English

Original Instructions

Installation, Operation and Maintenance Instructions

Vertical Epsilon Range

Size P14A - P1BK

Single Stage, Two Stage & K Build

OMMP/065/01
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ATEX Warning Statements

PUMPS AND PUMP UNITS

Where a pump or pump unit is to be installed in a potentially explosive atmosphere ensure that this has been specified at the time of purchase and that the equipment has been supplied accordingly and displays an ATEX nameplate or is supplied with a certificate of conformity. If there is any doubt as to the suitability of the equipment please contact Your Supplier before commencing with installation and commissioning.

Process liquids or fluids should be kept within specified temperature limits otherwise the surface of pump or system components may become an ignition source due to temperature rises. Where the process liquid temperature is less that 90ºC (194ºF) the maximum surface temperature will not exceed 90ºC (194ºF) provided the pump is installed, operated and maintained in accordance with this manual. Where the process fluid temperature exceeds 90ºC (194ºF) the maximum surface temperature will be equal to the maximum process fluid temperature.

Cavities that could allow the accumulation of explosive gases, such as under guards, should where possible, be designed out of the system. Where this is not possible they should be fully purged before any work is carried out on the pump or system.

Electrical installation and maintenance work should only be carried out by suitably qualified and competent persons and must be in accordance with relevant electrical regulations.

All electrical equipment, including control and safety devices, should be suitably rated for the environment in to which they are installed.

Where there may be a risk of an accumulation of explosive gases or dust non-sparking tools should be used for installation and maintenance.

In addition to causing permanent damage to the stator, dry running of the pump could generate a rapid rise in the temperature of the stator tube or barrel, which could become an ignition source. It is therefore essential that a dry run protection device be fitted. This must shut the pump down immediately should a dry run situation occur. Details of suitable devices are available from Your Supplier.

To minimise the risk of sparking or temperature rises due to mechanical or electrical overload the following control and safety devices should be fitted in addition to a dry run protection system. A pressure relief system whereby the pump can not generate pressures in excess of the maximum rated pressure or an over pressure device which should shut the pump down when the maximum discharge pressure is exceeded. A control system that will shut the pump down if the motor current or temperature exceed specified limits. An isolator switch that will disconnect all electrical supply to the motor and ancillary electrical equipment and be capable of being locked in the off position. All control and safety devices should be fitted, operated and maintained in accordance with the manufacturer's instructions. All valves on the system should be open when the pump is started otherwise serious mechanical overload and failure may result.

It is important that the pump rotates in the direction indicated on the nameplate. This must be checked on installation and commissioning and after any maintenance has been carried out. Failure to observe this may lead to dry running or mechanical or electrical overload.

ATEX Warning Statements

When fitting drives, couplings, belts, pulleys and guards to a pump or pump unit it is essential that these are correctly fitted, aligned and adjusted in accordance with the manufacturer's instructions. Failure to do so may result in sparking due to unintended mechanical contact or temperature rises due to mechanical or electrical overload or slipping of drive belts. Regular inspection of these parts must be carried out to ensure they are in good condition and replacement of any suspect part must be carried out immediately.

Mechanical seals should be suitably rated for the environment. The seal and any associated equipment, such as a flushing system, must be installed, operated and maintained in accordance with the manufacturer's instructions.

Where a packed gland seal is fitted this must be correctly fitted and adjusted. This type of seal relies on the process liquid to cool the shaft and packing rings so a constant drip of liquid from the gland section is required. Where this is undesirable an alternative seal type should be fitted.

Failure to operate or maintain the pump and ancillary equipment in line with the manufacturer's instructions may lead to premature and potentially dangerous failure of components. Regular inspection, and where necessary replacement, of bearings and lubrication is essential.

The pump and its components have been designed to ensure safe operation within the guidelines covered by legislation. Accordingly Your Supplier has declared the machine safe to use for the duty specified as defined by the Declaration of Incorporation or Conformity that is issued with this instruction manual.

The use of replacement parts that are not manufactured by or approved by Your Supplier may affect the safe operation of the pump and it may therefore become a safety hazard to both operators and other equipment. In these circumstances the Declaration provided will become invalid. The guarantee referenced on the Terms and Conditions of Sale will also be invalidated.

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EC Declaration as defined by Machinery Directive 2006/42/EC.

The following harmonised standards are applicable: BS EN 809, BS EN ISO 12100 Parts 1 & 2

EC Declaration of Incorporation

This declaration is only valid when partly completed machinery has been supplied.

In this case, the machinery meets the requirements of the said directive and is intended for incorporation into other machinery or for assembly with other machinery in order to constitute relevant machinery as defined by the said directive including any amendments, which are valid at the time of supply.

IMPORTANT

This machinery must not be put into service until the relevant machinery into which it is to be incorporated has been declared in conformity to the said directive.

This declaration is only valid when the machinery has been installed, operated and maintained in accordance with these instructions and safety guidelines contained within as well as instructions supplied for equipment assembled with or intended for use with this equipment.

EC Declaration of Conformity

This declaration is not valid for partly completed machinery that has been supplied.

In this case the machinery meets the requirements of the said directive including any amendments which are valid at the time of supply.

We further declare that, where applicable, said machinery also meets the requirements of:

The EMC Directive 2004/108/EC
The Low Voltage Directive 2006/95/E
The Pressure Equipment Directive 2005/88/EC
The Outdoor Noise Directive 2000/14/EC
and subsequent amemdments
The Drinking Water Directive 98/83/EC

IMPORTANT

This declaration is only valid when the machinery has been installed, operated and maintained in accordance with these instructions and safety guidelines contained within as well as instructions supplied for equipment assembled with or intended for use with this equipment.

Mr A. Morris - Engineering Manager - PDS
for Mono Pumps Limited, Greengate Way, Middleton,
Manchester, England, M24 1SA.

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.

1.2.1. GENERAL

When handling harmful or objectionable materials, adequate ventilation must be provided in order to disperse dangerous concentrations of vapours. It is recommended that wherever possible, Your Supplier's 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.

Pumps operating on high temperature duties should be allowed to cool sufficiently before any maintenance is carried out.

1.2.2. 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.

i. HORIZONTAL MOUNTING

All ranges excluding P Range Your Supplier's pumps are normally installed in a horizontal position with baseplates mounted on a flat surface, grouted in and bolted, thus ensuring firm fixing and a reduction in noise and vibration.

The unit should be checked after bolting down to ensure that the alignment of the pump to its prime mover is correct.

ii. VERTICAL MOUNTING P Range Pumps Only

The P range pumps are intended for vertical installation. Care must be taken when lifting the pump into the vertical position.

Normally 'P' range pumps will be designed with a sole plate that will be bolted to the customers framework.

If the pump is to be mounted in any way other than described above, confirmation of the installation must be agreed with Your Supplier. All the pipework should be independently supported.

1.3.1 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 bareshaft 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.

1.3.2 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 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.
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.

See section 1.8 prior to starting for instructions on how to fit constant level oilers.

1.4 ELECTRICAL

Electrical connection should only be made using equipment suitable for both rating and environment. Where any doubts exist regarding the suitability of equipment, Your Supplier, should be consulted before proceeding. Normally the Supplier's 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 pressurising 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.

1.5 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-pressurisation 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.

1.6 GENERAL SAFETY

GREAT CARE MUST BE TAKEN TO PROTECT ALL ELECTRICAL EQUIPMENYOUR SUPPLIER HAS 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. May contain substances from the ECHA SVHC Candidates List (REACH - Regulation (EC) No. 1907/2006)

1.7 DUTY CONDITIONS

Pumps should only be installed on duties for which Your Supplier has 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, YOUR SUPPLIER SHOULD BE CONTACTED AND THEIR RECOMMENDATIONS SOUGHT IN THE INTEREST OF APPLICATION, SAFETY OF PLANT, EFFICIENCY AND PUMP LIFE.

1.8 All vertical pumps require 2 constant level oilers to be fitted to the gland section in order to prevent the mechanical seals dry-running. The oilers will be supplied loose with the pump to avoid damage during transit, so upon receipt of the equipment they will need to be installed prior to operation. Instructions for fitting the oilers are as follows:

- Completely fill the two mechanical seal cavities through the upper ¼" NPT ports on the gland section with mineral oil so that no air is left surrounding the mechanical seals. The two cavities are connected however it may be necessary to fill with oil through both ports due to the intricate path between the two mechanical seal cavities.
- Before attaching the oilers to the gland section, ensure the ¼" male nipple is fitted to each oiler and proceed to completely fill the oilers with mineral oil.
- Attach the oilers to the ¼" NPT ports and tighten until no oil leaks from the connection.
- Note the level of oil in the oiler and regularly check the oilers to ensure they have not emptied.

Because mechanical seals do have an expected leak rate the oilers will need to be re-filled with oil periodically. The precise level of oil in the oilers is not critical because as long as there is oil visible in the oiler then the seals will be quenched with oil

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 owing to the close rotor/stator fit. However, this stiffness disappears when the pump is running normally against pressure.

Prior to start up ensure that all vertical pumps have constant level oilers fitted as per section 1.8.

2.1 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.

2.2 PUMP ROTATION DETAILS

PUMP RANGE	BI-DIRECTIONAL	COMMENT
Epsilon	Yes	†
E	Yes	†
Monobloc B	Yes	†
Compact	Yes	†
Merlin Industrial	Yes	†
S, SL	Yes	†
LF	Yes	†
W	No	**
Merlin Widethroat	No	**
MM, ML	No	*
MS	No	**
G	No	*
CB / SB	No	*
Placer	No	**
Grout Injection	No	**
P	No	*
CP0011	No	**
CP0025, CO0800, CP1600	No	*

* Clockwise when viewed from drive end.
** Anti-clockwise when viewed from drive end.
† Anti-clockwise gives inlet at drive end.

DIRECTIONS OF ROTATION

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

2.5 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.

2.6 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 50°C (122ºF).

In these instances, personnel must be made aware of this and suitable warnings/guarding used.

2.7 NOISE LEVELS

1. The sound pressure level should not exceed 85dB at one metre (3.3 yards) 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 or installation pipework
3. It is recommended the actual pump unit noise levels are ascertained once the unit is installed and running at duty conditions

2.8 LUBRICATION

Pumps fitted with bearings should be inspected periodically to see if grease replenishment is necessary, and if so, grease should be added until the chambers at the ends of the bearing spacer are approximately one third full.

Periodic bearing inspection is necessary to maintain optimum bearing performance. The most expedient time to inspect is during periods of regular scheduled equipment downtime - for routine maintenance or for any other reason.

Under tropical or other arduous conditions, however, a more frequent examination may be necessary. It is therefore advisable to establish a correct maintenance schedule or periodic inspection.

BP LC2 / Mobilgrease XHP 222 or their equivalent must be used for replenishment.

2.9 PUMP UNITS

Where a pump unit is dismantled and re-assembled, consideration must be given to ensure that where appropriate the following steps are covered.

1. Correct alignment of pump/gearbox
2. Use of appropriate couplings & bushes
3. Use of appropriate belts & pulleys correctly tensioned.

2.10 CLEANING PRIOR TO OPERATION

i. Non Food Use

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

ii. Food Use

When a pump has been supplied for a food application, it is important to ensure that the pump is clean prior to initial operation of the pump.

Therefore, it is important that a clean-in-place treatment is executed on the pump at the following times:

1. When the pump is first commissioned for use.
2. When any spare components are fitted into the wetted area of the pump.

A recommended CIP procedure is as follows:

This procedure should not be used on the CP Pump Range. Please consult our application engineers for a suitable procedure.

Caustic Wash

LQ94 ex Lever Diversey or equivalent 2% concentration

Acid Wash

P3 Horolith 617 ex Henkel
Ecolab or equivalent 1% concentration

Procedure

1. Caustic wash @ 75°C (167°F) for 20 mins
2. Water rinse @ 80°C (176°F) for 20 mins
3. Acid wash @ 50°C (122°F) for 20 mins
4. Water rinse @ 80°C (176) for 20 mins for 20 mins

- CIP flow rates (hence pump speeds) should be maximised to achieve highest level of cleanability.

  A C.I.P. liquid velocity of 1.5 m/s (4.9 ft/s) to 2.0 m/s (6.6 ft/s) is required for removal of solids and soiling.

  Pumps fitted with CIP by pass ports will permit higher flow rates without the need to increase pump speed.

- The use of neat active caustic and acid chemicals is not recommended. Proprietary cleaning agents should be used in line with manufacturers instructions.

- All seals and gaskets should be replaced with new if disturbed during maintenance.

- Pump internals should be regularly inspected to ensure hygienic integrity is maintained, especially with respect to elastomeric components and seals, and replaced if necessary.

  The four stages constitute one cycle and we recommend that this cycle is used to clean the pump before use on food.

  Once the pump has been commissioned, the cleaning process will depend upon the application. The user must therefore ensure that their cleaning procedures are suitable for the duty for which the pump has been purchased.

2.11 WIDETHROAT PUMPS

Specific pumps may have auger feed screws, with or without a bridge breaker system to feed the pumping element. If the pump installation requires that these cannot be enclosed, care must be taken to ensure personnel cannot gain access whilst the pump is operating. If this is not possible an emergency stop device must be fitted nearby.

2.12 EXPLOSIVE PRODUCTS/ HAZARDOUS ATMOSPHERES

In certain instances the product being pumped may well be of a hazardous nature.

In these installations consideration must be given to provide suitable protection and appropriate warnings to safeguard personnel and plant.

2.13 ACCESS PORTS

Where access ports are fitted then the following steps must be followed prior to removal:

1. Pump must be shut down and the electrical supply isolated.
2. Protective clothing should be worn, especially if the pumped product is obnoxious.
3. Remove access plate with care utilising where possible drip trays to collect product leakage.

Access ports are included to assist in removing blockages and to allow a visual check on the components within the suction chamber.

It is not to be considered as an additional method in dismantling the pump.

Re-assembly of the plate should be completed using new gaskets prior to the pump being switched on.

2.14 ADJUSTABLE STATORS

If adjustable stators are fitted then the following steps must be followed for adjusting the clamping devices.

The adjustable stator assembly is designed to give an even compression around the stator circumference. It is designed to be used when pump performance reduces through wear to an unacceptable level, to restore the required flow rate.

The stator compression is increased using the following steps:

1. Release the six locking screws half a turn.
2. Tighten the eight clamp screws until adjustment allowed by releasing the lock screws has been taken up.
3. Repeat steps 1 and 2 until the pump performance has been restored to its former level.

NOTE

It is imperative that when adjusting the stator that only sufficient pressure is placed on the stator to enable the capacity of the pump to be reinstated.

Over tightening of the stator could easily result in damage to the driver by overload and so extreme care must be taken when carrying out these adjustments.

It is therefore advisable to make the adjustment while the pump is running and power readings can be monitored.

REMOVAL OF ADJUSTABLE STATOR

The procedure for removal of an adjustable stator is the same as that of a standard one, except it is necessary to remove the clamp plates before the stator can be twisted off the rotor.

This can be done by undoing the clamp screws; then releasing the clamp plate by using the locking screws as jacking screws to remove the clamp plates.

Re-assembly will be done using the reverse procedure.

2.15 MAINTENANCE OF WEARING COMPONENTS

2.15.1 ROTOR AND STATOR

The wear rate on these components is dependent on many factors, such as product abrasivity, speed, pressure etc.

When pump performance has reduced to an unacceptable level one or possibly both items will need replacing.

2.15.2 DRIVE SHAFT - PACKED GLAND

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

2.15.3 COUPLING ROD JOINTS

Regular maintenance and lubrication will maximise life of the joints.

Replacement of one or both joint assemblies and possibly the coupling rod may be necessary when wear is apparent.

It is essential to replace all the joint items with genuine parts from your Supplier to ensure maximum life.

2.15.4 FLEXISHAFT DRIVE PUMPS

With this design there are no wearing items to replace in the drive train, however, if during routine inspection the shaft is visibly damaged / distorted or the protective coating is damaged, then this item should be replaced to avoid unexpected breakdowns.

2.16 MECHANICAL SPEED VARIATORS

Refer to the manufacturers instructions.

These machines require regular maintenance, which typically includes weekly adjustment through the full speed range.

3.0 ASSEMBLY AND DISMANTLING

Section 4 contains the steps to dismantle and re-assemble the pump. All fastenings must be tightened securely and when identified the appropriate torque figures should be used.

3.1 USE OF ITEMS NOT APPROVED OR MANUFACTURED BY YOUR SUPPLIER

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

As a consequence Your Supplier has declared the machine safe to use for the duty specified as defined by the Declaration of Incorporation or Conformity that is issued with this Instruction Manual.

The use of replacement items that are not approved by or manufactured by Your Supplier may affect the safe operation of the pump and it may therefore become a safety hazard to both operators and other equipment. In these instances the Declaration provided will therefore become invalid. 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 Your Supplier.

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.

IMPORTANT INFORMATION FOR VERTICAL P-RANGE PUMPS

PUMP ROTATION (DOG/SOG)

The direction of rotation is clockwise (when looking from the pump drive shaft end) such that DOG (Discharge-On-Gland) flow conditions prevail (i.e. product enters at the lower port and leaves at the port closest to the drive end)

PRESSURE LIMITATIONS

As vertical pumps run DOG (Discharge-On-Gland) as standard, the differential pressure is limited to 4 Bar (58 PSI) on single stage pumps, 3 Bar (43.5 PSI) on K-build pumps and 9 Bar (130.5 PSI) on 2 stage pumps.

MECHANICAL SEAL PROTECTION

The vertical pumps are supplied with an oil bath quench to prevent the seal faces from dry running. Oiler should be filled with SAE 30 oil (100-120ml) (0.03 - 0.05 USgal) or equivalent.

NPSH

As the pump performs a suction lift as standard (as opposed to flooded suction) attention must be paid to the NPSH calculations.

PRIMING TIME

Priming time should not exceed the values shown on the adjacent table. Ideally keep the pump primed using a non return valve. Permanent stator damage may occur if the maximum priming time is exceeded.

PAINTING

The pumps are supplied fully painted externally as standard. The option of a complete stainless pump is available on request.

SUPPORT

Where feasible it is recommended that the pump is supported at the suction port.

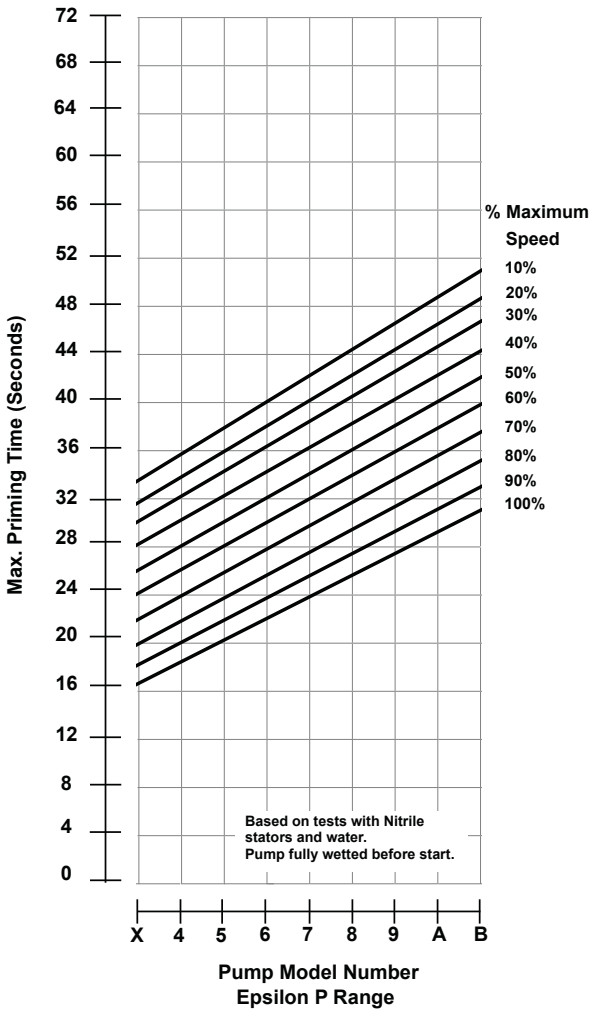
If the installation includes any suction extension tubes, we recommend that these are supported at a minimum of every 2 metres (6.6 feet).

All suction and discharge pipework must be independently supported.

LIFTING BRACKET

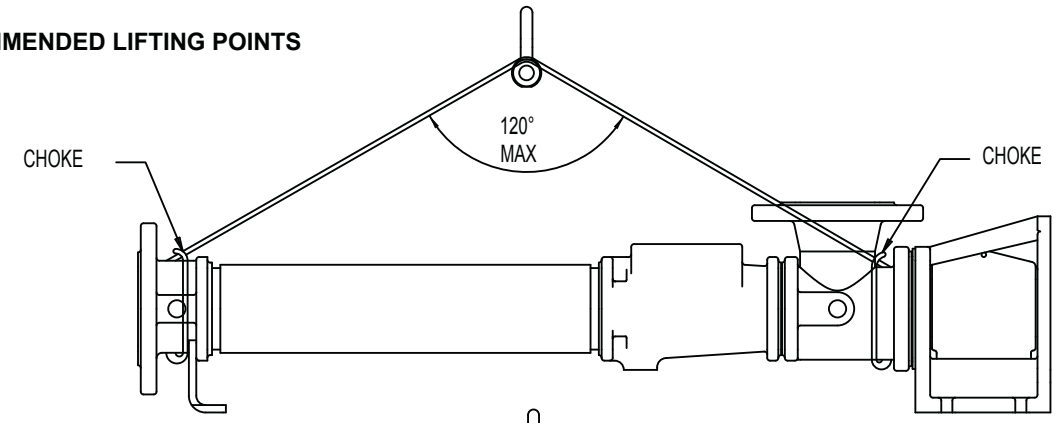
The lifting brackets are designed to be able to lift the weight of the equipment supplied by Your Supplier only. Any extension tubes / other equipment must be removed before lifting.

Maximum Allowable Priming Times



3.2 RECOMMENDED LIFTING POINTS

1



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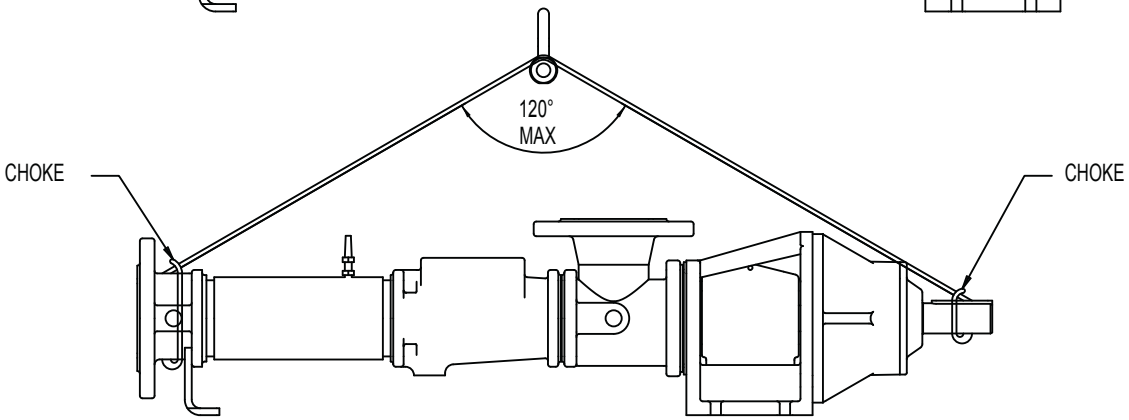

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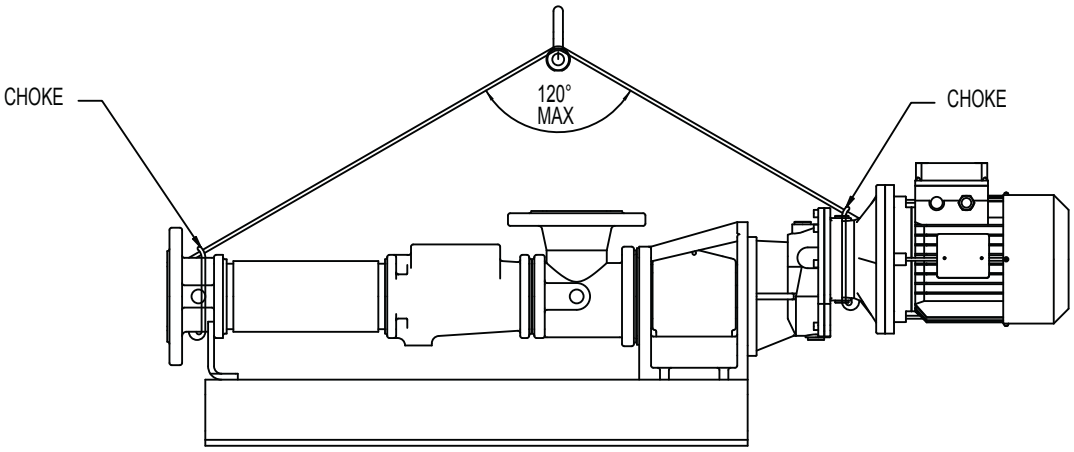

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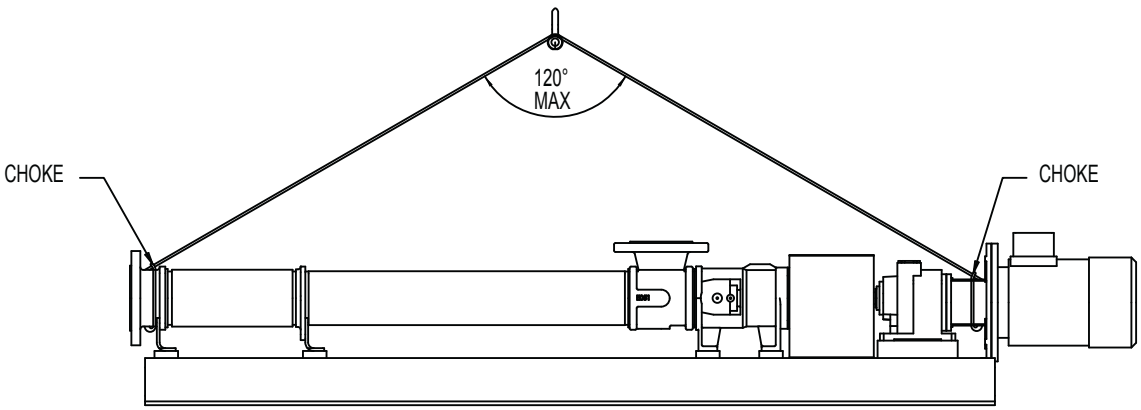


3.3 PUMP AND WEAR PARTS WEIGHTS.

NOTE: Weights are for guidance purpose only.
Please refer to the documentation issued with your pump or spares.

Vertical Epsilon

Model	Weight (kg)					
	Bloc Pump	Bareshaft Pump	Stator	Rotor	Flexishaft	Shaft
P14A	38	59	3.54	4.53	1.27	1.71
P14B	51	72	7.05	5	1	1.71
P14K	52	73	7.12	4.8	0.8	1.71
P15A	58	79	6.31	4.94	1	1.71
P15B	86	107	12.38	9.1	2.2	3.12
P15K	65	86	13	4.94	1	1.71
P16A	90	111	11	8.4	2.2	3.12
P16B	118	149	21.49	15.44	3.7	4.3
P16K	107	128	5	8.4	2.2	3.12
P17A	126	162	17.36	13.31	3.7	4.3
P17B	172	208	34.27	27.1	4.4	4.3
P17K	169	205	34.25	17.86	3.7	4.3
P18A	133	183	23.09	17.86	4.4	4.3
P18B	195	252	24.64	33.73	7.2	4.7
P18K	192	242	45.01	17.86	4.4	4.3
P19A	215	275	41.66	47.63	7.2	4.7
P19B	326	386	65.93	47.63	7.2	4.7
P19K	310	370	67.19	47.63	7.2	4.7
P1AA	258	318	37.36	38.83	9.3	4.7
P1AB	409	479	74.36	72.4	13.8	4.7
P1AK	344	414	74.43	38.83	9.3	4.7
P1BA	421	491	64.49	126.84	11.1	4.7
P1BK	542	612	122.86	131	13.8	4.7

3.3 PUMP AND WEAR PARTS WEIGHTS.

NOTE: Weights are for guidance purpose only.
Please refer to the documentation issued with your pump or spares.

Vertical Epsilon

Model	Weight (lb)					
	Bloc Pump	Bareshaft Pump	Stator	Rotor	Flexishaft	Shaft
P14A	83.8	130.0	7.8	10.0	2.8	3.8
P14B	112.4	158.7	15.5	11.0	2.2	3.8
P14K	114.6	160.9	15.7	10.6	1.8	3.8
P15A	127.8	174.1	13.9	10.9	2.2	3.8
P15B	189.5	235.8	27.3	20.1	4.8	6.9
P15K	143.3	189.5	28.7	10.9	2.2	3.8
P16A	198.4	244.6	24.2	18.5	4.8	6.9
P16B	260.1	328.4	47.4	34.0	8.2	9.5
P16K	235.8	282.1	11.0	18.5	4.8	6.9
P17A	277.7	357.0	38.3	29.3	8.2	9.5
P17B	379.1	458.4	75.5	59.7	9.7	9.5
P17K	372.5	451.8	75.5	39.4	8.2	9.5
P18A	293.1	403.3	50.9	39.4	9.7	9.5
P18B	429.8	555.4	54.3	74.3	15.9	10.4
P18K	423.2	533.4	99.2	39.4	9.7	9.5
P19A	473.9	606.1	91.8	105.0	15.9	10.4
P19B	718.5	850.7	145.3	105.0	15.9	10.4
P19K	683.2	815.5	148.1	105.0	15.9	10.4
P1AA	568.6	700.9	82.3	85.6	20.5	10.4
P1AB	901.4	1055.7	163.9	159.6	30.4	10.4
P1AK	758.2	912.5	164.0	85.6	20.5	10.4
P1BA	927.9	1082.2	142.1	279.6	24.5	10.4
P1BK	1194.6	1348.8	270.8	288.7	30.4	10.4

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

DRG REF	DESCRIPTION
01A	BODY
01B	BODY ADAPTOR
06A	NAMEPLATE (SOG)
06B	NAMEPLATE (DOG)
08A	GLAND
10A	MECHANICAL SEAL / GLAND PACKING
10B	ROTARY SHAFT LIPSEAL (OPTIONAL)
15A	THROWER GUARD
20B	GASKET - GLAND
22A	STATOR
23A	SUCTION CHAMBER
24A	END COVER
25A	ROTOR
26A	FLEXISHAFT
27A	DRIVE CLAMP
27B	DRIVE CLAMP PIN
29C	SHAFT PIN
32A	DRIVE SHAFT
42A	THROWER
65A	MECH SEAL CARRIER / GLAND SELECTION
66A	ABUTMENT RING
75A	SLEEVE
95A	TIE BARS - STATOR
P104	STL. HEX. HD. BOLT
P105	STL. HEX. NUT
P106	STL. BRIGHT WASHER
P107	SINGLE COIL SPRING WASHER
P109	STL. HEX. NUT

DRG REF	DESCRIPTION
P201	TAPER PLUG
P202	TAPER PLUG
P401	TOROIDAL SEAL RING
P402	TOROIDAL SEAL RING
P403	TOROIDAL SEAL RING
P404	TOROIDAL SEAL RING
P503	STL. HEX. NUT
P504	STL. BRIGHT WASHER
P505	SINGLE COIL SPRING WASHER
P506	STUD
P507	SPRING WASHER
P508	BRIGHT WASHER
P509	HEX NUT
P512	HEX SOC SET SCREW
P513	SOC CAP SCREW
P517	STL. HEX. HD. BOLT
P519	TAPER PLUG
P601	STL.HEX. HD. BOLT
P602	SINGLE COIL SPRING WASHER
P603	STL. BRIGHT WASHER
P604	STL.HEX. NUT
P701	CONSTANT LEVEL OILER
P702	HEX REDUCING NIPPLE
P703	FEMALE UNION
P704	MALE / FEMALE UNION

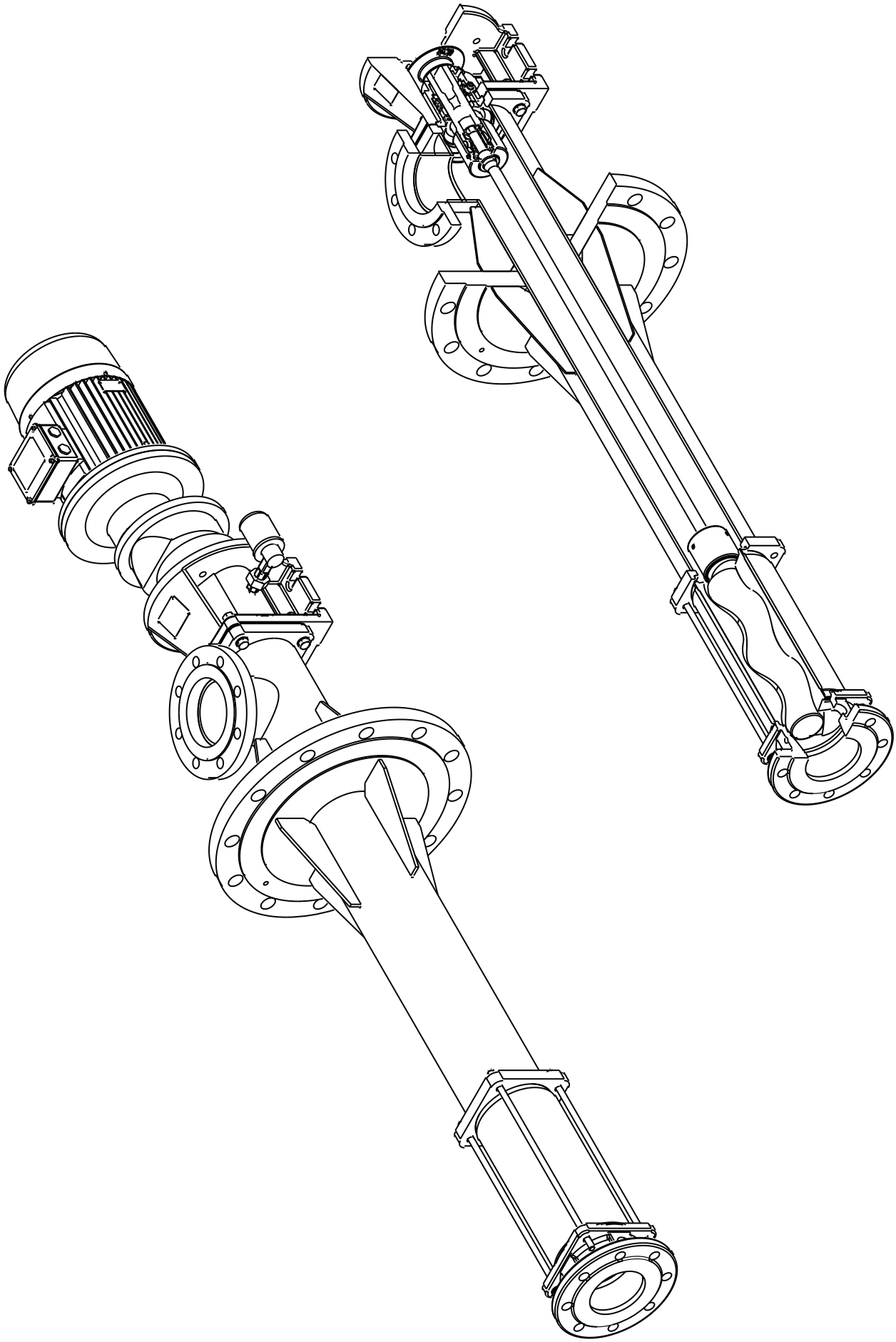
IMPORTANT NOTE

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.

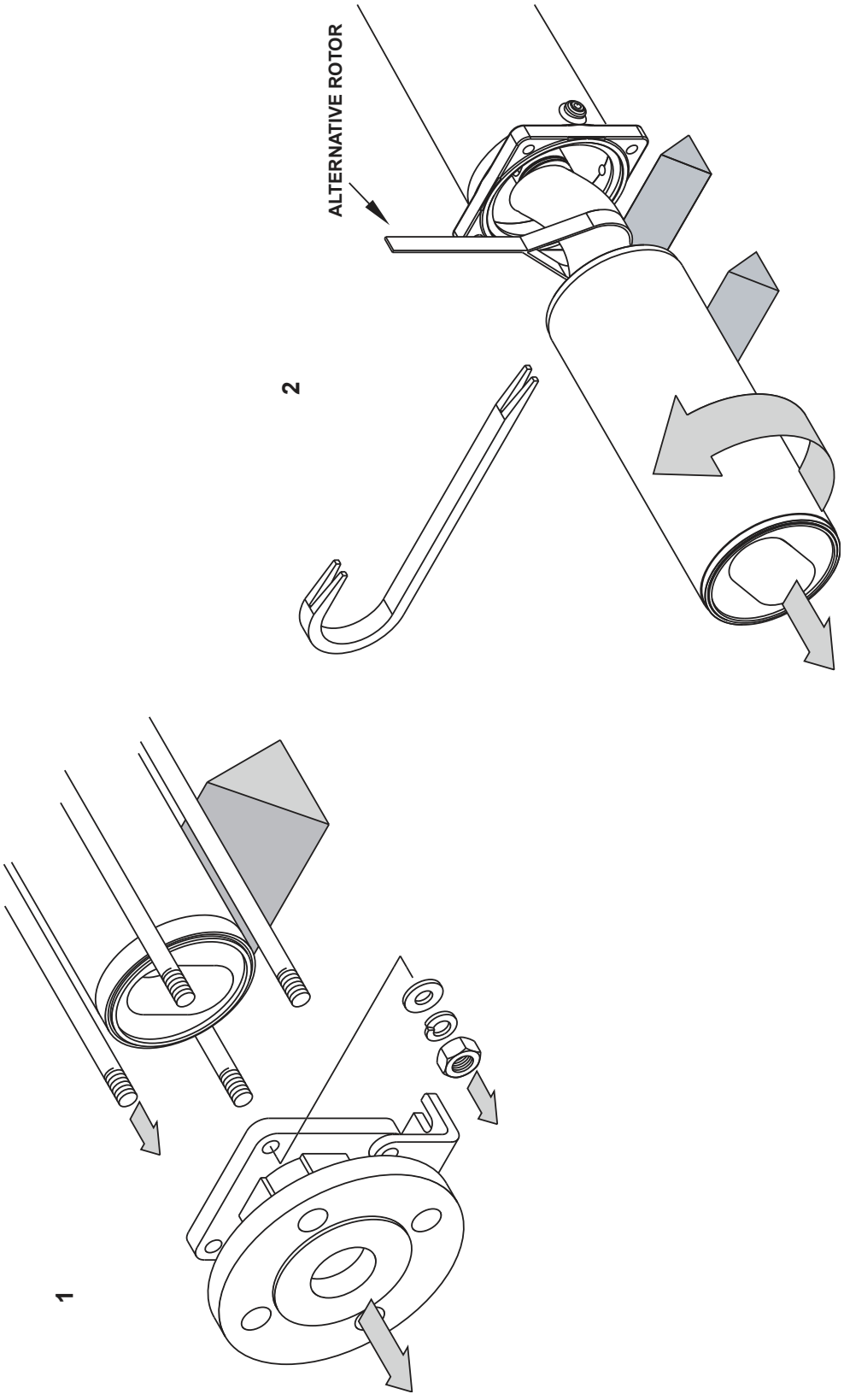
Pump Coding

Features	Description	Basic Pump Code										Standard Variation				
		1	2	3	4	5	6	7	8	9	10	/	12	13	14	15
Range	Epsilon Vertical	P														
Design Mk No	2008		1													
Maximum Pump Capacity at Maximum Speed and Zero Pressure	22m³/h (97 USGPM) @ 1000 rpm			4												
	37m³/h (163 USGPM) @ 800 rpm			5												
	57m³/h (251 USGPM) @ 700 rpm			6												
	79m³/h (348 USGPM) @ 600 rpm			7												
	97m³/h (427 USGPM) @ 500 rpm			8												
	125m³/h (551 USGPM) @ 450 rpm			9												
	165m³/h (727 USGPM) @ 400rpm			A												
	225m³/h (991 USGPM) @ 350 rpm			B												
Stages	Single stage				A											
	Two stage				B											
	Single stage - extended pitch				K											
Casing Material	Cast Iron					C										
	Stainless steel					S										
Rotating Parts	Code 1															
	Code 5						5									
	Code 8						8									
Rotor Mk No	Mk 0 (Oversized)															
	Mk1 (Standard)							1								
	Mk3 (Temperature)							3								
	Mk5 (Temperature)							5								
Stator Material	RA, RR etc.								R							
Flexishaft / Seal Type	Mechanical Seal - Std Flexishaft									M						
	Packed Gland - Std Flexishaft									P						
	Mechanical Seal - Short Flexishaft									R						
	Packed Gland - Short Flexishaft									S						
Build Option	Refer to product manual section 2 & 3, drive selections										B					
/												/				
Variation	For special requirements contact Your Supplier												A	1	2	3

Dismantling & Assembly Diagrams

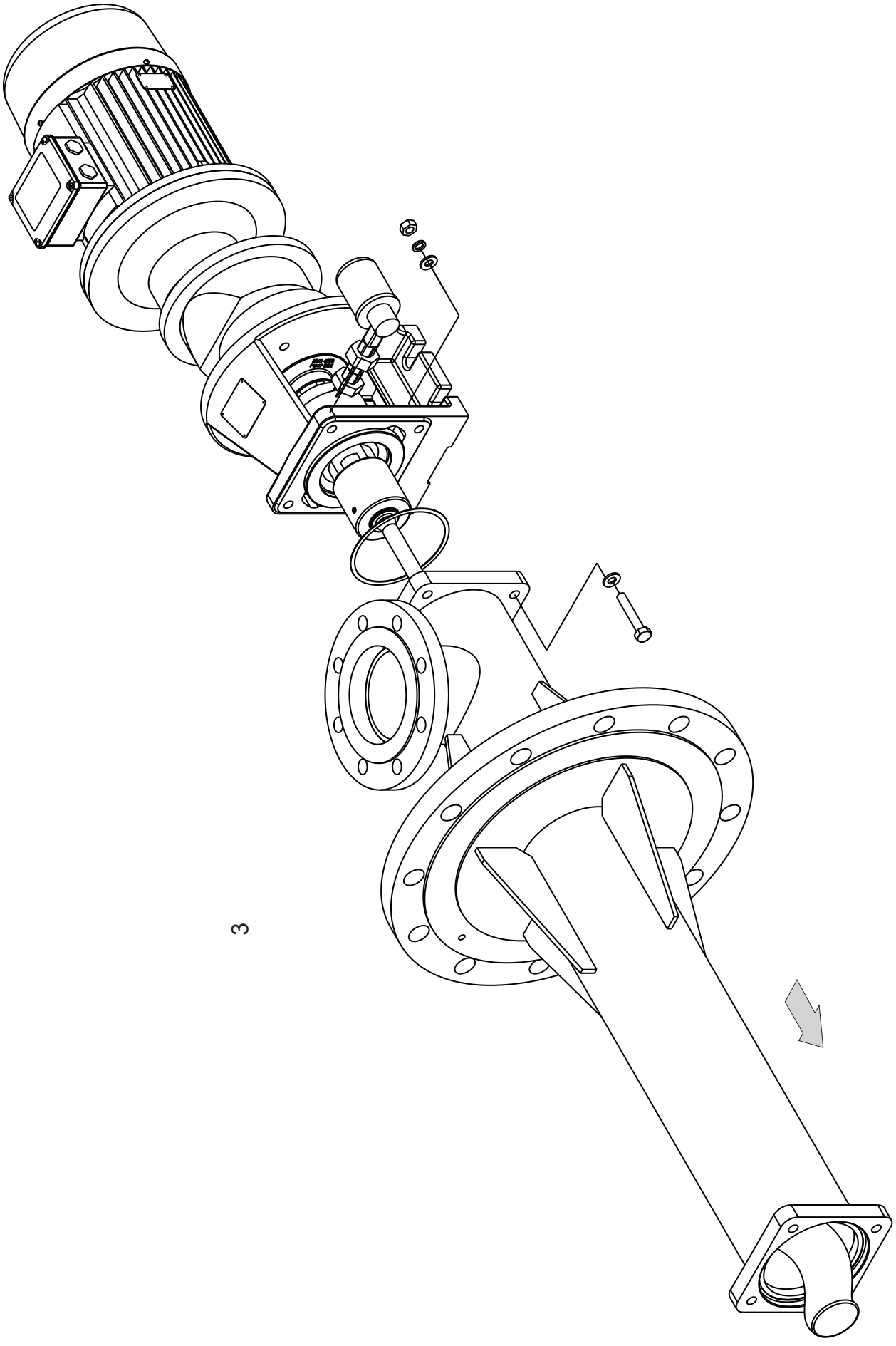


Dismantling & Assembly Diagrams

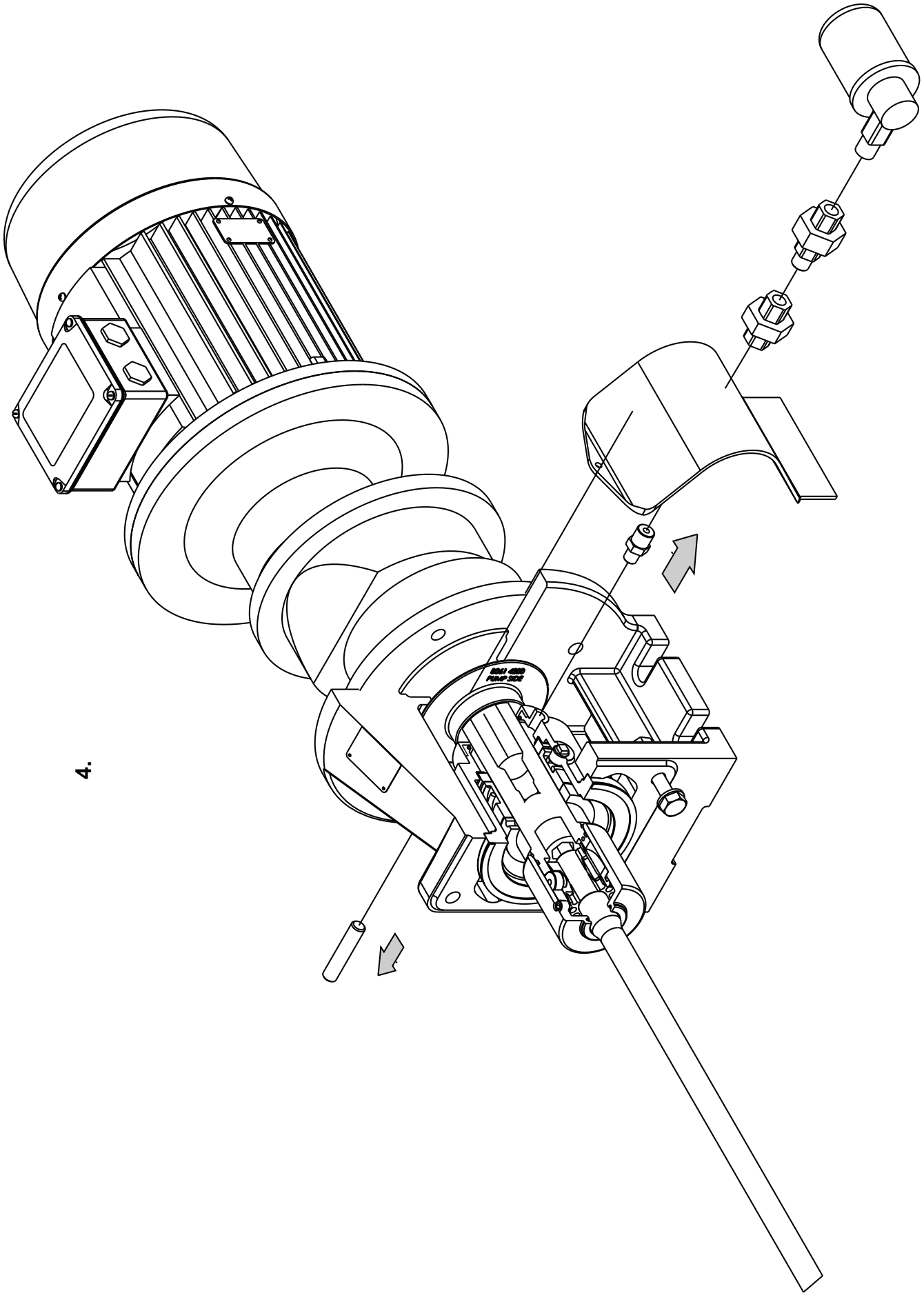


DISMANTLING PROCEDURE

Dismantling & Assembly Diagrams



Dismantling & Assembly Diagrams



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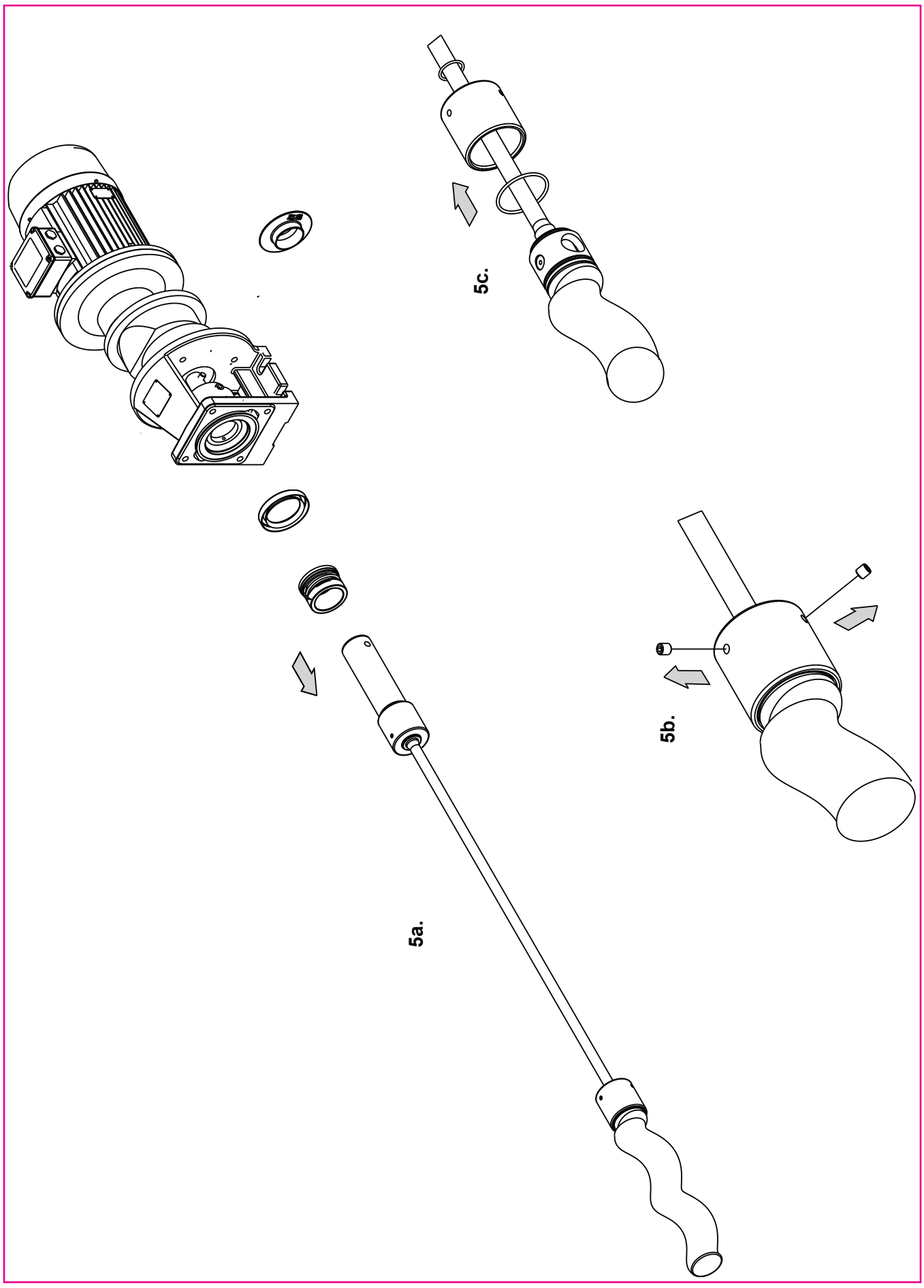
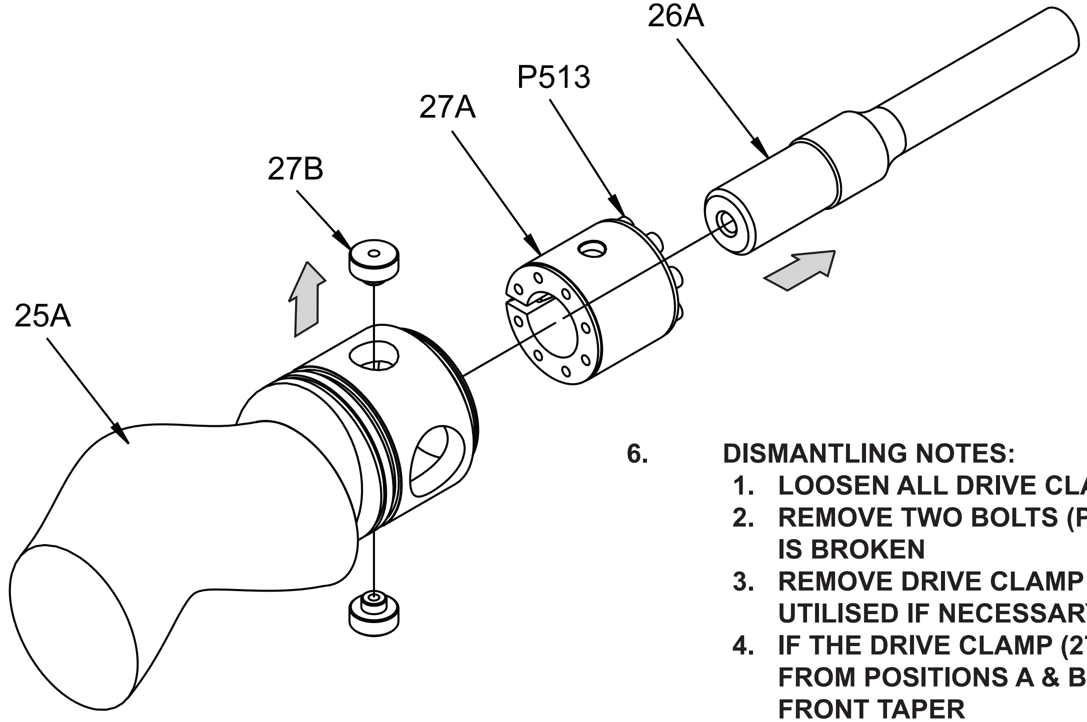
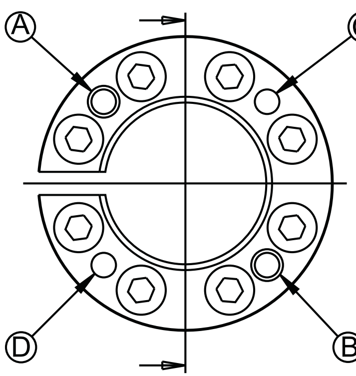
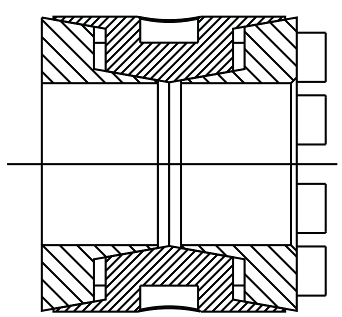
Dismantling & Assembly Diagrams

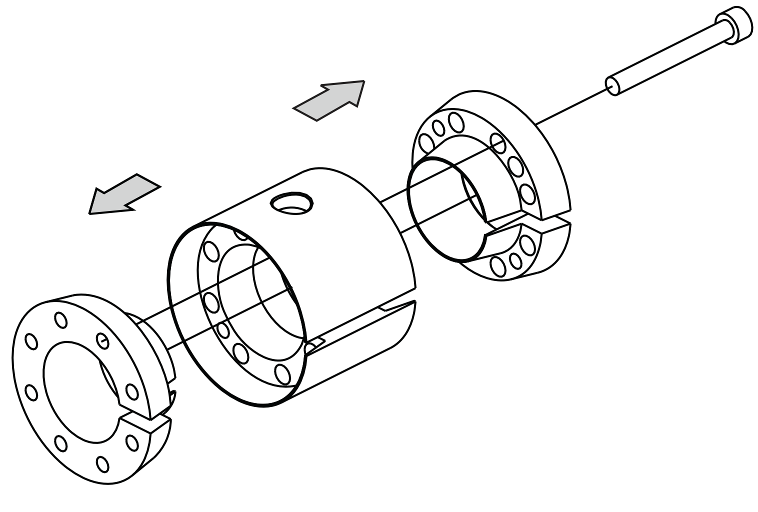




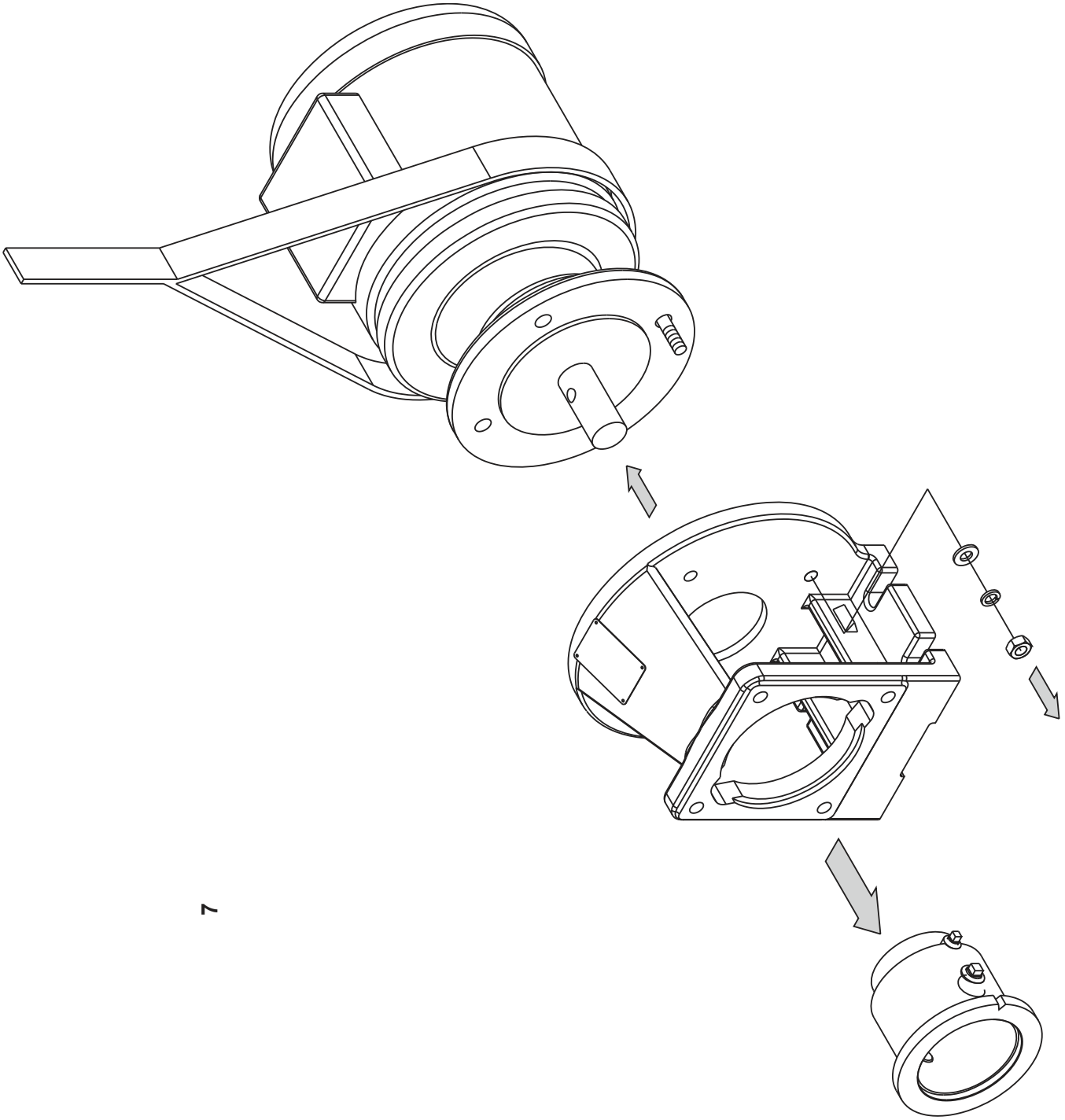
6. **DISMANTLING NOTES:**
   1. LOOSEN ALL DRIVE CLAMP BOLTS (P513)
   2. REMOVE TWO BOLTS (P513) AND SCREW INTO HOLES A & B UNTIL BACK TAPER IS BROKEN
   3. REMOVE DRIVE CLAMP PINS (27B). DRIVE CLAMP BOLTS (P513) MAY BE UTILISED IF NECESSARY.
   4. IF THE DRIVE CLAMP (27A) IS STILL LOCKED IN POSITION REMOVE BOLTS (P513) FROM POSITIONS A & B AND SCREW INTO TAPPED HOLES C & D TO BREAK FRONT TAPER







Dismantling & Assembly Diagrams



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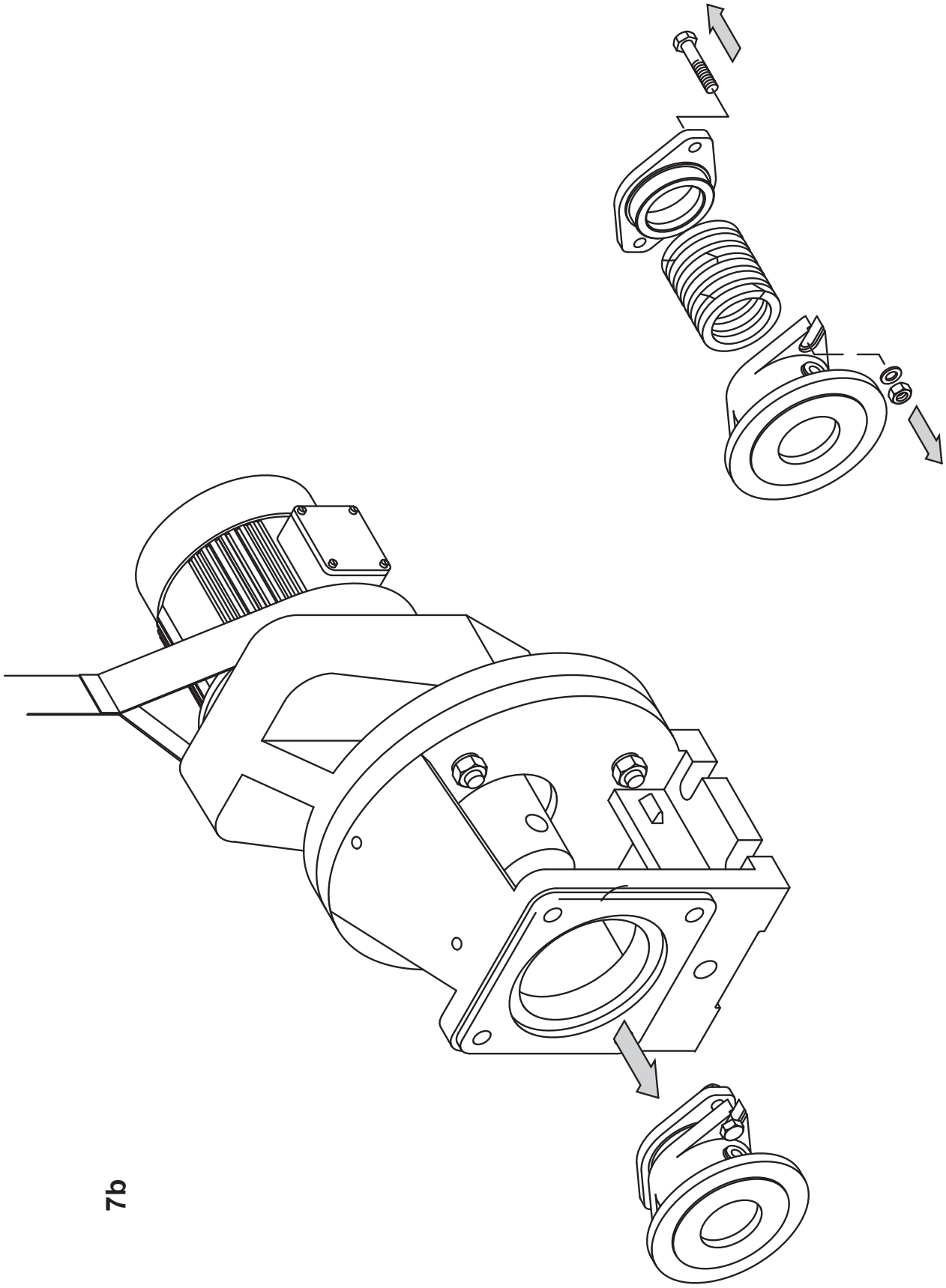
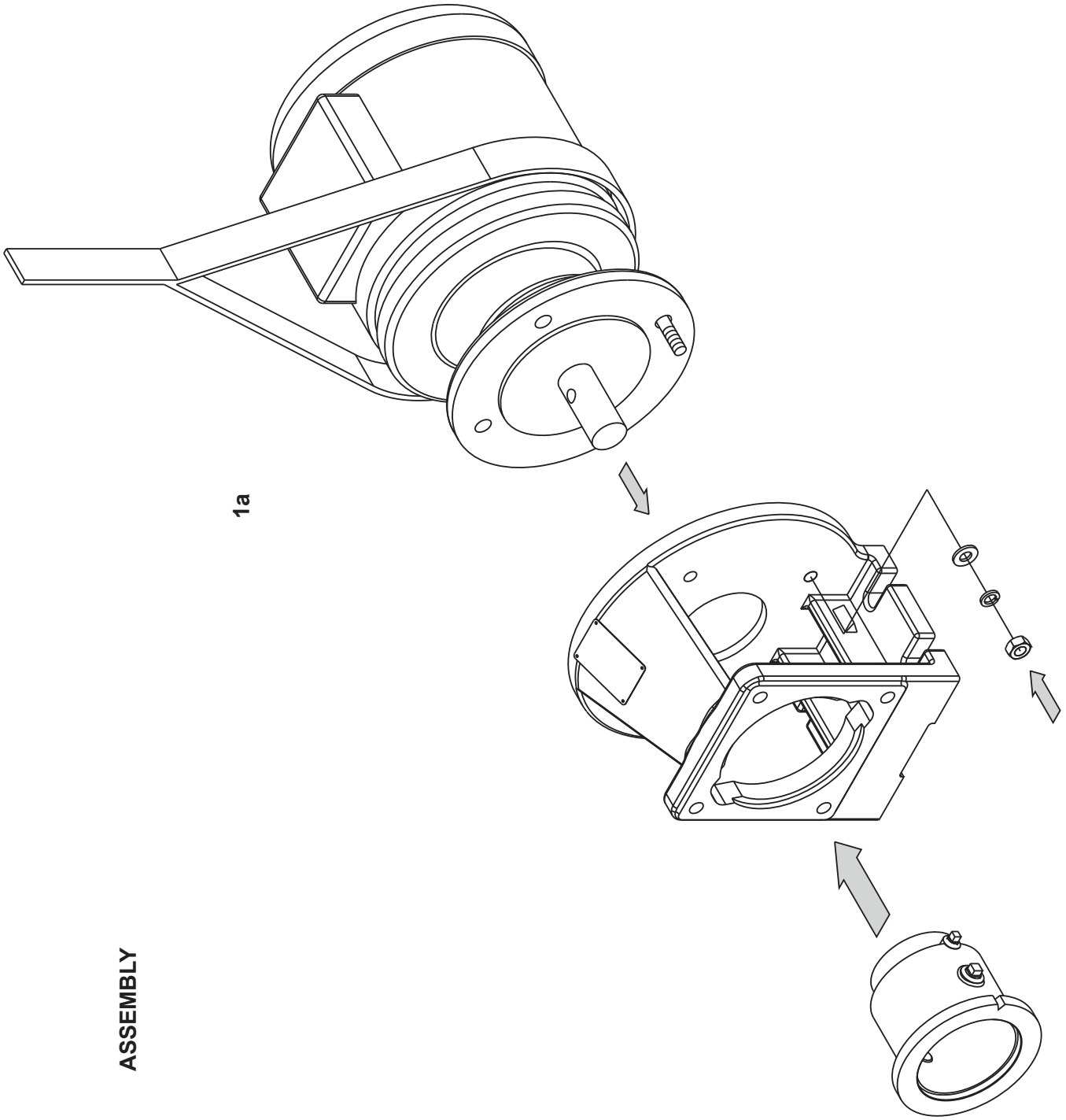
Dismantling & Assembly Diagrams



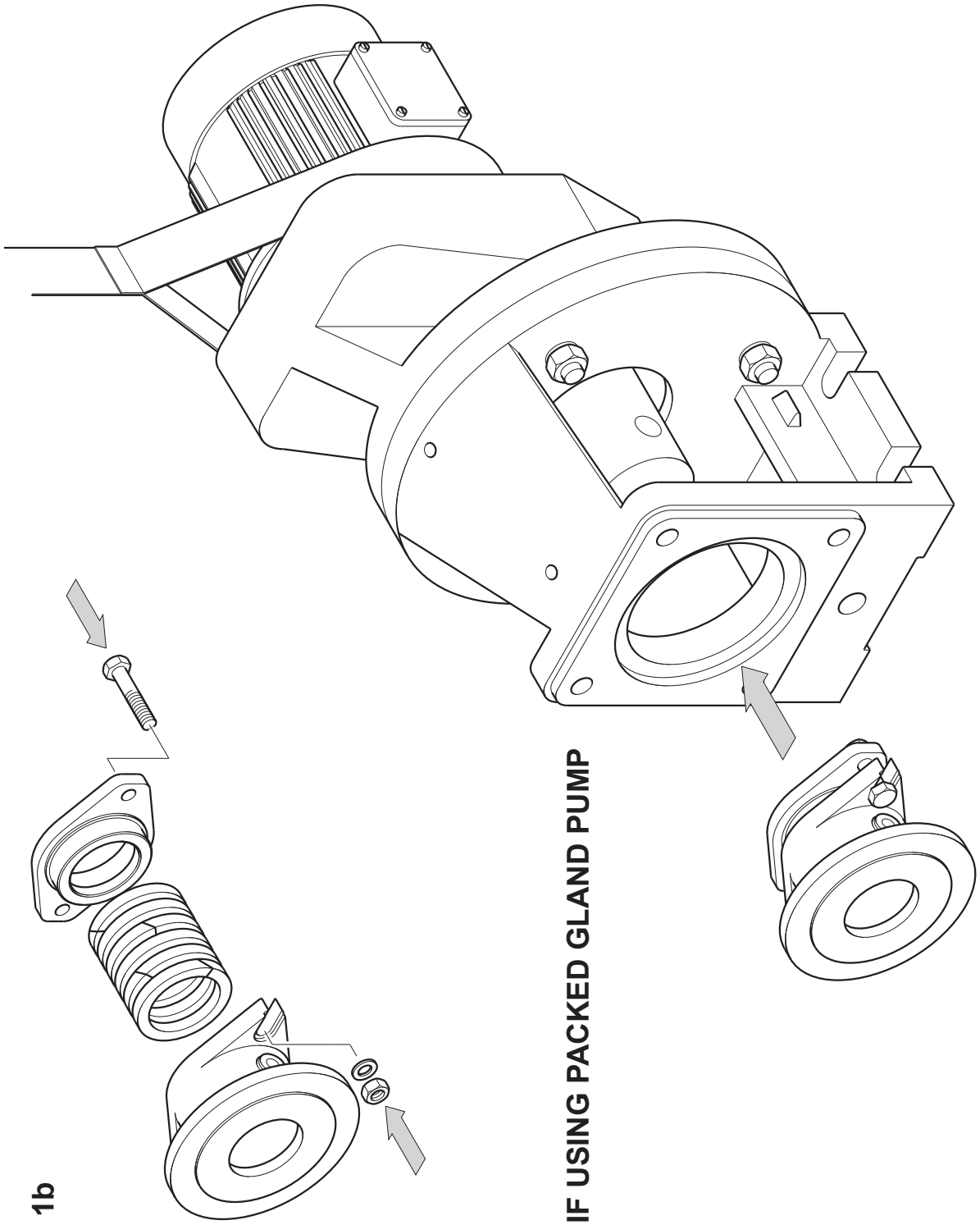
7b

ONLY APPLICABLE IF USING PACKED GLAND PUMP

Dismantling & Assembly Diagrams

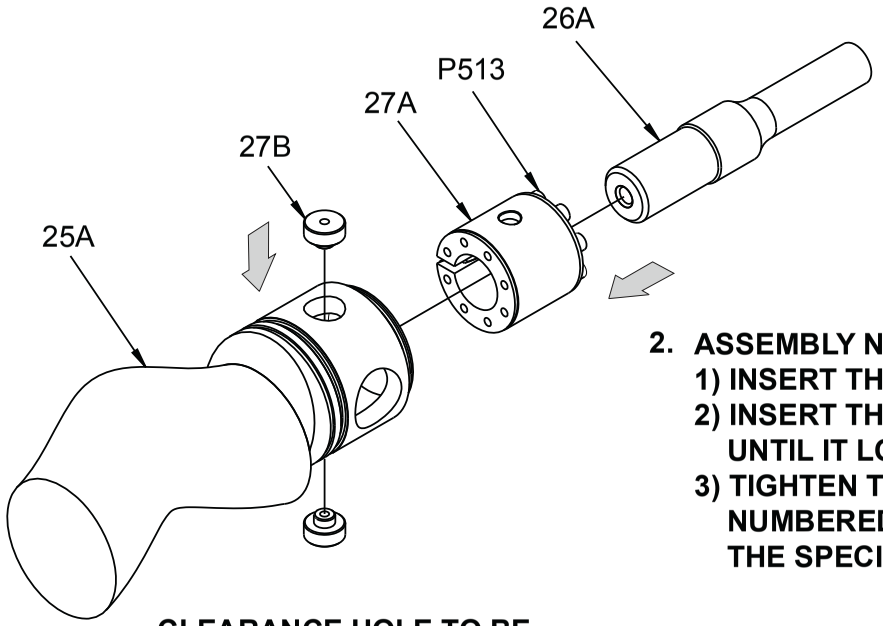


Dismantling & Assembly Diagrams



1b

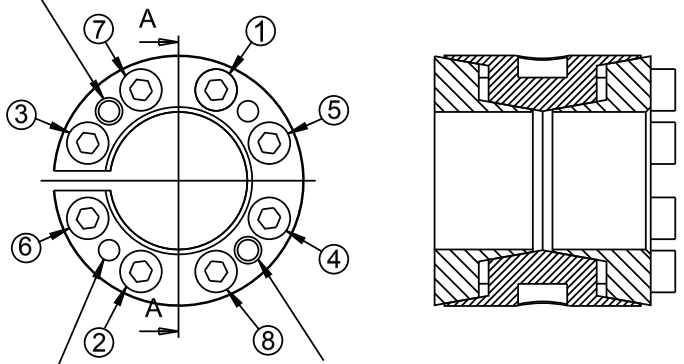
ONLY APPLICABLE IF USING PACKED GLAND PUMP

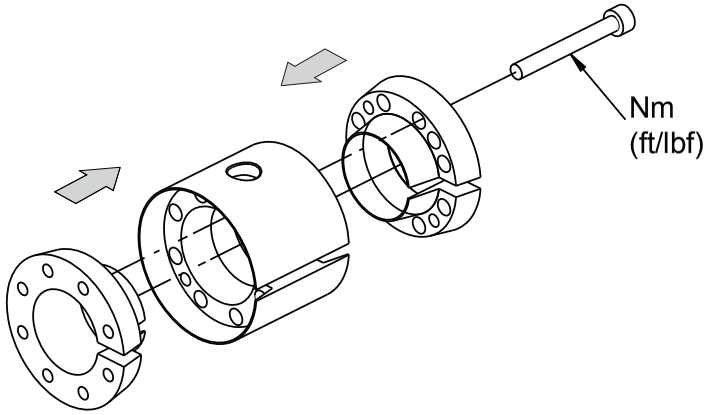


2. ASSEMBLY NOTES:

1) INSERT THE DRIVE CLAMP (27A) INTO THE ROTOR HEAD (25A)
2) INSERT THE FLEXISHAFT (26A) INTO THE DRIVE CLAMP (27A) UNTIL IT LOCATES ON THE CHAMFER
3) TIGHTEN THE DRIVE CLAMP BOLTS (P513) GRADUALLY IN THE NUMBERED SEQUENCE (SEE BOTTOM LEFT VIEW) UNTIL THE SPECIFIED TORQUE IS REACHED

CLEARANCE HOLE TO BE IN LINE WITH TAPPED HOLE IN CENTRE TAPER RING

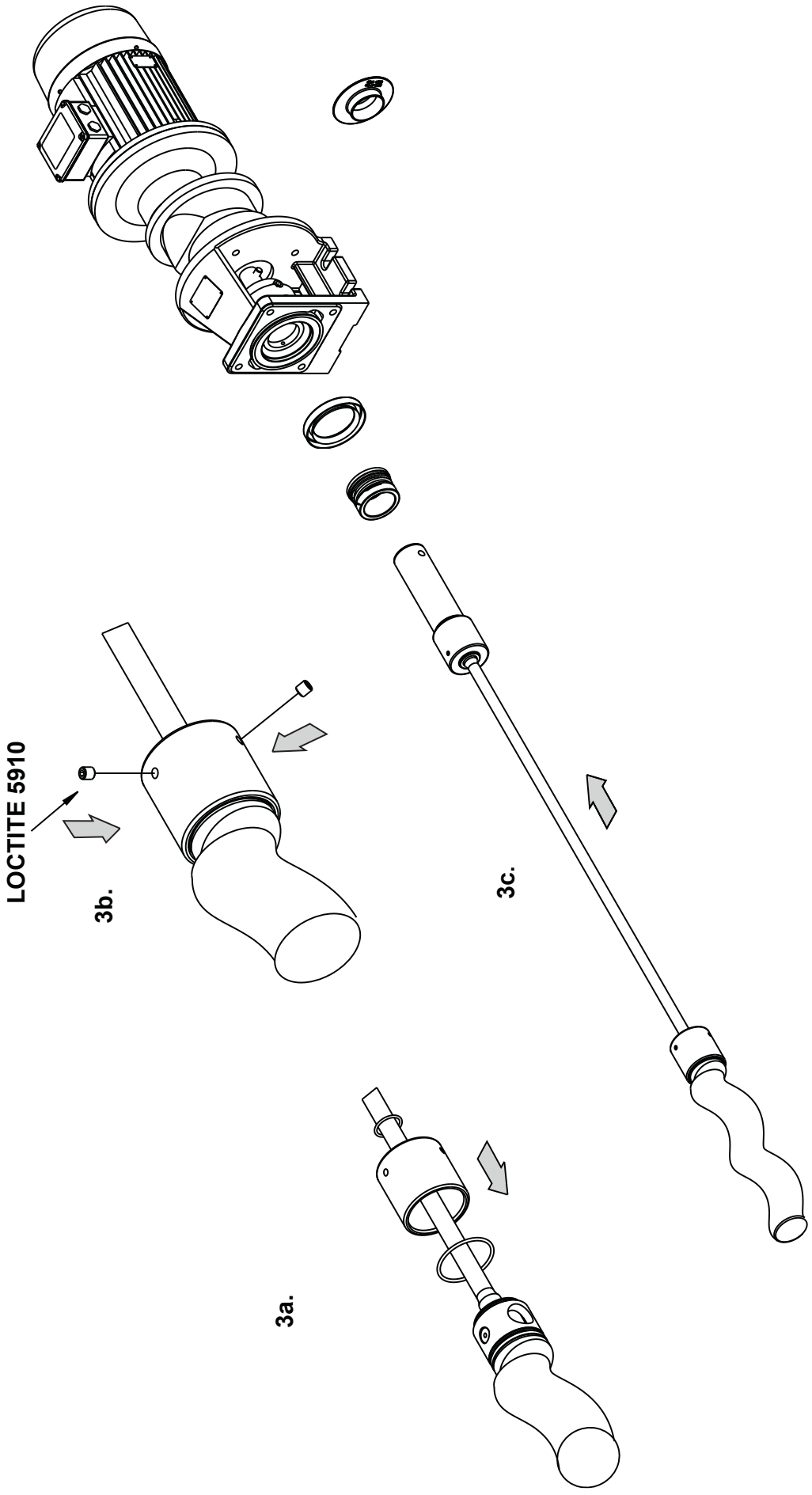




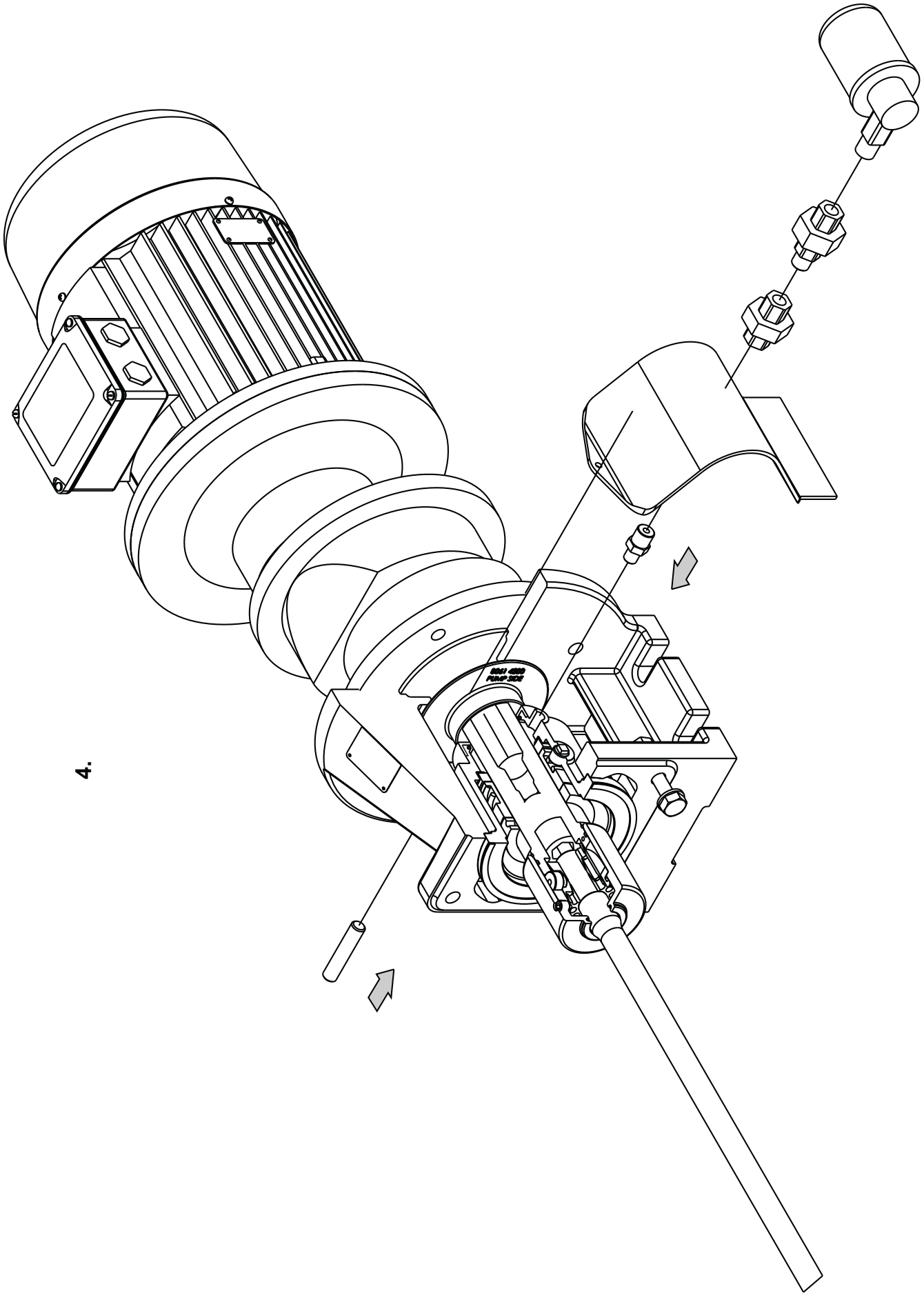
TAPPED HOLE TO BE LINED UP SO IT IS BLIND ON THE CENTRE TAPER RING

COUNTERBORE IN CENTRE TAPER RING TO BE AT THE FRONT

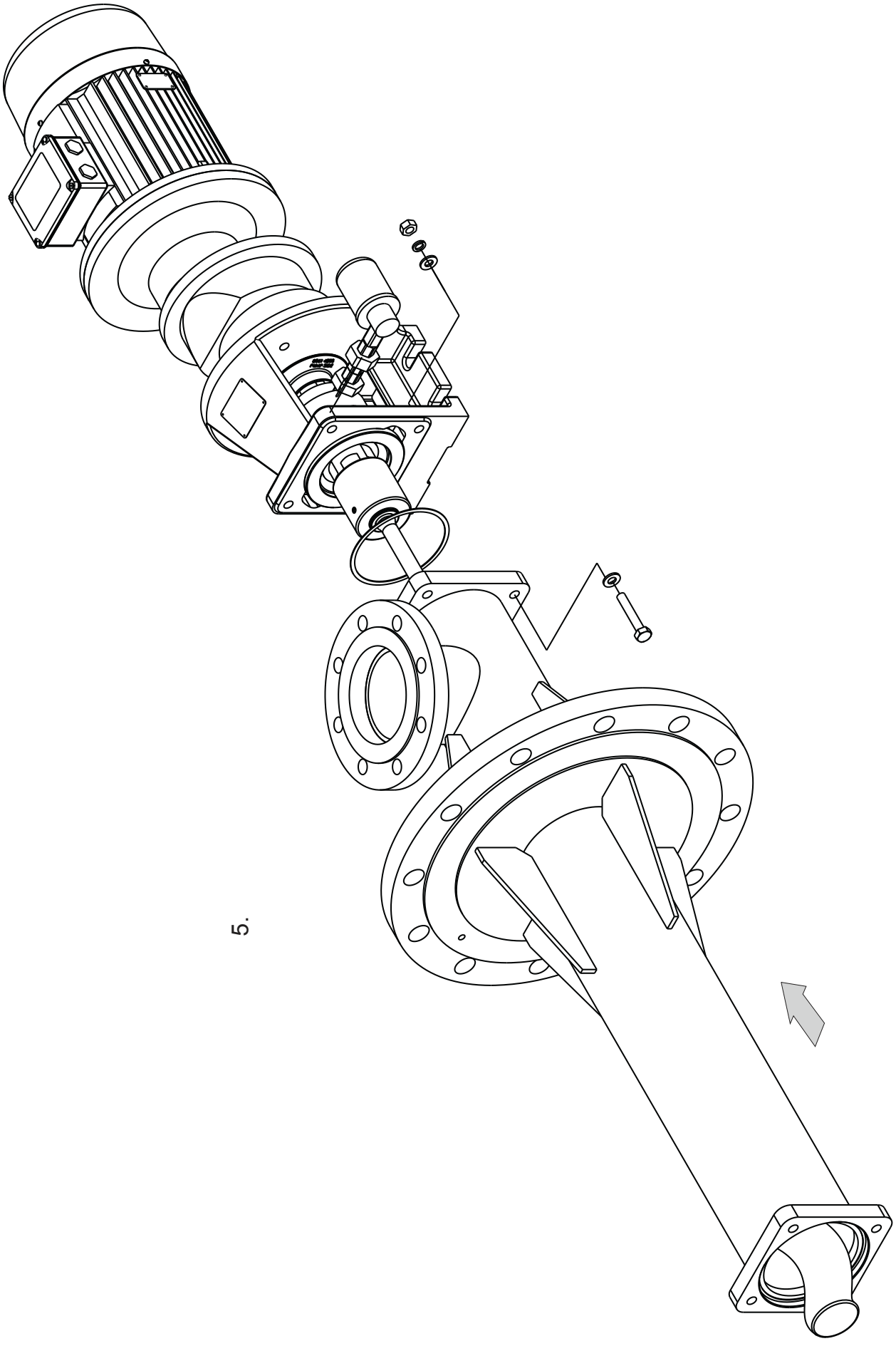
Dismantling & Assembly Diagrams



Dismantling & Assembly Diagrams

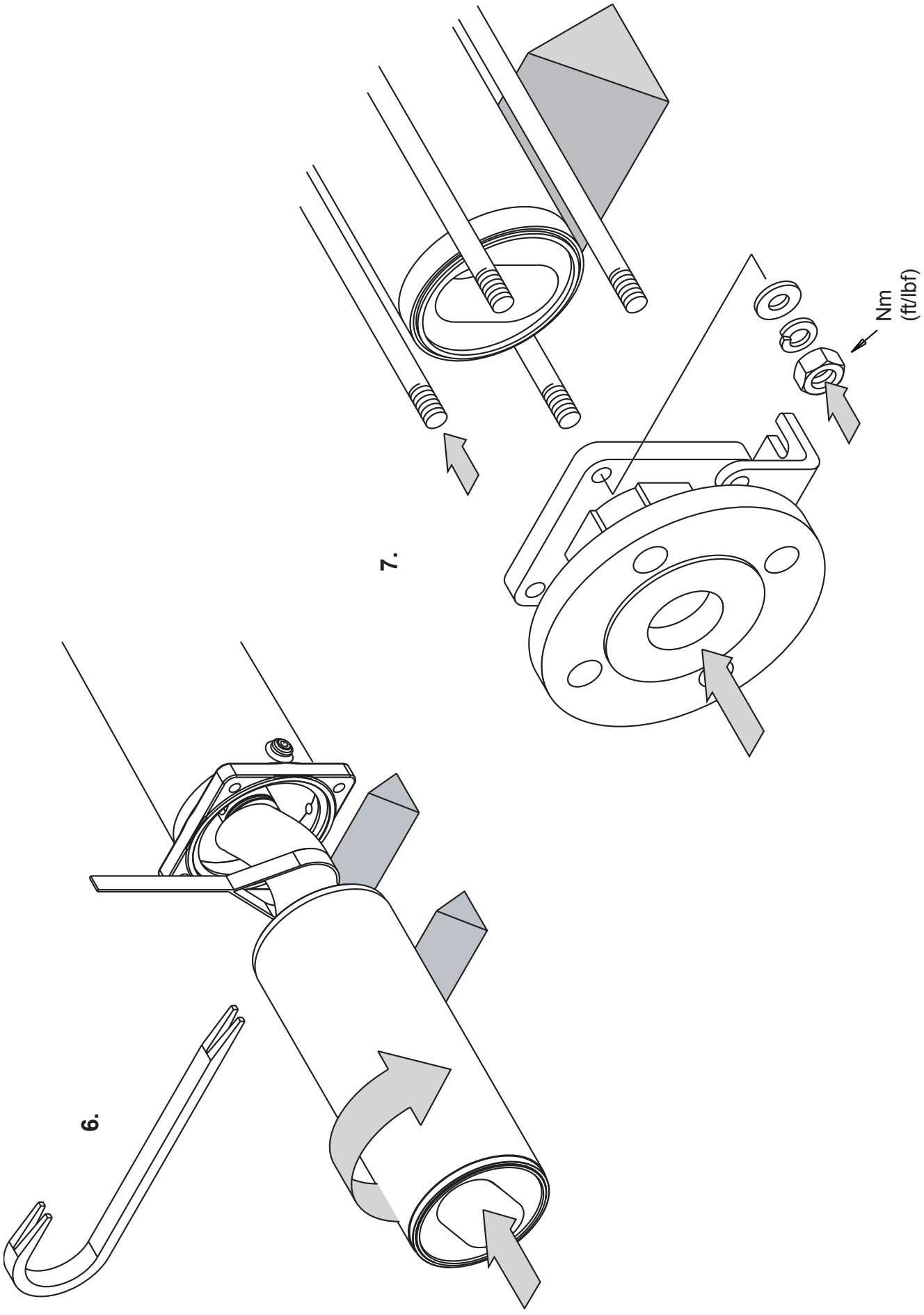


Dismantling & Assembly Diagrams

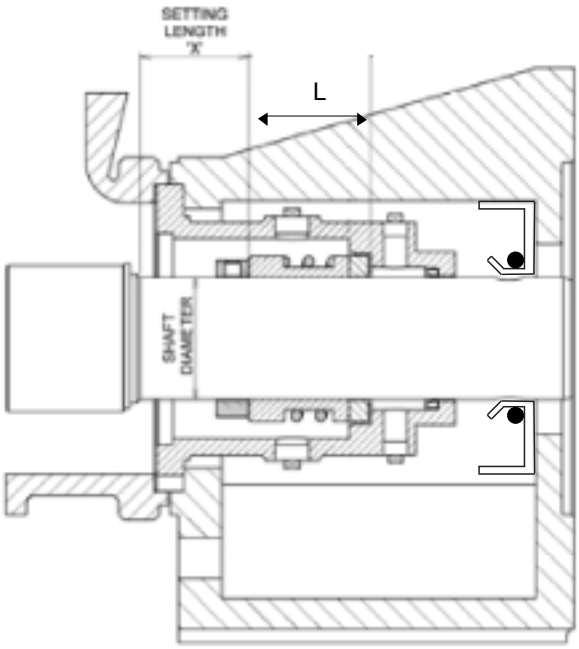


5.

Dismantling & Assembly Diagrams



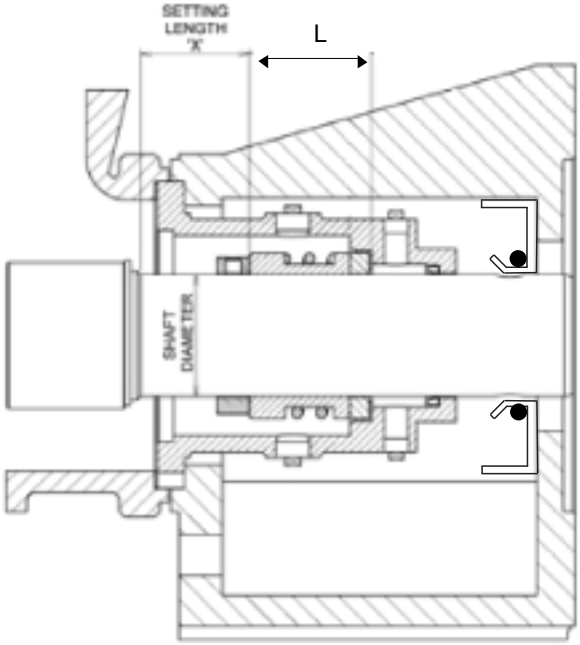
Setting Length - Mechanical Seal



Pump Size	Drive Type	Shaft Diameter mm (inches)	Seal Part No.	Seal Working Length L mm (inches)	Setting Distance X mm (inches)
P14A P14B P14K P15A P15K	Flexishaft	45 (1.77”)	M045139G & S347452P Lipseal	45.0 (1.77”)	33 (1.3”)
P15B P16A P16K	Flexishaft	55 (2.17”)	M055139G & S347555P Lipseal	47.5 (1.87”)	58 (2.28”)
P16B P17A P17B P17K P18A P18K	Flexishaft	65 (2.56”)	M065139G & S347651P Lipseal	52.5 (2.07”)	33.5 (1.32”)

NOTE: All seal working lengths are to DIN L1K dimensions.
This table is not to be used for standard or DIN L1N working length seals.
All seals use ‘M’ type seat except for 85mm (3.35”) which uses ‘BS’ type or ‘M’ type.
This table is not necessarily compatible with any other seal type - check with Your Supplier

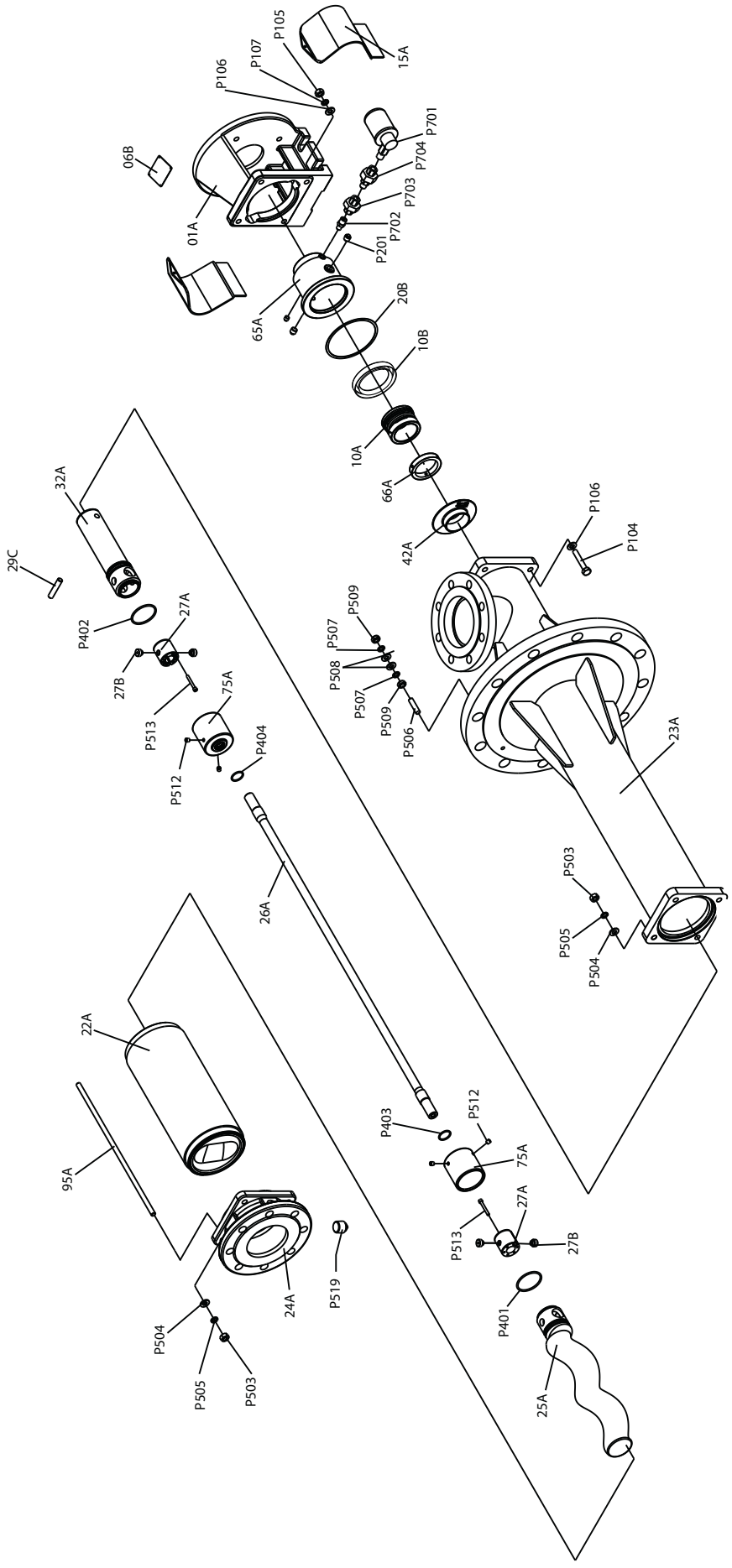
Setting Length - Mechanical Seal



Pump Size	Drive Type	Shaft Diameter mm (inches)	Seal Part No.	Seal Working Length L mm (inches)	Setting Distance X mm (inches)
P18B P19A P19B P19K P1AA P1AK	Flexishaft	85 (3.35”)	M085139G & S347853P Lipseal	60 (2.36 “)	33 (1.3”)
P1AB P1BA P1BK	Flexishaft Pin Joint	85 (3.35”)	M085139G & S347853P Lipseal	60 (2.36 “)	58 (2.28”)

NOTE: All seal working lengths are to DIN L1K dimensions.
This table is not to be used for standard or DIN L1N working length seals.
All seals use ‘M’ type seat except for 85mm (3.35”) which uses ‘BS’ type or ‘M’ type.
This table is not necessarily compatible with any other seal type - check with Your Supplier

Exploded Views



Torque Tightening Figures

PUMP SIZE	BODY/SUCT. CHAMBER Nm			STATOR TIE BARS Nm		DRIVE CLAMP BOLTS Nm
	P526	P105	P530	P506	P503	P513
P14A		11			11	5
P14K		11			11	5
P14B		11			11	5
P15A		11			11	5
P15K		21			11	5
P15B		21			11	10
P16A		21			24	10
P16K		21			24	10
P16B		36			24	10
P17A		36			24	10
P17K		36			24	10
P17B		36			24	10
P18A		36			40	10
P18K		36			40	10
P18B	50	-	36		40	17
P19A		90			75	17
P19K		90			75	17
P19B		90			75	17
P1AA		90			75	17
P1AK		90			75	17
P1AB		90			75	41
P1BA		176			120	41
P1BK		176			120	41

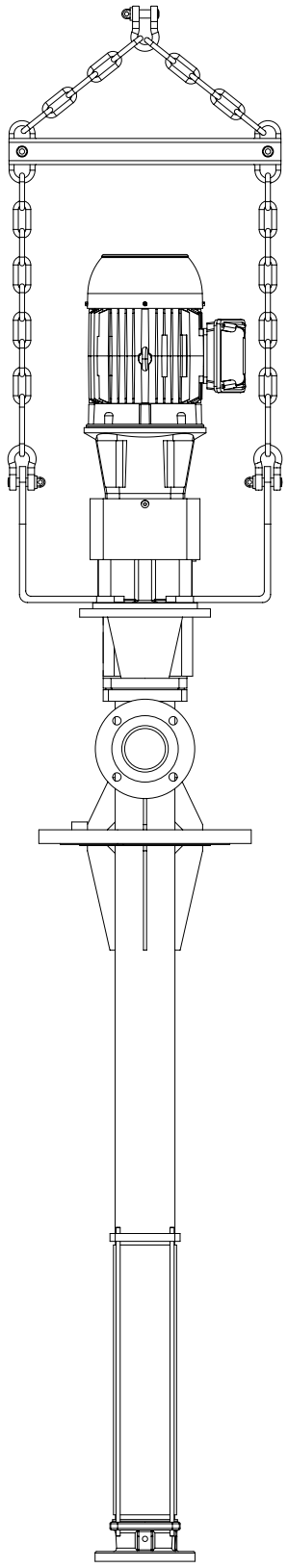
Note: Torque tolerances are +/-5% of stated nominal figures.

Torque Tightening Figures

PUMP SIZE	BODY/SUCT. CHAMBER (ft/lbf) P526	P105	P530	STATOR TIE BARS (ft/lbf) P506	P503	DRIVE CLAMP BOLTS (ft/lbf) P513
P14A	8.1			8.1		3.7
P14K	8.1			8.1		3.7
P14B	8.1			8.1		3.7
P15A	8.1			8.1		3.7
P15K	15.5			8.1		3.7
P15B	15.5			8.1		7.4
P16A	15.5			17.7		7.4
P16K	15.5			17.7		7.4
P16B	26.6			17.7		7.4
P17A	26.6			17.7		7.4
P17K	26.6			17.7		7.4
P17B	26.6			17.7		7.4
P18A	26.6			29.5		7.4
P18K	26.6			29.5		7.4
P18B	36.9	-	26.6	29.5		12.5
P19A	66.4			29.5		12.5
P19K	66.4			29.5		12.5
P19B	66.4			29.5		12.5
P1AA	66.4			29.5		12.5
P1AK	66.4			29.5		12.5
P1AB	66.4			29.5		30.2
P1BA	129.8			88.5		30.2
P1BK	129.8			88.5		30.2

Note: Torque tolerances are +/-5% of stated nominal figures.

Lifting Brackets



VERTICAL EPSILON PUMP - LIFTING BRACKETS

PUMP MODEL	BODY SIZE	BRACKET					
		A BUILD	BRACKET ONLY SPEC	CHAIN INCLUDED SPEC	B BUILD	BRACKET ONLY SPEC	CHAIN INCLUDED SPEC
	B012	P13A 9956		128315	P13B 9956	61688	
P14A	B041	P14A 9956	61686	Contact Your Supplier	P14B 9956	61687	Contact Your Supplier
P14B							
P14K							
P15A							
P15K							
P15B	B061	P16A 9956	61663	Contact Your Supplier	P17A 9956	Contact Your Supplier	128433
P16A							
P16B	B071	P16B 9956	61662	Contact Your Supplier	P17A 9956	Contact Your Supplier	128433
P17A							
P17B		P19A 9956	62146	128317	Contact Your Supplier		
P18A							
P18B	B091	P19A 9956	62146	128317	P17A 9956	Contact Your Supplier	128433
P19B							
P19K							
P19A							
P1AA							
P1AK							
P1AB	B121	P19A 9956	62146	128317	P1AB 9956	61660	
P1BA							

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