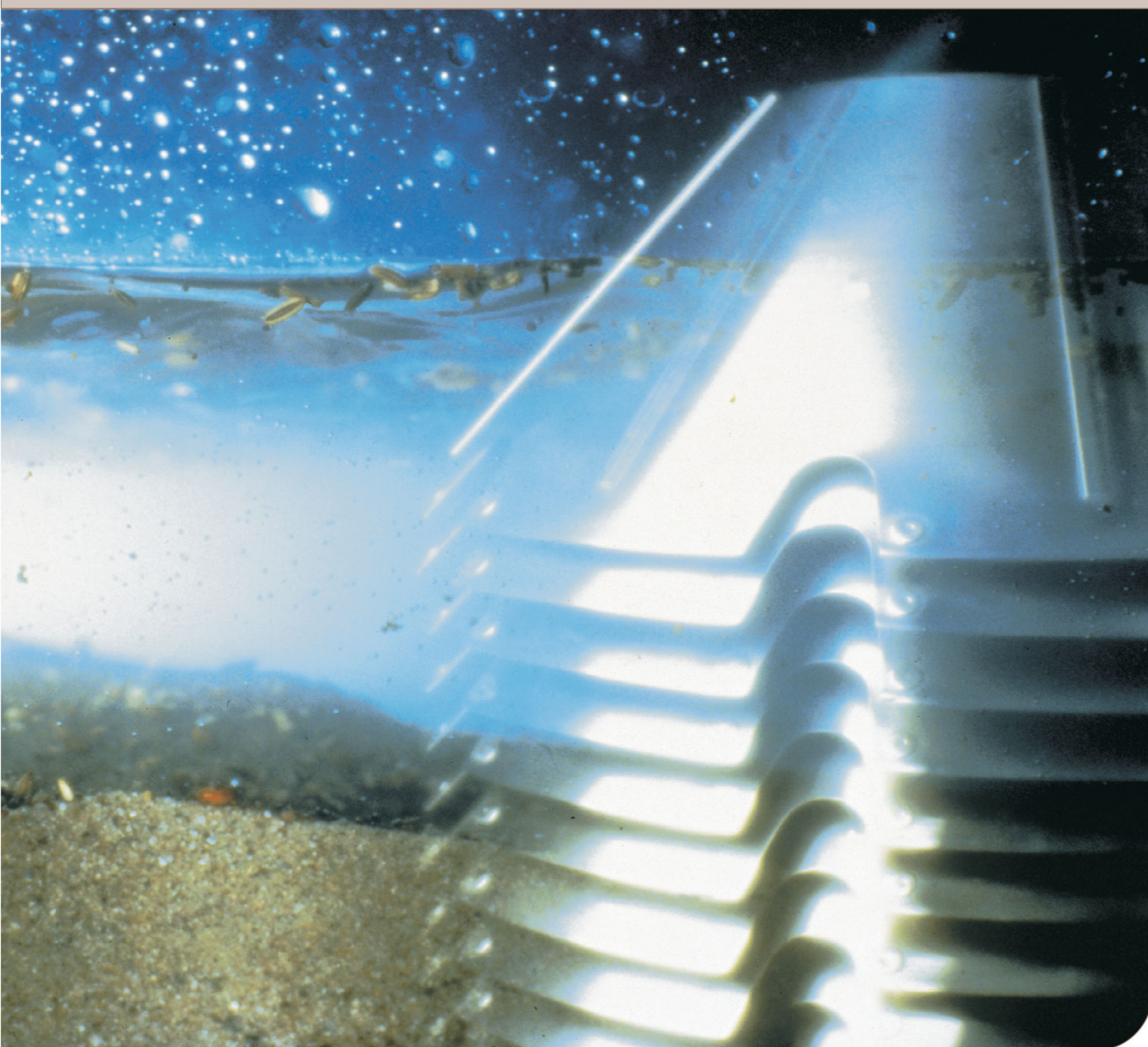




Separator Manual
High Speed Separator

S 881 & S 886



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1 Read This First

This manual is designed for operators, maintenance personnel and service engineers working with the Alfa Laval S 881 & S 886 separator.

If the separator has been delivered and installed by Alfa Laval as a part of a processing system, this manual should be viewed as part of the System Documentation. Study carefully all instructions in any System Documentation.

In addition to this Separator Manual a Spare Parts Catalogue, SPC is supplied.

The Separator Manual consists of:

Safety Instructions

Pay special attention to the safety instructions for the separator. Accidents causing damage to equipment and/or serious injury to persons or personnel can result if the safety instructions are not followed.

Basic Principles of Separation

This chapter describes the purpose of separation and separation principles.

Design and function

This chapter contains a description of the separator.

Operating Instructions

This chapter contains operating instructions for the separator only.

Service, Dismantling, Assembly

This chapter gives instructions for the maintenance procedures. It also contains step-by-step instructions for dismantling and assembly of the separator for service and repair.

Fault Finding

Refer to this chapter if the separator functions abnormally.

If the separator has been installed as a part of a processing system, always refer to the trouble-tracing instructions, in the System Documentation.

Technical Reference

This chapter contains technical data concerning the separator and drawings.

Installation

This chapter contains specifications and recommendations concerning separator installation.

NOTE

A complete reading of this manual by personnel in contact with the machine is essential to safety. Do not allow personnel to clean, assemble, operate or maintain the separator until they have read and fully understood this manual. Ensure that all personnel who operate and service the separator are well-trained and knowledgeable concerning the machine and the work to be carried out.

2 *Safety Instructions*



The centrifuge includes parts that rotate at high speed. This means that:

- Kinetic energy is high
- Great forces are generated
- Stopping time is long



Manufacturing tolerances are extremely fine. Rotating parts are carefully balanced to reduce undesired vibrations that can cause a breakdown. Material properties have been considered carefully during design to withstand stress and fatigue.

The separator is designed and supplied for a specific separation duty (type of liquid, rotational speed, temperature, density etc.) and must not be used for any other purpose.

Incorrect operation and maintenance can result in unbalance due to build-up of sediment, reduction of material strength, etc., that subsequently could lead to serious damage and/or injury.

The following basic safety instructions therefore apply:

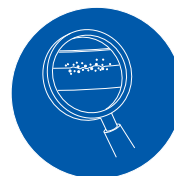
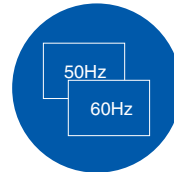
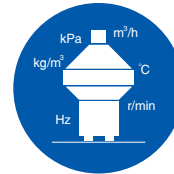
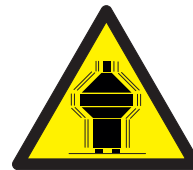
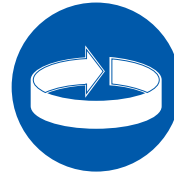
- **Use the separator only for the purpose and parameter range specified by Alfa Laval. Applies not only to the process but also to cleaning and service liquids.**
- **Strictly follow the instructions for installation, operation and maintenance.**
- **Ensure that personnel are competent and have sufficient knowledge of maintenance and operation, especially concerning emergency stopping procedures.**
- **Use only Alfa Laval genuine spare parts and the special tools supplied.**





Disintegration hazards

- When power cables are connected, always check direction of motor rotation. If incorrect, vital rotating parts could unscrew.
- If excessive vibration occurs, **stop** separator and **keep bowl filled** with liquid during rundown.
- Use the separator only for the purpose and parameter range specified by Alfa Laval.
- Check that the gear/pulley ratio is correct for power frequency used. If incorrect, subsequent overspeed may result in a serious break down.
- Welding or heating of parts that rotate can seriously affect material strength.
- Inspect regularly for **corrosion** and **erosion** damage. Inspect frequently if process or cleaning liquid is corrosive or erosive.



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S01512L1

S0151241

S01512H1



Entrapment hazards

- Make sure that rotating parts have come to a **complete standstill** before accessing parts inside the machine or starting **any** dismantling work.

If there is no braking function the run down time can exceed two hours.

- To avoid accidental start, switch off and lock power supply before starting **any** dismantling work. Assemble the machine **completely** before start. **All** covers, connections and guards must be in place.



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Electrical hazard

- Follow local regulations for electrical installation and earthing (grounding).
- To avoid accidental start, switch off and lock power supply before starting **any** dismantling work.



S0151271



Crush hazards

- Use correct lifting tools and follow lifting instructions.

Do **not** work under a hanging load.



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S01512Y1



Noise hazards

- Use ear protection in noisy environments.



S0151291



Burn hazards

- Lubrication oil, machine parts and various machine surfaces can be hot and cause burns. Wear protective gloves.



S01512A1



Skin irritation hazards

- When using chemical cleaning agents, make sure you follow the general rules and suppliers recommendation regarding ventilation, personnel protection etc.
- Use of lubricants in various situations.



S01512D1



Cut hazards

- Sharp edges, especially on bowl discs and threads, can cause cuts. Wear protective gloves.



S01512B1



Flying objects

- Risk for accidental release of snap rings and springs when dismantling and assembly. Wear safety goggles.

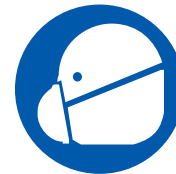


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Health hazard

- Risk for unhealthy dust when handling friction blocks/pads. Use a dust mask to make sure not to inhale any dust.



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Fall hazard

- Do **NOT** stand on the separator or parts of.



2.1 Warning signs in text

Pay attention to the safety instructions in this manual. Below are definitions of the three grades of warning signs used in the text where there is a risk for injury to personnel.



DANGER indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.



WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.



CAUTION indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.



NOTE indicates a potentially hazardous situation which, if not avoided, may result in property damage.



2.2 Environmental issues

Unpacking

Packing material consists of wood, plastics, cardboard boxes and in some cases metal straps.

Wood and cardboard boxes can be reused, recycled or used for energy recovery.

Plastics should be recycled or burnt at a licensed waste incineration plant.

Metal straps should be sent for material recycling.

Maintenance

During maintenance oil and wear parts in the machine are replaced.

Oil must be taken care of in agreement with local regulations.

Rubber and plastics should be burnt at a licensed waste incineration plant. If not available they should be disposed to a suitable licensed land fill site.

Bearings and other metal parts should be sent to a licensed handler for material recycling.

Seal rings and friction linings should be disposed to a licensed land fill site. Check your local regulations.

Worn out or defected electronic parts should be sent to a licensed handler for material recycling.



2.3 Requirements of personnel

Only **skilled** or **instructed** persons are allowed to operate the machine, e.g. operating and maintenance staff.

- **Skilled person:** A person with technical knowledge or sufficient experience to enable him or her to perceive risks and to avoid hazards which electricity/mechanics can create.
- **Instructed person:** A person adequately advised or supervised by a skilled person to enable him or her to perceive risks and to avoid hazards which electricity/mechanics can create.

In some cases special skilled personnel may need to be hired, like electricians and others. In some of these cases the personnel has to be certified according to local regulations with experience of similar types of work.

2.4 Remote start

If the separator is operated from a remote position where the separator cannot be seen or heard the power isolation device shall be equipped with an interlock device to prevent that a remote start command could result in liquid being fed to the separator when it is shut down for service.

The first start after the separator has been taken apart or been standing still for a long time shall always be manually supervised locally.

3 Basic Principles Of Separation

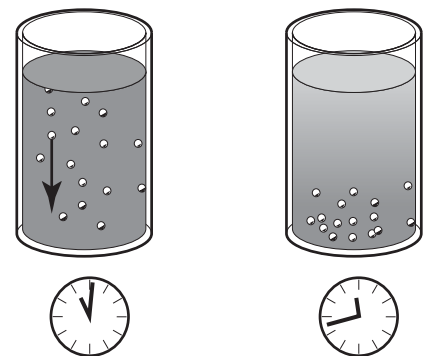
The purpose of separation can be to

- *free a liquid of solid particles,*
- *separate two mutually insoluble liquids with different densities while removing any solids present at the same time,*
- *separate and concentrate solid particles from a liquid.*

3.1 Separation By Gravity

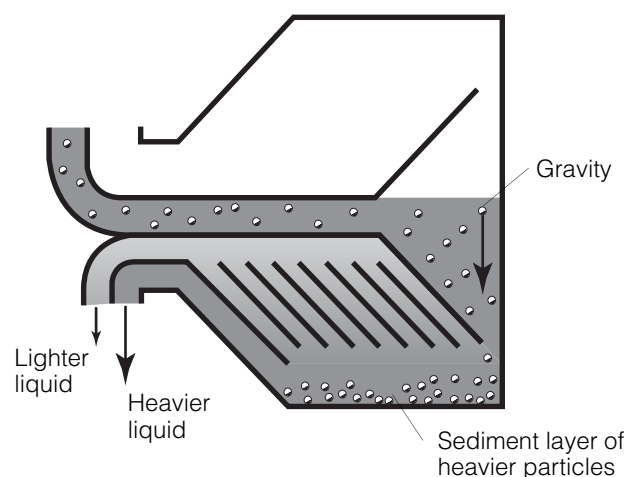
A liquid mixture in a stationary bowl will clear slowly as the heavy particles in the liquid mixture sink to the bottom under the influence of gravity.

A lighter liquid rises while a heavier liquid and solids sink.



Continuous separation and sedimentation can be achieved in a settling tank having outlets arranged according to the difference in density of the liquids.

Heavier particles in the liquid mixture will settle and form a sediment layer on the tank bottom.



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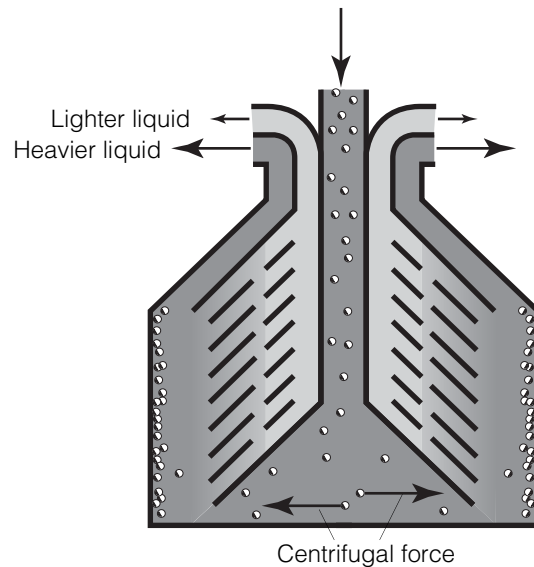
3.2 Centrifugal Separation

In a rapidly rotating bowl, the force of gravity is replaced by centrifugal force, which is many times greater.

Separation and sedimentation is continuous and takes place very quickly.

The centrifugal force in the separator bowl can achieve in a few seconds that which takes many hours in a tank under influence of gravity.

The separation efficiency is influenced by changes in the oil viscosity, separating temperatures and in throughput.



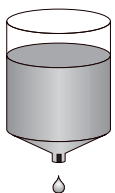
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3.3 Temperatures

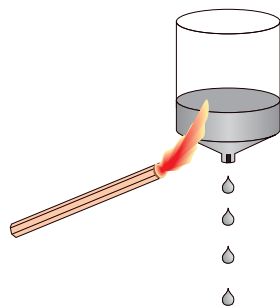
For some types of process liquids (e.g. mineral oils) a high separating temperature will normally increase the separation capacity. The temperature influences oil viscosity and density and should be kept constant throughout the separation.

Viscosity

Viscosity is a fluids resistance against movement. Low viscosity facilitates separation. Viscosity can be reduced by heating.



High viscosity

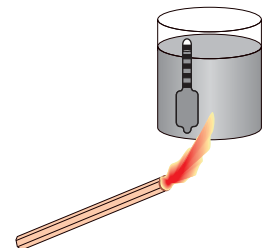
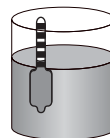


Low viscosity

Density difference

Density is mass per volume unit. The greater the density difference between the two liquids, the easier the separation. The density difference can be increased by heating.

Low density difference

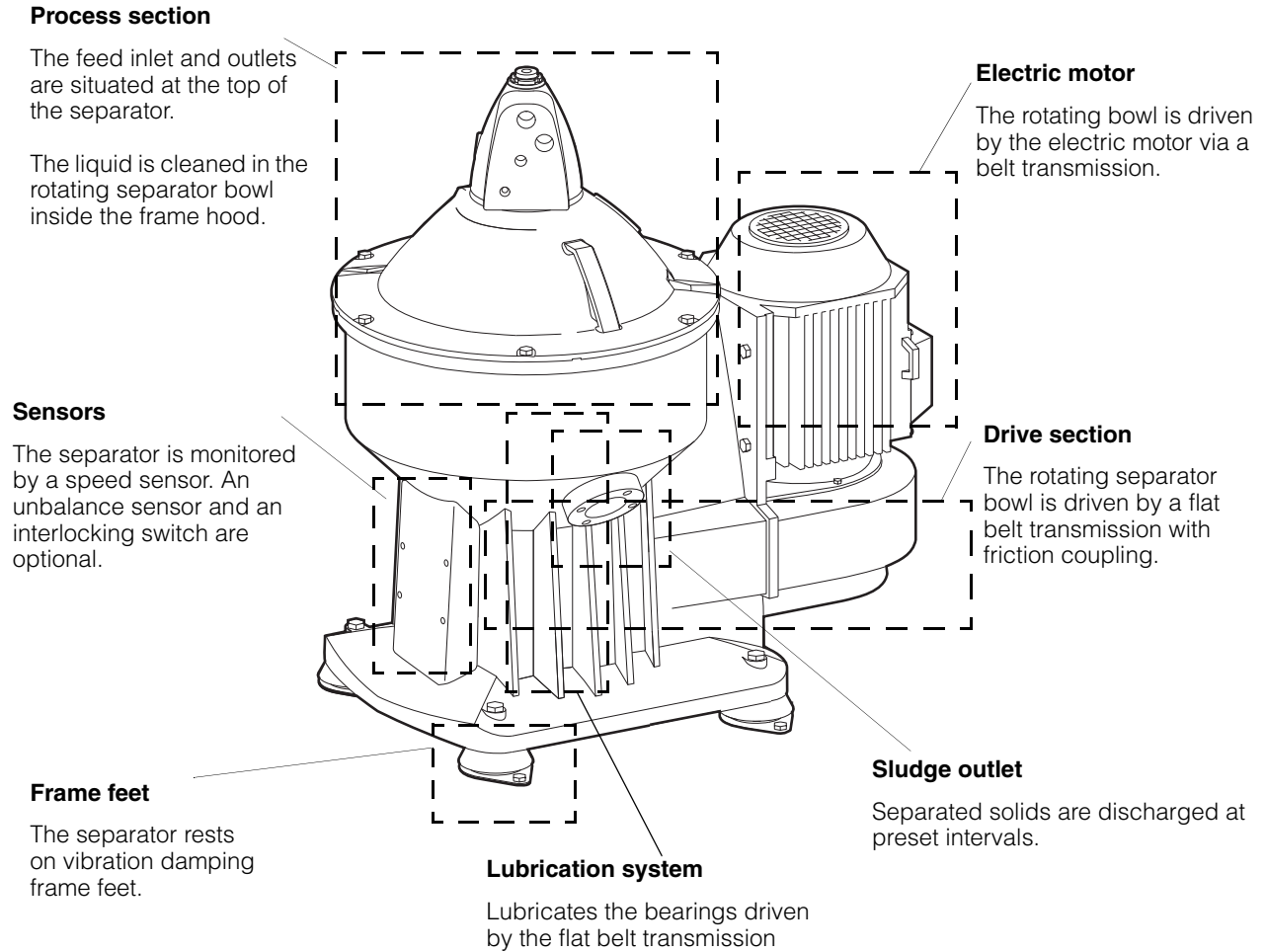


High density difference.

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4 Design



4.1 Overview

The separator comprises a process section and a drive section powered by an electric motor.

The separator frame comprises a lower body and a frame hood. The motor is attached to the frame. The frame feet dampen vibration.

The bottom part of the separator contains a flat belt transmission, a centrifugal clutch and a vertical spindle. The lower body also contains an oil sump for lubrication of spindle bearings.

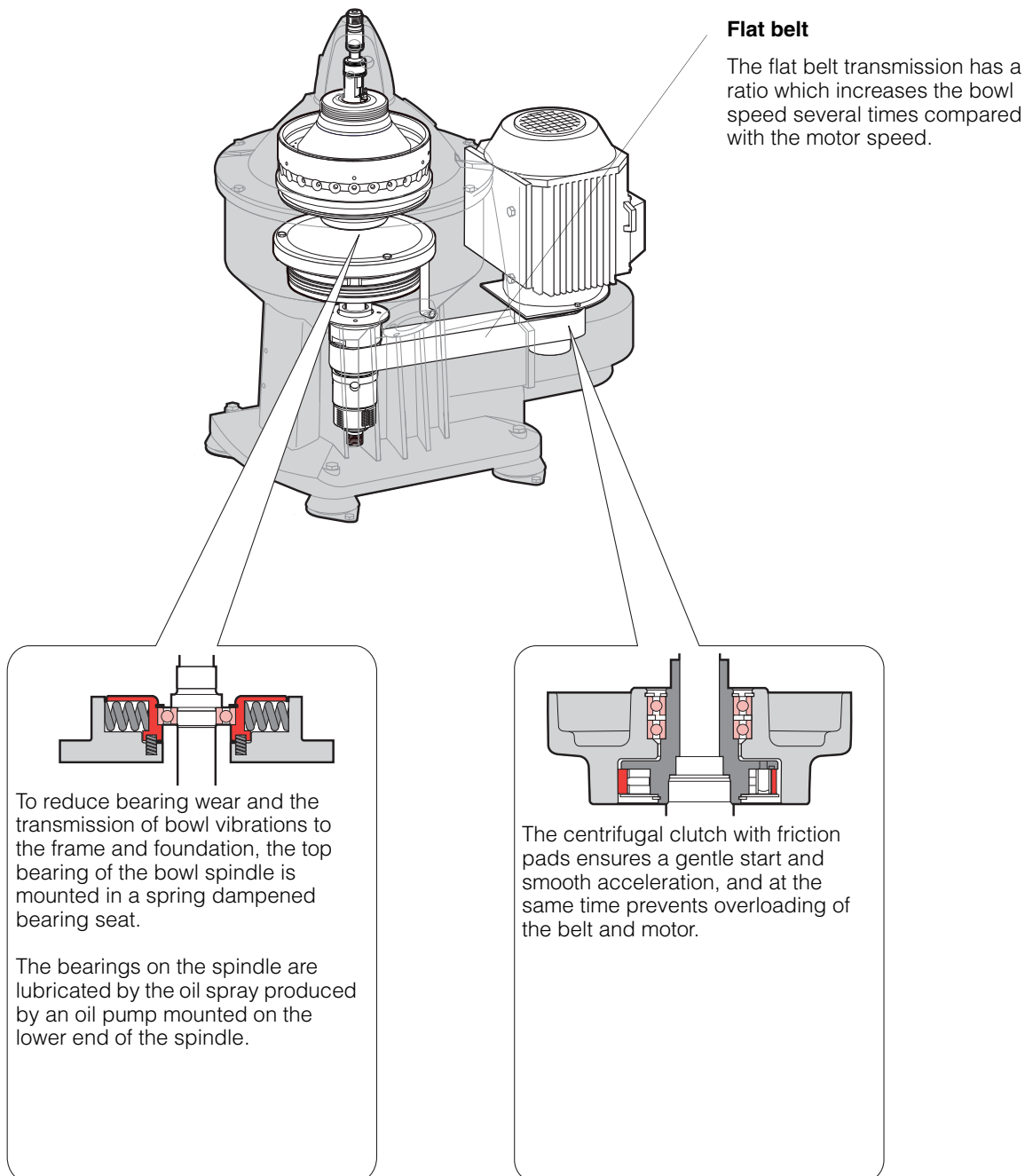
The frame hood contains the processing parts of the separator; the inlets, outlets and piping.

The process liquid is cleaned in the separator bowl. The bowl is fitted on the upper part of a vertical spindle and rotates at high speed inside the frame hood. The bowl also contains the discharge mechanism which empties the sludge during operation.

A speed sensor and an unbalance sensor (optional) are part of the equipment for monitoring the separator functions.

4.2 The Drive Section

The separator bowl is driven by an electric motor via a belt transmission. The belt pulley on the motor shaft includes a centrifugal clutch.



4.3 The Process Section

The separation process takes place inside the rotating separator bowl. The feed and outlet of process liquid takes place in the inlet and outlet unit on top of the separator frame hood.

Inlet and outlet

The inlet and outlet unit consists of the following parts:

A connection house for pipe connections.

A pipe with a paring disc and a paring tube is located inside the connection house. The pipe has channels for incoming and outgoing process liquid.

The paring disc and paring tube pump the cleaned oil and water respectively out of the bowl.

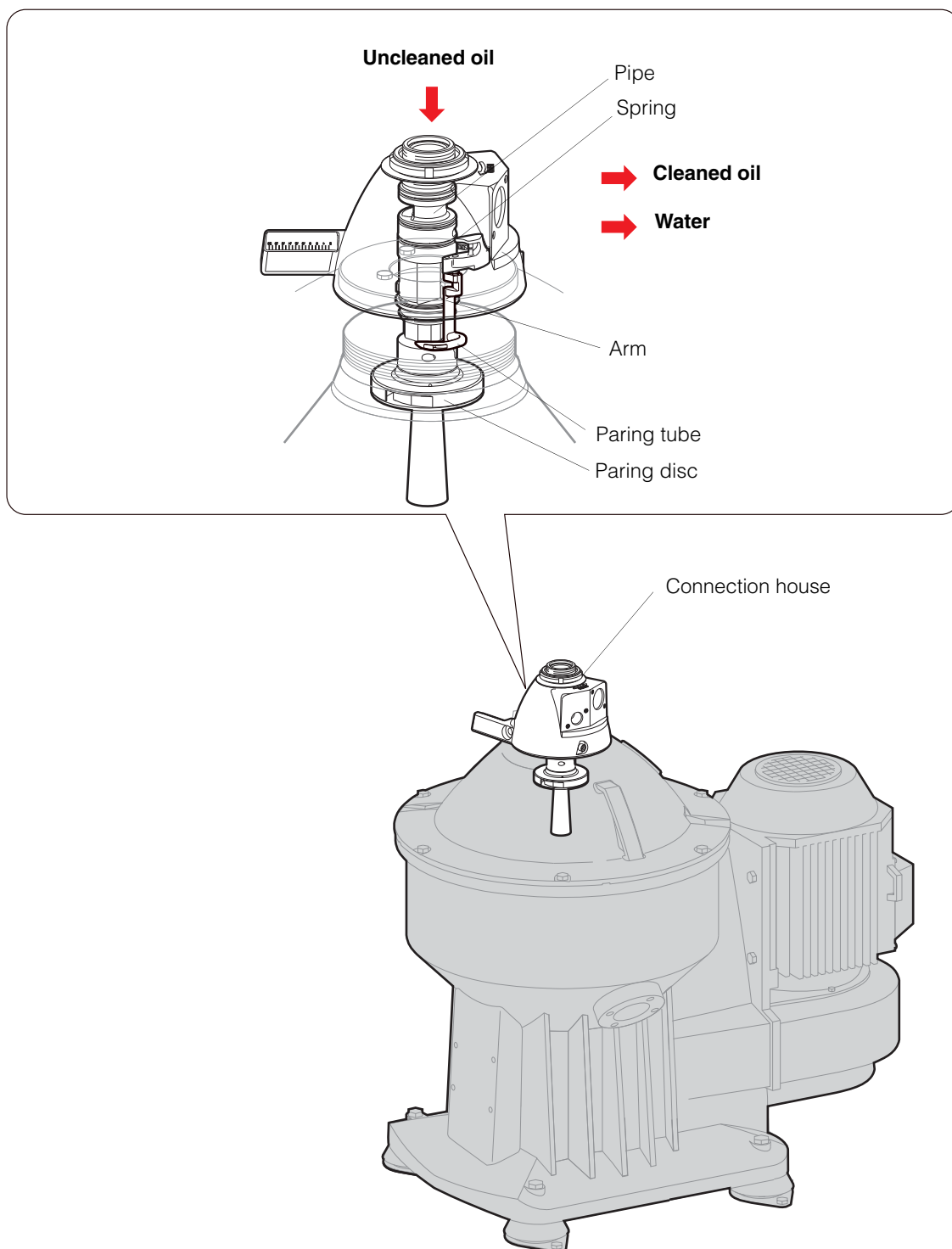
The paring tube can move radially. During separation it surfs on the liquid surface. It is balanced by a spring.

Under certain operating conditions, the paring tube radial position can be locked in place by two adjustable screws on the connection house.

The paring disc and tube are located inside and at the top of the separator bowl.

The inlet and outlet device is held together against the frame hood by a nut on the end of the inlet pipe.

Height adjusting rings determine the height position of the paring disc and paring tube relative to the bowl.



Separator bowl

The separator bowl, with its sludge discharge mechanism, is built-up as follows:

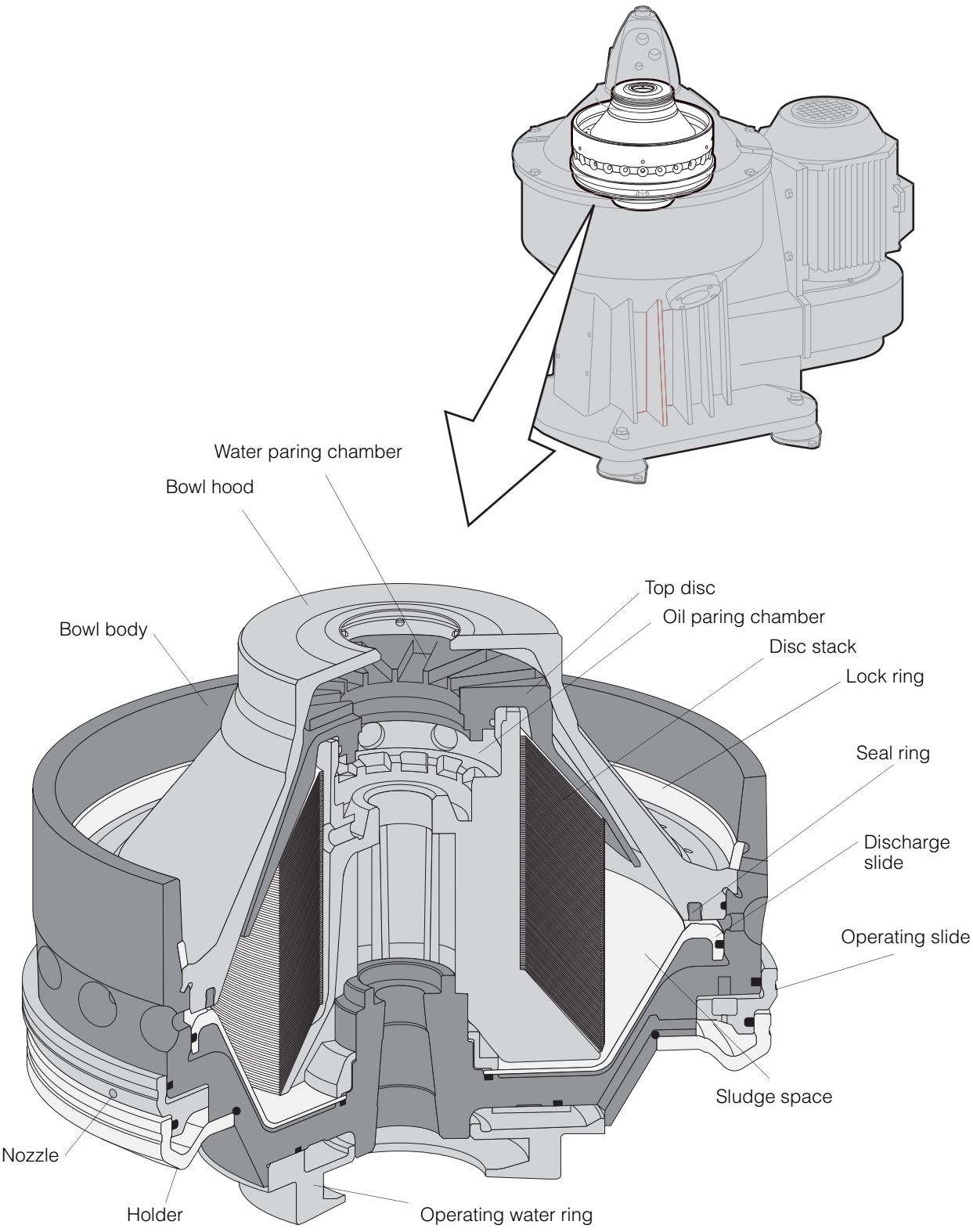
The bowl body and bowl hood are held together by a lock ring (Centrilock). Inside the bowl are the distributor and the disc stack. The disc stack is kept compressed by the bowl hood. The discharge slide forms a separate bottom in the bowl body.

The upper space between the bowl hood and the top disc forms the water paring chamber and contains the paring tube, which pumps the separated water out of the bowl. The oil paring chamber, with its paring disc, is located inside the top of the distributor. From here the cleaned oil is pumped out of the bowl.

The sludge space is in the bowl periphery. The bowl is kept closed by the discharge slide, which seals against a seal ring in the bowl hood.

At fixed intervals, decided by the operator, the discharge slide drops down to empty the bowl of sludge.

The sludge discharge mechanism, which controls the movement of the discharge slide, is comprised of an operating slide and an operating water device. Passive parts are: nozzle and valve plugs. The operating water cover, beneath the bowl, supplies operating water to the discharge mechanism via the operating water ring.



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4.4 Sensors

The separator is equipped with a speed sensor. As options, an unbalance sensor and an interlocking kit can be fitted.

Speed sensor

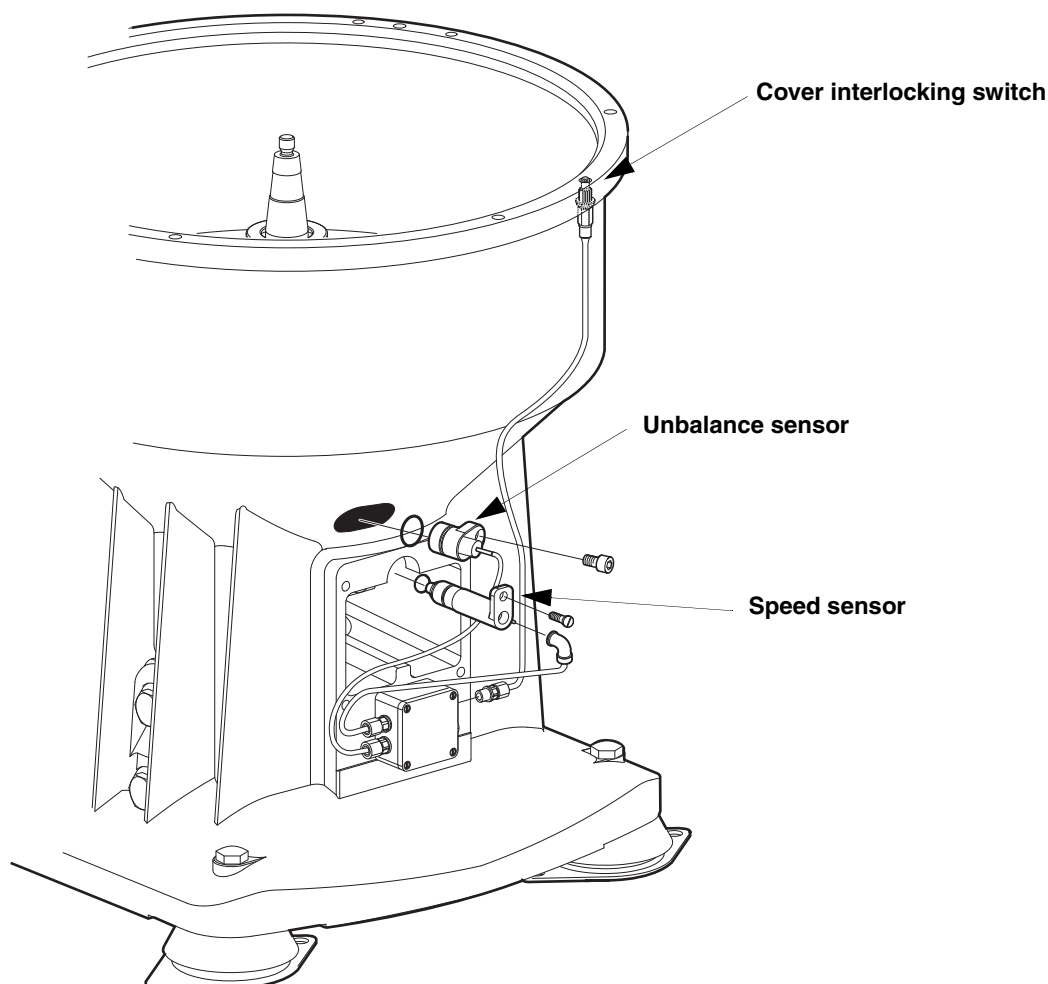
A speed sensor indicates the speed of the separator. The correct speed is needed to achieve the best separating results and for reasons of safety. Refer to type plate for speed particulars.

Monitoring kit (optional)

For indication of any abnormal unbalance, the separator can be equipped with a sensor monitoring the radial position of the bowl spindle.

Cover interlocking kit (optional)

When the cover is closed the interlocking circuit in the control system is closed which makes it possible to start the separator.

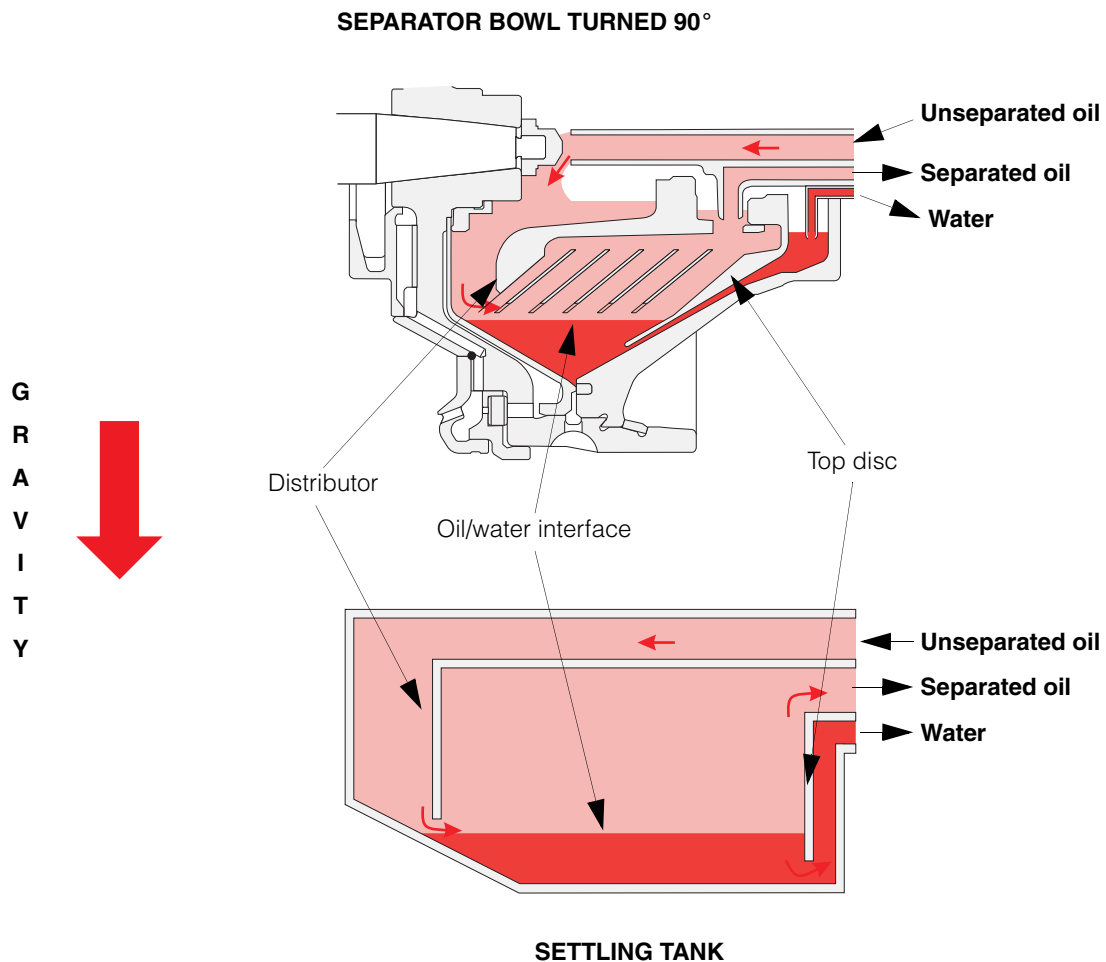


4.5 Separating Function

The separator separates water and solids from the uncleaned oil. Water normally leaves the separator through the water outlet. During sludge discharge, solids (sludge) and water are removed through the discharge ports.

4.5.1 The liquid balance in the bowl

The liquid levels in the bowl depend on many factors (bowl geometry, liquid densities, flow rates etc.). To get a picture of how the liquids are distributed in the bowl, imagine that the bowl is at standstill and turned 90° (only influenced by gravity). The bowl can now be compared with a settling tank:



4.5.2 Liquid flow

Unseparated oil is fed into the bowl through the inlet pipe and travels via the distributor towards the periphery of the bowl.

When the oil reaches slots in the distributor, it rises through the channels formed by the disc stack, where it is evenly distributed.

The oil is continuously cleaned as it travels towards the centre of the bowl. When the cleaned oil leaves the disc stack, it flows through a number of holes in the distributor and enters the oil paring chamber. From here it is pumped by the oil paring disc, and leaves the bowl through the oil outlet. Separated water, sludge and solid particles, which are heavier than the oil, are forced towards the periphery of the bowl and collect in the sludge space.

The space between the bowl hood and top disc, as well as the water paring chamber, is filled with oil, which is distributed over the entire circumference via the grooves in the top disc.

During normal operation, the water drain valve in the water outlet is closed.

4.5.3 Discharge of sludge and water

As the sludge space fills up and water enters the disc stack, traces of water will escape with the cleaned oil. The increase of water content in the cleaned oil is the sign of reduced separation efficiency.

This condition is monitored by the process control system, and water is removed from the bowl when minimal levels are recorded.

The water is removed by either of two ways:

- The water drain valve opens and the water leaves the bowl through the water outlet.
- Through the sludge ports at sludge discharge.

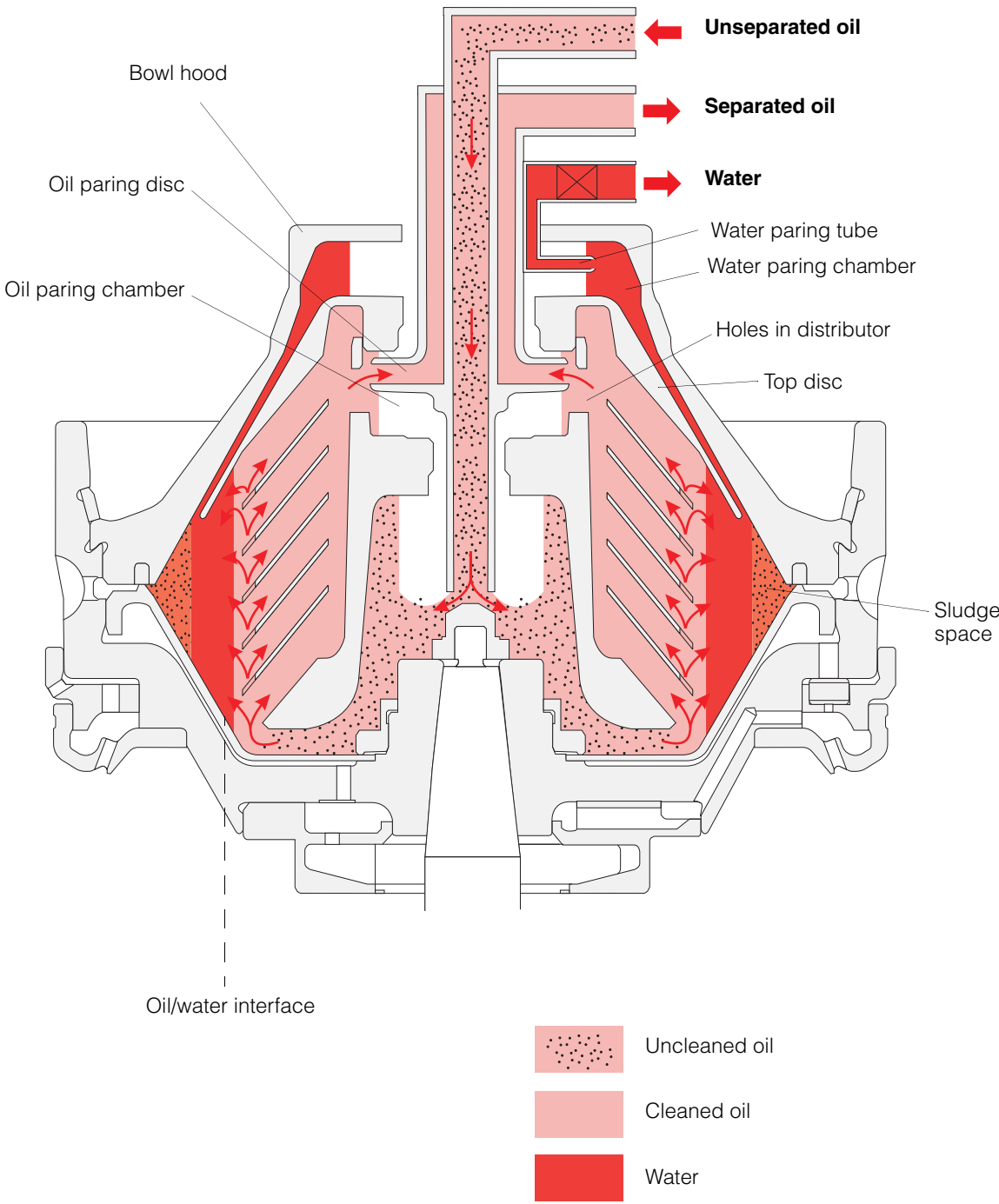
Which way is decided by the process control system.

4.5.4 ALCAP™ concept

When the sludge space is filled up and water enters the disc stack, traces of water will escape with the cleaned oil. The increase of water content in the cleaned oil is the sign of reduced separation efficiency.

This condition is monitored by the process control system, and water is removed from the bowl when minimal levels are recorded.

DISCHARGE OF WATER THROUGH WATER OUTLET



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5 Operating Instructions

These operating instructions describe routine procedures to follow before and during the start, running and stopping sequences of the separator.

If system documentation is available, always follow the operating instructions therein. If there is no system documentation, the instructions below are to be followed.

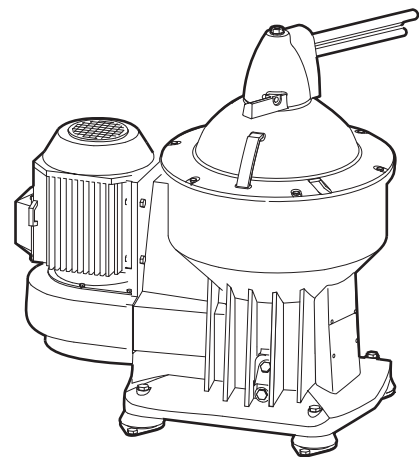
5.1 Before First Start-up

Technical demands for connections and limitations for the separator are listed in chapter *8 Technical Reference, page 149*:

- Technical data
- Connection list
- Interface description
- Basic size drawing
- Foundation drawing.

Before first start:

- Ensure the machine is installed and assembled correctly and that feed lines and drains have been flushed clean.
- Fill oil in the oil bath. See *6.7 Oil Change, page 132*. Quality of oil see *6.7.6 Lubricating oils, page 139*.
- Make sure that the bearings on the spindle are pre-lubricated.
- Check the direction of rotation by doing a quick start/stop. The motor fan should rotate clockwise.



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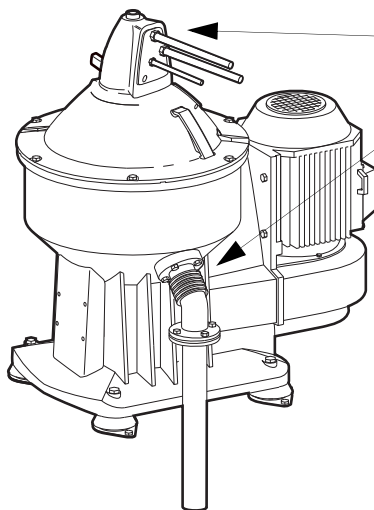
5.2 Start After Service

Pay special attention to any unusual sounds or vibrations when starting the separator after a service. Different fault symptoms are listed in chapter **7 Fault Finding, page 143**.

5.3 Before Normal Start

To achieve the best separation results, the bowl should be in a clean condition.

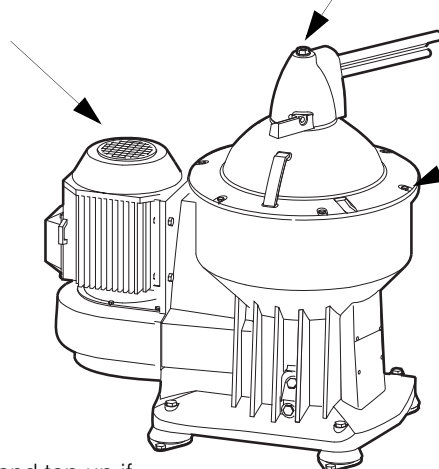
1 Check...



... that all couplings and connections are securely tightened to prevent leakages. Leaking hot liquid can cause burns.

... that the lock nut is fully tightened. Do not forget the washer.

... the direction of rotation by doing a quick start/stop. The motor fan should rotate clockwise.



... that all frame hood bolts as well as the clutch cover are fully tightened

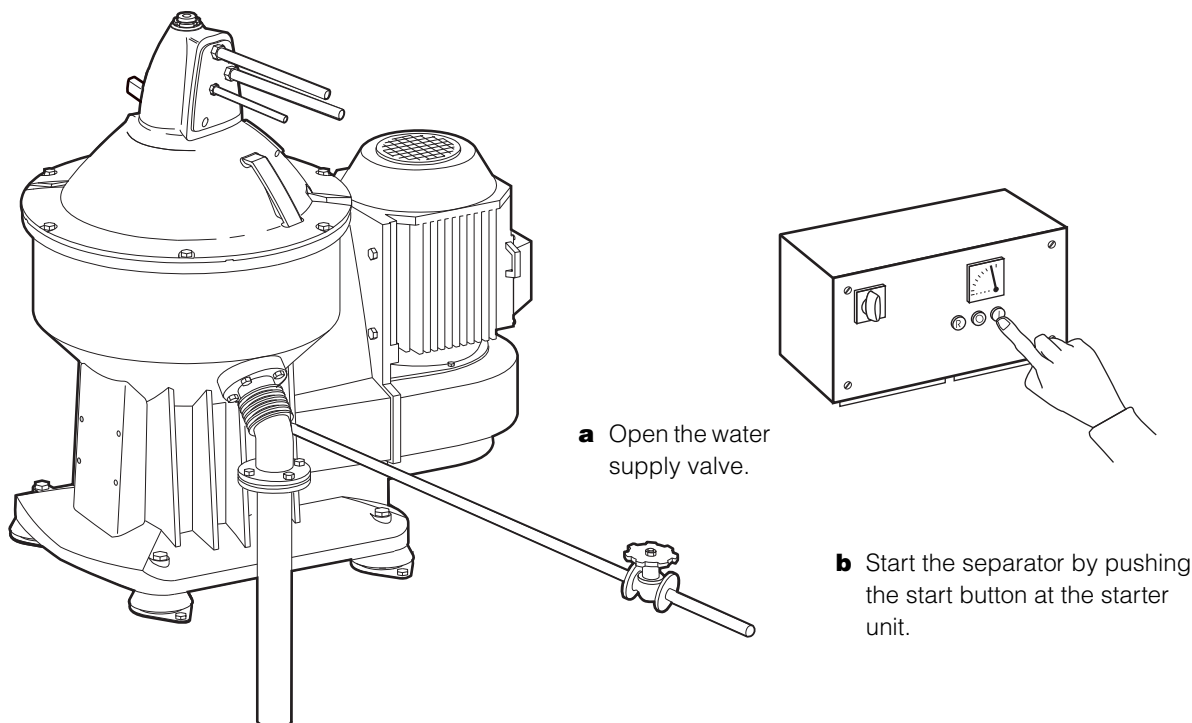
... the oil level and top up if necessary.

NOTE

The separator should be level and at standstill when oil is filled.

5.4 Start

1 Start of separator.



NOTE

After every start the separator must always be run continuously for a minimum of 1 hour to ensure proper lubrication.

2 Check the separator for vibration.

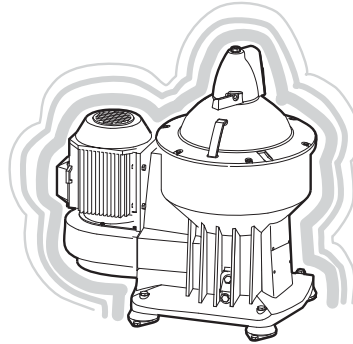


Excessive vibration

If vibration increases, or continues at full speed, keep bowl filled and stop the separator.

The cause of the vibration must be determined and corrected before starting again!

Excessive vibration may be due to incorrect assembly or insufficient cleaning of the bowl.



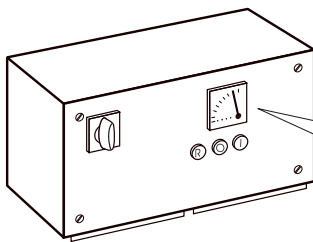
NOTE

Normal vibration

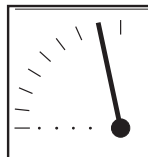
Vibration may occur during start up when passing critical speed. This is normal and should pass without danger.

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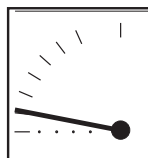
3 Ensure that the separator is at full speed (after about 120 - 210 seconds).



The time by full speed can be checked by studying the ammeter

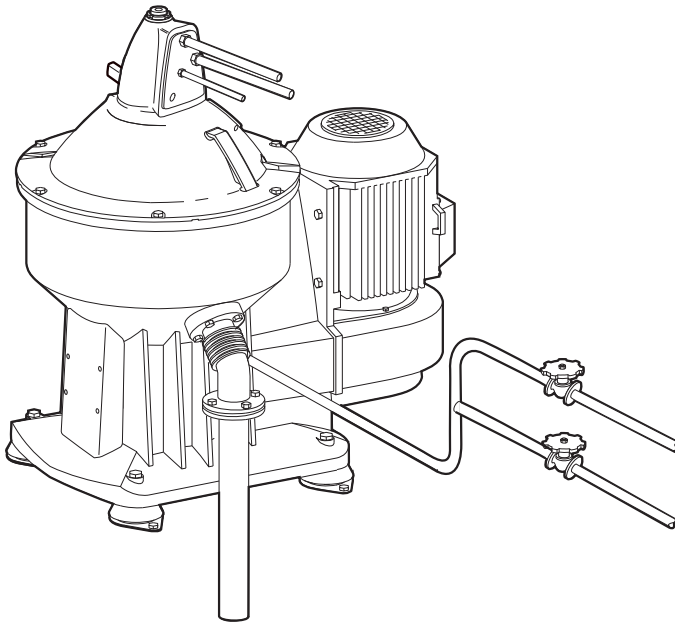


Current increases during start...



...to decrease to a stable value when full speed has been reached.

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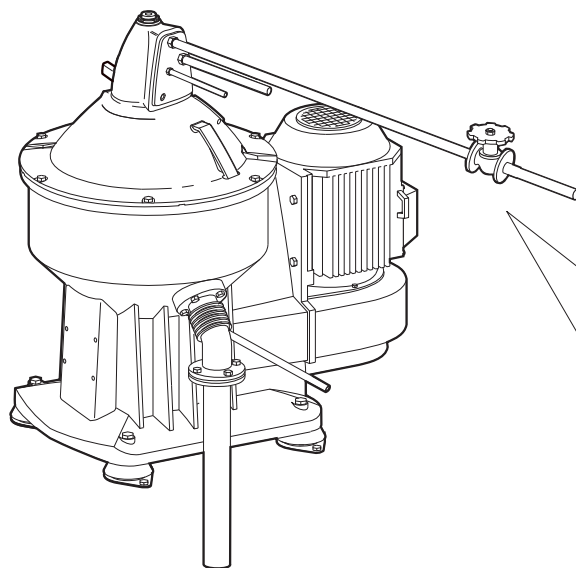
4 Perform a sludge discharge.

a Add opening water until a discharge sound is heard (3,0 seconds).

b Wait 15 seconds.

c Add closing water for 60 seconds.

G0872141

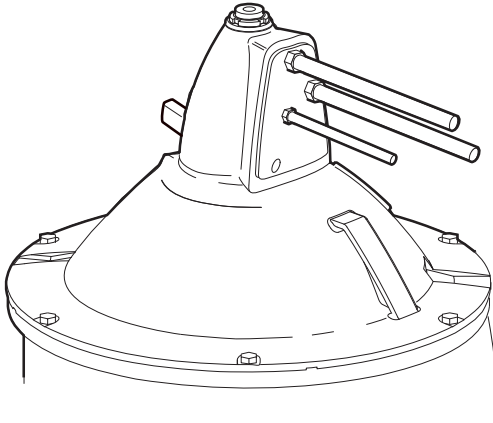
5 Turn on the oil feed.**NOTE**

Before turning on the feed make sure that the oil has the correct temperature.

G0872051

5.5 Operating

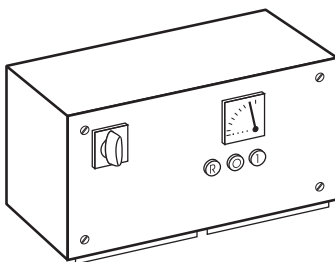
1 Checkpoints during operation:



a Check all connections for leakage.

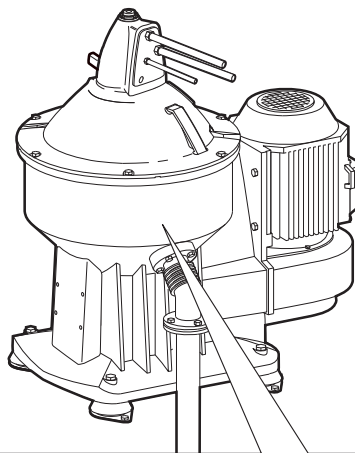
b Check that the feed has correct flow and temperature.

c Check the back pressure.



d Check that the starter ammeter reading is the normal low and steady value.

e Check for abnormal vibrations and sounds.



Disintegration hazard

Do not discharge a vibrating separator. Vibration can increase if solidified sludge is only partially discharged.

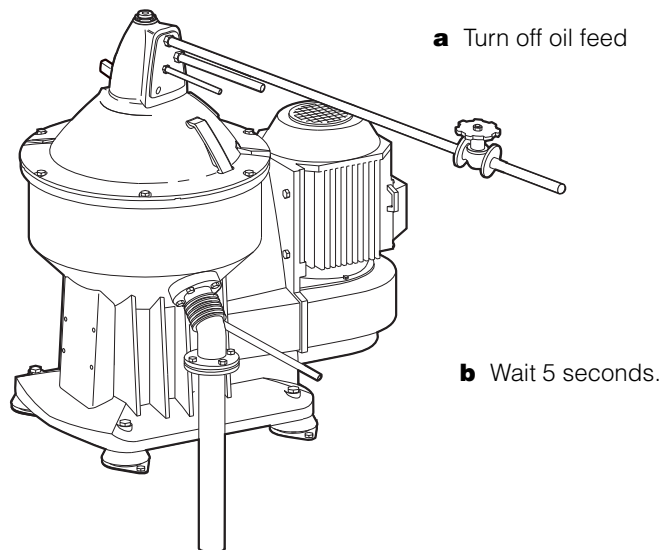


Burning hazard

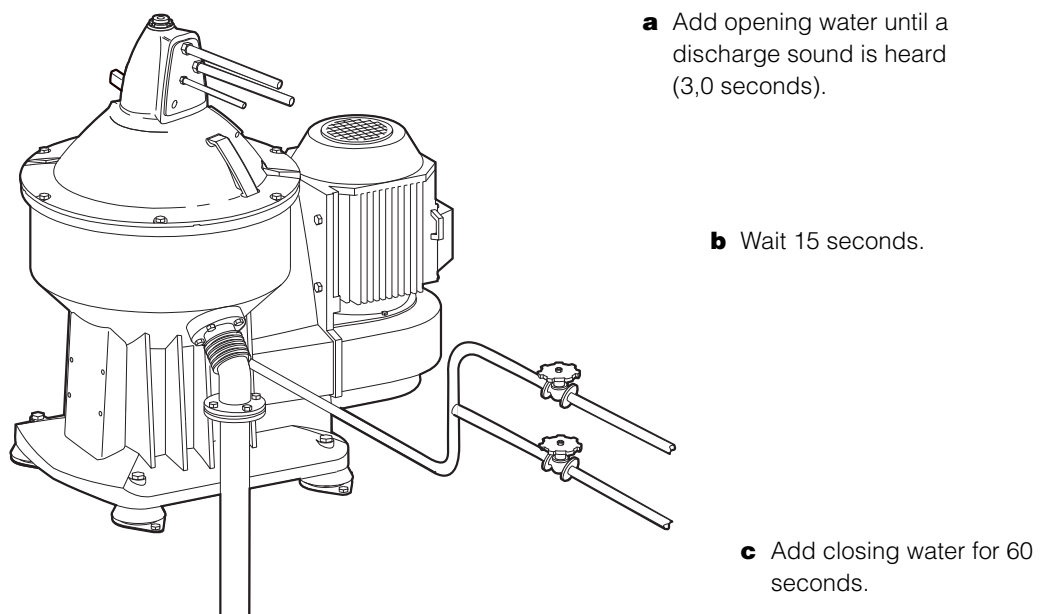
Lubricating oil and various machine surfaces can be hot and cause burns.

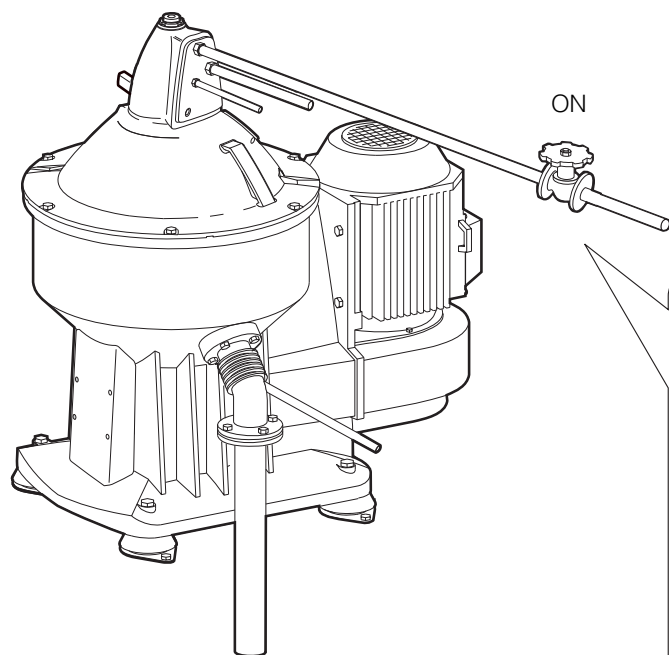
5.5.1 Sludge discharge during operation

- 1** Turn off the oil feed.



- 2** Perform a sludge discharge.

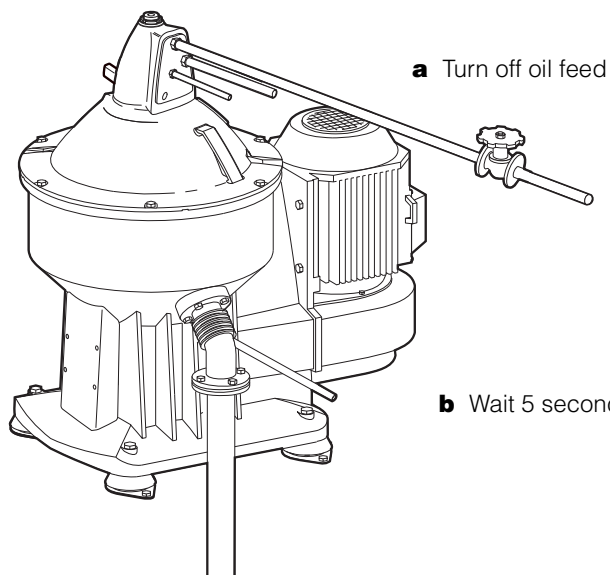


3 Turn on the oil feed.**NOTE**

Before turning on the feed,
make sure that the oil has the
correct temperature.

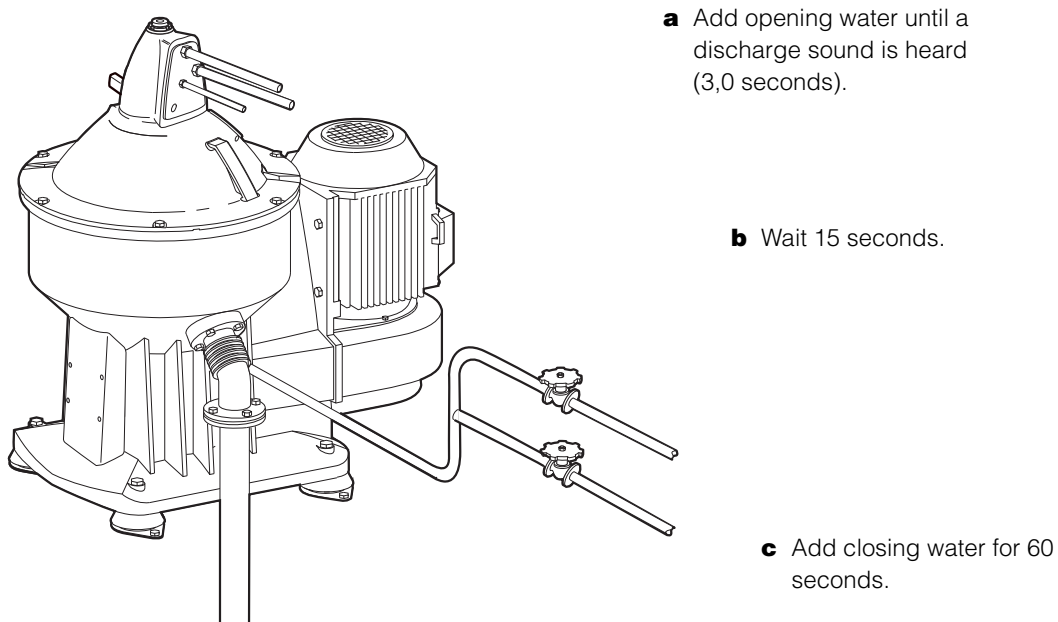
5.6 Stop

- 1** Turn off the oil feed.



G0872241

- 2** Perform a sludge discharge.

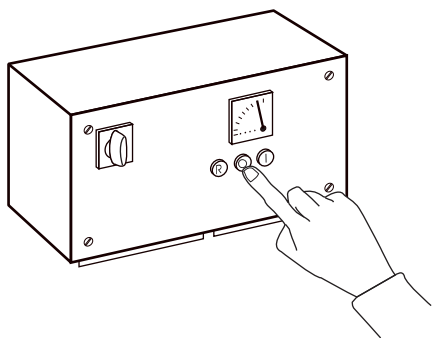


G0872141

- 3** Fill the bowl up with water and stop the separator.

NOTE

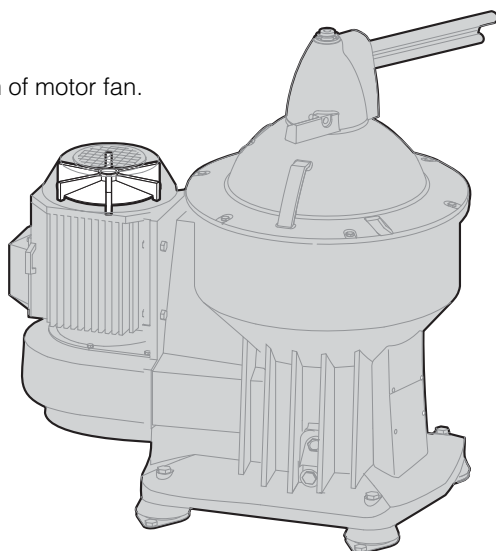
Keep the bowl filled during run-down to minimize the vibrations.



G0872311

- 4** Wait until the separator has stopped (after about 65 minutes).

Check rotation of motor fan.

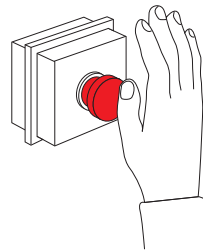
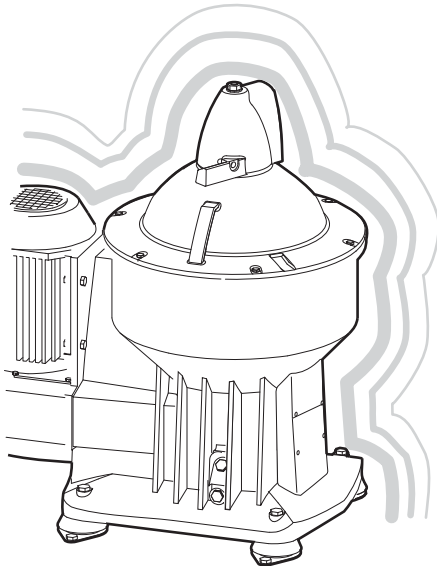


G0872411

5.7 Emergency Stop

1 If the separator vibrates excessively...

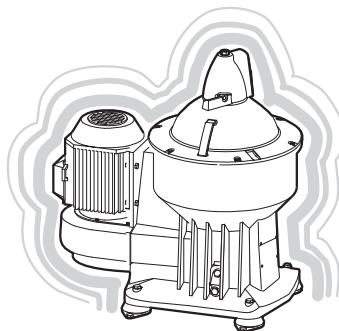
... push the emergency stop button.



NOTE

Keep the bowl filled during run-down to minimize the vibrations.

2 Evacuate the room.



! WARNING

Disintegration hazard
Never discharge a vibrating separator.

! WARNING

Disintegration hazard

After an emergency stop, the cause of the fault must be identified.

If all parts have been checked and the cause not found, contact Alfa Laval for advice before restarting the separator.

! WARNING

Entrapment hazard

Make sure that rotating parts have come to a complete standstill before starting any dismantling work.

6 Service, Dismantling, Assembly

6.1 Periodic Maintenance

Periodic (preventive) maintenance reduces the risk of unexpected stoppages and breakdowns. Follow the maintenance log in this chapter in order to facilitate the periodic maintenance.

6.1.1 Maintenance intervals

The following directions for periodic maintenance give a brief description of parts to be cleaned, checked and renewed at different maintenance intervals.

The maintenance log for each maintenance interval on page 43 gives a detailed list of actions to be performed.

Inspection

An Inspection consists of an overhaul of the separator bowl, inlet/outlet and operating water device at max. 6 months or 4000 operating hours.

Seals in bowl and gaskets in inlet/outlet device are renewed.

Overhaul

An Overhaul consists of an overhaul of the complete separator (including separator bowl, inlet/outlet and operating device) at max. 18 months or 12000 operating hours. Seals, bearings, friction blocks and flat belt in the separator are renewed. Also renew the bearings in the motor, see separate manual appendix for instructions.

Oil change

The oil should be changed every 4000 hours, or at least once every year if the total number of operating hours is less than 4000 hours/year.

6.1.2 Maintenance procedures

At each Inspection and/or Overhaul, take a copy of the maintenance log and use it to make notes during the service.

An inspection and overhaul should be carried out as follows:

- 1** Dismantle the parts as described in 6.3 *Dismantling, page 46.*

Place the separator parts on clean, soft surfaces such as pallets.
- 2** Inspect and clean the dismantled separator parts according to the maintenance log and description in 6.4 *Actions Before Assembly, page 82.*
- 3** Fit all the parts delivered in the service kit while assembling the separator as described in chapter 6.5 *Assembly, page 91.*
- 4** When the separator is assembled, make final checks described in 6.6 *Actions After Assembly, page 130.*



Disintegration Hazards

Separator parts that are either missing, worn beyond their safe limits or incorrectly assembled, may cause severe damage or fatal injury.



Burn and Corrode Hazards

Escaping hot and/or corroding process material, which can be hazardous, may still remain in the separator after stop.

The use of service symbols in the dismantling/assembly instructions

Parts that have to be renewed from the service kits (see below) are marked  and/or  in the assembly instructions.

Example:

a Fit the O-ring .

When dismantling and assembling between the service periods, some procedures do not have to be carried out. These procedures are marked  and/or .

Example:

5 Renew the valve plugs on the operating slide .

All symbols used in the instructions refer to activities mentioned in the maintenance logs.

6.1.3 Tightening of screws

Tightening all screws with the correct torque value is important.

These figures apply unless otherwise stated:

Torque						
Metric thread	Stainless steel			Carbon steel		
	Nm	kpm	lb.ft	Nm	kpm	lb.ft
M4	1,7	0,17	1,2	2,25	0,25	1,8
M5	3,4	0,34	2,5	4,9	0,49	3,6
M6	7	0,7	5	8	0,8	5,9
M8	17	1,7	13	20	2	14,7
M10	33	3,4	24	39	3,9	28,7
M12	57	5,8	42	68	6,9	50
M16	140	14	100	155	15,8	114
M20	270	28	200	325	33	239
M24	470	48	340	570	58	420

The figures apply to lubricated screws tightened with a torque wrench.

6.1.4 Service kits

A Commissioning kit is included in the delivery which contain various O-rings that might need to be changed when assembly for the first time.

Special service kits are available for Inspection and Overhaul.

For other services, a Support kit is available. Spare parts not included in the Support kit have to be ordered separately.

Note that the parts for Inspection **are** included in the Overhaul kit.

The contents of the kits are described in the Spare Parts Catalogue.

NOTE

Always use Alfa Laval genuine parts as otherwise the warranty may become invalid.

Alfa Laval takes no responsibility for the safe operation of the equipment if non-genuine spare parts are used.

WARNING

Disintegration hazards

Use of imitation spare parts may cause severe damage.

6.1.5 Cleaning

CIP (Cleaning In Place)

To prolong the intervals between manual cleaning of the separator the use of CIP together with repeated discharges can be used.

Some CIP liquids can be corrosive to brass- and aluminium alloy parts which are included in the separator.

CAUTION

Use only Alfa Laval recommended CIP liquids.

6.2 Maintenance Log

Name of ship/plant:	Local identification:
Separator: S 881 & S 886	Manufacture No./Year:
Total running hours:	Product No.: 881207-03-02/3 & 881207-02-02/2
Date:	Signature:

Part	i Inspection	o Overhaul	Check	Action	Page	Note
In and outlet device						
- All parts	x	x		Clean	82	
- All parts	x	x		Check for corrosion	84	
- All parts	x	x		Check for cracks	85	
- Connecting housing	x	x		Check for erosion damages	86	
	x	x		Renew O-rings for hoses	-	
- Frame hood	x	x		Renew O-ring	124	
		x		Control measure of paring disc height	125	
		x		Check height adjusting rings	125	
		x		Renew the spring	126	
- Inlet pipe	x	x		Lubricate the thread	126	
Bowl						
- All parts	x	x		Clean	82	
- All parts	x	x		Check for corrosion	84	
- All parts	x	x		Check for cracks	85	
- All parts	x	x		Check for erosion damages	86	
- Bowl body	x	x		Check for impact marks and corrosion	111	
	x	x		Renew rectangular ring	112	
	x	x		Renew O-rings	113, 116	
	x	x		Renew holder screws and washers	112	
- Operating slide	x	x		Renew rectangular ring	112	
	x	x		Renew valve plugs	111	
- Discharge slide	x	x		Renew rectangular ring	116	
- In and outlet pipe	x	x		Renew O-rings	119	
	x	x		Renew splash sealing	119	
- Paring tube	x	x		Renew O-rings, bushing and bearings	119	
- Bowl hood	x	x		Renew seal ring	121	
	x	x		Renew O-ring	121	
- Operating water ring	x	x		Renew seal ring and screws	113	

Part	Inspection 	Overhaul 	Check 	Action	Page	Note
Frame						
- Frame feet				Renew frame feet (including washers and screws)	87	Has to be ordered separately
- Drain and oil filling holes	x	x		Renew washers	110	
- Oil pin	x	x		Renew O-ring	110	
Driving device						
- All parts		x		Clean	82	
- All parts		x		Check for corrosion	84	
- All parts		x		Check for cracks	85	
- Bottom bearing housing		x		Renew O-ring	98	
- Labyrinth ring holder		x		Renew labyrinth ring	99	
		x		Renew O-ring	99	
- Top bearing housing		x		Renew springs	102	
- Flat belt		x		Renew flat belt	106	
- Bowl spindle		x		Pre-lubricate and renew ball bearing	101	
		x		Pre-lubricate and renew self-aligning roller bearing	103	
		x		Lubricate the spindle	111	
		x		Measure the radial wobble	109	
- Lubricating oil orifice		x		Renew O-ring	104	
- Neck bearing cover		x		Renew O-ring	108	
- Protective plate		x		Renew O-ring	108	
- Water inlet pipe		x		Renew O-ring	109	
- Operating water cover		x		Renew seal ring and O-ring	109	
- Fan		x		Renew the O-ring	105	
Coupling						
- All parts		x		Clean	82	
- All parts		x		Check for corrosion	84	
- All parts		x		Check for cracks	85	
- Coupling hub		x		Renew single row ball bearings	91	
		x		Renew snap rings	91	
- Friction blocks		x		Renew friction pads (if they are worn) or clean the pads if they are dirty	91	
Electrical motor						
- Electrical motor		x		Lubricate if nipples are fitted. See sign on motor	---	
- Bearings		x		Renew bearings	---	

Part	Inspection	Overhaul	Check	Action	Page	Note
						
Signs and labels on separator						
- Machine plate			x	Check attachment and legibility	130	
- Power supply frequency			x	Check attachment and legibility	130	
- Lifting instructions			x	Check attachment and legibility	130	
- Safety labels			x	Check attachment and legibility	130	
- Name plate			x	Check attachment and legibility	130	
- Representative label			x	Check attachment and legibility	130	

6.3 Dismantling

6.3.1 Introduction

The frame hood and heavy bowl parts must be lifted by means of a hoist. Position the hoist exactly above the bowl centre. Use a lifting sling and lifting hooks with safety catches.

The parts must be handled carefully. Don't place parts directly on the floor, but on a clean rubber mat, fibreboard or a suitable pallet.

NOTE

For safety reasons, it is essential that all personnel who work with the separator read this manual thoroughly and completely.

Do not allow personnel to clean, assemble, operate or maintain the separator until they have read and fully understood this manual.

Ensure that all personnel who operate and service the separator are well-trained and knowledgeable concerning the separator and the work to be carried out.

6.3.2 Tools

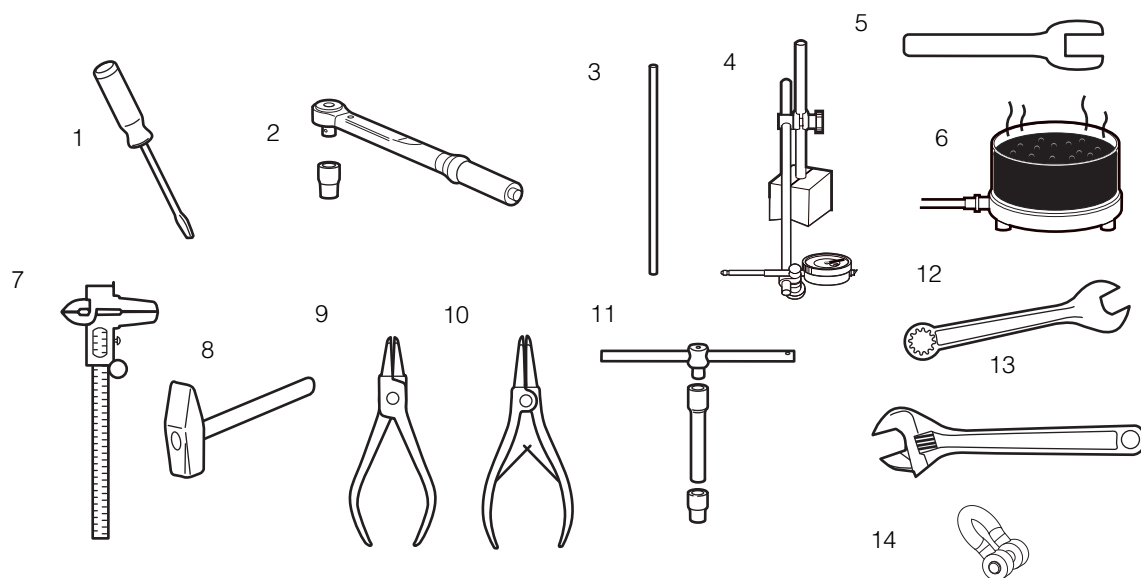
Special tools from the tool kit must be used for dismantling and assembly, as well as **Standard tools** (not included). The special tools are specified in the *Spare Parts Catalogue* and are illustrated at the beginning of each dismantling section.



Entrapment hazard

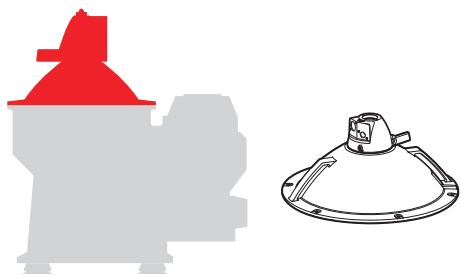
To avoid accidental start, switch off and lock-out power supply before starting any dismantling work.

Make sure that machine has come to a complete standstill before starting any dismantling work (takes about 65 minutes from switch off).

Standard Tools

- 1** Screwdriver
- 2** Torque wrench (capacity 0-300 Nm)
- 3** Drift (Ø 4 mm)
- 4** Dial indicator with magnetic base
- 5** Spanner for clutch
- 6** Heating equipment for bearings
- 7** Sliding calliper
- 8** Hammers (standard and soft-faced)
- 9** Pliers for internal snap rings
- 10** Pliers for external snap rings
- 11** T-handle with extension rod, sockets
(13, 16, 17, 18, 19, 27, 30 mm)
- 12** Spanners (various sizes)
- 13** Adjustable spanner
- 14** Shackle

6.3.3 Frame hood



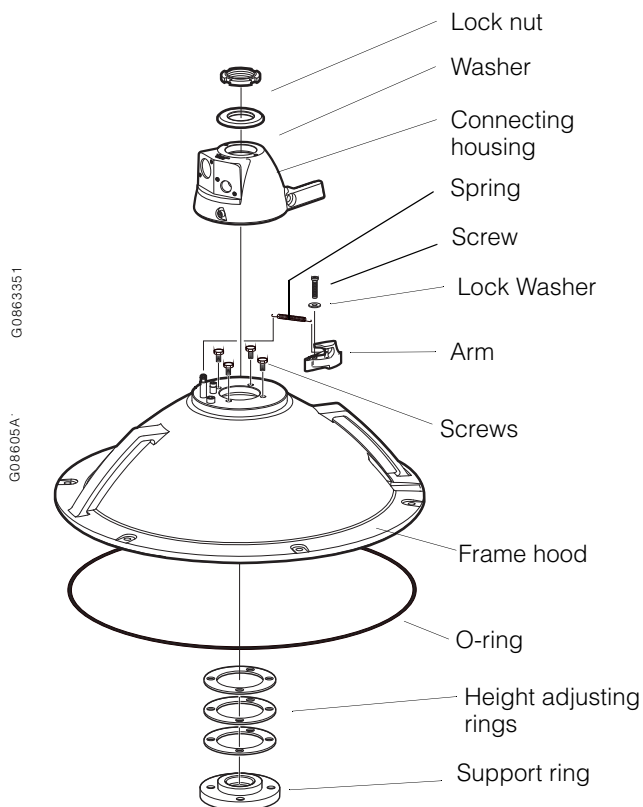
- 1 Hook spanner (lock nut)
- 2 Lifting eyes
- 3 Puller



Entrapment hazard

To avoid accidental start, switch off and lock-out the power supply before starting any dismantling work.

Make sure that machine has come to a complete standstill before starting any dismantling work (after about 65 minutes from switch off).



G08634R1

1 Removing the connecting housing.

- a Lubricate the inlet pipe thread.
- b Remove the lock nut using the hook spanner.



The nut must not be removed before the separator has stopped.

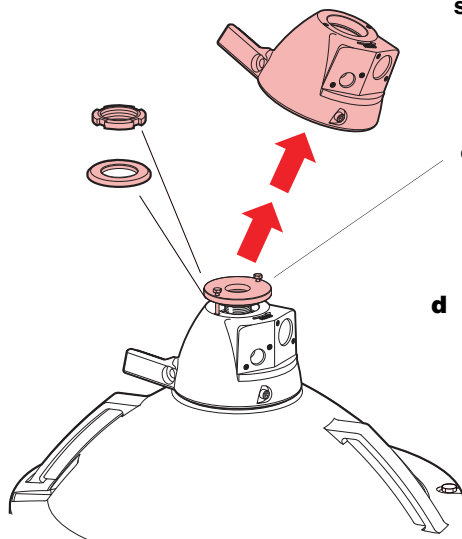
Remove the washer



Right hand thread.

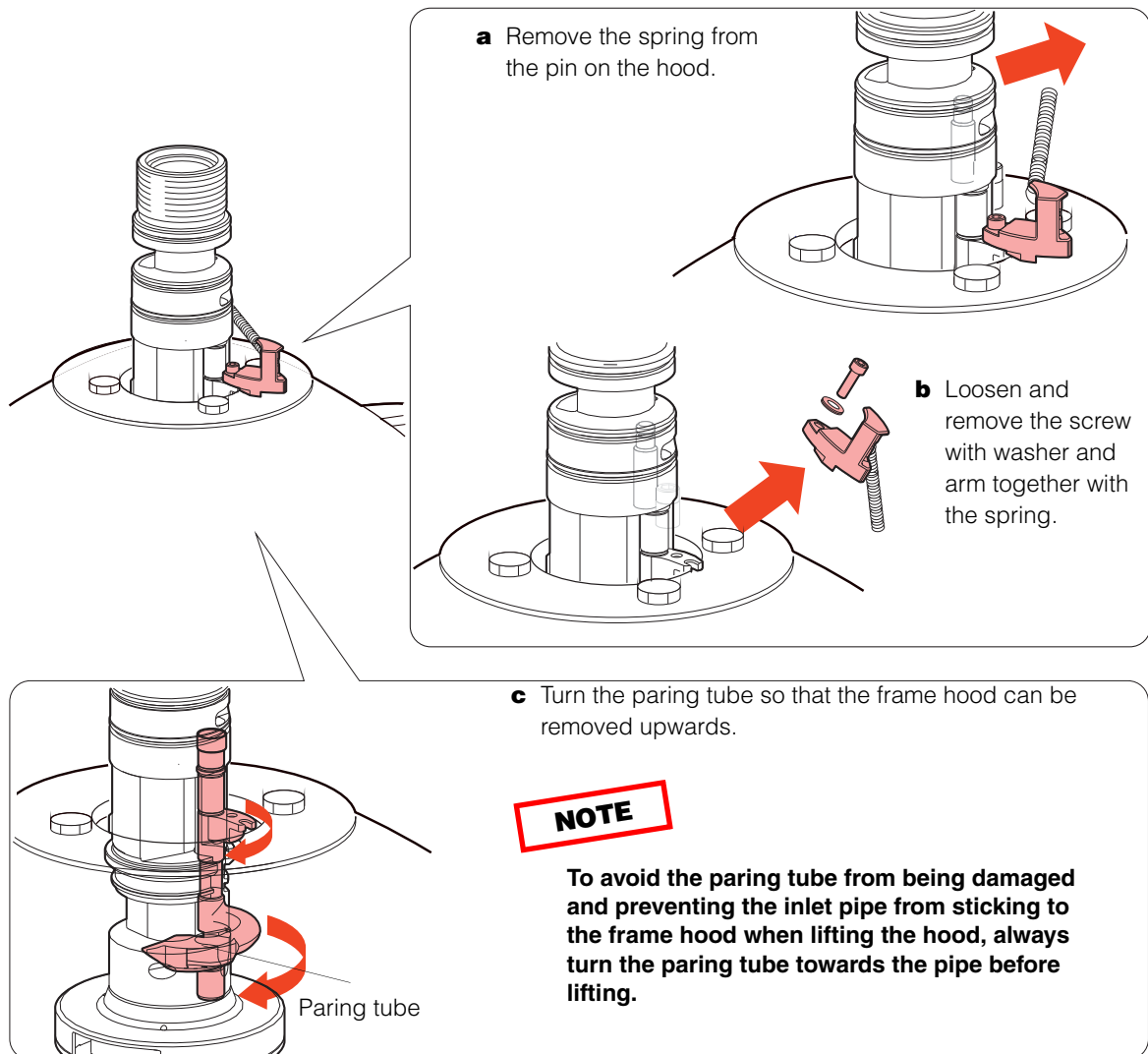


Remove connections before starting dismantling.

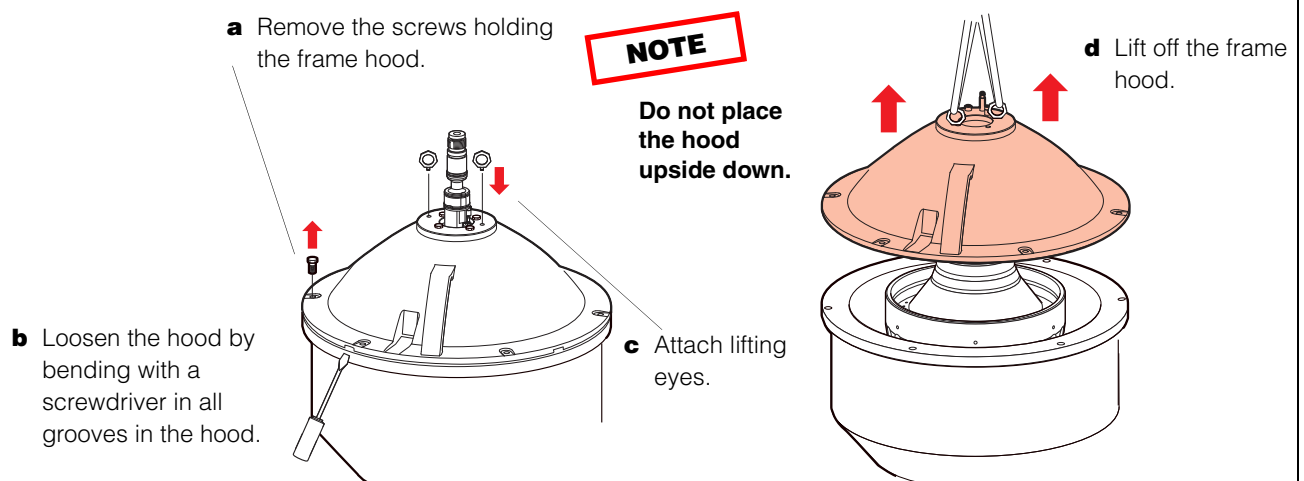


- c Attach the puller and tighten the screws to loosen the connecting housing.
- d Remove the connecting housing

G0863351

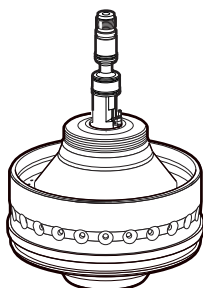
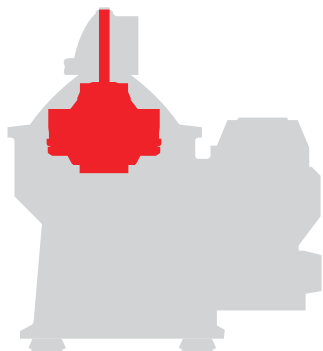
2 Removing the spring and arm.

G0863691

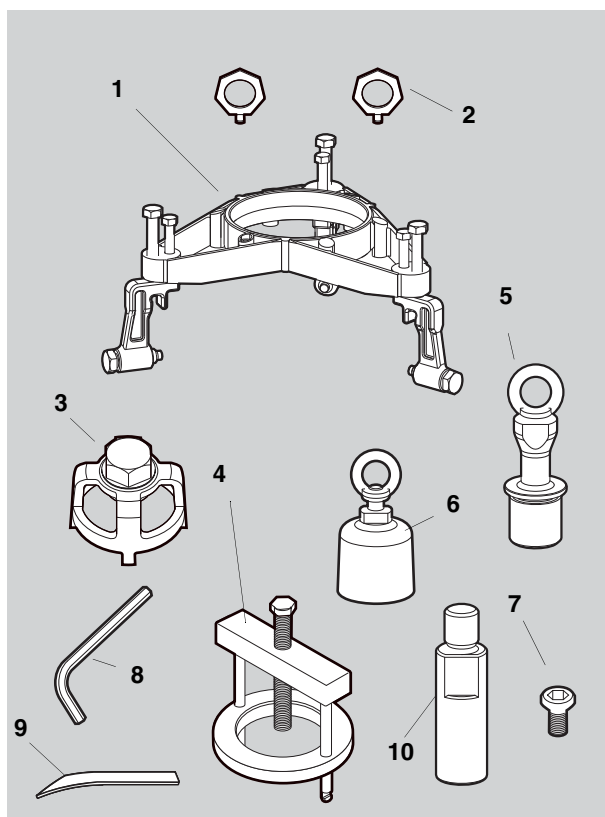
3 Removing the frame hood.

G0863681

6.3.4 Bowl

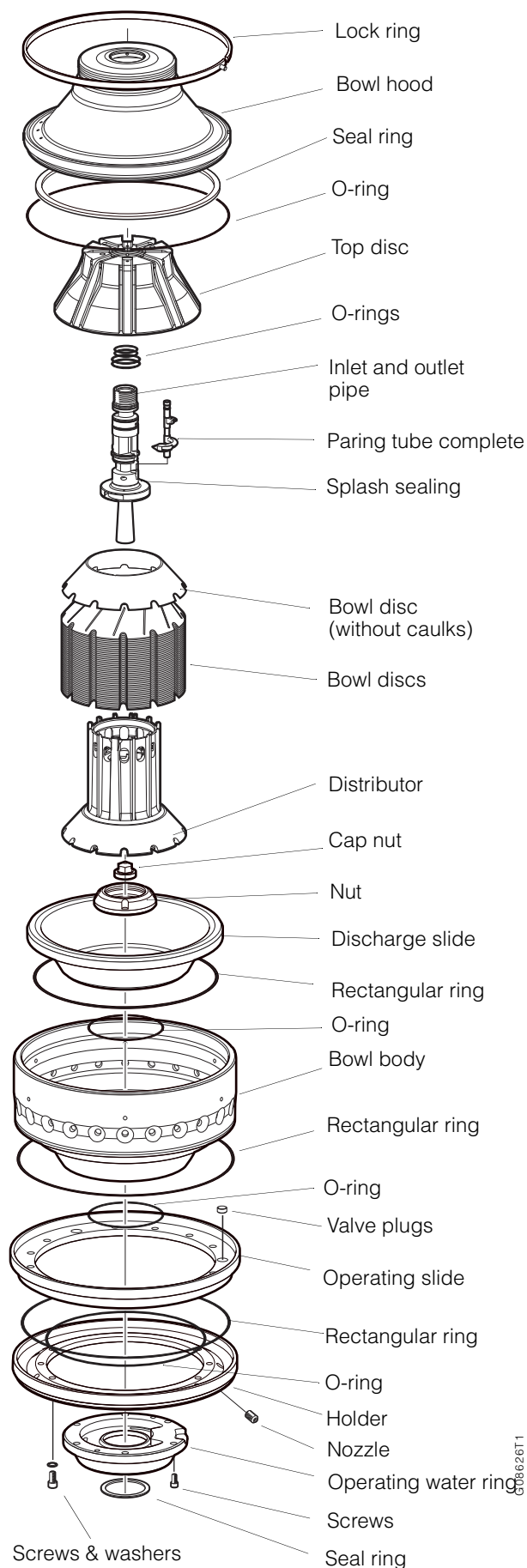


G0861621

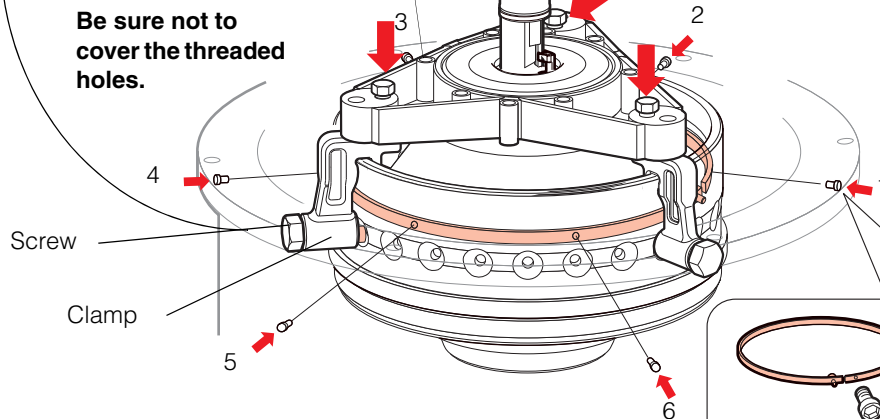


G0860511

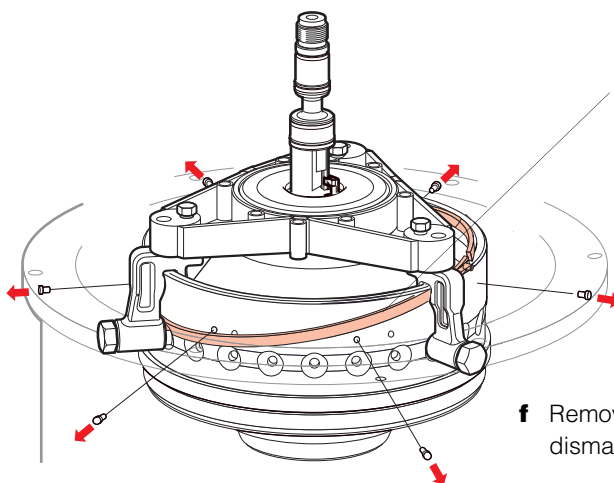
- 1 Compressing tool (lock ring)
- 2 Lifting eyes
- 3 Spanner for nut (nut/discharge slide)
- 4 Puller (discharge slide)
- 5 Lifting tool (distributor, spindle)
- 6 Puller (Bowl body)
- 7 Screw (lock ring) (M5)
- 8 Hexagon head key
- 9 Chisel (seal ring)
- 10 Pin (distributor/lifting tool)



G08626T1

1 Removing the lock ring.**a** Fit the compressing tool.**b** Fit the clamps and the screws to stop.**NOTE****Be sure not to cover the threaded holes.****c** Compress the disc stack by alternately tightening the inner screws on the compressing tool to a maximum of 60 Nm.

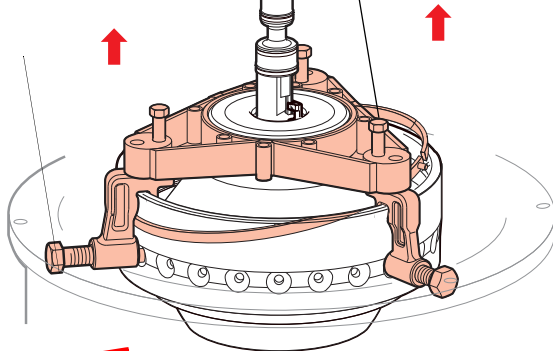
d Fit the dismantling screws to the bowl body and press out the lock ring by tightening the screws successively according to the numbering on the illustration (1-6). Start with the screw nearest the lock ring end (1). The lock ring can be removed when it has passed the edge of the groove.

e Remove the lock ring from the groove.**f** Remove the dismantling screws.

2 Removing the bowl hood.

a Remove the compressing screws.

b Loosen the screws on the clamp tool. Remove the tool. Remove the lock ring.



NOTE

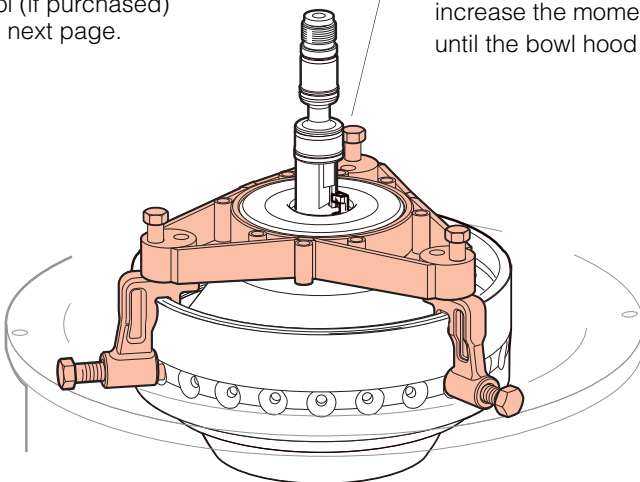
The bowl hood must be pulled off straight up, in order not to get stuck.

Recommendation: Take measurements with a calliper around the bowl, between the upper edge of the bowl body and the bowl hood, to check that the bowl hood is being pulled off straight up.

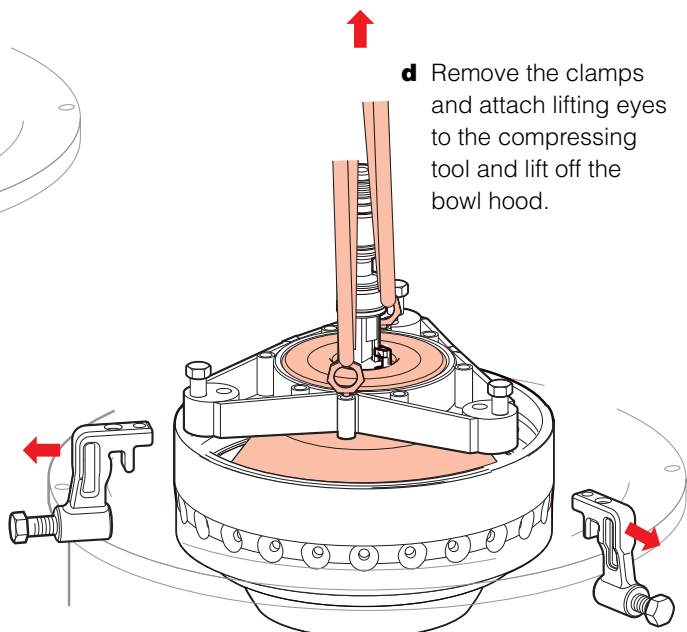
NOTE

See removing the bowl hood with optional hydraulic tool (if purchased) on next page.

c Fit the compressing tool and the puller screws. Pull the bowl hood off by screwing the screws alternately (max. 1/2 turn) and gradually increase the momentum evenly until the bowl hood come loose.



d Remove the clamps and attach lifting eyes to the compressing tool and lift off the bowl hood.



WARNING

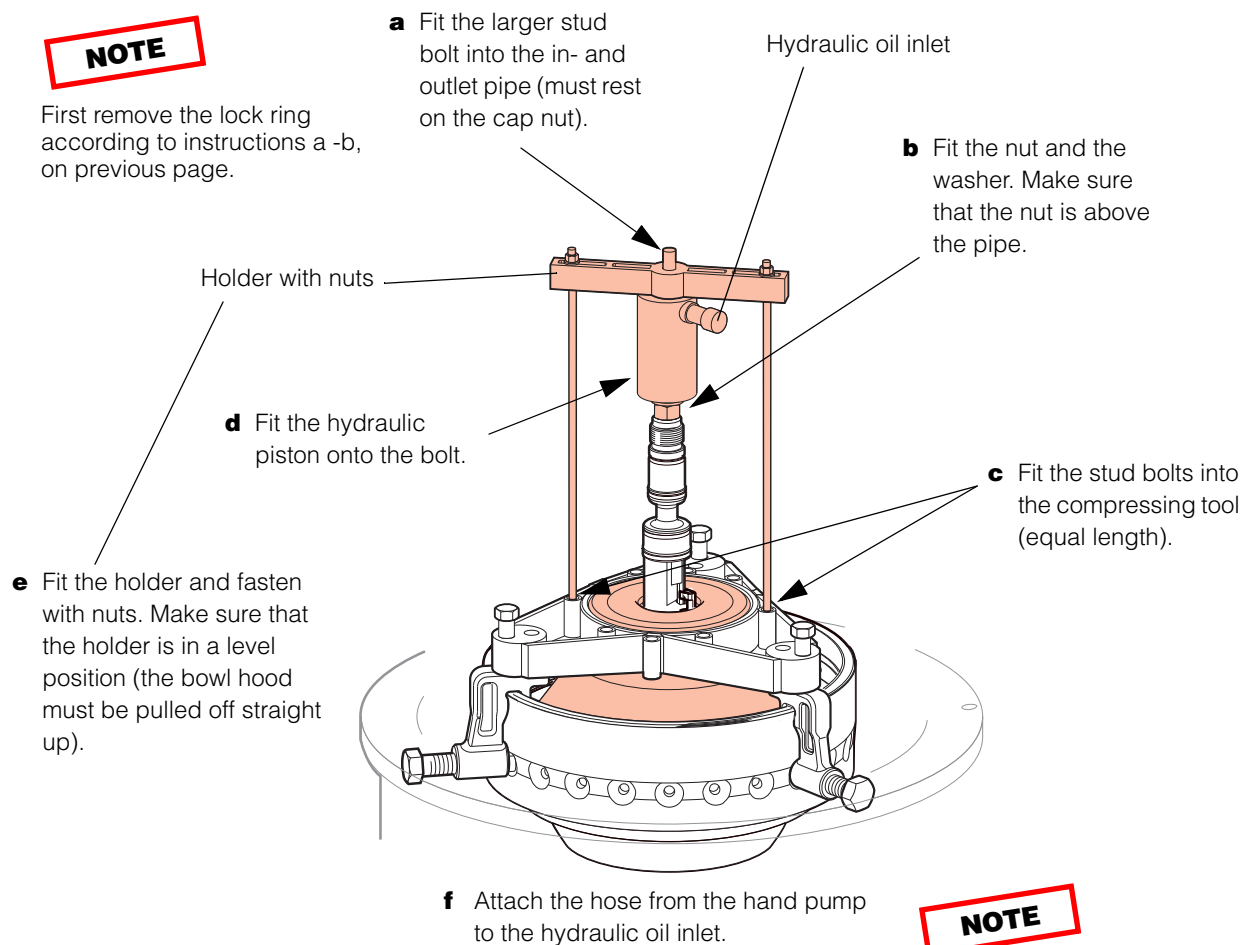
Crush hazard

The top disc can adhere to the bowl hood when lifting. Be careful not to accidentally drop it.

3 Removing the bowl hood using the optional hydraulic tool.

NOTE

First remove the lock ring according to instructions a -b, on previous page.



Ease off the bowl hood by pumping the handle on the pump.

NOTE

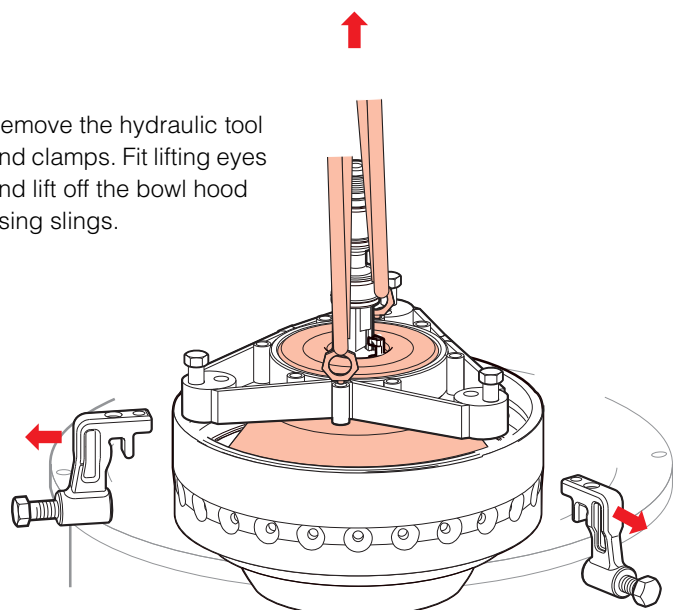
The bowl hood must be pulled off straight up, in order not to get stuck.

g Remove the hydraulic tool and clamps. Fit lifting eyes and lift off the bowl hood using slings.



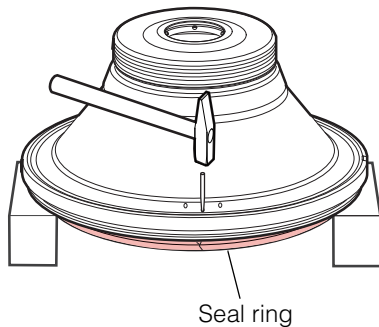
Crush hazard

The top disc can adhere to the bowl hood when lifting. Be careful not to accidentally drop it.



4 Removing the seal ring.

- a** Place the bowl hood on a support and tap out a piece of the seal ring using a drift in the holes.



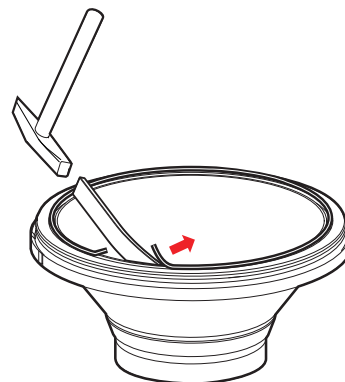
Risk for eye injury from flying seal ring parts or from splashing fluid

The seal ring breaks when removed from the bowl hood and may cause trapped fluid to splash. Wear safety goggles.

- b** Turn the bowl hood upside down and remove the seal ring by carefully knock pieces of the seal ring out of the groove, using the special tool: chisel.



It is very important not to damage the bottom of the groove!



G0862441

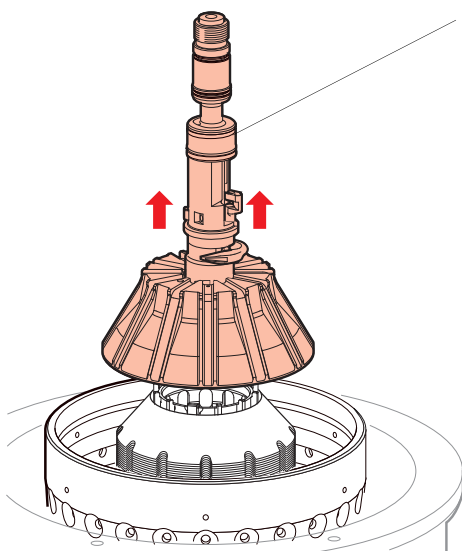
5 Removing the inlet/outlet pipe and top disc.

- a** Lift out the in- and outlet pipe together with the top disc.

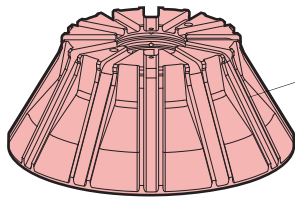


Crush hazard

The distributor and disc stack can adhere to the top disc. Separate them from the top disc so that they do not accidentally drop.



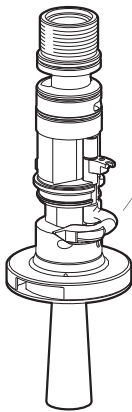
G0862961

6 Removing the paring tube.

- a** Remove the top disc from the inlet and outlet pipe.

NOTE

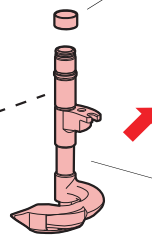
To avoid damaging the paring tube, turn it towards the centre of the pipe.



- b** Remove the splash sealing.



Bearing bushing



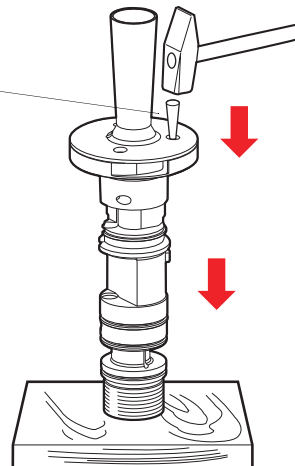
- d** Lift up and remove the paring tube.

Flanged bushing

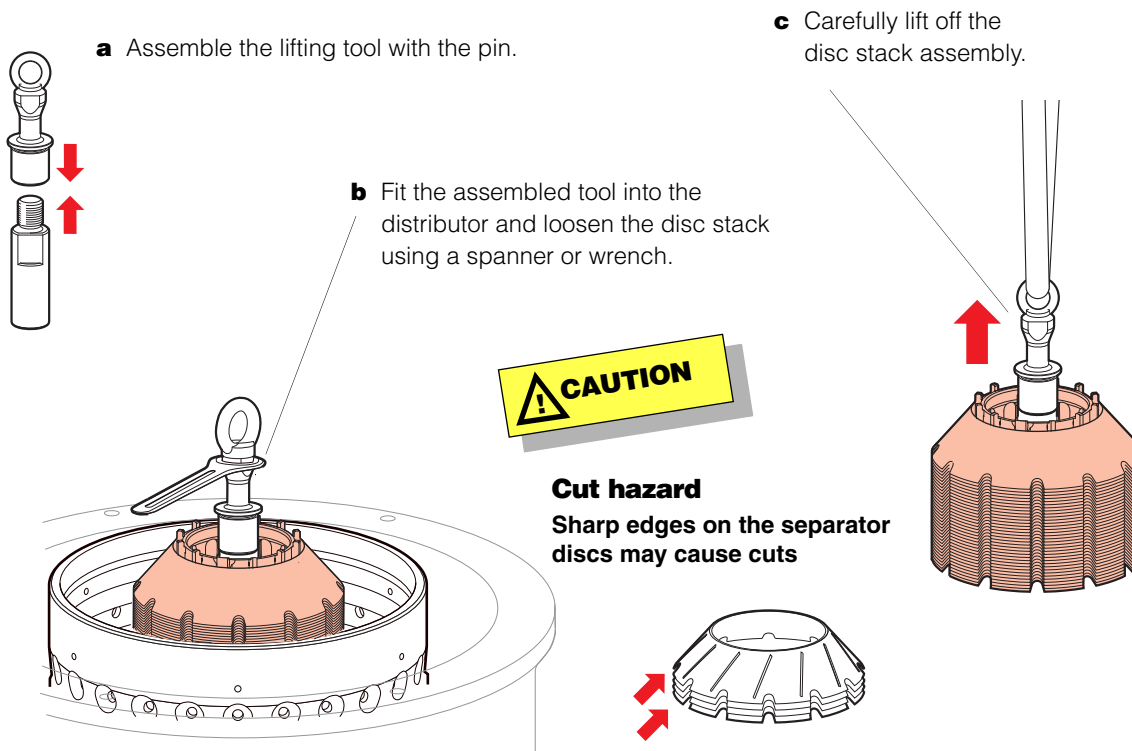
Bearing holder

NOTE

If the paring tube sticks; turn the assembly upside down and use a drift to carefully tap out the plug.

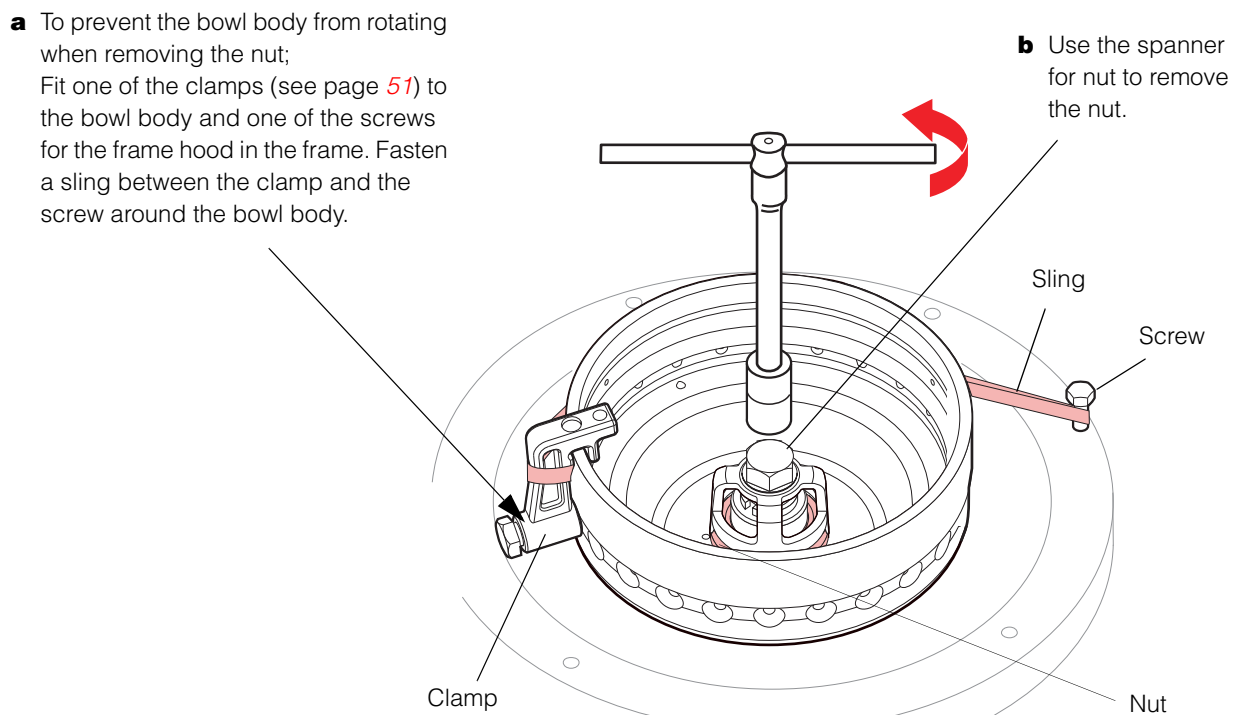


7 Removing the disc stack and distributor.



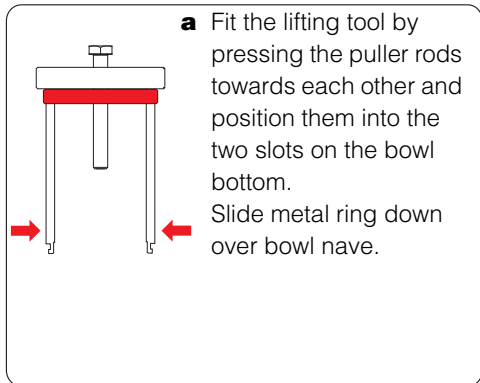
G0863171

8 Removing the nut



G0923861

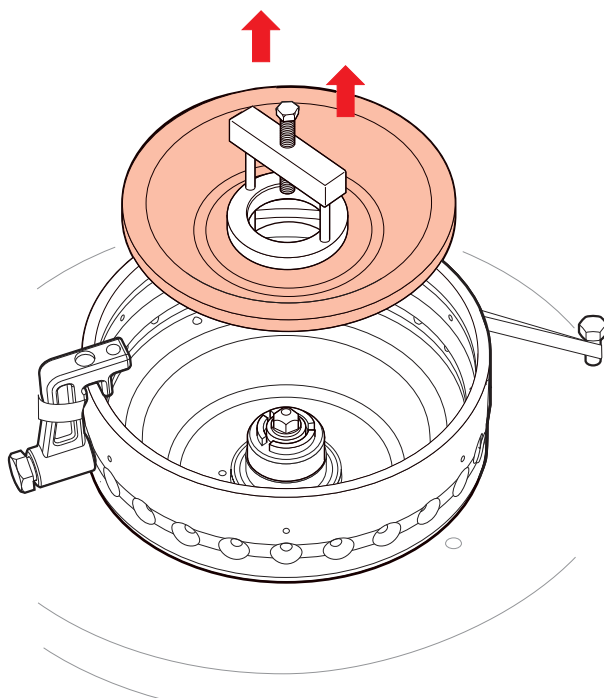
9 Removing the discharge slide.



b Ease off the discharge slide by turning the central screw.

NOTE

If discharge slide is difficult to remove, tap lightly on outside edge with a soft faced hammer.

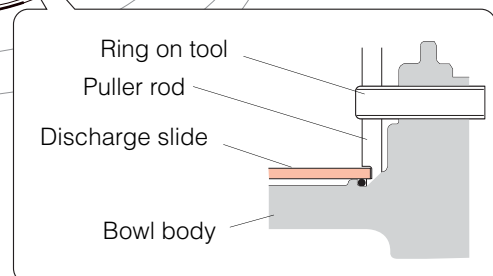


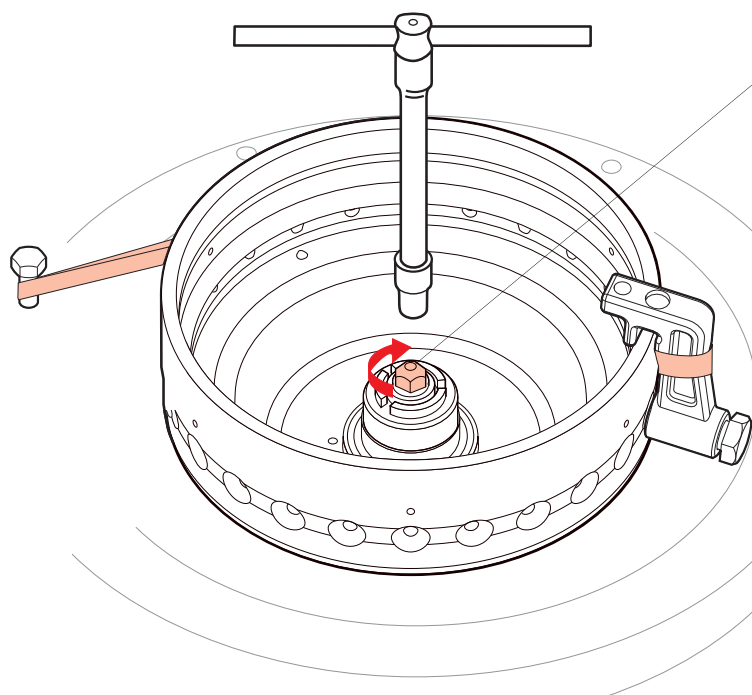
c Lift out the discharge slide.



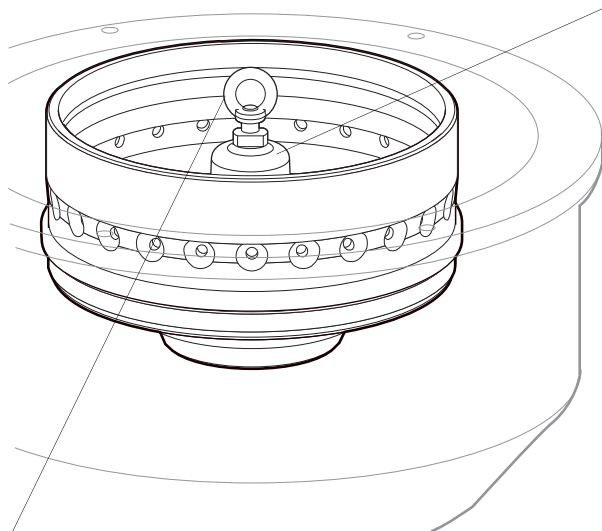
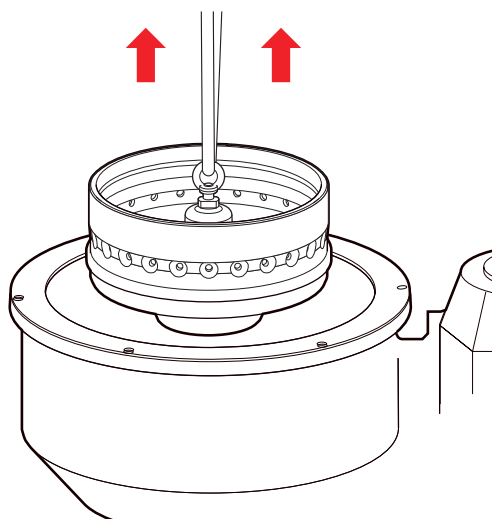
Crush hazard

The ring on the lifting tool must be pushed down against the discharge slide, otherwise the discharge slide may come loose from the tool.

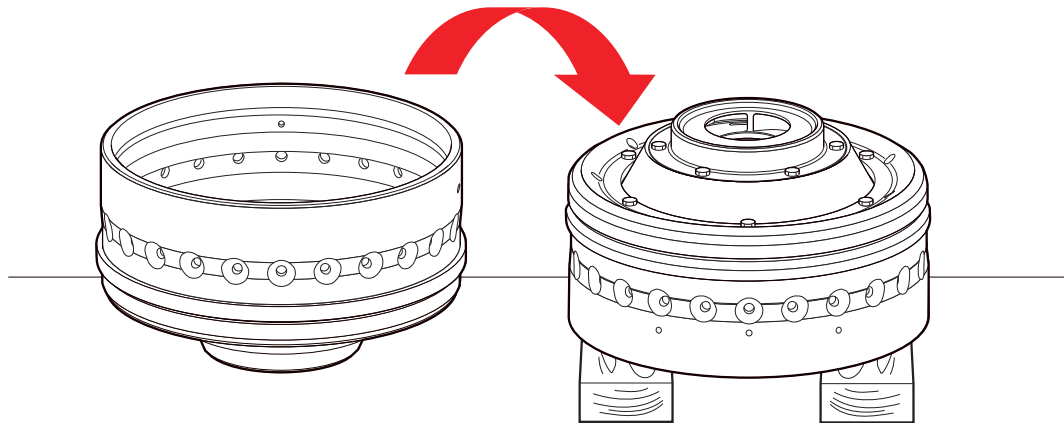


10 Removing the cap nut.**a** Remove the cap nut**NOTE****Left-hand thread!**

G0860661

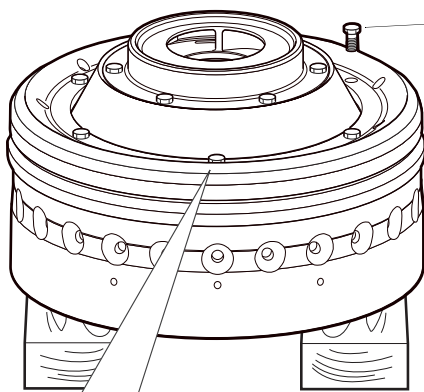
11 Removing the bowl body**a** Fit the lifting tool to the bowl body.**b** Raise the bowl body off the spindle taper by turning the lifting eye clock-wise.**c** Lift off the bowl body

G0860731

12 Turn the bowl body upside down.**Crush hazard**

Support the bowl body when turning to prevent it from rolling.

G0860821

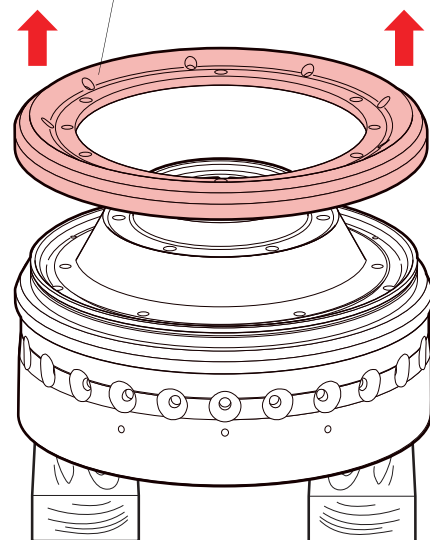
13 Removing the holder.

- a** Remove and discard the screws and washers. New screws and washers are included in the Inspection kit.

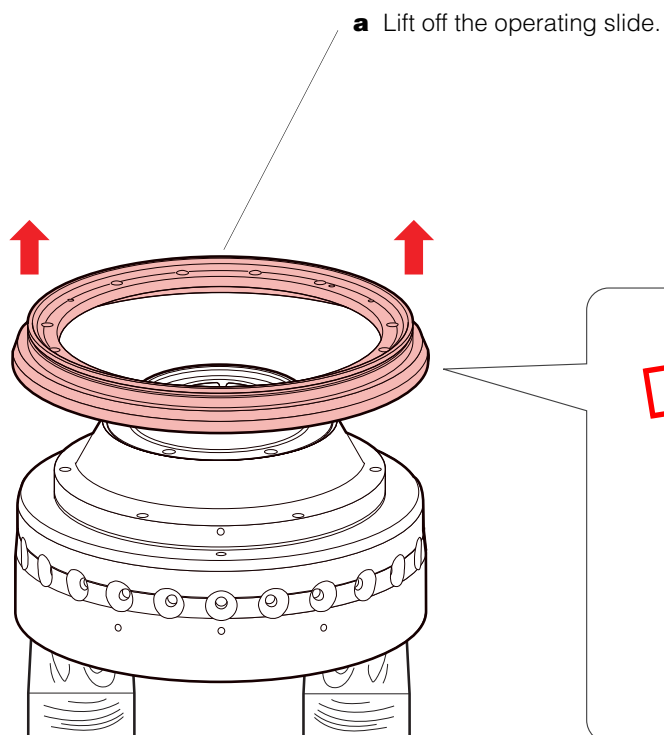
NOTE

If the ring sticks, use two M10 screws in threaded holes to raise the operating slide holder up and away from the bowl body.

- b** Lift off the holder.

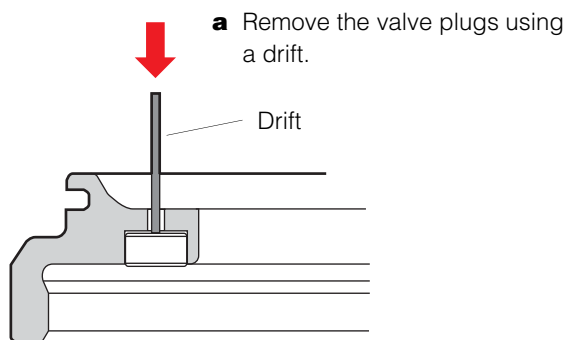


G0860921

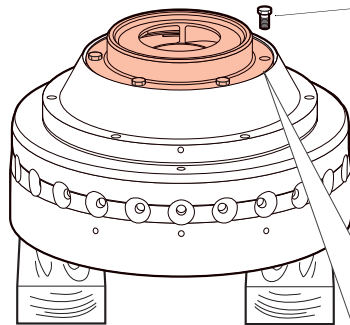
14 Removing the operating slide.**NOTE**

If the ring sticks, use two M10 screws in threaded holes to raise the operating slide holder up and away from the bowl body.

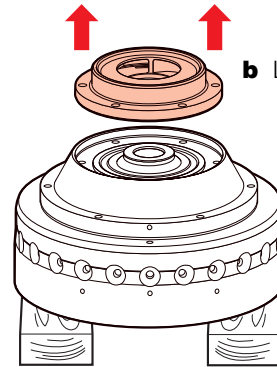
G0861021

15 Removing the valve plugs from the operating slide.

G0874881

16 Removing the operating water ring.

- a** Remove and discard the screws.
New screws are included in the Inspection kit.

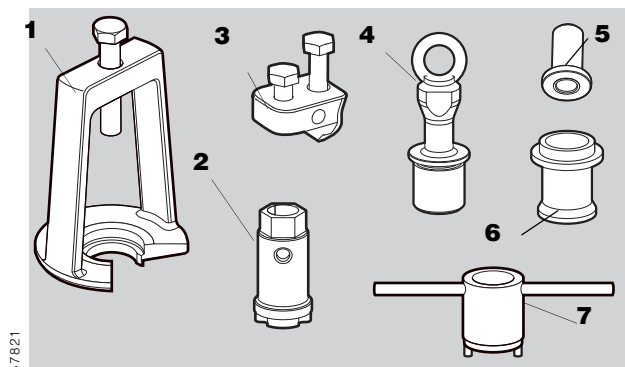
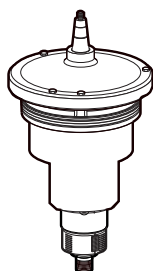


- b** Lift off the ring.

NOTE

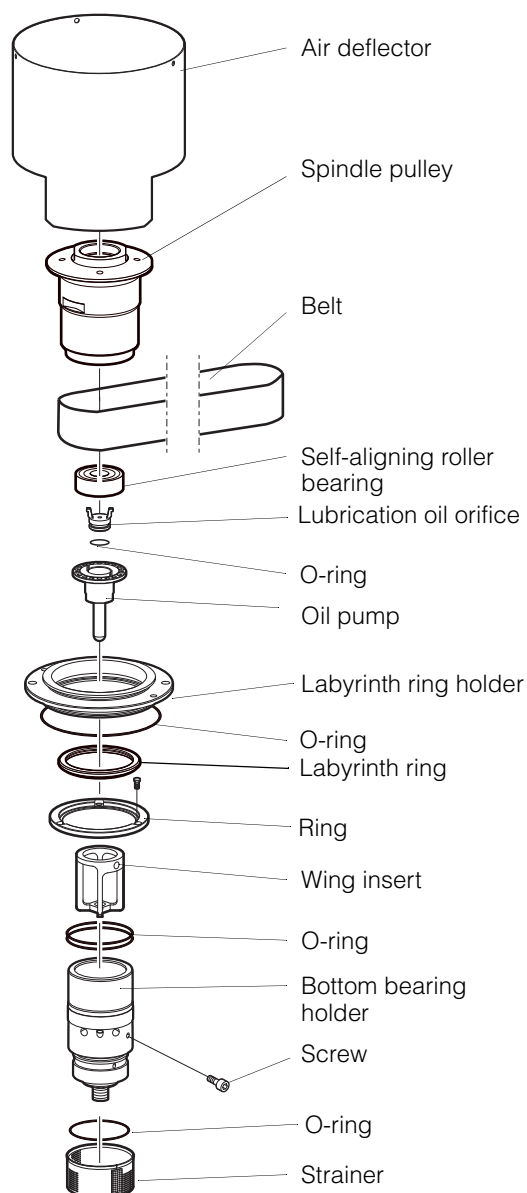
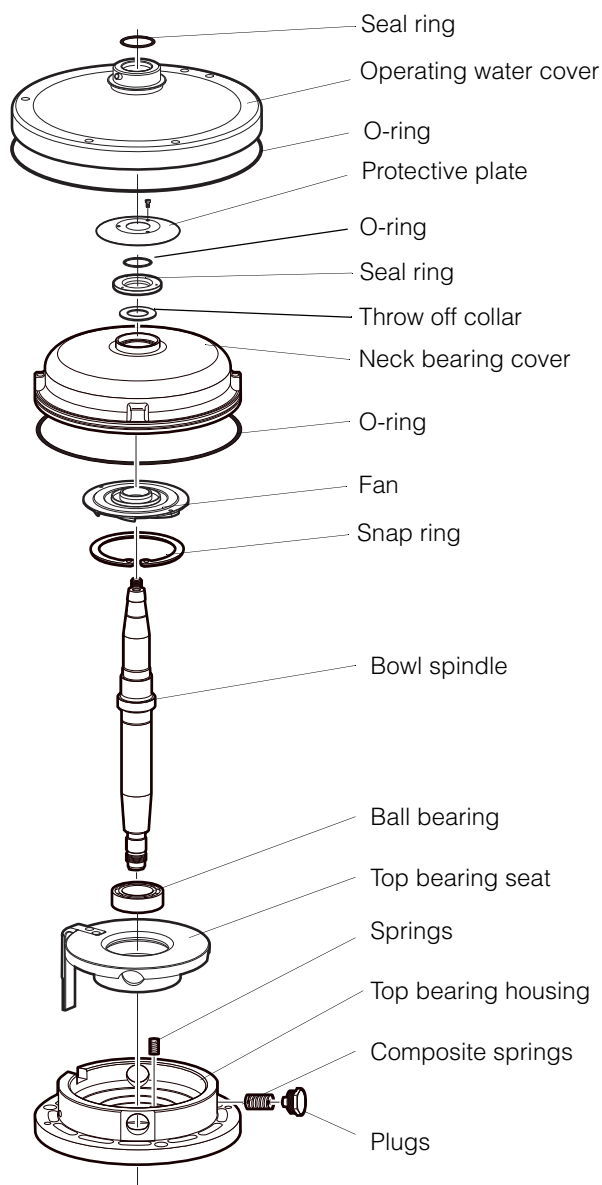
If the ring sticks, use two M10 screws in threaded holes to raise the operating water ring up and away from the bowl body.

6.3.5 Driving device



- 1** Puller (spindle pulley, ball bearing).
2 Tool (bearing housing).
3 Cover puller (neck bearing cover).
4 Lifting tool (spindle assembly).
5 Drift (bottom bearing).
6 Sleeve (ball bearing in top bearing seat).
7 Pin spanner (oil fan).

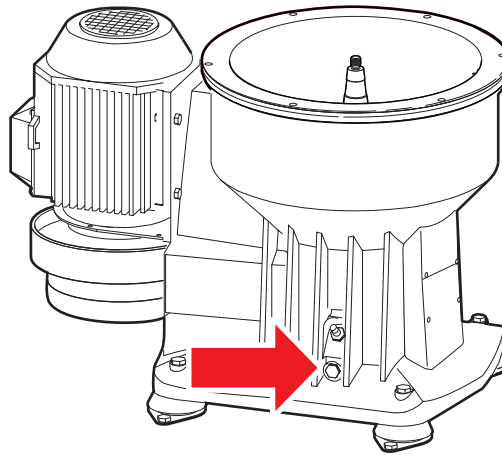
G0857972



G08580C1

1 Empty the oil sump.

Unscrew the oil plug and
empty the oil sump.

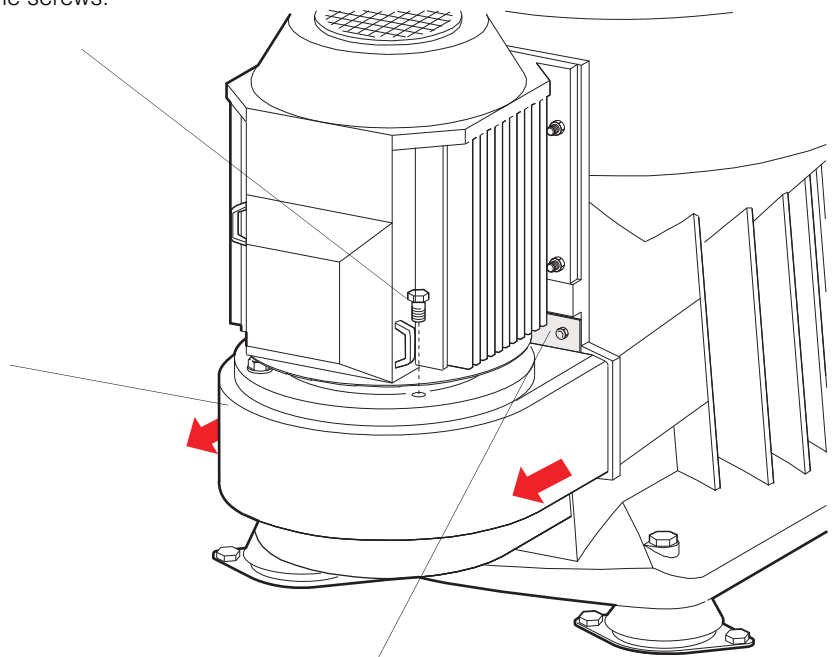


G0868571

2 Removing the clutch cover.

a Remove the screws.

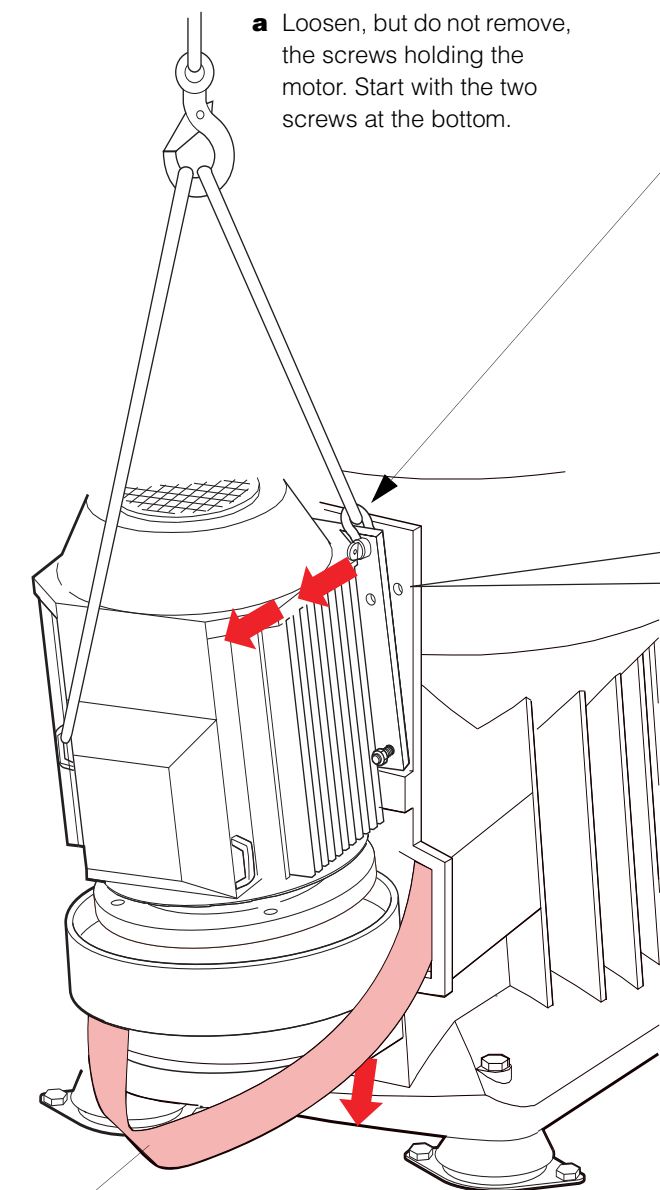
b Remove the clutch cover.



c Remove the plate.

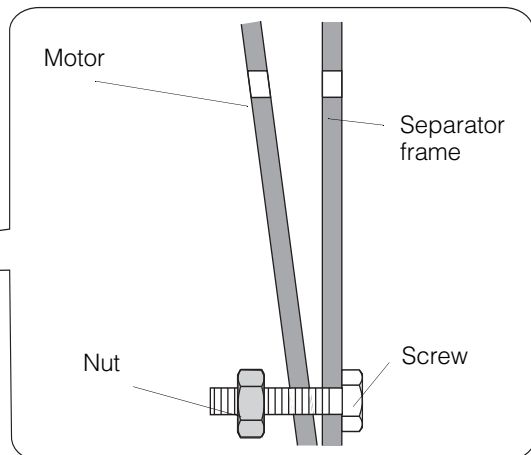
G0858171

3 Loosen the flat belt, by tilting the motor.



a Loosen, but do not remove, the screws holding the motor. Start with the two screws at the bottom.

b Attach shackle with lifting sling to the upper hole in the motor frame and remove the upper screws.



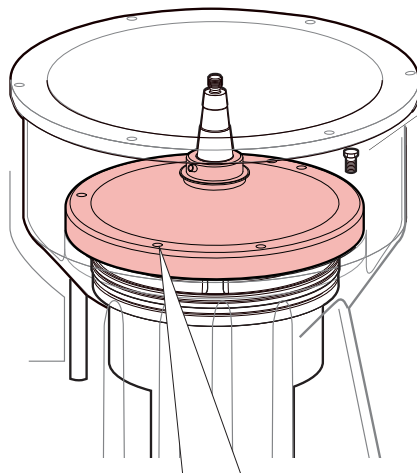
c Remove the two upper screws so that the motor can be tilted. Do not loosen more than shown in the illustration.



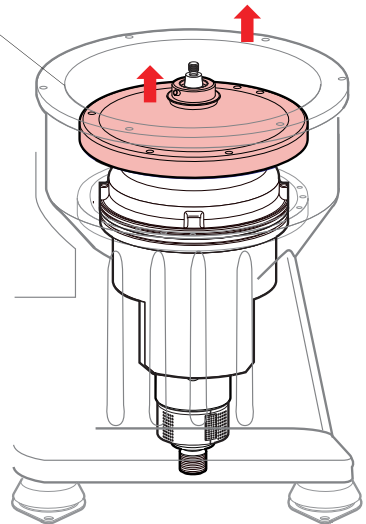
Crush hazard

Always use a shackle with lifting slings when removing the upper screws.

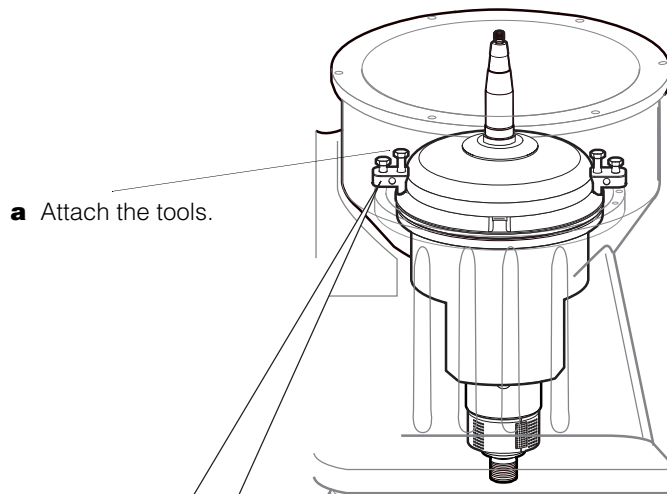
d Remove the flat belt from the motor pulley.

4 Removing the operating water cover.**a** Remove the screws.**b** Lift off the operating water cover.**NOTE**

If the cover sticks, fit two M16 screws to the threaded holes and tighten.

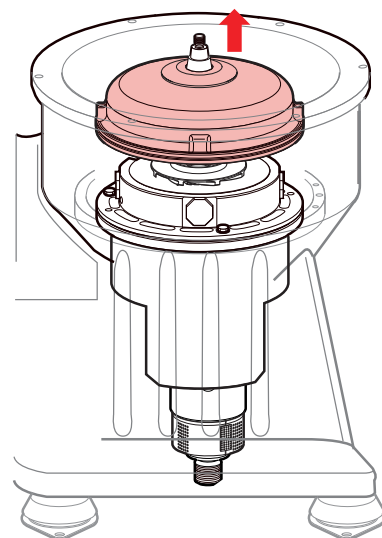


G0858931

5 Removing the neck bearing cover and protective plate.**a** Attach the tools.**d** Lift off the neck bearing cover together with the protective plate.**c** Ease off the cover by tightening the screw.**b** Fasten the tool to the cover.

Frame

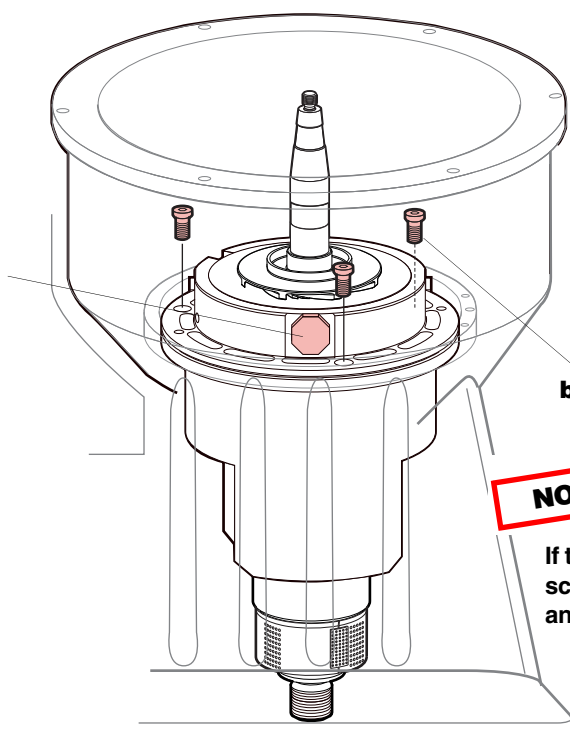
Cover



G0859051

6 Prepare for removal of spindle assembly.**NOTE**

- a** To facilitate later removal of plugs, loosen (do not remove) the plugs on the bearing housing.



- b** Remove the screws

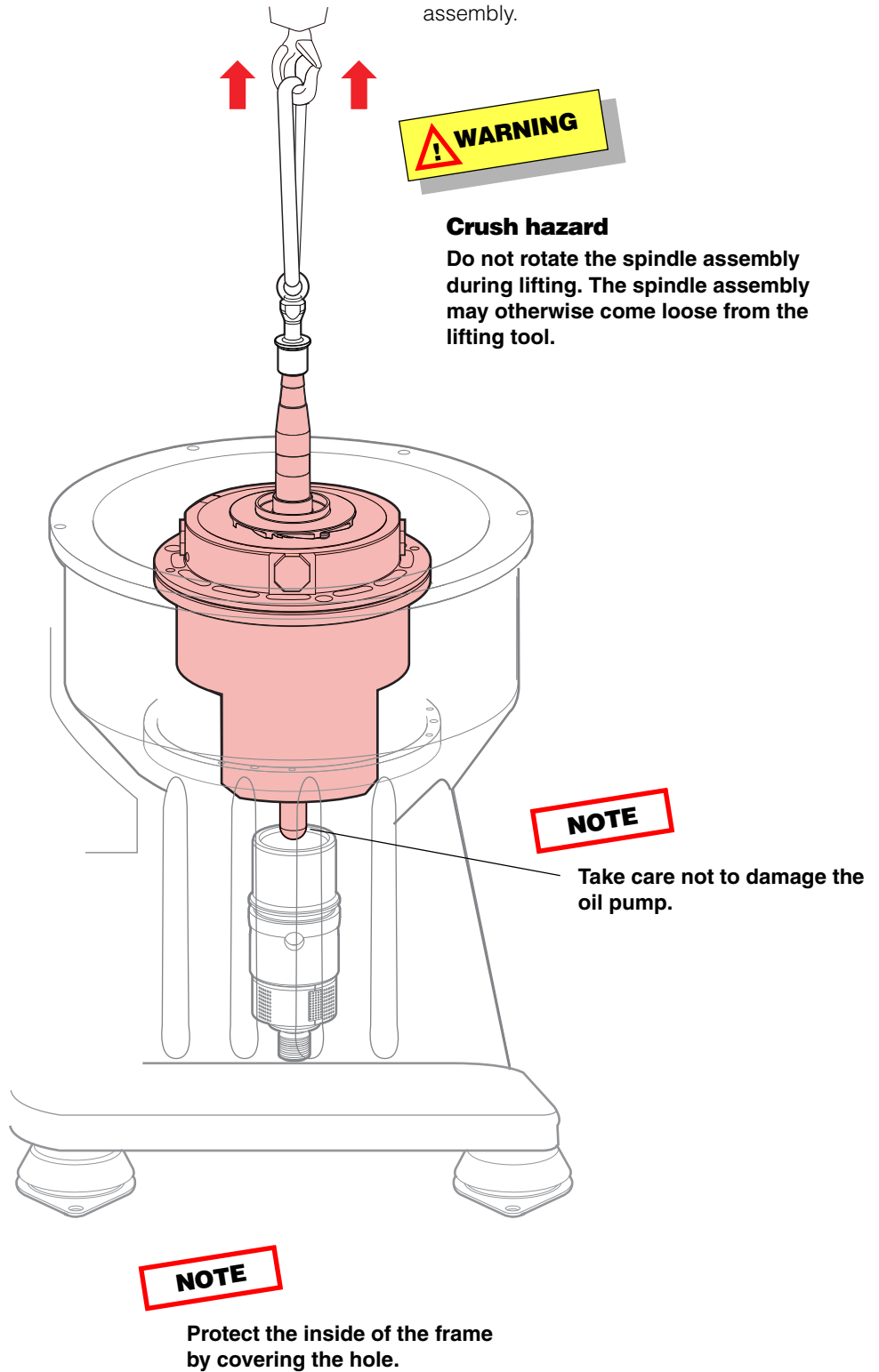
NOTE

If the cover sticks, fit two M10 screws to the threaded holes and tighten.

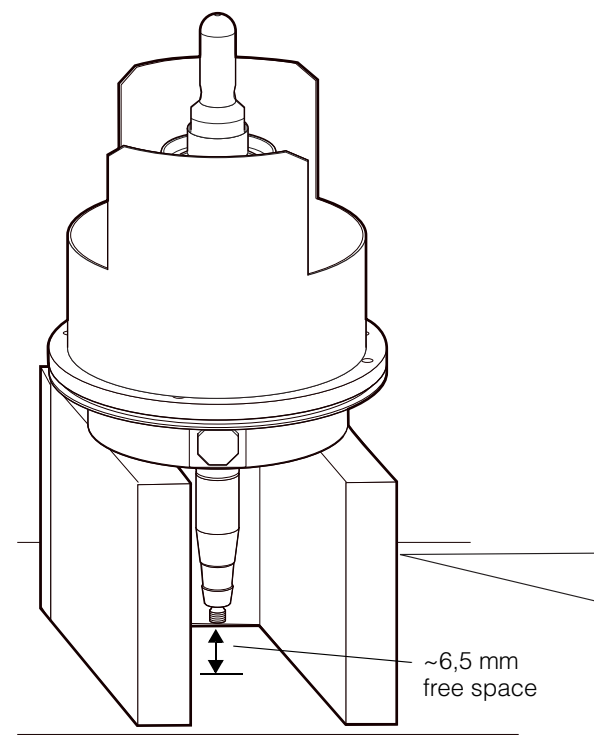
7 Lifting the spindle assembly from the frame.

a Fit the lifting tool to the spindle end.

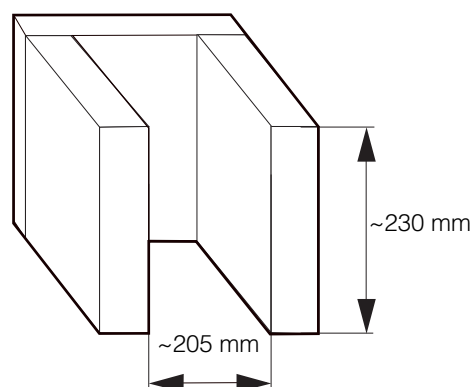
b Slowly raise and lift out the spindle assembly.



- 8** Place the spindle assembly upside down on a support.

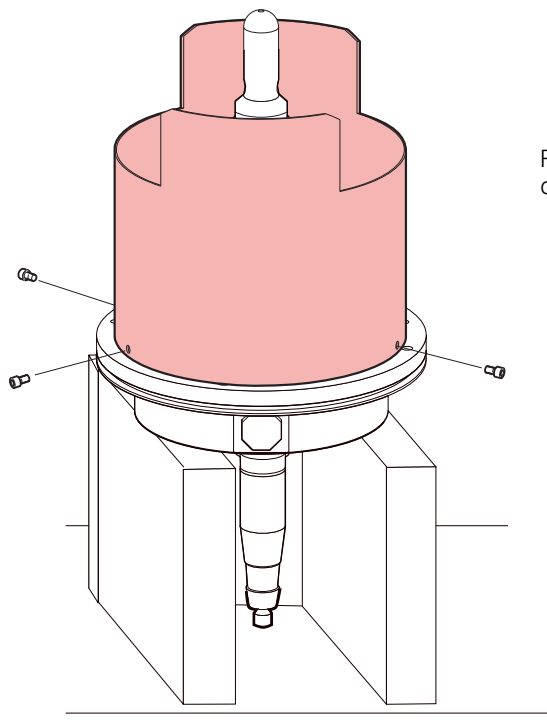


Make a support



G0859211

- 9** Removing the air deflector.



Remove the screws and the air deflector.

G0859241

10 Removing the fan.

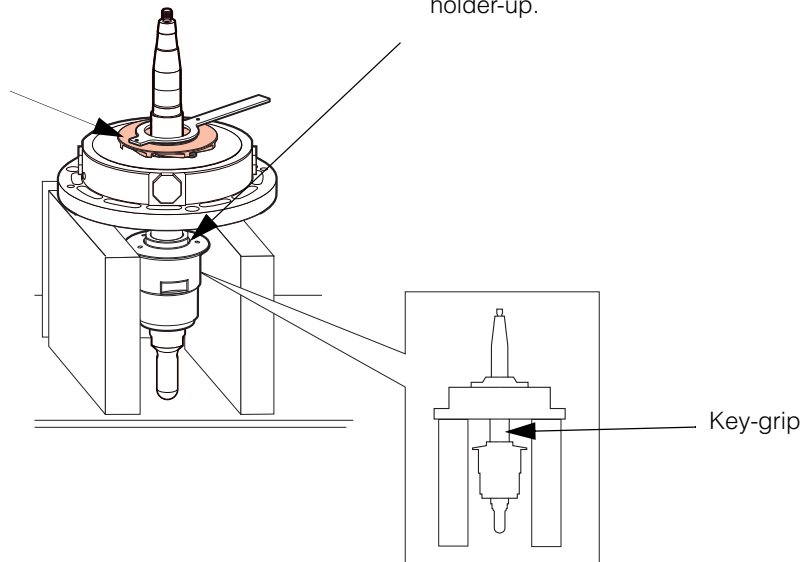
a Turn the spindle assembly the right way up.

b Place a spanner (or similar) on the spindle pulley key-grip, as holder-up.

c Fit the pin spanner and remove the fan.

NOTE

Left-hand thread!

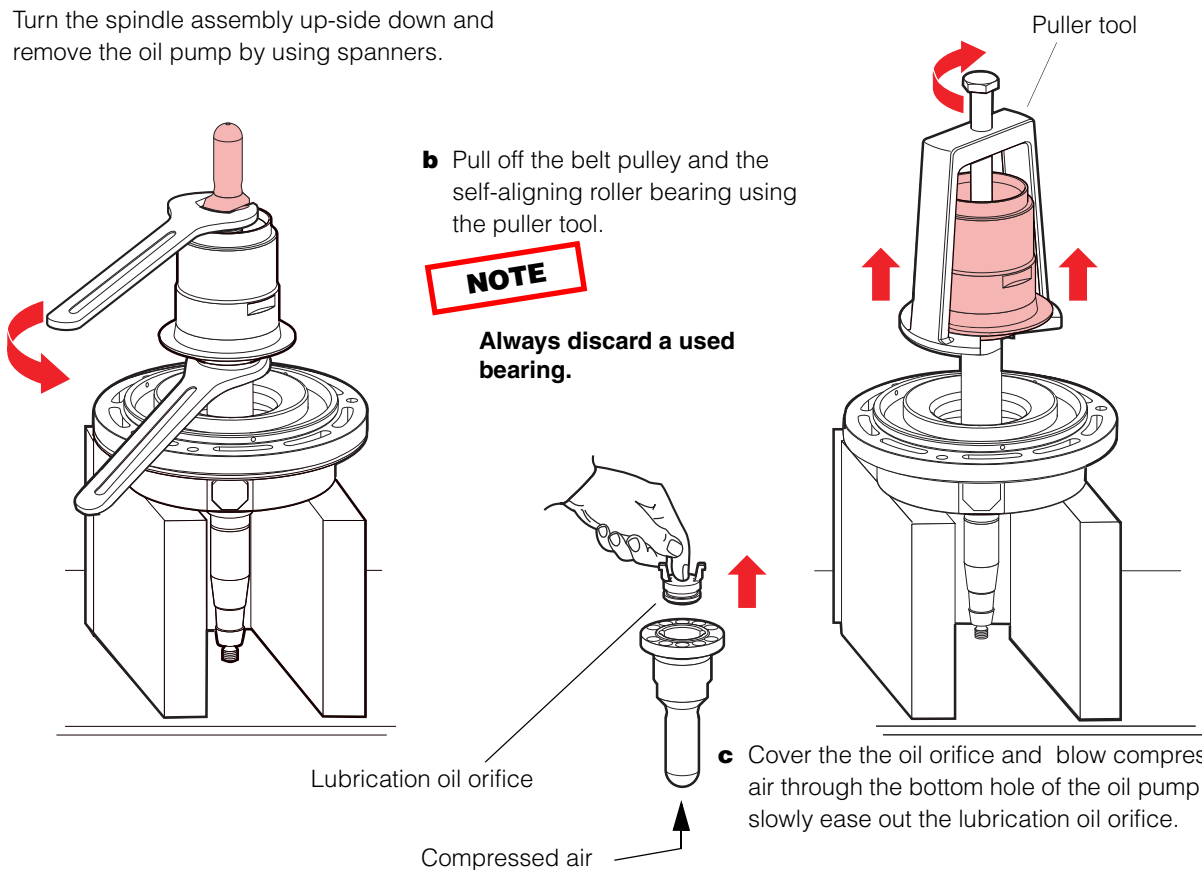
**11** Removing the bottom bearing assembly.

a Turn the spindle assembly up-side down and remove the oil pump by using spanners.

b Pull off the belt pulley and the self-aligning roller bearing using the puller tool.

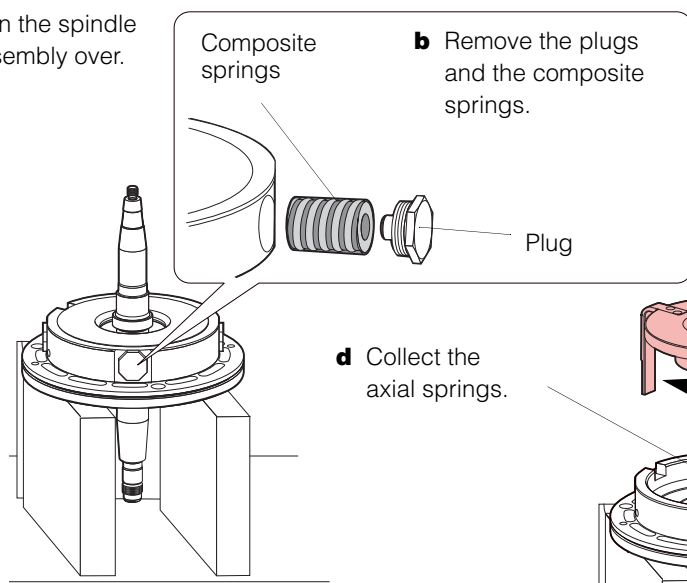
NOTE

Always discard a used bearing.



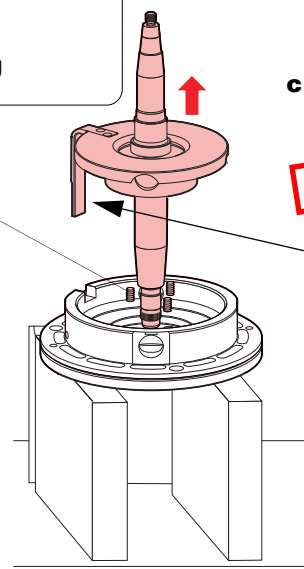
12 Removing the top bearing housing.

a Turn the spindle assembly over.



b Remove the plugs and the composite springs.

d Collect the axial springs.



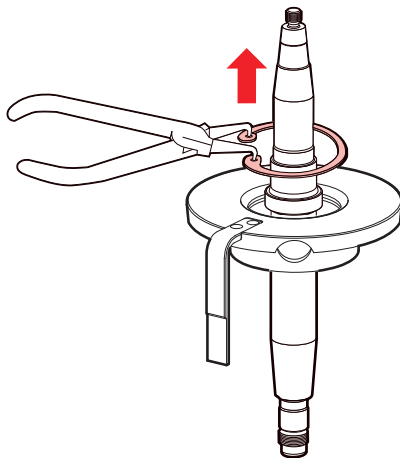
c Carefully remove the spindle from the top bearing seat.

NOTE

Be careful not to damage the vibration indicator.

13 Removing the ball bearing.

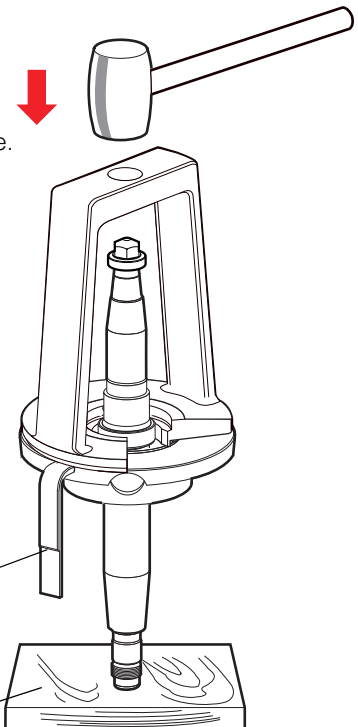
- a** Remove the snap ring.



Risk for eye injury from flying snap ring
Use the correct pliers for dismantling of snap ring to avoid accidental release.

- b** Fit the cap nut on the spindle to protect the threads.

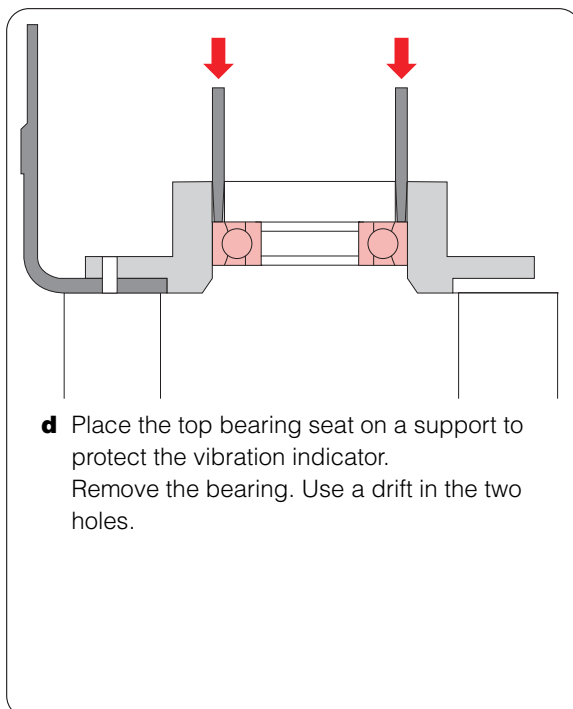
- c** Use the puller tool to remove the top bearing seat from the spindle.

**NOTE**

Do not damage threads on spindle.

NOTE

Take care not to damage the vibration indicator when separating the top bearing seat from the spindle.



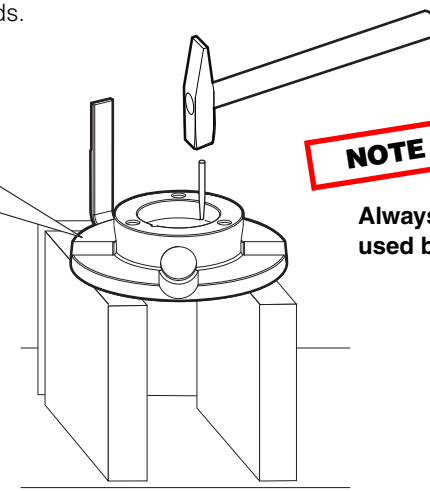
- d** Place the top bearing seat on a support to protect the vibration indicator. Remove the bearing. Use a drift in the two holes.

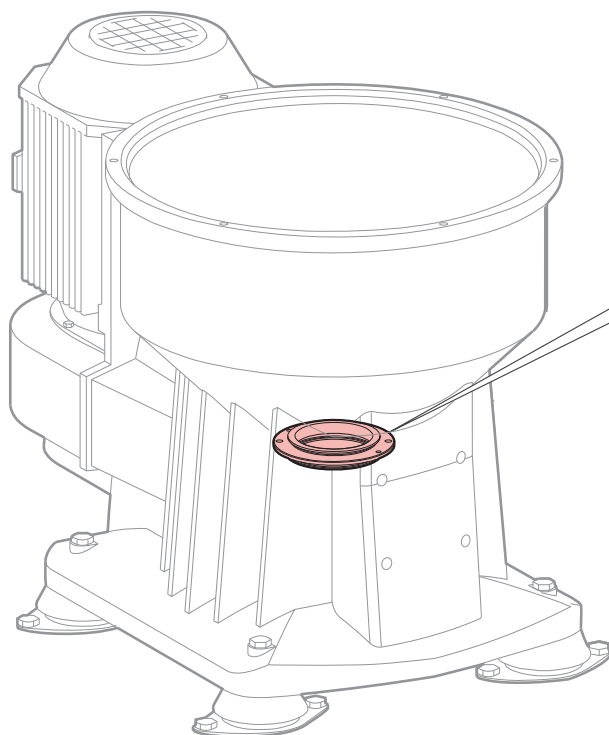
Vibration indicator

Piece of wood to protect the spindle threads.

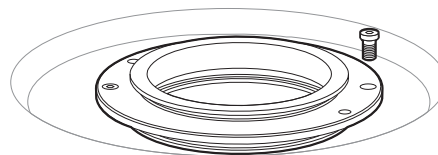
NOTE

Always discard used bearings.



14 Removing the labyrinth ring holder.

a Remove the screws.

**NOTE**

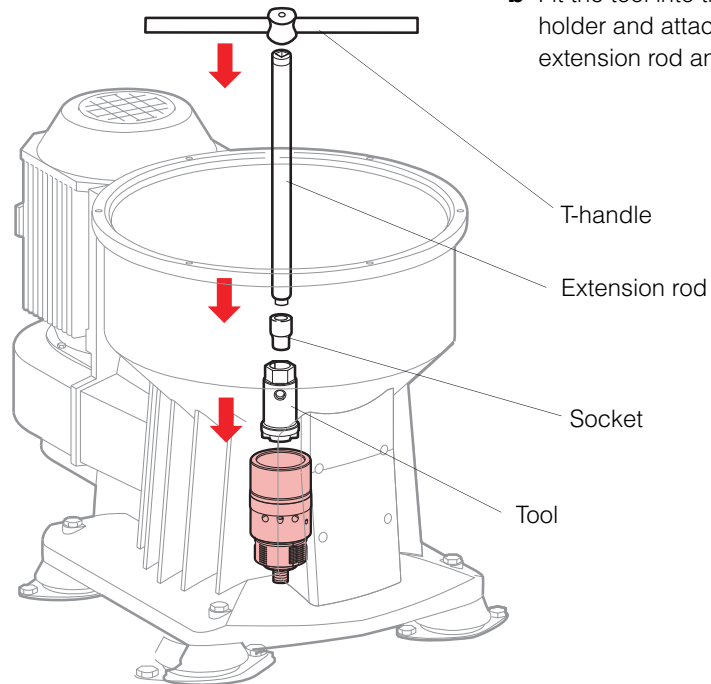
If the holder sticks, fit two screws M8 to the threaded holes and tighten.

15 Removing the bottom bearing holder.

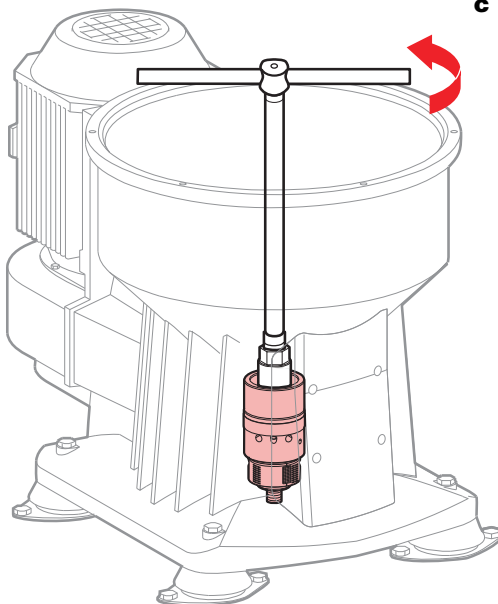
- a** Remove the O-ring and ring from the frame.



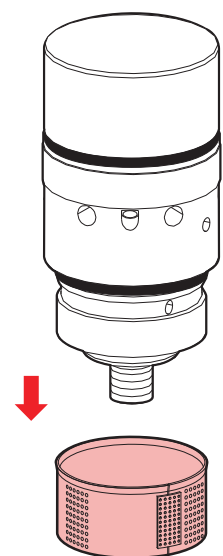
- b** Fit the tool into the bottom bearing holder and attach the socket, extension rod and T-handle.



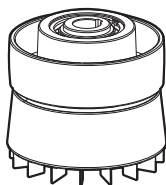
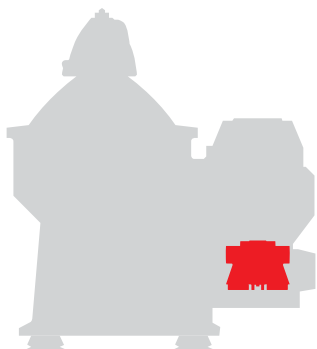
- c** Loosen the bottom bearing holder by turning it counter clockwise. Remove it by hand.



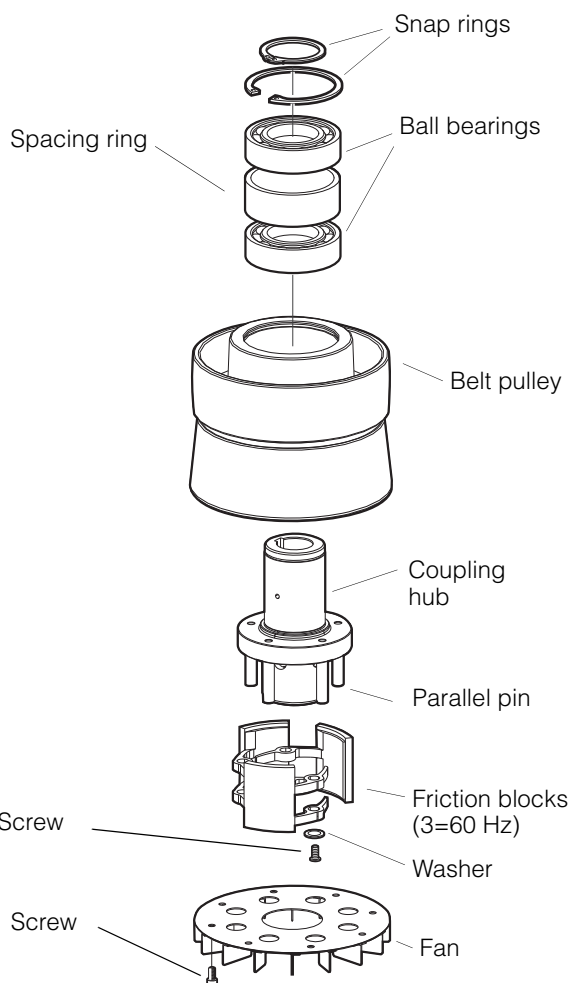
- d** Remove the strainer.



6.3.6 Centrifugal clutch



G08651F1



G08651G1



Entrapment hazard

To avoid accidental start, switch off and lock-out power supply before starting any dismantling work.

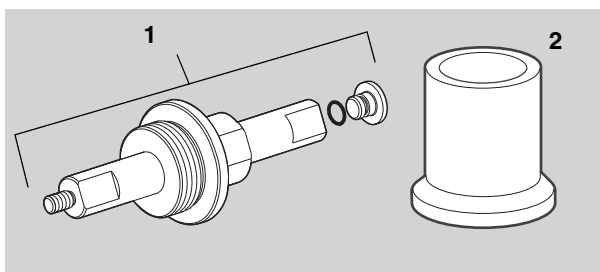
Make sure that machine has come to a complete standstill before starting any dismantling work (takes about 65 minutes from switch off).

NOTE

50 Hz = 5 Friction blocks

60 Hz = 3 Friction blocks

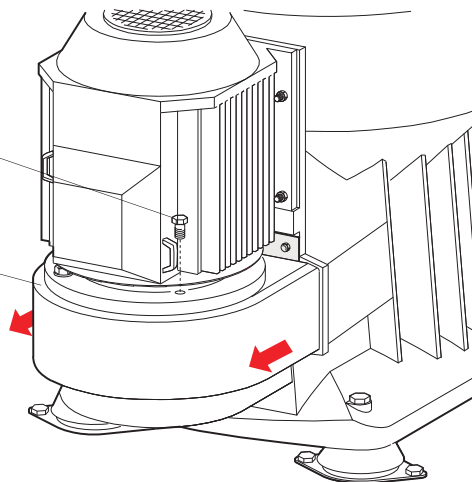
The illustration shows 60 Hz



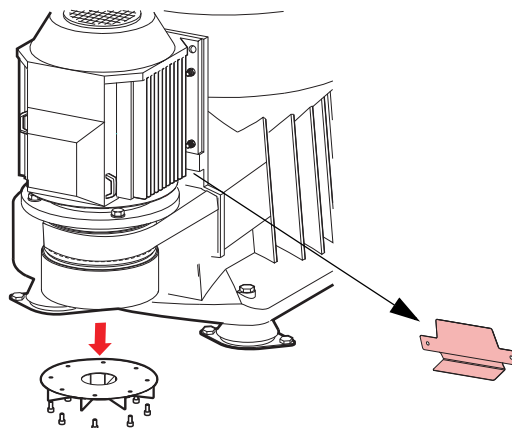
G0865041

1 Mounting /dismantling tool (centrifugal clutch).

2 Mounting /dismantling tool (ball bearing).

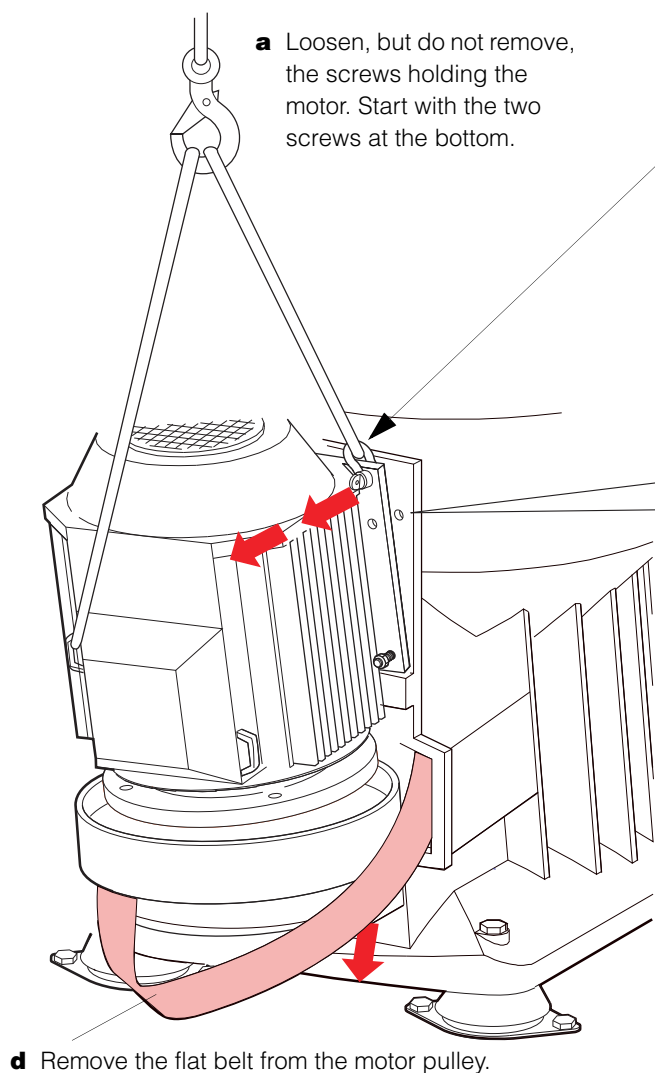
1 Removing the clutch cover.**a** Remove the screws.**b** Remove the clutch cover.

G0858171

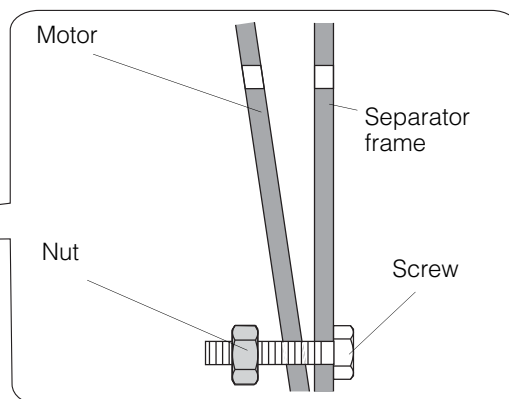
2 Remove the fan and plate.

G0858811

3 Loosen the flat belt, by tilting the motor.



b Attach shackle with lifting sling to the upper hole in the motor frame and remove the upper screws.



c Remove the two upper screws so that the motor can be tilted. Do not loosen more than shown in the illustration.



Crush hazard

Always use a shackle with lifting slings when removing the upper screws.

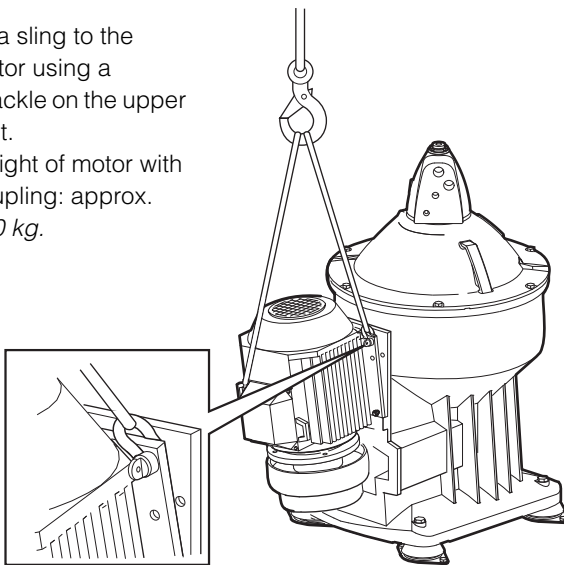
4 Removing the motor.

- a** Disconnect the electrical cables.

**Electrical hazard**

If the cables are not disconnected during lifting procedures, they may become damaged.

- b** Fit a sling to the motor using a shackle on the upper part.
Weight of motor with coupling: approx. 170 kg.



- c** Tense the lifting sling to support the motor and remove the screws. Lift the motor while supported.

**Crush hazard**

If not supported, the motor with coupling will drop when removing the screws.

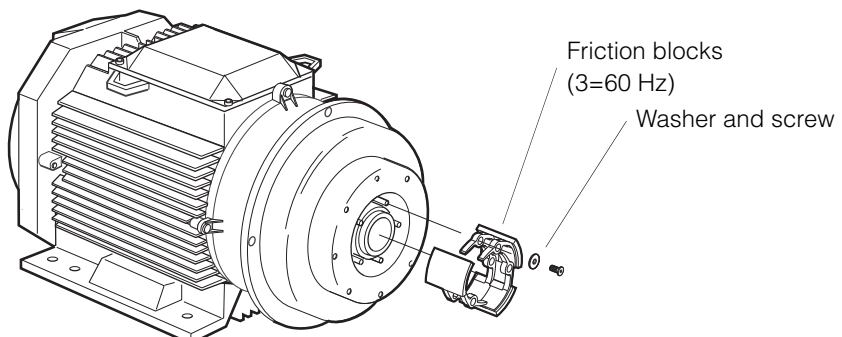
- d** Lower the motor onto a suitable pallet.

5 Removing the friction blocks.**Inhalation hazard**

When handling friction blocks/pads wear a mask to avoid inhalation of dust.

Do not use compressed air to remove dust. Remove dust using vacuum or a damp cloth.

- a** Remove the friction blocks.



50 Hz = 5 Friction blocks
60 Hz = 3 Friction blocks

6 Checking the condition of the friction blocks .**Inhalation hazard**

When handling friction blocks/pads wear a mask to avoid inhalation of dust.

Do not use compressed air to remove dust.

Remove dust using vacuum or a damp cloth.

If the blocks are worn:

Fit new friction blocks.

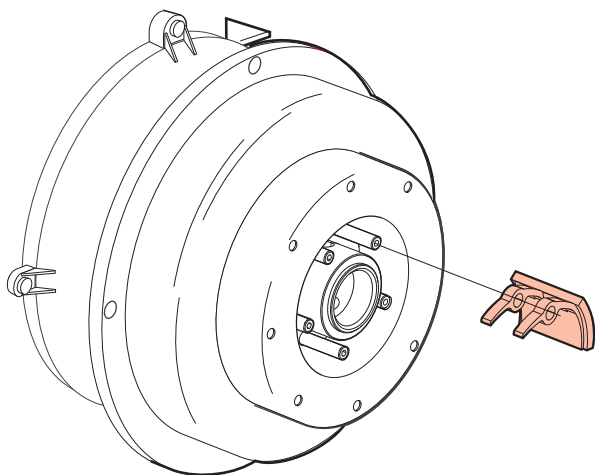
NOTE

Replace all blocks, even if only one is worn.

- a** Clean the pins of coupling hub and apply a thin film of lubricating paste to the pins.

NOTE

Make sure that there is no oil on the pads.

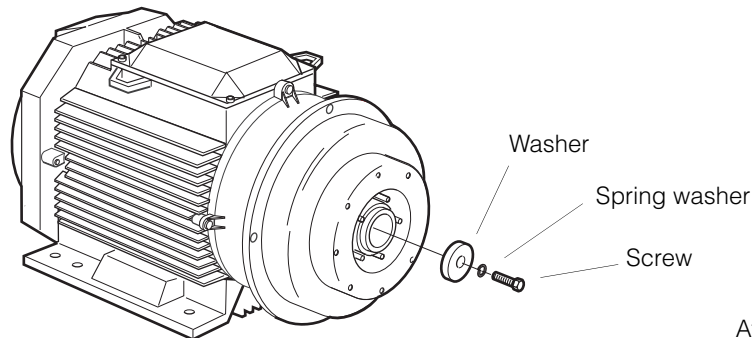


- b** If only friction block service is to be done, proceed to *"Assembly of friction blocks" on page 94.*

Complete dismantling of centrifugal clutch

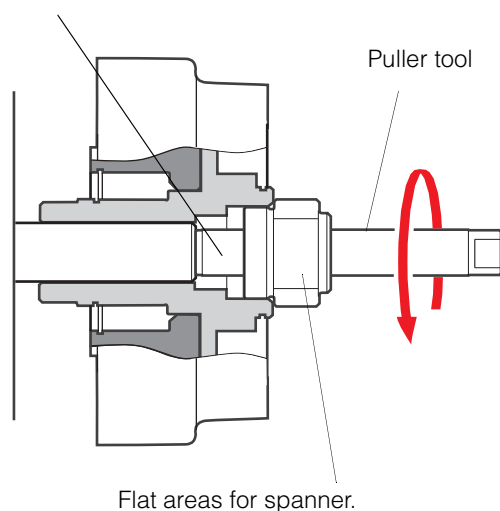
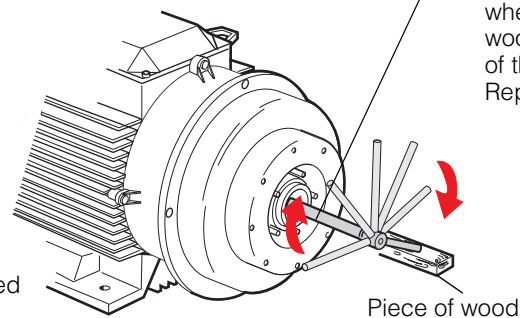
7 Removing the coupling from the motor.

a Remove the screw, spring washer and washer.



Attach a socket with extension rod and handle to the screw. Place a piece of wood according to the illustration. Push the handle to start the rotor moving, when the handle hits the piece of wood, the weight and movement of the rotor loosens the screw. Repeat until screw is loose.

b Check that the brass plug is mounted on the puller tool. Fit the tool to the friction clutch.



c Ease off the friction coupling.



Crush hazard

The centrifugal clutch is heavy and can fall, causing injury, when loosened from the motor shaft.

NOTE

See dismantling with optional hydraulic puller tool (if purchased) on next page.

8 Removing the coupling from the motor using the optional hydraulic tool.

NOTE

First remove the screw, spring washer and washer according to instructions a -b, on previous page.

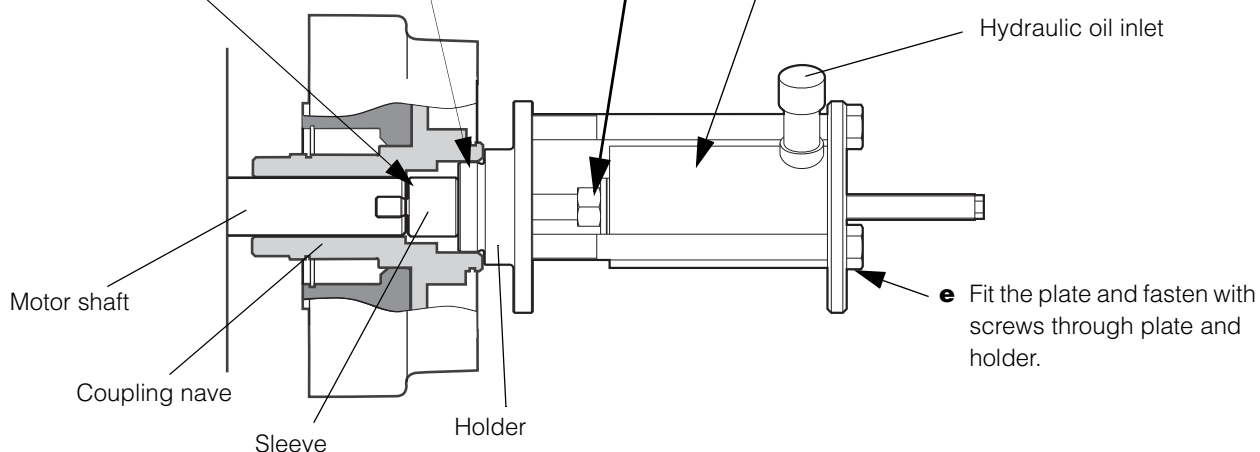
- a** Fit the sleeve to the stud bolt.

Fit the stud bolt with sleeve to the motor shaft.

- b** Fit the holder to the coupling nave.

- c** Fit nut and sleeve to the stud bolt as shown.

- d** Fit hydraulic cylinder as shown.



- f** Attach the hose from the hand pump to the hydraulic oil inlet.

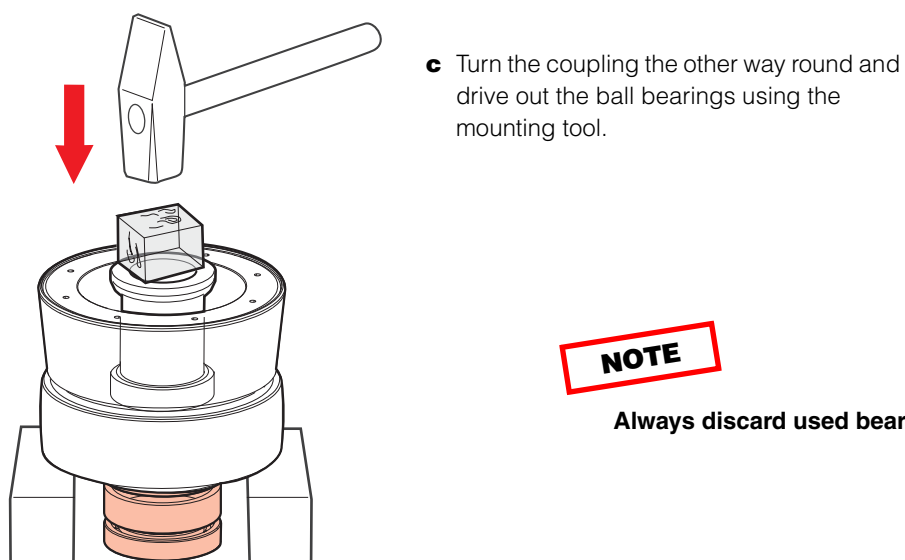
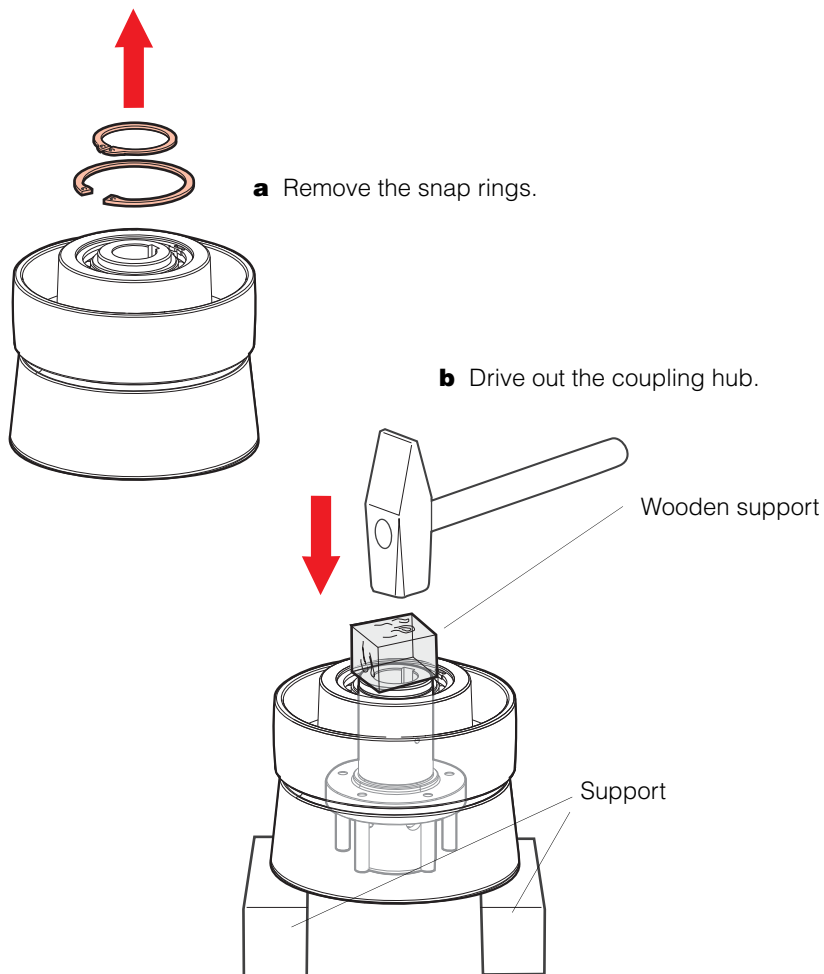
Ease off the friction coupling by pumping the handle on the pump until stop.
Release pressure on the hand pump and adjust the nut on the stud bolt.

Repeat until coupling is loose.



Crush hazard

The centrifugal clutch is heavy and can fall, causing injury, when loosened from the motor shaft.

9 Dismantling of the coupling assembly.

6.4 Actions Before Assembly

6.4.1 Cleaning

Clean the separator parts according to the diagram below. Afterwards, protect all cleaned carbon steel parts against corrosion by oiling.

Part	Procedure	Cleaning agents
Frame and motor	The external cleaning of the frame and motor should be restricted to brushing, sponging or wiping while the motor is running or still is hot.  WARNING Electrical hazard Never wash down a separator with a direct water stream. Never play a water jet on the motor. Totally enclosed motors can be damaged by direct hosing to the same extent as open motors, resulting in short-circuit and internal corrosion. Clean the inside of the frame with a clean cloth and remove visible particles.	Water and de-greasing agent.

Part	Procedure	Cleaning agents
Bowl Inlet/ outlet	Cleaning of bowl discs Handle the bowl discs carefully in order to avoid damage to the surfaces during cleaning 1 Remove the bowl discs from the distributor and place them individually in the cleaning agent. 2 Allow the discs to remain in the cleaning agent until the deposits have been dissolved. This will normally take between two and four hours. 3 Lastly, clean the discs with a soft brush. Cleaning of holder for operating slide, operating water ring and operating slide with nozzle. Use 10% acetic acid solution to dissolve lime deposits. The acid should be heated to 80 °C. Clean the nozzle on the operating slide using a soft iron wire or a similar object.	A chemical cleaning agent must dissolve the deposits quickly without attacking the material of the separator parts. <i>Fuel oil</i> sludge mainly consists of complex organic substances such as asphaltenes. The most important property of a cleaning liquid for the removal of fuel oil sludge is the ability to dissolve these asphaltenes.  Cut hazard Sharp edges on the separator discs may cause cuts.
Driving device	Use a sponge or a soft brush and clean the oil orifice, bearing holder and oil pump thoroughly.	White spirit, cleaning-grade kerosene or diesel oil.
Centrifugal clutch	Use a sponge or a soft brush.	White spirit, cleaning-grade kerosene or diesel oil.
Belt pulley	Use a a steel brush.	Solvent

6.4.2 Inspection for corrosion

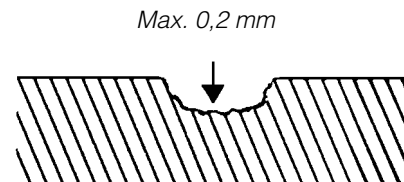


Inspect the separator parts for corrosion. Evidence of corrosion attacks should be looked for and rectified each time the separator is dismantled.



Disintegration hazards

Always contact your Alfa Laval representative if you suspect that the depth of the corrosion damage exceeds 0,2 mm for bowl body and bowl hood (0,5 for other parts) or if cracks have been found. Do not continue to use the separator until it has been inspected and given clearance for operation by Alfa Laval.



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Material	Type of corrosive environment	Appearance	Measure
Non-stainless steel and cast iron parts	Water or dampness	Rust	If damage exceeds 0,5 mm, contact Alfa Laval.
Stainless steel	Chlorides or acidic solutions	Acidic solutions cause general corrosion. Chloride corrosion begins as small dark spots that can be difficult to detect, and goes on to local damage such as pitting, grooves or cracks.	Polish dark-coloured spots and other corrosion marks with a fine grain emery cloth. This may prevent further damage. If damage exceeds 0,5 mm (0,2 mm for bowl body and bowl hood) contact Alfa Laval.
Other metal parts	"Aggressive" environment	Possible corrosion damage can be in the form of pits and/or cracks.	If damage exceeds 0,5 mm, contact Alfa Laval.



Disintegration hazard

Pits and spots forming a line may indicate cracks beneath the surface.

All forms of cracks are a potential danger and are totally unacceptable.

Replace any part where corrosion can be suspected of affecting its strength or function.

6.4.3 Inspection for cracks

Check the separator parts for cracks. It is particularly important to inspect for cracks in rotating parts, and especially the pillars between the sludge ports in the bowl wall.



Disintegration hazard

All forms of cracks are potentially dangerous as they reduce the strength and functional ability of components.

Always replace a part if cracks are present.

Cracks can occur from cyclic material stresses and corrosion. Keeping the separator and its parts clean and free from deposits will help to prevent corrosion attacks.



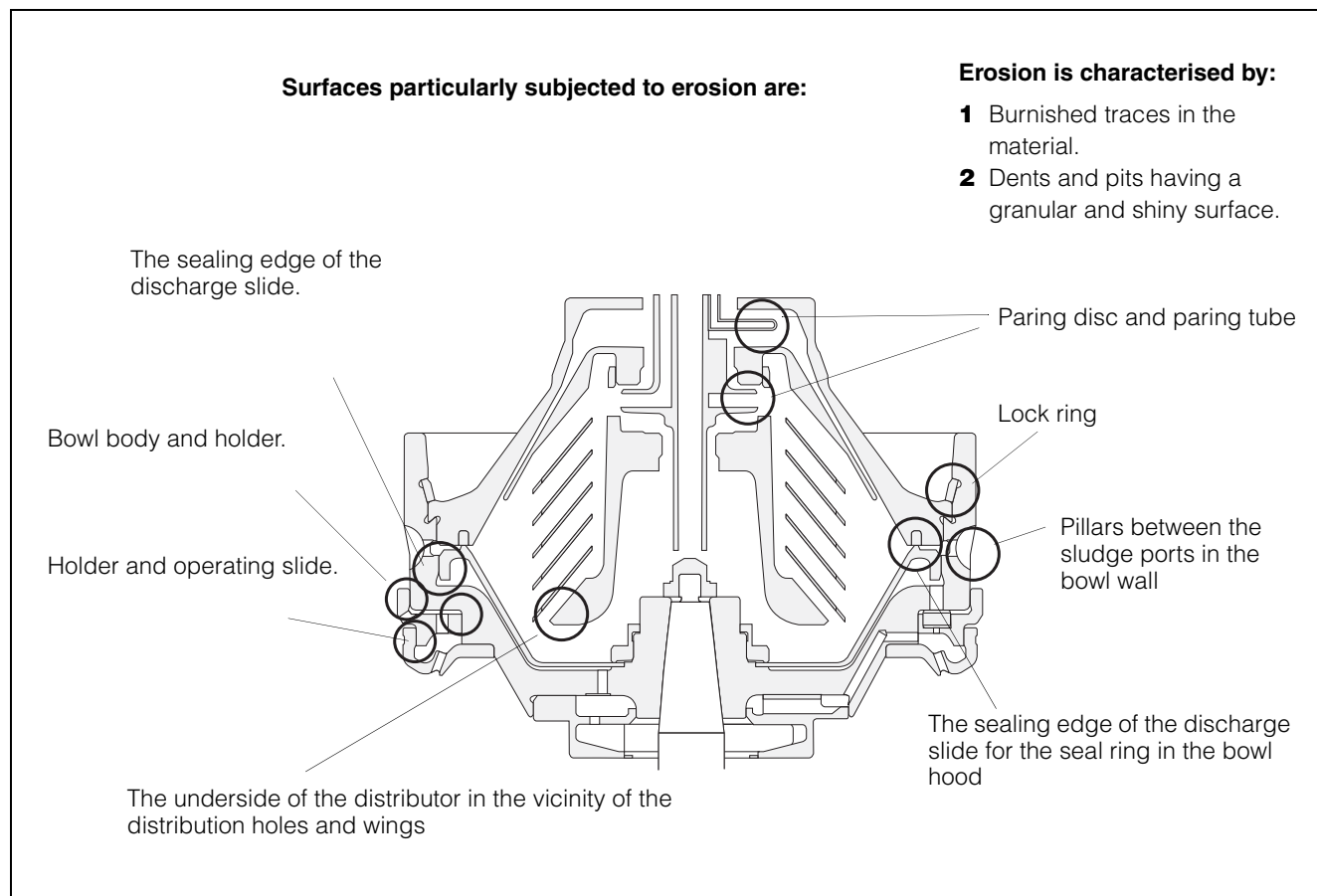
Disintegration hazards

Always contact your Alfa Laval representative if you suspect that the depth of the damage exceeds 0,2 mm for bowl body and bowl hood (*0,5 for other parts*).

Do not continue to use the separator until it has been inspected and given clearance for operation by Alfa Laval.

6.4.4 Inspection for erosion

Erosion may occur when particles suspended in the process liquid slide along or strike against a surface.



1 Inspect the bowl and inlet/outlet parts for erosion damages.

2 Replace parts if erosion is suspected.

NOTE

Always contact your Alfa Laval representative if you suspect that the depth of the damage exceeds 0,2 mm for bowl body and bowl hood (0,5 for other parts). Do not continue to use the separator until it has been inspected and cleared for operation by Alfa Laval.

WARNING

Disintegration hazard

Erosion damage weakens parts by reducing the thickness of the material.

Pay special attention to the pillars between the sludge ports in the bowl wall.

Replace parts if erosion is suspected of affecting strength or function.

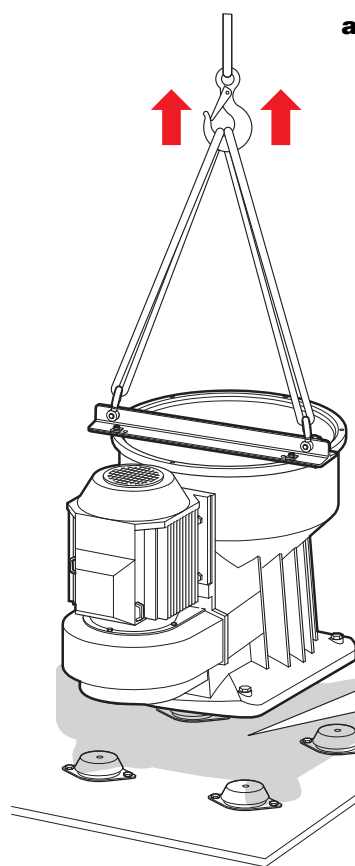
6.4.5 Exchange of frame feet

The frame feet have to be changed occasionally due to rubber deterioration from age.

When replacing the frame feet, the separator must be lifted. Follow [6.8.1 Lifting the separator](#), page 141.

NOTE

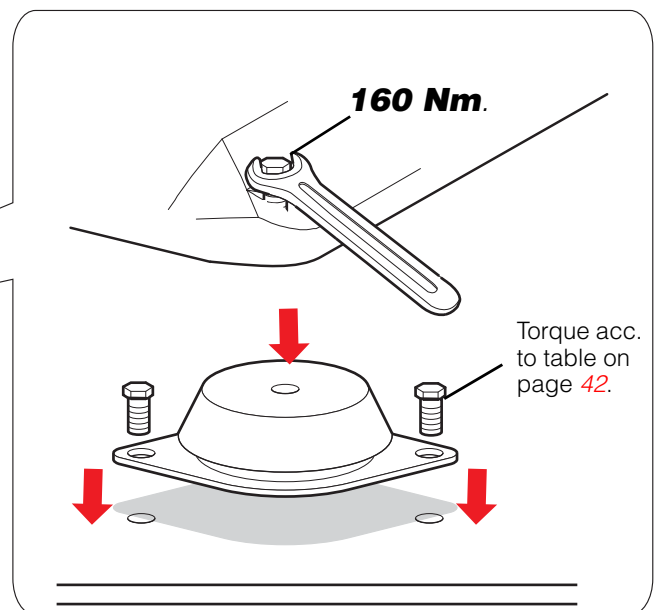
Discard the old frame feet, screws and washers.



- a** Loosen the bolts and prepare to remove the separator frame
- b** Lift the separator. See "[Lifting the separator](#)" on page 141
- c** Remove the existing frame feet.

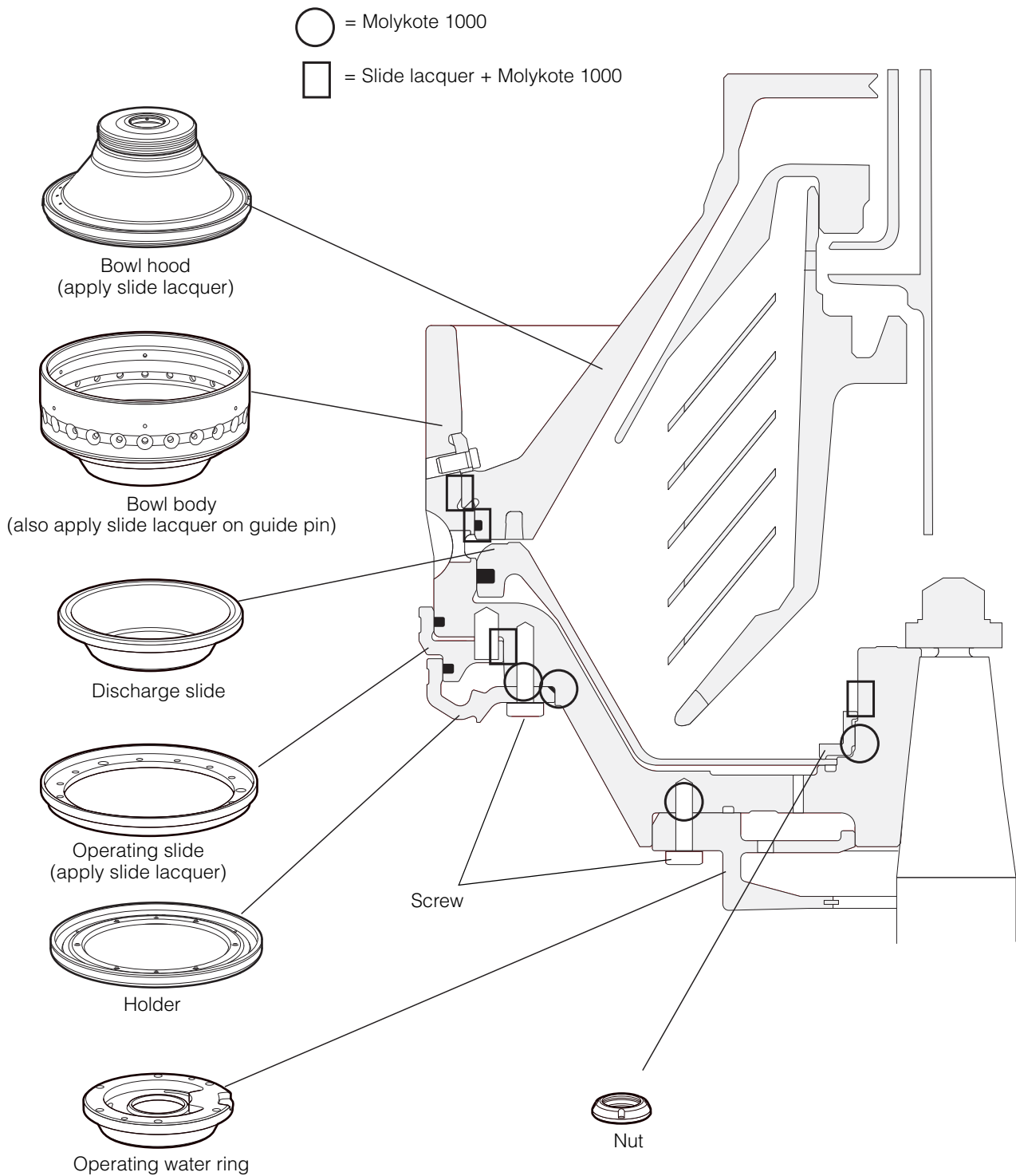
d Fit the new feet, screws and washers.

e Place the separator in its original position and fasten the mounting bolts.
Tightening torque: 160 Nm.

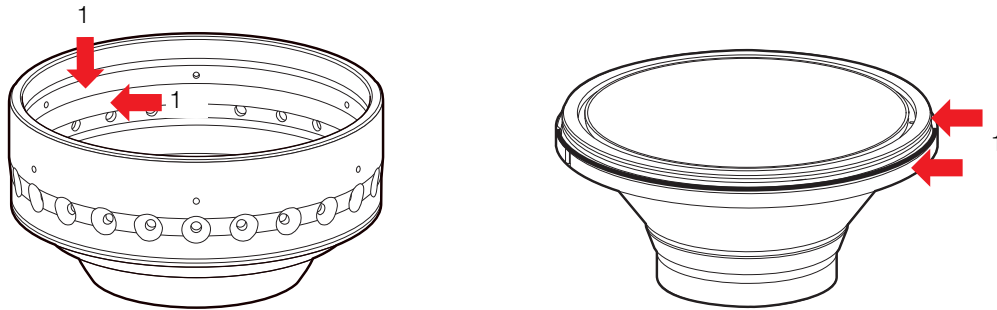


6.4.6 Lubrication of bowl parts

- a** Apply a thin layer of Molykote 1000, or equivalent lubrication, on all the following contact surfaces. Apply slide lacquer on the operating slide and the bowl body, guide pin and bowl hood.



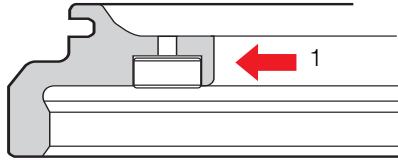
6.4.7 How to lubricate bowl parts with slide lacquer

**NOTE**

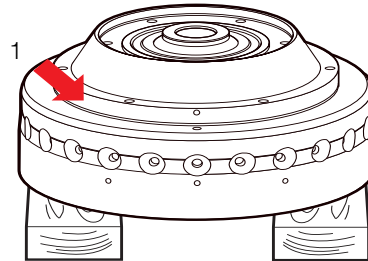
This instruction is also valid for the operating slide and the holder.

- a** Carefully clean the contact surfaces (1) on bowl body and bowl hood.
- b** Apply slide lacquer with a sponge.
- c** Rub the slide lacquer on the surfaces to a thin, evenly distributed layer using the sponge.
- d** Polish the film to a shiny surface, the film should look like well-polished leather when properly done.
- e** Finish the treatment by lubricating the contact surfaces with Alfa Laval lubricating paste or Molykote 1000 paste. Use a well cleaned brush and rub it into the surface, do not leave any excessive paste.

6.4.8 Check for galling on operating slide and bowl body



If any friction marks are found on the guide surfaces (1) of operating slide and bowl body, proceed as follows:



- a** Clean the surface thoroughly with a degreasing agent, i.e. white spirit.
This is important!
- b** Using an emery cloth (e.g. No. 320) to smooth the metal edges.
- c** Finish by polishing the damaged spots with polishing paper (e.g No. 600).
- d** Apply slide lacquer with a sponge.
- e** Rub the slide lacquer on the surfaces to a thin, evenly distributed layer using the sponge.
- f** Finish the treatment by lubricating the guiding surfaces with Alfa Laval lubricating paste or Molykote 1000 paste. Use a well cleaned brush. Rub it into the surface, do not leave any excessive paste.

NOTE

To avoid the risk of galling, the guiding surface of the operating slide should be primed with a slide lacquer at every inspection service.

6.5 Assembly

6.5.1 Centrifugal clutch

1 Assembly of the coupling.

- a** Slip the belt pulley over the coupling hub and place them on a firm and level foundation.

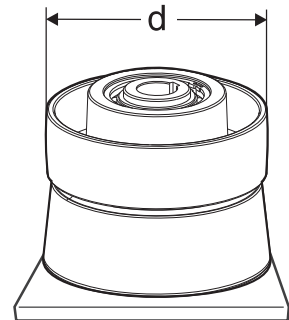


Disintegration Hazard

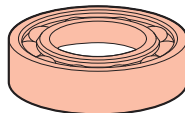
If the belt pulley must be renewed, check that the new pulley has the correct diameter. An incorrect pulley will cause the separator bowl to run at either an excessive or insufficient speed.

d=265 mm 50 Hz

d=221 mm 60 Hz



Remove rust from the belt pulley using a steel brush.



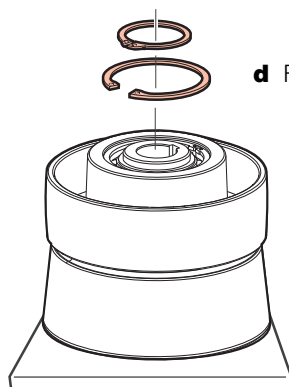
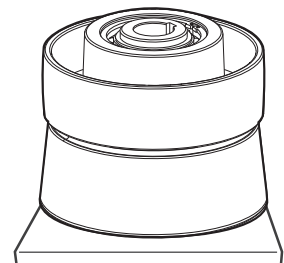
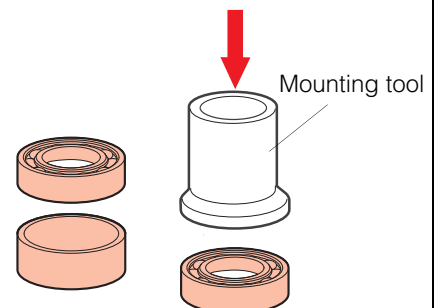
- b** Apply a thin film of oil onto the external and internal surfaces of the ball bearings .

- c** Press the ball bearings down one at a time into the coupling hub, preferably using a hydraulic press. Place the spacing ring between them.

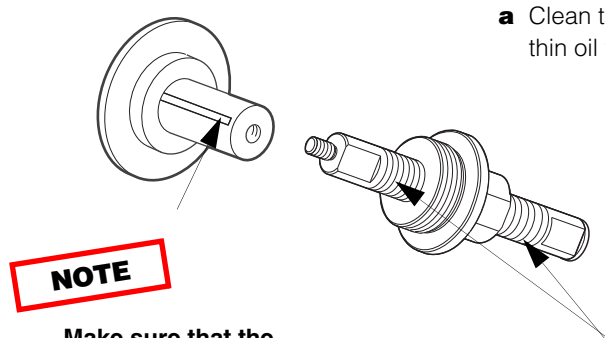


Never re-fit used ball bearings.

The ball bearings must not be heated as they are packed with grease and sealed with plastic membranes.



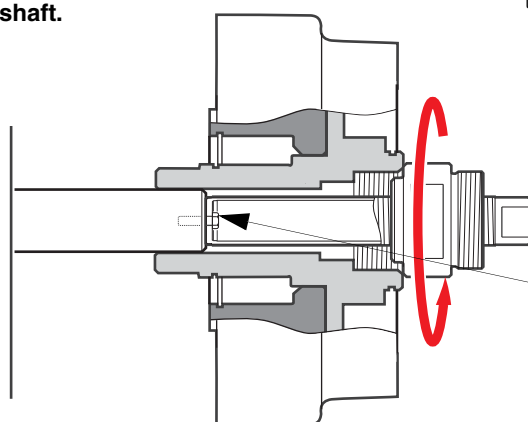
- d** Fit the snap rings .

2 Fitting the coupling to the motor.

Make sure that the key is in place on the motor shaft.

a Clean the motor shaft and apply a thin oil film.

b Apply lubricating paste to the tool threads (keep lubricated).



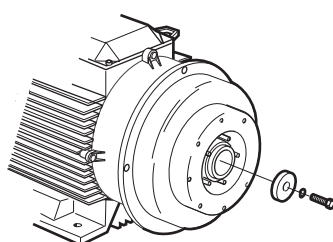
c Remove the brass plug.

d Fasten the sleeve of the tool to the motor shaft with the same screw that normally holds the centrifugal clutch to the motor.

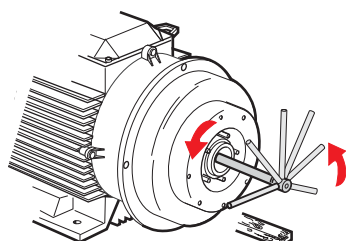
NOTE

See mounting with optional hydraulic puller tool (if purchased) on next page.

e Use a spanner to turn the nut on the tool. This will press the centrifugal clutch on to the shaft. Remove the tool.

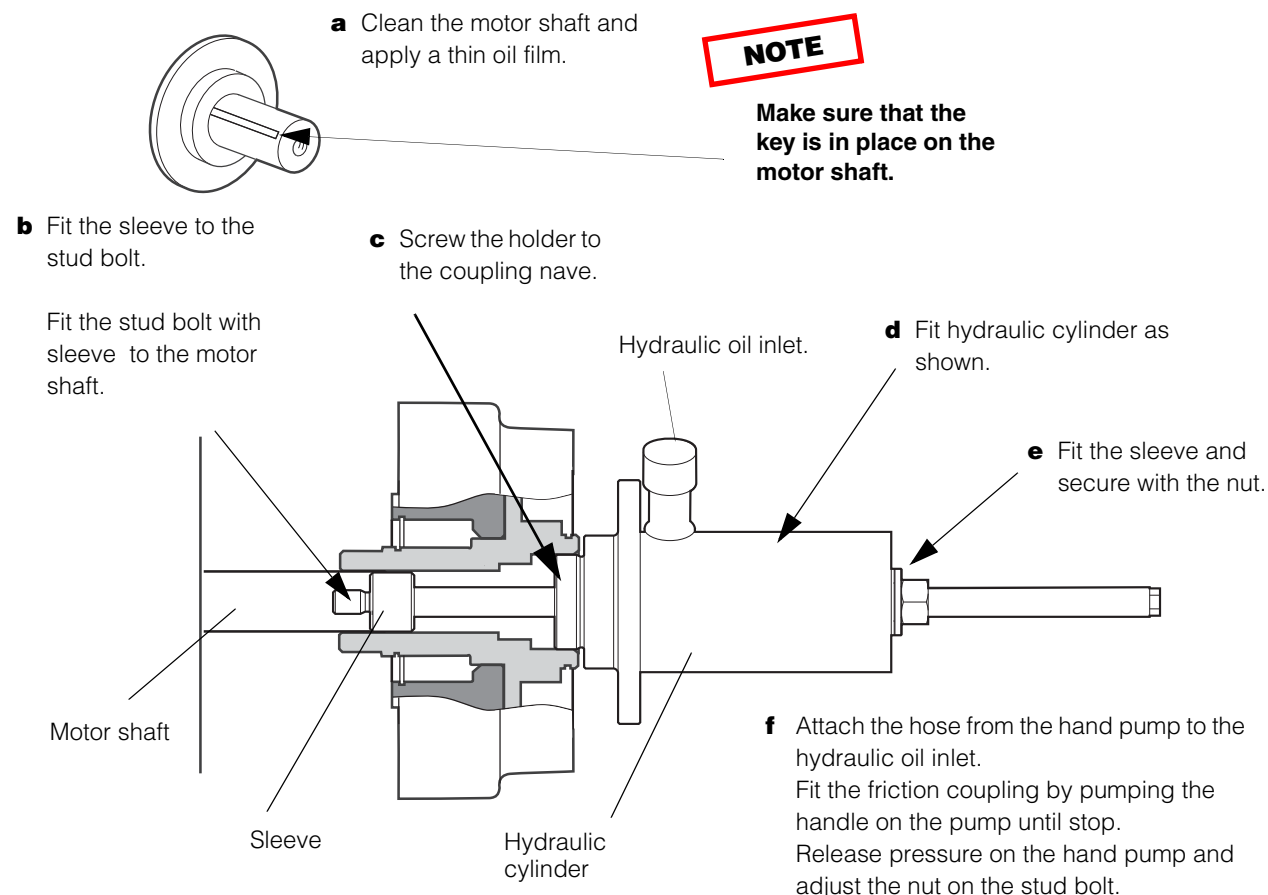


f Install and tighten the washer, spring washer and screw.

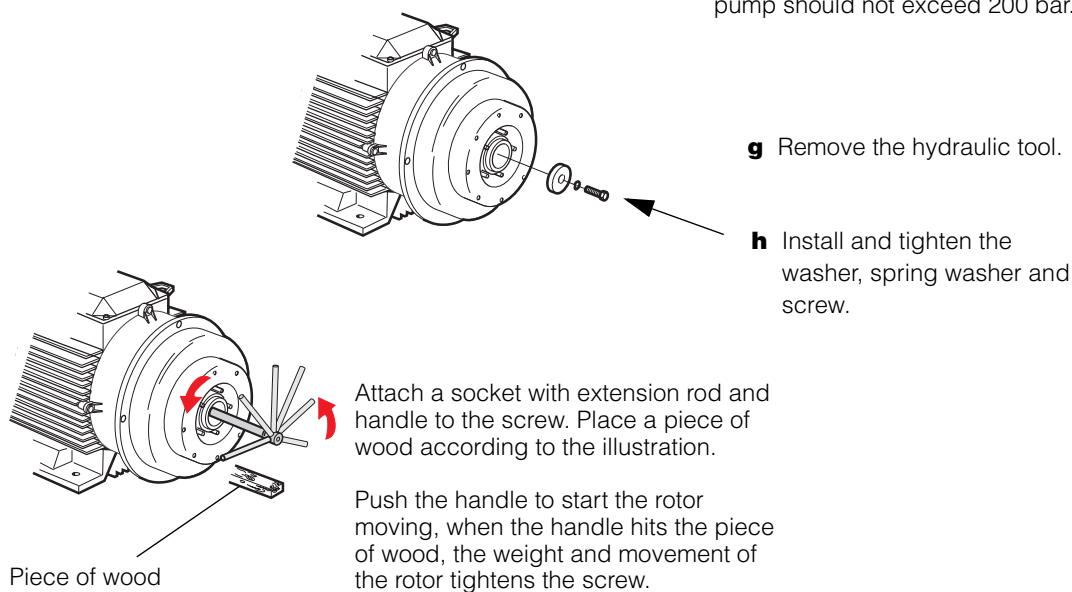


Piece of wood

Attach a socket with extension rod and handle to the screw. Place a piece of wood according to the illustration. Push the handle to start the rotor moving, when the handle hits the piece of wood, the weight and movement of the rotor tightens the screw. Repeat until screw is fastened.

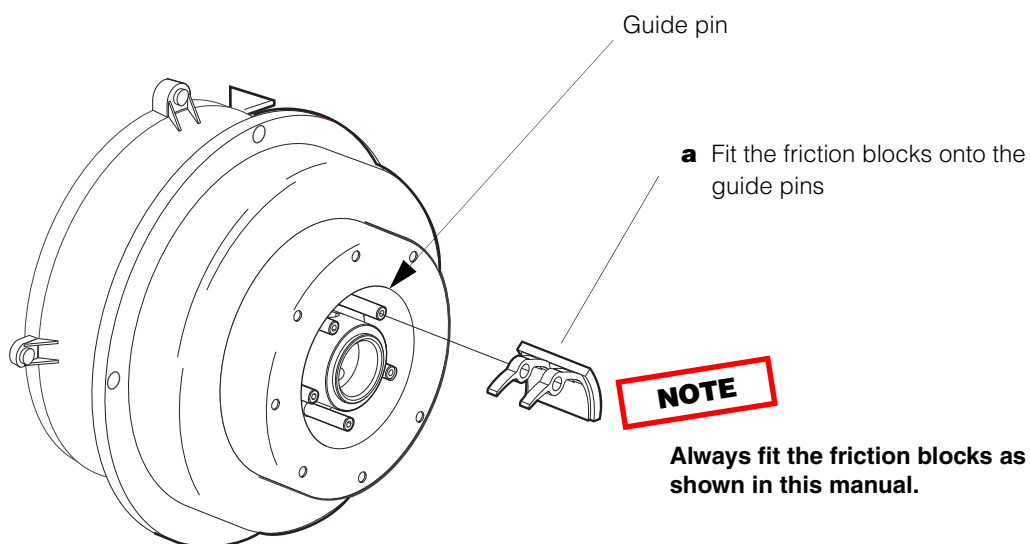
3 Fitting the coupling to the motor with optional hydraulic tool.

Repeat procedure until coupling is mounted. Note! The pressure on the hand pump should not exceed 200 bar.



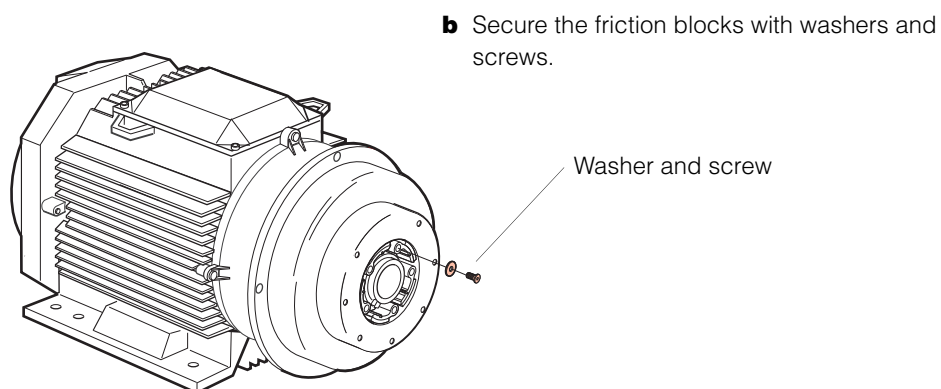
Assembly of friction blocks

4 Fitting the friction blocks.



NOTE

50 Hz = 5 Friction blocks
60 Hz = 3 Friction blocks



5 Fitting the motor.

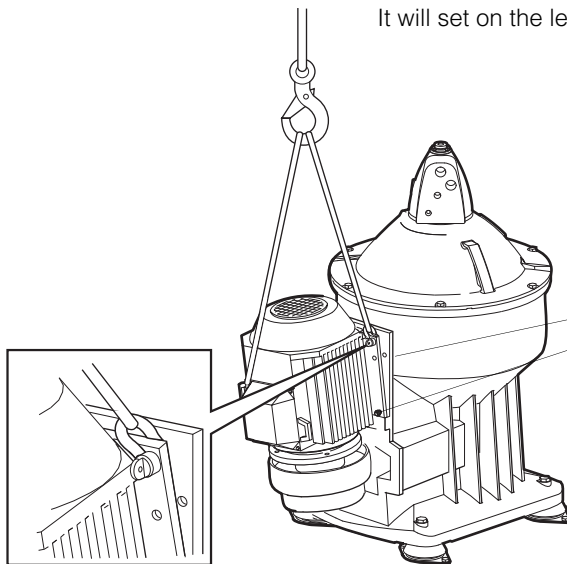
- a** Fit a lifting sling to the motor.
Use a shackle from the separator lifting tool.
Weight of motor with coupling: approx. 170 kg.

- b** Lower the motor (while supported) on to the separator frame.
It will set on the ledge.



Crush hazard

If not supported, the motor with coupling may drop when lifted.



- c** Fit the screws.
Do not tighten until the belt has been mounted.

- d** Connect the electrical cables.

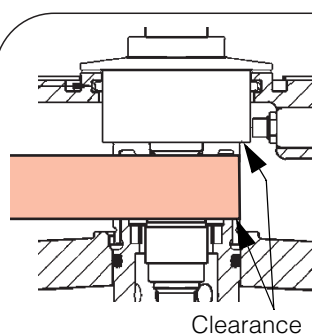
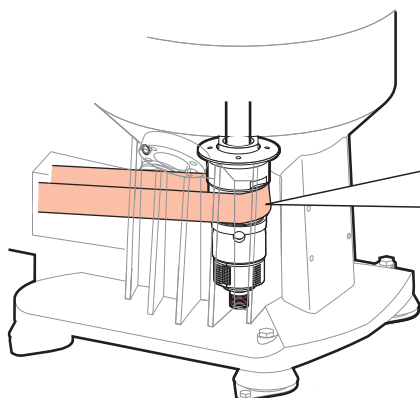
NOTE

If carrying out change of friction blocks only, continue with steps **6 to 8**.
If carrying out a complete machine assembly, continue with the driving device instructions on page **98**.

6 Fitting the flat belt.**NOTE**

Clean the inside of the frame before fitting the flat belt, and make sure that there is no oil on the belt.

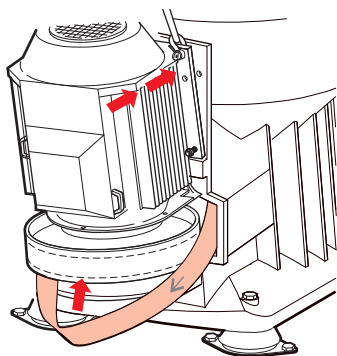
- a** Lift up the belt to the middle (centre) of the spindle pulley.

**NOTE**

For correct position, centre the belt on the spindle pulley camber.

- b** Fit the flat belt to the motor belt pulley.

- c** Tighten the two upper screws.

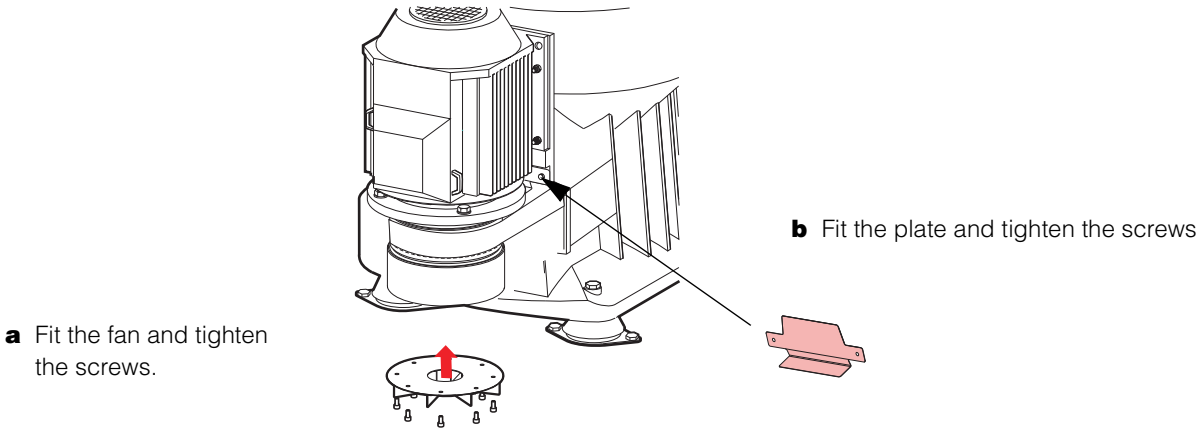


- d** Tighten all motor attachment screws.

NOTE

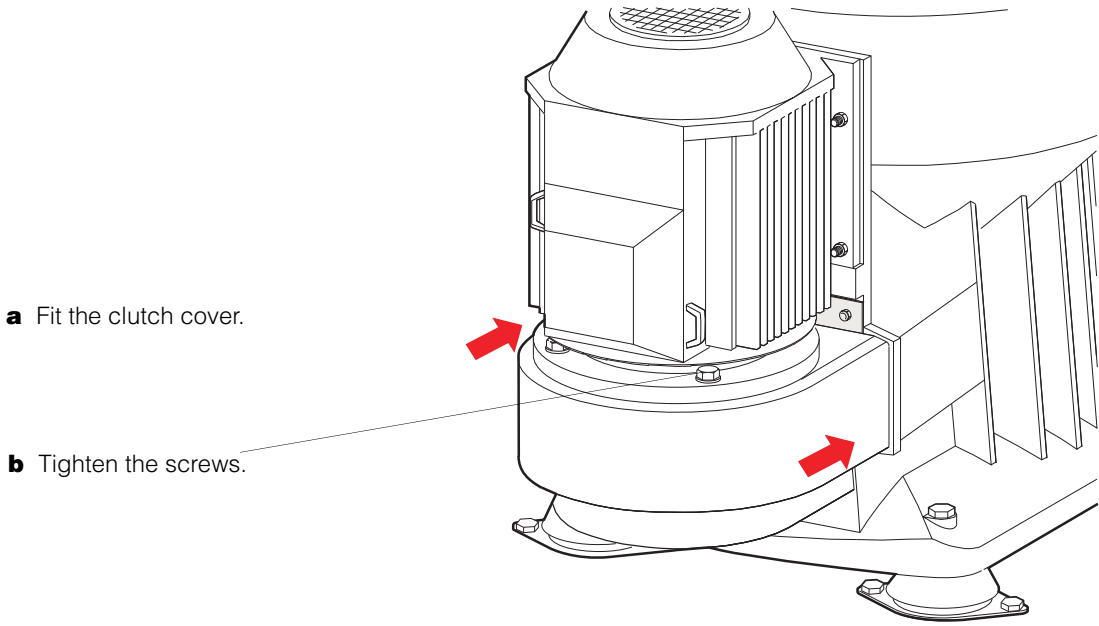
Do not turn the spindle until the motor is tightened properly to the frame.

7 Fitting the fan and plate.



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8 Fitting the clutch cover.



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6.5.2 Driving device

1 Fitting the bottom bearing holder.

NOTE

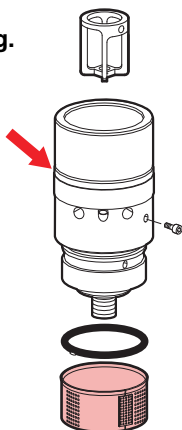
Clean the strainer and bearing holder thoroughly before fitting.

a Fit the wing insert, O-rings and strainer.

c To secure the bottom bearing holder into the frame, apply Loctite 222 on the surfaces directly above the upper O-ring.

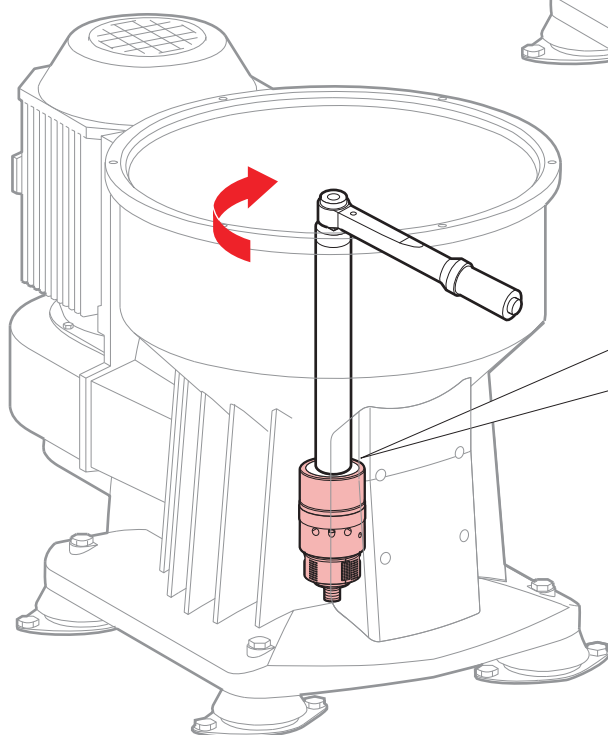
b Secure the wing insert with the screw secured with Loctite 222

d Thread the bottom bearing holder into the frame and fit the tool into the bottom bearing housing.

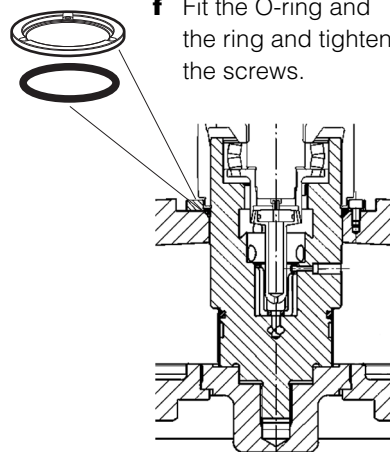


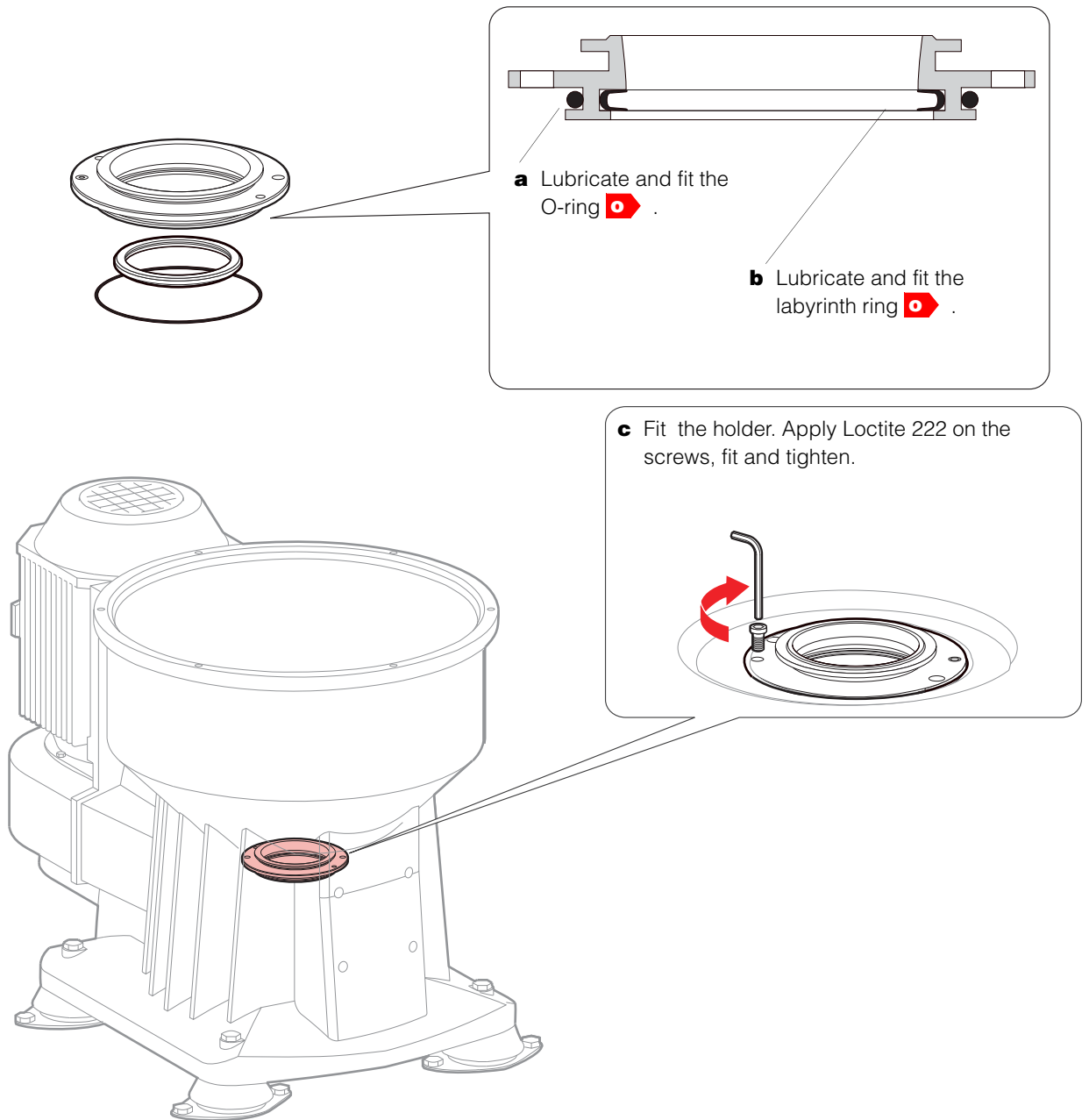
Tool
Bottom bearing holder

e Tighten the holder to a torque of 200 Nm.



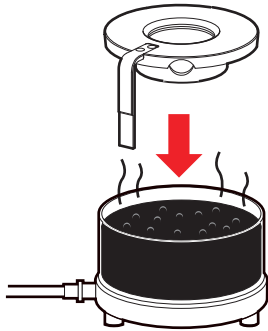
f Fit the O-ring and the ring and tighten the screws.



2 Fitting the labyrinth ring holder.

3 Fitting the ball bearing to the top bearing seat .

- a** Heat the top bearing seat in oil to +80°C above room temperature (max. 125 °C).



Burn hazard
Use protective gloves when handling any heated parts.

- b** Fit the ball bearing.

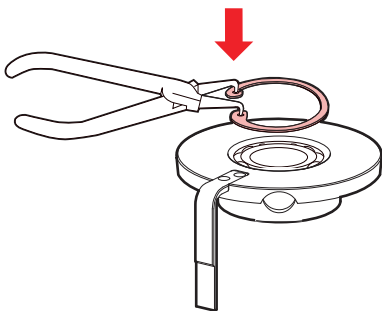


Always fit a new bearing.
Pre-lubricate before fitting.

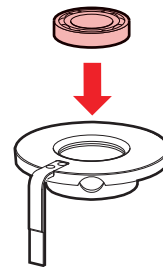


Drop some frame oil onto the bearing.

- c** Fit the snap ring.

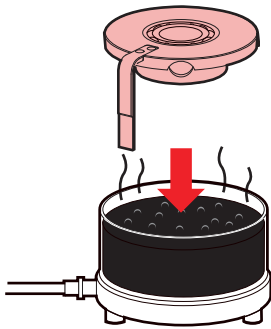


Risk for eye injury from flying snap ring
Use the correct pliers for assembly of snap ring to avoid accidental release.



4 Fitting the top bearing seat with bearing to the spindle.

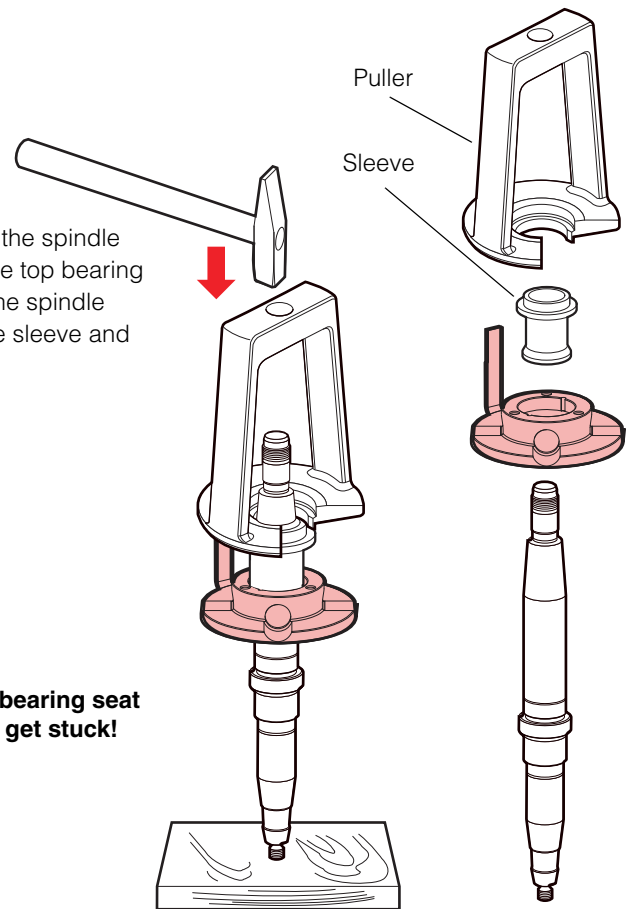
- a** Heat the top bearing seat together with the bearing in oil to +80°C above room temperature (max. 125 °C).



- b** Wipe off the spindle and fit the top bearing seat to the spindle using the sleeve and puller.

NOTE

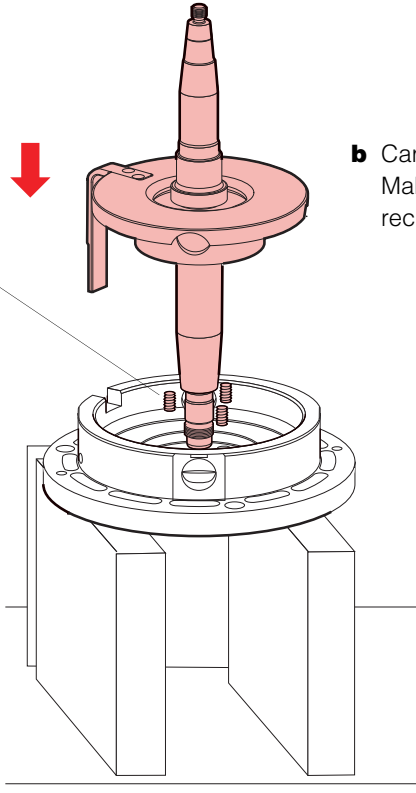
Make sure to fit the bearing seat correctly or it might get stuck!



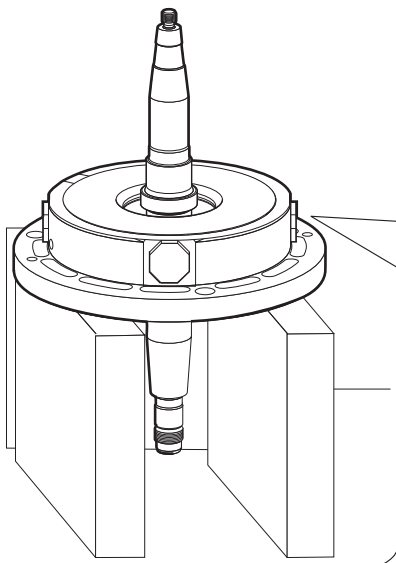
5 Fitting the top bearing housing.

- a** Fit the axial springs  to the top bearing housing.

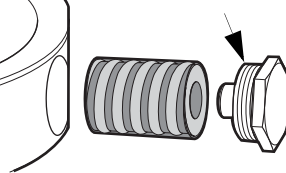
Axial springs



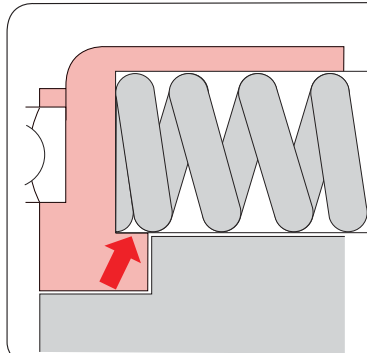
- b** Carefully lower the bowl spindle. Make sure that the springs enter the recesses on the top bearing seat.

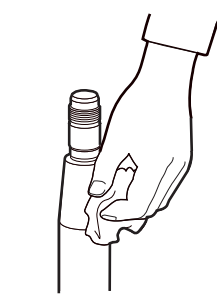


- c** Lubricate the threads with oil before assembly.



- d** Fit the composite springs  and plugs to the top bearing housing. Do not tighten the plugs. Make sure that the springs enter the recesses in the top bearing seat. The plugs should be tightened when the spindle assembly is mounted into the frame.



6 Fitting the spindle pulley.

a Turn the spindle assembly upside down.



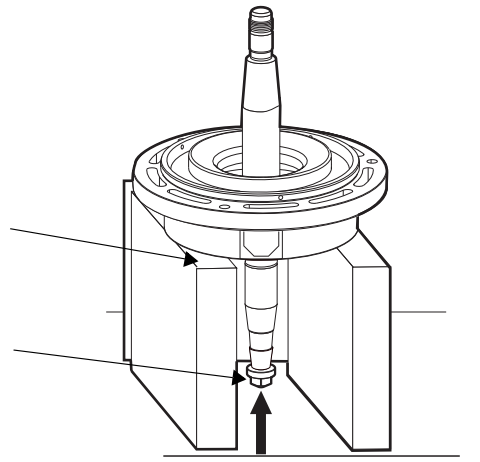
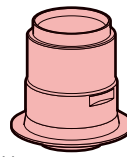
b Wipe off the spindle pulley seat on the spindle and have bore in the spindle pulley with a dry cloth.

NOTE

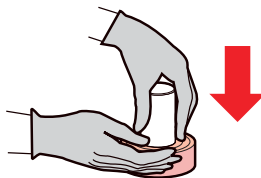
At least 1mm free space between support and spindle assembly to protect the bearing.

Mount the cap nut to protect the threads and support the spindle.

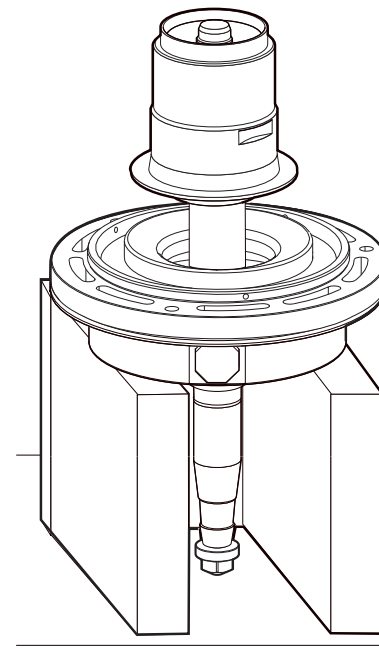
c Fit the spindle pulley firmly on the bowl spindle.

**7** Fitting the self-aligning roller bearing .**NOTE**

Always fit a new bearing.
Pre-lubricate before fitting.

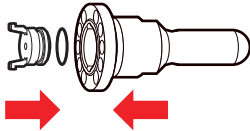


a Lower the bearing onto the spindle and press down onto the spindle pulley using the special drift tool.



8 Fitting the oil pump.

- a** Fit O-ring  onto lubrication oil orifice. Spread oil film on O-ring.
- b** Push lubrication oil orifice into oil pump. Be sure to line up tabs on orifice with slots in pump.

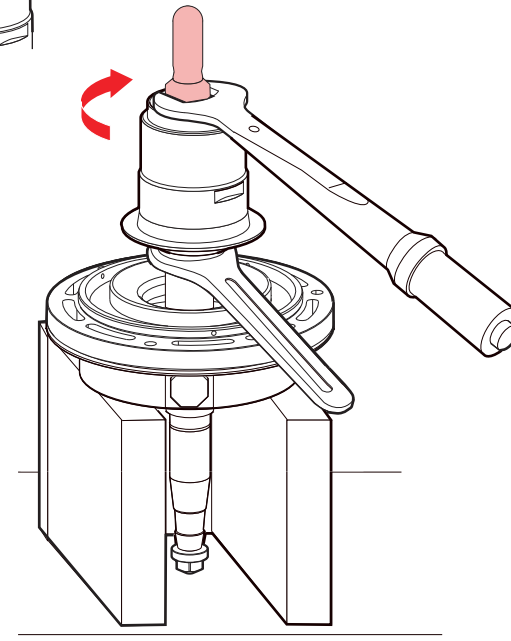
**NOTE**

Clean the oil pump and make sure that the bottom hole is not clogged.

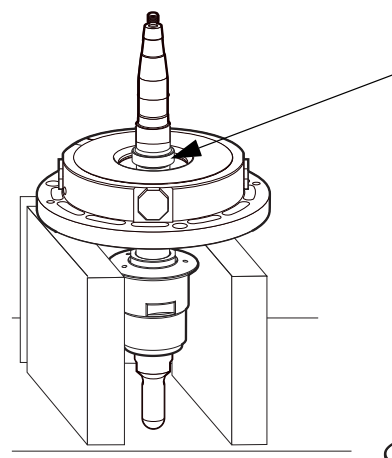
- c** Lubricate all threads before assembly.



- d** Fit the oil pump (260 ± 5 Nm) using spanners.



9 Fitting the fan



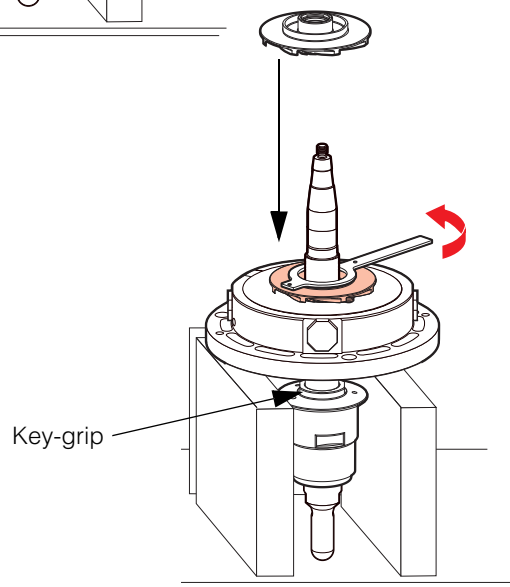
a Turn the spindle assembly up-side down.

NOTE

Ensure that the spindle is seated against the inner ring of the ball bearing.

NOTE

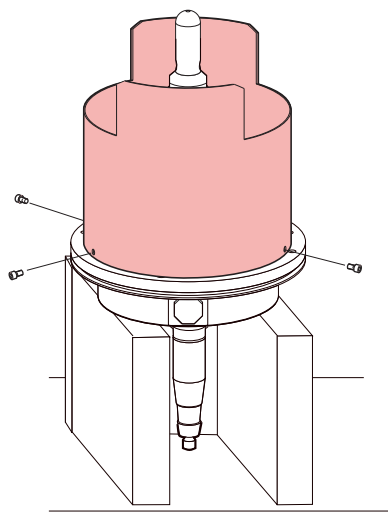
Make sure that the bearing is pre lubricated before fitting the fan.



c Place a spanner (or similar) on the spindle pulley key-grip, as holder-up and fit the fan. Tighten firmly, by hand, with the pin spanner.

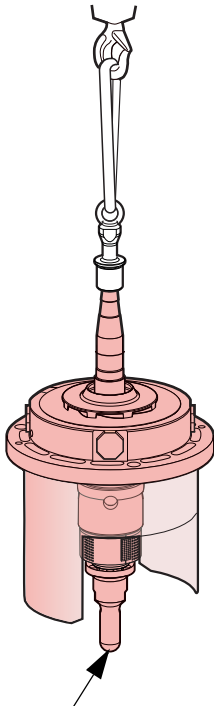
10 Fitting the air deflector.

a Turn the spindle assembly up-side down and fit the air deflector.



11 Lowering the spindle assembly into the frame.

- a** Turn the assembly and remove the cap nut from the spindle.
Fit the lifting tool to the spindle assembly and lift it.



Check the bottom hole.



Crush hazard

Do not rotate the spindle assembly during lifting. The spindle assembly may otherwise come loose from the lifting tool.



Check that the hole at the bottom of the oil pump is clean before lowering the assembly down.

- b** Position the flat belt  so that the spindle assembly can pass through when lowering. See note below.

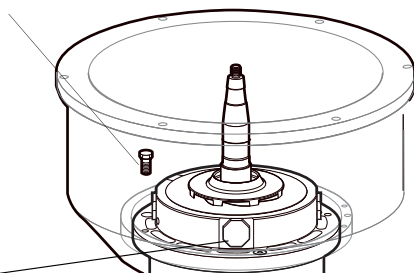
- c** Carefully lower the spindle assembly and position the bolt holes over the threaded frame holes. Make sure that the bottom bearing, enters the bottom bearing holder correctly. Do not use force.



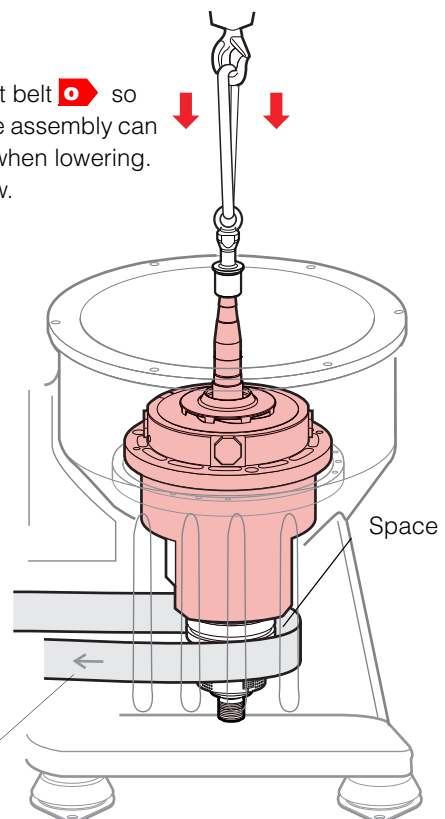
Cut hazard

Do not put fingers between the frame and air deflector while lowering the assembly.

- d** Fit and tighten the screws.



- e** Tighten the plugs firmly.



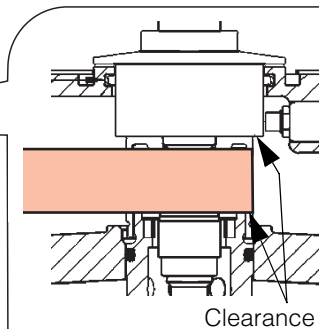
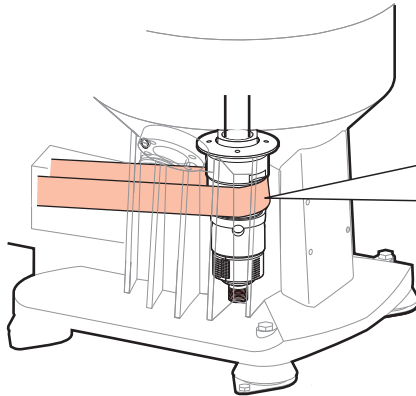
Check the direction arrows on the belt and the machine plate for correct position.

Make sure that the belt does not get smudged with oil or grease during handling.

12 Fitting the flat belt.**NOTE**

Clean the inside of the frame before fitting the flat belt, and make sure that the belt is clean.

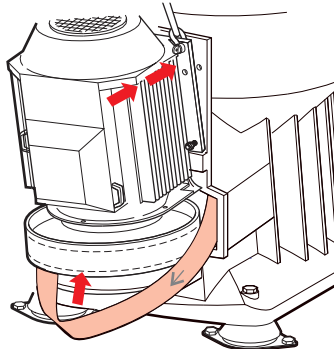
- a** Lift up the belt to the middle (centre) of the spindle pulley.

**NOTE**

For correct position, centre the belt on the spindle pulley camber.

- b** Fit the flat belt to the motor belt pulley.

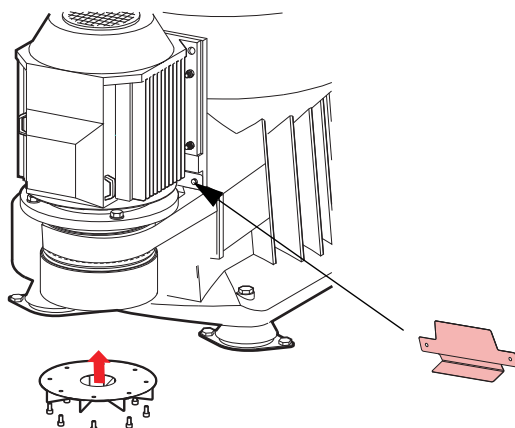
- c** Tighten the two upper screws.



- d** Tighten all motor attachment screws.

NOTE

Do not turn the spindle until the motor is tightened properly to the frame.

13 Fitting the fan and plate.

G08588H1

14 Fitting the neck bearing cover, throw off collar and protecting plate.

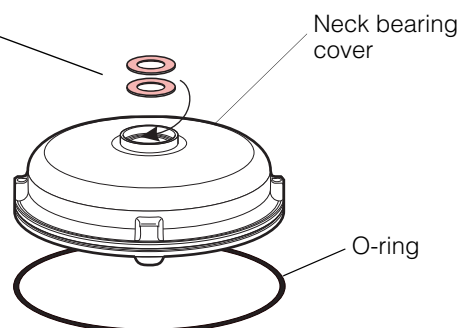
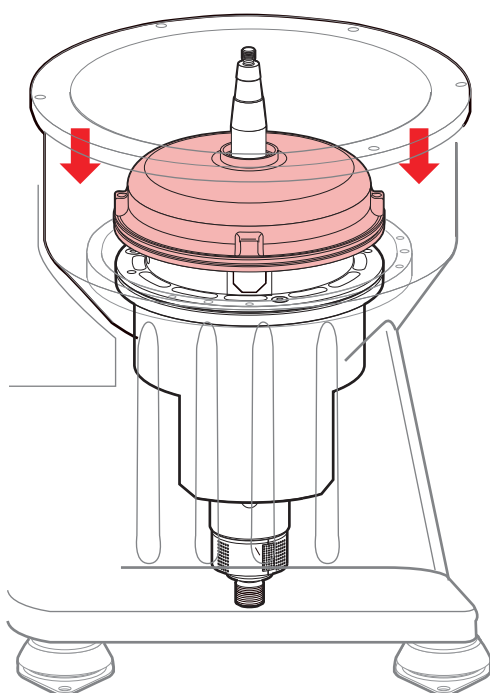
- a** Apply a thin layer of oil to the O-rings  and the seal rings .

Fit the seal rings in the neck bearing cover.

- b** Fit the neck bearing cover together with the O-ring.

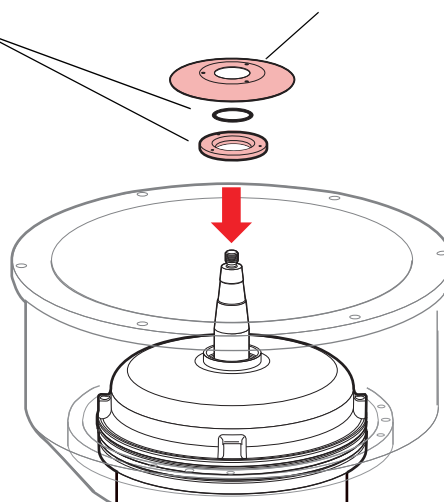
NOTE

The guide pin on the cover should enter one of the two holes in the bearing housing.

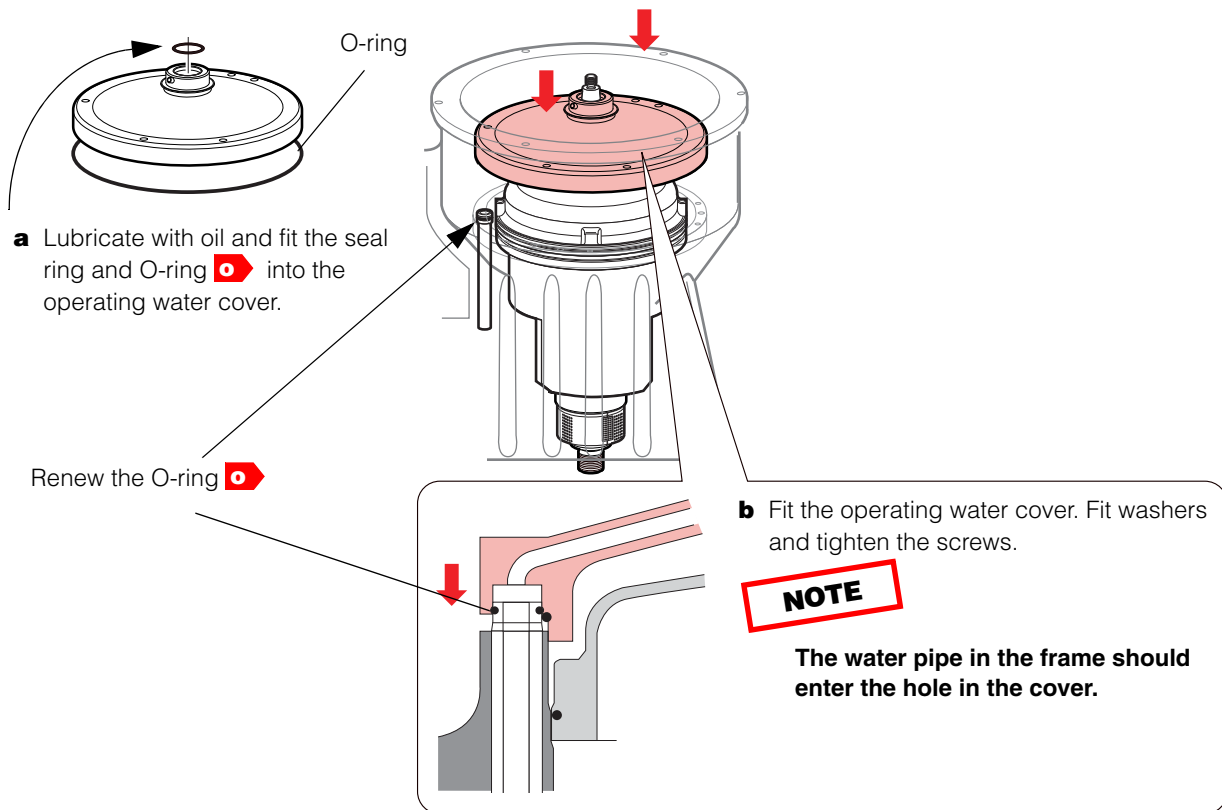


- c** Fit the throw off collar and the O-ring.

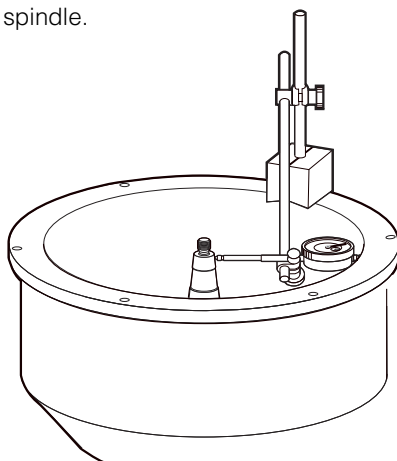
- d** Fit the protecting plate and tighten the screws.



G08680A1

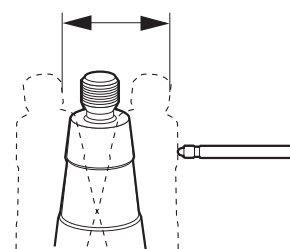
15 Fitting the operating water cover.**16** Measuring the radial wobble of the bowl spindle.

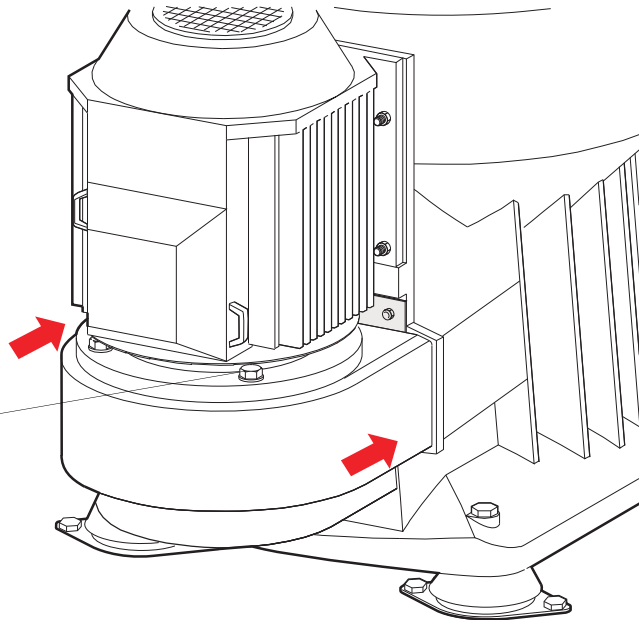
- a** Fit a dial indicator in a support and fasten it in position as illustrated. Use the flat belt to turn the spindle.

**NOTE**

Permissible radial wobble: max. 0,04 mm. If the spindle wobble exceeds this value, contact an Alfa Laval representative.

Max. 0,04 mm

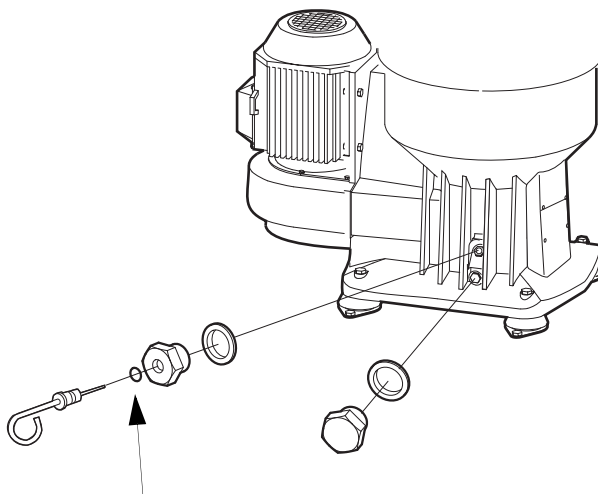


17 Fitting the clutch cover.**a** Fit the clutch cover.**b** Tighten the screws.

G0866181

18 Fill oil in the oil sump.**NOTE**

The separator should be level and at standstill when oil is filled.

a Remove the oil pin, plug and washer.**b** Fit new washer **i** and refit the drain plug.

c Fill with new oil until oil flows out from the filler hole.
For correct oil volume see *Lubricating oil volume, page 152*.

NOTE

For grade and quality of oil see *6.7.6 Lubricating oils, page 139*

d Fit new O-ring **i** onto the oil pin.**e** Refit the plug with new washer **i****f** Fit the oil pin.

G08667G1

6.5.3 Bowl

- 1** Check for impact marks and corrosion in bowl body nave and on spindle taper  .



Disintegration hazard

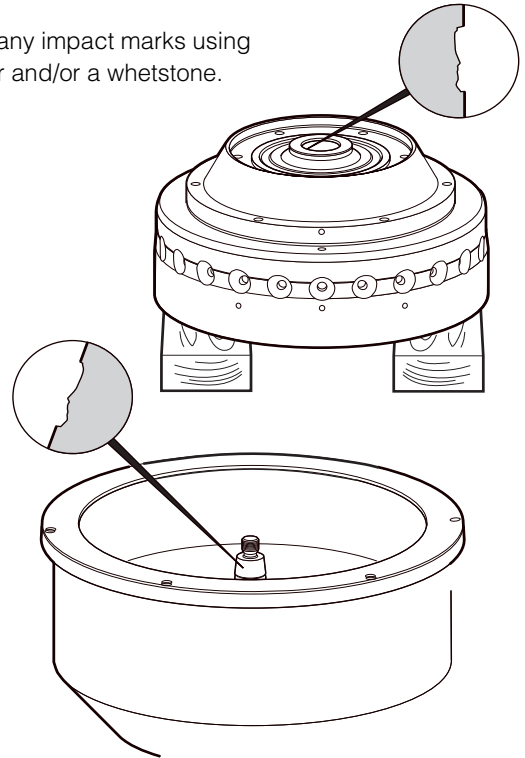
Impact marks may cause the separator to vibrate while running.

- a** Remove any impact marks using a scraper and/or a whetstone.

- b** Rust can be removed by using a fine-grain emery cloth (e.g. No. 320).

- c** Finish with polishing paper (e.g. No. 600).

- d** Lubricate to prevent further corrosion.



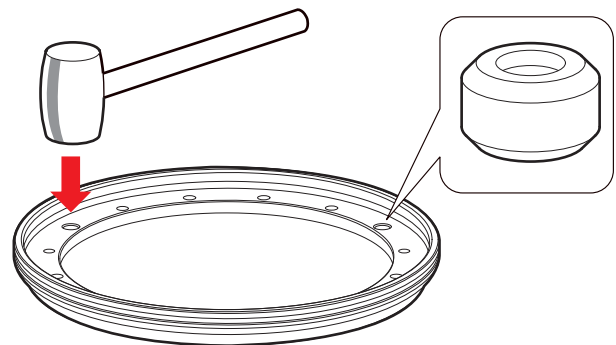
G0874611

- 2** Fitting new valve plugs on the operating slide .

- b** Carefully tap in new valve plugs, using a clean, soft-faced hammer.



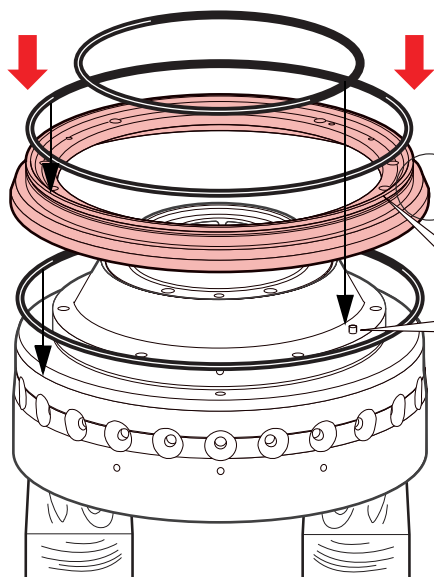
Make sure that the plugs are fitted as described in the illustration.



G0874871

3 Fitting the operating slide.

- a** Apply a thin layer of silicone grease and fit the rectangular ring on the operating slide and the rectangular ring and O-ring on the bowl body.



- b** Fit the operating slide.

NOTE

The guide pin in the bowl body should enter the hole in the operating slide (this hole is marked with a drill mark).

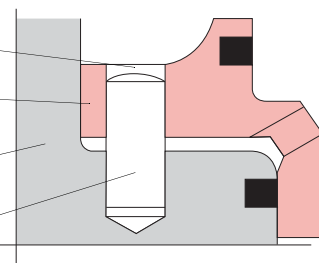
Nozzle secured with Loctite 222

Alignment hole

Operating slide

Bowl body

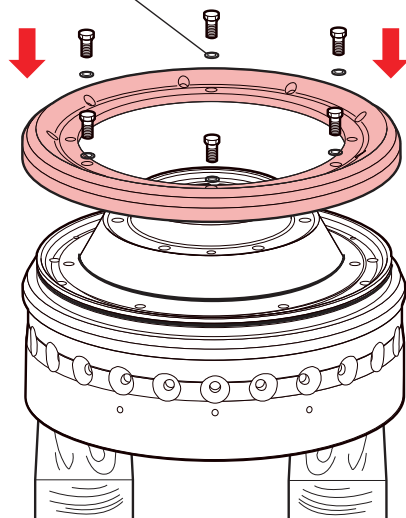
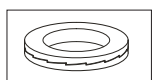
Guide pin



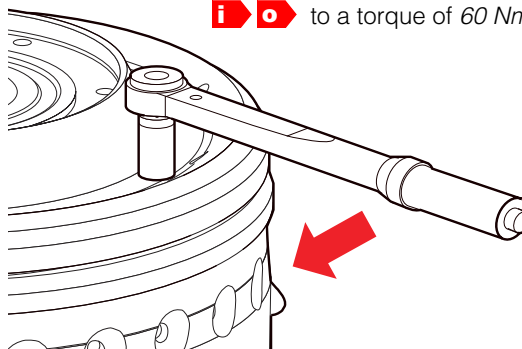
G0861241

4 Fitting the operating slide holder.

- a** Fit the holder over the operating slide.



- b** Apply a thin layer of molykote grease and fit and tighten new screws and washers to a torque of $60 \text{ Nm} \pm 2 \text{ Nm}$.



NOTE

Make sure that the flat surfaces of the pair-glued washers face outwards!

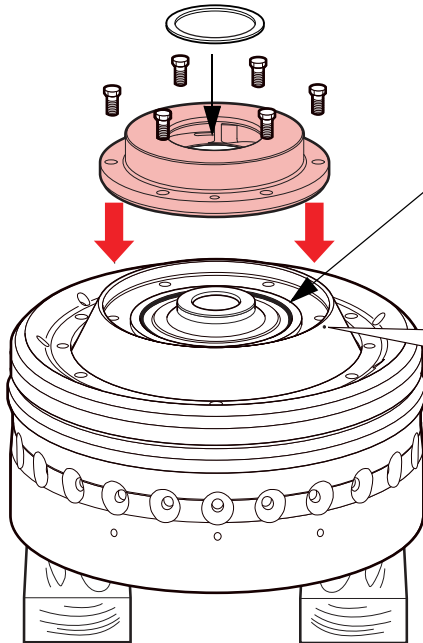
NOTE

It is very important not to refit used screws and washers. Always fit new ones included in the Inspection kit!

G0861342

5 Fitting the operating water ring.

- a** Fit the ring and screws  .

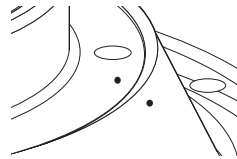


- b** Apply a thin layer of silicone grease and fit the O-ring  .

NOTE

It is very important not to refit used screws. Always fit new ones included in the Inspection kit!

- c** Fit the operating water ring.



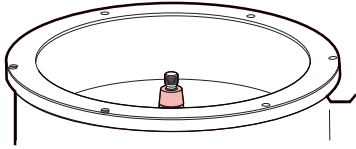
NOTE

The drilled assembly mark on the water ring should face the corresponding mark on the bowl body.

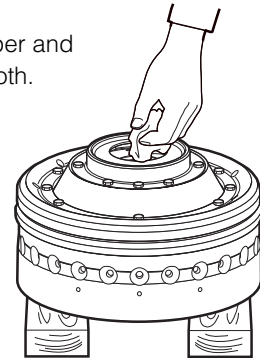
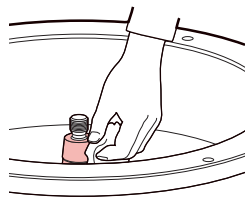
- d** Grease, fit and tighten the screws to a torque of $60 \text{ Nm} \pm 2 \text{ Nm}$.

6 Lifting the bowl body onto the spindle taper.

- a** Put a drop of oil on the spindle taper.



- b** Wipe off the spindle taper and nave bore with a dry cloth.

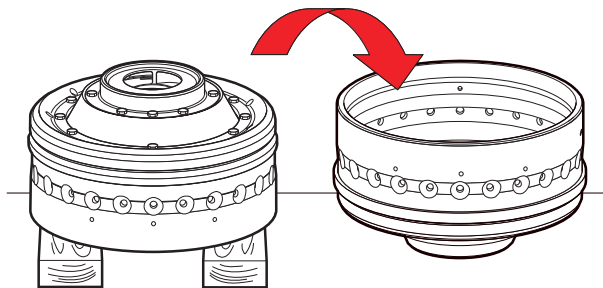


- c** Turn the bowl body over.

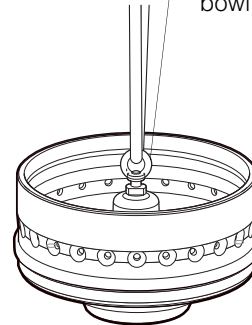


Crush hazard

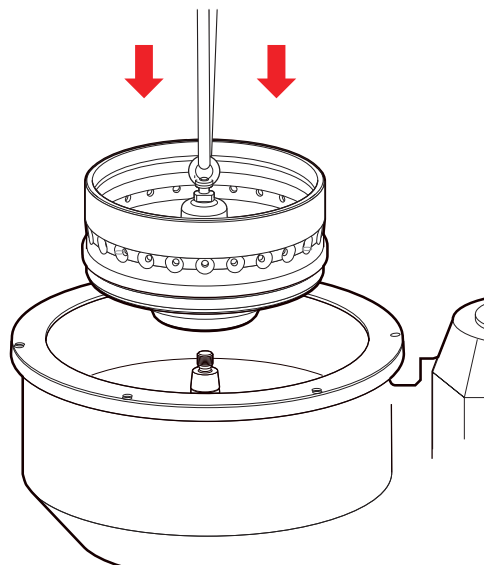
Support the bowl body when turning to prevent it from rolling.



- d** Fit the lifting tool and lift the bowl body.



- e** Carefully lower the bowl body onto the spindle taper.



- f** Remove the lifting tool.

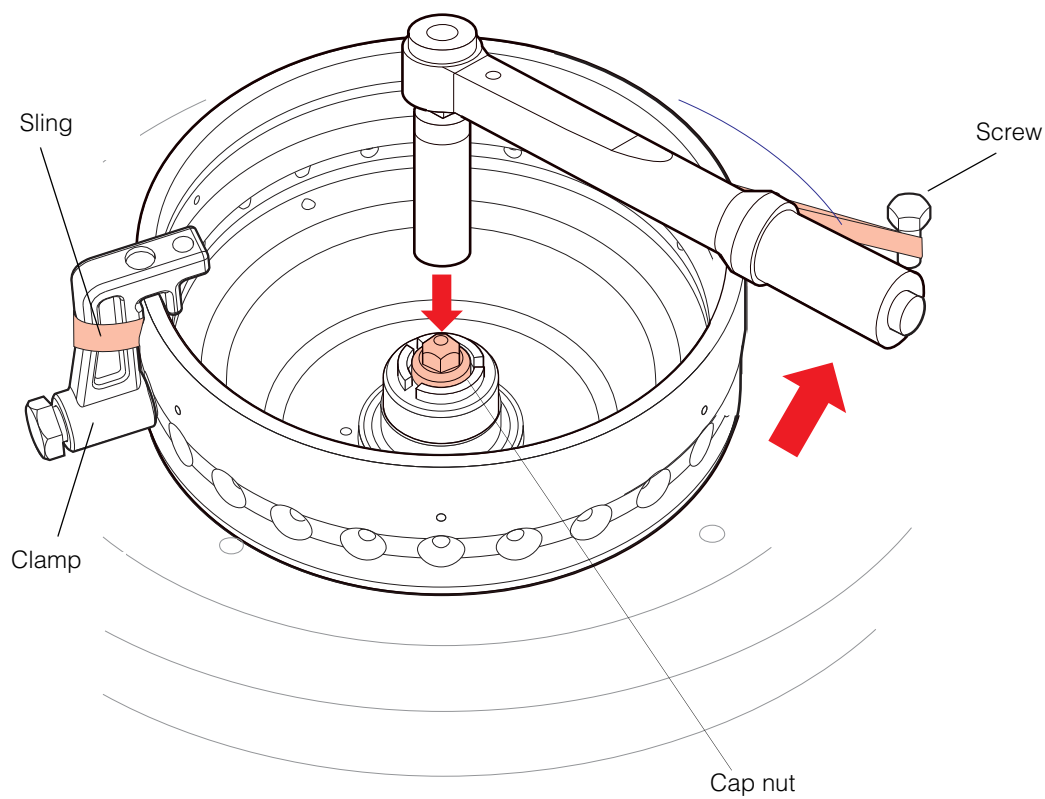
7 Fitting and tightening the cap nut.

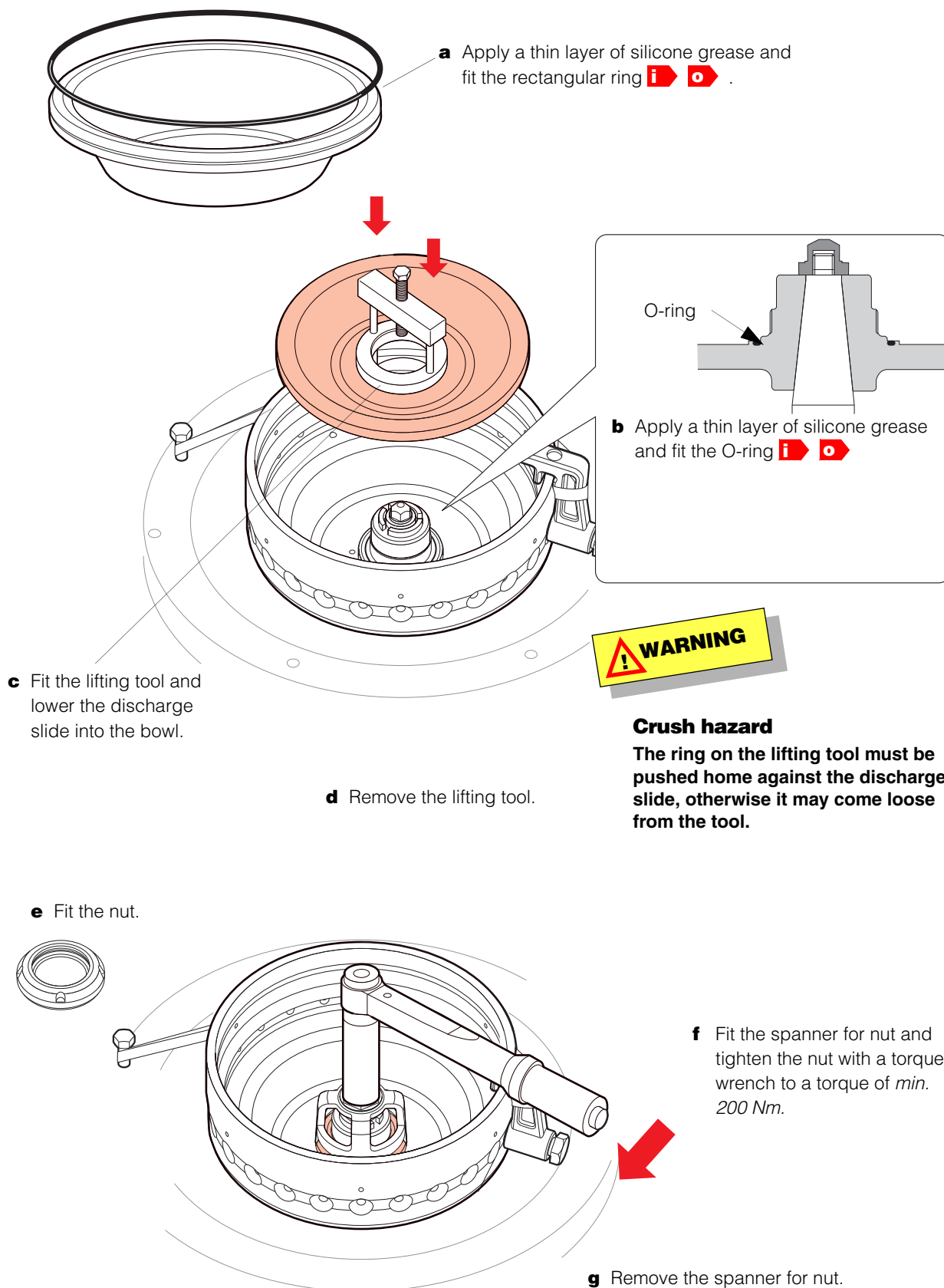
a To prevent the bowl body from rotating when fitting the cap nut; Fit one of the clamps (see page 51) to the bowl body and one of the screws for the frame hood in the frame. Fasten a sling between the clamp and the screw around the bowl body.

b Apply a thin layer of molykote grease. Fit and tighten the cap nut to a torque of 100 Nm.

NOTE

Left-hand thread!



8 Fitting the discharge slide.

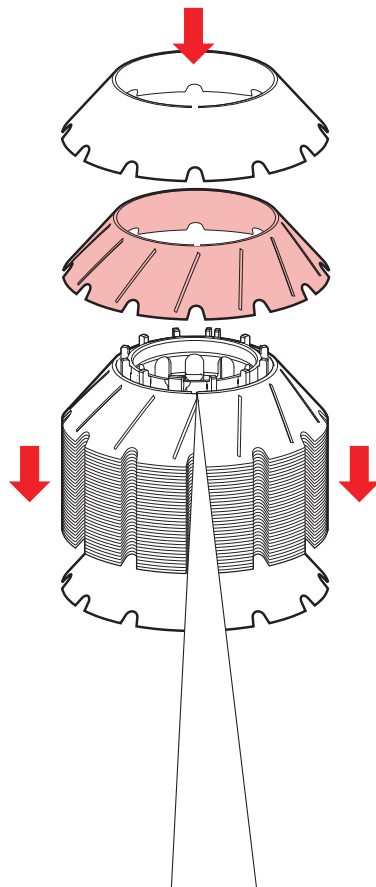
9 Assembly of the disc stack.

- a** Fit the discs one by one onto the distributor.
The distributor has a guide rib for the correct positioning of the bowl discs. Always end with the disc without caulks.



WARNING

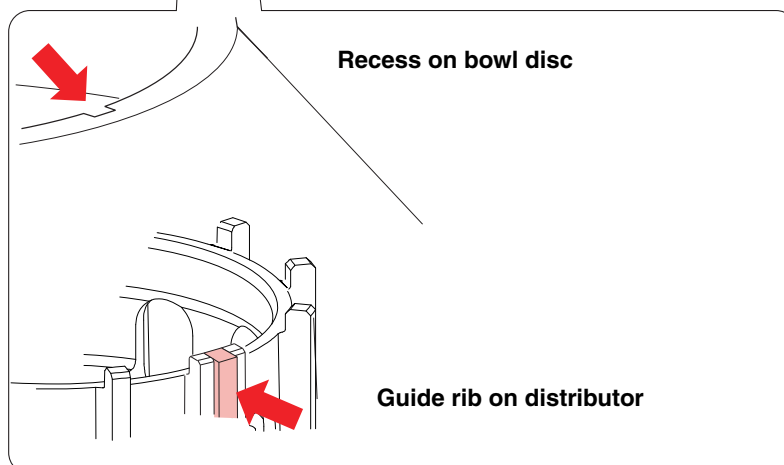
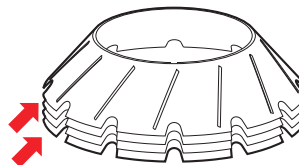
The number of discs may have to be increased to adjust the disc stack pressure. Always check before operating the separator. See *“Checking the disc stack pressure”* on page 123.

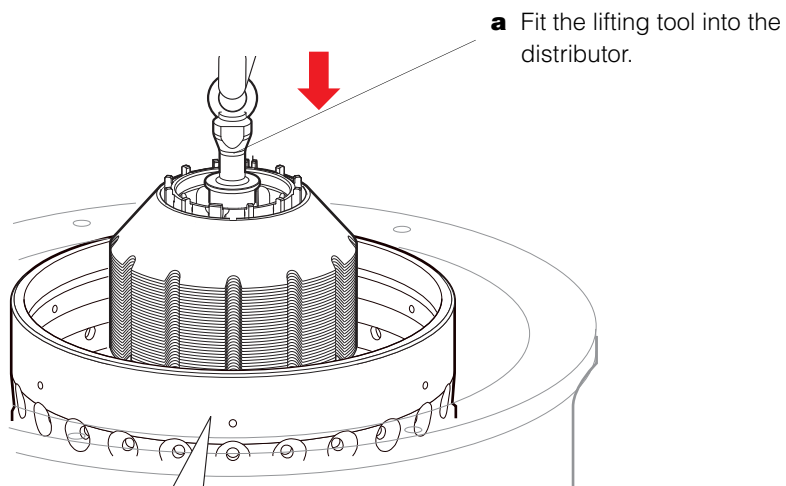


CAUTION

Cut hazard

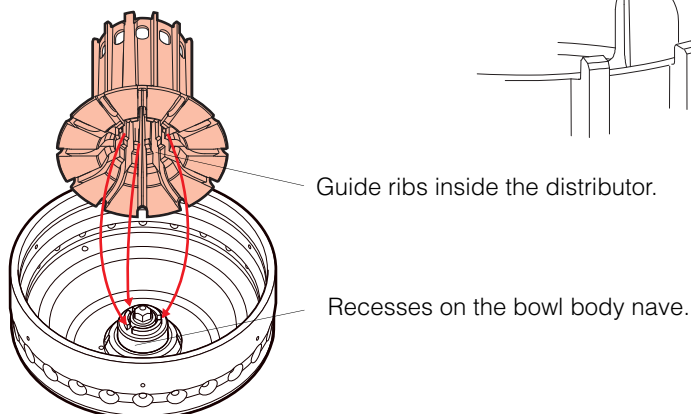
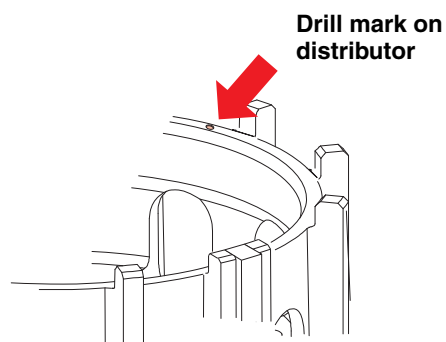
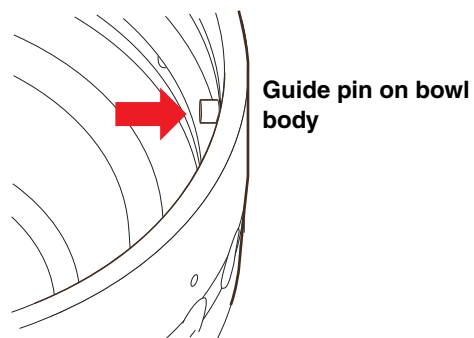
Sharp edges on the bowl discs may cause cuts.



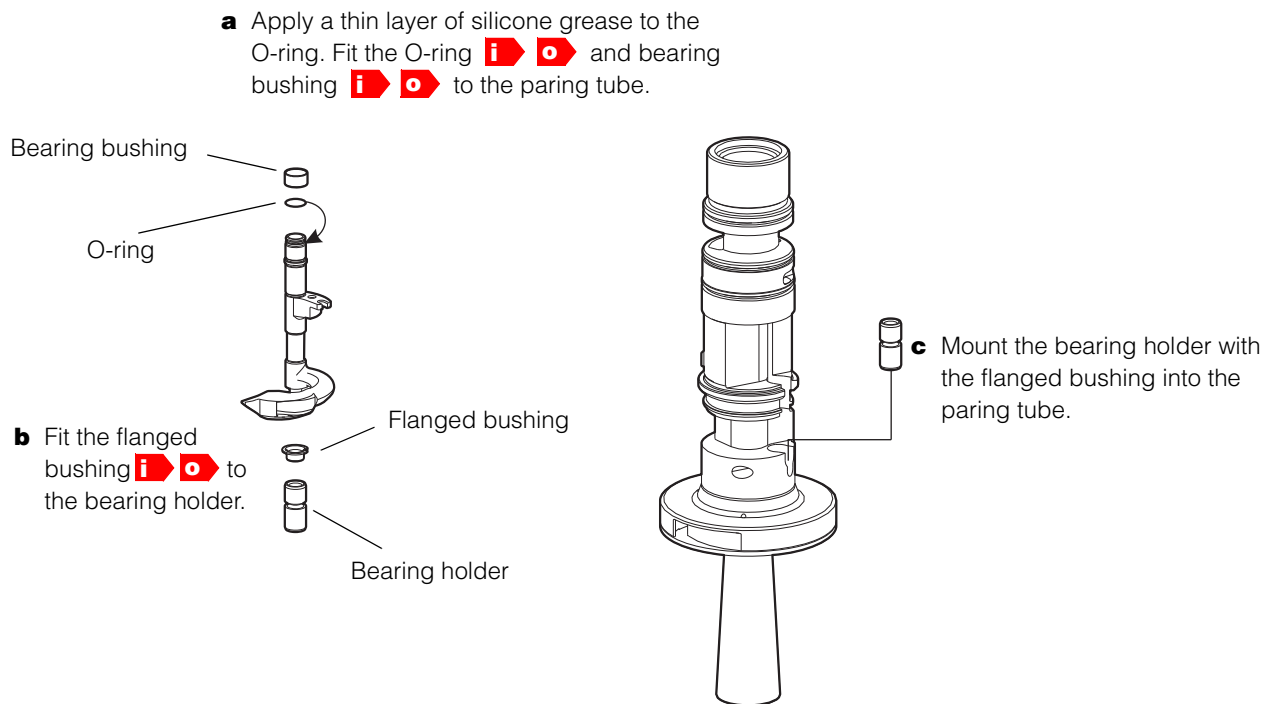
10 Fitting the disc stack assembly to the bowl body.**b** Lower the disc stack into the bowl.**NOTE**

The guide pin on the bowl body should face the drill mark on the distributor.

The guide ribs inside the distributor then enter the recesses on the bowl body nave.

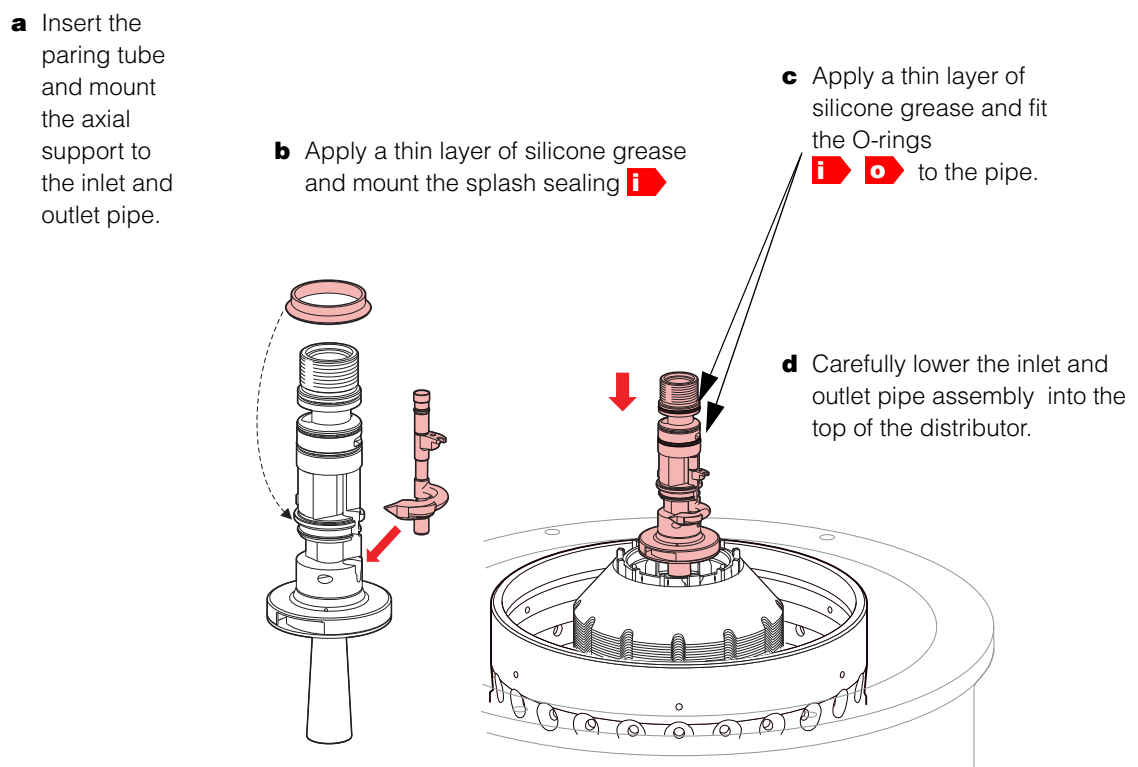


11 Assembling the paring tube and bearing holder .

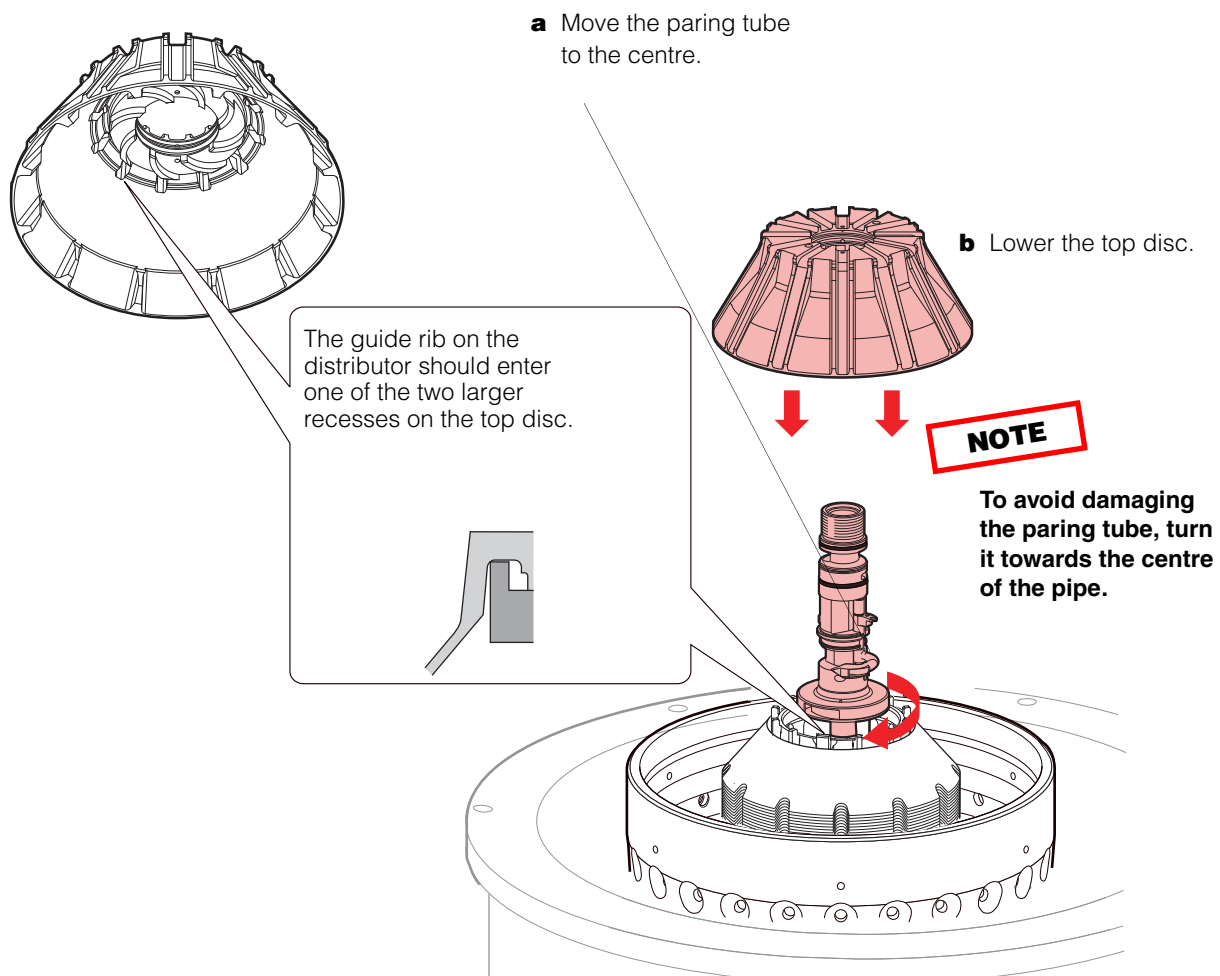


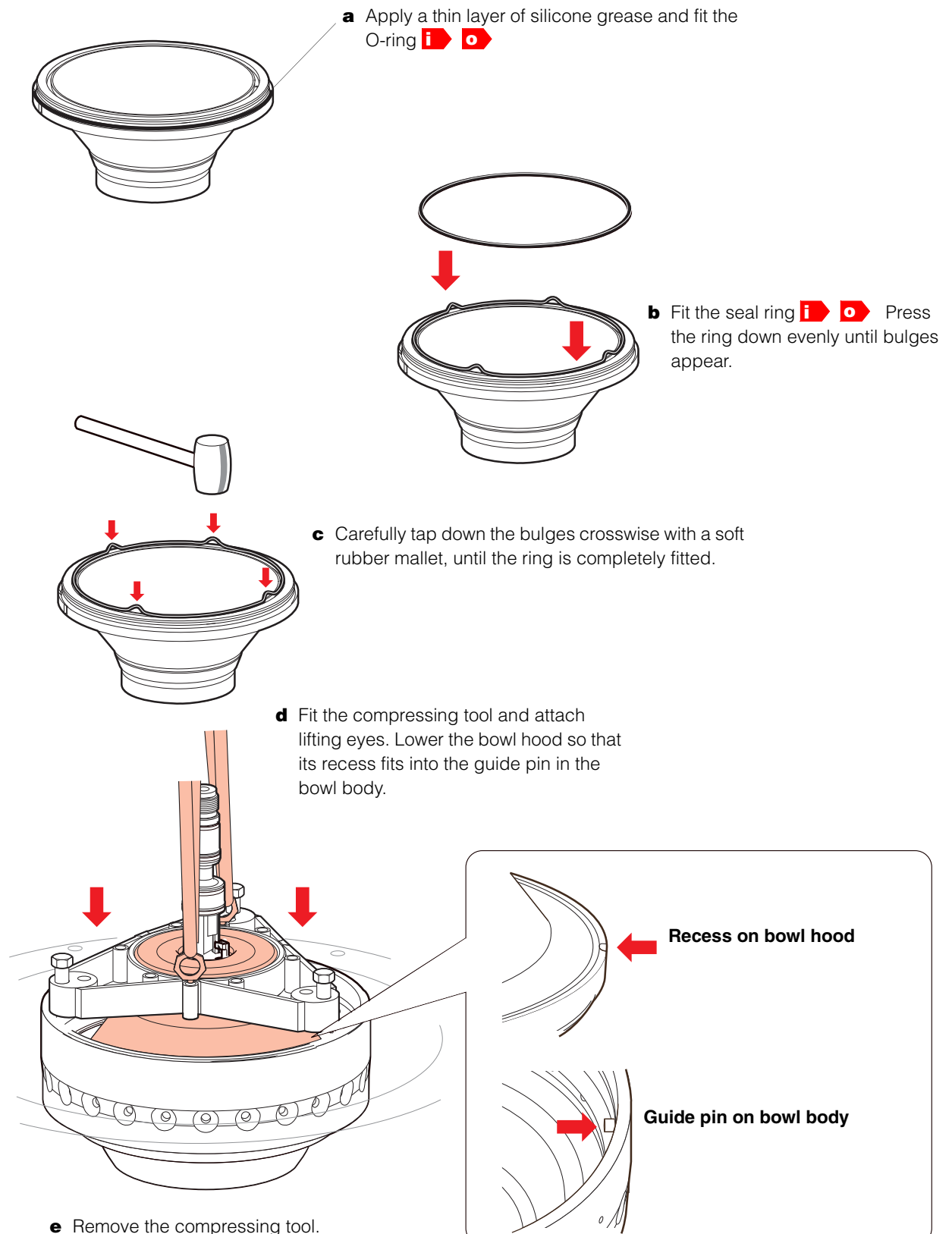
G0964931

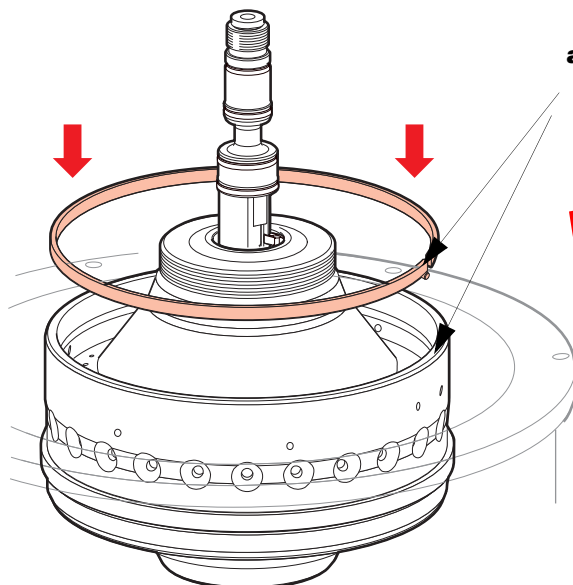
12 Mounting the paring tube and fitting the inlet and outlet pipe.



G08622L1

13 Fitting the top disc.

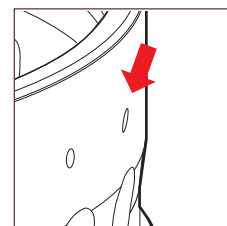
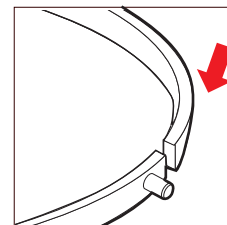
14 Fitting the bowl hood.

15 Fitting the lock ring.

- a** Place the lock ring on the bowl hood with its guide pin close to the corresponding hole in the bowl body.

NOTE

Make sure that the groove in the bowl body which retains the lock ring is clean.

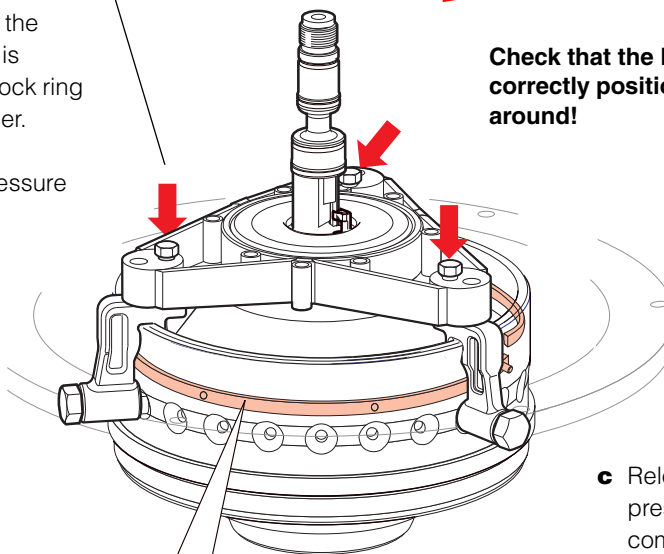


- b** Fit the complete compressing tool and compress the disc stack by alternately turning the screws a maximum of 40 Nm at a time until the lock ring fits into the bowl body. The lock ring is correctly fitted when the lock ring ends are facing each other.

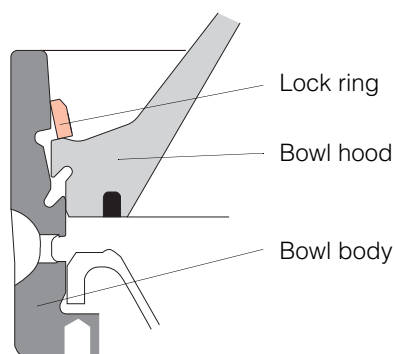
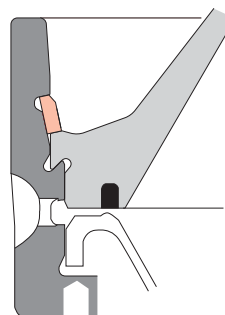
For correct disc stack pressure see [page 123](#).

NOTE

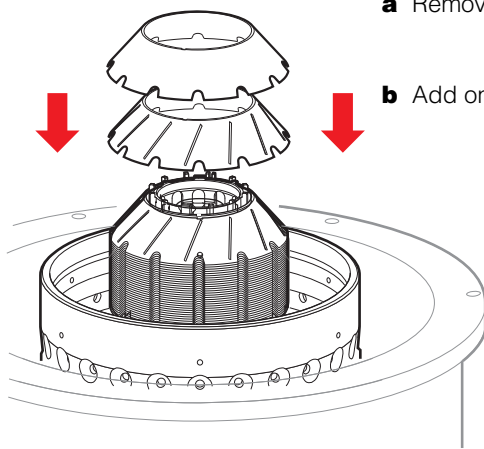
Check that the lock ring is correctly positioned all way around!

**NOTE**

Never remove any material from the lock ring. A hazardous situation could result.

**Before compressing****Lock ring in position**

- c** Release the pressure on the compressing tool and remove it.

16 Checking the disc stack pressure 

a Remove bowl hood, top disc and inlet and outlet pipe.

b Add one disc to the disc stack.

c Refit the disc without caulks, the top disc and bowl hood.

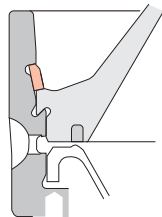
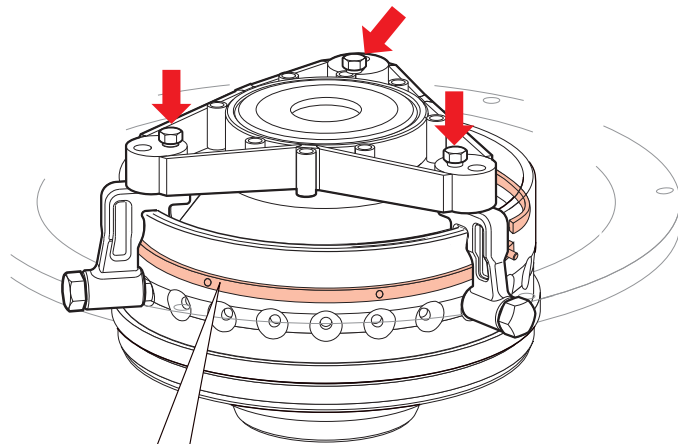
d Fit the lock ring and fully compress the disc stack with the compressing tool.

NOTE

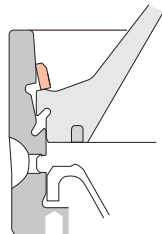
Do not use more power than 50 Nm/screw at a time, alternately.

NOTE

Always refit the disc without caulks on top of the disc stack!



e If the lock ring enters the groove, repeat a-d until the lock ring does not enter the groove.



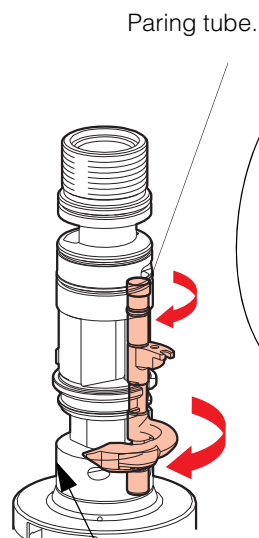
f Dismantle the bowl and remove one disc to get the correct disc stack pressure.

g Assemble the bowl with inlet and outlet pipe.

6.5.4 In and outlet device

1 Fitting the frame hood .

- a** Turn the paring tube so that the frame hood can pass.

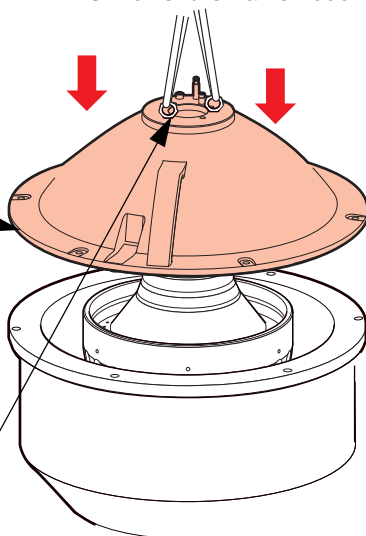


NOTE

Make sure to fit the frame hood groove and the projection of the pipe.

- b** Apply a thin layer of silicone grease and fit the O-ring onto the frame hood  .

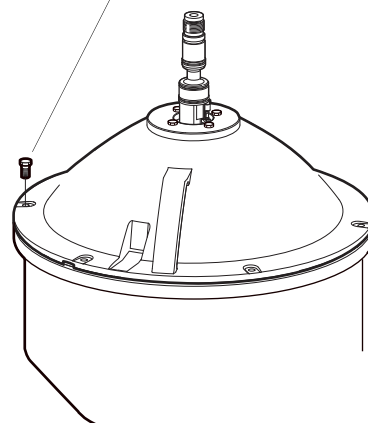
- c** Lower the frame hood.



NOTE

Make sure that the frame hood is mounted in its correct position according to the piping arrangement.

- d** Fit and tighten the screws.



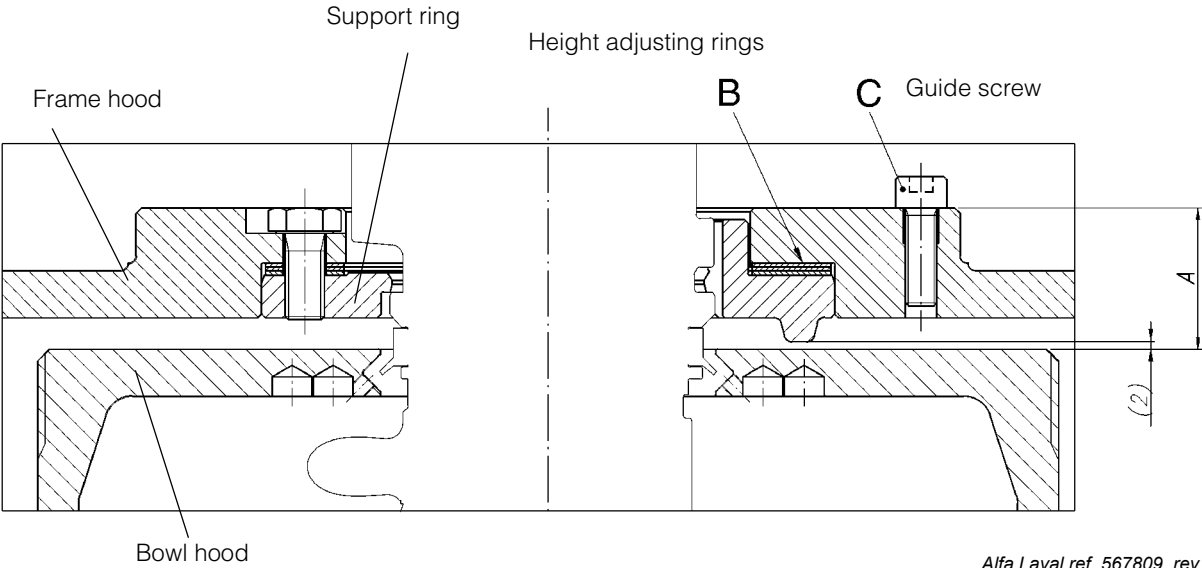
2 Control measurement of paring disc height .

a Remove the guide screw (C)

b Measure the distance A. Add or remove height adjusting rings (B) according to the table.

c Refit the guide screw (C).

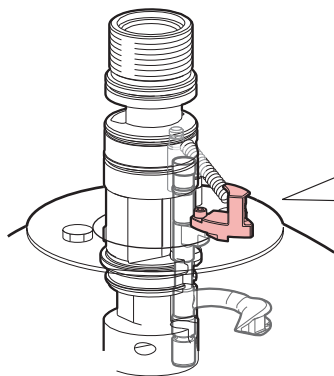
A mm	Quantity height adjusting rings
$38 \pm 0,5$	5
$37 \pm 0,5$	4
$36 \pm 0,5$	3
$35 \pm 0,5$	2
$34 \pm 0,5$	1



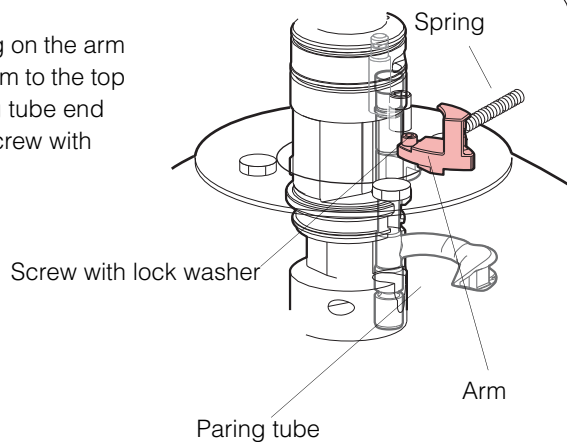
Alfa Laval ref. 567809, rev. 0

G09115C1

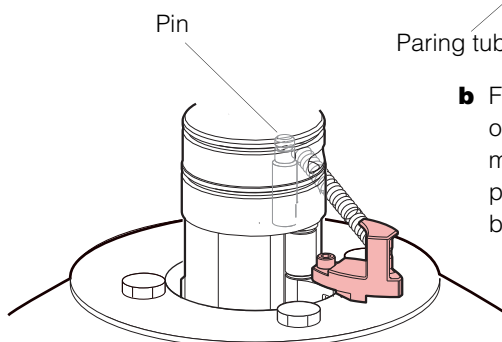
3 Fitting the spring and arm.



- a** Fit the spring on the arm and fit the arm to the top of the paring tube end and fit the screw with washer.

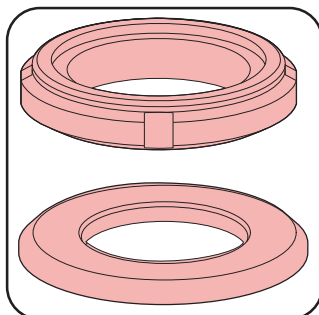


- b** Fit the spring to the pin on the frame hood and make sure that it is properly attached on both ends.



G08637A1

4 Fitting the connection housing.



- c** Lubricate the lock nut threads.

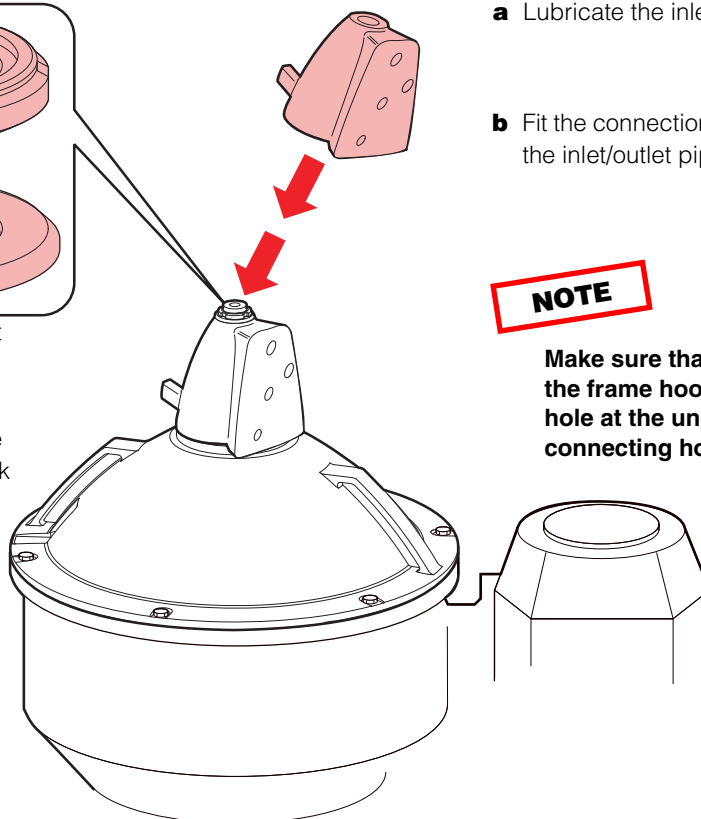
- d** Fit the washer and the lock nut using the hook spanner.

- a** Lubricate the inlet pipe thread.

- b** Fit the connection housing over the inlet/outlet pipe.

NOTE

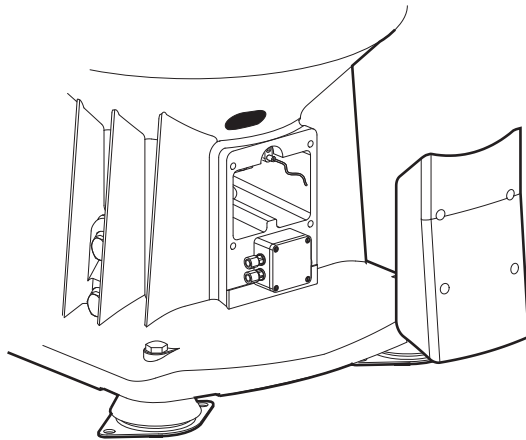
Make sure that the screw, on top of the frame hood, enters the guide hole at the underside of the connecting housing.



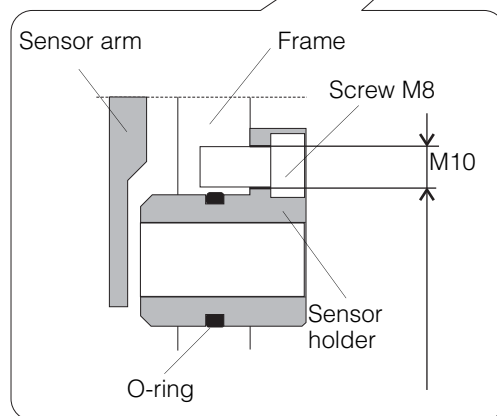
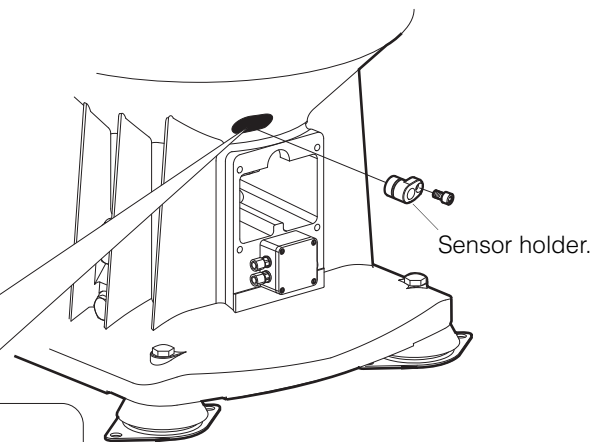
G08639A1

6.5.5 Unbalance sensor (optional)

1 Fitting the unbalance sensor holder.



a Remove the cover.



b Fit the O-ring on the holder. Fit the screw into the holder and mount the holder into the separator frame.

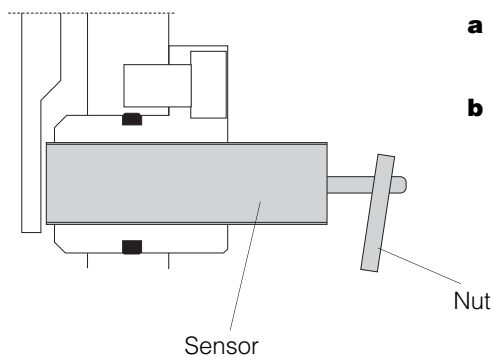
NOTE

If removing the sensor holder; use a M10 screw as a puller.

NOTE

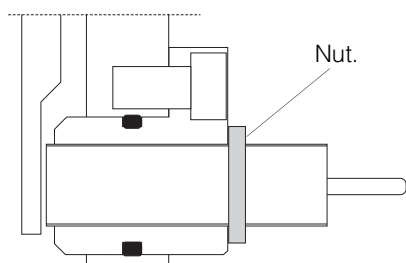
See next page for fitting and correct adjustment of the sensor.

2 Adjusting the unbalance sensor

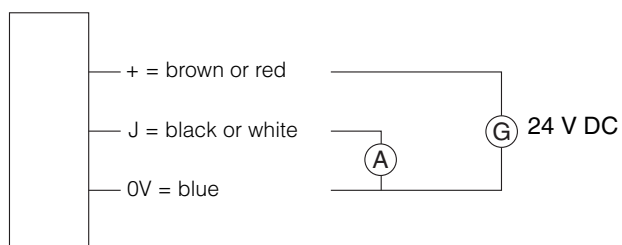


a Fit the sensor into the holder. Do not forget the nut.

b Adjust the sensor so that a value of 1,5 appears on the display.



c When correct distance is achieved tighten the nut against the holder.
Fit the cover (see previous page).

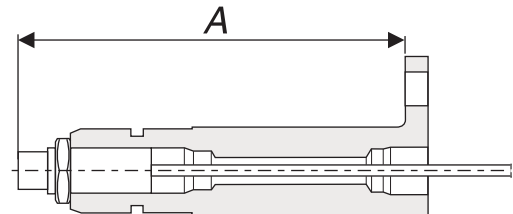


Adjustment value for the sensor is; $12 \text{ mA} \pm 1 \text{ mA}$.
For more details see *8.3 Connection List, page 153* and
752 Unbalance sensor (optional)., page 160.

6.5.6 Speed sensor

1 Adjusting the speed sensor

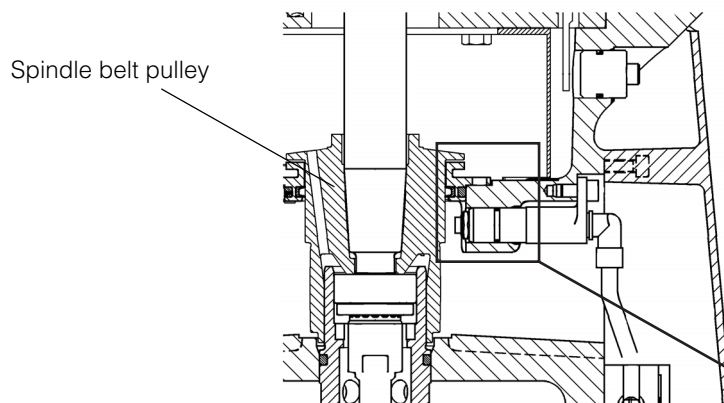
- a** Adjust the speed sensor. Distance $A = 102 \pm 0,1$ mm.
- b** Fit the sensor to the frame, see [4.4 Sensors, page 24](#).



NOTE

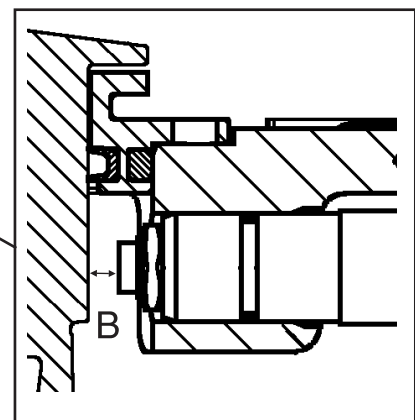
If the sensor does not work properly, check the distance between the sensor and the spindle belt pulley.

Adjust the sensor to achieve measure (B) shown below.



NOTE

The distance (B) between the sensor and the spindle belt pulley must be $2,5 \pm 0,5$ mm



6.6 Actions After Assembly

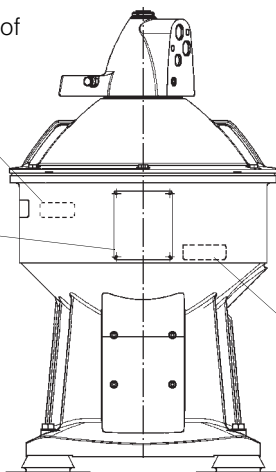
6.6.1 Control of machine plates and safety labels

Alfa Laval ref. 561498 rev. 4

1 Check that the following signs are attached.

Space for additional label for numbering of separator and function..

Machine plate

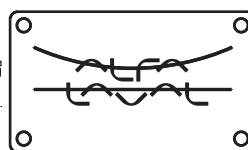
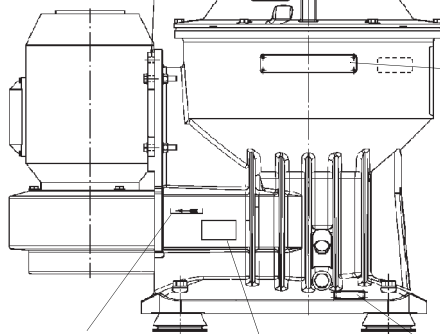


Space for label indicating representative.

Lifting instructions



Safety label.



Indicating direction of rotation of horizontal driving device.

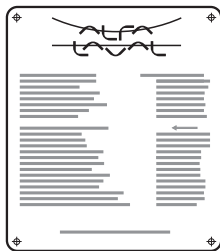


50Hz

60Hz

Oil type plate

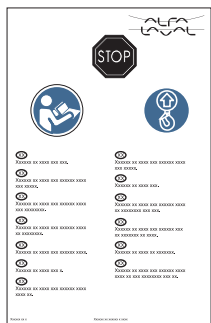
2 Check legibility. Following texts should be read on the labels.



- Separator
- Manufacturing serial No. / Year
- Product No.
- In and outlet device
- Bowl
- Machine bottom part
- Bowl speed synchronous
- Direction of rotation (bowl)
- Speed motor shaft
- El. current frequency
- Recommended motor power
- Max. density of feed
- Max. density of sediment
- Max. density of operating liquid
- Process temperature min./max.

WARNING

Read the instruction manuals **before** installation, operation and maintenance.
Consider inspection intervals.
Failure to strictly follow instructions can lead to fatal injury.
If excessive vibration occurs, **stop** separator and **keep bowl filled** with liquid during rundown.
Out of balance vibration will become worse if bowl is not full.
Separator must **stop rotating** before **any** dismantling work is started.



Read instruction manual before lifting.

6.7 Oil Change

The separator should be level and at standstill when oil is filled or the oil level is checked.

6.7.1 Lubricating oil

Do not mix different oil brands.

Always use clean vessels when handling lubricating oil.

Great attention must be paid not to contaminate the lubricating oil. Of particular importance is to avoid mixing of different types of oil. Even a few drops of motor oil mixed into a synthetic oil may result in severe foaming.

Any presence of black deposits in a mineral type oil is an indication that the oil base has deteriorated seriously or that some of the oil additives have precipitated. Always investigate why black deposits occurs.

If changing from one oil brand to another it is recommended to do this in connection with an overhaul of the separator. Clean the gear housing and the spindle parts thoroughly and remove all deposits before filling the new oil.



NOTE

Always clean and dry parts (also tools) before lubricants are applied.



CAUTION

Check the oil level before start. Top up when necessary.
Oil volume = see "Technical Data".

It is of utmost importance to use the lubricants recommended in our documentation.

This does not exclude, however, the use of other brands, provided they have equivalently high quality properties as the brands recommended. The use of oilbrands and other lubricants than recommended, is done on the exclusive responsibility of the user or oil supplier.

Applying, handling and storing of lubricants

Always be sure to follow lubricants manufacturer's instructions.

6.7.2 Check oil level

- 1 Remove the oil pin and make sure that the oil level is above the lower end of the pin.

6.7.3 Oil change procedure

- 1 Remove the oil pin, plug and washer.
- 2 Place a vessel under the drain plug.
- 3 Remove the drain plug.



Burn hazard

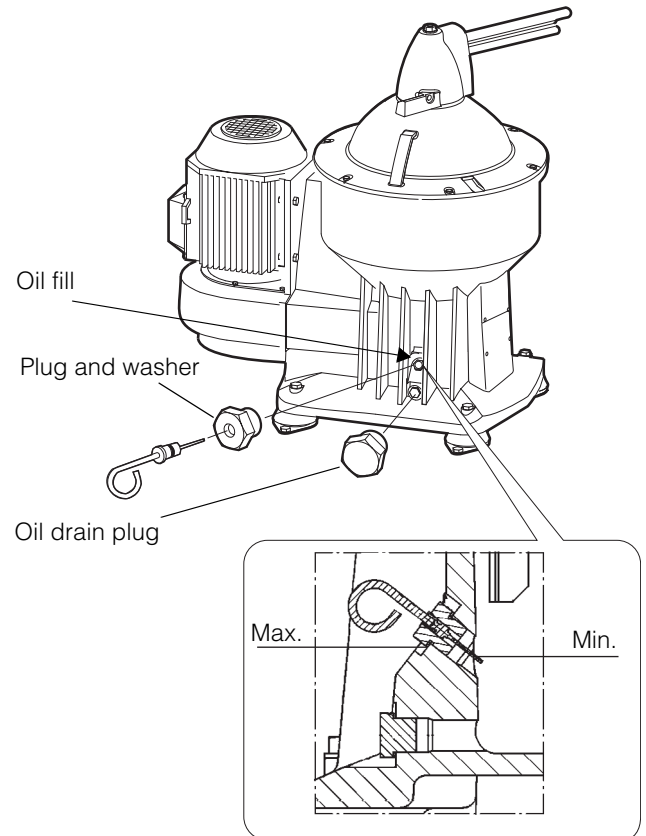
The lubricating oil and various machine surfaces can be sufficiently hot to cause burns.

- 4 Collect the oil in the vessel.
- 5 Fit and tighten the drain plug.
- 6 Fill with new oil until oil flows out of oil filler hole.



See **6.7.6 Lubricating oils, page 139.**

- 7 Fit the washer and the oil filling plug. Tighten the plug.
- 8 Fit the oil pin.



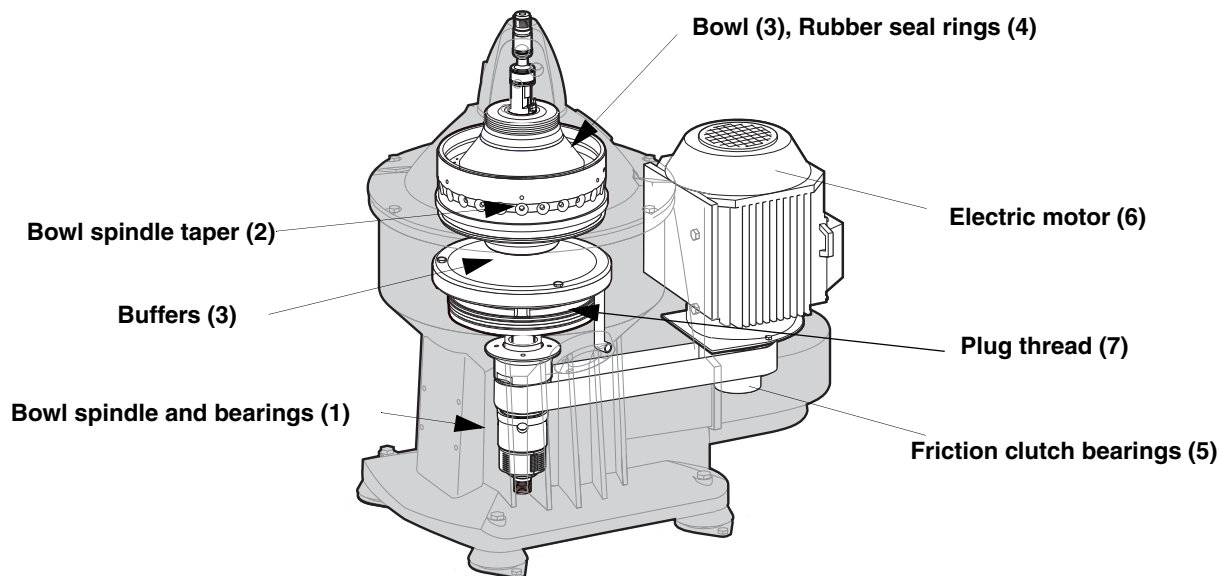
G08687H1



For Inspection service procedures; See "Fill oil in the oil sump." on page 110.

6.7.4 Lubrication chart

Alfa Laval ref. 567329-01, rev. 3



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	Lubricating points	Type of lubricant	Interval
1	The oil bath. Bowl spindle bearings are lubricated by oil mist from the oil bath.	See 6.7.1 Lubricating oil, page 132 Volume: 8.2 Technical Data, page 152 Ambient temperature 0 to +55°C	Oil change: 1. Continuous operation: 4000 hours 2. Seasonal operation: before every operating period 3. Short periods operation: 12 months even if total numbers of operating hours is less than stated above
2	Bowl spindle taper.	Lubricating oil, only a few drops for rust protection.	At assembly
3	Bowl: Sliding contact surfaces, thread of lock nut and cap nut.	Pastes specified in 6.7.5 Lubricants, page 135	At assembly.
4	Rubber seal rings.	Grease as specified in 6.7.5 Lubricants, page 135	At assembly
5	Friction clutch bearings.	The bearings are pre-lubricated with grease.	No need for extra lubrication.
6	Electric motor.	Follow the manufacturer's instructions.	Follow the manufacturer's instructions.
7	Plug thread (neck bearing assembly)	Lubricating oil.	At assembly.

NOTE

Check and pre lubricate new spindle bearings and those that have been out of service for one month or longer.
If not otherwise specified, follow the suppliers instructions about applying, handling and storing of lubricants.

CAUTION

Check the oil level before start.
Top up when necessary.
Do not overfill.
Do not check the oil level when separator is running.

6.7.5 Lubricants

Alfa Laval ref. 553217-01 rev. 14

Lubricant recommendation for hygienic and non-hygienic applications

Lubricants with an Alfa Laval part number are approved and recommended for use.

The data in the tables below is based on supplier information.

Trade names and designations might vary from country to country. Please contact your local supplier for more information.

Paste for assembly of metallic parts, non-hygienic applications:

Part No	Quantity	Designation	Manufacturer	Remark
537086-02	1000 g	Molykote 1000 Paste	Dow Corning	-
537086-03 537086-06	100 g 50 g	Molykote 1000 Paste	Dow Corning	-
537086-04	50 g	Molykote G-rapid plus Paste	Dow Corning	-
-	-	Gleitmo 705	Fuchs Lubritech	-
-	-	Wolfracoat C Paste	Klüber	-
-	-	Dry Moly Paste	Rocol	-
-	-	MTLM	Rocol	-

Bonded coating for assembly of metallic parts, non-hygienic applications:

Part No	Quantity	Designation	Manufacturer	Remark
535586-01	375 g	Molykote D321R Spray	Dow Corning	-
-	-	Gleitmo 900	Fuchs Lubritech	Varnish or spray

**Pastes for hygienic applications
(NSF registered H1 is preferred):**

Part No	Quantity	Designation	Manufacturer	Remark
-	-	Molykote D Paste	Dow Corning	-
537086-07	50 g	Molykote P-1900	Dow Corning	NSF Registered H1 (7 Jan 2004)
-	-	Molykote TP 42	Dow Corning	-
561764-01	50 g	Geralyn 2	Fuchs Lubritech	NSF Registered H1 (3 sep 2004)
-	-	Geralyn F.L.A	Fuchs Lubritech	NSF Registered H1 (2 Apr 2007) German §5 Absatz 1 LMBG approved
554336-01	55 g	Gleitmo 1809	Fuchs Lubritech	-
-	-	Gleitmo 805	Fuchs Lubritech	DVGW (KTW) approval for drinking water (TZW prüfzeugnis)
-	-	Klüberpaste 46 MR 401	Klüber	White; contains no lead, cadmium, nickel, sulphur nor halogens.
-	-	Klüberpaste UH1 84- 201	Klüber	NSF Registered H1 (26 Aug 2005)
-	-	Klüberpaste UH1 96- 402	Klüber	NSF Registered H1 (25 Feb 2004)
-	-	252	OKS	NSF Registered H1 (23 July 2004)
-	-	Foodlube Multi Paste	Rocol	NSF Registered H1 (13 Apr 2001)

Silicone grease/oil for rubber rings, hygienic and non-hygienic applications

Part No	Quantity	Designation	Manufacturer	Remark
-	-	No-Tox Food Grade Silicone grease	Bel-Ray	NSF Registered H1 (16 December 2011)
-	-	Dow Corning 360 Medical Fluid	Dow Corning	Tested according to and complies with all National Formulary (NF) requirements for Dimethicone and European Pharmacopeia (EP) requirements for Dimeticone or Silicone Oil Used as a Lubricant, depending on viscosity.
569415-01	50 g	Molykote G 5032	Dow Corning	NSF Registered H1 (3 June 2005)
-	-	Geralyn SG MD 2	Fuchs Lubritech	NSF Registered H1 (30 March 2007)
-	-	Chemplex 750	Fuchs Lubritech	DVGW approved according to the German KTW- recommendations for drinking water.
-	-	Paraliq GTE 703	Klüber	NSF Registered H1 (25 Feb 2004). Approved according to WRAS.
-	-	Unisilikon L 250 L	Klüber	Complies with German Environmental Agency on hygiene requirements for tap water. Certified by DVGW- KTW, WRAS, AS4020, ACS.
-	-	ALCO 220	MMCC	NSF Registered H1 (25 March 2002)
-	-	Foodlube Hi-Temp	Rocol	NSF Registered H1 (18 April 2001)

Greases for ball and roller bearings:**NOTE**

Always follow the specific recommendation for lubrication as advised by the manufacturer.

Part No	Quantity	Designation	Manufacturer	Remark
-	-	Energrease LS2	BP	-
-	-	Energrease LS-EP2	BP	-
-	-	Energrease MP-MG2	BP	-
-	-	APS 2	Castrol	-
-	-	Spheerol EPL 2	Castrol	-
-	-	Multifak EP2	Chevron	-
-	-	Multifak AFB 2	Chevron	-
-	-	Molykote G-0101	Dow Corning	-
-	-	Molykote Multilub	Dow Corning	-
-	-	Unirex N2	ExxonMobil	-
-	-	Mobilith SHC 460	ExxonMobil	-
-	-	Mobilux EP2	ExxonMobil	-
-	-	Lagermeister EP2	Fuchs Lubritech	-
-	-	Rembrandt EP2	Q8/Kuwait Petroleum	-
-	-	Alvania EP 2	Shell	-
-	-	LGEP 2	SKF	-
-	-	LGMT 2	SKF	-
-	-	LGFP 2	SKF	NSF Registered H1 (17 Aug 2007)
-	-	Multis EP2	Total	-

6.7.6 Lubricating oils

Alfa Laval ref. 567330-02, rev. 6

Mineral lubricating oil HM/HV 100 (Alfa Laval oil group A)

Trade names and designations might vary from country to country. Please contact your local supplier for more information.

Recommended oil brands (general demands)

Manufacturer	Designation
Alfa Laval	567335-01 1 litre 567335-02 4 litres
BP	Castrol Hyspin ZZ 100 Castrol Hyspin AWS 100
Chevron	Glass Machine oil AW 100 Clarity Machine oil 100 Rando HD 100 (H2)
ExxonMobil	Nuto H 100 Mobil DTE 27
Q8/Kuwait Petroleum	Haydn 100
Shell	Tellus Oil S2 M 100 Tellus Oil S3 M 100
Statoil/Fuchs	HydraWay HMA 100
Total	Azolla AF 100 Azolla ZS 100

Recommended oil brands (general demands, oils for use at cold start)

These oils should be used at cold start, when the ambient temperature is below 20°C.

These oils can also be used at ambient temperatures above 20°C

Manufacturer	Designation
BP	Castrol Hyspin AWH-M 100
Chevron	Rando HDZ 100
ExxonMobil	Mobil DTE 10 Excel 100
Shell	Tellus Oil S2 V 100
Statoil/Fuchs	HydraWay HVXA 100
Total	Equivalis ZS 100 Lubmarine Visga 100

Recommended oil brands (special hygienic demands)

Conform to U.S. Food and Drug Administration (FDA) requirements of lubricants with incidental food contact, Title CFR 21 178.3570, 178.3620 and/or those generally regarded as safe (US 21 CFR 182).

The hygienic oil on the list is in the online “NSF White Book™ Listing” at the time of the revision of this document. For more information about the NSF registration and up to date H1 registration, see [www.nsf.org \(http://www.nsf.org/business/nonfood_compounds/\)](http://www.nsf.org/business/nonfood_compounds/)

Manufacturer	Designation
Bel-Ray	No-Tox HD oil 100
Chevron	Lubricating oil FM 100
Fiske Brothers	Lubriplate FMO AW 500
Total	Nevastane EP 100

Requirements

- Viscosity grade (ISO 3448/3104) VG 100 / Viscosity index (ISO 2909) VI>95 (general demands and special hygienic demands).
Viscosity grade (ISO 3448/3104) VG 100 / Viscosity index (ISO 2909) VI>130 (general demands, oils for use at cold start).
The oil must have the correct viscosity grade. No other viscosity grade than specified should be used.
- The oil must follow the requirements in one of the standards below.

Standard (general demands and special hygienic demands)	Designation
ISO 11158 (International standard)	ISO-L-HM 100
DIN 51524 part 2 (German standard)	DIN 51524 – HLP 100

Standard (general demands, oils for use at cold start)	Designation
ISO 11158 (International standard)	ISO-L-HV 100
DIN 51524 part 3 (German standard)	DIN 51524 – HVLP 100

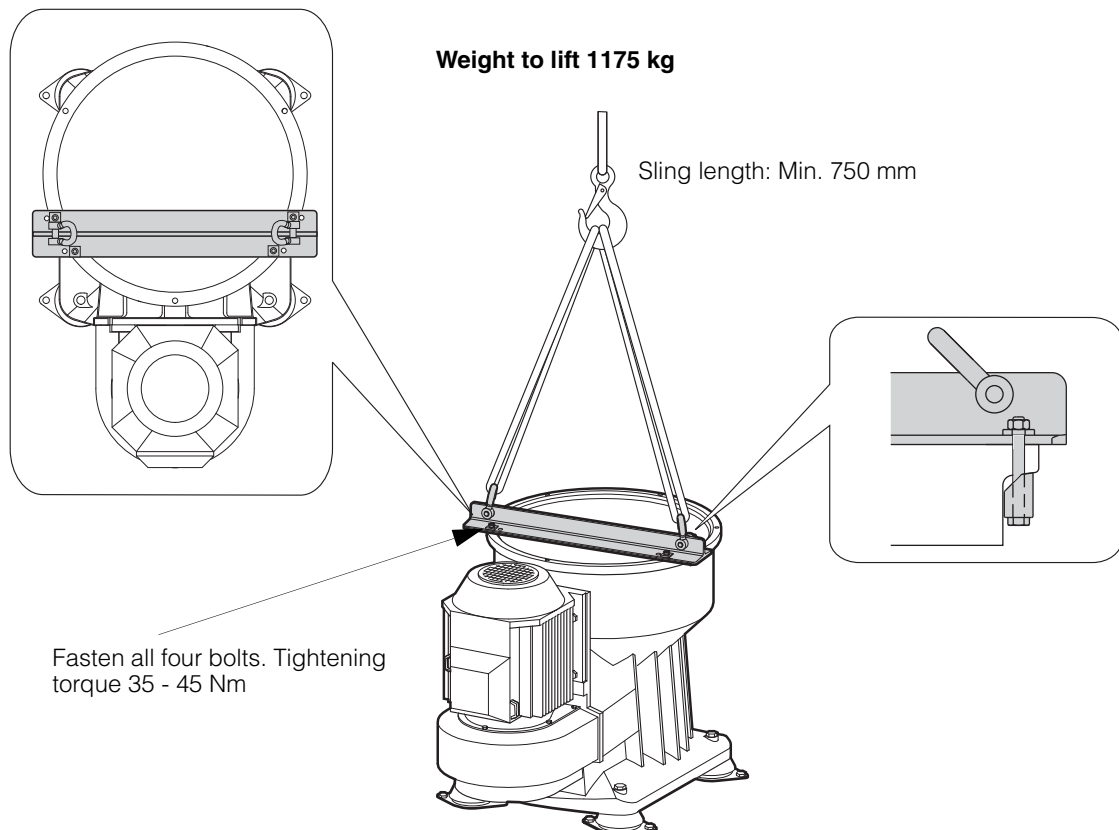
NOTE

Other oil brands may be used as long as they fulfill the requirements and have equivalent quality as the brands recommended.

6.8 Lifting instructions

Alfa Laval ref. 567333, rev. 2

6.8.1 Lifting the separator



- 1 Remove the inlet and outlet device, the frame hood and the bowl according to the instructions in [6.3 Dismantling, page 46](#).

NOTE

Never lift or transport the separator with the bowl still inside.

- 2 Disconnect all connections.
- 3 Fit the lifting tool (not included in set of tools). All four bolts on the lifting tool must be fastened to the frame.
- 4 Unscrew the foundation bolts.

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- 5** Use two lifting slings to lift the separator.
Total length of each loop: minimum 1,5 metres.
- 6** When lifting and moving the separator, follow normal safety precautions for lifting large heavy objects.



Crush hazards

A falling separator can cause accidents resulting in serious injury and damage.

Never lift the separator by any other method than described in this manual.



When lifting parts without weight specifications, always use lifting straps with the capacity of at least 500 kg.

6.8.2 Lifting the bowl

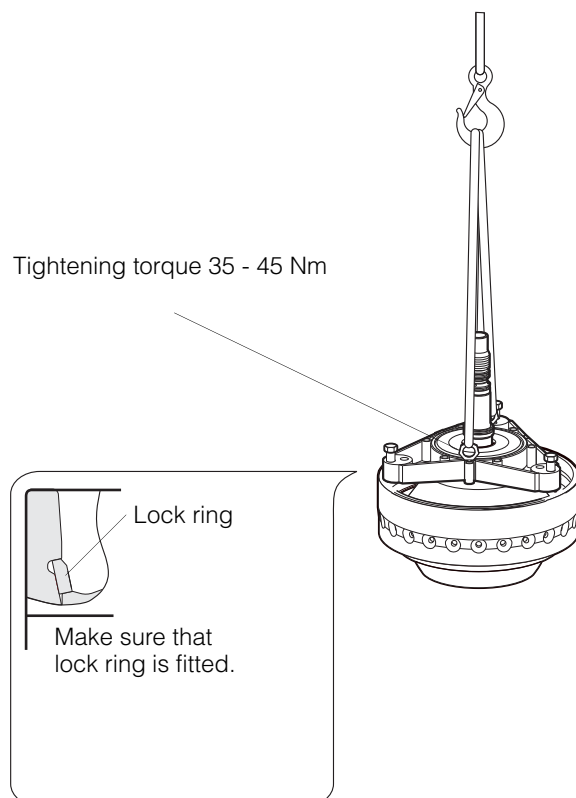
When lifting and moving an assembled bowl, always follow these instructions.

- 1** Fit the lifting tool with lifting eyes to the bowl assembly.
- 2** Check that the lock ring is mounted correctly before lifting the complete bowl.
- 3** Lift the bowl using a sling with the proper rating.



Never try to lift the bowl while it is still in the frame. The bowl body is fastened to the frame with the cap nut.

Weight to lift 360 kg



7 Fault Finding

These fault finding instructions are for the separator only.

If a fault occurs, study the System Documentation fault finding section (if applicable).

7.1 Mechanical Functions

7.1.1 Separator vibration



Disintegration hazards

If excessive vibration occurs, stop separator and keep bowl filled with liquid during rundown.

The cause of the vibration must be identified and corrected before the separator is restarted.



Some vibration is normal during the starting and stopping sequences when the separator passes through its critical speed.

Cause	Corrective action
Bowl out of balance due to: - poor cleaning - incorrect assembly - incorrect disc stack compression - bowl assembled with parts from other separators	Dismantle the separator and check the assembly and cleaning.
Uneven sludge deposits in the sludge space.	Dismantle and clean the separator bowl.
Height position of paring disc is incorrect.	Stop the separator, measure, and if necessary, adjust the height.
Bowl spindle bent.	Renew the bowl spindle.
Bearing(s) damaged or worn.	Renew all bearings.
The frame feet are worn out.	Renew the frame feet.
Spindle top bearing spring broken.	Renew all springs.

7.1.2 Smell

Cause	Corrective action
Normal occurrence during start while the friction blocks are slipping.	None. If smell continues when separator is at full speed, stop the separator and replace friction blocks.
Oil level in oil sump too low.	Check oil level and add oil if necessary.

7.1.3 Noise

Cause	Corrective action
Height position of paring disc is incorrect.	Stop the separator, measure and adjust the height.
Bearing(s) damaged or worn.	Renew all bearings.

7.1.4 Speed too low

Cause	Corrective action
Friction blocks are oily or worn.	Clean or renew friction blocks.
Bowl is not closed or leaking.	Dismantle the bowl and check.
Motor failure.	Repair the motor.
Bearing(s) damaged.	Renew all bearings.
Incorrect transmission parts (60 Hz belt pulley for 50 Hz power supply).	 WARNING Stop and change the belt transmission to suit the power supply frequency.

7.1.5 Speed too high

Cause	Corrective action
Incorrect transmission parts (50 Hz belt pulley for 60 Hz power supply).	 WARNING Stop and change the belt transmission to suit the power supply frequency.

7.1.6 Starting power too high

Cause	Corrective action
Incorrect transmission parts (60 Hz belt pulley for 50 Hz power supply).	 Stop and change the belt transmission to suit the power supply frequency.
Wrong direction of rotation.	Change electrical phase connections to the motor.

7.1.7 Starting power too low

Cause	Corrective action
Incorrect transmission parts (50 Hz belt pulley for 60 Hz power supply).	 Stop and change the belt transmission to suit the power supply frequency.
Friction blocks are oily or worn.	Clean or renew friction blocks.
Motor failure.	Repair the motor.

7.1.8 Starting time too long

Cause	Corrective action
Friction blocks are oily or worn.	Renew or clean friction blocks.
Height position of paring disc is incorrect.	Stop, check and adjust the height.
Motor failure.	Repair the motor.
Bearing(s) damaged or worn.	Renew all bearings.

7.2 Separating Functions

7.2.1 Bowl opens accidentally during operation

Cause	Corrective action
Strainer in the operating water supply is clogged.	Clean the strainer.
No water in the operating water system.	Check the operating water system and make sure the valve(s) are open.
Hoses between the supply valves and separator are incorrectly fitted.	Correct.
Nozzle in operating slide clogged.	Clean the nozzle.
Rectangular ring in discharge slide is defective.	Renew the rectangular ring.
Valve plugs are defective.	Renew all plugs.
Supply valve for opening water is leaking.	Rectify the leak.

7.2.2 Bowl fails to open for sludge discharge

Cause	Corrective action
Strainer in the operating water supply is clogged.	Clean the strainer.
Water flow too low.	Check the water flow
Hoses between the supply valves and separator are incorrectly fitted.	Correct.
Nozzle in operating slide missing.	Fit the nozzle.
Rectangular ring in the operating slide or bowl body is defective.	Renew the rectangular rings.

7.2.3 Unsatisfactory separation result

Cause	Corrective action
Incorrect separation temperature.	Adjust.
Throughput too high.	Adjust.
Disc stack is clogged.	Clean disc stack.
Sludge space in bowl is filled.	Clean and reduce the time between sludge discharges.
Bowl speed too low.	Examine the motor and power transmission including the belt transmission (clutch).
Bowl rotates i wrong direction	Check the electrical connections to the motor.

7.2.4 Bowl fails to close

Cause	Corrective action
Nozzle in operating slide clogged.	Clean nozzle.
Hoses reversed.	Adjust.
Rectangular ring in discharge slide is defective	Renew rectangular ring.
Valve plugs in operating slide missing or defective.	Renew valve plugs.
No water.	Turn on water supply.

8 Technical Reference

8.1 Product description

Alfa Laval ref. 574869, rev. 3 & 574870 rev. 3

NOTE

The separator is a component operating in an integrated system including a monitoring system.
If the technical data in the system description does not agree with the technical data in this instruction manual, the data in the system description is the valid one.

Product number: 881207-03-02/3 & 881207-02-02/2

Separator type: S 881 & S 886

Application: Cleaning of fuel oil and lube oil.

Technical design: Intended for marine- and land installations.

Total discharge.

Centrilock® lock ring.

Directives and standards:

See *8.1.1 Directives and standards, page 150*

Operational limits:

Feed temperature: 0°C to 100°C

Ambient temperature: 5°C to 55°C

Discharge intervals: min. 2 minutes max. 4 hours.

Maximum allowed density of operating liquid:
1000 kg/m³.

Viscosity max. 700 cSt at 50°C.

Not to be used for liquids with flashpoint below 60°C.

Risk for corrosion and erosion have to be investigated in each case.

Remote restart allowed under certain conditions, see Interface description.

8.1.1 Directives and standards

Alfa Laval ref. 589765, rev. 6

This declaration is issued under the sole responsibility of the manufacturer.

Manufacturer:.....

Manufacturer address:.....

Separator type:.....

Product specification:.....

Configuration number:.....

Serial number:.....

Declaration of Incorporation of Partly Completed Machinery

The machinery complies with the relevant, essential health and safety requirements of:

Designation	Description
2006/42/EC	Machinery Directive

To meet the requirements the following standards have been applied:

Designation	Description
EN 125 47	Centrifuges - Common safety requirements
EN 60204-1	Safety of machinery - Electrical equipment of machines. Part 1: General requirements
EN ISO 12100	Safety of machinery - General principles for design - Risk assessment and risk reduction

EU Declaration of Conformity

The machinery complies with the following Directives:

Designation	Description
2004/108/EC (to 2016-04-19)	Electromagnetic Compatibility Directive
2014/30/EU (from 2016-04-20)	

To meet the requirements the following standards have been applied:

Designation	Description
EN 61000-6-2	Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity for industrial environments
EN 61000-6-4	Electromagnetic compatibility (EMC) - Part 6-4: Generic standards - Emission standard for industrial environments

Declaration of Compliance

The machinery complies with:

Designation	Description
EC 1935/2004	Regulation on materials and articles intended to come into contact with food

The technical construction file for the machinery is compiled and retained by the authorized person Hans Thomasson within the Product Centre for High Speed Separators, Alfa Laval Tumba AB, SE-14780 Tumba Sweden.

This machinery is to be incorporated into other equipment and must not be put into service until it has been completed with starting/stopping equipment, control equipment, auxiliary equipment. e.g. valves, according to the instructions in the technical documentation, and after the completed machinery has been declared in conformity with the directives mentioned above, in order to fulfil the EU-requirements.

Signed for and on behalf of:

Place:

Date of issue:

Signature:

Name:

Function:

8.2 Technical Data

Alfa Laval ref. 569918, rev. 5

Subject	Value	Unit
General technical data:		
Motor power	31 / 35,6	kW (50 Hz / 60 Hz)
Jp reduced to motor	44,53 / 31,02	kg/m ²
Gear ratio	260 / 148	50Hz
Gear ratio	217 / 148	60Hz
Alarm levels for vibration monitor, connection 752, 1st/2nd	0,4 / 0,6	mm
Bowl max. inner diameter	512,5	mm
Discharge interval, min./max.	2 / 240	minutes
Max. density of operating liquid, max.	1000	kg/m ³
Max. density of feed/sediment	1100 / 2014	kg/m ³
Feed temperature, min./max.	0 / 100	°C
Max. running time without flow,		
- empty bowl	15	minutes
- filled bowl	15	minutes
Bowl body material	AL 111 2377-02	
Operating data:		
Bowl speed, synchronous	5270/5278	r/min 50Hz/60Hz
Motor speed synchronous	3000 / 3600	r/min 50Hz/60Hz
Power consumption at start-up, max.	39	kW
Power consumption idling/max. capacity:	8,2 / 31	kW
Starting time, min./max.	2 / 3,5	minutes
Stopping time min./max.	40 / 65	minutes
Sound power	9,6	Bel(A)
Sound pressure	79	dB(A)
Vibrations, separator in use	9,1	mm/s (r.m.s)
Volume and capacity data:		
Max. hydraulic capacity, bowl	38	m ³ /h
Bowl liquid volume	27,5	litres
Fixed discharge volume	26	litres
Sludge volume, efficient/total	4,1 / 11,1	litres
Lubricating oil volume	9	litres
Weight information:		
Motor drive	200	kg
Bowl	354	kg
Separator total	1525	kg

8.3 Connection List

Alfa Laval ref. 567311 rev. 2

No.	Description	Requirements/limits
201	Inlet for process liquid - Allowed temperature - Max allowed density - Allowed flow	Min. 0 °C, max. 100 °C See <i>“Technical Data” on page 152</i> Max 38 m ³ /h
206	Inlet for conditioning and displacement liquid Instantaneous flow	Fresh water 15 litres/minute
220	Outlet for light phase, clarified liquid Counter pressure	0 - 250 kPa
221	Outlet for heavy phase	No counter pressure.
222	Outlet for solid phase - Small discharge - Large discharge - Discharge frequency	Total discharge Max 24 discharge/h. The outlet from the cyclone must always be arranged to prevent the cyclone from being filled up with sludge. Solids are discharged by gravity.
375	Inlet for discharge and make-up liquid - Quality requirements - Max density - Pressure Make-up liquid - Flow (momentary) - Consumption - Interval - Time Discharge liquid - Flow - Consumption - Time Closing liquid - Flow - Consumption - Time Start up closing liquid - Flow - Time	See page 166. Max. 1000 kg/m ³ Min. 150 kPa 2,8 litres/minute 1,7 litres/hour 5 minutes 3 seconds 11 litres/minute 0,55 litres/discharge 3 seconds 2,8 litres/minute 2,8 litres/discharge 60 seconds 11 litres/minute 25 seconds

462	Drain of frame top section, lower	
701	Motor for separator Allowed frequency variation: (momentarily during 5 seconds)	$\pm 5\%$ $\pm 10\%$
740	Speed sensor for bowl spindle - Type - Supply voltage, nominal - With sensor activated (near metal) - With sensor not activated (far from metal) - Number of pulses per revolution	See page 159 . Inductive proximity switch 8 V Less or equal to 1,2 mA. More or equal to 2,1 mA. 1
752	Position transducer for bearing holder - Type - Supply voltage - Operation range (mild steel) - Output voltage within sensing range - Load resistance, R_L	See page 160 . Inductive analogue sensor 15 to 30 V DC $3,5 \pm 0,25$ mm 4 to 20 mA 1 kOhm max.
760	Cover interlocking switch - Type - Switch rating, resistive load max.	Mechanical limit switch 3 A (at 48 V DC) 1 A (at 220 V AC)

8.4 Interface Description

Alfa Laval ref. 564834 rev. 3

8.4.1 Scope

This document gives information, requirements, and recommendations about operational procedures and signal processing for safe and reliable operation of the separator. It is intended to be used for designing auxiliary equipment and control systems for the separator.

8.4.2 References

This Interface Description is one complementary document to the separator. Other such documents that contain necessary information and are referred to here are:

- *Interconnection diagram*
- *Connection List*
- *Technical Data*

Standards referred to are:

- EN 418 Safety of machinery - Emergency stop equipment, functional aspects - Principles of design
- EN 1037 Safety of machinery - Prevention of unexpected start-up
- EN 954-1 Safety of machinery - Safety related parts of control systems - Part 1 General principles for design.

8.4.3 Definitions

For the purpose of this document, the following definitions apply:

- Synchronous speed: The speed the machine will attain when it is driven by a three phase squirrel-cage induction motor and there is no slip in the motor and the drive system.
- Full speed: The synchronous speed minus normal slip.

8.4.4 Goal

To eliminate situations that can cause harm, i.e. injury, damage to health or property and unsatisfactory process result are e.g.:

Situation	Effect
Unbalance caused by uneven sediment accumulation in the bowl.	Too high stress on bowl and bearing system which might cause harm.
Too high bowl speed.	Too high stress on bowl which might cause harm.
Access to moving parts.	Can cause injury to person who accidentally touches these parts.
Insufficient cleaning of separator.	Unsatisfactory product quality.
Bowl leakage.	Product losses.

Information and instructions given in this document aim at preventing these situations.

Control and supervision can be more or less comprehensive depending on the type of used control equipment. When a simple control unit is used it would be impossible or too expensive to include many of the functions specified here while these functions could be included at nearly no extra cost when a more advanced control unit is used. For this reasons functions that are indispensable or needed for safety reasons to protect the machine and/or personnel are denoted with *shall* while other functions are denoted with *should*.

8.4.5 Description of separator modes

For control purposes the operation of the separator should be divided into different modes.

The normally used modes are described below but other modes might exist.

It is assumed that:

- The separator is correctly assembled.
- All connections are made according to Connection List, Interconnection Diagram and Interface Description.
- The separator control system is activated.

If above conditions are not fulfilled the separator will be in *SERVICE* mode.

Stand still means:

- The power to the separator motor is off
- The bowl is not rotating.

Starting means:

- The power to the separator motor is on.
- The bowl is rotating and accelerating

Running means:

- The power to the separator motor is on.
- The bowl is rotating at full speed.
- *RUNNING* is a collective denomination for a number of sub modes which e.g. can be:
 - *STAND BY*: Separator is in a waiting mode and not producing.
 - *PRODUCTION*: Separator is fed with product and producing.
 - *CLEANING*: Separator is fed with cleaning liquids with the intention to clean the separator.

Stopping means:

- The power to the separator motor is off.
- The bowl is rotating and decelerating.
- *STOPPING* is a collective denomination for a number of sub modes which e.g. can be:
 - *NORMAL STOP*: A manually or automatically initiated stop.
 - *SAFETY STOP*: An automatically initiated stop at too high vibrations.
 - *EMERGENCY STOP*: A manually initiated stop at emergency situations. This stop will be in effect until it is manually reset.

8.4.6 Remote start

This machine may be started from a remote location under the following conditions;

- First start after any kind of service or manual cleaning must be supervised locally in order to ensure that no mistakes has been made during assembly.
- The unbalance sensor is mandatory for remote start.
- The installation must include equipment to prevent unintentional start-up from remote location when the machine is disassembled.
- The installation must include equipment to prevent unintentional start of process flow from remote location when the machine is not properly connected to the piping.

8.4.7 Handling of connection interfaces**Electrical connections***701 Separator motor:*

The separator is equipped with a 3-phase DOL - (direct on line) started motor. The separator can also be started by a Y/D starter, but then the time in Y-position must be maximized to 5 seconds.

There shall be an emergency stop circuit designed according to EN 418 and a power isolation device according to EN 1037.

There shall be a start button close to the separator that shall be used for first start after assembly of the separator.

There should be a counter to count number of running hours.

There should be a current transformer to give an analogue signal to the control unit about the motor current.

740 Speed sensor

A proximity sensor of inductive type according to Namur standard is giving a number of pulses per revolution of the bowl (see *Connection List*).

Signal processing in *STARTING*:

- The separator should be stopped automatically according to *NORMAL STOP* procedure and an alarm should be given when the accumulated time for acceleration is longer than the maximum time specified in *Technical Data*. An abnormal start time indicates some malfunction of the separator equipment and should be investigated.
- If the speed exceeds “Bowl speed, synchronous” in Technical Data with more than 5% the separator shall be stopped automatically by *NORMAL STOP* and a high speed alarm shall be given.
- The speed monitoring system shall be checked continuously (e.g by checking that pulses are coming). In case of failure indication the separator shall be stopped automatically by *NORMAL STOP* with a timer controlled stop sequence and an alarm for speed monitoring system failure shall be given.
- The acceleration should be supervised to ensure that a certain speed (e.g 250 r/min.) has been reached within a certain time (e.g 30 seconds).

Signal processing in *RUNNING*:

- If the speed exceeds “Bowl speed, synchronous” in *Technical Data* with more than 5% for a period longer than 1 minute or momentarily during maximum 5 seconds more than 10% the separator shall be stopped automatically by *NORMAL STOP* and a high speed alarm shall be given.
- If the speed falls more than 10% below the synchronous speed for a period longer than 1 minute or 15% during more than 5 seconds a low speed alarm should be given. Low speed indicates some malfunction of the separator equipment and shall be investigated.
- The speed monitoring system shall be checked continuously (e.g. by checking that pulses are coming). In case of a failure indication an alarm for speed monitoring system failure shall be given. If there is a risk of too high speed the separator shall be stopped by *NORMAL STOP*.
- The speed drop during *DISCHARGE*, compared to the measured speed immediately before, should be between 3-8% which will indicate a proper discharge.

Signal processing in *STOPPING*:

- *STAND STILL* shall be indicated when no pulses are detected within 30 seconds.
- Stopping the separator when alarm for speed monitoring system failure is active, shall cause a timer controlled stop. (See “Stop time” in *Technical Data*.)

752 Unbalance sensor (optional).

For indication of any abnormal unbalance and to be able to perform appropriate countermeasures, the separator has been equipped with a inductive analogue sensor monitoring the radial position of the top bearing seat on the separator frame. The signal from the sensor shall be monitored and two alarm levels according to the vibration alarm levels in *Technical Data* should be set.

The vibration level shall be high for 3 seconds to generate an alarm. The first level is only used to generate an alarm while the second level shall stop the machine.

The vibration monitor shall include self check function to be performed at least at initiation of *STARTING*.

If vibrations exceed the second alarm level the separator shall be stopped the quickest way possible and it shall not be restarted until the reasons for the unbalance have been found and measures to remove them have been taken.

Signal processing in *STARTING*:

If vibrations exceed the second alarm level the separator shall be stopped automatically by *SAFETY STOP*.

If the self check system triggers, an alarm shall be given and an automatic stop by *NORMAL STOP* shall be initiated.

Signal processing in *RUNNING*:

- If vibrations exceed the first alarm level an alarm should be given. Vibrations of this magnitude will reduce the expected life time of the bearings and should therefore be eliminated.
- If vibrations exceed the second alarm level the separator shall be stopped automatically by *SAFETY STOP*.
- If the self check system triggers, an alarm shall be given.

Signal processing in *STOPPING*:

- If the self check system triggers, an alarm shall be given.

Signal processing in *NORMAL STOP*:

- If vibrations exceed the second level the system shall turn over automatically to *SAFETY STOP*.

760 Cover interlocking switch (optional)

The separator is equipped with a interlocking switch to detect if the cover is mounted.

Signal processing in *STAND STILL*:

- The circuit is closed when the cover of the separator is mounted.
- The interlocking switch should be connected in such a way that starting of the motor is prevented when the separator cover is not mounted.

Signal processing in *STARTING*, *RUNNING* and *CLEANING*:

- If the circuit is broken the separator should be stopped automatically by *NORMAL STOP*. This is to minimise the risk of having access to moving parts.

Fluid connections

Complementary information is given in the document Connection List.

201 Inlet

Processing in *STAND STILL*:

- Shall be closed.

Processing in *STARTING*:

- Should be closed. Bowl will be open and empty or closed and filled depending on if start is done from *STAND STILL* or *STOPPING*.

Processing in *RUNNING*:

- Could be closed or open.

Processing in *CLEANING*:

- A sequence of cleaning liquids should be fed to the separator. The flow rate should be as high as possible and preferably not less than the production flow rate.

Processing in *NORMAL STOP* or *EMERGENCY STOP*:

- Could be closed or open but the bowl should be filled unless the stop is initiated in *STARTING*.

Processing in *SAFETY STOP*:

- Could be closed or open but the bowl shall be filled unless the stop is initiated in *STARTING*.

206 Inlet for conditioning and displacement liquid

- According to process

220, 221 and 222 Outlets

Processing in *STAND STILL*:

- Could be closed or open.

Processing in other modes:

- Shall be open.

375 Inlet for discharge and make-up liquid

Processing in all modes:

- It is recommendable to supervise the supply pressure. If pressure is too low (see Connection List), start should be interlocked and if it happens in *PRODUCTION* or *CLEANING* turn over to *STAND BY* should take place.

Signal processing in *STARTING*:

- Below 85 % of synchronous bowl speed no water supply may be made.
- When coming from *PRODUCTION* a discharge shall be initiated to remove sediments from bowl to avoid problems due to solidification, see Connection List.

Signal processing in *PRODUCTION*:

- Automatic discharges shall be initiated by timer or ALCAP system.

Signal processing in *CLEANING*:

- Automatic discharges shall be initiated by timer or CIP-control system.

Signal processing in *NORMAL STOP*:

- Discharges should not be made.
- Below 85 % of synchronous bowl speed no water supply may be made.

Signal processing in *SAFETY STOP* and *EMERGENCY STOP*:

- Discharges should not be made.
- Below 85 % of synchronous bowl speed no water supply may be made.

8.5 Demand Specification Water

Alfa Laval ref. 574487 rev. 2

Operating water is used in the separator for several different functions: e.g. to operate the discharge mechanism, to lubricate and cool mechanical seals.

Poor quality of the operating water may cause erosion, corrosion and / or operating problem in the separator and must therefore be treated to meet certain demands.

NOTE

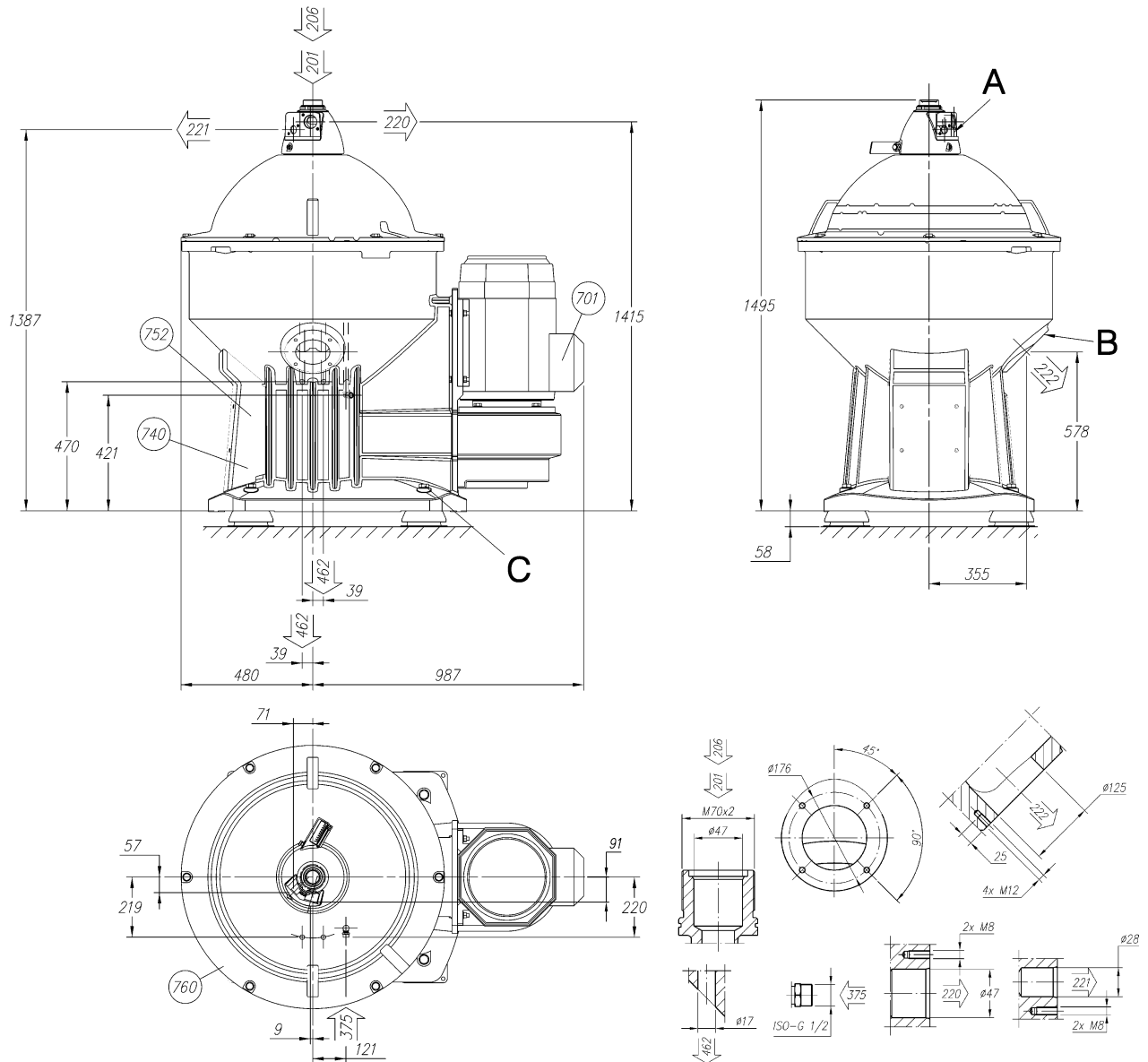
Alfa Laval accepts no liability for consequences arising from unsatisfactorily purified operating water supplied by the customer.

- 1** Turbidity-free water, solids content <0,001% by volume.
Deposits must not be allowed to form in certain areas of the separator.
- 2** A maximum particle size of 50 µm.
- 3** Total hardness less than 180 mg CaCO₃ per litre, which corresponds to 10 °dH or 12,5 °E. Hard water may with time form deposits in the operating mechanism. The precipitation rate is accelerated with increased operating temperature and low discharge frequency. These effects become more severe as the hardness of the water increases.
- 4** A chloride content of maximum 100 ppm NaCl (equivalent to 60 mg Cl/l).
A chloride concentration above 60 mg/l is not recommended.
Chloride ions contribute to corrosion on the separator surface in contact with the operating water, including the spindle. Corrosion is a process that is accelerated by increased separating temperature, low pH, and high chloride ion concentration.
- 5** 6,5 < pH < 9
Increased acidity (lower pH) increases the risk for corrosion; this is accelerated by increased temperature and high chloride ion content.
- 6** A bicarbonate content (HCO₃) of minimum 70mg HCO₃ per litre, which corresponds to 3.2 °dKH.

8.6 Drawings

8.6.1 Basic size drawing

Alfa Laval ref. 567307 rev. 2



Connection house, with connections 201, 220 and 221, turnable in 60° steps all around.

All connections to be installed non-loaded and flexible

All dimensions are nominal. Reservation for individual deviations due to tolerances.

Data for connection, see [8.3 Connection List, page 153](#).

A Maximum horizontal displacement at the inlet and outlet connections during operation ± 5 mm.

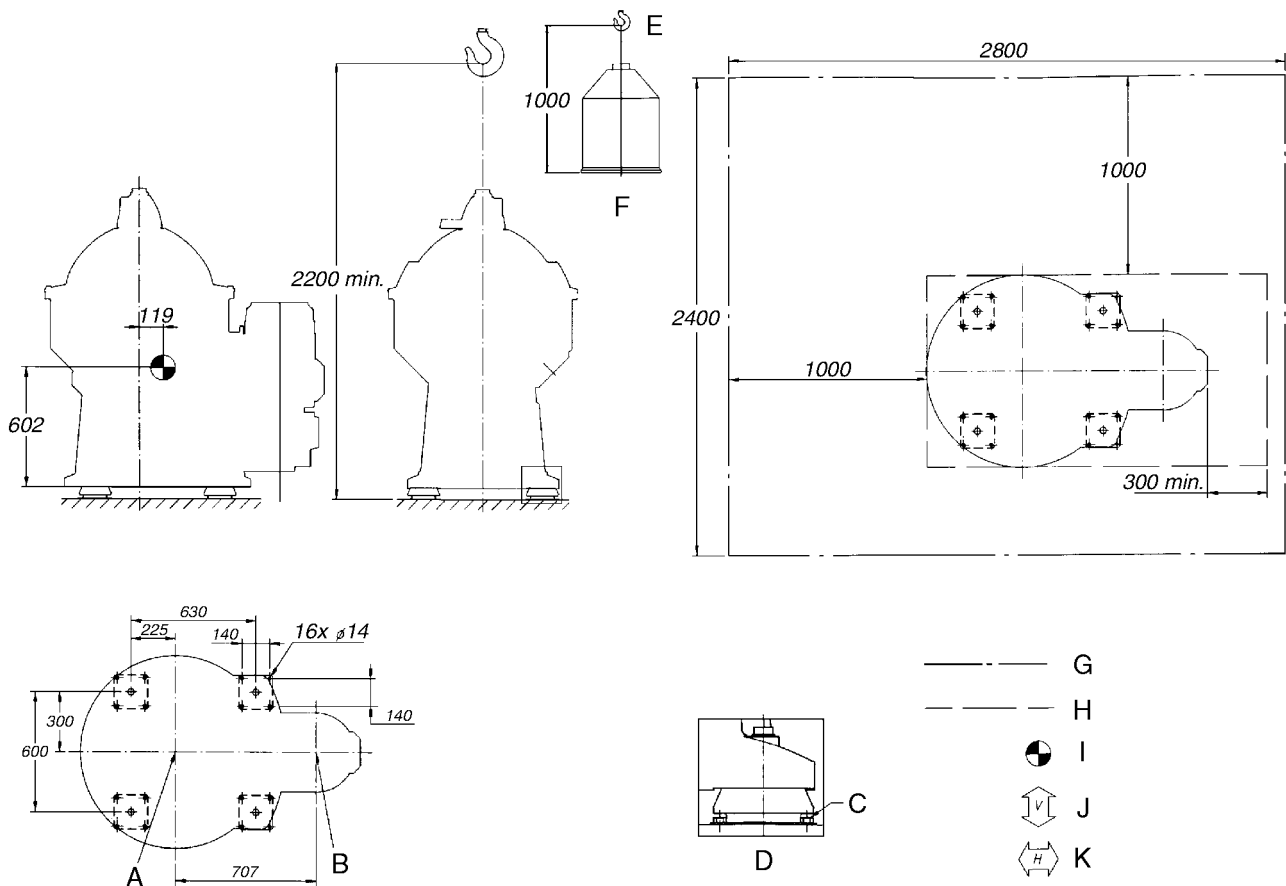
B Maximum vertical displacement at the sludge connection during operation ± 2 mm.

C Tightening torque = 160 Nm

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8.6.2 Foundation drawing

Alfa Laval ref. 567308 rev. 0

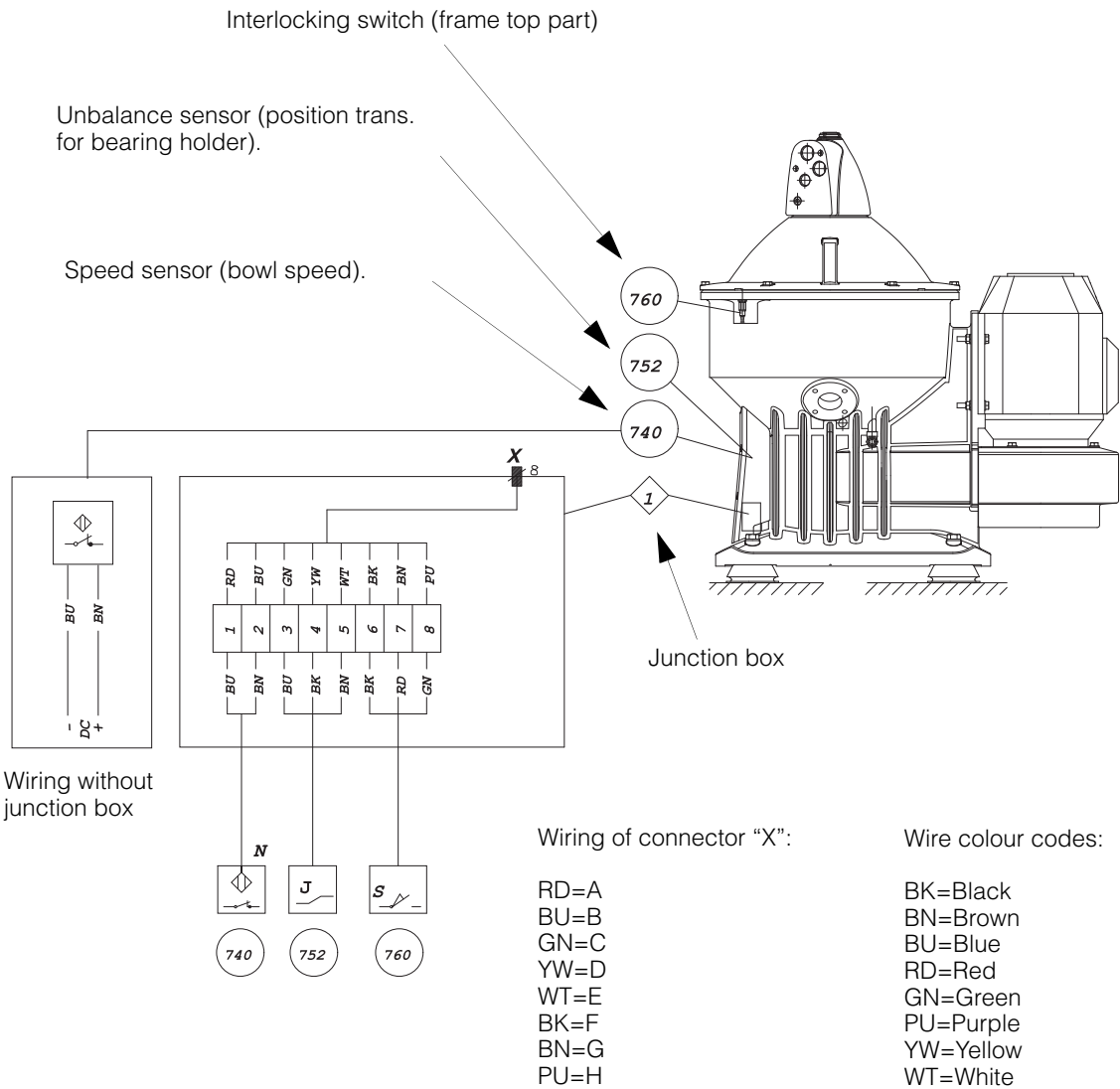


- A** Centre of separator bowl.
B Centre of motor.
C Foundation bolts.
D Installation according to stated foundation force.
 Foundation turnable 360°
E Min. lifting capacity required during service: 1500 kg.
F Max. height of largest component incl. lifting tool.
G Recommended free floor space for unloading when doing service.
H No fixed installation within this area.
I Centre of gravity (complete machine).
J Dynamic forces (static force excluded) from separator do not exceed.
 Vertical ±23,8 kN
 Horizontal ±23,8 kN
K Total foundation force (sum of all feet):
 Vertical ±23,8 kN
 Horizontal ±23,8 kN

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8.6.3 Interconnection diagram

Alfa Laval ref. 561786 rev. 5



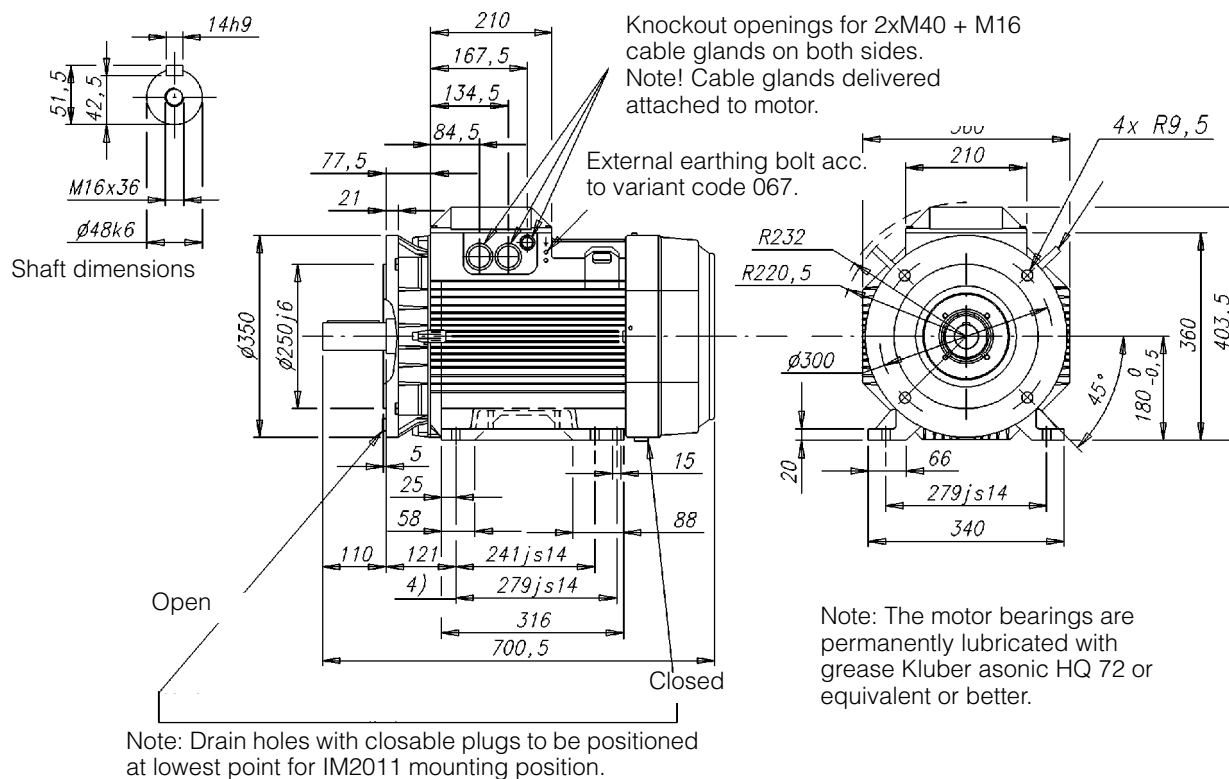
Demand specification wire
Approval: UL 1007/1569
CSA TR-64
Area acc. to AWG 18

Items showed in this document are not included in all separators. See product specification.

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8.6.4 Electric motor

Alfa Laval ref. 566151 rev. 6



G09382A1

Manufacturer	ABB Motors
Manuf. drawing	Cat. BA/Marine mot./GB 08-2001
Standards	IEC 34-series, 72, 79 and 85
Size	180 LB
Type	M3AA 180 LB
Weight	137 kg
Poles	2
Insulation class	F
Bearings  *	D-end 6310-2Z/C3 - AHQS N-end 6209-2Z/C3 - AHQS
Method of cooling	IC 411 (IEC 34-6)
Spec.	Totally enclosed three-phase motor for marine service ²⁾ Motor with feet and large flange.

* Changing of bearings, see separate manual appendix for instructions.

Type of mounting		Degree of protection
IEC 34-7		IEC 34-5
	IM 2011	IP 55

NOTE! Cast iron bearing shield in N-end

Rated output (kW) valid for temp. rise max. 90°.

Cast iron bearing shield at N-end.

Variants of these motors can be provided with heating element for 200V - 240V, acc. to variant code +451.



For complete information about motor variants, please contact your Alfa Laval representative.

9 Installation

9.1 Introduction

These installation specifications are valid for the S 881 & S 886 separator.

The installation instructions are specifications, which are compulsory requirements.

Any specific requirements from classification societies or other local authorities must be followed.

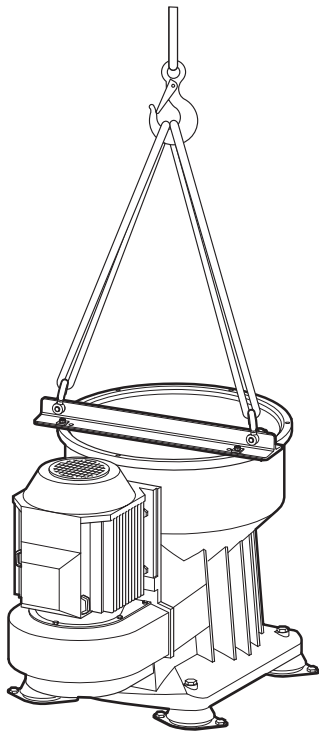
NOTE

If the specifications are not followed, Alfa Laval can not be held responsible for any malfunctions related to the installation.

9.2 Upon Arrival At The Storage Area

Ensure that the separator delivered is suitable for the application.

9.2.1 Transport



- c** During transport of the separator, the in- and outlet device, frame hood and bowl must always be removed.

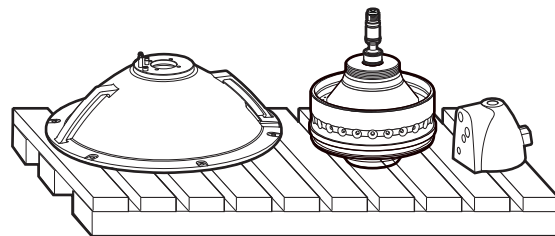
- a** When lifting the separator, make sure that tools and lifting devices are fastened securely. See chapter [6.8.1 Lifting the separator, page 141](#).



Crush hazards

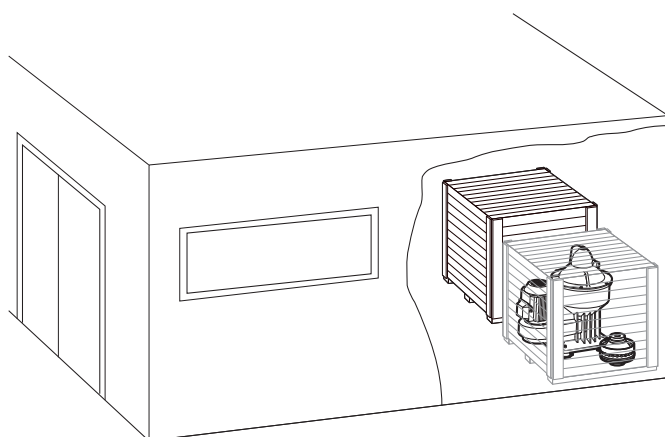
Use correct lifting tools and follow lifting instructions.

- b** When lifting the bowl see [6.8.2 Lifting the bowl, page 142](#).



9.2.2 Protection and storage of goods

- a** The separator must be stored indoors at 5 - 55 °C, if not delivered in a water-resistant box, designated for outdoor storage.



The following protection products are recommended:

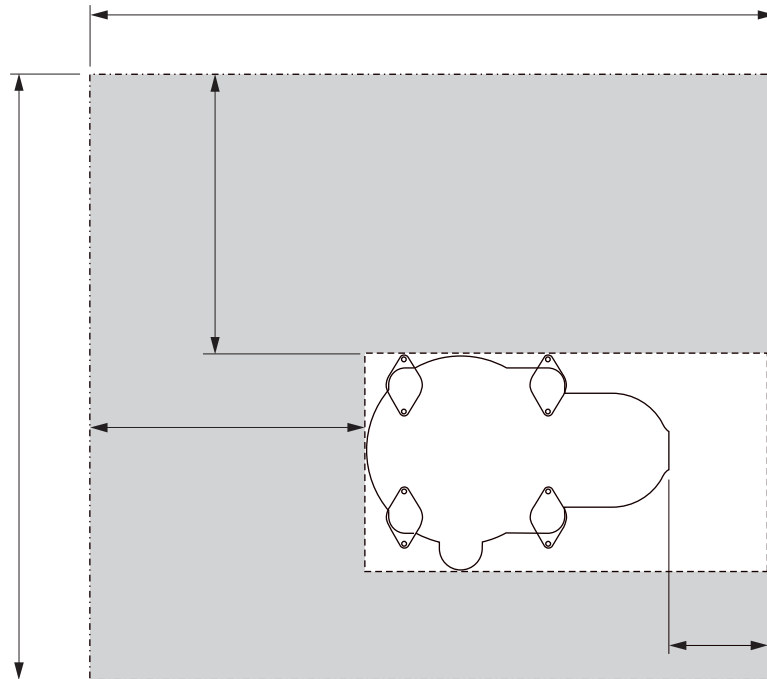
- 1** Anti-rust oil (Dinitrol 112 or equivalent) with long lasting effective treatment for external surfaces. The oil should prevent corrosion attacks and leaves a waxy surface.
- 2** Anti-rust oil (Dinitrol 40 or equivalent) is a thin lubricant for inside protection. It gives a lubricating transparent oil film.
- 3** Solvent, e.g. white spirit, to remove the anti-rust oil after the storage period.
- 4** Moist remover to be packed together with the separator equipment.

- b** If there is a risk for water condensation, the equipment must stand well ventilated and at a temperature above dew point.

- c** If the storage time exceeds 12 months, the equipment must be inspected every 6 months and, if necessary, the protection be renewed.

9.3 Planning of Installation

9.3.1 Important measurements

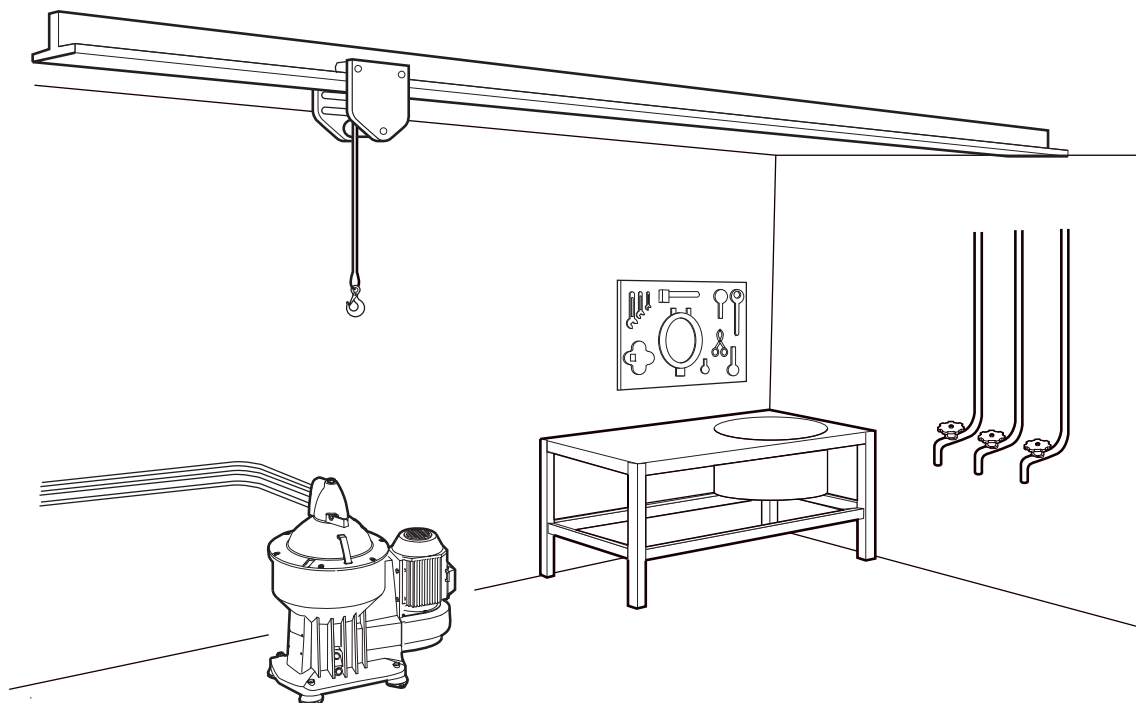


Important measurements are:

- minimum lifting height for lifting bowl parts
- shortest distance between driving motor and wall
- space for control and operation
- free passage for dismantling and assembly
- space for maintenance work
- space on floor for machine parts during maintenance work

For more detailed information, see [8.6.1 Basic size drawing, page 167](#) and [8.6.2 Foundation drawing, page 168](#).

9.3.2 Maintenance service



A work bench should be installed in the separator room.

Hot water, compressed air and diesel oil should be available near the work bench to make maintenance work easier.

An overhead hoist with capacity of 300 kg is required for transport of bowl parts to the working bench. Lifting point should be above the centre of the separator.

NOTE

When two or more separators are installed, the lifting height should be increased to enable bowl parts from one separator to be lifted and moved over an adjoining separator.

See 8.6.2 Foundation drawing, page 168

9.3.3 Connections to surrounding equipment

Local safety regulations

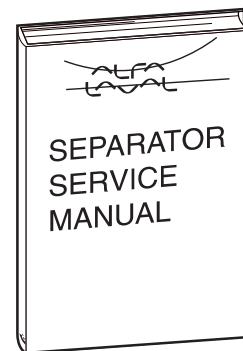
If the local safety regulations prescribe that the installation has to be inspected and approved by responsible authorities before the plant is put into service, consult with such authorities before installing the equipment and have the projected plant design approved by them.



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Service media

Ensure that all service media (electric power, operating and safety liquids etc.) required for the separator have the correct quality and capacity.

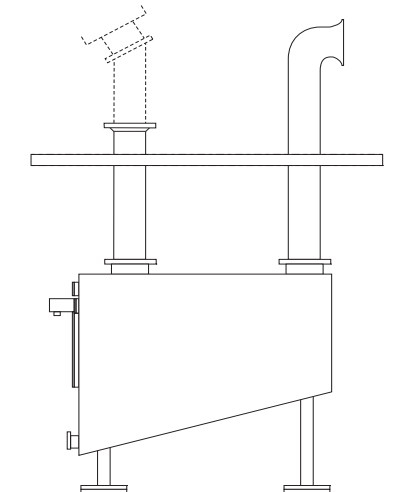


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Sludge discharge tank

If the sediment from the separator is discharged into a tank, this tank must be sufficiently ventilated. The connection between the separator and the tank must be of the size and configuration specified.

If the solids are discharged from the separator bowl casing into a closed system, ensure that this system cannot be overfilled or closed in such a way that the solids cannot leave the bowl casing. This could cause a hazardous situation.



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9.4 Storage at out of operation

If the separator is out of operation for more than **1 month**:

- 1** Lift out the bowl.
- 2** Protect the spindle taper from corrosion by lubricating it with oil.
- 3** Keep the separator and bowl well stored, dry and protected from mechanical damage.

For details see *9.2.2 Protection and storage of goods, page 175*

9.5 Before start-up

If the separator has been out of operation for:

1 months or longer

- Pre-lubricate the spindle bearings.

6 months or longer

- Perform an Inspection service  and make sure to pre-lubricate the spindle bearings.
- Change the oil before starting.

18 months or longer

- Perform an Overhaul service  and make sure to pre-lubricate the spindle bearings.
- Change the oil before starting.

