Silverson Multistage
High Shear In-Line Mixer
Double Seal Model: 500/700MS
Fitted with Nema C-Face Motor

MIXER SERIAL No. ________________

Silverson Machines Inc. 355 Chestnut Street. East Longmeadow. MA. 01028
Tel:(413) 525 4825. Fax:(413) 525 5804
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1.0 INTRODUCTION

The purpose of this manual is to provide you with the information needed to install, operate and maintain your Silverson High Shear In-Line Mixer.

With over 50 years of manufacturing experience Silverson has established an unequalled reputation for quality and reliability and we want you to get the best possible performance from your mixer.

IMPORTANT: Please read this manual carefully before attempting to set up or operate your machine. Neither Silverson Machines nor their representatives can accept responsibility for damage or injury resulting from improper set up or use. If you have any questions, please contact our Technical Service Department, or our representatives who will be pleased to help you.

1.1 WARRANTY

Silverson Machines Inc. offers comprehensive after-sales services. If any major fault develops, the mixer should be returned for repair and / or service.

The nature of the fault should be fully described and the Model and serial number of the machine quoted in any accompanying correspondence.

Repair or replacement under warrantee will be effected without charge for up to 1 year from the date of purchase.

The mixer must only be shipped suitably packed and with the approval of Silverson Machines or their accredited representatives.

1.2 TECHNICAL SERVICE

Spare parts and advice regarding the operation of your machine can be obtained from the Technical Service Department:

SILVERSON MACHINES INC
355 CHESTNUT STREET
EAST LONGMEADOW
MA. 01028
U.S.A

TEL:(413) 525 4825
FAX:(413) 525 5804

or our appointed agents
2.0 SAFETY

2.1 Throughout this manual you will find WARNINGS and CAUTIONS associated with certain procedures.

DANGER: INDICATES AN IMMINENTLY HAZARDOUS SITUATION WHICH, IF NOT AVOIDED, WILL RESULT IN DEATH OR SERIOUS INJURY.

WARNING: INDICATES A POTENTIALLY HAZARDOUS SITUATION WHICH, IF NOT AVOIDED, COULD RESULT IN DEATH OR SERIOUS INJURY.

CAUTION: Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.

NOTICE: indicates that the machine may be damaged if care is not taken when performing the procedure.

2.2 Please observe the Health and Safety regulations applicable to your particular location; these vary from place to place but their substance is the same - avoid all hazards to personnel and property.

2.3 WARNING: NEVER USE THE MACHINE IN A HAZARDOUS AREA WHERE A FLAMMABLE OR EXPLOSIVE ATMOSPHERE MAY BE PRESENT UNLESS THE MACHINE IS FITTED WITH A EXPLOSION PROOF MOTOR RATED TO THE RELEVANT STANDARD FOR THAT AREA.

2.4 Use special care when handling the rotor - THE ROTOR BLADES MAY BE SHARP!

2.5 If using solvents to clean components, use in a well ventilated area and avoid inhalation of fumes. Keep away from sources of ignition :- No Smoking.

2.6 Never use parts other than those supplied or recommended by Silverson Machines. The use of such parts will nullify any warranties and may cause premature wear or more seriously may cause component failure and possible injury.

2.7 Check that the voltage, phases and cycles (Hz) which are stamped on the electrical data plate are compatible with the available electricity supply.

2.8 WARNING: ALWAYS DISCONNECT THE MACHINE FROM THE ELECTRIC SUPPLY BEFORE CARRYING OUT ANY MAINTENANCE WORK.

Any electrical operation should only be carried out by a suitably qualified electrician.

2.9 WARNING: NEVER CARRY OUT ANY MAINTENANCE WORK OR REMOVE THE INLET/STATOR MOUNTING PLATE WHILE THE MACHINE IS RUNNING OR IS STILL CONNECTED TO THE ELECTRICAL SUPPLY. FAILURE TO OBSERVE THIS MAY RESULT IN BODILY INJURY.

2.10 WARNING: NEVER EXCEED THE SAFE WORKING OPERATING PRESSURE OF THE MACHINE. FAILURE TO OBSERVE THIS MAY RESULT IN BODILY INJURY OR MAY LEAD TO DAMAGE OF THE MACHINE.

If in any doubt as to the maximum pressure in the inlet piping, install a pressure relief valve set at the operating pressure of the machine in the inlet pipeline.

2.11 Always use suitable lifting equipment where necessary; some components are heavy and can be dangerous to lift without the correct equipment.

2.12 WARNING: THE MIXER BODY MUST BE FILLED WITH WATER OR ANOTHER SUITABLE FLUID BEFORE OPERATING THE MIXER. NEVER LET THE MIXER RUN DRY. FAILURE TO OBSERVE THIS WILL RESULT IN SERIOUS MECHANICAL DAMAGE AND MAY PRESENT A POTENTIAL SOURCE OF IGNITION.

Silverson Machines Ltd strongly recommends that a low level control system is fitted and inter-linked with the mixers electrical switchgear to ensure that the mixer is automatically switched off if no liquid is present in the system.

2.13 WARNING: THIS INLINE MIXER IS FITTED WITH DOUBLE BACK TO BACK MECHANICAL SHAFT SEALS. THE CHAMBER BETWEEN THE SEALS MUST BE FLUSHED WITH A PRODUCT COMPATIBLE FLUID (PREFERABLY NON-FLAMMABLE) AT A PRESSURE AT LEAST 1 BAR (14.7PSI) IN EXCESS OF THE MAXIMUM ENVISAGED PRESSURE IN THE MIXER BODY. FAILURE TO DO THIS WILL RESULT IN RAPID SEAL FAILURE AND PRESENT A POTENTIAL SOURCE OF IGNITION.
3.0 DESCRIPTION

3.1 Silverson Standard Multi-Purpose In-Line Mixers are designed to perform the widest possible variety of applications: Mixing, emulsifying, homogenising, disintegration and dissolving.

3.2 WORKHEADS (STATORS)

The Multi-Stage In-Line Mixer is fitted with a multi-toothed rotor consisting of two concentric sets of blades and teeth running against two separate stators.

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

These rapidly interchangeable workheads offer great versatility by allowing any machine to be adapted to perform a wide range of mixing operations. These include emulsifying, homogenising, disintegrating, dissolving, dispersing, blending, particle size reduction and de-agglomerating. Changing from one screen to another is quick and simple (see Maintenance Section 6.3).

The following workhead descriptions are provided to assist customers in making the correct choice. If you are in any doubt as to the suitability of a workhead for use with a particular application, please do not hesitate to contact us. We will be happy to advise and, where feasible, arrange for tests to determine the most suitable type of workhead for your needs.

3.2.1 General Purpose Disintegrating Head

Used for a wide range of applications, this head will give the greatest throughput. Suitable for the blending of liquids of similar or greatly varying viscosities, its uses also include the disintegration of solid and semi-solid materials.

3.2.2 Slotted Disintegrating Head And Positive Cut 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.

3.2.3 Square Hole High Shear Screen

The configuration and fine internal tolerances of this workhead provide exceptionally high shear rates which are ideal for the rapid size reduction of soluble and insoluble granular solids. It is also suitable for the preparation of emulsions, gels and thickeners and fine colloidal suspensions.

3.2.4 Emulsor Screens

These screens are suitable for liquid/liquid preparations and are especially useful for the production of emulsions. Emulsor screens are available in fine, standard or coarse perforations.

Fig.1 Workheads (Stators)
3.0 DESCRIPTION

3.3 METHOD OF OPERATION

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3.3.1 SINGLE PASS METHOD

There are basically three types of operation for which single pass processing can successfully be used.

**Continuous Blending**

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

![Fig. 2](image1)

**Series Processing**

In certain cases where a higher degree of homogenisation or comminution is required than can be obtained in a single pass, it is possible to achieve the required results using two or more mixers.

**Pre-mix Method**

The ingredients are coarsely pre-mixed in a holding vessel with a Silverson batch mixer or a simple agitator. A single pass through the Inline mixer will then ensure an agglomerate free homogeneous product. All the product must pass through the Inline mixer’s rotor/stator workhead as by-passing is impossible.

![Fig. 3](image2)

3.3.2 RECIRCULATION METHOD

When a higher degree of homogenisation, emulsification or particle size reduction is required a recirculation method is recommended. 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 liquid ingredients can be fed into the inlet pipeline and will be drawn immediately into the workhead and uniformly mixed before entering the vessel.
4.1 INSTALLATION - MECHANICAL

4.1.1 The mixer should be mounted on a firm and level surface. The Mixer is fitted with four adjustable feet, these feet should be adjusted so that the Mixer is level in both planes. The mixer should not be bolted down but should be free to move on its feet. There are no dynamic loads on the mixer.

**NOTICE:** To avoid undue distortion stresses being placed on the equipment NEVER WELD THE MIXER IN PLACE; such an installation will invalidate all warranties given by Silverson Machines Limited.

4.1.2 The mixer should be placed as close to the vessel as possible and the pipework should have as few bends and valves as possible in order to minimise pipework friction losses.

4.1.3 Inlet and Outlet piping should normally be of at least the same diameter as the mixer inlet/outlet connections. Long suction lines and those with several valves should be made one size larger. The outlet should normally be facing vertically upwards to prevent air locks.

4.1.4 Sufficient room should be left all around the mixer to allow for easy dismantling of pipework and for inspection and maintenance.

4.1.5 Pipework should be independently supported close to the inlet and outlet and no undue stresses should be allowed in the pipework. Failure to observe this precaution may result in the Mixer body being stressed and damage caused to the rotor/stator assembly. Allowances should be made for thermal expansion.

To prevent pipework stresses and to facilitate maintenance a short "spool piece" should be installed immediately at the inlet. This should be at least as long as the mixer body.

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4.2 BACK PRESSURE

If the pressure drop in the outlet pipeline is too great an auxiliary pump installed in the suction line to the Inline mixer should be considered. Consult Silverson Machines or their appointed agents for advice.

**WARNING:** THE MAXIMUM OPERATING PRESSURE OF THE MACHINE MUST NOT BE EXCEEDED. A SUITABLE PRESSURE RELIEF VALVE MUST BE INSTALLED IN THE INLET PIPELINE IF IT IS AT ALL POSSIBLE THAT THE MAXIMUM OPERATING PRESSURE COULD BE EXCEEDED.

4.3 INSTALLING A SEALANT SYSTEM

**WARNING:** THIS INLINE MIXER IS FITTED WITH DOUBLE BACK TO BACK MECHANICAL SHAFT SEALS. THE CHAMBER BETWEEN THE SEALS MUST BE FLUSHED WITH A PRODUCT COMPATIBLE FLUID (PREFERABLY NON-FLAMMABLE) AT A PRESSURE AT LEAST 1 BAR (14.7PSI) IN EXCESS OF THE MAXIMUM ENVISAGED PRESSURE IN THE MIXER BODY. FAILURE TO DO THIS WILL RESULT IN RAPID SEAL FAILURE AND PRESENT A POTENTIAL SOURCE OF IGNITION.

4.3.1 SEALANT SYSTEMS

There are three basic types of sealant system which are suitable for use with back to back double seals. Electrical interface as described in paragraph 4.4.5 is recommended with all three types. Silverson Machines can offer technical advice on the various systems.
4.3.2 Total Loss System

Either water or steam condensate are passed through the seal chamber to drain via a pressure sustaining or back pressure valve. A pressure gauge installed between the mixer and the valve will confirm that adequate sealant pressure is being maintained.

**NOTICE:** When installing a total loss system on water it is important that a constant pressure is maintained. Do not use a water supply that is subject to pressure fluctuations e.g. from a hose turned on up stream.

**WARNING:** WHEN USING STEAM CONDENSATE, TAKE NECESSARY PRECAUTIONS TO PROTECT PERSONNEL FROM BURNS OR SCALDS ETC. AND INSULATE ALL STEAM PIPEWORK.

4.3.3 Thermosyphon System

Various manufacturers offer proprietary sealant systems based on the thermosyphon principle. A pressurised chamber is mounted above the seal chamber and connected to it by inlet and outlet pipes which must be as straight as possible. The sealant fluid contained in the system is heated up by rotation of the seals which causes it to expand and reduce in density. It then rises up the outlet pipe to the pressure vessel where it cools and consequently reduces in density. A circulation is thus set up within the system ensuring that the seals are cooled and lubricated. Pressure is maintained either by compressed air or an independent nitrogen supply.

For duties where the product is hot, a cooling coil can be supplied fitted in the pressure vessel, this will ensure adequate circulation due to the cooling effect.

It is important, with this type of system that the sealant fluid has a viscosity of less than 30cps and has a degree of lubricity.

4.3.4 Pumped Systems

The sealant fluid is circulated from a reservoir through the seal chamber by a positive displacement pump. The pump and allied controls maintain a set pressure. Siting of the sealant system is relatively unimportant as the flow is maintained by the pump. Cooling coils can be fitted to the reservoir if the product is hot. These systems normally use oil as a sealant although models are available for circulating water and other low viscosity fluids.

4.4 INSTALLATION-ELECTRICAL

**WARNING:** ANY ELECTRICAL WORK SHOULD ONLY BE CARRIED OUT BY A SUITABLY QUALIFIED ELECTRICIAN. ALL NATIONAL, LOCAL AND SITE REGULATIONS SHOULD BE OBSERVED. WHEN MAKING ELECTRICAL CONNECTIONS THE SUPPLY SHOULD BE ISOLATED, FUSES REMOVED AND THE FUSE BOX LOCKED SHUT IN THE OFF POSITION WITH THE FUSES AND THE KEY IN THE POSSESSION OF THE ELECTRICIAN UNTIL THE WORK IS COMPLETE.

4.4.1 Checks and Precautions

Before connecting the In-Line mixer to the electrical supply the following checks/precautions must be taken.

4.4.2 Check that the voltage, phases and cycles (Hz) on the name plate attached to the motor are compatible with the available electricity supply.

4.4.3 All cables, starters etc. should be sized according to the relevant regulations and codes of practice.

4.4.4 Always follow the motor manufacturer’s instructions and wiring diagram when connecting three phase motors to the mains. The instructions are usually provided in the form of a printed sheet situated inside the terminal box, alternatively they may be printed on the terminal box itself or on the terminal box cover. If the motor instructions and wiring diagram cannot be located contact Silverson Machines so that a copy can be forwarded to you.
4.0 INSTALLATION

4.4.5 If seal failure could cause an unacceptable loss of product, a pressure switch should be connected to the sealant system to alert the operator of the problem or to switch the mixer off. The same switch can also be used to prevent starting the mixer with insufficient sealant pressure and thereby minimise the risk of seal failure.

4.4.6 The In-Line mixer requires adequate earthing to protect against possible sources of ignition. The earthing connections should be made to the earthing point provided on the motor as described in the supplied motor manual. Consideration should also be given to any applicable codes or regulations.

WARNING: FAILURE TO ENSURE ADEQUATE EARTHING FOR THE IN-LINE MIXER IS PROVIDED COULD LEAD TO DANGER TO PERSONNEL AND MAY PROVIDE A POSSIBLE SOURCE OF IGNITION.

4.5 DIRECTION OF ROTATION

WARNING: THE MIXER BODY MUST BE FILLED WITH WATER OR ANOTHER SUITABLE FLUID BEFORE OPERATING THE MIXER. NEVER LET THE MIXER RUN DRY. FAILURE TO OBSERVE THIS WILL RESULT IN SERIOUS MECHANICAL DAMAGE AND MAY PRESENT A POTENTIAL SOURCE OF IGNITION.

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4.5.1 The Inline mixer must be connected so that it runs in the direction shown by the direction arrow marked on the Silverson nameplate.

Perform the following checks:

WARNING: ENSURE THAT THE MIXER IS ISOLATED FROM THE ELECTRICAL SUPPLY BEFORE CARRYING OUT THE FOLLOWING PROCEDURE:

4.5.2 Refer to Fig. 5. Before attempting to start the machine, ensure the shaft/coupling (4) and the rotor (6) can be turned freely by hand. Remove the neck section side panels (15) and rotate the shaft/coupling (4) by gripping it and turning it by hand. This can also be carried out by removing the fan cowl and turning the fan. If the shaft/coupling does not turn freely check that the pipework is not stressing any part of the mixer. If the pipework is not at fault and the shaft/coupling can still not be turned freely, consult Silverson Machines.

4.5.3 If everything is in order, reconnect the electrical supply and check the direction of rotation as follows.

4.5.4 Press the START button on the starter and IMMEDIATELY press the STOP button. This will turn the motor sufficiently to view the direction of rotation which should be as the direction arrow fitted to the mixer - clockwise when viewed from the fan end of the motor.

4.5.5 If the motor rotates in the wrong direction, change over any two of the input phase lines and repeat the procedure given above.

NOTICE: Never allow the Inline mixer to run in reverse for more than a few seconds otherwise the rotor nut may loosen and the rotor may spin off the shaft/coupling.
5.0 OPERATION

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5.1 PRINCIPLES OF OPERATION

5.1.1 Stage 1
The high speed rotation of the multi toothed rotor blade within the precision machined mixing multi-stage workheads exerts a powerful suction. Liquid and solid materials are drawn into the rotor/stator assembly.

5.1.2 Stage 2
Centrifugal force then drives the materials towards the periphery of the workheads where they are subjected to a milling action which takes place within the clearance between the ends of the rotor blades and the inner wall of the workheads. As material passes through the Multi-stage workhead it is subjected to increasing rates of shear. The inner rotor subjects the product to an initial mixing action, reducing the size of large particles and producing a uniform pre-mix. The inner rotor also acts as the prime mover for the product, forcing it into the outer multi-bladed rotor/stator assembly.

5.1.3 Stage 3
Intense hydraulic shear occurs as the materials are forced, at high velocity, out through the perforations in the workhead, then through the mixers’ outlet and along the pipework. At the same time, fresh materials are continually drawn into the workhead, maintaining the mixing and pumping cycle.
5.2 PUMPING CAPACITY

Silverson In-line Mixers develop a high volume centrifugal pumping action which, in most cases, will be sufficient for the process requirements without the need for auxiliary pumps. Since its pump curve is centrifugal and therefore non-positive in character the flow rate will reduce with an increase in product viscosity.

Length of pipeline, vertical head, valves and pipe fittings etc. will also affect the pumping performance of the mixer and in extreme circumstances the flow may cease altogether. If the product viscosity or the back pressure is too great for the In-line Mixer’s self pumping capability then an auxiliary pump can be installed in the suction/inlet line to the mixer. It should not be placed on the outlet side of the In-line Mixer as this may cause cavitation inside the mixing chamber resulting in possible damage to the rotor/stator assembly and seal failure. (see Installation Section 4.1).

5.3 CLEANING

5.3.1 In most cases the Inline mixer can be cleaned in the same way as an ordinary centrifugal pump. It is designed to be incorporated into automated CIP systems but can easily be dismantled for inspection or manual cleaning. For non-sanitary industries, simply flushing through with an appropriate liquid is normally sufficient. The mixer should operate during CIP cleaning.

⚠️ WARNING: THE MIXER MUST BE ISOLATED ELECTRICALLY BEFORE IT IS DISMANTLED FOR INSPECTION.

5.3.2 The materials of construction are compatible with all commonly used cleaning chemicals.

Most sanitising chemicals, such as those that contain active chlorine, iodine etc. are, to some extent corrosive to stainless steel. Where these chemicals are used, 316 Stainless Steel should be specified.

NOTICE: Where Sodium Hypochlorite solutions are used for sterilising the mixer, the maximum concentration should be 150 ppm available Chlorine at a maximum temperature of 40°C, and for an absolute maximum time of 20 minutes. Failure to observe this precaution may result in corrosion of even 316 Stainless Steel.

⚠️ CAUTION: SUITABLE PROTECTIVE CLOTHING SHOULD BE WORN WHEN HANDLING AND USING CLEANING CHEMICALS. NATIONAL, LOCAL AND SITE REGULATIONS SHOULD BE OBSERVED.
6.0 MAINTENANCE

6.1 GENERAL MAINTENANCE

6.1.1 Machines should always be cleaned after use. As a general guideline, where a machine is being used repeatedly to process the same material it will be sufficient to run the machine for a short time with water, detergent or a suitable solvent or flushing agent.

If the machine is to be left idle for any length of time it should first be thoroughly flushed by running for a short time with a suitable liquid to wash any solids from between the seal faces and clearances between the rotor and the workhead. If this is not done, the solids may dry out and cement the components together causing damage when the machine is next started. When circumstances permit, it may suffice to leave the machine filled with a suitable cleaning fluid.

6.2 DISASSEMBLY AND ASSEMBLY

WARNING: BEFORE PERFORMING ANY DISASSEMBLY/ASSEMBLY PROCEDURE:

• ISOLATE THE UNIT ELECTRICALLY. THIS OPERATION SHOULD BE CARRIED OUT BY A SUITABLY QUALIFIED ELECTRICIAN.

• ISOLATE THE UNIT FROM THE PRODUCT.

• DETACH THE INLET SUPPLY, THE PIPEWORK AND, WHERE NECESSARY, THE OUTLET SUPPLY PIPEWORK.

6.2.1 TOOLS REQUIRED

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<tr>
<td>6mm</td>
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6.2.2 NUT TORQUE SETTINGS, SOCKET AND SPANNER SIZES

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Fig. 5 The Double Sealed Multi-stage In-Line Mixer Assembly
6.2.2 The following procedures are to be used as an aid to disassembly and reassembly of the machine should it become necessary to gain access to the components. The procedures detailed in this section will enable service and maintenance engineers to change / service the components as quickly and efficiently as possible as part of a scheduled maintenance routine.

NOTE: It is recommended by Silverson Machines Ltd that a routine maintenance programme is devised taking into account the process and operating conditions. Contact Silverson Machines Ltd for any assistance concerning part replacement intervals.

When performing any maintenance on the mixer, good engineering practice should be applied throughout. Consideration should be given to ensuring that all mating faces and surfaces are clean and free of foreign material and that squareness and concentricity are maintained to ensure correct mixer operation. Care should be taken to ensure that all soft seals ('O' Rings and Gaskets etc) are correctly seated.

WARNING: ENSURE ALL COMPONENTS ARE ASSEMBLED CORRECTLY AND VITAL CLEARANCES BETWEEN THE ROTOR AND STATOR ARE MAINTAINED. FAILURE TO OBSERVE THIS WARNING COULD LEAD TO MACHINE FAILURE AND PROVIDE A POSSIBLE SOURCE OF IGNITION.

6.3 CHANGING OR REPLACING THE WORKHEAD (Refer to Fig. 5)

6.3.1 Remove the eight body nuts (18).

6.3.2 Carefully remove the inlet/stator mounting plate (3 or 3A) complete with the stators (5 and 6) from the body and retrieve the body 'O' ring (22).

6.3.3 Remove the inner stator (6) from the inlet/stator mounting plate (3 or 3A) by removing the hex head retaining screws (37) and plain washers (38).

6.3.4 Retrieve the 'O' rings (26 and 28).

6.3.5 Remove the outer stator (5) by removing the hex head retaining screws (40) and washers (43).

6.3.6 Retrieve the 'O' rings (23 and 28).

6.3.7 Examine all the removed 'O' rings and replace where necessary.

6.3.8 Locate the 'O' rings (23 and 28) into recesses the inlet plate (3 or 3A) and fit the new outer stator (5), fit the retaining hex head screws (40) and washers (43) and fully tighten evenly and in sequence.

NOTE: Ensure that the mating faces of the outer stator and the stator register of the inlet plate are clean.

6.3.9 Fit the new inner stator (6) complete with the 'O' rings (26 and 28).

NOTE: Ensure that the mating face of the inner stator (6) and the outer stator (5) are clean.

6.3.10 Refit the four stator retaining screws (37) and washers (38) and fully tighten evenly in sequence.

6.3.11 Refit the inlet/stator mounting plate (3 or 3A) complete with body 'O' ring (22) onto the body (1).

NOTICE: Ensure that the stators (5 and 6) do not strike the rotor (9). The clearance between these machined components is minimal; the screen mesh stators can be damaged if they strike the rotor.

6.3.12 Refit and tighten the eight body nuts (18).

6.3.13 Ensure the shaft/coupling and the rotor can be turned freely by hand. Remove the neck section side cover plates (17) and rotate the shaft/coupling by gripping it and turning it by hand. This can also be carried out by removing the fan cowl and turning the fan.

6.3.14 Refit the side panels upon completing the check.
6.4 REPLACING THE ROTOR (Refer to Figs. 5 and 6).

6.4.1 Remove the eight body nuts (18).

6.4.2 Carefully remove the inlet/stator mounting plate (3 or 3A) complete with the workheads (5 and 6), from the body (2) (refer to Paragraph 6.3).

6.4.3 Fit the rotor locking tool on to two of the body studs (15) (See Fig. 6). This prevents the rotor (9) from turning while the rotor nut (10) is being removed or replaced.

6.4.4 Pass a socket head spanner through the centre of the locking tool and unscrew and remove the rotor nut (10) and ‘O’ ring (31).

NOTE: The rotor nut (10) has a standard right hand thread.

6.4.5 Remove the rotor locking tool, rotor sealing plate (11) and ‘O’ ring (30). Pull the rotor (9) off the end of the shaft/coupling (4) taking care not to lose the ‘O’ ring (29).

WARNING: THE ROTOR BLADES MAY BE SHARP.

6.4.6 Fit the new rotor (9) onto the shaft/coupling (4) ensuring that the rotor ‘O’ ring (29) is in place. Refit the rotor sealing plate (11) and ‘O’ ring (30).

Fig. 6 The Rotor Locking Tool

6.4.7 Fit the rotor locking tool onto two of the studs (15) to prevent the rotor from turning. Using a socket wrench refit and tighten the rotor nut (10) complete with rotor nut ‘O’ ring (31).

NOTICE: Ensure that the rotor (9) correctly engages onto the key (19) in the shaft coupling (4).

6.4.8 Refit the inlet stator mounting plate (3 or 3A) complete with the stators (5 and 6) and body ‘O’ ring (22) onto the body (2).

NOTICE: Ensure the workheads (5 and 6) do not strike the rotor (9). The clearance between these machined components is minimal; the screen mesh workheads can be damaged if they strike the rotor.

6.4.9 Refit the eight body nuts (18) and fully tighten evenly and in sequence.

6.4.10 Remove the neck section side cover plates (17) and ensure that the shaft/coupling (4) and the rotor (9) can be turned freely by hand. Refit the side cover plates (17) when the check is complete. Alternatively this check can be carried out by removing the motor fan cowl and turning the fan.
6.0 MAINTENANCE

6.5 REPLACING THE MECHANICAL SHAFT SEALS

Two types of seals are available; Type T2 or Type T109.

T2 Seals normally have some viton rubber components whereas T109 seals have PTFE components, the selection is dependent upon application.

**NOTICE:** The two types of seals are not interchangeable.

The seals are mounted as a pair, back to back on the shaft/coupling (4) within the seal housing (7 or 7a).

The removal procedure for the two types is identical but the fitment and setting up differs.

**Removal - Both Types**

6.5.1 Drain the sealant chamber (7 or 7A)

6.5.2 Remove the eight body nuts (18).

6.5.3 Remove the inlet/stator mounting plate (3 or 3A) complete with the workheads (5 and 6), from the body (2).

6.5.4 Fit the rotor locking tool (Fig. 6) onto two of the body studs (15). This will prevent the rotor (9) from turning while the rotor nut (10) is being removed.

6.5.5 Pass a socket head spanner through the centre of the rotor locking tool and unscrew and remove the rotor nut (10) and the ‘O’ ring (31). Remove the tool and rotor sealing plate (11) and the ‘O’ ring (30). Pull the rotor (9) off the shaft/coupling (4).

**WARNING: THE ROTOR BLADES MAY BE SHARP.**

6.5.6 Remove the ‘O’ ring (29) from the back of the rotor (9).

6.5.7 Remove the neck section side cover plates (17).

6.5.8 Using a socket wrench, unscrew and remove the seal housing securing nuts (41) and remove the washers (42 and 43) from inside the neck section (1).

**NOTICE:** Take care not to damage the shaft/coupling (4).

6.5.9 Pull the seal housing end plate (8 or 8A) away from the seal housing (7 or 7A) and withdraw the attached studs (16) from the body (2). The studs pass through the seal housing (7 or 7A), the body (2) and the neck (1). Retrieve the ‘O’ rings (25 and 27).

**NOTE:** The inboard seal seat (20 or 20A) will remain located in the seal housing end plate (8 or 8A).

6.5.10 **T2 ONLY:** Remove the rotating part of the seals (20 and 21) from the shaft/coupling (4).

**NOTICE:** Take care not to damage the shaft / coupling (4).

**NOTE:** The use of soft soap or similar may help to slide the seals off the shaft/coupling (4).

6.5.11 **T109 ONLY:** Loosen the grub screws located in the periphery of the rotating part of the seals (20A and 21A) until they are no longer in contact with the shaft (4). Withdraw the rotating part of the seals from the shaft (4).

**NOTICE:** Take care not to damage the shaft/coupling.

6.5.12 Prise out the seal seats from the housings in the seal end plate (8 or 8A) and the seal housing (7 or 7A).

**NOTICE:** Do not damage the seal seats housings or the shaft / coupling.

**NOTE:** If the stationary seal seat is not easy to remove from the seal housing (7 or 7A) it may prove easier to remove the flushing tubes (14), remove the two slotted head screws (53), and remove the seal housing (7 or 7A) from the body (2). The stationary seal seat can then be pushed out from the rear of the seal housing.
6.5.13 INSTALLING TYPE T2 SEALS ONLY

If the existing shaft/coupling (4) is to be re-used, ensure that it is free of scratches and burrs and that it is clean. Before commencing installation, inspect all the components removed and replace any that are worn. Once removed the seals must be replaced.

**NOTICE: Do not use abrasive paper or files to clean the shaft/coupling.**

*Note: If the seal housing (7) and flushing tubes (14) have been removed to aid removal of the seal seat, refit. "Loctite 222e Screwlock" or equivalent should be used to seal the threads of the flushing tubes.*

6.5.14 Ensure that the seal seat housing is clean and dry.

6.5.15 With reference to the manufacturers recommended installation instructions; enclosed with the new Mechanical Shaft Seals, install the new stationary seal seats and cup rubbers into the seal housing (7) and the seal end cap (8) ensuring that they seat squarely in the housings.

6.5.16 The rotating part of the seals are a very tight fit on the shaft, to aid assembly lubricate the shaft (4) with liquid soap or similar and slide on the new rotating parts of the seals. Push the seals firmly home ensuring that the notches are in exact alignment with the grooves in the seal ring. Do not use tools for this operation and do not tap them home as the seal faces can be damaged.

**NOTICE: Silicon grease must NOT be used.**

6.5.17 Fit the seal end cap (8) complete with 'O' rings (25 and 27); the studs pass through the clearance holes in the seal housing (7), the body (2) and the neck section (1). Fit the plain washers (43), spring washers (42) and retaining nuts (41) to the studs through the neck section and tighten evenly and radially to the torque setting listed in table 6.2. The seal setting lengths are set by this operation.

6.5.18 Flush the seal chamber with clean water or other compatible fluid and carry out the pressure test (Refer to Para 6.8). If a leak is detected check through the preceding steps.

6.5.19 Refit the rotor (9) and the inlet/stator mounting plate (3 or 3A) complete with the workheads (5 and 6) with reference to the procedure given in paragraphs 6.4.6 to 6.4.10 inclusive.

6.5.20 INSTALLING TYPE T109 SEALS ONLY

If the existing shaft/coupling (4) is to be re-used, ensure that it is free of scratches and burrs and that it is clean. Before commencing installation, inspect all the components removed and replace any that are worn. Once removed the seals must be replaced.

**NOTICE: Do not use abrasive paper or files to clean the shaft/coupling.**

*Note: If the seal housing (7A) and flushing tubes (14) have been removed to aid removal of the seal seat, refit them. "Loctite 222e Screwlock" or equivalent should be used to seal the threads of the flushing tubes.*

6.5.21 Ensure that the seal seat housings are clean and dry.

6.5.22 With reference to the manufacturers recommended installation instructions; enclosed with the new Mechanical Shaft Seals, install the new stationary seal seats (20A and 21A) into the seal housing (7A) and the seal end cap (8A) ensuring that they seat squarely in the housings and that the location pins in the housings engage with the respective notches in the seal seats. Push the seal seats squarely and fully into position but do not use force and do not tap the faces as they may break.

6.5.23 Remove the transit clips from one of the new seals (if fitted) and slide the new outboard rotating part of the seal (21A) onto the shaft/coupling. Fit the outboard seal setting tool onto the shaft/coupling (4), refit the rotor nut (10) and tighten fully home so that the tool abuts against the shoulder of the shaft (4) as shown in Fig. 7. Tighten the grub screws in the rotating section of the outboard seal (21A) evenly and radially ensuring that the seal is centralised on the shaft/coupling (4). Remove the outboard seal setting tool.
6.0 MAINTENANCE

NOTE: This operation sets the seal length of both the inboard and outboard seals.

6.5.24 Remove the transit clips (if fitted) from the remaining new seal and slide the inboard rotating section (20A) onto the shaft/coupling (4) so that it sits squarely against the outboard seal (21A). Remember that the seals are back to back and that the inboard seal face should be facing you.

6.5.25 Tighten the grub screws in the rotating section of the inboard (20A) seal evenly and radially ensuring that the seal is centralised on the shaft/coupling (4).

6.5.26 Fit the seal end cap (8A) complete with 'O' rings (25 and 27); the studs pass through the clearance holes in the seal housing (7A), the body (2) and the neck section (1). Fit the plain washers (43), spring washers (42) and retaining nuts (41) to the studs through the neck section and tighten evenly and radially to the torque setting listed in table 6.2.

6.5.27 Flush the seal chamber with clean water or other compatible fluid and carry out the pressure test (Refer to Paragraph 6.8). If a leak is detected check through the preceding steps.

6.5.28 Refit the rotor (9) and the inlet/stator mounting plate (3 or 3A) complete with the workheads (5 and 6) with reference to the procedure given in paragraphs 6.4.6 to 6.4.10 inclusive.

6.6 REPLACING THE SHAFT/COUPLING

NOTE: The following procedure requires the removal of the shaft seals. Replacement shaft seals should be fitted once the existing seals have been disturbed or removed.

6.6.1 Carry out the disassembly instructions detailed in paragraphs 6.5.1 to 6.5.12 inclusive.

6.6.2 Remove the flushing tubes (14).

6.6.3 Unscrew and remove the eight motor fixing bolts (50) and washers (51).

6.6.4 Remove the body and neck section (2 and 1) as a single unit from the motor and shaft/coupling (4) assembly.

6.6.5 Unscrew the two grub screws (39) in the shaft coupling (4) until clear of the motor drive shaft and slide the shaft coupling (4) off the motor drive shaft and key (35).

NOTE: If shaft/coupling is a tight fit on the motor drive shaft and will not respond to hand pressure place two blocks on the motor flange at 180° to each other and use suitable levers at the base of the shaft/coupling to remove. Do not apply heat.

⚠️ NOTICE: Where it is necessary to use the block and lever arrangement in order to remove the shaft/coupling as described in the above note, the shaft/coupling should be levered evenly and care should be exercised to avoid damaging the base of the shaft/coupling and the motor flange.

6.6.6 Carefully clean and dry the motor drive shaft and apply a light coating of grease.

6.6.7 Fit the new shaft coupling (4) over the motor shaft and key (35). Ensure that the two grub screws (39) are accurately located in the dimples in the motor shaft. This will ensure the correct positioning of the shaft/coupling (4).

NOTE: If there are no dimples in the motor shaft or if a new motor is being fitted, then the shaft/coupling position must be measured and set. See Section 6.7.
6.6.8 The concentricity of the shaft/coupling (4) must be checked whenever it has been disturbed, replaced or there is evidence of mechanical damage to the rotor.

6.6.9 Using a dial gauge measure the Total Indicator Reading (TIR) at the rotor journal at the end of the shaft. (See Fig 8). The reading should be no more than 0.025mm (0.001”).

6.6.10 Refit the neck and body assembly (1 and 2) onto the motor, ensuring that the shaft/coupling (4) and the seal seat housings are not damaged.

6.6.11 Refit and tighten the four motor fixing bolts (50), washers (47) and nuts (52) tightening evenly and in sequence.

6.6.12 Replace the mechanical shaft seals (20 and 21 or 20A and 20A) using the procedure given in paragraphs:

6.5.13 to 6.5.19 inclusive for Type T2 seals (20 and 21)

6.5.20 to 6.5.28 inclusive for Type T109 seals (20A and 21A).

6.6.13 Refit the rotor (9) and the inlet stator mounting plate (3 or 3A) complete with the workheads (5 and 6) with reference to the procedure given in paragraphs 6.4.6 to 6.4.10 inclusive.

6.6.14 Ensure the shaft/coupling (4) and the rotor (9) can be turned freely by hand; the shaft is accessed through the neck section side apertures.

6.6.15 Refit the neck section side cover plates (17) and retain with fixing screws (36)

6.6.16 Pressure test the body (Refer to Paragraph 6.9). If a leak is detected check through the preceding steps.

6.7 SETTING THE POSITION OF THE SHAFT/COUPLING ON THE MOTOR SHAFT

NOTE: To set the position of the shaft/coupling (4) on the motor drive shaft, the rotor (9) and seals (20 and 21 or 20A and 21A) must be removed and the body/neck assembly (1 and 2) must be removed from the motor (see preceding sections). The body (2) must then be removed from the neck (1) as follows:

6.7.1 Remove the neck section side cover plates (17).

6.7.2 Use a socket spanner to unscrew the body fixing screws (44) and washers (45, 46) and remove the body (2) from the neck (1).

6.7.3 Temporarily refit the neck (1) to the motor and refit and tighten the motor fixing bolts (50) and washers (51).

6.7.4 To accurately set the shaft/coupling length, measure the distance from the machined surface of the neck section (1) to the shoulder of the coupling (4) where it abuts the rotor.

(Dimn. A as shown on Fig. 9).
6.0 MAINTENANCE

### Table: Model Dimension A

<table>
<thead>
<tr>
<th>Model</th>
<th>Decimal Inch</th>
<th>Fractional Inch</th>
<th>Metric mm</th>
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</thead>
<tbody>
<tr>
<td>500/700MS</td>
<td>2.875</td>
<td>3.7/8</td>
<td>73.02</td>
</tr>
</tbody>
</table>

6.7.5 With the correct distance set, fit one of the grub screws (39) and tighten onto the motor shaft to retain the shaft/coupling (4) in position.

**NOTICE:** The grub screws must never be located in the key way on the motor shaft.

6.7.6 Remove the motor fixing bolts (50) and washers (51) and again remove the neck section (1) from the motor.

6.7.7 Using the recommended drill size 'A' located in the remaining grub screw hole, dimple the motor shaft with the drill point. Remove drill 'A'.

Using the recommended drill size 'B' located in the remaining grub screw hole, dimple the motor shaft with the drill point. Remove drill 'A'.

Using the recommended drill size 'B' located in the dimple, drill a hole in the motor shaft to a depth of between 3mm (min.) and 6mm (max.). Thoroughly clean the area and fit the remaining grub screw (39). Remove the first grub screw and repeat this procedure.

<table>
<thead>
<tr>
<th>Model</th>
<th>Recommended Drill Size 'A'</th>
<th>Recommended Drill Size 'B'</th>
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<tr>
<td>500/700MS</td>
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<td>7mm</td>
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</table>

6.7.8 The concentricity of the shaft/coupling (4) must be checked whenever it has been disturbed, replaced or there is evidence of mechanical damage to the rotor.

6.7.9 Using a dial gauge measure the Total Indicator Reading (TIR) at the rotor journal at the end of the shaft. See Fig. 8. The reading should be no greater than 0.025mm (0.001").

6.7.10 Refit the body (2) on to the neck section (1) ensuring that the faces are clean and dry. Refit the fixing bolts (44) and washers (45,46) tightening evenly and in sequence.

6.7.11 Fit the body/neck assembly (1 and 2) onto the motor and shaft/coupling (4) assembly, refit the motor fixing bolts (50) and washers (51) tightening evenly and in sequence.

**NOTICE:** Take care not to damage the shaft/coupling (4) and the seal seat housing.

6.7.12 Replace the mechanical shaft seals (20 and 21 or 20A or 21A) using the procedure given in paragraphs:-

6.5.13 to 6.5.19 inclusive for Type T2 seals (20 and 21)

6.5.20 to 6.5.28 inclusive for Type T109 seals (20A and 21A).

6.7.13 Refit the rotor (9) and the inlet stator mounting plate (3 or 3A) complete with the workheads (5 and 6) with reference to paragraphs 6.4.6 to 6.4.10 inclusive.

6.7.14 Ensure the shaft/coupling (4) and the rotor (9) can be turned freely by hand; the shaft is accessed through the neck section side apertures.

6.7.15 Refit the neck section side cover plates (17) and retain with fixing screws (36)

6.7.16 Pressure test the body (Refer to Paragraph 6.9). If a leak is detected check through the preceding steps.
6.8 PRESSURE TESTING THE MECHANICAL SHAFT SEALS

6.8.1 Prior to fitment of the Inlet and Stator Mounting Plate connect the pump hose to the inlet flushing tube (A).

6.8.2 Fit a short length of hose to the outlet flushing tube (B) to act as a bleed pipe.

6.8.3 Pump sufficient fluid through the seal housing to bleed and blank off the bleed pipe with a 'G' Clamp or similar.

6.8.4 To satisfactorily test the seals the pump pressure should be increased until a reading of:

\[ 2 \times \text{the stated maximum pressure} + 15 \text{ psi} \]

i.e.: A Mixer which states that the maximum working pressure is 40 psi., should have the seals tested at 95 psi. (2 x 40psi +15psi = 95psi)

Fig. 10 Pressure Testing the Mechanical Shaft Seals
6.9 PRESSURE TESTING THE BODY

6.9.1 Seal the inlet flushing tube (A) using a suitable plug or hose and 'G' clamp.

6.9.2 Fit a suitable test flange (B) to the inlet and stator mounting plate.

6.9.3 Connect a pipe from the outlet flushing tube (C) to the inlet test flange (B).

6.9.4 Fit a suitable test flange to the main body outlet (D) and connect the pump hose.

6.9.5 To satisfactorily test the seals the pumping pressure should be increased until a reading of:

\[ 2 \times \text{stated maximum pressure} \]

i.e.: A Mixer which states that the maximum working pressure is 40 psi. should have the body tested at 80 psi. (2 x 40psi = 80psi.)

---

**Fig. 11 Pressure Testing the Body**
7.0 SPARE PARTS

7.1 It is recommended that the following spare parts be kept in stock. Please refer to the Spare Parts List for part numbers and descriptions applicable to your machine.

<table>
<thead>
<tr>
<th>Qty</th>
<th>Description</th>
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<tbody>
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<td>2</td>
<td>Mechanical Shaft Seals</td>
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<td>2 Sets</td>
<td>'O' Rings</td>
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<td>Workhead</td>
</tr>
<tr>
<td>1</td>
<td>Rotor</td>
</tr>
<tr>
<td>1</td>
<td>Shaft/Coupling</td>
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</tbody>
</table>

7.2 Always quote the Machine Type and Serial Number when ordering spare parts

WARNING: NEVER USE PARTS OTHER THAN THOSE SUPPLIED OR RECOMMENDED BY SILVERSON MACHINES. THE USE OF SUCH PARTS WILL NULLIFY ANY GUARANTEES AND MAY CAUSE PREMATURE WEAR OR MORE SERIOUSLY MAY CAUSE COMPONENT FAILURE AND POSSIBLE INJURY.
Fig. 12 The Double Sealed Multi-stage In-Line Mixer Assembly
### 8.1 ILLUSTRATED PARTS LIST FOR MULTI-SHEAR IN-LINE MIXER

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<td>See Note 1 below</td>
</tr>
<tr>
<td>2B</td>
<td>Body - Flanged Outlet</td>
<td>1</td>
<td>See Note 1 below</td>
</tr>
<tr>
<td>3A</td>
<td>Inlet and Stator Mounting Plate - Sanitary Fitting Outlet</td>
<td>1</td>
<td>See Note 1 below</td>
</tr>
<tr>
<td>3B</td>
<td>Inlet and Stator Mounting Plate - Flanged Outlet</td>
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<td>See Note 1 below</td>
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<td>Shaft/Coupling</td>
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<td>5</td>
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<td>BS-274</td>
</tr>
<tr>
<td>23</td>
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<td>1</td>
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</tr>
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<tr>
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<tr>
<td>26</td>
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<td>BS-258</td>
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<td>27</td>
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<td>BS-259</td>
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<td>BS-136</td>
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<td>31</td>
<td>'O' Ring</td>
<td>1</td>
<td>BS-125</td>
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<tr>
<td>32</td>
<td>Adjustable Foot</td>
<td>4</td>
<td>AFA100/016</td>
</tr>
<tr>
<td>33</td>
<td>Nut</td>
<td>4</td>
<td>Q/AFN16</td>
</tr>
<tr>
<td>34</td>
<td>Plain Washer</td>
<td>4</td>
<td>Q/ASV16</td>
</tr>
<tr>
<td>35</td>
<td>Key</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>36</td>
<td>Slotted Pan Head Screw</td>
<td>8</td>
<td>Q/APH05/008</td>
</tr>
<tr>
<td>37</td>
<td>Hex Head Screw</td>
<td>4</td>
<td>Q/AHB08/050</td>
</tr>
<tr>
<td>38</td>
<td>Spring Washer</td>
<td>4</td>
<td>Q/APW08</td>
</tr>
<tr>
<td>39</td>
<td>Hex Socket Dog Nose Grub Screw</td>
<td>2</td>
<td>Q/MSG10/016</td>
</tr>
<tr>
<td>40</td>
<td>Hex Head Set Screw</td>
<td>6</td>
<td>Q/AHB10/045</td>
</tr>
<tr>
<td>40A</td>
<td>Hex Socket Cap Head Screw</td>
<td>6</td>
<td>Q/ACS10/035</td>
</tr>
<tr>
<td>41</td>
<td>Full Nut</td>
<td>6</td>
<td>Q/AFN10</td>
</tr>
<tr>
<td>42</td>
<td>Spring Washer</td>
<td>6</td>
<td>Q/ASV10</td>
</tr>
<tr>
<td>43</td>
<td>Plain Washer</td>
<td>12</td>
<td>Q/APW10</td>
</tr>
</tbody>
</table>

Note: 1: Due to the many variations of items 2, 3, 12, 20 and 21 which are supplied to suit customer applications or is recommended that, should you require replacements for these items, Silverson Machines should be contacted directly quoting the Mixer Serial Number.
ILLUSTRATED PARTS LIST FOR WORKHEADS (STATORS)

**Description**

<table>
<thead>
<tr>
<th>Part Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>5&quot; INNER STATOR</td>
</tr>
<tr>
<td><em>VF9188</em></td>
</tr>
<tr>
<td><em>VF7901</em></td>
</tr>
<tr>
<td>To Be Advised</td>
</tr>
<tr>
<td>To Be Advised</td>
</tr>
<tr>
<td>To Be Advised</td>
</tr>
</tbody>
</table>

*Where the workheads or rotor require special finishes i.e. hard chromed or hard tipped please state your requirements when ordering spares. Always quote the Machine Type and Serial Number when ordering spare parts.

CAUTION: NEVER USE PARTS OTHER THAN THOSE SUPPLIED OR RECOMMENDED BY SILVERSON MACHINES. THE USE OF SUCH PARTS WILL NULLIFY ANY GUARANTEES AND MAY CAUSE PREMATURE WEAR OR MORE SERIOUSLY MAY CAUSE COMPONENT FAILURE AND POSSIBLE INJURY.
Integral Horsepower
AC Induction Motors
ODP, WPI, WPII Enclosure
TEFC Enclosure
Explosion Proof

Installation & Operating Manual
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Section 1
General Information

Overview
This manual contains general procedures that apply to Baldor Motor products. Be sure to read and understand the Safety Notice statements in this manual. For your protection, do not install, operate or attempt to perform maintenance procedures until you understand the Warning and Caution statements. A Warning statement indicates a possible unsafe condition that can cause harm to personnel. A Caution statement indicates a condition that can cause damage to equipment.

Important: This instruction manual is not intended to include a comprehensive listing of all details for all procedures required for installation, operation and maintenance. This manual describes general guidelines that apply to most of the motor products shipped by Baldor. If you have a question about a procedure or are uncertain about any detail, Do Not Proceed. Please contact your Baldor distributor for more information or clarification.

Before you install, operate or perform maintenance, become familiar with the following:

- The National Electrical Code
- Local codes and Practices

Limited Warranty

1. Most Baldor products are warranted for 18 months from the date of shipment to Baldor’s customer from Baldor’s district warehouse or, if applicable, from Baldor’s factory. Baldor Standard–E® standard efficient motors are warranted for 24 months. Standard–E is limited to three phase, general purpose, 1–200 HP ratings that fall under the Energy Policy Act (EPAct). Baldor Super–E® premium efficient motors are warranted for 36 months. Baldor IEEE841 motors are warranted for 60 months. All warranty claims must be submitted to a Baldor Service Center prior to the expiration of the warranty period.

2. Baldor will, at its option repair or replace a motor which fails due to defects in material or workmanship during the warranty period if:
   a. the purchaser presents the defective motor at or ships it prepaid to, the Baldor plant in Fort Smith, Arkansas or one of the Baldor Authorized Service Centers and
   b. the purchaser gives written notification concerning the motor and the claimed defect including the date purchased, the task performed by the Baldor motor and the problem encountered.

3. Baldor will not pay the cost of removal of any electric motor from any equipment, the cost of delivery to Fort Smith, Arkansas or a Baldor Authorized Service Center, or the cost of any incidental or consequential damages resulting from the claimed defects. (Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above exclusion may not apply to you.) Any implied warranty given by laws shall be limited to the duration of the warranty period hereunder. (Some states do not allow limitations on how long an implied warranty lasts, so the above limitation may not apply to you.)

4. Baldor Authorized Service Centers, when convinced to their satisfaction that a Baldor motor developed defects in material or workmanship within the warranty period, are authorized to proceed with the required repairs to fulfill Baldor’s warranty when the cost of such repairs to be paid by Baldor does not exceed Baldor’s warranty repair allowance. Baldor will not pay overtime premium repair charges without prior written authorization.

5. The cost of warranty repairs made by centers other than Baldor Authorized Service Centers WILL NOT be paid unless first authorized in writing by Baldor.

6. Claims by a purchaser that a motor is defective even when a failure results within one hour after being placed into service are not always justified. Therefore, Baldor Authorized Service Centers must determine from the condition of the motor as delivered to the center whether or not the motor is defective. If in the opinion of a Baldor Authorized Service Center, a motor did not fail as a result of defects in material or workmanship, the center is to proceed with repairs only if the purchaser agrees to pay for such repairs. If the decision is in dispute, the purchaser should still pay for the repairs and submit the paid invoice and the Authorized Service Center’s signed service report to Baldor for further consideration.

7. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.
**Safety Notice:**

This equipment contains high voltage! Electrical shock can cause serious or fatal injury. Only qualified personnel should attempt installation, operation and maintenance of electrical equipment.

Be sure that you are completely familiar with NEMA publication MG-2, safety standards for construction and guide for selection, installation and use of electric motors and generators, the National Electrical Code and local codes and practices. Unsafe installation or use can cause conditions that lead to serious or fatal injury. Only qualified personnel should attempt the installation, operation and maintenance of this equipment.

**WARNING:** Do not touch electrical connections before you first ensure that power has been disconnected. Electrical shock can cause serious or fatal injury. Only qualified personnel should attempt the installation, operation and maintenance of this equipment.

**WARNING:** Be sure the system is properly grounded before applying power. Do not apply AC power before you ensure that all grounding instructions have been followed. Electrical shock can cause serious or fatal injury. National Electrical Code and Local codes must be carefully followed.

**WARNING:** Avoid extended exposure to machinery with high noise levels. Be sure to wear ear protective devices to reduce harmful effects to your hearing.

**WARNING:** This equipment may be connected to other machinery that has rotating parts or parts that are driven by this equipment. Improper use can cause serious or fatal injury. Only qualified personnel should attempt to install, operate or maintain this equipment.

**WARNING:** Do not by-pass or disable protective devices or safety guards. Safety features are designed to prevent damage to personnel or equipment. These devices can only provide protection if they remain operative.

**WARNING:** Avoid the use of automatic reset devices if the automatic restarting of equipment can be hazardous to personnel or equipment.

**WARNING:** Be sure the load is properly coupled to the motor shaft before applying power. The shaft key must be fully captive by the load device. Improper coupling can cause harm to personnel or equipment if the load decouples from the shaft during operation.

**WARNING:** Use proper care and procedures that are safe during handling, lifting, installing, operating and maintaining operations. Improper methods may cause muscle strain or other harm.

**WARNING:** Before performing any motor maintenance procedure, be sure that the equipment connected to the motor shaft cannot cause shaft rotation. If the load can cause shaft rotation, disconnect the load from the motor shaft before maintenance is performed. Unexpected mechanical rotation of the motor parts can cause injury or motor damage.

**WARNING:** Disconnect all electrical power from the motor windings and accessory devices before disassembly of the motor. Electrical shock can cause serious or fatal injury.

**WARNING:** Do not use non UL/CSA listed explosion proof motors in the presence of flammable or combustible vapors or dust. These motors are not designed for atmospheric conditions that require explosion proof operation.
Safety Notice  Continued

WARNING: Motors that are to be used in flammable and/or explosive atmospheres must display the UL label on the nameplate along with CSA listed logo.

Specific service conditions for these motors are defined in NFPA 70 (NEC) Article 500.

WARNING: UL Listed motors must only be serviced by UL Approved Authorized Baldor Service Centers if these motors are to be returned to a hazardous and/or explosive atmosphere.

Caution: To prevent premature equipment failure or damage, only qualified maintenance personnel should perform maintenance.

Caution: Do not over–lubricate motor as this may cause premature bearing failure.

Caution: Do not lift the motor and its driven load by the motor lifting hardware. The motor lifting hardware is adequate for lifting only the motor. Disconnect the load from the motor shaft before moving the motor.

Caution: If eye bolts are used for lifting a motor, be sure they are securely tightened. The lifting direction should not exceed a 20° angle from the shank of the eye bolt or lifting lug. Excessive lifting angles can cause damage.

Caution: To prevent equipment damage, be sure that the electrical service is not capable of delivering more than the maximum motor rated amps listed on the rating plate.

Caution: If a HI POT test (High Potential Insulation test) must be performed, follow the precautions and procedure in NEMA MG1 and MG2 standards to avoid equipment damage.

If you have any questions or are uncertain about any statement or procedure, or if you require additional information please contact your Baldor distributor or an Authorized Baldor Service Center.
Receiving  Each Baldor Electric Motor is thoroughly tested at the factory and carefully packaged for shipment. When you receive your motor, there are several things you should do immediately.

1. Observe the condition of the shipping container and report any damage immediately to the commercial carrier that delivered your motor.
2. Verify that the part number of the motor you received is the same as the part number listed on your purchase order.

Storage  If the motor is not put into service immediately, the motor must be stored in a clean, dry and warm location. Several precautionary steps must be performed to avoid motor damage during storage.

1. Use a “Megger” periodically to ensure that the integrity of the winding insulation has been maintained. Record the Megger readings. Immediately investigate any significant drop in insulation resistance.
2. Do not lubricate bearings during storage. Motor bearings are packed with grease at the factory. Excessive grease can damage insulation quality.
3. Rotate motor shaft at least 10 turns every two months during storage (more frequently if possible). This will prevent bearing damage due to storage.
4. If the storage location is damp or humid, the motor windings must be protected from moisture. This can be done by applying power to the motors’ space heater (if available) while the motor is in storage.

Unpacking  Each Baldor motor is packaged for ease of handling and to prevent entry of contaminants.

1. To avoid condensation inside the motor, do not unpack until the motor has reached room temperature. (Room temperature is the temperature of the room in which it will be installed). The packing provides insulation from temperature changes during transportation.
2. When the motor has reached room temperature, remove all protective wrapping material from the motor.

Handling  The motor should be lifted using the lifting lugs or eye bolts provided.

1. Use the lugs or eye bolts provided to lift the motor. Never attempt to lift the motor and additional equipment connected to the motor by this method. The lugs or eye bolts provided are designed to lift only the motor. Never lift the motor by the motor shaft or the hood of a WPII motor.
2. When lifting a WPII (Weather Proof Type 2) motor, do not lift the motor by inserting lifting lugs into holes on top of the cooling hood. These lugs are to be used for hood removal only. A spreader bar should be used to lift the motor by the cast lifting lugs located on the motor frame.
3. If the motor must be mounted to a plate with the driven equipment such as pump, compressor etc., it may not be possible to lift the motor alone. For this case, the assembly should be lifted by a sling around the mounting base. The entire assembly can be lifted as an assembly for installation. Do not lift using the motor lugs or eye bolts provided.

If the load is unbalanced (as with couplings or additional attachments) additional slings or other means must be used to prevent tipping. In any event, the load must be secure before lifting.
**Overview**

Installation should conform to the National Electrical Code as well as local codes and practices. When other devices are coupled to the motor shaft, be sure to install protective devices to prevent future accidents. Some protective devices include, coupling, belt guard, chain guard, shaft covers etc. These protect against accidental contact with moving parts. Machinery that is accessible to personnel should provide further protection in the form of guard rails, screening, warning signs etc.

**Location**

It is important that motors be installed in locations that are compatible with motor enclosure and ambient conditions. Improper selection of the motor enclosure and ambient conditions can lead to reduced operating life of the motor.

Proper ventilation for the motor must be provided. Obstructed airflow can lead to reduction of motor life.

1. **Open Drip-Proof/WPI** motors are intended for use indoors where atmosphere is relatively clean, dry, well ventilated and non-corrosive.

2. **Totally Enclosed and WPII** motors may be installed where dirt, moisture or dust are present and in outdoor locations.

Severe Duty, IEEE 841 and Washdown Duty enclosed motors are designed for installations with high corrosion or excessive moisture conditions. These motors should not be placed into an environment where there is the presence of flammable or combustible vapors, dust or any combustible material, unless specifically designed for this type of service.

**Mounting**

The motor must be securely installed to a rigid foundation or mounting surface to minimize vibration and maintain alignment between the motor and shaft load. Failure to provide a proper mounting surface may cause vibration, misalignment and bearing damage.

Foundation caps and sole plates are designed to act as spacers for the equipment they support. If these devices are used, be sure that they are evenly supported by the foundation or mounting surface.

After installation is complete and accurate alignment of the motor and load is accomplished, the base should be grouted to the foundation to maintain this alignment.

The standard motor base is designed for horizontal or vertical mounting. Adjustable or sliding rails are designed for horizontal mounting only. Consult your Baldor distributor or authorized Baldor Service Center for further information.

**Alignment**

Accurate alignment of the motor with the driven equipment is extremely important.

1. **Direct Coupling**
   For direct drive, use flexible couplings if possible. Consult the drive or equipment manufacturer for more information. Mechanical vibration and roughness during operation may indicate poor alignment. Use dial indicators to check alignment. The space between coupling hubs should be maintained as recommended by the coupling manufacturer.

2. **End-Play Adjustment**
   The axial position of the motor frame with respect to its load is also extremely important. The motor bearings are not designed for excessive external axial thrust loads. Improper adjustment will cause failure.

3. **Pulley Ratio**
   The pulley ratio should not exceed 8:1.

4. **Belt Drive**
   Align sheaves carefully to minimize belt wear and axial bearing loads (see End-Play Adjustment). Belt tension should be sufficient to prevent belt slippage at rated speed and load. However, belt slippage may occur during starting.

   **Caution:** Do not over tension belts.

5. Sleeve bearing motors are only suitable for coupled loads.
Doweling & Bolting

After proper alignment is verified, dowel pins should be inserted through the motor feet into the foundation. This will maintain the correct motor position should motor removal be required. (Baldor motors are designed for doweling.)

1. Drill dowel holes in diagonally opposite motor feet in the locations provided.
2. Drill corresponding holes in the foundation.
3. Ream all holes.
4. Install proper fitting dowels.
5. Mounting bolts must be carefully tightened to prevent changes in alignment. Use a flat washer and lock washer under each nut or bolt head to hold the motor feet secure. Flanged nuts or bolts may be used as an alternative to washers.

Power Connection

Motor and control wiring, overload protection, disconnects, accessories and grounding should conform to the National Electrical Code and local codes and practices.

Conduit Box

For ease of making connections, an oversize conduit box is provided. The box can be rotated 360° in 90° increments. Auxiliary conduit boxes are provided on some motors for accessories such as space heaters, RTD’s etc.

AC Power

Connect the motor leads as shown on the connection diagram located on the name plate or inside the cover on the conduit box. Be sure the following guidelines are met:

1. AC power is within $\pm 10\%$ of rated voltage with rated frequency. (See motor name plate for ratings).
   
   OR

2. AC power is within $\pm 5\%$ of rated frequency with rated voltage.
   
   OR

3. A combined variation in voltage and frequency of $\pm 10\%$ (sum of absolute values) of rated values, provided the frequency variation does not exceed $\pm 5\%$ of rated frequency.

Performance within these voltage and frequency variations are shown in Figure 2-2.

Figure 2-1 Accessory Connections

<table>
<thead>
<tr>
<th>HEATERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1</td>
</tr>
<tr>
<td>H1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>THERMISTERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>WINDING RTDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>RED</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>BEARING RTD</th>
</tr>
</thead>
<tbody>
<tr>
<td>RED</td>
</tr>
</tbody>
</table>

* One bearing RTD is installed in Drive endplate (PUEP), leads are labeled RTDDE.
* One bearing RTD is installed in Opposite Drive endplate (FREP), leads are labeled RTDOE.

* Note RTD may have 2–Red/1–White leads; or 2–White/1–Red Lead.
Figure 2-2 Typical Motor Performance VS Voltage Variations

- Changes in Motor Performance (%)
  - Full-Load Current
  - Power Factor
  - Efficiency
  - Maximum Torque

- Voltage Variations (%)
  - -15 to +15

Legend:
- Full-Load Current
- Power Factor
- Efficiency
- Maximum Torque

Graph shows the impact of voltage variations on motor performance.
First Time Start Up

Be sure that all power to motor and accessories is off. Be sure the motor shaft is disconnected from the load and will not cause mechanical rotation of the motor shaft.

1. Make sure that the mechanical installation is secure. All bolts and nuts are tightened etc.
2. If motor has been in storage or idle for some time, check winding insulation integrity with a Megger.
3. Inspect all electrical connections for proper termination, clearance, mechanical strength and electrical continuity.
4. Be sure all shipping materials and braces (if used) are removed from motor shaft.
5. Manually rotate the motor shaft to ensure that it rotates freely.
6. Replace all panels and covers that were removed during installation.
7. Momentarily apply power and check the direction of rotation of the motor shaft.
8. If motor rotation is wrong, be sure power is off and change the motor lead connections. Verify rotation direction before you continue.
9. Start the motor and ensure operation is smooth without excessive vibration or noise. If so, run the motor for 1 hour with no load connected.
10. After 1 hour of operation, disconnect power and connect the load to the motor shaft. Verify all coupling guards and protective devices are installed. Ensure motor is properly ventilated.

Coupled Start Up

This procedure assumes a coupled start up. Also, that the first time start up procedure was successful.

1. Check the coupling and ensure that all guards and protective devices are installed.
2. Check that the coupling is properly aligned and not binding.
3. The first coupled start up should be with no load. Apply power and verify that the load is not transmitting excessive vibration back to the motor though the coupling or the foundation. Vibration should be at an acceptable level.

4. Run for approximately 1 hour with the driven equipment in an unloaded condition. The equipment can now be loaded and operated within specified limits. Do not exceed the name plate ratings for amperes for steady continuous loads.

Jogging and Repeated Starts

Repeated starts and/or jogs of induction motors generally reduce the life of the motor winding insulation. A much greater amount of heat is produced by each acceleration or jog than by the same motor under full load. If it is necessary to repeatedly start or jog the motor, it is advisable to check the application with your local Baldor distributor or Baldor Service Center.

Heating - Duty rating and maximum ambient temperature are stated on the motor name plate. Do not exceed these values. If there is any question regarding safe operation, contact your local Baldor distributor or Baldor Service Center.
WARNING: UL Listed motors must only be serviced by UL Approved Authorized Baldor Service Centers if these motors are to be returned to a hazardous and/or explosive atmosphere.

**General Inspection**

Inspect the motor at regular intervals, approximately every 500 hours of operation or every 3 months, whichever occurs first. Keep the motor clean and the ventilation openings clear. The following steps should be performed at each inspection:

**WARNING:** Do not touch electrical connections before you first ensure that power has been disconnected. Electrical shock can cause serious or fatal injury. Only qualified personnel should attempt the installation, operation and maintenance of this equipment.

1. Check that the motor is clean. Check that the interior and exterior of the motor is free of dirt, oil, grease, water, etc. Oily vapor, paper pulp, textile lint, etc. can accumulate and block motor ventilation. If the motor is not properly ventilated, overheating can occur and cause early motor failure.

2. Use a “Megger” periodically to ensure that the integrity of the winding insulation has been maintained. Record the Megger readings. Immediately investigate any significant drop in insulation resistance.

3. Check all electrical connectors to be sure that they are tight.

**Relubrication & Bearings**

Bearing grease will lose its lubricating ability over time, not suddenly. The lubricating ability of a grease (over time) depends primarily on the type of grease, the size of the bearing, the speed at which the bearing operates and the severity of the operating conditions. Good results can be obtained if the following recommendations are used in your maintenance program.

**Type of Grease**

A high grade ball or roller bearing grease should be used. Recommended grease for standard service conditions is Polyrex EM (Exxon Mobil).

Equivalent and compatible greases include: Texaco Polystar, Rykon Premium #2, Pennzoil Pen 2 Lube and Chevron SRI.

**Relubrication Intervals**

Recommended relubrication intervals are shown in Table 3-1. It is important to realize that the recommended intervals of Table 3-1 are based on average use.

Refer to additional information contained in Tables 3-2, 3-3 and 3-4.

### Table 3-1 Relubrication Intervals *

<table>
<thead>
<tr>
<th>NEMA / (IEC) Frame Size</th>
<th>10000</th>
<th>6000</th>
<th>3600</th>
<th>1800</th>
<th>1200</th>
<th>900</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 210 incl. (132)</td>
<td>**</td>
<td>**</td>
<td>2700 Hrs.</td>
<td>5500 Hrs.</td>
<td>12000 Hrs.</td>
<td>18000 Hrs.</td>
</tr>
<tr>
<td>Over 210 to 280 incl. (180)</td>
<td></td>
<td>**</td>
<td>3600 Hrs.</td>
<td>9500 Hrs.</td>
<td>15000 Hrs.</td>
<td>18000 Hrs.</td>
</tr>
<tr>
<td>Over 280 to 360 incl. (225)</td>
<td></td>
<td>**</td>
<td>*2200 Hrs.</td>
<td>7400 Hrs.</td>
<td>12000 Hrs.</td>
<td>15000 Hrs.</td>
</tr>
<tr>
<td>Over 360 to 5800 incl. (300)</td>
<td></td>
<td>**</td>
<td>*2200 Hrs.</td>
<td>3500 Hrs.</td>
<td>7400 Hrs.</td>
<td>10500 Hrs.</td>
</tr>
</tbody>
</table>

* Relubrication intervals are for ball bearings.
  For vertically mounted motors and roller bearings, divide the relubrication interval by 2.

** For motors operating at speeds greater than 3600 RPM, contact Baldor for relubrication recommendations.
### Table 3-2 Service Conditions

<table>
<thead>
<tr>
<th>Severity of Service</th>
<th>Hours per day of Operation</th>
<th>Ambient Temperature Maximum</th>
<th>Atmospheric Contamination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>8</td>
<td>40°C</td>
<td>Clean, Little Corrosion</td>
</tr>
<tr>
<td>Severe</td>
<td>16 Plus</td>
<td>50°C</td>
<td>Moderate dirt, Corrosion</td>
</tr>
<tr>
<td>Extreme</td>
<td>16 Plus</td>
<td>&gt;50°C or Class H Insulation</td>
<td>Severe dirt, Abrasive dust, Corrosion, Heavy Shock or Vibration</td>
</tr>
<tr>
<td>Low Temperature</td>
<td></td>
<td>&lt;-29°C **</td>
<td></td>
</tr>
</tbody>
</table>

* Special high temperature grease is recommended (Dow Corning DC44). Note that Dow Corning DC44 grease does not mix with other grease types. Thoroughly clean bearing & cavity before adding grease.

** Special low temperature grease is recommended (Aeroshell 7).

### Table 3-3 Relubrication Interval Multiplier

<table>
<thead>
<tr>
<th>Severity of Service</th>
<th>Multiplier</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>1.0</td>
</tr>
<tr>
<td>Severe</td>
<td>0.5</td>
</tr>
<tr>
<td>Extreme</td>
<td>0.1</td>
</tr>
<tr>
<td>Low Temperature</td>
<td>1.0</td>
</tr>
</tbody>
</table>

Some motor designs use different bearings on each motor end. This is normally indicated on the motor nameplate. In this case, the larger bearing is installed on the motor Drive endplate. For best relubrication results, only use the appropriate amount of grease for each bearing size (not the same for both).

### Table 3-4 Bearings Sizes and Types

<table>
<thead>
<tr>
<th>Frame Size NEMA (IEC)</th>
<th>Bearing Description (These are the “Large” bearings (Shaft End) in each frame size)</th>
<th>Bearing</th>
<th>Weight of Grease to add * oz (Grams)</th>
<th>Volume of grease to be added</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>6203</td>
<td>0.08 (2.4)</td>
<td>0.15</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6205</td>
<td>0.15 (3.9)</td>
<td>0.2</td>
</tr>
<tr>
<td>140 (90)</td>
<td></td>
<td>6206</td>
<td>0.19 (5.0)</td>
<td>0.3</td>
</tr>
<tr>
<td>180 (100–112)</td>
<td></td>
<td>6307</td>
<td>0.30 (8.4)</td>
<td>0.6</td>
</tr>
<tr>
<td>210 (132)</td>
<td></td>
<td>6309</td>
<td>0.47 (12.5)</td>
<td>0.7</td>
</tr>
<tr>
<td>250 (160)</td>
<td></td>
<td>6311</td>
<td>0.61 (17)</td>
<td>1.2</td>
</tr>
<tr>
<td>320 (200)</td>
<td></td>
<td>6312</td>
<td>0.76 (20.1)</td>
<td>1.2</td>
</tr>
<tr>
<td>360 (225)</td>
<td></td>
<td>6313</td>
<td>0.81 (23)</td>
<td>1.5</td>
</tr>
<tr>
<td>400 (250)</td>
<td></td>
<td>6316</td>
<td>1.25 (33)</td>
<td>2.0</td>
</tr>
<tr>
<td>440 (280)</td>
<td></td>
<td>6319</td>
<td>2.12 (60)</td>
<td>4.1</td>
</tr>
<tr>
<td>5000 to 5800 (315–450)</td>
<td></td>
<td>6328</td>
<td>4.70 (130)</td>
<td>9.2</td>
</tr>
<tr>
<td>5000 to 5800 (315–450)</td>
<td></td>
<td>NU328</td>
<td>4.70 (130)</td>
<td>9.2</td>
</tr>
<tr>
<td>360 to 449 (225–280)</td>
<td></td>
<td>NU319</td>
<td>2.12 (60)</td>
<td>4.1</td>
</tr>
</tbody>
</table>

** AC Induction Servo

| 76 Frame 180 (112)   | 6207 | 0.22 (6.1) | 0.44 | 1.4 |
| 77 Frame 210 (132)   | 6210 | 0.32 (9.0) | 0.64 | 2.1 |
| 80 Frame 250 (160)   | 6213 | 0.49 (14.0)| 0.99 | 3.3 |

* Weight in grams = .005 DB of grease to be added

Note: Not all bearing sizes are listed. For intermediate bearing sizes, use the grease volume for the next larger size bearing.
Caution: To avoid damage to motor bearings, grease must be kept free of dirt. For an extremely dirty environment, contact your Baldor distributor or an authorized Baldor Service Center for additional information.

**Relubrication Procedure**

Be sure that the grease you are adding to the motor is compatible with the grease already in the motor. Consult your Baldor distributor or an authorized service center if a grease other than the recommended type is to be used.

**Caution:** Do not over-lubricate motor as this may cause premature bearing failure.

**With Grease Outlet Plug**

1. With the motor stopped, clean all grease fittings with a clean cloth.
2. Remove grease outlet plug.
3. Add the recommended amount of grease.
4. Operate the motor for 15 minutes with grease plug removed. This allows excess grease to purge.
5. Re-install grease outlet plug.

**Without Grease Provisions**

**Note:** Only a Baldor authorized and UL or CSA certified service center can disassemble a UL/CSA listed explosion proof motor to maintain its UL/CSA listing.

1. Disassemble the motor.
2. Add recommended amount of grease to bearing and bearing cavity. (Bearing should be about 1/3 full of grease and outboard bearing cavity should be about 1/2 full of grease.)
3. Assemble the motor.

**Sample Relubrication Determination**

Assume - NEMA 286T (IEC 180), 1750 RPM motor driving an exhaust fan in an ambient temperature of 43° C and the atmosphere is moderately corrosive.

1. Table 3-1 list 9500 hours for standard conditions.
2. Table 3-2 classifies severity of service as “Severe”.
3. Table 3-4 shows that 1.2 in³ or 3.9 teaspoon of grease is to be added.

**Note:** Smaller bearings in size category may require reduced amounts of grease.
<table>
<thead>
<tr>
<th>Symptom</th>
<th>Possible Causes</th>
<th>Possible Solutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor will not start</td>
<td>Usually caused by line trouble, such as, single phasing at the starter.</td>
<td>Check source of power. Check overloads, fuses, controls, etc.</td>
</tr>
<tr>
<td>Excessive humming</td>
<td>High Voltage.</td>
<td>Check input line connections.</td>
</tr>
<tr>
<td></td>
<td>Eccentric air gap.</td>
<td>Have motor serviced at local Baldor service center.</td>
</tr>
<tr>
<td>Motor Over Heating</td>
<td>Overload. Compare actual amps (measured) with nameplate rating.</td>
<td>Locate and remove source of excessive friction in motor or load.</td>
</tr>
<tr>
<td></td>
<td>Single Phasing.</td>
<td>Reduce load or replace with motor of greater capacity.</td>
</tr>
<tr>
<td></td>
<td>Improper ventilation.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Unbalanced voltage.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rotor rubbing on stator.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Over voltage or under voltage.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Open stator winding.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Grounded winding.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Improper connections.</td>
<td></td>
</tr>
<tr>
<td>Bearing Over Heating</td>
<td>Misalignment.</td>
<td>Check and align motor and driven equipment.</td>
</tr>
<tr>
<td></td>
<td>Excessive belt tension.</td>
<td>Reduce belt tension to proper point for load.</td>
</tr>
<tr>
<td></td>
<td>Excessive end thrust.</td>
<td>Reduce the end thrust from driven machine.</td>
</tr>
<tr>
<td></td>
<td>Excessive grease in bearing.</td>
<td>Remove grease until cavity is approximately ( \frac{3}{4} ) filled.</td>
</tr>
<tr>
<td></td>
<td>Insufficient grease in bearing.</td>
<td>Add grease until cavity is approximately ( \frac{3}{4} ) filled.</td>
</tr>
<tr>
<td></td>
<td>Dirt in bearing.</td>
<td>Clean bearing cavity and bearing. Repack with correct grease until cavity is approx( \frac{3}{4} ) filled.</td>
</tr>
<tr>
<td>Vibration</td>
<td>Misalignment.</td>
<td>Check and align motor and driven equipment.</td>
</tr>
<tr>
<td></td>
<td>Rubbing between rotating parts and stationary parts.</td>
<td>Isolate and eliminate cause of rubbing.</td>
</tr>
<tr>
<td></td>
<td>Rotor out of balance.</td>
<td>Have rotor balance checked are repaired at your Baldor Service Center.</td>
</tr>
<tr>
<td></td>
<td>Resonance.</td>
<td>Tune system or contact your Baldor Service Center for assistance.</td>
</tr>
<tr>
<td>Noise</td>
<td>Foreign material in air gap or ventilation openings.</td>
<td>Remove rotor and foreign material. Reinstall rotor. Check insulation integrity. Clean ventilation openings.</td>
</tr>
<tr>
<td>Growling or whining</td>
<td>Bad bearing.</td>
<td>Replace bearing. Clean all grease from cavity and new bearing. Repack with correct grease until cavity is approximately ( \frac{3}{4} ) filled.</td>
</tr>
</tbody>
</table>
Suggested bearing and winding RTD setting guidelines

Most large frame AC Baldor motors with a 1.15 service factor are designed to operate below a Class B (80°C) temperature rise at rated load and are built with a Class H winding insulation system. Based on this low temperature rise, RTD (Resistance Temperature Detectors) settings for Class B rise should be used as a starting point. Some motors with 1.0 service factor have Class F temperature rise.

The following tables show the suggested alarm and trip settings for RTDs. Proper bearing and winding RTD alarm and trip settings should be selected based on these tables unless otherwise specified for specific applications.

If the driven load is found to operate well below the initial temperature settings under normal conditions, the alarm and trip settings may be reduced so that an abnormal machine load will be identified.

The temperature limits are based on the installation of the winding RTDs imbedded in the winding as specified by NEMA. Bearing RTDs should be installed so they are in contact with the outer race on ball or roller bearings or in direct contact with the sleeve bearing shell.

Winding RTDs – Temperature Limit In °C (40°C Maximum Ambient)

<table>
<thead>
<tr>
<th>Motor Load</th>
<th>Class B Temp Rise ≤ 80°C (Typical Design)</th>
<th>Class F Temp Rise ≤ 105°C</th>
<th>Class H Temp Rise ≤ 125°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alarm</td>
<td>130</td>
<td>155</td>
<td>175</td>
</tr>
<tr>
<td>Trip</td>
<td>140</td>
<td>165</td>
<td>185</td>
</tr>
<tr>
<td>≤ Rated Load</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rated Load to 1.15 S.F.</td>
<td>140</td>
<td>160</td>
<td>180</td>
</tr>
<tr>
<td></td>
<td></td>
<td>150</td>
<td>185</td>
</tr>
</tbody>
</table>

Note: • Winding RTDs are factory production installed, not from Mod–Express.
• When Class H temperatures are used, consider bearing temperatures and relubrication requirements.

Bearing RTDs – Temperature Limit In °C (40°C Maximum Ambient)

<table>
<thead>
<tr>
<th>Bearing Type Oil or Grease</th>
<th>Anti–Friction</th>
<th>Sleeve</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Alarm</td>
<td>Trip</td>
</tr>
<tr>
<td>Standard*</td>
<td>95</td>
<td>100</td>
</tr>
<tr>
<td>High Temperature**</td>
<td>110</td>
<td>115</td>
</tr>
</tbody>
</table>

Note: • Bearing temperature limits are for standard design motors operating at Class B temperature rise.
** High temperature lubricants include some special synthetic oils and greases.

Greases that may be substituted that are compatible with Polyrex EM (but considered as “standard” lubricants) include the following:
- Texaco Polystar
- Mobilith SHC–100
- Darmex 707
- Petro–Canada Peerless LLG
- Rykon Premium #2
- Pennzoil Pennzlube EM–2
- Darmex 711
- Chevron SRI #2
- Chevron Black Pearl
- Petro–Canada Peerless LLG

See the motor nameplate for replacement grease or oil recommendation. Contact Baldor application engineering for special lubricants or further clarifications.