MGNewell
We Make It Work Better.

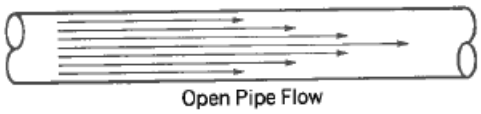



Mixing Basics

In basic terms, mixing is simply defined as blending two or more materials into one single product. The individual components, each with their distinct properties (composition, temperature, density, etc) are considered "mixed" when the final product reaches the maximum state of uniformity and all individual differences (temperature, density, etc) have been eliminated. Mixing is a critical process because the quality of the final product and its attributes are derived by the quality of the mix. Improper mixing results in a non-homogenous product that lacks consistency with respect to desired attributes like chemical composition, color, texture, flavor, reactivity, and particle size.

Often, the term "dispersion" is interchanged with mixing, however dispersion is defined as the combination of two materials into a final product in which there are still two separate materials. Examples include suspending solids in a liquid medium or emulsions (oil-water blends). Homogenizing is another form of intense mixing which literally means that all components are so thoroughly mixed that they are "made alike".

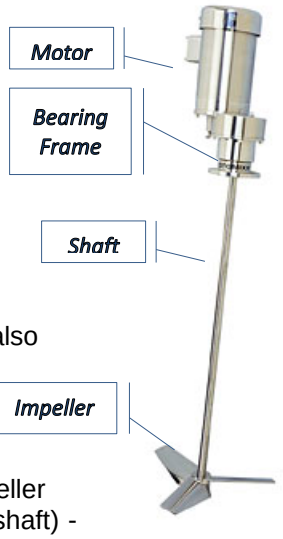
Mixing requires motion or flow to combine the individual components. Laminar flow is smooth parallel motion in layers along a boundary, i.e. water in a pipe. Turbulent flow is disturbed with local velocities and pressures that fluctuate randomly.


Open Pipe Flow


Disturbed Flow

How a Mixer Works

The principal behind a mixer is to provide an adequate amount of power to mix the products efficiently. The motor is the driving force that provides the power to drive and turn the shaft. The bearing frame provides support for the motor, coupling and shaft. In sanitary processing applications, the motor, housings and shaft are typically made of 316L stainless. This provides greater corrosion resistance and allows for complete wash-down during cleaning.



At the end of the shaft is the impeller or rotor. To increase mixing and pumping in a tank, several impellers may be arranged on a single shaft. The combination of the speed of the shaft rotation and the orientation and type of blade pumps the liquid to provide mixing or flow of the product.

Impellers are classified into two types, axial and radial, depending on the angle that the impeller (also known as agitator) blade makes with the plane of impeller rotation. All impellers produce both fluid velocity and fluid shear, but different types of impellers produce different degrees of flow and turbulence.

· ***Axial Flow Impellers:*** The impeller blade makes an angle of less than 90° with the plane of impeller rotation. As a result the locus of flow occurs along the axis of the impeller (parallel to the impeller shaft) - e.g.: Marine Propellers, Pitched Blade Turbine

· ***Radial Flow Impellers:*** The impeller blade in radial flow impellers is parallel to the axis of the impeller. The flow draws from above and below the impeller and discharges it toward the tank wall (perpendicular to the impeller shaft) - e.g.: Flat Blade Turbine, Paddle, Anchor

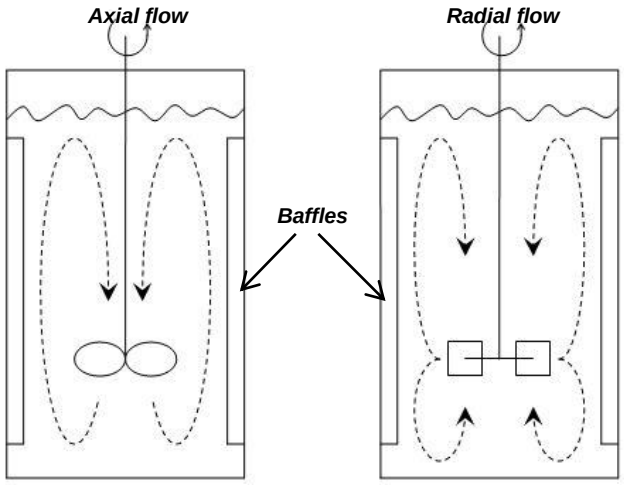
Greensboro Division / Corporate Headquarters
Phone: 336.393.0100 / 800.334.0231
Fax: 336.393.0140

Louisville Division
Phone: 502.459.7475 / 800.459.7475
Fax: 502.459.7633

Nashville Division
Phone: 615.822.3030 / 855.749.4820
Fax: 615.822.3031

www.mgnewell.com **sales@mgnewell.com** **espanol@mgnewell.com**

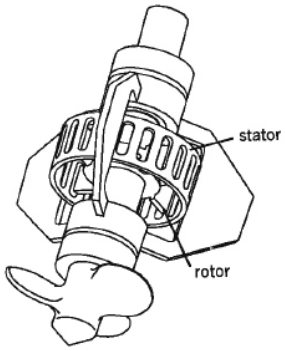
· ***Baffles:*** Long strips or flat blades attached to the inside tank wall either directly or on tabs. Baffles create turbulence and reduce vortexing or swirling. Baffles are recommended within tanks or kettles where the material is water-like or has a viscosity less than 500 cps.



Without baffles, a center vortex can form in the tank, and as a result, the liquid simply rotates around the vessel with very poor mixing between adjacent fluid levels. Swirling is **not** mixing. A vortex is normally not desired as it can increase the amount of air entrapped in the fluid.

In a situation where solids or powders must be mixed into a fluid, full baffles are not recommended.

Shear is a mechanical force that deforms or cuts a material between two blades. The term 'Velocity head' is interchangeable with shear in mixing terms. A high-shear mixer can be used to create emulsions, suspensions or dissolve granular products. They are commonly used for powders that tend to float on water, form "fish eyes", or granules that require particle size reduction.



A rotor/stator mixer is a common high-shear mixer used in sanitary processing. The rotor is a rotating impeller that rotates at a high speed to move the product from the inside to the outside through the stator. The stator is the stationary cage or shell with very close clearance to the rotor. A high-shear area is formed as the product is forced through the small clearances between the rotor and stator. This action reduces particle size and increases surface area for better wetting and/or dispersion.


Typical Static Mixer

Static mixers are not commonly found in sanitary processing but offer a low-energy mixing alternative for liquids that are easily miscible. It is used for continuous processing applications in which a tube or housing is fitted with baffles. The baffles may be constructed of stainless steel, Teflon®, PVC or other material.

As the product streams move through the tube, the baffles create a turbulent flow pattern. These mixers provide a uniform mixing option that is quick, economical and has no moving parts.

.