



# In-Line 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.

# 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

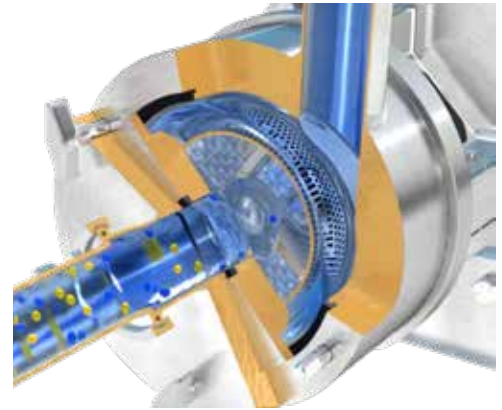
- Aeration free
- Self-pumping
- No bypassing
- Interchangeable workheads
- Hygienic construction
- Easy maintenance
- Lower power requirements
- Eliminates agglomerates and fish eyes
- Creates stable emulsions and suspensions
- Reduces particle size
- Rapidly dissolves solids
- Accelerates reactions



# How the In-Line Works

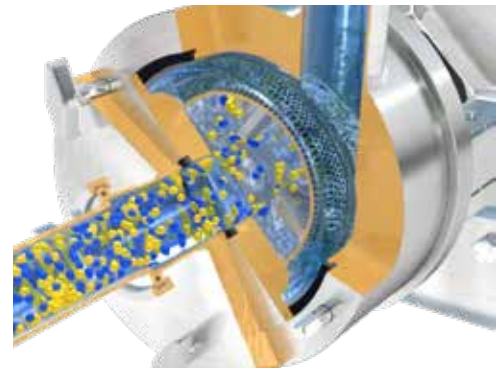
## Stage 1

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.



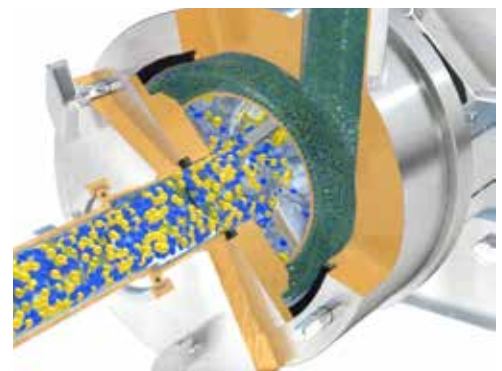
## Stage 2

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.



# Interchangeable Heads and Screens

A comprehensive range of workheads and screens is available for Silverson In-Line mixers. UHS Range mixers can be used with single or multistage configurations, allowing mixing characteristics to be adapted to suit specific process requirements. 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.



Multistage General Purpose Disintegrating Head, Inner and Outer

## 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.



Multistage Slotted Disintegrating Head, Inner and Outer

## 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.



Inner General Purpose with Outer Slotted Disintegrating Head

## Emulsor Screen

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



Slotted with Outer Square Hole High Shear Screen™

# How to Use In-Line Mixers

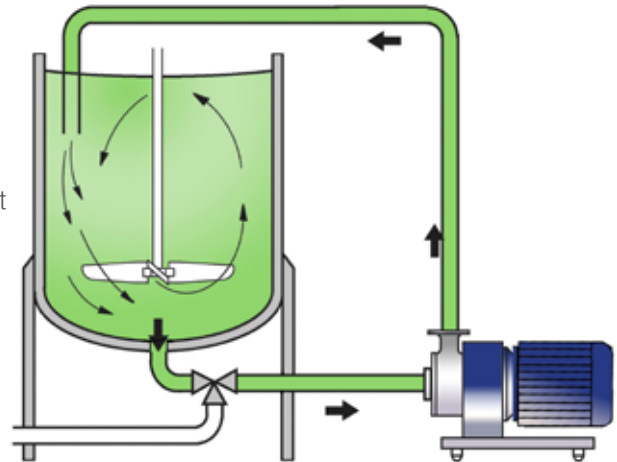
## Recirculation Method

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.

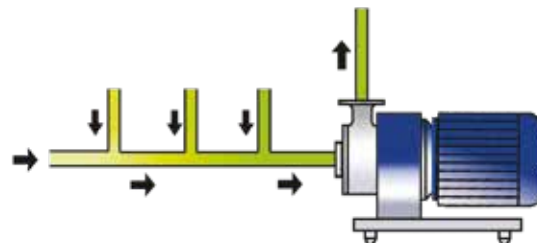
Additional fluid ingredients can be fed into the workhead and uniformly mixed before entering the vessel.

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.

# 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.



# 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 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.

