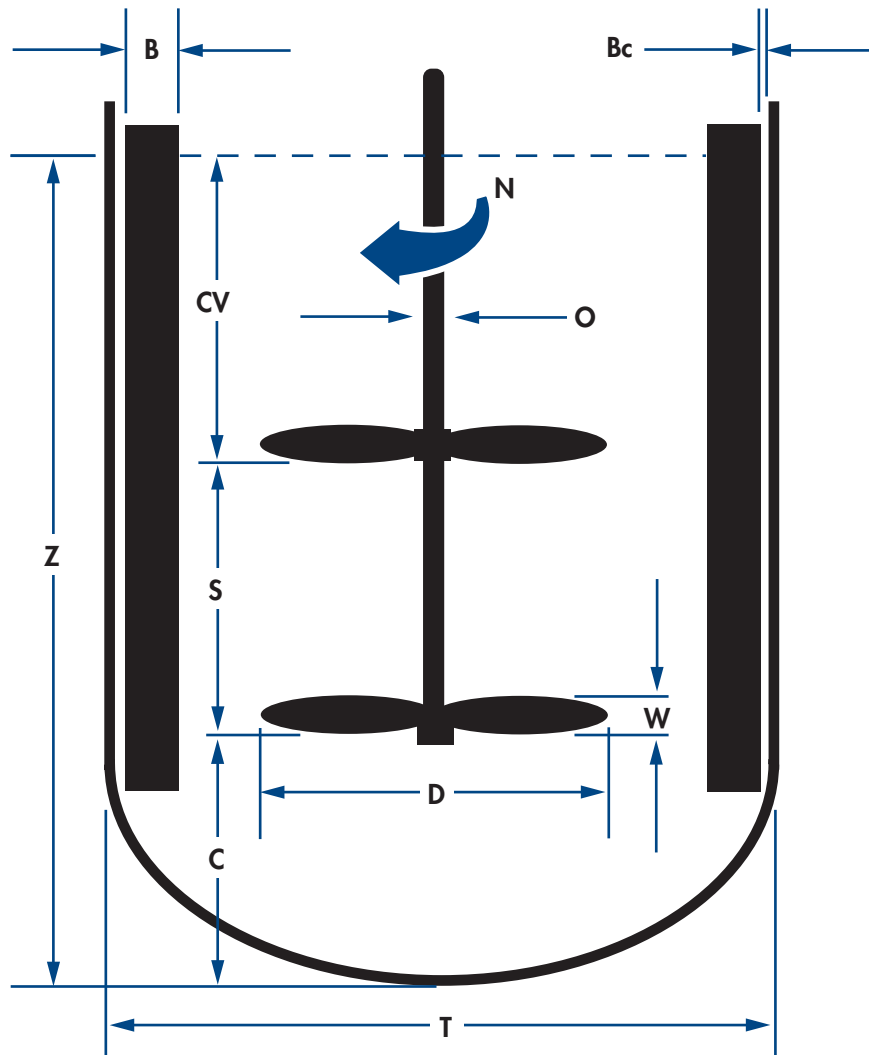


MUELLER® TURBINE MIXERS

The Perfect Mix



- Z = Liquid Product Height
- T = Inside Tank Diameter
- B = Baffle Width
- Bc = Baffle Wall Clearance
- C = Impeller Bottom Clearance
- S = Spacing Between Impellers
- CV = Impeller Liquid Coverage
- D = Impeller Diameter
- W = Projected Blade Height
- O = Shaft Diameter
- N = Shaft Speed

MUELLER®

PROCESSING SYSTEMS AND EQUIPMENT

Mueller Turbine Mixers...

AXIAL TURBINE

An axial flow impeller is used to promote a downward velocity profile important for:

- Blending of miscible liquids
- Solid suspension
- Promotion of heat transfer
- Incorporating dry powders into liquids

Figure A shows the flow pattern induced by an axial turbine. A predominant axial velocity component results as the fluid is drawn in from above the impeller and forced down to the bottom of the tank. From there the baffles assist in redirecting the fluid back up the tank walls, resulting in an efficient top-to-bottom turnover of the product with high flow rates and minimum shearing action. The interaction between upward and downward streams inherent in this rolling action is used to blend fluids with viscosities of up to 100,000 centipoise. Solid suspension is achieved when the rising velocity of the fluid is greater than the settling rate of the solids. By knowing the particulars of your product and process needs, Mueller can provide an efficient, economical solution.

AXIAL TURBINE AGITATION LEVELS

The table on the following page is based on a single axial flow turbine in a cylindrical tank with the product height equal to the tank diameter ($Z=T$) and a final product specific gravity of 1.0. Presented are possible combinations of horsepower and shaft speed required to achieve mild, medium, and vigorous levels of agitation for a range of tank volumes and final product viscosities. Heavier or more viscous products and different tank volumes and geometries are easily accommodated.

- **Mild Agitation**—Establishes complete batch motion with a flat fluid surface sufficient for maintaining product temperature or blending liquids with similar viscosities and specific gravities.
- **Medium Agitation**—The most common, it produces surface rippling at lower viscosities, decreases blend time, blends fluids with large differences in viscosity, and aids in heating or cooling.
- **Vigorous Agitation**—Produces surface surging at lower viscosities and is required when mixing time is critical or viscosity differences are great.

Often several combinations of impeller diameter and shaft speed, which in turn determine the required horsepower, will produce the same level of agitation in the same tank. The correct choice for a particular

application must be based on tank geometry, product characteristics, and cost considerations.

TURBINE MIXER

The top-entering turbine mixer is the most common form of agitation equipment used in the process industry. The turbine agitator is an open impeller that may be thought of as a centrifugal pump without a housing. The impeller is characterized by 4, 6, or 8 flat blades either pitched at a 45° angle (axial turbine) or in line with the axis of the shaft (radial turbine). Mueller incorporates these two common configurations, or any special variation that may be required, into a system to meet your particular process needs.

The flow pattern induced by a turbine contains three distinct velocity components: axial, radial, and tangential. The axial and radial components act parallel and normal to the shaft, respectively. They provide the flow and turbulence necessary for effective mixing. The tangential component produces a circular pattern or swirling effect, and must be broken through the use of baffles or off-center mounting of the shaft in order to provide a desirable flow pattern in the tank. The relative magnitude of each component is determined by the impeller type.

The type, number, and rotational speed of the turbine(s) is selected for your particular application and is readily adaptable to a wide variety of products, processes, and tank geometries. Mueller will provide the engineering and the complete agitation package and then install the system in your tank or ours—with a 100% guarantee of process results.

RADIAL TURBINE

A radial or flat blade turbine is used to promote a velocity profile for:

- Blending of immiscible liquids
- Gas dispersion
- Promotion of heat transfer

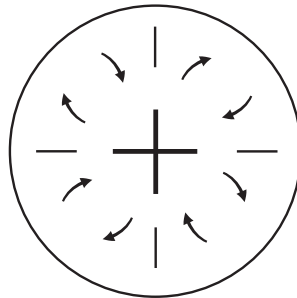
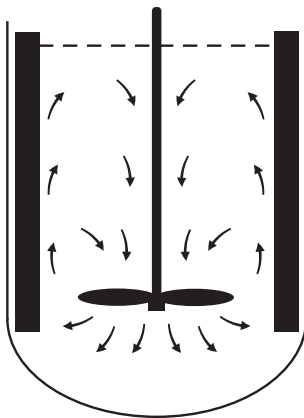
Figure B illustrates the flow pattern of a radial turbine. The fluid is drawn into the impeller area from both the top and bottom in an axial direction and then discharged radially to the tank wall. At the wall the fluid is directed down to the tank bottom and up to the fluid surface. The high shearing action which results as the flow is changed from axial to radial in the impeller zones is required for effective mass transfer in the processes listed above. Because more torque is needed to deliver this shear, the radial turbine consumes more power than an axial turbine.

TYPICAL HORSEPOWER/SPEED COMBINATIONS FOR AGITATION LEVELS TABLE

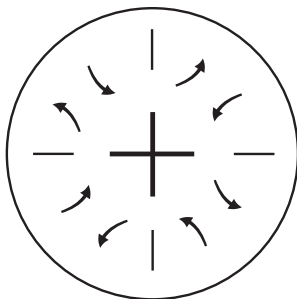
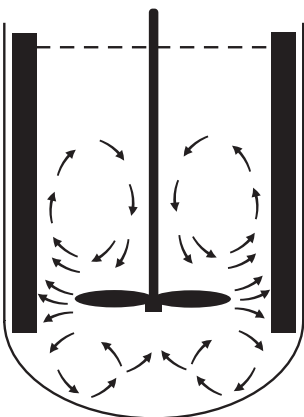
Viscosity (Centipoise)	Agitation Level*	Volume (Gallons)					
		250	500	1,000	2,500	5,000	10,000
100	A	1/2 hp-115 rpm	1/2 hp-115 rpm	1/2 hp-115 rpm	1/2 hp-69 rpm	1 hp-43 rpm	1 hp-43 rpm
	B	1/2 hp-115 rpm	1/2 hp-43 rpm	1 hp-69 rpm	1 1/2 hp-43 rpm	3 hp-43 rpm	5 hp-43 rpm
	C	1 hp-69 rpm	1 1/2 hp-69 rpm	3 hp-69 rpm	5 hp-43 rpm	15 hp-69 rpm	25 hp-69 rpm
500	A	1/2 hp-115 rpm	1/2 hp-115 rpm	1/2 hp-115 rpm	1/2 hp-43 rpm	1 hp-43 rpm	1 1/2 hp-69 rpm
	B	1/2 hp-69 rpm	1/2 hp-43 rpm	1 hp-43 rpm	3 hp-69 rpm	3 hp-43 rpm	7 1/2 hp-43 rpm
	C	1 1/2 hp-115 rpm	2 hp-69 rpm	3 hp-69 rpm	7 1/2 hp-69 rpm	15 hp-69 rpm	40 hp-115 rpm
1,000	A	1/2 hp-115 rpm	1/2 hp-115 rpm	1/2 hp-69 rpm	1 hp-69 rpm	1 1/2 hp-69 rpm	1 1/2 hp-43 rpm
	B	1/2 hp-69 rpm	1 hp-43 rpm	1 hp-43 rpm	3 hp-69 rpm	5 hp-69 rpm	10 hp-69 rpm
	C	2 hp-115 rpm	2 hp-69 rpm	3 hp-69 rpm	10 hp-69 rpm	20 hp-69 rpm	50 hp-115 rpm
2,500	A	1/2 hp-115 rpm	1/2 hp-69 rpm	1/2 hp-69 rpm	1 hp-43 rpm	1 1/2 hp-43 rpm	2 hp-43 rpm
	B	1 hp-115 rpm	1 1/2 hp-115 rpm	1 1/2 hp-43 rpm	3 hp-43 rpm	7 1/2 hp-69 rpm	15 hp-115 rpm
	C	3 hp-115 rpm	3 hp-69 rpm	5 hp-69 rpm	10 hp-69 rpm	20 hp-69 rpm	50 hp-115 rpm
5,000	A	1/2 hp-69 rpm	1/2 hp-69 rpm	1 hp-115 rpm	1 1/2 hp-69 rpm	2 hp-43 rpm	3 hp-43 rpm
	B	1 1/2 hp-115 rpm	1 1/2 hp-69 rpm	3 hp-69 rpm	5 hp-69 rpm	10 hp-69 rpm	15 hp-69 rpm
	C	5 hp-115 rpm	7 1/2 hp-115 rpm	7 1/2 hp-69 rpm	15 hp-69 rpm	25 hp-69 rpm	60 hp-115 rpm

*Agitation Levels: A = Mild, B = Medium, and C = Vigorous

Axial Turbine: Figure A



Radial Turbine: Figure B



Mueller turbine agitation systems offer a broad range of possibilities in providing a package that is right for you.

- Constructed of 304, 316, or special alloys; welded, ground, and polished to meet your specifications for cleanliness and sterility. Also available in bolted construction where allowed.
- Wide range of shaft speeds available with high quality, reliable gear reduction units sized to assure long life.
- Prime movers include AC and DC motors with a full range of enclosures including special wash down and explosion-proof units. Variable speed drives of mechanical or frequency control. Air and hydraulic motors also available.
- Vapor seals, high- and low-pressure stuffing boxes, and single- and double-mechanical seals.
- Pedestal mounting for standard ANSI flanges or truss mounting.
- Bottom steady guides and impeller stabilizers to reduce shaft whip and end play.
- Other agitation systems including scrapers, side and bottom sweeps, side-entering, dual motion, and custom designs. Contact your Mueller representative.

MUELLER SPECIALIZES IN SOLVING YOUR AGITATION PROBLEMS

Paul Mueller Company fabricates a broad range of agitation systems, all designed with performance in mind. Whether it be heavy-duty or lighter agitation systems, or for use in a sanitary application, the quality that made Mueller a major producer of stainless steel processing equipment is evident in every system.



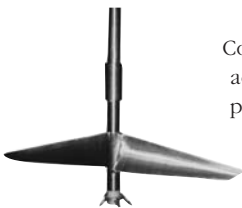
Side and Bottom Scrape

Designed to ensure complete scraping of sidewall and bottom with Polysulfone scraper blades eliminating product burn-on or freeze-on. Increases heat transfer efficiency by moving product across the heat transfer surface sidewall and bottom.



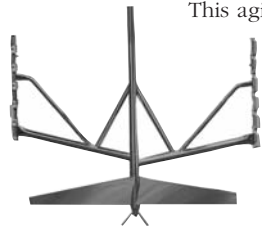
Side and Bottom Sweep

An anchor-type agitator consisting of bottom and side blades providing close clearance to the sidewall while promoting rapid heat transfer and reducing localized burn-on or freeze-on. This low speed agitator is also useful for processing shear sensitive product.



Bottom Sweep

Consisting of a large-diameter paddle sweeping across the tank bottom, lifting the product and pushing it ahead with a horizontal and vertical mixing action. Ensures thorough mixing and aids in unloading product.



Side Scrape and Bottom Sweep

This agitation system combines a low-level sweep paddle with a circumferential scraper. The cupped bottom blade ensures a homogenous product mix and an even temperature distribution while Polysulfone scrapers continually expose new product to the sidewall, providing rapid heat transfer and eliminating film buildups which might burn or freeze on the sidewall surface.



Side-Entering Agitator

Consists of a direct-drive horizontal propeller which provides thorough bottom to top pumping of product. This provides a gentle mixing of light- and medium-bodied products, assures good heat transfer, and ensures an adequate blending of liquids.

Ribbon Blender

Triple-action agitation ensures thorough blending and mixing with capacities from 13 to 106 cubic feet. Product is moved simultaneously in opposite directions while the mixing action of the ribbons moves the product across the heat transfer surface completing the blending or heat transfer process.



Dual Motion

Provides fast, efficient blending and heat transfer through the combination of a slow speed scraper and a higher speed turbine assembly, rotating opposite each other. Designed to ensure complete movement of viscous product in the tank, not just in the area of the impeller.



Portable Mixer

Utilizing single or dual, high-flow propellers driven directly or through a 5:1 gear box, these mixers are applicable to a wide range of products and tank volumes. The universal clamp mounting makes them ideal for most simple open tank mixing problems.



Vertical Offset

These agitation systems incorporate multiple paddles or turbines in an off-center tank mounting. This configuration eliminates the need for baffles and guarantees thorough top-to-bottom pumping of product, producing complete movement of the entire body of product in your tank. This agitation system is ideal for applications in a tank with a height-to-diameter ratio greater than one to one.



CUSTOM AGITATION SYSTEMS

Along with our "standard" agitation system, our expertise in solving agitation problems can result in solutions for your company. Whatever the need, our staff will work with you to isolate and solve the problem.

MUELLER®

P.O. Box 828 • Springfield, Missouri 65801-0828, U.S.A.
Phone: (417) 575-9000 • 1-800-MUELLER • Fax: (417) 831-3528
www.muel.com • Email: processing@muel.com