



English

Installation, Operation and Maintenance Instructions

XL Range

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Installation, Operation & Maintenance Instructions

INSTALLATION

1.1 INSTALLATION AND SAFETY RECOMMENDATIONS

In common with other items of process plant a pump must be installed correctly to ensure satisfactory and safe operation. The pump must also be maintained to a suitable standard. Following these recommendations will ensure that the safety of personnel and satisfactory operation of the pump is achieved.

1.2 GENERAL

When handling harmful or objectionable materials, adequate ventilation must be provided in order to disperse dangerous concentrations of vapors. It is recommended that wherever possible, Monoflo pumps should be installed with provision for adequate lighting, thus ensuring that effective maintenance can be carried out in satisfactory conditions. With certain product materials, a hosing down facility with adequate draining will simplify maintenance and prolong the life of pump components.

1.3. SYSTEM DESIGN & INSTALLATION

At the system design stage, consideration must be given to provision of filler plugs, and the installation of non-return and/or isolating valves. Pumps cannot be reliably used as non-return valves. Pumps in parallel and those with high static discharge head must be fitted with non-return valves.

The pumps must also be protected by suitable devices against over pressure and dry running.

1.4. PIPING

1.4.1 Suction Piping

The piping should be as short as attainable, and where possible the pipe diameter should be the same diameter as the pump suction inlet. It is advised that Long Sweep 90° or 45° elbows are used in preference to standard elbow piping. Piping configurations which could trap air should be avoided.

1.4.2 Discharge Piping

The Discharge end piping has to have an easily removable section, that is between 1 to 2 times longer than the pumps connecting rod. This will enable the stator to be removed for repair or replacement, without having to dismantle the complete pump. Where possible the piping should be the same diameter as the pump ports.

1.4.3 Suction Housing Rotation

The suction housing can be put in any position 360° about the centerline of the pump. To rotate the suction housing, loosen the bolts on the clamp ring attached to the bearing housing, and loosen the bolts clamping the 2 halves of the stator support. Remove the packing gland halves and the packing studs and rotate the suction housing, stator and discharge flange together to the required angle. Tighten all bolts and fix the pump into position.

1.5 MOUNTING

All pumps are installed horizontally on steel base plates, they are then mounted on a flat surface or concrete foundation if required. The base plate should be grouted in and bolted, thus ensuring firm fixing and a reduction in noise and vibration.

1.6 SHAFT ALIGNMENT

After the base is bolted down securely the following checks have to be made.

1.6.1 Coupling Connected Pumps

Make sure the pump and driver are aligned before the coupling is connected.

Check that the gap between the coupling halves, in line with the manufacturers recommendations.

1.6.2 Belt Drive Pumps

Make sure sheaves or sprockets are aligned.

Check that the belts have the correct requirements in line with the manufacturers recommendations.

1.7 WATER FLUSH OF PACKING

The packing can be grease lubricated through a grease nipple in the stuffing box, or to allow for water flushing, it could be connected to a water supply. No grease lubrication takes place to the packing before shipping.

If it is an abrasive material being pumped, to extend the shaft life, water flushing is recommended.

Clean water can be injected through a 1/8" NPT hole in the side of the suction housing. The water should then leak along the shaft, and be removed from the tapped hole on the opposite side of the suction housing.

Flow rate should be 1/2 - 2 gpm approx.

Consult manufacturers instructions for seal flush requirements, if a mechanical seal is required.

1.8 HANDLING

During installation and maintenance, attention must be paid to the safe handling of all items. Where a pump or its components weigh in excess of 20 kg (45lb) it is recommended that suitable lifting tackle should be used to ensure that personal injury or damage to components does not occur.

For safe handling of both bare shaft pumps and pump units (pump/ gearbox/motor etc.) slings should be used. The position of the slings will depend upon the specific pump/unit construction and should be carried out by personnel with the relevant experience to ensure that the pump is not damaged and injury to personnel does not occur.

If eyebolts do exist then these should only be used for lifting the individual components for which they are supplied.

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- 1.9 STORAGE AND INFREQUENT OPERATION**
The situation where a pump is used infrequently is also covered by the instructions in this section.

SHORT TERM STORAGE

Where a pump has to be stored for 6 months or less then the following steps are advised:-

- 1) Store the pump inside wherever possible or if this is not feasible then provide protective covering. Do not allow moisture to collect around the pump.
- 2) Remove the drain plug, if fitted. Any inspection plates fitted should also be removed to ensure that the suction housing can drain and dry completely.
- 3) Loosen the packed gland and inject sufficient grease into the stuffing box. Tighten the gland nut hand tight. If a water flush system is to be used do not grease, a small amount of light oil is recommended for these.
- 4) See manufacturers instructions for motor/gearbox/drive instructions for storage procedures.

LONG TERM STORAGE

If the pump is to be kept in storage for more than six months then in addition to the above the following procedures should be carried out regularly (every 2 - 3 weeks if possible):

- 1) If practicable rotate the pump at least three quarters of one revolution to avoid the rotor setting in the stator. This is to be done on a monthly basis.
- 2) Note, however, that the pump is not to be rotated for more than two revolutions each time because damage could be caused to the rotor/ stator elements.

IMMEDIATELY PRIOR TO INSTALLATION AND STARTING



Before installing the pump please ensure that all plugs and inspection plates are replaced and that excess grease/oil is removed from the stuffing box.



ELECTRICAL

Electrical connection should only be made using equipment suitable for both rating and environment. Where any doubts exist regarding the suitability of equipment, Monoflo, should be consulted before proceeding. Normally the Monoflo pump should be installed with starting equipment arranged to give direct on line starting.

Earthing points will be provided on electric drives (if supplied) and it is essential that these are correctly connected. When the motor is being wired and checked for rotation, the start/stop sequence must be instantaneous to prevent dry running (see 2) or pressurizing upstream equipment. (Check direction arrow on pump nameplate). The electrical installation should include appropriate isolating equipment to ensure that the pump unit is safe to work on.

1.11 PRESSURE RELIEF VALVES AND NON-RETURN VALVES

- 1) It is recommended that a suitable safety device is installed on the discharge side of the pump to prevent over-pressurization of the system.
- 2) It is also recommended that a non-return valve is installed on the discharge side of the pump to prevent reverse flow through the system.

When both are installed it is advised that the relief valve is positioned closer to the pump than the non return valve.



IMPORTANT

The pump must never run against a closed inlet or outlet valve, as this could result in mechanical failure.

1.12



GENERAL SAFETY

GREAT CARE MUST BE TAKEN TO PROTECT ALL ELECTRICAL EQUIPMENT FROM SPLASHING WHEN HOISING DOWN. WHERE MONOFLO HAVE SUPPLIED A BARESHAFT PUMP THE ONUS IS ON THE USER TO FIT ADEQUATE GUARDS IN COMPLIANCE WITH THE REQUIREMENTS OF THE RELEVANT REGULATIONS.

All nuts and bolts, securing flanges and base mounting fixtures must be checked for tightness before operation. To eliminate vibration, the pump must be correctly aligned with the drive unit, and all guards must be securely fixed in position. When commissioning the plant, all joints in the system must be checked thoroughly for leakage.

If, when starting, the pump does not appear to operate correctly (see 2), the plant must be shut down immediately and the cause of the malfunction established before operations are recommenced. It is recommended that depending upon plant system operation, either a combined vacuum and pressure gauge, or a vacuum gauge only be fitted to the pump inlet port, and a pressure gauge fitted to the outlet port, these will then continuously monitor the pump operating conditions.

1.13 DUTY CONDITIONS

Pumps should only be installed on duties for which Monoflo have specified the materials of construction, flow rates, pressure, temperature, speed etc. Where dangerous materials are to be pumped, consideration must be given to the safe discharge from relief valves, gland drains etc.

IF THE DUTY SHOULD BE CHANGED, MONOFLO SHOULD BE CONTACTED AND THEIR RECOMMENDATIONS SOUGHT IN THE INTEREST OF APPLICATION, SAFETY OF PLANT, EFFICIENCY AND PUMP LIFE.

1.14 ASSEMBLY AND DISMANTLING

Sections 3 to 5 contain the steps to dismantle, maintain and re-assemble the pump. All fastenings must be tightened securely and when identified the appropriate torque figures should be used.

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1.15 USE OF ITEMS NOT APPROVED OR MANUFACTURED BY MONOFLO

The pump and its components have been designed to ensure that the pump will operate safely within the guidelines covered by current legislation.

The use of replacement items that are not approved by or manufactured by Monoflo may affect the safe operation of the pump and it may therefore become a safety hazard to both operators and other equipment.

The guarantee referenced in the terms and conditions of sale will also be invalidated if replacement items are used that are not approved or manufactured by Monoflo.

DISPOSAL OF WORN COMPONENTS

When replacing wearing parts, please ensure disposal of used parts is carried out in compliance with local environmental legislation. Particular care should be taken when disposing of lubricants.

2. OPERATION

2.1 INITIAL INSTALLATION CHECK

- Pump, driver alignment
- Electrical connections
- Gauges
- Water flush connection to stuffing box
- Pump rotation
- All valves open (suction and discharge)

2.2. START UP PROCEDURE

Pumps must be filled with liquid before starting. The initial filling is not for priming purposes, but to provide the necessary lubrication of the stator until the pump primes itself. When the pump is stopped, sufficient liquid will normally be trapped in the rotor/stator assembly to provide lubrication upon restarting.

If, however, the pump has been left standing for an appreciable time, moved to a new location, or has been dismantled and re-assembled, it must be refilled with liquid and given a few turns before starting. The pump is normally somewhat stiff to turn by hand due to the close rotor/stator fit.

However, this stiffness disappears when the pump is running normally against pressure.

Once the pump is filled, check the direction of pump rotation. Do this by momentarily starting and stopping the drive. The direction of rotation will be indicated on the pumps nameplate.

In suction lift applications, it may be necessary to replace the grease nipples at the stuffing box with pipe plugs, to prevent loss of prime due to air leakage.

2.3.



DRY RUNNING

NEVER RUN THE PUMP IN A DRY CONDITION EVEN FOR A FEW REVOLUTIONS OR THE STATOR WILL BE DAMAGED IMMEDIATELY. CONTINUAL DRY RUNNING COULD PRODUCE SOME HARMFUL OR DAMAGING EFFECTS.

RECOMMENDED FITTING FOR DRY RUN PROTECTION DEVICE.

PUMP	PROBE REQ
XL12	80D2433
XL22	
XL36	80D2434
XL50	
XL65	
XL90	
XL115	
XL175	

2.4. GLAND PACKING (SEE FIG 1.1)

Where a pump is supplied fitted with gland packing (manufactured from a non-asbestos material), the gland will require adjustment during the initial running in period. Newly packed glands must be allowed to run-in with only finger tight compression on the gland follower nuts. This should continue for about 3 days. The gland follower should be gradually tightened over the next week to achieve a leakage rate as shown in the table below. Gland followers should be adjusted at regular intervals to maintain the recommended leakage flow rate. Under normal working conditions a slight drip from the gland under pressure assists in cooling and lubricating the packing.

A correctly adjusted gland will always have small leakage of fluid.

Over-tightening the gland could wear the packing and damage the shaft. If leaking cannot be tolerated, then a mechanical seal should be used.

Typical Leakage Rates from Packed Glands

Up to 50mm	shaft diameter 2 drops per minute
50 ... 75mm	shaft diameter 3 drops per minute
75 ... 100mm	shaft diameter 4 drops per minute
100 ... 125mm	shaft diameter 5 drops per minute
125 ... 160mm	shaft diameter 6 drops per minute

A gland drip is, however, undesirable when handling corrosive, degreasing, or abrasive materials. Under these conditions the gland must be tightened the minimum amount whilst the pump is running to ensure satisfactory sealing when under pressure, or to stop entry of air when under suction conditions.

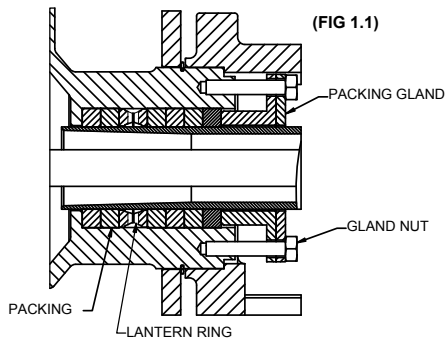
The gland leakage of toxic, corrosive or hazardous liquids can cause problems of compatibility with the pumps materials of construction.

Provision of a gland drain should be considered, especially for the leakage of hazardous products.

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CARE IS REQUIRED WHEN ADJUSTING THE GLAND WHILST THE PUMP IS RUNNING.

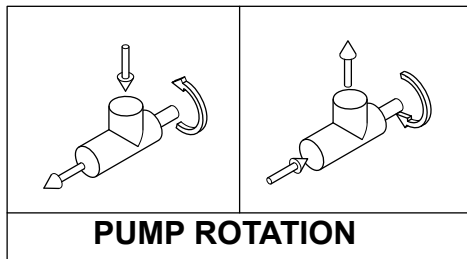


2.5. MECHANICAL SEALS - ALL PUMPS

When a mechanical seal is fitted to the pump it may be necessary to provide a barrier fluid to some part of the seal. This should be provided in line with the seal manufacturers instructions.

2.6. PUMP ROTATION DETAILS

BEFORE THE DIRECTION OF ROTATION IS CHANGED, MONOFLO MUST BE CONSULTED SO THAT THE SUITABILITY OF THE PUMP CAN BE CONFIRMED WHEN OPERATING THE NEW DUTY.



2.7. WARNING/CONTROL DEVICE

Prior to operating the pump, if any warning or control devices are fitted these must be set in accordance with their specific instructions.

2.8. PUMP OPERATING TEMPERATURE

The range of temperatures the pump surfaces will develop is dependent upon factors such as product temperature and ambient temperature of the installation. There may be instances where the external pump surface can exceed 122°F. In these instances, personnel must be made aware of this and suitable warnings/guarding used.

2.9. NOISE LEVELS

- 1) The noise sound pressure level will not exceed 85dB at 40 inch distance from the pump.
- 2) This is based on a typical installation and does not necessarily include noise from other sources or any contribution from building reverberation.

2.10. CLEANING PRIOR TO OPERATION

During the commissioning of a new pump or re-commissioning of an overhauled pump, it is advisable to clean the pump prior to the initial operation of the pump in the process.

Clean all parts in a suitable cleaning solvent.

3. DISMANTLING PROCEDURES

3.1. DISCONNECT PUMP

- 1) Flush out the pump with clean water if possible.
- 2) Shut off the pump
- 3) Close valves on discharge and suction ends.
- 4) Turn off water supply to packing or mechanical seal.
- 5) Disconnect from power supply
- 6) Remove drain plug (M) to drain any fluid in the pump.
- 7) Remove inspection plate (32) and inspection plate gasket (33).

3.2. PACKING REMOVAL

- 1) Complete section 3.1.
- 2) Remove gland adjustment nuts (J) packing gland studs (H) and packing gland halves (21) from the stuffing box (gland section).
- 3) Remove packing rings (22) use two packing extractors simultaneously on each side of the rings. Pull out with caution and evenly. Pull apart at joint and take off shaft.
- 4) Remove lantern rings (23)
- 5) Remove remaining packing rings.

ALWAYS USE PACKING TAMPER TOOL TO REMOVE/INSTALL PACKING. TO ASSURE REQUIRED SHAFT LUBRICATION NEVER USE A ONE-PIECE SPIRAL WRAP PACKING.
(see section 5 for re-lubrication procedures.)

3.3. STATOR REMOVAL (SECTION 4, PAGE 2 DIAGRAMS)

- 1) Complete section 3.1.
- 2) Remove section of pipe attached to discharge end of pump (section 1.4.2).
- 3) Remove discharge flange (37) by unbolting hex head screws (R) from stator clamp ring (36B)
- 4) Remove stator gasket (34) retaining ring (35) and stator clamp ring (36B) from stator (30)
- 5) Remove hex head screws (Q) from stator support (31).
- 6) Remove top half of stator support.
- 7) Unbolt clamp ring (36A) from the suction housing (29).
- 8) Pull stator (30) off rotor (40) in clockwise motion.
- 9) Remove stator gasket (34) retaining ring (35) and stator clamp ring (36A) from stator (30)
- 10) Check stator (30) and rotor (40) for wear.

3.4. ROTOR REMOVAL (SECTION 4, PAGE 3 DIAGRAMS)

- 1) Complete sections 3.1, and 3.3
- 2) Inspection plate (32) and gasket (33) previously removed in section 4.1
- 3) Remove vent plug (B) and set screw (N) from the gear joint shell (39).
- 4) Remove socket head screws (O) from the head ring (42).
- 5) Remove head ring (42) and o-ring (41).
- 6) Remove rotor (40) from gear joint shell (39).
- 7) Remove primary thrust plate (6) from the drive shaft head and remove two keys (7).

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3.5 DRIVE END GEAR JOINT REMOVAL (SECTION 4, PAGE 4 DIAGRAMS)

- 1) Complete section 3.1.
- 2) Remove drive, coupling or v- belts from drive shaft head (4).
- 3) Remove pipe plugs (B) from drive shaft head (4) and drive shaft (14).
- 4) Remove socket head screws (C) from drive shaft head.
- 5) Remove drive shaft head (4).
- 6) Remove primary thrust plate (6) from the drive shaft head and remove two keys (7).
- 7) Remove locknut (9) from connecting rod (38).
- 8) Remove ring gear (8)
- 9) Remove gear ball (10)
- 10) Remove secondary thrust plate (11).
- 11) Remove seal support (12).
- 12) Remove seal (13)

NOTE: It is recommended that the o-ring (5) and gear joint seal (13) is replaced each time the drive end gear joint is dismantled.

3.6 CONNECTING ROD REMOVAL (SECTION 4, PAGE 5 DIAGRAMS)

- 1) Complete sections 3.1, 3.3, 3.4 and 3.5
- 2) Pull connecting rod (38) out of pump.
- 3) Clamp connecting rod in a vice or hold it with pipe wrench and remove locknut (9) from the connecting rod.
- 4) Remove ring gear (8)
- 5) Remove gear ball (10)
- 6) Remove secondary thrust plate (11).
- 7) Remove seal support (12).
- 8) Remove seal (18)

NOTE: It is recommended that the o-ring (41) and gear joint seal (13) is replaced each time the rotor end gear joint is dismantled.

3.7 DRIVE SHAFT AND BEARINGS REMOVAL (SECTION 4, PAGE 7 DIAGRAMS)

- 1) Complete sections 3.1, and 3.5
- 2) Remove hex head screws (D) from bearing cover plate (2)
- 3) Remove radial grease seal (1) from bearing cover plate.
- 4) Remove o-ring (3)
- 5) Pull the drive shaft (14) and bearing assembly out of the bearing housing.
- 6) Remove grease seal (19) from bearing housing (26).

NOTE: If there is not enough space to remove the shaft/bearing assembly, follow steps 7 to 11. If space is available move on to step 12.

- 7) Complete sections 3.2 & 3.3 this will release the connecting rod/rotor assembly. Pull the assembly out of the pump.
- 8) Remove the hex head screws (K) from the clamp ring (28) attached to the bearing housing.
- 9) Release the cap screws attaching the bearing housing (26) to the base .

- 10) Slide the drive shaft and bearing assembly out or the suction housing until the end of the drive shaft clears the stuffing box.
- 11) The bearing housing and drive shaft/ bearing assembly can now be moved to a more suitable area to remove the drive shaft/bearing assembly.
- 12) Remove bearing Lock plug (17) from the bearing lock nut (18).
- 13) Using a suitable spanner remove the bearing lock nut (18) from the drive shaft (14).
- 14) Remove both halves of the bearing spacer (16)
- 15) Using a suitable bearing press and equipment remove the bearings (15) from the drive shaft.

CAUTION: CARE MUST BE TAKEN WHEN REMOVING THE BEARINGS FROM THE SHAFT. THIS IS TO AVOID DAMAGE TO COMPONENTS. THE BEARINGS ARE PRESSED ON THE SHAFT DURING ASSEMBLY.

4. MAINTAINANCE

4.1 ROTOR AND STATOR

The wear rate on these components is dependant on many factors, such as abrasivity, speed, pressure etc. When pump performance has reduced to an unacceptable level, one or possibly both items will need replacing.

- 1) Complete section 3.3 & 3.4
- 2) Replace rotor or stator and assemble

4.2 DRIVE SHAFT – PACKED GLAND

The wear rate of the gland area is dependant on many factors such as product abrasivity and speed. Regular gland maintenance will maximize the life of the shaft. Replacement of both the packing and shaft will be necessary when shaft sealing becomes difficult to achieve.

4.2.1 Drive Shaft Replacement

- 1) Complete section 3.7.
- 2) Replace driveshaft and assemble.

4.2.2 Packing Replacement

When tightening the gland nuts no longer regulates the leakage rate, the packing needs removing and replacing.

- 1) Complete section 3.2.
- 2) Inspect surface of driveshaft (14) for wear.
- 3) If the driveshaft is worn, through the chrome plating to the base metal, or the surface is badly scored or grooved it will need replacing.
- 4) If driveshaft is not worn, replace the packing,
- 5) Lubricate packing rings and put new packing as well as lantern rings back in to stuffing box. (packing ring joints should be staggered at 90° increments).
- 6) Replace packing gland halves (21) and packing gland studs (H).
- 7) Replace gland adjusting nuts (J)
- 8) Adjust packing (see section 2.4)

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4.3. LUBRICATION

Approved lubrication is SHELL ALVANIA EP (LF) 2

4.3.1 Bearings

Bearings should only need re-lubricating when the shaft/bearing assembly is removed from the pump. The lubrication takes place before the pump is sent out during production.

4.3.2 Gear Joints

Gear joints are also lubricated when the pump is assembled. They will only need re-lubricating when the gear joints are dismantled.

4.4. GUARDS

In the interests of safety, all guards must be replaced after necessary adjustments have been made to the pump.

4.5 INSPECTION

4.5.1 Bearings

- 1) Clean bearings.
- 2) Rotate the bearings slowly under hand pressure to feel for smoothness.
- 3) Check for cracks, galling, pitting, burrs etc.
- 4) Replace bearing if necessary.

NOTE: Never spin a dry bearing.

(see section 5 for re-lubrication procedures.)

4.5.2 Driveshaft

- 1) Clean drive shaft
- 2) Rotate driveshaft slowly checking for scoring, burrs, cracks etc.
- 3) Replace driveshaft if necessary.

4.5.3 Seals

- 1) It is advised to always replace grease seals (1 & 19) whenever the driveshaft is removed.
- 2) Apply locktite 690 to seals when replaced.

4.5.4 Packing

- 1) It is advised to always replace packing (22) whenever the bearing housing is dismantled.

4.5.5 Stator

- 1) Check stator is not pitted or gouged.
- 2) A worn stator can appear smooth like new, and so it can be difficult to know by inspection whether the stator is worn.
- 3) Performance is the best way to measure stator to rotor fit.
- 4) Suspected stator wear can be evaluated by Monoflo.

4.5.6 All other parts

- 1) Check for cracks, excessive wear, and damage to holes or threaded holes etc.
- 2) Gaskets and o-rings are to be replaced each time they are dismantled from the pump.

5. ASSEMBLY

5.1 GENERAL

To re-assemble the pump, follow the dismantling procedures in reverse order.

- 1) When the pump has been dismantled, check all parts for worn components.
- 2) Replace all worn items.
- 3) Replace the following recommended items:
 - Gear joint seals (13)
 - O-rings (3, 5 & 41)
 - Grease seals (1 & 19)
 - Packing rings (22)
- 4) When re-assembling the pump it is important to make sure that all bearings and gear joint components are handled with care and kept clean. This will help to avoid premature failure.

5.2 LUBRICATING DURING ASSEMBLY

NOTE: DO NOT MIX DIFFERENT BRANDS OF LUBRICANTS FOR THE SAME APPLICATION.

5.2.1 Bearings

The bearings only need re-lubricating when the shaft and bearings have been completely removed from the pump. The bearings are lubricated before the pump is sent out during production.

To re-lubricate

- 1) Pack bearings on to shaft. (Section 5.3)
- 2) Make sure lubricant completely covers the rollers and faces of the bearings.
- 3) The inside of the spacer between the bearings, should be filled about half way with lubricant.

5.2.2 Gear Joints

- 1) Gear joints should be packed with lubricant during assembly.
- 2) Grease nipples are not to be used to lubricate the gear joints after assembly.
- 3) The pipe plugs (B) must be removed during assembly from the driveshaft head, driveshaft and gear joint shell. This allows excess lubricant to vent from the gear joints.

5.2.3 Packing

- 1) The packing rings should be lubricated during assembly.
- 2) The grease nipples on the side of the stuffing box can be used to add more grease if required after assembly.

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5.3 PACKING INSTALLATION

Packing ring sets consist of six packing rings (22). Lantern rings (23) need to be ordered separately.

- 1) Lubricate two packing rings and insert rings into the stuffing box.
- 2) Insert two lantern ring halves in to stuffing box.
- 3) Lubricate and insert remaining packing rings firmly in to stuffing box.
- 4) Install packing gland studs (H).
- 5) Install packing gland halves (21).
- 6) Tighten gland adjusting nuts (J) so finger tight.
- 7) Adjust packing (See Section 2.4)

5.4 BEARING HOUSING/SUCTION HOUSING ASSEMBLY

(SECTION 4, PAGE 9 DIAGRAMS)

The bearing/suction housing assembly can be assembled before or after the bearing/driveshaft assembly.

- 1) Put the clamp ring (28) on to the end of the suction housing (29).
- 2) Place the retaining ring (27) in to the groove on the suction housing
- 3) Place the suction housing machined end into the bore on the end of the bearing housing (26).
- 4) Put hex head screws (K) through clamp ring (28) holes, and into the threaded holes in the bearing housing. Tighten finger tight.
- 5) Rotate the suction flange to the required angle and tighten the hex head screws (K).

5.5 BEARING/DRIVESHAFT ASSEMBLY

(SECTION 4, PAGE 8 DIAGRAMS)

- 1) The following list the steps that must be taken to press the bearings (15) on to the shaft (14). The larger units G-drive upwards require the bearings to be heated to 250°F before assembly.
 - Press the bearing cone on to the shaft, making sure that the rollers face in the correct direction. The cone should be firmly pressed against the shoulder of the shaft.
 - Place the cup on to the rollers of the bearing.
 - Place the bearing spacers on the cup.
 - Place the next cup on to the spacers.
 - Press the second bearing cone on to the shaft, again making sure that the bearing is facing in the correct direction. The cone should be pressed until the face of the cone is level with the shoulder on the shaft.

CAUTION: THE SECOND CONE MUST NOT BE PRESSED PAST THE SHOULDER ON THE SHAFT.

- 2) The bearing nut (18) should then be threaded on to the shaft (14) until tight against the shoulder of the drive shaft.
- 3) Tighten the bearing lock plug (17) in the bearing nut (18).
- 4) Remove the bearing spacer halves (16), and lubricate rollers and races.
- 5) Replace one of the bearing halves and fill the area between the bearing halves full of lubricant.

- 6) Replace the other half of bearing spacer.

CAUTION: IF THERE HAS BEEN TOO MUCH GREASE PACKED INTO THE BEARINGS, THERE COULD BE LUBRICANT SEEPING OUT FROM THE GREASE SEALS. WHEN THE PUMP IS TURNED OFF, THIS LUBRICANT SHOULD BE WIPED AWAY FROM THE SEAL AREA TO PREVENT CONTAMINANTS COLLECTING IN THE SEAL AREA.

- 7) Light press the grease lip seals (1 & 19) with locktite, in to the bearing housing (26) and the bearing cover plate (2).
- 8) The driveshaft with bearings should now be inserted in to the bearing housing.

CAUTION: BE CAREFUL WHEN INSERTING THE DRIVESHAFT, AVOID DAMAGING THE LIPSEALS.

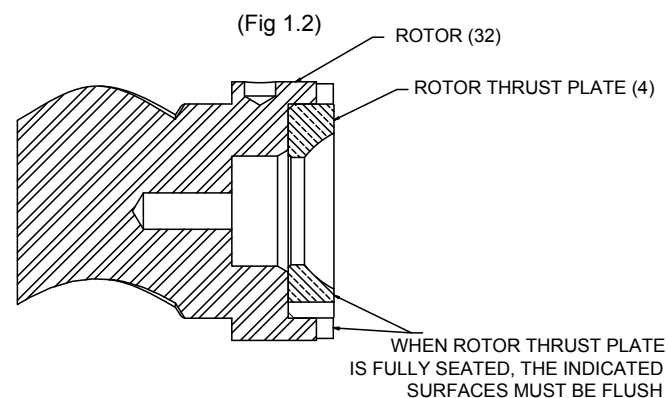
- 9) O-ring (3) is placed on to bearing cover plate (2).
- 10) Bolt the bearing cover plate with hex screws (D) to the bearing housing.

5.6

ROTOR GEAR JOINT ASSEMBLY

(SECTION 4, PAGE 10 DIAGRAMS)

- 1) Place the gear joint shell (39) over the connecting rod (38).
- 2) Next fit the joint seal (13) into the bush on the connecting rod. Apply lubricant between the flat faces of the part and the seal.
- 3) Next is the seal support (12). Apply lubricant between the face of the support and the seal (13).
- 4) Apply grease to the concave spherical surface of the secondary thrust plate (11). The step on the back of the thrust plate should line up with the lip on the outside diameter of the seal (13).
- 5) Apply grease to the splines on the inside of the gear ball (10).
- 6) Slide gear ball (10) on to the connecting rod (38), counter bored end first.
- 7) Tighten lock nut (9) against the gear ball (10). Apply grease to spherical surfaces and to the teeth of the gear ball.
- 8) Apply grease to the teeth of the ring gear (8).
- 9) Slide ring gear on to the gear ball (10). Make sure that keyways are facing towards the lock nut.
- 10) Insert primary thrust plate (6) into the rotor head.
(See Fig 1.2)

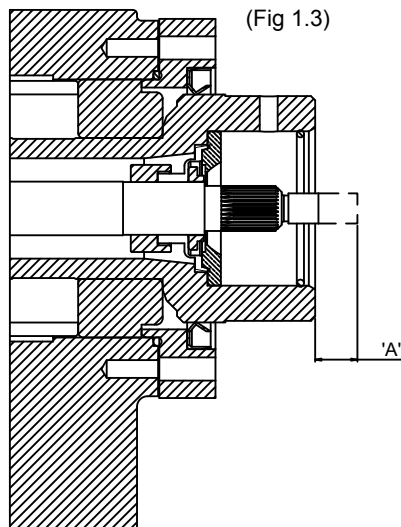


Installation, Operation & Maintenance Instructions

- 11) Thrust plate (6) and rotor head surfaces must be flush.
- 12) Apply grease to spherical surface of the primary thrust plate located inside the rotor head.
- 13) Place the gear joint shell (39) over all of the assembled components.
- 14) The gear joint shell should line up with the outside diameter of the gear joint seal (13).
- 15) Align the two tapped holes on the gear joint shell up with one of the keyways in the ring gear.
- 16) Insert the keys (7) into the keyways on the on the ring gear.
- 17) Insert the rotor into the gear joint shell, making sure that the keyways in the rotor head are aligned with the keys in the ring gear.
- 18) The hole in the rotor head should line up with the first hole in the gear joint shell.
- 19) Thread the set screw (N) in to the hole until contact is made with the hole in the rotor head.
- 20) Place o-ring (41) and the head ring (42) over the rotor and line up with the step in the gear joint shell.
- 21) Bolt the head ring to the gear joint shell using hex head screws (O).
- 22) Tighten the hex head screws, evenly making sure the o-ring (41) stays in place.
- 23) Any excess grease should vent through the vent hole in the side of the gear joint shell.
- 24) Tighten the set screw (N), locking in the rotor head.
- 25) Turn the free end of the connecting rod. This will help more excess grease come through the vent hole.
- 26) Clean away excess grease, and put the stainless steel pipe plug (B) in to the vent hole and tighten.

5.7 DRIVE END GEAR JOINT ASSEMBLY (SECTION 4, PAGE 11 DIAGRAMS)

- 1) Place connecting rod/rotor assembly through the pump and into the driveshaft (14) checking that the connecting rod is in the correct position.
(See Fig 1.3)



GEAR JOINT INSTALLATION	
DRIVE END	DIM 'A' + 1/8" - 0
E	0.935
F	1.125
G	1.435
H	1.560
J	2.069

ALL DIMENSIONS IN INCHES

- 2) Fit the joint seal (13) into the bush on the connecting rod, inside the drive shaft (14). Apply lubricant between the flat faces of the part and the seal.
- 3) Next is the seal support (12). Apply lubricant between the face of the support and the seal (13).
- 4) Apply grease to the concave spherical surface of the secondary thrust plate (11). The step on the back of the thrust plate should line up with the lip on the outside diameter of the seal (13).
- 5) Apply grease to the splines on the inside of the gear ball (10).
- 6) Slide gear ball (10) on to the connecting rod (38). counter bored end first.
- 7) Tighten lock nut (9) against the gear ball (10). Apply grease to spherical surfaces and to the teeth of the gear ball.
- 8) Apply grease to the teeth of the ring gear (8).
- 9) Slide ring gear on to the gear ball (10). Make sure that keyways are facing towards the lock nut, and are in line with the tapped vent hole on the driveshaft.
- 10) Place the primary thrust plate (6) making sure it lines up with the location pin, into the driveshaft head (4).
- 11) Apply grease to the spherical surface of the thrust plate and fill the recess in the driveshaft head with grease.
- 12) Place the o-ring (5) into the groove on the drive shaft head.
- 13) Insert the keys (7) into the keyways on the on the ring gear.
- 14) Insert the drive shaft head (4) into the drive shaft, making sure that the keyways in the drive shaft head are aligned with the keys in the ring gear.
- 15) Bolt the drive shaft head to the drive shaft using socket head screws (C).
- 16) Tighten the socket head screws evenly.
- 17) Any excess grease should vent through the vent hole in the side of the drive shaft.
- 18) Clean away excess grease, and put the stainless steel pipe plug (B) in to the vent hole and tighten.

Installation, Operation & Maintenance Instructions

5.8 DISCHARGE FLANGE & STATOR ASSEMBLY (SECTION 4, PAGE 12 DIAGRAMS)

- 1) Slip stator clamp rings (36A & 36B) on to stator and fix into place with retaining rings (35).
- 2) Place stator gasket (34) in to the recess of the suction housing (29)
- 3) Coat the rotor and stator with a suitable lubricant compatible with the stator elastomer.
- 4) Place stator (30) over the rotor (40) turning counter-clockwise until stator mates with the gasket in the suction housing recess.
- 5) Tighten hex head screws (P) through the stator clamp (36A) and into the tapped holes on the suction housing.
- 6) Place the top half of the stator support (31) over the stator and fasten to the bottom half using hex head screws (Q).
- 7) Place stator gasket (34) into the recess of the discharge flange (37).
- 8) Align tapped holes in the discharge flange (37) with the holes in the stator clamp (36B).
- 9) Tighten hex head screws (R) through The stator clamp (36B) and into the discharge flange/gasket assembly.

5.9 FINAL ASSEMBLY AND START-UP

- 1) Install all pipe plugs and grease fittings into the designated holes.
- 2) Assemble onto the suction chamber the inspection plates (32) and inspection plate gaskets (33) using hex head screws (L).
- 3) Connect up to power.
- 4) Start flush water to packing if required.
- 5) Open suction and discharge valves.
- 6) Start up the pump.

NOTE: Before operating the pump for the first time fill it with liquid. The liquid fill up will lubricate the stator for initial start up.

Diagnostic Chart

SYMPTOMS		POSSIBLE CAUSES	
1. NO DISCHARGE		1. 2. 3. 7. 26. 28. 29.	
2. LOSS OF CAPACITY		3. 4. 5. 6. 7. 8. 9. 10. 22. 13. 16. 17. 21. 22. 23. 29	
3. IRREGULAR DISCHARGE		3. 4. 5. 6. 7. 8. 13. 15. 29.	
4. PRIMING LOST AFTER START		3. 4. 5. 6. 7. 8. 13. 15	
5. PUMP STALLS AT START UP		8. 11. 24.	
6. PUMP OVERHEATS		8. 9. 11. 12. 18. 20	
7. MOTOR OVERHEATS		8. 11. 12. 15. 18. 20.	
8. EXCESSIVE POWER ABSORBED BY PUMP		8. 11. 12. 15. 18. 20	
9. NOISE AND VIBRATION		3. 4. 5. 6. 7. 8. 9. 11. 13. 15. 18. 19. 20. 22. 23. 27. 31	
10. PUMP ELEMENT WEAR		9. 11.	
11. EXCESSIVE GLAND OR SEAL WEAR		12. 14. 25. 30.	
12. GLAND LEAKAGE		13. 14.	
13. SEIZURE		9. 11. 12. 20.	
LIST OF CAUSES		REMEDIAL ACTIONS	
1. INCORRECT DIRECTION OF ROTATION		1. REVERSE MOTOR	
2. PUMP UNPRIMED		2. BLEED SYSTEM OF AIR/GAS	
3. INSUFFICIENT N.P.S.H. AVAILABLE		3. INCREASE SUCTION HEAD OR REDUCE SPEED/TEMP.	
4. PRODUCT VAPORISING IN SUPPLY LINE		4. INCREASE N.P.S.H. AVAILABLE (SEE 3 ABOVE)	
5. AIR ENTERING SUPPLY LINE		5. CHECK PIPE JOINTS/GLAND ADJUSTMENT	
6. INSUFFICIENT HEAD ABOVE SUPPLY VESSEL OUTLET		6. RAISE VESSEL/INCREASE PIPE SIZE	
7. FOOTVALVE/STRAINER OBSTRUCTED OR BLOCKED		7. CLEAN OUT SUCTION LINE/VALVES	
8. PRODUCT VISCOSITY ABOVE RATED FIGURE		8. DECREASE PUMP SPEED/INCREASE TEMP.	
9. PRODUCT TEMP. ABOVE RATED FIGURE		9. COOL THE PRODUCT	
10. PRODUCT VISCOSITY BELOW RATED FIGURE		10. INCREASE PUMP SPEED/REDUCE TEMP.	
11. DELIVERY PRESSURE ABOVE RATED FIGURE		11. CHECK FOR BLOCKAGES IN DELIVERY LINE	
12. GLAND OVERTIGHT		12. ADJUST GLAND SEE O&M INSTRUCTIONS	
13. GLAND UNDERTIGHT		13. ADJUST GLAND SEE O&M INSTRUCTIONS	
14. GLAND FLUSHING INADEQUATE		14. CHECK FLUID FLOWS FREELY INTO GLAND	
15. PUMP SPEED ABOVE RATED FIGURE		15. DECREASE PUMP SPEED	
16. PUMP SPEED BELOW RATED FIGURE		16. INCREASE PUMP SPEED	
17. BELT DRIVE SLIPPING		17. RE-TENSION BELTS	
18. COUPLING MISALIGNED		18. CHECK AND ADJUST ALIGNMENT	
19. INSECURE PUMP/DRIVE MOUNTING		19. CHECK AND TIGHTEN ALL PUMP MOUNTINGS	
20. SHAFT BEARING WEAR/FAILURE		20. REPLACE BEARINGS	
21. WORN PUMP ELEMENT		21. FIT NEW PARTS	
22. RELIEF VALVE CHATTER		22. CHECK CONDITION OF VALVE/RENEW	
23. R.V. INCORRECTLY SET		23. RE-ADJUST SPRING COMPRESSION	
24. LOW VOLTAGE		24. CHECK VOLTAGE/WIRING SIZES	
25. PRODUCT ENTERING PACKING AREA		25. CHECK PACKING CONDITION AND TYPE	
26. DRIVE TRAIN BREAKAGE		26. CHECK AND REPLACE BROKEN COMPONENTS	
27. NEGATIVE OR VERY LOW DELIVERY HEAD		27. CLOSE DELIVERY VALVE SLIGHTLY	
28. DISCHARGE BLOCKED/VALVE CLOSED		28. REVERSE PUMP/RELIEVE PRESSURE/CLEAR BLOCKAGES	
29. STATOR TURNING		29. REPLACE WORN PARTS/TIGHTEN UP STATOR BOLTS	
30. STUFFING BOX "EATS" PACKING		30. CHECK FOR WORN SHAFT AND REPLACE	
31. VEE BELTS		31. CHECK AND ADJUST TENSION OR REPLACE	

Drawing Reference Numbers

PART LIST

Part Number	Part Description	Quantity
1	Radial Grease Seal	1
2	Bearing Cover Plate	1
3	Bearing Cover Plate O'Ring	1
4	Drive Shaft Head	1
5	Drive Shaft O'Ring	1
6	Primary Thrust Plate	2
7	Key	4
8	Ring Gear	2
9	LockNut	2
10	Gear Ball	2
11	Secondary Thrust Plate	2
12	Seal Support	2
13	Gear Joint Seal	2
14	Drive Shaft	1
15	Tapered Roller Bearing	2
16	Bearing Spacer	1
17	Bearing Lock Plug	1
18	Bearing Nut	1
19	Thrust Grease Seal	1
20	Slinger Ring	1
21	Packing Gland Half	2
22	Packing	1 SET
23	Lantern Half Rings	2
26	Bearing Housing	1
27	Retaining Ring	1
28	Clamp Ring	1
29	Suction Housing	1
30	Stator	1
31	Stator Support	1
32	Inspection Plate	2
33	Inspection Plate Gasket	2
34	Stator Gasket	2
35	Stator Retaining Ring	2
36A & B	(A) Stator Ring Clip (B) Stator Clamp Ring	2
37	Discharge Flange	1
38	Connecting Rod	1
39	Gear Joint Shell	1
40	Rotor	1
41	Head Ring O'Ring	1
42	Head Ring	1

IMPORTANT NOTE

THE DRAWING REFERENCES SHOWN GIVE THE DESCRIPTION OF ALL THE PARTS DETAILED ON THE SECTIONAL DRAWINGS IN THIS SECTION OF THE BOOK. THEREFORE SOME OF THE REFERENCES MAY NOT BE SHOWN ON ANY ONE.

Drawing Reference Numbers

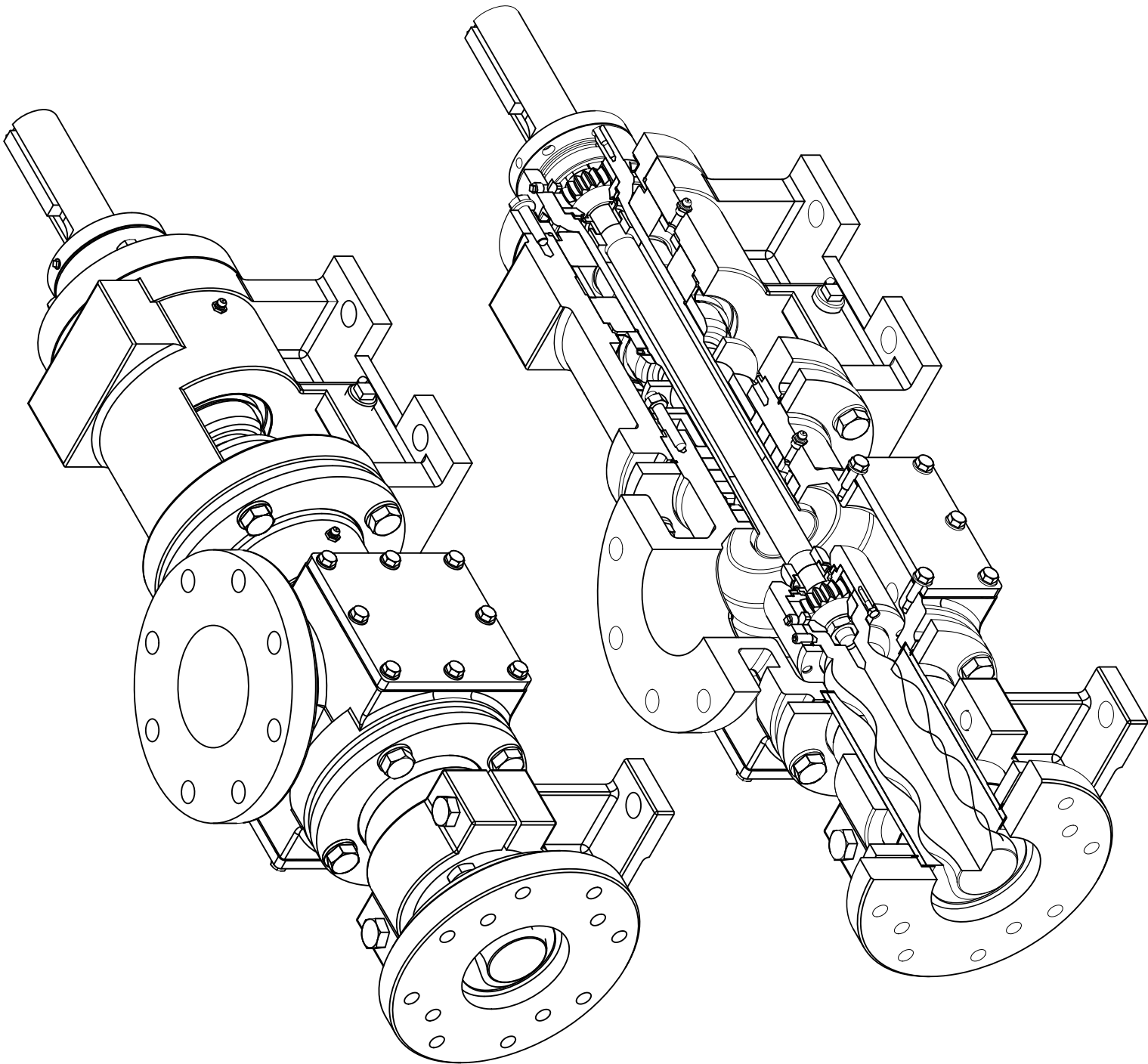
STANDARD HARDWARE

PART NUMBER	PART DESCRIPTION	QUANTITY
A	Shaft Key	1
B	Pipe Plug (SS)	3
C	Socket Head Screw	6
	Hex Head Screw	6
D	Lock Washer	6
E	Pipe Plug	2
F	Zerk Fittings	2
G	Pipe Plug	2
H	Packing Gland Studs	2
J	Gland Adjusting Nuts	2
	Hex Head Screw	4
K	Lock Washer	4
	Hex Head Screw	16
L	Lock Washer	16
M	Pipe Plug	1
N	Set Screw (SS thread sealing compound)	1
O	Socket Head Screw	6
	Hex Head Screw	4
P	Lock Washer	4
	Hex Head Screw 5/8" BSW	2
Q	Lock Washer	2
	Hex Head Screw 5/8" BSW	4
R	Lock Washer	4

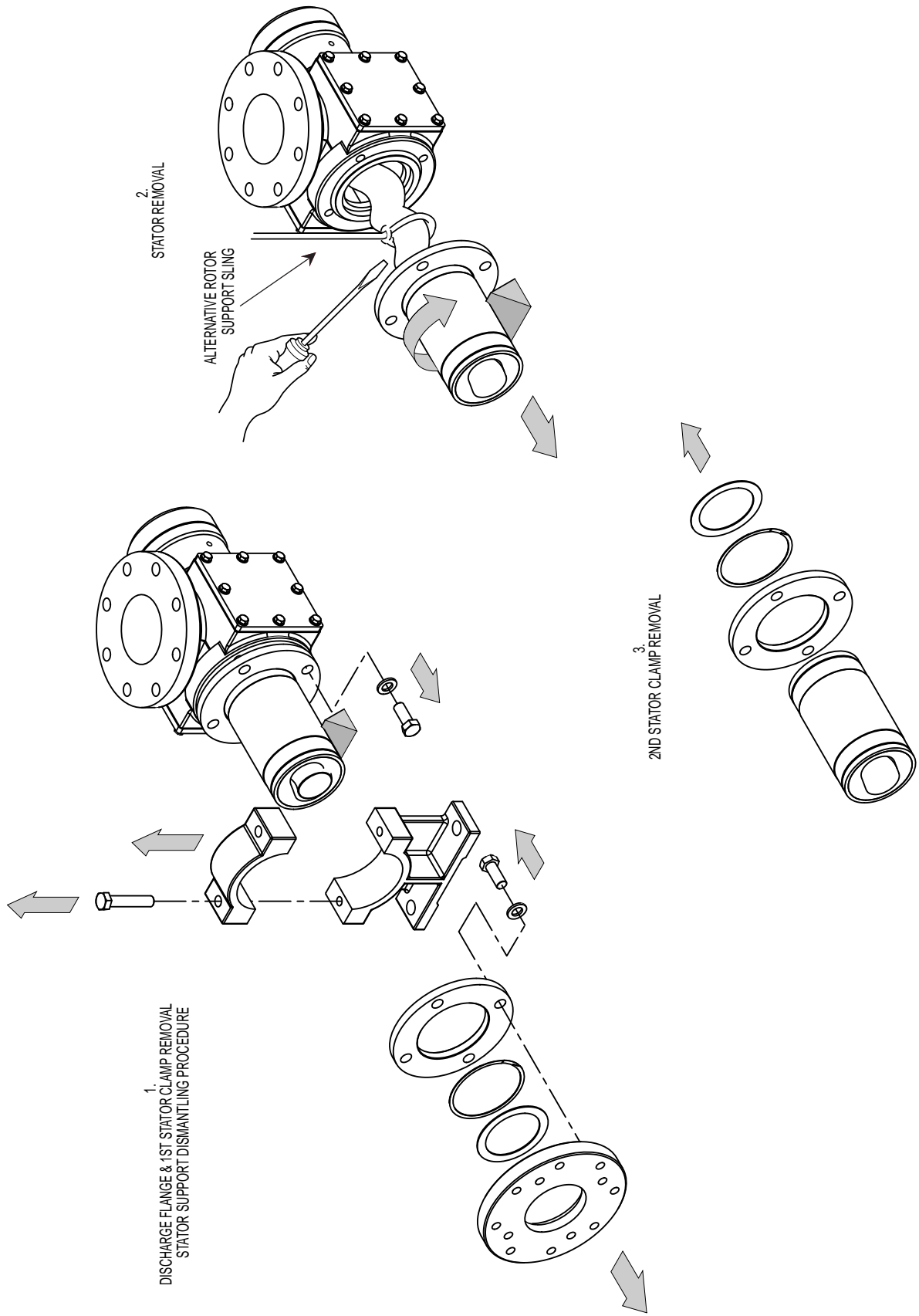
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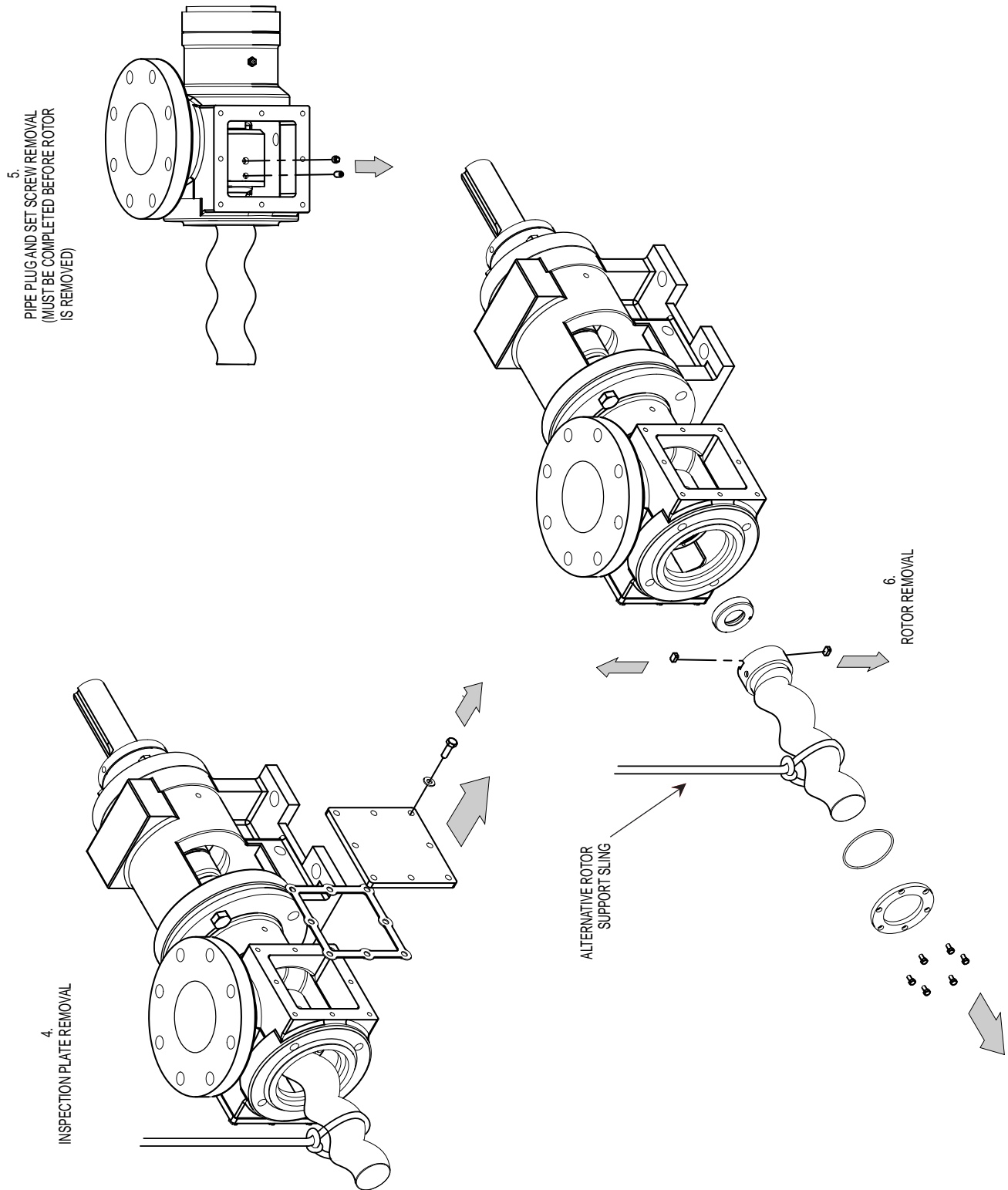
Dismantling & Assembly Diagrams



Dismantling & Assembly Diagrams

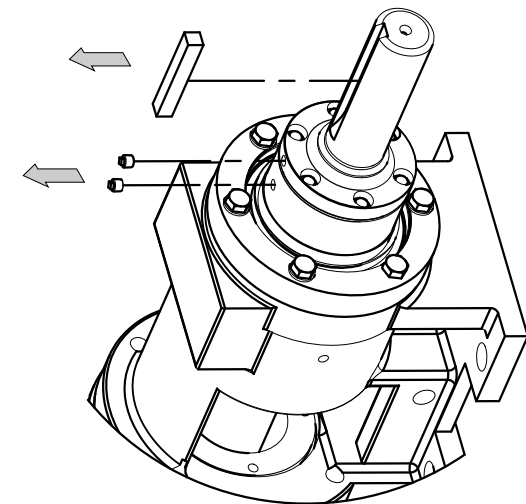


Dismantling & Assembly Diagrams

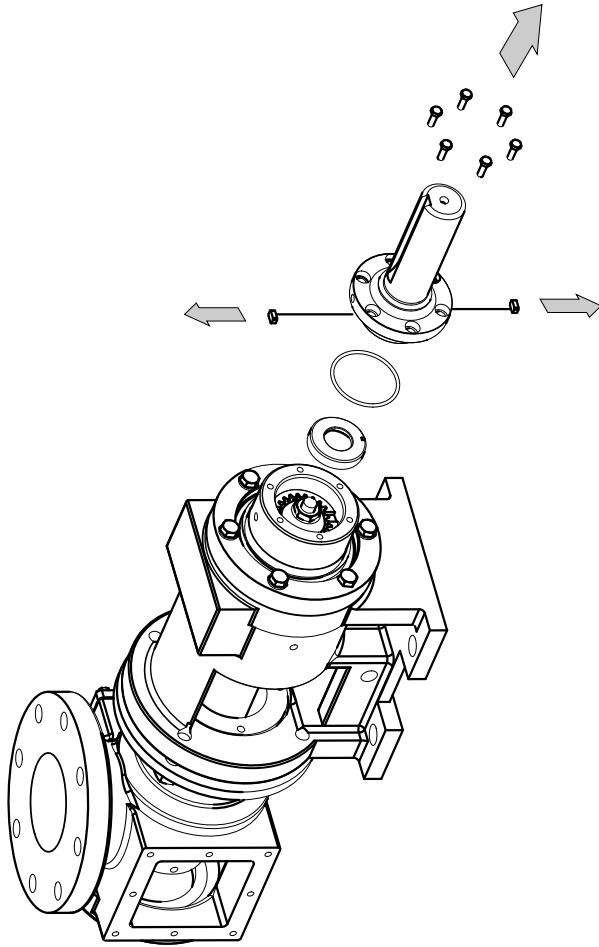


Dismantling & Assembly Diagrams

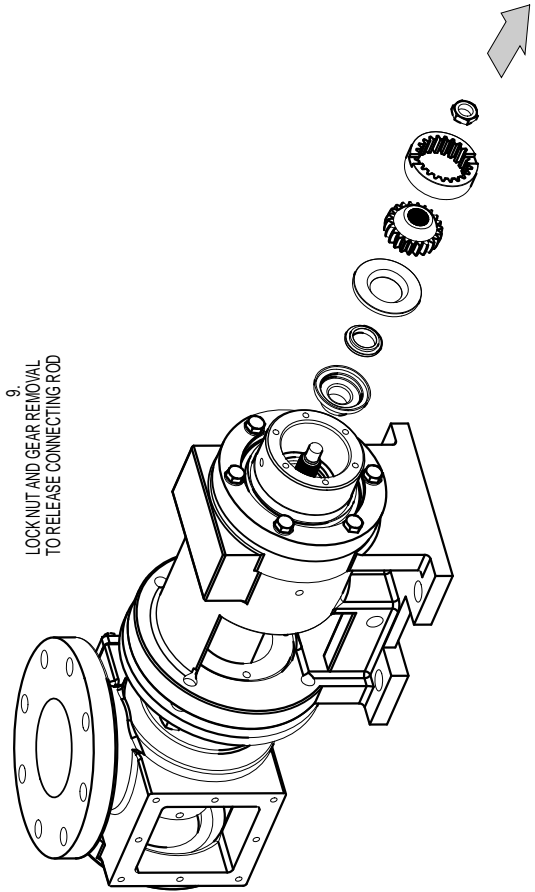
7.
PIPE PLUG AND SET SCREW REMOVAL
(MUST BE COMPLETED BEFORE DRIVESHAFT
HEAD IS REMOVED)



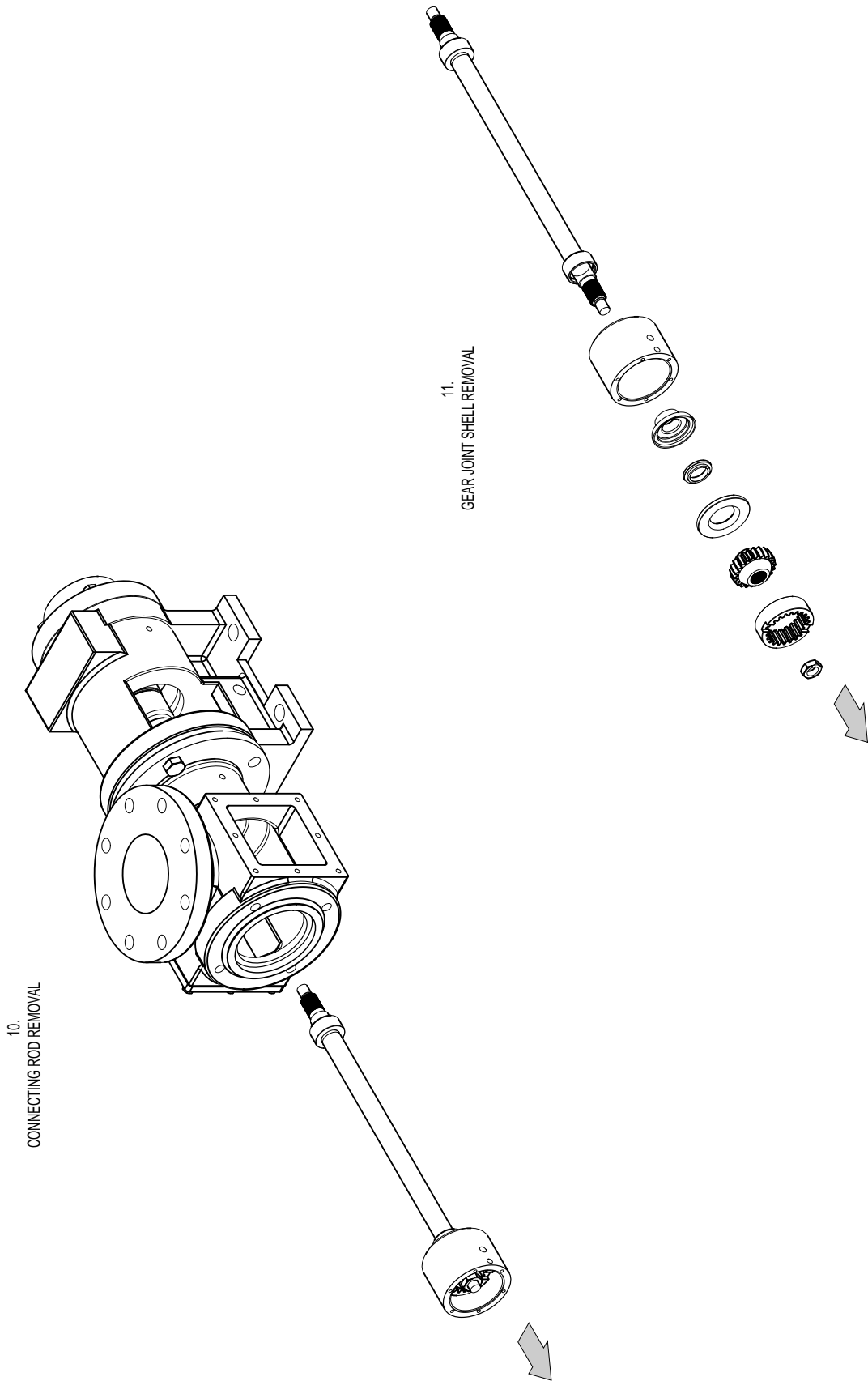
8.
DRIVESHAFT HEAD REMOVAL



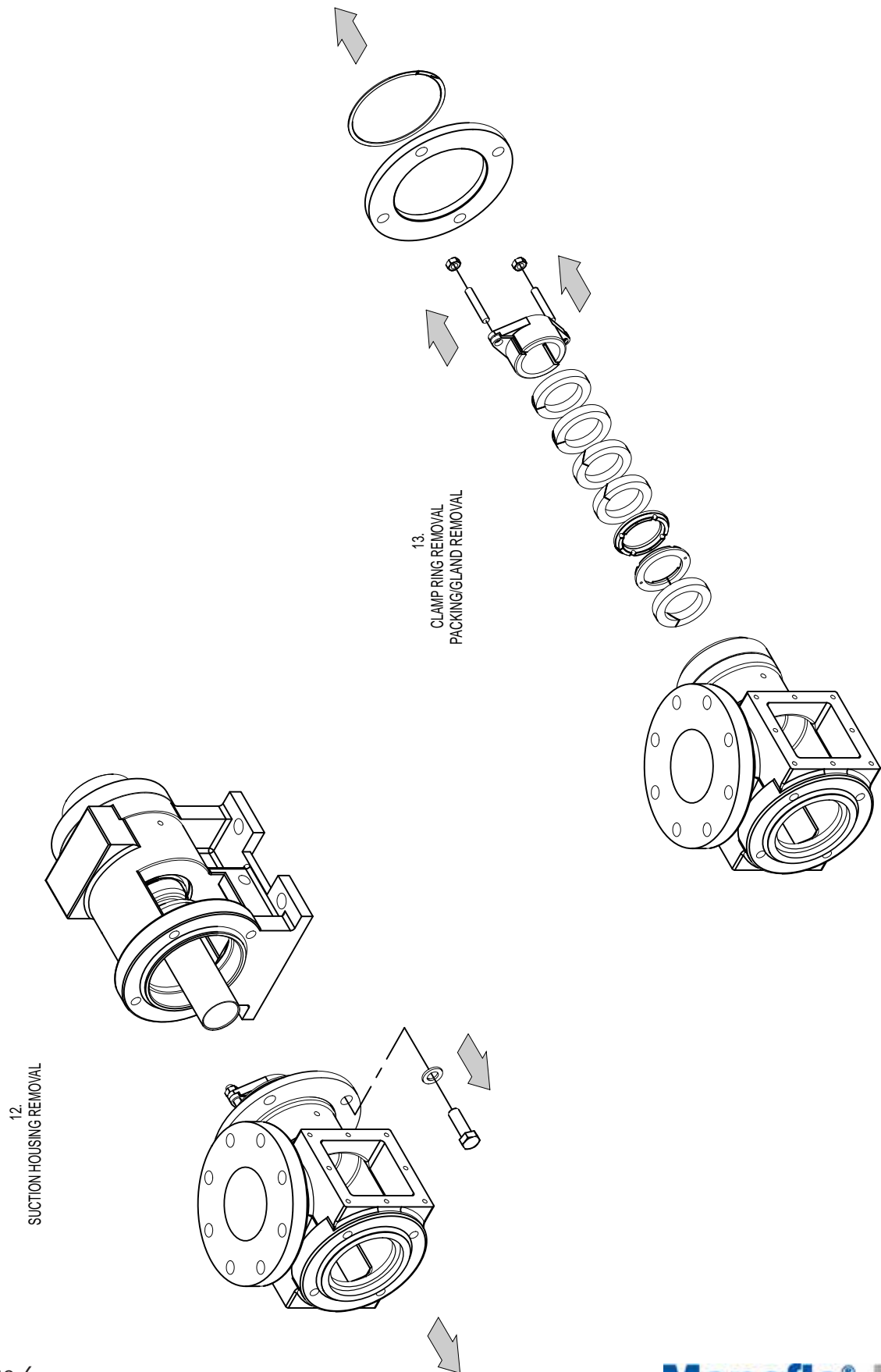
9.
LOCK NUT AND GEAR REMOVAL
TO RELEASE CONNECTING ROD



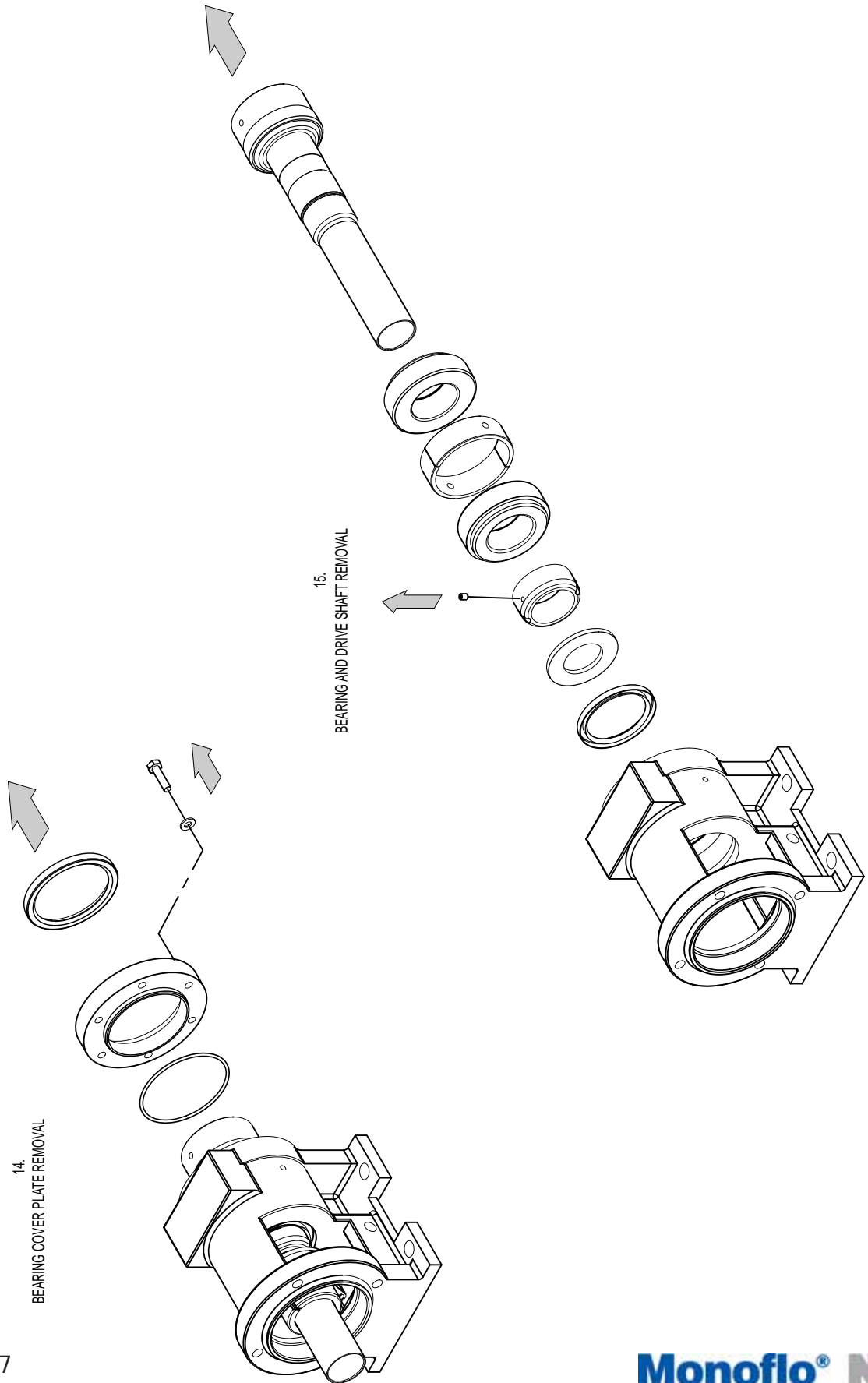
Dismantling & Assembly Diagrams



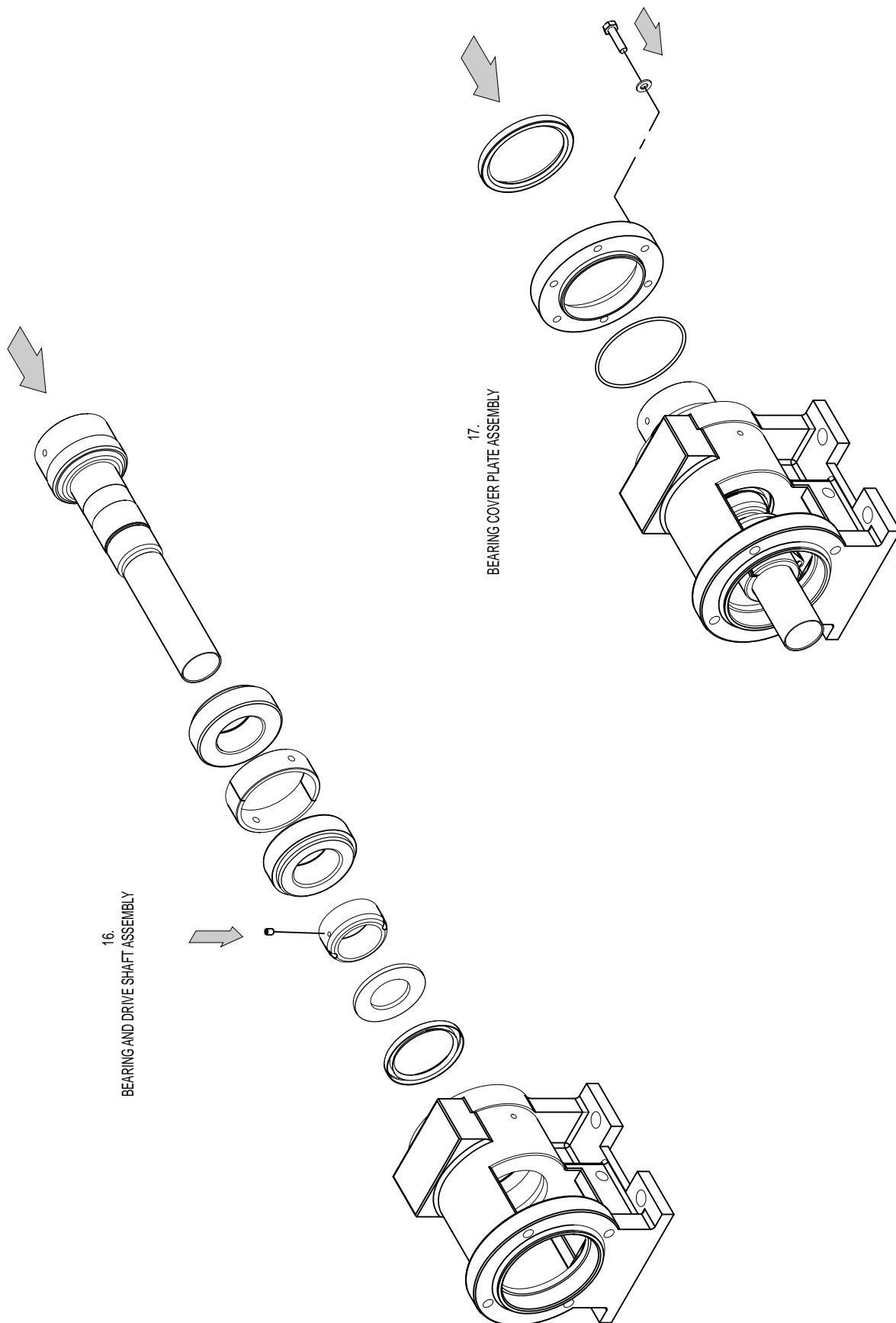
Dismantling & Assembly Diagrams



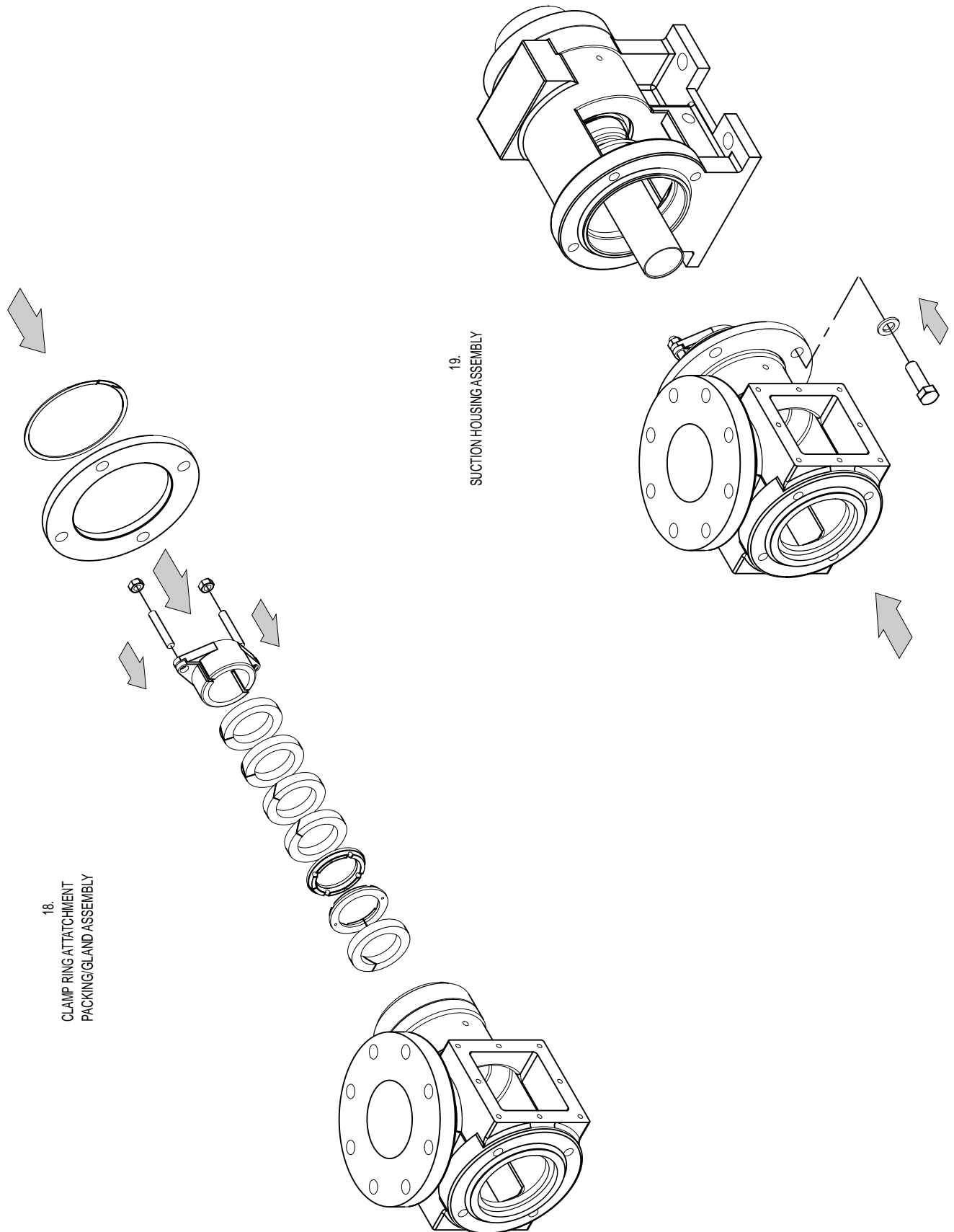
Dismantling & Assembly Diagrams



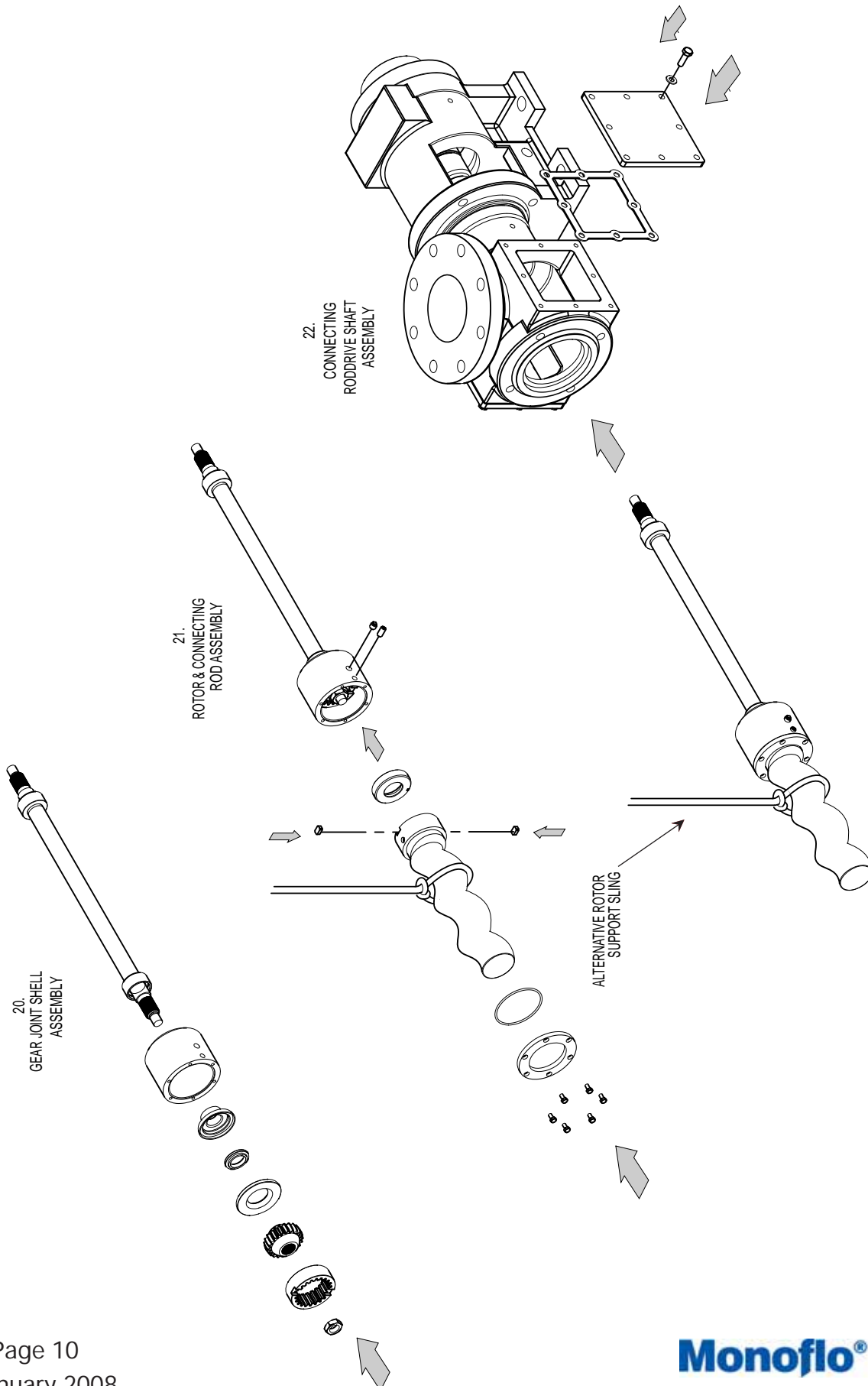
Dismantling & Assembly Diagrams



Dismantling & Assembly Diagrams

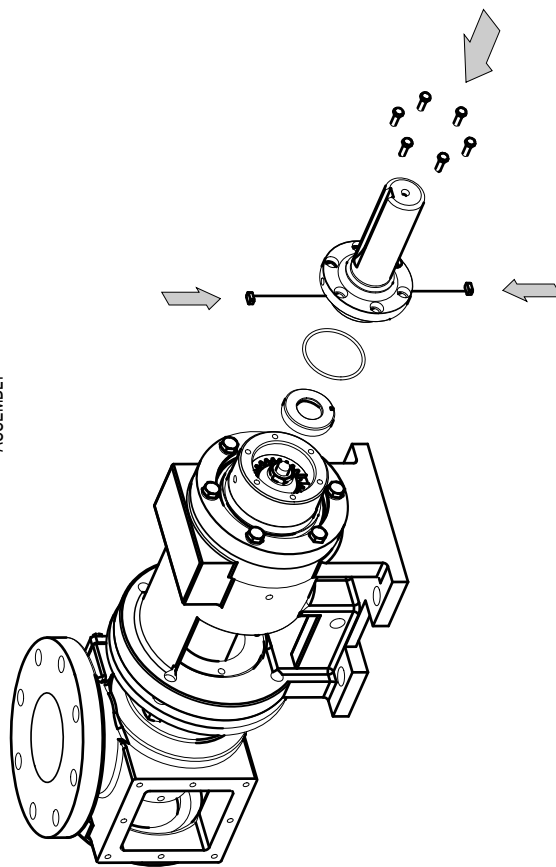


Dismantling & Assembly Diagrams

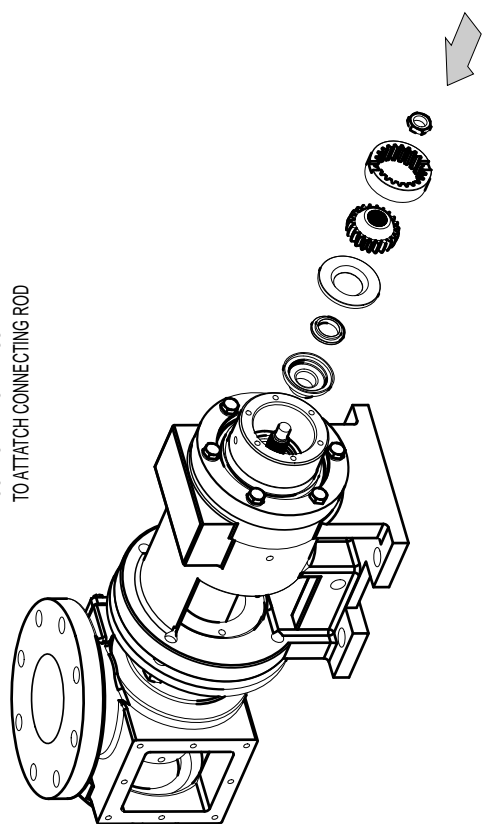


Dismantling & Assembly Diagrams

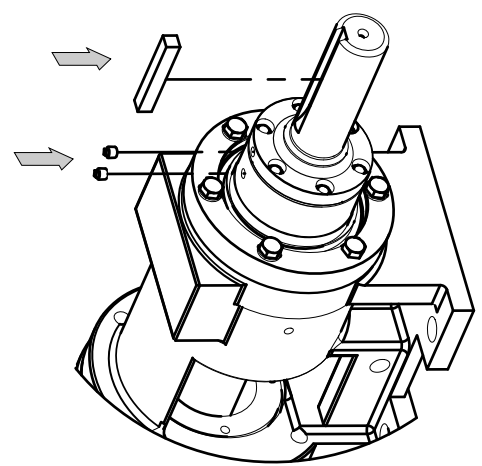
24.
DRIVESHAFT HEAD
ASSEMBLY



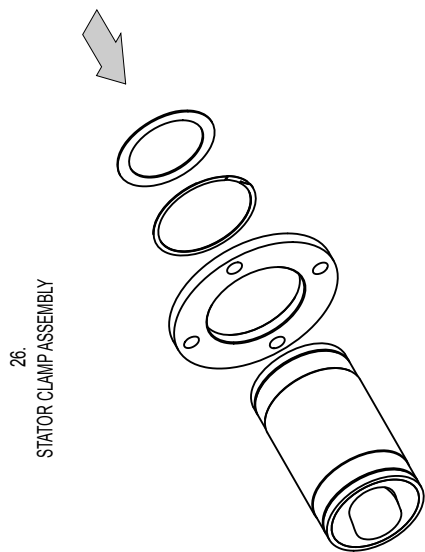
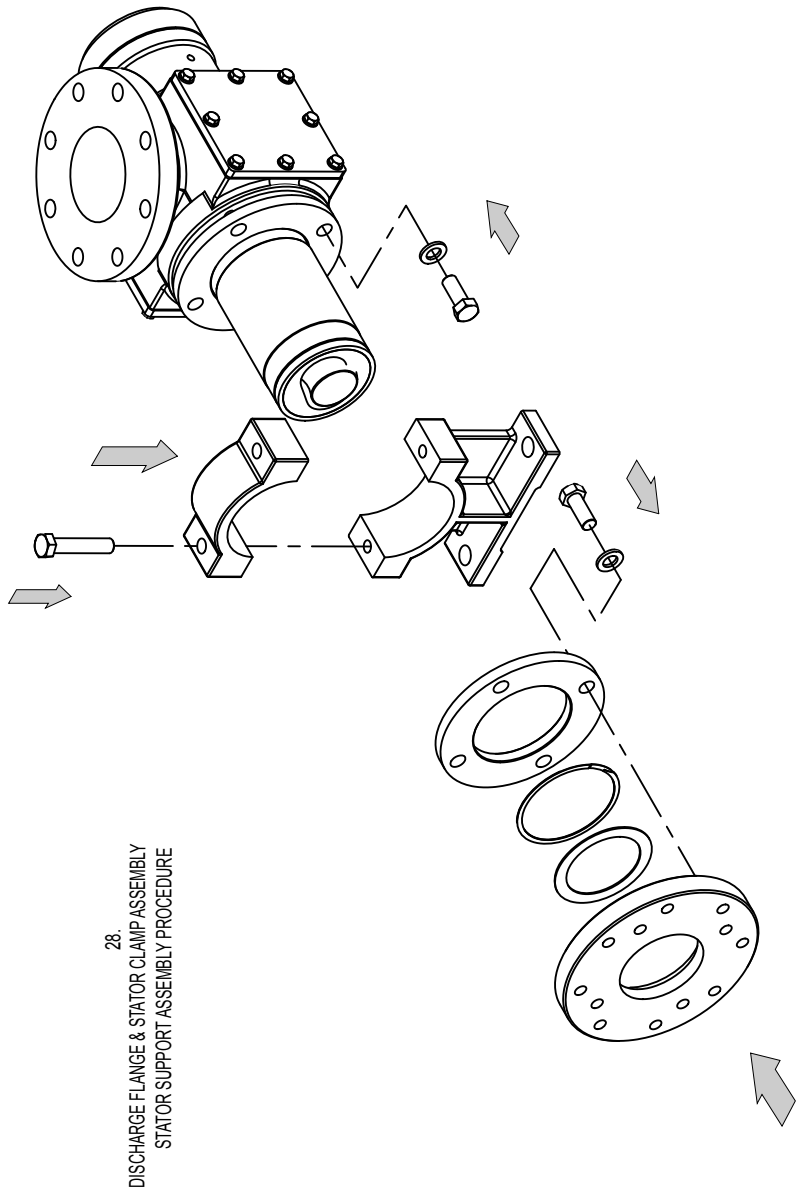
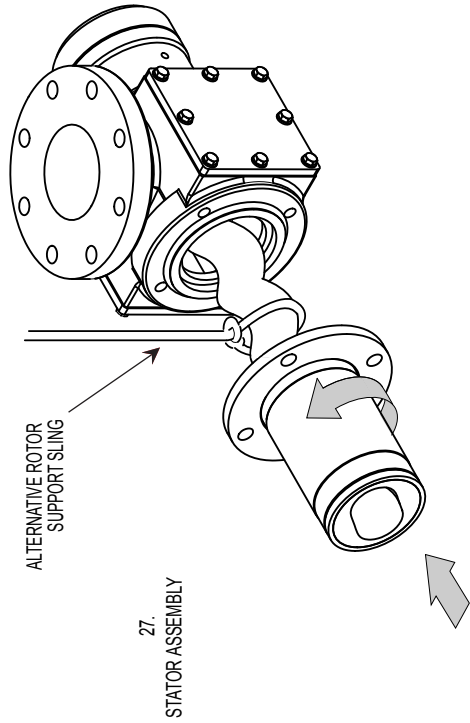
23.
LOCK NUT AND GEAR ASSEMBLY
TO ATTACH CONNECTING ROD



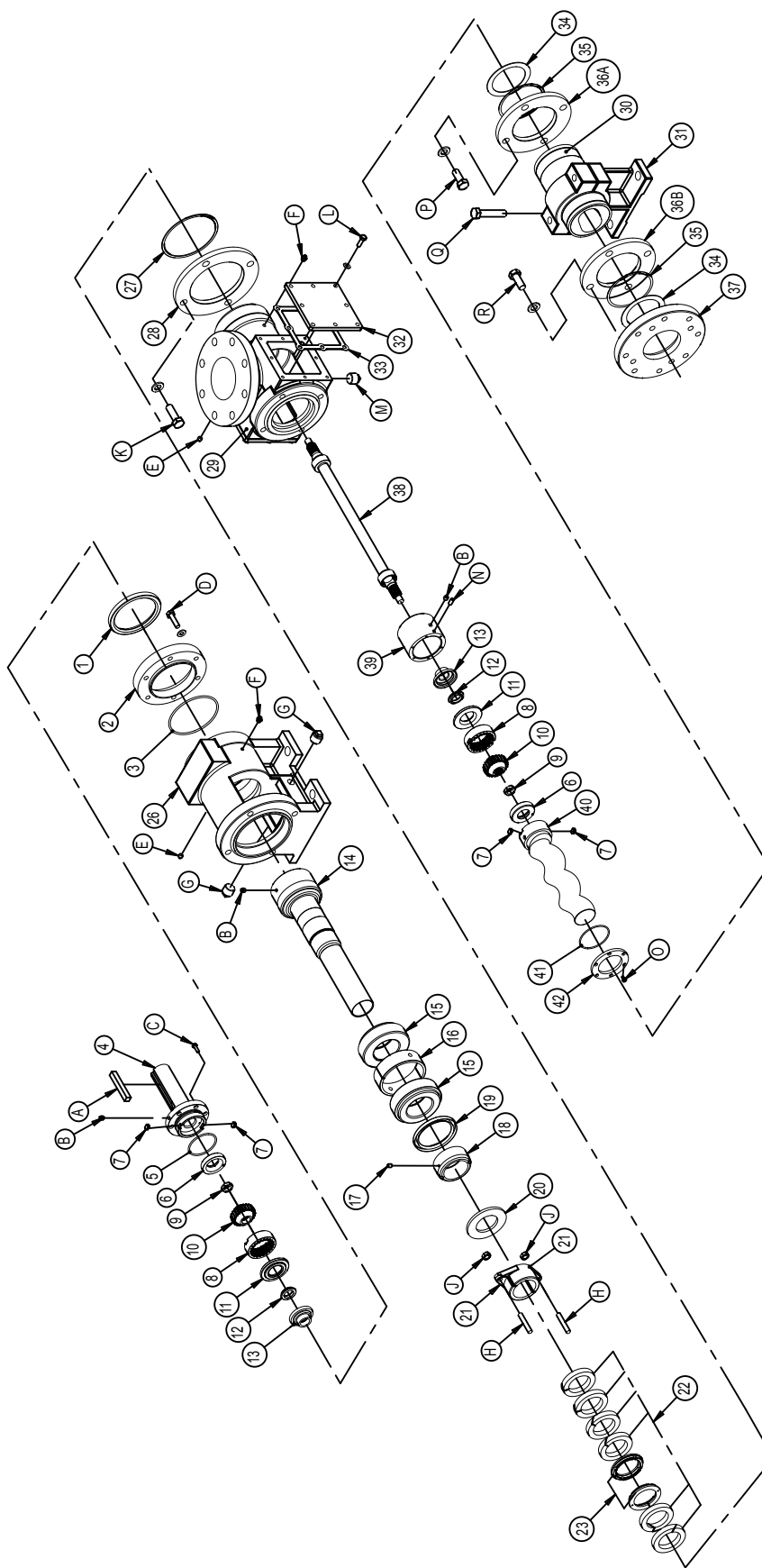
25.
DRIVESHAFT KEY, PIPE PLUG AND
SET SCREW ASSEMBLY



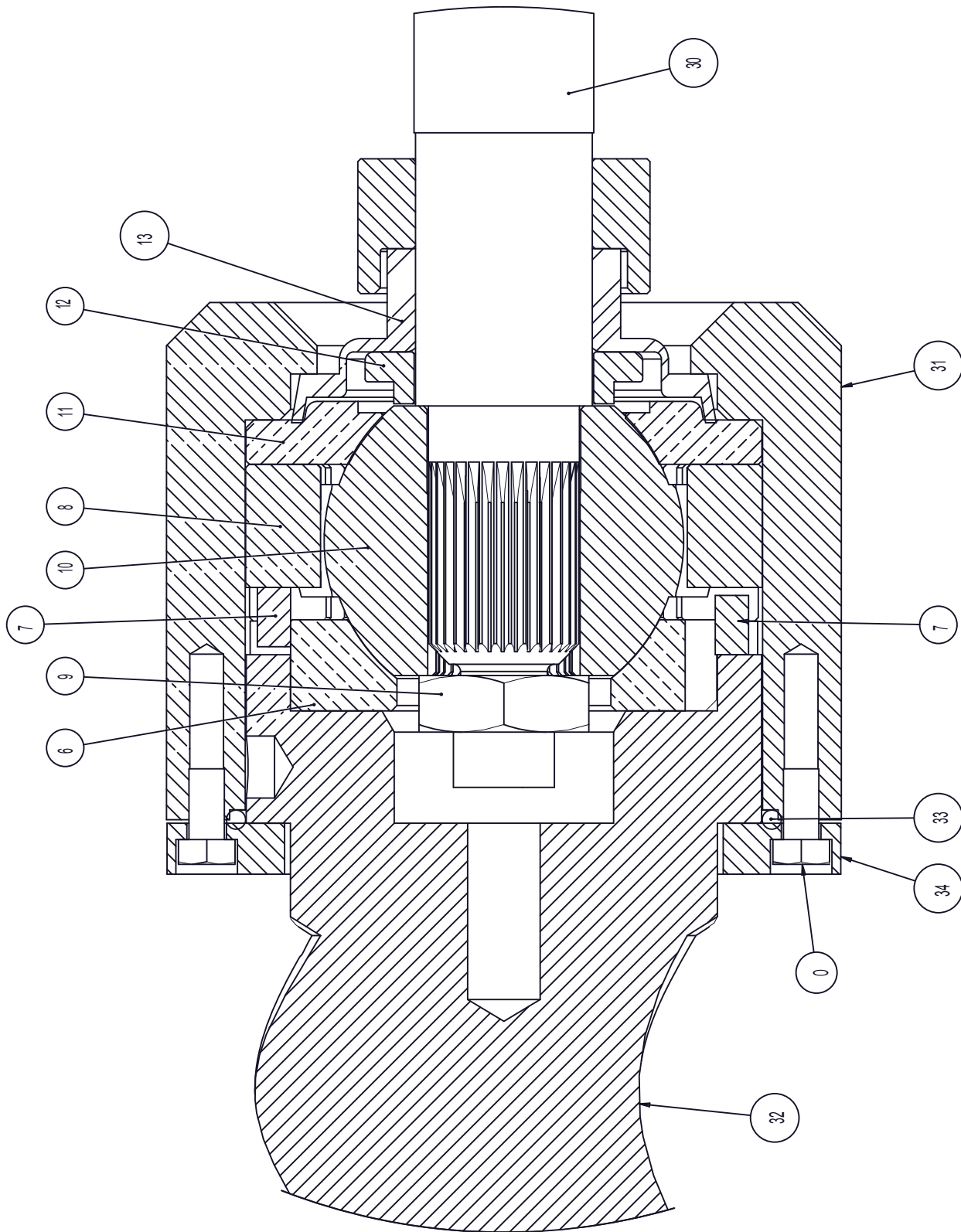
Dismantling & Assembly Diagrams



Exploded Views



Exploded Views



SECTIONAL VIEW OF GEAR JOINT
NOTE: ROTOR END SHOWN, DRIVE END IDENTICAL

Torque Tightening Figures

TORQUE GUIDELINES CHART			
Stainless Steel		Carbon Steel Bolts	
Size	Max Torque	Size	Max Torque
NO. 10 - 24	22.8 in. lb	5/16"-18	10 ft.lb.
1/4"-20	75.2 in. lb	3/8"-16	21.7 ft.lb.
5/16"-18	132 in. lb	1/2"-13	43.5 ft.lb.
3/8"-16	236 in. lb	5/8"-11	86 ft.lb.
1/2"-13	517 in. lb	3/4"-10	152 ft.lb.

CONNECTING ROD LOCK NUTS		
Drive End	Size	Max Torque
E	9/16"-18	25 ft. lb.
F	3/4"-16	35 ft. lb.
G	7/8"-14	50 ft. lb.
H	1 1/4"-12	85 ft. lb.
J	1 1/2"-12	110 ft. lb.

Torque Values are from the Industrial Fasteners Institute and Craftsman Corp.

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