



 **SILVERSON**<sup>®</sup>  
High Speed High Shear Mixers

# The Silverson Principle

**For over 75 years Silverson has specialised in the manufacture of quality high shear mixers for processing and manufacturing industries worldwide.**

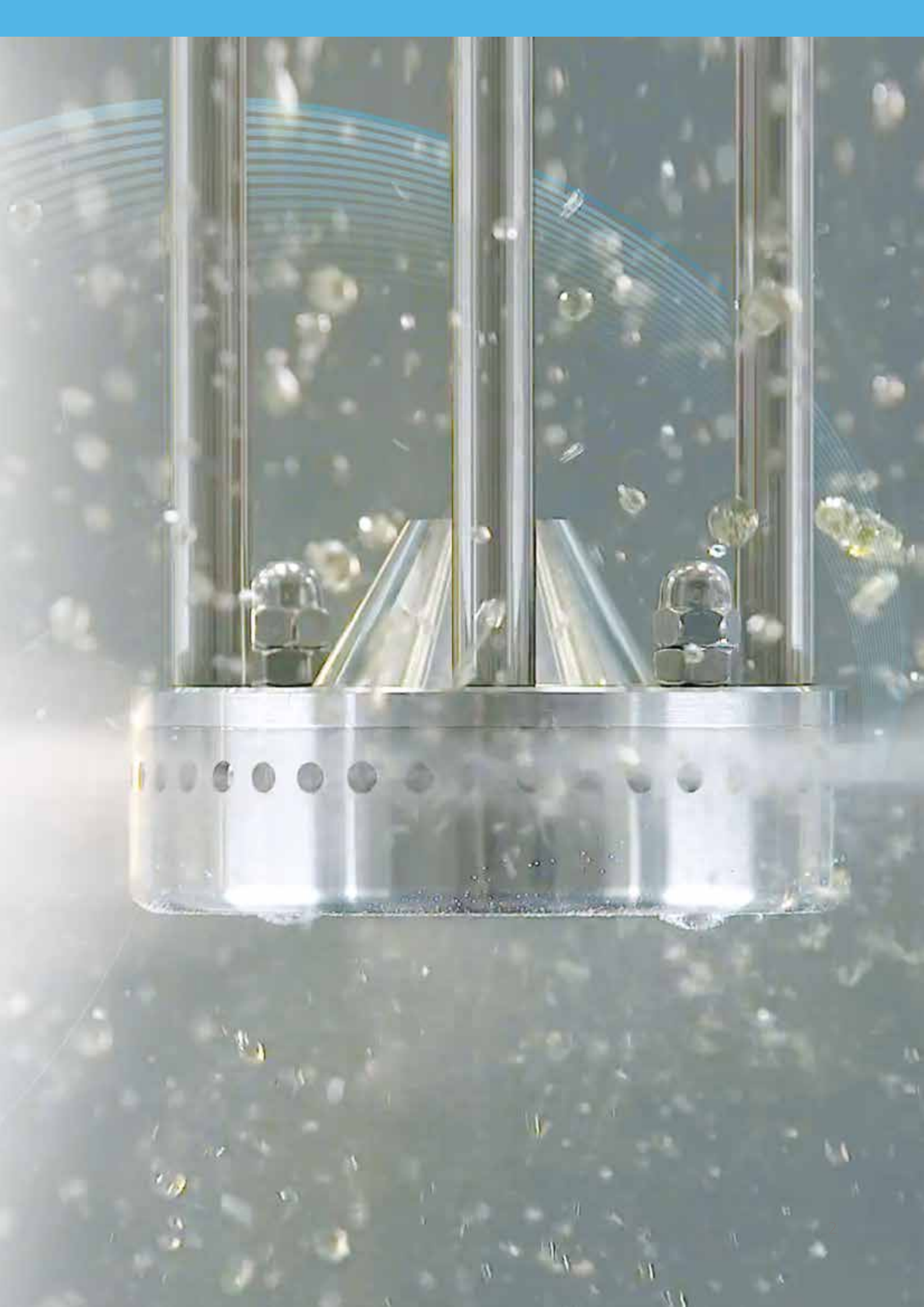
With customers in over 150 countries, and serving industries as diverse as food, pharmaceuticals, cosmetics, luboils and petrochemicals, Silverson has become the world leader in the field of high shear mixing. Time after time, companies specify Silverson mixers as the “standard” equipment for their manufacturing process.

The key to this success is based on the professionalism and commitment Silverson shows to each of its customer’s needs. Whether supplying machines from its standard range of mixers or designing equipment specifically to meet an individual customer’s requirements, quality is guaranteed.

With a customer base that includes many of the world’s largest companies, Silverson is constantly at the forefront of new technologies. Developing and applying new high shear mixing techniques to meet these needs, Silverson has the experience, knowledge and commitment to both quality and service to solve today’s mixing needs and those of the future.

A truly international company, Silverson is represented by a network of associated companies, distributors and agents in over 50 countries, serving Europe, North America, Asia, Australasia, South America and Africa.





# Why Silverson?

## Speed

The exceptionally rapid Silverson mixing action substantially reduces process times compared with conventional agitators and mixers and can reduce mixing times by up to 90%.

## Versatility

The advantage of the Silverson approach to mixing is that any one machine can perform the duties that in the past may have required several different pieces of process equipment. This unrivalled versatility allows any machine to perform the widest range of mixing applications:

- **Blending** - A homogeneous product is rapidly produced when blending liquids of similar or greatly varying viscosities, eliminating problems such as stratification.
- **Emulsifying and homogenising** - Emulsions (typically in the range of 0.5 to 5 microns) can be easily achieved.
- **Disintegration** - All Silverson rotor/stator mixers can disintegrate matter of animal, vegetable, mineral or synthetic origin in a single operation.
- **Particle size reduction** - Uniformly mill both solid and semi-solid materials into either solution or fine suspension.
- **Gelling and solubilising** - The high shear action of the Silverson rotor/stator can rapidly disperse gums, alginates, CMC, carbopols, etc., resulting in an agglomerate-free solution within minutes.

# Some of Our Clients



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# How the Silverson Works

The advantages of Silverson's high shear rotor/stator mixer over simple conventional stirrers or agitators stem from the multistage mixing/shearing action as materials are drawn through the specially designed Silverson workhead - the heart of every machine.



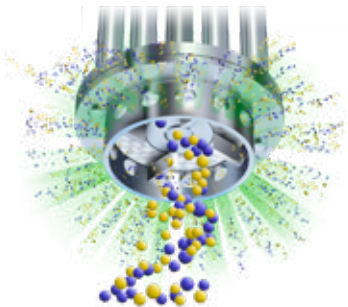
## Stage 1

The high-speed rotation of the rotor blades within the precision-machined mixing workhead exerts a powerful suction, drawing liquid and solid materials upwards from the bottom of the vessel and into the centre of the workhead.



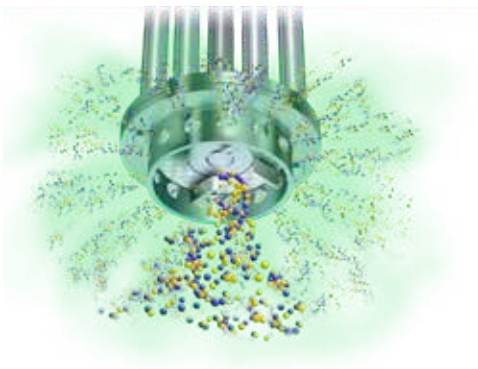
## Stage 2

Centrifugal force then drives the materials towards the periphery of the workhead where they are subjected to a milling action in the precision clearance between the ends of the rotor blades and the inner wall of the stator.



## Stage 3

This is followed by intense hydraulic shear as the materials are forced, at high velocity, out through the perforations in the stator and circulated into the main body of the mix.



## Stage 4

The materials expelled from the head are projected radially at high speed towards the sides of the mixing vessel. At the same time, fresh material is continually drawn into the workhead, maintaining the mixing cycle. The effect of the horizontal (radial) expulsion and suction into the head is to set up a circulation pattern that minimises aeration caused by disturbance of the liquid's surface.

# Interchangeable Heads and Screens

A comprehensive range of workheads and screens is available for all Silverson rotor/stator mixers. These easily interchangeable workheads offer great versatility by allowing any machine to be adapted to perform a wide range of mixing operations including emulsifying, homogenising, disintegrating, dissolving, dispersing, blending, particle size reduction and de-agglomerating. Changing from one head or screen to another is quick and simple.



## General Purpose Disintegrating Head

This is the most versatile of all the heads, giving an exceptionally vigorous mixing action. Ideal for general mixing applications, its uses also include the disintegration of solids and the preparation of gels and thickeners, suspensions, solutions and slurries.



## Slotted Disintegrating Head

For the disintegration of fibrous materials such as animal and vegetable tissue, as well as the disintegration and solubilisation of “elastic” materials such as rubbers and polymers.



## Square Hole High Shear Screen™

Provides exceptionally high shear rates ideal for the rapid size reduction of soluble and insoluble granular solids. It is also suitable for the preparation of emulsions and fine colloidal suspensions.



## Standard Emulsor Head and Emulsor Screen

Suitable for liquid/liquid preparations and especially useful for all emulsions. Emulsor screens are available in fine and medium perforations.

# Laboratory Scale Mixers

Silverson Laboratory mixers are suitable for the widest range of applications - mixing, emulsifying, homogenising, disintegrating and dissolving - with an efficiency and flexibility unmatched by other machines.

With a capacity from 1ml up to 12 litres and the ability to mix in-line with flow rates up to 20 litres/minute, they offer excellent reproducibility when scaling up and provide an accurate means of forecasting the performance of larger Silverson machines under full-scale working conditions.







# L5 Series

Silverson L5 Series mixers are ideal for all routine laboratory work, research and development, QA analysis and small scale production in all industries.

## L5M-A

The multifunctional L5M-A features a powerful 0.75kW (1hp) motor and touch pad control with digital tachometer, programmable integral timer and amperage display, all accessed via the Mode button. The unit can be supplied with a "Data Logger" program, allowing monitoring of speed and power draw over time. This level of instrumentation is invaluable for applications where process validation and reproducibility are required.

## L5M

The L5M is fitted with a 0.25kW (0.33 hp) motor unit and features touch pad control with digital tachometer, programmable integral timer and amperage display.

## L5T

As L5M but supplied with tachometer only.



#1 rated  
laboratory  
mixer

30,000  
units in use  
worldwide

# Mixing Assemblies

## Standard Assembly (Two Arm)

The L5M-A is supplied complete with a General Purpose Disintegrating Head, Square Hole High Shear Screen, Standard Emulsor Screen and Axial Flow Head. Slotted Disintegrating Heads, Fine Emulsor Screen, Pump Heads and other special heads are available as optional extras.

Capacity - depending on viscosity - up to 12 litres.

Mixing unit dimensions length 290mm (11 1/2"), width 57mm (2 1/4").

## Tubular Mixing Assemblies

A series of interchangeable tubular mixing units suitable for use in narrow-necked containers are available, with capacities from 1 - 500ml depending on viscosity,

**1" tubular** Capacity 50ml up to 500ml.

**3/4" tubular** Capacity 20ml up to 250ml.

**5/8" micro** Capacity 5ml up to 50ml.

**3/8" mini-micro** Capacity 1ml up to 10ml.

## Duplex Assembly

The Duplex comprises two workheads facing in opposite directions. The upper head pulls materials down from the surface of the mix, and provides a coarse disintegrating action, while the lower head draws material up from the base of the mixing container, further reducing particle size to accelerate solubilisation or suspension.

This combined use of two workheads makes the Duplex ideal for high viscosity mixes and applications where light or buoyant material (powders, rubbers and polymers, etc.) need to be drawn down from the surface of a mix and rapidly dispersed.

## Ultramix

The Silverson Ultramix is designed for applications that are beyond the capabilities of a conventional agitator or stirrer but do not necessarily require the intense high shear of a Silverson rotor/stator mixer.



## In-Line Mixing Assembly

The In-Line assembly fits onto the model L5 Series Laboratory range and converts it into an In-Line mixer/homogeniser.

The centrifugal action of the rotor in the high shear rotor/stator workhead generates a non-positive pumping action which gives a throughput on low viscosity liquids of approximately 20 litres/minute, reducing as the viscosity increases.

The In-Line assembly is suitable for use at atmospheric pressure only. It is not recommended for use on abrasive, corrosive or flammable materials.



# Specialised Mixers

## Model L2/Air (Compressed Air)

Suitable for use in Flameproof/ATEX Rated areas. The L2/Air is powered by a 0.25 hp, 6000 rpm variable speed air motor. The L2/Air will accept all L5 Series mixing assemblies. Supplied with a manually operated adjustable bench stand.



## Sealed Unit

The Silverson Sealed Unit laboratory mixer is designed for mixing sterile or hazardous materials and for working under vacuum.

Processing can be carried out under conditions of absolute safety, since the mechanical seal protects sterile materials from airborne contamination and eliminates the risk of hazardous materials escaping into the surrounding atmosphere.

The Sealed Unit features a Quick-Release mechanism permitting use with a wide range of mixing assemblies.

### Mixing Vessels

Glass vessels with capacities from 7ml up to 1 litre are available. Stainless steel vessels are available with volumes from 1 - 10 litres.

### Operation Under Vacuum

Special sealed mixing assemblies are available for operation under vacuum.



# Pilot Scale Mixers

## AX Series

This series of mixers is designed for small-scale production in pilot plants, research institutes, hospital pharmacies, etc. Light and easily operated, AX series models have a capacity of up to 50 litres.



## Model AX5

The AX5 features touch pad controls and is compatible with Silverson's "DataLogger" system.

### Motor

Powerful 0.75kW (1 hp) 220volt single phase motor (110 volt optional) 50/60 Hz.

### Speed Control

Infinitely variable speed control. Nominal maximum speed 6000 rpm.

### Electric Rise & Fall Stand

The unit features an integral rise and fall stand with touch pad controls.

## Model AX3

The Model AX3 features a fixed speed 0.75kW (1 hp) 3 phase motor. TEFC, Flameproof/ATEX Rated and stainless steel motors are available. Variable speed available via an inverter as an optional extra.

More powerful motors allowing a maximum speed of up to 6000 rpm are also available.

## Model AX/Air

The Model AX/Air is powered by an intrinsically safe compressed air motor suitable for use in Flameproof/ATEX Rated areas.

### Stands

Manual or electric rise and fall stands are available for use with the AX3 and AX/Air models.

# Technical Specifications

## Controls & Instrumentation

	L5M-A	L5M	Sealed Unit	L2 Air	AX60	AX5	AX Air
Touch Pad Control	●	●	●			●	
Tachometer	●	●	●			●	
Programmable Timer	●		●			●	
Ammeter	●	●	●			●	
DataLogger	○	○	○			○	

## Materials

Wetted Parts: 316L Stainless	●	●	●	●	●	●	●
Body: Nylon Coated Stainless*	●	●	●			●	
Body: Engineered Polymer*	●	●	●			●	
Body: Stainless Steel	○	○	○	○	○	○	○

\*Engineered Polymer is standard material for some territories

## Motor

Power	0.75kW (1hp)	0.25kW (0.33hp)	0.75kW (1hp)	0.18kW (0.25hp)	Various Motors	0.75kW (1hp)	0.375kW (0.5 hp)
Single Phase	●	●	●		●	●	
3 Phase					○		
Variable Speed	●	●	●	●	○	●	●
Nominal Max Speed RPM	10,000	8,000	10,000	6,000	up to 6,000	6,000	3,600

## Stand

Electric Rise & Fall	●	●	●		○	●	
Manual Stand				●	○		●

● Standard ○ Optional

# Verso

## Pilot Scale In-Line Mixer

The Silverson Verso is a bench top In-Line mixer ideal for laboratory or pilot scale applications. The unit offers excellent reproducibility when scaling up and provides an accurate and easy means of forecasting the performance of larger In-Line mixers under full-scale working conditions.

The Verso is equipped with a digital tachometer, ammeter and programmable timer, invaluable for applications where process validation and reproducibility are required. It is also compatible with the Silverson "DataLogger" program.

### Features

- Touch pad control panel
- Powerful 0.75 kW (1 hp) motor with infinitely variable speed control
- Single or multistage interchangeable workheads available
- Self-pumping
- Maximum operating pressure 150 psi (10 bar)
- 0.75" Tri-clamp inlet/outlet connections
- Single mechanical shaft seal
- All wetted parts are in grade 316L stainless steel
- Hygienic construction
- Vessel package available, comprising vessel, stand, valve and pipework

### Advantages

- Eliminates agglomerates and fish eyes
- Creates stable emulsions and suspensions
- Reduces particle size
- Rapidly dissolves solids
- Accelerates reactions
- Aeration free
- No bypassing



# Specialised Mixers

## Verso UHS

An Ultra-Hygienic version of the standard model, the Verso UHS is designed for stringent applications in the Pharmaceutical and Biotechnology industries as well as Food, Cosmetics and other clean industries.

It features Silverson-designed Ultra-Hygienic single mechanical shaft seals and can be converted to double mechanical shaft seals.



## Verso-HV

The Verso-HV is designed for mixing higher viscosity products. It incorporates the same unique and innovative 'pumping rotor' design as the production scale UHS-HV In-Line mixers. This substantially increases its self-pumping capacity, allowing it to process products such as gels, creams, sauces and gum solutions on a laboratory scale.

The Verso-HV also provides simple and accurate means of scaling up to Silverson's production scale UHS-HV mixers.



## FMX5 Powder/Liquid Mixer

The new Silverson FMX5 is a laboratory scale version of the Flashmix powder/liquid mixer (see page 39). It provides a simple, effective and hygienic means of powder/liquid mixing on a laboratory scale and is capable of handling higher viscosity mixes.

The FMX5 is supplied with a 1 litre stainless steel powder feed hopper. Other types of hopper, e.g., a profiled version to assist with the flow of cohesive powders are available.

The FMX5 is suitable for small scale manufacturing and offers an accurate and easy means of predicting the performance of production scale Flashmix models in the laboratory, streamlining the scale-up process.





# Technical Specifications

## Materials of Construction

	Verso	Verso UHS	Verso -HV	FMX5
Wetted Parts: 316L Stainless	●	●	●	●
Wetted Parts: Special Materials	○	○	○	○
Elastomers: Viton	●	●	●	●
Elastomers: EPDM	○	○	○	○
Elastomers: FFKM			○	○
Elastomers: Other	○	○	○	○
Operating Pressure*	150 psi (10 bar)	150 psi (10 bar)	150 psi (10 bar)	150 psi (10 bar)

\*Higher pressure units available on request

## Motor

TEFC	●	●	●	●
Other - Stainless, Flameproof/ATEX				

## Inlet/Outlet Connections

Tri-Clamp	●	●	●	●
Flange	○	○	○	○
Other e.g., RJT, SMS, etc.	○	○	○	○

## Sealing

Single Mechanical	●		●	●
Ultra-Hygienic Single/Double Mechanical		●	○	○
Special Seal Arrangements		○	○	○

## Workheads

Single Stage	●	●	●	●
Multistage	○	○		

● Standard ○ Optional





# Batch Mixers

Silverson offers a complete range of multipurpose batch mixers able to perform the widest variety of applications - mixing, emulsifying, homogenising, disintegrating and dissolving - with an efficiency and flexibility unmatched by other machines.

# Batch Mixers

Medium Range

## Models BX to GX

Any machine in this range from the 0.75kW BX to the 15kW GX25 can be used on a mobile hydraulic floor stand (local safety regulations permitting). This option greatly increases the flexibility of these mixers, allowing them to be moved from vessel to vessel and to be raised and lowered during operation, if required, in order to give the optimum mixing position at varying stages of the process.



Speed-Performance  
Versatility-Reliability

# Large Range Models 700X to MX

Silverson is the world leader in the specialised design and manufacture of large scale rotor/stator mixers with a capacity of up to 30,000 litres. All these machines are individually built to order and constructed specifically to suit each customer's requirements.

The large scale mixers possess all the qualities and flexibility of Silverson's medium range models and include a number of additional and unique features.

Each mixer is designed and built to the highest possible engineering standards. From the specially balanced motors to the fitting of precision ground shafts which are finish turned in-house to ensure critical vibration free running, no aspect of manufacture escapes our rigorous inspection.

These machines are designed to be maintained and serviced in-situ wherever possible. Quick release shaft couplings, split two-part downthrust propellers and hard-surfaced sacrificial shaft journal sleeves are just a few of the features designed to keep maintenance and downtime to a minimum.

In every case, Silverson's technical staff will ensure that the customer's needs are precisely catered for.



# Duplex Disintegrator Dissolver

The Duplex was specifically developed for the disintegration and solubilisation of solid rubbers and polymers for the lube and adhesive industries, but its success has now seen its introduction into all fields of mixing, whether chemical, pharmaceutical or food.

The Duplex differs from the standard multipurpose batch mixers in having two workheads facing in opposite directions; the upper head pulls materials down from the surface of the mix, while the lower head draws material up from the base of the vessel.

The combined use of two workheads makes the Duplex ideal for applications where light or buoyant material (powders, rubbers and polymers, etc.) needs to be drawn down from the surface of a mix and rapidly dispersed. Because of the added movement afforded by the two workheads, the Duplex is also ideal for use on high viscosity materials.

## Typical Applications

- Rapid solution of rubbers and polymers into lubricating oils, solvents and bitumen for the production of lubeoils, adhesives and bituminous compounds
- Disintegration and dissolving of solid resin for the production of varnish
- Vegetable and meat purée/slurries
- Recovery of waste confectionery

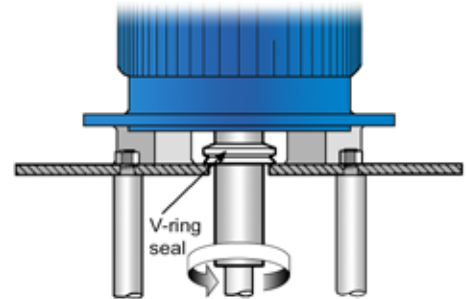


# Sealing

Unless otherwise stated all machines are designed for operation in unsealed vessels at atmospheric pressure. Where sealing is required machines can be supplied with the appropriate shaft sealing and mounting flange as an optional extra.

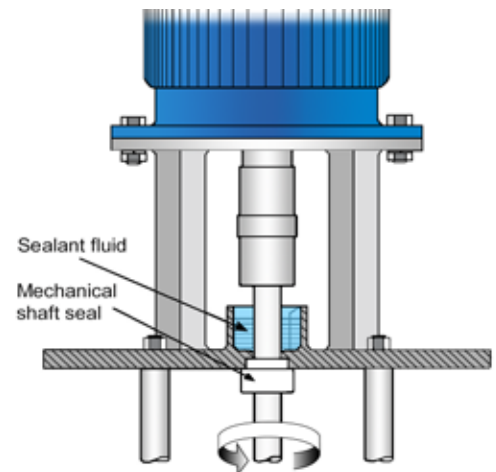
## V-Ring Shaft Seal

This is the simplest form of shaft sealing and is designed to prevent the possible ingress of material from outside the vessel. It is also used to minimise vapour loss from the vessel and prevent liquid escaping if a spray ball is used.



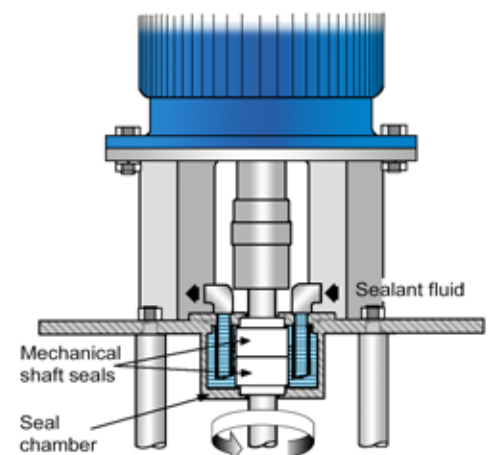
## Single Mechanical Shaft Sealing

If the vessel needs to be fully sealed, mechanical shaft sealing is necessary. The mixer shaft is sealed where it passes through the mounting flange by a single mechanical shaft seal. This seal is surrounded by a quench cup which must be filled at all times during operation with a compatible non-flammable fluid to cool and lubricate the seal. This type of arrangement is suitable for operation at atmospheric pressure or vacuum only.



## Double Mechanical Shaft Sealing

Where there is positive pressure in the vessel, double mechanical shaft seals will be required. The seals are mounted in a chamber that must be flushed with a compatible non-flammable fluid at a pressure not less than 1 atmosphere (15 psi) in excess of the pressure in the vessel. This type of arrangement is suitable for operation under positive pressure, atmospheric pressure and vacuum. Sealant flushing systems can be supplied as an optional extra. Gas lubricated non-contacting double mechanical shaft seals are also available.



# Technical Specifications

## Materials of Construction

	Medium Range	Large Range	Duplex
Wetted Parts: 316L Stainless	●	●	○
Wetted Parts: Special Materials	○	○	
Bush Material: Bronze Alloy	●	●	●
Bush Material: PTFE	●	●	●



General Purpose Disintegrating Head

## Motor

TEFC	●	●	●
Other - Stainless, Flameproof/ATEX	○	○	○



Slotted Disintegrating Head

## Mounting

Mobile Hydraulic Floor Stand	●		up to GDD
Vessel Mounting	●	●	●



Square Hole High Shear Screen™

## Sealing

V Ring	○	○	○
Single Mechanical	○	○	○
Double Mechanical	○	○	○
Special Sealing Arrangements	○	○	

## Advanced Features

Ultra-Hygienic Specification	○	up to KX	
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Standard Emulsor Head and Emulsor Screen

● Standard ○ Optional



# Mobile Floor Stands

A comprehensive range of mobile hydraulic floor stands is available for small to medium scale batch mixers. These enable a machine to be moved from vessel to vessel and to be raised and lowered during operation, if required, in order to give the optimum mixing position at varying stages of the process. The use of a suitable stand greatly increases the flexibility and versatility of the machine.



## Construction

Manually operated hydraulic rams are standard. Pneumatically and electrically powered units are available as an optional extra. Unless otherwise specified, all stands are constructed in mild steel and finished in a durable polyester epoxy paint finish. Stands are also available constructed in Grade 304 stainless steel.

## Yoke Mounting

Yoke mounting jib arms are available for applications where a low ceiling height or high vessel rim height prevents a standard floor stand from being used. They also restrict the movement of the mixer in the vessel.

## Floor/Wall Mounted Stands

Where a mobile stand is not required, fixed position floor/wall mounted stands are available.



# Ultramix Mixers

The Silverson Ultramix is designed for applications that are beyond the capabilities of a conventional agitator or stirrer but do not necessarily require the intense high shear of a Silverson rotor/stator mixer.

# Ultramix

The Silverson Ultramix features an innovative single-piece dynamic mixing head, combining superior performance with minimised cleaning and maintenance requirements.

Ideal for rapidly wetting out powders including gums and thickeners, the Ultramix is also ideal for use in vessels with narrow openings. The vigorous mixing action is capable of moving the entire contents of vessels even in difficult shaped containers. For this reason the Ultramix offers considerable advantages for customers using IBCs (tote bins).

The range includes a laboratory scale unit, allowing the user to accurately reproduce the performance of production mixers in the laboratory.

## Advantages

- Ultra Hygienic design: single-shaft, single-piece mixing head
- Designed for Clean-In-Place (CIP) with Sterilise-In-Place (SIP) as an option
- Full compliance with 3A, USDA and cGMP requirements
- Rapid incorporation of large volumes of powders
- Excellent in-tank movement, even when processing high viscosity mixes
- Low maintenance - no wearing parts or bushes
- Reduced power requirement
- Suitable for aggressive chemical service to the most demanding hygiene requirements



Ideal for Powder Incorporation  
gums & thickeners



# How the Ultramix Works

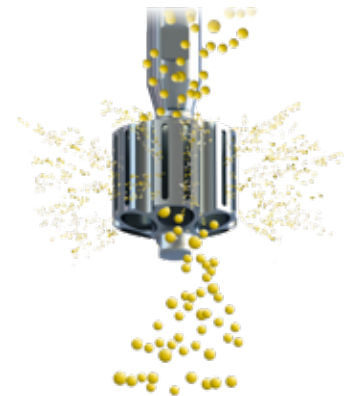
## Stage 1

As the mixer rotates at high speed, the propulsion grooves on the outside of the mixing head project the surrounding product outwards, creating an area of low pressure outside the head.



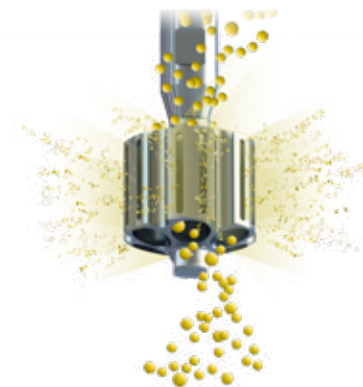
## Stage 2

This draws product from within the mixing head through the radial slots to the outside. The material is subjected to a shearing action as it passes through the slots and is projected back into the body of the mix with great force.



## Stage 3

Fresh material is simultaneously sucked in through the holes in the top and bottom of the mixing head, setting up a vigorous flow pattern throughout the vessel.



# Ultramix Options

## Stand Mounting

The Ultramix is primarily designed for fixed mounting in a vessel, but mobile floor stands are available for models up to U10. These enable the mixer to be moved from vessel to vessel and to be raised and lowered during operation, if required, in order to give the optimum mixing position at varying stages of the process.



## IBC Mixing

The Ultramix is ideal for mixing in problematic containers such as IBCs and Tote Bins - the highly efficient in-tank movement provided by the small diameter workhead overcomes the problems often encountered with difficult vessel geometry.



## Bottom Entry Mounting

Silverson Bottom Entry mixers can be supplied with an Ultramix head in place of the standard rotor/stator workhead. This is ideal for applications that are beyond the capabilities of a conventional agitator or stirrer but do not necessarily require the intense high shear of a Silverson rotor/stator mixer. It can also be used for rapid dispersion of gums and thickeners and ultra-hygienic applications in the food and pharmaceutical industries.



# Technical Specifications

## Materials of Construction

	Standard	Bottom Entry
Wetted Parts: 316L Stainless	<input checked="" type="radio"/>	<input checked="" type="radio"/>
Wetted Parts: Special Materials	<input type="radio"/>	<input type="radio"/>

## Motor

TEFC	<input checked="" type="radio"/>	<input checked="" type="radio"/>
Other - Stainless, Flameproof/ATEX	<input type="radio"/>	<input type="radio"/>

## Mounting

Mobile Hydraulic Floor Stand	up to U10	
Vessel Mounting	<input checked="" type="radio"/>	<input checked="" type="radio"/>

## Sealing

V Ring	<input type="radio"/>	
Single Mechanical		<input checked="" type="radio"/>
Double Mechanical		<input type="radio"/>
Special Sealing Arrangements		<input type="radio"/>

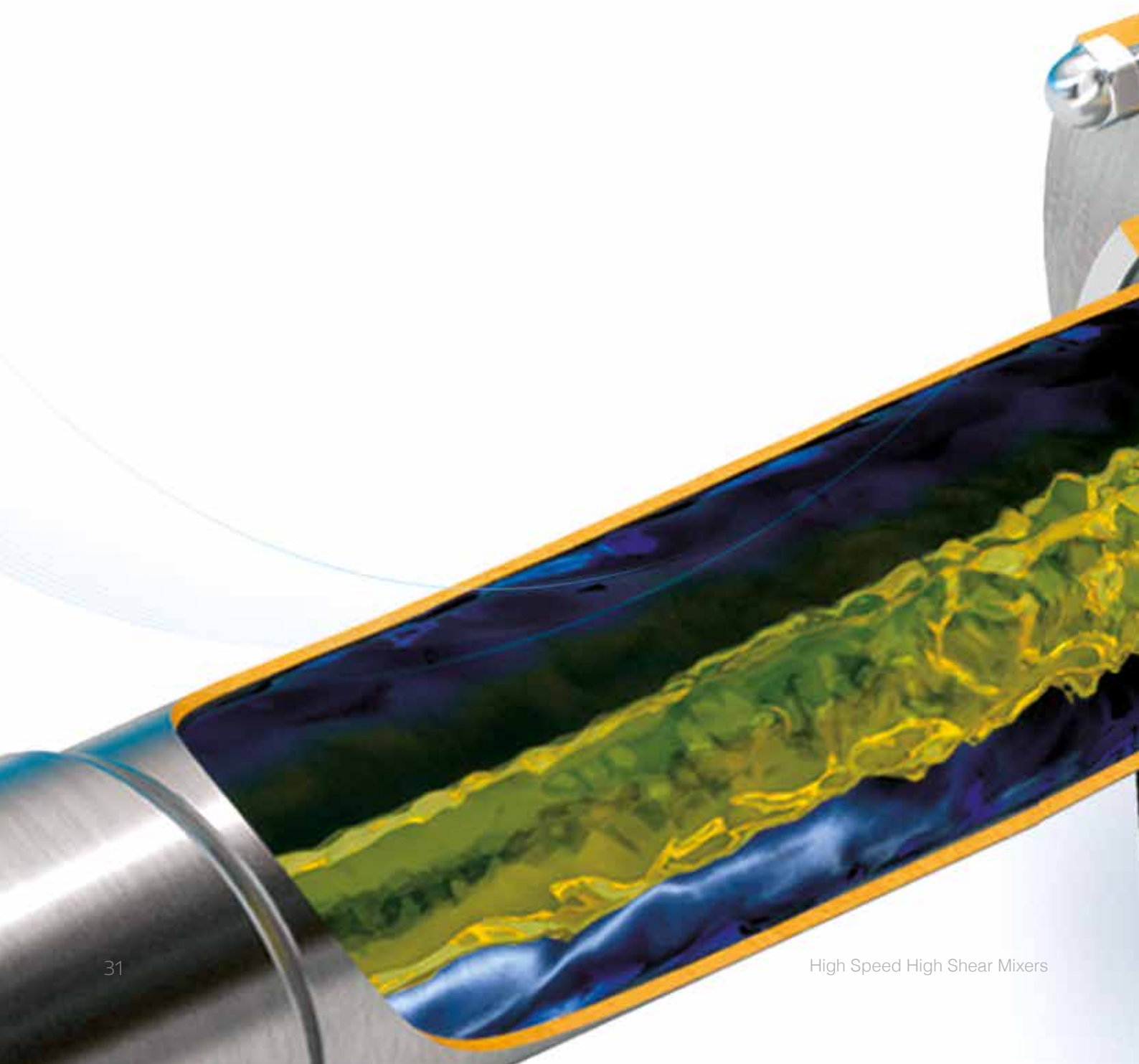
## Advanced Features

Ultra-Hygienic Specification	<input type="radio"/>	<input type="radio"/>
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Standard     Optional

# In-Line Mixers

Silverson's self-pumping High Shear mixers are supremely efficient and rapid in operation and are capable of reducing mixing times by up to 90%.







# In-Line Mixers

Silverson's In-Line mixers are able to perform the widest variety of applications - mixing, emulsifying, homogenising, disintegrating and dissolving - with an efficiency, flexibility and hygienic construction unmatched by other machines.

Ultra-Hygienic  
Ultra-Efficient



## Features

- Aeration free
- Self-pumping
- No bypassing
- Interchangeable workheads
- Hygienic construction
- Easy maintenance
- Lower power requirements
- Eliminates agglomerates and fish eyes
- Creates stable emulsions and suspensions
- Reduces particle size
- Rapidly dissolves solids
- Accelerates reactions

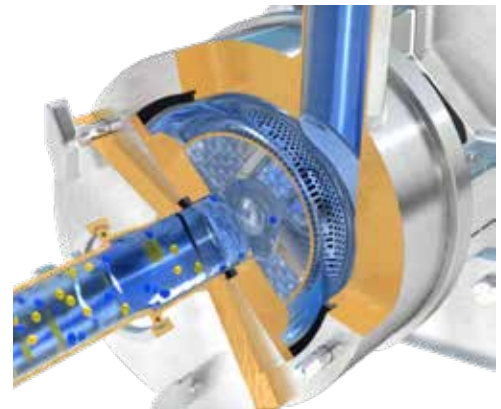


# How the In-Line Works

The action of any Silverson In-Line mixer can be modified with the use of rapidly interchangeable workheads. This enables any machine to mix, emulsify, homogenize, solubilize, suspend, disperse and disintegrate solids.

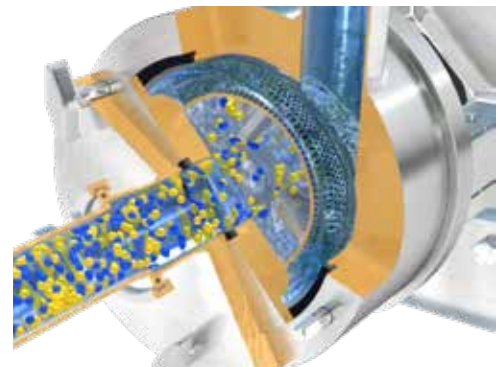
## Stage 1

The high-speed rotation of the rotor blades within the precision-machined mixing workhead exerts a powerful suction, drawing liquid and solid materials into the rotor/stator assembly.



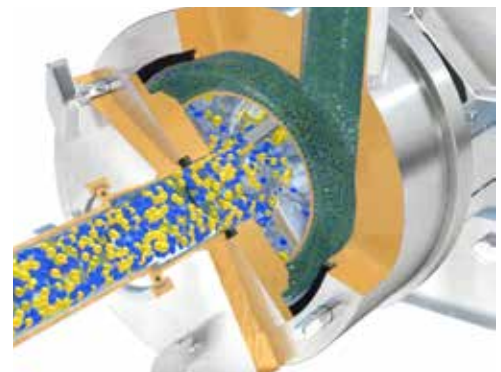
## Stage 2

Centrifugal force then drives materials towards the periphery of the workhead where they are subjected to a milling action in the precision-machined clearance between the ends of the rotor blades and the inner wall of the stator.



## Stage 3

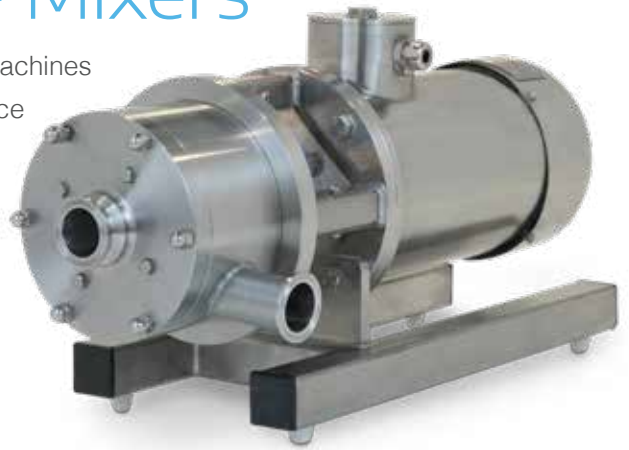
This is followed by intense hydraulic shear as the materials are forced, at high velocity, out through the perforations in the stator, then through the mixer's outlet and along the pipework. At the same time, fresh materials are continually drawn into the workhead, maintaining the mixing and pumping cycle.



# Ultra Hygienic In-Line Mixers

Designed to comply with FDA and cGMP guidelines, these machines are ideally suited for industries where advanced Clean-In-Place (CIP) and Sterilise-In-Place (SIP) facilities are required. UHS range mixers are 3-A TPV (Third Party Verification) Certified and EHEDG Certified models are available.

The design offers further versatility with multistage rotor/stator configurations as standard options, resulting in substantially faster mixing times by reducing the number of recirculation passes required, and offering greater particle size reduction.



## Features

- Interchangeable workheads with single or multistage configurations
- Ultra-Hygienic single mechanical shaft seals, easily converted to Ultra-Hygienic double mechanical shaft seals
- Tangential self-draining outlet which can be reconfigured to self-venting vertical position
- Clean-In-Place (CIP) and Sterilise-In-Place (SIP) operation
- Self-pumping
- Aeration free
- Crevice-free construction
- No metal-to-metal contact, no castings - no porosity
- All 316L stainless steel construction of wetted parts
- No manual dismantling and cleaning is required



# High Viscosity In-Line Mixers

Silverson's UHS-HV Series In-Line mixers are designed for processing higher viscosity products.

They offer all the advantages of the standard UHS range but incorporate a unique and innovative "pumping rotor" design which substantially increases the mixer's self-pumping capacity.

The high flow rate is maintained as viscosity rises, often eliminating the need for an additional feed pump when processing many higher viscosity products.



## Typical Applications

High Viscosity In-Line mixers are ideal for applications in the food, pharmaceutical, cosmetic and chemical industries, including preparation of gels, creams, gums & thickeners, etc.

# General Duty In-Line Mixers

Silverson offers a range of In-Line mixers suitable for hazardous and aggressive chemical service. These units are of robust and simple construction which ensures that maintenance is easy and downtime minimal.

With some of the highest rotor tip speeds and shear rates in the industry, production times can be cut by up to 90%, reducing mechanical wear and maintenance requirements while offering better particle size reduction, emulsification, rapid solubilisation and dispersion.



## Optional Features

- Jacketed units for temperature sensitive products
- Non-standard materials of construction such as hastelloy, titanium and hardened steels for processing highly abrasive or corrosive products
- High capacity units with self-pumping capacities of up to 200,000 litres per hour

## Typical Applications

Bitumens, Edible oil refining, Drilling Muds, Adhesives, Luboils, Pigment dispersions, Titanium dioxide, etc.

# In-Line Workheads



General Purpose Disintegrating Head



Slotted Disintegrating Head



Square Hole High Shear Screen™



Emulsor Screen



General Purpose Disintegrating Head, Multistage Inner and Outer



Slotted Disintegrating Head, Multistage Inner and Outer



Combined Configuration: Inner General Purpose with Outer Slotted Disintegrating Head



Combined Configuration: Inner Slotted with Outer Square Hole High Shear Screen™

# How to Use In-Line Mixers

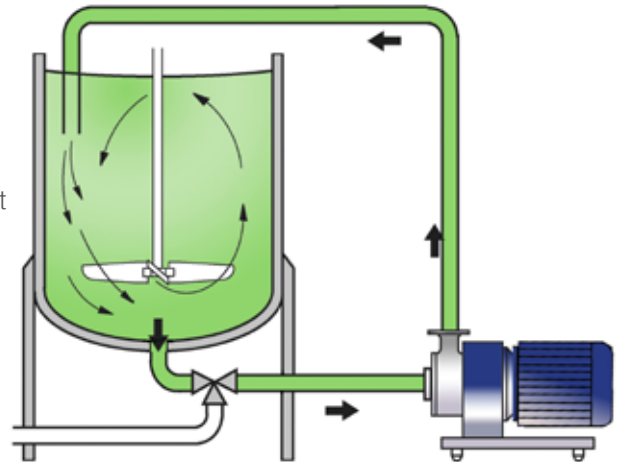
## Recirculation Method

This is the most common way of using an In-Line mixer, providing a higher degree of homogenisation and particle size reduction. Here product is drawn from the bottom of the vessel, processed through the high shear rotor/stator workhead and passed back into the top of the vessel.

In small vessels this will ensure adequate in-tank movement but in larger vessels an auxiliary in-tank mixer or agitator will be required.

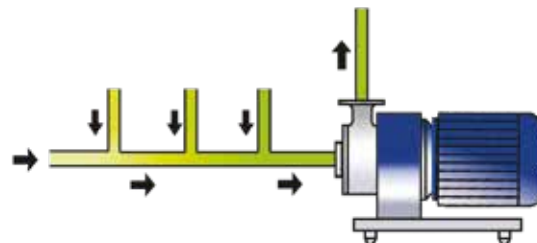
Additional fluid ingredients can be fed into the workhead and uniformly mixed before entering the vessel.

Where quality assurance (QA) demands a set number of passes through the rotor/stator workhead, product can be passed back and forth between two separate vessels.



## Single Pass Method

There are basically three types of operations for which single pass processing can be used:



### Continuous Blending

Ingredients are metered into the mixer or a manifold just prior to the rotor/stator workhead. This ensures that products that react together are mixed immediately on contact. This method is ideal for continuous liquid/liquid blending and for products where aeration must be avoided, e.g. detergents.

### Series Processing

In cases where a higher degree of homogenisation or comminution is required than can be obtained by a single pass through the In-Line mixer, it is possible to achieve the required results by using two or more machines in series.

### Premix Method

The ingredients are coarsely premixed in a holding vessel with a Silverson Batch mixer, Ultramix or a simple agitator. A single pass through the In-Line mixer will then ensure an agglomerate-free homogeneous product. All the product must pass through the In-Line mixer's rotor/stator workhead as by-passing is impossible.

# Technical Specifications

## Materials of Construction

	UHS	UHS-HV	General Duty
Wetted Parts: 316L Stainless	●	●	●
Wetted Parts: Special Materials	○	○	○
Elastomers: Viton	●	●	●
Elastomers: EPDM	○	○	○
Elastomers: PTFE			○
Elastomers: Other	○	○	○
Operating Pressure*	150 psi (10 bar)	150 psi (10 bar)	100 psi (7 bar)

\*Higher pressure units available on request

## Motor

TEFC	●	●	●
Other - Stainless, Flameproof/ATEX	○	○	○

## Inlet/Outlet Connections

Tri-Clamp	●	●	●
Flange	○	○	●
Other e.g., RJT, SMS, etc.	○	○	○

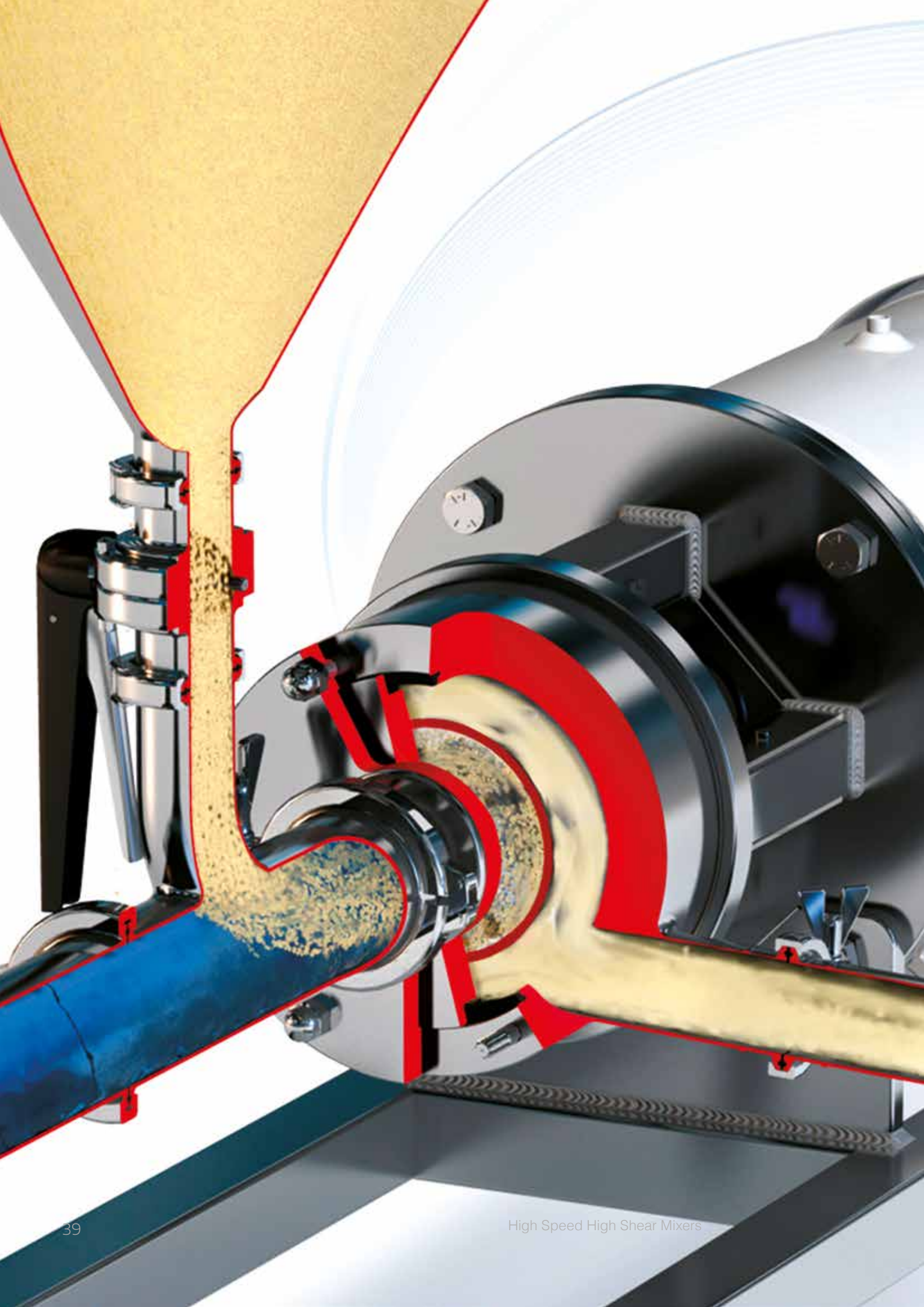
## Sealing

Single Mechanical			●
Double Mechanical			○
Ultra-Hygienic Single/Double Mechanical	●	●	
Special Seal Arrangements	○	○	○

## Workheads

Single Stage	●	●	●
Multistage	○		○

● Standard ○ Optional







# Silverson Powder/ Liquid Mixers

Silverson has over 75 years experience in powder/liquid mixing and offers mixers for a wide range of materials and batch sizes.

The Flashmix is a modular unit that provides a simple, effective and sanitary means of incorporating powders into liquids, even at higher viscosities and at elevated temperatures.

The Flashblend is a semi-automated system designed for bulk powder dispersion and ultra-hygienic applications.

# Flashmix

## Powder/Liquid Mixer

The Silverson Flashmix takes a revolutionary approach to powder/liquid mixing. Unlike many powder/liquid mixers, which use vacuum to pull in powders, the Flashmix literally forces powder into the liquid stream.

This not only allows it to disperse and hydrate large volumes of powders, it means it can be used at higher temperatures and with higher viscosity mixes - offering the advantages of high shear mixing to a wide range of applications that were previously not possible.

The range features 3 production mixers and a laboratory model (see page 15).

Powder Incorporation Rate of up to  
**15,000** kilos/hour

### Advantages

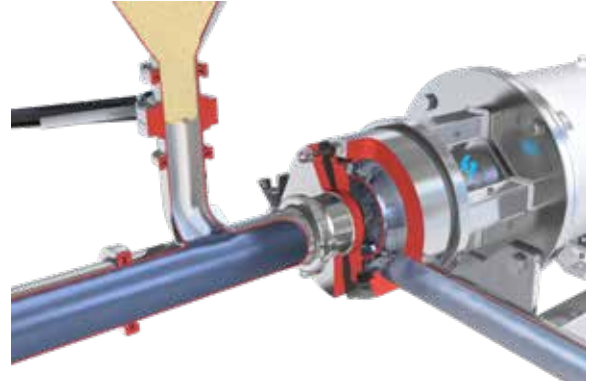
- Powder incorporation rates of up to 15,000 kilos/hour
- Agglomerate-free, consistent product, time after time
- Suitable for operation at higher temperature
- Suitable for higher concentrations of gums and thickeners
- Minimum aeration
- Modular construction with a range of options to suit requirements
- Hygienic design - based on an EHEDG and 3-A Certified mixer
- Low power requirement; no additional pump required
- Low level, ergonomic design
- The Flashmix is easy to install, easy to operate and easy to clean



# How the Flashmix Works

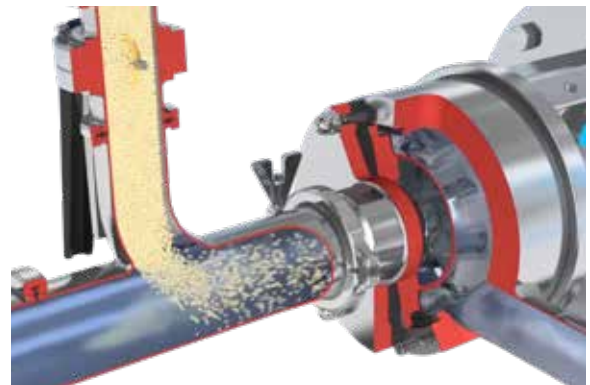
## Stage 1

The specially modified Silverson In-Line mixer recirculates liquid from the process vessel through the Flashmix at high velocity.



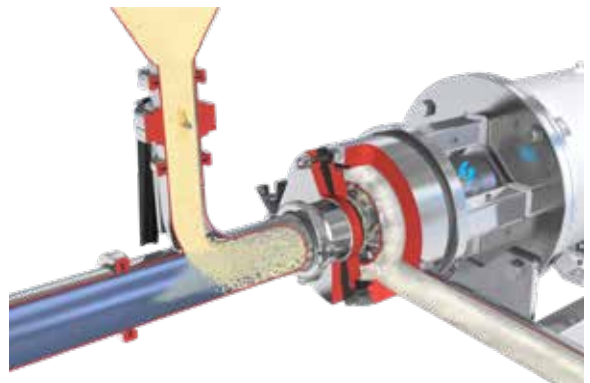
## Stage 2

The powder feed valve is opened, and the high pumping action of the In-Line mixer forces the powder into the liquid stream.



## Stage 3

The powder and liquid components are introduced straight into the high shear zone of the mixer, and are instantaneously combined as they are subjected to intense mechanical and hydraulic shear. The resultant mix is passed back to the vessel by the self-pumping Flashmix.

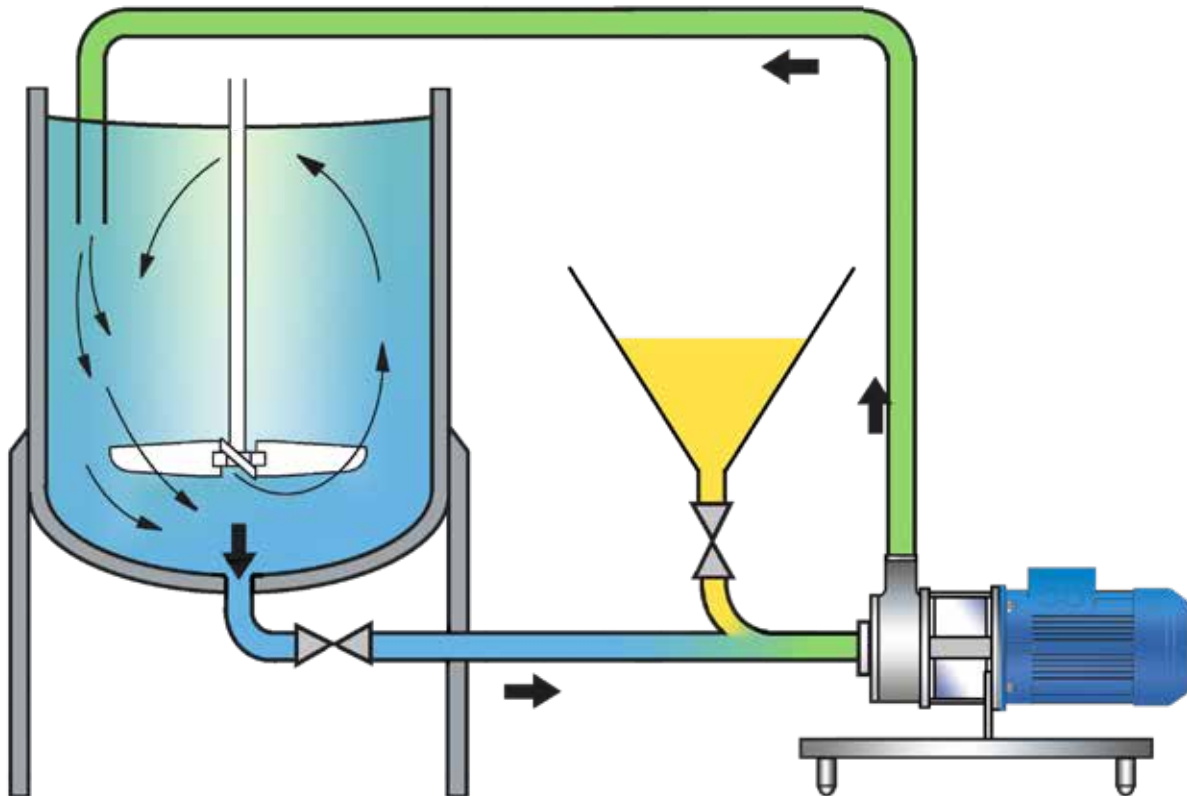


# Performance

Typical liquid flow and powder incorporation rates are as follows:

Model	Liquid Flow (tonnes/hour)	Gums & Thickeners	Milk Proteins	Sugars
FMX25	20	600	1,700	1,000
FMX50	40	1,100	7,000	3,500
FMX75	90	2,600	14,000	10,000

\*Powder incorporation rates shown are in kilos/hour and are for guidance only



# Operation

The Flashmix is designed for use in a recirculation system as shown above. Powder is rapidly incorporated by the self-pumping Flashmix, and a brief period of recirculation results in an agglomerate-free, homogeneous dispersion.

An auxiliary in-tank mixer or agitator will normally be required to maintain uniformity in the process vessel.

# Technical Specifications

## Materials of Construction

	Standard Unit	Chemical Duty
Wetted Parts: 316L Stainless	<input checked="" type="radio"/>	<input checked="" type="radio"/>
Wetted Parts: Special Materials	<input type="radio"/>	<input type="radio"/>
Chassis: 304 Stainless	<input checked="" type="radio"/>	<input checked="" type="radio"/>
Elastomers: Viton	<input checked="" type="radio"/>	<input checked="" type="radio"/>
Elastomers: Other	<input type="radio"/>	<input type="radio"/>
Operating Pressure	150 psi (10 bar)	150 psi (10 bar)

## Motor

TEFC	<input checked="" type="radio"/>	<input checked="" type="radio"/>
Other - Stainless, Flameproof/ATEX	<input type="radio"/>	<input type="radio"/>

## Inlet/Outlet Connections

Tri-Clamp	<input checked="" type="radio"/>	<input type="radio"/>
Flange	<input type="radio"/>	<input checked="" type="radio"/>
Other e.g., RJT, SMS, etc.	<input type="radio"/>	<input type="radio"/>

## Sealing

Single Mechanical		<input checked="" type="radio"/>
Double Mechanical		<input type="radio"/>
Ultra-Hygienic Single/Double Mechanical	<input checked="" type="radio"/>	

## Powder Feed

Manual Butterfly Valve	<input checked="" type="radio"/>	<input checked="" type="radio"/>
Other e.g., Manual Ball Valve, Pneumatic, etc.	<input type="radio"/>	<input type="radio"/>
Powder Feed Suction Hose	<input type="radio"/>	<input type="radio"/>

Standard     Optional



FMX25 with 40 litre hopper



Sack table option



FMX50 with 100 litre profiled hopper



Powder feed suction hose



FMX75 with 300 litre profiled hopper

# Flashblend Powder/Liquid Mixing System

The Silverson Flashblend is designed to incorporate large volumes of powders on a continuous and semi-continuous basis, at rates of up to 15,000 kilos/hour. The semi-automated system can be specified for ultra-hygienic applications and custom built to suit clients' specific requirements. There are over 500 Flashblend systems in use worldwide, throughout all sectors of the process industry.



## Technical Specifications

### Materials of Construction

	FLB 30	FLB 60
<b>Wetted Parts: 316L Stainless</b>	●	●
<b>Wetted Parts: Special Materials</b>	○	○
<b>Chassis: 304 Stainless</b>	●	●
<b>Elastomers: Viton</b>	●	●
<b>Elastomers: Other</b>	○	○

### Motor

<b>TEFC</b>	●	●
<b>Other - Stainless, Flameproof/ATEX</b>	○	○

● Standard    ○ Optional

### Inlet/Outlet Connections

	FLB 30	FLB 60
<b>Tri-Clamp</b>	●	●
<b>Other e.g., RJT, SMS, etc.</b>	○	○

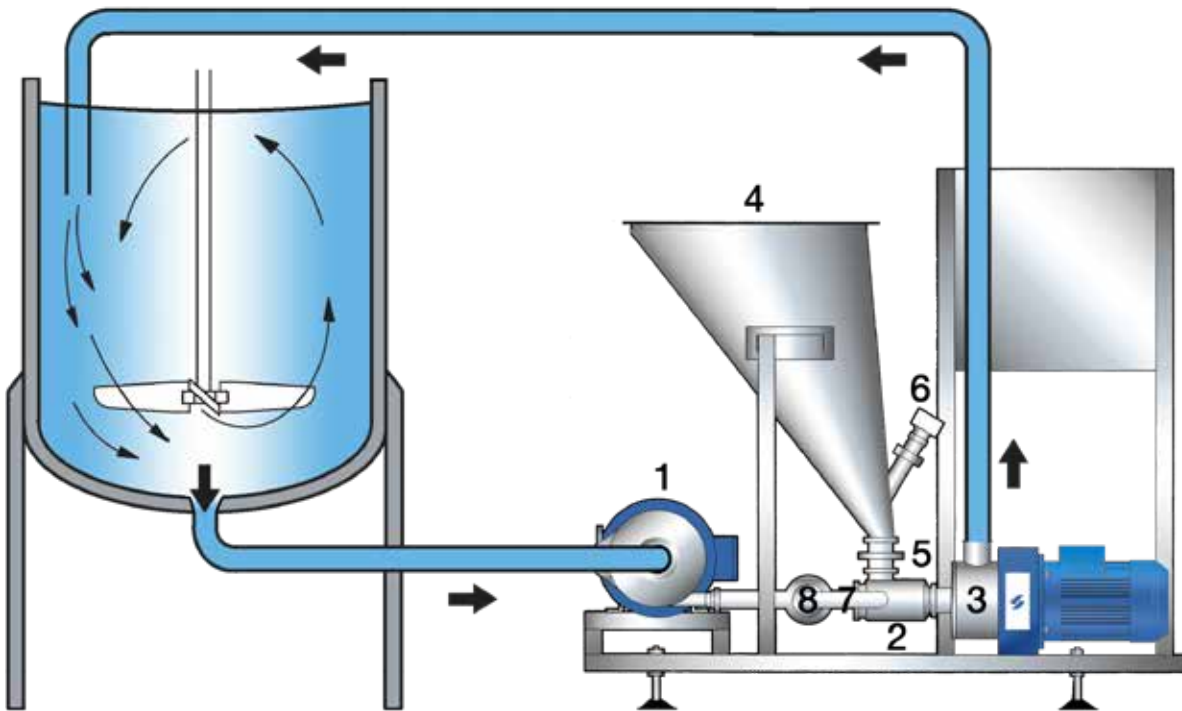
### Sealing

<b>Single Mechanical</b>	●	●
<b>Double Mechanical</b>	○	○

### Powder Feed

<b>Pneumatic Butterfly Valve</b>	●	●
<b>Hopper</b>	100L	300L

# Operating Sequence



## Operation

Liquid is forced through the system by the pump (1). The liquid flow through the venturi assembly (2) creates a vacuum, boosted by the pumping action of the Silverson In-Line mixer (3). When powder is present in the hopper (4), the valve (5) can be opened and powder is drawn down into the venturi by the vacuum.

The powder/liquid mix immediately passes into the high shear rotor/stator assembly of the Silverson In-Line mixer, ensuring a finely dispersed and agglomerate-free mixture. The resultant product is passed back to the process vessel by the pumping action of the machine.

Once the hopper is empty, the sensor (6) will automatically shut the valve, minimising aeration. When the powder sensor closes the powder feed valve, product flow can be diverted round a bypass line (7) by the diverter valve (8). The high flowrate in this mode ensures a scouring action of the venturi housing, keeping the area free of any build-up of partially hydrated powder. The bypass position is also used for Cleaning-In-Place (CIP), ensuring that the venturi area is cleaned to as high a standard as normal hygienic piping.

## Advantages

- Suitable for large scale production
- Can be incorporated into automated systems
- Fully sterilisable units available
- Can be customised to suit client requirements
- Agglomerate-free product
- Repeatability
- Speed
- Minimum aeration
- Improved vessel hygiene







# Bottom Entry Mixers & Disintegrators

Silverson Bottom Entry mixers are ideal for disintegrating solids, forming emulsions and incorporating powders into liquids, particularly those with a tendency to float or raft.

# Bottom Entry Mixers

Silverson's hygienic High Shear Bottom Entry mixers are ideal for disintegrating solids and incorporating powders that have a tendency to float on the liquid surface. They can also be used in conjunction with a slow speed anchor stirrer or scraper unit for high viscosity products.

The Silverson Bottom Entry mixer gives high shear homogenisation while the stirrer/scraper distributes the homogenised output uniformly through the vessel. This is ideal for high viscosity cosmetic, pharmaceutical and food products.

As with all Silverson rotor/stator mixers, rapidly interchangeable stators, disintegrating heads or screens are available to adapt machines for a wide range of mixing duties.

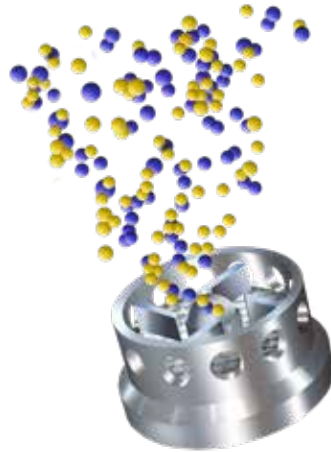


Ideal for  
Ultra-Hygienic  
Applications

# How the Bottom Entry Mixer Works

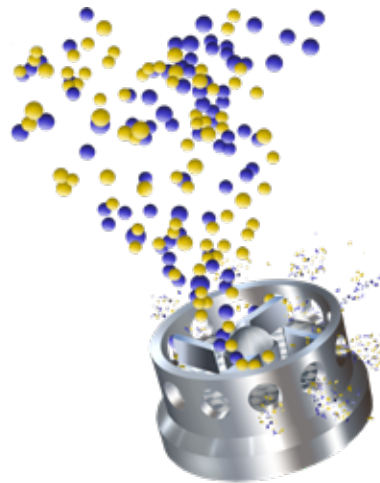
## Stage 1

The high speed rotation of the rotor blades exerts a powerful suction, drawing liquid and solid materials downwards into the centre of the workhead.



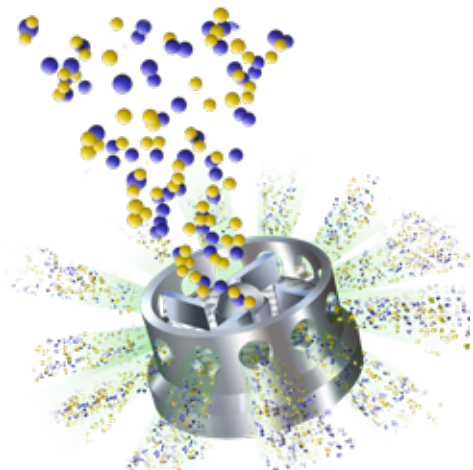
## Stage 2

Centrifugal force then drives the materials towards the periphery of the workhead where they are subjected to intense hydraulic shear in the clearance between the rotor and the stator.



## Stage 3

The product is forced out through the stator and projected radially at high speed towards the sides of the mixing vessel. Fresh material is simultaneously drawn into the workhead, maintaining the mixing cycle.



# Technical Specifications

## Materials of Construction

	Standard	Ultra Hygienic	Ultramix
Wetted Parts: 316L Stainless	●	●	●
Wetted Parts: Special Materials	○	○	○
Operating Pressure*	40 psi (2.8 bar)	40 psi (2.8 bar)	40 psi (2.8 bar)

\*Higher pressure units available on request



**General Purpose Disintegrating Head**

## Motor

TEFC	●	●	●
Other - Stainless, Flameproof/ATEX	○	○	○



**Slotted Disintegrating Head**

## Mounting

Flange Fitting	●	●	●
Clamp-on Fitting*	○	○	○

\*For smaller units only



**Square Hole High Shear Screen™**

## Sealing

Single Mechanical	●	●	●
Double Mechanical	○	○	○
Special Seal Arrangements	○	○	○
Ultra-Hygienic Specification		●	○

● Standard ○ Optional



**Standard Emulsor Head and Emulsor Screen**

# Pilot Disintegrator Plant



The Silverson Pilot Disintegrator Plant was designed to provide a small scale version of the D2500 Disintegrator/Dissolver for R&D installations, but its versatility has seen it being used as a production unit for batches of around 150 litres in applications as diverse as luboils, chemicals and foods.

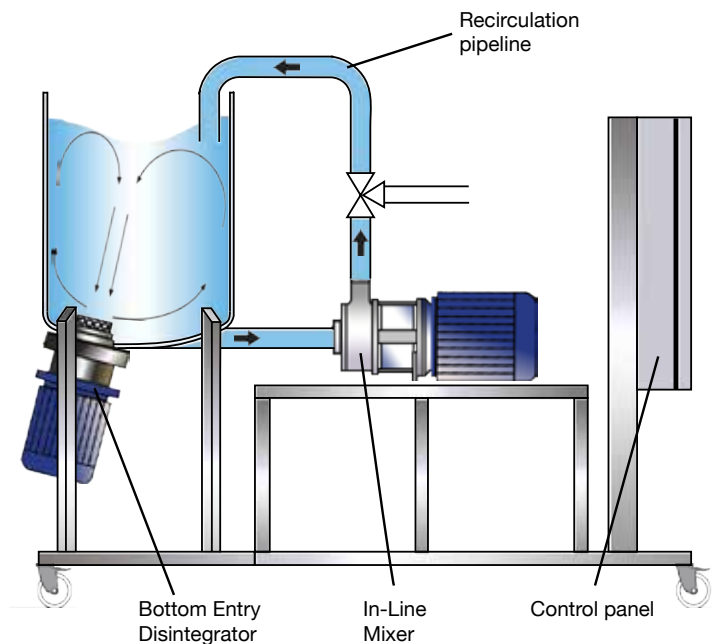
The unit comprises a vessel mounted Bottom Entry mixer coupled to a High Shear In-Line mixer homogeniser, and incorporates a control panel and all associated pipework.

During operation, the Bottom Entry mixer initially reduces solids down to granular size. The In-Line mixer is then started and the product is further reduced as it is recirculated through the high shear workhead, accelerating the solubilisation or disintegration process.

Pilot Disintegrator Plants are usually built to order and can be customised to meet each client's specific requirements.

## Typical Applications

- VM (viscosity modifiers) polymers into oil for the automotive industry
- Paper reclaim
- Pulping and disintegrating of fresh and dried fruit
- Confectionery reclaim - including hard sugar confectionery, soft gum type sweets and chocolate/biscuit waste
- Preparation of vegetable smoothies
- Re-dispersion of filter cake
- High viscosity product applications including bulk powder dispersion







# Disintegrator 2500

If you thought it couldn't be done think again. Silverson's mighty Disintegrator mixing system will disintegrate, solubilise or disperse the largest of solids - up to 1000mm across - in a single operation and in times you wouldn't believe!

# Disintegrator 2500

The D2500 incorporates a powerful and unique Silverson mixer located in the bottom of a custom-built vessel. The mixer exerts a massive suction downwards from the surface of the liquid, pulling down even the most buoyant of solids, no matter what the size. These solids are literally ripped apart and dispersed throughout the mix, and with the refinement of a Silverson In-Line mixer, included in the system, are totally solubilised or suspended.

Specified by  
All the Major  
Oil Companies





# How the D2500 Works

The D2500 is a self-contained high-powered unit consisting of a specially designed Silverson high shear rotor/stator disintegrating workhead set into a custom-built vessel coupled with a Silverson high shear In-Line mixer.

## Stage 1

The unit is charged with liquid and started. Large solids are fed into the vessel and drawn down into the workhead which will rapidly shear lumps and slices off the edges and corners. These will be drawn into the interior of the workhead, driven by centrifugal force to the periphery and further sheared by the rotor tips against the edges of the stator as they are expelled radially from the head.

## Stage 2

Rapid fragmentation of the large solids continues until all the particles are small enough to be drawn into the workhead for further disintegration. Materials are discharged horizontally from the workhead and forced up the vessel's walls, drawn into the vortex and repeatedly through the workhead for final disintegration. This cycle continues until all solids are reduced to granular size.

## Stage 3

Once the solids are down to granular size the self-pumping Silverson In-Line mixer is started. The product is drawn from the bottom of the vessel, processed through the In-Line mixer's high shear rotor/stator workhead and passed back into the top of the vessel, ensuring complete solution or suspension.



### **Advantages**

- Size and shape of product is inconsequential. The Disintegrator 2500 can take odd shapes and the largest sized polymer bales commercially produced.
- No need for pre-grinding, slicing or cutting of large solids. All solids are dissolved in one vessel
- Elimination of additional equipment such as grinders or choppers reduces maintenance costs and dust emissions
- Puts products into complete solution or suspension without leaving undesired particles on vessel walls
- Can handle poly-wrapped bales without prior removal of wrapper, eliminating the need for cutting and excess waste

### **Typical Applications**

- Rapid solution of rubbers and polymers into lubricating oils and solvents for the production of VM luboils, and adhesives
- Dispersion of filter cakes
- Disintegration of solid blocks of cheese, butter, compressed raisins and dried fruit, oleoresins and frozen meat
- Disintegration and dispersion of animal and vegetable matter
- Wet crumbing of waste rubber
- Disintegration of solid gums, resins and varnishes
- Recovery of waste confectionery



# Silverson Service

## Experience and Know-How

Silverson has been the leader in High Shear Mixing technology for over 75 years and has built up a detailed knowledge of mixing process requirements. This accumulated knowledge enables our technical staff and sales representatives to clearly identify a client's needs and recommend the type of mixer most suited to provide an efficient and economical solution.

## Extensive Test Facilities

Available for the use of all clients, Silverson operates dedicated test facilities equipped with a wide range of laboratory and production scale machines where customers may test new products and discuss their applications with our technical staff. If preferred, Silverson mixers can be provided for on-site trials to allow evaluation under actual production conditions.

## Customisation

Increasingly today's process manufacturers require equipment to be designed to meet their own particular needs. Silverson has a positive approach and flexibility which allows mixers to be custom designed and built to suit individual users' specific requirements.

## Worldwide Support

A truly international company, Silverson is represented by a network of associated companies, distributors and agents in over 50 countries, serving Europe, North America, Asia, Australasia, South America and Africa.

## Installation

Silverson offers expert advice and, if required, can assist with and supervise installation and start up.

## After-sales service

With over 75 years of experience, Silverson realises the importance their customers place on reliable and rapid back-up service. Our large stock of manufactured parts enables us to despatch most standard spares the same day they are ordered.

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Patent Pending.