

Alfa Laval

Decanter Centrifuge

OM

English EN

OPERATOR'S MANUAL

**OPERATION
SERVICE
MAINTENANCE**

Decanter Centrifuge

Machine No.: 5022529 **Type Designation:** **ALDEC 406**
Order No.: 213350 **Specification No.:** 882018891-3

Max. Bowl Speed: 4000 RPM **Min. Feed Temperature:** 0°C (32°F)
Operating Speed: 4000 RPM **Max. Feed Temperature:** 100°C (212°F)
Max. Density of Compact Wet Cake at Max. Bowl Speed: 1.2 kg / dm³

Data Not Included in the Spare Parts Catalogue:

Radius of Liquid Phase*: 61232712-10, Plate Dam, R=106mm
Solids Discharge Wear Protection: 61202927-07
Lock Ring for Conveyor Bearings: 61209980-80
Main Motor: 61195524-00
30kW (40HP) / 1800RPM / 3x460V, 60Hz
Dimension Drawing No.: 61235549
Electric Connection No.: 61211372

IMPORTANT! *When ordering Spare Parts, always state:*

- *Machine No. and Type indicated on the Nameplate of the decanter*
- *Part No. and Designation*
- *Quantity*

* Neutral Beach R=101mm

Machine No.: **5022529**Decanter Type: **ALDEC 406**

Noise Declaration

Noise emission data for the decanter declared in accordance with the requirements in EN ISO 4871 and EN12547:

Operating Speed [rpm]	Sound Power Level L_{wAd} [B(A) re 1 pW]	Sound Pressure Level L_{pAd} [dB(A) re 20 μPa]
4000	9.9	82
3580	9.8	81
3250	9.7	80
2900	9.6	79
2700	9.4	77

L_{wAd} : Declared A-weighted sound power level from the decanter

L_{pAd} : Declared A-weighted emission sound pressure level in a free field over a reflecting plane at 1 m distance from the decanter

Uncertainty on declared values : L_{wAd} : $K_{wA}=2$ dB

L_{pAd} : $K_{pA}=4$ dB

The noise does not contain significant impulsive or tonal components and the peak C-weighted instantaneous sound pressure level L_{pCpeak} is below 130 dB(C) at all operating speeds.

The emission sound power level is measured according to ISO 9614-2 while operating the decanter with water as process medium. The sound pressure level is determined from the measured sound power level according to EN ISO 11203.

The sound pressure level can vary -1 dB to 2 dB at different positions around the decanter.

For decanters with hydraulic back drive some operating modes will give up to 2dB increase in sound pressure at the back drive end of the decanter.

The declared values are based on measurements conducted on typical new decanters.

Note that the sound pressure levels are based on free-field conditions and not guaranteed values. In a normal indoor installation the sound pressure level will be significantly higher than the declared free-field sound pressure level due to the reflection of sound from walls and surroundings.

In order to minimise the sound pressure level at the decanter it is recommended to install the decanter in a room with low reflection of sound from the walls and always keep the decanter in a properly maintained condition.

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1 Safety Instructions

FAILURE TO FOLLOW THESE RULES MAY RESULT IN SEVERE PERSONAL INJURY OR PROPERTY DAMAGE.

The Decanter

1. The decanter delivered must not be used to separate flammable, toxic, corrosive, or radioactive process media without prior written approval from Alfa Laval.
2. Read this manual and the Operator's Manual before attempting to install or operate the decanter equipment, and follow all recommendations.
3. Do not operate the decanter with damaged or missing warning labels.
4. Do not operate the decanter if the vibration level exceeds 24 mm/sec (RMS) (US: 1 inch/sec).
5. Do not operate the decanter with feed temperatures exceeding the limits stated on the DATA SHEET included in all three volumes of the Instruction Manual.
6. Never attempt to start the decanter with frozen water or frozen or hardened process material in the bowl.
7. Do not exceed the maximum bowl speed or solids density specified on the decanter name-plate and DATA SHEET.
8. Do not operate the decanter without belt guards and other guards provided.
9. Periodically check all the automatic shut-off devices and monitoring systems for correct operation.

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10. Do not attempt dismantling until the decanter has come to a complete stop, the main power is shut off, and the disconnected main switch is locked with a safety lock.
11. Do not operate the decanter if the bowl, motor, or supporting structure show cracks, pitting, holes, or grooves.
12. Do not use tools other than those recommended by Alfa Laval to dismantle and assemble the decanter.
13. Do not attempt to use the decanter for any application or process material other than that stated on the original purchase documentation without first consulting Alfa Laval.
14. Follow all lubricating procedures and schedules.
15. Check periodically - at least once a year - for loose bolts on foundation and supporting structures, covers, hatches and pipe connections of decanter and motor.
16. Do not get rags or loose clothing near rotating parts.
17. At all times follow the recommended sequence and procedures for dismantling, assembly, operation, and maintenance. Do not introduce new procedures without first consulting Alfa Laval.
18. Only allow trained personnel to operate, clean, dismantle or assemble the decanter.
19. Do not operate the decanter before the installation is complete.
20. Do not operate the decanter with any electrical motor running in the opposite direction to that indicated by the arrows on the frame or otherwise specified.

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21. If the decanter is fitted with a frequency inverter, make sure that the maximum possible frequency will not cause overspeeding of the decanter. At least two separate protections against overspeed must be provided. See section 6.9 of the ID manual.
22. Do not turn on feed or water before the decanter has attained its full speed.
23. If the decanter is operated with hot, corrosive, or aggressive liquids, care should be taken that any incidental spillage from the decanter cannot hit persons below the centre line of the decanter.
24. Never turn on feed or large amounts of hot, corrosive, or aggressive liquids when the decanter is at a standstill, as these liquids might hit persons below the centre line of the decanter.
25. Never start the feed pump or flush the decanter before opening the discharge valves or starting the discharge pumps, including any conveying means for the liquid and solids phases.
26. When personnel are working on a decanter with a hinged cover, care should be taken that the cover is not closed unintentionally by other persons or by moving machinery, which might cause injury.
27. Do not touch the solids phase discharging from the decanter as hard lumps being ejected with high speed might cause injury.
28. When using straps to lift the complete decanter or any of its parts such as the rotating assembly, make sure to prevent the part hanging by the straps from sliding.
29. When lifting the decanter assembly four equal length round slings must be used and connected to the lifting eyes on the decanter frame by means of shackles. The minimum length of the slings is specified on the dimensioned drawing.
30. The lifting eyes in the bearing housings, if fitted, must not be used for lifting the bowl assembly.

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Electrical Installation

1. Install and earth all equipment in accordance with requirements of the Local Electricity Authority.
2. Use an “on-load” isolator or circuit breaker (a main switch for switching off during run-up) on the main power supply.
3. Check that the voltage and the frequency are in agreement with labels on motors and other electrical equipment.
4. De-energize all equipment before connecting and disconnecting test equipment.

Repairs

1. Major repairs to decanter must not be made without first consulting with Alfa Laval.

In no circumstances should weld repairs, heating with a naked flame, or other alterations be made to bowl shells, bowl hubs, gearbox adapter, shafts, or other rotating parts without prior written approval and instructions from Alfa Laval. Failure to obtain this approval may result in failure of parts involved with possible serious damage to equipment, property, or personnel.

2. Do not operate the decanter on completion of the repairs until the belt and/or other guards are re-fitted.

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3. Do not exceed the maximum load carrying capacity of the lifting tools. Only use the lifting tools for the intended purpose.
4. Replace worn or damaged parts with only original Alfa Laval parts.

Alfa Laval cannot be held responsible for any damage to property or for injury to persons if genuine parts are not used.
5. Do not interchange bowl parts, since specific parts are balanced as a unit.

The Motor

1. Do not operate a decanter equipped with flame proof motor(s) and control unit(s) until all enclosures have been assembled in accordance with the appropriate standards.
2. If a motor should become inoperative, immediately shut off the power.
3. Always follow motor manufacturer's specifications on bearing lubrication.
4. Do not attempt to operate a motor that is overheated due to frequent starts and stops. Allow motors to cool to ambient temperature (as designated on the motor nameplate) before each restart.

Do not attempt to start motor unless the rotating elements turn freely.

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Corrosion, Erosion and Pitting of Decanter Equipment

It should be recognized that equipment subjected to severe erosive or corrosive environments may deteriorate over a period of time, depending upon the severity of exposure and/or possible misuse. Users of high speed centrifugal equipment should be aware of this fact and also that extremely high forces are brought into play when their equipment is in operation. Any weakening of highly stressed members by misuse, erosion, corrosion, chemical pitting, or stress cracking must be guarded against.

The following points should be noted and the recommended action taken:

1. Inspect the outside of the bowl for erosion and corrosion, at least every two months.
2. Do not operate equipment when:
 - 2.1 Holes are worn through rotating parts.
 - 2.2 Grooves greater than 2 mm (0.08 inch) deep are worn in rotating parts.
 - 2.3 Evidence of cracks is present in rotating parts.
 - 2.4 Chemical pitting of 2 mm (0.08 inch) depth or greater is present on rotating parts.

3. Chemical Pitting Observed:

All cases of chemical pitting, even under 2 mm depth, should be monitored carefully. This action is almost always due to the breakdown of the passive film on stainless bowl shell walls, in the presence of chlorides. This often occurs under deposits that have not been cleaned from the outside of the bowl wall. High temperature and high acidity accelerate the action.

4. Pay special attention to the bolts assembling the bowl sections. If the process liquid or cleaning agents contain chlorides, check these bolts at least once a year and exchange them at least every three years. Contact Alfa Laval, if in doubt.

Contact Alfa Laval regarding the repair or replacement of pitted bowl shells or other parts.

2 Decanter Operating Principle

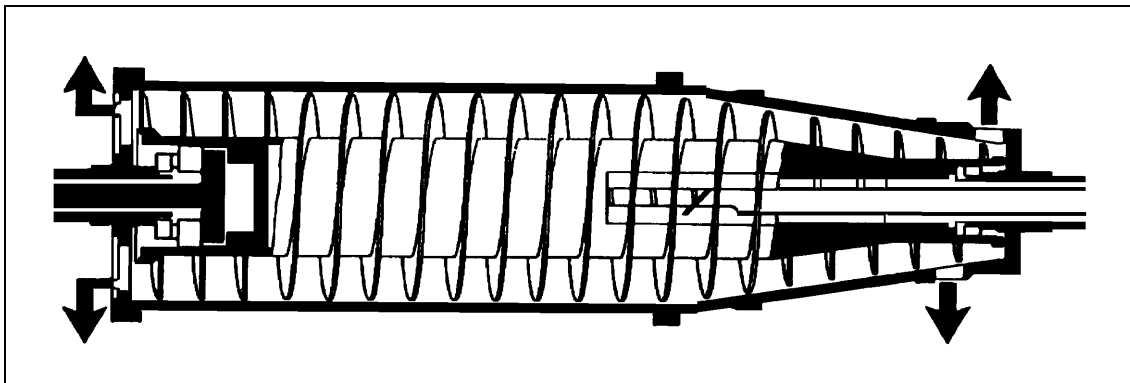


Figure 2.1

The feed enters the decanter at the intersection of the conical and the cylindrical part of the bowl through a central feed pipe in the hollow drive shaft. After leaving the feed pipe, the feed suspension is distributed into the rotating liquid in the bowl and smoothly accelerated to the full rotational speed. The centrifugal force makes the solids settle at the bowl shell. The screw conveyor continuously transports the solids toward the conical end of the bowl and through conical bowl part.

The separation takes place throughout the total length of the cylindrical part of the bowl, and the clarified liquid discharges at the large end where it flows over the rim of exchangeable and/or adjustable plate dams.

The solids are discharged from the small end by centrifugal force through outlet openings.

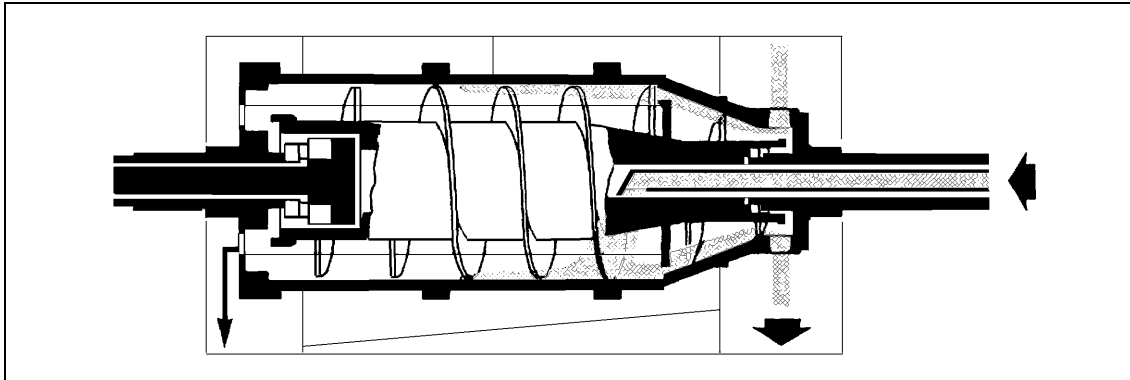


Figure 2.2

Decanter with Baffle Disc

The space in the cylindrical and conical parts of the bowl, with the baffle disc between them, act as two communicating vessels. The plate dams can be set to a smaller radius than that of the solids discharge (negative beach).

Then the heavy phase (the solids) is pressed under the baffle disc by the hydrostatic pressure of the light phase (the clarified liquid).

ATTENTION *The liquid and the solids are discharged at roughly the same radius, and consequently, during start-up, flushing, and irregularities in process, discharge of liquid through the solids discharge ports may occur owing to lack of solids in the bowl. This should be taken into consideration when the decanter is installed.*



2.1 Main Drive

The decanter is driven by an electric motor. The motor shaft carries a drive pulley, and motive power is transmitted through V-belts to the bowl pulley to drive the bowl.

2.2 Back Drive

The purpose of the back drive system is to make it possible to control the speed of the sunwheel shaft of the gearbox and consequently control the differential speed between bowl and conveyor.

Two automatic back drives are available, one with Eddy Current Brake (ECB) and one with Variable Frequency Drive (VFD).

For both the ECB and the VFD back drive two specialized de-canter back drive controllers can be used, i.e. either the ABC (**A**dvanced **B**ack **D**rive **C**ontroller) or the DSC (**D**ifferential **S**peed **C**ontroller).

See specific manuals for the ABC and DSC for further information about the back drive controllers.

2.2.1 Eddy Current Brake

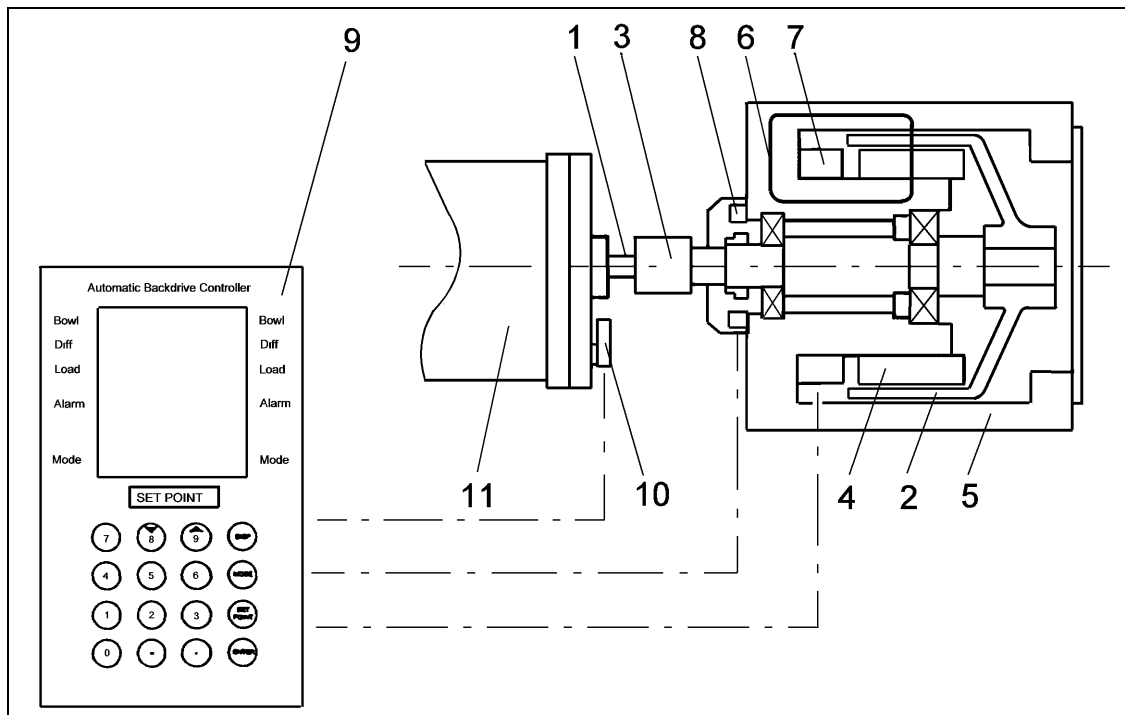


Figure 2.2.1

Key Features of ECB

- | | | | |
|----------------------|-------------------------|------------------------------|-----------------------|
| 1. Pinion Shaft | 4. Poled Wheel Assembly | 7. Magnetic Coil | 10. Bowl Speed Sensor |
| 2. Torque Tube | 5. Stator | 8. Tach-generator | (when fitted) |
| 3. Flexible Coupling | 6. Magnetic Field | 9. Advanced Brake Controller | 11. Gearbox |

For identification of the parts mentioned in the below description, refer to Figure 2.2.1.

The Eddy Current Brake operates on a principle commonly employed in variable speed drives as follows:

The gearbox pinion shaft (first stage sun gear) [1] is attached to torque tube [2] via a flexible coupling [3] which isolates vibrations and permits slight misalignment between the two shafts.

The torque tube, of highly conductive material, surrounds a poled member [4] which is attached to stator [5].

In operation, stationary field coil [7] is energized to set up magnetic flux [6]. As the torque tube revolves, it induces eddy currents by traversing the poled member; these eddy currents tend to resist rotation of the torque tube thus creating the braking effect.

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The minimum controllable speed of the rotor is in the order of 300 rpm, which represents approximately 90% of the fixed differential speed obtainable with the mechanical type of torque control, dependent upon the type of gearbox fitted.

Control over the speed of the eddy current brake is effected by an integral Tach-generator and separate control unit.

The Tach-generator [8], which is incorporated on the shaft to the torque tube, generates a voltage and frequency which is directly proportional to its speed.

The signal from the Tach-generator is fed to the control circuit and used by the controller to determine the appropriate current to the field coil. The controller either increases the current to increase the braking effect, thus decreasing the speed of the brake, and increasing the scrolling differential, or decreases the current to reduce the braking effect, thus allowing the brake speed to increase and consequently decreasing the scrolling differential.

CAUTION



Although it is quite acceptable for the eddy current brake to rotate with the centrifuge bowl at maximum bowl speed for short periods, such as may occur in the event of a conveyor blockage, it is not advisable to allow the ECB to freewheel for longer periods than absolutely necessary.

The reason for this restriction lies in the inherent nature of the epicyclic gearbox, where, unless the rotational speed of the gearbox pinion shaft is restricted to less than the speed of the centrifuge bowl, the ring gears in the gearbox will not be able to drive the planetary gears around the sun gear. In this situation, no oil will be picked up and passed from gear to gear or bearing to bearing; oil will instead migrate by centrifugal force to the walls of the gearbox leaving gears in metal to metal contact.

To prevent excessive speed from being induced unnecessarily, the control circuit is designed and preset to prevent the brake from being operated above a predetermined limit, i.e., approximately 82 to 90% of the maximum bowl speed dependent upon the type of gearbox fitted.

3 Operation and Routine Maintenance

3.1 Before First Start

ATTENTION *Be sure the decanter has been properly lubricated according instructions in section 3.8. If the decanter has been in stock for more than a few months, the grease in the main bearings might have stiffened, which makes it difficult to attain full speed. The remedy is to apply new grease while turning the bowl slowly by hand (see section 3.8.1).*



Be sure that the transport safety devices (the yellow wedges) have been removed. Check that the bowl rotates freely in both directions.

WARNING *In all decanters the bowl rotates at very high speeds. Very great energy is accumulated and it is therefore essential that both the directions concerning assembly of parts, starting, stopping and overhaul, and the safety precautions given are followed strictly.*



3.1.1 Noise and Vibrations

In spite of the most accurate balancing a rotating body is always slightly out of balance. As the bowl and the conveyor are two separately balanced units rotating at different speeds, the negligible unbalance of each unit will coincide, and a momentary increase of noise and vibration occurs in the machine.

The period of time between the moments when this happens depends on the difference in the speeds of bowl and conveyor. The higher the differential speed the shorter the intervals, and vice versa.

Increased unbalance caused by wear and/or accumulation of solids will increase the amplitude of noise and vibration.

A practical hint: The differential speed of the conveyor can be found by counting these vibrations for exactly one minute.

3.2 Start/Stop procedures

3.2.1 Inspect Bowl

A bowl which has not been cleaned, but left clogged by solids after operation must be cleaned before the decanter is restarted, because dried solids may cause severe unbalance and eventual generation of an overload condition. See section 3.3.1.

3.2.2 Before Start

3.2.2.1 Checkpoints

If the decanter has stopped due to overload, the following points must be checked before the decanter is started:

- Are the upper and lower casings free from solids deposits?
- Are the discharges open?
- Is the bowl easily rotated by hand?
- Are all guards correctly placed and properly secured?

3.2.2.2 Decanters with Mechanical Seals

Before starting a decanter with mechanical seals, the gas supply system for the seals must be activated and the flow and pressure of gas to the seals must be checked. If the decanter is to be used for inflammable substances, it must be purged with inert gas and it must be ensured that the oxygen concentration has gone down to a safe level before the machine is started. Also during run-down until the decanter has stopped, the gas supply to the seals must be activated. See section 3.10.1 'Installation, Start-up and Operation of Decanters with Circumferential Seals'.

3.2.3 Start Decanter

Release EMERGENCY STOP (in most cases: pull out the EMERGENCY STOP knob - or turn it as indicated by arrows).

Start the decanter motor.

Wait 2-4 minutes for the decanter to attain full speed with star connected circuit before switching to delta connected circuit.

Start the belt conveyor or other transport means for discharged solids.

Open the feed valve (if any).

Start polymer pump (if used).

Start the feed pump.

3.2.4 Stop Decanter

ATTENTION *When stopping a decanter with mechanical seals make sure that the supply of gas continues until the decanter has stopped.*



Stop feed and polymer pumps (if used), close feed valve (if fitted).

Before stopping, flush out with water of suitable temperature. Flush while the machine is running.

Stopping the decanter before its bowl is sufficiently cleaned may give rise to heavy vibrations both during decanter rundown and during its successive run-up.

ATTENTION *When flushing decanters for fat and oil applications, optimal flushing effect is achieved by using flushing liquids holding temperatures above the melting points of the fats and oils run through the decanter.*



Using e.g. cold water might cause solidified lumps of fat/oils to remain in the decanter, which in their turn would give unbalance during decanter rundown and during its successive run-up.

Stop the decanter motor when the bowl is thoroughly flushed. Do not flush the decanter when it is inactive.

Press the CENTRIFUGE STOP button on operator panel.

3.3 Monitoring Operation

Make particularly sure that there is no increase in vibration.

Check the surface temperature of the main bearing housings from time to time. A temperature rise may indicate a possible malfunction in the bearing.

ATTENTION *After lubrication the bearing temperature may remain high for some hours.*



3.3.1 Overload

If the centrifuge torque exceeds a certain limit, the control system will deactivate the feed permissive contact and stop the feed and polymer pumps.

Under these circumstances the control system can be reset and the feed pump restarted.

If the conveyor torque exceeds a higher limit, the main motor will be also be switched off.

Then it is advisable to have the feed replaced by water until the bowl speed has reached 300 r p m.

When the bowl has stopped rotating, reset the control system to operative condition.

3.3.1.1 Causes of Overload

The causes of overload may be:

- Too high throughput.
- Too high feed concentration.
- The properties of the solids (prestraining or grinding the process liquid before feeding it into the decanter may be necessary).
- Too low differential speed.
- Solids clogging the discharge from the casing.

3.3.1.2 Cleaning an Overloaded Bowl

Be sure the bowl has stopped rotating.

Reset the overload relay or clear the torque alarm on the control panel.

Check whether the casing is free of solids.

Then test whether the decanter can eliminate the overload by itself during runup.

If not, supply an ample amount of water into the feed pipe. Remove the gearbox cover and prevent the coupling on the sunwheel shaft from rotating with a piece of tying.

Then rotate the bowl by hand in the direction of rotation indicated by the arrow (on top of the feed pipe bracket), while supplying water.

If supplying water through the feed pipe proves unsuccessful, try to loosen the deposits by rotating the bowl by hand, first backwards a few revolutions, then forward several revolutions, keeping the sunwheel shaft fixed.

If the bowl can be turned by hand only to a certain point relative to the sunwheel shaft, then the solids are so hard that the bowl must be disassembled for removal of the solids. Any damaged parts must be replaced before the machine is restarted.

3.3.2 Vibrations

If excessive vibrations occur while the bowl rotates, stop the main motor immediately and supply liquid to soften the vibrations.

3.3.2.1 Vibration Switch

To protect the decanter against damage due to heavy vibration, it can be equipped with a vibration sensor which cuts off the power supply to the main motor and opens the feed permissive contact to stop the feed and polymer pumps in case of excessive vibration.

The control panel (or the motor starter) must be provided with a terminal for the vibration switch.

Vitec Vibration Switch

The standard factory-set levels are $\frac{3}{4}$ in/sec alarm level and $1\frac{1}{4}$ in/sec as decanter shutdown level.

For further details about the vibration switch, see sub-supplier's descriptions included in the decanter supply.

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3.3.3 Measuring the Conveyor Wear

When the conveyor transports the solids toward the conical bowl section and press them up to the solids outlets, the front side as well as the edge of the conveyor flights are exposed to wear the rate of which is dependent on different factors such as the hardness of the solids particles, the differential speed, the amount of conveyed solids, and especially the type of hardsurfacing used for the conveyor installed in the decanter delivered.

Concurrently with the conveyor wearing down, its conveyance capacity is increasingly reduced, and as a consequence of this, the separation result deteriorating and furthermore the decanter vibration level increasing. The acceptable limit of the wear depends entirely on the actual separation process and on the level to which the decanter vibrations reach, the latter often being the factor which determines when to repair the conveyor.

For this reason it will be advantageous to check the wear regularly to settle how fast the conveyor is wearing down. Normally the conical part of the conveyor gets more worn than its cylindrical part.

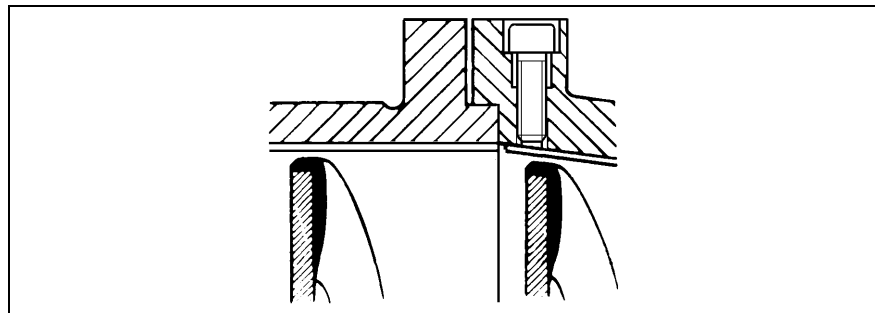


Figure 3.3.1

The bowl has a hole for measuring the conveyor wear located in the conical section either where the conical and cylindrical sections meet or in the middle of the conical section (see Fig. 3.3.1). This wear measuring hole makes it possible to determine the conveyor wear without disassembling the bowl. The only tool needed is a calliper gauge to put through the measuring hole.

Measuring the Wear

Open the upper casing and rotate the bowl by hand until the wear measuring hole points upwards.

Remove the screw and clean the hole.

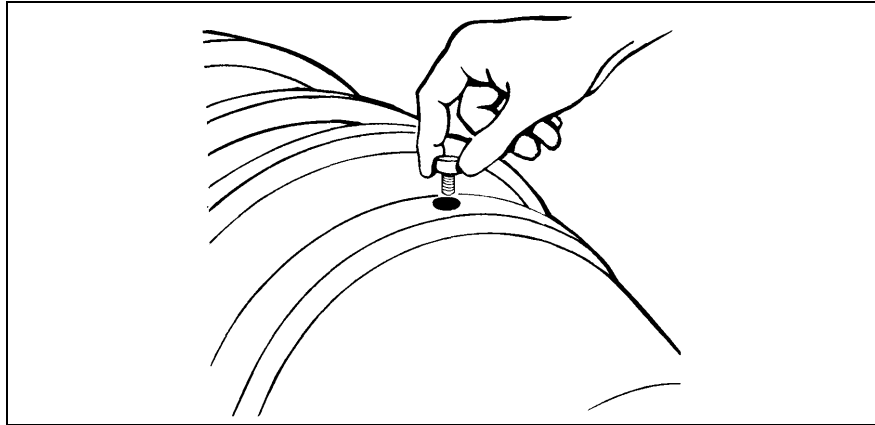


Figure 3.3.2

Rotate the sunwheel shaft at the end of the gearbox until one of the conveyor flights appears exactly under the hole. The placement of the conveyor flight can be determined by means of a thin small stick inserted into the hole if only one staff member is set to make the measurement; the wooden stick will break as the flight is positioned centrally under the hole, but look into hole anyway to check whether the position of the flight is correct (see Figs. 3.3.2 and 3.3.3).

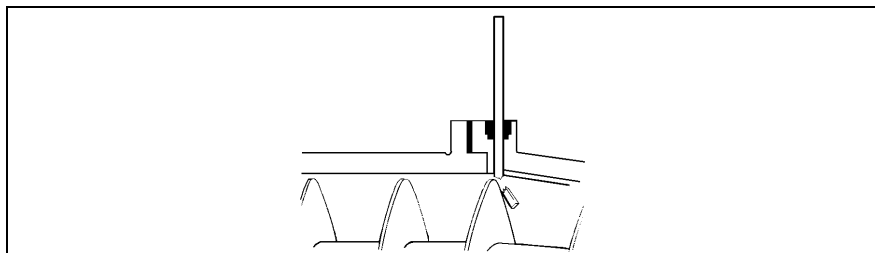


Figure 3.3.3

contd...

Measuring the Wear, cont...

Put a calliper gauge as far it goes into the hole before the end of the gauge hits the highest positioned point of the flight and check the calliper gauge reading to see how deep the gauge went (see Fig. 3.3.4).

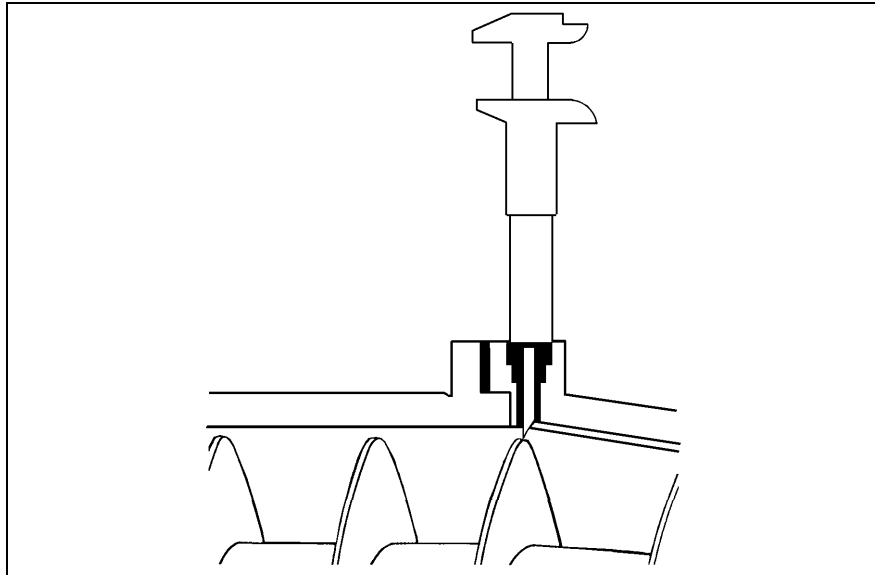


Figure 3.3.4

ATTENTION *In order to secure accuracy of measurement whenever measuring the conveyor wear, position the conveyor flight right in the middle of the measuring hole and turn the calliper gauge the same way every time.*



contd...

Measuring the Wear, cont...

Refit the screw after having measured the conveyor wear, not forgetting to apply a suitable slip agent to the screw (see Fig. 3.3.5).

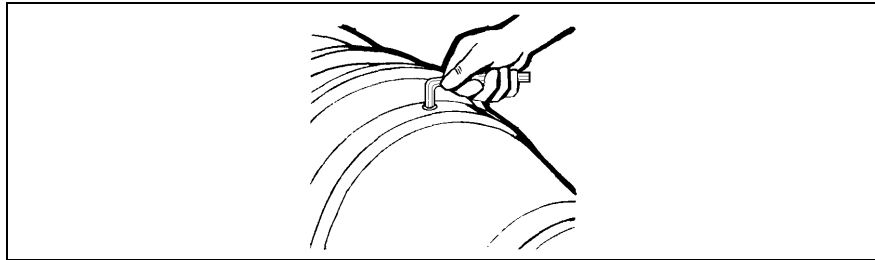


Figure 3.3.5

Intervals of measurement

Make the first measurement before starting the decanter for the first time and note the depth.

Measuring the conveyor wear more frequently is recommended during the initial hours of operation, e.g. every 100 hours (do not forget to note the result of each measurement made), to determine the approximate wear rate.

When knowing the wear rate, make the periods between the intervals of measurement shorter or longer as occasion requires.

3.4 Routine Cleaning Procedure

Before stopping, raise differential speed to scroll out residual solids then flush with water until liquid discharge appears clean (approximately 5-10 minutes).

Switch off the motor and continue flushing. Shut off flush water before the bowl speed drops below 300 r p m.

Do not flush the decanter when it is inactive or rotating less than 300 r p m. If this should occur, the conveyor bearings should be lubricated to ensure they are free from liquid contamination. See section 3.8 'Lubrication'.

Check whether the flushing had the intended effect, for example by checking if the bowl is easily rotated by hand while keeping the sunwheel shaft fixed.

If not, rotate the bowl above 300 r p m and clean thoroughly with water. Do it immediately after stopping, because it is easier to remove fairly moist and soft deposits than to remove deposits hardened over time in an inactive machine.

The cleaning water may escape through the solids discharge opening. Take precautions to avoid liquid being fed to downstream equipment as required.

Clean the upper and lower casings every six month or as required by process conditions.

Practical Hint: Flushing time required is site specific. If the centrifuge appears to have higher than normal vibration during centrifuge starting, but runs with normal vibration on process, then flushing time should be extended on shut down. If there are no abnormal vibrations, the flushing time is adequate.

If cleaning as outlined above proves unsuccessful, the bowl must be disassembled for cleaning.

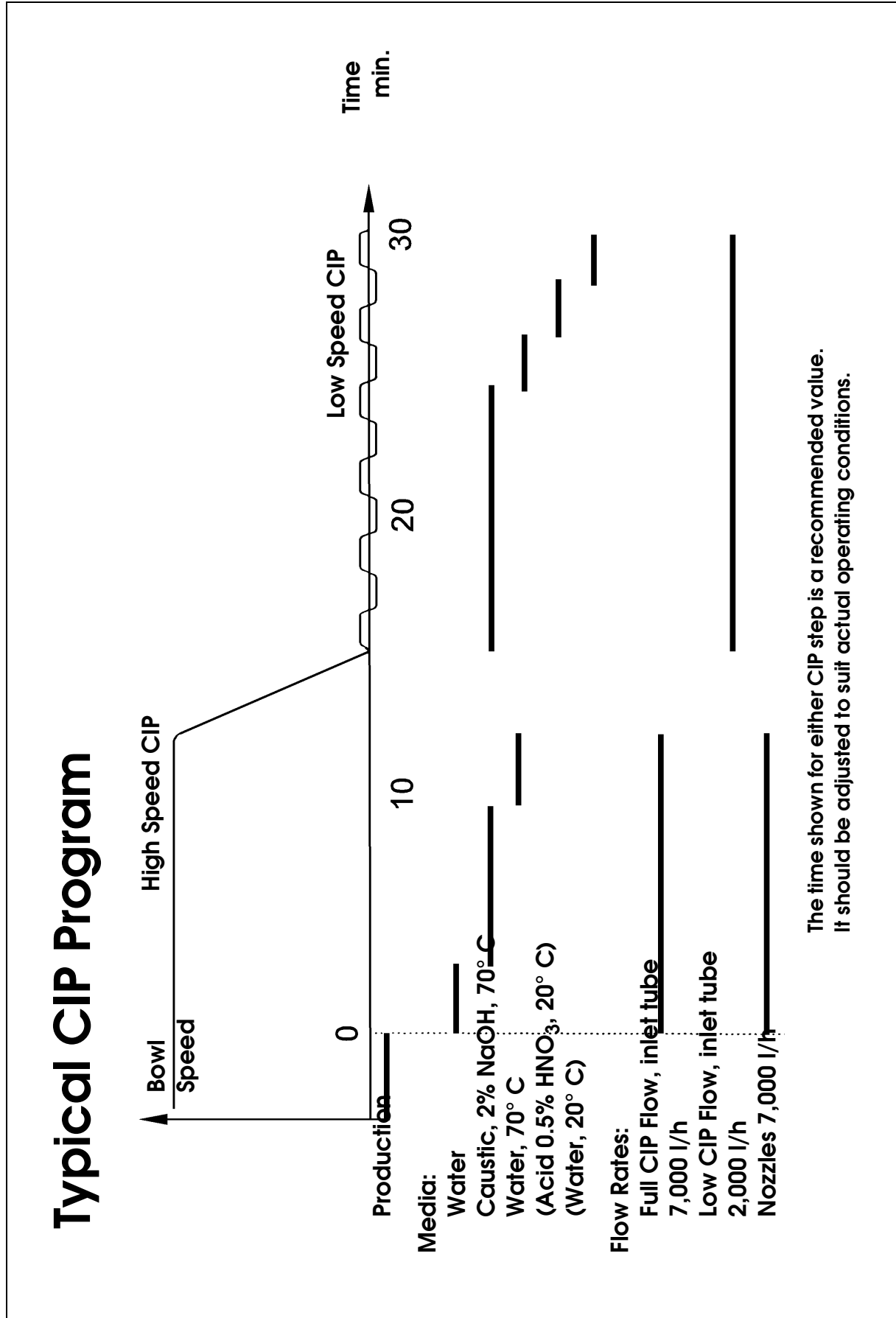


Figure 3.4.1

3.4.1 Cleaning In Place (Optional)

The CIP of the decanter is carried out in two steps:

First a High-speed CIP at full bowl speed, which is followed by a Low-speed CIP at speeds corresponding to just under 1*g (50 - 150 r p m).

While the high-speed CIP is performed, the pipings, the inlet parts, and the outside of bowl and decanter casing are cleaned. The sludge remaining in the bowl after completion of the high-speed is cleaned out during the low-speed CIP.

When terminating the separation performance, the decanter should be prerinsed with water until all visible solids and process material have been removed before using a liquid with cleaning detergent.

In most cases water alone cannot remove the dirt and deposits, its removing power being insufficient.

Chemicals such as sodium hydroxide, also known as caustic soda, must be added in order to achieve a satisfactory result. Caustic Solution: 1-1.5% NaOH, to ensure a pH value of 12 to 13. A detergent compound of NaOH with an admixture of complexing agent such as sodium-polyphosphates, EDTA, or NTA should be used.

An acid cleaning could be carried out as a supplement to the caustic cleaning. Nitric acid (HNO), concentration 0.5%, is suitable.

The time shown in Fig. 3.4.1 for either CIP step is a recommended value. It should be adjusted to suit actual operating conditions.

contd...

3.4.2 High Speed CIP

During the high-speed CIP the pipings, the decanter casing, the bowl outside, and the inlet space of the decanter are cleaned.

The CIP flow to the feed tube of the decanter should be 7000 l/h. At full-speed CIP the spray nozzles in the casing should also be activated to feed 7000 l/h at 3 bar.

The CIP flow from the feed tube will be recovered at the paring disc and can be pumped back to the CIP unit.

The liquid sprayed through the nozzles will come out at the solids discharge aperture of the casing. The liquid is polluted with solids and need to be rinsed before it is reused.

The full-speed CIP is finalized by a five-minute water flushing, to flush the cleaning agent out of the piping.

After the full-speed CIP the decanter and flow are stopped. When the decanter has come to a complete stop, zero speed is indicated and the low-speed CIP is started.

contd...

3.4.3 Low Speed CIP

During the low-speed CIP the sludge residues are flushed off the bowl inside and the screw conveyor body.

The decanter rotates at a speeds within the range of 50-150 r p m, where the bowl direction of rotation can be reversed at certain intervals, to achieve a washing machine effect. In this way the cleaning liquid is lifted up, to some extent, on the bowl wall from where it falls down as the bowl rotation reverses. The result is a mechanical cleaning effect on the bowl and conveyor, which combined with the chemical efficiency of the cleaning liquid improves the cleaning efficiency and ensures a good cleaning effect.

The low-speed rotation is performed by the main motor frequency converter controlled by the decanter panel.

During the low-speed CIP the flow into the decanter should be 2000 l/h.

All liquid fed to the decanter escapes at the solids discharge apertures. Take precautions to avoid liquid being fed to downstream equipment intended for sludge treatment.

The CIP liquid recovered is polluted with sludge and need to be rinsed before it is re-used.

	Capacities	
	Feed Tube 1/h	Nozzles 1/h at 3 bar
High-speed CIP	7000	7000
Low-speed CIP	2000	0

Table 3.4.1

3.5 Performance Optimization

The decanter can be adjusted to suit individual requirements by varying the following control parameters:

Bowl Speed

By varying the rotational speed of the bowl, the G-force can be adjusted to suit the application. The higher speed, the better separation.

Liquid Level

Adjust the liquid level (pond depth) to give the optimal balance between liquid clarity and solids dryness by selecting different plate dams.

In general terms, the centrate becomes more clear and the cake more wet when diminishing the liquid radius and vice versa.

Differential Speed (Δn or ΔRPM)

The dryness of the cake can be increased when operating with a lower differential speed, but the centrate will be less clear and vice versa. The torque increases with the lower Δn .

The differential speed can be regulated automatically to compensate for varying content of solids in the feed.

Feed rate

The lower feed rate, the better separation.

3.6 Main Drive

Store spare V-belts in a dry and cool place.

Never roll up the V-belts. Sharp bends will damage them.

All types of V-belts used for the main drive should normally be exchanged every 16000 hours.

3.7 Eddy Current Brake

The once-for-all lubricated bearings of the brake make in principle maintenance unnecessary.

The brake is open and fan cooled to achieve enough air flow for effective cooling and, consequently, it must not be flushed.

Being open, the brake is also sensitive to dust and oil mist.

For this reason it is recommended to avoid their occurrence near the brake if possible. If, however, exposing the brake to dust and/or oil mist proves inevitable, Alfa Laval recommend that the brake be disassembled for cleaning once a year or more frequently as required.

3.7.1 Adjust Bowl Speed Sensor (Fig. 3.7.1)

The bowl speed sensor at the gearbox adapter must be set at a radial distance of 3-4 mm (1/8 inch) from the iron the sensor is to see. Placing the speed sensor too close or too far from the corresponding surface can cause misreadings.

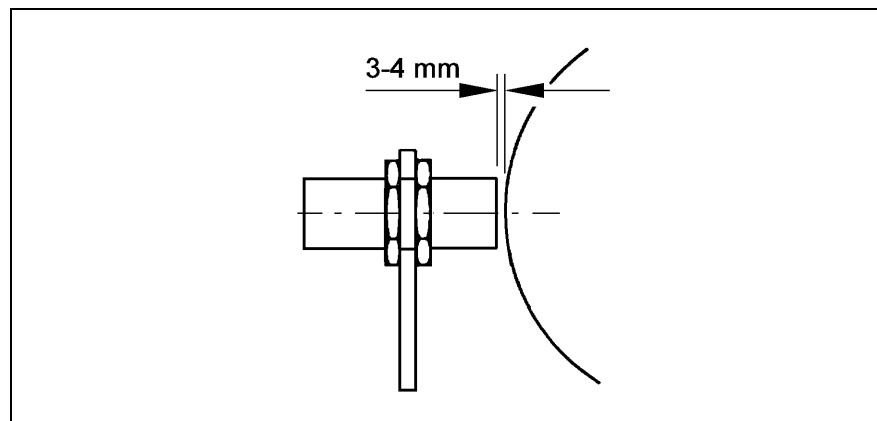


Figure 3.7.1

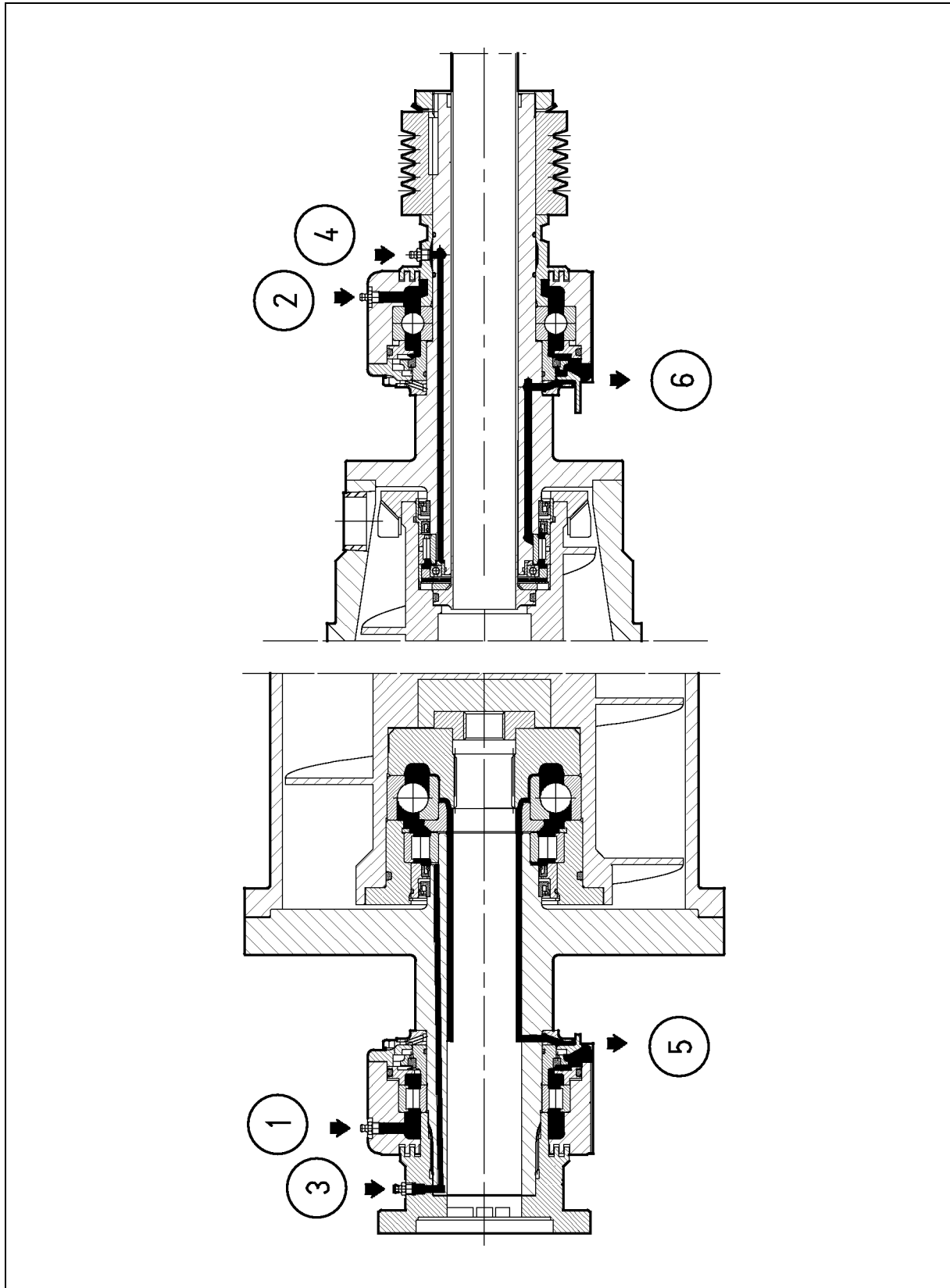


Figure 3.8.1

- | | |
|---------------------------------|---------------------------------|
| 1. Main Bearing Large End | 2. Main Bearing, Small End |
| 3. Conveyor Bearing, Large End | 4. Conveyor Bearing, Small End |
| 5. Discharge opening, Large End | 6. Discharge Opening, Small End |

3.8 Lubrication

(Fig. 3.8.1 shows where the lubricating nipples are located)

The lubricants must be kept in a dry and cool location (15-20°C =59-68°F). The containers must be kept closed to prevent contamination of the lubricants by dust and moisture.

When lubricating, refer to the lubrication and lubricant tables in the next section of this manual and proceed as follows:

3.8.1 Main Bearings (Nipples 1 and 2 in Fig. 3.8.2)


Always lubricate the main bearings while the decanter is running, and preferably, just before stopping it for any prolonged period of time.

This will ensure the best distribution of grease, which in its turn gives optimum lubrication condition and maximum protection against contamination of the bearings.

Greasing on daily basis is acceptable, provided that before greasing a calculation will be made of the amount of grease to be injected which is proportional to the recommended quantity for a longer lubrication interval, according to the formular X grams (oz) multiplied by the daily hours of running divided by the prescribed lubrication interval hours of operation.

Using X grams every 300 hours at 24 hour running, the equation is:

$$\frac{X \text{ grams (oz)} \times 24}{300} = 0.08X \text{ grams (oz) per day.}$$

ATTENTION  *It is not advisable to grease more often than once per day. Using larger quantities than those recommended may lead to over-greasing and thereby problems of high bearing temperatures or even bearing breakdown.*

Hint: If the decanter is taken out of service for a certain period every week, lubricate the main bearings just before stopping the decanter.

If the decanter is taken out of service for more than two weeks, its main bearings must be lubricated every two weeks during the inactive period.

Using the grease gun included in the standard decanter delivery, apply 15 grammes (0.5 oz) - 10 strokes - of grease to each bearing. Then turn the bowl slowly by hand.

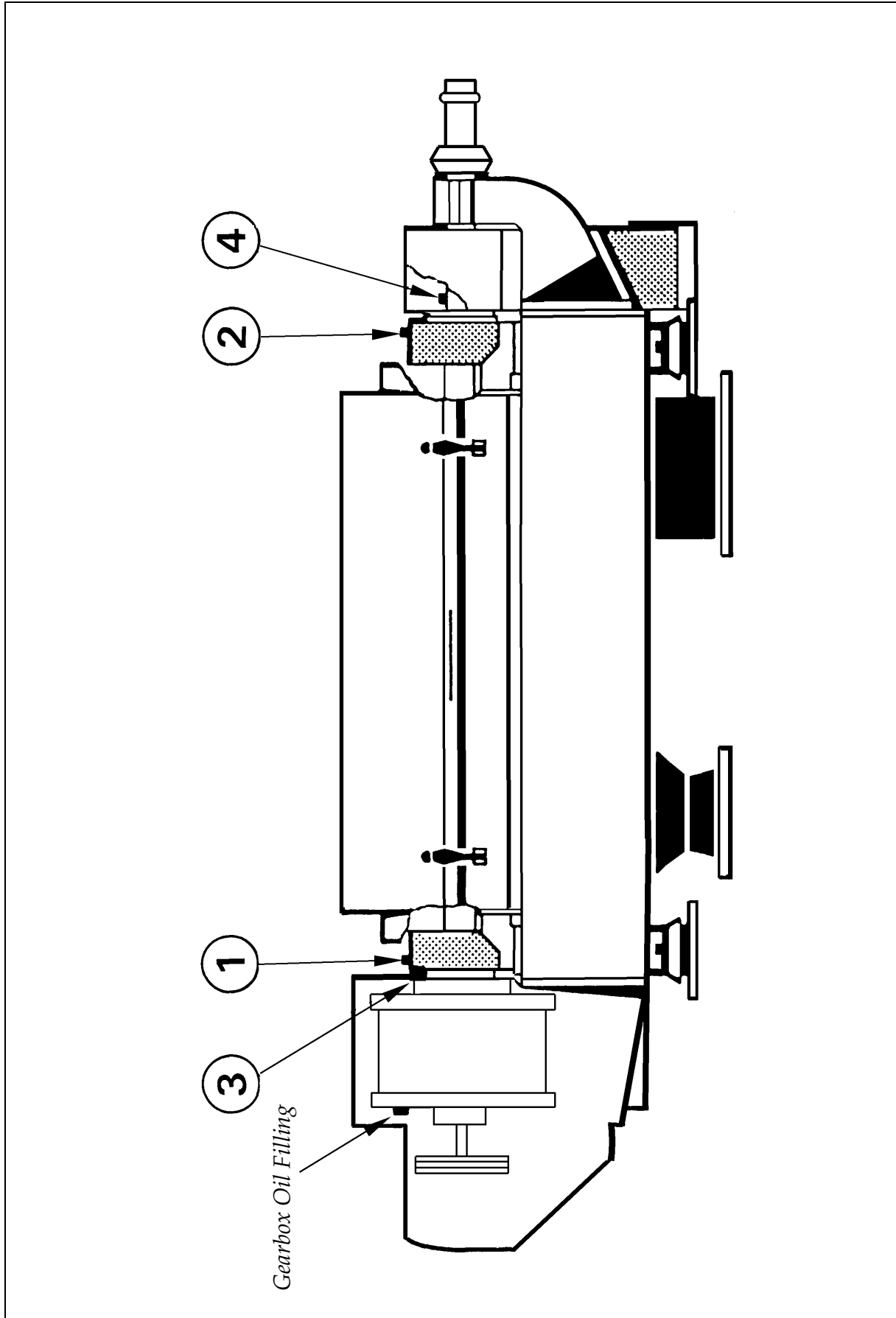


Figure 3.8.2

3.8.2 Conveyor Bearings (Nipples 3 and 4 in Fig. 3.8.2)

Lubricate the conveyor bearings with the decanter stopped and the power effectively disconnected from the main motor.

Using the grease gun included in the standard decanter delivery, apply 100 g (3.5 oz) - 67 strokes - of grease to each bearing.

ATTENTION *Sufficient amount of lubricating grease applied: If the lubricating grease flows out from the grease discharge opening located behind the main bearing housing, add no more grease.*



“Solids Oil” Conveyor Bearings An option is to equip the decanter with prelubricated and thus in principle maintenance-free “Solids Oil” conveyor bearings.

Lubricating conveyor bearings of this type now and then is recommendable, to prevent outside dirt from entering the bearings. Do not, however, apply more than 1/5 of the recommended normal grease quantity, i.e. 20 g (0.7 oz) to each bearing. If applying the normal quantity of 100 g (3.5 oz) to a “Solids Oil” conveyor bearing, the lip seal pointing against the bearing may be damaged.

The conveyor bearings should also be lubricated after each stationary Clean-In-Place or if large amounts of flush water are introduced when the unit is stopped or rotating less than 300 r p m.

3.8.3 Gearbox (Fig. 3.8.3)

Change the oil in the gearbox at the intervals given in Table 3.9.1 'Lubrication Table'.

In the front face of the gearbox there are two plugs (drain plugs) screwed into two holes.

Drain the oil from the gearbox into a suitable container as follows:

Rotate the gearbox until the two drain plugs are set in vertical alignment.

First remove the upper plug and then the lower plug. After draining, flush the gearbox with clean gearbox oil: Insert one of the removed drain plugs into the lower hole and pour approx. 1 litre of gearbox oil through the upper hole, using an oil syringe. Insert the second plug into the upper hole and rotate the gearbox by hand as fast as possible and drain it again as described above.

Then refill the gearbox with oil of the quality given in the lubrication table. To check the oil level, rotate the gearbox until its arrow marked "UP" points straight up. The oil surface inside the gearbox should then level with the upper drain hole (see level indication mark in Figure 3.8.3 below).

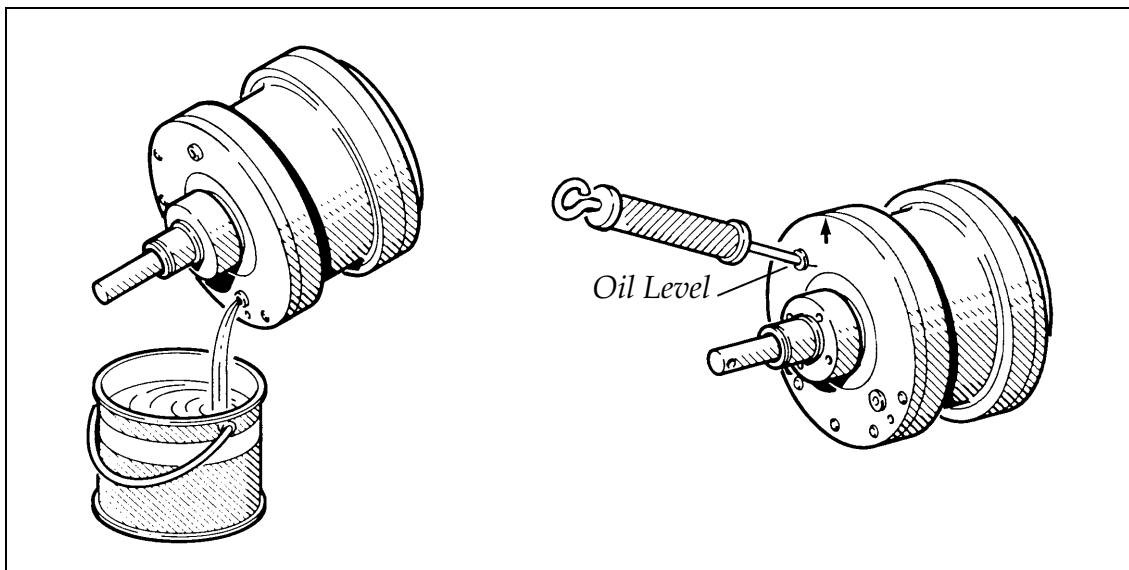


Figure 3.8.3

3.9 Maintenance Tables (Tables 3.9.1, 3.9.1.1, and 3.9.2)

General Information

For proper lubrication and maintenance, see the tables on the following pages.

Lubrication: In cases where no Alfa Laval lubricants are available, other types of lubricants acceptable by Alfa Laval may be used; refer to the table 3.9.2.

WARNING *Use of non acceptable lubricants will void Alfa-Laval's warranty with respect to damages resulting from such incorrect use.*



ATTENTION *If changing from one grease type to another, it will be necessary to disassemble all bearings and remove old grease by washing the bearing itself in petrol or a similar detergent. Other parts must be carefully cleaned of old grease. When having reassembled the cleaned bearing parts, the new type of grease can be applied.*



3.9.1 When to lubricate and to perform maintenance

Lubrication Table				
	First Running	Intervals	Lubricant	Quantities
Main Bearings	Lubricate during running at 50-150rpm	See table 3.9.1.1	See table 3.9.2	15 g (0.5 oz) at each grease nipple *
Conveyor Bearings	Before the first start	See table 3.9.1.1	See table 3.9.2	100 g (3.5 oz) at each grease nipple a
Gearbox	Check oil level (see section 3.8.3). If necessary, add oil.	See table 3.9.1.1	Alfa Laval 61203671-10 61203671-16 Statoil Mereta 320	2.5 kNm : 2.5 Litres (2¾ quarts) 3.0 kNm : 3.0 Litres (3⅓ quarts) 3.5 kNm : 2.8 Litres (3 quarts) 3.5 kNm DD : 3.3 Litres (3½ quarts)
Splines (of shaft and hub)		See table 3.9.1.1	Alfa Laval 61203671-33 Texclad Premium 2	See section 4.1.8

Table 3.9.1

a When injecting grease with the grease gun ** included in the standard decanter delivery:
 1 stroke = approx 1.5 g (0.05 oz)
 7 strokes = approx 10 g (0.35 oz)

** For P/N, see table 3.9.2 or Spare Parts Catalogue, List TOOLS.

Intervals for Maintenance			
	Item	Interval [hours]	
		8h Daily	24h Service
Main Bearings	Lubrication		
	Product temperature < 60°C (140°F)	100 a **) **)	300 *) **) **)
	Product temperature > 60°C (140°F)	50 *) **) **)	150 *) **) **)
Conveyor Bearings	Lubrication		
	Product temperature < 60°C (140°F)	200 **) **)	600 **) **)
	Product temperature > 60°C (140°F)	100 **) **)	300 **) **)
Gearbox	Oil Check	1000	1000
	Oil Change	2000	2000
	Change lip seal(s), sunwheel shaft(s)***	4000	4000
	Change sunwheel shaft bearings	8000	8000
Splines (of shaft and hub)	Lubrication	2000	8000
Main Motor	Lubrication	2000	2000
V-belts	Tightening up and Check	2000	2000
	Change	16000	16000
Bowl	Check for wear and corrosion.		
	Max permissible wear: 2 mm. Check bolts if chlorides in process liquid. Check even more frequently than specified if process requires so.	1000	1000
Solids Discharge Bushings	Check	1000	1000
Safety Equipment	Check functioning of:		
	All alarm devices Safety equipment	2000	2000
Labels	Check:		
	Name-plate All warning labels	2000	2000
Foundation bolts	Check	4000	4000
Vibration dampers	Check		
	Fit new, if necessary.	4000	4000

Table 3.9.1.1

a If using Alfa Laval grease 6120.3671-34 or Klüber Isoflex NBU 15:
The lubrication intervals for main bearings can be doubled.
Lower main bearing temperature can be achieved.

** At least once a month

*** For P/N, see Spare Parts Catalogue

3.9.2 Applicable Lubricants

Lubricant			Parts to Lubricate	
Brand	Type		Bearings	
			Main	Conveyor
Alfa Laval	61203671-23	Grease	■	■
	61203671-34	Grease	□	
	61203671-40 *	Grease		▲
BP	Energrease LC 2	Grease	□	□
Castrol	LMX Grease	Grease	□	□
Caltex	Texando FO 20	Grease	□	□
Esso	Unirex N2	Grease	□	□
FAG	Arcanol L135V	Grease	□	□
Klüber	Isoflex NBU 15	Grease	□	
	Microlube GLY 92	Grease	□	□
	Klübersynth UH 1 64-62 *	Grease		□
Shell	Alvania Grease RL2	Grease	□	□
	Cassida EPS 2 *	Grease		▲
Statoil	UniWay LiX 42 PA	Grease	□	□
Texaco	Texando FO 20	Grease	■	■

Table 3.9.2

- Lubricants applied to the decanter when delivered
- ▲ Lubricants applied to conveyor bearings on sanitary decanters
- Other types of lubricants accepted by Alfa Laval

* Food Grade Grease

4 Disassembling and Assembling

WARNING *Do not make any disassembly/assembly operations on the decanter unless the main power is shut off, and the disconnected main switch is locked with a safety lock.*



Replacing parts

To ensure trouble-free operation of the decanter, great care must be taken during replacement of parts:

- Contacting and sliding surfaces, as well as O-rings and seals must be care fully cleaned.
- Always place removed parts on a clean, soft surface to avoid scratching the surfaces.
- Ensure that screws used to pull parts from each other have smooth ends.

O-rings, Seals, and Gaskets

Check O-rings, seals and gaskets for defects.

Check that O-ring grooves and sealing surfaces are clean.

After replacing an O-ring, check that it fills the groove completely and that it is not twisted.

Ensure that seals are mounted with the open end pointing the correct way. See illustrations.

contd...

Special tools

Always use the recommended special tools for removing, disassembling, assembling, and mounting the bowl. In case of negligence of this point, Alfa Laval accepts no liability for possible damage to the parts.

Alfa Laval supplies a variety of special tools and accessories to facilitate maintenance of the decanter. See volume SPC (Spare Parts Catalogue).

When lifting the decanter assembly four equal length round slings must be used. Connect them to the lifting eyes on the decanter frame by means of shackles. The minimum length of the slings is specified on the dimensioned drawing.

When Lifting Minor Decanter Parts by Straps always use lifting straps having a load capacity of minimum 1000 kg (2200 lbs).

Vibration Dampers

Check regularly and change those crumbled and dampers whose rubber has swelled or cracked. Do not run the decanter if any of its dampers is defective.

contd...

Spare Parts Kits

Alfa Laval supplies two types of spare parts kits for the decanter:

The intermediate kits for main bearings and conveyor bearings, respectively, contain rubber parts for the main bearings and the conveyor bearings.

The major kit for main bearings and conveyor bearings, respectively, contains parts necessary for the complete overhaul of the decanter. It includes all sealing components and bearings. See volume SPC (Spare Parts Catalogue).

4.1 Rotating Assembly

4.1.1 Remove Bowl (Fig. 4.1.1)

WARNING Do under no circumstances loosen or remove the upper casing while the bowl is rotating.

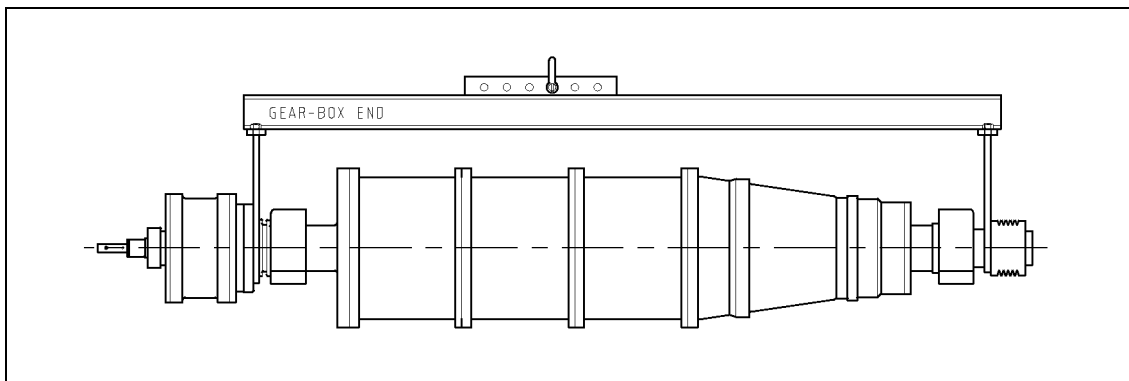


Figure 4.1.1

When the bowl is standing still, remove the hose from the outlet of the paring disc (if any), gearbox guard, belt guard, feed tube, belts for main drive, and belts or coupling for sunwheel drive.

Remove the screws fastening the bearing housings to the frame: Remove plastic caps covering nuts on guide pins at the bearing housings. Turn nut clockwise as if fastening it. This will pull guide pin out of its conical hole. Remove guide pins with nuts still on. Now loosen and remove screws which fasten the bearing housings to the frame.

contd...

Unscrew the clamping bolts fastening cover to casing and open cover.

Place the stirrups of the lifting tool around the bowl, the widest stirrup around the flange facing the gearbox and the other stirrup around the groove in the deflector on the inlet side.

Fasten the stirrups to the lifting tool and hook the lifting hook into the lifting tool eye located nearest to the gearbox.

ATTENTION *Be careful not to damage the grease nipple on the gearbox adapter.*



The individual design of both bowl and conveyor means that each bowl has its own centre of gravity and, as a consequence of this, that the axial point on the lifting tool corresponding to the bowl centre of gravity displaces accordingly. To find bowl centre of gravity, proceed as follows:

Place the shackle in the lifting tool centre hole and lift the bowl carefully, to see how the bowl balances.

If the bowl is not in balance, place the lifting tool in horizontal position on the frame and then insert the shackle into the next lifting tool hole nearer to the heavy end of the bowl and lift the bowl carefully again.

Repeat this procedure until the bowl is in balance and mark the centre of gravity hole of the lifting tool, to facilitate future disassembling and assembling.

Carefully lift the assembly of bowl, bearing housings, and gearbox.

Place it on a table or two trestles, securing the assembly by means of two blocks to prevent it from rolling.

4.1.2 Install Bowl (Fig. 4.1.1)

Place the stirrups of the lifting tool around the bowl.

Attach the stirrups to the lifting tool and hook the lifting hook into the tool eye located farthest from the gearbox.

ATTENTION *Be careful not to damage the grease nipple on the gearbox adapter.*



Make sure that the bearing housings surfaces in contact with the frame and the corresponding frame surfaces are perfectly clean.

Lower the assembly of bowl and bearing housings carefully on the frame.

Line up the assembly into its exact position by visually sighting through the taper pin holes.

Insert with gentle taps - no hard blows - the taper pins of the bearing housings and tighten nuts, using no tools. Put the plastic caps on top of the the nuts to secure them from being pulled out by further tightening of them.

Fasten the bearing housings, not forgetting the spring washers.

Close the upper casing and secure with the clamps.

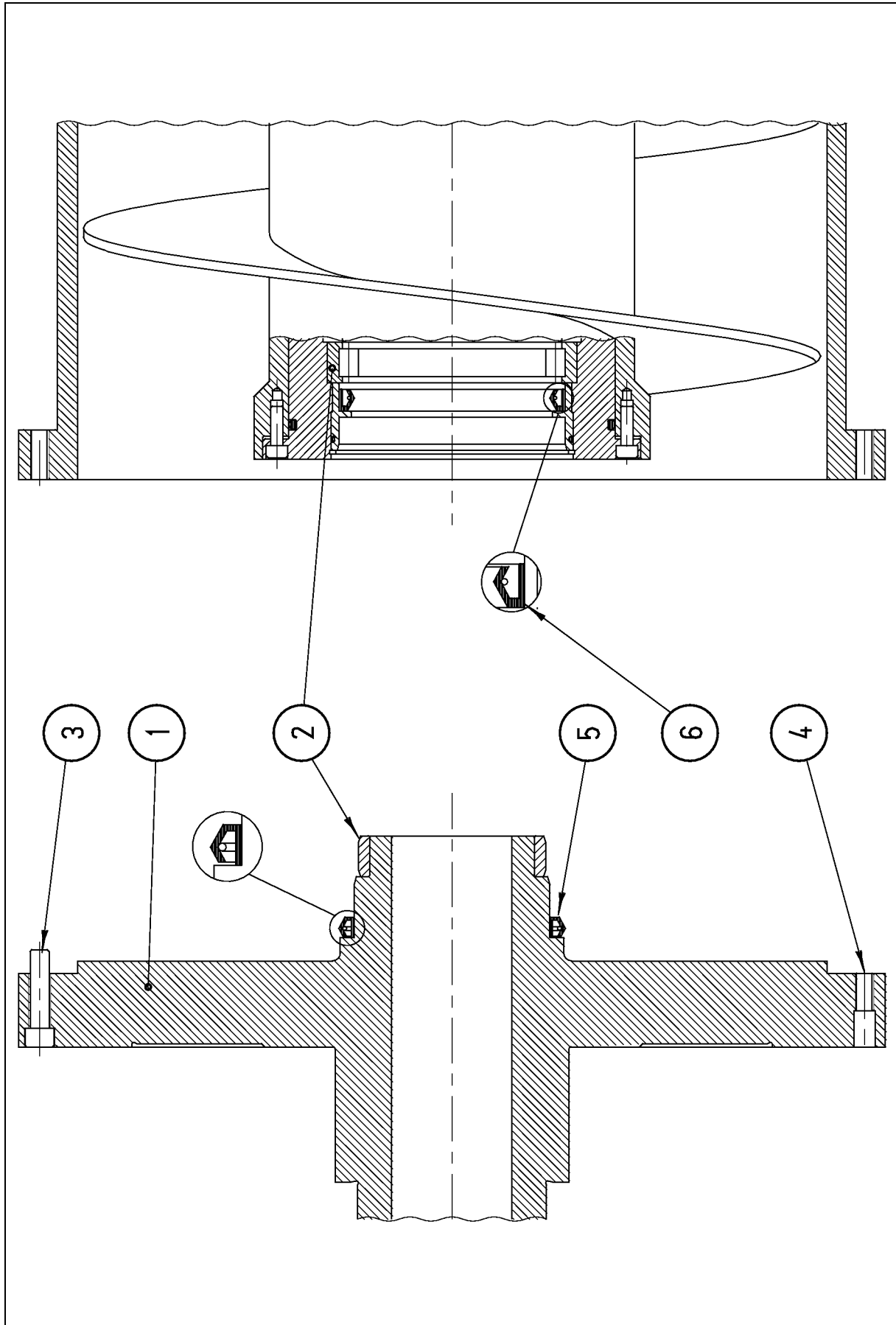


Figure 4.1.2

4.1.3 Remove Large End Hub (Fig. 4.1.2)

This procedure describes how to remove the large end hub with the gearbox assembled to it. For removal of the gearbox from the large end hub, see section 4.1.7.

ATTENTION *When removing the large end hub [1], always suspend it with a sling from a hoist or the like, to avoid excessive load to the roller bearing [2]. Place a sling around both sides of the pillow block.*



The 16 long screws [3]: Remove 15 of them, loosen the last one, and leave it in place until the end hub [1] is ready to be removed.

The end hub can now be jacked off: Using the four jacking screws [4], clear it of the bowl.

Be careful not to damage the roller bearing [2].

ATTENTION *Put a wooden stick or the like into one of the solids openings, to prevent the conveyor form being pulled out along with the end hub being removed.*



Remove the loosened long screw [3] left in place and carefully pull out the end hub [1].

Turn the four jacking screws [4] back to their original position. They must not stick out through the large end hub contact surface when the hub is installed again.

4.1.4 Install Large End Hub (Fig. 4.1.2)

This procedure describes how to install the large end hub with the gearbox assembled to it. For assembling the gearbox to the large end hub, see section 4.1.8.

ATTENTION *When mounting the large end hub [1], always suspend it with a sling from a hoist or the like, to avoid excessive load to the roller bearing [2]. Place a sling around both sides of the pillow block.*



Grease the outside of the lip seals [5] and [6].

Place the large end hub [1] on the bowl, being careful not to damage the roller bearing [2].

Fit the 16 screws [3] and tighten them to a torque of 38 Nm (336 in-lbs)

Fasten the four jacking screws [4].

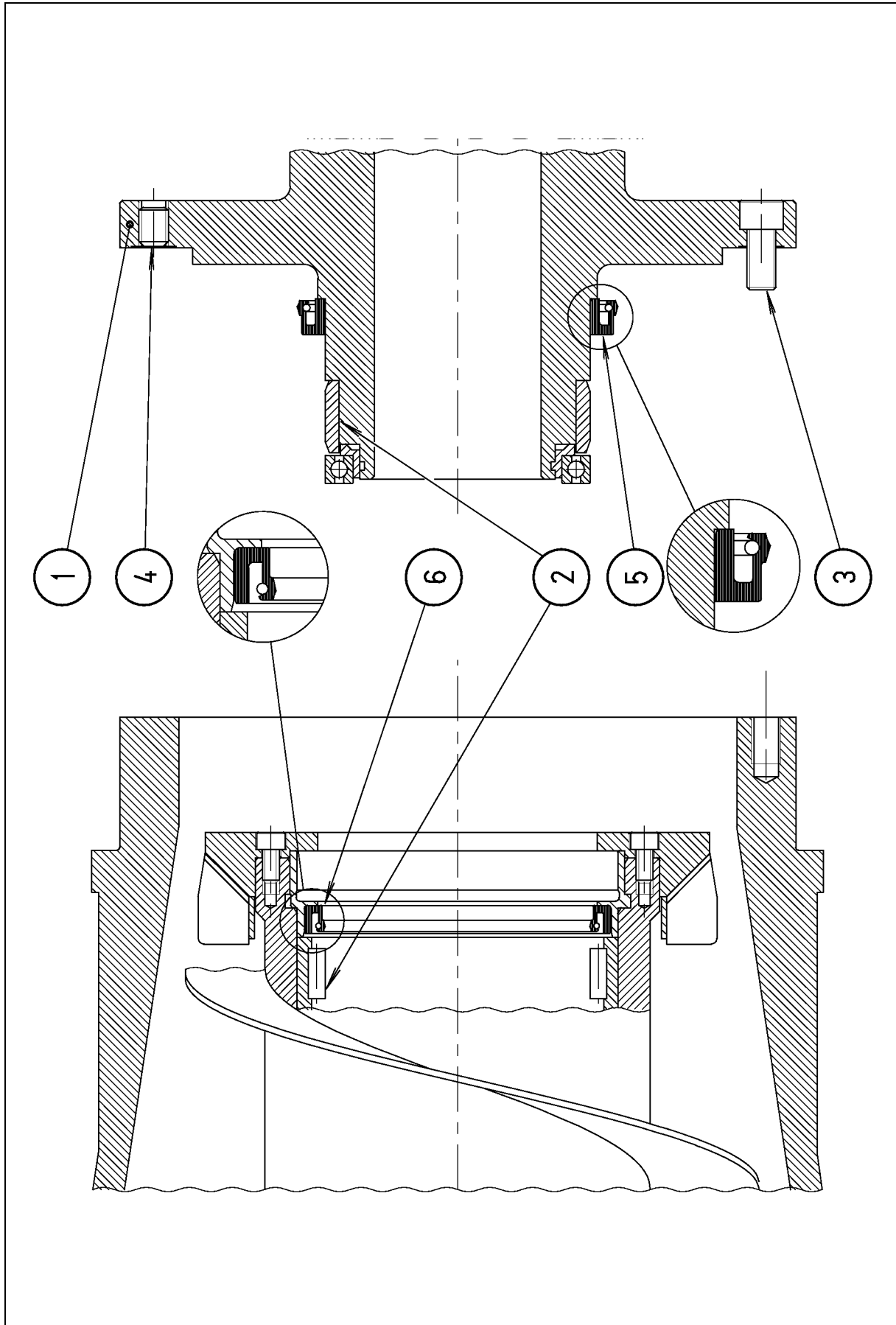


Figure 4.1.3

4.1.5 Remove Small End Hub (Fig. 4.1.3)

ATTENTION *When removing the small end hub [1], always suspend it with a sling from a hoist or the like, to avoid excessive load to the needle bearing [2]. Place a sling around both sides of the pillow block.*



Remove the eight screws [3] and jack off the small end hub by means of the two jacking screws [4].

Turn the two jacking screws [4] back to their original position. They must not stick out through the small end hub contact surface when the hub is installed again.

Be careful not to damage the needle bearing [2].

4.1.6 Install Small End Hub (Fig. 4.1.3)

ATTENTION *When mounting the small end hub [1], always suspend it with a sling from a hoist or the like, to avoid excessive load to the needle bearing [2]. Place a sling around both sides of the pillow block.*



Grease the outside of the lip seals [5] and [6].

Place the small end hub [1] on the bowl, being careful not to damage the needle bearing [2].

Fit the eight screws [3] and tighten them to a torque of 38 Nm (336 in-lbs).

Tighten the two jacking screws [4].

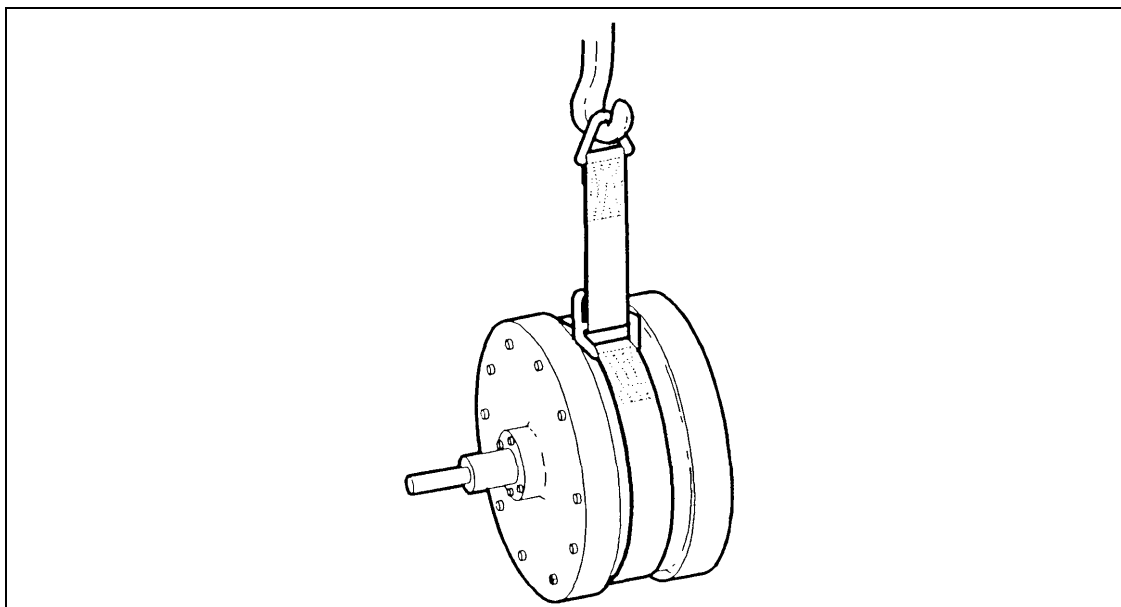


Figure 4.1.4

4.1.7 Remove Gearbox (Fig. 4.1.4)

ATTENTION When removing or installing the gearbox, always suspend it from a hoist or the like to avoid excessive load to the splined shaft. Use the lifting sling* as shown in Figure 4.1.4.



2.5 kNm Gearbox Remove the ten screws (5/16" UNC) connecting the gearbox to the gearbox adapter. Be sure to use an 1/4" hexagon key and not a 6 mm key, as this might damage the screws.

3.0 kNm Gearbox Remove the six screws (M16) connecting the gearbox to the gearbox adapter.
3.5 kNm Gearbox

Place the lifting sling* as shown above and tighten its screws.

Suspend the gearbox from a hoist or the like and jack it off, using the three jacking screws.

Turn the jacking screws back to their original position. They must not stick out through the contact surface between the gearbox and the gearbox adapter when the gearbox is installed again.

Carefully pull out the suspended gearbox.

* For P/N, see Spare Parts Catalogue

4.1.8 Install Gearbox (Figs. 4.1.4 and 4.1.5)

Apply an ample amount of grease* to the splined shaft and the splined hub in the conveyor.

Push the gearbox assembly with splined shaft carefully into place.

Rotate the sunwheel shaft a few turns, to make the splines engage.

2.5 kNm Gearbox Insert the ten screws (5/16" UNC) assembling the gearbox adapter to the gearbox and tighten them to a torque of 22 Nm (195 in-lbs) in the sequence indicated in Figure 4.1.5. *Be sure to use an 1/4" hexagon key and not a 6 mm key, as this might damage the screws.*

3.0 kNm Gearbox Insert the six screws (M16) assembling the gearbox adapter to the gearbox and tighten them to a torque of 197 Nm (1743 in-lbs) in the sequence indicated in Figure 4.1.5.

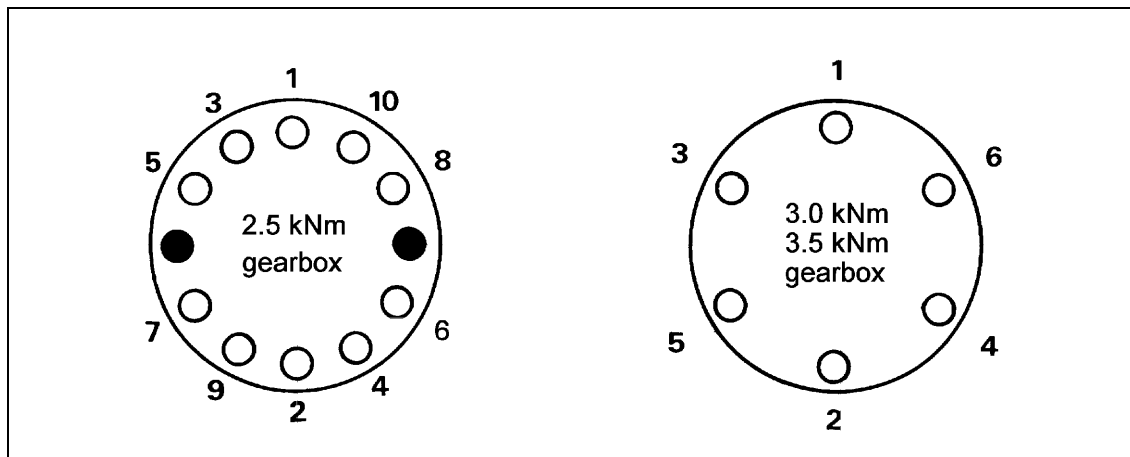


Figure 4.1.5

* For P/N, see Spare Parts Catalogue, Section TOOLS AND LUBRICANTS

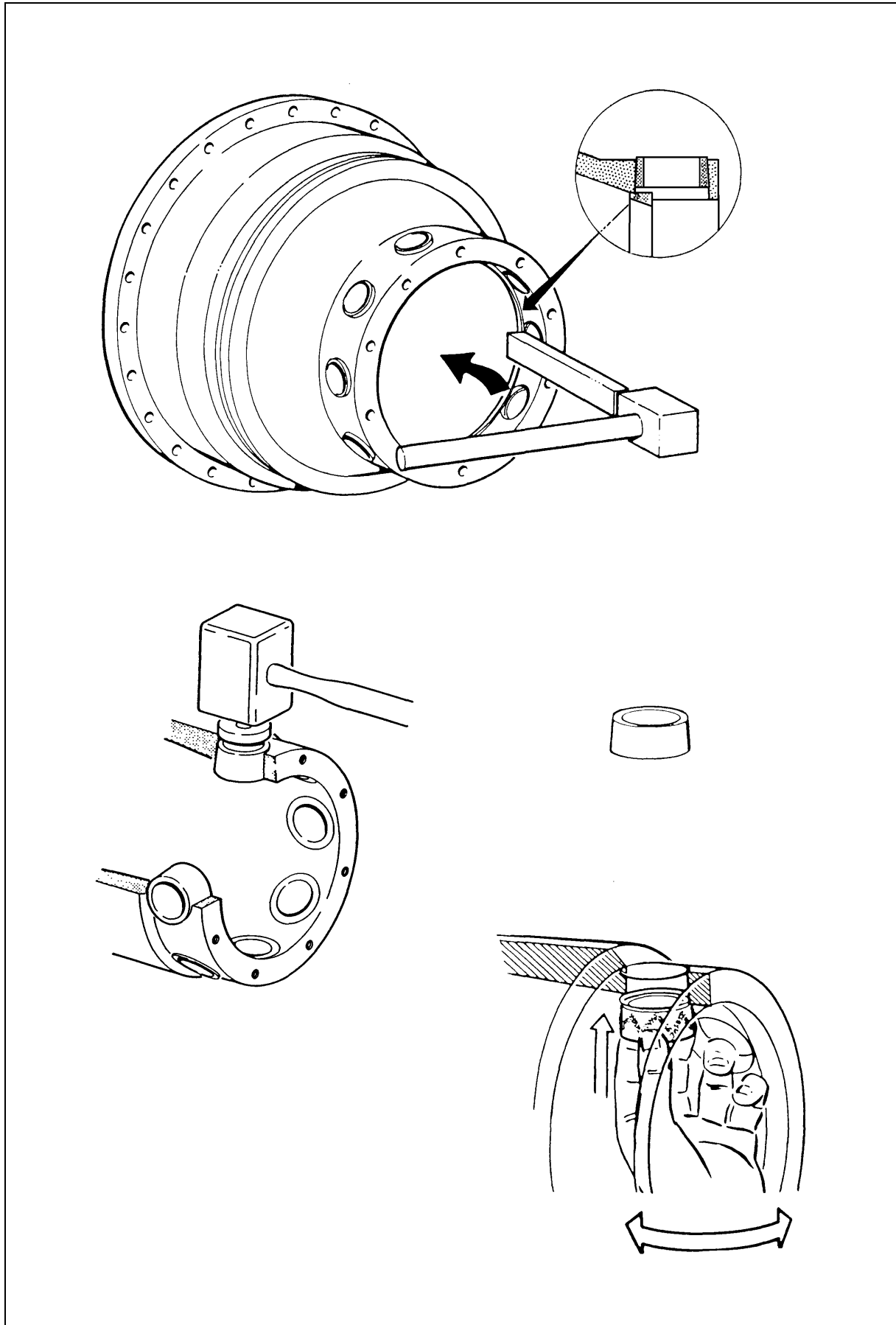


Figure 4.1.6

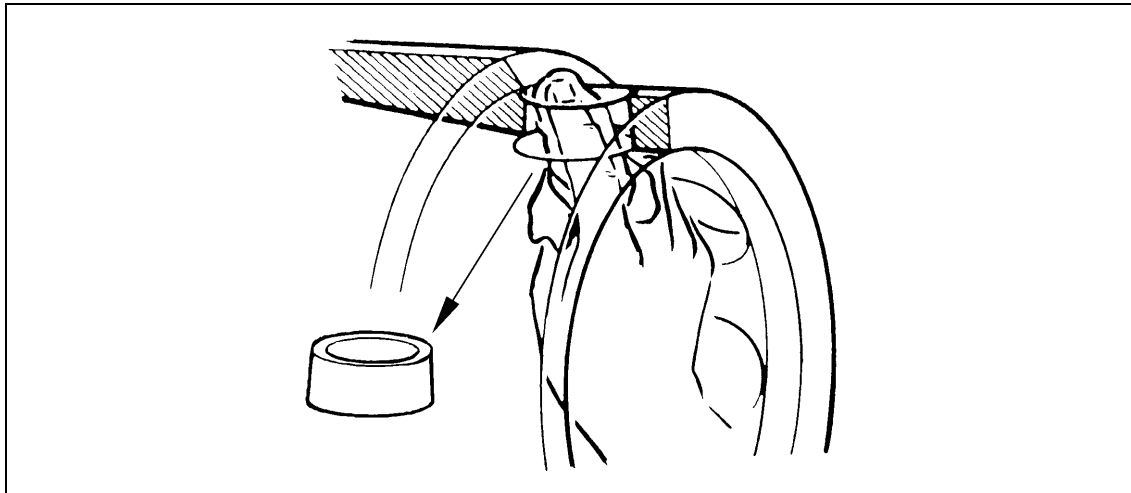


Figure 4.1.7

4.1.9 Fit New Solids Discharge Bushings

(Figs. 4.1.6 and 4.1.7)

Before fitting the sludge bushings, both end hubs and the conveyor must be removed from the bowl according to the procedures in sections 4.1.5, 4.1.3, and 4.4.1 of this book.

Bowls with Steep Cone Remove the sludge ring*, using a hammer and a wooden drift (see top sketch in Figure 4.1.6).

Use the drift** for discharge bushings and a soft hammer to force out the old bushings. Hold a hand under the bushing - or place some rags in the bowl, to prevent damage to the inside of the bowl.

Wipe off oil and grease from the new bushing and its seat in the bowl and clean the surfaces carefully of old "Loctite", using a clean cloth moistened with acetone.

Apply, in zigzag, a thin layer of "Loctite" (the type is stated under "BOWL" in the Spare Parts Catalogue) to the cleaned surface of the bushing.

contd...

* For P/N, see Spare Parts Catalogue, Section BOWL

** For P/N, see Spare Parts Catalogue, Section TOOLS

Insert the bushing into the seat. Holding it as shown in illustration above, turn the bushing to and fro until it is felt to be "floating", then press it into place without using any tools.

ATTENTION *The glued joint may be handled after 20 minutes, but it takes approximately 3 hours to achieve maximum strength.*



If the sludge ring has been worn or damaged, it must be replaced:*

Wipe off oil and grease from the sludge ring and its seat in the bowl and clean the surfaces carefully of old "Loctite", using a clean cloth moistened with spirit.

Apply, in zigzag, a thin layer of "Loctite" (the type is stated under "BOWL" in the Spare Parts Catalogue) to the cleaned outer surface of the sludge ring.

Fit the sludge ring without using any tools. Take care that it seats fully against the shoulder in the bowl all the way around.

* For P/N, see Spare Parts Catalogue, Section BOWL

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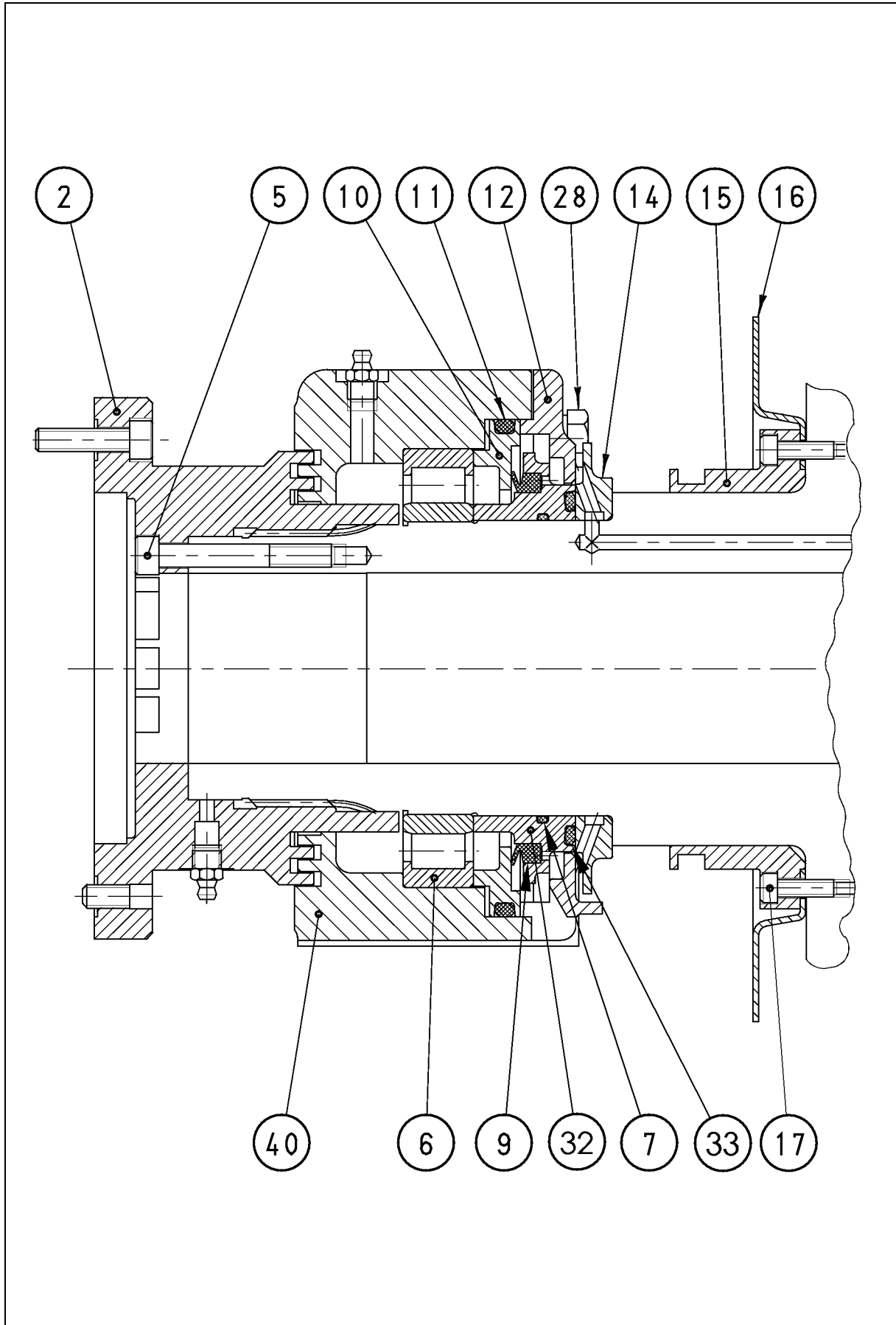



Figure 4.2.1

4.2 Main Bearings (Fig. 4.2.1)

ATTENTION  *The bearing housings were individually fitted into place on the frame - i.e. aligned and in correct distance from each other in relation to the bowl length - and their positions were marked. After this the bearings were mounted on the bowl. The bowl with bearings was then placed on the frame.*

Therefore, before removing the bowl with bearing housings from the frame, mark each housing as well as its position on the frame, to avoid confusion when mounting the housings again. Never shift bearing housings from one machine to another.

Optional for decanters with a ring fitted on the end of the protecting tube: For illustration and how to disassemble and assemble this ring, see pages 4.4-0, 4.4-1, and 4.4-3.

4.2.1 Disassemble Main Bearing Large End (Fig. 4.2.1)

Prior to disassembling the main bearing large end, the gearbox must be removed according to instructions given in section 4.1.7.

Remove the 10 screws [5].

Using two of them as jacking screws, pull off the gearbox adapter [2], tightening the jacking screws equally to avoid pulling out the adapter [2] askew.

Remove the four screws [28].

Now remove by hand the complete bearing assembly consisting of pillow block [40], roller bearing outer race [6], and ring [10].

Use a hammer and a brass mandrel to remove the roller bearing outer race [6], taking care that the mandrel does not damage the pillow block [40].

contd...

The roller bearing inner race [6] can be removed from the pinion by means of a standard two-armed puller as shown in Figure 4.2.2. Two milled recesses in the V-Ring holder [32] allow space for the puller claws.

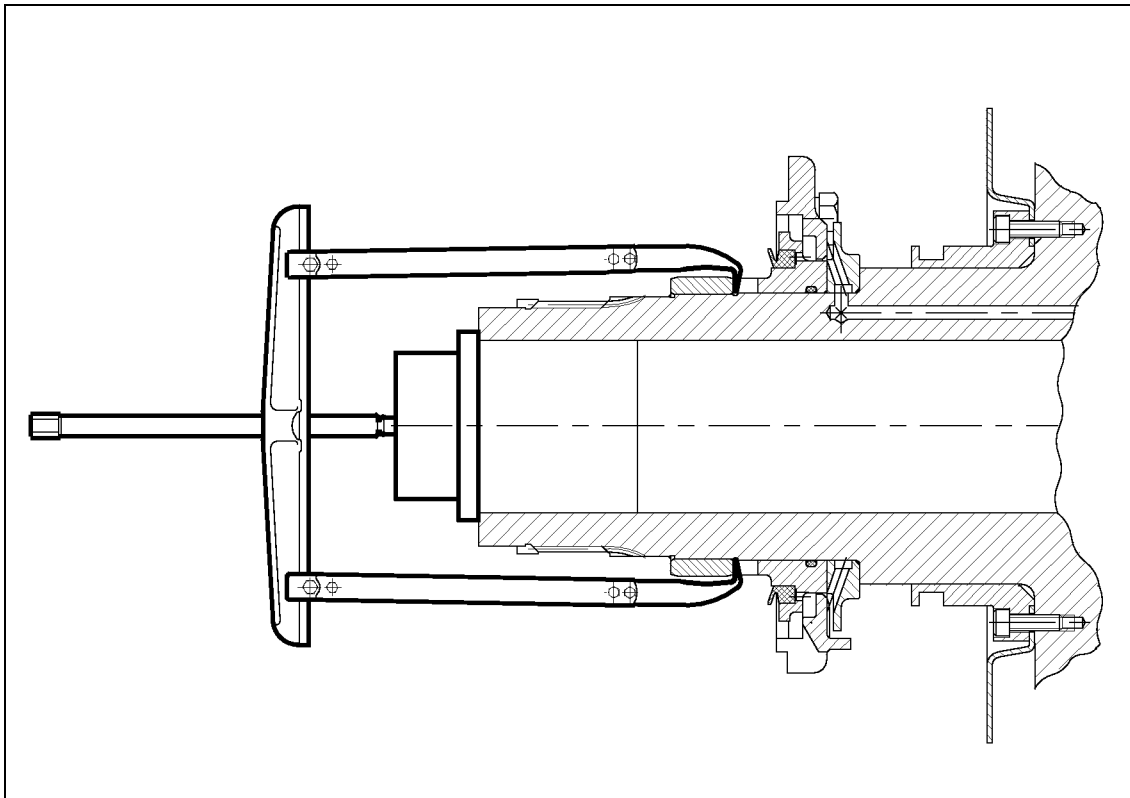


Figure 4.2.2

Remove, by hand and in the order mentioned, the remaining parts: V-Ring holder [32], bearing cover [12], and guard ring [14].

If necessary, remove the eight screws [17], the splash disc [16], and the seal ring [15].

4.2.2 Assemble Main Bearing Large End (Fig. 4.2.1)

Fit by hand the splash disc [16] and the seal ring [15] onto the pinion.

Insert and tighten the eight screws [17].

Fit the guard ring [14] onto the pinion, its two holes pointing outwards.

Push the bearing cover [12] on the guard ring [14], its grease discharge pointing downwards, and then fit the V-Ring holder [32] including V-ring [9] and O-Rings [7] and [33] on the pinion. Do not apply any lubricant at all to the V-ring [9] when fitting it!

Heat the main bearing inner race [6] by means of an induction heater or in an oven to a temperature of 80°C (175°F) and push it on the pinion as far it goes; it must seat fully against the V-Ring holder [32] all around.

Insert the roller bearing outer race [6] into the pillow block [40] and grease the rollers.

Then fit the ring [10] including the O-Ring [11] and push carefully the assembly onto the main bearing inner race [6].

contd...

Insert the four screws [28] attaching the bearing cover [12] to the pillow block [40] and tighten them.

Carefully clean the contact surfaces between the gearbox adapter [2] and the pinion.

Place the gearbox adapter [2] on the large end pinion, aligning the axial hole in the adapter and the guide pin on the end surface of the pinion.

Fit the 10 screws [5]. Tighten them to a torque of 40 Nm (354 in-lbs), tightening them crosswise a few times to ensure tightening of all 10 screws to the correct torque.

Install the gearbox according to the instructions given in section 4.1.8.

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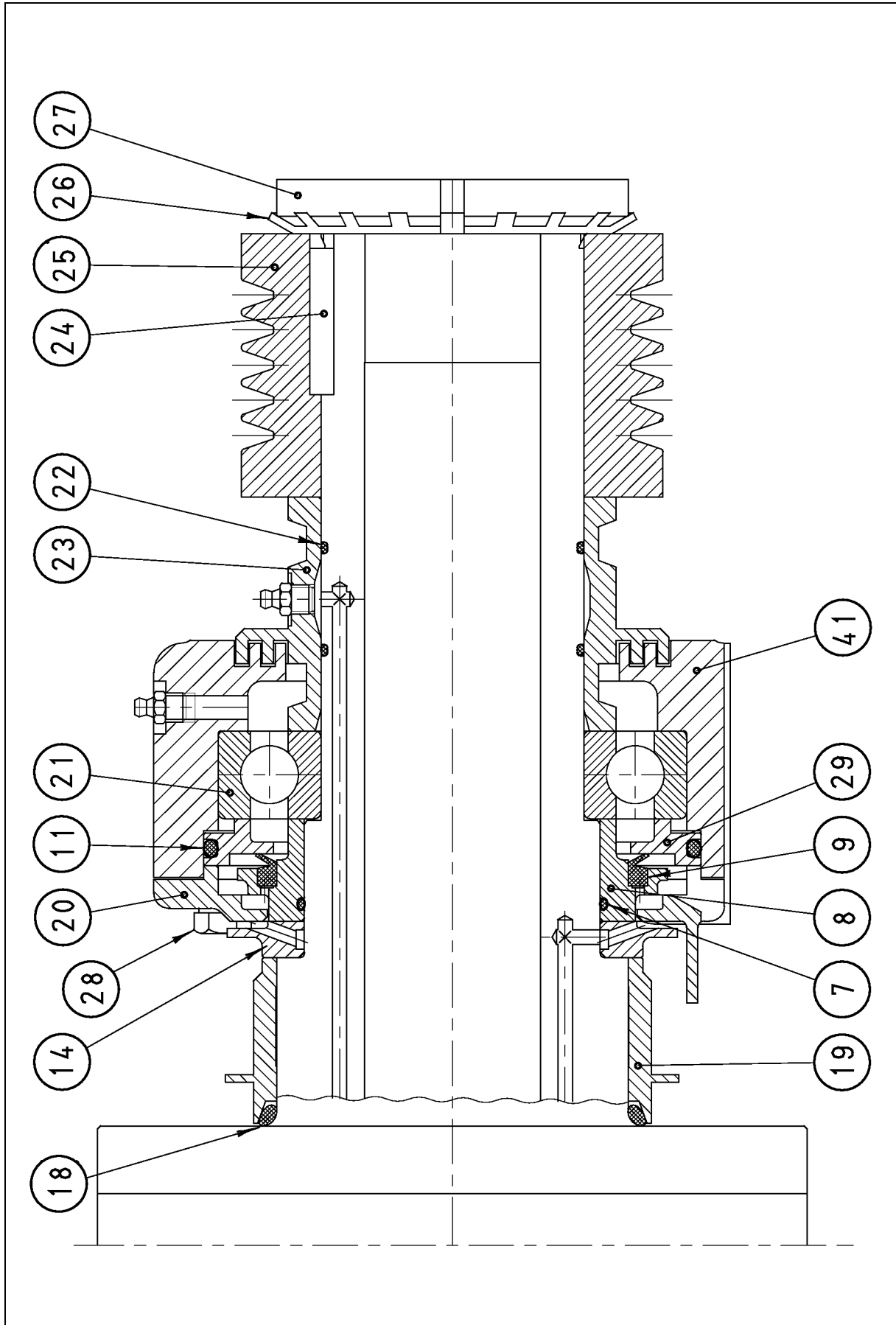


Figure 4.2.3

4.2.3 Disassemble the Main Bearing Small End

(Fig. 4.2.3)

Open the bent tap on the lock washer [26] securing the lock nut [27].

Remove the nut, using a lead hammer and the spanner for lock nuts*.

Remove the lock washer [26].

ATTENTION *The lock washer [26] should be replaced when reassembling bearings. Bent taps may break if the lock washer is reused.*



Remove the V-belt pulley [25], either by hand, or using a standard two-armed puller.

Remove the labyrinth ring [23].

contd...

* For P/N, see Spare Parts Catalogue

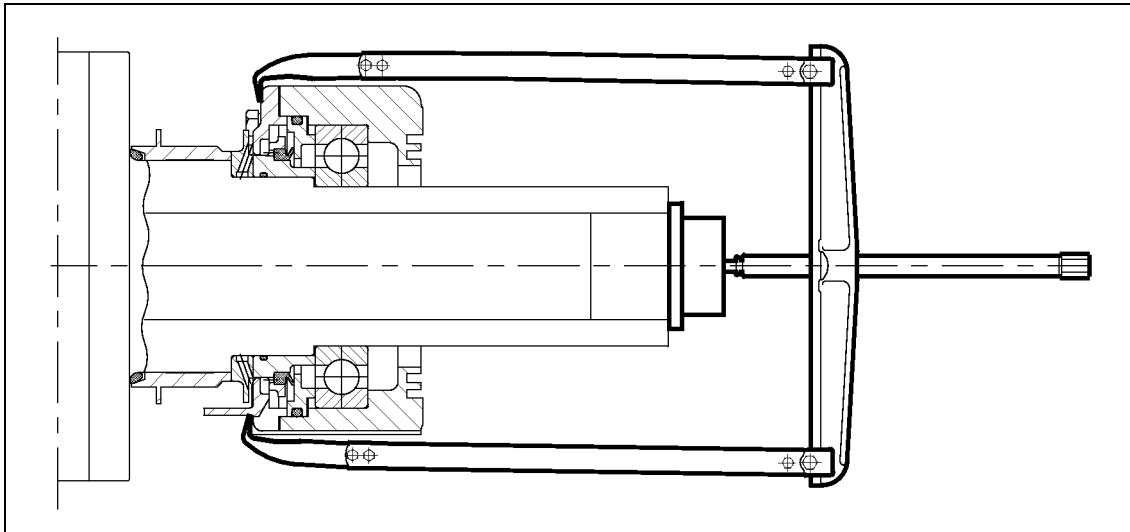


Figure 4.2.4

Then pull off the assembly consisting of: Pillow block [41], ball bearing [21] and ring [29], V-Ring holder [8], and the bearing cover [20].

To disassemble the pillow block: Remove, in the following order, the four screws [28], the bearing cover [20], the V-Ring holder [8], and the ring [29].

Use a hammer and a brass mandrel to remove the ball bearing [21]. Take care that the mandrel does not damage the pillow block [41].

Remove by hand the guard ring [14].

If necessary, the protective lining [19] can be removed by hand.

4.2.4 Assemble Main Bearing Small End (Fig. 4.2.3)

Insert the O-Ring [18] into the protective lining [19] and fit the lining [19] onto the pinion.

Fit the guard ring [14] onto the pinion, its two holes pointing outwards.

Push the bearing cover [20] on the guard ring [14], its grease discharge pointing downwards, and then fit the V-Ring holder [8] including V-ring [9] and O-Ring [7] on the pinion. Do not apply any lubricant at all to the V-ring [9] when fitting it!

Insert the ball bearing [21] into the pillow block [41] and grease the rollers.

Then fit the ring [29] including the O-Ring [11] and then press, with the pressure acting on the inner race of the ball bearing [21], the assembly onto the pinion.

ATTENTION *As the ball bearing may have been damaged during removal, a new one must be fitted after disassembling.*



Insert the four screws [28] attaching the bearing cover [20] to the pillow block [41] and tighten them.

Make sure that the O-Rings [22] lie correctly in their grooves, and that they are not damaged.

Fit by hand the labyrinth ring [23], the parallel key [24], and the V-belt pulley [25].

Grease the surface between the lock washer [26] and the lock nut [27] with 'Copaslip' or a similar slipping agent.

Fit the lock washer [26] and tighten the nut [27] with the spanner for lock nuts* to a torque of 900 Nm.

Bend a meshing tab of the lock washer [26] into the lock nut groove.

ATTENTION *Fit a new lock washer [26]. Bent tabs may break if the original lock washer is reused.*



* For P/N, see Spare Parts Catalogue

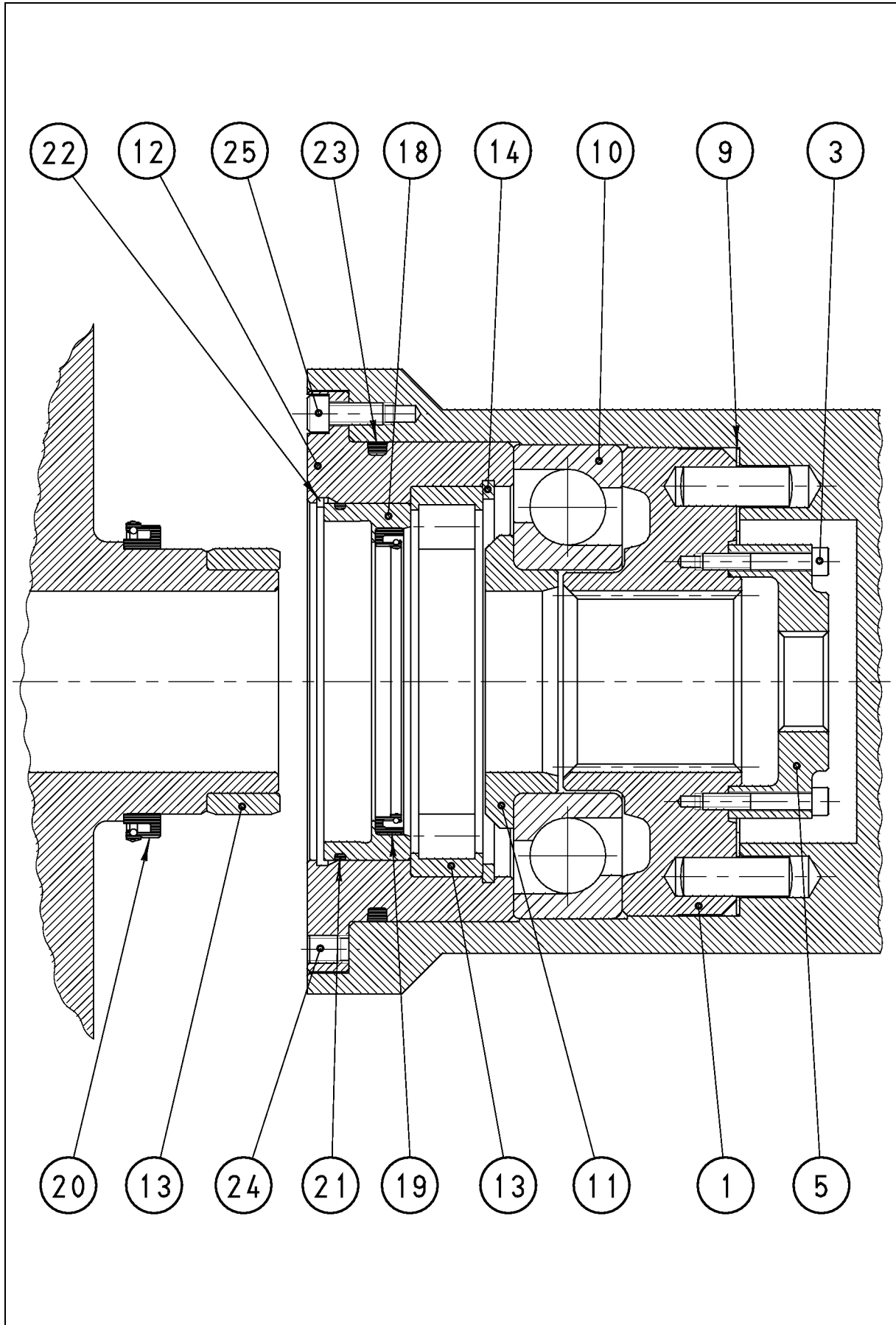


Figure 4.3.1

4.3-0

4.3 Conveyor Bearings (Fig. 4.3.1)

4.3.1 Disassemble Conveyor Bearing Large End

Remove the large end hub according to the instructions given in section 4.1.3

Being press-fitted, the roller bearing inner race [13] can be removed only with the special puller ring for bearings*.

Place this ring on the pinion and place the two half-rings around the inner race.

Then push ring onto the two half-rings and use the puller as shown in Figure 4.3.2.

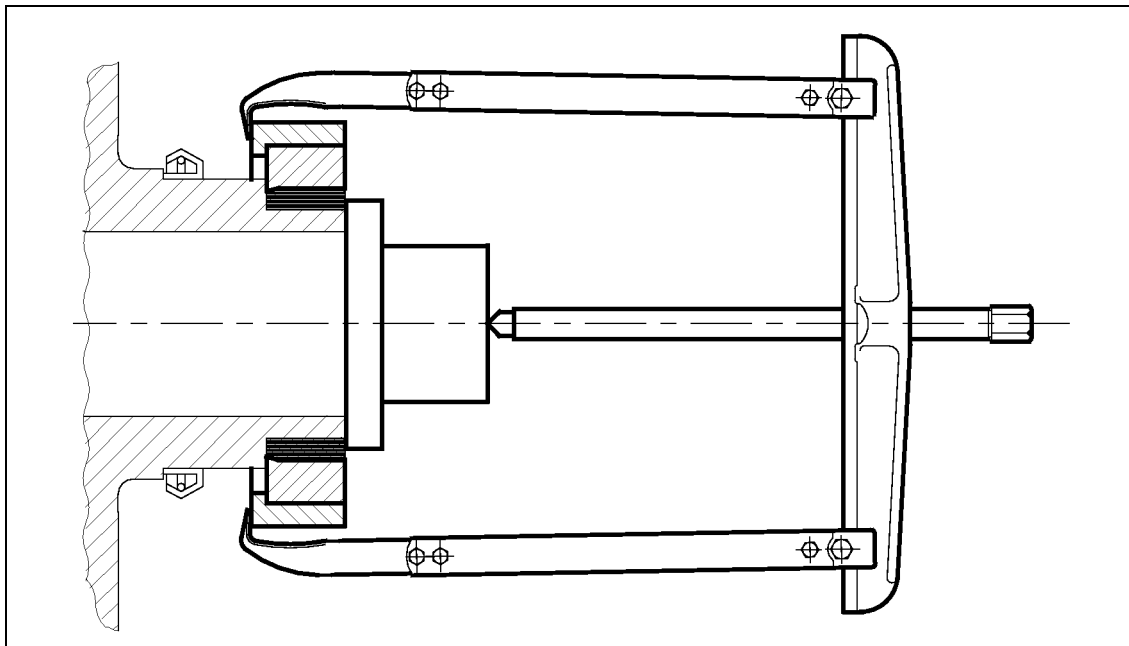


Figure 4.3.2

ATTENTION *Prior to disassembling, index the bearing holder flange [12] and the conveyor edge with a centre punch, to facilitate alignment when re-assembling flange and conveyor.*



* For P/N, see Spare Parts Catalogue

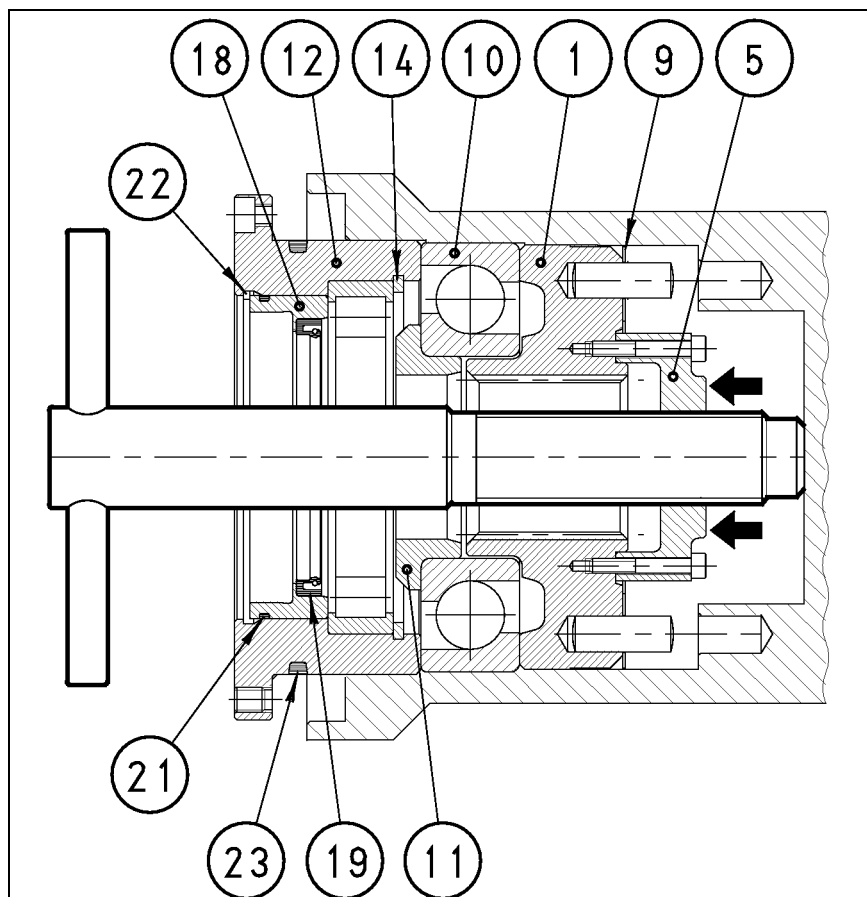


Figure 4.3.3

Using the T-handle screw (see Figure 4.3.3 above), remove the assembly consisting of: Bearing holder [12], thrust ring [11], angular contact ball bearing [10], spline bush [1], shim [9], and ejector disc [5].

Now it is possible to remove the O-ring [23], the snap ring [22], and the roller bearing outer race [10] from the bearing holder [12].

If the roller bearing outer race [10] seizes, remove the two snap rings [14, 22] and the wear bushing [18] and tap out the outer race, using a mandrel.

If the snap ring [14] and the wear bushing [18] have not been removed, they - as well as the O-ring [21] and the seal [19] - can be removed now.

4.3.2 Assemble Conveyor Bearing Large End

(Fig. 4.3.1)

ATTENTION *If a new conveyor or new hubs are to be installed, follow the procedure in section 4.4.3 to determine the number of shims [9] to be fitted.*



Fit the ejector disc [5] on the spline bush [1] and secure with the four screws [3].

Place the shims [9] on the four pins of the spline bush [1].

It is not possible to push in the spline bush [1] by hand. Use a pipe as a drift and gently tap the holder into place.

Carefully align the pins of the spline bush [1] with the holes in the conveyor. Make sure that the spline bush [1] has been pushed in as far it goes.

Fill the spline bush [1] with grease and fit the ball bearing [10], ensuring that the narrow shoulder of the outer race faces the gearbox end.

Fit the internal parts of the bearing holder [12] in the following order:

Roller bearing outer race with rollers [13]

Snap ring [22]

Wear bushing [18] with fitted seal [19], the sealing lip pointing outwards

O-ring [21]

Snap ring [14]

O-ring [23] into the groove on the outside.

contd...

The lip seal [19], the roller bearing outer race [13], and the angular contact ball bearing [10], fill those parts with grease and fit the supporting ring [11].

Fit the assembly into the conveyor and pull it into place by tightening the six screws [25].

Fit the two pointed screws [24] and tighten them.

Fit the lip seal [20] and the inner race of the roller bearing [13] on the inner pinion of the end hub:

Grease the lip seal [20] and push it into place, its open side facing the end hub.

Heat the roller bearing inner race [13] by means of an induction heater or in an oven to approximately 80°C (175°F) and fit it onto the inner pinion; be sure it seats fully against the shoulder of the pinion.

Place the conveyor into the bowl according to the instructions given in section 4.4.2.

Install the large end hub according to the instructions given in section 4.1.4.

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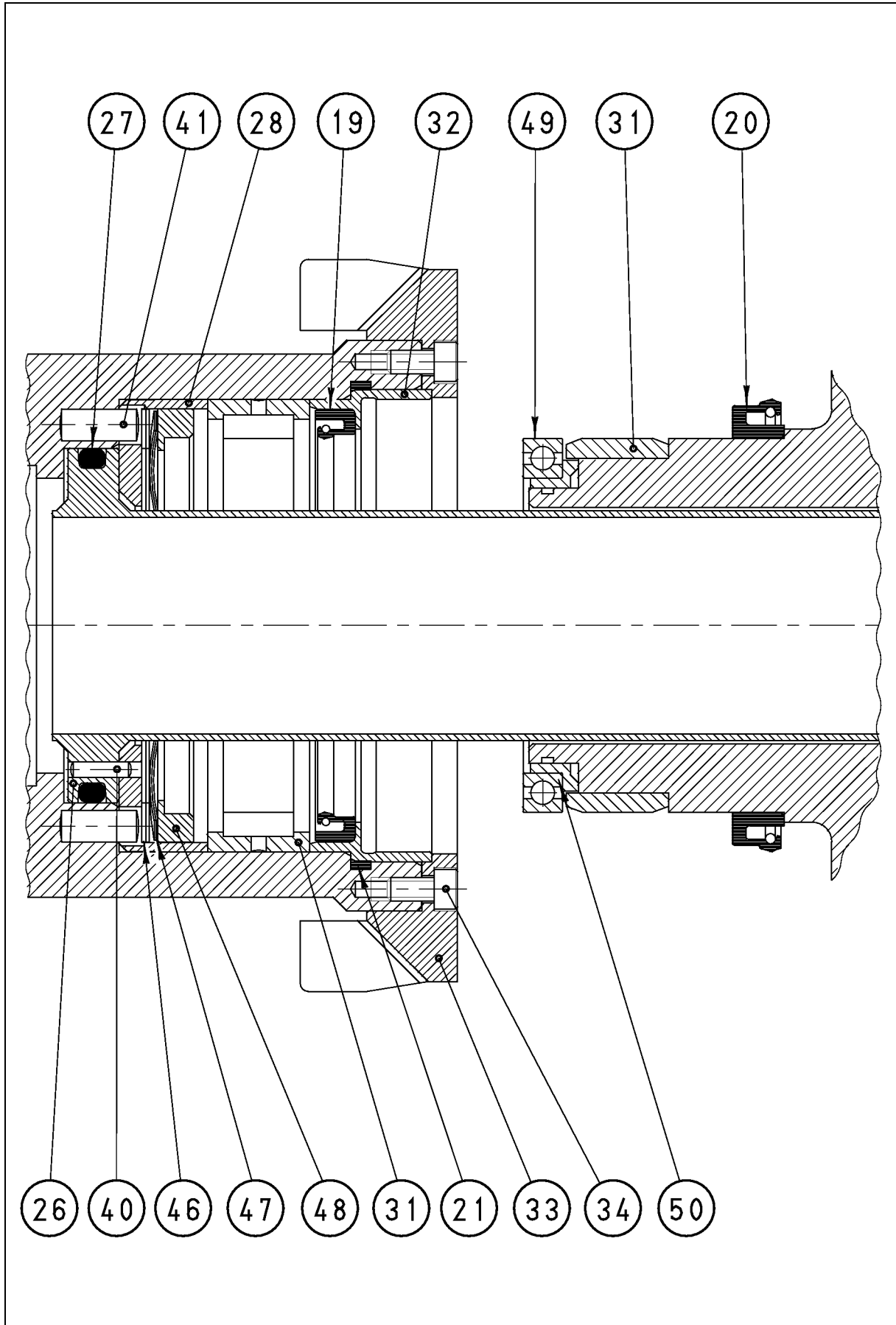


Figure 4.3.1

4.3.1 Disassemble Conveyor Bearing Small End

(Fig. 4.3.1)

Remove the small end hub according to the instructions given in section 4.1.5.

If the needle bearing inner race [31] or the lip seal [20] is to be removed, remove the ball bearing [49], using no tools.

Do not remove the protecting tube [26] unless it needs exchanging.

Being press-fitted, the needle bearing inner race [31] can be removed only with the special puller ring for bearings*.

Place the puller ring on the pinion and the two half-rings around the inner race.

Then push the ring onto the two half-rings and use the puller tool as shown in Fig. 4.3.5.

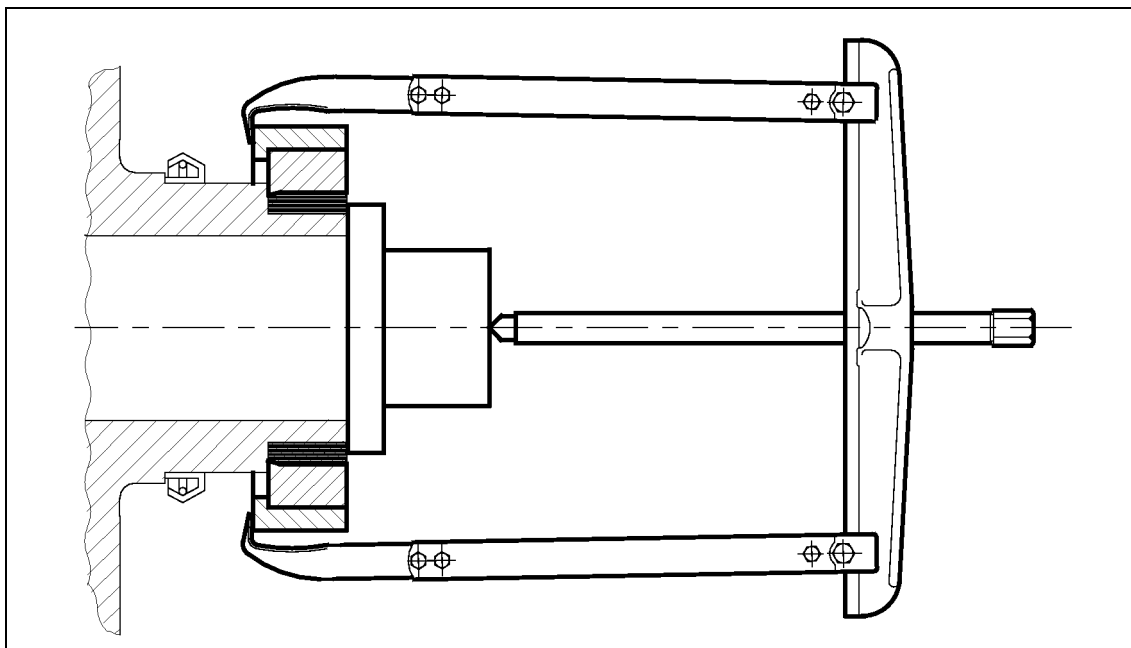


Figure 4.3.2

contd...

* For P/N, see Spare Parts Catalogue

Remove the eight screws [34] and remove the lock ring [33].

Using the two M10x80 jacking screws* as shown in Figure 4.3.6, carefully pull out the puller disc [28], the shims [46], the wavy springs [47], the guide ring [48], the needle bearing outer race [31], and the wear bushing [32] with lip seal [19].

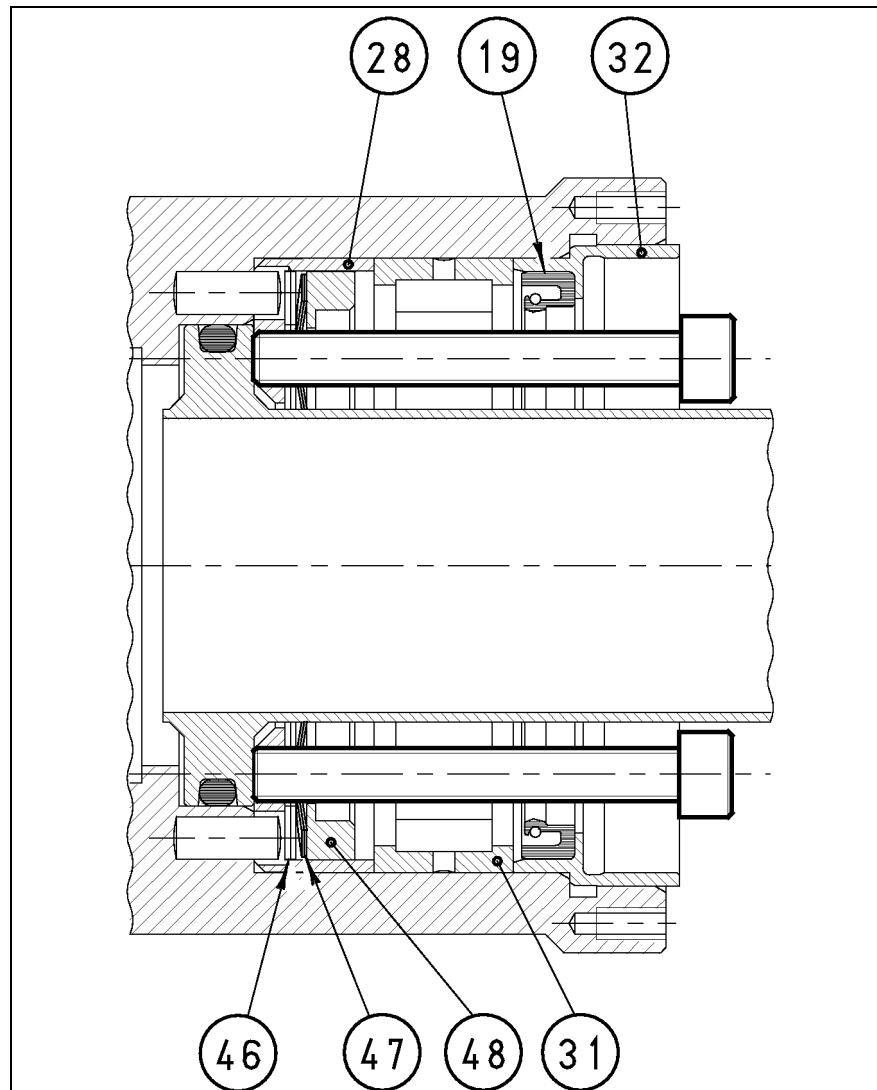


Figure 4.3.3

If necessary, the protecting tube [26] can be removed by hand.

* For P/N, see Spare Parts Catalogue

4.3.2 Assemble Conveyor Bearing Small End

(Fig. 4.3.1)

ATTENTION *Is a new conveyor to be installed, follow the procedure in section 4.4.1 to determine the number of shims [46] to be fitted.*



Fit the protecting tube [26] with inserted O-Ring [27] and fit the puller disc [28].

Make sure that both the pin [40] in the flange of the protecting tube [26] and the pin [41] inside the conveyor are correctly aligned with the two corresponding holes in the disc so that pins and holes mesh properly.

Fit the shims [46], the wavy springs [47], and the guide ring [48].

Apply grease to the needle bearing outer race [31] and fit it.

Grease the O-ring [21] and insert it into the internal groove of the conveyor.

Insert the lip seal [19] into the wear bushing [32], the sealing lip pointing outwards, and insert the assembly into the conveyor.

Fit the lock ring [33].

Fit the eight screws [34] and tighten them.

Fit the lip seal [20] and the inner race of the needle bearing [31] on the inner pinion of the end hub:

Grease the lip seal [20] and push it into place, its open side facing the end hub.

Heat the inner race of the needle bearing [31] by means of an induction heater or in an oven to approximately 80°C (175°F) and fit it onto the inner pinion; be sure that the race seats fully against the shoulder of the pinion.

Fit the ring [50] and the ball bearing [49] on the small end hub. Secure the ring [50] with Loctite 270.

Install the small end hub according to the instructions given in section 4.1.6.

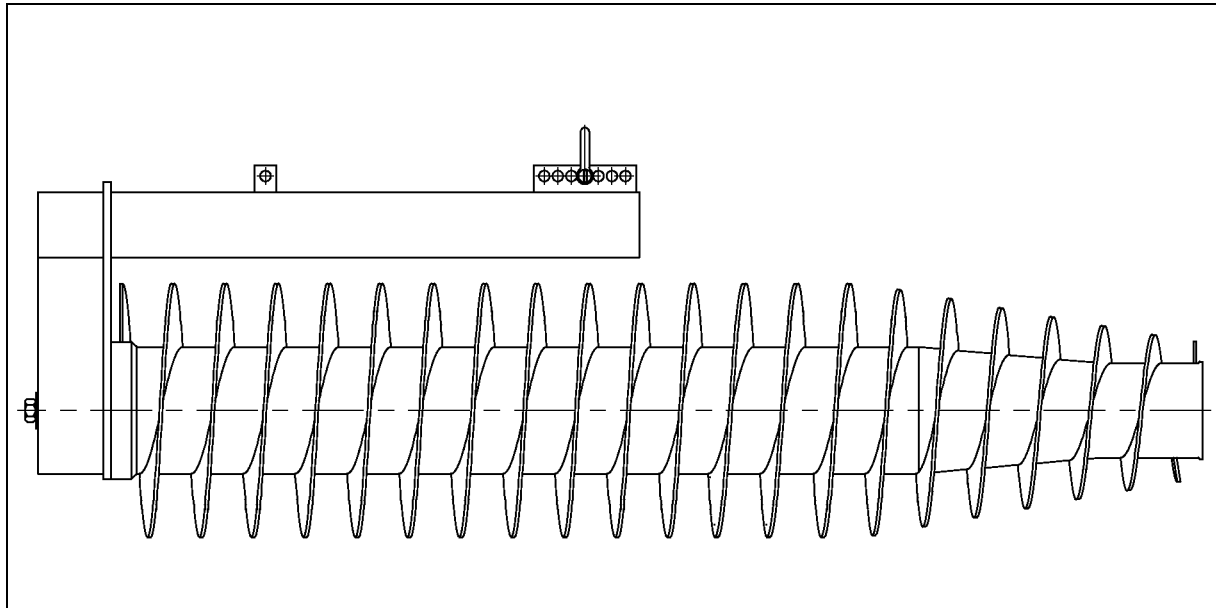
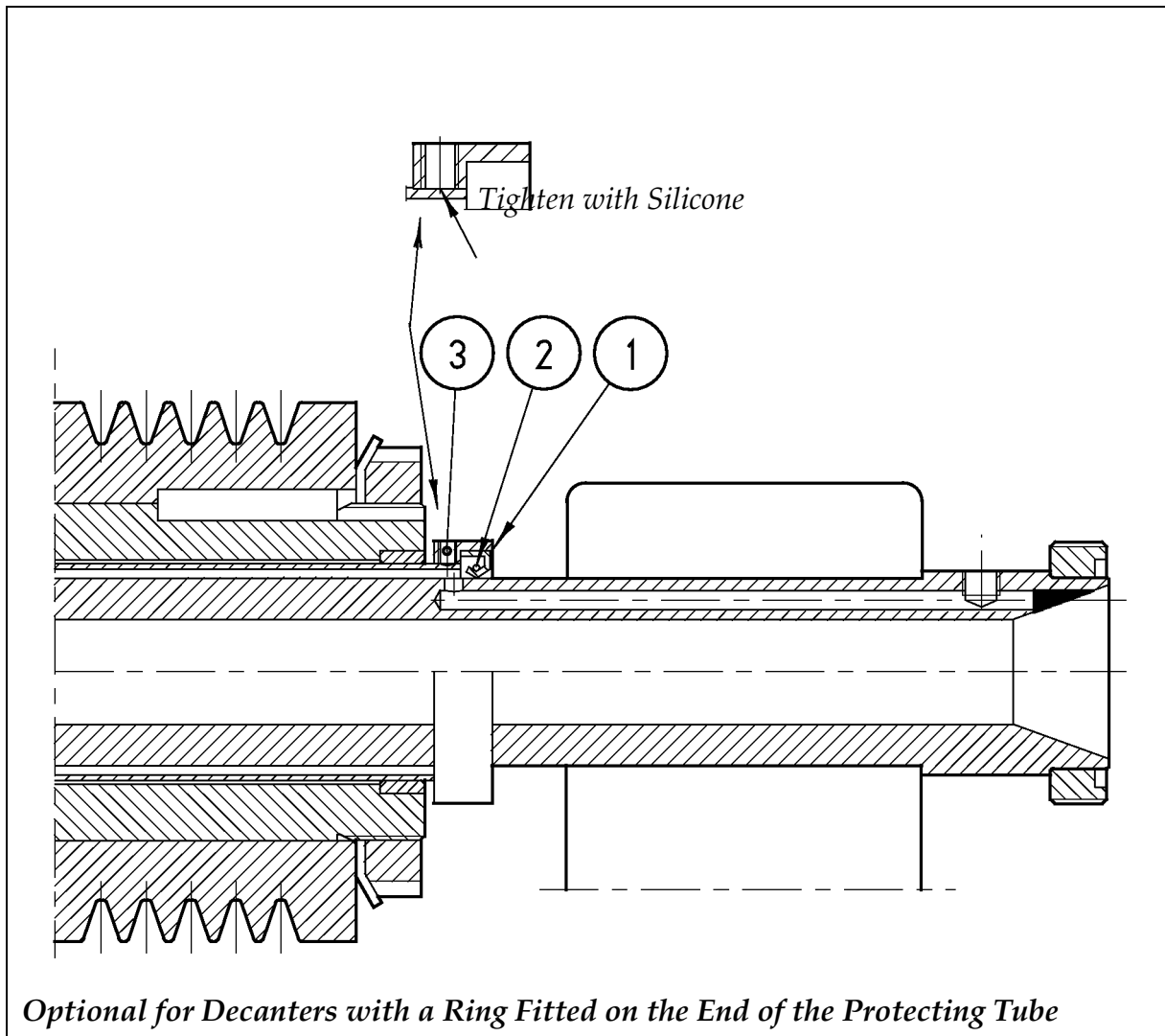


Figure 4.4.1



Optional for Decanters with a Ring Fitted on the End of the Protecting Tube

Figure 4.4.2

4.4 Conveyor

4.4.1 Remove Conveyor from Bowl (Fig. 4.4.1)

Remove the large end hub according to instructions given in section 4.1.3.

Optional for Decanters with a Ring Fitted on the End of the Protecting Tube: See Figure 4.4.2 for identification of parts. Loosen the four pointed screws [3] and remove the ring [1].

Place the bowl (without large end hub) horizontally on two wooden trestles or the like: Attach the lifting tool* to the large end of the conveyor as shown in Figure 4.4.1.

Connect the shackle to the hoist and fit the shackle into the lifting tool hole. Because of its individual design each conveyor has its own centre of gravity. As consequence of this the axial point on the lifting tool corresponding to the conveyor centre of gravity is not the same for all conveyors. To find the actual conveyor centre of gravity, proceed as follows:

Fit the shackle in the lifting tool centre hole and lift the conveyor carefully, to see how the it balances.

If the conveyor is not in balance, then insert the shackle into the next lifting tool hole nearer to the heavy end of the conveyor and lift the conveyor carefully again.

Repeat this procedure until the conveyor is in balance and mark the centre of gravity hole of the lifting tool, to facilitate future disassembling and assembling.

Carefully pull out the conveyor.

contd...

* For P/N, see Spare Parts Catalogue

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4.4.2 Insert Conveyor into Bowl (Fig. 4.4.1)

Place the bowl horizontally on two wooden trestles or the like: Attach the lifting tool* to the large end of the conveyor as shown in Figure 4.4.1.

Connect the shackle to the hoist and fit the shackle into the lifting tool hole where the conveyor will be in balance when lifted and push it carefully into the bowl.

CAUTION *Be careful not to cut your fingers, when pushing the conveyor into the bowl.*

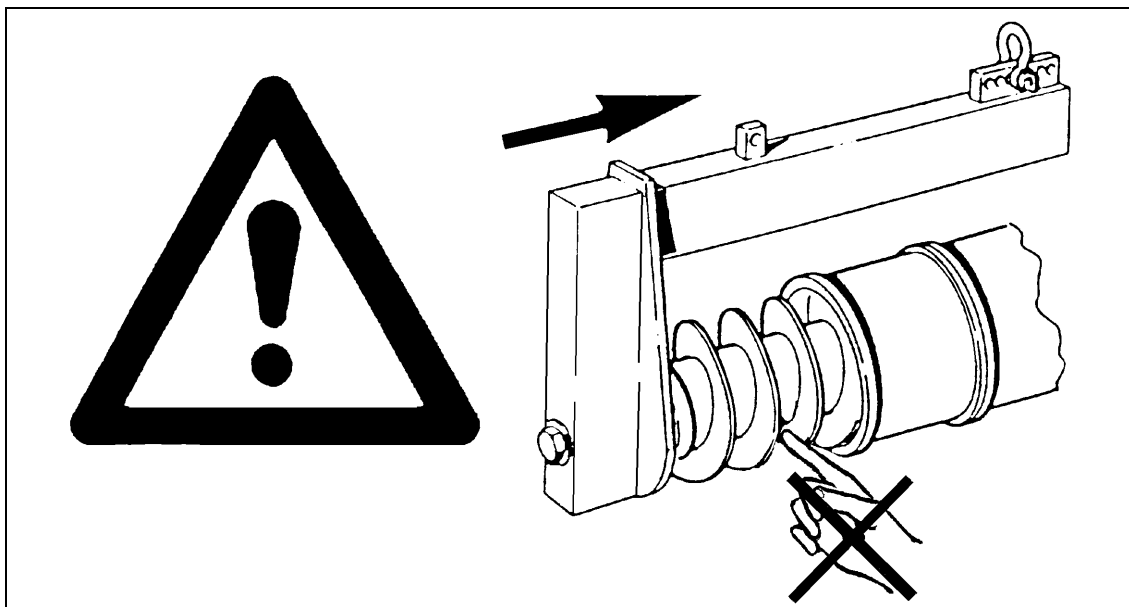


Figure 4.4.3

ATTENTION *If installing another conveyor than that removed from the bowl, adjust it axially according to the instructions given in sections 4.4.3, and 4.4.4.*



Optional! Decanters whose ring on the end of the protecting tube was removed: Refer to Figure 4.4.2 for identification of parts. Apply silicone to one of the joining surfaces between ring [1] and protecting tube. Then fit the ring [1] and secure with the four pointed screws [3], being careful not to tighten them too much

Install large and small end hubs according to the instructions given in sections 4.1.4, and 4.1.6, respectively.

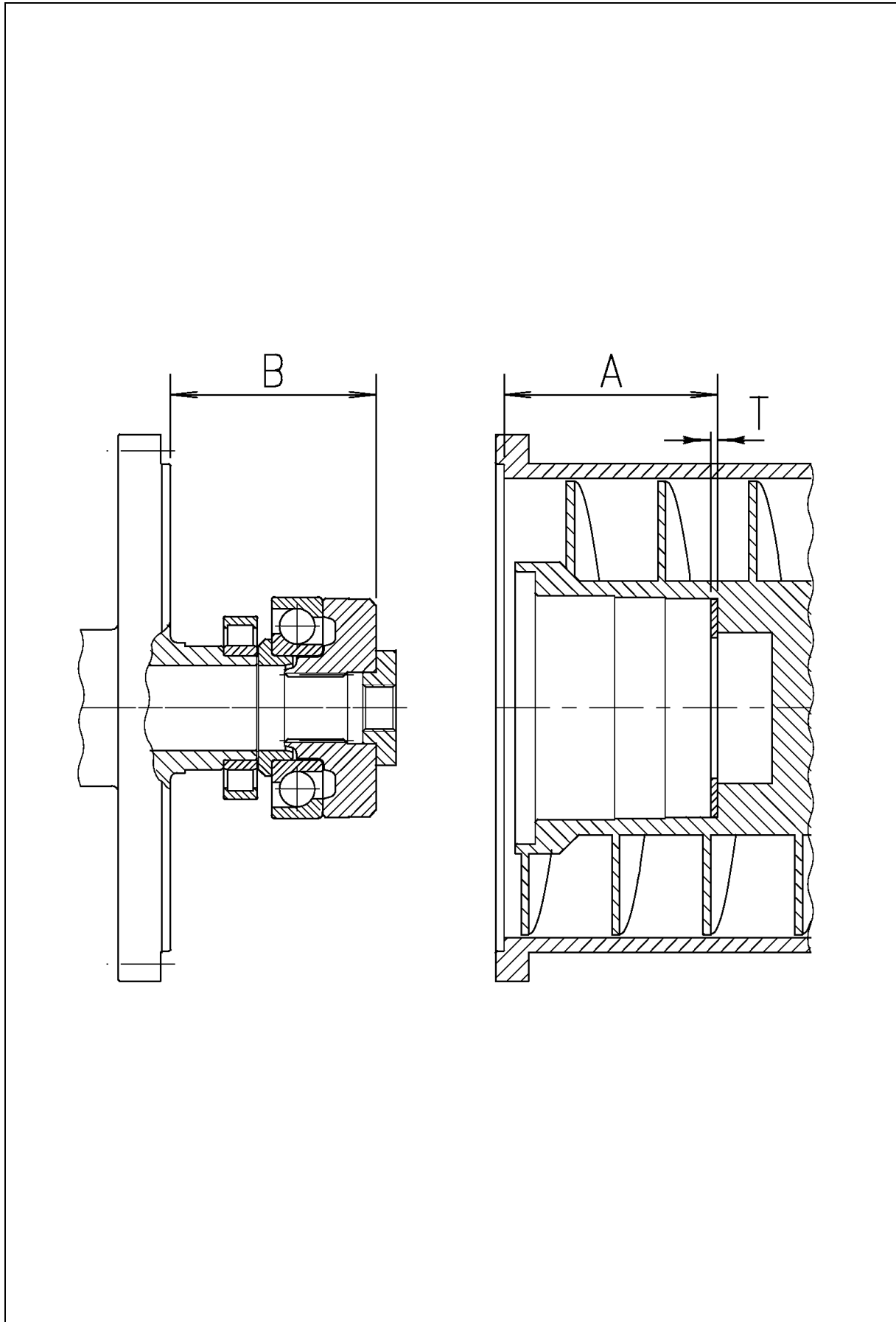


Figure 4.4.4

(A-B) mm		T mm		
Greater than	Less than or equal to	Spray hardsurfaced		Tiles
		Standard Cone	Steep Cone	
	4	0	0	0
4	5	0	1	0
5	6	1	2	0
6	7	2	2	0
7	8	2	2	1
8		2	2	2
Shims:		P/N:		
1 mm		6120.6106-01		
2 mm		6120.6106-02		

Table 4.4.1

4.4.3 Axial Adjustment of Conveyor (Fig. 4.4.4)

This section describes how to determine the thickness of the shim packet adjusting the play between the conical parts of the conveyor and bowl shell.

ATTENTION *If the small end hub has not been removed, remove it according to the instructions given in section 4.1.5.*



Insert the conveyor (shims and bearing parts removed) into the bowl.

Using suitable tools, push the conveyor as far it goes into the bowl to ensure that its conical surface seats fully against that of the bowl.

Measure the distance A from the bowl contact face for the large end hub to the bottom of the bearing bore in the conveyor as shown in Figure 4.4.4. Note down the result.

Measure the distance B from the large end hub contact face for the bowl to the splined bushing as shown in Figure 4.4.4. Note down the result.

Using the result of the difference (A-B) and the above table, select the number of adjusting shims to fill to the space T.

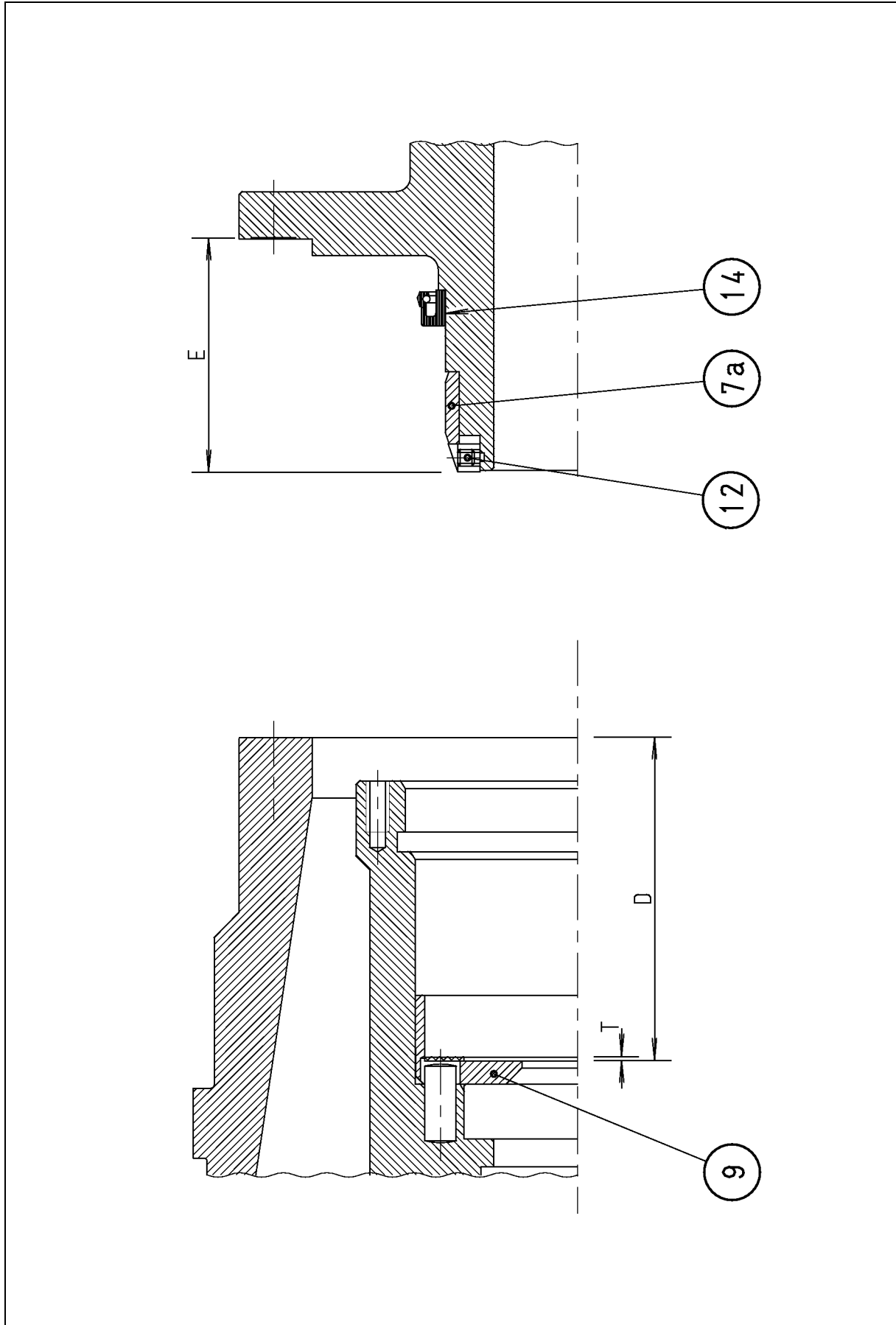


Figure 4.4.5

P/N	Quantity	Part
6119.4423-47	1	Supporting Disc, 3.5 mm
6119.4421-07	2	Shim, 0.2 mm
6119.4422-27	2	Shim, 0.5 mm
6119.4422-87	2	Shim, 1.0 mm

Table 4.4.2

4.4.4 Adjust Axial Play of Conveyor (Fig. 4.4.5)

When installing a new conveyor, make sure that the adjustment of the large end play between conveyor and bowl shell has been done according to instructions in section 4.4.3.

Then determine the thickness of the shim packet in the small end, to achieve the permissible axial conveyor play in the bowl:

Fit the puller disc [1]. Do not fit the protecting tube.

Push the conveyor against the large end hub using a wooden lever put through the sludge bushings.

Keep by hand the puller disc pressed against the conveyor.

Measure the distance "D" between the bowl rim and the bottom of the puller disc as shown in Fig. 4.4.5 and note down the result.

Fit the lip seal [14], the needle bearing inner race [7a], bearing ring [2], and ball bearing [3] onto the small end hub.

Measure the distance "E" from the ball bearing to the small end hub contact face for the conical bowl section as shown in Fig. 4.4.5 and note down the result.

Using the result of the computation $X = D - (E + 4.2)$ and the above table, select the adjusting shims [7] to fill the computed space "X".

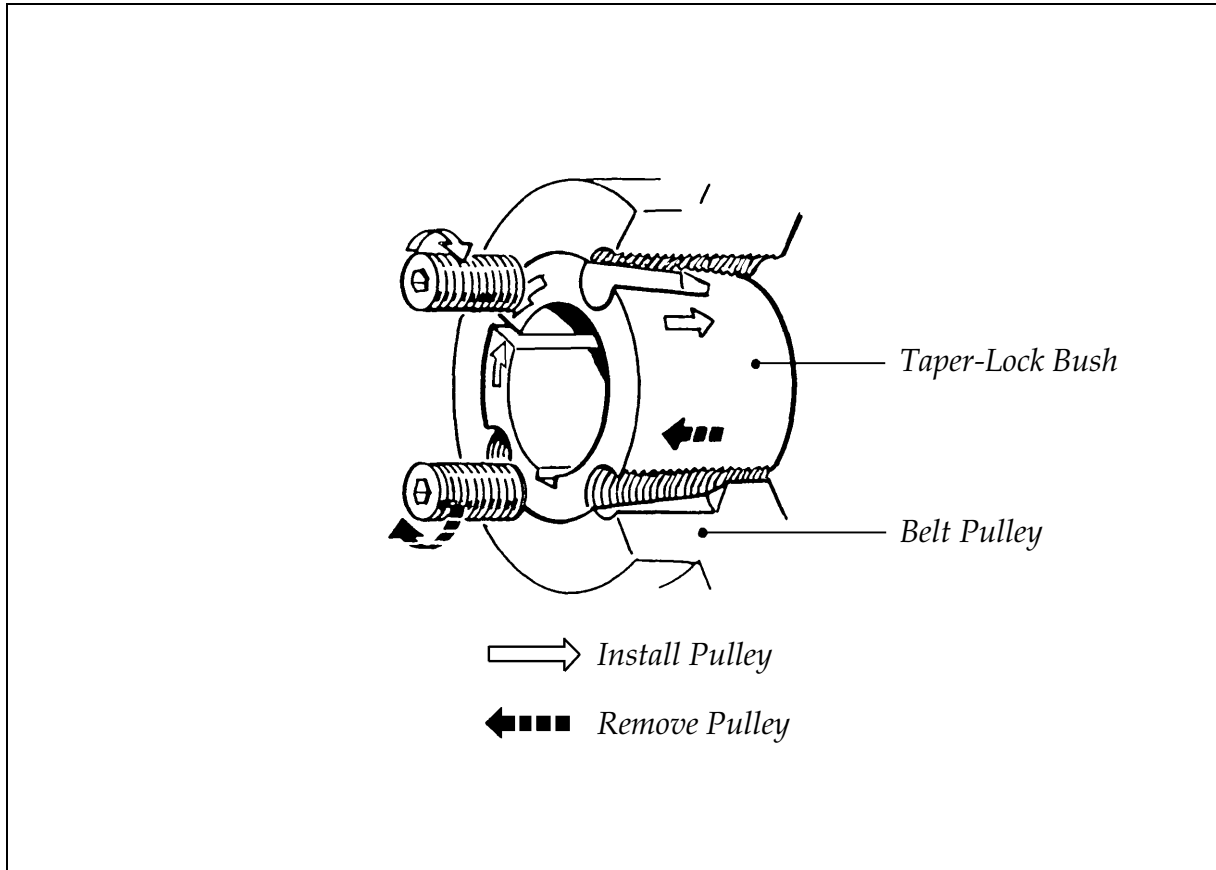


Figure 4.5.1

4.5 Main Drive

4.5.1 Belt Pulley with 'Taper-Lock' Bush (Fig. 4.5.1)

Figure 4.5.1 illustrates a hub of a belt pulley secured with 'Taper-Lock' bush.

The inside of the split bush is cylindrical and its outside is tapered. In the outside there are two (in large-size bushes three) semi-cylindrical dead-end holes and one semi-circular threaded through hole.

The belt pulley hub bore has the same taper as the clamping bush. In the hub bore there are three holes: two semi-cylindrical threaded through holes which face the dead-holes of the bush, and a semi-cylindrical dead-end hole which faces the threaded hole of the bush.

Tightening the screws fitted in the threaded hub bores of the pulley installed on the shaft will press the clamping bush into the tapered hub bore. Being split, the bush will clasp with increasing force as the screws are tightened until the bush is pressed far enough into the hub bore and secured to the shaft with the same force as if fastened by interference fit.

4.5.2 Remove Belt Pulley (Fig. 4.5.1, Lower Half of Sketch)

Remove the screws.

Place one of them in the threaded hole of the Taper-Lock bush.

Tighten the screw until the bush loosens.

The belt pulley can be pulled off by hand.

4.5.3 Install Belt Pulley (Fig. 4.5.1, Upper Half of Sketch)

Carefully clean the parts.

Put the bush into the belt pulley hub and align the holes.

Fit the screws in the threaded holes of the belt pulley hub.

Push the assembly on to the shaft and align it axially.

Using a hexagon key, tighten the screws alternately, until the Taper-Lock bush is pressed in far enough.

5 Supplementary Documentation

