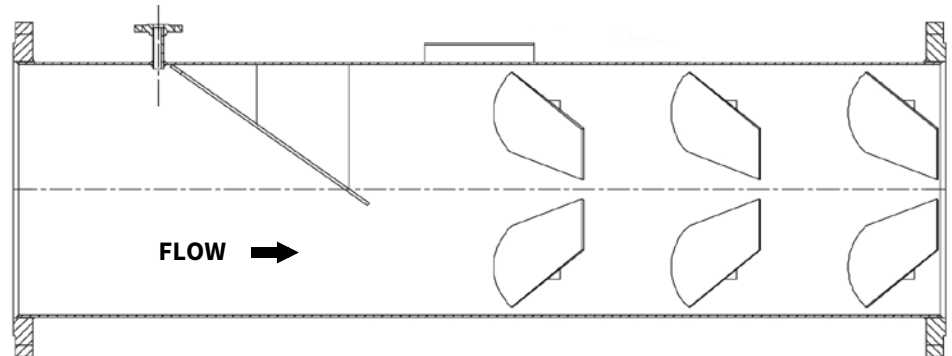


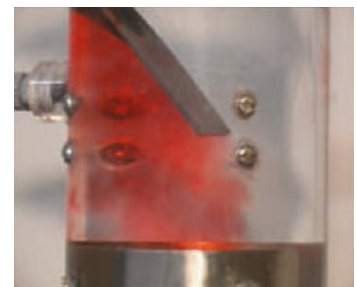
Kenics™ WVM Static Mixers for the Water Industry

The Kenics Water Vortex Mixer (WVM) builds on the HEV static mixer to offer more flexibility for differing flow conditions and improved additive injection. Three different WVM designs are available. These allow the project design parameters of length and pressure drop to achieve a certain CoV within a certain time to be optimized.

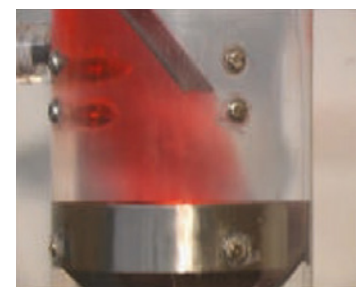


The WVM mixers consist of a simple wall additive injection point, a pre-distribution tab immediately downstream of the injection point and banks of trapezoidal shaped mixing elements. The number of banks of mixing elements varies depending on the mixture quality required for the process. The dimensions, angle of attack and spacing of the trapezoidal mixing elements varies between the WVM models A, B and C. The pre-distribution tab and the injection point design are the same for all WVM models.

The pre-distribution tab was shown to improve quantifiable mixture quality (CoV) by at least 10% over a wide range of flow rates compared to the use of a multihole sparger injector. The improvement in mixing at low Reynolds number (velocity 0.1 m/sec) conditions was the greatest.



Reynolds number 10,000



Reynolds number 100,000

Visual modeling of the dispersion of red dye into water using the WVM pre distribution tab.

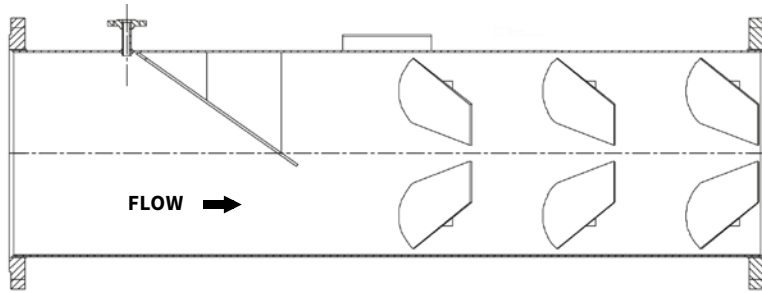
WVM Pre-distribution Tab

The pre-distribution tab was visually modeled and optimized in Chemineer's laboratory before being modeled again using CFM (Computation Fluid Mixing) software. Additives injected at the wall of the pipe are spread into a horseshoe shape by the pre-distribution tab.

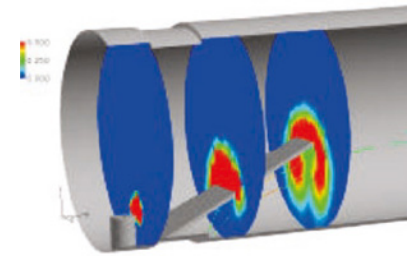
Use of the pre-distribution tab allows the simplest of injectors to be used – either a flanged nozzle or a threaded boss to which the chemical injection line can be connected. An injection fitting with shut off device can also be fitted to the wall mounted boss if required.

Model	Pressure loss	Length to achieve mixture quality (CoV) of 0.05 (5%)
WVMA	Highest	Shortest
WVMB	Medium	Medium
WVMC	Lowest	Longest

CoV = Coefficient of Variation, or σ/x is the standard deviation of additive concentrations in any samples divided by the mean mixed concentration of the additive, a commonly used and quantifiable measure of mixture quality.



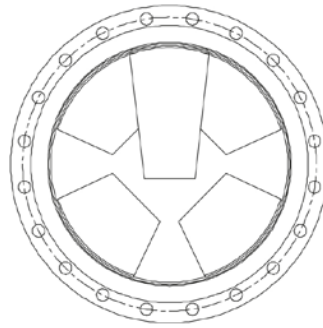
Typical WVM arrangement



CFM model showing distribution of additive from wall injection point

WVM mixing elements

The banks of WVM mixing elements are arranged in line with each other but off centre with respect to the pre-distribution tab. The horseshoe shaped pre-distributed additive is then caught by the tips of the first bank of WVM elements and drawn into the axially oriented spinning vortices behind them. Each element creates two vortices and each bank therefore creates eight. The successive banks maintain and intensify vortices throughout the length of the mixer and for some length downstream.



End view down WVM mixer showing position of injection boss and pre-distribution tab relative to mixing elements

The Kenics WVM has the following key features:

- Simple wall injection point
- Optimization of length vs. pressure drop parameters to suit the application is now possible
- Improved performance at very low flow rates (0.1-0.3 m/sec)
- Lower capex and opex
- Test data validated by independent organization