High speed separator

S 9410

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Separator manual

BRITISH ENGLISH

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The original instructions are in English

Contents

1 Read this first

This manual is designed for operators, maintenance personnel and service engineers working with the Alfa Laval 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

Study instruction manuals and observe the warnings before installation, operation, service and maintenance.

Not following the instructions can result in serious accidents.

In order to make the information clear only foreseeable conditions have been considered. No warnings are given, therefore, for situations arising from the unintended usage of the machine and its tools.

2.1 Separator safety

The separator 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.

2.2 Hazards

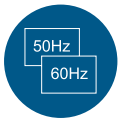
2.2.1 Disintegration hazards

- If power cables have been disconnected, always check direction of motor rotation. Incorrect direction of motor rotation can cause vital rotating parts to unscrew.

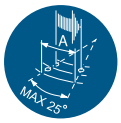
- If excessive vibration occurs, stop separator and keep bowl filled with liquid during rundown.

- 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.



- If the separator is run by a variable frequency drive, it is extremely important that the frequency does not exceed the allowed maximum, to avoid serious break down by too high speed.
- If the separator is equipped with a threaded lock ring, wear on the large lock ring thread must not exceed safety limit.Φ-mark on lock ring must not pass opposite Φ-mark by more than specified distance.



- 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.

2.2.2 Fall hazard

- Do NOT stand on the separator or separator parts.

2.2.3 Entrapment hazards

- Make sure that rotating parts have come to a complete standstill before accessing parts inside the separator or starting any dismantling work. If there is no braking function the run down time can be very long.

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

- Assemble the separator completely before start. All covers, connections and guards must be in place and properly tightened.

2.2.4 Electrical hazards

- Follow local regulations for electrical installation and earthing (grounding).

- Only qualified electricians are allowed to install and maintain the drive.

- If the separator is run by a variable frequency drive, make sure the intermediate circuit capacitors discharge before you start working on the drive, motor or motor cable. After disconnecting the input power, always wait in accordance with the documentation for the frequency converter.

- If the application is gas separation, wait six minutes after separator has come to complete standstill before starting any dismantling work. Conductors may have residual charge.

2.2.5 Crush hazards

- Use correct lifting tools and follow lifting instructions.
- Do not work under a hanging load.

2.2.6 Noise hazards

- Use ear protection in noisy environments.

2.2.7 Burn hazards

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

- Sterilizable separators are very hot on all surfaces during and immediately after sterilization.

2.2.8 Corrosion hazards

- When using chemical cleaning agents, make sure you follow the general rules and suppliers recommendation regarding ventilation, personnel protection etc.

- When using lubricants, make sure you follow the general rules and suppliers recommendation regarding ventilation, personnel protection etc.

2.2.9 Cut hazards

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

2.2.10 Flying object hazards

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

2.2.11 Dust hazards

- Risk for unhealthy dust when handling friction blocks/pads. Use a dust mask to make sure not to inhale any dust. DO NOT USE COMPRESSED AIR TO REMOVE DUST. Remove dust using vacuum or a damp cloth.

2.3 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

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

WARNING

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

CAUTION

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

NOTE

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

2.4 Recycling information

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.

Scrapping

At the end of use, the equipment must be recycled according to relevant local regulations.

Besides the equipment itself, any hazardous residues from the process liquid must be taken into consideration and dealt with in a proper manner. When in doubt, or in the absence of local regulations, please contact your local Alfa Laval sales company.

2.5 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.

2.6 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 or gas 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

3.1 Introduction

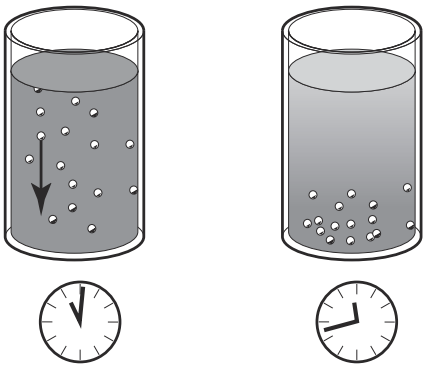
The purpose of separation can be:

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

3.2 Separation by gravity

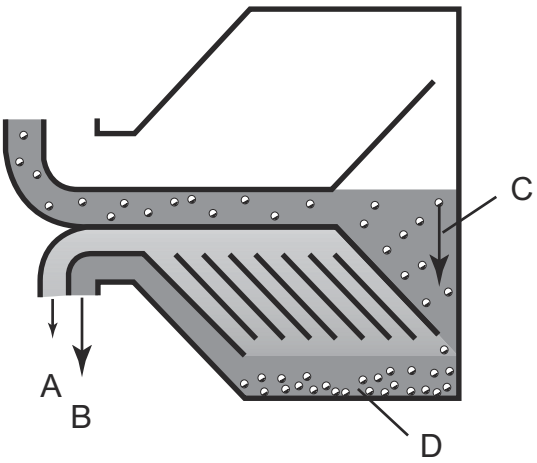
A liquid mixture in a stationary bowl will clear slowly as the heavy particles in the liquid mixture sink to the bottom under the influence of gravity.

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



Continuous separation and sedimentation can be achieved in a settling tank having inlet and outlet arranged according to the illustration.

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



A. Lighter liquid
B. Heavier liquid
C. Gravity
D. Sediment layer of heavier particles

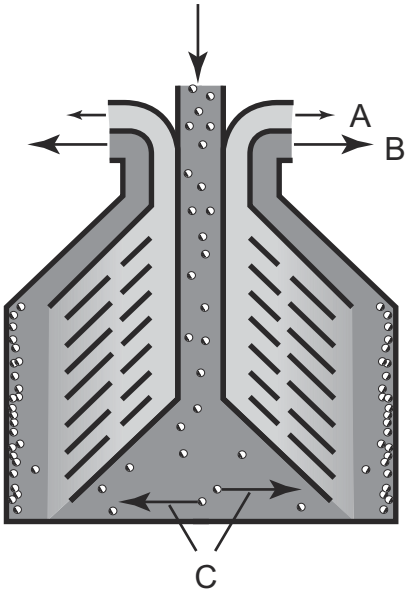
3.3 Centrifugal separation

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

Separation and sedimentation is continuous and happens very quickly.

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

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

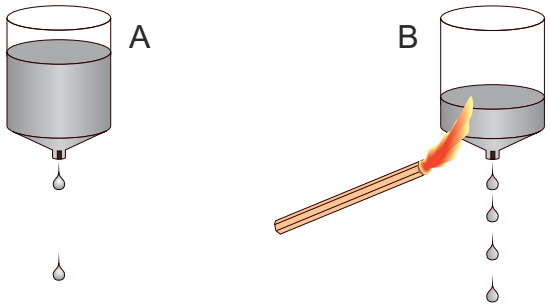


A. Lighter liquid
B. Heavier liquid
C. Centrifugal force

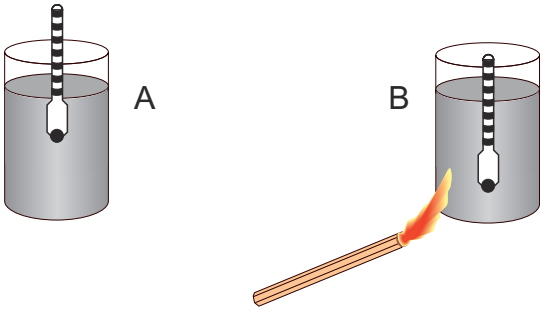
3.4 Separating temperatures

For some types of process liquids a high separating temperature will normally increase the separation capacity. The temperature influences viscosity and density and should be kept constant throughout the separation.

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

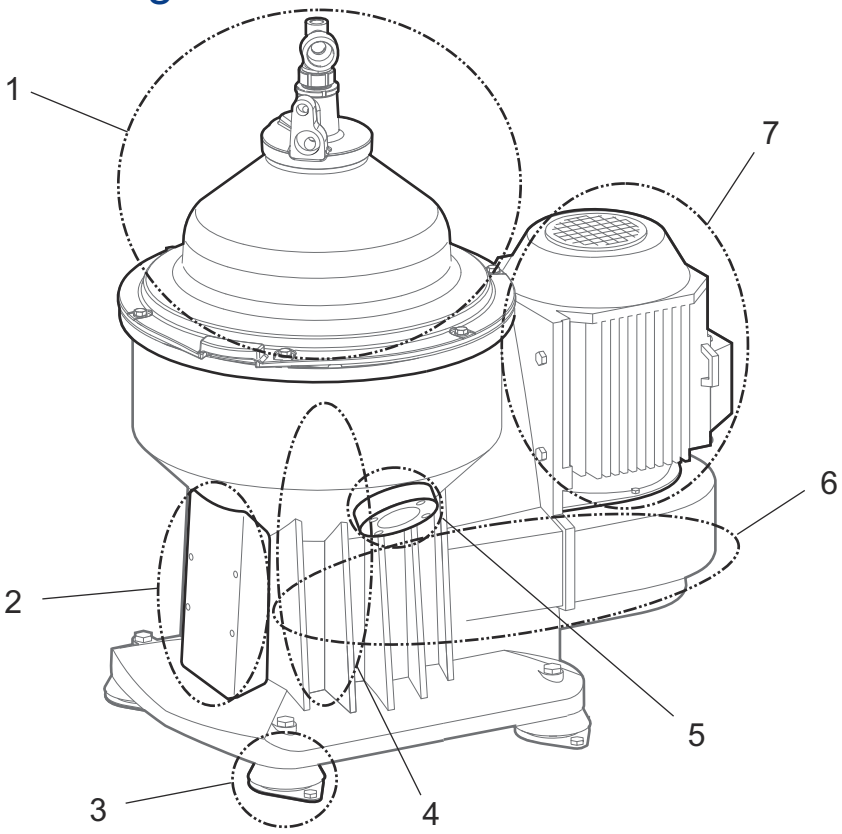


A. High viscosity
B. Low viscosity



A. High density (with low temperature)
B. Low density (with high temperature)

4 Design and function



1. **Process section**
   The feed inlet and outlets are situated at the top of the separator. The liquid is cleaned in the rotating separator bowl inside the frame hood.
2. **Sensors**
   The separator is monitored by a speed sensor. An unbalance sensor is optional.
3. **Frame feet**
   The separator rests on vibration damping frame feet.
4. **Lubrication system**
   Lubricates the bearings driven by the flat belt transmission.
5. **Sludge outlet**
   Separated solids are discharged at preset intervals.
6. **Drive section**
   The rotating separator bowl is driven by a flat belt transmission with friction coupling.
7. **Electric motor**
   Rotating bowl is driven by the electric motor via a belt transmission.

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 the optional unbalance sensor, are parts of the equipment for monitoring the separator functions.

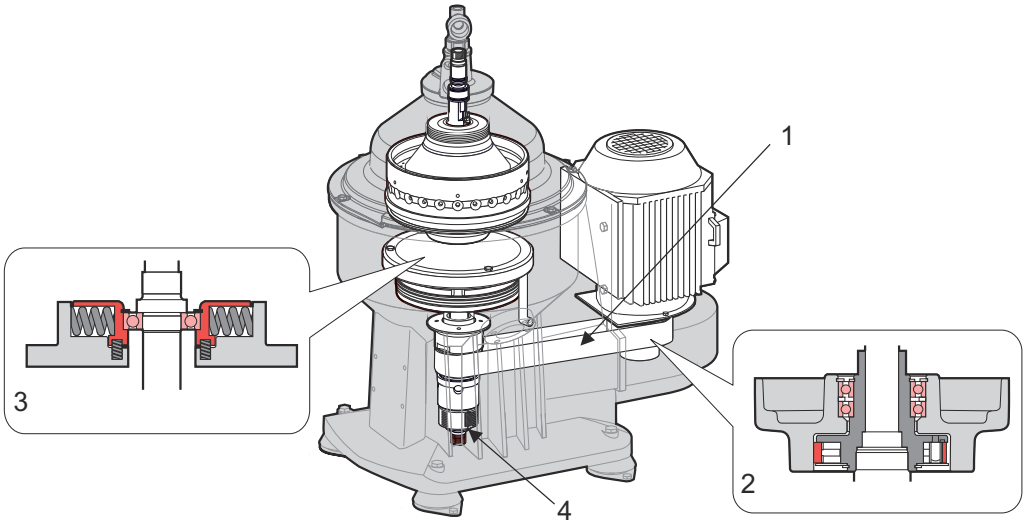
4.2 Drive section

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

The centrifugal clutch (2) with friction pads ensures a gentle start and smooth acceleration, and at the same time prevents overloading of the belt and motor.

To reduce bearing wear and the transmission of bowl vibrations to the frame and foundation, the top bearing of the bowl spindle is mounted in a spring dampened bearing seat (3). The bearings on the spindle are lubricated by the oil spray produced by an oil mist generator (4) mounted on the lower end of the spindle.

The flat belt (1) transmission has a ratio which increases the bowl speed several times compared with the motor speed.



1. Flat belt
2. Centrifugal clutch
3. Spring dampened bearing seat
4. Oil mist generator

4.3 Process section

The separation process takes place inside the rotating separator bowl. The feed and outlet of process liquid takes place in the in- 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.

An inlet 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.

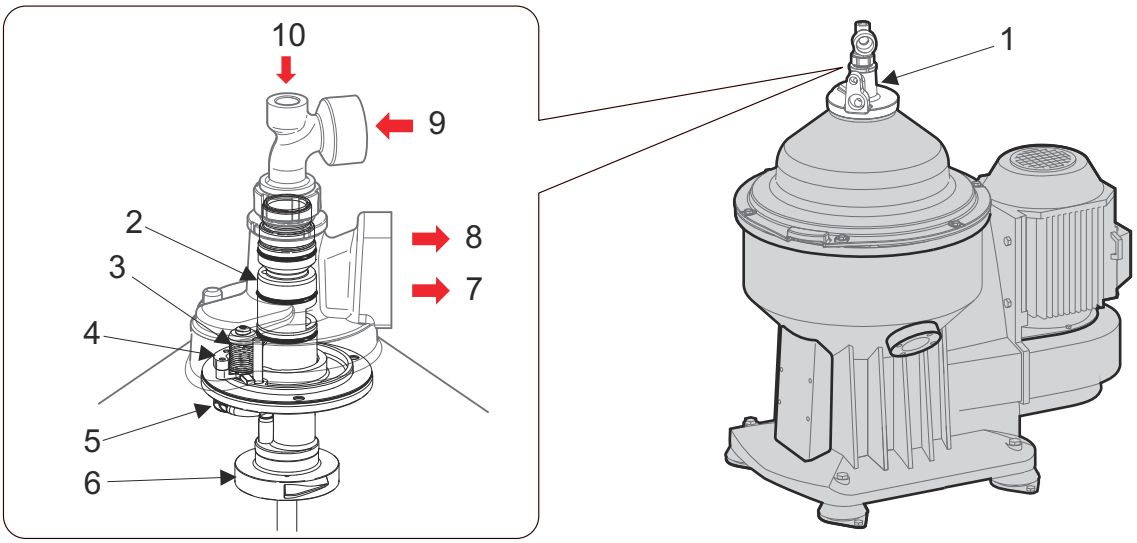
The paring disc and paring tube pump the cleaned oil and water respectively out of the bowl.

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

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.



1. Connecting housing
2. Inlet pipe
3. Spring
4. Arm
5. Paring tube
6. Paring disc
7. Cleaned oil
8. Separated water
9. Uncleaned oil
10. Inlet for conditioning and displacement liquid

Separator bowl

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

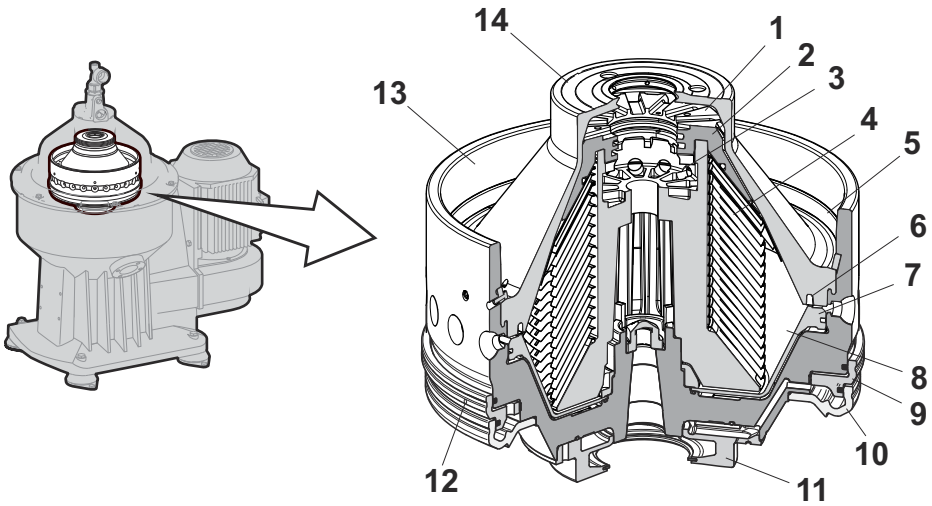
The bowl body and bowl hood are held together by a lock ring (Centrilock). Inside the bowl are the distributor and the disc stack. The disc stack is kept compressed by the bowl hood. The discharge slide forms a separate bottom in the bowl body.

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.



1. Water paring chamber
2. Top disc
3. Oil paring chamber
4. Disc stack
5. Lock ring
6. Seal ring
7. Discharge slide
8. Sludge space
9. Operating slide
10. Holder
11. Operating water ring
12. Nozzle
13. Bowl body
14. Bowl hood

4.4 Sensors and indicators

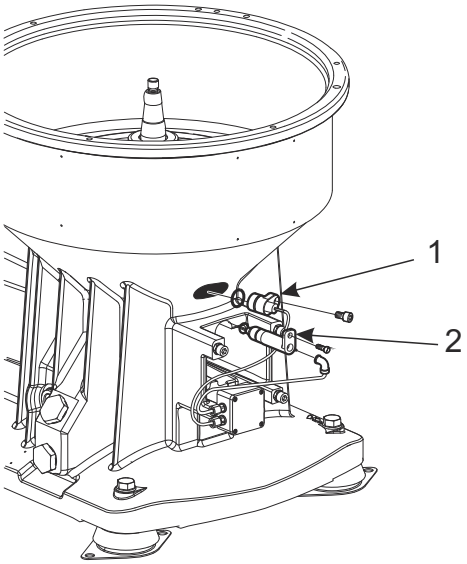
The separator is equipped with a speed sensor. As option, an unbalance sensor can be fitted.

Speed sensor

A speed sensor (2) 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 (1) monitoring the radial position of the bowl spindle.



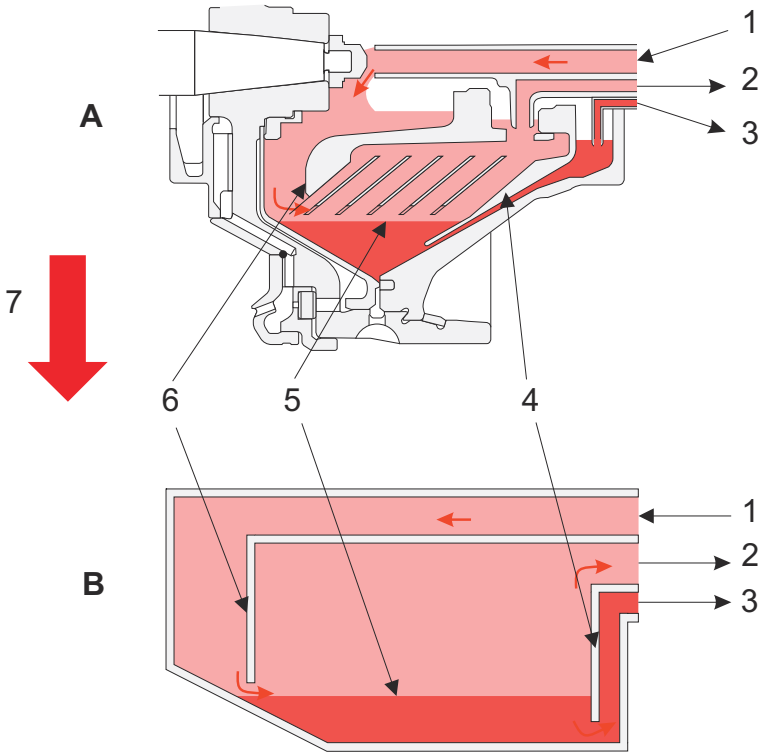
1. Unbalance sensor
2. Speed sensor

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:



A. Separator bowl turned 90º
B. Settling tank
1. Unseparated oil
2. Separated oil
3. Separated water
4. Top disc
5. Oil/water interface
6. Distributor
7. Gravity

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 (ALCAP™ concept)

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.

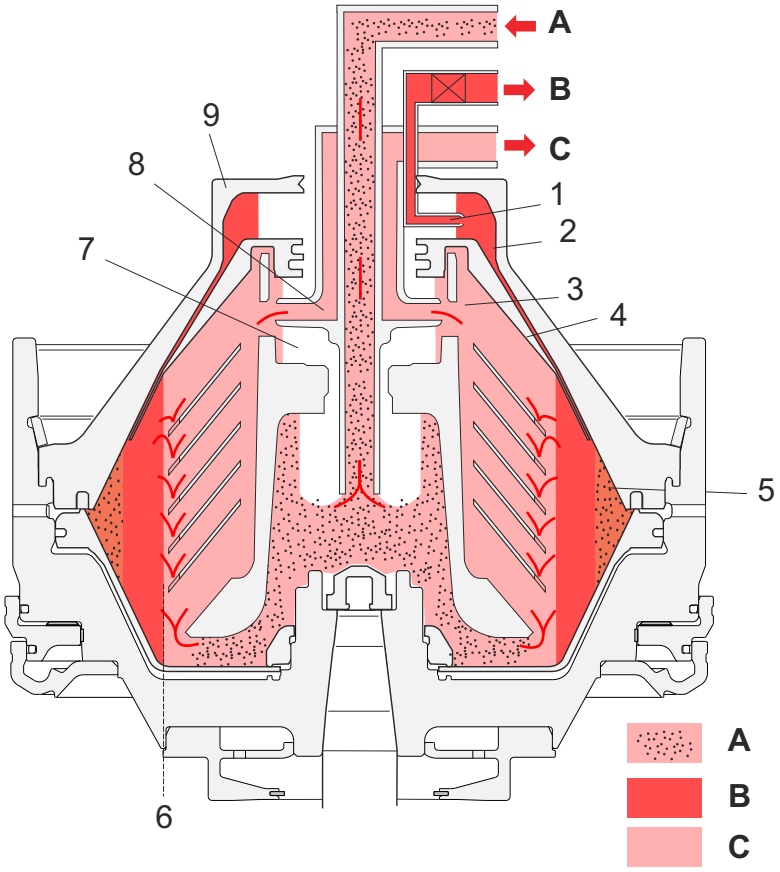
This condition is monitored by the process control system, and water is removed from the bowl when maximum levels are recorded.

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 Discharge of water through water outlet



Discharge of water through water outlet

A. Unseparated oil
B. Water
C. Separated oil

1. Water paring tube
2. Water paring chamber
3. Holes in distributor
4. Top disc
5. Sludge space
6. Oil/Water interface
7. Oil paring chamber
8. Oil paring disc
9. Bowl hood

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.

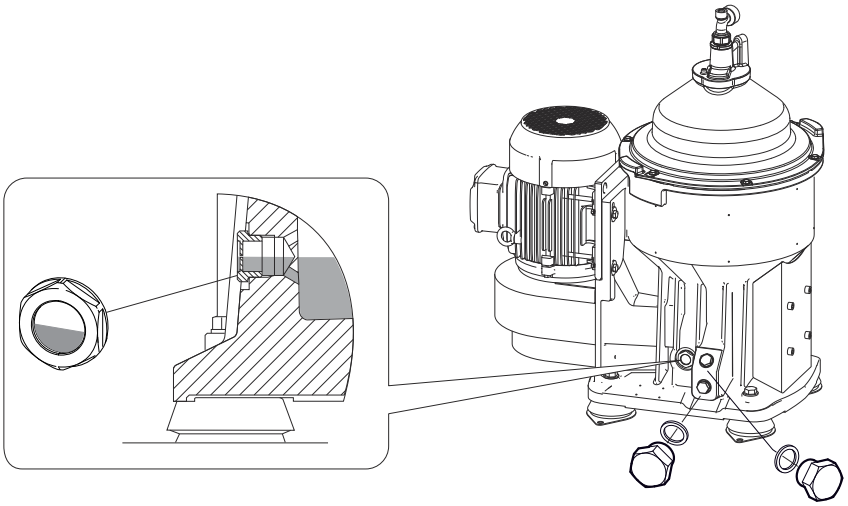
5.1 Before first start

Technical demands for connections and limitations for the separator are listed in *Technical reference*.

- *Technical data*
- *Connection list*
- *Functional Requirement Specification (FRS)*
- *Operating water demands*
- *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 oil change procedure in section *Oil change* on page 148. For quality of oil, see section *Lubricating oils* on page 155.
- Make sure that the oil level can be seen in the sight glass. The oil level should not be above the max. level in the middle of the sight glass, see *Oil change* on page 148.



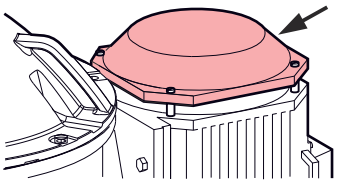
NOTE

Too much or too little oil can damage the separator bearings.

NOTE

The separator should be level when oil is filled.

- Check the direction of rotation by doing a quick start/stop. The motor fan should rotate clockwise. If motor fitted with additional end cover, this can be removed to see motor fan. Refit end cover when direction of rotation checked.



5.1.1 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 *Fault finding* on page 159.

5.2 Normal operation

5.2.1 Before normal start

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

1. Check:

- that all couplings and connections (1) are securely tightened to prevent leakages. Leaking hot liquid can cause burns.
- that the two lock nuts (2) is fully tightened. The bottom one holding connecting housing and outlet pipe in position. The upper one holding the inlet bend in place.
- that all frame hood bolts (3) as well as the belt cover are fully tightened.
- the direction of rotation by doing a quick start/stop. The motor fan (4) should rotate clockwise.
- the oil bath level and top up if necessary.

NOTE

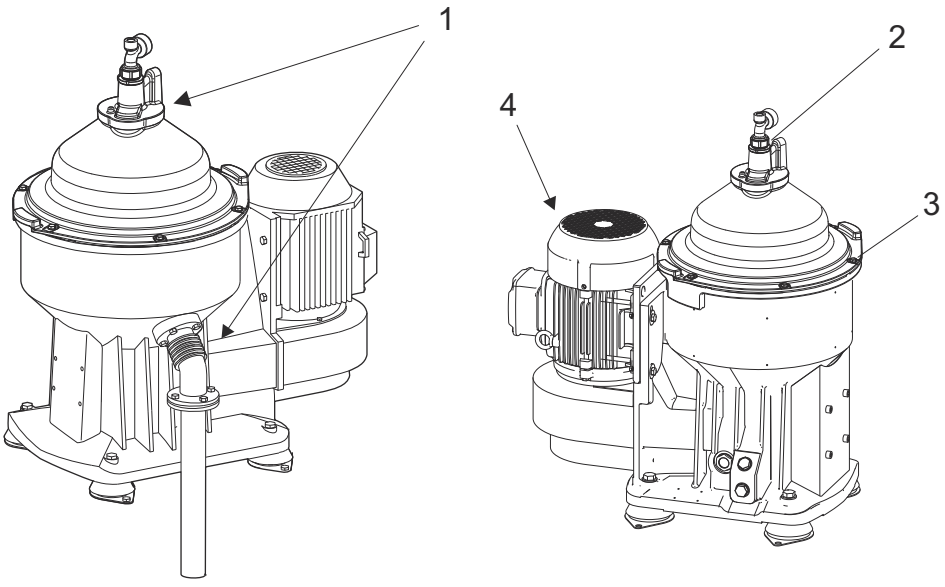
The separator should be level and at standstill when oil is filled.

CAUTION **Disintegration hazard**

If power cable polarity has been reversed, the separator will rotate in reverse, and vital rotating parts can loosen.

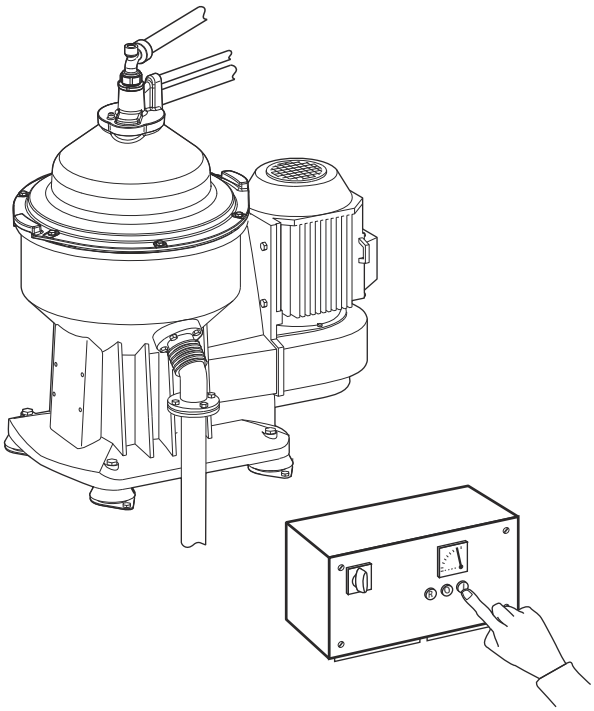
CAUTION **Disintegration hazard**

After change of feed the sludge discharge interval must be adjusted. Breakdown may result if the intervals between discharges are too long.



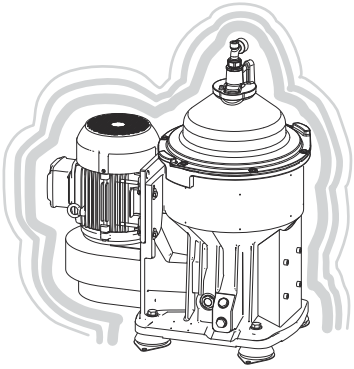
5.2.2 Start

1. Start of separator:
   a) Open the water supply valve.
   b) Start the separator by pushing the start button at the starter unit.



> **NOTE**
>
> After every start the separator must always be run continuously for a minimum of 1 hour to ensure proper lubrication. Try to learn the vibration characteristics during the critical speeds.

2. Check the separator for vibration.



> **WARNING**
>
> **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.

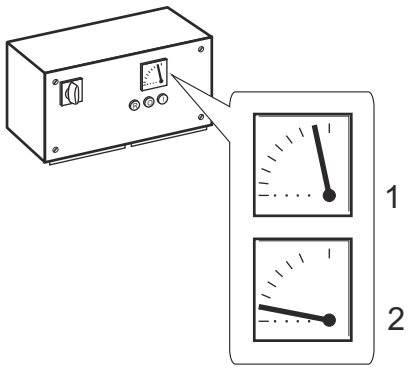
> **NOTE**
>
> **Normal vibration.**
>
> Vibration may occur during start up when passing critical speed. This is normal and should pass without danger.

3 Ensure that the separator is at full speed.

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

- Current increases during start (1).
- When full speed has been reached, the current decreases to a stable value (2).

For normal length of the start-up period, see *Technical data* on page 166.



4 Perform a “discharge” to fill up the operating water system.

a) Add opening water until a discharge sound is heard (5 seconds).

b) Wait 15 seconds.

c) Add closing water for 15 seconds.

5 Add some hot conditioning water.

6

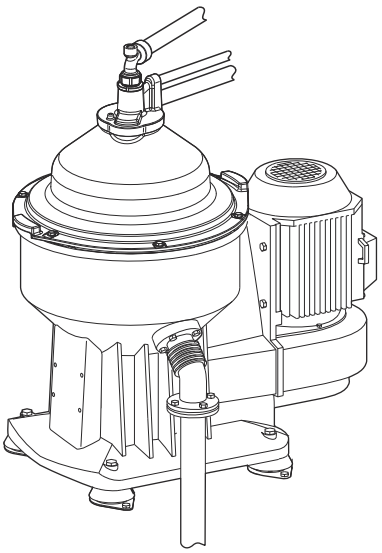
NOTE

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

Turn on the oil feed.

5.2.3 Operating

1. Checkpoints during operation.



> **WARNING**
>
> **Burning hazard**
>
> Lubricating oil and various machine surfaces can be hot and cause burns.

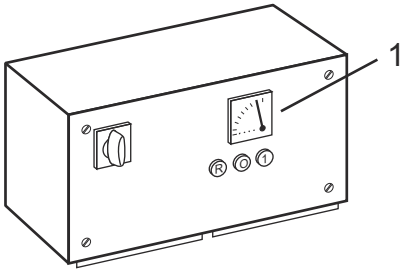
a) Check all connections for leakage.

b) Check that the feed has correct flow and temperature.

c) Check the back pressure.

d) Check that the starter ammeter reading (1) is the normal low and steady value.

e) Check for abnormal vibrations and sounds.



> **WARNING**
>
> **Disintegration hazard**
>
> Do not discharge a vibrating separator. Vibration can increase if solidified sludge is only partially discharged.

5.2.3.1 Sludge discharge

1. Turn off the oil feed.

2. Perform a displacement of the oil by adding water (not more than bowl volume). The recommendation is to use hot water but its not a requirement.

3. Perform a sludge discharge.

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

b) Wait 15 seconds

c) Add closing water for 15 seconds.

4.

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

Turn on the oil feed.

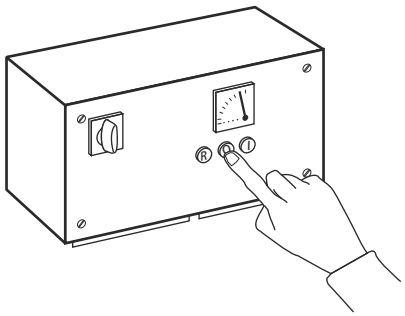
5.2.4 Stop

1. Turn off the oil feed.

2. Perform a displacement of the oil by adding water (not more than bowl volume). The recommendation is to use hot water but its not a requirement.

3. Perform a sludge discharge.
   a) Add opening water until a discharge sound is heard (max. 3 seconds).
   b) Wait 15 seconds.
   c) Add closing water for 15 seconds.

4. Fill the bowl up with water and stop the separator.



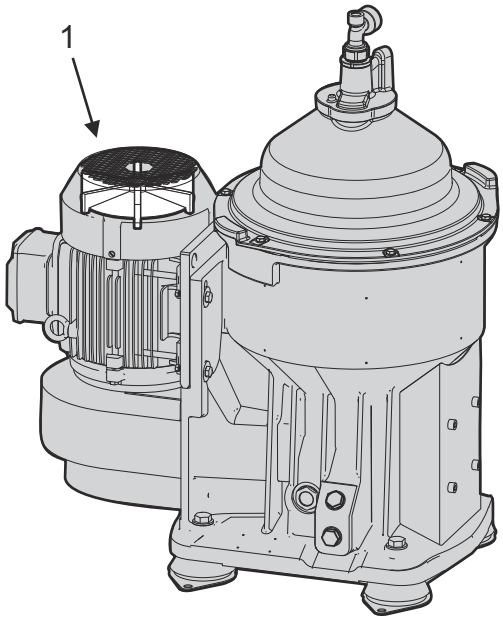
NOTE

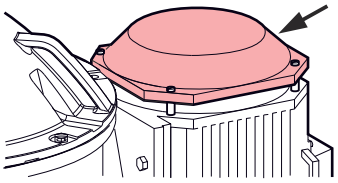
Keep the bowl filled during run-down to minimize the vibrations.

5. Wait until the separator has stopped (after about 35 minutes).

   Check rotation of motor fan (1).

   If motor fitted with additional end cover, this can be removed to see if motor fan is rotating. Refit end cover when separator has come to complete standstill.





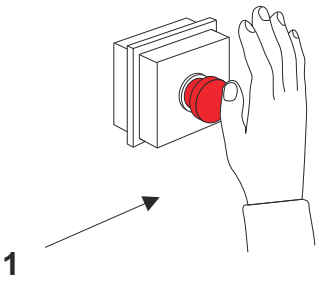
WARNING

Entrapment hazard

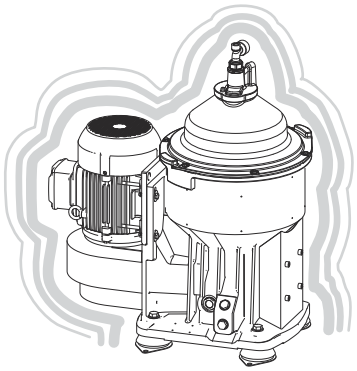
Make sure that rotating parts have come to a complete standstill before starting any dismantling work.

5.3 Emergency stop

1. If the separator vibrates excessively push the emergency stop button (1).



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

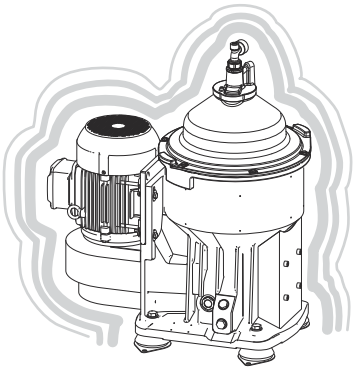


2. Evacuate the room.

> **WARNING**
>
> **Disintegration hazard**
>
> Never discharge a vibrating separator

> **WARNING**
>
> **Entrapment hazard**
>
> Make sure that rotating parts have come to a complete standstill before starting any dismantling work.

> **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.



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.

WARNING **Disintegration hazards**

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

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, see page *Maintenance logs* on page 45, 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 after **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) after **max.** 18 months or 12000 operating hours. Seals, bearings, friction blocks and flat belt in the separator are renewed.

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.

Electric motor

Motor service consists of an overhaul of the motor after **max.** 36 months or 24000 operating hours. Bearings, fan, seals and washers for the motor are renewed.

Ancillary

Verify correct flow from water valveblock **at least** every 36 months.

6.1.2 Maintenance procedure

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 *Dismantling* on page 49. 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 *Actions before assembly/Check points* on page 92
3. Fit all the parts delivered in the service kit while assembling the separator as described in *Assembly* on page 101.
4. When the separator is assembled, make final checks described in *Actions after assembly* on page 146.

WARNING **Disintegration hazard**

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

CAUTION **Burn and corrode hazard**

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 i and/or O in the assembly instructions.

Example

a. Fit the O-ring i.

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

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

Special service kits are available for Inspection, Overhaul and Motor.

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 hazard**

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 logs

Name of ship/plant:	**Local identification:**
Separator:	**Manufacture No./Year:**
Total running hours.	**Product No:**
Date:	**Signature:**

Part	i	o	Check	Action	Page	Note
In- and outlet device						
- All parts	x	x		Clean	*Cleaning* on page 92	
- All parts	x	x		Check for corrosion	*Inspection for corrosion* on page 93	
- All parts	x	x		Check for cracks	*Inspection for cracks* on page 94	
- Connecting housing	x	x		Check for erosion damages	*Inspection for erosion* on page 95	
	x	x		Renew O-rings for hoses	- - -	
- Frame hood	x	x		Renew O-ring	*In- and outlet device* on page 140	
		x		Control measure of paring disc height	*In- and outlet device* on page 140	
		x		Check height adjusting rings	*In- and outlet device* on page 140	
		x		Renew the spring	*In- and outlet device* on page 140	
- Inlet pipe thread	x	x		Lubricate	*In- and outlet device* on page 140	

Part	i	o	Check	Action	Page	Note
Bowl						
- All parts	x	x		Clean	*Cleaning* on page 92	
- All parts	x	x		Check for corrosion	*Inspection for corrosion* on page 93	
- All parts	x	x		Check for cracks	*Inspection for cracks* on page 94	
- All parts	x	x		Check for erosion damages	*Inspection for erosion* on page 95	

Part	i	o	Check	Action	Page	Note
- Bowl body	x	x		Check for impact marks and corrosion	*Bowl* on page 56	
	x	x		Renew rectangular ring	*Bowl* on page 56	
		x		Renew guide ring	*Bowl* on page 56	
	x	x		Renew O-rings	*Bowl* on page 56	
	x	x		Renew holder screws and washers	*Bowl* on page 56	
- Operating slide	x	x		Renew rectangular ring	*Bowl* on page 56	
	x	x		Renew valve plugs	*Bowl* on page 56	
- Discharge slide	x	x		Renew rectangular ring	*Bowl* on page 56	
- In- and outlet pipe	x	x		Renew O-rings	*Bowl* on page 56	
	x	x		Renew splash sealing	*Bowl* on page 56	
- Paring tube	x	x		Renew O-rings and bearings	*Bowl* on page 56	
- Lock ring	x			Check for deformations	*Bowl* on page 56	
	x			Check for impact marks	*Bowl* on page 56	
	x			Check pin not deformed or loose	*Bowl* on page 56	
- Bowl hood	x	x		Renew seal ring	*Bowl* on page 56	
	x	x		Renew O-ring	*Bowl* on page 56	
- Operating water ring	x	x		Renew seal ring and screws	*Bowl* on page 56	

Part	i	o	Check	Action	Page	Note
Frame						
- Frame feet				Renew frame feet (including washers and screws)	*Exchange of frame feet* on page 97	Has to be ordered separately
- Drain and oil filling holes	x	x		Renew washers	*Driving device* on page 107	

Part	i	o	Check	Action	Page	Note
Driving device						
- All parts		x		Clean	*Cleaning* on page 92	
- All parts		x		Check for corrosion	*Inspection for corrosion* on page 93	

Part	i	o	Check	Action	Page	Note
- All parts		x		Check for cracks	*Inspection for cracks* on page 94	
- Bottom bearing housing		x		Renew O-ring	*Driving device* on page 107	
- Labyrinth ring holder		x		Renew labyrinth ring	*Driving device* on page 107	
		x		Renew O-ring	*Driving device* on page 107	
- Top bearing housing		x		Renew springs	*Driving device* on page 107	
- Flat belt		x		Renew flat belt	*Driving device* on page 107	
- Bowl spindle		x		Pre-lubricate and renew ball bearing	*Driving device* on page 107	
		x		Pre-lubricate and renew self-aligning roller bearing	*Driving device* on page 107	
		x		Lubricate the spindle	*Driving device* on page 107	
		x		Measure the radial wobble	*Driving device* on page 107	
- Neck bearing cover		x		Renew O-ring	*Driving device* on page 107	
- Deflector ring		x		Renew O-ring	*Driving device* on page 107	
- Water inlet pipe		x		Renew O-ring	*Driving device* on page 107	
- Operating water cover		x		Renew seal ring and O-ring	*Driving device* on page 107	
		x		Check that operating water channel is free from blockage	*Driving device* on page 107	
- Fan		x		Renew O-ring	*Driving device* on page 107	

Part	i	o	Check	Action	Page	Note
Coupling						
- All parts		x		Clean	*Cleaning* on page 92	
- All parts		x		Check for corrosion	*Inspection for corrosion* on page 93	
- All parts		x		Check for cracks	*Inspection for cracks* on page 94	
- Coupling hub		x		Renew single row ball bearings	*Centrifugal clutch* on page 101	
		x		Renew snap rings	*Centrifugal clutch* on page 101	
- Friction block		x		Renew friction pads (if they are worn) or clean the pads if they are dirty	*Centrifugal clutch* on page 101	

Part	i	o	Check	Action	Page	Note
Electrical motor						
- Bearings		x*		Renew bearings, fan, seals and washers	*Change of motor bearings* on page 99	*) Check maintenance interval Electric motor

Part	i	o	Check	Action	Page	Note
Signs and on separator						
- Machine plate		x		Check attachment and legibility	*Control of machine plates and safety labels* on page 146	
- Power supply frequency		x		Check attachment and legibility	*Control of machine plates and safety labels* on page 146	
- Lifting instructions		x		Check attachment and legibility	*Control of machine plates and safety labels* on page 146	
- Safety labels		x		Check attachment and legibility	*Control of machine plates and safety labels* on page 146	
- Name plate		x		Check attachment and legibility	*Control of machine plates and safety labels* on page 146	
- Representative label		x		Check attachment and legibility	*Control of machine plates and safety labels* on page 146	

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, fiberboard 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.

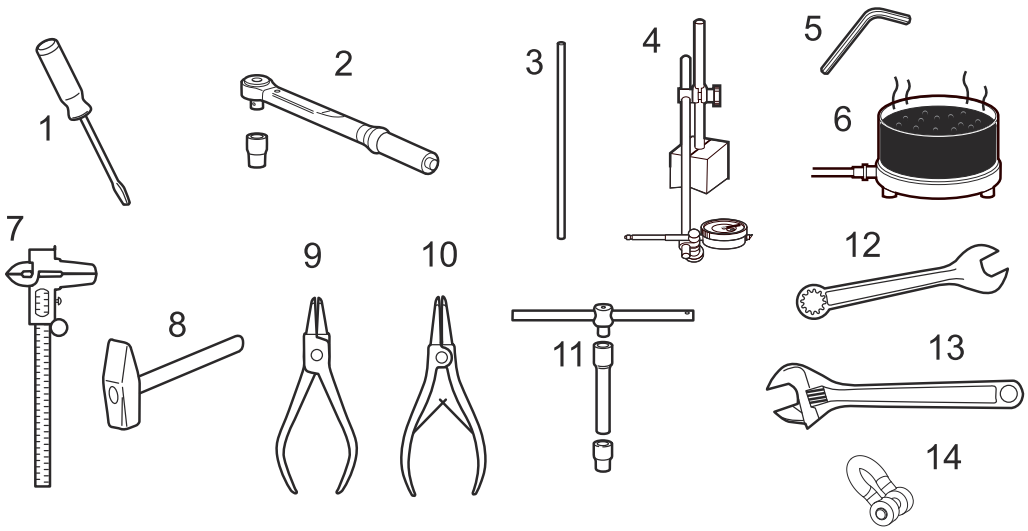
WARNING **Entrapment hazard**

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 35 minutes from switch off).

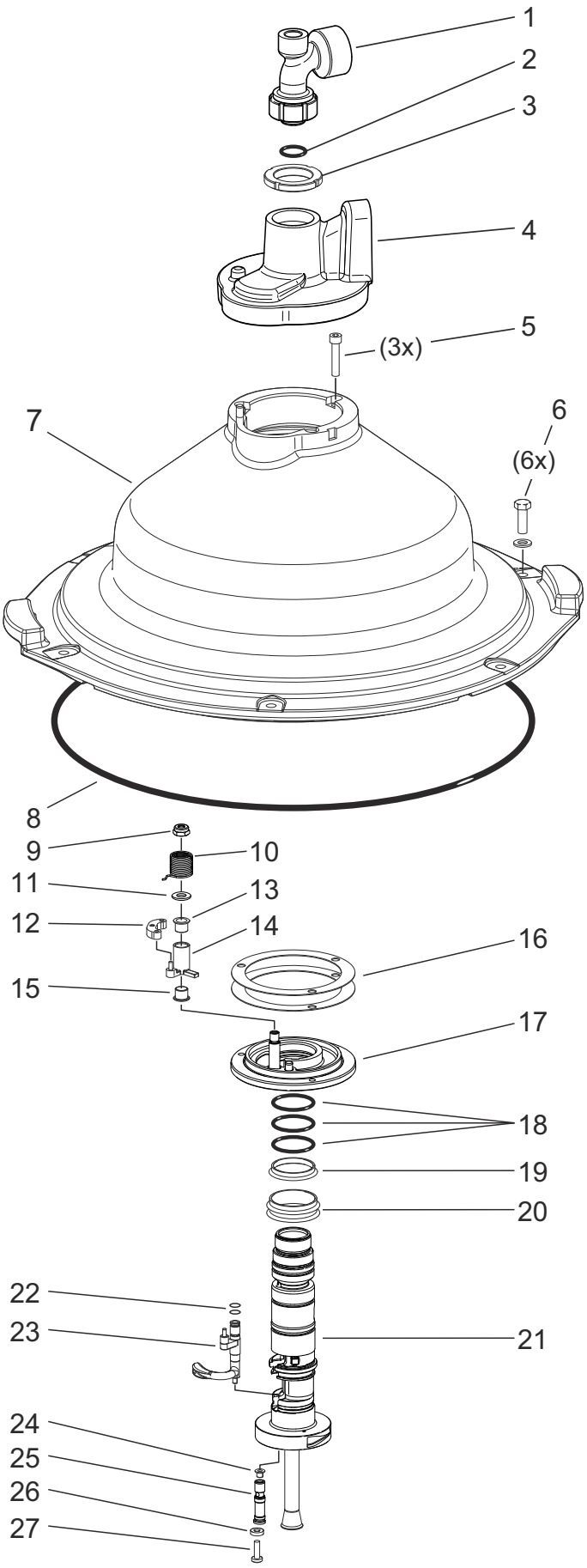
If motor fitted with additional end cover, this can be removed to see if motor fan is rotating. Refit end cover when separator has come to complete standstill.

Standard Tools

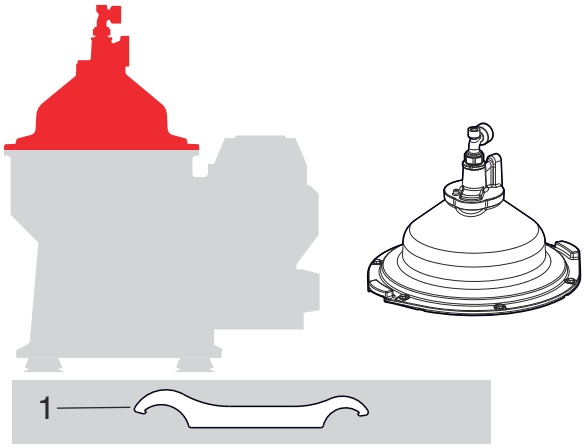


1. Screwdriver and Torx screwdriver
2. Torque wrench (capacity 0-200 Nm)
3. Drift (Ø 4 mm)
4. Dial indicator with magnetic base
5. Hexagon head keys, various sizes
6. Heating equipment for bearings
7. Sliding calliper
8. Hammers (standard and soft-faced)
9. Pliers for internal snap rings
10. Pliers for external snap rings
11. T-handle with extension rod, sockets (various sizes)
12. Spanners (various sizes)
13. Adjustable spanner
14. Shackle

6.3.3 In- and outlet device



1. Inlet bend
2. O-ring
3. Round Nut
4. Connecting housing
5. Screws
6. Screws
7. Frame hood
8. O-ring
9. Nut
10. Torsion spring
11. Washer
12. Arm
13. Plain bearing
14. Spring hub
15. Plain bearing
16. Height adjusting rings
17. Support ring
18. O-rings
19. Splash sealing
20. Splash sealing
21. Inlet and outlet pipe with paring disc
22. O-rings
23. Paring tube
24. Plain bearing
25. Bearing holder
26. Washer
27. Screw



1. *Hook spanner (for the lock nut)*

1 Removing the inlet pipe bend

a)

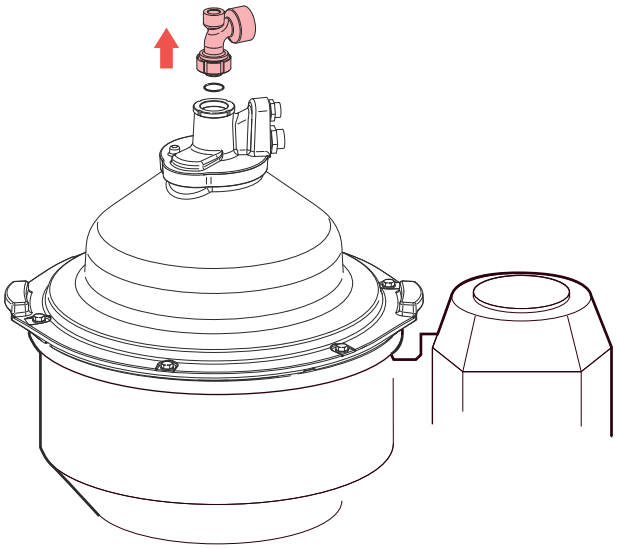
> **CAUTION**
>
> **Burn hazard**
>
> Hot liquid may remain in the hoses.

Remove connections before starting dismantling.

b)

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

Remove the nut on the inlet bend, using the hook spanner.



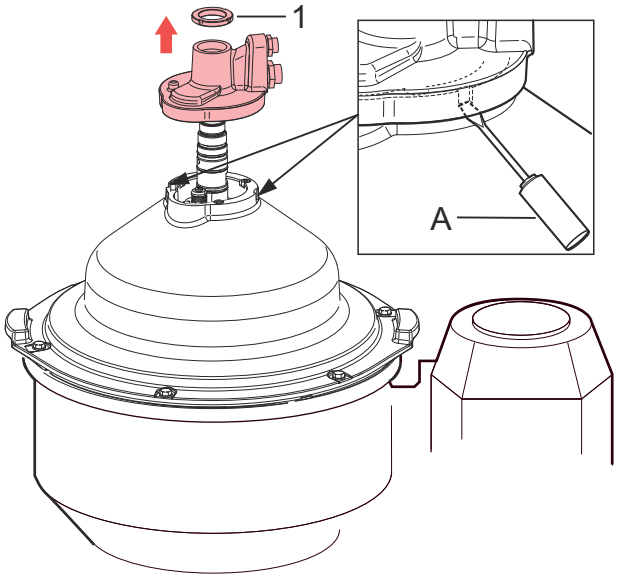
2 Removing the connecting housing.

a) Lubricate the inlet pipe thread

b) Remove the round nut (1), using the hook spanner.

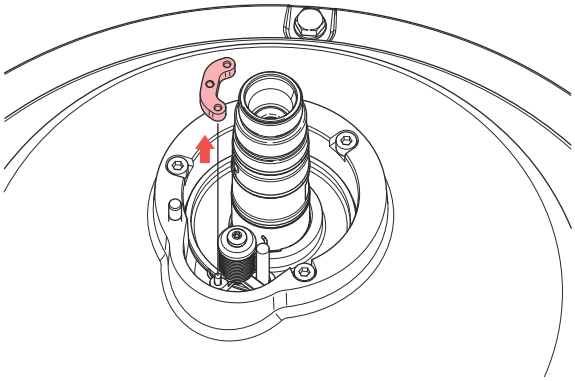
c) Press the inlet pipe down, with a soft material, to loosen the connecting housing.

> **NOTE**
>
> Screwdriver (A) can be used in the two grooves in frame hood to ease off the connecting housing.



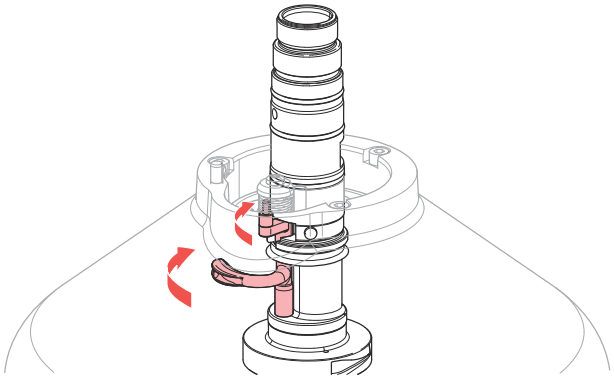
3 Removing the arm for paring tube.

> **NOTE**
>
> If the arm is hard to grip, a screw (M5) can be used in the threaded hole.



4 Turn the paring tube towards the pipe so that the frame hood can be removed upwards.

> **NOTE**
>
> To avoid the paring tube from being damaged and preventing the inlet pipe from sticking to the frame hood when lifting the hood, always turn the paring tube towards the pipe before lifting.



5 Removing the frame hood.

a) Remove the screws (A) holding the frame hood.

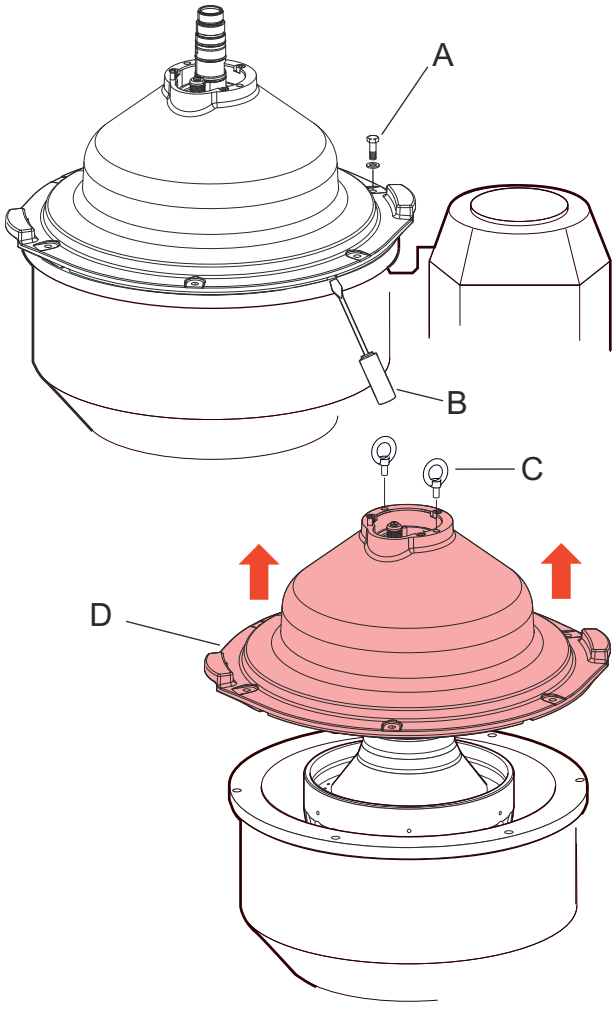
b) Loosen the hood by bending with a screwdriver (B) in all grooves in the hood.

c) Lift off the frame hood (D) using lifting eyes (C) and hoist.

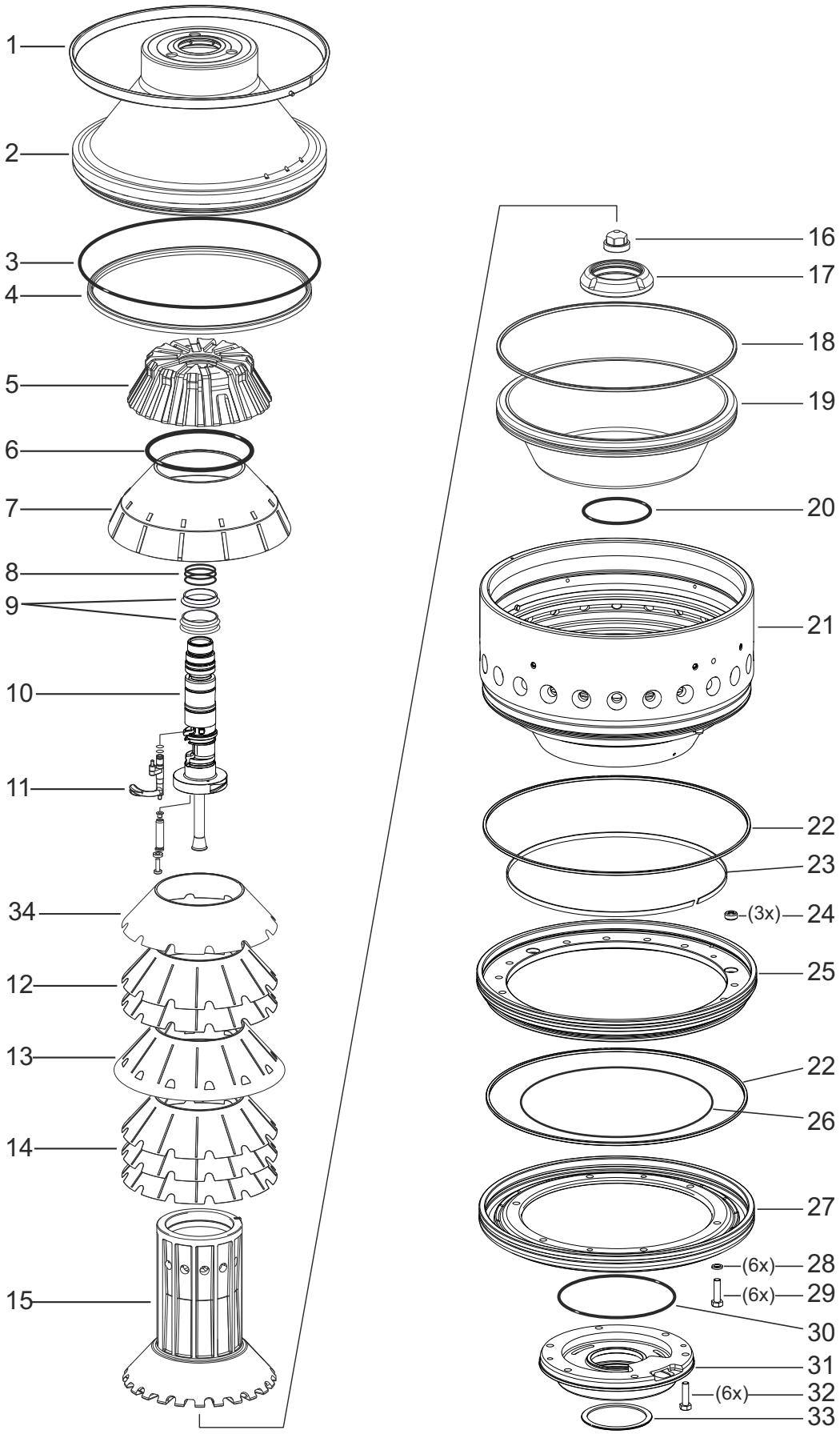
d)

> **NOTE**
>
> Do not place the hood upside down.

Place the frame hood on a clean flat surface.



6.3.4 Bowl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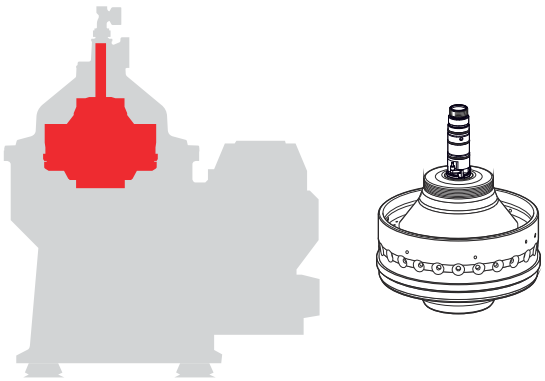
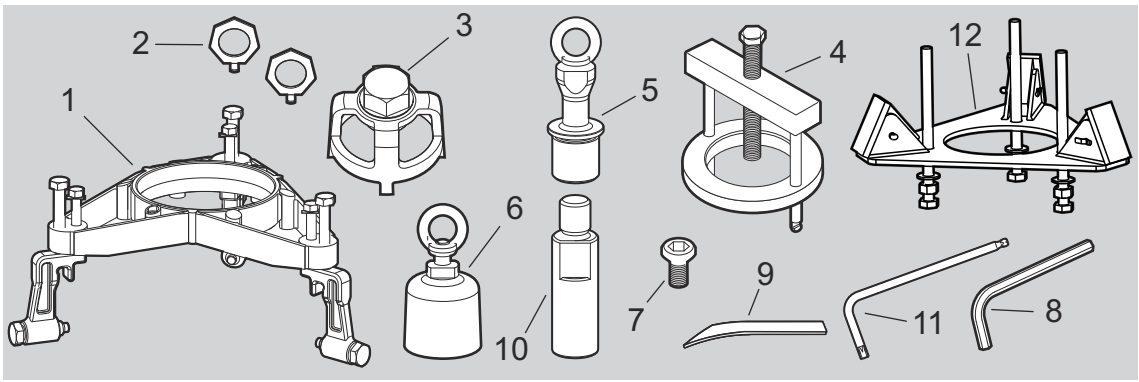
21
22
23
(3x) 24
25
22
26
27
(6x) 28
(6x) 29
30
31
(6x) 32
33

1. Lock ring
2. Bowl hood
3. O-ring
4. Seal ring
5. Top disc, upper part
6. O-ring
7. Top disc, bottom part
8. O-rings
9. Splash sealing
10. Inlet and outlet pipe
11. Paring tube
12. Bowl discs
13. Bowl disc (largest diameter)
14. Bowl discs
15. Distributor
16. Cap nut
17. Nut
18. Rectangular ring
19. Discharge slide
20. O-ring
21. Bowl body
22. Rectangular ring
23. Guide ring
24. Valve plug
25. Operating slide
26. O-ring
27. Holder
28. Lock washer
29. Screw
30. O-ring
31. Distributing ring
32. Screw
33. Seal ring
34. Bowl disc (without caulks)





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)*
11. *Torx head key*
12. *Puller (top disc) [Optional]*

1 Removing the lock ring.

a) Fit the compressing tool (A).

b) Fit the clamps (C) and the screws (B) to stop.

> **NOTE**
>
> Be sure not to cover the threaded holes for the lock ring.

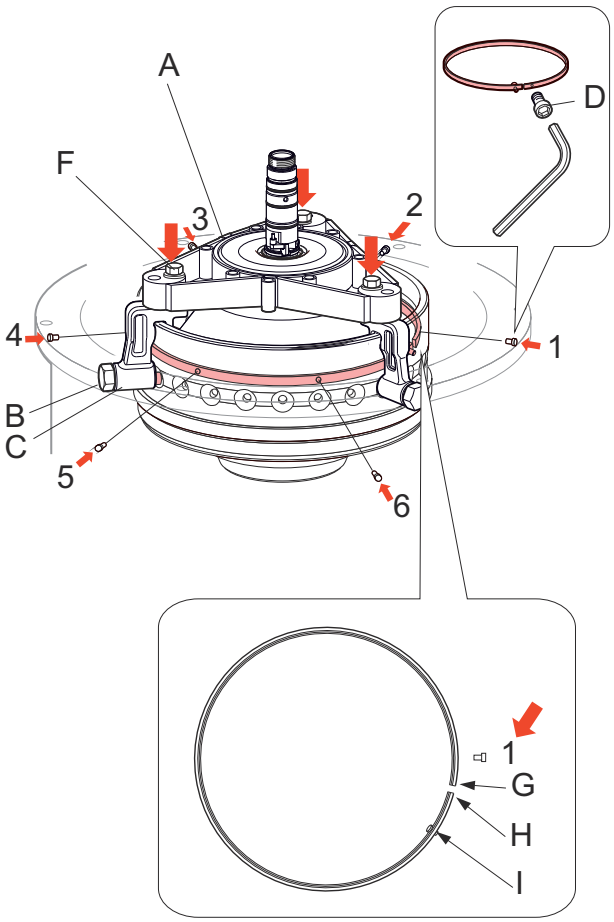
c) Compress the disc stack by alternately tightening the inner screws with washers (F) on the compressing tool in increments of **5 Nm** up to a maximum of **33 Nm**.

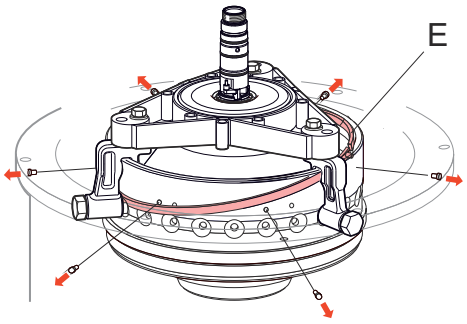
> **NOTE**
>
> If the separator have been out of operation and the bowl is cold, a higher compression torque might be required due to oil residue between bowl hood and bowl body. In these cases a compression torque up to **60 Nm** can be used to open the bowl.

d) Fit the dismantling screws (D) to the bowl body and press out the lock ring by tightening the screws successively according to the numbering in the illustration (1-6). Start with the screw (1) nearest to the lock ring end (G), the one without pin (I), and then continue around until the other end (H) is reached. The lock ring can be removed when it has passed the edge of the groove.

e) Remove the lock ring (E) from the groove.

f) Remove the dismantling screws (D).



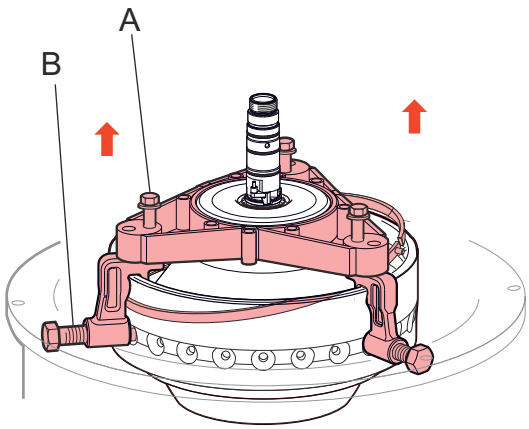


2 Removing the bowl hood.

a) Remove the compressing screws with washers(A).

b) Loosen the screws (B) on the clamp tool. Remove the tool. Remove the lock ring.

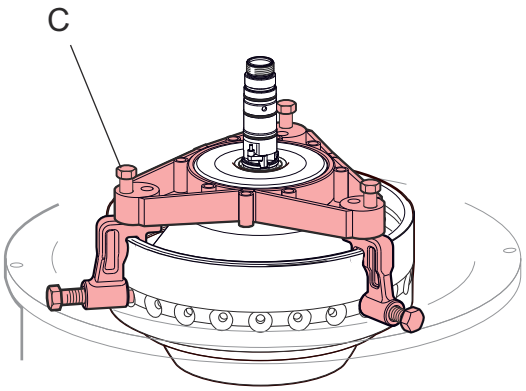
c) Fit the compressing tool and the puller screws (C). Pull the bowl hood off by screwing the screws alternately (max. 1/2 turn) and gradually increase the momentum evenly until the bowl hood come loose.



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.

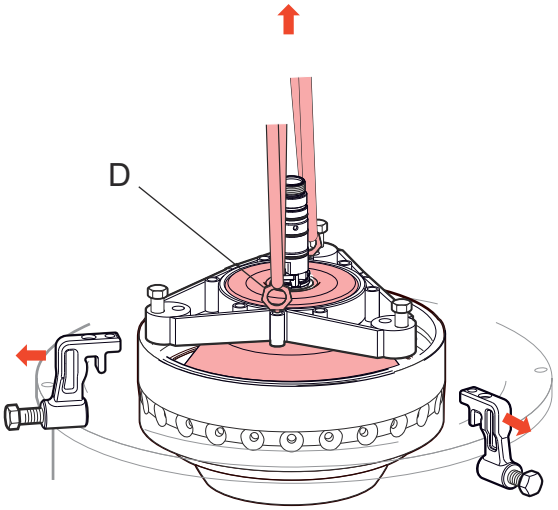


d) Remove the clamps and attach lifting eyes (D) to the compressing tool and lift off the bowl hood using slings and hoist.

WARNING

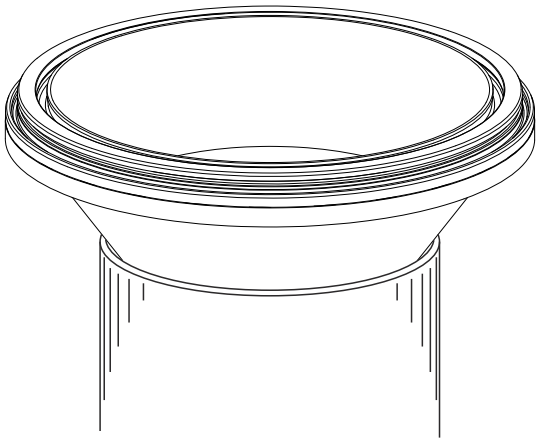
Crush hazard

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



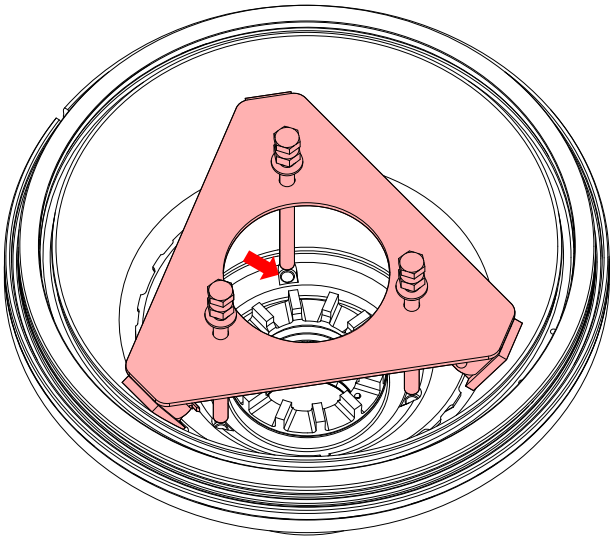
3 Proceed with this step only if the top disc adhere to bowl hood and is hard to remove. (Described with optional puller tool)

a) Place the bowl hood with top disc in a pipe or similar not to damage inlet pipe.



b) Remove the plugs in the three holes in the top disc top part.

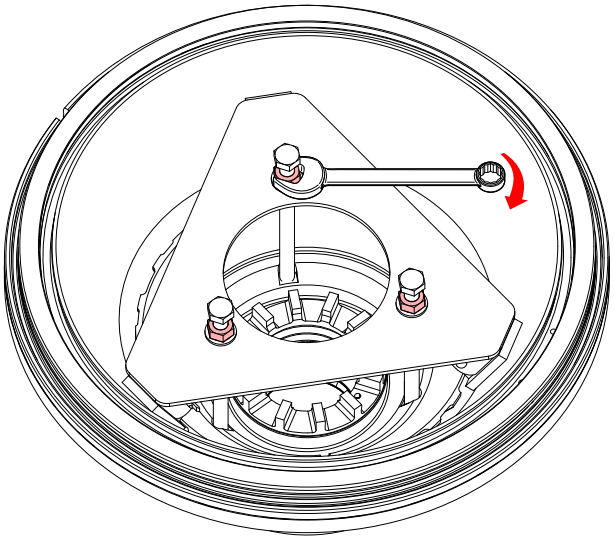
c) Fit the puller tool screws into the holes in the top disc top part.



> **NOTE**
>
> Apply diesel or other solvent for easier removal of the top disc top part.

d) Pull the top disc off by alternately tightening the screws, (max. 1/2 turn) and gradually increase the momentum evenly until the top disc come loose.

e) Remove the tool and fit the plugs into the three holes in the top disc top part.

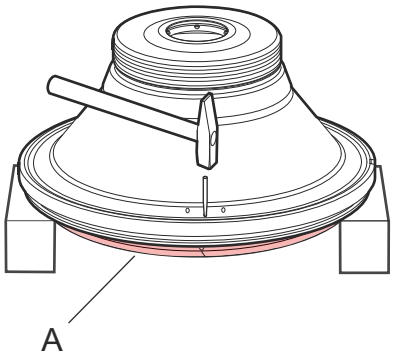


4 Removing the seal ring.

WARNING

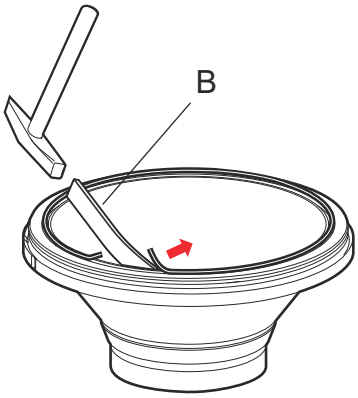
Risk for eye injury from flying seal ring parts or from splashing fluid

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



a) Place the bowl hood on a support and tap out a piece of the seal ring (A) using a drift in the holes.

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 chisel (B) tool.

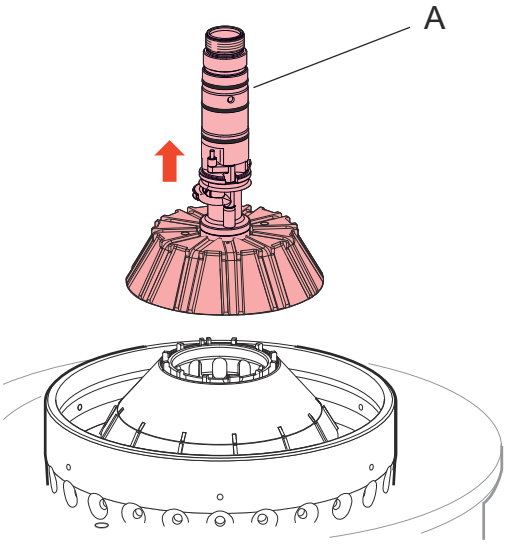


NOTE

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

5 Removing the inlet/outlet pipe and top disc top part.

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



WARNING

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.

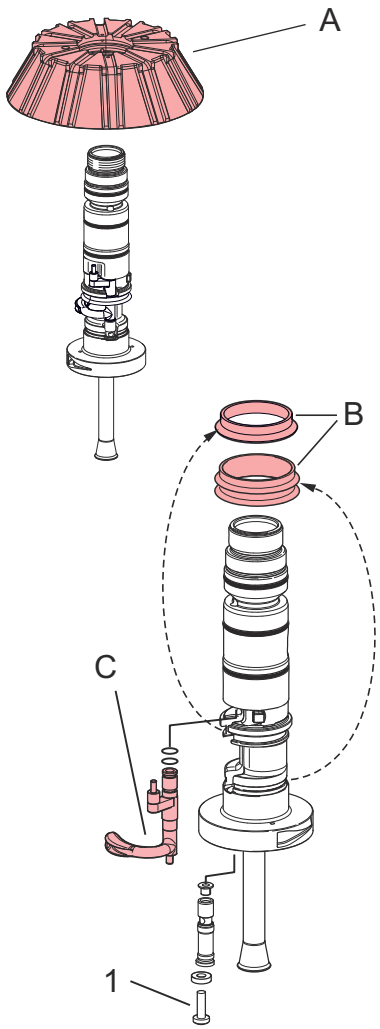
6 Removing the paring tube.

a) Remove the top disc top part (A) from the inlet and outlet pipe.

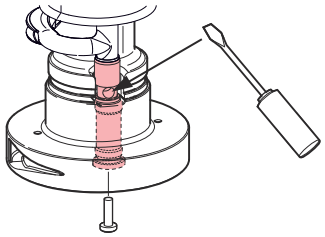
> **NOTE**
>
> To avoid damaging the paring tube, turn it towards the centre of the pipe.

b) Remove the splash sealing (B).

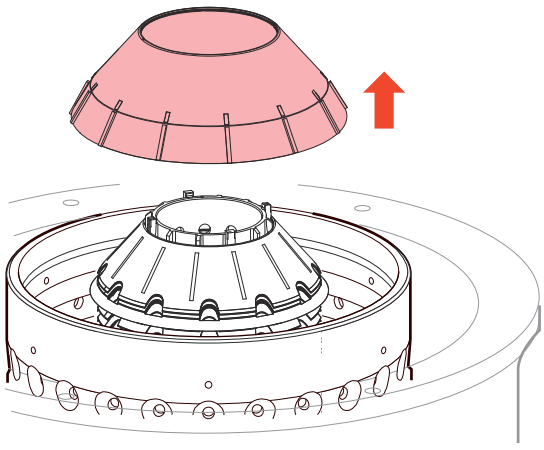
c) Remove screw (1) using a torx head key and remove the bearing holder and paring tube (C).



d) If bearing holder is hard to remove, fit a screw in bottom of bearing holder to pull out. Alt. use a screwdriver in the hole in bearing holder to push out.



7 Removing the top disc bottom part.

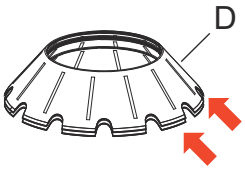


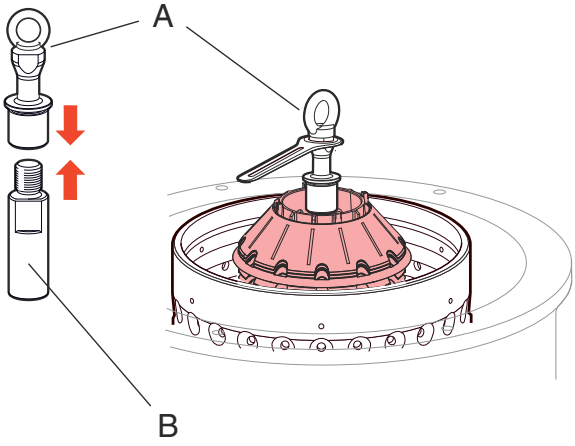
8 Removing the disc stack and distributor.

CAUTION

Cut hazard

Sharp edges on the bowl discs (D) may cause cuts.

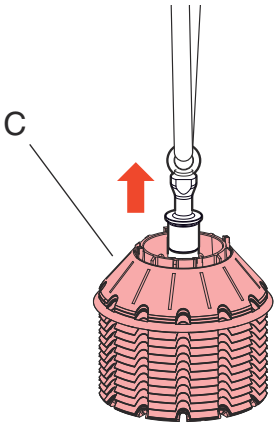




a) Assemble the lifting tool (A) with the pin (B).

b) Fit the assembled tool into the distributor and ease off the disc stack using a spanner or wrench.

c) Carefully lift out the disc stack (C) assembly.



9 Removing the nut.

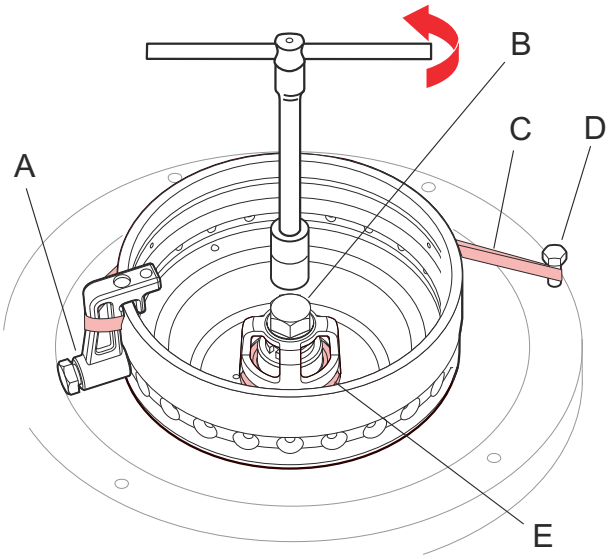
NOTE

Before the nut can be loosened, the bowl body must first be secured to prevent it from rotating

a) Fit a lifting sling on one of the compressing tool clamps (A). Fit the clamp (A) to the bowl body.

NOTE

Make sure that the screw on clamp (A) is tightened and that clamp will not loosen.



b) Fit one of the frame hood screws (D) to the frame.

NOTE

Make sure that the screw (D) in frame bottom part is sufficiently tightened so as not to loosen.

c) Fasten the other end of the lifting sling (C) on the screw (D). Make sure that the lifting sling is fully tensed before starting to unscrew the nut.

> **NOTE**
>
> Make sure that the lifting sling is positioned below the head of the screw (D).

d) Use the spanner (B) to remove the nut (E).

10 Removing the discharge slide.

a) Fit the lifting tool (A) by pressing the puller rods (E) towards each other and position them into the two slots on the bowl body (F).

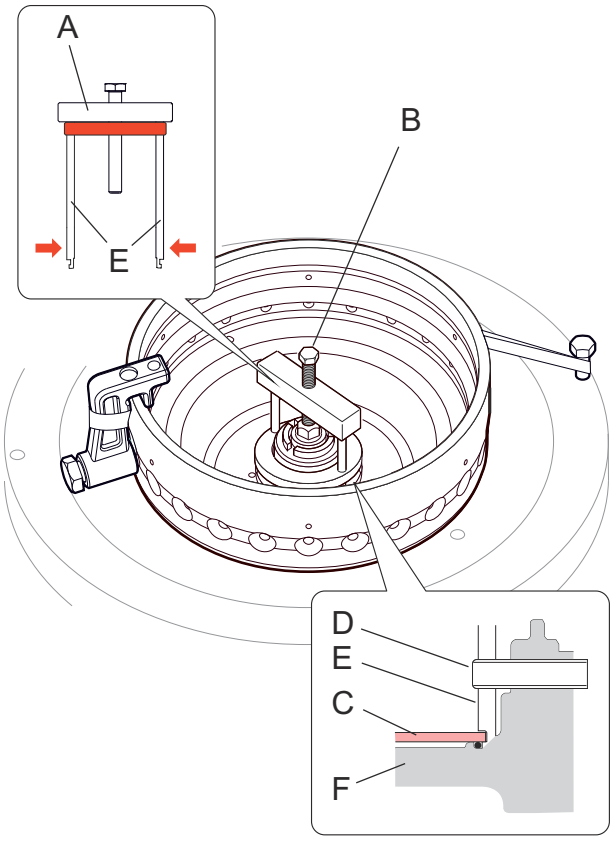
b) Slide metal ring (D) down over bowl nave.

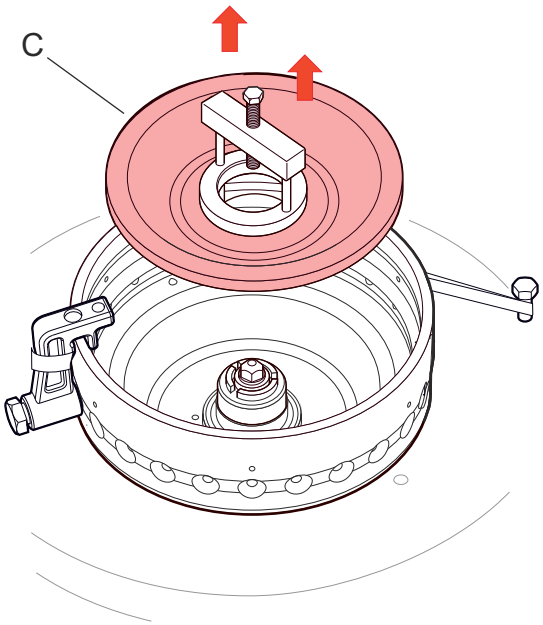
c) Ease off the discharge slide (C) by turning the central screw (B).

> **NOTE**
>
> If discharge slide is difficult to remove, apply diesel or other solvent along the periphery, tap lightly on outside edge with a soft faced hammer.

d) Lift out the discharge slide (C).

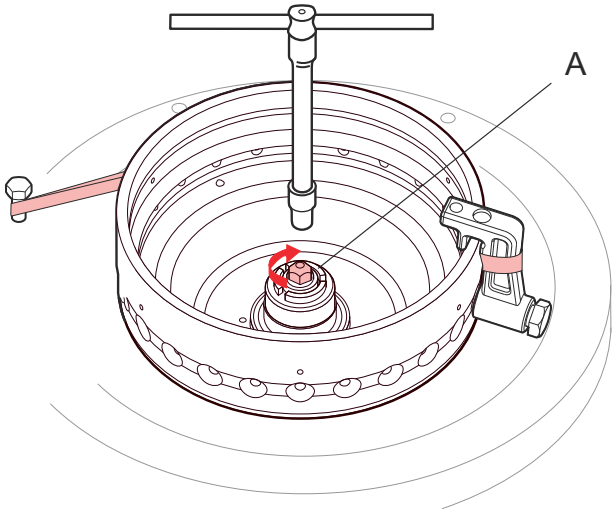
> **WARNING**
>
> **Crush hazard**
>
> The ring on the lifting tool must be pushed down against the discharge slide, otherwise the discharge slide may come loose from the tool.





11 Removing the cap nut.

a) Remove the cap nut (A).
Note! Left-hand thread!

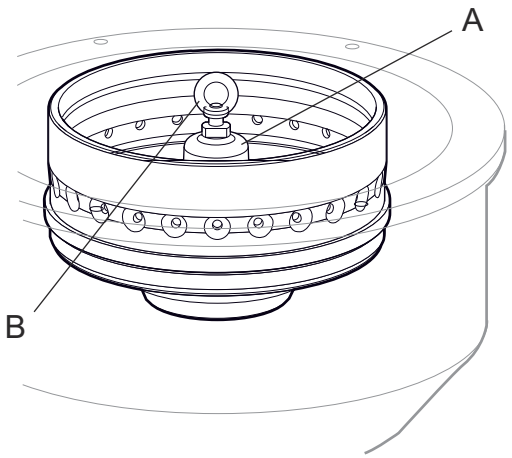


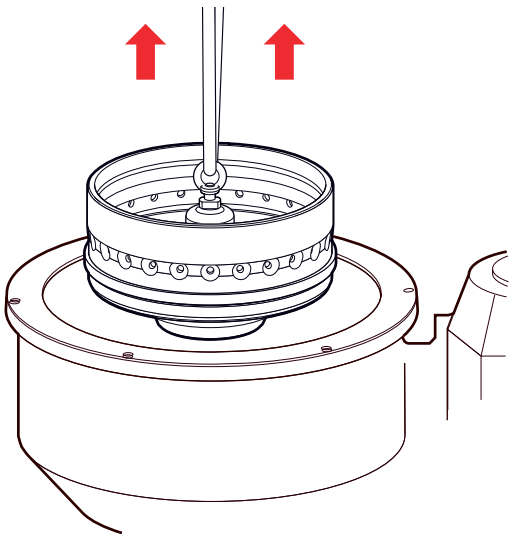
12 Removing the bowl body.

a) Fit the lifting tool (A) to the bowl body.

b) Raise the bowl body off the spindle taper by turning the lifting eye (B) clock-wise

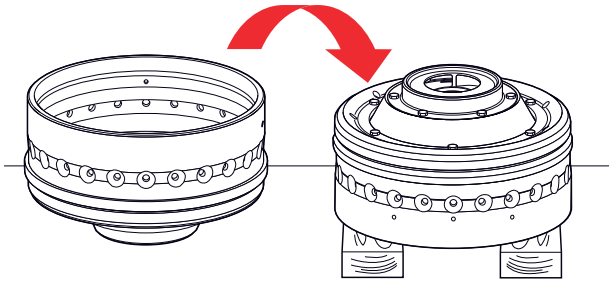
c) Lift off the bowl body using sling and hoist.





13 Turn the bowl body upside down.

> **WARNING**
>
> **Crush hazard**
>
> Support the bowl body when turning to prevent it from rolling.

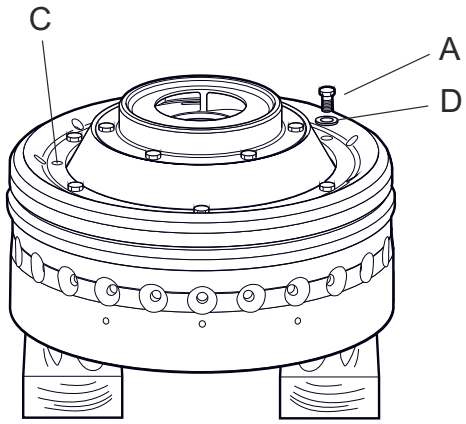


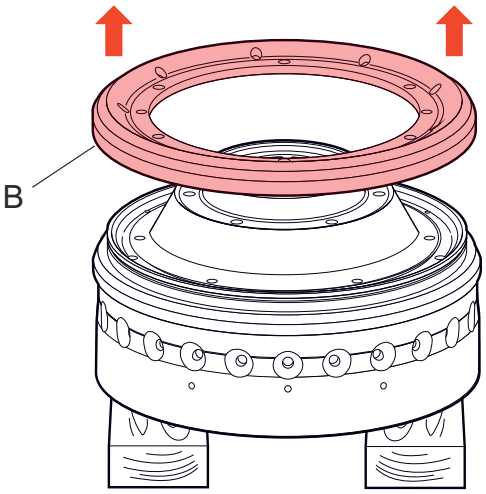
14 Removing the holder.

a) Remove and discard the screws (A) and washers (D). New screws and washers are included in the Inspection kit.

b) Remove the holder (B).

> **NOTE**
>
> If the ring sticks, use two M8 screws in threaded holes (C) to raise the operating slide holder up and away from the bowl body.

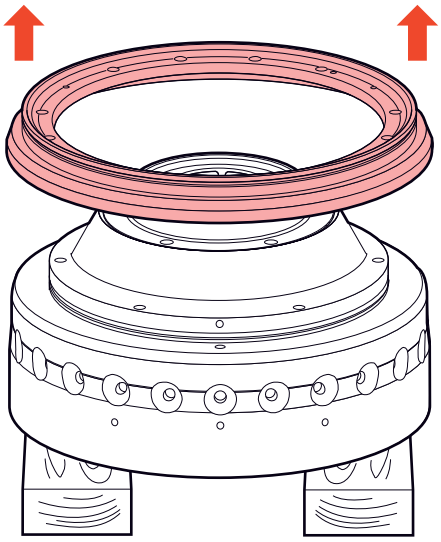




15 Removing the operating slide.

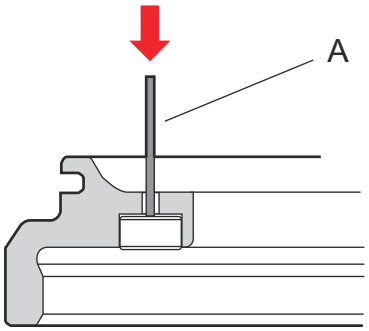
a) Lift off the operating slide.

> **NOTE**
>
> If the ring sticks, use two M8 screws in threaded holes to raise the operating slide holder up and away from the bowl body.



16 Removing the valve plugs from the operating slide.

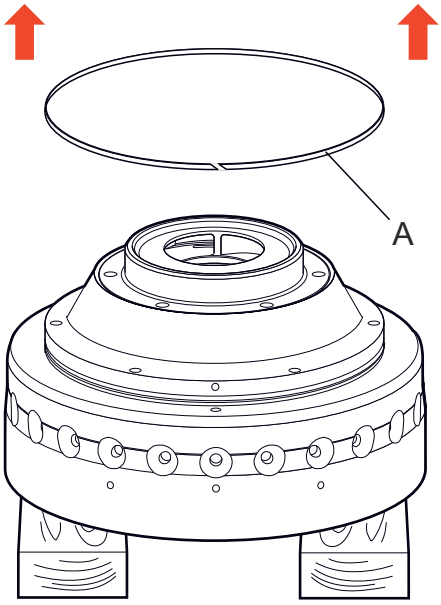
a) Remove the valve plugs using a drift (A).



17 Removing the guide ring.

> **NOTE**
>
> Do NOT remove the guide ring if only an Inspection service is performed.

a) Gently pry loose the guide ring (A) and remove it from the bowl. Discard the guide ring. A new guide ring is included in the Overhaul kit.

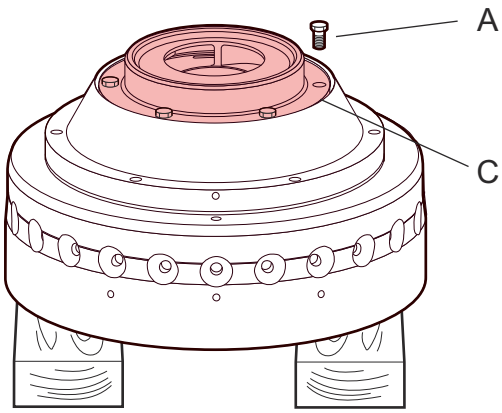


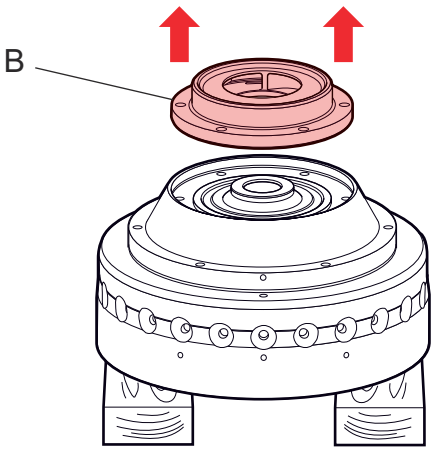
18 Removing the operating water ring.

a) Remove and discard the screws (A). New screws are included in the Inspection kit.

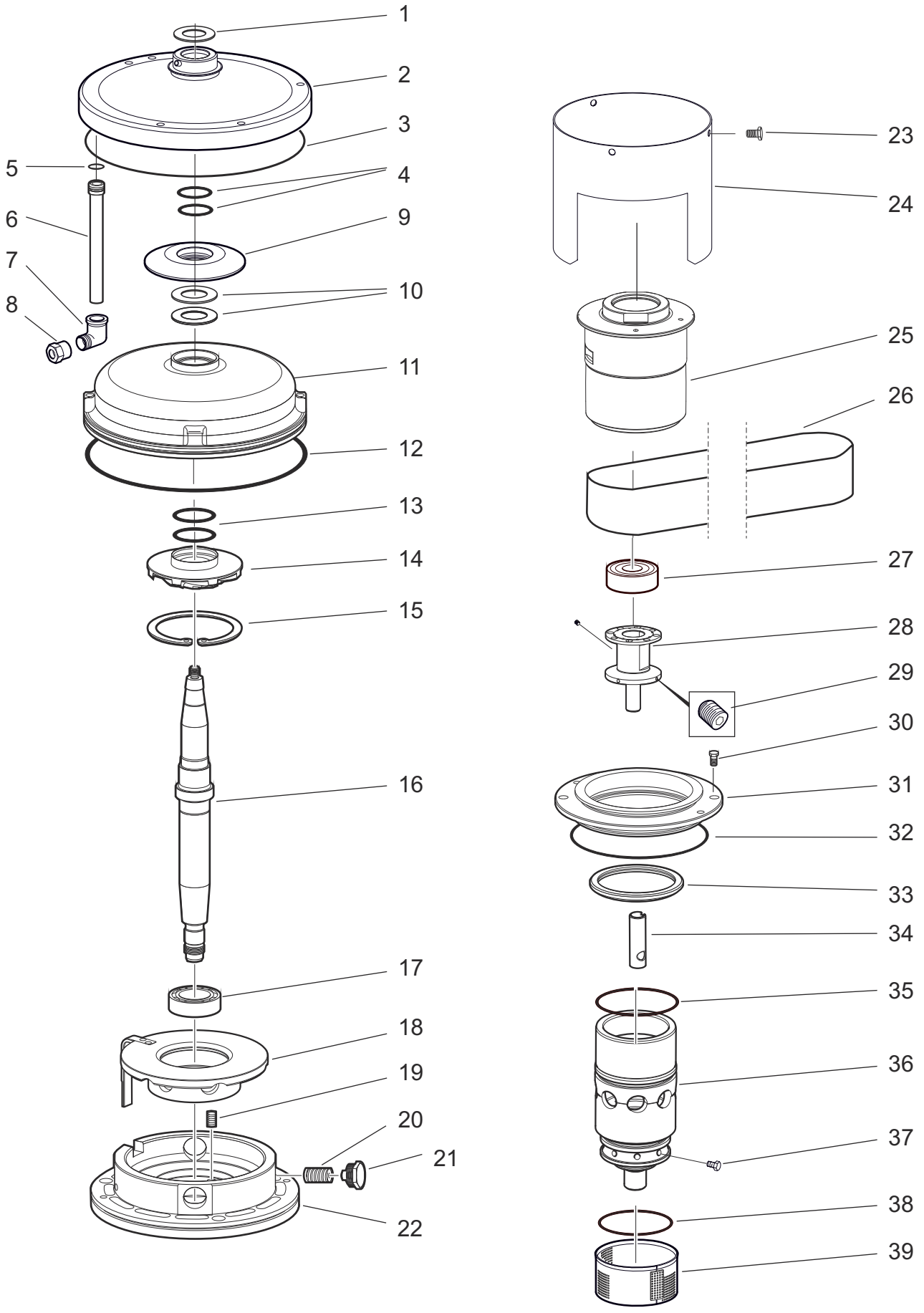
b) Lift off the ring (B).

> **NOTE**
>
> If the ring sticks, use two M8 screws in threaded holes (C) to raise the operating slide holder up and away from the bowl body.

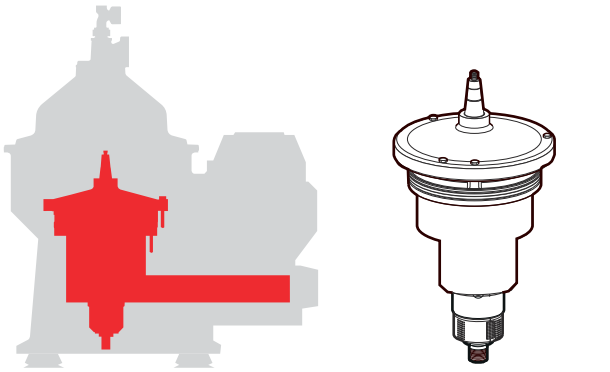


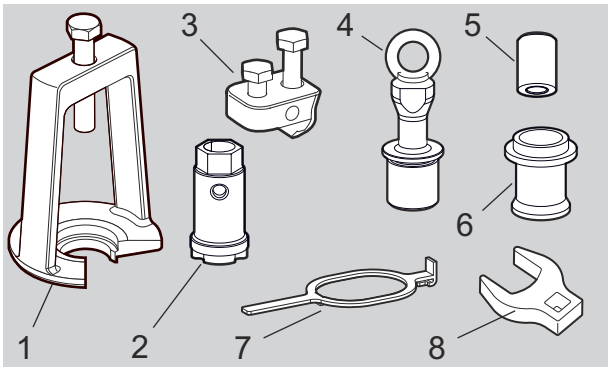


6.3.5 Driving device



1. Seal ring
2. Operating water cover
3. O-ring
4. O-rings
5. O-ring
6. Pipe
7. Elbow
8. Bushing
9. Deflector ring
10. Seal rings
11. Neck bearing cover
12. O-ring
13. O-rings
14. Fan
15. Snap ring
16. Bowl spindle
17. Ball bearing
18. Top bearing seat
19. Helical spring
20. Composite spring
21. Plug
22. Top bearing housing
23. Screw
24. Air deflector
25. Spindle pulley
26. Belt
27. Self-aligning roller bearing
28. Oil mist generator
29. Nozzle
30. Screw
31. Labyrinth ring holder
32. O-ring
33. Labyrinth ring
34. Pipe
35. O-ring
36. Bottom bearing holder
37. Screw
38. O-ring
39. Strainer



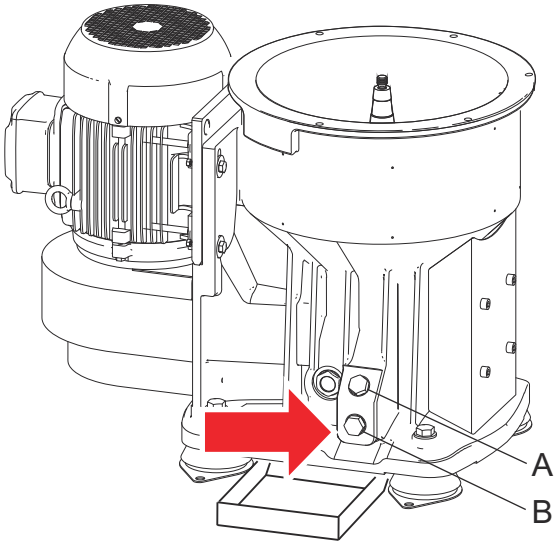


1. Puller (spindle pulley, ball bearing)
2. Tool (bearing housing)
3. Cover puller (neck bearing cover)
4. Lifting tool (spindle assembly)
5. Drift (bottom bearing)
6. Sleeve (ball bearing in top bearing seat
7. Spanner (fan)
8. Crowfoot wrench head (oil mist generator)

1 Empty the oil sump.

a) Remove oil filling plug (A).

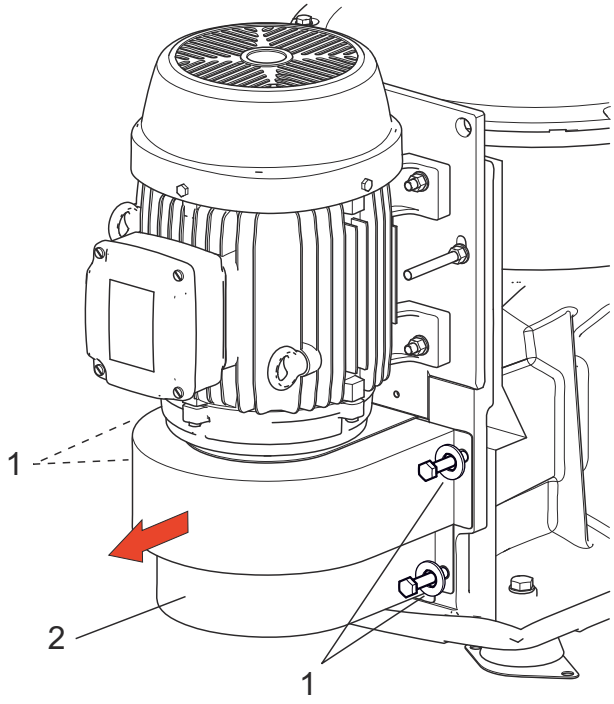
b) Unscrew the oil plug (B) and empty the oil sump.



2 Removing the belt cover.

a) Unscrew the screws (1). They are captive and will hang on cover.

b) Remove the belt cover (2).



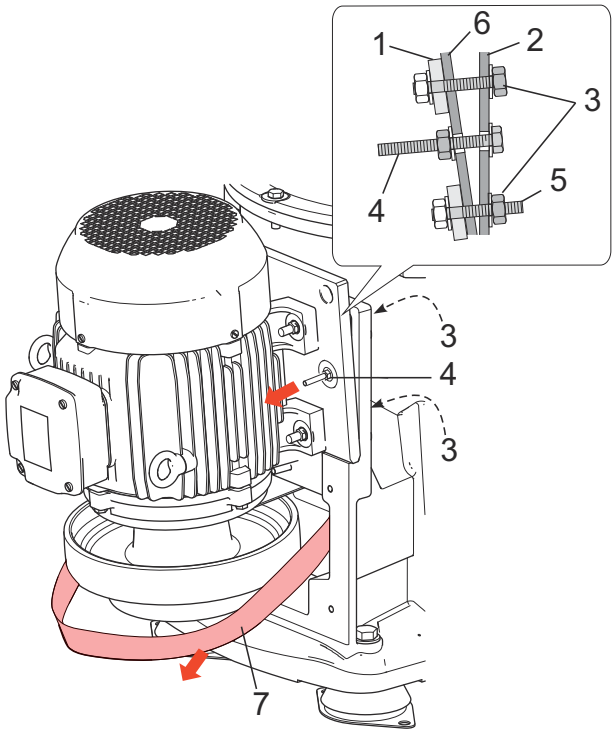
3 Loosen the flat belt, by tilting the motor.

a) Loosen, but do not remove, the screws holding the adaptor plate. Start with the four stud bolt nuts (3) on separator frame side.

b) Loosen, but do not remove, the two tilting screws (4) holding the adaptor plate. Tilt the motor together with the adaptor plate slightly.

> **WARNING**
>
> **Crush hazard**
>
> The motor will come off if the screws are unscrewed.

c) Remove the flat belt (7) from the motor pulley.

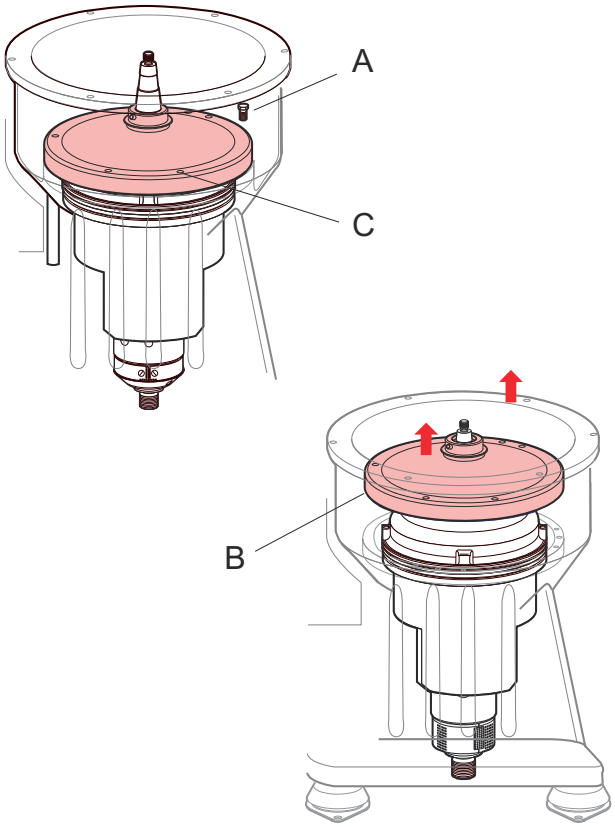


4 Removing the operating water cover.

a) Remove the screws (A).

b) Lift off the operating water cover (B).

> **NOTE**
>
> If the cover (B) sticks, fit two M10 screws to the threaded holes (C) and tighten.



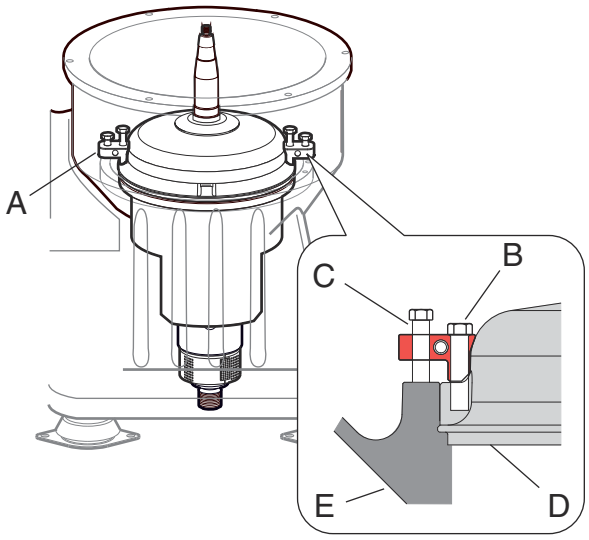
5 Removing the deflector ring and neck bearing cover.

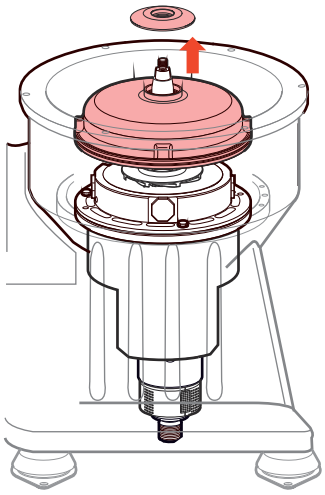
a) Attach the tools (A).

b) Fasten the tool to the cover using mounting screw (B).

c) Ease off the cover (D) by tightening the screw (C).

d) Remove the deflector ring and neck bearing cover.



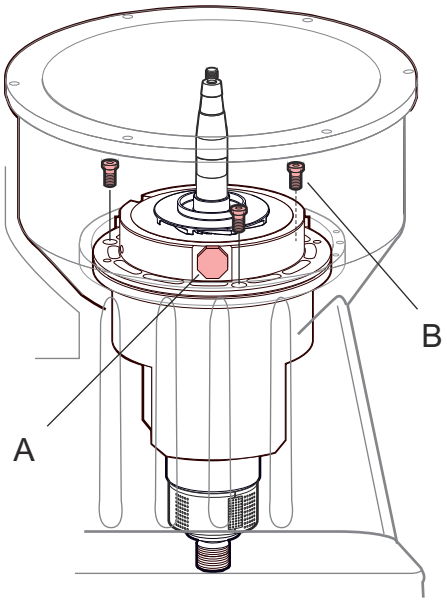


6 Prepare for removal of spindle assembly.

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

b) Remove the screws (B).

> **NOTE**
>
> If the housing sticks, fit two M10 screws to the threaded holes and tighten.



7 Lifting the spindle assembly from the frame.

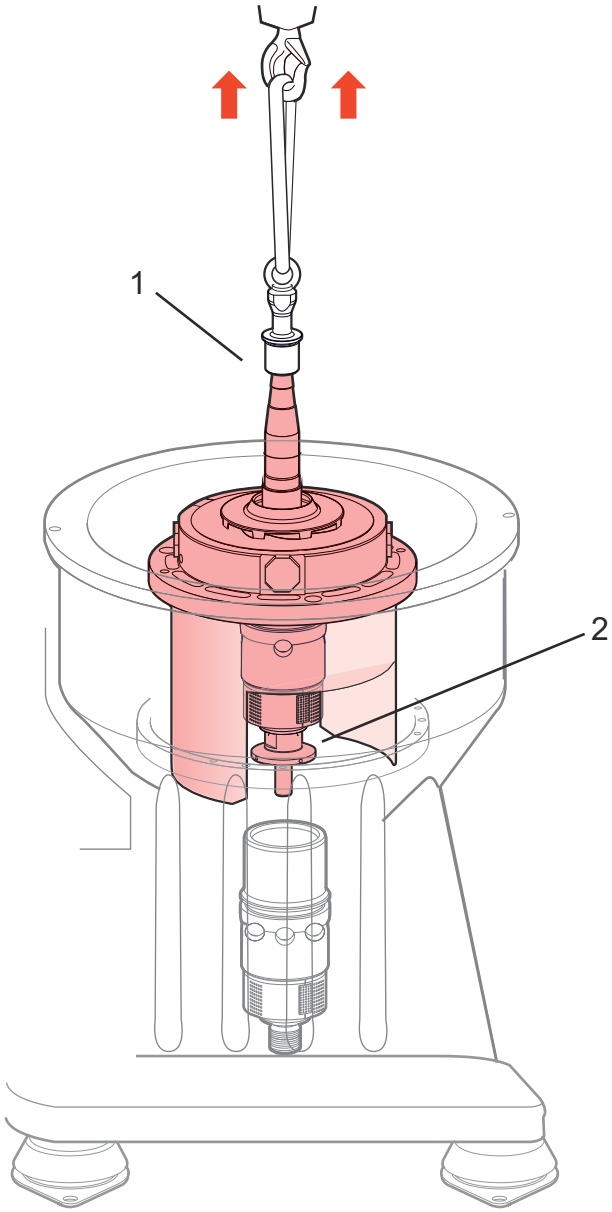
a) Fit the lifting tool (1) to the spindle end.

b) Slowly raise and lift out the spindle assembly using a hoist.

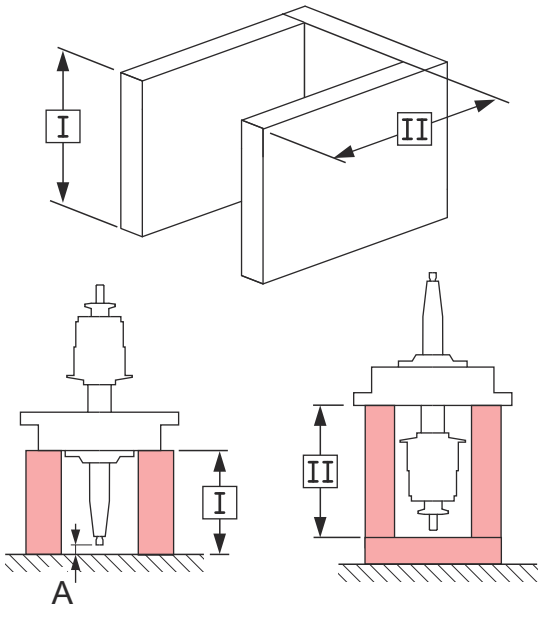
> **WARNING**
>
> **Crush hazard**
>
> Do not rotate the spindle assembly during lifting. The spindle assembly may otherwise come loose from the lifting tool.

> **NOTE**
>
> Take care not to damage the oil mist generator (2).

c) Protect the inside of the frame by covering the hole.

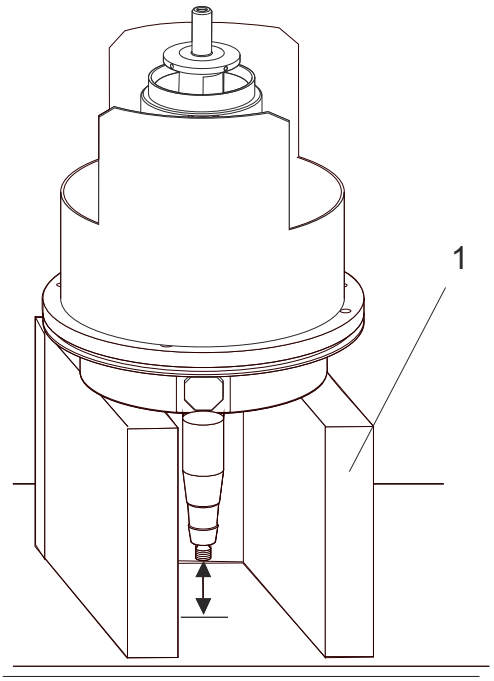


8 Make a support which when placed on its side gives free space (A) between the spindle top and the floor. When support is placed on its end it must give clearance for oil mist generator. (A=5 mm)



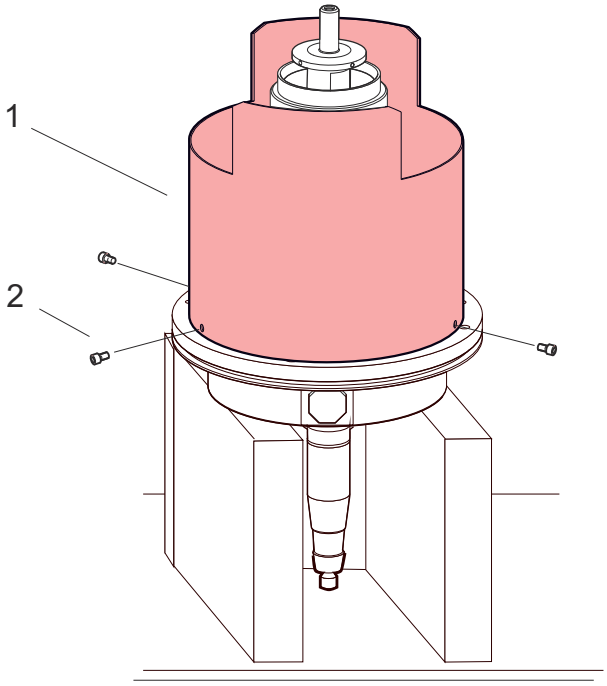
9 Place the spindle assembly upside down on a support (1).

> **NOTE**
>
> Always use a support as per this sketch when overhaul service is performed on the spindle assembly. It is very important that the top of the spindle does not touch the ground.



10 Removing the air deflector.

a) Remove the screws (2) and the air deflector (1).

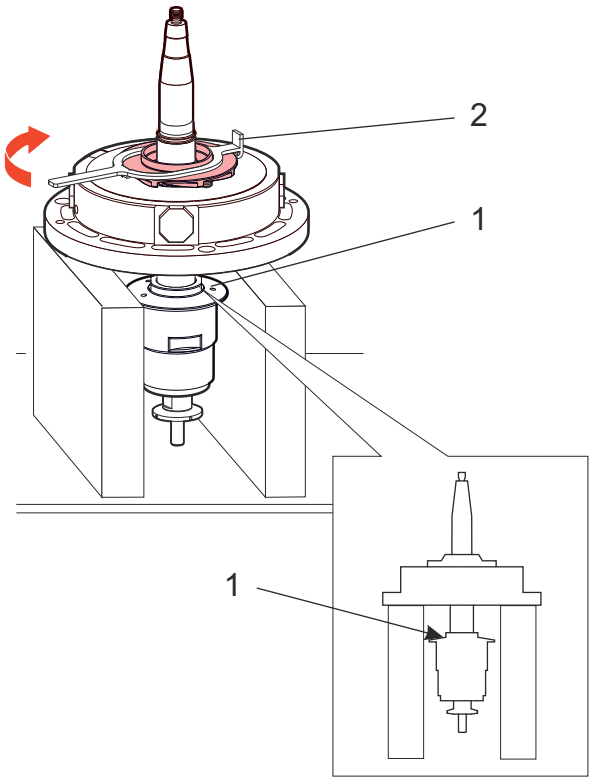


11 Removing the fan.

a) Turn the spindle assembly the right way up.

b) Place a spanner (or similar) on the spindle pulley key-grip (1), as holder-up.

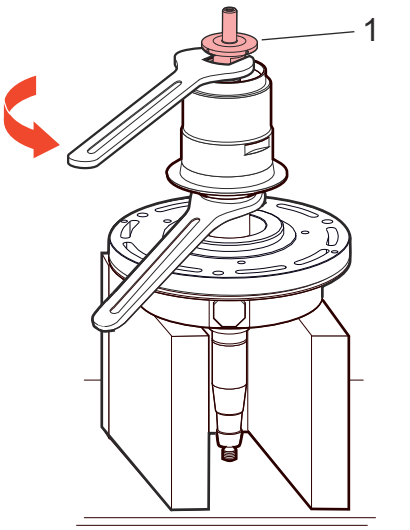
c) Fit the spanner and remove the fan (2).
Note! Left-hand thread!

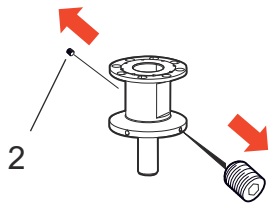


12 Removing the oil mist generator.

a) Turn the spindle assembly up-side down and remove the oil mist generator (1) by using spanners.

b) Remove the two nozzles (2) using an Allen key.

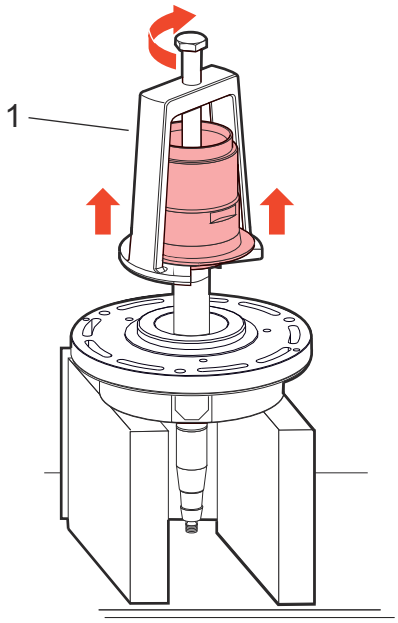




13 Removing the bottom bearing assembly.

a) Pull off the belt pulley and the self-aligning roller bearing using the puller tool (1).

> **NOTE**
>
> Always discard a used bearing.



14 Removing the top bearing housing.

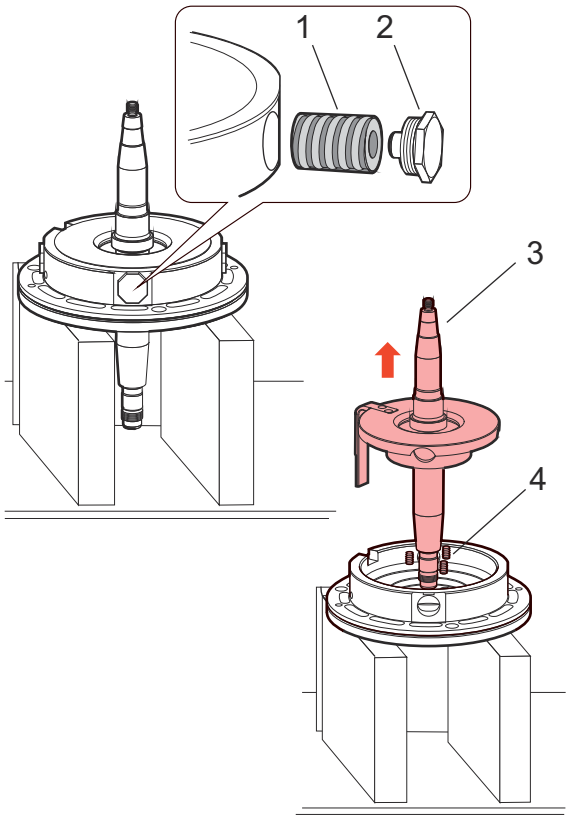
a) Turn the spindle assembly over.

b) Remove the plugs (2) and the composite springs (1).

c) Carefully remove the spindle (3) and bearing seat from the top bearing housing.

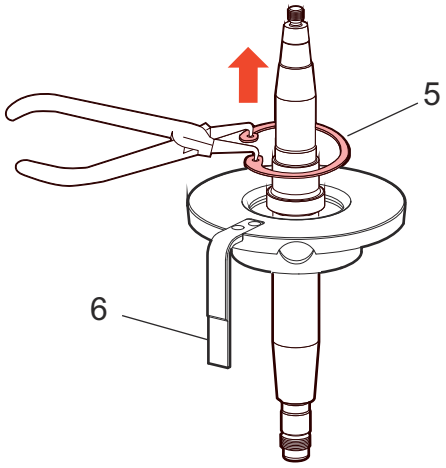
> **NOTE**
>
> Be careful not to damage the vibration indicator (6).

d) Collect the axial springs (4).



e) Remove the snap ring (5).

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



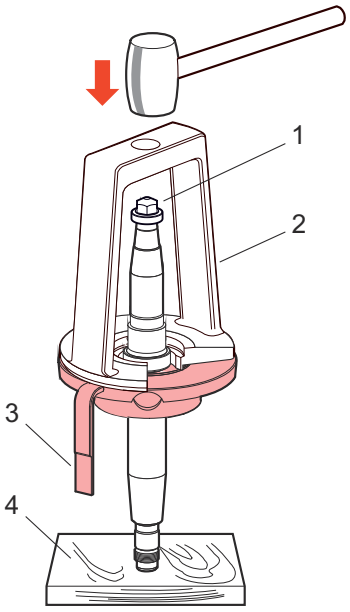
15 Removing the ball bearing.

a) Fit the cap nut (1) on the spindle to protect the threads.

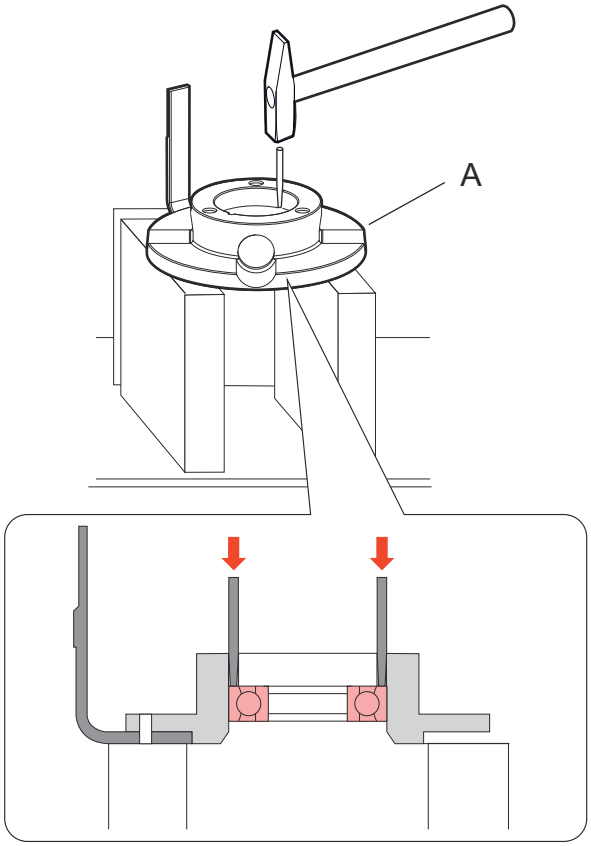
b) Use the puller tool (2) to remove the top bearing seat from the spindle.

> **NOTE**
>
> Take care not to damage the vibration indicator (3) when separating the top bearing seat from the spindle.

> **NOTE**
>
> Do not damage threads on spindle, use piece of wood (4) to protect the spindle.



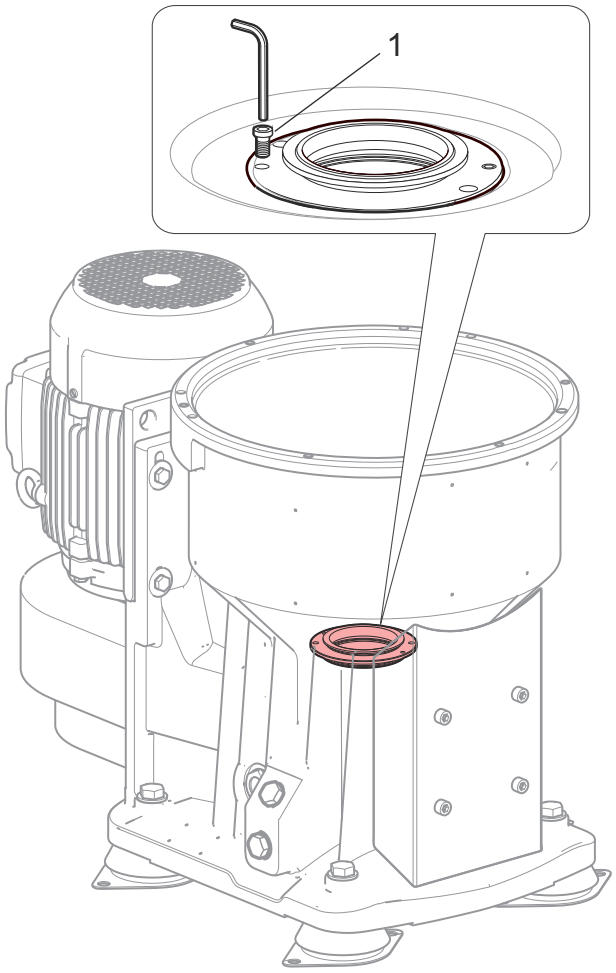
c) Place the top bearing seat (A) on a support to protect the vibration indicator. Remove the bearing. Use a drift in the two holes.



16 Removing the labyrinth ring holder.

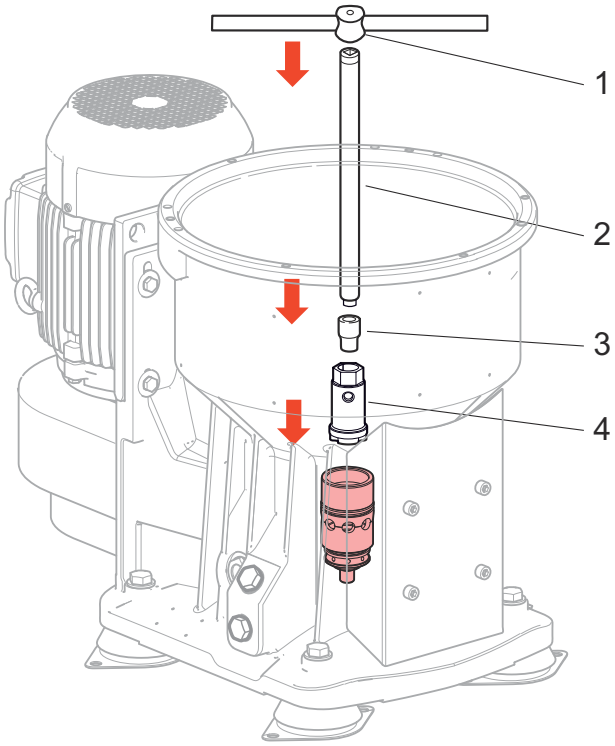
a) Remove the screws (1).

b) Remove the O-ring and labyrinth ring.

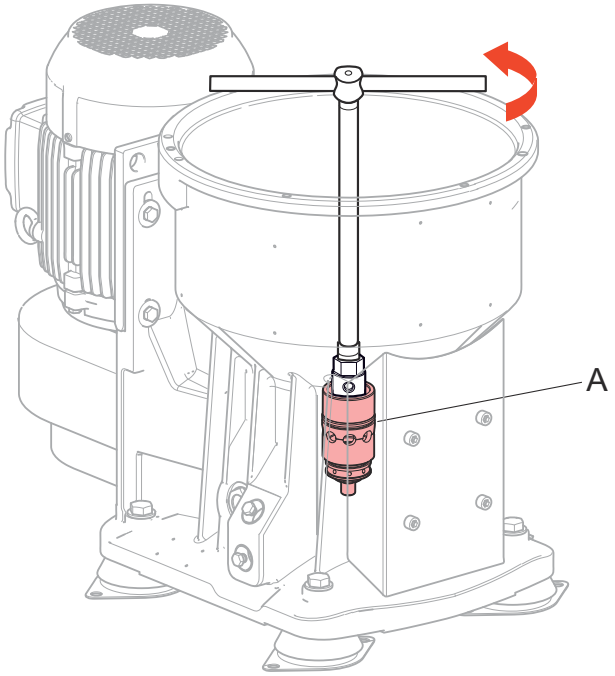


(17) Removing the bottom bearing holder.

a) Fit the tool (4) into the bottom bearing holder and attach the socket (3), extension rod (2) and T-handle (1).



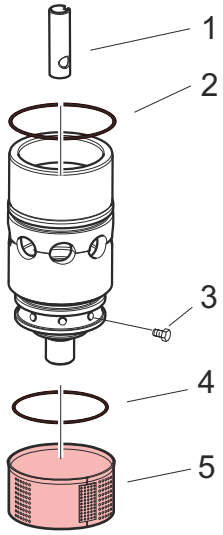
b) Loosen the bottom bearing holder (A) by turning it counter clockwise. Remove it by hand.



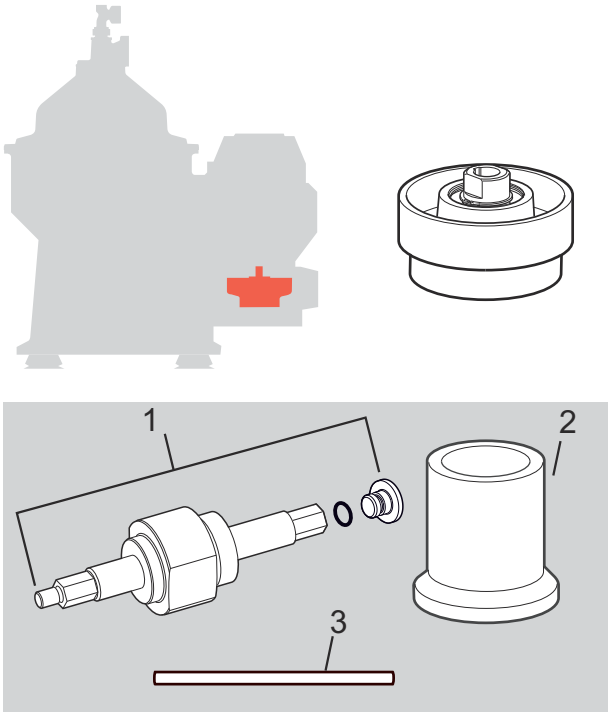
18 Dismantling the bottom bearing holder (when necessary).

a) Unscrew the screw (3).

b) Remove the pipe (1), O-rings (2), (4) and strainer (5).



6.3.6 Centrifugal clutch



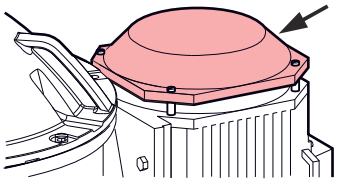
1. *Mounting / dismantling tool (centrifugal clutch)*
2. *Mounting / dismantling tool (ball bearing)*
3. *Rod for holding coupling*

WARNING **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 35 minutes from switch off).

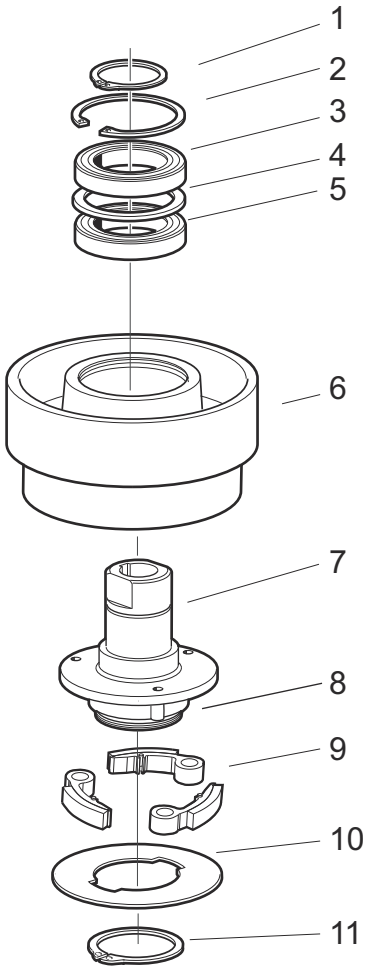
If motor fitted with additional end cover, this can be removed to see if motor fan is rotating. Refit end cover when separator has come to complete standstill.



Note!

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

The illustration shows 60 Hz



1. *Snap ring*
2. *Snap ring*
3. *Ball bearing*
4. *Spacing ring*
5. *Ball bearing*
6. *Belt pulley*
7. *Coupling hub*
8. *Parallel pin*
9. *Friction blocks (3=60 Hz), (5=50 Hz)*
10. *Cover*
11. *Snap ring*

1

NOTE

If belt cover and drive belt have not been removed, proceed with this before removing the motor. See *Driving device* on page 72

2 Removing the motor.

WARNING

Electrical hazard

To avoid electrical shock, switch off and lock power supply before starting dismantling work.

a) Disconnect the electrical cables.

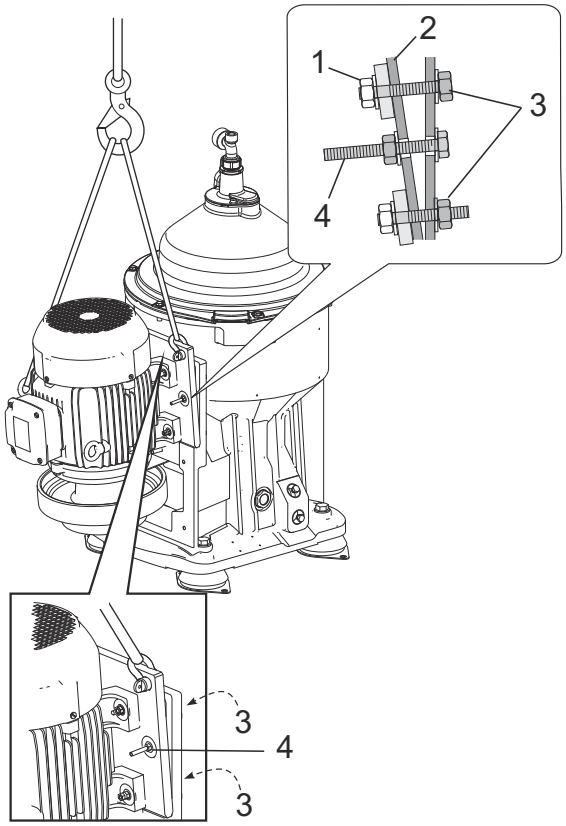
NOTE

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

b) Fit a sling to the motor and adapter plate (2) using a shackle on the upper part.

Weight of motor with coupling and adaptor plate: approx. **159** kg.

c) Tense the lifting sling to support the motor adapter plate and unscrew the four stud bolts nuts (3) on separator frame side and then remove the two tilting screws (4). Lift the motor while supported.



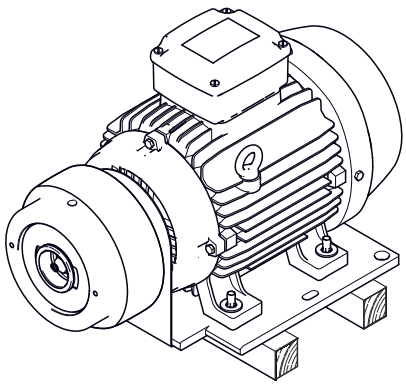
WARNING

Crush hazard

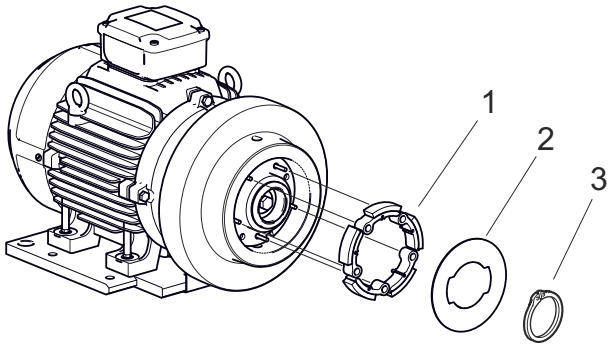
If not supported, the motor with coupling will drop when removing the screws.

Do not unscrew the motor nuts (1).

d) Lower the motor onto a suitable pallet.



3 Removing the friction blocks.



CAUTION

Flying objects

Risk for accidental release of snap ring. Wear safety goggles.

CAUTION

Inhalation hazard

When handling friction blocks/pads (1) wear a mask to avoid inhalation of dust.

Do not use compressed air to remove dust.

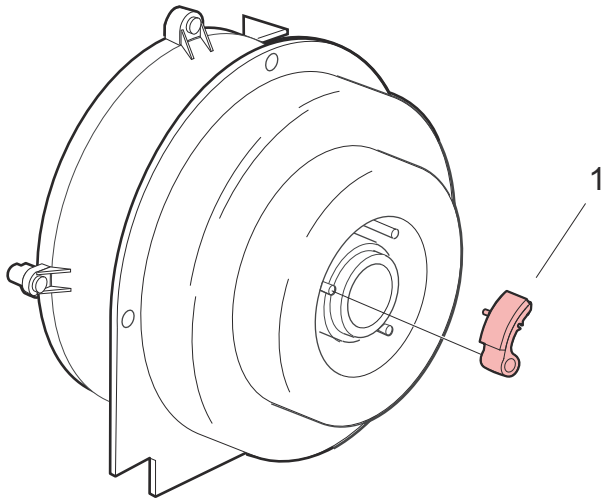
Remove dust using vacuum or a damp cloth.

a) Remove the snap ring (3), cover (2) and friction blocks (1).

Note!

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

4 Checking the condition of the friction blocks (1).



CAUTION

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) If the blocks are worn:
Fit new friction blocks.

NOTE

Replace all blocks, even if only one is worn.

NOTE

Be sure that the pins on the back of the blocks project into the grooves in the clutch hub.

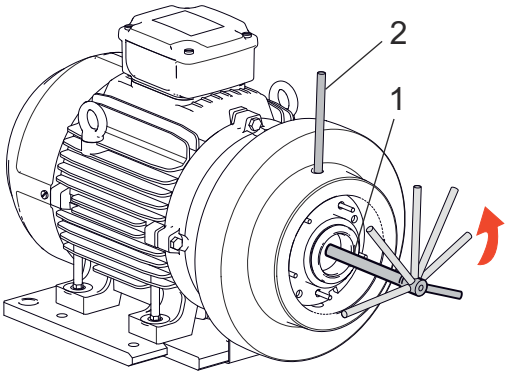
b) Clean the pins of coupling hub and apply a thin film of lubricating paste to the pins.

> **NOTE**
>
> Make sure that there is no oil on the pads.

c) If only friction block service is to be done, proceed to fitting the friction blocks on page, *Centrifugal clutch* on page 101

5 Removing the coupling from the motor (complete dismantling of centrifugal clutch).

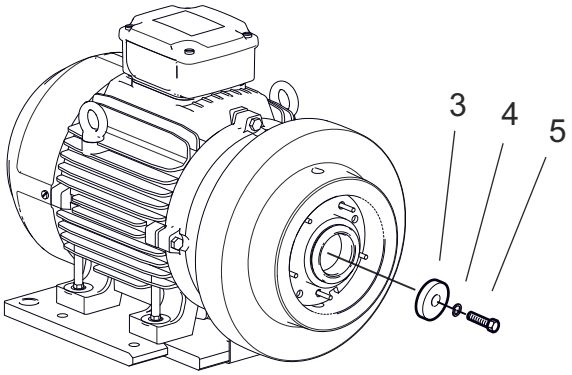
a) Attach a socket with extension rod and handle (1) to the screw. Use the rod (2) to prevent the coupling from rotating when removing the screw.



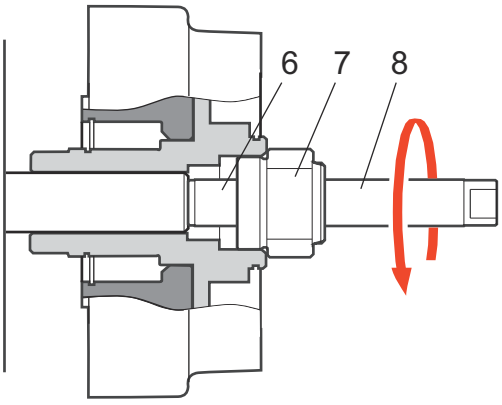
b) Remove the screw (5), spring washer (4) and washer (3).

c) Check that the brass plug (6) is mounted on the puller tool (8). Fit the tool to the friction clutch.

d) Ease off the friction coupling.



> **WARNING**
>
> **Crush hazard**
>
> The centrifugal clutch is heavy and can fall, causing injury, when loosened from the motor shaft.



6 Dismantling of the coupling assembly.

CAUTION

Flying objects

Risk for accidental release of snap ring.

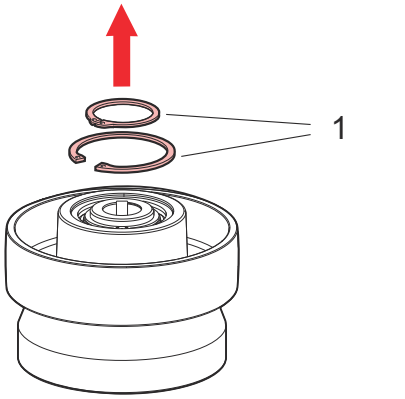
a) Remove the snap rings (1).

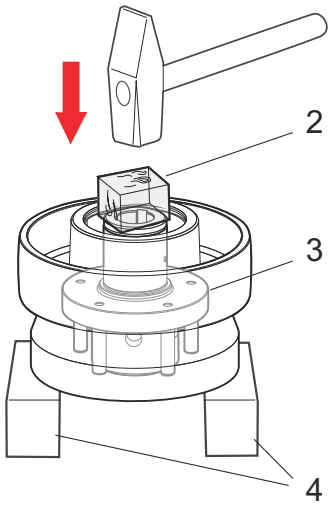
b) Drive out the coupling hub (3).

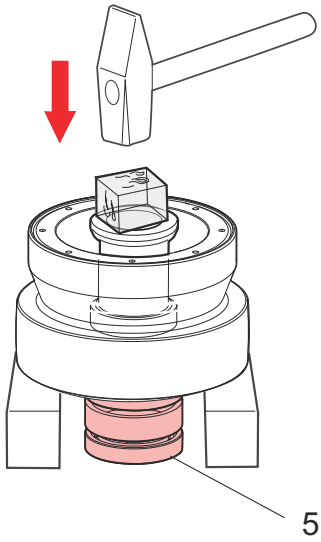
c) Turn the coupling the other way round and drive out the ball bearings (5) using the mounting tool.

NOTE

Always discard used bearings.







6.4 Actions before assembly/Check points

NOTE

If the ambient lighting is not enough to carry out an inspection, use a flashlight.

6.4.1 Cleaning

i / O

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

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.

CAUTION **Cut hazard**

Sharp edges on the separator discs may cause cuts.

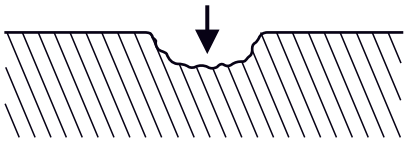
Part	Procedure	Cleaning agents
Frame and motor	The external cleaning of the frame and motor should be restricted to brushing, sponging or wiping while the motor is running or still is hot. Clean the inside of the frame with a clean cloth and remove visible particles.	Water and de-greasing agent.
Bowl, Inlet/outlet	**Cleaning of bowl discs** Handle the bowl discs carefully in order to avoid damage to the surfaces during cleaning. Remove the bowl discs from the distributor and place them individually in the cleaning agent. - Allow the discs to remain in the cleaning agent until the deposits have been dissolved. This will normally take between two and four hours. - 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. Use Alfa Laval bowl disc cleaning agent. Mix 1 part cleaning agent to 10 parts water. The temperature should be 60–80 °C. Fuel oil 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.
Driving device	Use a sponge or a soft brush and clean the oil mist generator and bearing holder 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 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.

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 mm** for other parts)



- cracks have been found
- any corrosion damage on bowl discs where its clear that material has corroded away, (surface integrity is compromized).

WARNING **Disintegration hazards**

If corrosion damage exceeds the limits stated above, do NOT continue to use the separator until it has been inspected and given clearance for operation by Alfa Laval.

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, Sulfide or acidic solutions	Acidic solutions cause general corrosion. Chloride and Sulfide 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) or any bowl disc corrosion which compromises surface integrity 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.

WARNING **Disintegration hazards**

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.

If you suspect that corrosive media has entered the separator, (corrosion damages on other equipment etc.) an inspection of rotating parts is of paramount importance.

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.

WARNING **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.

WARNING **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 mm for other parts) or any bowl disc corrosion which compromises surface integrity.

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.

Erosion is characterised by:

- Burnished traces in the material.
- Dents and pits having a granular and shiny surface.

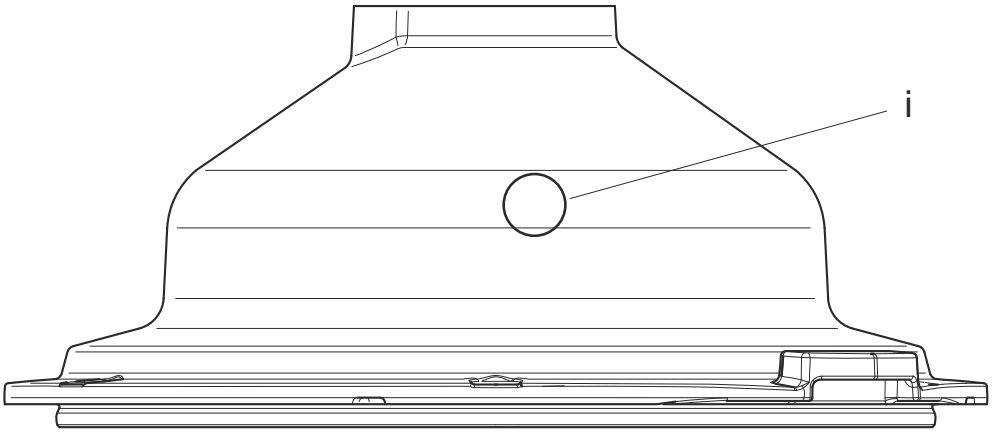
1. Inspect the bowl and inlet/outlet parts for erosion damages.

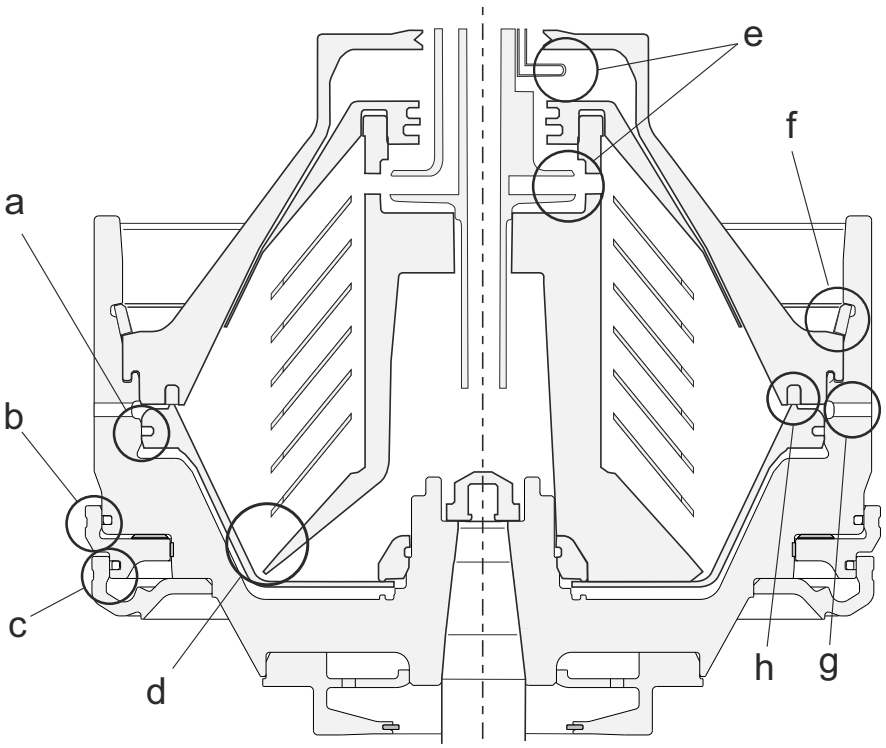
> **NOTE**
>
> Always contact your Alfa Laval representative if you suspect that the depth of the damage exceeds 0,2 mm for bowl body and bowl hood (0,5 for other parts). Do not continue to use the separator until it has been inspected and cleared for operation by Alfa Laval.

2. Inspect inside and outside of the frame hood.
3. Replace parts if erosion is suspected.

> **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.

Surfaces particularly subjected to erosion are:





a. The sealing edge of the discharge slide

b. Bowl body and holder

c. Holder and operating slide

d. The underside of the distributor in the vicinity of the distribution holes and wings

e. Paring disc and paring tube

f. Lock ring

g. Pillars between the sludge ports in the bowl wall

h. The sealing edge of the discharge slide for the seal ring in the bowl hood

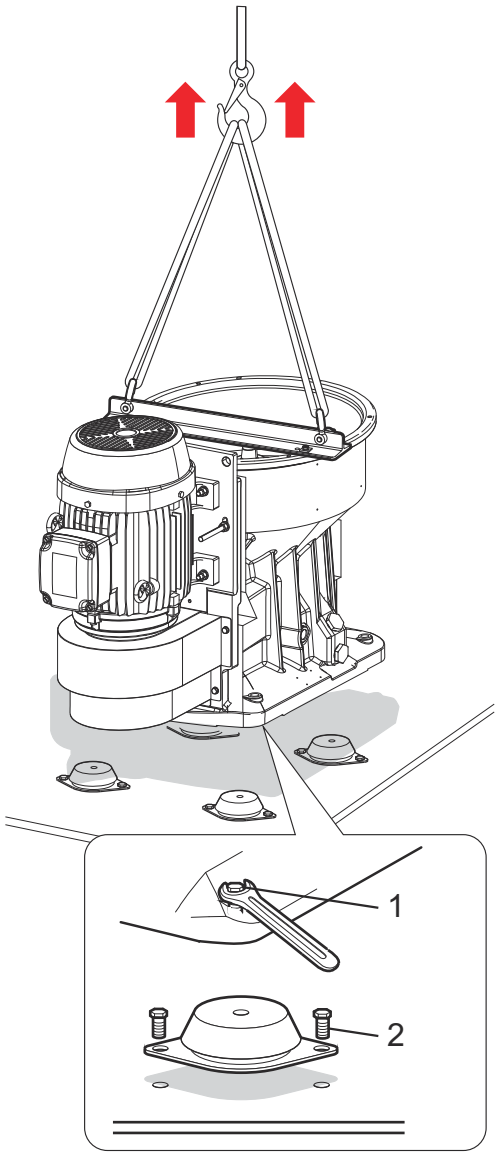
i. Inspect both the inside and outside of the frame hood.

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 the instructions in *"Lifting instructions"*

1. Loosen the central bolts (1) and prepare to remove the separator frame



2. Remove the separator. See *"Lifting intructions"*.

3. Remove the existing screws (2), washers and frame feet.

> **NOTE**
>
> Discard the old frame feet, screws and washers.

4. Fit the new feet, screws and washers.

5 Place the separator in its original position and fasten the central mounting bolts (1).
Tightening torque: **160 Nm**.

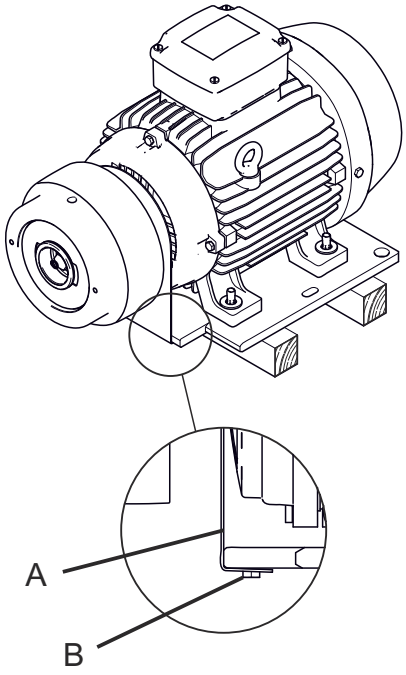
6.4.6 Change of motor bearings

1. Remove motor according to instructions in chapter *Centrifugal clutch* on page 86.

2. Place motor onto suitable support to protect stud bolts.

   NOTE

   Make sure not to place motor onto guard (A).



3. Remove screws (B) holding the guard in place.

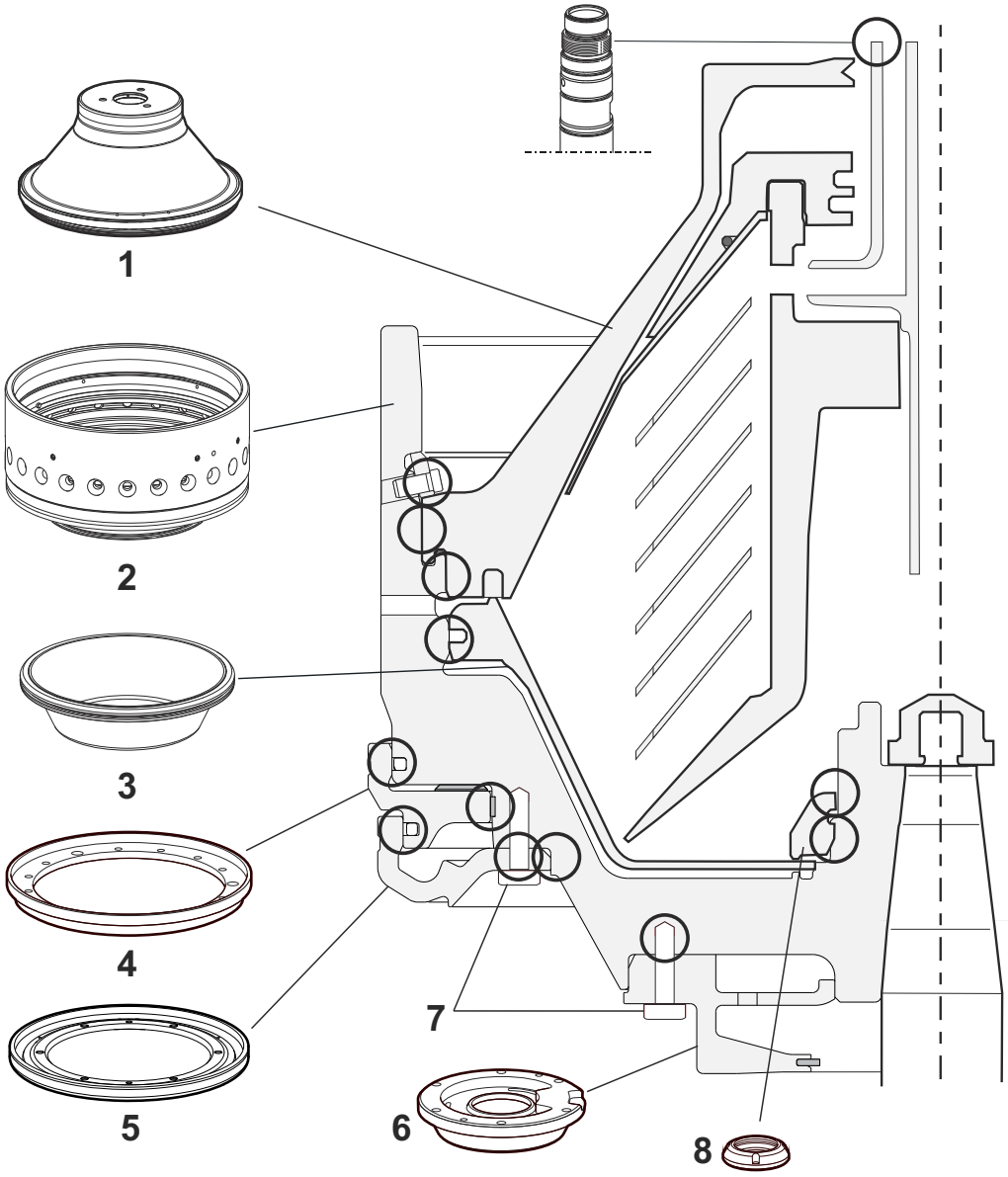
4. Dismantle the coupling according to instructions in chapter *Centrifugal clutch* on page 86.

5. Follow instructions from motor manufacturer to proceed with change of motor bearings.

6. Assembly:
   a) Fit the guard (A) to adaptor plate, motor shaft going through guard and secure with the two screws (B).
   b) Assembly complete coupling to the motor, see step *2* on page 102
   c) Assembly motor to frame, see step *5* on page 104

6.4.7 Lubrication of bowl parts

Apply a thin layer of Molykote, or equivalent lubrication, on **all** the contact surfaces shown in the illustration.



1. Bowl hood
2. Bowl body
3. Discharge slide
4. Operating slide
5. Holder
6. Operating water ring
7. Screw
8. Nut

6.5 Assembly

WARNING **Entrapment hazard**

To avoid accidental start, switch off and lock power supply before starting **any** assembly work.

6.5.1 Centrifugal clutch

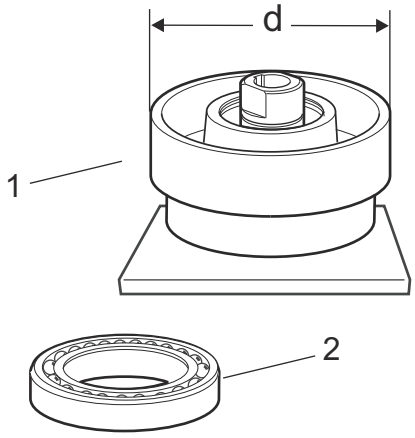
(1) Assembly of the coupling.

WARNING

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=252 mm 50 Hz
d=210 mm 60 Hz



a) Slip the belt pulley (1) over the coupling hub and place them on a firm and level foundation.

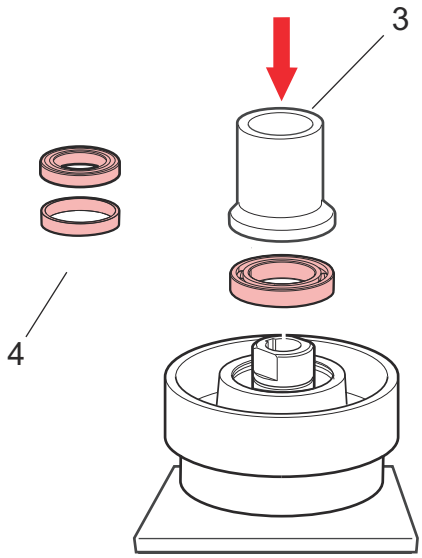
NOTE

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 (2).

NOTE

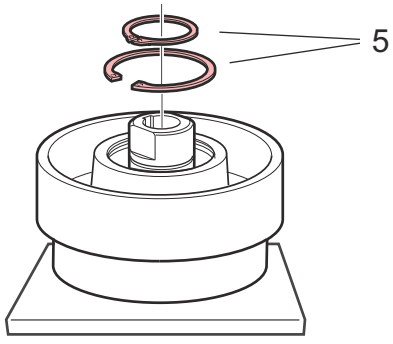
Never re-fit used ball bearings.



c) Press the ball bearings (2) down one at a time into the coupling hub, preferably using a hydraulic press. Place the spacing ring (4) between them.

NOTE

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



d) Fit the snap rings (5).

2 Fitting the coupling to the motor.

> **NOTE**
>
> Make sure that the key (1) 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 (2). Keep the threads lubricated.

c) Remove the brass plug (3).

d) Fasten the sleeve of the tool to the motor shaft with the screw (4) on the tool.

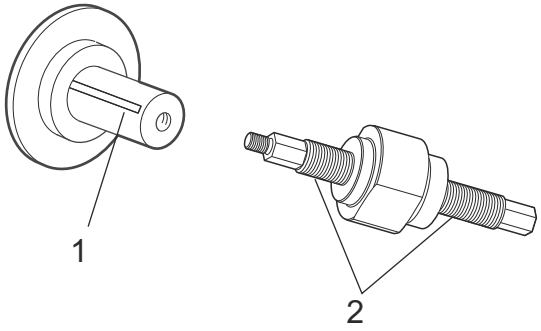
e) Use a spanner to turn the nut on the tool. This will press the centrifugal clutch on to the shaft. Remove the tool.

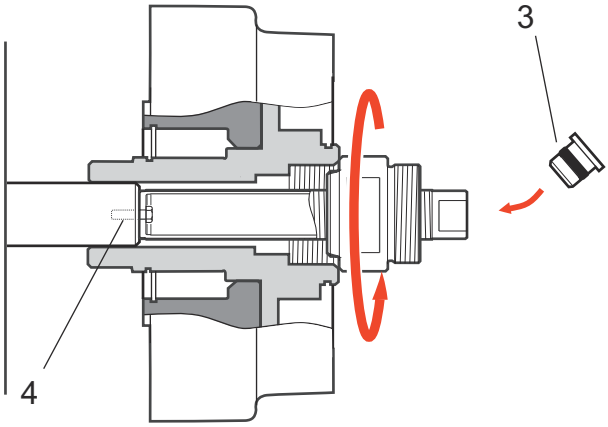
Note! Left hand thread!

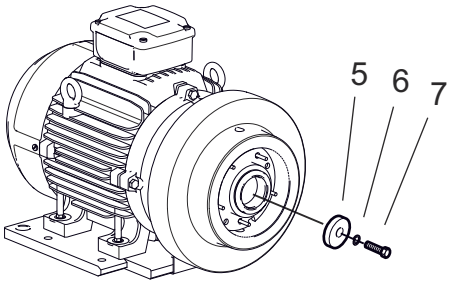
f) Install and tighten the washer (5), spring washer (6) and screw (7).

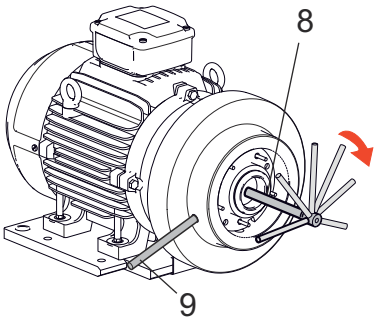
g) Attach a socket with extension rod and handle (8) to the screw.

h) Fit the rod (9) into the hole in coupling hub and hold steady when tightening the screw.









3 Fitting the friction blocks.

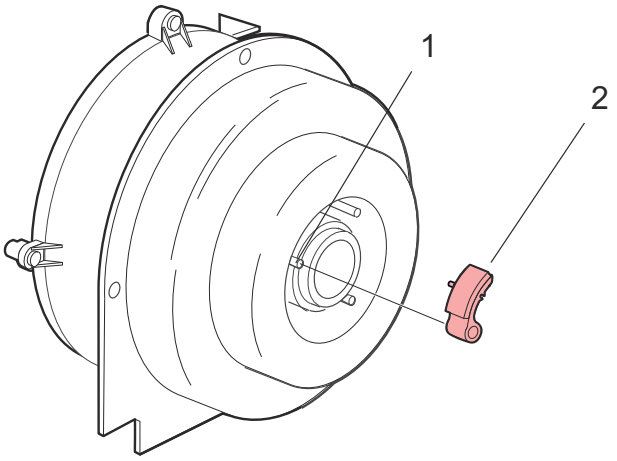
a) Fit the friction blocks (2) onto the guide pins (1).

NOTE

Be sure that the pins on the back of the blocks project into the grooves in the clutch hub.

NOTE

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

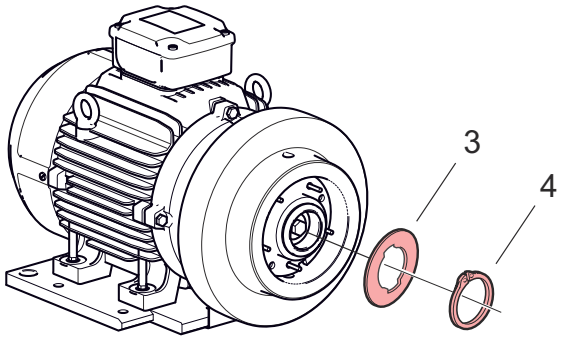


b) Place the cover (3) in position and secure it with the snap ring (4).

CAUTION

Flying objects

Risk for accidental release of snap ring. Wear safety goggles.



4 If fitting motor for first time or if replacing motor with new one proceed as follows. Otherwise proceed from next step.

a) Fit the four stud bolts to the adaptor plate, with the longest threaded end through the plate and secure stud bolts with loctite (x). Put the adaptor plate on a workbench with the unthreaded part of stud bolt facing up, standing on the stud bolts.

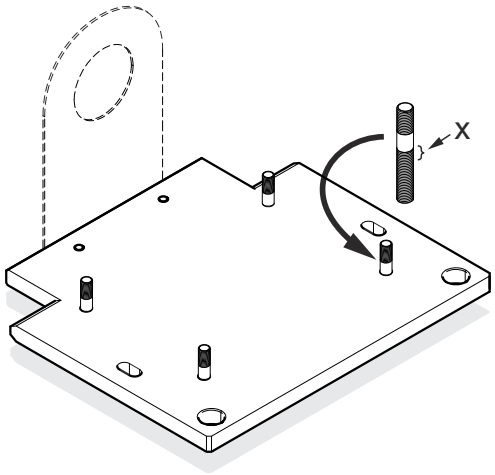
b) Place adaptor plate onto suitable support to protect stud bolts.

c) Fit motor to adaptor plate. Stud bolts going through feet.

d) Add washer and tighten nuts without loctite to fit motor to adaptor plate.

e) Fit the guard to adaptor plate, motor shaft going through guard and secure with the two screws.

f) Assemble complete coupling to the motor, See step 2 on page 102



g) Fit one lifting sling to the motor and another to the adaptor plate and lift motor onto the separator frame. It will rest on the ledge.

h) Tilt up the motor by tightening the outer clamping screws (4).

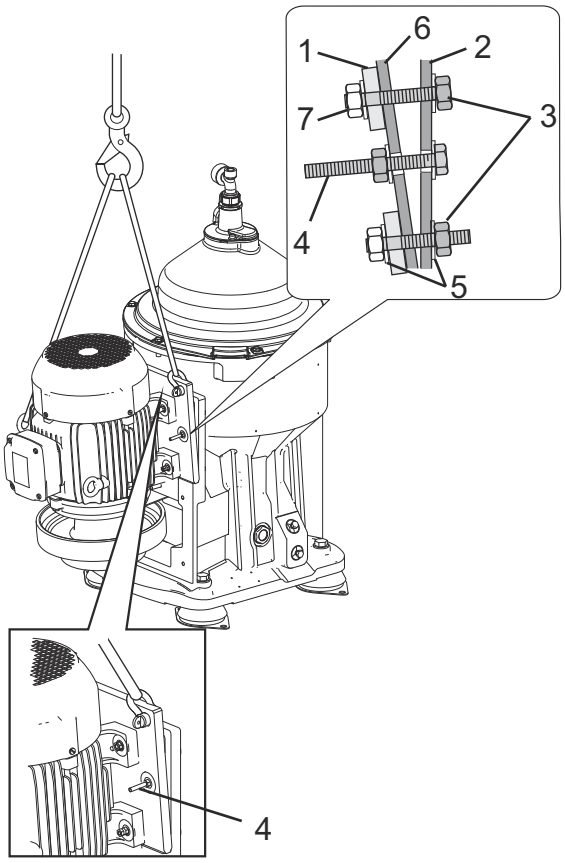
i) Fit the four stud bolt nuts (3) with washers (5) and tighten on separator frame side to secure adaptor plate (6) to separator frame (2).

j) Loosen the four stud bolt nuts (7) on the motor feet (1) to allow the motor to find its lowest position relative to adapter plate.

k) Tighten the bolt nuts (7) slightly.

l) Unscrew bolt nuts (7) one at a time and apply loctite. Refit and tighten the bolt nuts.

m) Release the bolt nuts (3) on separator frame side and tilting screws (4) to be able to fit drive belt.



5 Fitting the motor.

a) Fit lifting sling to the motor and adaptor plate. Use shackle from the separator lifting tool. Weight of motor with coupling and adaptor plate: approx. **159 kg**.

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

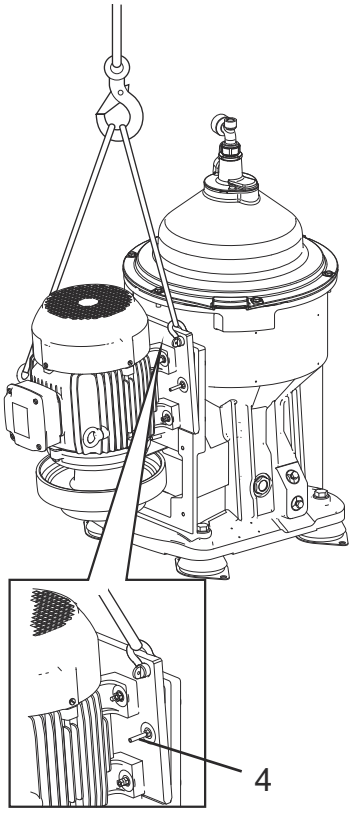
> **WARNING**
>
> **Crush hazard**
>
> If not supported, the motor with coupling may drop when lifted.

c) Fit the two tilting screws (4) and tighten until motor is in a slightly leaning position.

d)

> **WARNING**
>
> **Electrical hazard**
>
> To avoid electrical shock, switch off and lock power supply before starting assembly work.

Connect the electrical cables.



NOTE

If carrying out change of friction blocks only, continue with steps below.

If carrying out a complete machine assembly, continue with *Driving device* on page 107

6 Fitting the flat belt.

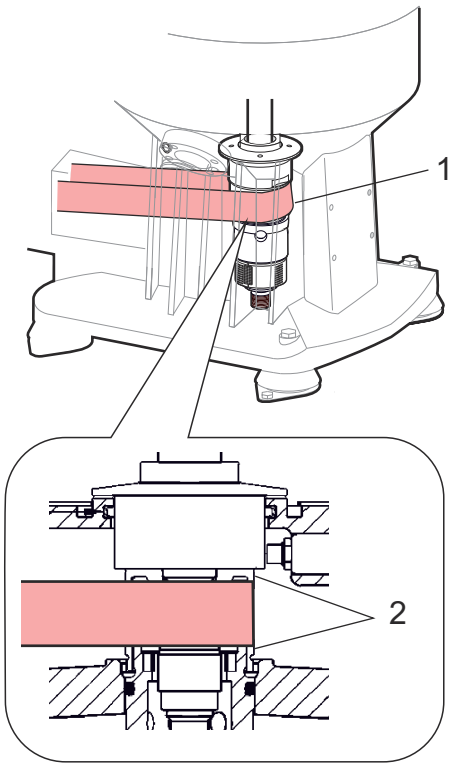
NOTE

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 (1) to the middle (centre) of the spindle pulley, with clearance (2) above and below the belt.

NOTE

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



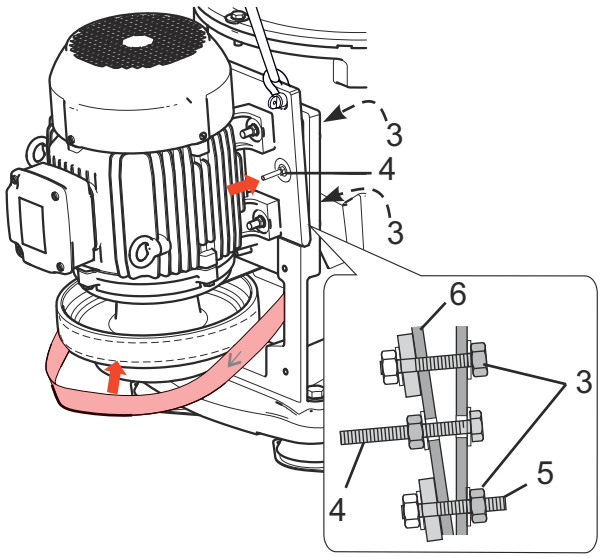
b) Fit the flat belt to the motor belt pulley.

c) Tighten the two tilting screws (4).

d) Tighten the four nuts (3) on separator frame side.

NOTE

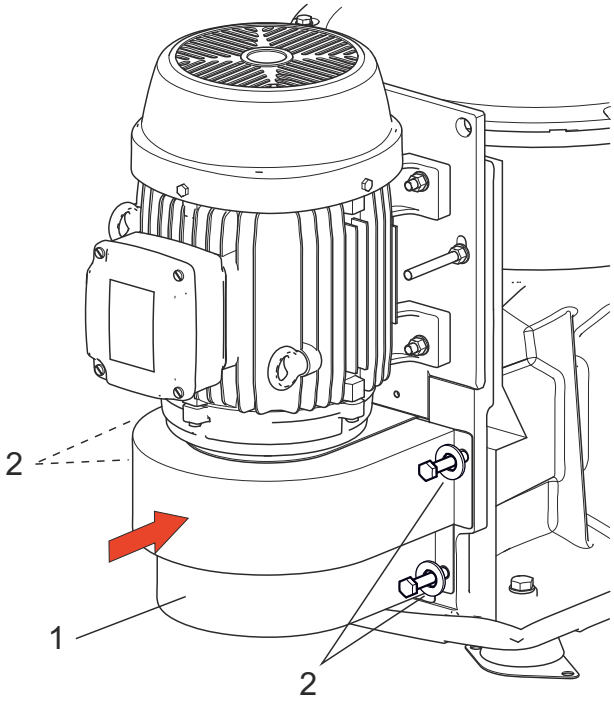
Do not turn the spindle until the motor is tightened properly to the frame.



7 Fitting the belt cover.

a) Fit the belt cover (1).

b) Tighten the screws (2).



6.5.2 Driving device

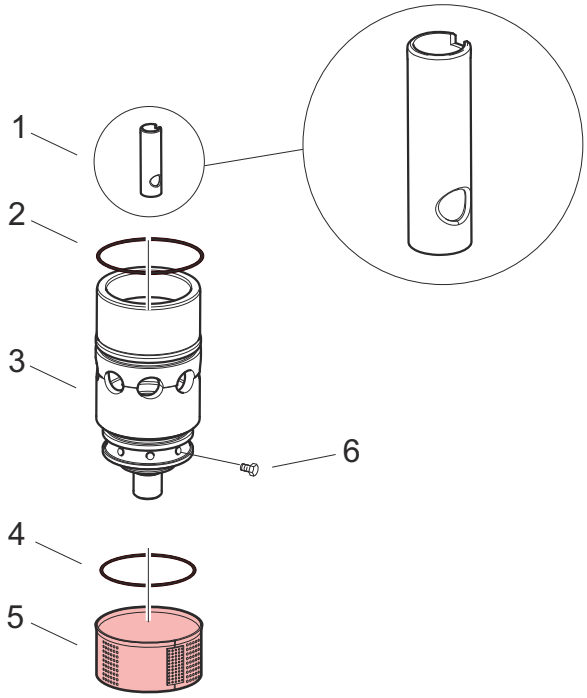
1 Assembling the bottom bearing holder (where necessary)

> **NOTE**
>
> Clean the pipe and strainer before fitting.

> **NOTE**
>
> Make sure to fit the pipe the right way up!

a) Fit the pipe (1), O-rings (2,4) and strainer (5).

b) Secure the pipe (1) with the screw (6) secured with Loctite 222.

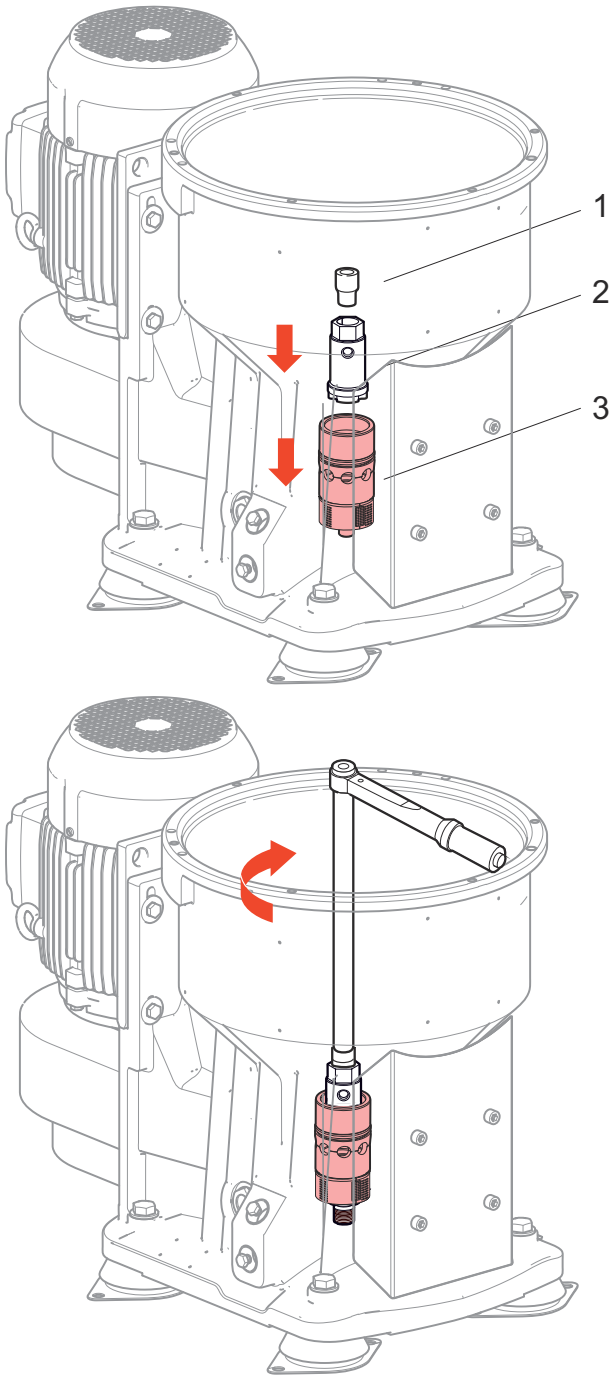


2 Fitting the bottom bearing holder.

a) To secure the bottom bearing holder (3) into the frame, apply Loctite 222 on the surfaces directly above the upper O-ring.

b) Thread the bottom bearing holder (3) into the frame and fit the tool (1),(2) into the bottom bearing housing.

c) Tighten the holder to a torque of **200 Nm**.

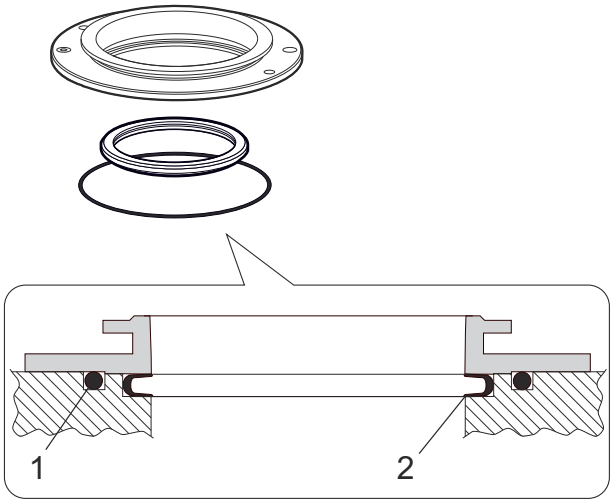


3 Fitting the labyrinth ring holder.

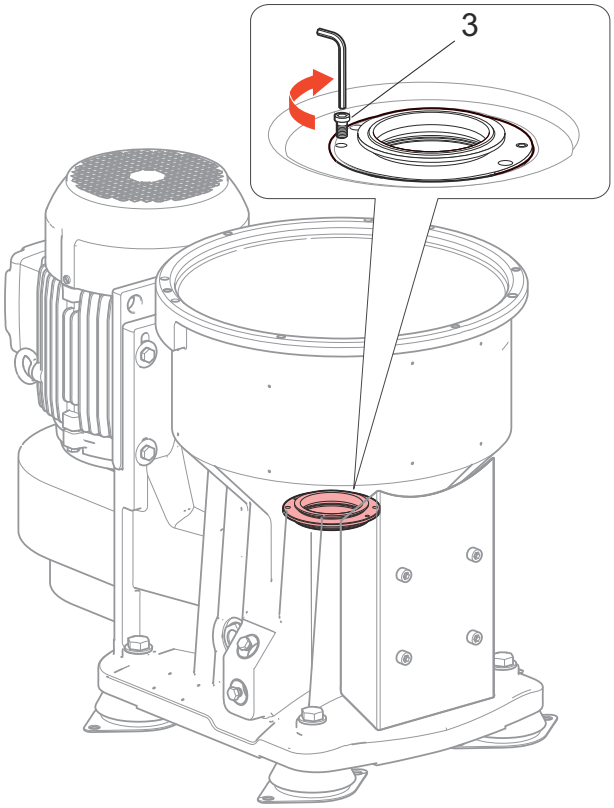
a) Make sure surfaces are clean from dirt.

b) Lubricate and fit the O-ring (1).

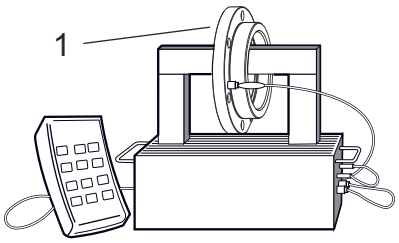
c) Lubricate and fit the labyrinth ring (2).



d) Fit the labyrinth ring holder into the frame. Apply Loctite 222 to screws (3). Fit and tighten the screws.



4 Fitting the ball bearing to the top bearing seat.



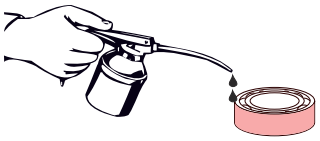
WARNING

Burn hazard

Use protective gloves when handling any heated parts.

a) Heat the top bearing seat (1) to minimum 110 °C and maximum 125 °C, either using induction heater or hot clean oil (induction heater is recommended).

b) Drop some oil onto the bearing.

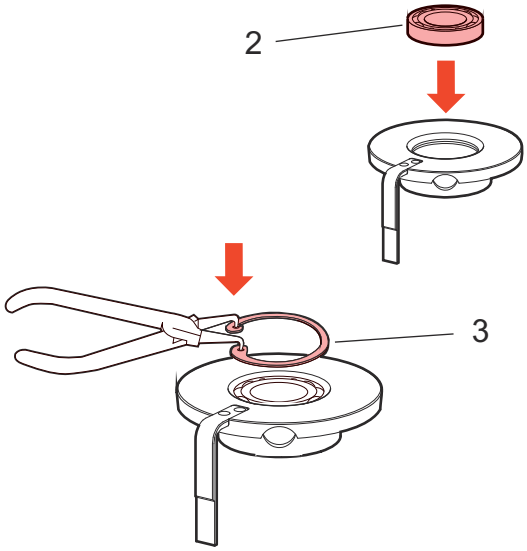


NOTE

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

c) Fit the bearing (2) into the bearing seat.

d) Fit the snap ring (3).



CAUTION

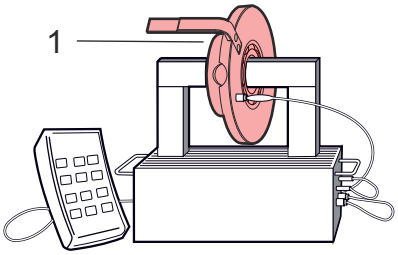
Risk for eye injury from flying snap ring

Use the correct pliers for assembly of snap ring to avoid accidental release.

NOTE

Make sure snap ring is correct fitted and slides easily in the groove.

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



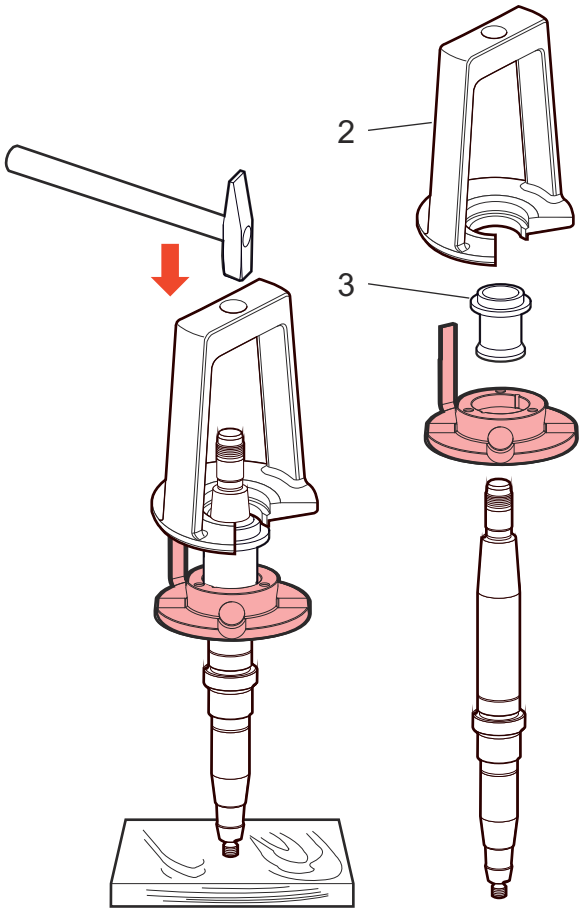
WARNING

Burn hazard

Use protective gloves when handling any heated parts.

a) Heat the top bearing seat (1) and bearing to minimum 110 °C and maximum 125 °C, either using induction heater or hot clean oil (induction heater is recommended).

b) Wipe off the spindle and fit the top bearing seat to the spindle using the sleeve (3) and puller (2).



NOTE

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

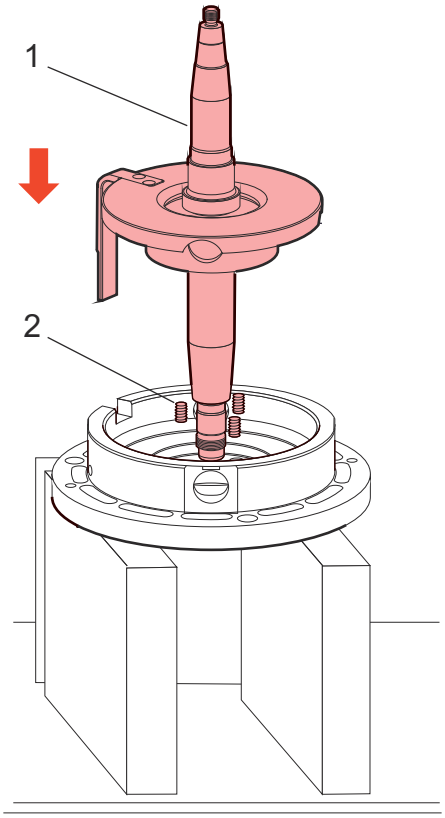
NOTE

Be careful not to damage the vibration indicator!

6 Fitting the top bearing housing.

a) Apply a thin layer of lube oil to the axial springs (2) and fit the springs to the top bearing housing.

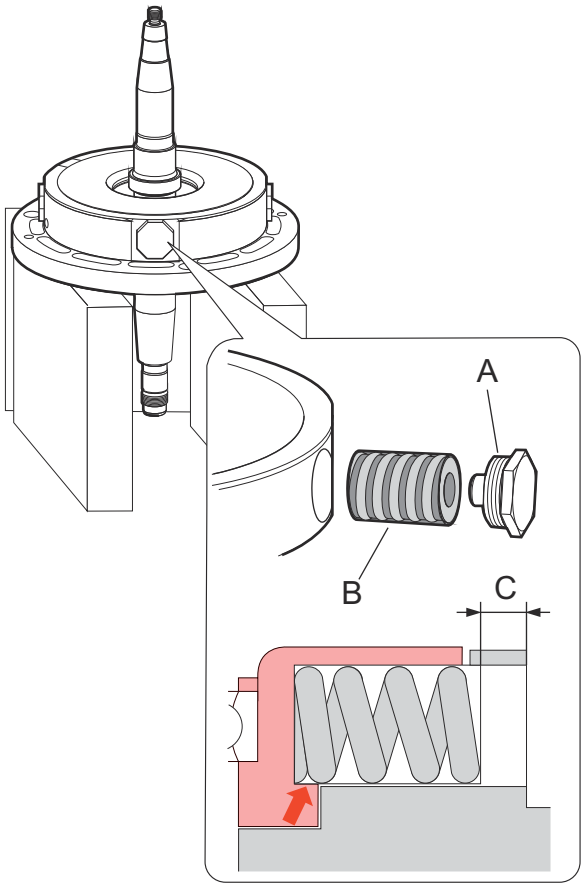
b) Carefully lower the bowl spindle (1). Make sure that the springs enter the recesses on the top bearing seat.



c) Lubricate the threads (A) and both ends of the composite springs (B) with oil before assembly.

d) Fit the composite springs (B) and plugs to the top bearing housing. Make sure that the springs enter the recesses in the top bearing seat. Distance (C) shall be 9±1 mm.

Tighten the plugs by hand only. The plugs should be tightened when the spindle assembly is mounted into the frame.



7 Fitting the spindle pulley.

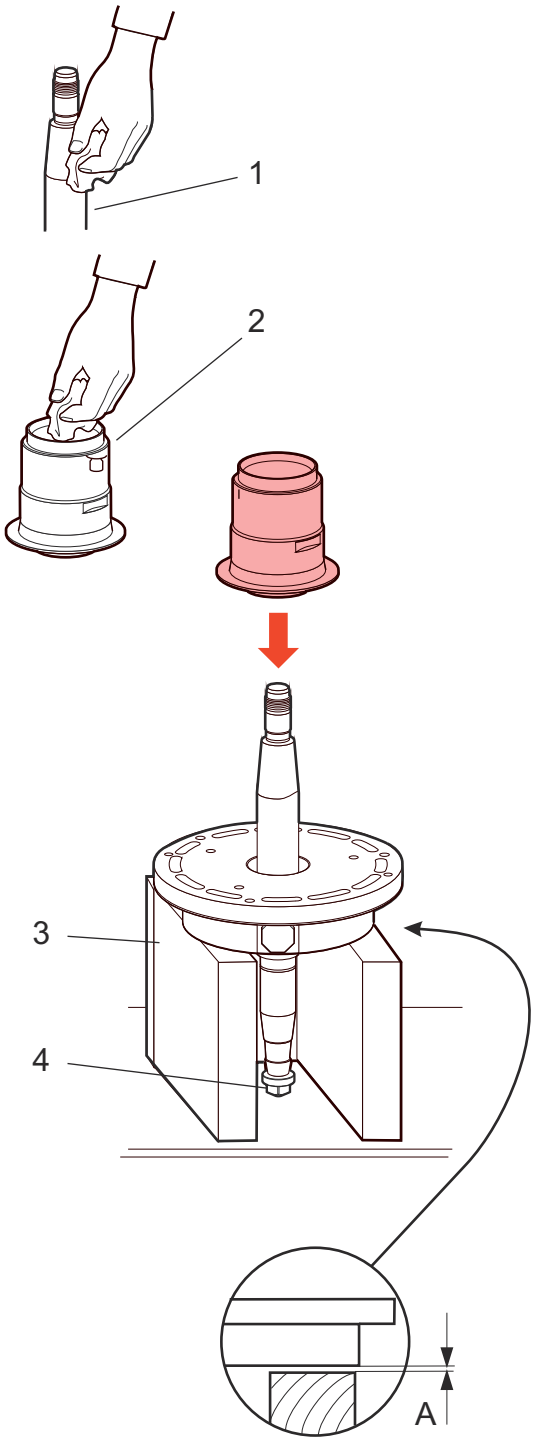
a) Screw the cap nut (4) onto the spindle.

b) Turn the spindle assembly upside down and let the spindle rest on the cap nut.

> **NOTE**
>
> It is of utmost importance to use cap nut and the support as the neck bearing may be forced out of its position and damage the neck bearing when the bottom bearing is mounted otherwise.
>
> The cartridge has to stand on the spindle top with a clearance of minimum 1 mm (“A” in the picture) between top bearing housing and the support.

c) Wipe off the spindle pulley seat on the spindle (1) and nave bore in the spindle pulley (2) with a dry cloth.

d) Fit the spindle pulley firmly on the bowl spindle.

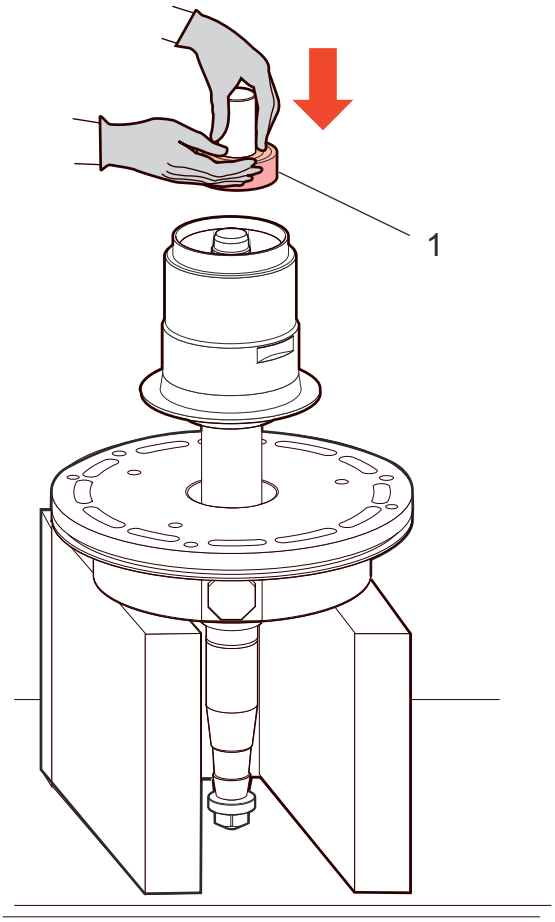


8 Fitting the self-aligning roller bearing.

> **NOTE**
>
> Always fit a new bearing.

a) Lubricate the bearing with clean oil.

b) Lower the bearing (1) onto the spindle and press down onto the spindle pulley using the special drift tool.

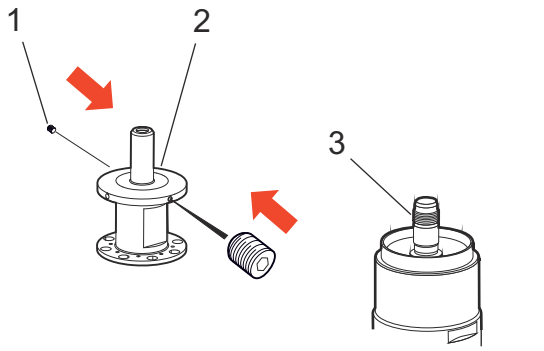


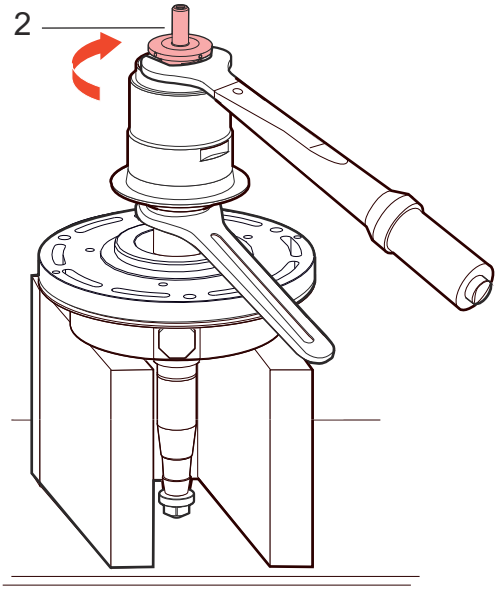
9 Fitting the oil mist generator.

> **NOTE**
>
> Clean the oil mist generator and nozzles before assembly.

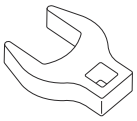
a) Apply Loctite 222 and screw the two nozzles (1) into the pump (2) so that they lie level with the pump edge using an Allen key.

b) Lubricate all threads (3) with a few drops of oil before assembly.





c) Fit the oil mist generator. Use a spanner and a crowfoot wrench head together with a torque wrench handle. Tighten to **150 Nm**.

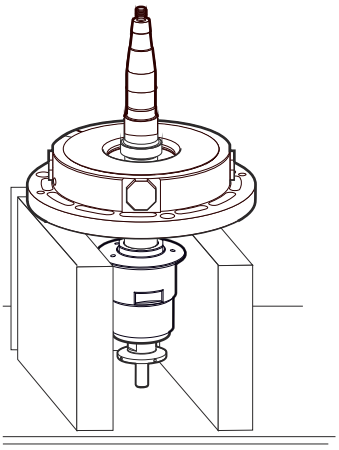


Crowfoot wrench head

10 Fitting the fan.

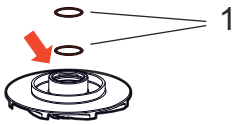
a) Turn the spindle assembly to up-right position.

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

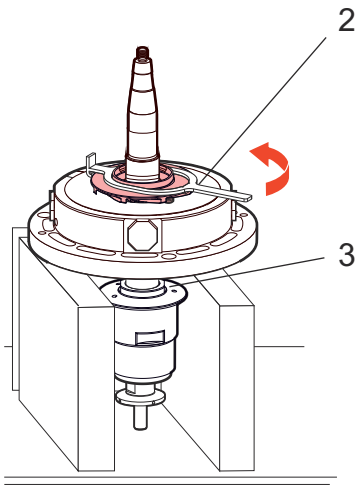


b) Apply a thin layer of oil and fit the O-rings (1) into the fan.

> **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 (3), as holder-up and fit the fan. Tighten firmly, by hand, with the spanner (2).



11 Measure the misalignment between the bowl spindle and the top bearing seat.

a) Fit a dial indicator in a support and attach to the spindle according to the illustration.

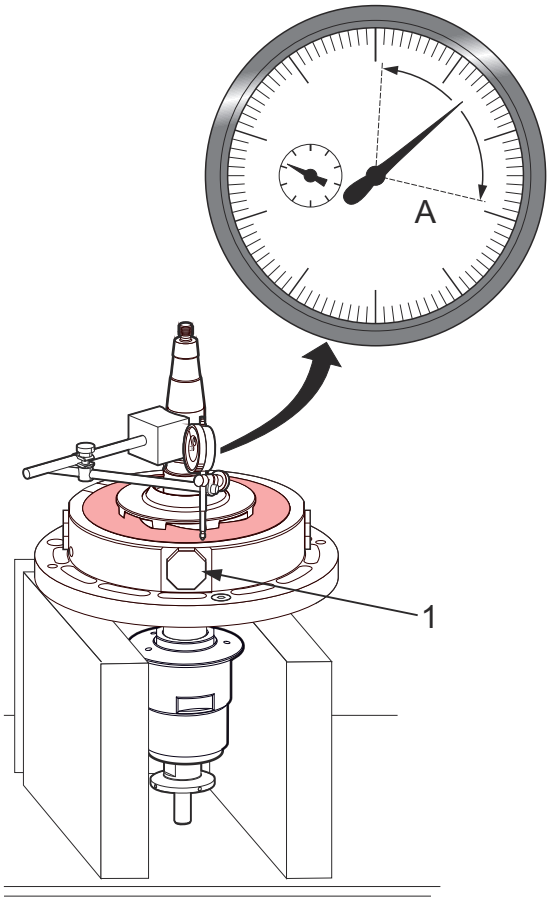
> **NOTE**
>
> Measuring point on top bearing seat:
> Ø 189 mm

b) Turn the spindle 360°.

> **NOTE**
>
> Permissible axial run-out: max. 0.8 mm.

If the dial indicator (A) exceeds this value, proceed as follows.

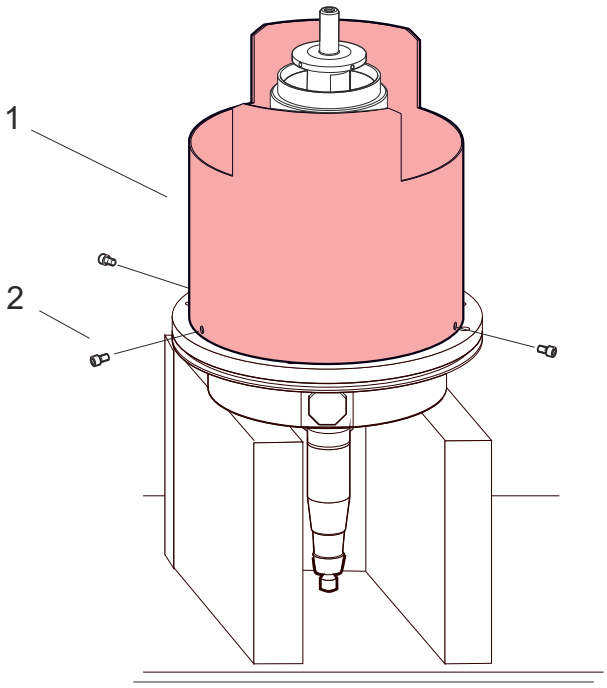
1. Remove the plugs and rearrange springs.
2. Fit the plugs (1).
3. Gradually tighten the plugs crosswise.
4. Repeat step a-b until the misalignment is within accepted value.



12 Fitting the air deflector.

a) Turn the spindle assembly up-side down and fit the air deflector (1).

b) Tighten screws (2).



13 Lowering the spindle assembly into the frame.

WARNING

Crush hazard

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

a) Turn the assembly and remove the cap nut from the spindle. Fit the lifting tool (1) to the spindle assembly and lift it.

NOTE

Check that the hole at the bottom of the oil mist generator (2) and nozzles are clean before lowering the assembly.

b) Position the flat belt (3) so that the spindle assembly can pass through when lowering.

NOTE

When replacing the belt with new one, make sure it has the right article number according to SPC.

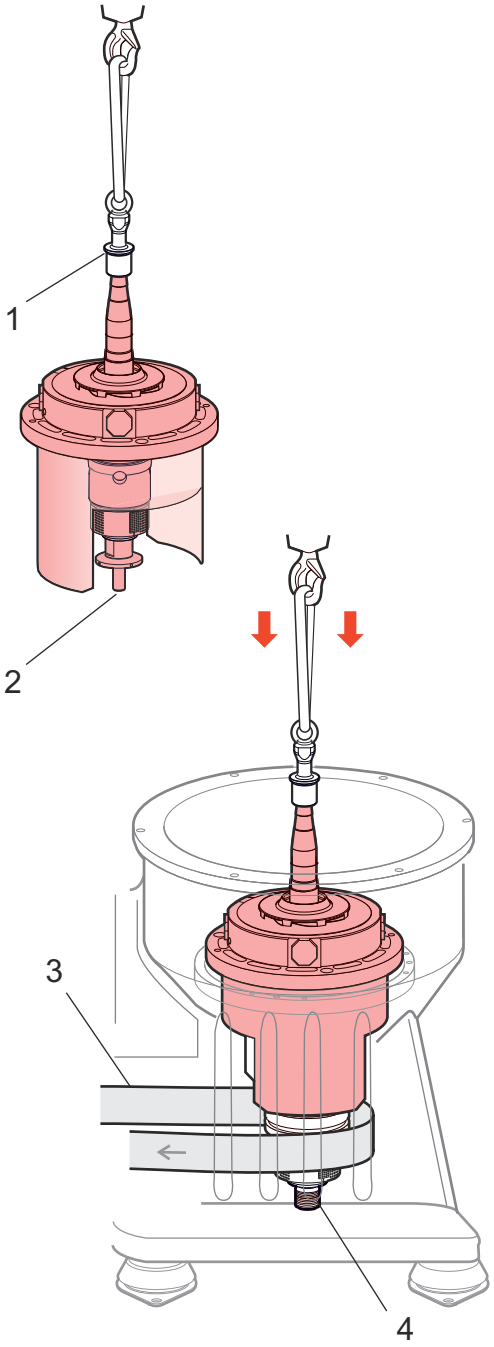
- Check the direction arrows on the belt and the machine plate for correct position.
- Make sure that the belt does not get smudged with oil or grease during handling.

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 (4) correctly. Do not use force. If spindle not enters bearing holder correctly, lift spindle and rotate before lowering it again.

WARNING

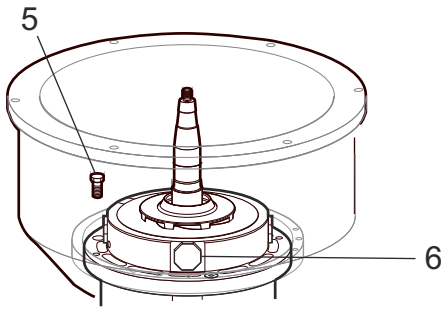
Cut hazard

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



d) Fit and tighten the screws (5).

e) Gradually tighten the plugs (6) crosswise.



14 Measure the misalignment between the bowl spindle and the top bearing seat.

a) Fit a dial indicator in a support and attach to the spindle according to the illustration.

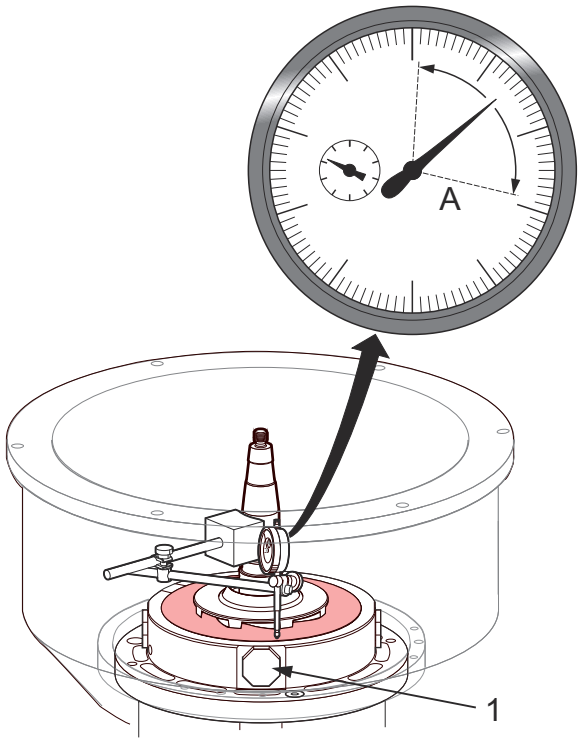
> **NOTE**
>
> Measuring point on top bearing seat:
> Ø 189 mm

b) Turn the spindle 360°.

> **NOTE**
>
> Permissible axial run-out: max. 0.36 mm.

If the dial indicator (A) exceeds this value, proceed as follows.

1. Lift out spindle assembly.
2. Remove the plugs and rearrange springs.
3. Fit the plugs (1).
4. Gradually tighten the plugs crosswise.
5. Repeat step a-b until the misalignment is within accepted value.

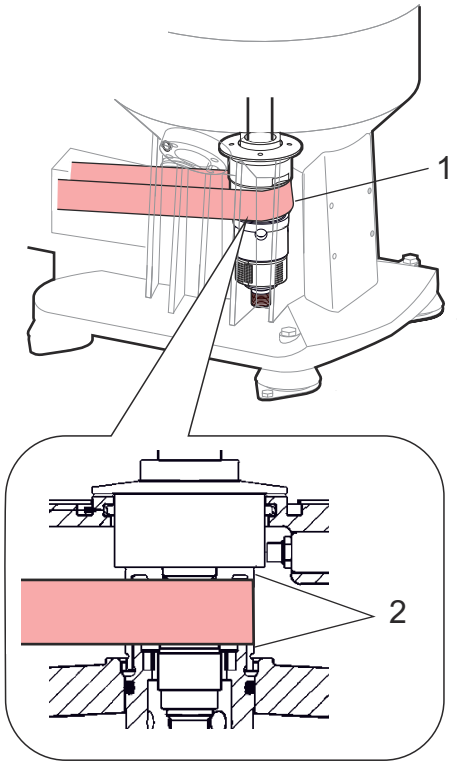


15 Fitting the flat belt.

> **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 (1) to the middle (centre) of the spindle pulley, with clearance (2) above and below the belt.

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

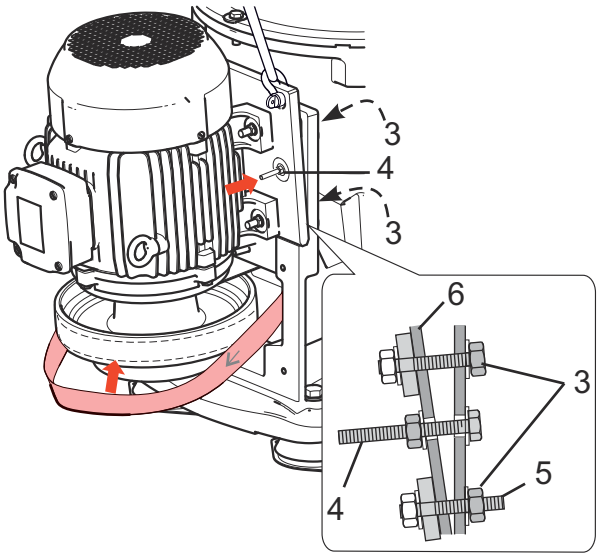


b) Fit the flat belt to the motor belt pulley.

c) Tighten the two tilting screws (4).

d) Tighten the four nuts (3) on separator frame side.

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



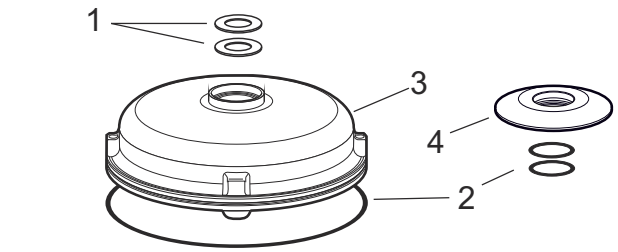
16 Fitting the neck bearing cover and deflector ring.

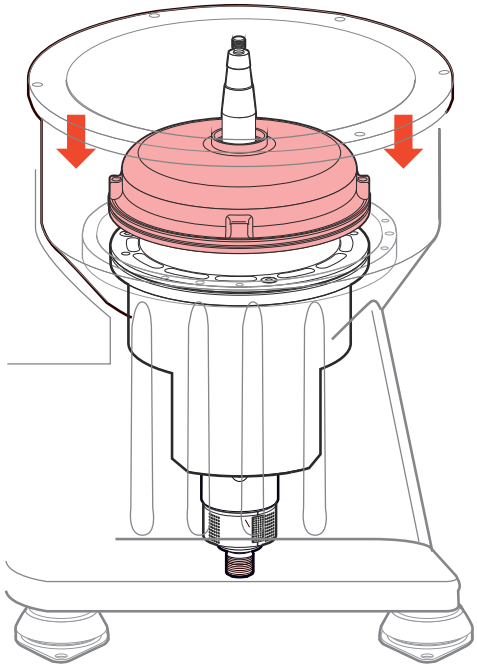
a) Apply a thin layer of oil and fit the O-rings (2) and seal rings (1).

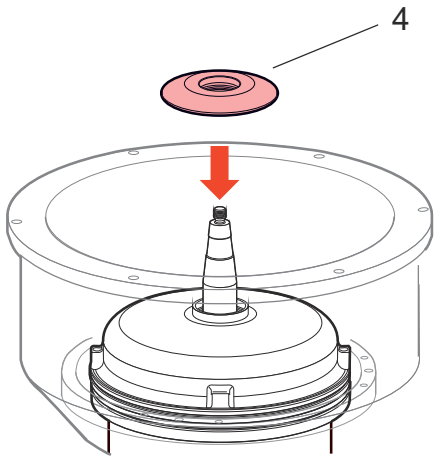
b) Fit the neck bearing cover (3).

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

c) Push the deflector ring (4) down until it stops.







(17) Fitting the operating water cover.

a) Check that the operating water channel (5) is not clogged. Clean if necessary.

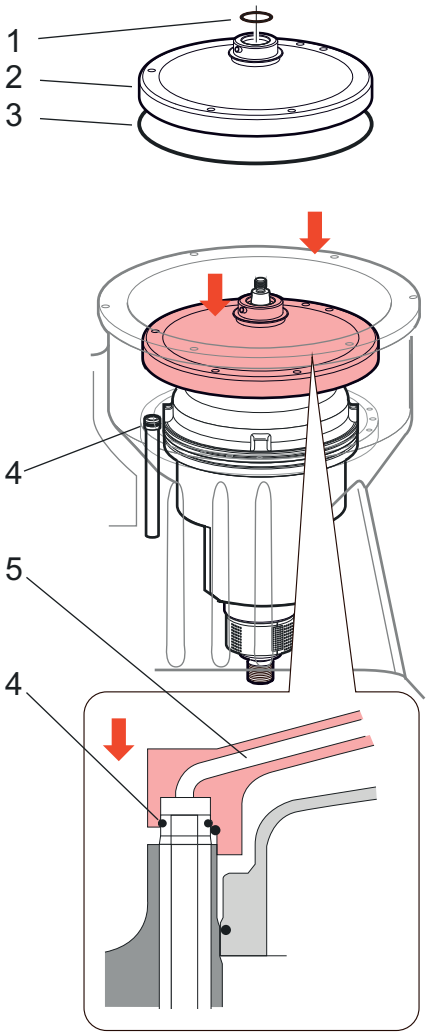
> **NOTE**
>
> A blocked operating water channel can lead to failure of the separator discharge function.

b) Lubricate with oil and fit the seal ring (1) and O-ring (3) into the operating water cover (2).

c) Renew the O-ring (4).

d) Fit the operating water cover. Fit washers and tighten the screws.

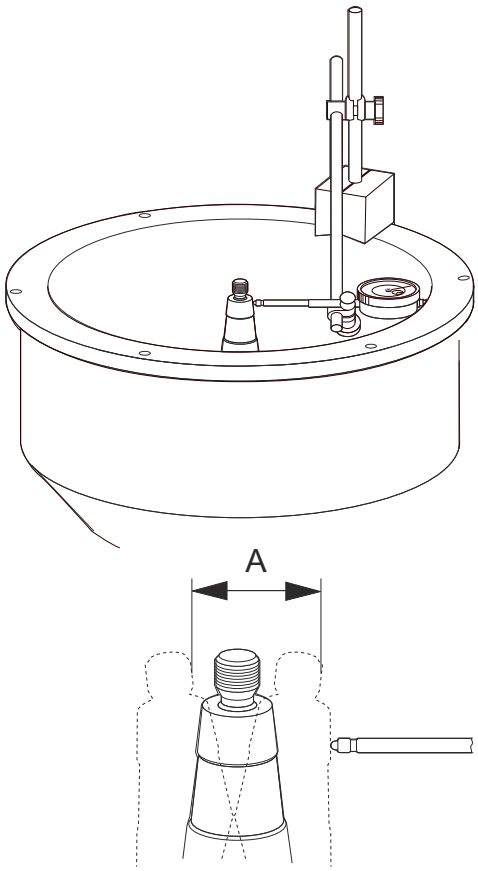
> **NOTE**
>
> The water pipe in the frame should enter the hole in the cover.



18 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.

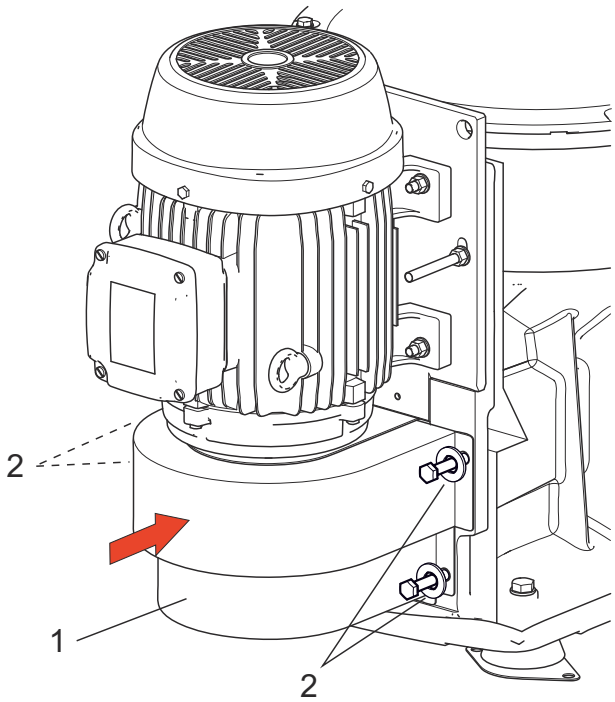
> **NOTE**
>
> Permissible radial wobble:
> max. **0,04 mm**. If the spindle wobble exceeds this value, contact an Alfa Laval representative.



19 Fitting the belt cover.

a) Fit the belt cover (1).

b) Tighten the screws (2).



20 Fill oil in the oil sump.

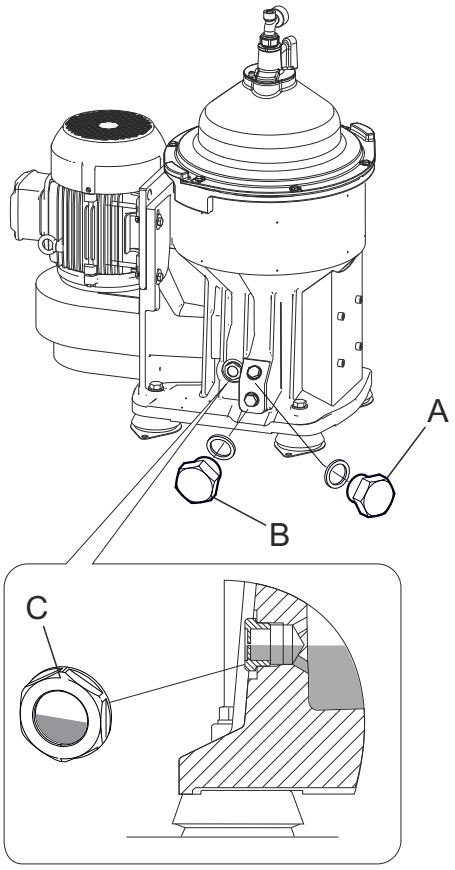
> **NOTE**
>
> The separator should be level when oil is filled.

a) Fit new washer and refit the drain plug (B).

b) Fill with new oil until the level is halfway up the sight glass (C). For correct oil volume see “Lubricating oil volume” on page *“Technical data”*.

> **NOTE**
>
> For grade and quality of oil see *Lubricating oils* on page 155

c) Refit the plug (A) with new washer.



6.5.3 Bowl

1 Check for impact marks and corrosion in bowl body nave and on spindle taper. i / o

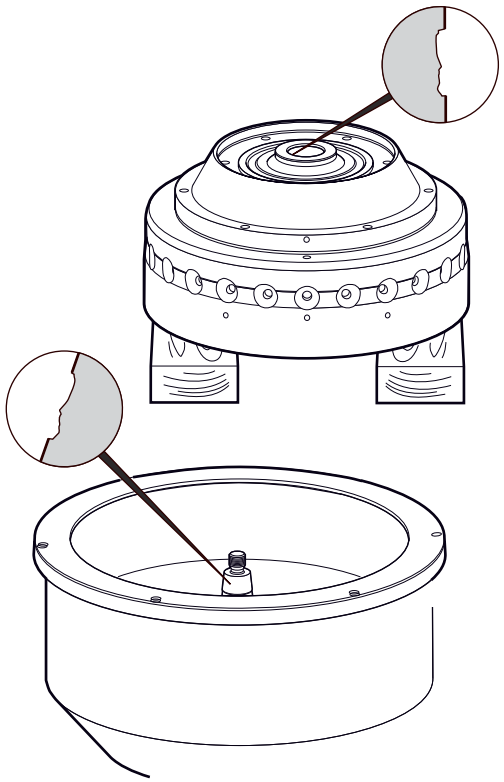
a) Remove any impact marks using a scraper and/or a whetstone.

> **CAUTION**
>
> **Disintegration hazard**
>
> Impact marks may cause the separator to vibrate while running.

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).

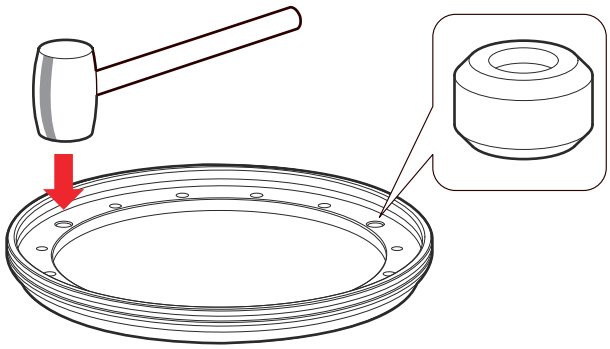
d) Lubricate to prevent further corrosion.



2 Fitting new valve plugs on the operating slide. i

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

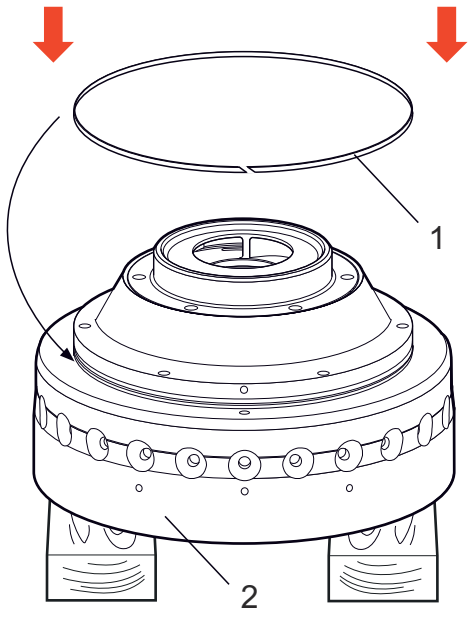
> **NOTE**
>
> Make sure that the plugs are fitted as described in the illustration.



3 Fitting the guide ring. o

a) Pointwise apply a small amount of silicone grease in the groove on bowl body (2) and mount the guide ring (1) into the groove on bowl body. Secure that the guide ring is fully inserted into the groove and that it is secured in its position by the silicone grease.

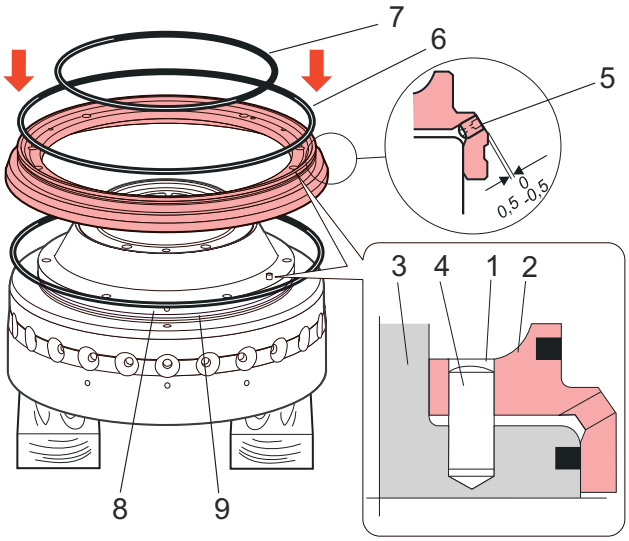
> **WARNING**
>
> If too much silicon grease is applied to the guide ring there is a risk that the silicone grease will clog the nozzles on the operating slide.



4 Fitting the operating slide.

a) Apply a thin layer of silicone grease and fit the rectangular ring (6) on the operating slide and the rectangular ring (8) and O-ring (7) on the bowl body (3). i / o

b) Fit the operating slide (2).



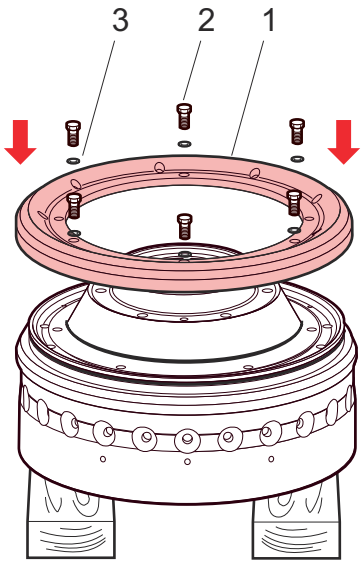
> **NOTE**
>
> The guide pin (4) in the bowl body (3) should enter the hole (1) in the operating slide (this hole is marked with a drill mark).
>
> Nozzle (5) secured with Loctite 243, only if nozzle has been removed.

> **NOTE**
>
> Take special care to ensure that the guide ring (9) is not pressed out of its position in the groove during the fitting of operating slide.

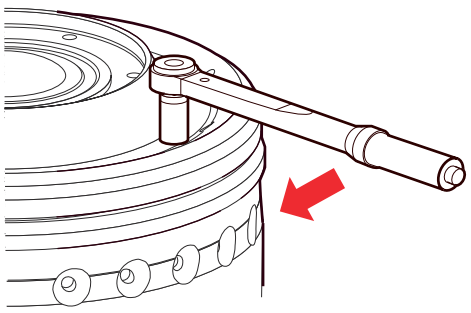
5 Fitting the operating slide holder.

a) Fit the holder (1) over the operating slide.

b) Apply a thin layer of molykote grease and fit and tighten new screws (2) and washers (3) to a torque of **30 ± 2 Nm**. i / o



> **NOTE**
>
> It is very important NOT to refit used screws and washers. Always fit new ones included in the Inspection kit!
>
> Every washer (3) consists of two parts which must be correctly locked together.



6 Fitting the operating water ring.

a) Assemble the seal ring (5) into the operating water ring (2). i / o

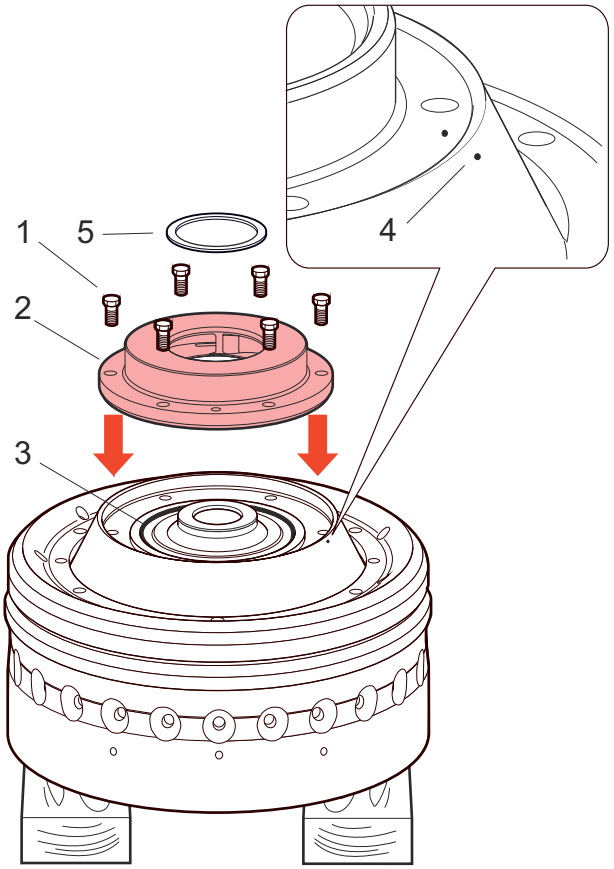
b) Apply a thin layer of silicone grease and fit the O-ring (3). i / o

c) Fit the ring (2) onto the bowl body. i / o

> **NOTE**
>
> The drilled assembly mark (4) on the water ring (2) should face the corresponding mark on the bowl body.

d) Grease, fit and tighten the screws (1) to a torque of **30 ± 2 Nm**.

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



7 Lifting the bowl body onto the spindle taper.

a) Put a drop of oil on the spindle taper (1).

b) Wipe off the spindle taper (1) and nave bore (2) with a dry cloth.

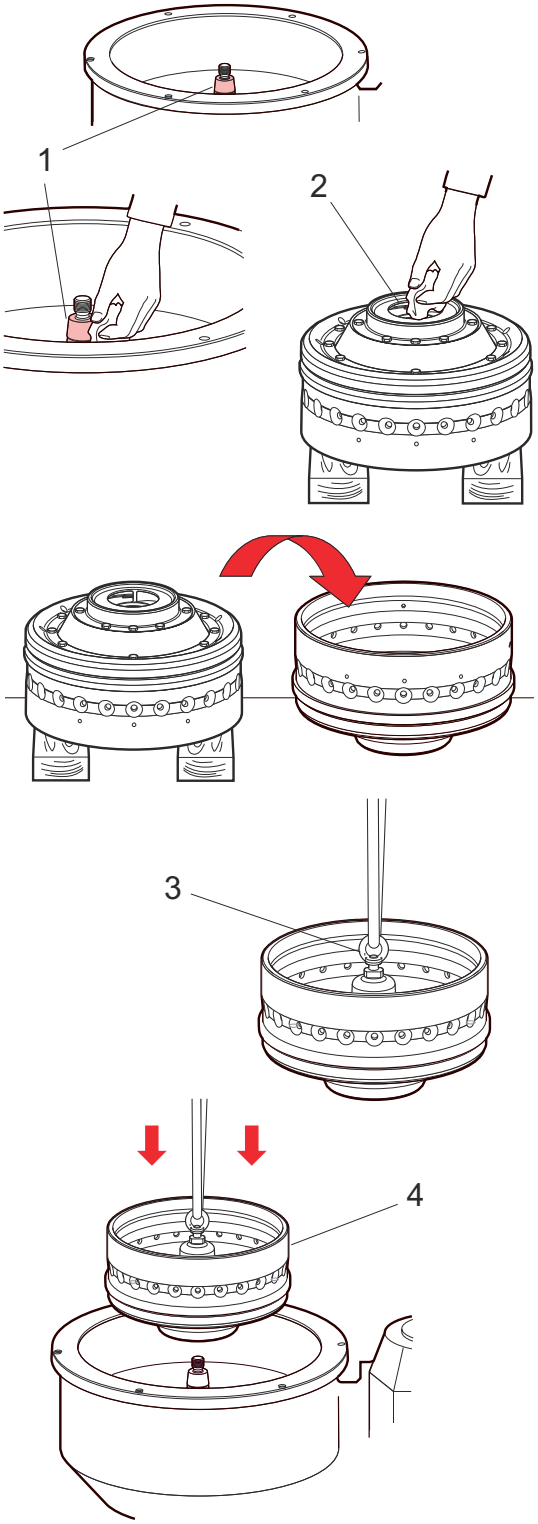
c) Turn the bowl body over.

> **WARNING**
>
> **Crush hazard**
>
> Support the bowl body when turning to prevent it from rolling.

d) Fit the lifting tool (3) and lift the bowl body using sling and hoist.

e) Carefully lower the bowl body (4) onto the spindle taper.

f) Remove the lifting tool.

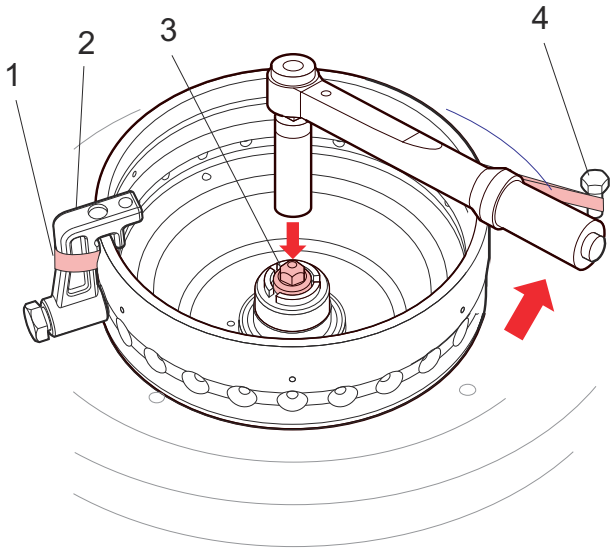


8 Fitting and tightening the cap nut.

a) To prevent the bowl body from rotating when fitting the cap nut; Fit one of the clamps (2) to the bowl body and one of the screws (4) for the frame hood in the frame. Fasten a sling (1) between the clamp and the screw around the bowl body.

b) Apply a thin layer of molykote grease. Fit and tighten the cap nut (3) to a torque of **100 Nm**.

Note! Left-hand thread!



9 Fitting the discharge slide.

a) Apply a thin layer of silicone grease and fit the rectangular ring (1). i / o

b) Apply a thin layer of silicone grease and fit the O-ring (3). i / o

c) Fit the lifting tool (2) and lower the discharge slide into the bowl.

> **WARNING**
>
> **Crush hazard**
>
> The ring on the lifting tool must be pushed down against the discharge slide, otherwise it may come loose from the tool.

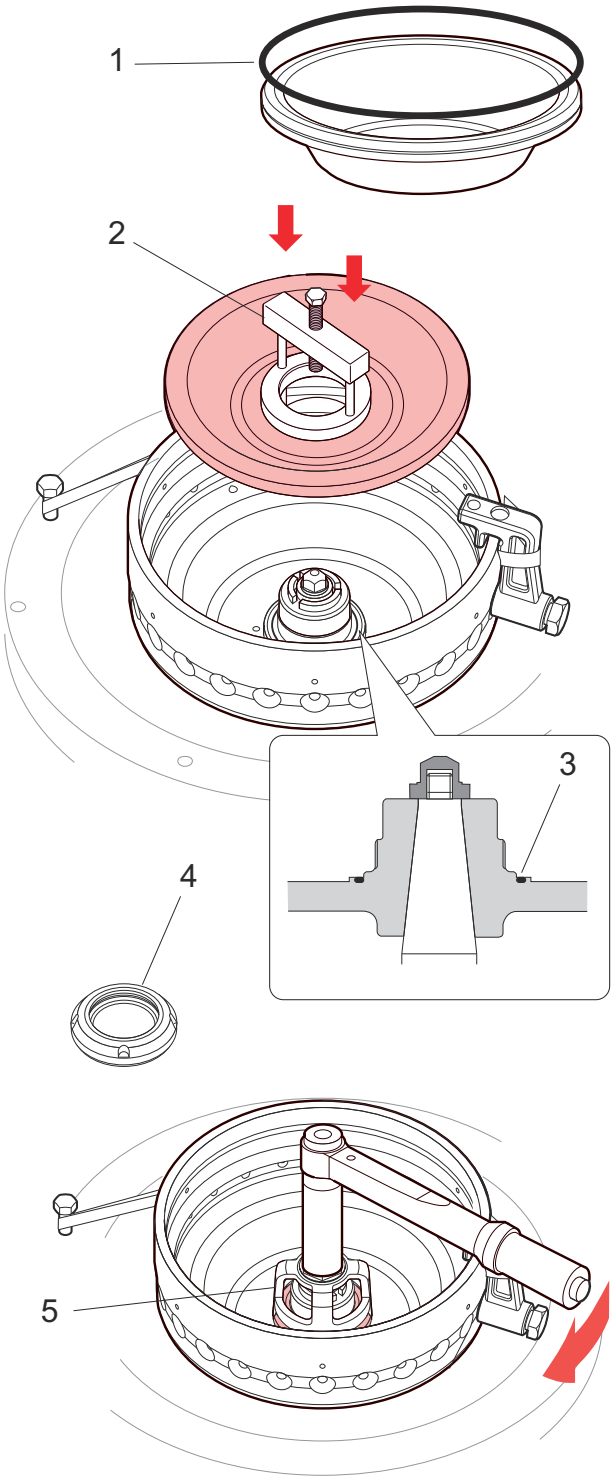
d) Remove the lifting tool.

e) Fit the nut (4).

> **NOTE**
>
> Apply a thin layer of molykote grease to the thread in the bowl body before mounting the nut.

f) Fit the spanner for nut (5) and tighten the nut with a torque wrench to a torque of min. **200 Nm**.

g) Remove the spanner for nut.



10 Assembly of the disc stack.

NOTE

The two spare discs and the disc without caulks are not to be included in this step.

a)

CAUTION

Cut hazard

Sharp edges (2) on the bowl discs may cause cuts.

Fit the discs (1) one by one according to quantity stated in the Spare parts catalogue. The distributor has a guide rib (4) for the correct positioning of the bowl discs.

WARNING

Disintergration hazard

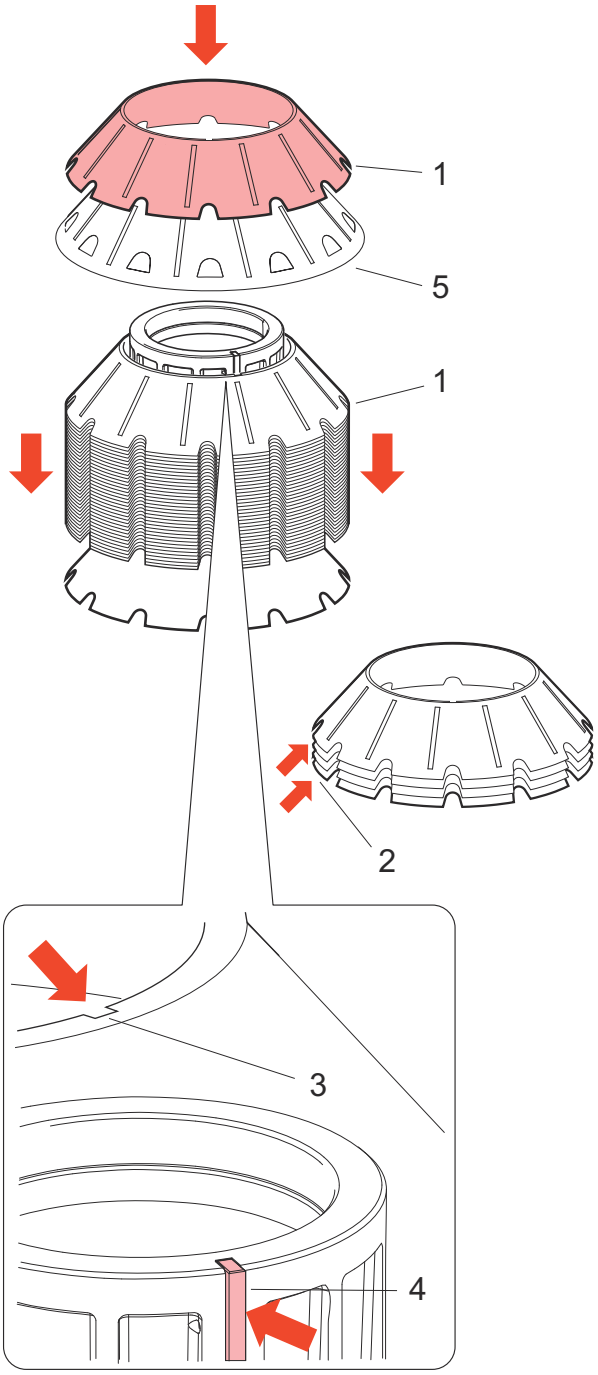
The number of discs may have to be increased to adjust the disc stack pressure. Always check before operating the separator. See “Checking the disc stack pressure” step *18* on page 136

b) Fit the largest diameter bowl disc (5) onto the distributor.

c) Fit the remaining discs (1), quantity stated in the Spare parts catalogue onto the distributor.

NOTE

There must always be correct amount of discs above the largest disc, see Spare parts catalogue.

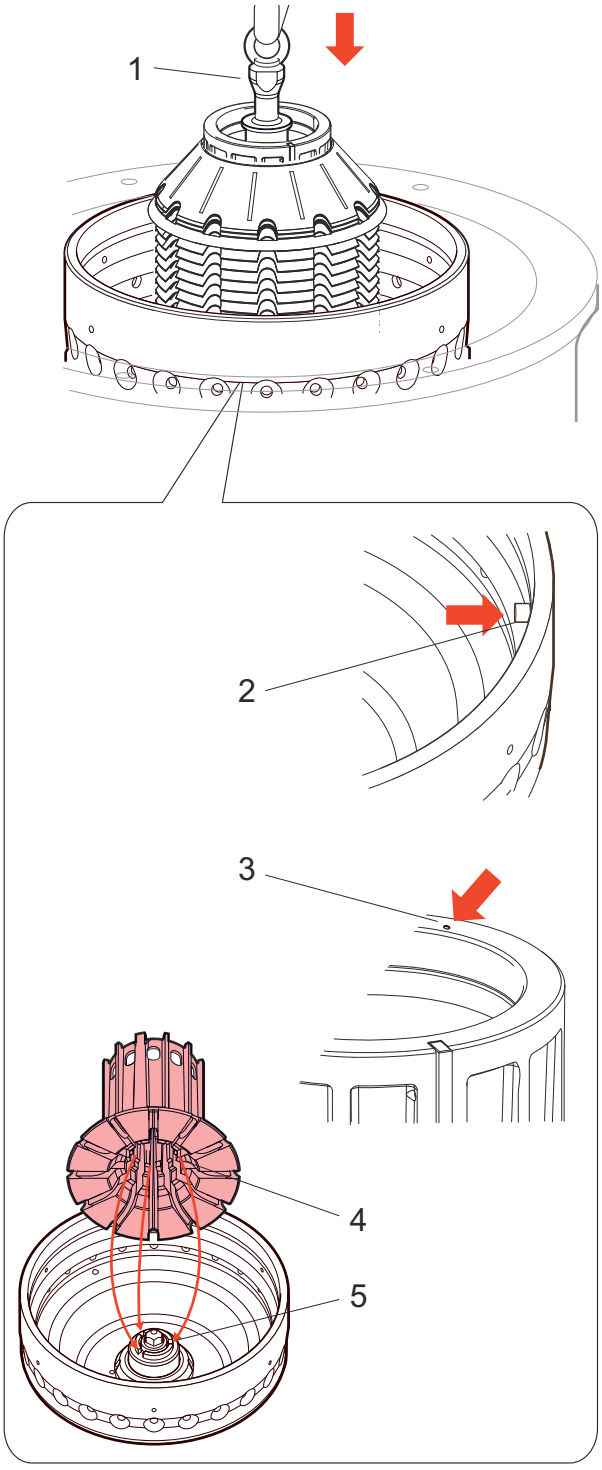


(11) Fitting the disc stack assembly to the bowl body.

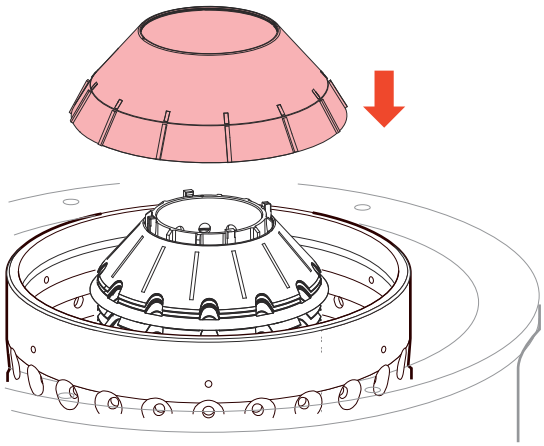
a) Fit the lifting tool (1) into the distributor.

b) Lower the disc stack into the bowl using sling and hoist.

> **NOTE**
>
> The guide pin (2) on the bowl body should face the drill mark (3) on the distributor. The guide ribs (4) inside the distributor will then fit the recesses (5) on the bowl body nave in the right way.

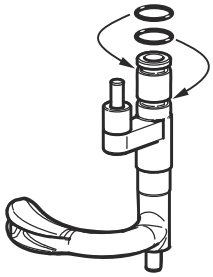


12 Fitting the top disc bottom part.



13 Assembling the paring tube.

a) Apply a thin layer of silicone grease to the O-rings and fit the O-rings to the paring tube. i / o



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

a) Insert the paring tube (1) to the inlet and outlet pipe.

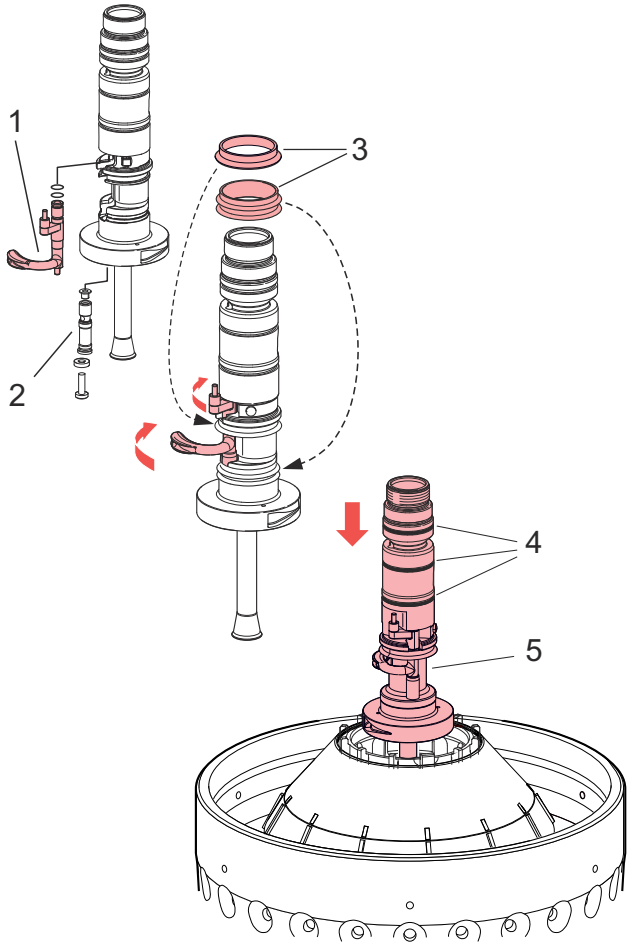
b) Fit Bearing holder (2).

c) Tighten screw with washer to secure paring tube. Torque **9 Nm**.

d) Apply a thin layer of silicone grease and mount the splash sealing (3). i / o

e) Apply a thin layer of silicone grease and fit the O-rings (4). i / o

f) Carefully lower the inlet and outlet pipe assembly (5) into the top of the distributor.



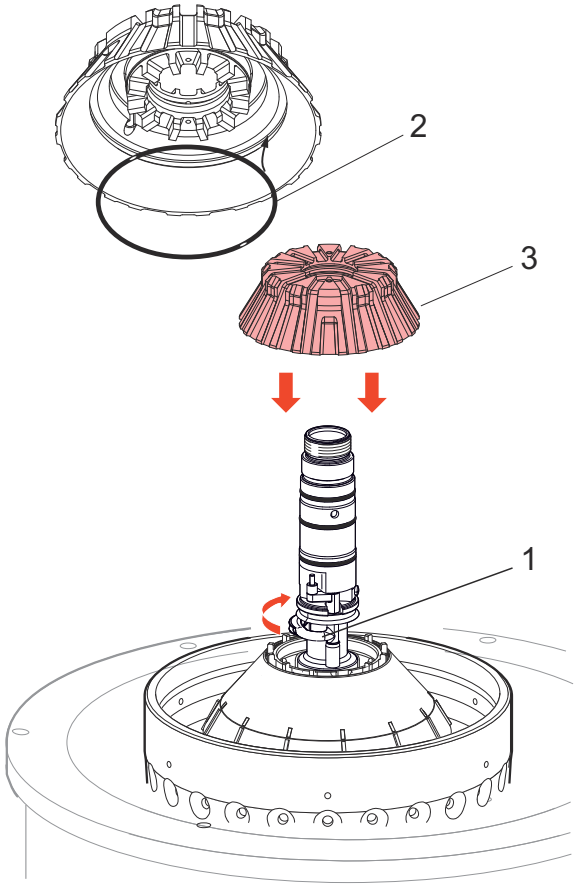
(15) Fitting the top disc top part.

a) Move the paring tube (1) to the centre.

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

b) Fit the o-ring (2) in the groove.

c) Fit the top disc top part (3), make sure the polar guidance groove in top disc fit the guide rib in the distributor.



16 Fitting the bowl hood.

a) Apply a thin layer of silicone grease and fit the O-ring (1). i / o

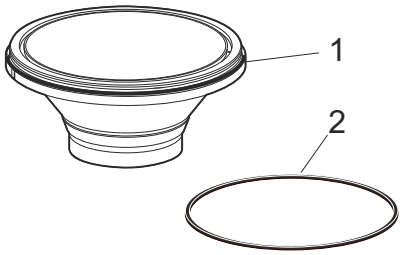
b) Fit the seal ring (2). Press the ring down evenly into the groove all around. i / o

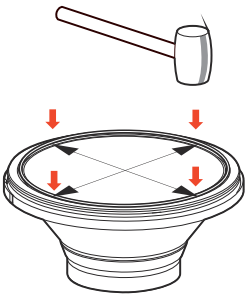
c) Gently tap down the seal ring crosswise with a soft rubber mallet, until the entire ring is fitted all the way around.

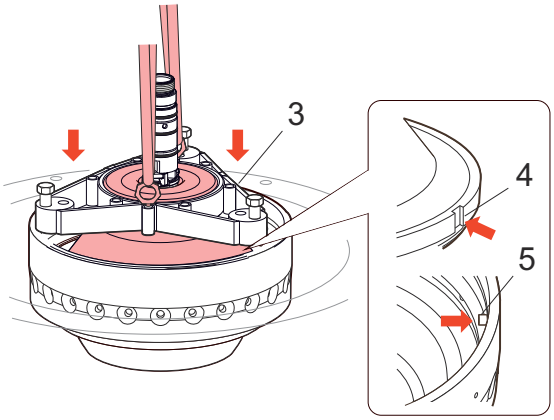
d) Fit the compressing tool (3) and attach lifting eyes.

e) Lower the bowl hood so that its groove (4) fits into the guide pin (5) in the bowl body. Use drill mark in bowl body to guide the groove and pin.

f) Remove the compressing tool.



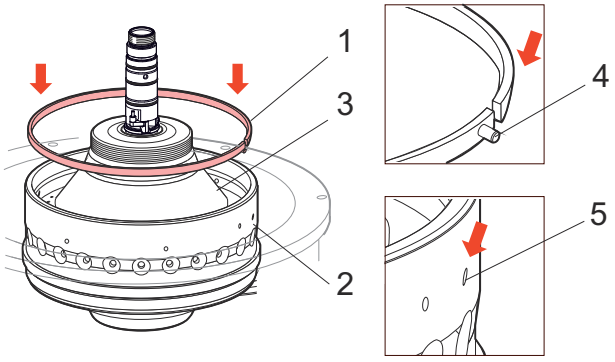




17 Fitting the lock ring.

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

a) Place the lock ring (1) on the bowl hood (3) with its guide pin (4) close to the corresponding hole (5) in the bowl body (2).



(18) Checking the disc stack pressure.

> **NOTE**
>
> The disc stack must always be compressed with **18-33 (Nm)**. Disc stacks that are compressed with torque level outside recommendations (18-33 Nm) might result in damaged parts or instability when operating the separator.

1. Reaching correct disc stack pressure (no extra discs added)

a) Set torque wrench to **18 Nm**. Tighten the screws with washers on the compressing tool (3) until the lock ring (2) enters the groove (4). If lock ring does not enter the groove, increase torque value in increments from 18 to 33 Nm, according to the table below.

> **NOTE**
>
> Always tighten screws alternately in increments of 5 Nm.

Steps (Nm)

Step 1: 18 (minimum)

Step 2: 23

Step 3: 28

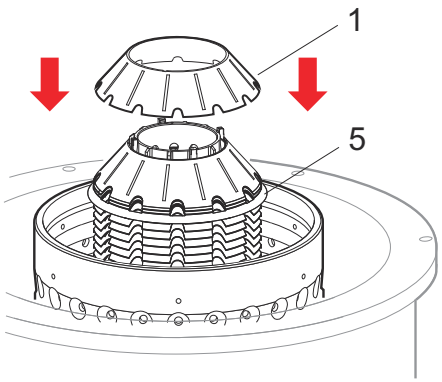
Step 4: 33 (maximum)

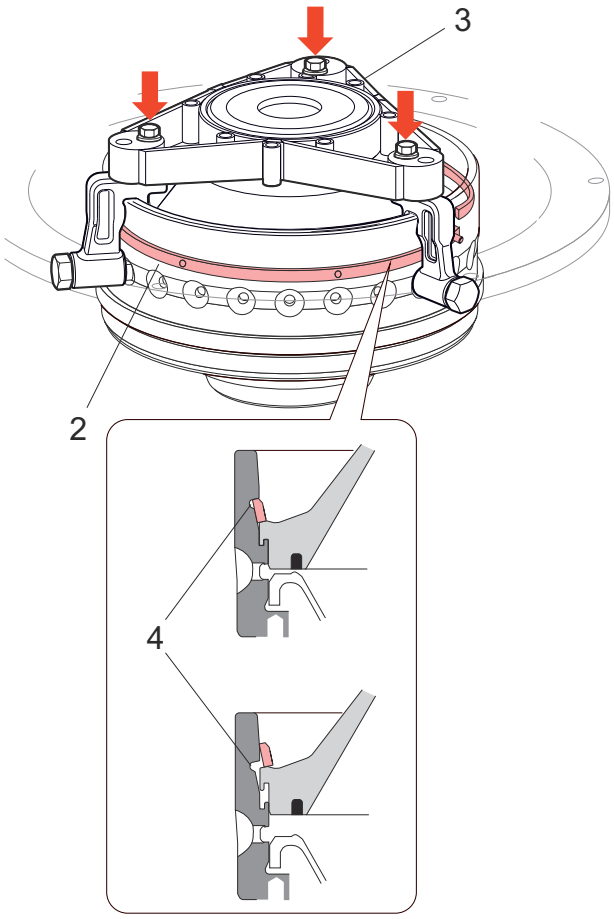
b) If lock ring enters the groove with a torque value less than **18 Nm** refer to step 2.

c) If lock ring does not enter the groove with torque value **33 Nm** refer to step 3.

2. If Torque value is below 18 Nm when lock ring enter the groove

Add disc when lock ring enters the groove with torque less than **18 Nm** (insufficient compression).

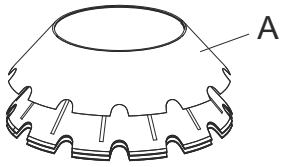




- Fit one of the spare discs (1) below the largest disc (5) and re-check disc stack pressure (1a-c).

> **NOTE**
>
> There must always be correct amount of discs above the largest disc, see Spare parts catalogue.

- If lock ring still enters the groove with torque less than **18 Nm**. Fit the second spare disc below the largest disc (5) and re-check disc stack pressure (1a-1c).
- If lock ring does not enter the groove with two spare discs. Replace one disc with caulk above the largest disc (5) with the disc without caulks and re-check disc stack pressure (1a-1c).

> **NOTE**
>
> The placement of the disc without caulks (A) must always be at the top of disc stack. Only use this disc as the last option.
>
> 
>

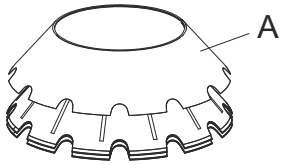
3. If lock ring does not enter the groove with torque value 33 Nm

Remove discs when lock ring does not enter the groove with torque level set on **33 Nm** (excessive compression).

- Remove one of the discs that are below the largest disc (5) and re-check disc stack pressure (1a-c).
- If the lock ring enters the groove with torque less than 18 Nm after removing two discs below the largest disc. Add one caulked disc under the largest disc and replace the upper disc on the stack with the spare disc without caulks and re-check disc stack pressure (1a-1c).

NOTE

The placement of the disc without caulks (A) must always be at the top of disc stack. Only use this disc as the last option.



19 Checking that the lock ring is correct fitted.

a) Make sure that the lock ring is fully engaged over it's full length in the groove and does not flex anywhere. The lock ring ends must be facing each other with a gap between them. The lock ring ends must not be flush or overlap each other.

CAUTION

If there is not a gap between the lock ring ends, the lock ring is damaged and must be replaced with a new one immediately.

b) Measure gap C of lock ring and make sure it does not exceed 5,5 mm.

CAUTION

If the lock ring gap is greater than 5,5 mm, the lock ring is damaged and must be replaced with a new one immediately.

WARNING

Health hazard

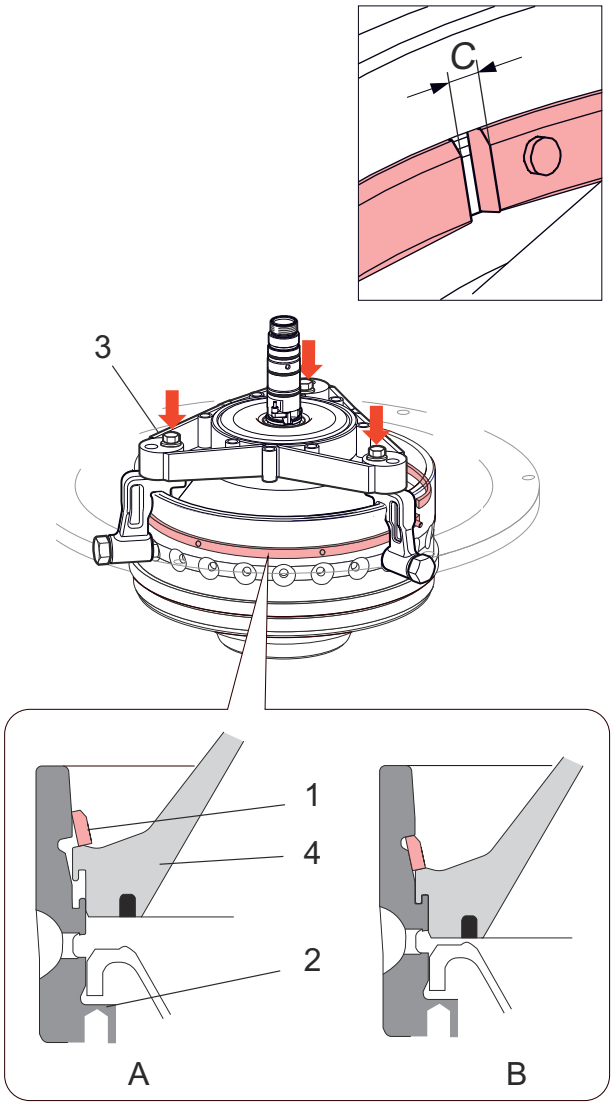
Welding of the lock ring is not allowed, as this can seriously affect the material strength. If the lock ring is either worn beyond the safety limits or incorrectly assembled it may cause severe damage or fatal injury.

WARNING

Health hazard

Never remove any material from the lock ring. This may cause severe damage or fatal injury.

c) Release the pressure on the compressing tool and remove it.



6.5.4 In- and outlet device

1

Fitting the frame hood. i / o

a) Turn the paring tube (1) so that the frame hood (2) can pass the paring tube.

b) Apply a thin layer of silicone grease and fit the O-ring (3) onto the frame hood.
i / o

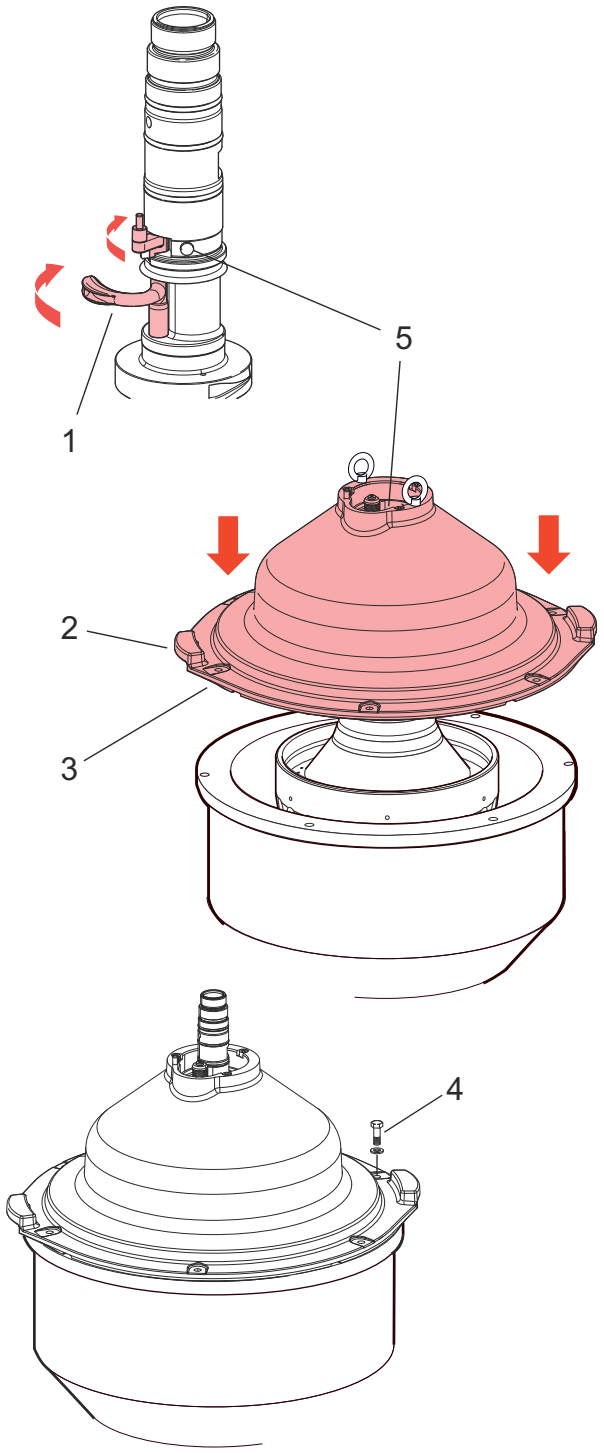
c) Lower the frame hood, using lifting eyes and hoist.

> **NOTE**
>
> Make sure to fit the frame hood groove into the projection of the pipe (5).

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

d) Fit and tighten the screws (4).

e) Remove lifting eyes.



2 Control measurement of paring disc height.

Alfalaval ref. 9027937, rev. 2

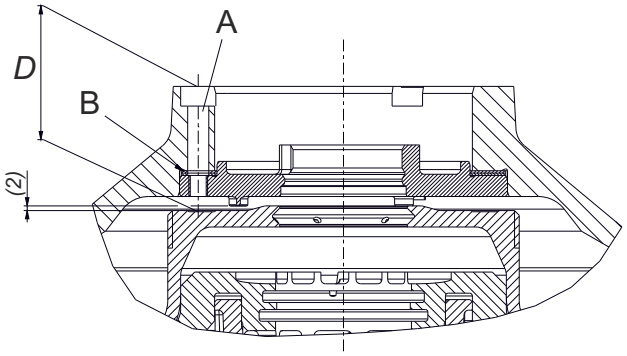
a) Measure the distance (D) through one of the three screw holes (A).

b) Check the table column D for the measured distance.

c) Assemble the correct number of height adjusting rings (B) according to the table.

D	Qty B
52,5 ± 0,5 mm	1
53,5 ± 0,5 mm	2
54,5 ± 0,5 mm	3

d) Refit the screw.



3 Fitting the paring tube spring. (If spring has been removed)

a) Fit the spring hub (1).

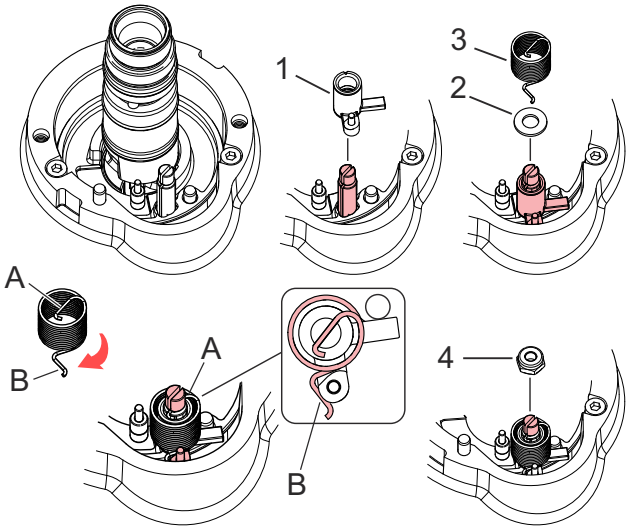
b) Fit the washer (2) and torsion spring (3) with top end (A) in the groove pointing away from bowl hood center.

c) Fit a new unused nut (4), do not tighten.

d) Tighten spring by turning the spring bottom end (B) clockwise until resting in the groove in the spring hub.

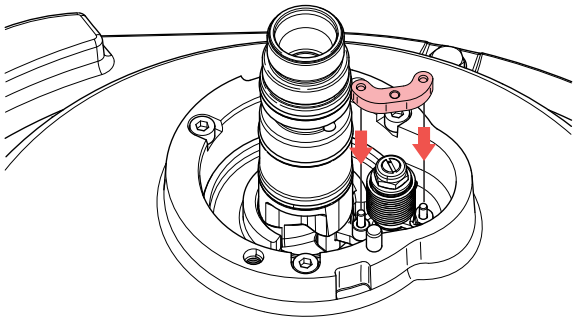
e) Tighten the nut (4). Tightening torque 8 Nm.

f) Check that the spring hub can move freely.



4 Fitting the arm for paring tube.

> **NOTE**
>
> If the arm is hard to grip a screw (M5) can be used in threaded hole.



5 Fitting the connecting housing.

a) Lubricate the inlet pipe thread.

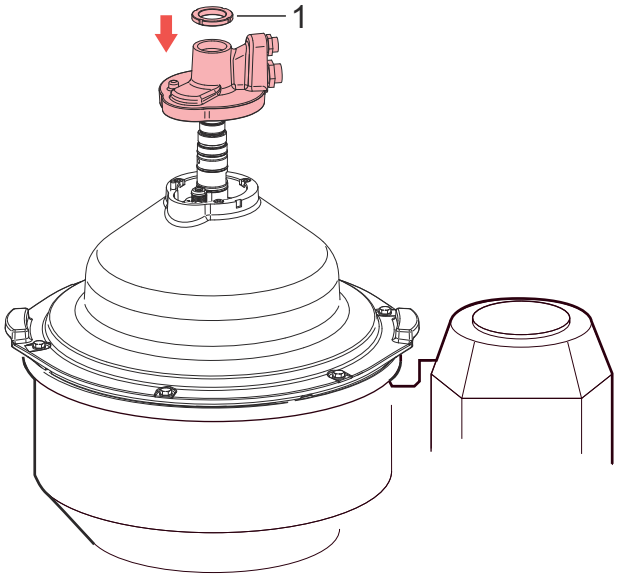
b) Fit the connecting housing over the inlet/ outlet pipe.

> **NOTE**
>
> Make sure that the pin, on top of the frame hood, enters the guide hole at the underside of the connecting housing.

c) Lubricate the round nut threads.

d) Fit the round nut (1) using the hook spanner.

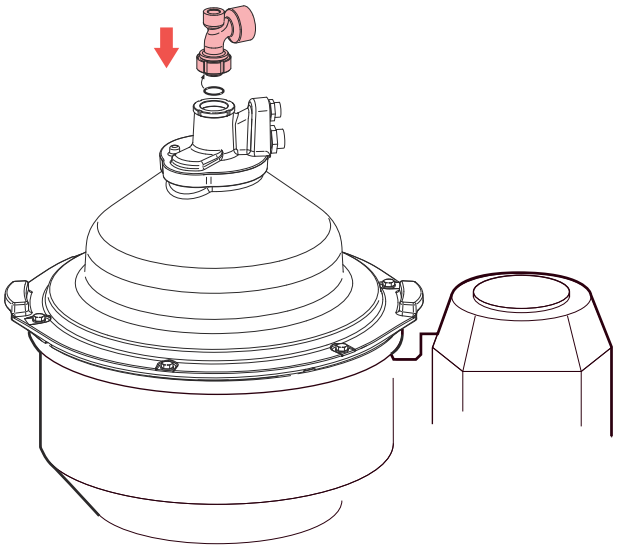
> **NOTE**
>
> Fine threads on the pipe. Make sure that the round nut has entered the pipe threads correctly before tightening with the hook spanner.



6 Fitting the inlet pipe bend.

a) Apply a thin layer of silicone grease and fit the O-ring onto the inlet pipe bend.
i / o

b) Fit the inlet pipe bend and tighten the nut using the hook spanner.



7 Fit all connections to the separator.

> **NOTE**
>
> Make sure that all connections are correct fitted.

6.5.5 Unbalance sensor (optional)

1 Fitting the unbalance sensor holder.

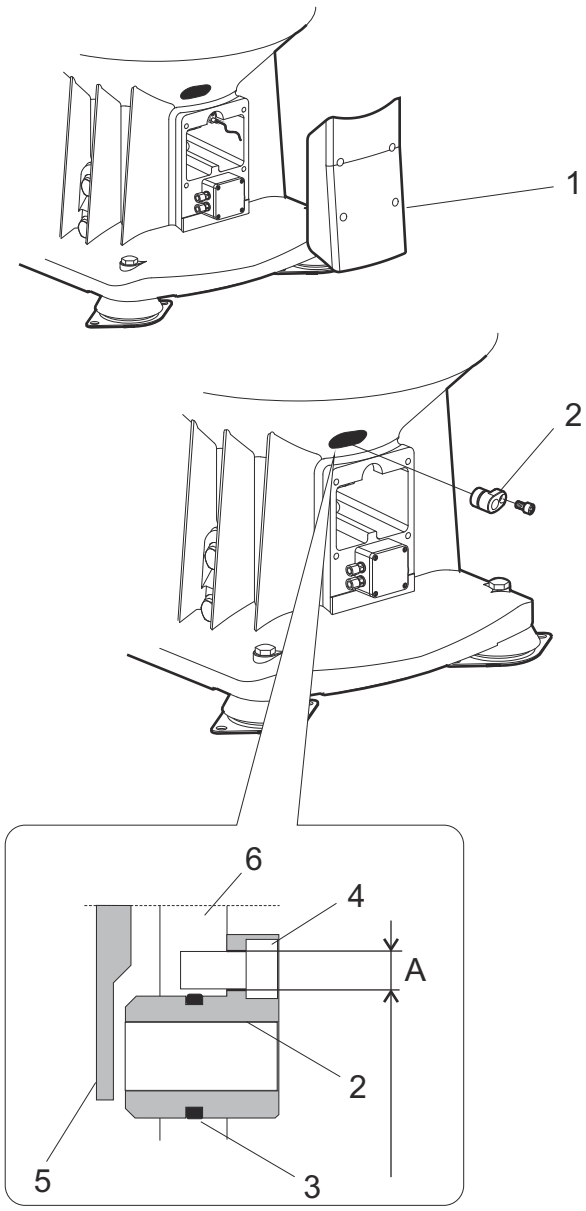
a) Remove the cover (1).

b) Fit the O-ring (3) on the holder (2).

c) Fit the screw (4) into the holder and mount the holder into the separator frame (6).

> **NOTE**
>
> If removing the sensor holder; use a M10 screw as a puller (A).

> **NOTE**
>
> See next step for fitting and correct adjustment of the sensor.

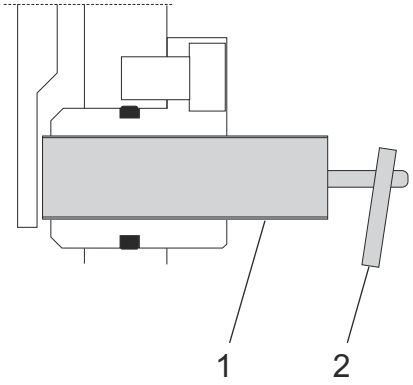


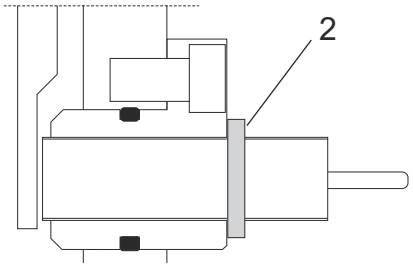
2 Adjusting the unbalance sensor

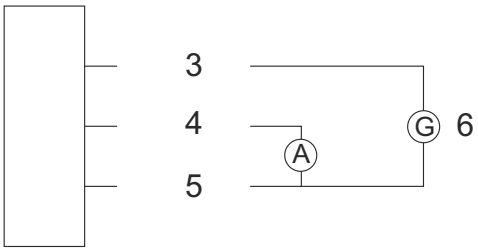
a) Fit the sensor (1) into the holder. Do not forget the nut (2).

b) Adjust the sensor so that a value of 3,5 appears on the display.

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





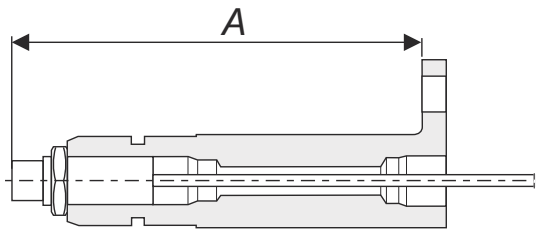


3. + = brown or red
4. J = black or white
5. OV = blue
6. 24 V DC

6.5.6 Speed sensor

(1) Adjusting the speed sensor.

a) Adjust the speed sensor. Distance A = 81 ± 0,1 mm.



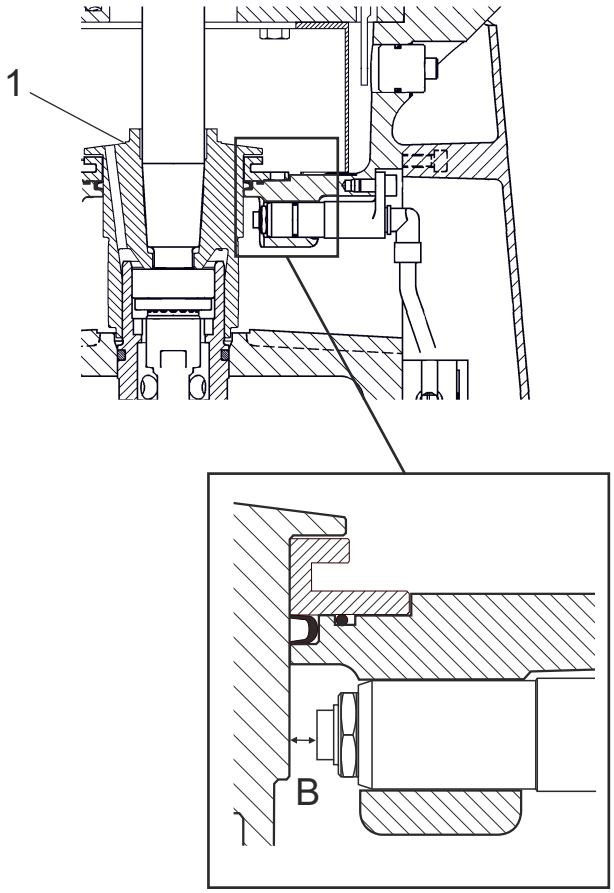
b) Fit the sensor to the frame, see *Sensors and indicators* on page 28

c)

> **NOTE**
>
> If the sensor does not work properly, check the distance between the sensor and the spindle belt pulley (1).

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

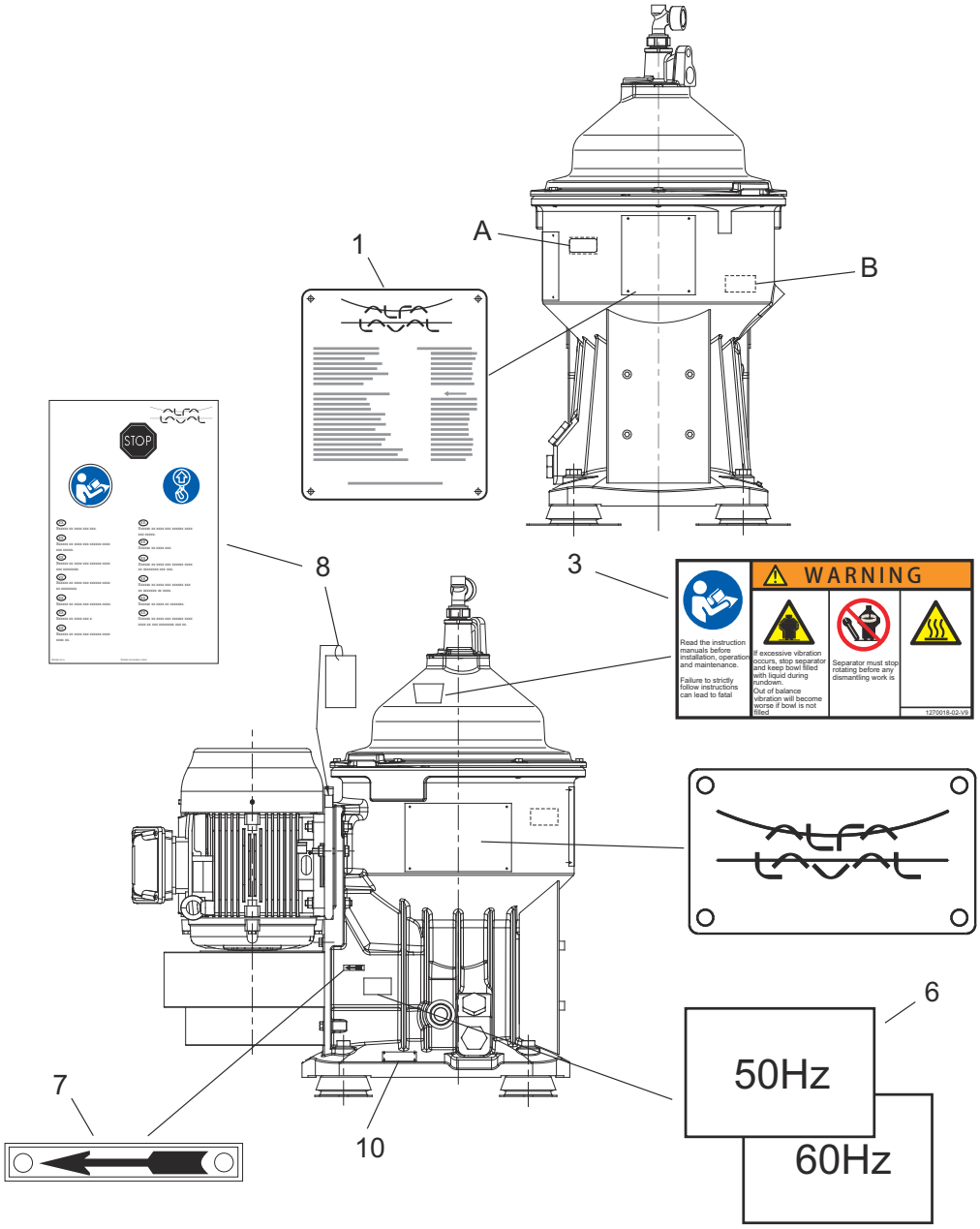
> **NOTE**
>
> The distance (B) between the sensor and the spindle belt pulley (1) must be 3,5 ± 0,5 mm.



6.6 Actions after assembly

6.6.1 Control of machine plates and safety labels

1. Check that the following signs are attached.



1. Machine plate
3. Safety label
6. Indicating drive frequency
7. Indicating direction of rotation of horizontal driving device
8. Lifting instructions
10. Oil type plate
A. Space for additional label for numbering of separator and function
B. Space for label indicating representative

2. Check legibility.

Following texts should be read on the labels.

Machine plate

Separator type

Serial No / Year

Product No

Main group no

Configuration no

Designation

Max. allowed speed (bowl)

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.

Inside diameter of bowl body

Manufacturer

Service enquiries: www.alfalaval.com

Safety label

Text on label: **Warning**

Read the instruction manuals **before** installation, operation and maintenance. Consider inspection intervals.

Failure to strictly follow instructions can lead to fatal injury.

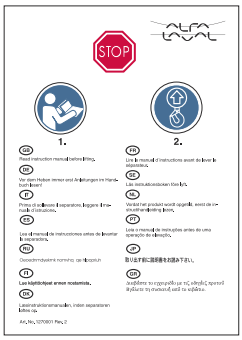
If excessive vibration occurs, **stop** separator and **keep bowl filled** with liquid during rundown.

Out of balance vibration will become worse if bowl is not full.

Separator must **stop rotating** before **any** dismantling work is started.

Lifting instructions

Text on label: Read instruction manual before lifting.



6.7 Oil change

NOTE

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 oil bath 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. For correct oil volume, see “Lubricating oil” in the table in chapter *“Technical data”*.

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

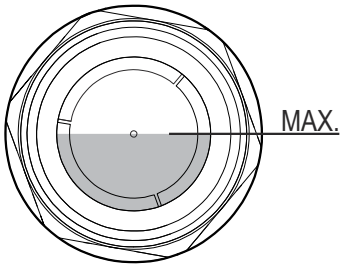
This does not exclude, however, the use of other brands, provided they have equivalently high quality properties as the brands recommended. The use of other oil brands and lubricants than recommended, is done on the exclusive responsibility of the user or oil supplier.

Applying, handling and storing of lubricants

Always be sure to follow lubricants manufacturer's instructions.

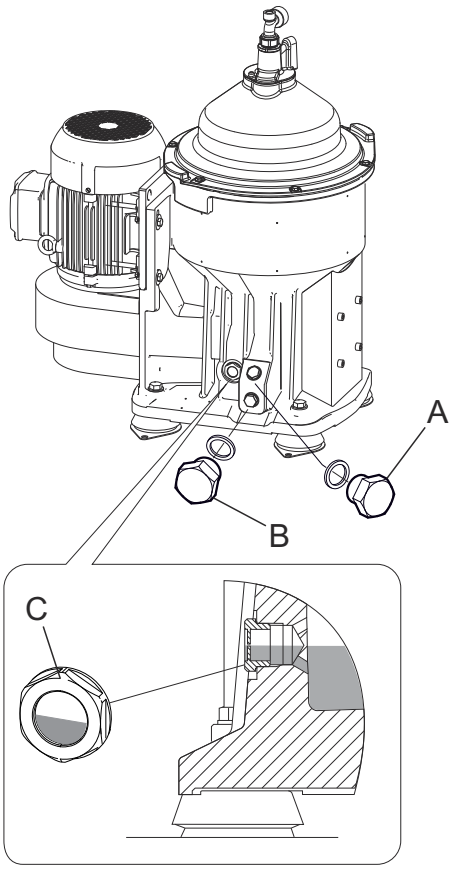
6.7.2 Check oil level

1. Check that the oil level can be seen in the sight glass. The oil level should not be above the max. level in the middle of the sight glass.



6.7.3 Oil change procedure

1. Remove the oil filling plug (A).



2. Place a vessel under the drain plug (B).

3. **CAUTION**

   Burn hazard

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

   Remove the drain plug.

4. Collect the oil in the vessel.

5. Fit and tighten the drain plug (B).

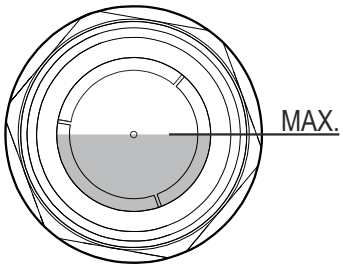
6. Fill with new oil filler hole (A).

   NOTE

   For grade and quality of oil, see chapter *“Lubricating oils”*.

   For correct oil volume, see “Lubricating oil” in the table in chapter *“Technical data”*.

7 Check that the oil level can be seen in the sight glass. The oil level should not be above the max. level in the middle of the sight glass.



8 Fit and tighten the plug (A).

6.7.4 Lubrication chart

Alfa Laval ref. 567329 02 v. 2

CAUTION

Check the oil level before start, top up when necessary and do not overfill.

Do not check the oil level when separator is running.

NOTE

If not otherwise specified, follow the supplier's instructions about applying, handling and storing of lubricants.

NOTE

Check and pre-lubricate new spindle bearings and spindle bearings that have been out of service for three months or longer. If the ambient temperature is below 25°C at start up, the spindle bearings that have been out of service for a shorter period than three months must also be prelubricated.

Lubrication chart

Lubricating point	Lubrication	Interval
The oil bath. Bowl spindle bearings are lubricated by oil mist from the oil bath.	Lubricate with oil, see *Recommended oil brands*. Lubricating oil volume see *Technical data.*	• Continous operation: 4000h • Seasonal operation: Before every operating period • Short period´s operation: 12 months even if total number of operating hours is less than stated above.
Bowl spindle taper	Lubricate with oil Only a few drops for rust protection	At assembly
Bowl: Sliding contact surfaces, thread of lock nut and cap nut.	Lubricate with paste, see *Recommended lubricants*.	At assembly
Rubber seal rings.	Lubricate with grease, see *Recommended lubricants*.	At assembly
Friction clutch bearings.	The bearings are pre-lubricated with grease and need no extra lubrication.	–
Electric motor.	Follow manufacturer's instructions.	Follow manufacturer's instructions.
Plug thread (neck bearing assembly)	Lubricate with oil, if not otherwise stated.	At assembly

6.7.5 Recommended lubricants

Alfa Laval ref. 553217 01 v. 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 G-n plus 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

Paste for assembly of metallic parts, 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 (22 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 April 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)

Part no	Quantity	Designation	Manufacturer	Remark
-	-	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 April 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.
-	-	Unisilkon 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)

Grease for ball and roller bearings in electric motors

Always follow the lubrication recommendations of the bearing 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 EP2	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 01 v. 7

Selection of lubricating oil for belt drive HSS

Select lubricating oil type with regards to ambient temperature

Ambient temperature (°C)	Frame temp and cooling	Oil type	Oil change interval (operating hours)
+20 to +55	N/A	Mineral lubricating oil AL 116 3147 ISO-L-HM 68 Viscosity grade: VG68 Viscosity index: VI > 90	4000
		Alfa Laval oil types: 567334-01 1 litre 567334-02 4 litre	
±0 to +55	N/A	Mineral lubricating oil AL 116 3149 ISO-L-HV 68 Viscosity grade: VG68 Viscosity index: VI > 140	4000

General requirements for HSS lubricating oils

- Compatible with non-ferrous metals.
- Compatible with most paints and conventional sealing materials

Oil change interval

Oil change interval is dependent on operating conditions.

Operating conditions	Oil change interval
In a new installation.	200 hours
Continuous operation.	See Selection of lubricating oil
When the separator is operated for short periods.	12 months
Seasonal operation	Before every operating period

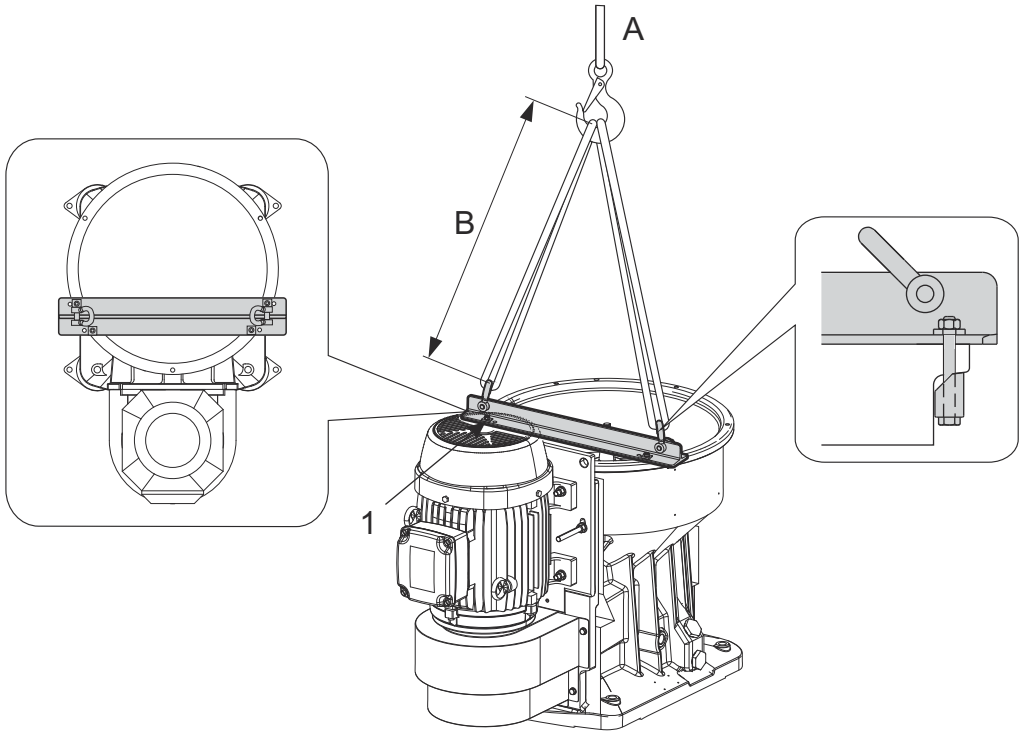
Other information

Check and prelubricate spindle bearings on separators which have been out of service for 6 months or longer.

6.8 Lifting Instructions

Alfa Laval ref. 9031238 v. 0

6.8.1 Lifting the separator



A. Weight to lift: **431 kg**
B. Sling length: Min. **750 mm**
1. Bolts, Tightening torque **35-45 Nm**

1. Disconnect all connections.

2. Remove the inlet and outlet device, the frame hood and the bowl according to the instructions in *Dismantling* on page 49.

> **NOTE**
>
> Never lift or transport the separator with the bowl still inside.

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.

5. Use two lifting slings to lift the separator. Total length of each loop: minimum **1,5 metres**.

6

WARNING

Crush hazard

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.

WARNING

Crush hazard

Never lift the separator by the motor adapter plate.

When lifting and moving the separator, follow normal safety precautions for lifting large heavy objects.

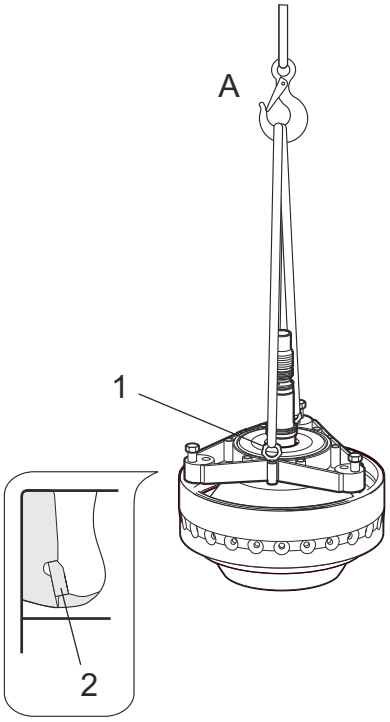
NOTE

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.



A. Weight to lift: **95 kg**
1. Lifting eye, Tightening torque **40±5 Nm**
2. Lock ring (Make sure that lock ring is fitted.)

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.

> **NOTE**
>
> 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.

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

WARNING **Disintegration hazard**

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.

NOTE

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

Possible 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).	**WARNING** 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).	**WARNING** 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 discharg-es.
Bowl speed too low.	Examine the motor and power transmission including the belt transmission (clutch).
Bowl rotates in the 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.
Operating water flow too low.	Check the water flow.

8 Technical reference

8.1 Product description

Alfa Laval ref. 9046126 v. 0

> **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 specification:	881404-03-02
Commercial name:	S 9410
Application:	Cleaning of fuel oil and lubrication oil. Intended for marine- and land installations.
Technical Design:	Total discharge. Centrilock® lock ring.
Directives and standards:	See chapter *Declaration* on page 164.
Operational limits:	
Feed temperature:	0 °C to +100 °C
Ambient temperature:	+5 °C to +55 °C
Maximum allowed speed:	9340 r/min.
Discharge intervals:	Min. 2 minutes to max. 4 hours.
Maximum allowed density of operating liquid:	1000 kg/m^3.
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 Functional Requirement Specification.

8.1.1 Declaration

In addition to the information in this manual a declaration document is delivered with the product. The declaration document contains the same information but is completed with supplier and product information and a signature by responsible person.

8.1.1.1 Declaration

Alfa Laval ref. 589764 v. 11

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

Manufacturer:	Alfa Laval Tumba AB
Manufacturer address:	Alfa Laval Tumba AB, SE-147 80 Tumba - Sweden
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

The following essential requirements of 2006/42/EC are applied and fullfilled:

1.1, 1.1.2., 1.1.3, , 1.1.4, 1.1.5, 1.1.6, 1.1.7, 1.2.3, 1.2.4, 1.3.1, 1.3.2, 1.3.3, 1.3.4, 1.3.7, 1.3.8, 1.3.9, 1.5.1, 1.5.2, 1.5.4, 1.5.5, 1.5.6, 1.5.8, 1.5.9, 1.5.11, 1.5.15, 1.6.1, 1.6.3, 1.6.4, 1.6.5, 1.7

To meet the requirements the following standards have been applied:

Designation	Description
EN 12547	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
2014/30/EU	Electromagnetic Compatibility Directive
2011/65/EU	Restriction of the use of certain hazardous substances in electrical and electronic equipment

To meet the requirements the following standards have been applied:

Designation	Description
EN IEC 63000	Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances

The technical construction file for the machinery is compiled and retained by the authorized person Fredrik Nytomt within the Business Unit High Speed Separators, Alfa Laval Tumba AB, SE-147 80 Tumba, Sweden. By reasoned request all relevant technical documentation will be sent by post to national authorities.

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 fulfill the EU-requirements.

Signed for and on behalf of: Alfa Laval Tumba AB

Place: .....

Date of issue: .....

Signature: .....

Name: .....

Function: .....

Entity: .....

8.2 Technical data

Alfa Laval ref. 9031276 v. 1

General technical data	Value	Unit
Motor power, 50/60 Hz:	9,5 / 9,5	kW
Jp reduced to motor, 50/60 Hz:	12,70 / 8,86	kgm^2
Gear ratio, 50 Hz:	3.03:1	
Gear ratio, 60 Hz:	2.53:1	
Alarm levels for vibration monitor, connection 752, 1st/2nd:	0,3 / 0,45	mm
Min./Max. discharge interval:	2 / 240	minutes
Max. density of operating liquid:	1000	kg/m^3
Max. density feed/sediment:	1100 / 1400	kg/m^3
Min./Max. feed temperature:	0 / 100	°C
Max. running time without flow, bowl empty/filled:	30 / 30	minutes
Bowl material:	AL 111 2377-02	

Operating data	Value	Unit
Bowl speed, synchronous, 50/60 Hz:	9090 / 9108	r/min
Motor speed, synchronous, 50/60 Hz:	3000 / 3600	r/min
Maximum allowed bowl speed:	9545	r/min
Max. power consumption, start-up:	12	kW
Power consumption, idling/max. capacity:	3.9 / 9.5	kW
Start time min./max.:	1,5 / 2,5	minutes
Stop time min./max.:	20 / 42	minutes
Sound power:	9,4	Bel(A)
Sound pressure:	79	dB(A)
Max. vibration level, separator in use: (r.m.s)	9,1	mm/s

Volume and Capacity data	Value	Unit
Bowl liquid volume:	4,3	litres
Fixed discharge volume:	4	litres
Sludge volume, efficient/total:	0,74 / 2,17	litres
Lubricating oil volume:	2,8	litres

Weight information	Value	Unit
Separator total:	548	kg
Bowl:	93	kg
Motor drive:	159	kg

8.3 Connection list

Alfa Laval ref. 9031277 v. 4

200 - Connections for process flows

201	**Inlet for process liquid**		
	Remark	-	
	- Max. Allowed density	See *Technical data* on page 166	
	- Allowed flow	Max. 11,1	m³/h
	- Allowed temperature	Min. 0 to Max. 100	°C
206	**Inlet for conditioning and displacement liquid**		
	Remark	Fresh water	
	- Instantaneous flow	2,8	litres/ minute
	- Quality requirements	See *Quality specification water* on page 188	
220	**Outlet for light phase, clarified liquid**		
	Remark	-	
	- Counter pressure	0-250	kPa
221	**Outlet for heavy phase**		
	Remark	-	
	- Counter pressure	No counter pressure	
222	**Outlet for solid phase**		
	Remark	The outlet from the sludge cover must always be arranged to prevent the cover from being filled up with sludge. Solids are discharged by gravity.	
	- Small discharge - Large discharge	Total discharge	
	- Discharge frequency	Max. 30	discharge/h

300 - Connections for flushing, CIP, and operating systems

375	**Inlet for discharge and make-up liquid**		
	Remark	-	
	- Quality requirements	See *Quality specification water* on page 188	
	- Max. density	min. 1000	kg/m³
	- Pressure	min. 150	kPa
	Make-up liquid		
	- Flow (momentary)	2,8	litres/ minute
	- Consumption	1,12	litres/h
	- Interval	5	minute
	- Time	2	second
	Discharge liquid		

375	Inlet for discharge and make-up liquid		
	- Flow	11	litres/ minute
	- Consumption	0,55	litres/ discharge
	- Time	3	second
	Closing liquid		
	- Flow	2,8	litres/ minute
	- Consumption	0,7	litres/ discharge
	- Time	15	second

400 - Connections for liquids

462	Drain of frame top part, lower	
	Remark	Should be possible to drain liquids by gravity

700 - Connections for electricity

701	Motor for separator	
	Remark	-
	- Max. deviation from nominal frequency:	± 5% (± 10% momentarily during 5 seconds)

740	Speed sensor for bowl spindle		
	Remark	See “Functional requirement specification”	
	- Type	Inductive proximity switch	
	- Supply voltage, nominal	8	V
	- With sensor activated (near metal)	≤ 1,2	mA.
	- With sensor not activated (far from metal)	≥ 2,1	mA.
	- Number of pulses per revolution	1	

752	Position transducer for bearing holder (unbalance sensor)		
	Remark	See “Functional requirement specification”	
	- Type	Inductive analogue sensor	
	- Supply voltage	15 to 30	V DC
	- Operation range (mild steel)	3,5 ± 0,25	mm
	- Output current analogue	4 to 20	mA
	- Load resistance, R_L	Max. 1 kΩ	

8.4 Functional requirement specification

Alfa Laval ref. 9033726 v. 4

8.4.1 Intended use

This document provides information, requirements and recommendations about operational procedures and signal processing for a safe and reliable operation of a separator. It is intended for the design of auxiliary equipment and control systems for a separator.

8.4.2 References

This *Function Requirements Specification (FRS)* is one document related to the separator. Other such documents that contain necessary information and are referred to here are:

- *Interconnection Diagram*
- *Connection List*
- *Technical Data*
- *Motor Rating Plate and motor documentation in manual*

Standards and directives referred to are:

- EN ISO 13850 Safety of machinery - Emergency stop - Principles of design
- EN ISO 14118 Safety of machinery - Prevention of unexpected start-up
- EN ISO 13849-1 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:

- **Max allowed bowl speed:** Data given in *Technical Data*.
- **Set speed:** The speed that is intended to be used when using a frequency control drive. Shall be the same as synchronous speed specified in Technical Data. Note that set speed shall always be below max bowl speed in Technical Data. How far below depends on the speed regulating precision of the VFD. For a DOL motor rated speed should always be chosen according to *Technical Data*.
- **Full speed:** Normally when the speed has reached 95% of set speed for production.

8.4.4 Purpose

The purpose of this FRS is to prevent situations that can cause harm, i.e. injury, damage to health or property and unsatisfactory separation results by providing information and instructions.

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 that might cause harm
Access to moving parts	Can cause injury to person who accidentally touches these parts
Insufficient cleaning of separator	Unsatisfactory separation quality
Bowl leakage	Process liquid losses

Control and supervision can be more or less comprehensive depending on the type of control equipment used. 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 reason, 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*.

For analogue signals it should be checked that the signal is in correct range. If not, an alarm should be given and alarm action taken according to chapter “Alarm activation diagram”.

For analogue signals normally two alarm levels should be set. The low level should only be a warning while the high level gives some action according to chapter “Alarm activation diagram”.

For most alarms there is an alarm delay that is specified in chapter “Alarm activation diagram”.

Adjustable parameters are listed in chapter “Parameter list”.

8.4.5 Description of separator modes

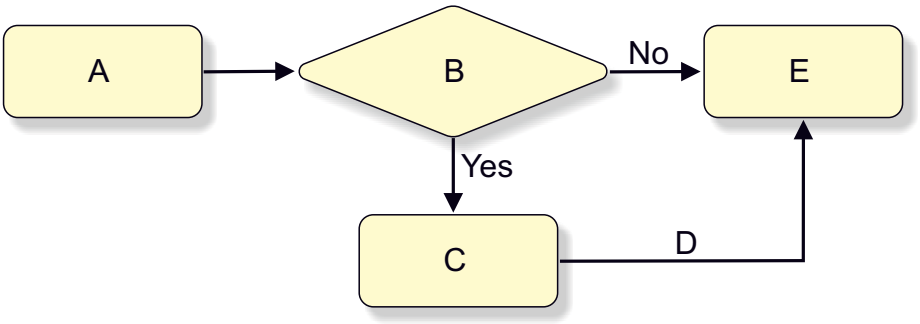
8.4.5.1 Operation modes and operating conditions

The operation of the separator should be divided into different modes for control purposes. The modes that are normally used are described below although other modes might exist. It is assumed that:

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

If above conditions are not fulfilled the separator is unready for operation.

8.4.5.1.1 Power on/Stand still



A. Power on

B. STOP, HARDWARE STOP or MACHINERY PROTECTION STOP flag in flash-memory?

C. Go to appropriate sequence

D. Transition when completed

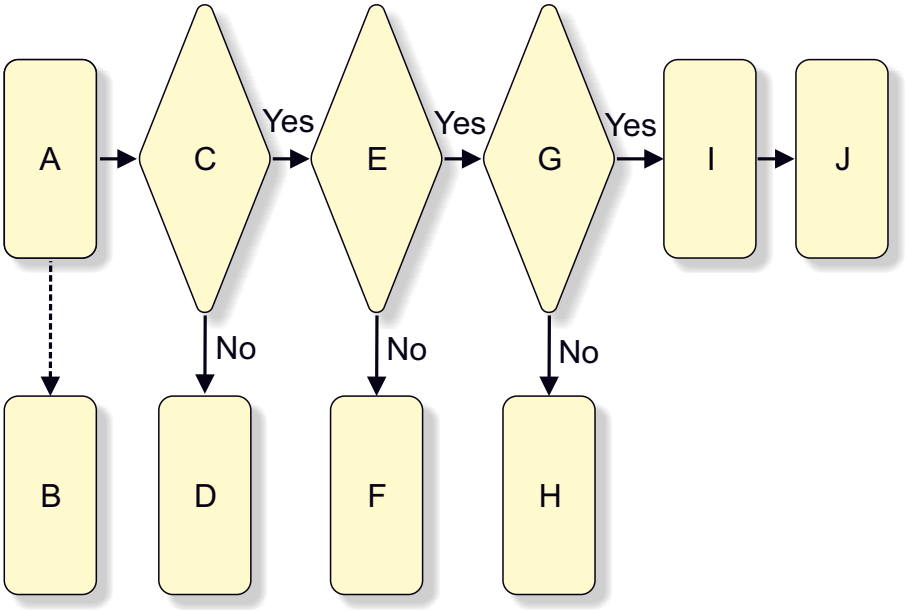
E. Go to STAND STILL

Connection	(x=open)
201 inlet product	
206 Displacement/conditioning water	
220 light phase outlet	X
221 heavy phase outlet	
222 discharge solids outlet	
375-1 discharge	
375-2 make up water (closing)	
M701 Separator motor	

STAND STILL means:

- The power to the separator motor is off.
- The bowl is open and not rotating and 220 is open to the surrounding to prevent vacuum in the system at temperature changes. It is normally recommended to keep 222 closed at stand still to avoid splashing from a shared sludge tank to enter the separator.
- Transition from power on to STAND STILL shown above.

8.4.5.1.2 Starting



A. Start separator motor
B. Open 222 (optional sludge outlet valve)
C. Check for start feedback (e.g. contactor or VFD running signal)
D. Go to NORMAL STOP Show alarm - Separator start failure
E. Speed > S_SpeedTest within T_SpeedTest after contactor feedback?
F. Go to NORMAL STOP Show alarm - Slow start acceleration
G. Speed ≥ S_lowspeed after T_start s?
H. Go to NORMAL STOP Show alarm - Too long start up time
I. Open 375-1, 5s (priming operating water, open bowl)
J. Open 375-2, T_CloseBowl (close bowl)

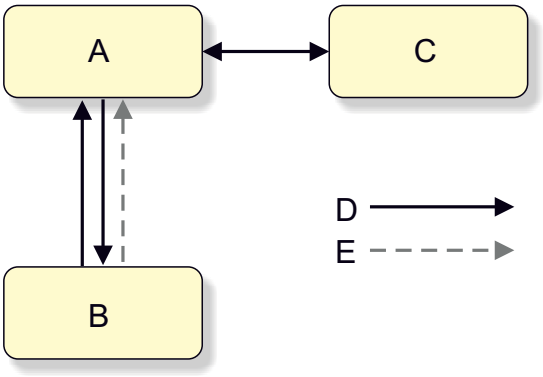
Connection	(x=open)
201 inlet product	
206 Displacement/conditioning water	
220 light phase outlet	X
221 heavy phase outlet	
222 discharge solids outlet	X
375-1 discharge	X
375-2 make up water (closing)	X
M701 Separator motor	X

STARTING means:

- The power to the separator motor is on. Start feedback should be received promptly, otherwise a transition should be made to NORMAL STOP and alarm “Separator starter failure” shown.
- The bowl is rotating and 220 shall be open to the surrounding to prevent pressure build up from the pairing disc. 222 should be open.

- To ensure that motor and clutches operates as intended and reduce any damage to these parts in case of problems, speed should be above S_SpeedTest rpm within T_SpeedTest after contactor feedback, otherwise a transition should be made to NORMAL STOP and alarm “Slow start acceleration” be shown.
- The bowl speed should be ≥ S_lowspeed after T_start s. Otherwise a transition should be made to NORMAL STOP and alarm “Separator motor run-up time too long” be shown.
- After bowl speed > S_lowspeed, 375-1 should be open for 5s to fill operating water channels fully and perform a discharge. Since the main purpose is to prime the operating water channels and not the discharge itself, feedback is not monitored. Wait 15 seconds and after this 375-2 is open T_CloseBowl to close the bowl.

8.4.5.1.3 Running



A. STANDBY DRY
B. PRODUCTION
C. CLEANING
D. Operator selected transition
E. Automatic transition triggered by an alarm

Connection	STANDBY DRY (x=open)	PRODUCTION (x=open)
201 inlet product		X
206 Displacement/conditioning water		
220 light phase outlet	X	X
221 heavy phase outlet		
222 discharge solids outlet	X	X
375-1 discharge		
375-2 make up water (closing)	X*	X*
M701 Separator motor	X	X

* Open 2s every 5 min.

RUNNING means:

- The power to the separator motor is on.
- The bowl is closed and rotating at full selected speed.
- The discharge system is enabled.

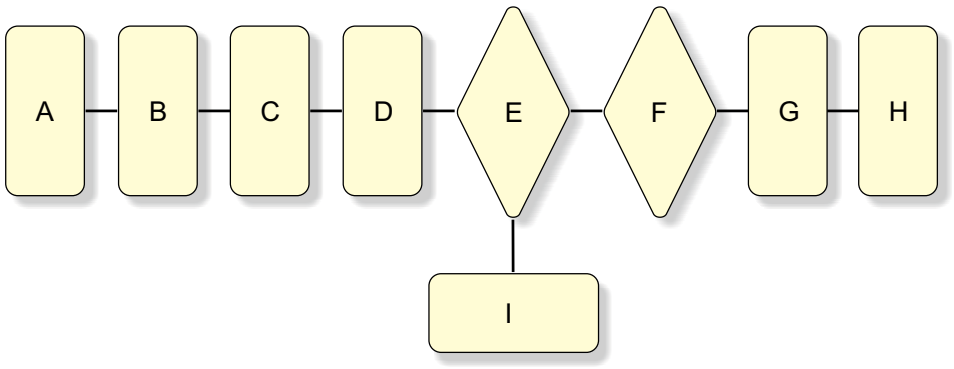
RUNNING is a collective denomination for a number of sub modes, which are:

- *STANDBY DRY*: Separator is in waiting mode and not producing. Discharges should be initiated only manually. Time limitation for Standby Dry given in technical data.
- *PRODUCTION*: Separator is fed with product and producing.
- *CLEANING*: Separator is fed with cleaning liquids with the intention to clean the separator.

See also chapter "*Transition between different operating modes*" for a description of the transitions between different process modes. Transitions to be done avoiding closed outlets, and providing displacement between different process media.

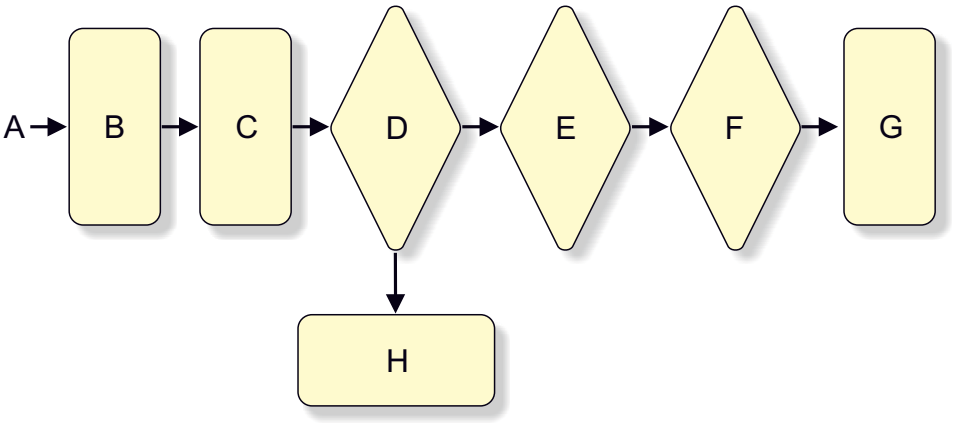
8.4.5.1.4 Stopping

NORMAL STOP



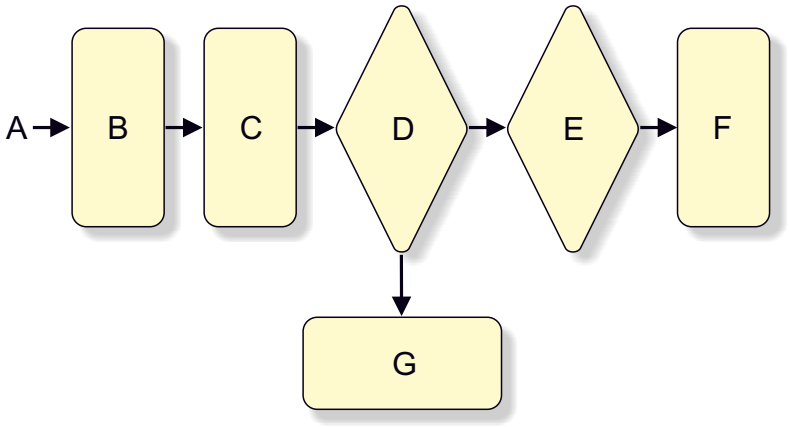
A. Perform DISPLACEMENT and DISCHARGE
B. Close 220, open 206 until bowl filled
C. Open 220, 221 and 206 for T_flush, s
D. Power off motor
E. Bowl speed < S_SpeedTest RPM after T_SpeedTest s?
F. When bowl speed < S_fullspeed/2, Open 375-2, 2s
G. When bowl speed S_DischStopSpeed, perform a DISCHARGE
H. Go to STAND STILL after 60s with zero speed
I. Alarm - High speed at STOP

MACHINERY PROTECTION STOP



A. Transition from any mode
B. Close 201, Open 206
C. Power off motor
D. Bowl speed < S_SpeedTest RPM after T_SpeedTest s?
E. When bowl speed < S_fullspeed/2, Open 375-2, 2s
F. When bowl speed <S_MPStop, close 206
G. Go to STAND STILL after 60s with zero speed
H. Alarm - High speed at STOP

HARDWARE STOP



A. Transition from any mode
B. Close 201
C. Power off motor
D. Bowl speed < S_SpeedTest RPM after T_SpeedTest s?
E. When bowl speed < S_fullspeed/2, Open 375-2, 2s
F. Go to STAND STILL after 60s with zero speed
G. Alarm - High speed at STOP

Connection	NORMAL STOP (x=open)	MACHINERY PROTECTION STOP (x=open)	HARDWARE STOP (x=open)
201 inlet product			
206 Displacement/ conditioning water	X*	X	
220 light phase outlet	X	X	X
221 heavy phase outlet	X*		
222 discharge solids outlet	X	X	X
375-1 discharge	X*	X*	X*
375-2 make up water (closing)	X*	X*	X*
M701 Separator motor			

* See flowchart when used

STOPPING means:

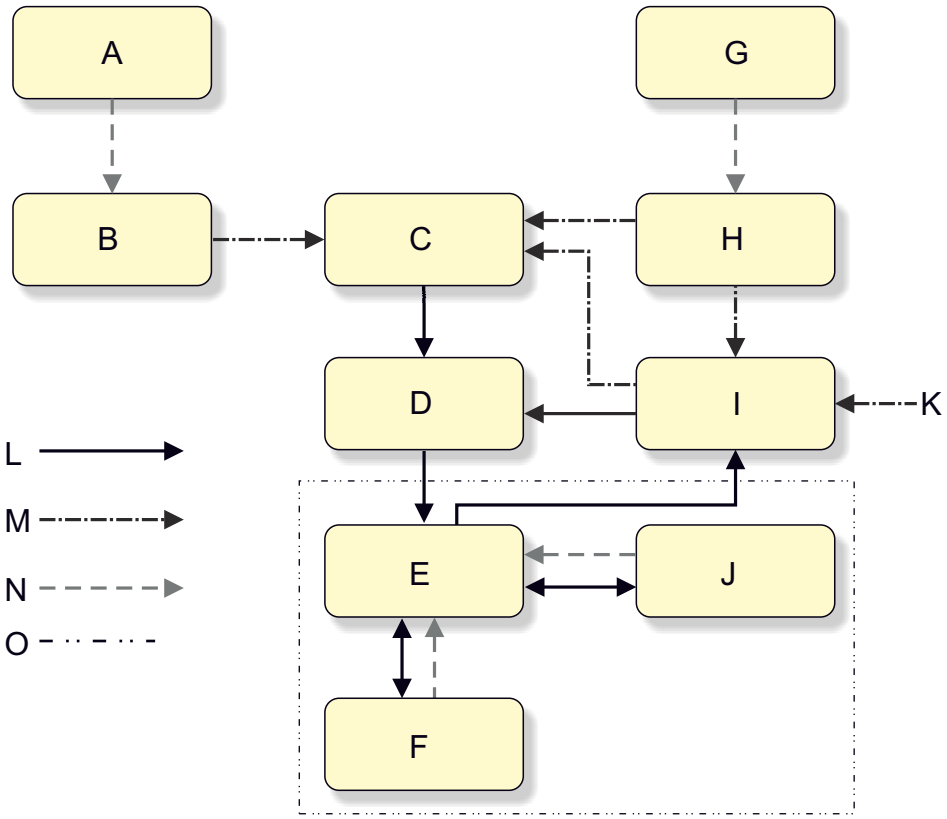
- The power to the separator motor is off.
- No flow rate except in *MACHINERY PROTECTION STOP*
- The bowl is rotating and decelerating.
- *STAND STILL* is reached automatically after 60s of zero speed. (see chapter, ST740 speed sensor).

STOPPING is a collective denomination for a number of sub modes, which are:

- *NORMAL STOP*: A manually or automatically (on alarm) initiated stop. A DISPLACEMENT and DISCHARGE is performed to empty bowl and flush discharge channels. 201 shall be kept closed after DISCHARGE. Then 206 should be opened until bowl is filled to reduce vibrations during stopping. Then 206, 220 and 221 should be opened for T_flush seconds to flush paring disc and paring tube to avoid clogging at next start up. When done the separator motor is powered off. Bowl speed is expected to have decreased by S_SpeedTest after T_SpeedTest. If not alarm –High speed at STOP should be shown. When bowl speed < S_fullspeed/2, open 375-2 for 2s to top up discharge system and keep bowl closed. When bowl speed S_DichStopSpeed perform a discharge, omitting feedback. The purpose is to avoid high vibrations by stopping with an empty bowl since a "standing wave" otherwise can occur in the bowl. After 60s with speed sensor indicating zero speed, go to STAND STILL.
- *MACHINERY PROTECTION STOP*: An automatically (on alarm) initiated stop where the most important matter is to stop the bowl as quick as possible. No discharges are possible. Motor is switched off. 206 shall be open to the separator. 206 is closed at speed S_{SfStop}. This stop will be in effect until *STAND STILL* is reached, i.e. flying restart is not possible. Bowl speed is expected to have decreased by S_SpeedTest after T_SpeedTest. If not alarm -High speed at STOP should be shown. When bowl speed < S_fullspeed/2, open 375-2 for 2s to top up discharge system and keep bowl closed. After 60s with speed sensor indicating zero speed, go to STAND STILL.
- *HARDWARE STOP:* A STOP initiated by an emergency stop button or certain alarms that require a STOP without discharge as part of the stopping sequence. 201 shall close. The separator motor is powered off. Bowl speed is expected to have decreased by S_SpeedTest after T_SpeedTest. If not alarm –High speed at STOP should be shown. When bowl speed < S_fullspeed/2, open 375-2 for 2s to top up discharge system and keep bowl closed. After 60s with speed sensor indicating zero speed, go to STAND STILL.

8.4.5.2 Transition between different operating modes

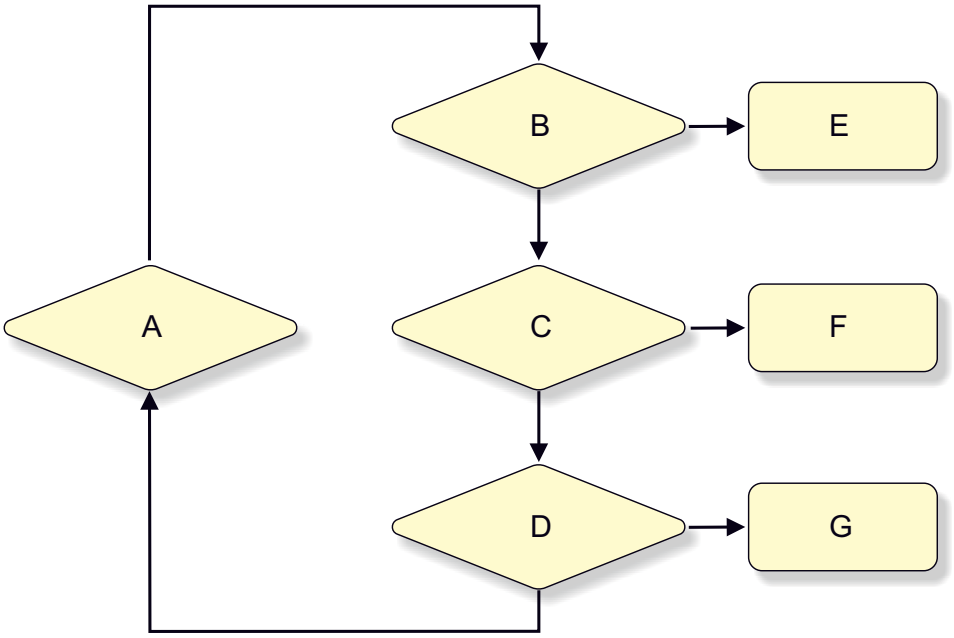
Main mode diagram



A. From all modes except STAND STILL
B. MACHINERY PROTECTION STOP
C. STAND STILL
D. STARTING
E. STANDBY DRY
F. PRODUCTION
G. From all modes except STAND STILL, at Estop, Over speed, VFD fault
H. HARDWARE STOP
I, NORMAL STOP
J, CLEANING
K. Power on
L. Operator selected transition
M. Automatic transition
N. Automatic transition triggered by an alarm
O. Running mode

These are the process modes described in chapter “*Operation modes and operating conditions*”, but other process modes might exist.

RUNNING sequence with alarm transitions

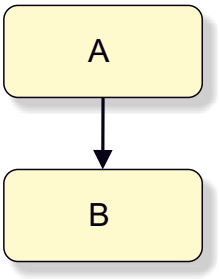


A. RUNNING
B. Emergency stop activated
C. YT750 Vibration sensor frame shutdown
D. High bowl speed, Too low bowl speed, Too long time Standby dry, Discharge feedback error
E. HARDWARE STOP
F. MACHINERY PROTECTION STOP
G, NORMAL STOP

8.4.5.3 Additional modes

For some operational modes, it can be possible to have an additional mode at the same time as the main mode.

8.4.5.3.1 Displacement



A. Close 201

B. Open 206 for T_displacement s

Connection	(x=open)
201 inlet product	
206 Displacement/conditioning water	X
220 light phase outlet	X
221 heavy phase outlet	
222 discharge solids outlet	X
375-1 discharge	
375-2 make up water (closing)	
M701 Separator motor	X

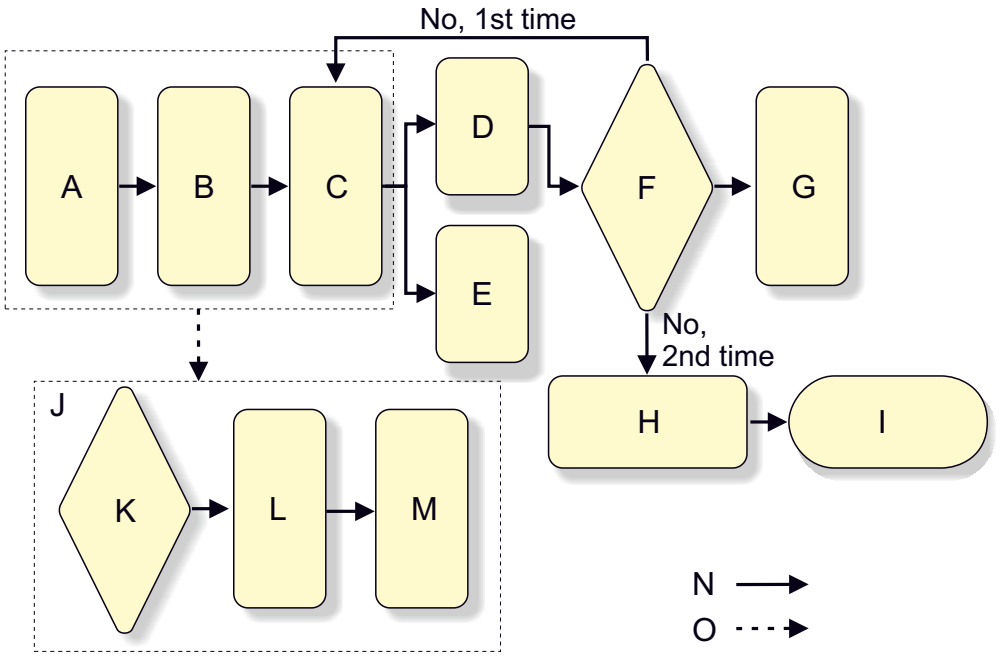
DISPLACEMENT means that bowl contents is displaced by water before a *DISCHARGE* is performed. This is done to not lose any product during *DISCHARGE*. It is important that 201 is closed since displacement with normal feed flow might make the water coming from 206 to go right out 220.

Therefore it is important to both ensure that 201 is closed before 206 is opened and that water is supplied through 206. One way of doing this could be to monitor a pressure sensor at 220 and monitor the pressure drop when 201 is closed. The operation of 206 could be ensured by closing 220 and monitoring a pressure increase when 206 opens.

206 should be open for T_displacement s.

T_displacement is a timer that preferably is calibrated. This could be done by monitoring pressure at 220 at start. With an empty bowl, close 220 and open 206. The bowl fill time is then the time until a pressure increase can be monitored at 220. An exact displacement could also be achieved by monitoring water content in light phase.

8.4.5.3.2 Discharge



A. Close 201
B. Open 375-2 for 5s (top up operating water system)
C. Open 375-1 (open bowl) for T_OpenBowl
D. Start 10 s timer
E. Open SV375-2 (close bowl) for T_CloseBowl
F. Bowl speed decreased S_DischTest after timer elapsed?
G. Open 206 (sealing water) for T_Sealing
H. Alarm- Discharge feedback error
I. Go to NORMAL STOP
J. Alarm handling with bowl open
K. Alarm activated that will change process mode while bowl is open?
L. Open SV375-2 (close bowl) for T_closeBowl
M. Continue with alarm action
N. Automatic transition
O. Alarm transition in case of alarm action

Connection	(x=open)
201 inlet product	
206 Displacement/conditioning water	
220 light phase outlet	X
221 heavy phase outlet	
222 discharge solids outlet	X
375-1 discharge	X
375-2 make up water (closing)	X
M701 Separator motor	X

DISCHARGE means that the bowl is opened and the sludge in the sludge space as well as the complete bowl content (total discharge) is released to the sludge outlet (222). *DISCHARGE* can only be performed with 201 closed and

after a *DISPLACEMENT*, since large product losses over time otherwise would occur.

First 375-2 is opened for 5s to ensure that the operating water system is well filled and prepared for discharge.

375-1 is opened for T_OpenBowl which will trigger opening of the bowl. After T_OpenBowl has elapsed 375-2 will be opened for T_CloseBowl. In parallel with bowl closing water there is a feedback check where a bowl speed decrease of S_DischargeTest is anticipated. If speed drop did not occur the bowl is assumed to not open correctly and a second try will be done. If the speed drop still is missing, Alarm –Discharge feedback error, will be shown and the separator should go to *NORMAL STOP* but omitting the *DISPLACEMENT AND DISCHARGE* part of the *NORMAL STOP* sequence.

If the speed decreases by S_DischTest as anticipated, 206 will be opened for T_Condition (sealing water).

8.4.5.4 Logging recommendations

We strongly recommend that the following signals are logged; the log data should be available for at least 60 days:

Signal	Logging interval
Separator speed ST740	Adjustable 1s to 60s sampling rate
Vibration sensor YT752	Adjustable 1s to 60s sampling rate

In addition, all operation mode changes, discharge activations and all alarms should be logged.

The file containing the log-data should be in .csv-format, i.e. readable with a spreadsheet program like Microsoft Excel. < column content >

8.4.5.5 Remote start

The separator can be started and controlled from a remote location. According to EN ISO 14118, the installation shall be equipped with a power isolation device to ensure a reliable isolation when dismounting the separator for service. This isolation device should be equipped with an interlock device that prevents any liquid being fed to the separator when it is shut down for service.

During first start after service or if the separator has been unused for a long time, the starting shall be manually supervised locally.

8.4.6 Connections

Electrical connections

8.4.6.1 M701 Separator motor

The separator is equipped with a 3-phase DOL-(direct on line) started motor.

There shall be an emergency stop circuit designed according to EN ISO 13850 and a power isolation device according to EN ISO 14118.

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.

Operation of separator motor is shown in the connections table for each sequence.

8.4.6.2 ST740 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*). See respective mode for alarms related to speed.

8.4.6.3 YT752 Unbalance sensor, (Option)

For indication of any abnormal unbalance and to be able to perform appropriate countermeasures, the separator has been equipped with an 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 the alarm “YT752 sensor fault” to continuously monitor function of the vibration transmitter.

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

Signal processing in *STARTING*:

- Only sensor fault is monitored during starting.

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 *MACHINERY PROTECTION 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 *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 *MACHINERY PROTECTION STOP*.

Signal processing in *HARDWARE STOP*:

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

8.4.7 Parameter list

Pwd = Password level, 1: operator, 2: supervising operator, 3: service engineer AL

Parameter	Pwd	Name	Default value	Unit	Min. value	Max. value
Separator speed, ST740						
$S_{MaxSpeed}$		Separator max speed.	Not adjustable, see Technical Data or machine plate.			
$S_{SpeedSP}$	2	Set speed.	See definition set speed and Technical Data			
$S_{HighSpeed}$	3	Alarm limit High speed (rpm exceeding $S_{SpeedSP}$)	105	%	101	105
$S_{LowSpeed}$	3	Alarm limit Low bowl speed (percent of $S_{SpeedSP}$).	95	%	95	100
$S_{LowLowSpeed}$	3	Alarm limit Too low bowl speed (percent of $S_{SpeedSP}$)	90	%	90	100
T_{Start}	3	Max time to reach low speed setpoint ($S_{LowSpeed}$)	3	min	0	30
$S_{SpeedTest}$	3	Setpoint used to detect changes in speed during *STARTING* and *STOPPING*	90	rpm	50	200
$T_{SpeedTest}$	3	Time window for $S_{SpeedTest}$ to occur.	10	s	5	30
S_{MPStop}	2	Close 206 at *MACHINERY PROTECTION STOP*	1000	rpm	300	2000

Parameter	Pwd	Name	Default value	Unit	Min. value	Max. value
Discharge system						
$T_{Discharge}$	2	Discharge interval	30	min	2	240
$S_{DischTest}$	2	Minimum required speed drop at discharge	400	rpm	30	300
$T_{OpenBowl}$	3	375-1 time to open bowl	3	s	-	-
$T_{CloseBowl}$	3	375-2 time to close bowl	15	s	-	-
$T_{Displacement}$	3	206 open time to displace bowl contents	62	s	60	200
$T_{Conditioning}$	3	206 open time for conditioning water (based on sludge volume to topdisc of 0.75 l and desired volume to condition 0.5 l)	20	s	10	30
$S_{DischStopSpeed}$	3	Additional Discharge during NORMAL STOP	3000	rpm	3000	4000

Parameter	Pwd	Name	Default value	Unit	Min. value	Max. value
Vibration supervision						
$S_{VibWarning}$	3	Alarm limit vibration prewarning frame YT752	0.3	mm	0.0	2.5
$S_{VibShutdown}$	3	Alarm limit vibration shutdown frame YT752	0.5	mm	0.0	2.5
$S_{Crit1Upper}$	3	1. crit. speed upper value	2000	rpm	0	9000
$S_{Crit1Lower}$	3	1. crit. speed lower value	1000	rpm	0	9000

Parameter	Pwd	Name	Default value	Unit	Min. value	Max. value
System and process						
T_{Stdby}	3	Time limit in *STANDBY DRY*, change to *NORMAL STOP*	30	min	0	60

8.4.8 Alarm activation diagram

Note: Start blocking means interlock of the Start command both from Stand still and Stop (restart). Transition to *STARTING* is only allowed if all alarms are acknowledged.

Note: All alarms leading to Stop are mandatory to implement in the control system, other alarms are strongly recommended to have.

Start block	Description	Stand Still	Starting	Running	Normal Stop (NStop)	Machinery Protection Stop (MPStop)	Hardware Stop (HStop)	Alarm delay	Comments
	Separator speed supervision, ST740								
	ST740 Speed sensor fault		NStop					10 s	Signal out of range
	High bowl speed	Alarm	NStop	NStop	Alarm	Alarm	Alarm	2 s	Alarm limit $S_{HighSpeed}$
	Low bowl speed			Alarm*				10 s	* Recommended automatic action: transition to *STAND-BY DRY*. Alarm limit in $S_{Low-Speed}$. Not supervised during discharge.
	Too low bowl speed			NStop				5 s	Alarm limit in $S_{LowLowSpeed}$.
	Separator start failure		NStop					10 s	No start feedback after start command.
	Slow start acceleration		NStop					$T_{SpeedTest}$	Alarm limit $S_{SpeedTest}$
	Too long start up time		NStop					T_{Start}	Alarm limit $S_{LowSpeed}$.
	High speed at STOP				Alarm	Alarm	Alarm	$T_{SpeedTest}$	To alert operator that speed is not decreasing although motor power should be off.

Start block	Description	Stand Still	Starting	Running	Normal Stop (NStop)	Machinery Protection Stop (MPStop)	Hardware Stop (HStop)	Alarm delay	Comments
	Discharge system								
	Discharge feedback error			Alarm / NStop*				$T_{DischTest}$	Alarm limit $S_{DischTest}$. Supervised during discharge only. *Recommended automatic action: repeat discharge and transition to NSTOP, omitting displacement and discharge, if discharge still not ok.

Start block	Description	Stand Still	Starting	Running	Normal Stop (NStop)	Machinery Protection Stop (MPStop)	Hardware Stop (HStop)	Alarm delay	Comments
	Vibration supervision								
X	YT752 Vibration sensor frame, pre-warning	Alarm	Alarm	Alarm	Alarm	Alarm	Alarm	3 s	Alarm limit $S_{VibWarning}$. Supervision blocked during discharge and during *STARTING*. Start blocking.

Start block	Description	Stand Still	Starting	Running	Normal Stop (NStop)	Machinery Protection Stop (MPStop)	Hardware Stop (HStop)	Alarm delay	Comments
X	YT752 Vibration sensor frame, shutdown	Alarm	MPStop	MPStop	MPStop	Alarm	MPStop*	3 s	Alarm limit $S_{VibShutdown}$. Supervision blocked during discharge and *STARTING*. Open 206 until S_{MPStop}. Start blocking. No restart. Discharge blocking. If Hardware stop active at the same time, MPStop conditions shall remain active as far as possible.
	YT752 sensor fault	Alarm	NStop	NStop	Alarm	Alarm	Alarm	15s	Signal out of range

Start block	Description	Stand Still	Starting	Running	Normal Stop (NStop)	Machinery Protection Stop (MPStop)	Hardware Stop (HStop)	Alarm delay	Comments
	System and process supervision								
X	Emergency stop activated	Alarm	HStop	HStop	HStop	HStop	Alarm	1 s	Start blocking.
	Too long time in *STANDBY DRY*			NStop*				T_{Stdby}	* In *STANDBY DRY* only.

8.5 Quality specification water

Alfa Laval ref. 574487 ver. 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 unsatisfactory purified operating water supplied by the customer.

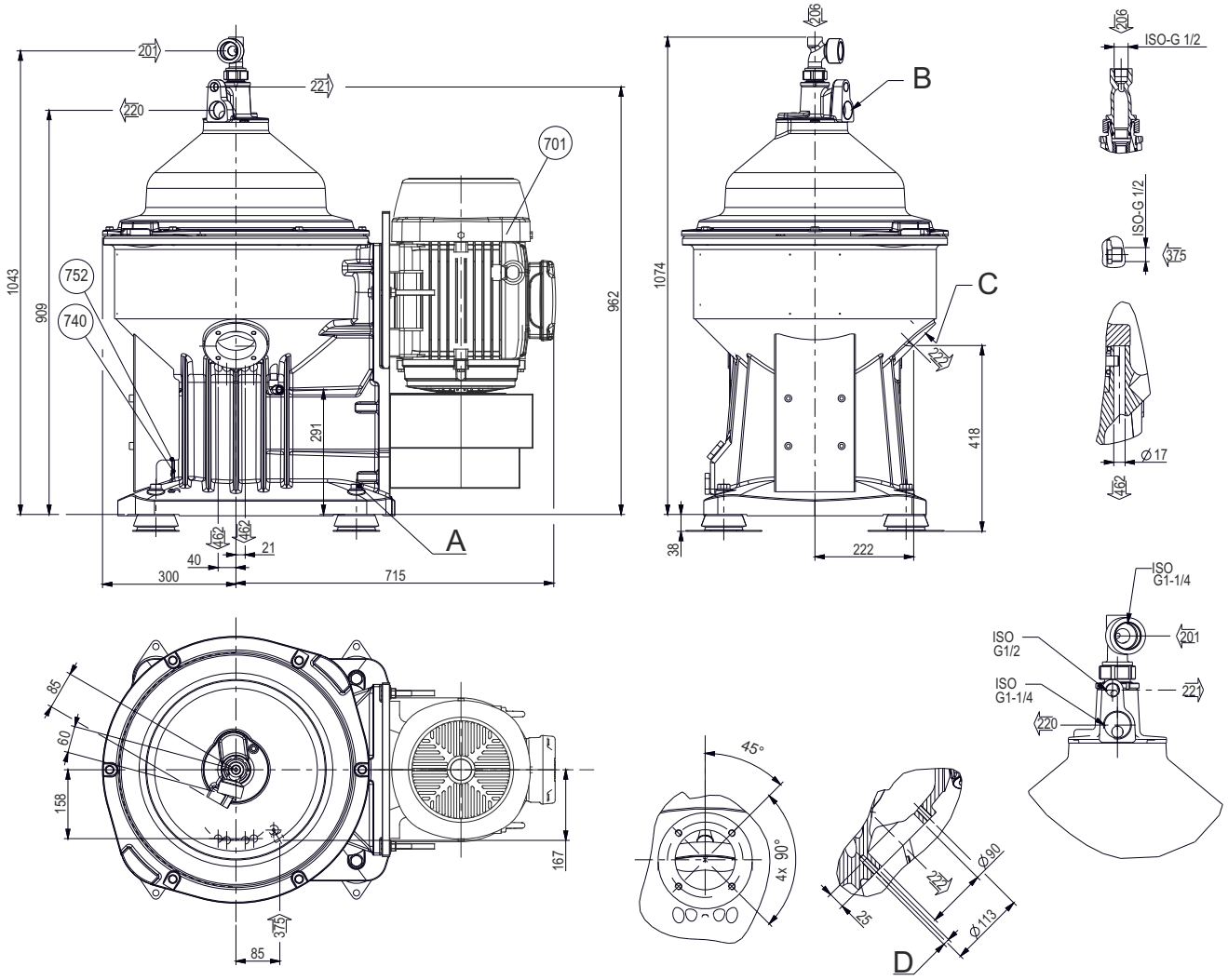
The following conditions must be fulfilled:

1. Turbidity free water, solids content <0.001% by volume.
   Deposits must not be allowed to form in certain areas in the separator.
2. A maximum particle size of 50 µm.
3. A total hardness of <180 mg $CaCO_3$ 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 increase.
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 (HCO_3) of minimum 70 mg HCO_3 per litre, which corresponds to 3.2°dKH.

8.6 Drawings

8.6.1 Basic size drawing

Alfa Laval ref. 9028136 v. 0



A. Tightening torque 160 Nm.

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

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

D. 4 holes M10

Connection 201 turnable 360°.

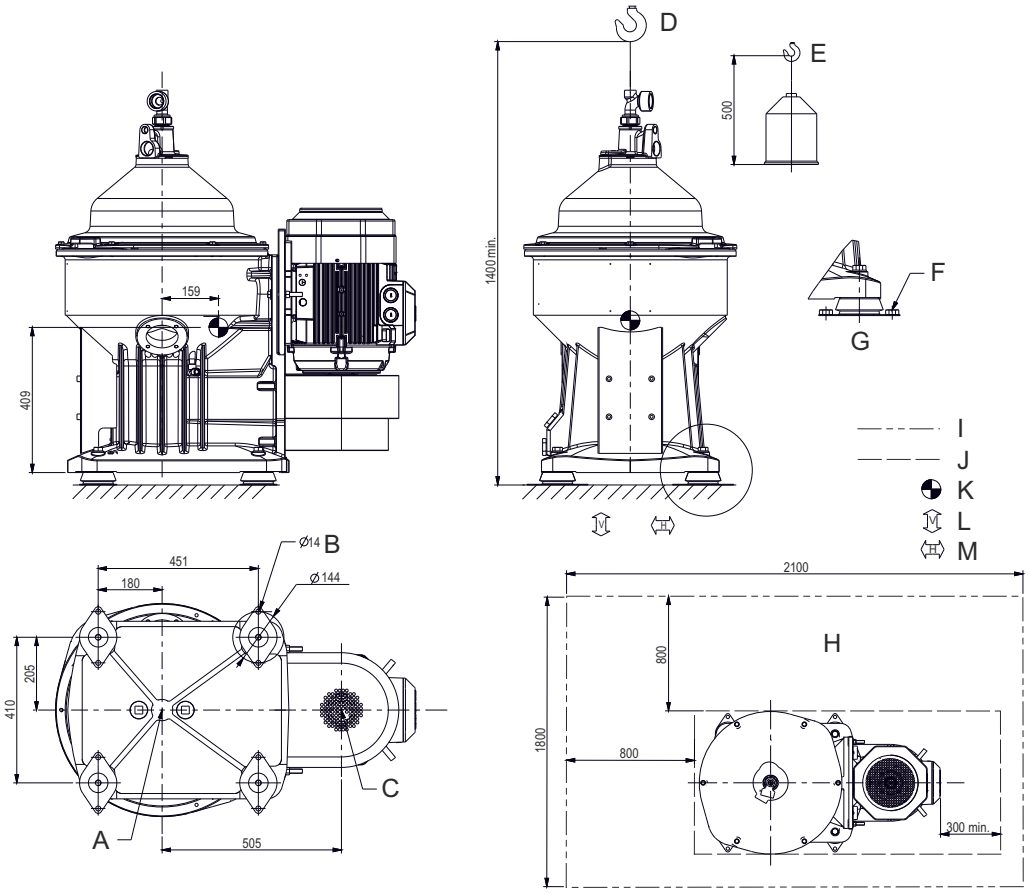
Connection 220 and 221, turnable in 60° steps all around.

All connections to be installed non-loaded and flexible.

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

8.6.2 Foundation drawing

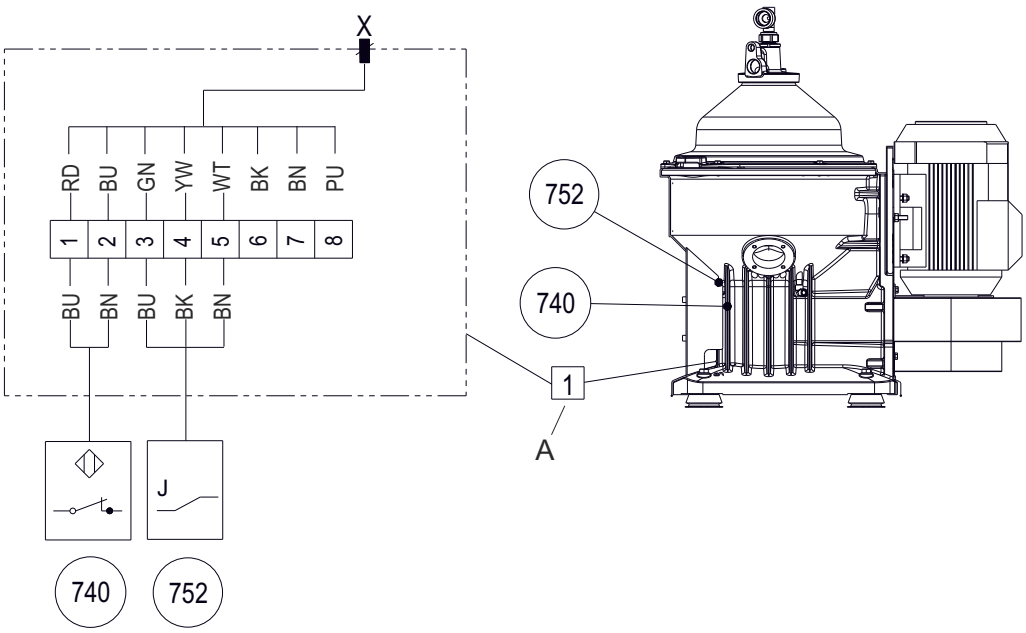
Alfa Laval ref. 9028137 ver. 0



A. Centre of separator bowl
B. 8 holes ø14 for foundation bolt.
C. Centre of motor
D. Max. height of largest component incl. lifting tool
E. Min. lifting capacity required during service: 300 kg.
F. Service side
G. Foundation bolt
H. Installation according to stated foundation force. Foundation turnable 360°
I. Recommended free floor space for unloading when doing service.
J. No fixed installation within this area.
K. Centre of gravity (complete machine)
L. Dynamic forces (static force excluded) from separator do not exceed. Vertical ±12 kN. Horizontal ±12 kN
M. Total foundation force (sum of all feet): Vertical ±12 kN. Horizontal ±12 kN.
Total static load max. 4.5 kN

8.6.3 Interconnection diagram

Alfa Laval ref. 9037997 ver. 0



A:	Junction box	Wiring of connector “X”:	Wire colour codes:
		RD=A	BK=Black
740:	Speed sensor	BU=B	BN=Brown
752:	Unbalance sensor, (position trans. for bearing holder)	WT=C	BU=Blue
		YE=D	RD=Red
		GN=E	GN=Green
		BK=F	PU=Purple
		BN=G	YE=Yellow
		PU=H	WT=White

Demand specification wire

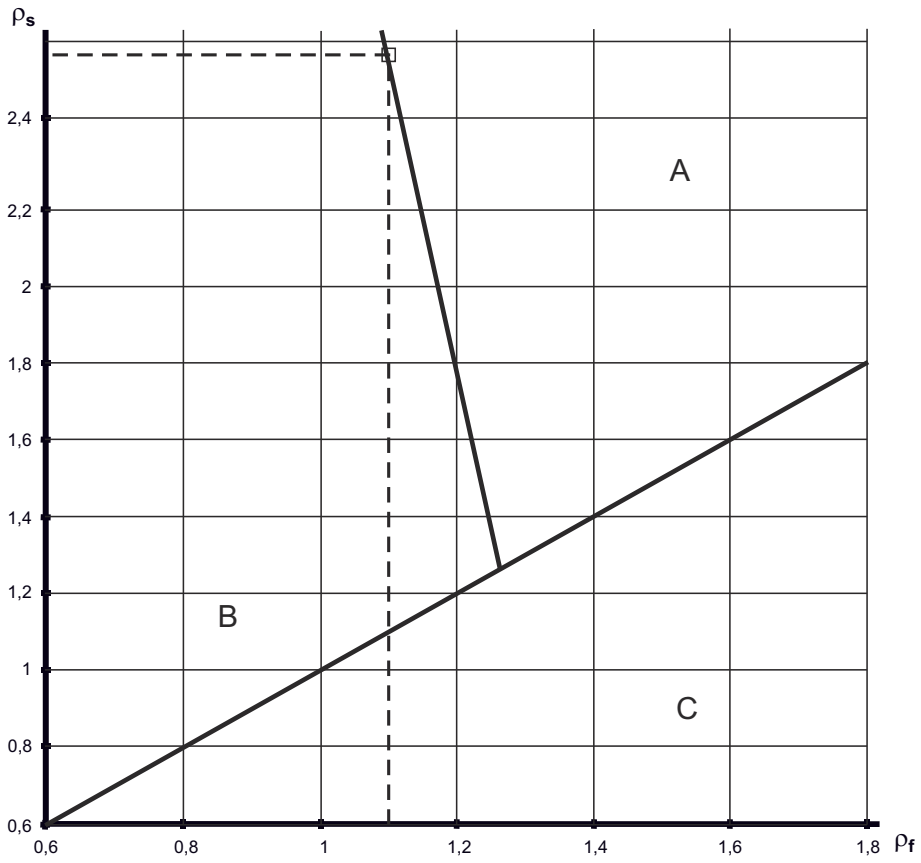
Approval:	UL 1007/1569
	CSA TR-64

Area acc. to AWG 18

Not all items shown in this document are not included in all separators. See product specification.

8.6.4 PX sealing diagram

Alfa Laval ref. 9031278 v. 2



A. No sealing

B. Operational envelope

C. Non physical

Separator bowl number: 9046129-01, 9046129-02, 9046130-01

Separator bowl speed: 9090 r/min

References density for Feed: 1100 kg/m^3

References density for Wet solids: 2590 kg/m^3

NOTE

Max. allowed operating liquid density: 1000 kg/m^3

8.6.5 Electric motor

For information regarding motor specifications, see motor plate.

For further information see motor manufacturer’s documentation.

NOTE

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

9 Installation

9.1 Introduction

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.

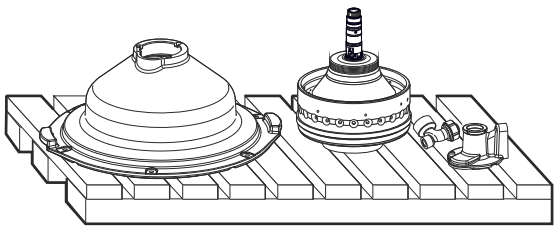
9.2.1 Transport

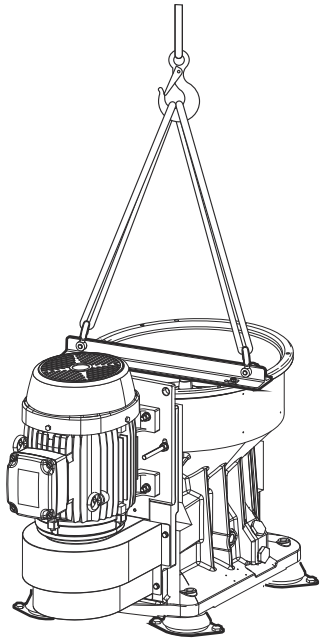
1. When lifting the separator, make sure that tools and lifting devices are fastened securely. See chapter *"Lifting instructions"*.

   WARNING **Crush hazard**

   Use correct lifting tools and follow lifting instructions.

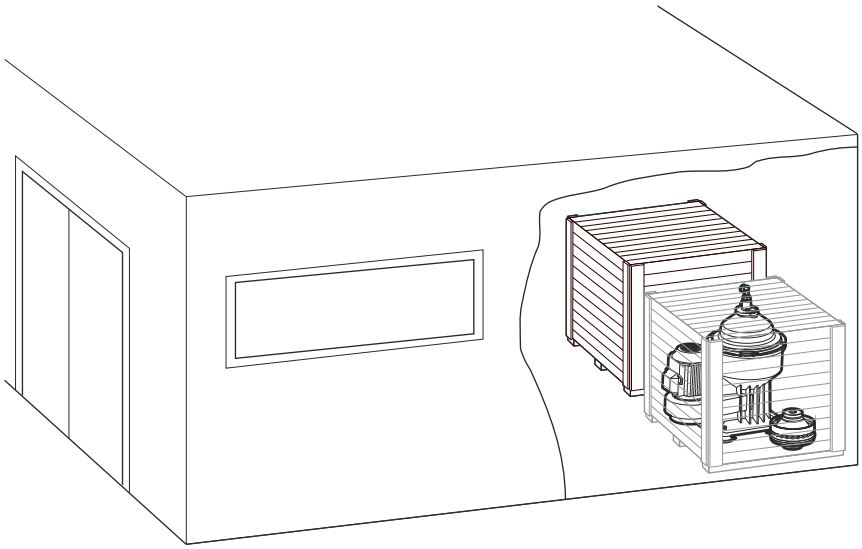
2. When lifting the bowl see chapter *"Lifting instructions"*.
3. During transport of the separator, the in- and outlet device, frame hood and bowl must **always** be removed.





9.2.2 Protection and storage of goods

1. Before storing a separator that has been in operation, make sure to drain any parts containing water, such as Operating water module (if any), Operating water system and Cooling jackets.
2. The separator must be stored indoors at 5 - 55 °C, if not delivered in a water-resistant box, designated for outdoor storage.

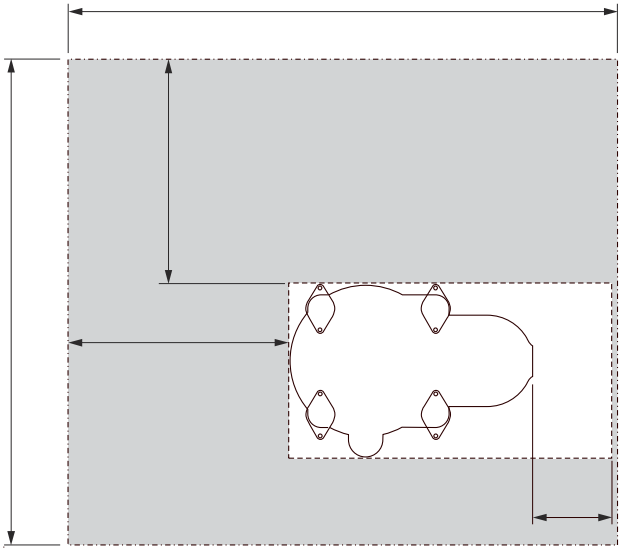


3. If there is a risk for water condensation, the equipment must stand well ventilated and at a temperature above dew point.
4. If the storage time exceeds 12 months, the equipment must be inspected every 6 months and, if necessary, the protection be renewed.

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.

9.3 Planning of installation

9.3.1 Important measurements

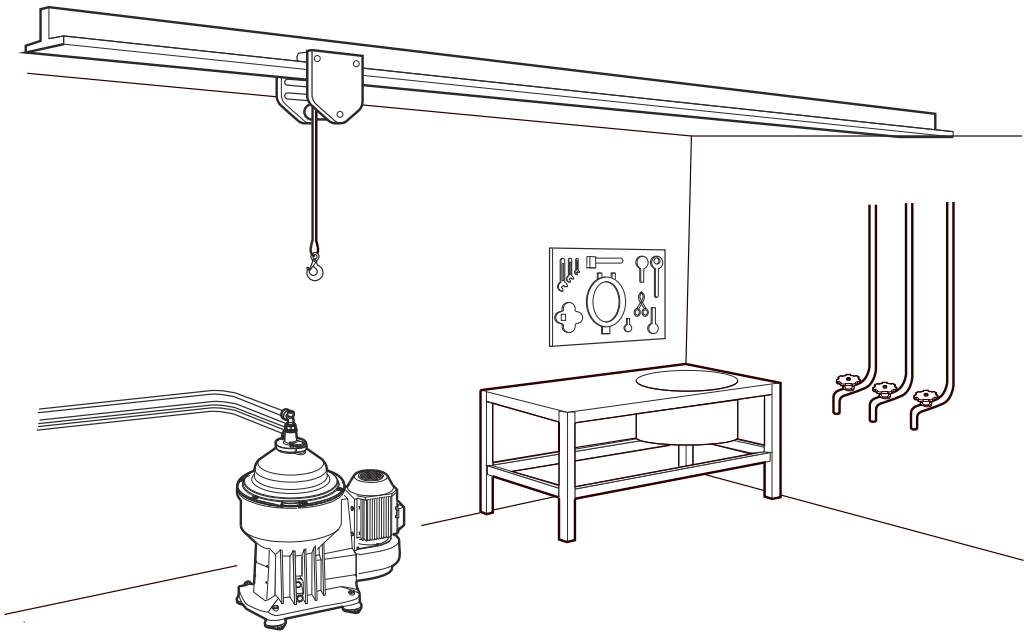


Important measurements are:

- 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 *“Basic size drawing”* and *“Foundation drawing”*.

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 *“Foundation drawing”*.

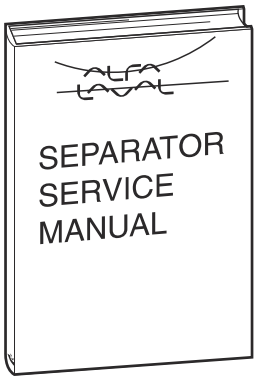
9.3.3 Connections to surrounding equipment

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.

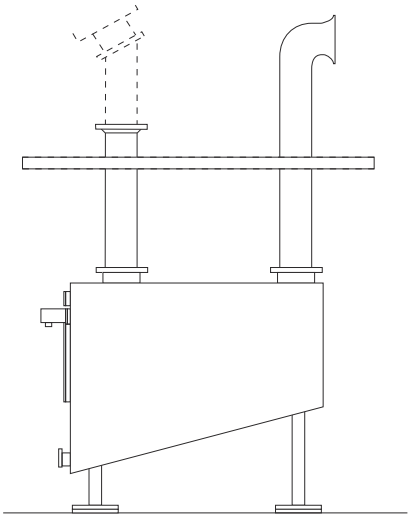
Service media

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



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.



9.4 Storage out of operation

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

Preferred alternative - Run every month:

Start the separator at least once every month.

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

If separator will not be run once every 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 chapter *Protection and storage of goods* on page 196.

9.5 Before start-up

If the separator has been out of operation for:

3 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.

See chapter *Lubrication chart* on page 151.