For over 50 years Silverson has specialised in the manufacture of quality High Shear Mixers for processing and manufacturing industries worldwide.

With customers in over 140 countries and serving industries as diverse as food, pharmaceuticals, cosmetics, chemicals, luboiis and petrochemicals, Silverson has become a world leader in the field of High Shear Mixing. Time and again companies specify Silverson Mixers as the “standard” equipment for their manufacturing processes.

A truly international company, Silverson is represented by a network of associated companies, distributors and agents in over 40 countries, serving Europe, North America, Asia, Australasia, South America and Africa.
How the Silverson Works

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.

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.

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.

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 down into the workhead, maintaining the mixing cycle. The effect of the horizontal (radial) expulsion and suction into the head is to set up a circulatory pattern of mixing which is all below the surface.

As a result there is no unnecessary turbulence at the surface. Provided the machine is correctly chosen for size and power, the entire contents of the vessel will pass hundreds of times through the workhead during the mixing operation to give uniform progressive processing and homogenisation. A further benefit derived from the controlled mixing pattern is that aeration is minimised.
WHAT ARE THE ADVANTAGES OF A SILVERSON HIGH SHEAR MIXER?

► 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.

Unrivalled versatility allows any machine to be adapted to perform the widest range of mixing applications - mixing, emulsifying, homogenising, disintegrating, dissolving, dispersing, blending, particle size reduction and de-agglomerating.

WHAT WILL THE SILVERSON DO?

► BLENDING In blending liquids of similar or greatly varying viscosities, the unique Silverson mixing action can rapidly produce a guaranteed homogeneous product. The Silverson batch mixer outperforms all conventional agitators and mixers in both speed, efficiency and product uniformity and, eliminating the need of in-tank baffles, improves hygiene and allows vessel load cell mounting.

► EMULSIFYING AND HOMOGENISING The Silverson high shear rotor/stator design means that emulsions (typically in the range of 0.5 to 5 microns) can be easily achieved, in many cases dispensing with the need for more costly and complicated equipment such as high pressure homogenisers.

► DISINTEGRATION All Silverson mixers are able to disintegrate matter of animal, vegetable, mineral or synthetic origin in a single operation.

Silverson expertise distinguishes it from all other manufacturers in its ability to disintegrate large blocks of solid material. From the Duplex Dissolver to the mighty D2500 capable of disintegrating whole bales of rubber 80 x 40 x 15cms, a single Silverson mixer is capable of performing duties that in the past would have required several operations.

► PARTICLE SIZE REDUCTION For particle size reduction, this same rotor/stator action will ensure the rapid and uniform milling of both solid and semi-solid materials
into either solution or fine suspension. The degree of size reduction will always depend on the hardness or toughness of the product, but, in many applications, the use of a Silverson may dispense with the need for conventional size reduction equipment, such as dispersers/cavitation mixers, grinders and mills, at a fraction of the cost.

**GELLING AND SOLUBILISING**  The solution of gums, alginates, C.M.C., carbopols, etc., can be a slow and difficult process if a conventional agitator or mixer is used. Agglomerates frequently form and these can only be removed slowly by the washing action of the agitator.

With a Silverson mixer, however, the high shear action of the rotor/stator rapidly disperses the material, constantly exposing increasing areas of the solid to the surrounding liquid. The result is an agglomerate-free solution within minutes.

## Silverson Service

**EXTENSIVE TEST FACILITIES**
Available for the use of all clients, Silverson maintains a dedicated test facility equipped with a wide range of laboratory and production scale machines. Here customers may test new products and discuss their applications with our technical staff. If preferred, Silverson mixers can be provided for on-site trials at the customer’s own premises to allow evaluation when operating under actual production conditions.

**CUSTOMISATION**
Increasingly today’s process manufacturers require equipment to be designed to meet their own particular needs. Silverson, working in close co-operation with the customer, has a positive approach and flexibility which allows custom designed and built mixers specifically suited to the individual user’s requirements.
MATERIALS OF CONSTRUCTION Unless otherwise stated, all product contact parts are constructed in Grade 316 Stainless Steel. Where required, machines can be constructed in non-standard materials, such as carbon steel or Hastelloy.

BUSH MATERIAL The bush will normally be bronze alloy or re-inforced PTFE depending on the application. Other materials are available.

MOTORS The standard range of motors available includes:
TEFV: Totally Enclosed Fan Ventilated.
ExN T3: Non-sparking
EEedx: Flameproof CENELEC/EURONORM/BASEEFA Groups 2A, 2B, T1 - T4
IP55 Weatherproof/Hoseproof enclosure is standard for all motors. Other types of enclosures and standards i.e. C.S.A., U.L., or P.T.B. certified are available on request.

MOUNTING Models BX up to GX can be mounted on specially constructed Mobile Hydraulic Floor Stands (See Page 14). Alternatively they can be supplied with either a rectangular or circular flange for mounting on the vessel.
Tri-clamp mounting is also available. Larger machines (Model 700X and above) are of a size and weight which requires them to be vessel mounted.

SEALING All Silverson batch mixers are designed for operation in open vessels. Single and double mechanical shaft sealing for operation under vacuum and/or positive pressure is available for most machines (See Page 13).

CLEANING The machines are in most cases self-cleaning, a short run between successive operations in water, detergent or an appropriate solvent being all that is necessary. For more thorough cleaning, dismantling is easy and downtime minimal.

VESSEL SELECTION To obtain the best results with a Silverson batch mixer it is important to use a suitable shaped mixing vessel. Vertical, cylindrical vessels with a shallow dish or cone bottom and hemispherical vessels are ideal but machines can also be used in vessels of other configurations. Baffles are undesirable as they impede the mixing action of the machine. Silverson technical staff will always be happy to advise.
Interchangeable Heads and Screens

A comprehensive range of workheads and screens is available for all Silverson high shear 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.

► 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.

► 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.

► AXIAL FLOW HEAD
This special head expels jets of material vertically upwards parallel to the shaft and is used in certain circumstances where aeration needs to be minimised. It may also be used to maintain heavy insoluble solids in constant circulation.

► STANDARD EMULSOR HEAD AND EMULSOR SCREEN
Suitable for liquid/liquid preparations and especially useful for all emulsions. Emulsor screens are available in fine, medium, or coarse perforations.

► DOWNTHRUST PROPELLER
Used to increase the overall circulation within the vessel and assist in the incorporation of light powders. The Downthrust Propeller is adjustable so that it can be raised and lowered to give the optimum effect. Upthrust Propellers are also available to assist in maintaining heavy insoluble solids in suspension.
Standard Multi-purpose Mixers

The “standard” multi-purpose high shear mixers of the Silverson range are able to perform the widest variety of applications - mixing, emulsifying, homogenising, disintegrating and dissolving - with an efficiency and flexibility unmatched by other machines.

Each machine employs the special “Interchangeable” Silverson Rotor/Stator Mixing Head, which allows it to be used on a wide variety of different products, while the robust and simple construction ensures that cleaning and maintenance are kept to an absolute minimum.

► MEDIUM RANGE - MODELS BX TO GX20
Any machine in this range from the BX 0.75kW to the GX20 15kW can be used on a mobile hydraulic floor stand. This option greatly increases the flexibility of the 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.

► COMPRESSED AIR MODELS
Mixers powered by compressed air are available up to 3kW and offer an alternative to the use of Explosion Proof electric motors, as well as having the advantage of offering variable speeds. Additional information is available on request.

► 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.
Diagrams and Dimensions

Motor power ratings in this brochure are based on 50 Hz power supply and on materials with a viscosity up to 10,000 centipoise and specific gravity up to 1.3. For operation on 60 Hz electricity supply (because of the higher shaft speeds) and on materials of higher viscosity or specific gravity, higher power motors will be required.

Electrical switchgear is not supplied.

| MODEL | kW  | RPM | A  | B  | TEFV C | EExD C | D | E  | F  | G  | H  | I  | J  | K  | CAPACITY (litres) |
|-------|-----|-----|----|----|--------|--------|---|----|----|----|----|----|----|------------------|
|       |     |     |    |    |        |        |   |    |    |    |    |    |    | WATER VISC | HIGH VISC |
| BX    | 0.75| 3000| 118| 610| 277    | 312    | 229| 229| 178| 203| 4x10| 254| 203| 6x10  | 220     | 20      |
| DX    | 1.5 | 3000| 160| 690| 303    | 330    | 254| 254| 203| 229| 4x10| 254| 203| 6x10  | 450     | 50      |
| EX    | 3   | 3000| 165| 790| 334    | 379    | 305| 305| 267| 267| 4x11| 337| 292| 6x11  | 675     | 90      |
| FX    | 4   | 3000| 165| 1042| 334 | 379 | 305| 305| 267| 267| 4x11| 337| 292| 6x11  | 1200    | 150     |
| GX10  | 7.5 | 3000| 286| 1220| 413 | 460 | 305| 407| 254| 369| 4x11| 407| 356| 6x11  | 1800    | 275     |
| GX10  | 7.5 | 1500| 286| 1220| 413 | 460 | 305| 407| 254| 369| 4x11| 407| 356| 6x11  | 2250    | 400     |
| GX20  | 15  | 3000| 286| 1220| 561 | 600 | 381| 483| 305| 432| 4x14| 407| 356| 6x14  | 2250    | 400     |
| 700X  | 11  | 1500| 368| 1525| 561 | 600 | 482| 381| 432| 305| 4x14| 483| 406| 6x14  | 3500    | *       |
| HX10  | 7.5 | 1000| 419|  +  | 565 | 605 | 520| 432| 476| 381| 4x17.5| 584| 521| 6x20.5| 5000    | *       |
| HX30  | 22  | 1500| 419|  +  | 670 | 710 | 520| 432| 476| 381| 4x17.5| 584| 521| 6x20.5| 5000    | *       |
| JX    | 15  | 1000| 419|  +  | 670 | 710 | 520| 432| 476| 381| 4x17.5| 584| 521| 6x20.5| 7000    | *       |
| KX    | from 30  | 1000| 610|  +  | 860 | 935 | 864| 711| 787| 610| 4x17.5| 864| 794| 8x17.5| 10000   | *       |

+ Length adjusted to suit vessel
* Capacities available upon request

Dimensions of larger models available upon request

All dimensions shown are in millimetres

The dimensions shown are approximate only and certified diagrams should be used for installation purposes.

Silverson reserves the right to change dimensions and specifications without notice.
The Duplex was specifically developed for the disintegration and solublisation of solid rubbers and polymers for the luboil 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 multi-purpose 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.) need 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 luboils, adhesives and bituminous compounds
- Disintegration and dissolving of solid resin for the production of varnish
- Vegetable and meat purée/slurries
- Recovery of waste confectionery
V Range Mixers

These machines have been developed for use in applications where a powerful vortex from the surface is required to absorb and wet out large volumes of powders rapidly.

In the V range the workhead faces upwards and draws materials down from the surface of the liquid. This creates a powerful vortex which is ideally suited for rapid dispersion of large volumes of powder or absorption of materials which are difficult to wet out and that have a tendency to float or ‘raft.’

Once wetted out, repeated passes through the workhead ensure that a fine suspension or solution is obtained.

Due to the mixing action of the machine, it is best suited for products where aeration does not create a problem.

► TYPICAL APPLICATIONS
• Bulk powder dispersion • Batters
• Sugar slurries • Concentrated gum dispersion
• Fumed silica dispersions • Viscous slurries

VSP Mixers

VSP batch mixers are specially designed to allow free flowing powders to be incorporated into liquids by feeding them through a hopper or vacuum wand directly into the rotor/stator workhead. This provides a highly efficient and hygienic method of powder/liquid mixing using an in-tank mixer.

The high speed rotation of the rotor within the workhead creates a powerful suction which draws powders through the eductor tube into the centre of the mixing zone. The powder is therefore introduced to the liquid under intense high shear, ensuring the materials are instantaneously mixed before being forced out through the stator and projected into the body of the mix. There is virtually no opportunity for agglomeration of the particles, and problems such as rafting, dusting and “scumline” on the vessel walls are practically eliminated. Flow of powder is controlled by a manual butterfly valve, keeping aeration to a minimum.

Small volumes of light, dusty powders can be absorbed straight from original containers by using a vacuum wand in place of the powder feed hopper. This ‘fluidises’ the powder with air and draws it through the eductor into the workhead as before.
**NO IMMERSED BEARING**
With the standard Silverson mixer a highly abrasive product can cause excessive wear on the bush and the shaft. In the Abramix RBX the bush has been completely eliminated by the use of a heavy-duty shaft which is firmly supported by two precision roller bearings, situated above the level of the product being mixed. Minimum maintenance is a key feature of the design.

**DRY RUNNING**
Dry running in non-flammable products is possible, allowing mixing to continue uninterrupted while emptying the mixing vessel.

**TYPICAL APPLICATIONS**
- Liquid Glazes - Preparation and Re-dispersion including Incorporation of Pigments, Wetting Agents, Hardeners, etc.
- Ceramic slips • Clays and Silicas • Texture Paints
- Foundry Compounds.

**Silverson tubular mixers** are designed for operation in sealed vessels where a product lubricated mechanical shaft seal is required.

Tubular mixers are suitable for operation under atmospheric or positive pressures and are ideal for mixing products where sealant fluids need to be avoided.

The mixer shaft is sealed at its lower end by a conventional mechanical shaft seal which is lubricated and cooled by the product being mixed.

As with all Silverson units, interchangeable stators are available to adapt the machine for varying processes.

The tubular design also allows the machine to fit through relatively small diameter vessel openings.

Each mixer is designed to suit individual process requirements.

**TYPICAL APPLICATIONS**
- Active ingredients into inhalants • Injectables • Vaccines
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.

▶ 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 which 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.
Hydraulic 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. All 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 prevent 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.

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SAFE WORKING LOAD
D = 60 kilos
E = 95 kilos
F = 110 kilos

All dimensions in millimetres
Other Silverson Products

From small laboratory units to 30,000 litre production scale machines, the Silverson range offers consistently high quality equipment producing uniform and reliable results.

▶ IN-LINE HIGH SHEAR MIXERS
For continuous processing or batch recycling, Silverson has a complete range of high shear In-Line mixers from the 0.25kW laboratory unit to the 125kW Multishear Mill. Throughput from 20 litres/minute up to 200,000 litres/hour.

▶ FLASHBLEND
For high speed entraining and instant dispersion of powder into liquid. Designed to produce a homogeneous agglomerate-free solution/dispersion without entraining air, the Flashblend range comprises units capable of incorporating up to 15,000 kilos/hour of powder.

▶ MULTI-PURPOSE LABORATORY MIXERS
For everyday laboratory work Silverson offers a full range of multi-purpose laboratory mixers with capacities from 1 ml to 12 litres.

▶ DISINTEGRATOR 2500
SOLID/LIQUID MIXING SYSTEMS
Designed to disintegrate and solubilise whole bales or blocks of rubbers and polymers rapidly without the need for any preliminary crumbing. Other uses include disintegration of large solids in the food industry, dispersion of filter cakes and disintegration of solid gums, resins and varnishes, etc.
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Silverson can be found on the World Wide Web at www.silverson.com

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