

# ADMIXTURE

The Newsletter of Mixing Technology for Sanitary Processors

VOLUME 7, NUMBER 1

## Are All High Shear Mixers Created Equal?

### ABSOLUTELY NOT!

Since their introduction many years ago, true high shear mixers (versus simple radial blades turning at high speed), have always been a powerful and rapid method for dispersing and emulsifying liquids and liquid/solid formulations. Starting with saw tooth disc impellers, followed by the introduction of rotor/ stator mixers, and more recently evolving into single piece stators, high shear mixers have always provided excellent shear capabilities, but most provide only moderate flow and pumping.

As illustrated by the table below, one of the major improvements in both the Admix Rotosolver and Rotostat designs is the ability to generate very high flow rates in addition to high shear rates. The result is substantially more throughput of material driven through the mixing head, increasing the turnover rate of the batch many more times a minute relative to competitive equipment. This in turn allows more work and shear to be provided to the formula to quickly and completely disperse and reduce all particles and droplets.

### HOW DO WE RATE?

This table quantifies the pumping rate and batch turnover rates of the leading high shear mixers for a typical 250 gallon batch.

MIXER	Hp	Head Size	Tip Speed (ft/sec)	Flow Rate* (gpm)	Turnover Rate (turns/min)
Rotosolver®	5	3.5"	52	1255	5.0
Rotostat®	5	3.2"	48	1111	4.4
Type "ST"	7.5	4"	63	420	1.7
Type "G"	10	3.8"	58	300	1.2
Type "R"	10	4"	63	260	1.0
Type "AB"	7.5	3-7/8"	61	235	.94
Type "S"	7.5	4.25"	66	160	.64

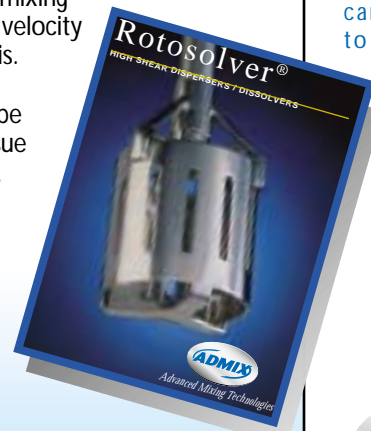


### THE TOTAL PICTURE:

To fully qualify the expected degree of mixing of any high shear device, parameters beyond pumping and turnover rate are necessary.

Peripheral tip speed, cutting action, and shear rate must also be considered along with an "Intensity" factor which relates to bulk fluid velocity. A tip speed of 40 feet/second is generally adequate for most high shear applications (all of the units shown below exceed that value). Shear rate is often difficult to quantify for some mixer designs, but it is generally agreed that all of the high shear mixers listed will provide particle sizes in the 5-25 micron range, with some models approaching 1 micron.

The "Intensity" factor developed by Admix provides a useful measurement of the expected "degree of mixing" based on a bulk fluid velocity and mass flow analysis. More information on Intensity factors will be in the next issue of Admixture.



\* Information shown obtained from company's literature or actual testing. Flow is for waterlike viscosity (under 10 cps).

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This issue focuses on high shear mixing technology and how you can apply its advantages to your process!



# WINTER

## Admix Product Pick: Rotosolver® Dispersers

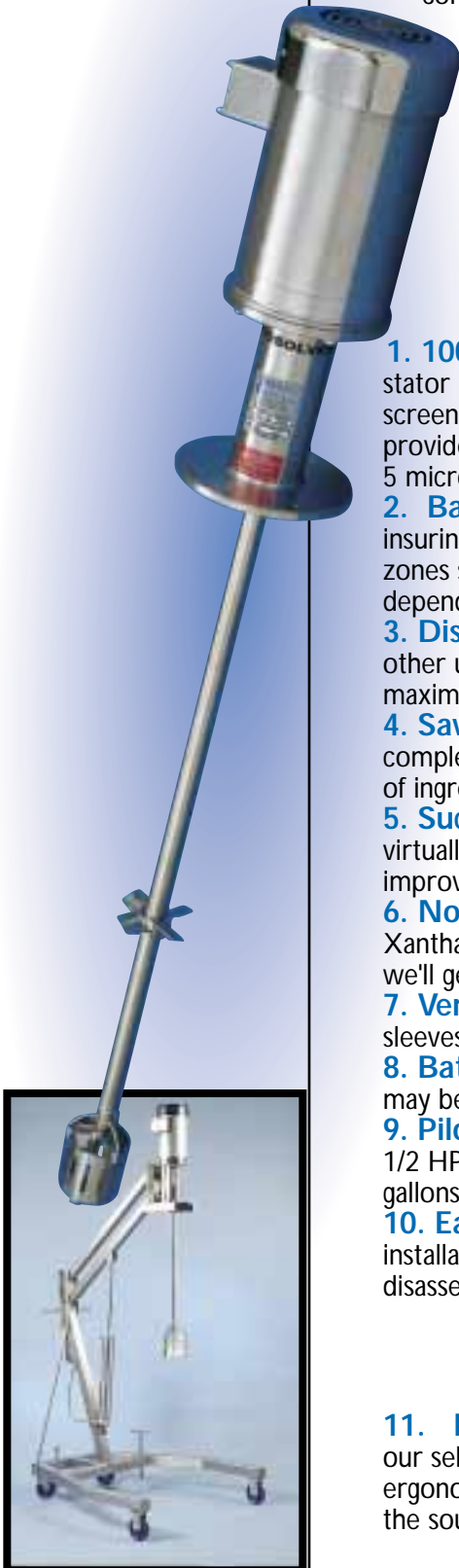
If your production line requires a mixing device which promotes intense vortex control, superior wetting out of powders, and a 3A approved easy to clean head design, the Rotosolver disperser may be the solution. The Rotosolver is a top entry mount, USDA certified high shear mixer with the following advantages:

### Ten ways to improve your formula...and reduce your workload!

- 1. 100% Consistent and Homogenous Blends.** A unique one-piece stator head with integral high flow airfoil blades eliminates the need for multiple screens to achieve the desired results. This single design will consistently provide a 100% homogenous mixture with average droplet sizes under 5 microns.
- 2. Batch Times Under 10 Minutes.** Superior flow and tank circulation, insuring that all process materials and ingredients are exposed to high shear zones several times a minute. Mix times from 2 to 10 minutes are typical depending upon the viscosity and solids level.
- 3. Disintegrate fisheyes.** Completely eliminates lumps, fisheyes, and other unprocessed agglomerates to insure consistently smooth mixtures with maximum usage and functionality of expensive ingredients.
- 4. Save big bucks on ingredients.** The Rotosolver is so effective and complete in powder blending utilization that most plants can reduce their cost of ingredients by more than 10%.
- 5. Suck in Floating Powders.** The strong vortex action of the Rotosolver virtually instantaneously pulls down all powders from the surface, dramatically improving dispersion and hydration of ingredients.
- 6. No Gum Too Tough.** Whether you are processing with Guar, Acacia, Xanthan, Arabic, Methocel, CMC, Food Starch, Maltodextrin or Carageenan, we'll get it in quickly and fully hydrated.
- 7. Very low maintenance.** Absolutely no wearing parts such as bushings or sleeves in the product zone.
- 8. Batch size versatility.** Ideal for low level operation where small batches may be desirable.
- 9. Pilot Plant to Production Models.** A complete range of sizes from 1/2 HP benchtop lab units through 100 HP production models for up to 3000 gallons.
- 10. Easy mounting and cleaning.** Detachable mixing head simplifies installation and cleaning. An optional shaft coupling further eases mounting and disassembly.

### .....and our Bonus Advantage...

- 11. Handle, Convey and Feed your ingredients with ease.** With our selection of Optifeed, Fastfeed and VacuShear feed systems, we offer ergonomic, low dusting or dust free methods of getting your powders from the source to the mix station, with minimal aeration and maintenance.



# Lets Get Technical! Successful Scale-Up of High Shear Mixers

Scale-up of mixing machinery has become a key issue with sanitary processors as development times have been reduced, and new products are brought to market at very quick speeds. Testing formulations in small beakers or 5 gallon pails is often the only testing done on some products, and a leap of faith is taken that the process will scale to large tanks with similar results. Admix recently released a 5 page Technical Report detailing how to succeed with the scale-up of mixers from a 3 liter beaker right up to a 1000 gallon (or larger) production vessel. This column is an excerpt of the full article and focuses on scaling of high shear only. Scale-up of high shear mixers is a particularly challenging issue as many of the variables typically observed with low speed agitators do not apply. The most critical parameters that may be used for conducting small-scale tests and resizing similar machinery for the full-scale application are as follows in order of importance:

## 1. Intensity

Is related to Bulk Fluid Velocity as practiced by some agitation companies, and is expressed in feet per second. Intensity takes into account the process fluid velocity, pumping rate, volume of the vessel, and the distance traveled by particles or molecules in the batch. Intensity values can range from a low of 3 to a high of 30, with an average value from 8 to 12. These "average" values roughly equate to bulk velocities in the 40 to 60 fps range, considered quite vigorous for low speed agitation.

*Helpful Hint: If no other parameter was available, scaling the Intensity would provide a better than 90% success in the full scale.*

## 2. Tip Speed

Tip speed is the peripheral velocity of the mixing head,

as opposed to the bulk fluid velocity. Most high speed mixing applications can be completed with a tip speed of 35 to 60 fps. Tip speed only considers the speed of the mixer and the rotor diameter, and ignores the impact of viscosity, volume, and specific gravity on fluid behavior. For this reason tip speed is a useful tool but is not sufficient by itself to insure 100% scale-up success.

*Helpful Hint: High tip speeds are critical for maximum particle and droplet size reduction.*

## 3. Tank Turnovers

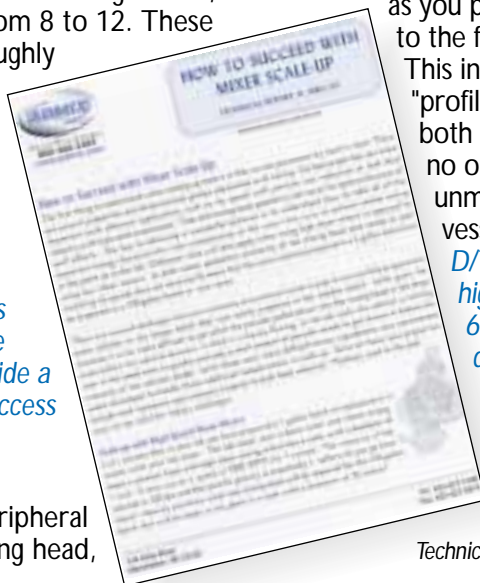
Tank turnover is a measure of how effective a mixer's pumping rate is relative to turning a batch over a particular number of times a minute. In order to make this calculation, the pumping rate of the mixer is divided by the volume of the batch. *Helpful Hint: While Intensity and Tip Speed should be scaled completely proportional, the number of tank turnovers is going to be far greater for the lab mixer than with the production mixer. The objective therefore is to insure a minimum turnover value in the large tank and not try to match the lab mixer.*

## 4. Geometric Similarity (D/T)

It is desirable to match the ratio of mixing head diameter to tank diameter as you progress from the lab vessel to the full size production vessel. This insures that the flow control "profile" observed is similar in both vessels, such that there are no obvious "dead zones" or unmixed areas of the larger vessel. *Helpful Hint: A minimum D/T of 0.1 is desirable for most high speed applications, i.e. a 6" mix head within a 60" tank diameter.*

Call 1-800-466-2369 to request your complete copy of "How to Succeed with Mixer Scale-Up".

Technical Report #MSU-101



## Admix Team Members



Within each quarterly issue of the Admixture, we acknowledge the efforts of our employees who are helping to make Admix the leader in Sanitary Mixing and Blending.

Paul Foskitt, our Operations Manager, has spent over 10 years at Admix overseeing production, parts and service, and our Jetfoil impeller installations. His 20+ years in the mixing industry have given him the hands-on expertise to resolve your mechanical mixing issues.

Mark Cody is our Western Regional Sales Manager heading up our sales office in Denver, CO, with 12 years of process equipment experience in agitation, powder conveying and process troubleshooting.

# We'll See You There!!

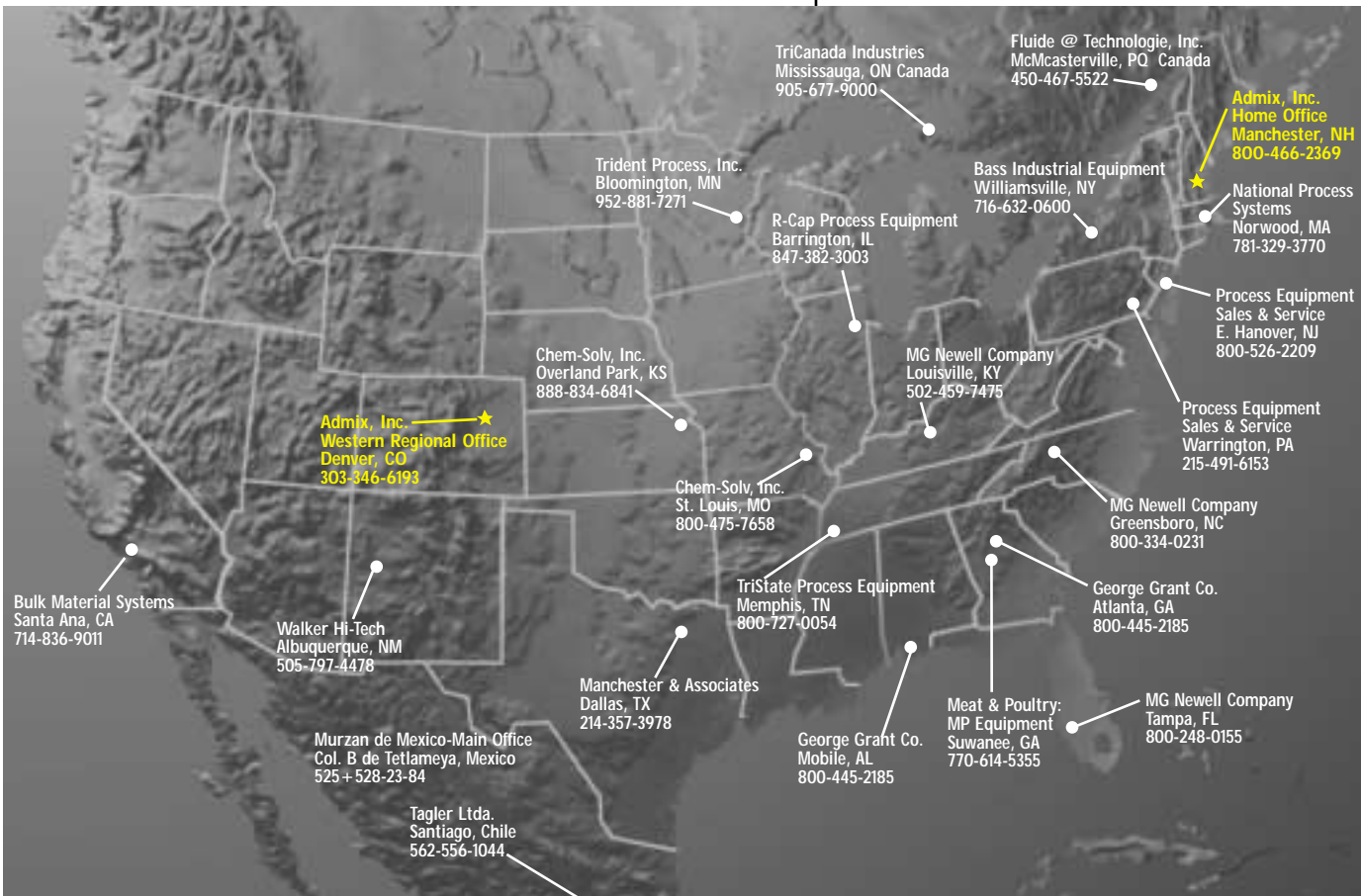
Come see us in 2001 at the following trade exhibits for hands-on demonstrations!

Date	Show Name	Location	Admix Booth #
Jan. 17-19	International Poultry Expo	Atlanta, GA	6103
Sept. 10-12	IEFP/PAK EXPO	Las Vegas, NV	118
Oct. 18-21	WWFE / AMI	Chicago, IL	502
May 15-16	New York, SCC	Meadowlands, NJ	Tabletop
Oct. 16	California, SCC	Long Beach, CA	Tabletop



## Contact Our Experts

Admix has applications expertise throughout North and South America (See Map) to answer any and all of your Advanced Mixing Technology needs.



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