Ampco Pumps Company

# Jet-Shear Series

- Installation and Maintenance Manual

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# Introduction

To ensure the best results and service, please read and fully understand this manual prior to putting this mixer into service. For any questions regarding operation, maintenance, or installation, please contact your local distributor or Ampco Pumps Company:

*Ampco Pumps Company*
*2045 W. Mill Road*
*Glendale, WI 53209*
*Phone: (800) 737-8671 or (414) 643-1852*
*Fax: (414) 643-4452*
*Email: ampcocs@ampcopumps.com*

# General Information

Standard maintenance practices are outlined in this manual. For more information, please refer to the Maintenance section starting on page 11. Following these guidelines will provide long-lasting, trouble-free service when the mixer is incorporated in a properly designed system.

# Shipping Damage or Loss

Upon receiving equipment that is damaged or if your shipment is lost in transit, immediately file a claim with the carrier. At time of pick-up, the carrier signed the bill of lading, acknowledging that they have received the product from Ampco in good condition.

# Mixer Receiving

Remove the mixer from its packaging and check for damage. Please make note of the mixer serial number; this will assist in the process of ordering replacement parts and/or a warranty claim. For more information regarding shipment damage or warranty, please refer to Terms and Conditions (page 19).

# Safety

**IMPORTANT:** Read and understand this manual BEFORE installation, operation, or maintenance of the mixer. Improper installation, operation, or maintenance may result in severe injury or death. Equipment damage caused by user neglect will invalidate the mixer warranty.

There are safety symbols used throughout this manual identifying safety concerns.

***WARNING:*** Hazards or unsafe practices that COULD result in severe personal injury or death, and how to avoid them.

***CAUTION:*** Hazards or unsafe practices that COULD result in minor personal injury or damage to product or property.

**Specifications**

Temperature Range ..... 40º F to 400º F/ -40º C to 204º C

**Materials of Construction**

Bearing Housing..... AISI 304 Stainless Steel
Mounting Flanges..... AISI 304 Stainless Steel
Mixing Shaft ..... AISI 316 Stainless Steel
Workhead..... AISI 316L Stainless Steel
Product Contact Surface Finish .....32Ra
Wetted end O-Rings..... Viton
Bearing Frame O-rings.....Buna

**Seal**

Type.....Internal Single Lip Seal
Lip Seal Polymer Material.....UHMW-PE
Lip Seal O-Ring Material ..... Viton

**Recommended Torque Values**

Mounting Flange Socket Head Cap Screws
JS125..... 12ft-lbs / 17N-m
JS150..... 21ft-lbs / 27N-m
JS225..... 43ft-lbs / 59N-m

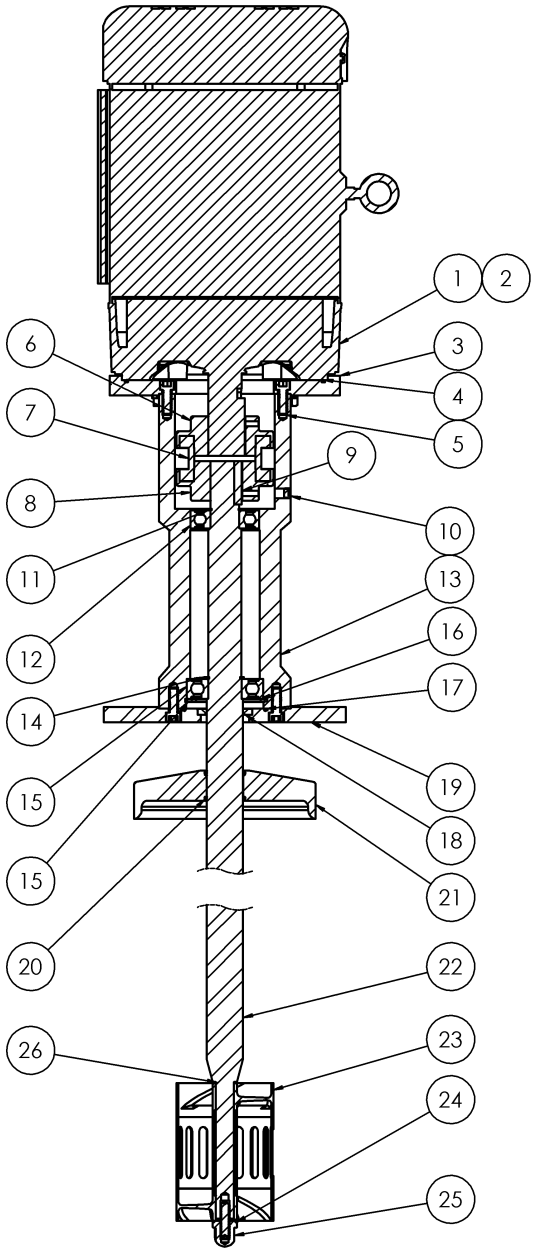
Motor Adapter Bolts
NEMA 56C-140TC/ IEC 80-112..... 20ft-lbs / 27N-m
NEMA 180TC-280TC/ IEC 132-200..... 55ft-lbs / 68N-m

Workhead Screws
JS125..... 21ft-lbs / 27N-m
JS150..... 21ft-lbs / 27N-m
JS225..... 43ft-lbs / 59N-m

**Recommended Tools for Assembly and Disassembly**

9/16” socket.....56C-140TC motor bolts, JS125 workhead screw
3/4” socket.....180TC-280TC motor bolts, JS150 workhead screw
1” socket.....JS255 workhead screw
1-1/8” adjustable wrench ..... JS125 mixing shaft
1-3/8” adjustable wrench ..... JS150 mixing shaft
2” adjustable wrench ..... JS225 mixing shaft
1/8” Allen wrench.....JS125 upper & lower coupling flanges
3mm Allen wrench.....JS150 lower coupling flange
3/16” Allen wrench.....JS125 & JS150 housing plug
5/32” Allen wrench.....JS150 lower coupling flange, JS225 coupling flanges
1/4” Allen wrench..... JS225 housing plug, JS125,150, & 225 mounting flanges
3/8” Allen wrench.....JS225 lower mounting flange
Torque wrench
Snap ring pliers
Vernier calipers
Torch / heat gun
Bearing heater

# Parts List




| COMPONENT | COMPONENT NAME |
|---|---|
| 1 | MOTOR |
| 2 | MOTOR BOLTS |
| 3 | MOTOR MOUNT FLANGE |
| 4 | MOTOR O-RING |
| 5 | FLANGE BOLTS |
| 6 | UPPER COUPLING FLANGE |
| 7 | COUPLING SLEEVE |
| 8 | LOWER COUPLING FLANGE |
| 9 | MIXER DRIVE KEY |
| 10 | UPPER SNAP RING |
| 11 | HOUSING PLUG |
| 12 | UPPER BEARING |
| 13 | BEARING HOUSING |
| 14 | LOWER SNAP RING |
| 15 | LOWER BEARING |
| 16 | INSERT SNAP RING |
| 17 | BEARING HOUSING O-RING |
| 18 | LIP SEAL |
| 19 | BRIDGE MOUNT FLANGE |
| 20 | UMBRELLA SHIELD O-RINGS |
| 21 | UMBRELLA SHIELD |
| 22 | MIXING SHAFT |
| 23 | WORKHEAD |
| 24 | WORKHEAD O-RING |
| 25 | WORKHEAD SCREW |
| 26 | WORKHEAD DRIVE KEY (JS225 ONLY) |

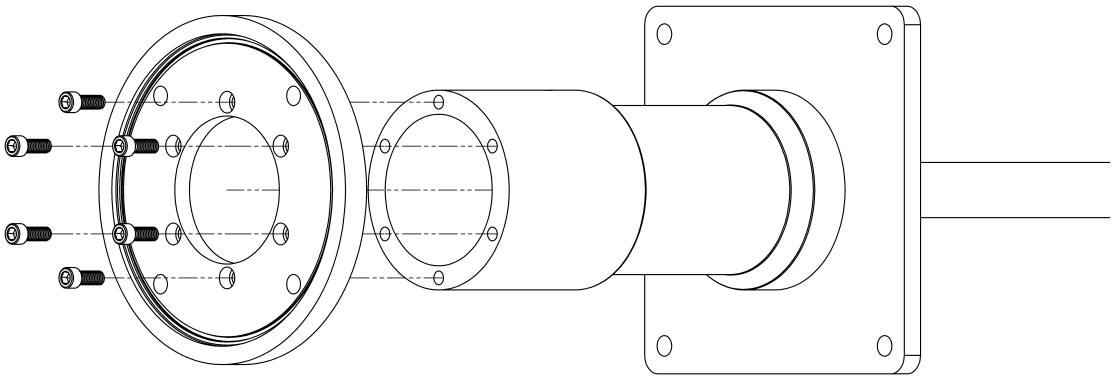
# Moving and Mounting Mixer

This equipment should only be installed, set up, maintained, and operated by qualified personnel. The use of standard millwright practices for installation should be followed. Equipment can be large, heavy, and awkward. The use of a forklift truck or other adequate lifting equipment may be necessary. Several people should be involved in the assembly process. Ensure that when moving and installing the mixer that the mixing shaft is supported so as to prevent damage. If there is an eyebolt on the motor frame, DO NOT LIFT THE MIXER WITH THE MOTOR EYE-BOLT as this is only rated for the weight of the motor alone. The mixer can ONLY be installed vertical or on a 0-10 degree incline for proper operation in a fixed mount application.

Your mixer may have been partially disassembled for shipment. If so, the motor will be separated from the rest of the mixer.

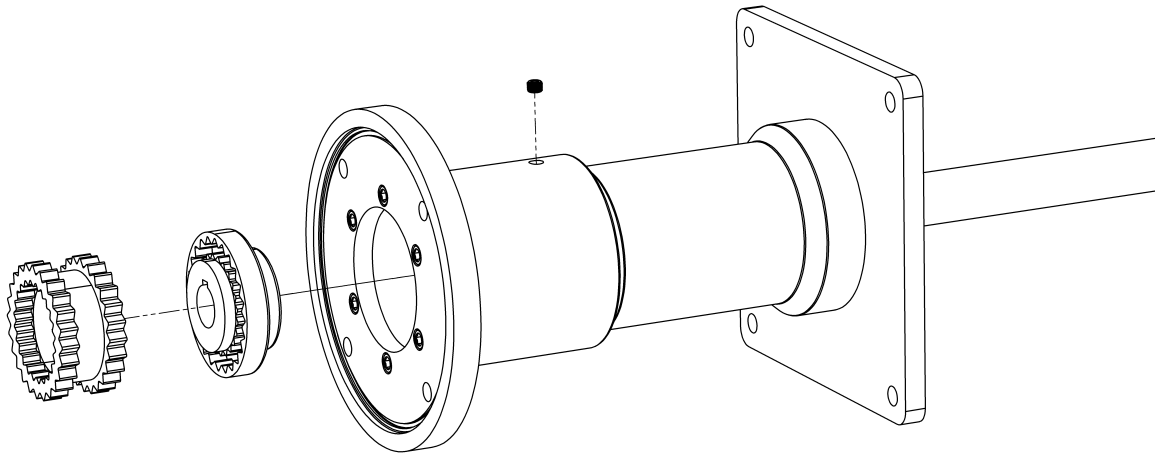
**To install the motor:**

1. Ensure the motor mounting flange (3) and bridge mounting flange (19) are installed on the bearing housing (13), and that the flange bolts (5) are tightened to the appropriate specification. See page 4 for proper bolt torque specs.

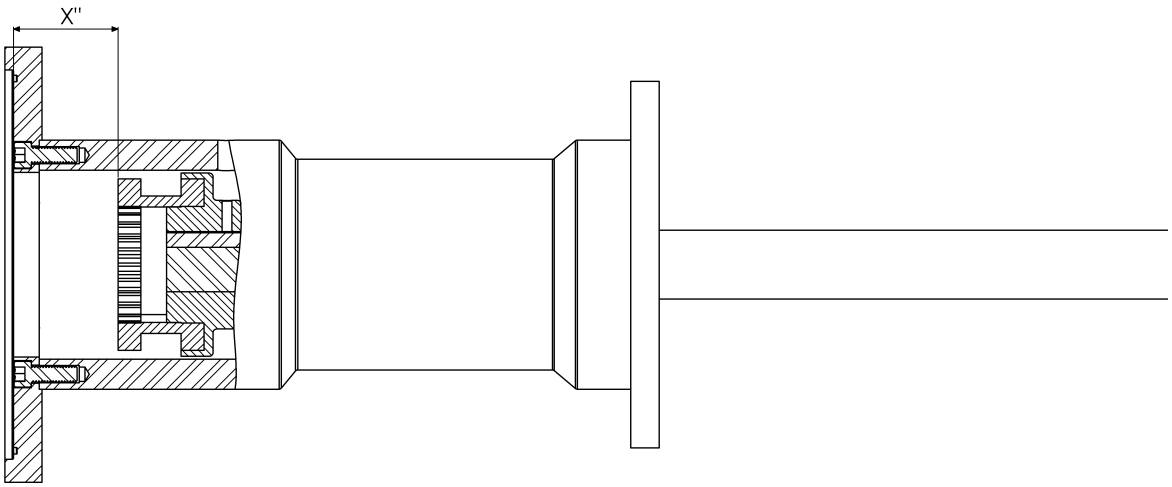


2. Line up the keyway on the lower coupling flange (8) with the drive key (9) on the mixing shaft (22). Slide the lower coupling flange down on to the mixing shaft inside of the bearing housing (13).
3. Tighten both coupling flange set screws with an Allen wrench through the access port in the bearing housing (13).
4. Place the coupling sleeve (7) into the lower coupling flange (8). Make sure the sleeve is seated properly.
5. Install the housing plug (11) in the bearing housing (13).

**To install the motor (contd.)**



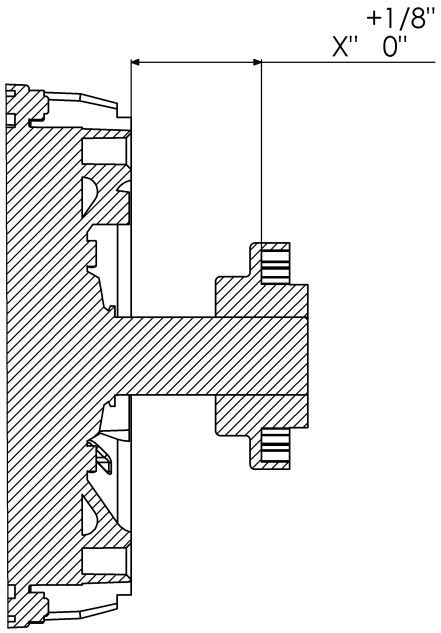
6. Measure the distance between the surface of the coupling sleeve (7) and the motor side of the motor mounting flange (3). This measurement will be necessary for determining the placement of the upper coupling flange on the motor shaft (1).



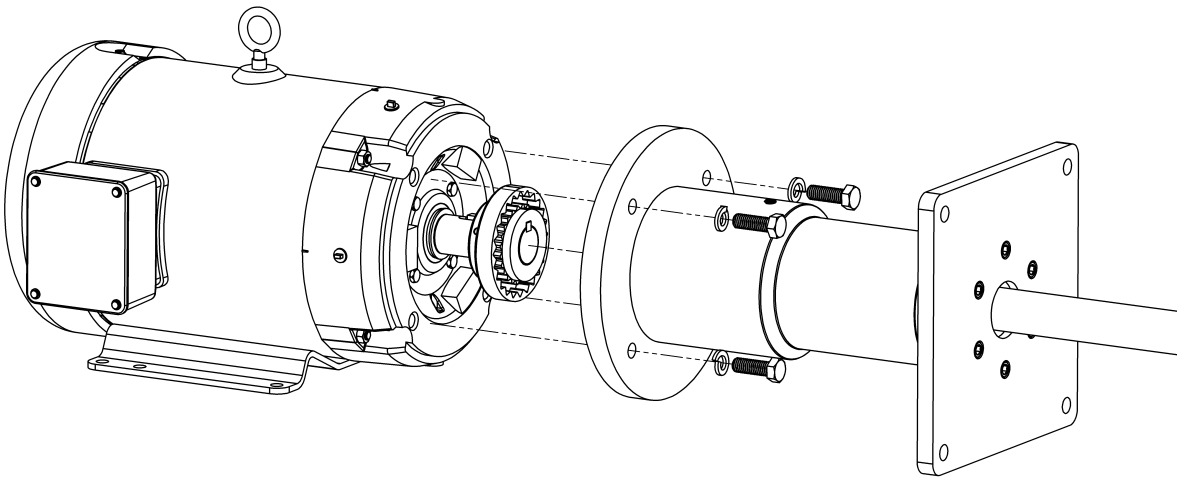

7. Line up the keyway on the upper coupling flange (6) with the key on the motor shaft (1) and slide the upper coupling flange onto the motor shaft.
8. Set the height of the interior surface of the upper coupling flange to the height measured on the coupling sleeve (7) and motor mount flange (3). Slide the upper coupling flange back on the motor shaft to allow for clearance between the coupling flanges(6,8) and the sleeve, up to 1/8” extra maximum.

**To install the motor (contd.)**

9. Tighten both set screws on the upper coupling flange (6).
10. Place the motor O-ring (4) into the motor mount flange (3).
11. Rotate the mixing shaft (22) so that the coupling sleeve (7) aligns with the upper coupling flange (6) to insure a proper fit. Place the motor (1) into the motor mount flange (3).
12. While watching the motor fan (1), rotate the mixing shaft (22) by hand to ensure that the motor shaft engages the mixing shaft properly.
13. When the coupling is properly seated, secure the motor (1) to the motor mount flange (3) with motor bolts (2) and lock washers. Torque the motor bolts to the recommended torque values found on page 4.




The motor (1) may be installed on the mixer assembly after the mixer has been mounted onto the tank or bridge. Guide the mixer shaft (22) through the bridge and tank top opening. Remove the work head assembly (23) if necessary to fit the shaft through the opening. Do not allow the shaft to be bent or mishandled. Bolt securely with appropriately sized stainless fasteners to the bridge mount flange (19).

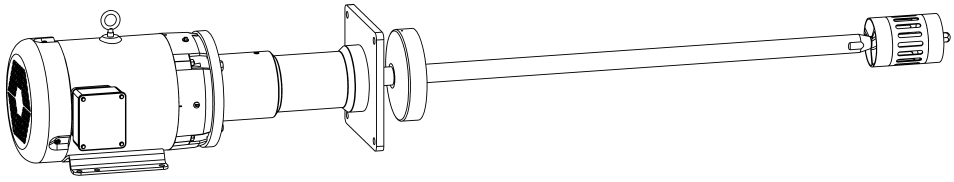


***WARNING:*** Frequently inspect the mounting hardware to ensure it is properly tightened. Improper mounting could lead to personal injury.

# Start-up Checklist

**BEFORE STARTING THE MIXER, CHECK THE FOLLOWING:**

1. Workhead is fully submerged.
2. Check that the workhead has proper off bottom clearance (one head diameter).
3. The mixer should be rotating clockwise when viewing the unit from above. Verify clockwise rotation by “bumping” the motor, or by switching on the motor then quickly switching it back off. Watch the motor fan from the top to ensure correct rotation. If the mixer runs backwards, swap two of the leads between the motor and the power source.



***CAUTION:*** Rotation should be checked prior to mounting the mixing head; the mixing head could spin off if turned incorrectly. Mixer rotation should be clockwise when viewed from above.

4. Check mixing shaft runout with a dial indicator to ensure that it does not exceed 0.004” at any point.

# Shaft Straightness

Shaft straightness is critical to bearing life. Each mixer has its shaft straightened to a TIR of 0.004" at the factory. Shafts can only be straightened once installed in the mixer, and straightness MUST be checked when new bearings or a new shaft is installed. See page 15 for the procedure for straightening the mixing shaft.

**CHECK DURING OPERATION:**

1. Mixer is not vibrating on its mounting stand.
2. Shaft is turning smoothly without wobble or deflection.
3. Bearings are quiet and bearing frame is warm to the touch but not excessively hot (over 180° F)
4. All hardware is tightened.
5. Liquid in vessel is not exhibiting extreme vortexing.

**Lock Out Critical Speed:**

All mixers have a critical speed. Typically, it will be seen in the form of a vibration or wobble in the shaft system. Many times this becomes apparent when a variable frequency drive (VFD) is added and the mixer speed is changed to optimize the process. Make note of any critical speeds you find. DO NOT RUN THE MIXER AT THIS CRITICAL SPEED as this can lead to damage of your mixer. Typically, you would lockout 20% on either side of the critical speed on your VFD. Note that there may or be more than one critical speed for your mixer set-up.

# Mixer Position

**For Liquid-Liquid, Non-Vortex Conditions:**
The mixer will operate satisfactorily in most cylindrical tanks, with full hemispherical bottoms providing the best flow pattern. Tanks can also be conical or dished, but should be selected with the smallest diameter and greatest depth providing the shaft length limits are not exceeded.

The best mixing is obtained with vertical mounting, having an off center from approximately 1/5th to 1/4th of the tank diameter away from the tank's center-line. In larger tanks the mixer should be positioned 1/4th of the tank's diameter (from the tank wall).

**For Liquid-Solid, Vortex Conditions:**
If a vortex is required (for instance, to draw down light, powered materials), the mixer should be mounted vertically, at approximately 1/6th to 1/5th of the tank's inside diameter, off center.

Slight changes in this off center location will make drastic differences in the amount of vortex created. The key is to find a location that creates sufficient vortex without entraining too much air.

The vortex should never be so big that the mixing head runs dry or partially dry. If the vortex extends to the mixing head, move the mixing head a few inches off the tank's center to avoid cavitation.

**For Liquid-Solid Mixing:**
Powders/Solids that sink: Mount should be 1/5th of the tank diameter off center.

Powders that float: Mount should be 1/6th of the tank diameter off center.

Powders that float but air entrainment is necessary: Mount should be 1/4th of the tank diameter off center.

Meat or poultry brine applications: Mount should be 1/5th of the tank diameter off center in cylindrical tanks, and the mount should be dead center in square or rectangular tanks.

If you are unsure, please call an Ampco Applications Engineer at 800-737-8671

# Workhead Height

The recommended location of the workhead is approximately one head diameter off the bottom of the tank. A minimum of 1/2" (13mm) of space is required between the bottom of the workhead and the bottom of the tank.

In tanks equipped with other rotating equipment, the workhead should be located no closer than 3 to 4 inches from the scraper arms. The mixer should be located directly opposite to the low speed vertical agitator.

## 3-A Mixing Device Supports

The mixer must be supported to provide a minimum of 4 inches (102 mm) between the drive and the opening of the vessel

There must be a minimum of 2 inches (51 mm) above the umbrella shield to allow for inspection and cleaning.

Shaft openings must have a minimum 1 inch (25.4 mm) of cleaning space between the agitator shaft and the inside surface of the flanged opening.

## Preventative Maintenance

Little maintenance is required for your Jet Shear Mixer. The following requirements will aid in keeping the system in top operating condition and help prevent any serious issues:

Weekly:

- Inspect all fasteners for looseness
- Check the impeller screw that attaches the workhead to the mixing shaft. Refer to page 4 for Recommended Torque Values.

In Addition:

- Shaft bearings should be replaced every 5,000 hours. Use only premium FAG or SKF brand bearings.
- See manufacturer's maintenance manual for information on changing bearings and grease in the motor.

## Cleaning

The Jet-Shear mixer and parts should NEVER be cleaned with a metal scraper or other abrasive materials. High pressure wash down nozzles should NOT be directed at any connection which could force moisture into the bearing frame or electrical motor.

For closed tank systems, CIP is recommended. For open tank systems, pressure wash-down with manual cleaning using a non-metallic brush is recommended. Always use an appropriate cleaning solution when cleaning the Jet-Shear.

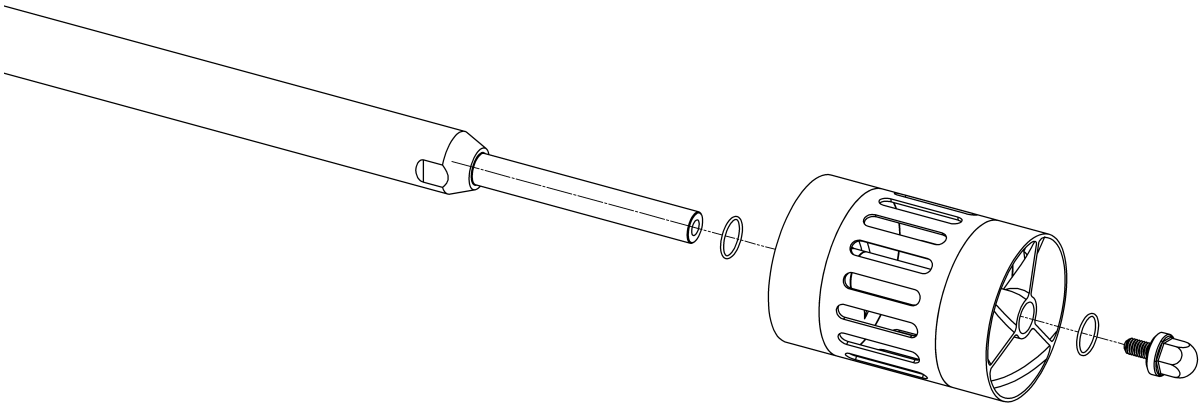
Clean the workhead after final use. This can be done by either running it a few minutes in hot water or use a suitable cleaning solution. Remnants of dried material could impact the mixer's operation. Proper cleaning should occur immediately after usage is completed.

Before cleaning, the operator MUST ensure that the mixer is off and all electrical connections are locked out. Occasionally disassemble the "wet end" of the mixer and inspect that all surfaces are clean. Reassemble replacing any O-rings or seals showing wear or damage.

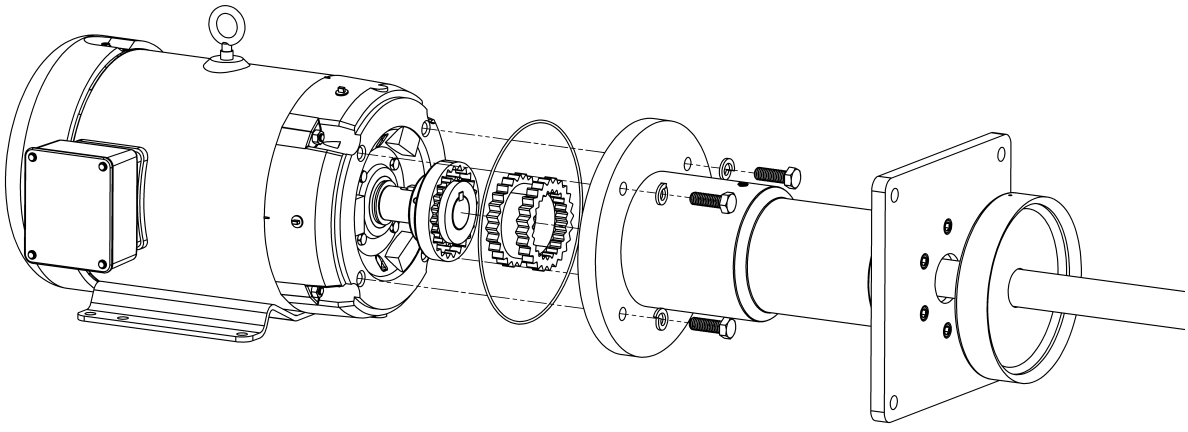
# Mixer Disassembly

To remove the mixer from the bridge or tank, several people should be involved. The mixer is heavy and may drop to the floor if not correctly handled.

1. Shut off and lock out the electrical power to the motor (1) and disconnect the necessary wiring prior to servicing.
2. Remove the workhead assembly (23) by removing the workhead screw (25).

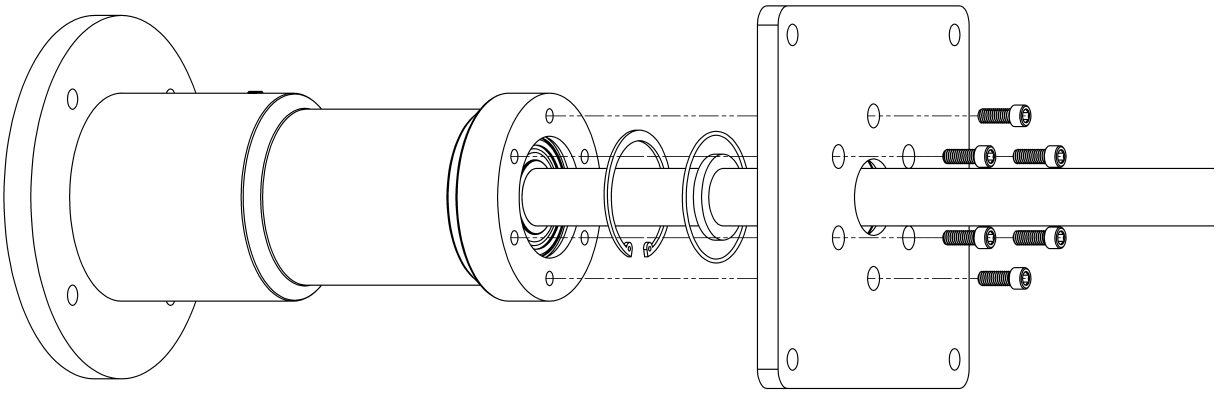


3. Remove the motor (1) from the bearing frame by undoing the motor bolts (2) and lock-washers.
4. Remove and inspect the motor O-ring (4). Replace as needed.
5. Remove and inspect the coupling sleeve (7). Replace as needed.
6. Remove all hardware attaching the mixer mounting flange (3) to the tank or bridge.

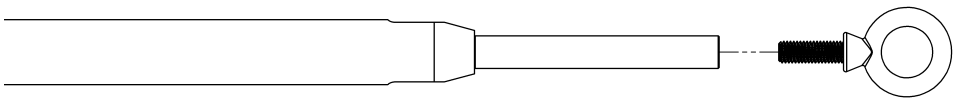


7. Lift the bearing frame assembly from the tank, taking care not to bang or bend the mixing shaft (22).
8. Lay the mixer assembly on a worktable, fully supporting the mixing shaft (22).
9. Remove the housing plug (11) to gain access to the setscrews on the lower coupling flange (8). Loosen both set screws to remove the coupling.
10. Remove the mixing shaft drive key (9).

11. Slide the shaft umbrella shield (21) and its O-rings (20) off of the mixing shaft. Inspect the O-rings (20) and replace as needed.
12. Remove the flange bolts (5) securing the bridge mounting flange (19) to the bearing housing (13) and set aside.
13. Slide the bridge mounting flange (19) off the bearing housing (13) and down the mixing shaft (22) and set aside. The lip seal (18) may still be installed in the pocket of the mounting flange.
14. Remove and inspect the lip seal (18) and bearing housing O-ring (17). Replace if necessary.
15. Remove the insert snap ring (16).



16. Remove the shaft assembly from the bearing housing, using caution not to bend or hit the mixer shaft (22). It may be necessary to heat the bearing housing (13) assembly for ease of disassembly. Install an appropriately sized eye-bolt (not supplied) into the workhead end of the mixing shaft . Using a shop crane or a fork truck, raise the mixer assembly from the eye bolt such that the mixer is vertical. Raise the mixer so that the motor mount flange (3) is off the floor only an inch or two. Use a non-cutting shop torch or heat gun and evenly heat the bearing housing around the bearing journals. Do not apply excessive heat. Remove the shaft with bearings from the bearing housing by tapping the top side of the bearing housing with a rubber mallet. DO NOT HIT THE MIXING SHAFT! Continue to evenly heat the bearing journals and tap the housing until the housing assembly drops onto the floor.



17. Remove the upper snap ring (10) with a snap ring pliers. Remove the upper bearing (12) using a bearing puller.
18. Remove the lower snap ring (14) with a snap ring pliers. Remove the lower bearing (15) using a bearing puller.

Replace the bearings with premium FAG or SKF brand bearings only. Replace the lip seal with proprietary product provided by Ampco Pumps Company.

# Mixer Reassembly

Note: The inner race of the bearings must be heated with a bearing heater to allow for a proper fit on the shaft. Install the snap rings with an appropriately sized snap ring pliers.

1. Heat and install the lower bearing (15) onto the mixing shaft (22). Re-install the lower snap ring (14) to secure it in place. Replace the snap ring if necessary.
2. Heat and install the upper bearing (12) onto the mixing shaft (22). Re-install the upper snap ring (10) to secure it in place. Replace the snap ring if necessary.
3. Warm the bearing housing (13) to approximately 140° F. Insert the shaft and bearing assembly into the bearing housing until the lower bearing (15) is resting squarely on the lower bearing journal stop.
4. Install the insert snap ring (16) into the bearing housing (13) to secure the shaft and bearing assembly.
5. Install the lower coupling flange (8) onto the sheave end of the mixing shaft (22) and secure with two setscrews via the access port in the bearing housing (13). The hub of the lower coupling flange should be flush with the end of the mixing shaft. Replace the housing plug (11) in access port to seal the bearing housing.
6. Squarely mount the lip seal (18) into the bridge mounting flange (19). Replace the bearing housing O-ring (17).
7. Slide the bridge mounting flange (19) with lip seal (18) and housing O-ring (17) up the mixing shaft (22) and secure to the bearing housing (13) with the flange bolts (5).
8. Place the umbrella shield O-rings (20) into the shaft umbrella shield (21) and slide the assembly onto mixing shaft (22). Once the mixer is installed this assembly can be slid over the opening of the mixing tank.
9. Lift the shaft and bearing frame assembly into position on the bridge and secure with hex bolts, lock-washers, and hex nuts to the mounting base. Take caution to prevent damaging the mixing shaft (22) during this operation.
10. Place the coupling sleeve (7) into the lower coupling flange (8) already installed on the shaft (22).
11. Place the motor O-ring (4) into the motor mounting flange (3).
12. Carefully place the motor (1) onto the bearing frame, aligning the upper coupling flange (6) with the coupling sleeve (7). Attach the motor (1) to the bearing housing using motor bolts (2) and lock-washers. Tighten these bolts in a star pattern to the recommended torque values as specified on page 4.
13. Install the workhead drive key (26, JS225 ONLY).
14. Place the workhead (23) on the shaft end. Attach the workhead screw (25) to secure the workhead assembly to the shaft. Lubricate threads with food grade anti-seize lubricant. Torque the workhead screw (25) to the recommended torque value on page 4 to prevent the workhead assembly from spinning and leading to damage of the various components.
15. Evaluate mixing shaft runout and straighten as needed.
16. Connect the mixer assembly to the power supply.

# Straightening the Mixing Shaft

Clamp a dial indicator to a rigid support that can be repositioned along the length of the shaft in 8”-12” increments.

**Heating**
Mark a point 8”-12” from the lower flange. Label this point “A”. Rotate the shaft by hand to find the point having the greatest runout. Mark this point with a vertical line. If the runout at this point is within the limit, move down the shaft another 8”-12". If it exceeds the limit, straighten this portion of the shaft.

With a pinpoint, high heat flame, heat a point located at 180 degrees from the vertical line and as close to the lower flange as possible. The heat source should be 3-4 inches away from the dial indicator at all times. Be sure to avoid burning the seal. The heating point should be no larger than 1/4” in diameter. The shaft diameter will determine the amount of time the flame will be held on the shaft. Do NOT use propane as you will not be able to achieve a high enough temperature.

**Note:** 3-5 seconds of exposure typically pulls .005”-.010” out of the bend for shafts ranging from 1.25” to 1.5”. 10-12 seconds of exposure is the maximum time for all shaft sizes.

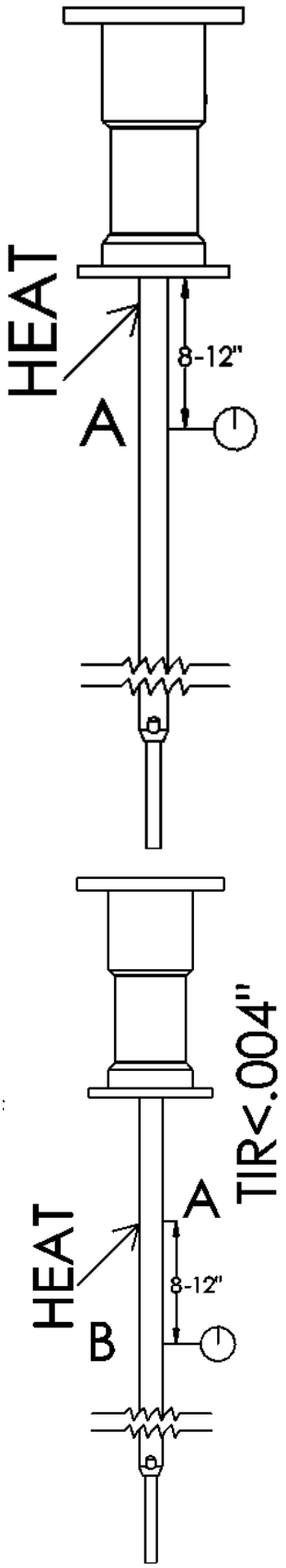
**Cooling:**
After heating, quench ONLY the heated spot with an ice cold wet rag. Re-wet, cool, and replace the rag every 10-20 seconds. Continue to hold the rag onto the shaft until all of the heat has been pulled from the shaft.

Rotate the shaft to recheck the runout at point “A”. If the runout is still over the limit, repeat the heating and cooling only this time move 1” closer to point “A” from the previous heating point.

Continue to repeat these steps until the runout is within the limit. Do not heat the same spot twice.

Move the indicator to a point 8”-12” from point “A” and label this point “B”. Rotate the shaft to check runout at point “B”. Point “A” is now the point to apply the heat. Repeat steps heating and cooling until the runout at point “B” is within the specified limit.

Continue to move down along the shaft through points “C”, “D”, “E” (8”-12” between each) until there is no point along the shaft with runout greater than the specified limit.



# Troubleshooting

Each Ampco Jet-Shear is assembled and tested at the factory and is designed to have trouble-free operation. Problems may occur over the life of the mixer due to system variations, standard wear, or user error. The following table has information that may help identify and solve a problem. For additional technical assistance, please contact Ampco with the mixer's serial number.

| Symptom | Cause | Solution |
|---|---|---|
| Mixing shaft is vibrating | Bent shaft | Shaft run out and end play should not exceed 0.004" when measured just above the shaft end. Shaft must be straightened or replaced if run out or end play is excessive. |
| | Loose workhead | Tighten the screw attaching the work-head to the shaft. |
| | Failed bearing | Replace the bearing(s) |
| Mixer is making loud rumbling noise | Shaft bearing(s) | Replace if necessary |
| Motor is making loud rumbling noise | Motor bearing(s) | Replace if necessary |
| | Motor Shaft | Indicate shaft run-out and shaft end-play from motor housing. Run-out and end-play should not exceed 0.005" |

**AMPCO PUMPS**
**Made of SELECTED corrosion-resistant alloys**

## TERMS AND CONDITIONS OF SALE

**1. ENTIRE AGREEMENT.** This document contains all of the terms and conditions of the agreement ("the agreement") between Ampco Pumps Company, Inc. ("Seller") and the purchaser ("Purchaser") of the Products ("Products") to be sold to Purchaser, to the exclusion of any other statements and agreements, and to the exclusion of any terms and conditions incorporated in Purchaser's order or other documents of Purchaser. Seller's acceptance of Purchaser's order is expressly conditioned on Purchaser's acceptance of the terms and conditions contained herein, and Purchaser, upon placing an order, is presumed to have accepted all the terms and conditions without modification. No alteration, waiver, modification of or addition to the terms and conditions herein shall be binding on Seller unless set forth in writing and specifically agreed to by an officer of Seller No course of dealing, usage of trade or course of performance will be relevant to supplement or explain any terms used in the agreement. All offers to purchase, quotations and contracts of sale are subject to final acceptance by Seller at its home office at Milwaukee, Wisconsin.

**2. PRICES**. Prices for Products manufactured by Seller pursuant to written accepted orders will remain firm for thirty (30) days from the date of any subsequent price change.

**3. TERMS OF PAYMENT**. Standard terms are ½% 10 days, 30 days net, from date of invoice unless otherwise stated. If, in the judgment of Seller, the financial condition of Purchaser at any time does not justify continuance of production or shipment on the terms of payment specified, Seller may require full or partial payment in advance. In cases of delays in payment, Seller reserves the right to charge interest on delinquent balances at the rate of 1 ½% per month.

**4. DELIVERY**. Except as otherwise provided expressly stated in the agreement, Products are sold F.O.B. Milwaukee. Seller will use reasonable commercial efforts to fill orders within the time stated, but the stated delivery date is approximate only, and Seller reserves the right to readjust shipment schedules without liability. Acceptance by Purchaser of the Products waives any claim for loss or damage resulting from a delay, regardless of the cause of the delay. Except as otherwise provided herein, Seller will not be responsible for freight, transportation, insurance, shipping, storage, handling, demurrage or similar charges. Claims by Purchaser for shortages in the Products must be made to Seller in writing within ten (10) days after date of receipt of the Products. No such shortage shall entitle Purchaser to withhold payment for Products which were received by Purchaser. Each such claim shall set forth in detail the basis and amount of such claim.

**5. TAXES AND FEES.** Seller shall pay all present and future sales, excise, privilege, use or other taxes, customs duties, and all other fees or other costs, imposed by any federal, state, foreign, or local authorities arising from the sale, purchase, transportation, delivery, storage, use or consumption of the Products or will, if applicable, provide Seller with an appropriate exemption certificate. Seller shall be under no obligation to contest the validity of any such taxes or to prosecute any claims for refunds or returns.

**6. INSTALLATION**. The Products shall be installed by and at the expense of Purchaser.

**7. LOSS, DAMAGE OR DELAY**. Seller will not be liable for loss, damage or delay resulting from causes beyond its reasonable control, including, without limitation, strikes or labor difficulties, lockouts, acts or omissions of any governmental authority or Seller, insurrection or riot, war, fires, floods, Acts of God, breakdown of essential machinery, accidents, embargoes, cargo or material shortages, delays in transportation, lack of production capacity or inability to obtain labor, materials or parts from usual sources. In the event of any such delay, performance will be postponed by such length of time as may be reasonably necessary to compensate for the delay. In the event performance by Seller under the agreement cannot be accomplished by Seller due to any of the foregoing causes within a reasonable period of time, Seller may, at its option, terminate the agreement without liability.

**8. RETURNS**. No Products or parts may be returned by Purchaser without the prior written consent of Seller.

**9. WARRANTY**. Seller warrants that the Products manufactured by Seller will be free from defects, material and workmanship under normal use and service for a period of one (1) year from date of shipment. In addition, the specified rating of each pump is warranted; however, the characteristic shape of the performance curves may vary from the published standards, and the capacity, head and efficiency guarantees are based on actual shop tests using clear cold water, and therefore the rating is specified in equivalent units of clear cold water. The sole obligation of Seller and the exclusive remedy of Purchaser for breach of this warranty shall be the repair (at Seller's facility) or replacement by Seller (F.O.B. Milwaukee, Wisconsin), at Seller's option, of any parts found to be defective, without charge and shall be conditioned upon Seller receiving written notice of any alleged breach of this warranty within a reasonable time after discovery of the defects, but in no event later than the end of the warranty period. The parts alleged to be defective shall be returned to Seller upon its request, freight prepaid. This warranty does not cover ordinary wear and tear, abuse, misuse, overloading, alteration or Products or parts which have not been installed, operated or maintained in accordance with Seller's written instructions. Seller shall not be liable for any expenses for repairs, additions or modifications to the Products outside of Seller's factory without its prior written consent, and any such repairs without such consent shall void this warranty. THIS WARRANTY IS EXCLUSIVE AND IS IN LIEU OF ALL OTHER EXPRESS AND IMPLIED WARRANTIES WHATSOEVER, INCLUDING BUT NOT LIMITED TO IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. Seller may from time to time provide its facilities, personnel and experience to assist customers in the selection of materials, design, installation and operation of Products for maximum resistance to corrosion and abrasion with due consideration to the economy of the installation. This service is provided in an advisory capacity only and the final selection and operation of the Products and ancillary equipment shall be the sole responsibility of Purchaser or any user thereof. Accessories and parts manufactured by third parties are warranted only to the extent of such third party's warranty. IN NO EVENT SHALL SELLER BE LIABLE UNDER ANY CIRCUMSTANCES FOR ANY INCIDENTAL, CONSEQUENTIAL OR SPECIAL DAMAGES (INCLUDING, WITHOUT LIMITATION, ANY LOST PROFITS OR LABOR COSTS) ARISING FROM THE BREACH OF THIS WARRANTY OR OTHERWISE ARISING FROM OR RELATING TO THE PRODUCTS OR THEIR SALE, USE OR INSTALLATION.

**10. CHANGES**. Changes in any work to be performed hereunder may be made only upon Purchaser's written instructions and acceptance by Seller in its discretion. Any change in drawings, materials or design of the Products, or to tools, fixtures or other items used to produce the Products, which affects Seller's cost to produce the Products will entitle Seller to adjust the price to take into account any additional costs. If work has been started, Seller shall be properly reimbursed for work already performed; if Products already produced are not accepted by Purchaser, Seller has the right to adjust the price to take into account any additional costs caused by an increase or decrease in quantities or in the time required for performance under the agreement.

**11. TERMINATION**. After Seller has commenced work, ordered any materials or made any other commitments pursuant to the agreement, it may be terminated only with the prior written agreement of Seller providing for equitable cancellation charges. Such charges shall reimburse Seller for any completed items at the contract price, and for any work-in-process items at the contract price less the cost to complete. Termination on any other basis must be specifically agreed on in writing in advance between Purchaser and Seller.

**12. DEFERRED DELIVERIES**. Orders or deliveries will be deferred only upon the prior written agreement of Seller in its discretion, and then only upon the following conditions:

(a) The deferral period may not exceed sixty (60) days. At the end of the deferral period, if no release is provided by Purchaser, Seller reserves the right to render an invoice for and ship the completed portion of the order to the destination specified in Purchaser's order, or to store such material at Purchaser's expense at Seller's standard storage charges then in effect.

(b) For the portion of the order that is not completed, if no release is provided by Purchaser at the expiration of the deferral period, Seller reserves the right to render an invoice for any completed items at the contract price, and for any work-in-process items at the contract price less the cost to complete.

(c) Purchaser shall bear the risk of loss or damage to materials held at Purchaser's request.

**13. LIMITATION OF LIABILITY**. IN NO EVENT SHALL SELLER BE LIABLE UNDER ANY CIRCUMSTANCES: (a) FOR ANY INCIDENTAL, CONSEQUENTIAL OR SPECIAL DAMAGES (INCLUDING, WITHOUT LIMITATION, ANY LOST PROFITS OR LABOR COSTS) ARISING FROM OR RELATING TO THE PRODUCTS OR THEIR SALE, USE OR INSTALLATION; (b) FOR DAMAGES TO PROPERTY (OTHER THAN THE PRODUCTS PURCHASED FROM SELLER); (c) FROM ANY BREACH OF ITS WARRANTY OR ANY OTHER OBLIGATIONS TO BUYER; OR (d) FOR ANY OTHER CAUSE WHATSOEVER, WHETHER BASED ON WARRANTY (EXPRESSED OR IMPLIED) OR OTHERWISE BASED ON CONTRACT, OR ON TORT OR OTHER THEORY OF LIABILITY, AND REGARDLESS OF ANY ADVICE OR REPRESENTATIONS (WHETHER OR NOT IN WRITING) THAT MAY HAVE BEEN RENDERED BY SELLER CONCERNING THE DESIGN, MANUFACTURE, SALE, USE OR INSTALLATION OF THE PRODUCTS.

**14. INFRINGEMENT**. Seller at its expense will defend and hold Purchaser harmless from and against all damages, costs and expenses arising from any valid claim of infringement by a third party with respect to any patent or other intellectual property rights (collectively, the "Intellectual Property Rights") caused by Products originally manufactured by Seller, provided Purchaser (a) has not modified such Products, (b) gives Seller immediate notice in writing of any claim or commencement or threat of suit, and (c) permits Seller to defend or settle the same, and gives all immediate information, assistance and authority to enable Seller to do so. In the event any such originally manufactured Products are held to infringe an Intellectual Property Right and if Purchaser's use thereof is enjoined, Seller will, at its expense and option: (1) obtain for Purchaser the right to continue using the Products, (2) supply non-infringing Products, (3) modify the Products so that they become non-infringing, or (4) refund the then market value of such Products. In no event shall Seller's liability exceed the sale price of the infringing Products. THE FOREGOING REPRESENTS SELLER'S ENTIRE AND EXCLUSIVE OBLIGATION WITH RESPECT TO ANY CHARGE OF INFRINGEMENT OF ANY INTELLECTUAL PROPERTY RIGHT AND IS IN LIEU OF ANY STATUTORY WARRANTY RELATING TO INFRINGEMENT. Notwithstanding the foregoing, Seller shall have no liability as to any Products or parts thereof that are manufactured or modified by Purchaser or a third party, or that are manufactured or modified by Seller in accordance with Purchaser's specifications. Purchaser will defend and hold Seller harmless from and against all damages, costs and expenses whatsoever arising from any claim for infringement of any Intellectual Property Rights relating to Products that have been manufactured or modified by Seller according to specifications provided by Purchaser.

**15. CERTAIN LAWS**. Seller will comply with the applicable requirements of the Fair Labor Standards Act of 1938, as amended, Executive Order 11246, and THE rules, regulations and orders of the Secretary of Labor relating thereto.

**16. PERIOD FOR ACCEPTING QUOTATIONS**. Unless accepted without modification within thirty (30) days of issuance, or prior to withdrawal by Seller if earlier, all quotations automatically expire at the end of such thirty (30) day period.

**17. PROVISIONS FOR INTERNATIONAL TRANSACTIONS.** The following provisions shall apply if the Products are to be shipped to Purchaser at a location outside the United States, and apply regardless of other provisions set forth in these Terms and Conditions:

(a) The 1980 United Nations Convention on Contracts for the International Sale of Products shall not apply.

(b) Except as otherwise provided expressly stated in the agreement, terms of delivery are Ex-Works (within the meaning of INCOTERMS 2000) and all customs fees, import duties, cargo insurance, taxes and other charges imposed on or relating to the purchase or sale of the Products shall be paid by Purchaser in addition to the stated price.

(c) Except as otherwise provided expressly stated elsewhere in the agreement, payment shall be made by issuance to Seller of an irrevocable letter of credit which (i) is issued and confirmed by a U.S. bank acceptable to Seller, (ii) is governed by the Uniform Customs and Practice for Documentary Credits (UCP 600) and otherwise acceptable in form and substance to Seller, and (iii) provides for payment to Seller of the purchase price in U.S. dollars upon presentation by Seller of Seller's certification and/or such other documents as shall be required by the letter of credit. All banking and other charges for such letter of credit shall be for the account of Purchaser.

(d) Prices include Seller's standard commercial export packaging which may vary depending on whether shipment is made by air, land or sea. Except as otherwise provided expressly stated in the agreement, Purchaser will bear any additional expenses required to satisfy Purchaser's packaging requirements. Packages will be marked in accordance with Purchaser's instructions, if any. Seller shall furnish packing lists and such other information as may be necessary to enable Purchaser's agent to prepare documents required for export shipment.

(e) All shipments hereunder are subject to compliance with the U.S. Export Administration Act, as amended, regulations thereunder and all other U.S. laws and regulations concerning exports. Purchaser shall comply with all such laws and regulations concerning the use, disposition, re-export and sale of the Products provided hereunder.

**18. GENERAL.** No modification or waiver of the agreement or any of its provisions is valid unless expressly agreed to by Seller in writing, and no waiver by Seller of any default under the agreement is a waiver of any other or subsequent default. The unenforceability or invalidity of one or more of the provisions of the agreement will not affect the enforceability or validity of any other provision of the agreement. Purchaser may not assign any of its rights, duties or obligations under the agreement without Seller's prior written consent and any attempted assignment without such consent, even if by operation of law, will be void. The agreement is governed by and shall be construed in accordance with the laws of the State of Wisconsin, including the Uniform Commercial Code as enacted by such state, without giving effect to its conflict of laws principles.

# Return Policy Ampco Pumps Company

This policy is intended for returns that are not covered by product warranty, i.e. wrong pump or part was ordered, customer canceled order, etc. Before returning any product, contact us for a Returned Material Authorization Number (RMA#). This will eliminate confusion when the parts are received and facilitate processing the return. No action will be taken on returned parts without an RMA.

| Type of Return | Restocking Charge |
|---|---|
| Standard pump with a replacement order | 10% |
| Standard pump without a replacement order | 15% |
| Standard parts with a replacement order | 5% |
| Standard parts without a replacement order | 10% |

Additional restocking charges may be assessed for any of the following circumstances.

1. Special order motors and seals are not returnable unless we have a use for them. Credit will be determined on a case-by-case basis.

2. Impellers that are trimmed to a diameter that we don't regularly use are not returnable. Credit will be determined on a case-by-case basis.

3. Used seals and motors are not returnable.

Credits

Credit will be issued only after parts are returned and inspected. Customer is responsible for packaging parts so they are returned in "as new" condition. Any labor required by Ampco to return the parts to "as new" condition will be deducted from the credit.

**Ampco Pumps Company**
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**Glendale, WI 53209**
**Phone: (800) 737-8671 or (414) 643-1852**
**Fax: (414) 643-4452**
**Email: ampcocs@ampcopumps.com**

For additional information on the Jet-Shear series and other Ampco Pumps products, please visit our website: **www.ampcopumps.com**