

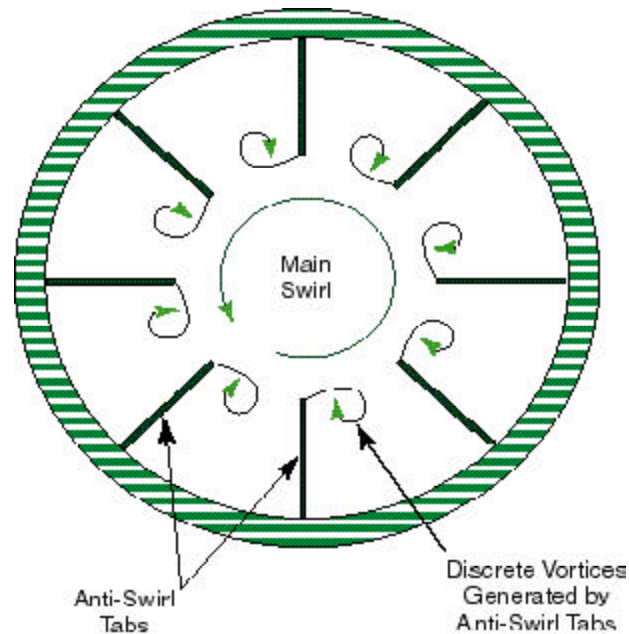


# VORTAB FLOW CONDITIONERS

## Illustrated Principles of Operation

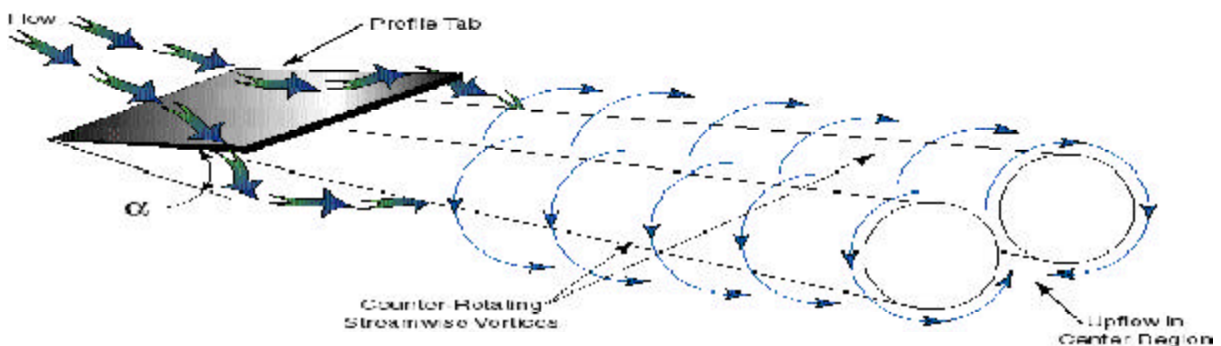
### Process of Swirl Cancellation

Swirl reduction and velocity profile correction occur naturally in long lengths of straight pipe due to diffusion and turbulent mixing. The VORTAB Flow Conditioner uses a series of radial and inclined traverse tabs projecting, from the conduit's inner surface to generate vortices that accelerate and amplify these natural pipe effects. Eight swirl reduction tabs are uniformly spaced around the pipe's circumference with their long axes oriented streamwise. The presence of swirl causes discrete vortices to be generated by each of these swirl tabs. These vortices are opposite the main swirl circulations and the cancellation of opposing forces quickly causes essentially non-swirling flow.



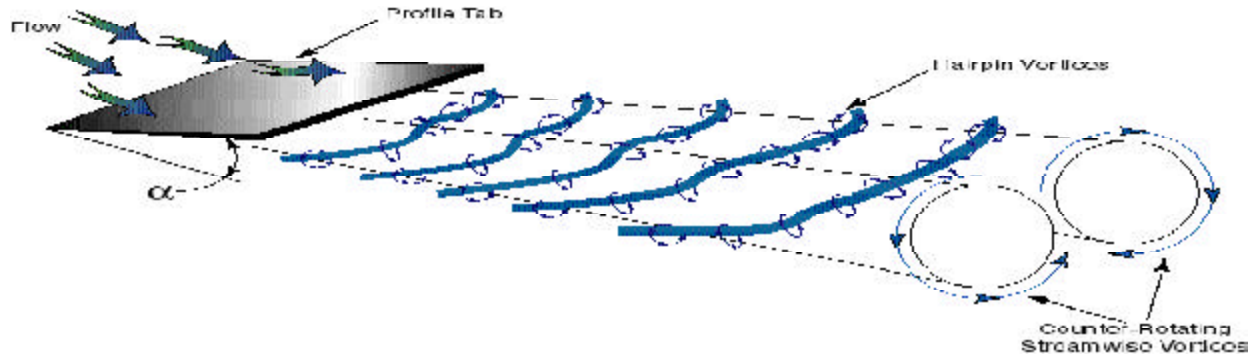
### Counter-Rotating Streamwise Vortices

Immediately following the swirl tabs are a series of profile tabs. Counter-rotating streamwise vortices attached to the conduit's wall are formed in the wakes of the profile tab's corners. Media is pulled toward the conduit wall by a sharp pressure gradient generated by the profile tabs. An upflow in the center region of the counter-rotating streamwise vortices is generated and spirals downstream with the axes of these vortices parallel with the profile tab.



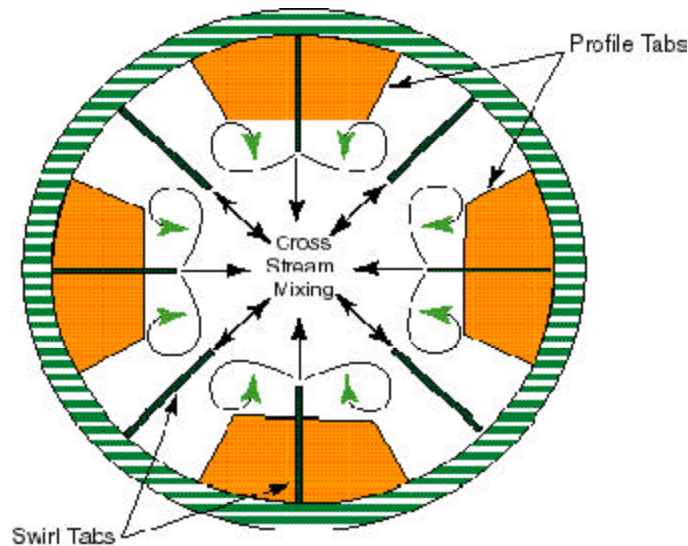
## Generating Hairpin Vortices

The tabs also shed transient hairpin-like vortices which move downstream along with the counter-rotating streamwise vortices. A high shear region at the edge of the tab generates a strong eruptive flow along its symmetry plane and pumps media into the hairpin vortices. Legs of the hairpin vortex entrain free-stream media into the mixing wake of the profile tabs.



## Profile Tab Flow Pattern

As hairpin vortices merge, the boundary layer thickens. The media is either expelled into the hairpin vortices or continues to spiral downstream in the counter-rotating streamwise vortices. The result is a vigorous cross stream mixing which rapidly mixes faster velocity regions with slower regions. The mixing quickly produces a homogeneous (i.e., conditioned), reproducible velocity profile. In addition, uneven particulate distributions or temperature profiles are made more uniform through this process. Three sets of four symmetrically arranged profile tabs generate a turbulent intensity large enough to blend the media over the whole cross section of the conduit. Combining the swirl and profile tabs result in a flat, non-swirling profile which enhances flow meter accuracy and repeatability with minimal pressure



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