

UNIQUELY LEE

The Features That Bring Processing Perfection.



TRI-MIX

TRI-MIX™ TURBO-SHEAR™ MIXING SYSTEM
Combined Agitation and High-Speed Mixing Head for
High-Viscosity and High-Shear Applications

UNIQUELY LEE:

Tri-Mix™ Turbo-Shear™ Mixing System

In order to reach peak performance, manufacturers of high-viscosity products must pay particular attention to the mixing process within their operations. The inherent nature of products that require high-shear, consistent deaeration and uniform, precise batch ingredient distribution poses challenges to efficiency, product quality and consistency.

The Lee Tri-Mix™ Turbo-Shear™ mixing system is specifically engineered to meet these demands for high-viscosity products of all types:

- BioPharma ointments, lotions and gels
- Toothpastes
- Cosmetics and personal care products
- Adhesives
- Lubricants

The Lee Tri-Mix™ Turbo-Shear™ system combines a heavy-duty, double-motion, counter-rotating agitator with an independently driven high-shear mixing head to combine pre-mix and final mix agitation in the same vessel. The Tri-Mix™ Turbo-Shear™ system offers manufacturers a robust and cost-effective solution with key advantages over other high-performance mixing options.

A Comprehensive System for High-Viscosity Mixing Applications

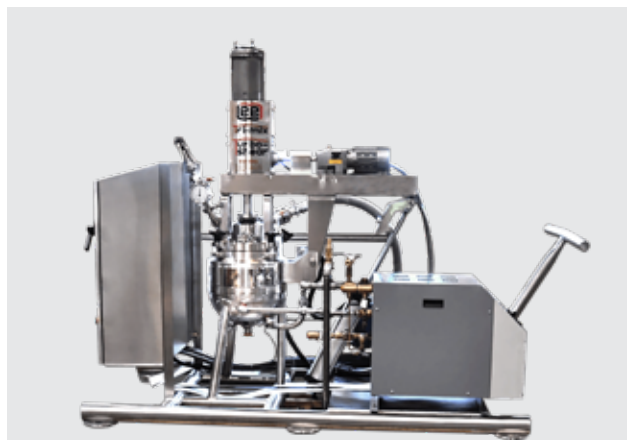
The Tri-Mix™ Turbo-Shear™ system integrates robust double-motion scraped-surface agitation with a unique and proprietary high-shear mixing head to blend miscible and non-miscible ingredients commonly used in BioPharma, personal care, lubrication and other high-viscosity products. It is built to handle viscosities as high as 2,000,000 cps and provide particle size reduction.

A More Efficient and Cost-Effective Solution

Through its unique engineering, the Tri-Mix™ Turbo-Shear™ system overcomes the design limitations conventional dual-head mixing systems encounter with high-viscosity mixing. It is also significantly less expensive and more efficient than other systems designed for high-viscosity products requiring high-shear:

Multiple vessel systems:

Multiple process vessels are often used to mix high-viscosity or difficult-to-wet-out ingredients. Typically, a smaller vessel is used to pre-mix a small quantity of ingredients, which are then transferred to a main vessel for mixing with the balance of the batch for final processing. The Tri-Mix™ Turbo-Shear™ system replaces both the pre-mix vessel and related transfer pumps



The Lee Tri-Mix™ Turbo-Shear™ mixing system combines a heavy-duty, double-motion, counter-rotating agitator with an independently driven high-shear mixing head to address challenging high-viscosity mixing requirements for a wide variety of products.

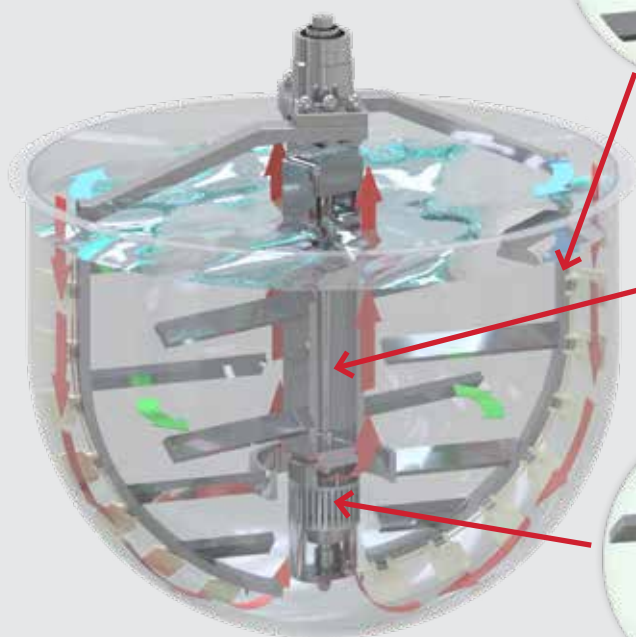
and lines, for a single mixing solution that is less expensive, faster and more efficient than multiple vessel processing.

Bottom-shear and recirculating mixing systems:

Expensive and complex high-shear recirculating mixing systems and bottom-entry high-shear mixers are also used in high-viscosity applications where ingredients are reduced to very fine submicron-level particle sizes. The Tri-Mix™ Turbo-Shear™ system is a more affordable alternative to these mixing systems and provides efficient processing of most high-viscosity ingredients.

**Lee Tri-Mix™ Turbo-Shear™
High-Viscosity Mixing System**

Combining double-motion agitation and concentric high-shear mixing for fast, consistent mixing of high-viscosity bio-pharma products up to 2,000,000 cps.



1. Robust Scraped-Surface Agitation directs high-viscosity ingredients toward the middle and down the sides of the vessel into the high-shear mixing head.

2. Inside Counter-Rotating Mixing Bars provide additional mixing power to move ingredients efficiently around the vessel.

3. High-Shear Mixing Head expels the product at high velocity through slots in the head, creating hydraulic and/or mechanical shear to force the product to the top or bottom of the vessel, depending on head configuration.

Double-Motion Agitation for Powerful and Consistent Mixing Action

The Tri-Mix™ system utilizes a robust double-motion counter rotating scrape surface agitator powerful enough to direct high-viscosity ingredients down into its Turbo-Shear™ high-shear mixing head, located at the bottom of the vessel.

The scrapers on the outer agitator arms clear product from the vessel walls with each revolution of the mixer, driving the product toward the middle and down the sides of the batch, where the inside counter-rotating agitator bars provide additional mixing power as the product is moved down to the high-shear mixing head.

TRI-MIX™ TURBO-SHEAR™ MIXING SYSTEM

Turbo-Shear™ Mixing Head for Fast, Efficient and Uniform Ingredient Distribution

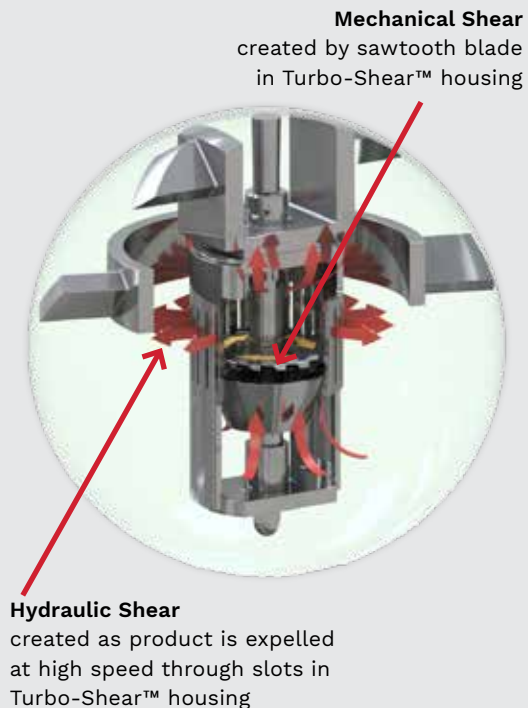
The unique continuous pumping action of the Turbo-Shear™ mixing head, driven by a separate motor through the center agitator shaft, forces the high-viscosity product to move from the top or the bottom of the vessel by expelling it radially, at high velocity, through slots in the high-shear head housing. This fast pumping velocity creates hydraulic and/or mechanical shear, depending on head and vessel configuration.

Lee Turbo-Shear™ Mixing Head Operation Creates both mechanical and hydraulic shear for rapid and thorough blending of powder and liquid ingredients.

The Turbo-Shear™ head operates at speeds up to 3,450 RPM to provide thorough homogenization of powder or liquid ingredients into the product batch, eliminating fisheyes and lumps of unmixed materials.

The inner sawtooth blade of the Turbo-Shear™ head, rotating at high speed, creates mechanical shear, which forces the product through narrow slots in the housing to create hydraulic shear as the product is expelled at high speed through the head.

The Turbo-Shear™ mixing head is available in a variety of blade and housing configurations to meet a wide range of material-processing requirements.



The result of this combined double-motion agitation and high-shear mixing action delivers very efficient blending of high-viscosity products, superior blending consistency, and uniform ingredient distribution. It also delivers efficient processing times compared to bottom-entry high-shear and recirculating mixers.

Different Operating Modes Provide Maximum Versatility Across a Wide Range of Process Requirements

Because the double-motion agitator and high-shear mixing head are each operated by their own independent drive motors, the Tri-Mix™ Turbo-Shear™ system can be operated in different modes to meet a wide range of unique mixing and processing requirements:

The Turbo-Shear™ high-shear mixing head can be run at the start of the process

to uniformly pre-mix a smaller quantity of ingredients, which are then combined with the balance of the ingredients for the batch and mixed using double-motion agitation. In this mode, the Tri-Mix™ Turbo-Shear™ system replaces the use of an extra pre-mix vessel and transfer pumps and lines attached to the main vessel, for faster and more efficient processing with less equipment.

The high-shear and double-motion mixing units can be operated simultaneously

throughout the batch process, to ensure uniform product blending.

The heavy-duty, double-motion agitator can be configured with independent ‘piggy-back’ motors

to provide customizable functionality and control. The independent motors allow for separate control of the scraped-surface agitator as well as the inner agitator, giving more flexibility on agitator speed and direction to accommodate challenging products.

Configuration Options to Solve Challenging Mixing Problems

The Tri-Mix™ Turbo-Shear™ system can be configured in a variety of ways to address specific ingredient mixing, processing and safety requirements:

Customizable high-shear mixing head configurations:

Impeller blade designs and housing components of the Turbo-Shear™ mixing head are available in a variety of configurations to vary the amount of mechanical and hydraulic shear required, based on ingredient characteristics.

Vacuum-ingredient-addition:

The Tri-Mix™ Turbo-Shear™ system can be equipped with a secondary offset valve, enabling ingredients to be loaded under vacuum in a closed vessel. Vacuum ingredient addition effectively “pulls” dry and difficult-to-wet-out ingredients into the liquid batch for faster and more complete blending, eliminating fisheyes and lumps of unmixed material in the batch. Vacuum ingredient addition also eliminates the health risk from inhaling airborne particles when hazardous ingredients are loaded into a conventional open-top vessel.

Vacuum deaeration:

Pulling a vacuum during the mixing process will remove trapped air bubbles within the batch. This is especially important for high-value products dispensed in small containers or vials, where additional air bubbles in the product can prevent accurate dispensing of the correct amount of product into each package.



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