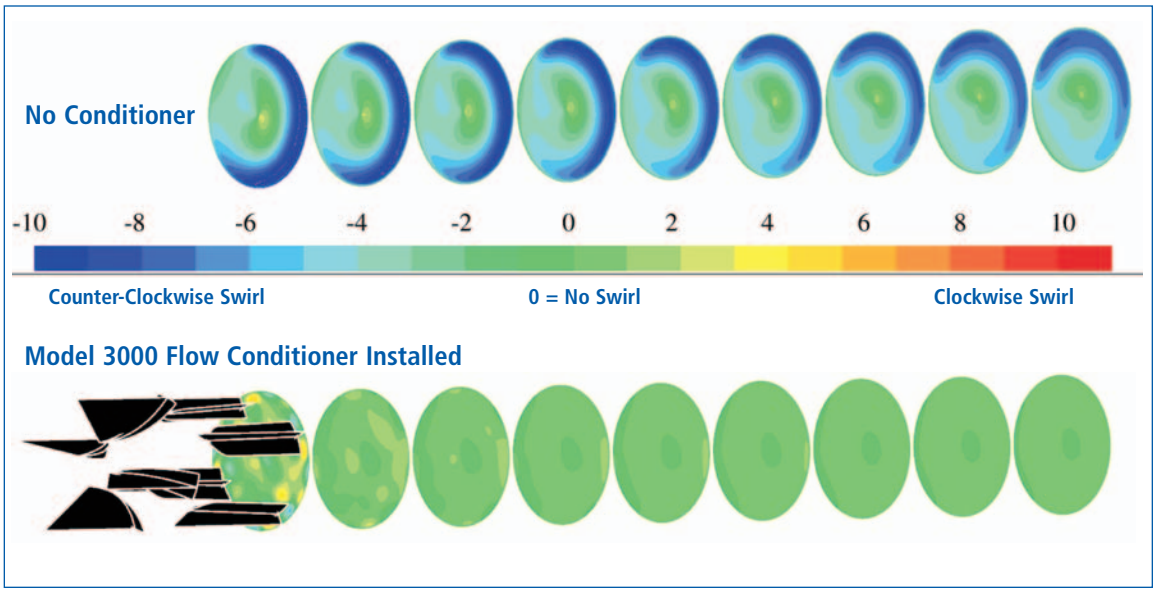
Conditioner Eliminates Swirl within Two Diameters

Tangential velocity is reduced to less than $^1/_2$ %.

Westfall Innovates Others Imitate

Alden Research Laboratory, Inc. performed numerical simulations using the CFD software package FLUENT V6.3.26, a state-of-the-art, finite volume-based fluid flow simulation package, to calculate the three-dimensional, incompressible, turbulent flow through the pipe and around the flow conditioner.

They simulated 1000-cfm air flow in a 6-in Sch40 steel pipe, after two out-of-plane 90° bends. The flow conditioner is installed 4D downstream of the second bend.



Contours of Tangential Velocity (ft/s) for distances 2-10 D downstream of the flow conditioner inlet

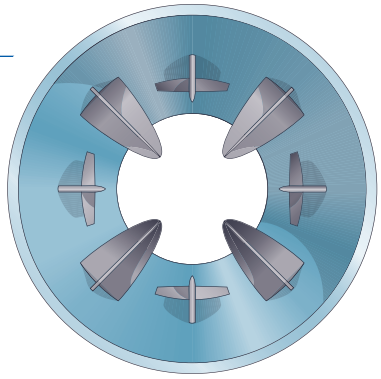
Model 3000 Flow Conditioner Creates Fully Developed Velocity Profile within Six Diameters

Beneficial Flow Characteristics
Reported by Alden Research Laboratory

- Two strong counter-rotating vortices are generated at the edges of the primary tabs in the bulk flow away from the wall. These vortices very quickly exchange momentum between the flow at the center of the pipe with the flow at the wall.
- The vortices quickly migrate to the wall in the wake of the primary tabs due to the tab angle, and the vortex pair's close proximity to each other. Once attached to the wall, the vortices quickly decrease in intensity due to high shear stress at the pipe wall, through which rotational momentum is lost, and excessive turbulence is dissipated.
- Radial fins that effectively eliminate swirl near the pipe walls, where rotational inertia is greatest.
- Relatively low pressure loss associated with this device (0.94 inwg with ambient air at 1000 acfm in a 6" pipe, or a k-value of 0.57).
- Tapered leading edges and other geometric features that prevent fouling.
- Secondary tabs located downstream of the primary tabs that eliminate the trailing vortices and quickly establish a radially symmetric fully developed velocity profile.

— Kimbal Hall

For full report data: westfallmfg.com/alden



Cross section of Westfall 3000 Flow Conditioner

Typical Applications for 3000 Flow Conditioner

- Municipal and Industrial Water Treatment
- Potable Water
- Waste Water
- Gas Pipelines
- All Fluid Flow Measurement Applications

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Westfall Manufacturing Company