

APD AGITATOR MANUAL

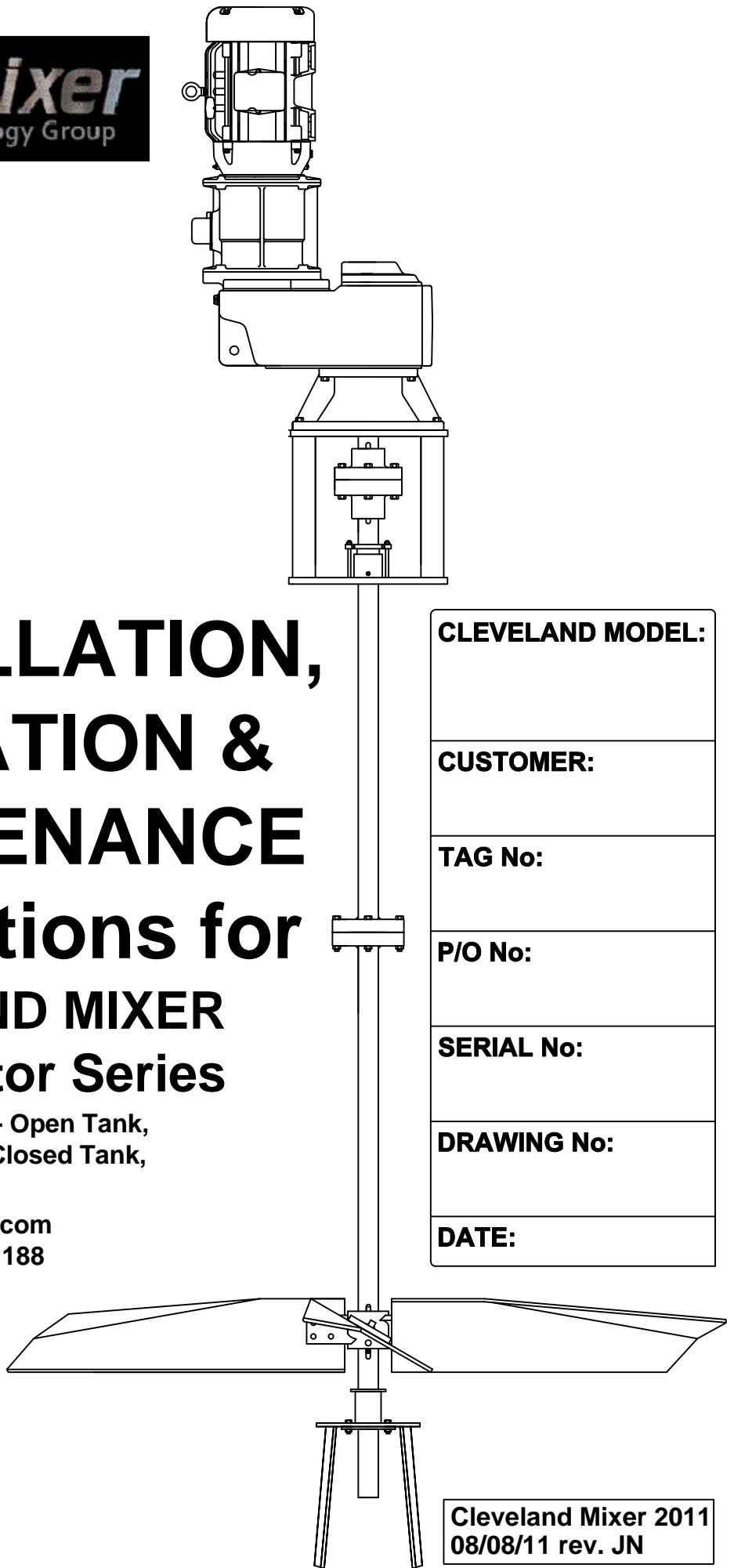
INSTALLATION, OPERATION & MAINTENANCE Instructions for CLEVELAND MIXER APD Agitator Series

Models: APD, APDO - Open Tank,
APDS/M - Sealed or Closed Tank,
SAPD/S - Side Entry

www.clevelandmixer.com

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CLEVELAND MODEL:

CUSTOMER:

TAG No:

P/O No:

SERIAL No:

DRAWING No:

DATE:

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MIXER ASSEMBLY

There are two style of agitators addressed in this manual; Open Tank and Closed Tank:

Open tank models are typically mounted to a pair of beams or bridge work that traverses the tank. This superstructure can be either independent from the vessel or an integral part of the tank itself.

Closed or sealed tank units are typically mounted on ASA schedule nozzles and incorporate some style of sealing mechanism to contain pressure or rogue emissions.

In either case it is critical that the mounting has a solid foundation which is rigid enough to withstand the torque of the mixing and the horsepower of the motor. Excess vibration and movement can cause critical damage to the mixer and tank.

The mixer should be mounted to sit level (90° for vertical units and 0°/180° for horizontal side mounted units).

We suggest laser aligning the shaft from the hollow output of the reducer to the bottom of the tank. Shaft alignment will help to assure the shaft will run true. You do not want the shaft sitting on even the slightest angle. An angled or misaligned shaft can cause excess vibration and speed wobble which can cause critical damage to the mixer and the tank. (Refer to page 12 for alignment info).

Be sure that the turbine blades can freely rotate a full 360°. Be sure that the blades will not come in contact with: baffles, dip tubes, tank walls, etc. Refer to approval drawings for clearance information.

As previously mentioned; to ensure a long service life and dependable performance, the mixer must be rigidly supported and the shaft(s) accurately aligned (the shaft should not move more than 1/32" per foot of shaft due to deflection of the structure) . It is important that the gear reducer sits level (unless it was specifically designed for angle mounting) for it's lubrication system to work properly. Be sure to take into account where the oil drain plug is before mounting. The following describes the minimum precautions required to accomplish this end.

Foundation

The responsibility for the design and construction of the foundation lies with the user. The foundation must be adequate to withstand normal operating loads and possible overloads while maintaining alignment to attached system components under such loads.

Concrete Foundation

If a concrete foundation is used, steel mounting pads and bolts of sufficient size to distribute the stress into the concrete should be grouted into the foundation.

Steel Foundation

If a structural steel foundation is used (i.e. wide flange beams or channels), a base plate of suitable thickness should be used and should extend under the entire unit.

INSTALLATION

Uncrating & Inspection

Be sure to use care when uncrating and handling the mixer. Certain parts such as turbine hubs, turbine blades, couplings, steady bearings, seals, hardware, spare parts and accessories may be packed in boxes or inside of the crate.

Make sure all components are accounted for before discarding the packaging materials or crates. It is common for parts to be missed or overlooked.

The mixer should be carefully checked for possible shipping damage at time of delivery. Any damage should be reported immediately to the TRANSPORTATION COMPANY AND CLEVELAND MIXER.

Improper handling may cause damage to the mixer and seriously reduce the service life. The shaft has been straightened to within .003" per foot. Extra care should be taken to see that it is not damaged in the process of uncrating.

Lifting & Moving

Always use a crane, hoist or other mechanical assistance to move APD units. Exercise care to prevent damage when moving. Lift only at designed lift points. Insure that adequate safety measures are taken to protect personnel during transportation. Protect the mounting surface from damage.

Pre Installation Check List

Most mixer operational problems can be avoided by following proper installation and operation instructions. The following is a list of suggestions to help insure proper installation and therefore satisfactory mixer service.

- 1 Before permanently wiring the motor, check for the correct rotation of the shaft. Standard rotation is clockwise when looking down from the the top. Gear reducers reverse rotation, take that into account when wiring. All wiring should be done by a qualified electrician.
- 2 Read and follow the instructions of all tags and nameplates before operating.
- 3 Check the operating full load motor amperage and voltage before operating the mixer.
- 4 The mixers are designed to run against a design specific gravity. DO NOT RUN MIXER DRY. Always test run in fluid less than or equal to design specific gravity and viscosity unless otherwise stated.
- 5 When starting the mixer, make sure that the impeller is not buried in solids.
- 6 When making field changes of motor horsepower, speed, shaft length, impeller diameter, width, etc., consult with Cleveland Mixer.

Before beginning work on any installation, make sure you have all required parts. Keep all parts for installation together at all times.

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Foundation for Installation

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Steel Foundation

If a structural steel foundation is used (i.e. wide flange beams or channels), a base plate of suitable thickness should be used and should extend under the entire unit.

SHAFT & IMPELLER INSTALLATION - VERTICAL MOUNT

Mixer Assembly

Both the hollow shaft and the driven shaft should be liberally lubricated before assembly. The reducer must slide freely onto the driven shaft. Do not hammer or force the unit into place.

The lower mixer shaft extension consists of one or more rigid shaft sections and will accommodate one or more impeller assemblies.

This shaft will either mount directly to the gear reducer as one piece shaft or it will be assembled from sections of shaft that are joined by bolted flanged connections.

Insert shouldered shafts into the hollow output of the gearbox until the shoulder butts up against the bottom of the gear reducer and stops. The use of the inner snap ring is not necessary. Torque the cap plate bolt to its dimensional torque value.

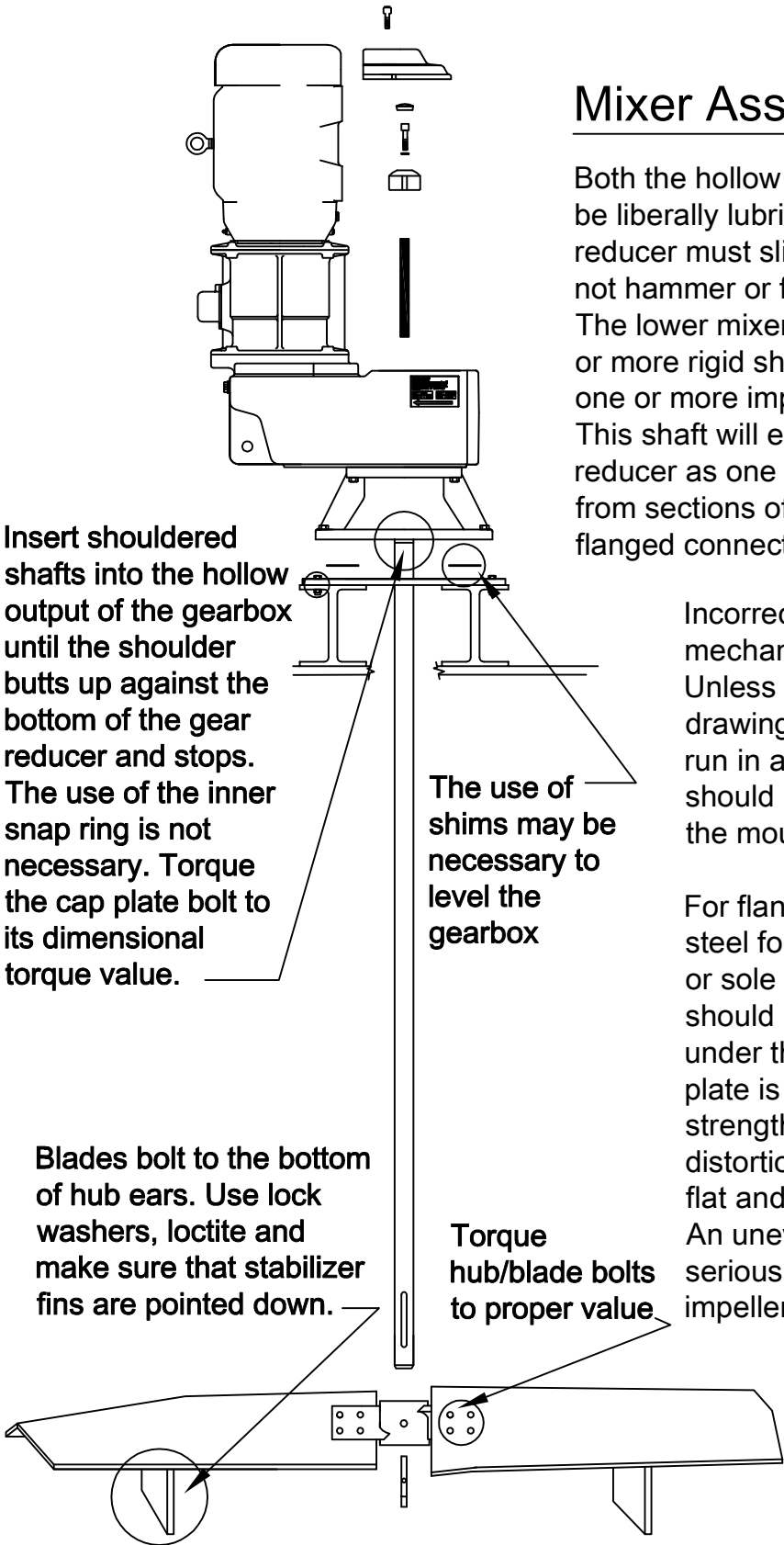
The use of shims may be necessary to level the gearbox

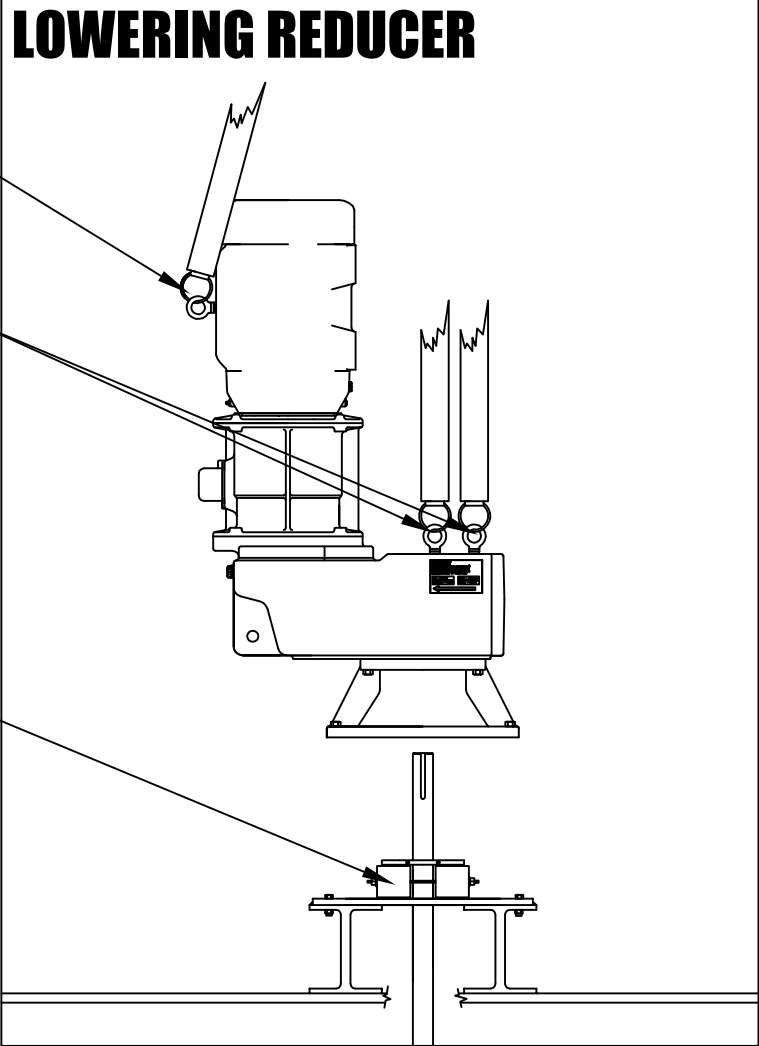
Blades bolt to the bottom of hub ears. Use lock washers, loctite and make sure that stabilizer fins are pointed down.

Torque hub/blade bolts to proper value.

Incorrect mounting is often a cause of mechanical difficulty with a mixer. Unless specified on the mixer assembly drawing, the mixer shaft is designed to run in a true vertical position. Shims should be used in installations where the mounting surface isn't level.

For flange mounted unit; if a structural steel foundation is used, a base plate or sole plate of suitable thickness should be used and should extend under the entire unit. If a bulk head plate is used, it should be of proper strength to minimize buckling distortions. Make sure that the plate sits flat and level before installing the mixer. An uneven mounting plate can cause serious problems with shaft and impeller runout.

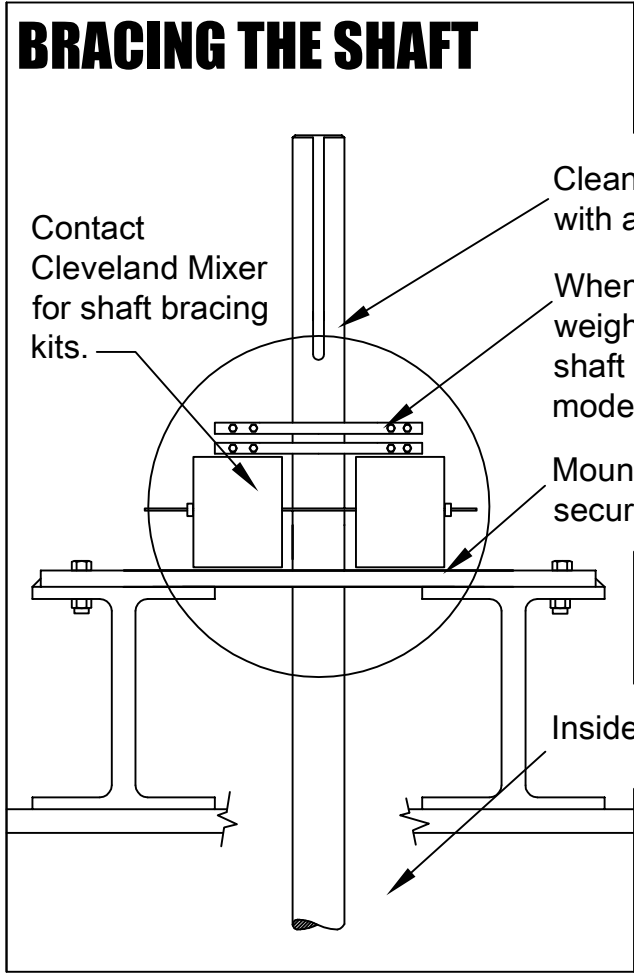




Use motor eyelet to help balance reducer while lowering onto shaft.

Bulk of reducer weight. Use these eyelets to raise and lower reducer.

On larger units, (APD-3 or larger) because of the weight, we suggest using 4 x 4 wood blocks, connected together with threaded rod. Shaft supports and block supports can be purchased from Cleveland Mixer. Contact factory for more info.



Contact Cleveland Mixer for shaft bracing kits.

Clean the top of the shaft and cover with a generous coat of Antiseize

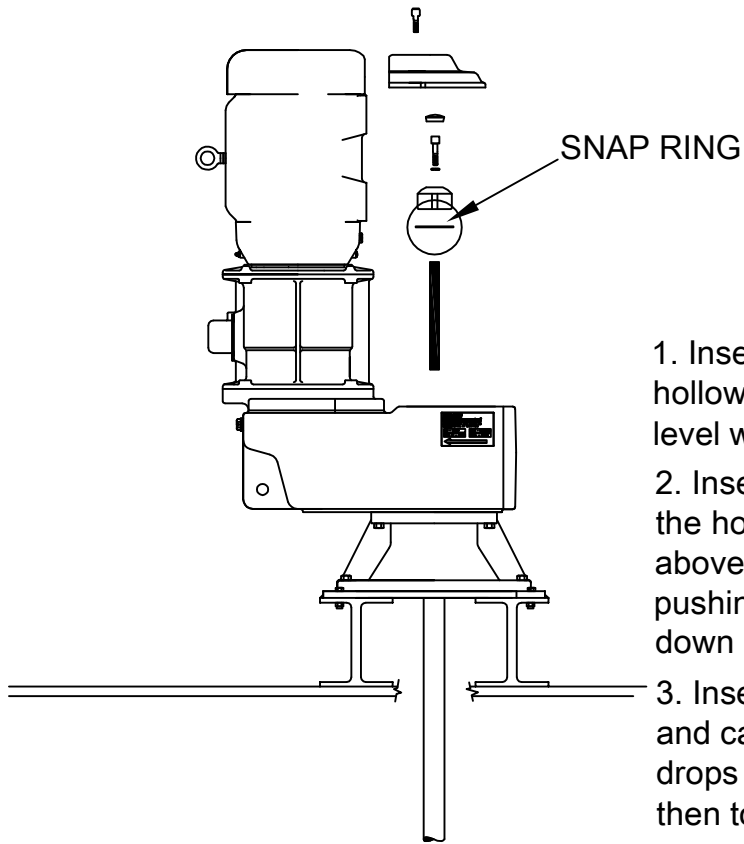
When bracing the shaft, take into account that the weight of the reducer will be pushing down on the shaft during installation. When installing larger models (APD-3 or larger) use double bracing.

Mounting base plate, make sure to level plate before securing

Inside of tank

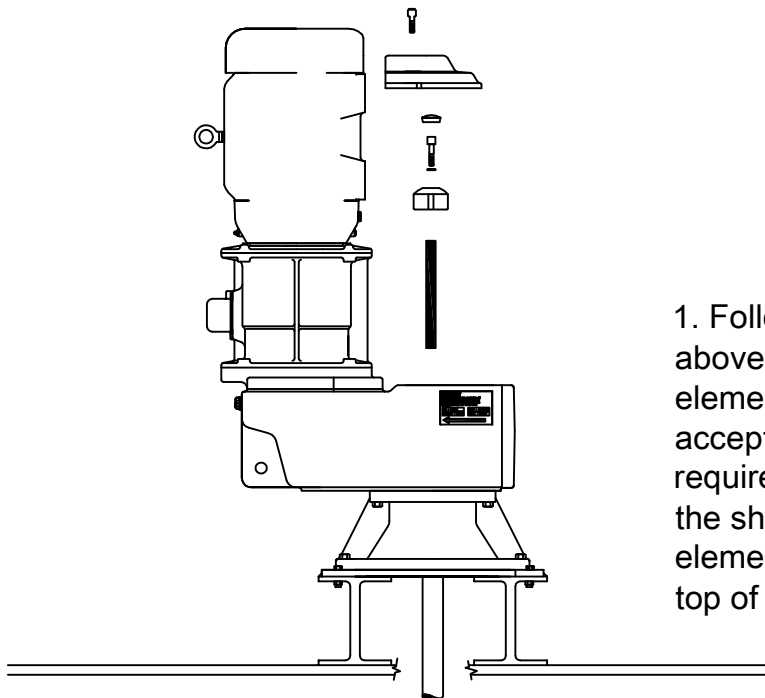
Both the hollow quill and the shaft should be liberally lubricated before assembly. The unit must slide freely onto the driven shaft. **DO NOT HAMMER** or **FORCE** the unit into place. Lubricate with with Antiseize compound (preferred), assembly paste or at minimum #2 grease. This will aid installation of the reducer but more importantly, the lubricant will aid removal should it be required at a later date.

FIXING ELEMENT - STRAIGHT SHAFT



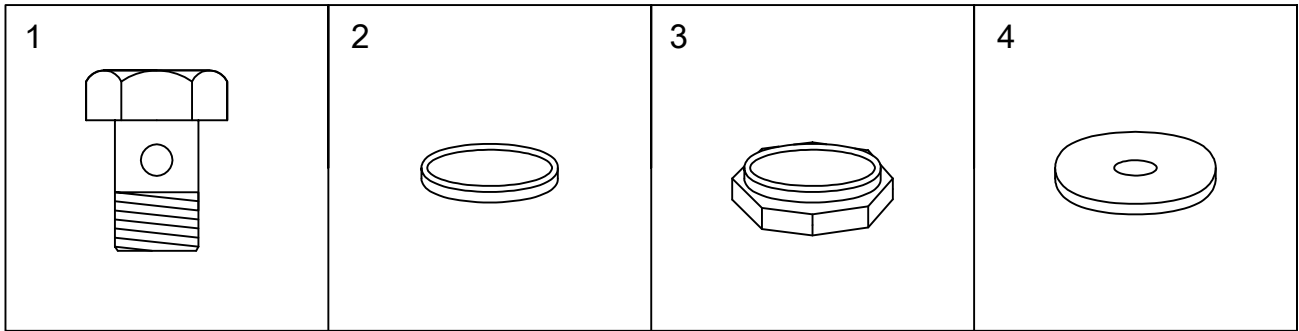
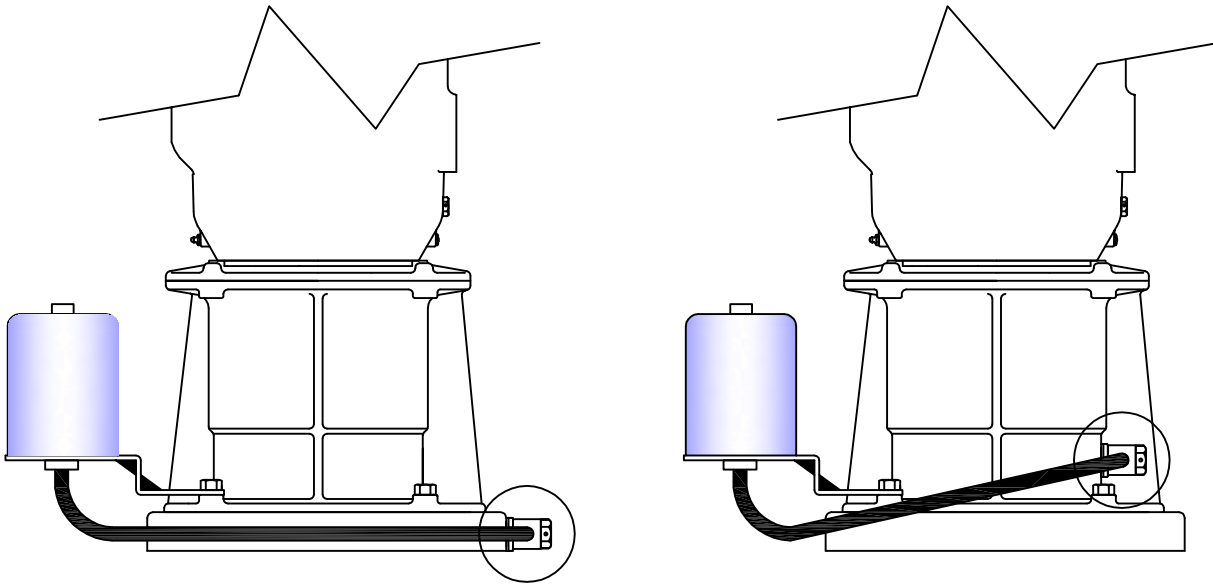
1. Insert shaft key through the top of the hollow output shaft. Push key down until it's level with the top of the shaft keyway.
2. Insert snap ring into the snap ring groove in the hollow output shaft. The snap ring will sit above the shaft to prevent the shaft from pushing upward. The groove is typically 1-2" down into the quill.
3. Insert fixing element cap plate, lock washer and cap plate bolt. We suggest using a few drops of thread locker on the cap plate bolt and then torquing the bolt.

FIXING ELEMENT - SHOULDERED SHAFT



1. Follow steps 1 & 3 from the instructions above. The procedure for installing the fixing element to a shouldered shaft is the same except that the shouldered shaft does not require a snap ring. The shoulder will prevent the shaft from pushing upwards. The fixing element cap plate can be torqued right to the top of the shaft.

INSTALLING THE OIL EXPANSION CHAMBER



INSTALLATION INSTRUCTIONS

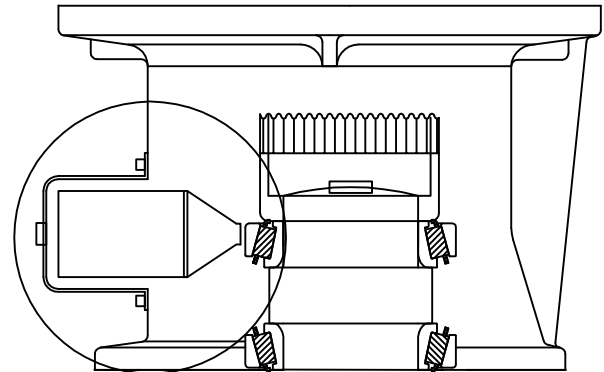
In some cases APD Drives require the use of an oil expansion chamber. Most frequently on vertical mounted units larger than a size APD-3.

1. After the mixer is securely mounted and the shaft is installed: Remove the vent plug from the gear reducer on the NEMA face above the gearcase. Make sure that the Oil Expansion Chamber is mounted above the oil fill line.
2. Screw the adapter fitting into the reducer housing port. Make sure to use all gaskets provided.
3. Mount the chamber support leg of the overflow tank to one of the NEMA mounting bolts just above the gearcase.
4. Attach vent hose assembly to adapter fitting.

AUTOMATIC LUBRICATOR

With all APD-7 and larger mixers, Cleveland Mixer supplies the larger C-face motor adapters with an Automatic Lubricator. This will provide additional grease lubrication to the outboard bearing. As the pressure from the lubricator canister pushes the new grease into the bearing, the old grease will flow into the cavity towards the gearbox. When the cavity is filled with "used" grease, the pressure from the new grease pushes the used grease into the gearbox thru the input seal. The old grease mixes with oil but will not cause harm to the gearing or bearings. Regular oil changes with the gearbox will remove the old grease which has been pushed into the gearbox.

After tightening the plastic activating screw, the Zinc-Molybdenum pellet drops into the citric acid electrolyte. The chemical reaction builds up pressure that causes the piston to move forward. The lubricant is continuously injected into the lubrication point. At the end of the lubrication period, the discharge indicator cap becomes fully visible indicating that the lubricant has been fully discharged. The lubrication period is determined and defined by the color of the activation screw.



Automatic Lubricator

For the bearings used in Cleveland Mixer products, a 12-month lubrication period is standard, indicated by a gray activating screw, This applies for an average operating time of 8 hours per day. For longer operating times, the replacement interval decreases to 6 months. Lubrication canisters are also available for cold temperature applications. Contact factory for more information.

INSTALLATION INSTRUCTIONS

1. Remove the plug from the male connecting thread.
2. Screw male fitting into bearing housing within Adapter.
3. Insert activating screw into end of canister. Tighten until ring-eyelet breaks off.
4. Replace every twelve months.

CLEVELAND MIXER AUTO LUBRICATOR SPECS

STANDARD LUBRICANT - KLUBER PETAMO GHY 133 (synthetic)

LUBRICANT VOLUME - 120mL (4oz)

OPERATING TEMP RANGE - (-22°F - 302°F) (-30°C - 150°C)

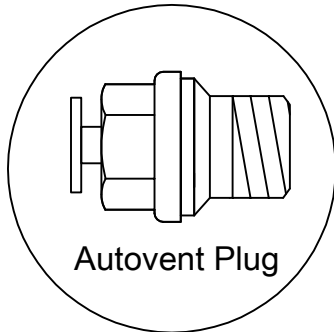
DISCHARGE TIME - 12 months at 25°C (77°F)

OPERATING POSITION - Independent of mounting position, operates even under water.

MALE CONNECTING THREAD - 1/4" NPT

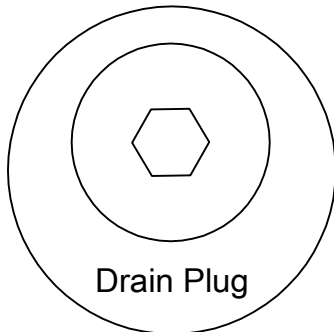
LUBRICATION & PLUGS

The autovent plug is brass in color and will be located at the highest point on the gearbox. It operates like a check-valve to allow the reducer to relieve internal pressure while preventing lubricant contamination during cooling. A spring releases a ball or plunger against a machine's orifice until pressure exceeds 2 PSI. Above 2 PSI the air is allowed to escape depressurizing the gearcase. When internal pressure drops below 2 PSI, the autovent re-seals closing the unit to the outside environment. After shutdown, the reducer cools along with the air inside the reducer. The unit will temporarily maintain a slight vacuum until normalization occurs. Cleveland Mixer supplies an autovent as a standard feature.



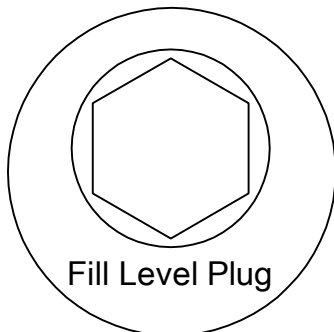
FILL LEVEL & DRAIN PLUGS

The drain plugs are metric socket head cap screws. They will be located at the lowest part of the gearbox for ease of draining. The fill level plug is a hex head cap screw. It will be located between the Autovent and drain plug. Both types of plugs will have gaskets included to prevent oil from leaking.



LUBRICANT

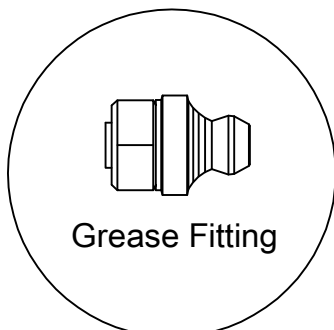
All Cleveland Mixer APD reducers are shipped from the factory properly filled with lubricant and all plugs are installed according to the mounting position given on the reducer nametag. Acceptable oil fill level is within 1/2" of the bottom of the fill plug threads. The APD reducer will be marked with a yellow sticker on the side of the gearcase which will indicate the brand and grade of oil inside the gearbox. Our standard lubricant is a synthetic lubricant, designed to extend the service life of the gear box. The brand and grade of the lubricant will be indicated on the yellow lubrication sticker on the side of the gear case.



GREASE FITTINGS

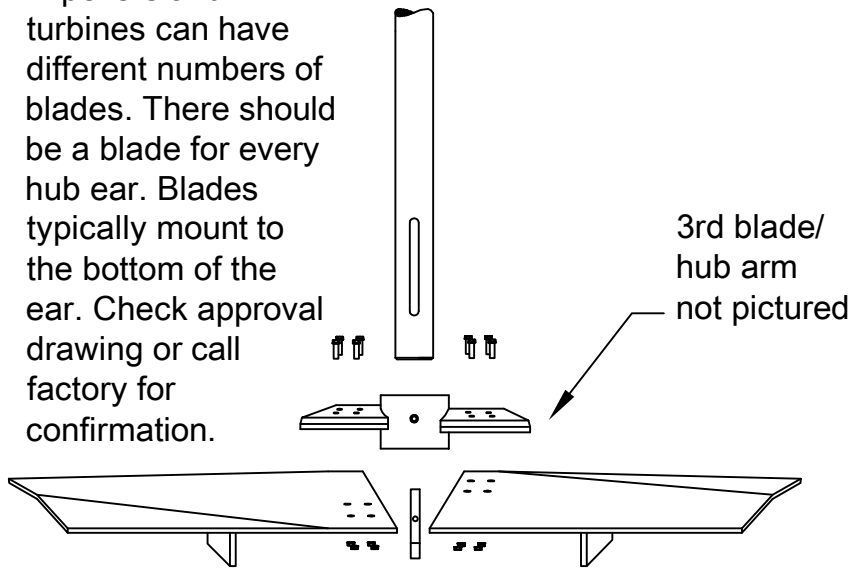
Add grease to high speed and slow speed bearings through grease fittings. APD reducers will come with grease fittings pre-installed in the appropriate locations. Bearing greases must be compatible with the type of gear lubricant being used (i.e. mineral, synthetic, food grade, etc.)

For mineral oils, use a synthetic bearing grease such as Mobil Synthetic Universal grease, Mobilith SHC 100 or suitable equivalent. Add grease as needed to keep bearings properly lubricated. Do not over pump grease into the grease fittings.



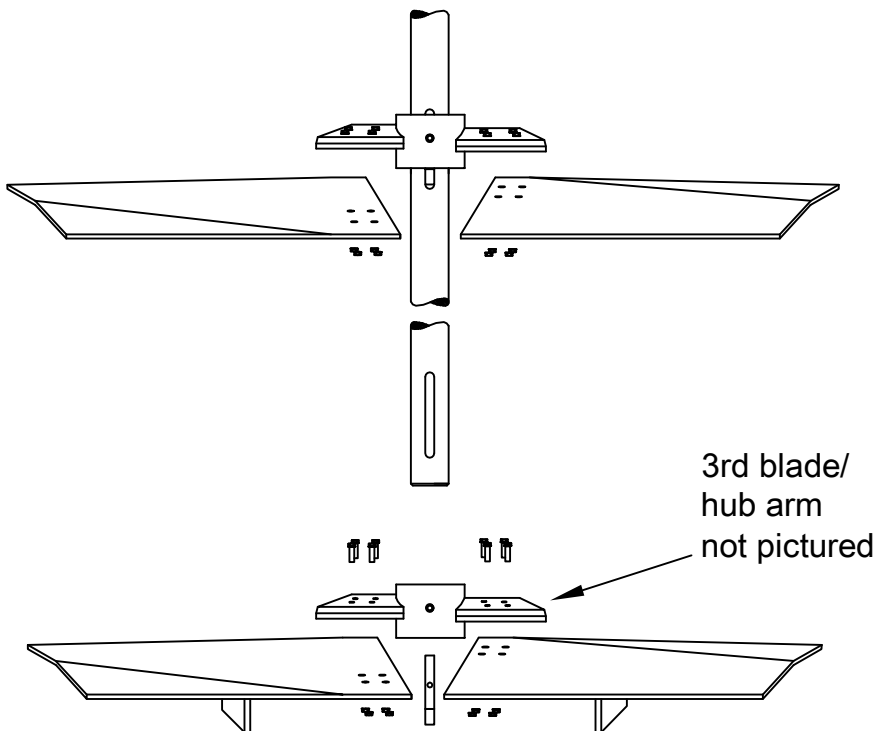
IMPELLERS & SHAFTS

Impellers and turbines can have different numbers of blades. There should be a blade for every hub ear. Blades typically mount to the bottom of the ear. Check approval drawing or call factory for confirmation.



Both the hollow shaft and the driven shaft should be liberally lubricated before assembly. The reducer must slide freely onto the driven shaft. Do not hammer or force the unit into place. The lower mixer shaft extension consists of one or more rigid shaft sections and will accommodate one or more impeller assemblies. This shaft will either mount directly to the gear reducer as one piece shaft or it will be assembled from sections of shaft that are joined by bolted flanged connections.

SINGLE IMPELLER INSTALLATION



NOTE: The extension shaft and other machined parts with close tolerances have been straightened and balanced to several thousandths of an inch. Please be careful when handling and installing this equipment. NOTE: Keys have drill points on one side for set screw alignment. To install any impeller, simply slide the impeller hub (top end of hub will be marked top) onto the shaft above the keyway. Slide the hub back down over the key until the hub is positioned with the set screw hole over the drill point on the key. Firmly tighten the hub set screw into the key.

MULTIPLE IMPELLER INSTALLATION

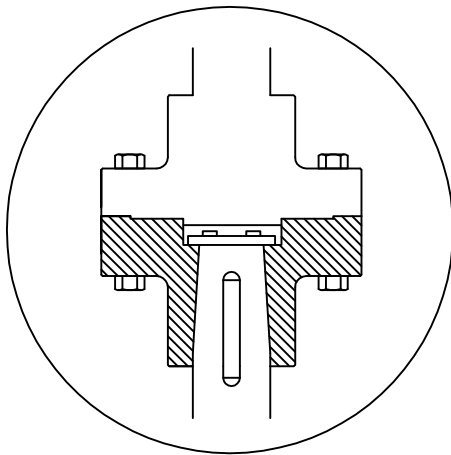
IMPELLERS & SHAFTS

Now that the impeller hub is on the shaft, firmly bolt the impeller hardware (blades, discs, stabilizers) into place. All in-tank fasteners involving the couplings and turbine hubs do not use lockwashers. All in-tank fasteners should be rechecked for tightness after 1500 hours of operation. It is also recommended to check at scheduled shut down periods. All shaft and impeller bolts should be torqued to the values shown in the torque value table in this manual.

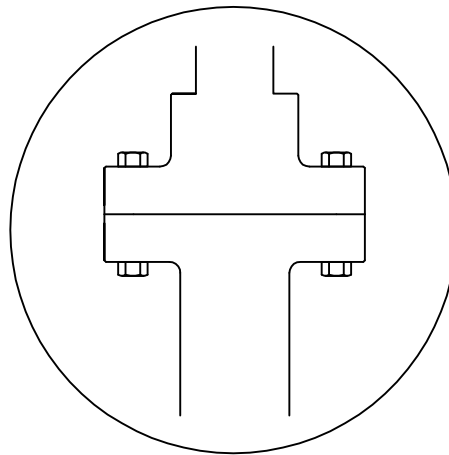
The upper shaft or shaft section, if it is a multi-piece shaft assembly, will have either a welded coupling or a removable tapered bore coupling that will mate with the low speed shaft on the reducer.

The welded coupling is used on upper shaft sections for open tank mixers that do not have any impellers mounted to it that would need to be removed. With a taper bore coupling, the upper shaft is assembled to the taper coupling and held in place by the internal cap plate bolted to the top of the shaft.

The rigid coupling is the welded flange type that requires no installation and would normally be found attached to the upper shaft assembly, either in or out of the process. There may be several of these connections between shaft sections in the assembly.



TAPER BORE COUPLING



RIGID COUPLING

IMPELLER INSTALLATION

1. XTF-3R Impeller blades and hubs are shipped disassembled.
2. Slide the hub to the desired location over the key (the hub should be marked with "TOP" make sure that side is up). Tighten the set screw over the key. Impellers over 50 inches in diameter are provided with Gib keys. Lower the hub slowly until it rests on the Gib, then tighten the set screw.
3. Assemble the blades to the underside of the hub using four hex head cap screws and nuts per blade. Torque all bolts to the required specifications.
4. Retighten all bolted connections using proper torque settings before starting the mixer.

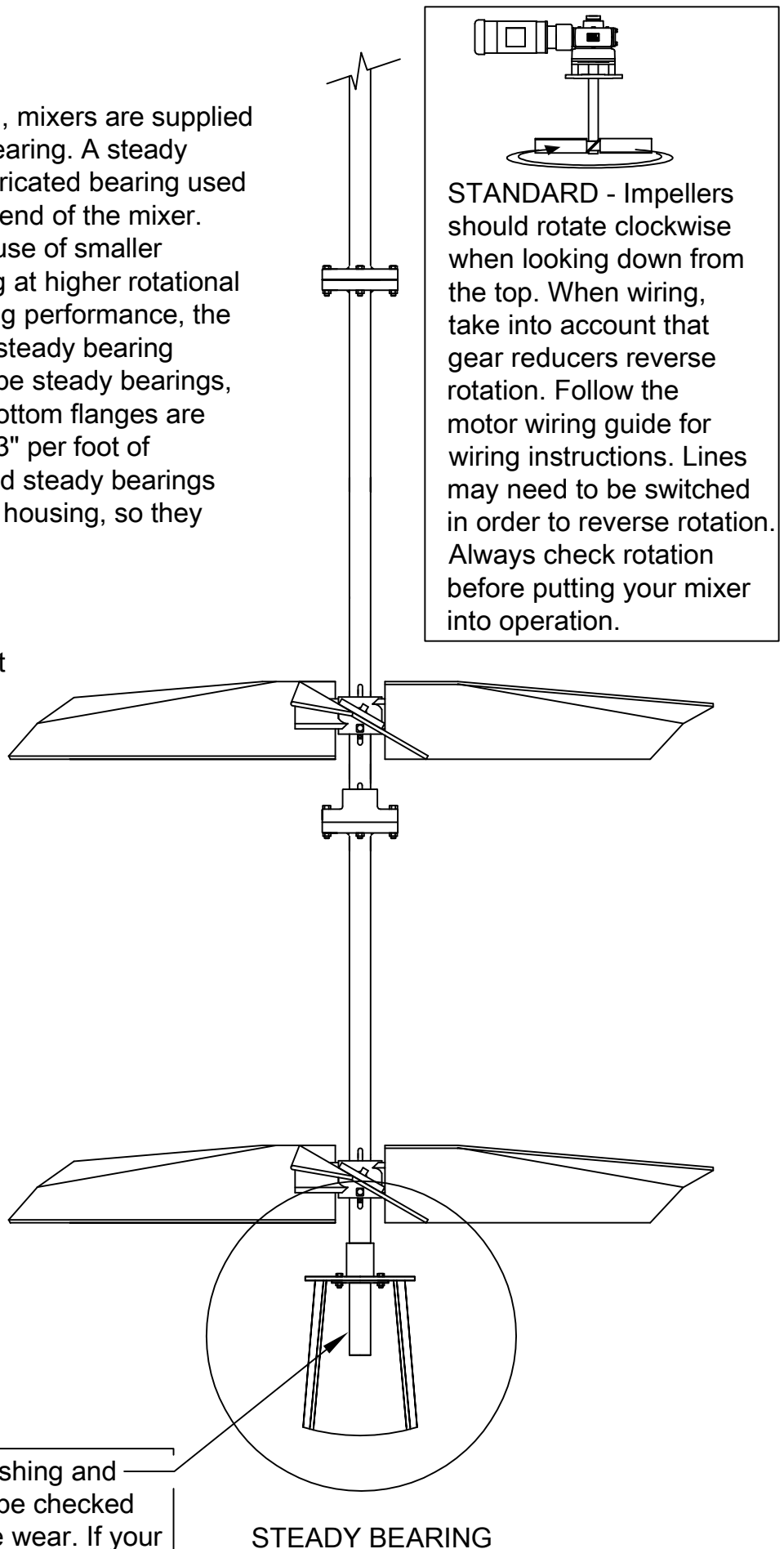
IMPELLERS & SHAFTS

Steady Bearings: When specified, mixers are supplied with an optional in-tank steady bearing. A steady bearing is an in-tank, process lubricated bearing used to support and restrain the lower end of the mixer. Steady bearings permit the safe use of smaller diameter, longer shafts, operating at higher rotational speeds. For proper steady bearing performance, the mixer shaft must be straight and steady bearing centered on the shaft. For pad type steady bearings, be sure that the vessel top and bottom flanges are parallel and concentric within .003" per foot of separation. Shim bracket mounted steady bearings between the bracket and bearing housing, so they stay centered on the shaft.

Even though a shaft may be straight and properly machined, it may appear to wobble a bit toward the bottom. For longer shafts (20-30') 1/2 the shaft diameter may be acceptable. However, for shorter shafts, the wobble should not exceed 1".

For best results, the steady bearing should be laser aligned with the reducer quill and welded down. Steady bearing bushing should be inspected for wear and tear during every shut down period. If the bushings are worn down to the metal of the bushing housing, they should be replaced. Call Cleveland Mixer with your mixer's serial number for replacement bushings.

STEADY BEARING - Bushing and bushing housing should be checked periodically for excessive wear. If your installment alignment is precise, you will experience less bushing wear.



MOUNTING

REDUCER AND MOUNTING PLATE BOLTS

These bolts are also subject to high loads and should be properly torqued to prevent bolt stretch and reducer wobble.

For situations where the reducer is on the larger side, the shafting is on the longer side and/or the unit is equipped with large turbines; use additional care to make sure that the bolts are installed and torqued properly.

If torque wrenches are not available, use "turn of the nut method". This method can be summed up in one sentence: Turn the nut 1/2 to 2/3's of a turn past the snug tight position. This applies to any bolt of any size.

ALL FASTENERS SHOULD BE CLEAN, RUST FREE AND LIGHTLY OILED.

AXIAL RETENTION

Each drive shaft must be retained in place relative to the gear reducer. EMI recommends the use of shaft shoulders, locking collars, snap rings or fixing elements to axially retain the shaft gear reducer position. Most units are designed and come equipped with these items.

SET SCREWS

If set screws are used for axial retention, they should be tightened evenly. It is a good idea to use a drop of "Lock-Tite" or some form of thread locker on the set screws before installing them. This will help in the prevention of set screw back off. Flats or dimples may be used on the drive shafts to give set screws something to grab onto.

SNAP RINGS

Snap rings are used to retain the shaft from sliding upward in cases where the shaft doesn't have a shoulder. The snap ring should be inserted into the groove inside of the hollow output bore. The snap ring will sit just above the top of the drive shaft. There may be a space between the cap plate and the top of the shaft. Cleveland Mixer suggests the use of a thread locking adhesive on the cap plate bolt, the cap plate bolt should screw down into the drive shaft at least the same diameter of the bolt if not all the way to the end of the shaft thread. This bolt should be torqued in accordance with the torque chart in this manual.

THRUST PLATE

In applications which are subject to high vibratory loads, a thrust plate may have been provided. For these applications, follow the special certified installation drawings which would have been provided with these units.

IMPELLERS & SHAFTS

TORQUE VALUES FOR THRUST BOLTS

BOLT SIZE	ALL MATERIALS	
	FOOT POUNDS	NUMBER
1/2 - 13	50	68
5/8 - 11	90	122
3/4 - 10	160	217
7/8 - 9	140	190
1 - 8	220	298
1 - 1/8 - 7	300	407
1 - 1/4 - 7	420	570
1 - 3/8 - 6	556	754
1 - 1/2 - 6	740	1003
1 - 3/4 - 5	825	1118
2 - 4 - 1/2	1125	1525
2 - 1/4 - 4 - 1/2	1725	2338
2 - 1/2 - 4	2300	3117

* Lubricate bolt before installation. Torque each bolt to the appropriate value as shown above.

NOTE: The bolt torques shown here will develop a fastener pre load of 80% of the fastener's minimum yield.

COUPLING BOLTS - LOW SPEED SHAFT: At least Grade 5. The torque required may be found using the Grade 5 chart and reading across from the bolt diameter to be used. If stainless bolts are used, proceed with the proper stainless steel chart. Any looseness in these bolts causes the coupling to apply a shear load on the bolt and a high impact tensile load or shock load.

This shock load and shear load can cause the bolts to snap, the holes to elongate or the coupling to fail to keep the shaft running straight which can have numerous disastrous effects on the mixer.

IMPELLERS & SHAFTS

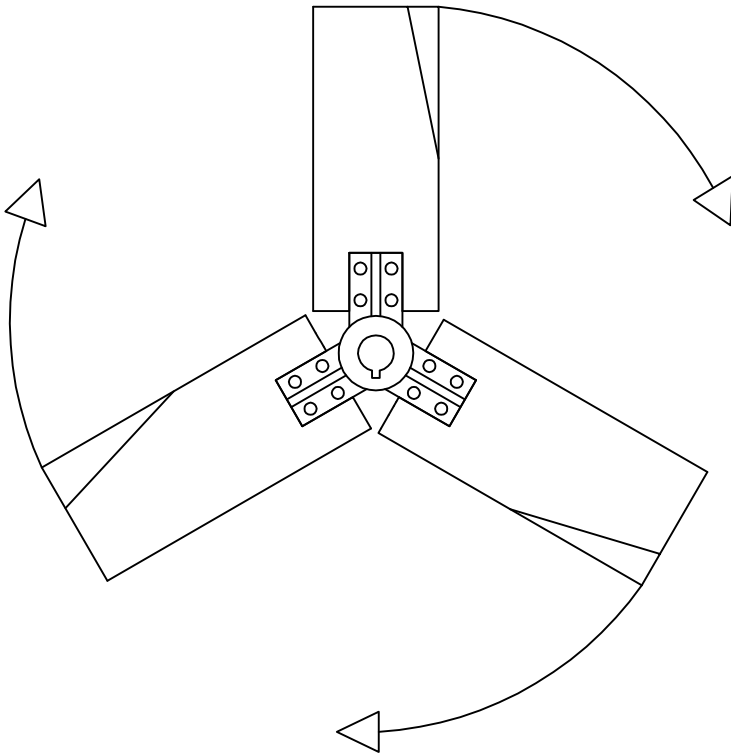
TORQUE VALUES FOR RIGID SHAFT COUPLINGS

BOLT SIZE	CARBON STEEL				Stainless Steel, Alloy 20, Monel, Hastelloy C	
	Grade 2		Grade 5			
	FT-LB	Nm	FT-LB	Nm	FOOT-LBS	NUMBER
3/8 - 16	15	20	23	30	15	21
1/2 - 13	38	51	56	77	37	50
9/16 - 12	50	68	83	112	54	72
5/8 - 11	68	92	113	152	74	101
3/4 - 10	120	163	200	271	131	178
7/8 - 9	105	143	296	401	212	287
1 - 8	165	224	443	601	318	432
1 - 1/8 - 7	225	305	596	808	450	610
1 - 1/4 - 7	315	428	840	1139	636	862
1 - 3/8 - 6	417	566	1003	1495	834	1130
1 - 1/2 - 6	555	752	1463	1983	1470	1500

NOTES:

1. Tighten all fasteners to the values shown unless specifically instructed to do otherwise.
2. Lubricate all fasteners at assembly with grease, oil or anti-seize material.
3. If fasteners cannot be lubricated, multiply table values by 1.33

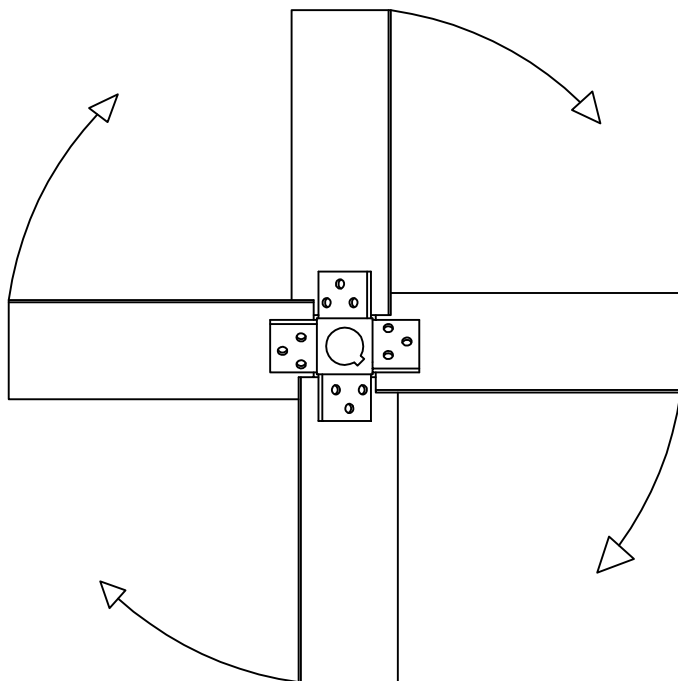
IMPELLERS



XTF-3R IMPELLER - TOP VIEW
STANDARD CLOCKWISE ROTATION

XTF-3R IMPELLER

1. Before sliding the hub(s) onto the shaft, check for burrs and imperfections that may have been caused in shipping.
2. Slide the hub up over the keyway and then insert key into keyway.
3. Slide hub down over key until the set screw lines up with the set screw dimple in the key.
4. Hand tighten the set screw until it locks into place.
5. Bolt the blades to the underside of the hub ears with the curved ends and stabilizers (if supplied) angled down. Torque the bolts to the required specifications with the nut against the blade.



AXF-4 IMPELLER - TOP VIEW
STANDARD CLOCKWISE ROTATION

AXF-4 IMPELLER

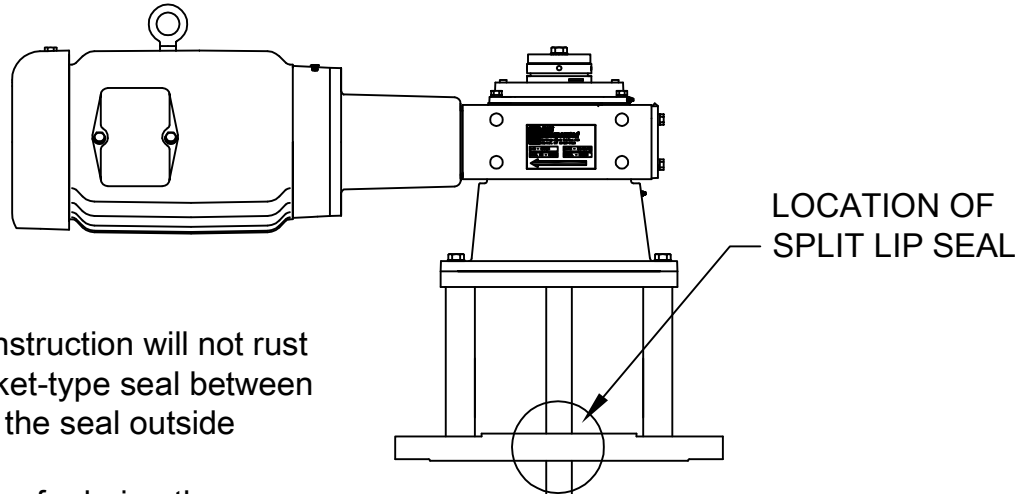
1. Before sliding the hub(s) onto the shaft, check for burrs and imperfections that may have been caused in shipping.
2. Slide the hub up over the keyway and then insert key into keyway.
3. Slide hub down over key until the set screw lines up with the set screw dimple in the key.
4. Hand tighten the set screw until it locks into place.
5. Bolt the blades to the underside of the hub ears with the curved ends and stabilizers (if supplied) angled down. Torque the bolts to the required specifications with the nut against the blade.

SPLIT LIP SEAL INFORMATION

The Clipper design features an integrally molded rubber fiber outer case and an elastomeric seal lip.

The unique, nonmetallic construction will not rust or corrode and forms a gasket-type seal between the equipment housing and the seal outside diameter.

Clipper Split Seals are known for being the easiest split seal to install because they do not require a cover plate to keep them in the housing. The robust, composite OD provides the best retention of any split seal on the market. Replacing failed seals in the field saves on downtime and lost production. To change out the seals in the field, simply remove the coil tensioner, separate the split seal and peel the seal off from the shaft. Follow the same procedure in reverse to reinstall.



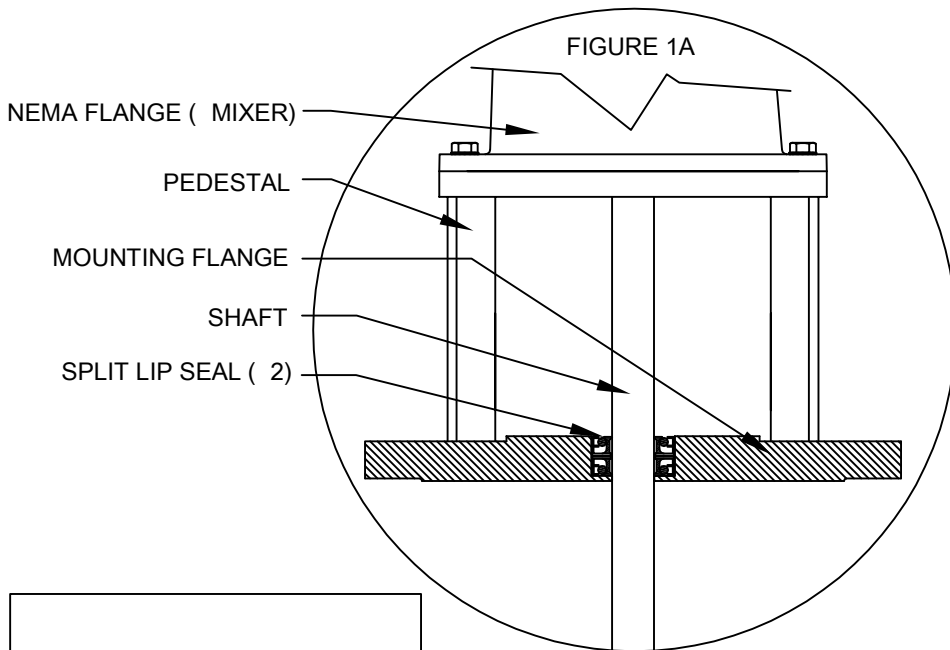
SEEN DETAIL IN FIGURE 1A

TOP VIEW OF SPLIT SEAL

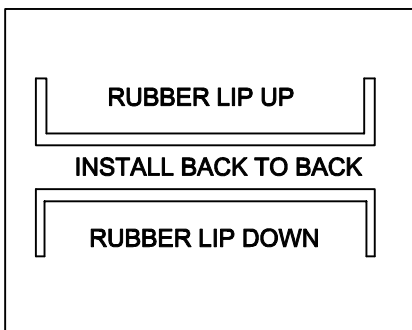
CLOSED POSITION FOR WHILE IN OPERATION

COIL TENSIONER

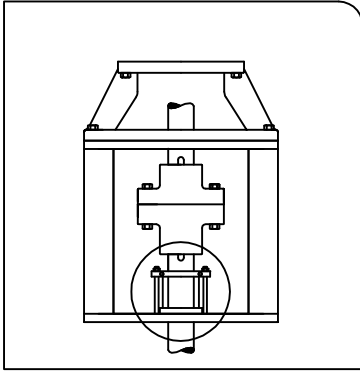
OPEN POSITION; REMOVAL, MAINTENANCE



INSTALLED SPLIT SEAL



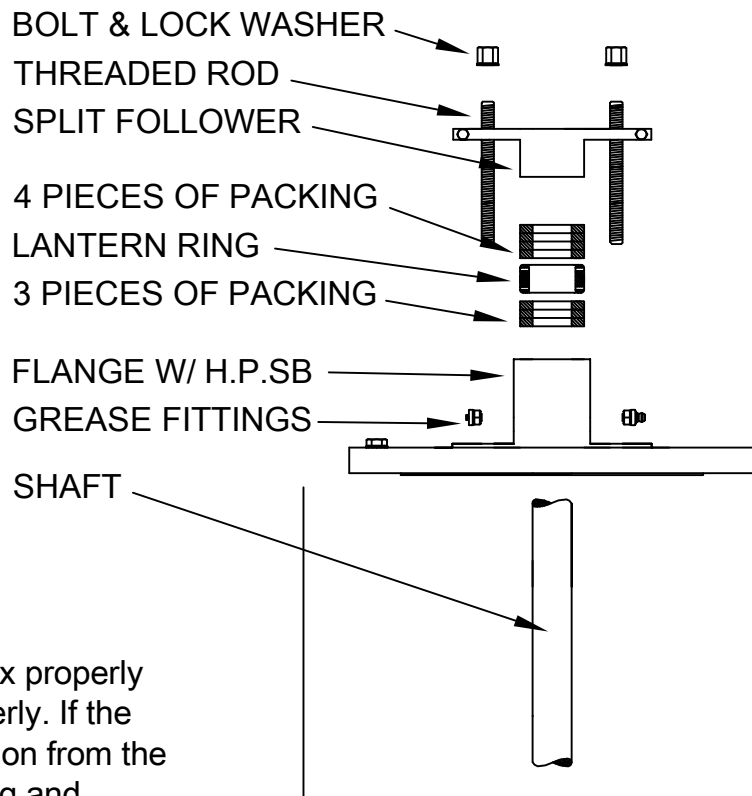
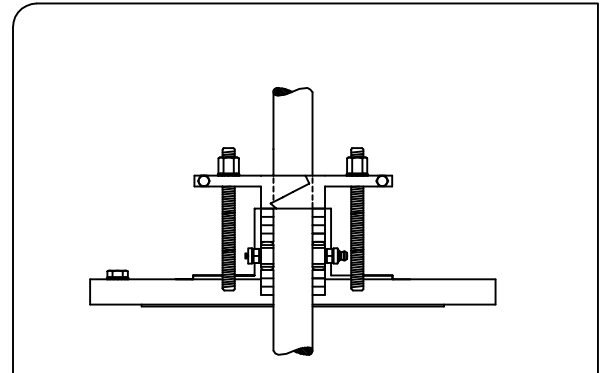
STUFFING BOX INFORMATION



LOW PRESSURE STUFFING BOX

Packing should always be inserted as individual rings, never wound in a spiral. Lubricate each ring generously with grease on the top and bottom surfaces. This will help minimize down time. Typically the set up for a high pressure stuffing box is 3 packing rings on the bottom then the lantern ring, 4 packing rings on top and then the split follower. For a low pressure stuffing box - 2 pieces of packing with the split follower on top.

It is important to keep the Stuffing Box properly lubricated in order for it to work properly. If the lantern ring and packing dry out, friction from the spinning shaft will burn up the packing and damage the shaft. The sealing properties of the packing will also not work if they are running dry. Lubricate the stuffing box through the grease fittings with a grease gun. Once the rings are properly greased, tighten down the follower finger tight only. Turn the mixer on and run at atmospheric pressure for 5-10 minutes. Then turn the mixer off and tighten down on the follower 1/2 turn of the follower bolts. The follower should always be pulled down uniformly and never more than 1/2 turn on the bolts at one time.



HIGH PRESSURE STUFFING BOX

With the mixer running, slowly pressurize the vessel to its most extreme operating pressure. At the same time, tighten slowly on the follower bolts to hold pressure as it rises. Never tighten more than 1/2 turn at one time, and let the mixer run at least five minutes between each tightening.

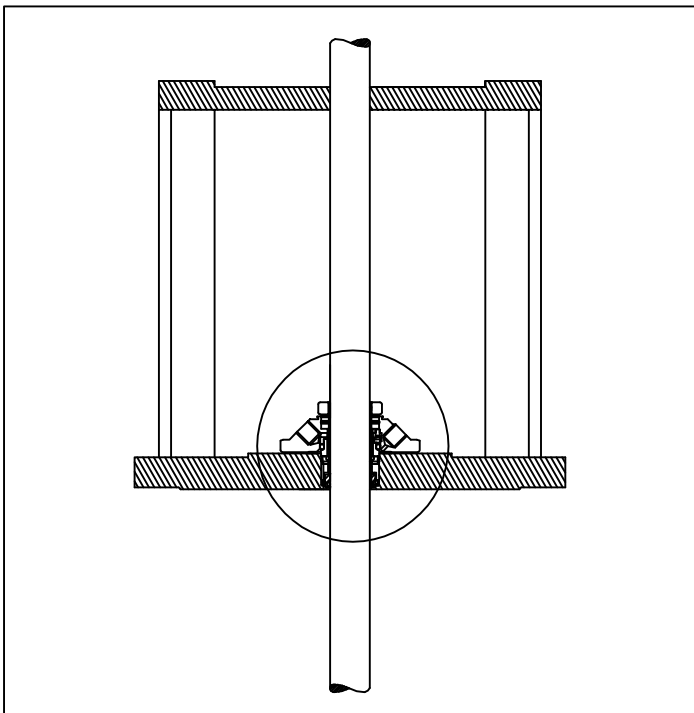
MECHANICAL SEAL INFORMATION

The total amount of tightening will vary, depending on the degree of tamping, the operating pressure and the density of the packing. Hard packing should seal in about one full turn of the bolts. Softer packing may take two or more turns. If the stuffing box is not sealed after one or two turns on the bolts, back off until they are loose and add a stroke of grease through the fitting slowly. Draw down the bolts until they are again just finger tight. Allow the mixer to run for a few minutes, then resume the tightening process.

Do not tighten the packing beyond the point required to seal the box. Check the box two or three times the first 24 hours of operation. If it starts to leak, an additional 1/4 turn should be sufficient to stop the leak in a minute or two.

After it has been installed and run in, the stuffing box should be periodically lubricated and inspected for leaks. Do not wait for a leak to start before lubricating the box. Longer packing life will be realized by preventing leaks through frequent lubrication. One stroke of a hand grease gun for a 2" diameter or larger shaft; somewhat less than one stroke for a smaller shaft. After some experience with the amount of grease required, the lubrication interval can be shortened or lengthened. The unit can be lubricated while the unit is running or off. It is a good practice to lubricate after a prolonged shutdown.

When a leak does occur, the first impulse should be to lubricate the packing, not tightening the follower. The packing does not provide the seal, the lubrication does. Make sure the lantern ring has adequate lubricant. Adding lubricant will often stop the leak within a minute or so. If the box is still leaking after five minutes, the follower should be evenly tightened a quarter turn until the leak stops.

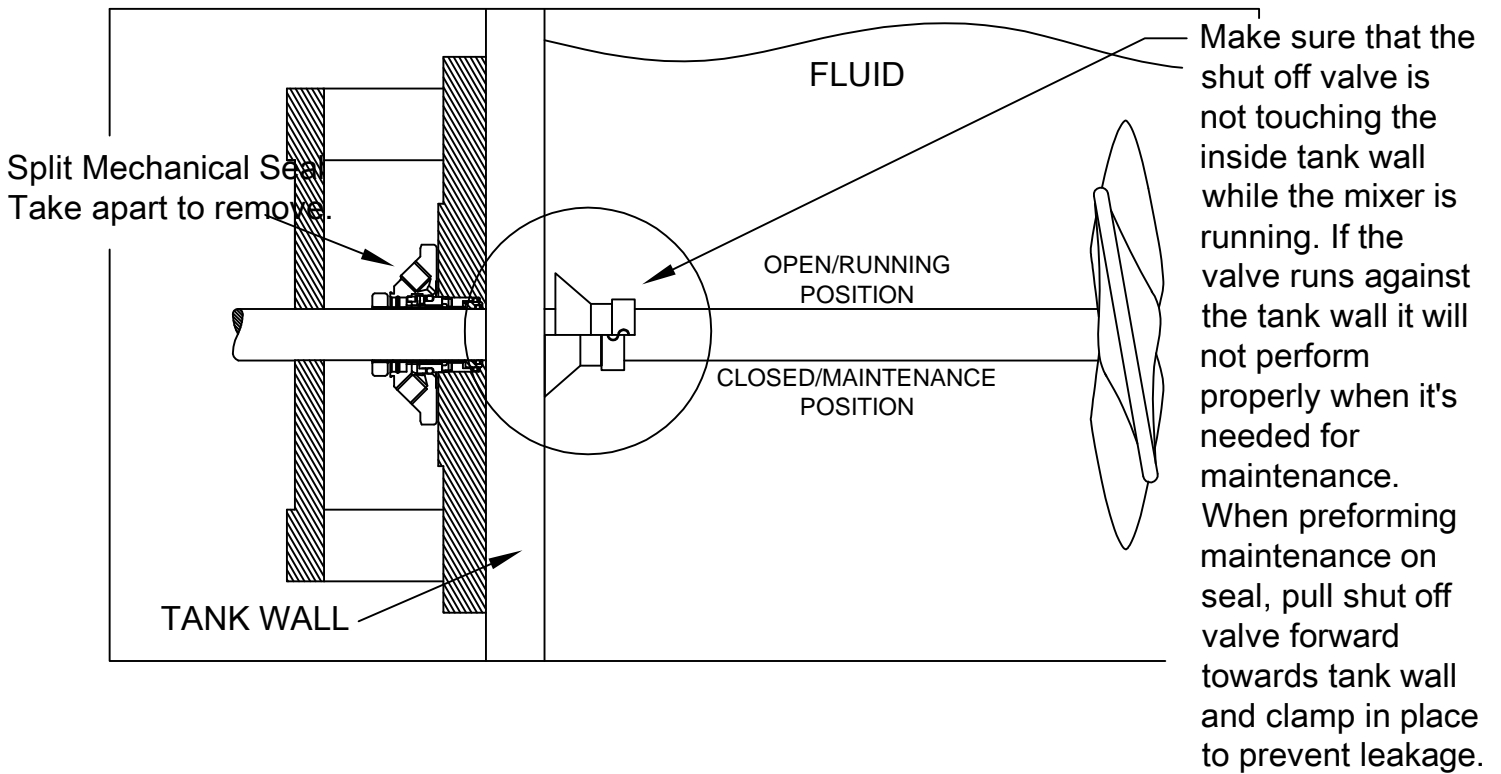


MECHANICAL SEALS

In some applications use of a mechanical seal may be necessary. Refer to assembly drawing for seal mounting info and to Seal Manufacturers Manual for seal maintenance.

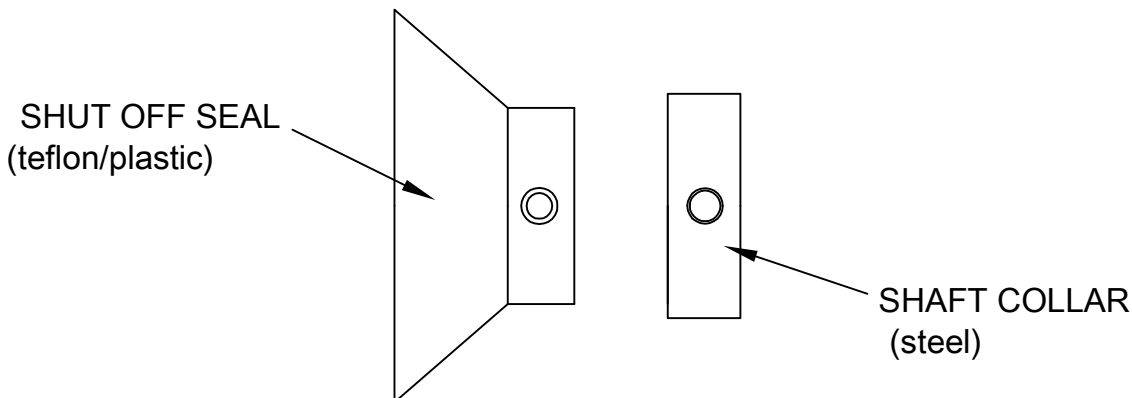
Side Entry applications will be supplied with a split mechanical seal. Split mechanical seals allow for the seal to be replaced or for maintenance to be performed on the seal w/o having to remove the flange or drain the tank. Refer to the assembly drawing for seal mounting info and to seal manufacturer's manual for seal maintenance.

SIDE ENTRY SEAL INFORMATION

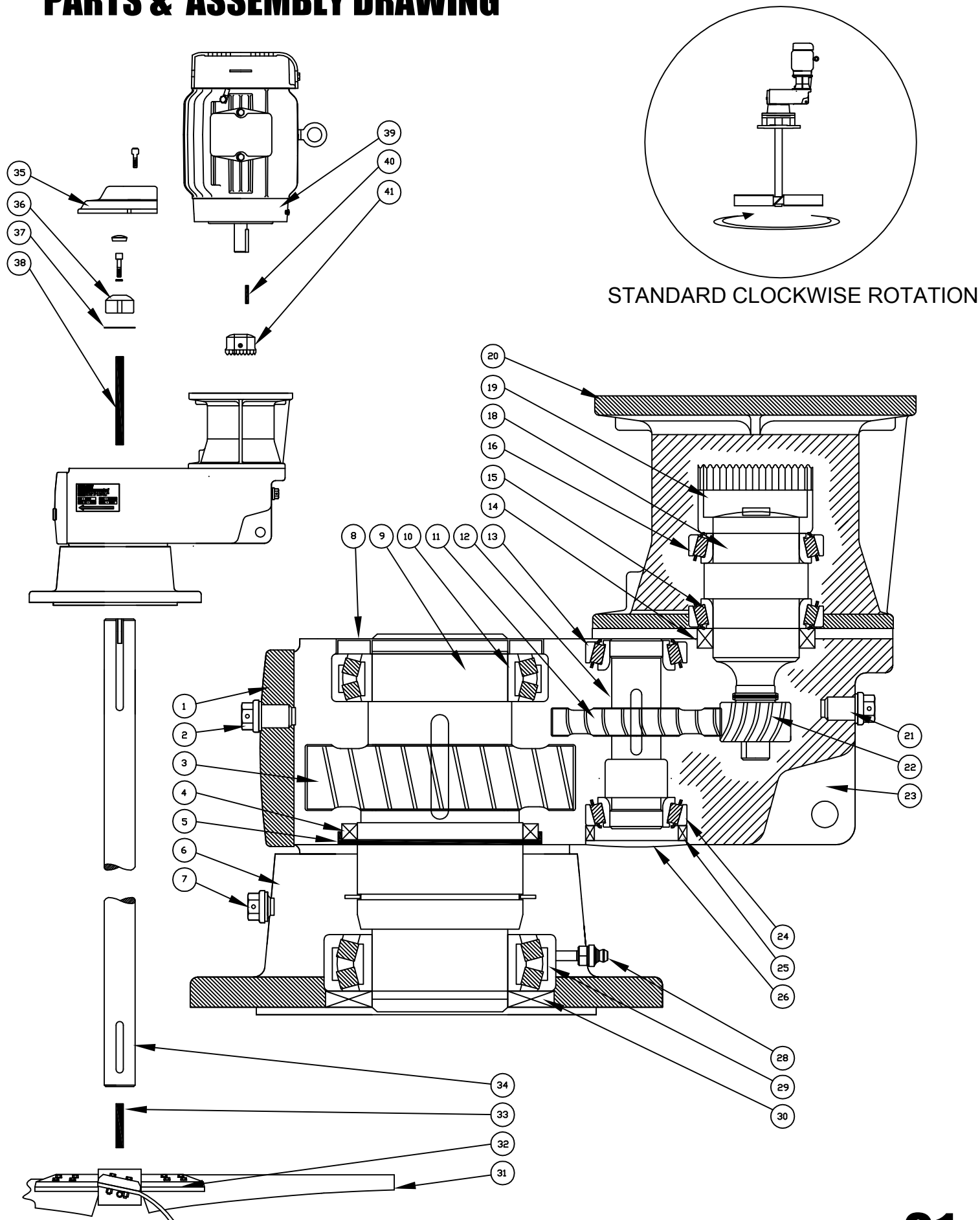


SIDE ENTRY SHUT OFF DEVICE

The side entry shut off device is located inside the tank and is intended to assist the maintenance personnel when changing the the stuffing box packing or split mechanical seal. It consists of a piece of UHMW-PE (ultra high molecular weight polyethylene) or PTFE (Teflon) with a clamp collar backer and is set at the factory to be slightly off the face of the mounting flange. During a maintenance procedure, the set screw securing the shaft in the coupling on the outside of the tank is loosened. Slide the shaft in slightly so that the shutoff presses against the flange face with the set screw secured. The seal can now be repaired or replaced without severe leakage. Once the packing is replaced, the set screw is loosened and the shaft is slid back into the tank to the original operating position and re-secured.



PARTS & ASSEMBLY DRAWING



GENERAL PARTS LIST

PARTS LIST FOR APD REDUCER

1. INSPECTION COVER
2. DRAIN PLUG W/ SEAL
3. MAIN GEAR
4. LOWER SLOW SPEED SEAL
5. OIL SLINGER
6. LOWER FLANGE MOUNT
7. DRAIN PLUG W/ SEAL
8. BORE PLUG
9. HALLOW (OR SOLID) OUTPUT SHAFT
10. SLOW SPEED BEARING (UPPER)
11. INPUT GEAR
12. INPUT SHAFT 2
13. INPUT SHAFT BEARING 2(UPPER)
14. INPUT SEAL 1 (HIGH SPEED)
15. HIGH SPEED BEARING 1 (LOWER)
16. HIGH SPEED BEARING 1 (UPPER)
17. SNAP RING
18. INPUT SHAFT 1
19. INPUT COUPLING (HIGH SPEED LOWER)
20. NEMA FACE (MOTOR MOUNT)
21. VENT
22. INPUT PINION
23. GEARBOX HOUSING
24. INPUT SHAFT SEAL 2 (LOWER)
25. INPUT SHAFT SEAL 2 (LOWER)
26. BORE PLUG (INPUT)
- 27.
28. GREASE NIPPLE
29. OUTPUT BEARING (LOWER)
30. OUTPUT SEAL (SEAL)
31. BLADES
32. HUB
33. HUB KEY
34. SHAFT
35. COVER ASSY
36. FIXING ELEMENT ASSY
37. SNAP RING (SAME AS 17)
38. UPPER SHAFT KEY
39. MOTOR
40. MOTOR OUTPUT SHAFT KEY
41. HIGH SPEED COUPLING (MOTOR SIDE)

Each APD style gear reducer is designed and built custom to each job. Being that there are single, double and triple reduction APD reducers, each with a different gear ratio and with different input and output shaft sizes. We recommend that you consider stocking spare parts such as: input and output bearings and seals for your reducer. Keeping a regular maintenance schedule and keeping your reducer properly lubricated will extend its life. If you are running your reducer(s) 18 hours per day or more and you are in a situation where you cannot shut the reducer down for an extended period of time, it is a good idea to keep spare parts in stock. It can sometimes take up to a week or more to get replacement parts for certain APD reducers. Replacement gearing can take several weeks to replace. To obtain spare parts for your APD reducer please contact the factory at 1-800-243-1188

DEACTIVATION & STORAGE

DEACTIVATION

SHORT TERM SHUTDOWN - Units may be deactivated and left offline for up to four months without special precautions.

LONG TERM SHUTDOWN - If the unit is to be deactivated or stored for more than four months after any period of operation:

1. Indoor dry storage is recommended for all inactive units. Deactivated units stored outdoors should be protected from the weather. It is most important to keep the unit dry and in a temperature controlled area.
2. Drain the oil from the unit and spray the inside of the gearcase with a long term storage lubricant such as "Motorstor" or a suitable vapor phase rust inhibitor at the rate of one ounce per cubic foot. Make sure to mark the gearbox appropriately so that the storage lubricant is drained and the gearcase is refilled with the proper lubricant before restarting.
3. Mixer shafts should be removed and coated with Cosmoline or suitable preservative (even stainless steel shafts should be coated where they come into contact with steel or banding straps) Make sure the shafts are properly supported to prevent bending. It is good to rotate the shafts periodically to keep them from settling in one position which can cause them to bend. When storing carbon steel parts outdoors, apply suitable grease or rust preventative to all parts. Turbine parts should also be coated with preservative, especially the bore of the turbine hub.
4. Motors should be stored in a cool, dry environment. The motor shaft should be rotated once each month.
5. Inspect stored or inactive units at 90 day intervals. Re-spray with rust preventative or add rust inhibitor at least once every six months as required.

PREVENTATIVE MAINTENANCE

The first week after startup / restart: Check all external fasteners and plugs for tightness. Gears and internal bearings have been factory set and require no adjustments. Driven shaft bearings require no maintenance other than periodic regreasing.

After the first month: Start the unit. When the sump oil reaches normal operating temperature, shut the drive down and immediately drain the oil. The magnetic plug should be cleaned at this time.

Flush the unit immediately with warm oil (100°F) of the same type and viscosity used in the original fill (APD gearboxes are marked with the oil used to fill them on the side of the gearcase)

DEACTIVATION & STORAGE

PREVENTATIVE MAINTENANCE CONTINUED

Pour or pump oil equivalent in volume to 25% of the original fill through the unit, if necessary repeat the procedure until clean oil appears at the drain.

Close the drain and refill the unit to the correct level with fresh oil. Periodically check oil level and condition with unit stopped. Be sure that oil is normal operating temperature. Add oil if needed but be careful NOT TO OVERFILL.

NOTE: If the oil level has risen since the previous check, have the oil analyzed for water content. Moisture in the oil may indicate seal leakage or condensation. Drain the oil, correct the defect and refill the unit with fresh oil.

Mineral lubricant should be changed every 10,000 service hours or after two years of service. For synthetic oils, the lube should be changed every 20,000 service hours or after four years. In cases of extreme operating conditions (e.g. high humidity, aggressive environment or large temperature variations) shorter intervals between changes are recommended.

Cleveland Mixer supplies all APD reducers filled with oil from the factory. Consult the sticker adjacent to the fill plug to determine the type of lubricant installed at the factory. Standard lubricant is ISO VG220 mineral-based oil.

OPERATION & MAINTENANCE CHECKLIST

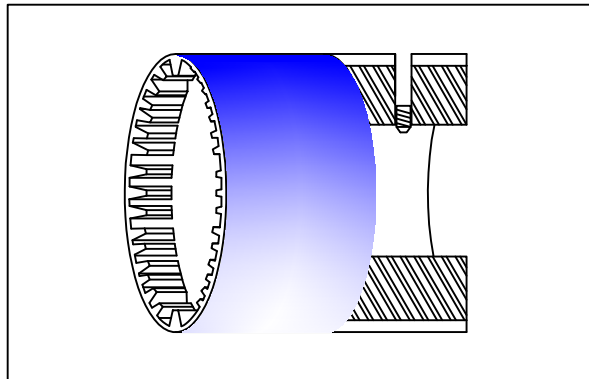
1. Operate the equipment as it was intended to be operated.
2. Do not overload
3. Run at correct speed
4. Maintain lubricant in good condition and at proper level.
5. Apply proper maintenance to attached equipment at prescribed intervals recommended by Cleveland Mixer.
6. Perform periodic maintenance of the gear drive as recommended by Cleveland Mixer.

STANDARD OIL - INDICATED ON THE SIDE OF THE REDUCER.
* DO NOT MIX OILS. ALWAYS DRAIN UNIT COMPLETELY BEFORE USING A NEW GRADE OR BRAND OF OIL. MIXING MINERAL OIL AND SYNTHETIC OIL IN THE SAME WELL MAY CAUSE PERMANENT DAMAGE TO GEAR REDUCER.

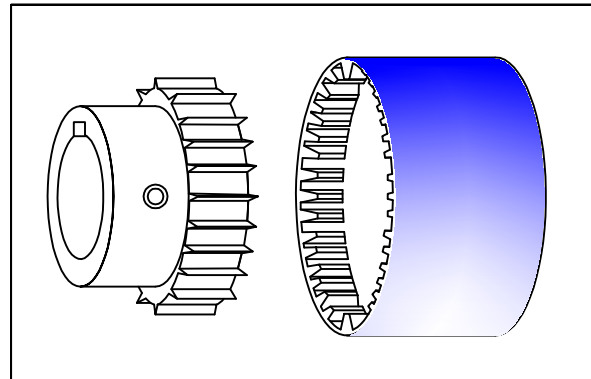
COUPLINGS

Depending on the size of the input adapter to the gearbox, Cleveland Mixer supplies different styles of couplings, BoWex (gear tooth) and Rotex (jaw)

BoWex Couplings - Cleveland Mixer C-face adapter input shafts have a machined spline on the end. Cleveland Mixer incorporates two styles of BoWex Couplings; the "J" and "M" styles. "J" style is a one-piece coupling with a metal hub and nylon spline. The "M" style is a two-piece coupling - the metal hub and nylon sleeve. Nylon and steel components allow them to operate in high ambient temperatures without lubrication or maintenance.



"J" STYLE COUPLING



"M" STYLE COUPLING

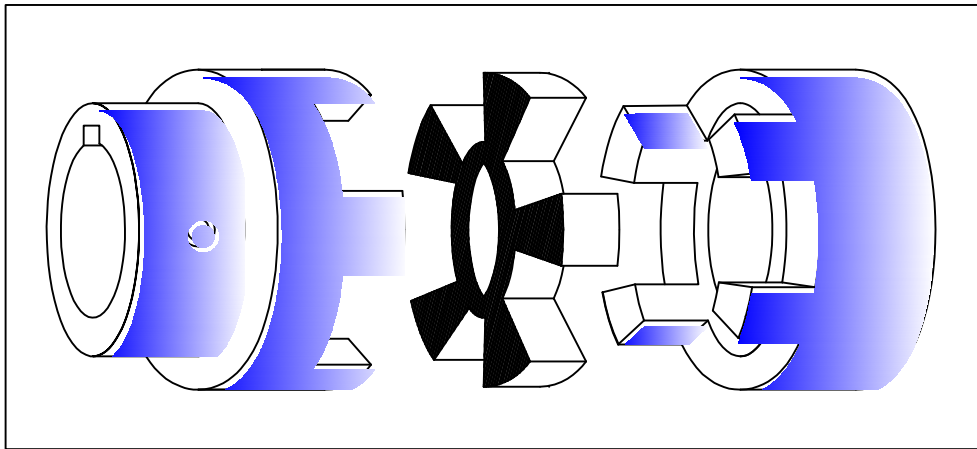
"M" STYLE COUPLING

Coupling Type	M38	M42	M48
Avail. bore size	38mm, 1-1/8", 1-3/8"	42mm, 1-5/8"	48mm, 1-7/8"
Cont. peak torque	80/160nm, 708/1416"lb	100/200nm, 885/1770"lb	140/280nm, 1240/2478"lb
Input	NEMA 180TC, 210TC	NEMA 250TC	NEMA 280TC

"J" STYLE COUPLING

Coupling Type	J14	J24	J28
Avail. bore size	11,14mm, 5/8"	19,24mm, 5/8-7/8"	28mm, 1-1/8"
Cont. peak torque	10/20nm, 89/177"lb	20/40nm, 177/354"lb	45/90nm, 399/797"lb
Input	NEMA 56C	NEMA 56C, 140TC	NEMA 180TC

COUPLINGS



ROTEX STYLE COUPLING

Rotex Couplings

The cast iron jaw style couplings have an integral urethane "spider" that provides smooth transmission of the motor torque. A set screw on the coupling prohibits axial movement along the motor shaft.

JAW STYLE COUPLING INSTALLATION INSTRUCTIONS

1. Measure the distance from the face of the input adapter to the face of the coupling.
2. Subtract the "X" dimension from the measured distance.
3. Use the measurement to locate the coupling from the face onto the shaft of the motor.
4. The metal portion of the coupling should be heated up prior to assembly (this will aid in opening up the inside dimension of the shaft bore, this procedure is only necessary in cases where the coupling won't slide onto the motor shaft) , generally 250° to 300°F. DO NOT HEAT THE URETHANE SPIDER.
5. Once in place, tighten the set screw to lock the coupling in place. Let the coupling cool down before placing the spider into the jaws. It is recommended that the key is staked or bonded in place to prohibit the key from vibrating out.
6. Mount the motor onto the input adapter with customer supplied bolts. Make sure that the coupling from the adapter and the motor engage securely. Use lock washers or Loctite to prohibit the bolts from becoming loose from vibration.

"R" STYLE COUPLING

Coupling Type	R38	R65	R90
Avail. bore size	42,48mm 1-5/8, 1-7/8"	60mm 2-1/8, 2-3/8"	65,75,80mm 2-1/8,2-3/8"
Cont. peak torque	310/620nm 2740/5485"lb	625/1250nm 5530/11060"lb	2400/4800nm 21240/42480"lb
Input	NEMA 250T, 280T	NEMA 320T,360T	NEMA 360T, 400/440TS

TROUBLE SHOOTING

PROBLEM WITH THE REDUCER		POSSIBLE CAUSES	SUGGESTED REMEDY
RUNS HOT	Overloading	Load exceeds the capacity of the reducer	Check rated capacity of reducer, replace with unit of sufficient capacity or reduce load
		Insufficient Lubrication	Check lubrication level and adjust down to recommended level
	Improper Lubrication	Excessive Lubrication	Check lubrication level and adjust down to recommended level
		Wrong Lubrication	Flush out and refill with correct lubricant as recommended
RUNS NOISY	Loose Foundation Bolts	Weak Mounting Structure	Inspect mounting of reducer. Tighten loose bolts. Reinforce mounting structure
		Loose hold down bolts	Tighten bolts
	Bearing Failure	May be due to lack of lubricant	Replace bearing. Clean and flush reducer and fill with recommended lubricant.
		Overload	Check rated capacity of reducer
	Insufficient Lubrication	Level of lubricant inside the reducer not properly maintained	Check lubrication level and adjust down to recommended level
OUTPUT SHAFT DOESN'T TURN	Internal Parts are Broken	Overloading of a reducer can cause damage	Replace broken parts. Check rated capacity of reducer.
		Key missing or sheared off in input shaft	Replace key
		Coupling loose or disconnected	Properly align reducer and coupling. Tighten coupling.
OIL LEAKAGE	Worn Seals	Caused by dirt or grit entering seal	Replace seals. Autovent may be clogged. Replace or clean.
		Overfilled reducer	Check lubricant level and adjust to recommended level.
		Autovent clogged	Clean or replace, being sure to prevent any dirt from falling into the reducer.
		Improper mounting position, such wall or ceiling mount horizontal reducer	Check mounting position to approval drawings

LUBRICANT CHARTS

VISCOSITY ISO NLGI	FORMULATION	SERVICE TEMPERATURE RANGE	MOBIL	SHELL	CASTROL	KLUBER	BP	TRIBOL
VG 460	CONVENTIONAL MINERAL	20°C TO +50°C 68°F TO +122°F	Mobilgear 634	Omala 460	7EP	Kluberoil GEM 1-460	Energol GR-XP 460	Tribol 1100/460
	SYNTHETIC PAO	-30°C TO +80°C 22°F TO +176°F	Mobil SHC 634	Omala 460 HD	Isolube EP 460	Klubersynth EG 4-460	N/A	Tribol 1510/460
VG 320	CONVENTIONAL MINERAL	0°C TO +30°C 32°F TO +86°F	Mobilgear 632	Omala 320	6EP	Kluberoil GEM 1-320	Energol GR-XP 320	Tribol 1100/320
	SYNTHETIC PAO	-35°C TO +80°C 31°F TO +176°F	Mobil SHC 632	Omala 320 HD	Isolube EP 460	Klubersynth EG 4-320	N/A	Tribol 1510/320
VG 220	CONVENTIONAL MINERAL	-5°C TO +40°C +20°F TO +104°F	Mobilgear 630	Omala 220	5EP	Kluberoil GEM 1-220	Energol GR-XP 220	Tribol 1100/220
	SYNTHETIC PAO	-35°C TO +80°C 31°F TO +176°F	Mobil SHC 630	Omala 220 HD	Isolube EP 220	Klubersynth EG 4-220	N/A	Tribol 1510/220
VG 150 & VG 100	CONVENTIONAL MINERAL	-15°C TO +25°C +5°F TO +77°F	Mobilgear 629	Omala 100	4EP	Kluberoil GEM 1-150	Energol GR-XP 100	Tribol 1100/100
	SYNTHETIC PAO	-35°C TO +10°C 35°F TO +50°F	Mobil SHC 629	Omala 150 HD	Isolube EP 150	Klubersynth EG 4-150	N/A	N/A
VG 68	CONVENTIONAL MINERAL	-15°C TO +25°C +5°F TO +77°F	Mobilgear 626	Omala 68	2EP	Kluberoil GEM 1-68	Energol GR-XP 68	Tribol 1100/68
	SYNTHETIC PAO	-35°C TO +10°C 35°F TO +50°F	Mobil SHC 626	N/A	Isolube EP 68	N/A	N/A	N/A
VG 32	-	-	N/A	N/A	N/A	N/A	N/A	N/A
	SYNTHETIC PAO	-40°C TO +10°C 40°F TO +50°F	Mobil SHC 624	N/A	N/A	Kluber-Summit HySyn FG-32	N/A	N/A

* PAO - Poly Alpha Olefin

SPECIAL PURPOSE LUBRICANTS

AMBIENT TEMPERATURE	FORMULATION	MANUFACTURER	OIL BRAND NAME
20°F TO +104°F (-5 TO 40°C)	FOOD GRADE OIL - SYNTHETIC	CHEVRON	FM ISO 220
20°F TO +104°F (-5 TO 40°C)	FOOD GRADE OIL - SYNTHETIC	OILJAX	MAGNAPLATE 85W 140FG
5°F TO +125°F (-20 TO 50°C)	FLUID GREASE	MOBILE	MOBILUX EP023
-30°F TO +140°F (-35 TO 60°C)	FLUID GREASE - SYNTHETIC	MOBILE	MOBILUX SHC 007
-30°F TO +140°F (-35 TO 60°C)	FLUID GREASE - SYNTHETIC	SHELL	ALBIDA LC

STANDARD BEARING GREASE

AMBIENT TEMPERATURE	FORMULATION
-20°F TO +140°F (-30 TO 60°C)	MINERAL

OPTIONAL BEARING GREASES

AMBIENT TEMPERATURE	FORMULATION	MANUFACTURER	OIL BRAND NAME
-40 to 230°F (-40 - 110°C)	SYNTHETIC	SHELL	AEROSHELL 6
-40 to 230°F (-40 - 110°C)	FOOD GRADE OIL - SYNTHETIC	LUBRIPLATE	SFL1

LUBRICATION CAPACITY CHART

DOUBLE REDUCTION VERTICAL MOUNTING POSITION

MIXER TYPE	UNIT of MEASURE	VERTICAL MNTG
APD-1	QUARTS	1.27
	LITERS	1.20
APD-2	QUARTS	2.11
	LITERS	2.00
APD-3	QUARTS	4.33
	LITERS	4.10
APD-4	QUARTS	5.71
	LITERS	5.40
APD-5	QUARTS	9.30
	LITERS	8.80
APD-6	QUARTS	18.50
	LITERS	17.50
APD-7	QUARTS	28.50
	LITERS	27.00
APD-8	QUARTS	43.30
	LITERS	41.00
APD-9	QUARTS	76.10
	LITERS	72.00
APD-10	QUARTS	95.00
	LITERS	90.00
APD-11	QUARTS	206.00
	LITERS	195.00

*NOTE: Filling quantities are approximate figures.
 Oil level must be checked according to oil level plug after final installation.
 Acceptable oil fill level is within 1/2" of the bottom of the fill plug threads.
 For mounting angles not shown, consult factory.

NOTE: For side mounted applications;
 you must fill gearcase completely in order to cover all bearings and gears.

LUBRICATION CAPACITY CHART

TRIPLE REDUCTION VERTICAL MOUNTING POSITION

MIXER TYPE	UNIT of MEASURE	VERTICAL MNTG
N/A	QUARTS	-
	LITERS	-
APD-2	QUARTS	3.28
	LITERS	3.10
APD-3	QUARTS	5.92
	LITERS	5.60
APD-4	QUARTS	8.77
	LITERS	8.30
APD-5	QUARTS	14.80
	LITERS	14.00
APD-6	QUARTS	19.00
	LITERS	18.00
APD-7	QUARTS	26.40
	LITERS	25.00
APD-8	QUARTS	40.20
	LITERS	38.00
APD-9	QUARTS	78.20
	LITERS	74.00
APD-10	QUARTS	93.00
	LITERS	88.00
APD-11	QUARTS	222.00
	LITERS	210.00
APD-12	QUARTS	222.00
	LITERS	210.00

*NOTE: Filling quantities are approximate figures.
 Oil level must be checked according to oil level plug after final installation.
 Acceptable oil fill level is within 1/2" of the bottom of the fill plug threads.
 For mounting angles not shown, consult factory.

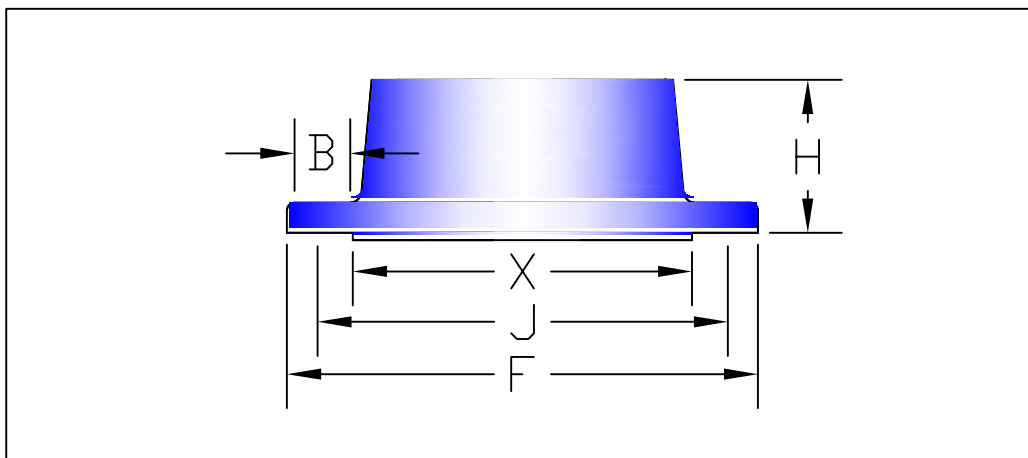
RECOMMENDED SUPPORT BEAM SELECTIONS

TABLE - 1 LOADS IMPOSED BY MIXER			
UNIT SIZE	BENDING MOMENT IN-LBS	TORQUE IN-LBS	VERT DOWNWORD LOAD IN-LBS
APD 3	60,000	16,800	3,000
APD 4	93,600	28,500	4,800
APD 5	134,000	44,600	6,500
APD 6	254,000	66,800	8,800
APD 7	336,000	107,800	13,000

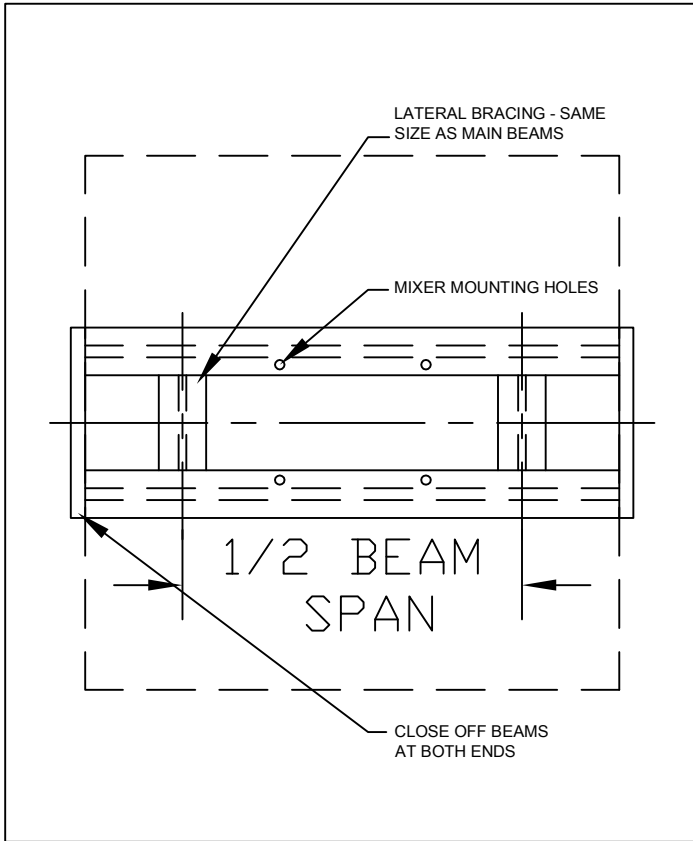
TABLE - 2 TYPICAL MOUNTING BEAMS					
UNIT SIZE	UP TO 10	OVER 10 UP TO 15	OVER 15 UP TO 20	OVER 20 UP TO 25	OVER 25 UP TO 30
APD 3	W5 X 16	W8 X 18	W8 X 35	W10 X 45	W10 X 68
APD 4	W6 X 20	W8 X 21	W8 X 48	W10 X 60	W10 X 100
APD 5	W6 X 25	W8 X 28	W8 X 48	W10 X 68	W10 X 100
APD 6	W8 X 24	W8 X 40	W10 X 45	W10 X 100	W14 X 90
APD 7	W8 X 35	W8 X 58	W10 X 60	W14 X 61	W16 X 89

TABLE - 3 BASE DIMENSIONS					
UNIT SIZE	"B"	"H"	"X"	"F"	"J"
APD 3	.55	3.35	9.055	11.81	10.43
APD 4	.55	4.45	9.055	11.81	10.43
APD 5	.71	5.31	9.834	13.78	11.81
APD 6	.71	6.54	11.811	15.75	13.78
APD 7	.71	7.24	13.780	17.72	15.75

FIGURE - 1 BASE DIMENSIONS VLII MOUNTING



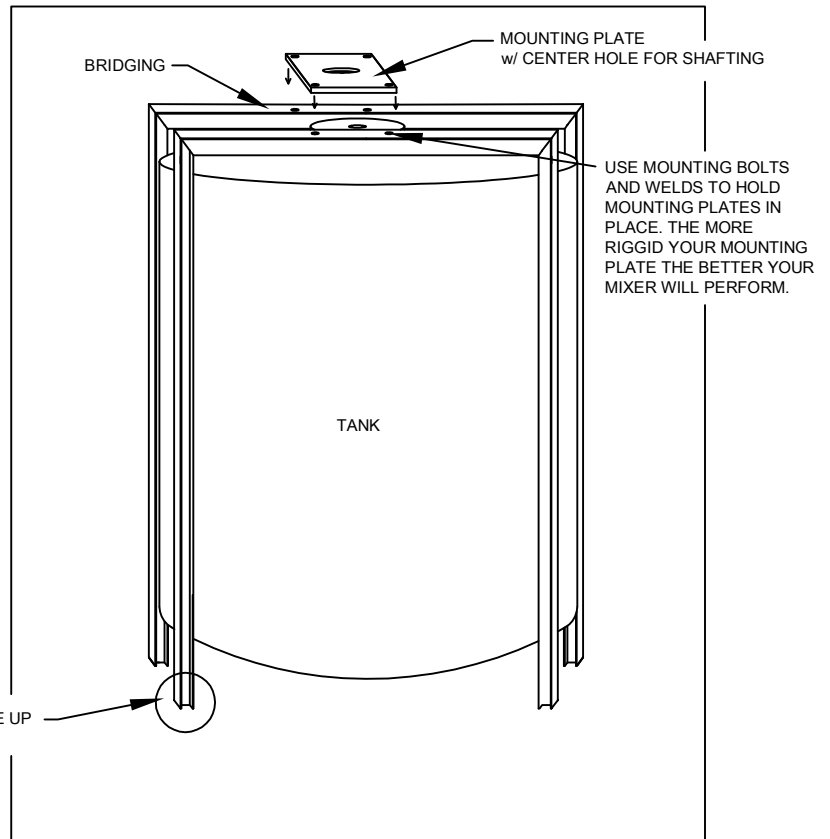
SUPPORT BEAM RECOMMENDATIONS



1. Standard Beam Designation Symbols
 M - Misc. (wide flange) shapes
 W - Wide flange shapes
2. Design loads exceed actual loads by a factor consistent with construction codes. If the recommended beams are to carry additional loads to the mixer, larger beams may be required.
3. The Cleveland Mixer warranty applies only to items furnished by Cleveland Mixer. Cleveland Mixer does not warrant, guarantee or assume any responsibility for the design or construction of the tank, mounting structure or any other equipment not manufactured by Cleveland Mixer.

Support beams should be bridged over the tank and be supported by a solid surface. Tanks often vibrate. If the support bridging is only supported by the tank, the mixer will not have the rigidity it needs to operate.

Even if your tank is made from steel, when thousands of gallons start moving around, the tank can vibrate, pulsate, sway, etcetera. Those events can create forces and movement that the shaft and impellers were not designed to handle.



SERVICE RECORDS

DATES	NOTES