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# High Shear Pipeline Mixer Installation, Operation and Maintenance Manual

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Model:

**In-Line Pipeline Mixer**

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Unit Serial Number:

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Customer:

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Purchase Order:

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For Service and Information Contact:

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***Chemineer, Inc.***  
A Unit of Robbins & Myers, Inc.

Greerco High Shear  
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We at Chemineer, Inc would like to take this opportunity to thank you for choosing us for your processing equipment needs.

Whether you are one of our many repeat customers or a brand new customer, our goal is to supply you with a piece of equipment that is superior in both design and ease of operation. By following the instructions in this manual and performing regular maintenance, we trust you will receive years of trouble – free operation from this machine.

If you have any questions at all, or require additional information, do not hesitate to contact your local Chemineer representative or our Customer Service Department.

**CAUTION**

**THIS MACHINE SHOULD ONLY BE OPERATED BY QUALIFIED PERSONNEL WHO HAVE READ THIS MANUAL & UNDERSTAND HOW THE MACHINE OPERATES.**

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## EQUIPMENT DESCRIPTION

You have just purchased a Greerco<sup>®</sup> In-Line, Industrial Pipeline Mixer. This pipeline mixer is a high speed, high shear mixer for full-scale continuous in-line processing. The machine will blend, emulsify, de-agglomerate and produce a thorough wetting of dispersed substances resulting in a completely homogeneous product. However, a pipeline mixer will NOT dry grind and should never be considered a “pump”.

## PRINCIPLE OF OPERATION

The Greerco<sup>®</sup> Pipeline Mixer employs a high-speed turbine running in close proximity to a fixed stator to perform its shearing operation. Product is processed as it passes through one (*single*) or two (*tandem*) of these shear zones, where intense shear and hydraulic forces result in a product that has been broken down into its primary particle size or the dispersion of the dispersed phase throughout the continuous, carrier phase.

You will note that the inlet to your pipeline mixer is of a smaller line size than the mixer body itself. This design ensures that the mixer will draw the fluid into the shear zone. Though the mixer design will pump certain water-like fluids, the mixer should never be considered a “pump”. In many cases it will be desirable and even necessary to use a pump to pressure feed the mixer. **It is recommended that the system pump be placed upstream of the mixer to ensure that the mixer is never starved.**

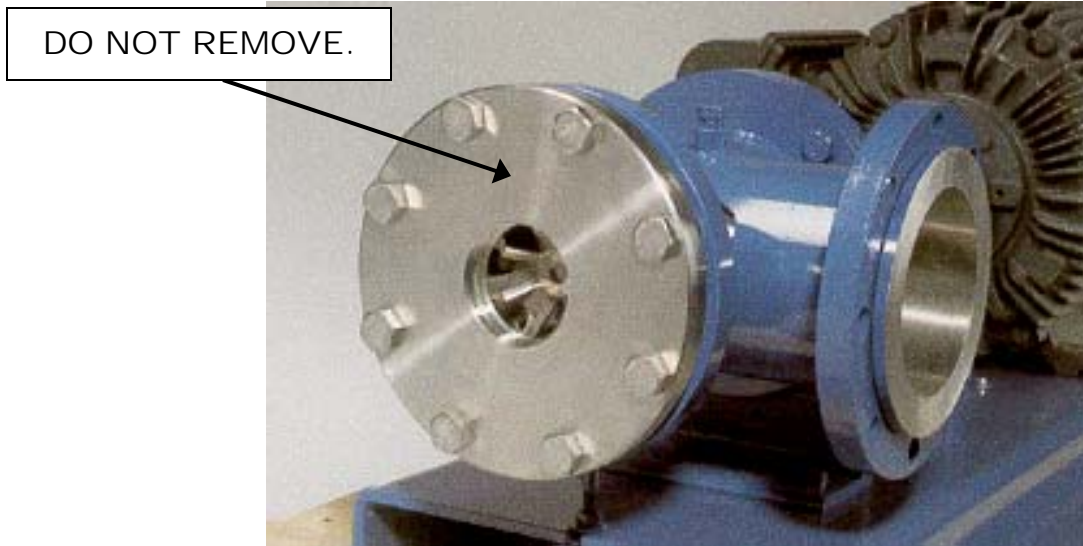


Should additional retention time be required, throttling a valve at the mixer outlet will reduce flow through the mixer and increase residence time for more thorough mixing. If the supply pump speed is reduced to obtain this result, be aware that cavitation may result and be certain that the mixing chamber is kept fluid full at all times. (See comments about dry operation under “Common Damage” on page 7 and parts 7 & 10 on page 9).



## PIPELINE MIXER INLET CONFIGURATION

All industrial pipeline mixers are supplied with a blind inlet flange drilled with an NPT process connection. **This flange is integral to proper operation of the equipment. Do not operate this mixer without the blind flange in place.**



Consult factory for custom inlet configuration designs.

## SINGLE VS. TANDEM SHEAR

Greerco<sup>®</sup> offers two styles of Sanitary Pipeline Mixers: the single shear and the tandem shear. The single shear consists of a single rotor-stator combination and the tandem shear consists of two rotor-stator combinations. In tandem shear configurations, the secondary stator is a multi-port stator consisting of several rows of smaller holes, where the primary consists of a single row of large holes.

### NOTE:

All Pipeline Mixers can be converted to or from a tandem shear configuration as required. However, stators and turbines from the two configurations are NOT interchangeable.

## PRODUCT OUTLET

The mixer head assembly is bolted to the bearing housing utilizing a common ANSI flange. By rotating the head assembly at this joint, the mixer may be installed with the discharge in any position that meets the needs of the piping scheme.

The factory standard configuration is for the product outlet to be towards the right side when facing the inlet of the mixer.

## DIRECTION OF ROTATION

A red arrow (affixed to the bearing housing or the coupling halves and may be hidden by the coupling guard) indicates proper rotational direction for operation of your Industrial Pipeline Mixer. **OPERATING DIRECTION IS COUNTERCLOCKWISE WHEN FACING THE INLET PORT OF THE MIXER (MOTOR IS AWAY FROM YOU).**



DO NOT OPERATE YOUR MIXER IN REVERSE  
CATASTROPHIC DAMAGE CAN OCCUR WITH ONLY  
MOMENTARY OPERATION IN THE WRONG DIRECTION

\*\*\*\*\*

MOTOR COUPLING IS DISENGAGED TO PREVENT DRY-  
RUNNING WHILE VERIFYING OPERATING DIRECTION

## MACHINE INSTALLATION & START-UP GUIDELINES

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The Industrial Pipeline Mixer is shipped assembled and ready to connect and operate after the motor is wired and the motor coupling is engaged.

1. Make sure that the base is bolted to a flat surface and is not twisted. Any distortion in the base will misalign the motor coupling, which may cause excessive stress and failure of the mixer shaft.
2. Do not operate this mixer without first checking that the shaft spins freely and that no foreign material has been lodged in the mixing head during transport and piping.
3. Stock Industrial Pipeline Mixers are supplied with 3600rpm, 3-phase, 60Hz, 230/460Volt Explosion-Proof Motors. Follow the motor's wiring directions. The mixer is shipped with the coupling disengaged to prevent "dry-running" damage to the mixer upon start-up. Once wired, confirm that the motor turns in the required direction to properly drive the mixing head in a counterclockwise direction (when facing inlet port) prior to engaging coupling. This will prevent the turbine from unscrewing, becoming disengaged and causing major damage to inlet port and mixing head components.
4. After the motor has been wired and proper rotational direction is confirmed, the mixer can be connected to the motor for operation.

**NOTE:** The 2" Industrial Pipeline Mixer is equipped with a *Belt Driven Motor* to achieve higher mixer head rotation speeds. It is shipped with the belt disconnected. When installing or re-installing the timing belt, do not over-tighten or bearing failure may result. Proper tension will allow deflection approximately equal to the thickness of the belt (including the teeth) without exerting excessive pressure.

5. Do not remove the blind flange on the mixer inlet. This is NOT an "extra" piece or adapter. Consult the factory for alternate connections.
6. The mixing head must always be supplied with product (water is sufficient) and be "fluid full" to lubricate the sleeve and bushing in the mixing head. If operating at the low-end of the unit's operating capacity and/or processing low viscosity product, it may be necessary

to apply backpressure (20 PSIG) with a down-stream valve. This will ensure a full mixing head and prevent cavitation that may cause a “dry-running” condition and damage the stellite sleeve and bushing.

## MECHANICAL SEALS

The Industrial Pipeline Mixer can be supplied with either a single or double mechanical seal. Both seal options are self-contained and preloaded.

### Single Mechanical Seals

- Do not require a separate seal flush, but **MUST** be immersed in a liquid at all times when operating. Seal is lubricated by process fluid and mixer must be flooded prior to operation.
- Factory Stock Model is a *John Crane 81T* for a 2” machine and a *John Crane 5610* for the larger models.

### Double Mechanical Seals

- Need to be flushed with a barrier fluid to lubricate and clean seal faces. The fluid should be compatible with process fluids and should be at a pressure approximately 20psi higher than the process pressure.
- Seal is supplied with pipe nipples, pressure gauge, and ball valve for regulation of barrier fluid flow and pressure. A lube system or “lube pot” may require piping changes; follow the manufacturer’s installation and operation instructions carefully.
- Factory Stock Model is a *John Crane Type 88T* for a 2” machine and a *John Crane 5620* for the larger models.

\*\*\*\*\*CAUTION\*\*\*\*\*

SEAL CHAMBER MUST BE FLOODED PRIOR TO OPERATION.

FOLLOW ALL SEAL & LUBE SYSTEM INSTALLATION &  
OPERATION INSTRUCTIONS FOR PROPER SEAL PERFORMANCE

Standard Factory Seal Construction (unless specified at time of order): Viton Elastomers, 316SS Hardware, and Carbon vs. Silicon Carbide Faces.

Alternate seal faces and seal manufacturers are available – Please consult the factory for cost and/or designs.



## MAINTENANCE OF THE INDUSTRIAL PIPELINE MIXER

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Maintenance requirements on the pipeline mixers are minimal. However, proper care and maintenance are essential to optimal service life.

**“Normal Wear”** – Normal wear is confined to the turbine sleeve and the stator bushing. Both parts are constructed of wear-resistant Stellite. If you are processing abrasive materials, wear may also be seen on the turbine and stator. The *rate* of abrasive wear will be different for every product and processing condition.

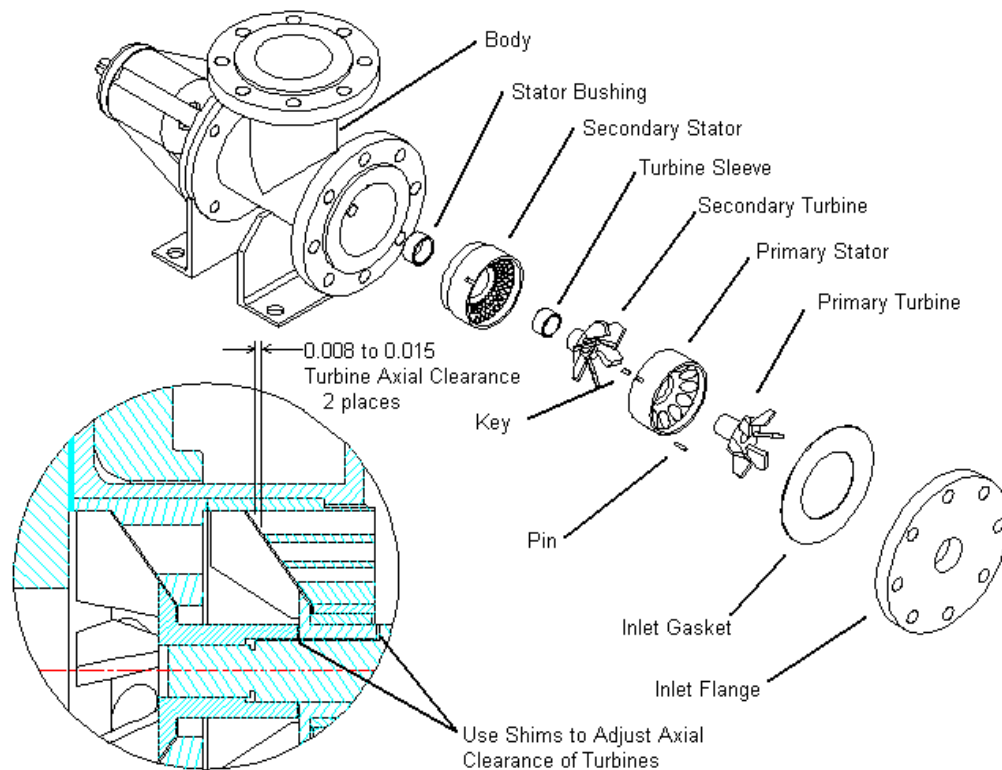
**Common Damage** – The most common cause of damage to mixing head components is *physical*. Contamination of product fluid with hard objects such as tramp metal or stones may cause catastrophic damage to the mixing head. It is imperative that hard objects be kept out of the mixer, as the operating speed is so high that there is a low probability that rigid objects will pass the moving parts without causing damage. Foreign objects will result in irreparable damage to the turbine and either superficial or catastrophic damage to the stator. Depending on the length of operation under such a condition, the shaft and bearings could also be damaged.

The second most common mode of failure is *running the machine dry*. Even a momentary dry operation (jogging the motor for instance) will lead to damage. The stellite sleeve on the turbine requires the process fluid for lubrication. Failures of this sort could be limited to sleeves and bushings or could be as catastrophic as the welding of the mixing head to the shaft.

Last are failures caused by reverse operation, the results of which are obvious. Operation in the reverse direction will allow the turbine to unthread, back off the shaft, and into the inlet cap. Minor cases result in a damaged turbine and superficial inlet cap damage. Major cases result in severe bending of the turbine blades, and damage to the inlet cap and stator.

Before you begin any maintenance procedures on this machine, be sure to...

- Note any exterior damage to unit.
- Make a note of product and operating conditions.
- If failure has occurred, make a note of important information that may assist in diagnosing the problem (product temperature, product pressure, viscosity, noise, excessive heat, or process changes, etc.).



## MIXING HEAD DISASSEMBLY

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1. Disengage the motor coupling.
2. Unbolt the blind flange from the inlet flange of the mixer.
3. Remove the Inlet Gasket
4. Inspect the exposed turbine area for anything unusual (product build-up or damage, etc)

If possible, measure the turbine-stator gap - Especially if the turbine blades are worn and there is a noticeable or uneven gap where the turbine blades meet the stator.

- In the field, we recommend using Mylar feeler gauges to determine if the gap is within the 0.008-0.012" factory setting. The gap setting should be checked along the entire length of *each* turbine blade. This will provide a more accurate "lowest point" measurement.

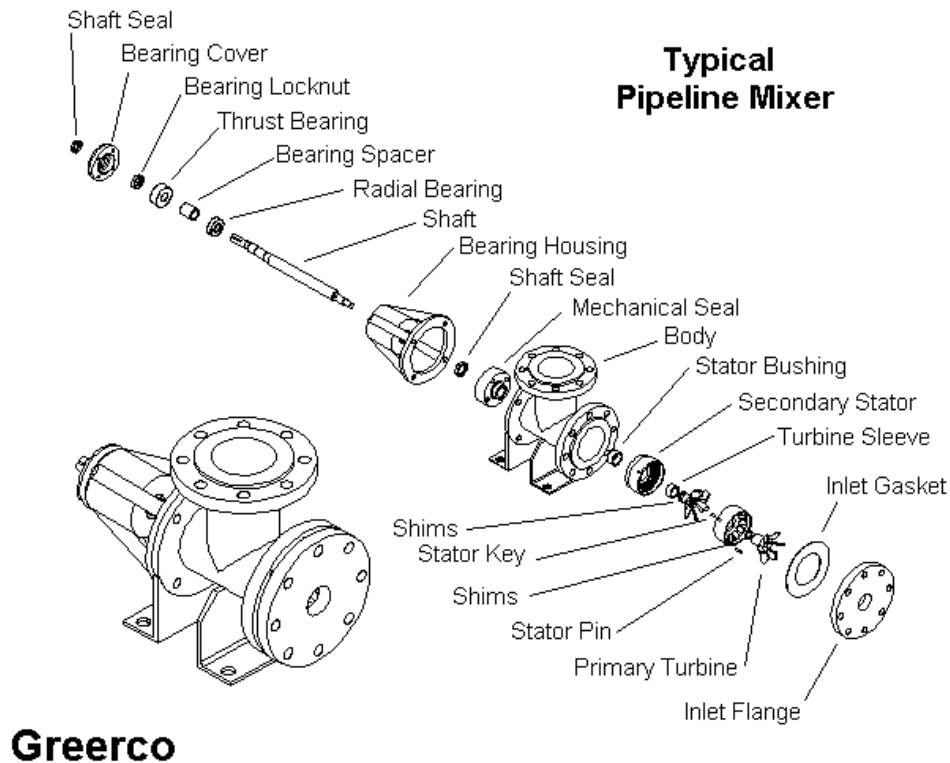
5. Rotate the primary turbine counter-clockwise while holding the coupling stationary. Turbine should freely unscrew.
6. Inspect primary turbine for damage, corrosion or worn edges (lack of sharpness). Turbine edges should be sharp. The turbine should “stand” on the blade ends and have all the blades rest solidly on a flat surface, without any wobble or misalignment.

Note that the turbine blades are (should be) sharp and care should be taken not to damage the edge or cut the technician’s hands.

7. Inspect turbine sleeve around neck of turbine for excess wear. Mild, consistent scuffing is normal. Gouges or uneven wear is abnormal.
  - If Stellite<sup>®</sup> sleeve has ripples or gouges in the surface it should immediately be replaced. These marks are indications of dry operation or abrasion. Wear like this will create escalating damage to the mixing head components if allowed to continue operating in this condition.
  - If uneven wear is present, put a dial indicator on the end of the shaft and rotate the shaft at the coupling end. Optimal operation requires less than 0.003” shaft run-out.
8. Remove the primary stator. Hole edges should be sharp. Take care not to cut yourself.  
(Do not lose the pin that holds the stator in place.)
9. Check the primary stator for wear or corrosion.
10. Inspect the stator bushing for wear.
  - If worn, note the position and pattern of the wear. The bushing will need to be replaced by pressing the component out of the stator from the rear side of the stator.
  - If the Stellite sleeve has ripples or gouges in the surface it should immediately be replaced. These marks are indications of dry operation or abrasion. Wear like this will create escalating damage to the mixing head components if allowed to continue operating in this condition.
11. If a tandem shear unit, a second turbine and stator will now be revealed. The secondary turbine should now easily slid off the

shaft and the secondary stator slid out of the body. Inspect these components as you would the primary pair.

12. Remove and save any shims; note the position, thicknesses and quantity used (reference the drawing at the beginning of this section).



## BEARING HOUSING DISASSEMBLY

1. From backside of seal chamber, remove any seal anchor screws.
2. The mixer housing can now be unbolted and removed from the shaft and bearing housing assembly. Note orientation of outlet port so that machine is properly configured during reassembly.
3. Using care, slide mechanical seal off the shaft.
  - Refer to your seal manual for guidelines on inspecting and repairing the mechanical seal.

- Check the shaft surface area under the seal. If there are any defects note the type and location. Shaft defects may cause seal leakage or damage.
4. Spin the mixer shaft by hand to inspect the bearings. Shaft should spin smoothly with no rumbling and very little “play”. Be sure to replace/grease any bearings exhibiting signs of wear.
  5. If the bearings and/or shaft need replacement, use the following procedure and consult the equipment drawings at the back of this manual for part identification:
    - Loosen the setscrew and remove the mixer coupling.
    - Unbolt the thrust cap from the motor end of the bearing housing and remove.
    - Inspect the motor end shaft seal (located within the thrust cap) for damage, oxidation, cracking or simple dryness and inflexibility. Replace if damaged.
    - Pull the shaft and bearing assembly out of the bearing housing.
    - Remove the Locknut (Locknuts should not be re-used more than twice)
    - Bearings and bearing spacer can now be pulled from the shaft.
    - Inspect mixer end shaft seal (located in bearing housing) for damage, oxidation, cracking or simple dryness and inflexibility. Replace if damaged.

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## REASSEMBLY OF INDUSTRIAL PIPELINE MIXER

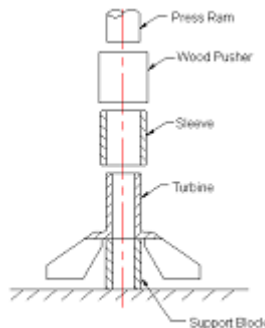
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The industrial pipeline mixer may be reassembled by simply reversing the procedure outlined above. Keep in mind the following.

- Be sure all components are clean and free of debris before reassembly.
- Lubricate o-rings prior to installation
- Ensure that shaft run out is less than 0.003” before installing shaft.
- Check all surfaces for burrs before sliding seals or o-rings over rough surfaces that may damage integrity of the seal.
- It is possible to inadvertently cause damage to the shaft during machine reassembly. This damage of this type is evident in extreme run-out after assembly that was not seen when the individual shaft is inspected. When the bearings are pressed into place on the shaft, be careful not to use the shoulder at the threads as a point of applied force. Utilize a fixture that allows pressure to be applied at the main shoulder of the shaft so that forces are applied to the thicker cross section rather than at the thinner, threaded shoulder.



- It is also possible to cause damage to the turbine(s) while pressing the turbine sleeve into place. Support the turbine as shown in the following drawing:

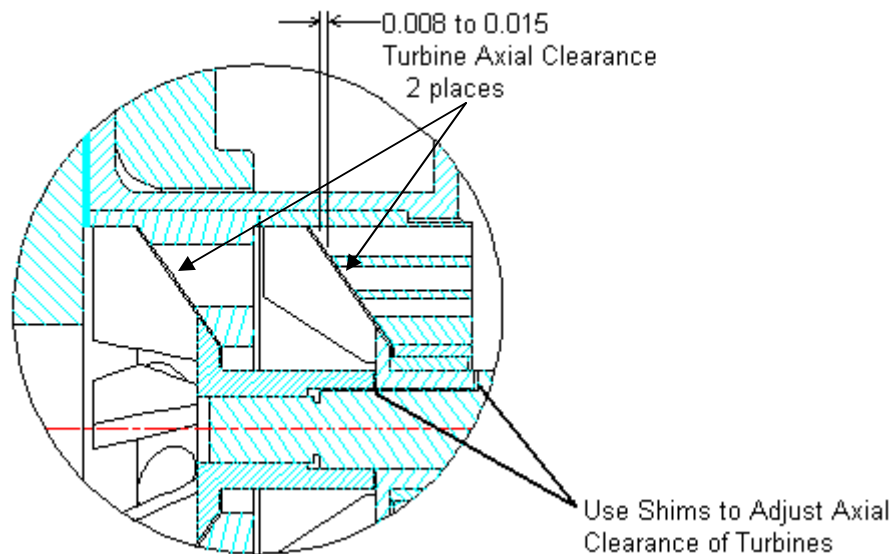


- Be sure to follow all motor, seal, and coupling precautions when installing.

- Jog motor to ensure proper direction of rotation prior to coupling to mixer.
- Rotate the shaft by hand to ensure free movement before coupling machine to motor.
- Use common sense and safety at all times.

## AXIAL ADJUSTMENT OF ROTOR-STATOR GAP

For optimal performance, your pipeline mixer should be operating with a 0.008-0.012" gap between the rotor(s) and stator(s). Thin metal (washer-like) shims are used to create this gap. The gap should be measured at the lowest point along each of the rotor blades.



## SPARE PARTS

Included, at the back of this manual, is a complete assembly drawing of the pipeline mixer you have just purchased. Recommended spare parts are denoted with an asterisk on this drawing. These are parts that over time will need replacement. It is recommended that the customer maintain an inventory of these parts as protection against down time due to wear or accidental damage such from foreign objects. For your convenience, we offer multiple discounted spare parts kits for use in the maintenance of this machine.

***Consumable Spares Kit***

Available for any shaft seal configuration, this kit contains all lip seals, bearings, shaft seals, gaskets and retaining ring. *Please specify machine serial number at time of quote/order.* – Mechanical Seal is NOT included in this kit.

***Machine Rebuild Kit***

Available for any shaft seal configuration, this kit contains all wearing parts including shaft, rotor, o-rings, bearings, seals and locknuts. The stator(s) are NOT included in this kit. *Please specify machine serial number at time of quote/order.*

Should you need to order parts, please contact your local Chemineer-Kenics/Greerco representative, as listed on the front of this manual, or our factory at (978) 687-0101.

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