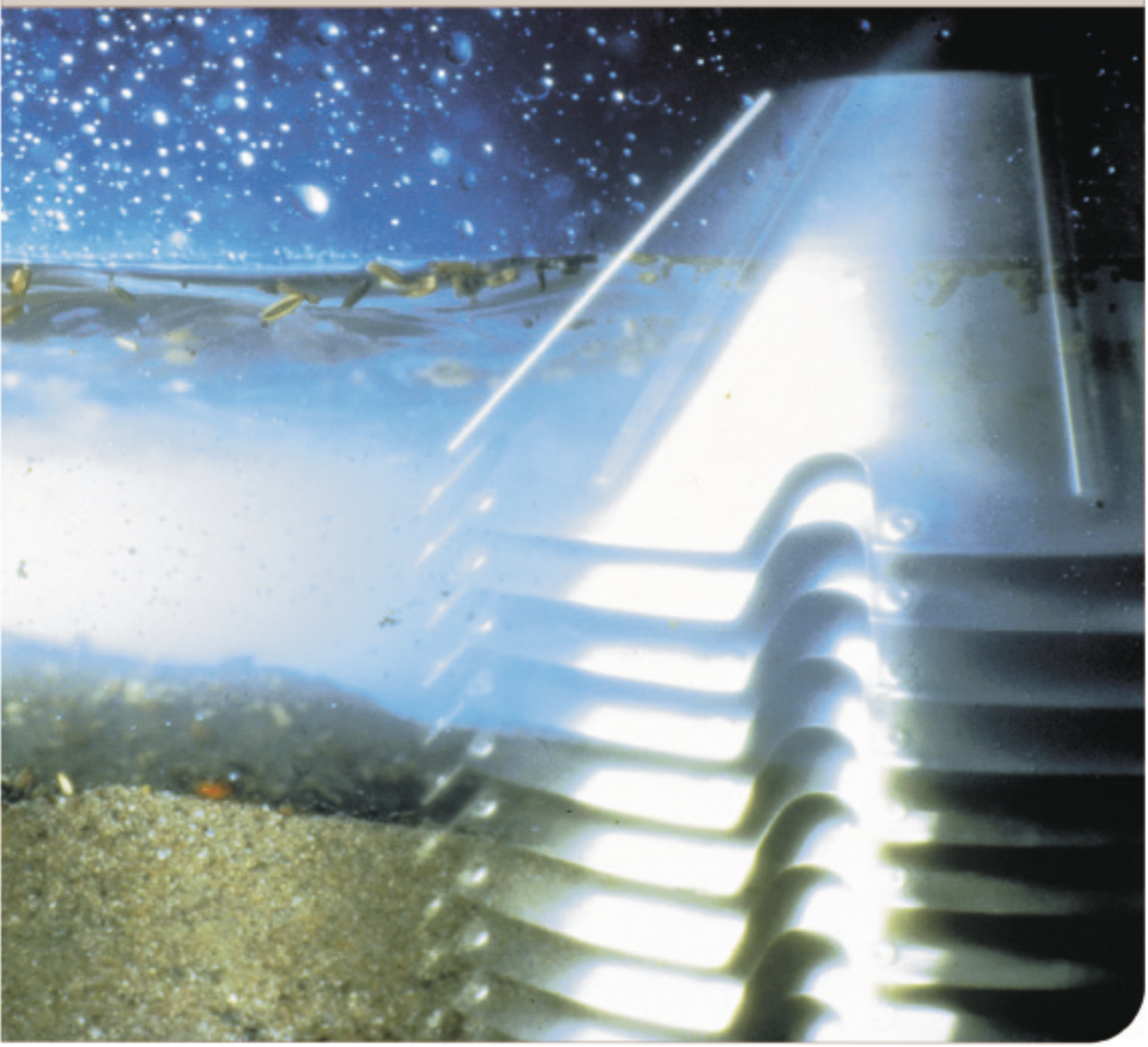
Separator Manual
High Speed Separator

P 646



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Original instructions

Contents

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

Not following the instructions can result in serious accidents.

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.

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

2 Safety instructions

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

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

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

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

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

The following basic safety instructions therefore apply:

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

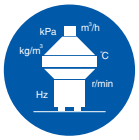
Disintegration hazards

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

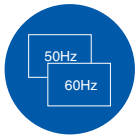
- This can be done by checking the rotation on the motor fan.

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

- Use the separator only for the purpose and parameter range specified by Alfa Laval.



- Check that the gear/pulley ratio is correct for power frequency used. If incorrect, subsequent overspeed may result in a serious break down.



- Welding or heating of parts that rotate can seriously affect material strength.

- Inspect regularly for **corrosion** and **erosion** damage. Inspect frequently if process or cleaning liquid is corrosive or erosive.

Fall hazard

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

Entrapment hazards

- Make sure that rotating parts have come to a **complete standstill** before accessing parts inside the machine or starting **any** dismantling work. If there is no braking function the run down time can exceed two hours.

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

Electrical hazard

- Follow local regulations for electrical installation and earthing (grounding).
- Only qualified electricians are allowed to install and maintain the drive.

Crush hazards

- Use correct lifting tools and follow lifting instructions.

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

Noise hazards

- Use ear protection in noisy environments.

Burn hazards

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

Skin irritation hazards

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

Cut hazards

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

Flying objects

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

Health hazards

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

2.1 Warning signs in text

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

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

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

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

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

2.2 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.

2.3 Requirements of personnel

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

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

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

2.4 Remote start

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

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

3 Basic principles of separation

3.1 Introduction

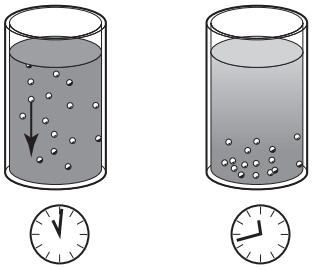
The purpose of separation can be:

- *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.



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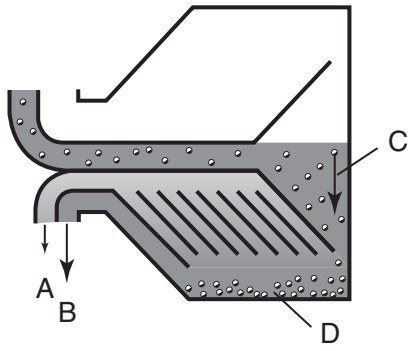
Continuous separation and sedimentation can be achieved in a settling tank having inlet and outlet arranged according to the illustration.

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



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

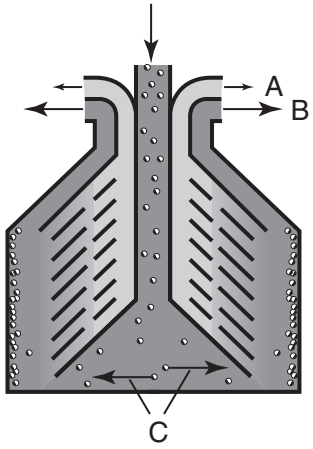
3.3 Centrifugal separation

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.



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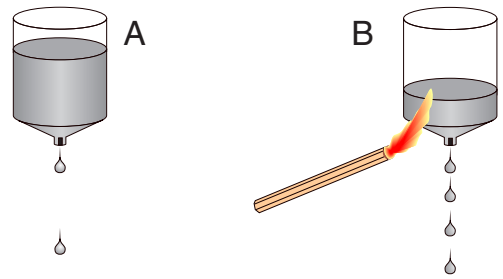
A. Lighter liquid
B. Heavier liquid
C. Centrifugal force

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

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



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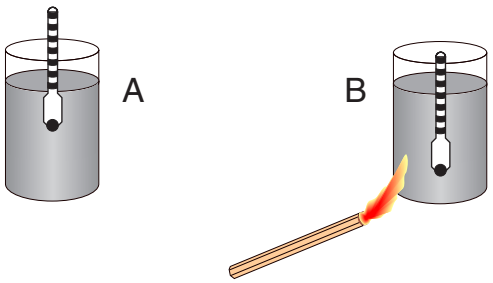
A. High viscosity
B. Low viscosity

Density difference

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



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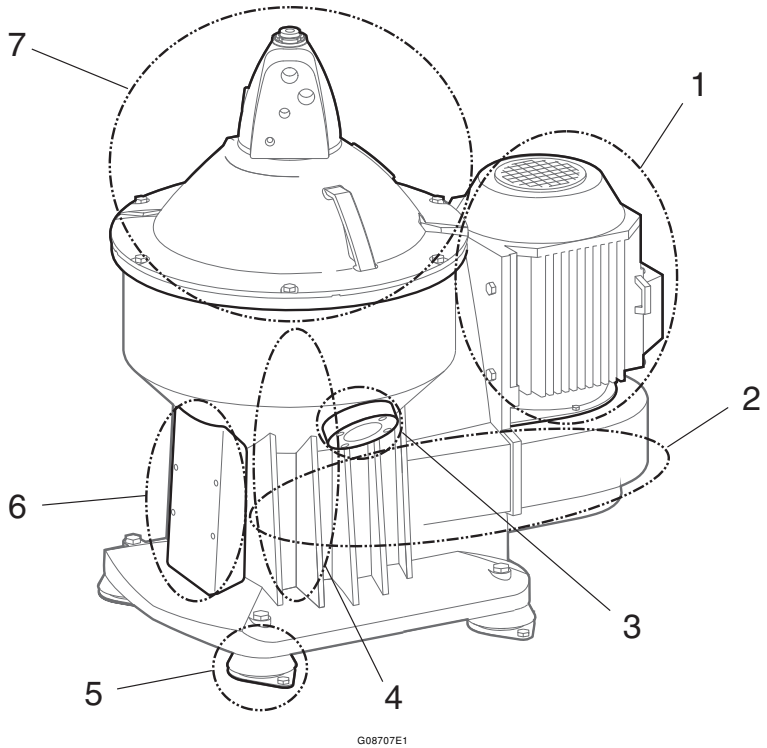
A. High density (with low temperature)
B. Low density (with high temperature)

4 Design and function



1. **Electric motor**
   The rotating bowl is driven by the electric motor via a belt transmission.
2. **Drive section**
   The rotating separator bowl is driven by a flat belt transmission with friction coupling.
3. **Sludge outlet**
   Separated solids are discharged at preset intervals.
4. **Lubrication system**
   Lubricates the bearings driven by the flat belt transmission.
5. **Frame feet**
   The separator rests on vibration damping frame feet.
6. **Sensors (optional)**
   The separator can be monitored by a speed sensor and an unbalance sensor.
7. **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.

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 inlet and outlet device 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 (option) and an unbalance sensor (option) are part of the equipment for monitoring the separator functions.

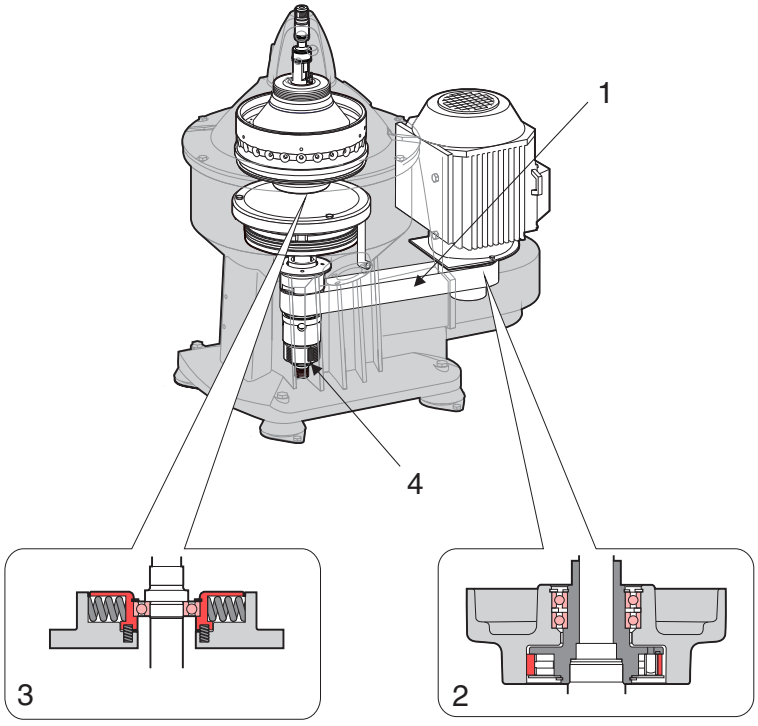
4.2 Drive section

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.



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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 inlet and outlet unit on top of the separator frame hood.

4.3.1 Inlet and outlet

The inlet and outlet unit consists of the following parts:

A connecting housing for pipe connections.

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

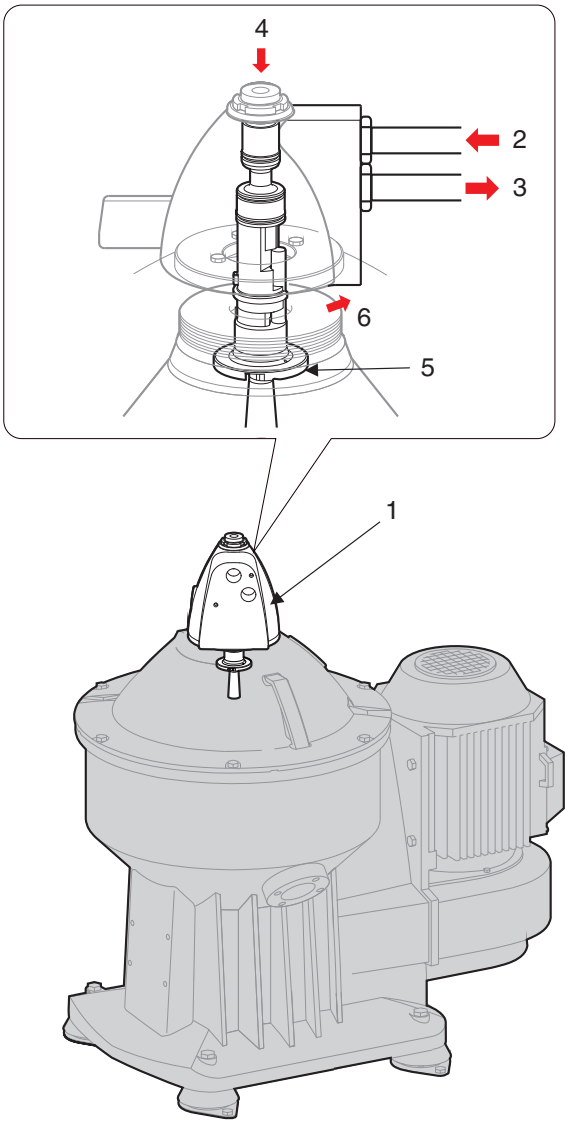
The paring disc, pumps the cleaned oil out of the bowl.

Separated water leaves the bowl through holes in the bowl hood and is discharged through the sludge outlet.

The paring disc is 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 relative to the bowl.



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1. *Connecting housing*
2. *Uncleaned oil*
3. *Cleaned oil*
4. *Sealing water*
5. *Paring disc*
6. *Separated water*

4.3.2 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.

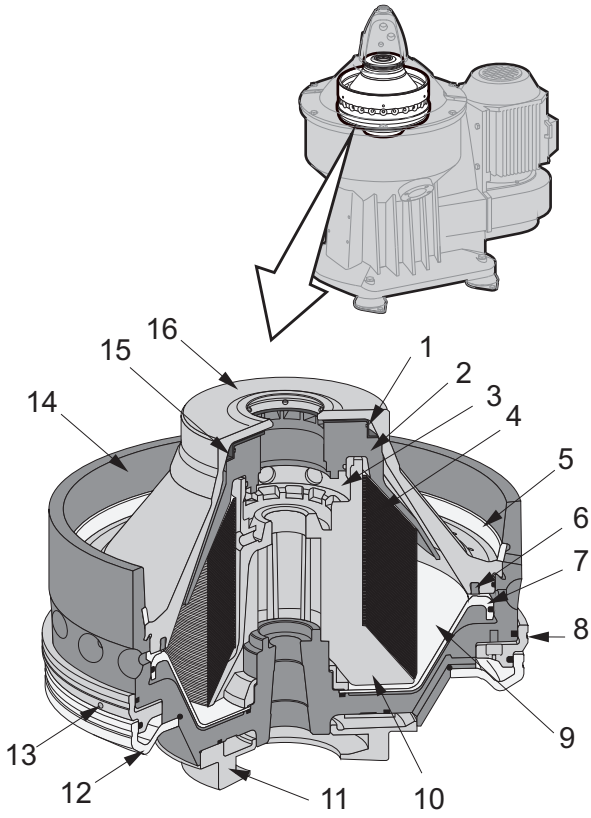
The upper space between the bowl hood and the top disc forms the water chamber. From here the separated water is discharged through holes in the bowl hood.

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 ring. Passive parts are: nozzle and valve plugs. The operating water cover, beneath the bowl, supplies operating water to the discharge mechanism via the operating water ring.



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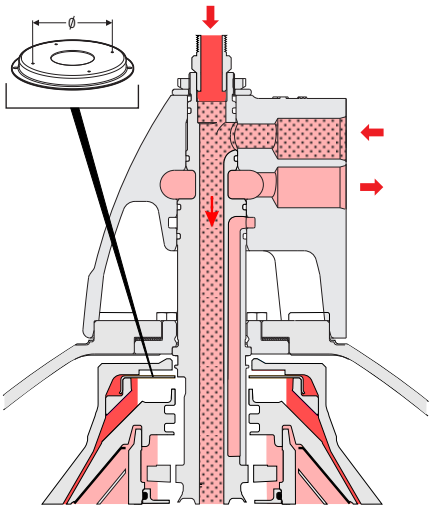
1. *Gravity disc*
2. *Top disc*
3. *Oil paring chamber*
4. *Disk stack*
5. *Lock ring*
6. *Seal ring*
7. *Discharge slide*
8. *Operating slide*
9. *Sludge space*
10. *Distributor*
11. *Operating water ring*
12. *Holder*
13. *Nozzle*
14. *Bowl body*
15. *Water paring chamber*
16. *Bowl hood*

Purifier bowl

The illustration shows the characteristic part of the purifier bowl, the gravity disc. The disc should be chosen according to directions in “Selection of gravity disc”.

The gravity disc determines the interface position in a purifier bowl.

A purifier bowl has two liquid outlets, oil and water.



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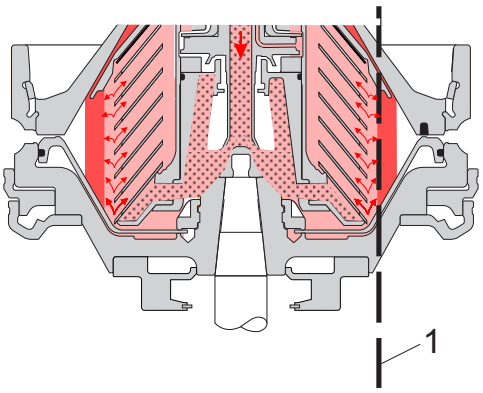
Position of interface

An interface (1) is formed between the oil and water in the bowl. In order to achieve optimum separation of the oil, the interface must be maintained in the correct position, which is between the disc stack and the outer edge of the top disc. If the interface moves outside the outer edge of the top disc the water seal will break and oil will be discharged with the water. An interface positioned inside the disc stack will cause bad separation results.

The position of the interface is adjusted by altering the pressure balance of the liquid phases oil and water inside the separator, which is done by exchanging the gravity disc. For this purpose a number of gravity discs with various hole diameters are delivered with the separator.



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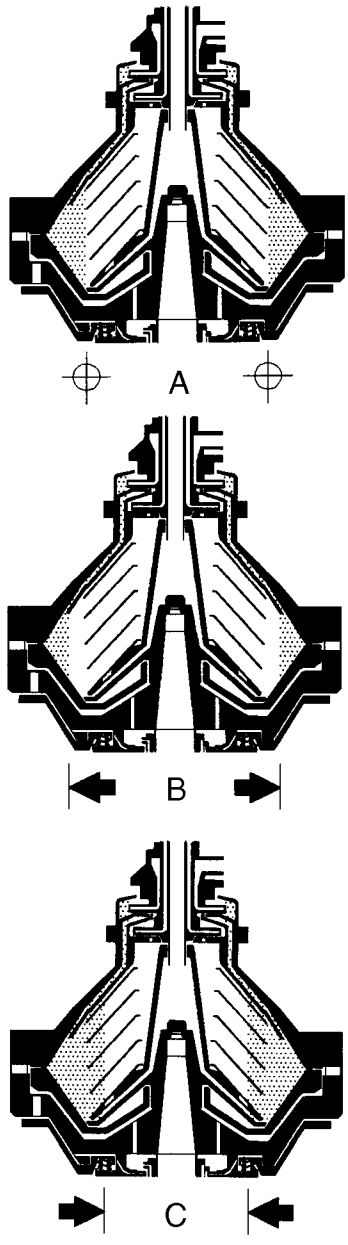
A. Correct interface position

B. Wrong interface position - broken water seal

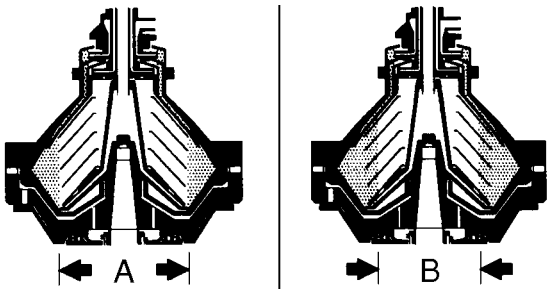
C. Wrong interface position - bad separation



Factors influencing the interface position

1 – Oil viscosity, density and throughput

Oil with high density and/or high viscosity, as well as high throughput, will position the oil/water interface closer to the bowl periphery than for oil with low properties.



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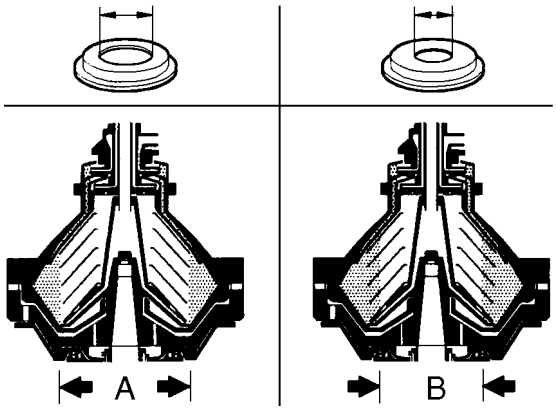
A. High viscosity/density/throughput
B. Low viscosity/density/throughput

2 – Gravity disc

To compensate for the above factors the interface is adjusted to a correct position by altering the outlet for the water, i.e. exchanging the gravity disc. Changing to a gravity disc with a larger hole diameter will move the interface towards the bowl periphery, whereas, a disc with a smaller hole diameter will move the interface closer to the bowl centre.



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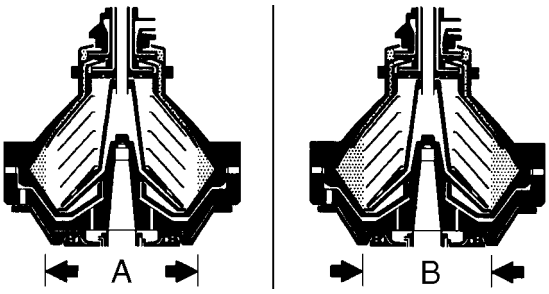
A. Gravity disc with large hole diameter
B. Gravity disc with small hole diameter

3 – Excessive back pressure.

Excessively high back pressure in the oil outlet prevents the oil from being pumped out. The inner oil level will then move towards centre of the bowl and, at the same time, push the oil/water interface outwards towards the bowl periphery. The effect is a wrong interface position, which may cause broken water seal.



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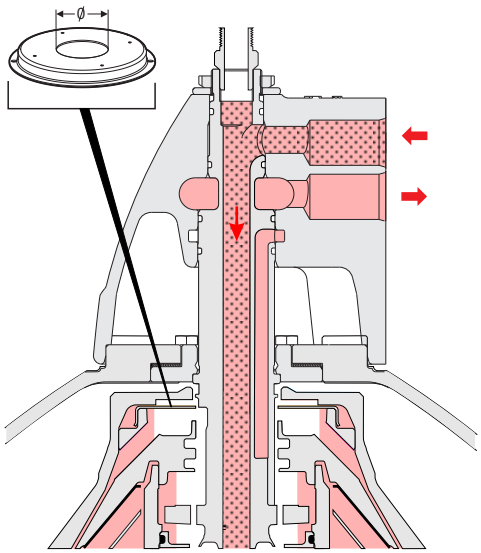
A. Excessive back pressure
B. Normal back pressure

Clarifier bowl

The illustration shows the characteristic part of the clarifier bowl. In clarification the gravity disc is replaced by a so called clarifier disc, i.e. a disc with the smallest possible hole diameter (Ø) which seals off the water outlet. No liquid seal is needed when clarifying.



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4.3.3 Selection of gravity disc

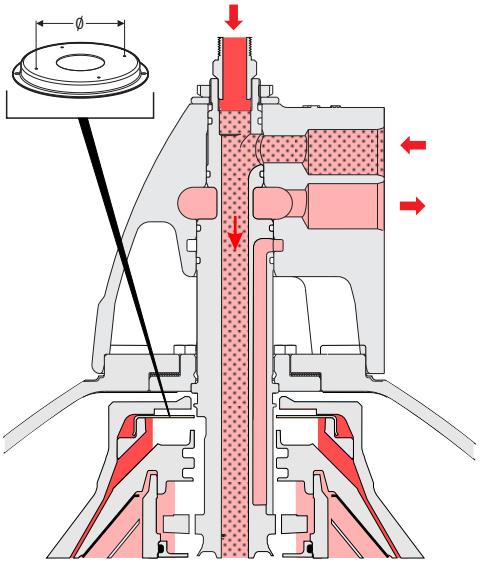
The separator is delivered with a set of gravity discs.

Clarification

When running the separator as a clarifier, select the gravity disc with the smallest hole diameter, the so-called clarifier disc. See the Spare Parts Catalogue for correct hole diameter.

Purification

A number of gravity discs are delivered for operating the separator as a purifier. The diameter of a gravity disc sets the position of the oil-water interface in the separator. The separation efficiency can be optimized by selection of the correct diameter for each process.



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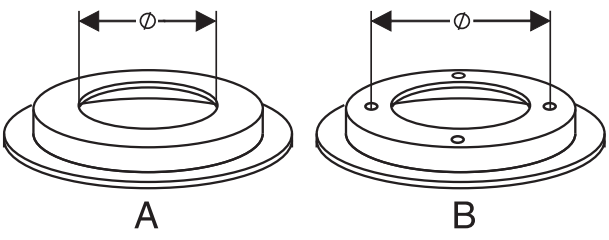
When selecting a gravity disc the general rule is to use the disc with the largest possible hole without causing a break in the water seal.

The heavier or more viscous the light phase (oil) and the larger the liquid feed the smaller the diameter should be.

To remove more of the light phase (oil) from the heavy phase (water), the interface should be placed nearer the bowl centre, however not inside the outer edge of the discs (too small gravity disc), as this would prevent the liquid flow.

For a more detailed description of the interface position, see Purifier bowl on page 26.

Some gravity discs have four small holes drilled outside the large hole. You must pay regard to these holes when measure the diameter Ø, see the illustration. Measure between the centres of the holes.



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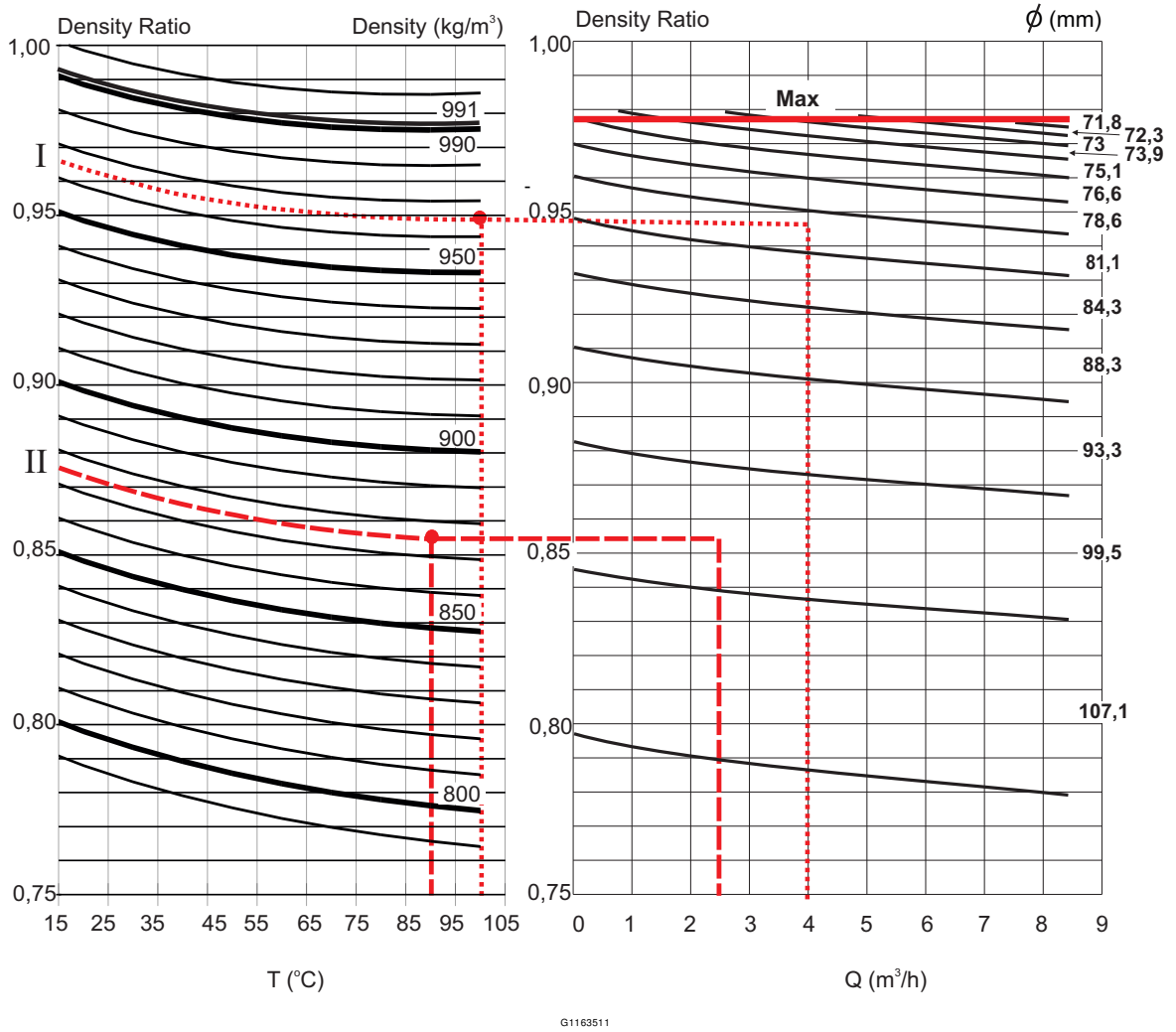
All gravity discs have their diameters stamped on them.

As an aid, use the nomogram to find the correct gravity disc. It can be used when the density of the oil at a temperature of 15 °C is known. However, note that the nomogram is purely theoretical. In practical operation, practice the following general rule:

1. Fit a gravity disc one size larger than the recommended in the nomogram.
2. Run the separator.
3. Observe if oil flows through the sludge outlet.
   - If Yes, stop the separator and fit the next smaller gravity disc.
   - If No, stop the separator and fit the next larger gravity disc.
4. Repeat steps 1-3 above until having the gravity disc with the largest hole diameter without causing a break of the water seal.

Nomogram, gravity disc

Alfa Laval ref. 9023592 Rev. 0



Density above 991 at 15°C not allowed.

How to use the nomogram

The presence of salt water may demand the use of a gravity disc with a larger diameter than indicated in the nomogram (the nomogram is based on the properties of fresh water).

Example I in nomogram

Reference in graph:

G10348h1

Oil density: 965 kg/m^3 at 15 °C

Separating temperature: 98 °C

Throughput: 4 m^3/h

The nomogram indicates that a gravity disc with a hole diameter of 81,1 mm should be tried.

Example II in nomogram

Reference in graph:

G10348i1

Oil density: 875 kg/m^3 at 15 °C

Separating temperature: 90 °C

Throughput: 2,5 m^3/h

The nomogram indicates that a gravity disc with a hole diameter of 99,5 mm should be tried.

4.4 Sensors (optional)

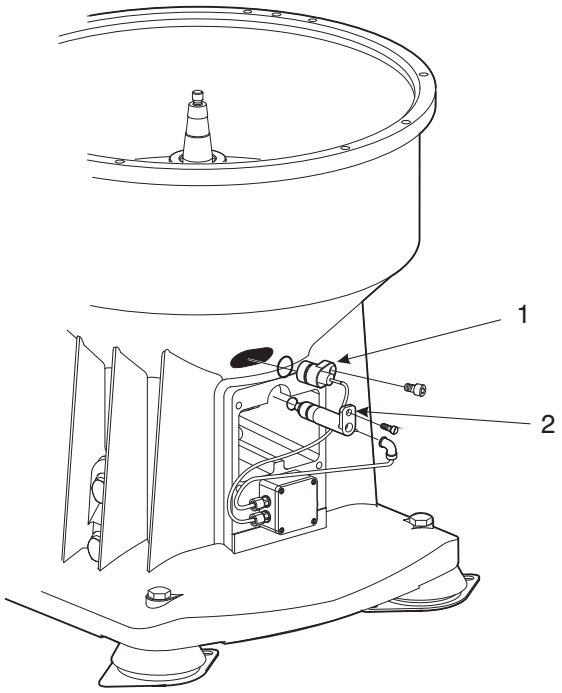
The separator is equipped with a speed sensor. As option, an unbalance sensor can be fitted.

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.



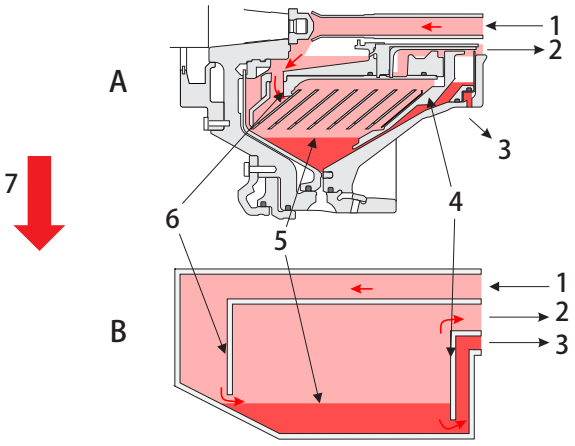
1. *Unbalance sensor*
2. *Speed sensor*

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:



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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

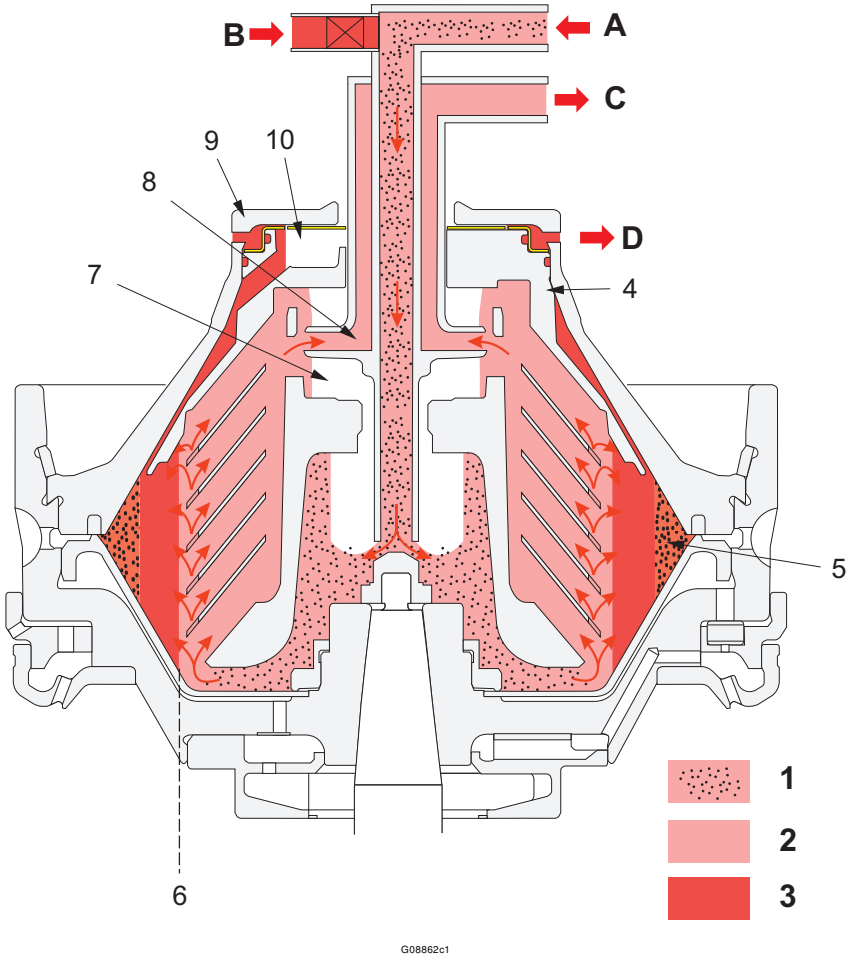
Unseparated oil is fed into the bowl through the inlet pipe and travels via the distributor towards the periphery of the bowl.

When the oil reaches slots in the disc stack, 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, over a level ring. 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 chamber, is filled with water, which flows over the gravity disc through holes in the bowl hood.

4.5.3 Discharge of water through water outlet



A. Unseparated oil
B. Water
C. Separated oil
D. Water outlet
1. Uncleaned oil
2. Cleaned oil
3. Liquid seal / displacement- / separated water
4. Top disc
5. Sludge space
6. Oil/water interface
7. Oil paring chamber
8. Oil paring disc
9. Bowl hood
10. Water chamber

5 Operating instructions

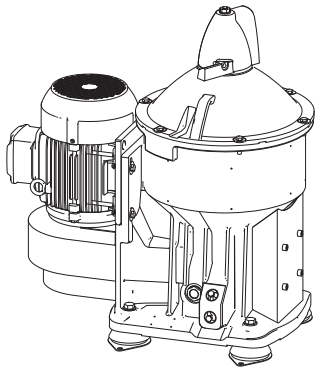
These operating instructions describe routine procedures to be followed before and during the start sequence, during the running and stopping sequence of the separator.

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*
- *Interface description*
- *Operating water demands*
- *Basic size drawing*
- *Foundation drawing*



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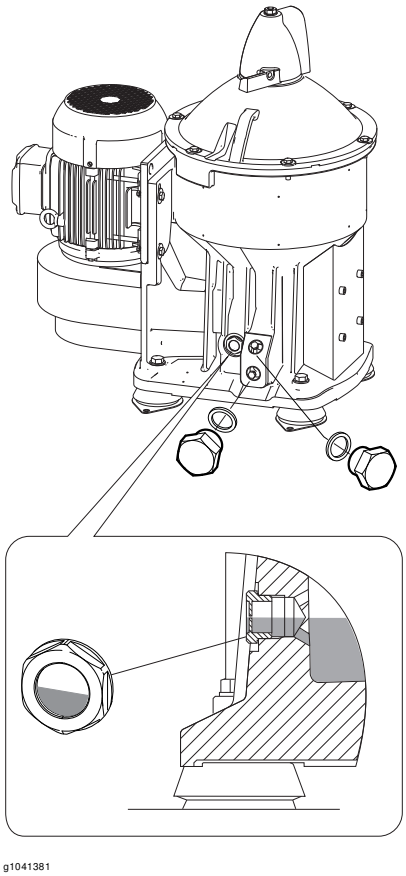
Before first start:

- 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 172. For quality of oil, see section Lubricating oils on page 179.

- Make sure that the oil level is in middle of the sight glass, see Oil change on page 172.



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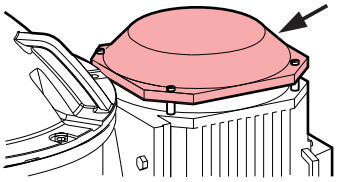
NOTE

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.



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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 7 Fault finding on page 183*.*

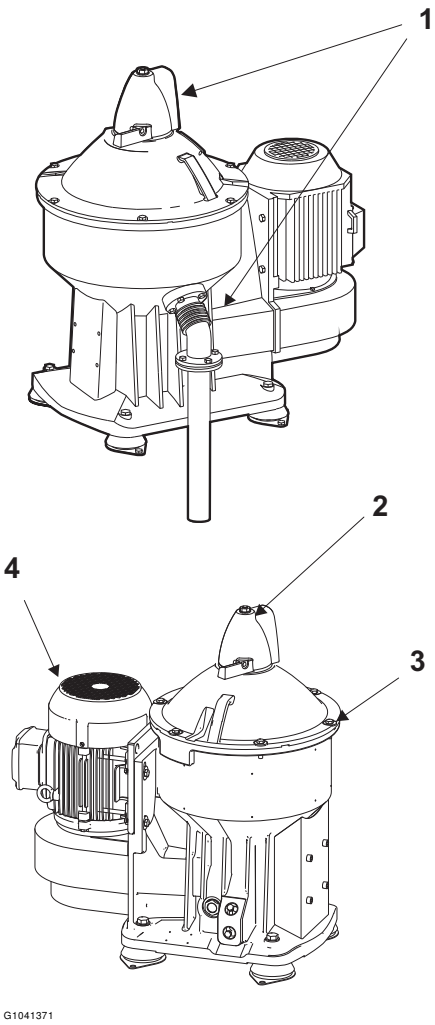
5.2 Normal operation

5.2.1 Before normal start

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

1. Make sure that the bowl is clean and that the separator is properly assembled. Check:

   - that all couplings and connections (1) are securely tightened to prevent leakages. Leaking hot liquid can cause burns.
   - that the lock nut (2) is fully tightened. Do not forget the washer.
   - 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. Top up if necessary.



NOTE

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

CAUTION

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

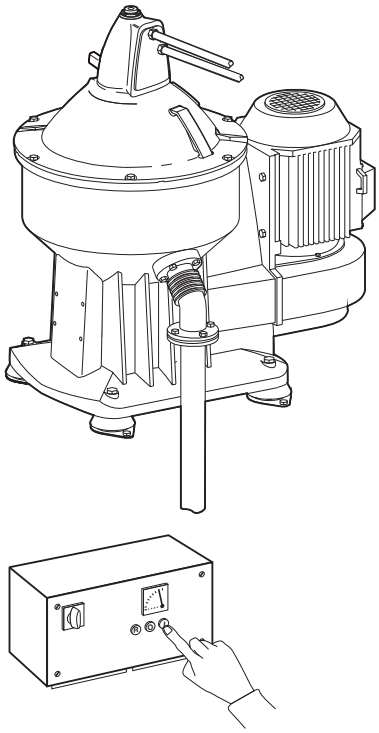
1. Start of separator.

   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.



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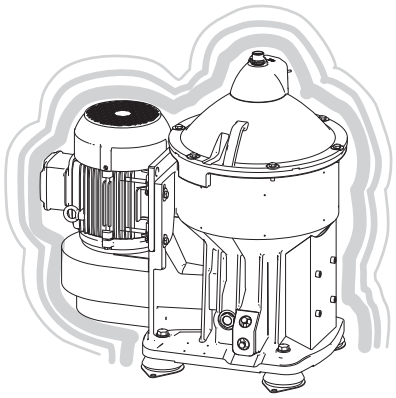
2. Check the separator for vibration.



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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

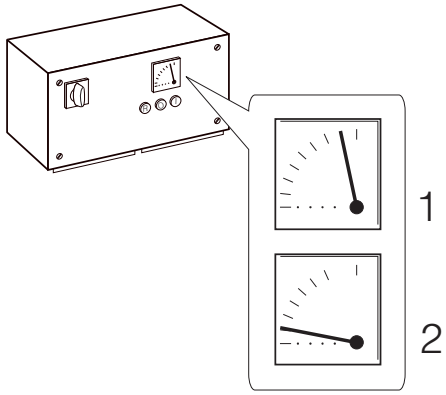
Normal vibration

Some vibrations occur for short periods during the starting cycle, when the separator passes through its critical speeds. This is normal and passes without danger. Try to learn the vibration characteristics during the critical speed.

NOTE

Be alert for unusual noises and any other unusal conditions.

3. Ensure that the separator is at full speed (after about 60 - 150 seconds).



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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 8.2 Technical data on page 194

4. For purification:

   Supply water to form the water-seal. The water should be hot.

   a. Close the water feed when water flows out through the water outlet.

   b. Start the oil feed slowly to avoid breaking the water seal.

5. For clarification:

   a. Start the oil feed with full flow.

6. Adjust to desired throughput.

7. For both purification and clarification modes:

   Check the separator inlet and outlet pressures. See recommended values in your system documentation.

5.2.3 Operating

1. Checkpoints during operation:

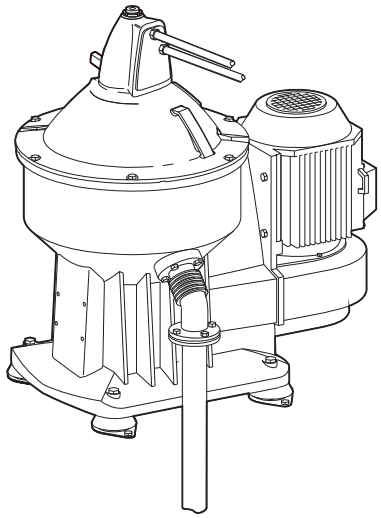
   a. Check all connections for leakage.

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

   c. Check the back pressure.

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

   e. Check for abnormal vibrations and sounds.



1. Ammeter

Disintegration hazard

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

Burning hazard

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

5.2.3.1 Sludge discharge

1. Performing a discharge.

   a. Close the feed (connection 201).

   b. Perform a displacement (of the oil) by opening connection 206 for 10 seconds.

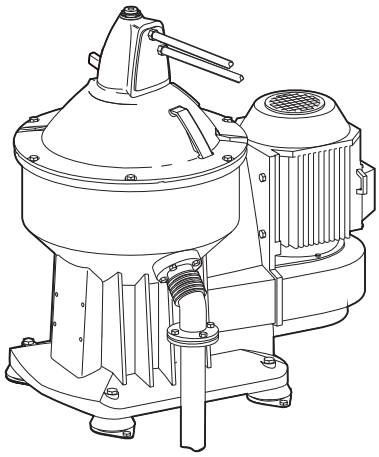
   c. Initiate a discharge by supplying discharge water (connection 375) for 3 seconds.

   d. Pause for 15 seconds.

   e. Close the bowl by supplying make up water (connection 375) for 15 seconds.

   f. Apply liquid seal by opening connection 206 for 4 seconds.

   g. Open the feed (connection 201).



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NOTE

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

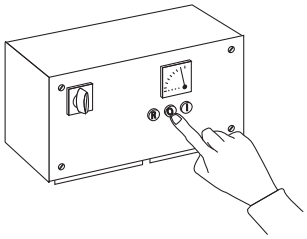
5.2.4 Stop

1. Stopping the separator.

   a. Turn off the oil feed.

   b. Perform an oil displacement.

   c. Stop the separator.



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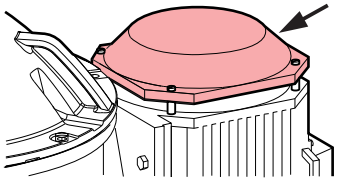
NOTE

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

   d. Wait until the separator has come to a complete standstill (it takes approximately 35 minutes).



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   Check rotation of motor fan.
   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.

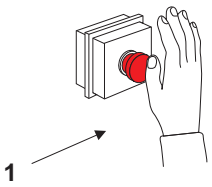
WARNING

Entrapment hazard

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

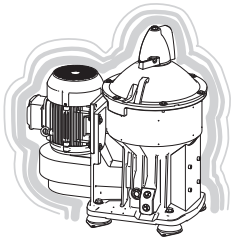
5.3 Emergency stop

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



NOTE

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



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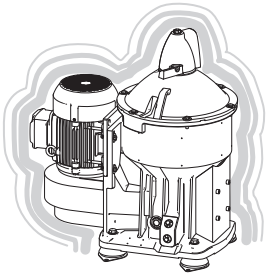
2. Evacuate the room.

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.



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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.

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 54, gives a detailed list of actions to be performed.

Inspection [i]

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

Overhaul [o]

An Overhaul consists of an overhaul of the complete separator (including separator bowl, inlet/outlet and operating device) at max. **18 months** or **12000 operating hours**. Seals, bearings, friction blocks and flat belt in the separator are renewed.

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 at max. **36 months** or **24000 operating hours**.
Bearings, fan, seals and washers for the motor are renewed.

Ancillary

Verify correct flow at inspection service overhaul 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 6.3 Dismantling on page 57.

   Place the separator parts on clean, soft surfaces such as pallets.
2. Inspect and clean the dismantled separator parts according to the maintenance log and description in 6.4 Actions before assembly on page 106.
3. Fit all the parts delivered in the service kit while assembling the separator as described in 6.5 Assembly on page 116.
4. When the separator is assembled, make final checks described in 6.5.7 Actions after assembly on page 170.

Disintegration hazard

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

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.

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

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

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

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.

Disintegration hazard
Use of imitation spare parts may cause severe damage.

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	106	
- All parts	x	x		Check for corrosion	108	
- All parts	x	x		Check for cracks	110	
- Connecting housing	x	x		Check for erosion damages	111	
	x	x		Renew O-rings for hoses	- - -	
- Frame hood		x		Renew O-ring	164	
		x		Control measure of paring disc height	164	
		x		Check height adjusting rings	164	
- Inlet pipe thread	x	x		Lubricated		
Bowl						
- All parts	x	x		Clean	106	
- All parts	x	x		Check for corrosion	108	
- All parts	x	x		Check for cracks	110	
- All parts	x	x		Check for erosion damages	111	
- Bowl body	x	x		Check for impact marks and corrosion	62	
	x	x		Renew rectangular ring	62	
		x		Renew guide ring	62	
	x	x		Renew O-rings	62	
	x	x		Renew holder screws and washers	62	
- Operating slide	x	x		Renew rectangular ring	62	
	x	x		Renew valve plugs	62	
- Discharge slide	x	x		Renew rectangular ring	62	
- In- and outlet pipe	x	x		Renew O-rings	62	
	x	x		Renew splash sealing	62	

Part	[i]	[o]	Check	Action	Page	Note
- Lock ring	x			Check for deformations	62	
	x			Check for impact marks	62	
	x			Check pin not deformed or loose	62	
- Bowl hood	x	x		Renew seal ring	62	
	x	x		Renew O-ring	62	
- Operating water ring	x	x		Renew seal ring and screws	62	
Frame						
- Frame feet				Renew frame feet (including washers and screws)	125	Has to be ordered separately
- Drain and oil filling holes	x	x		Renew washers	125	
Driving device						
- All parts		x		Clean	106	
- All parts		x		Check for corrosion	108	
- All parts		x		Check for cracks	110	
- Bottom bearing housing		x		Renew O-ring	125	
- Labyrinth ring holder		x		Renew labyrinth ring	125	
		x		Renew O-ring	125	
- Top bearing housing		x		Renew springs	125	
- Flat belt		x		Renew flat belt	125	
- Bowl spindle		x		Pre-lubricate and renew ball bearing	125	
		x		Pre-lubricate and renew self-aligning roller bearing	125	
		x		Lubricate the spindle	125	
		x		Measure the radial wobble	125	
- Neck bearing cover		x		Renew O-ring	125	
- Deflector ring		x		Renew O-ring	125	
- Water inlet pipe		x		Renew O-ring	125	
- Operating water cover		x		Renew seal ring and O-ring	125	
		x		Check that operating water channel is free from blockage	125	
- Fan		x		Renew O-ring	125	
Coupling						
- All parts		x		Clean	106	
- All parts		x		Check for corrosion	108	
- All parts		x		Check for cracks	110	

Part	[i]	[o]	Check	Action	Page	Note
- Coupling hub		x		Renew single row ball bearings	97	
		x		Renew snap rings	97	
- Friction block		x		Renew friction pads (if they are worn) or clean the pads if they are dirty	97	
Electrical motor						
- Bearings		x*		Renew bearings, fan, seals and washers	49	*) Check maintenance interval Electric motor
Signs and on separator						
- Machine plate		x		Check attachment an legibility	170	
- Power supply frequency		x		Check attachment an legibility	170	
- Lifting instructions		x		Check attachment an legibility	170	
- Safety labels		x		Check attachment an legibility	170	
- Name plate		x		Check attachment an legibility	170	
- Representative label		x		Check attachment an legibility	170	

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.

For safety reasons, it is essential that all personnel who work with the separator read this manual thoroughly and completely. Do not allow personnel to clean, assemble, operate or maintain the separator until they have read and fully understood this manual. Ensure that all personnel who operate and service the separator are well-trained and knowledgeable concerning the separator and the work to be carried out.

6.3.2 Tools

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

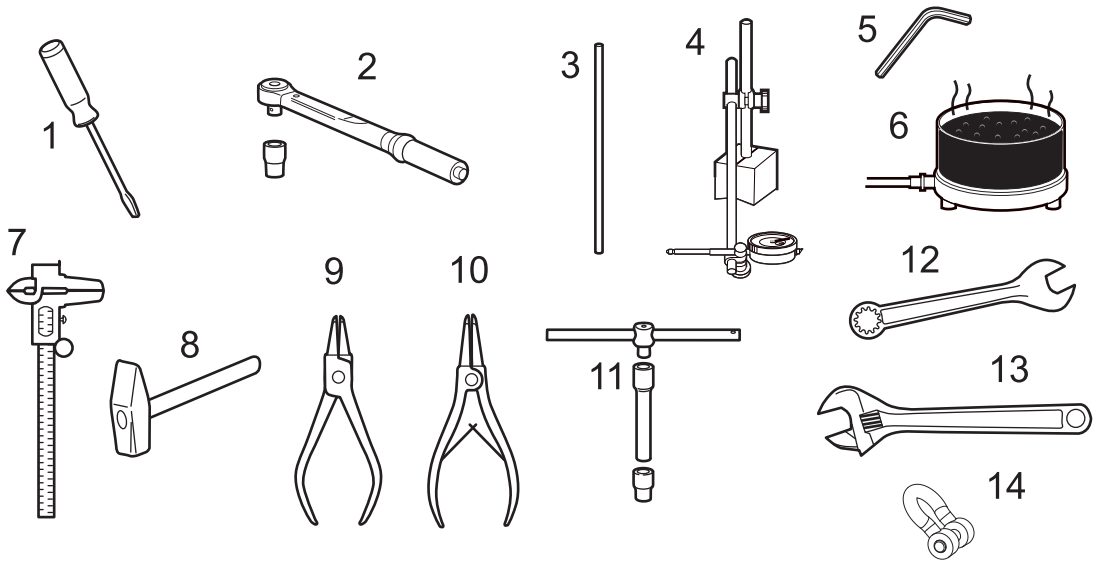
Entrapment hazard

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

Make sure that machine has come to a complete standstill before starting any dismantling work (takes about 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



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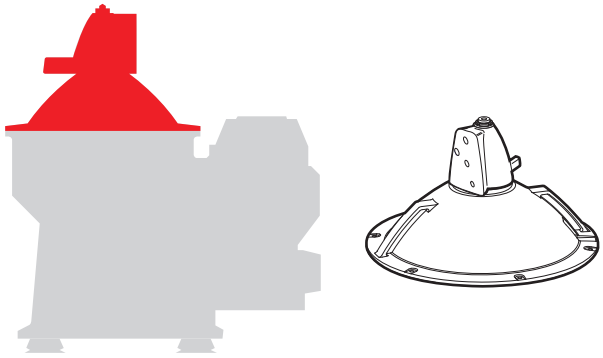
1. Screwdriver
2. Torque wrench (capacity 0-200 Nm)
3. Drift (Ø 4 mm)
4. Dial indicator with magnetic base
5. Hexagon head keys, various sizes
6. Heating equipment for bearings
7. Sliding calliper
8. Hammers (standard and soft-faced)
9. Pliers for internal snap rings
10. Pliers for external snap rings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

6.3.3 Frame hood



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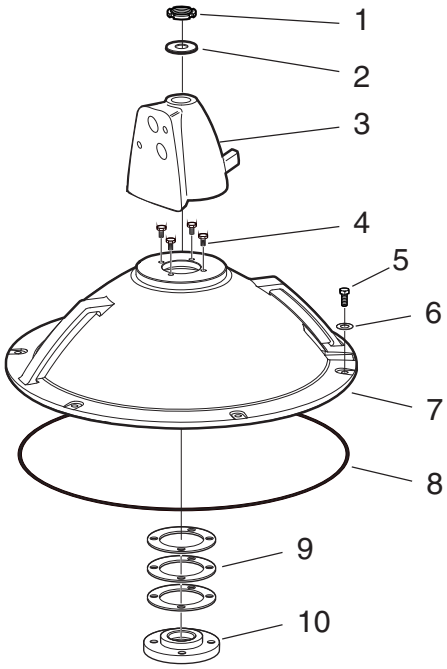

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1. *Lock nut*
2. *Washer*
3. *Connecting housing*
4. *Screws*
5. *Screws*
6. *Washer*
7. *Frame hood*
8. *O-ring*
9. *Height adjusting rings*
10. *Support ring*

1. Removing the connecting housing.

   a. Remove connections before starting dismantling.

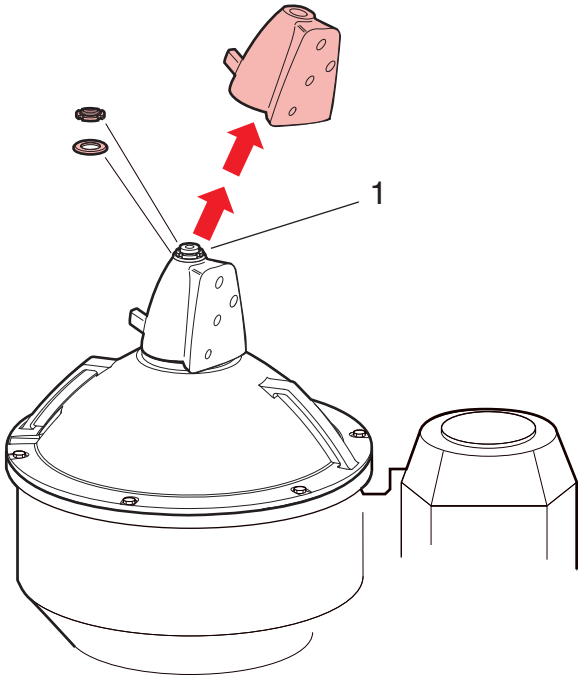
   b. Lubricate the inlet pipe thread

   c. Remove the lock nut, using the hook spanner, and the washer.

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

   d. Press the inlet pipe (1) down, with a soft material, to loosen the connecting housing.

   e. Remove the connecting housing.



G08635c1

1. Inlet pipe

2. Removing the frame hood.

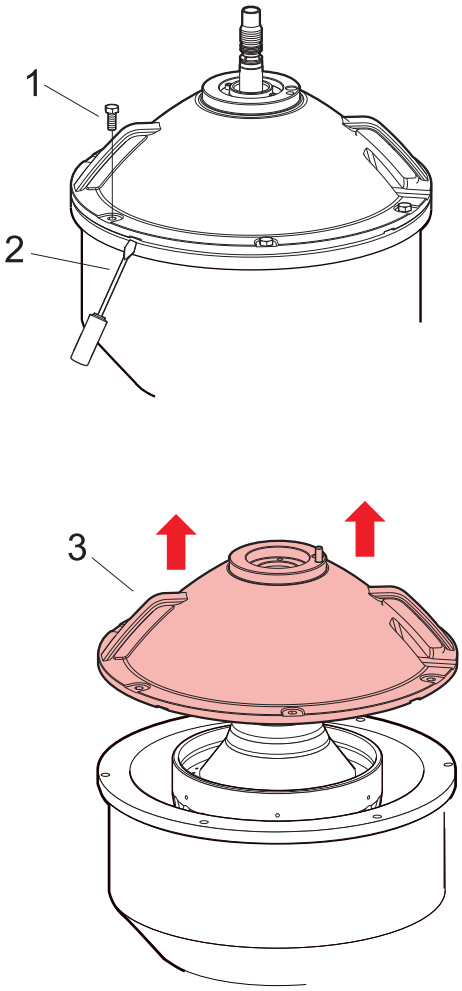
   a. Remove the screws (1) with washers holding the frame hood.

   b. Loosen the hood by bending with a screwdriver (2) in all grooves in the hood.

   c. Lift off the frame hood (3).

NOTE

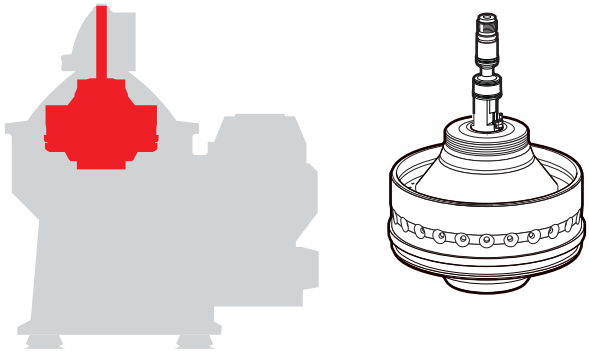
Do not place the hood upside down.



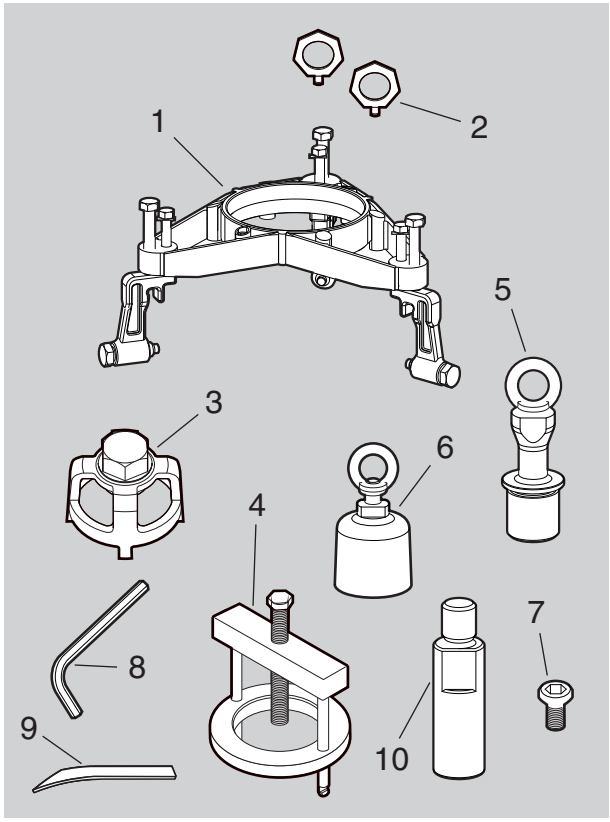
G08636I1

1. Screws
2. Screwdriver
3. Frame hood

6.3.4 Bowl

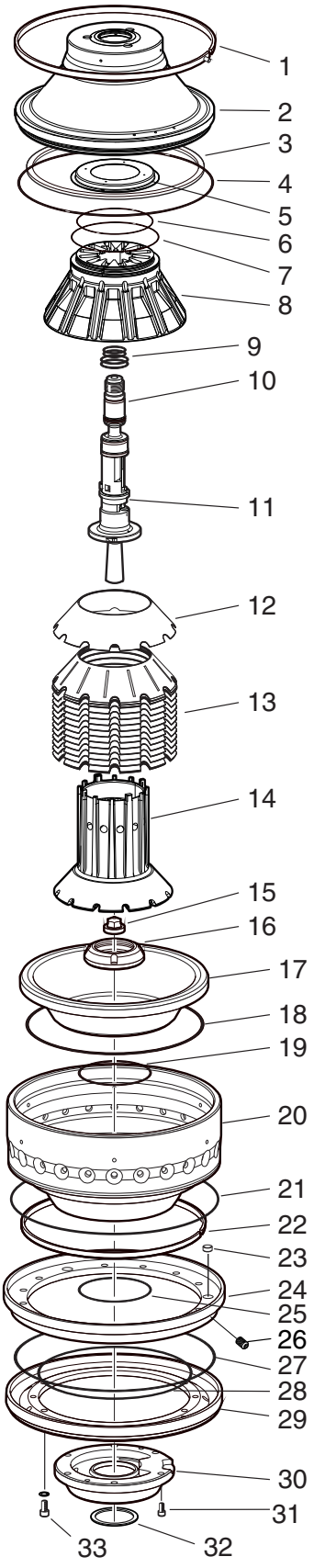


G0861621



G1019231

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)*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G1139211

1. *Lock ring*
2. *Bowl hood*
3. *Seal ring*
4. *O-ring*
5. *Gravity disk*
6. *O-ring*
7. *O-ring*
8. *Top disc*
9. *O-rings*
10. *Inlet and outlet pipe*
11. *Splash sealing*
12. *Bowl discs*
13. *Bowl discs*
14. *Distributor*
15. *Cap nut*
16. *Nut*
17. *Discharge slide*
18. *Rectangular ring*
19. *O-ring*
20. *Bowl body*
21. *O-ring*
22. *Guide ring*
23. *Valve plugs*
24. *Guide ring*
25. *O-ring*
26. *Nozzle*
27. *Rectangular ring*
28. *O-ring*
29. *Holder*
30. *Operating water ring*
31. *Screws*
32. *Seal ring*
33. *Screws & washers*

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 *30 Nm*.

   NOTE

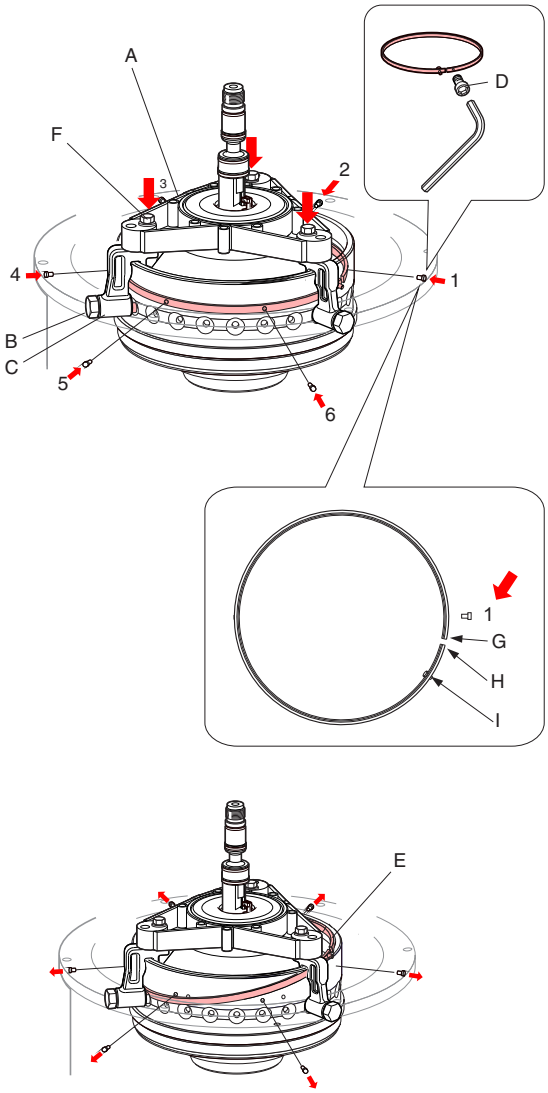
   If the separator have been out of operation and the bowl is cold, a higher compression torque might be required due to oil residue between bowl hood and bowl body. In these cases a compression torque up to 60 Nm can be used to open the bowl.

   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.

   NOTE

   Remove the dismantling screws.



G08627B3

A. Compressing tool
B. Screw
C. Clamp
D. Dismantling screw
E. Lock ring
F. Compressing screw with washer
G. Lock ring end without pin
H. Lock ring end with pin
I. Pin

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.

NOTE

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

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.

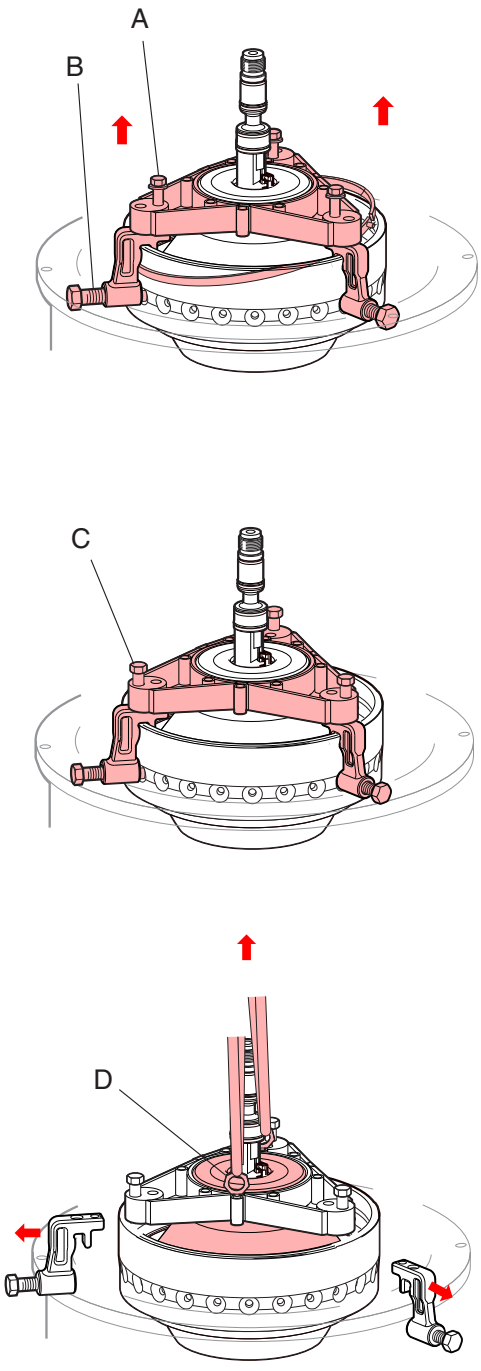
Recommendation: Take measurements with a calliper around the bowl, between the upper edge of the bowl body and the bowl hood, to check that the bowl hood is being pulled off straight up.

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.

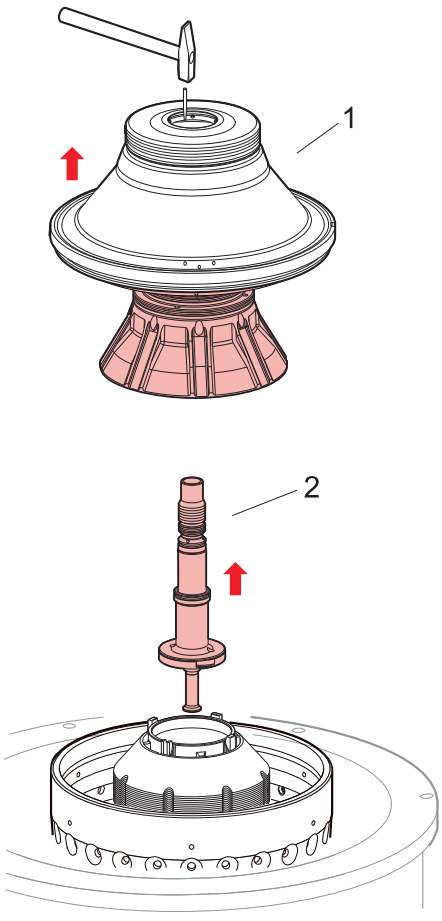


A. Compressing screw with washer
B. Screw
C. Puller screw
D. Lifting eye

3. Removing the top disc and in- and outlet pipe.

   a. Carefully tap out the top disc, together with the gravity disc, and lift up the bowl hood (1).

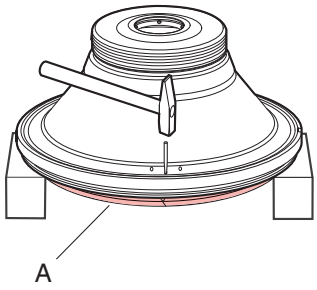
   b. Lift out the in- and outlet pipe (2).



1. Bowl hood
2. Inlet and outlet pipe

4. Removing the seal ring.

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

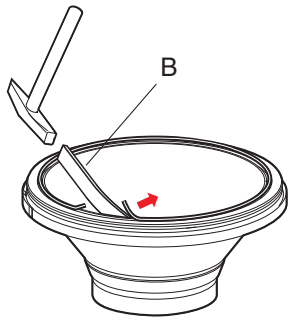


WARNING

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.

   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.



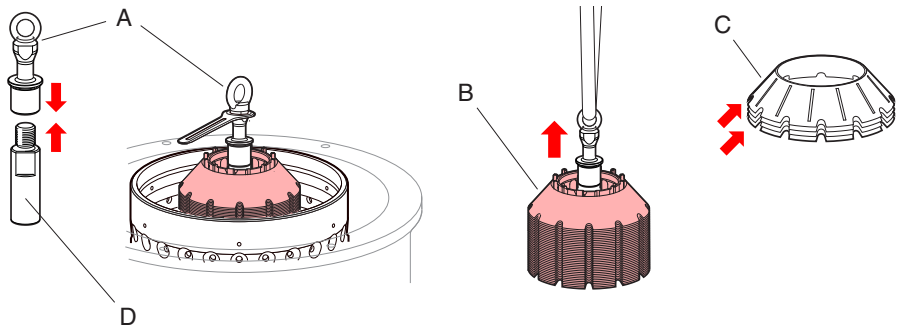
G08624A1

A. Seal ring
B. Chisel

NOTE

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

5. Removing the disc stack and distributor.



A. Lifting tool
B. Disc stack
C. Bowl discs
D. Pin

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

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 (B) assembly.

Cut hazard

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

6. Removing the nut.

   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

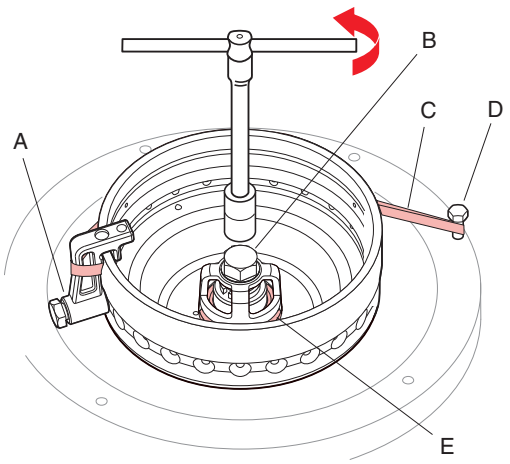
   Make sure that the screw (D) in frame bottom part is sufficiently tightened so as not to loosen.

   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 uncrew 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).



G0923871

A. Clamp
B. Spanner
C. Lifting sling
D. Screw
E. Nut

7. 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).

Slide metal ring (D) down over bowl nave.

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

NOTE

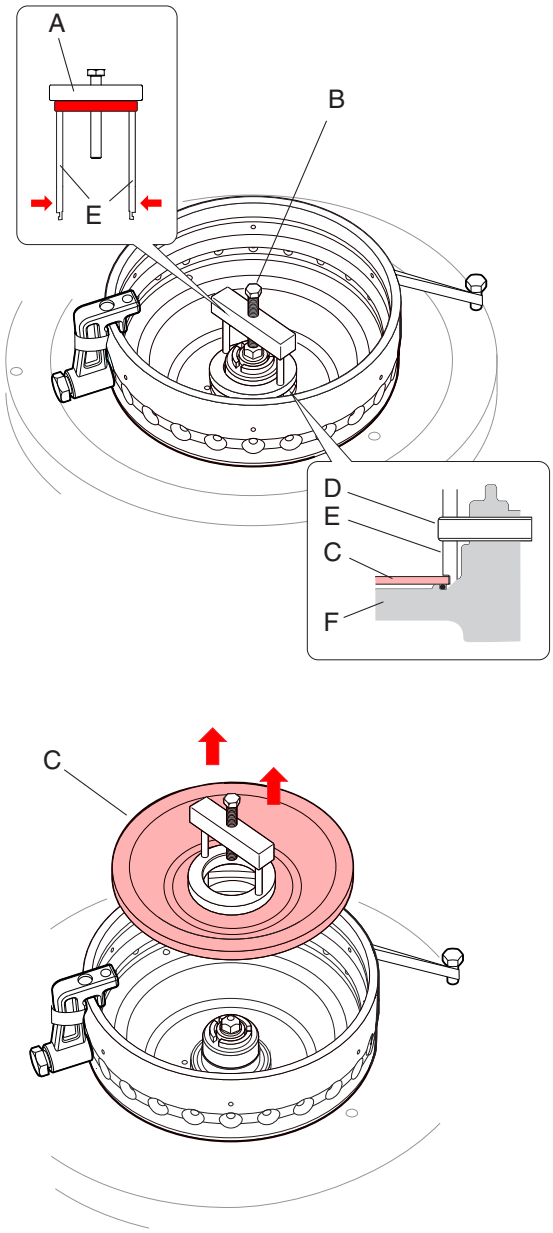
If discharge slide is difficult to remove, tap lightly on outside edge with a soft faced hammer.

c. 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.



G0863291

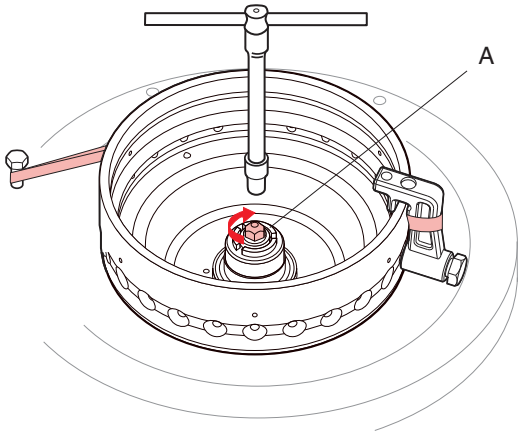
A. Lifting tool
B. Screw
C. Discharge slide
D. Ring
E. Puller rod
F. Bowl body

8. Removing the cap nut.

a. Remove the cap nut (A).

NOTE

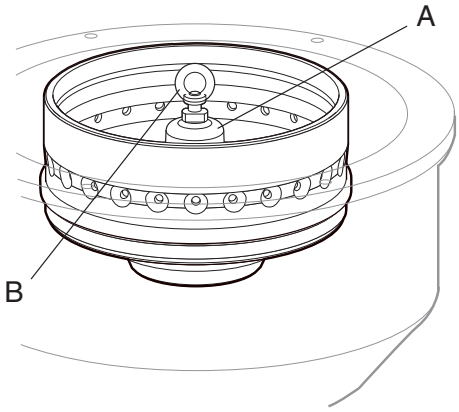
Left-hand thread!

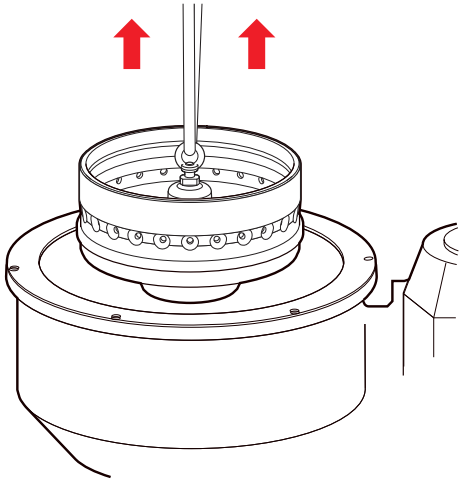


G08606F1

A. Cap nut

9. Removing the bowl body.





G0860741

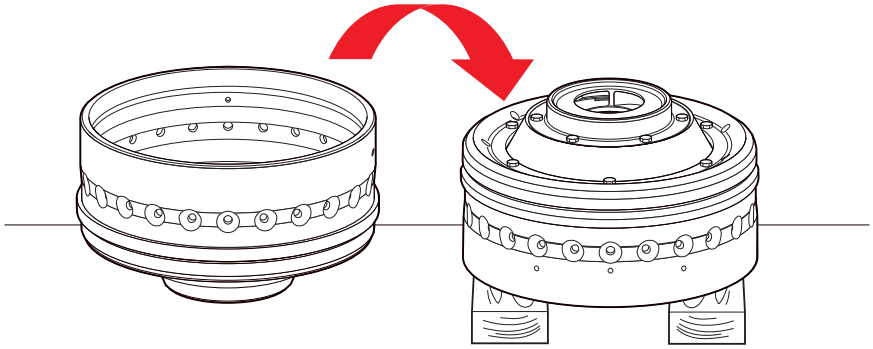
A. Lifting tool
B. Lifting eye

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.

10. Turn the bowl body upside down.



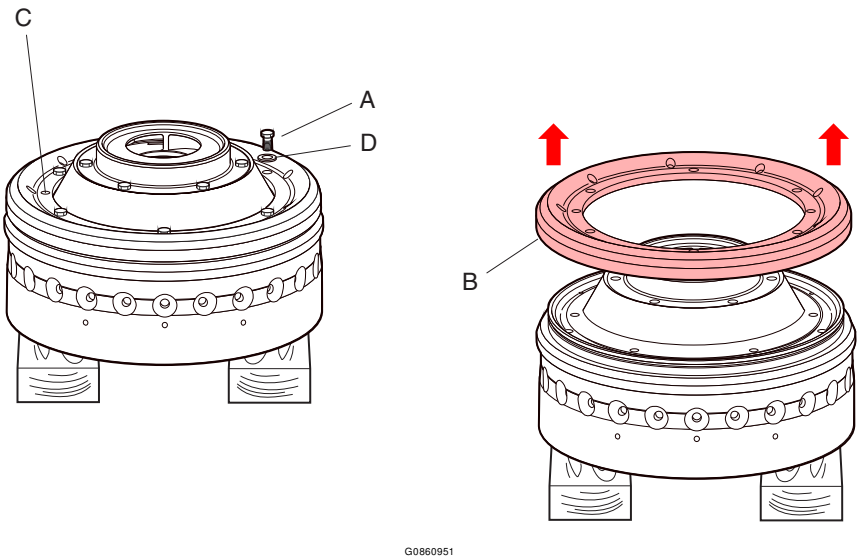
G0860841

WARNING

Crush hazard

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

11. Removing the holder.



A. Screw
B. Holder
C. Threaded hole
D. Washer

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

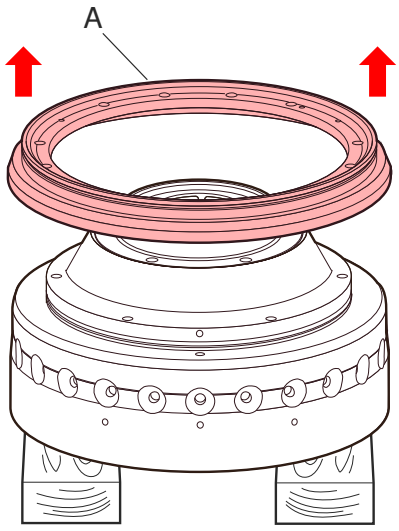
If the ring sticks, use two M8 screws in threaded holes (C) to raise the operating slide holder up and away from the bowl body.

12. 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.

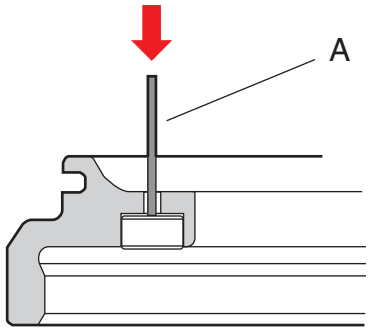


G08610N1

A. Operating slide

13. Removing the valve plugs from the operating slide.

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



G0874891

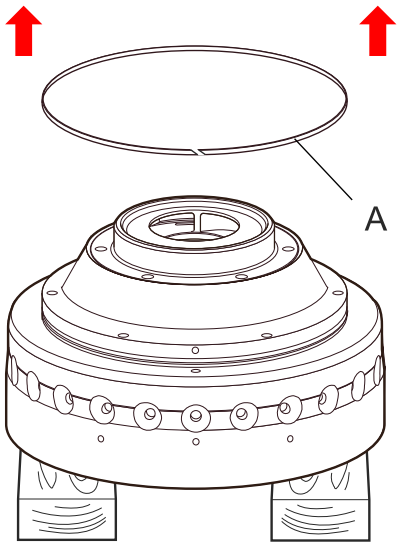
A. Drift

14. Removing the guide ring. **[O]**

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

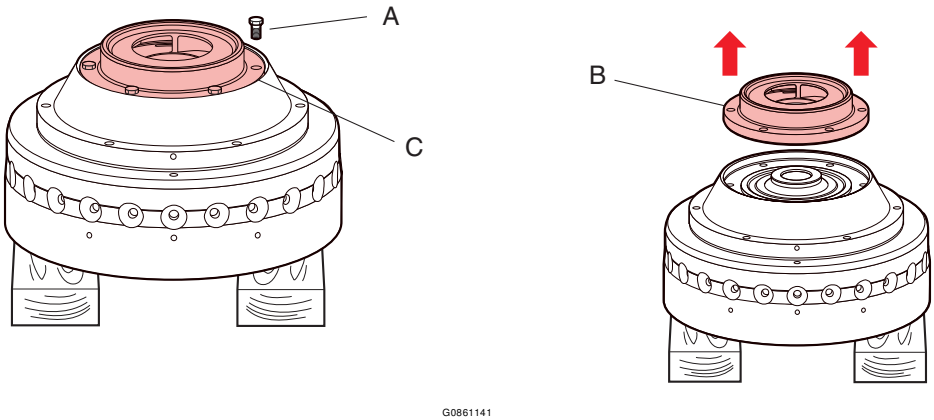
NOTE

Do NOT remove the guide ring if only an Inspection service [I] is performed.



A. Guide ring

15. Removing the operating water ring.



A. Screw
B. Ring
C. Threaded hole

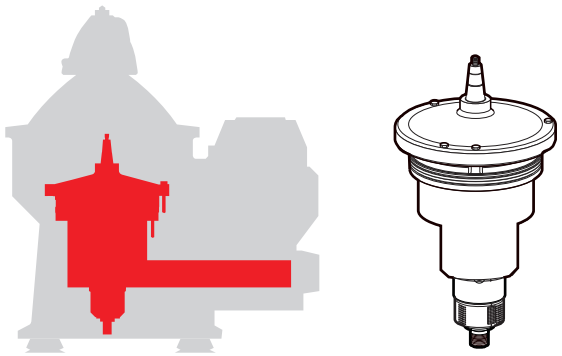
a. Remove and discard the screws (A). New screws are included in the Inspection kit.

b. Lift off the ring (B).

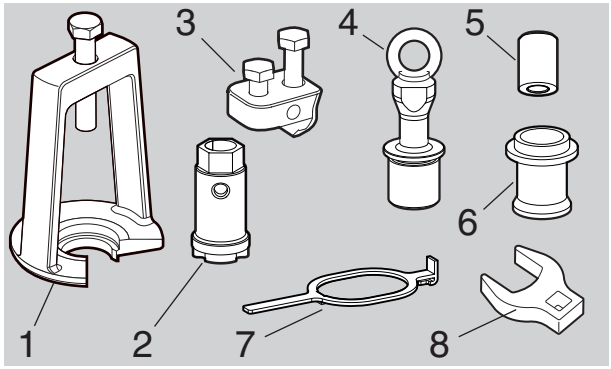
NOTE

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

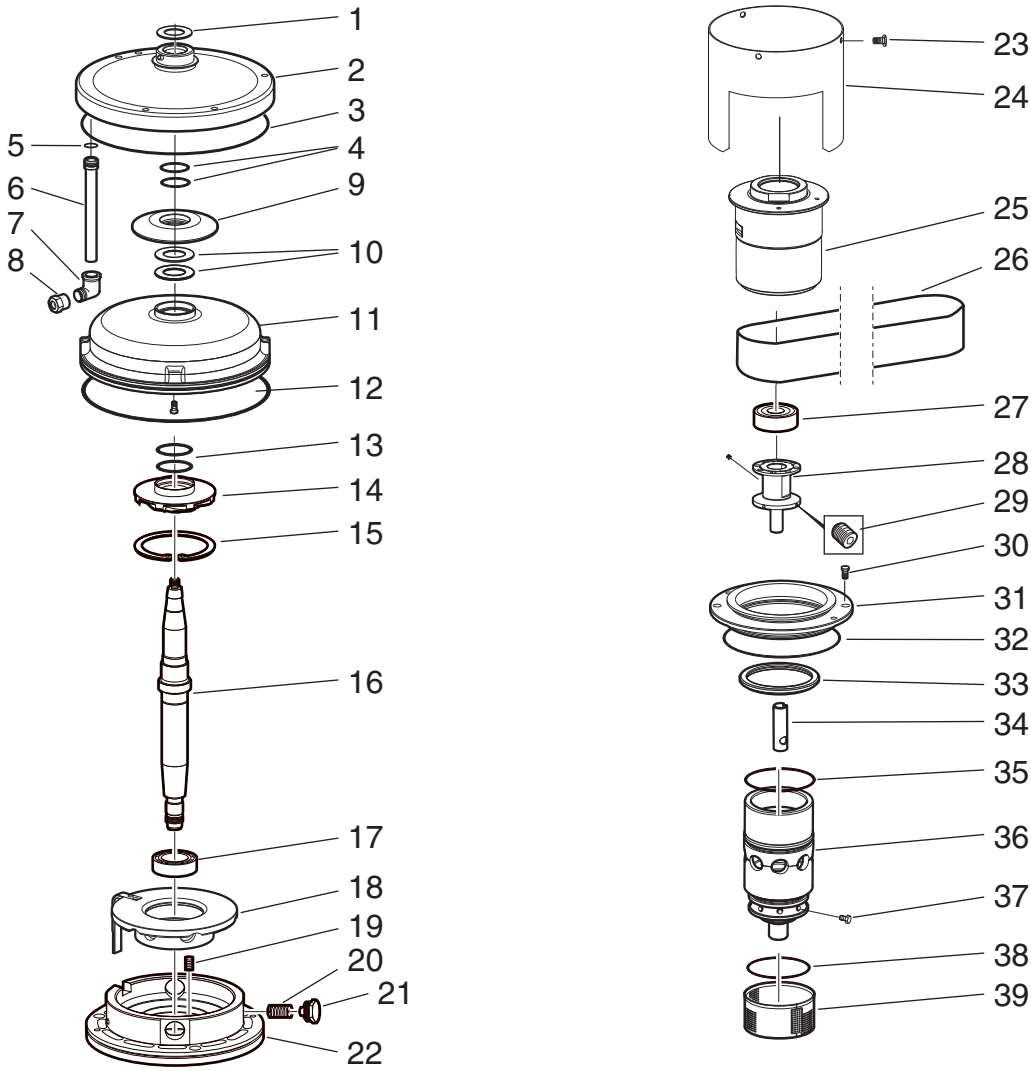


G0857821



G08579j1

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)*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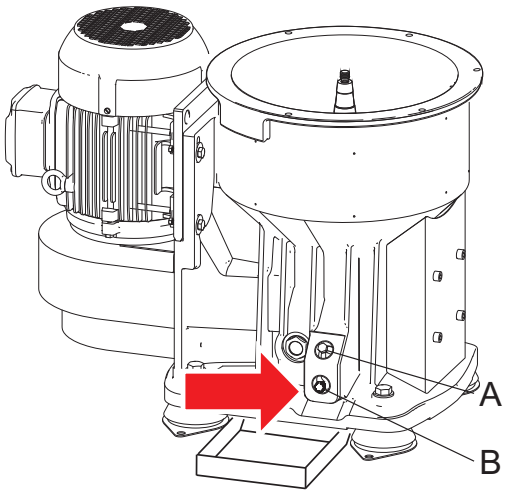
G08580h1

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. Empty the oil sump.

   Remove oil filling plug (A).

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



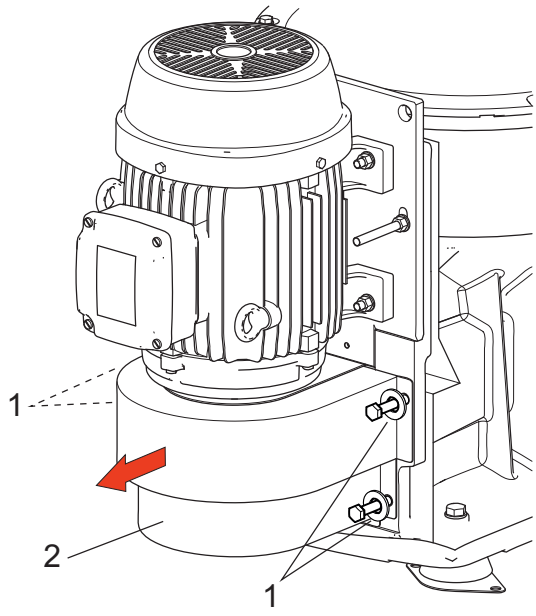
G0868591

A. Oil filling plug
B. Oil plug

2. Removing the belt cover.

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

   b. Remove the belt cover (2).



G1045931

1. Screw
2. Belt cover

3. Loosen the flat belt, by tilting the motor.

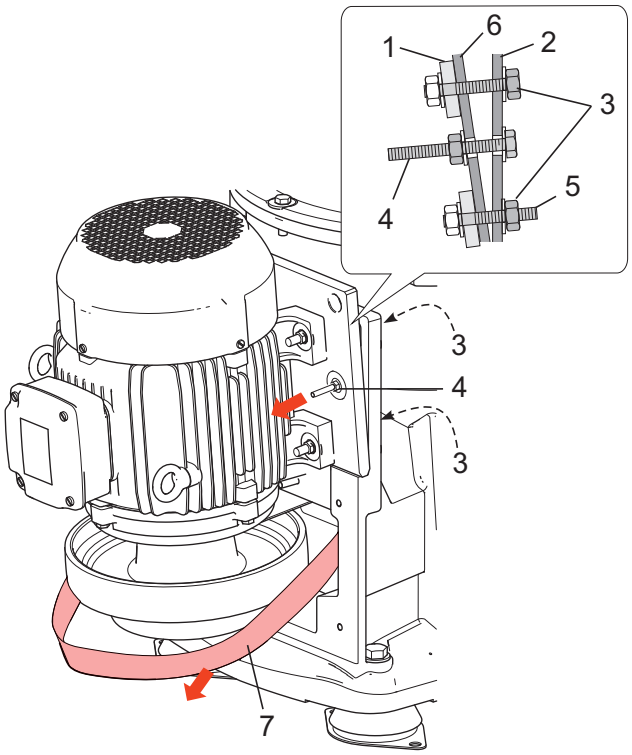
   a. Loosen, but do not remove, the screws holding the adaptor plate. Start with the four stud bolt nuts (3) on separator frame side.

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

Crush hazard

The motor will come off if the screws are unscrewed.

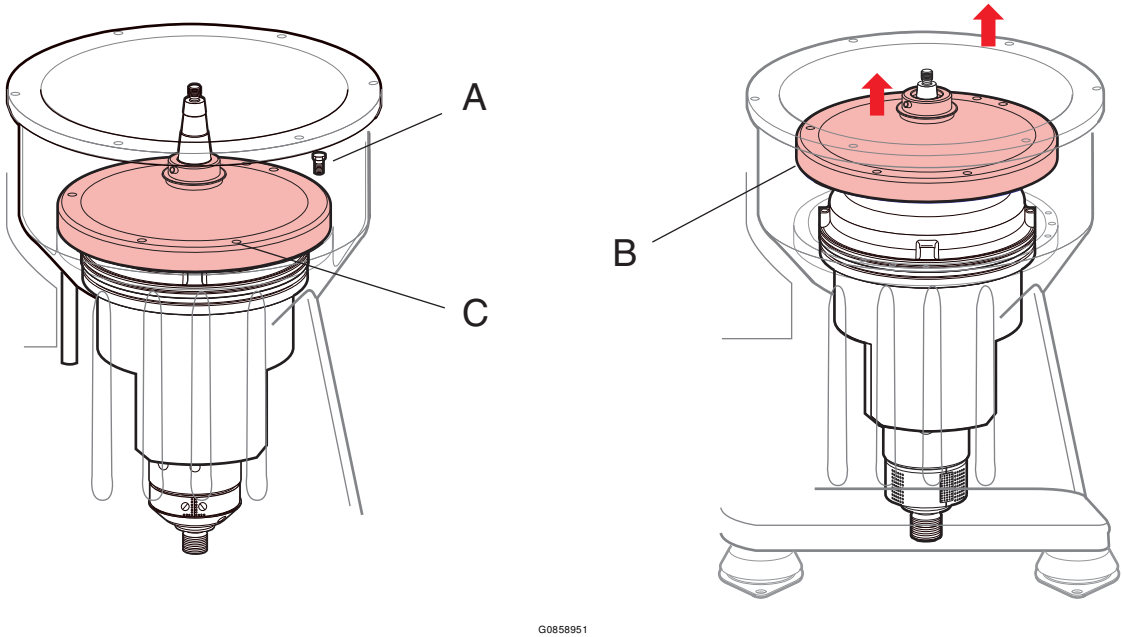
   c. Remove the flat belt from the motor pulley.



G08646D1

1. *Motor*
2. *Separator frame*
3. *Nut*
4. *Screw*
5. *pin screw*
6. *Adaptor plate*
7. *Flat belt*

4. Removing the operating water cover.



A. Screw
B. Operating water cover
C. Threaded holes

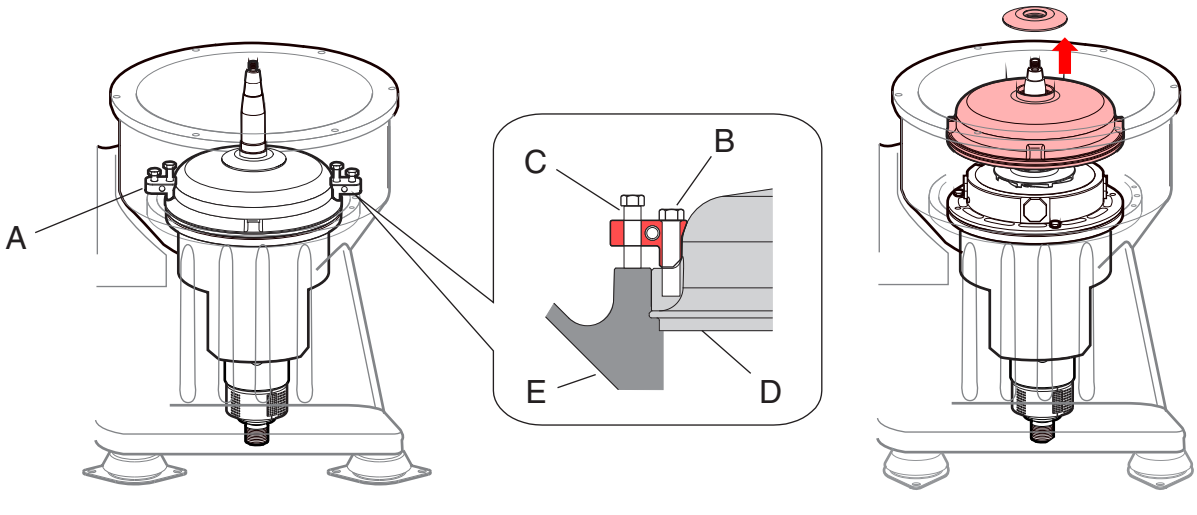
a. Remove the screws (A).

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. Tool
B. Mounting screw
C. Screw
D. Cover
E. Frame

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.

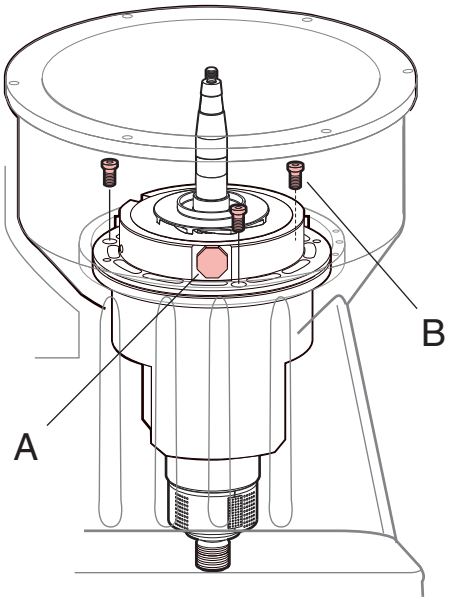
6. Prepare for removal of spindle assembly.

   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.



G0859181

A. Plug
B. Screw

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

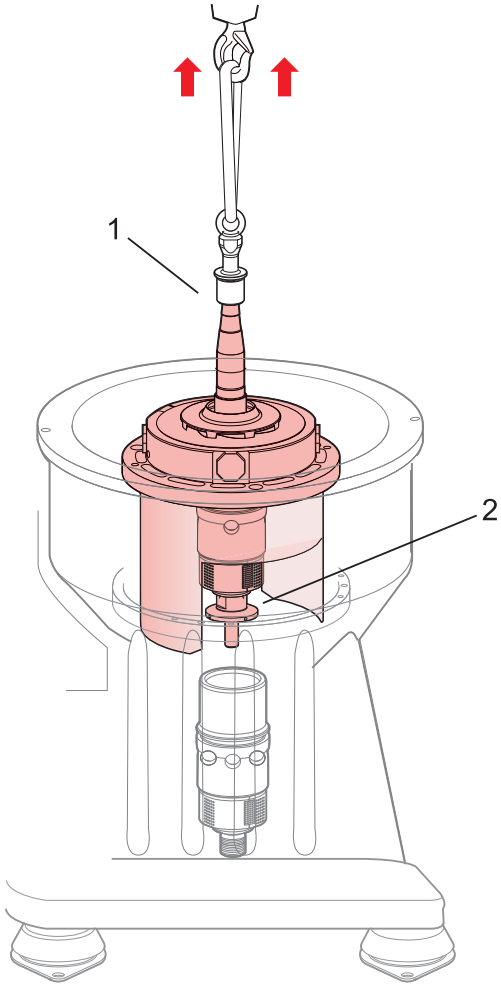
Do not rotate the spindle assembly during lifting. The spindle assembly may otherwise come loose from the lifting tool.

NOTE

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

NOTE

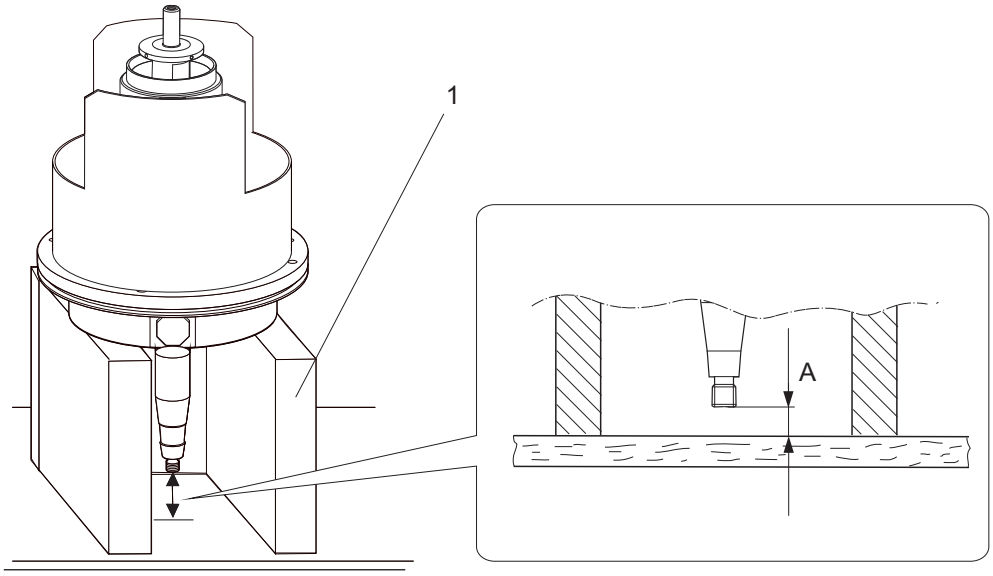
Protect the inside of the frame by covering the hole.



1. Lifting tool
2. Oil mist generator

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

   Make a support (1) with a free space (A) between the spindle top and the floor.



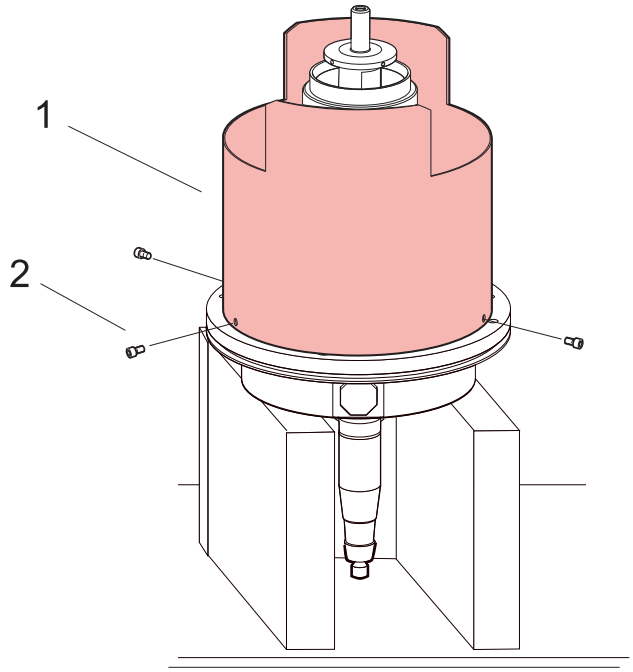
A=5 mm

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.

9. Removing the air deflector.

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



G08592b1

1. Air deflector
2. Screw

10. Removing the fan.

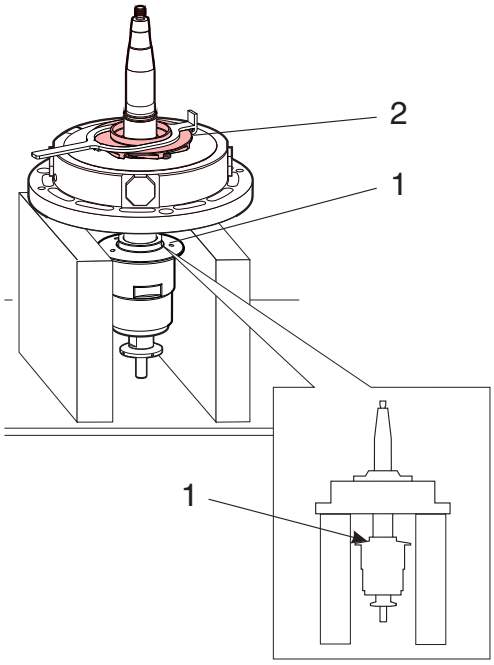
    a. Turn the spindle assembly the right way up.

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

    c. Fit the spanner and remove the fan (2).

NOTE

Left-hand thread!



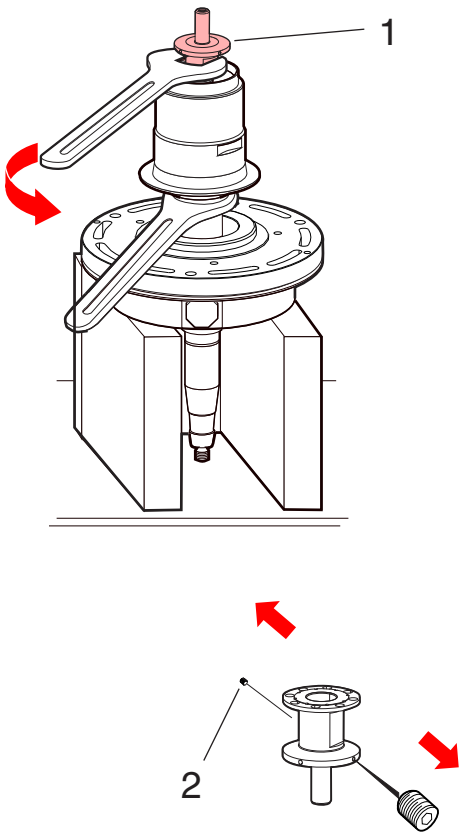
G09239A1

1. Key-grip
2. Fan

11. 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.



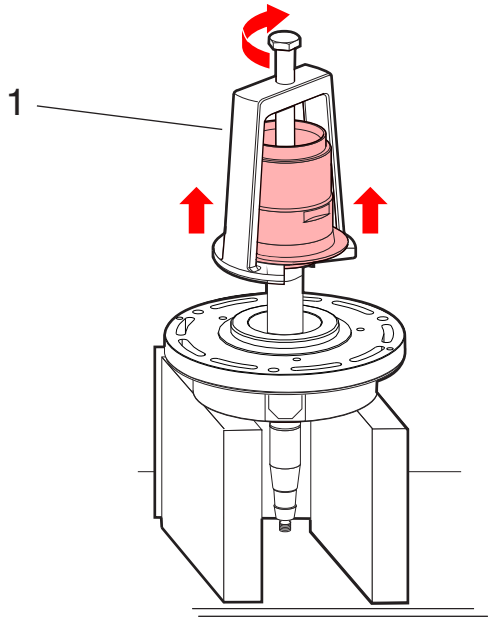
1. Oil mist generator
2. Nozzle

12. Removing the bottom bearing assembly.

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

NOTE

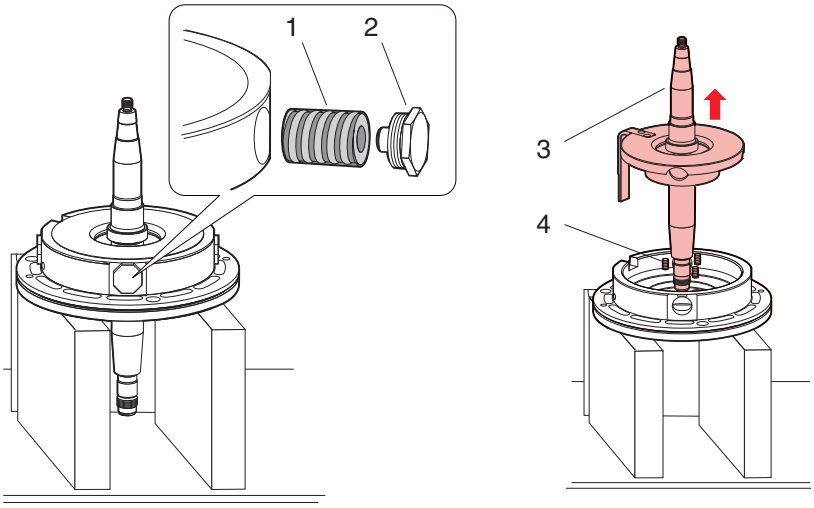
Always discard a used bearing.



1. Puller tool

13. Removing the top bearing housing.

a. Turn the spindle assembly over.

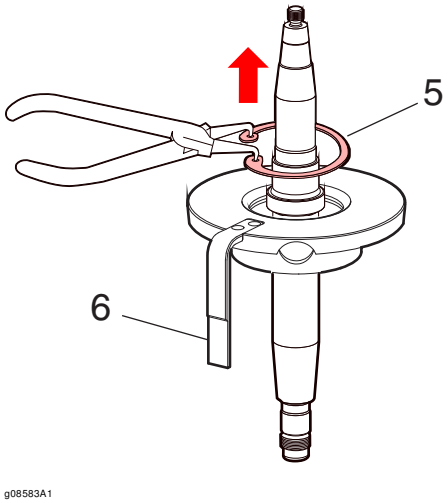


1. *Composite spring*
2. *Plug*
3. *Spindle*
4. *Axial springs*

b. Remove the snap ring (5).

Risk for eye injury from flying snap ring

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



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

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

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

e. Collect the axial springs (4).

14. 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.

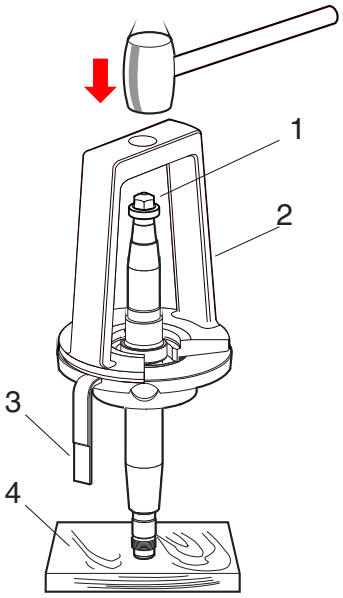
NOTE

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

NOTE

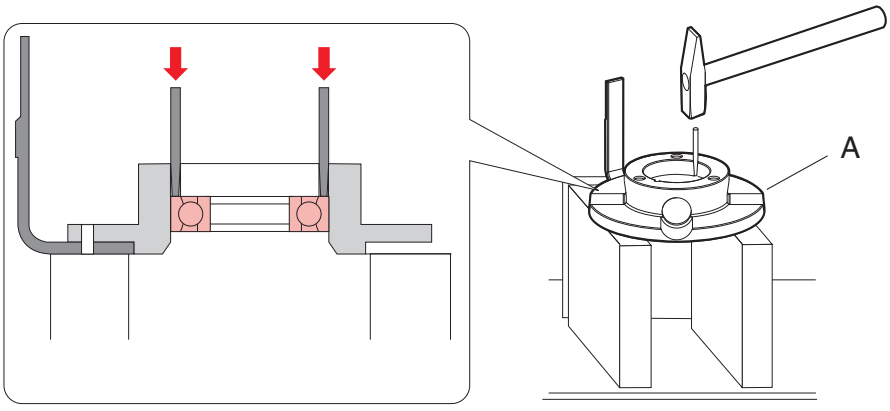
Do not damage threads on spindle.

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.



G0858381

1. Cap nut
2. Puller tool
3. Vibration indicator
4. Piece of wood to protect the spindle.



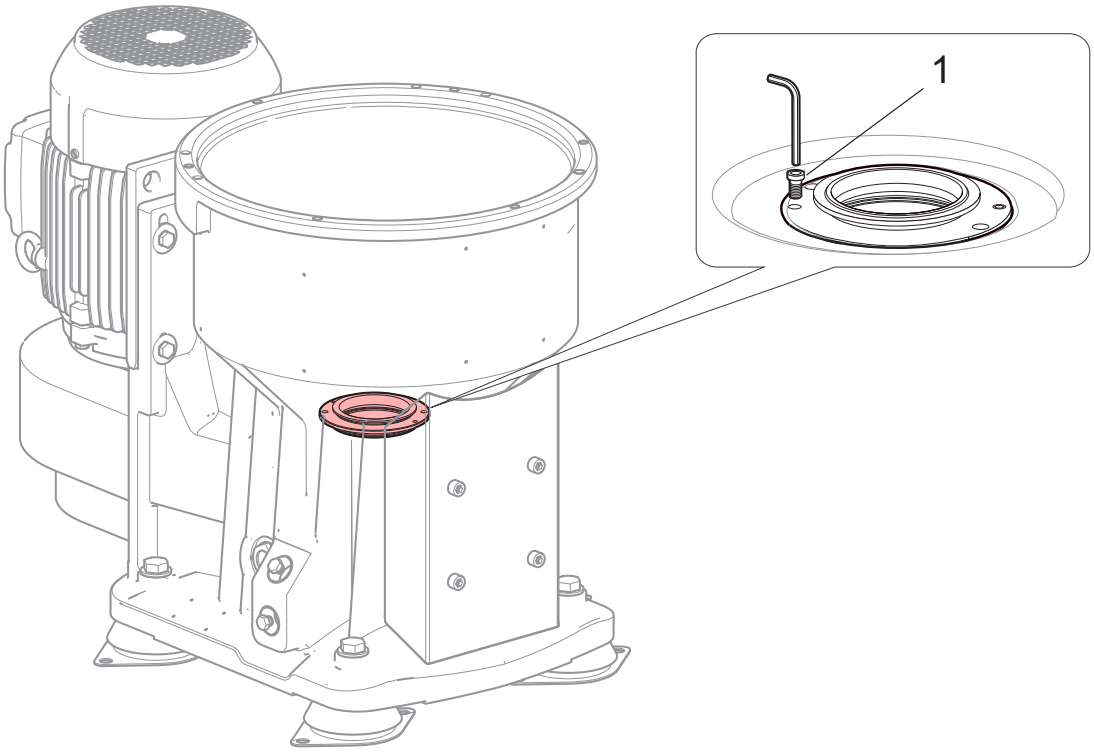
G0858371

A. Top bearing seat

15. Removing the labyrinth ring holder.

    a. Remove the screws (1).

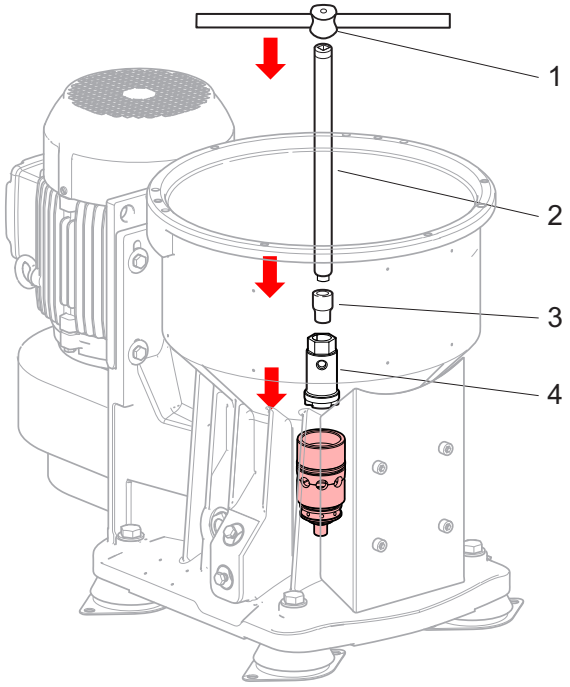
    b. Remove the O-ring and labyrinth ring.



1. Screw

16. Removing the bottom bearing holder.

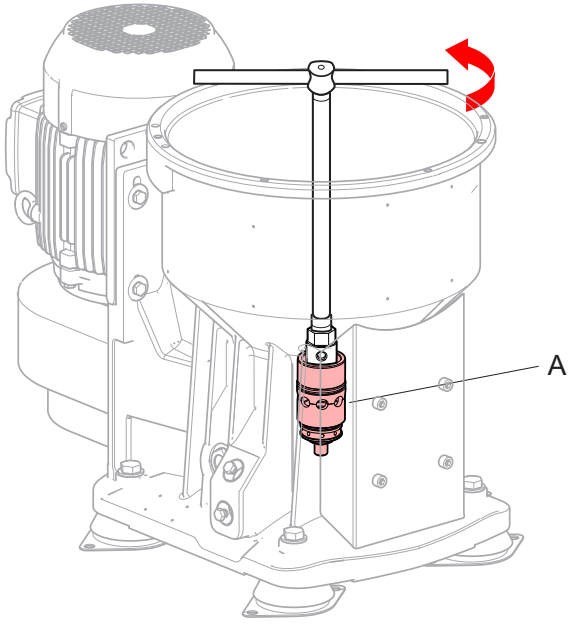
a. Fit the tool (4) into the bottom bearing holder and attach the socket (3), extension rod (2) and T-handle (1).



G1046011

1. T-handle
2. Extension rod
3. Socket
4. Tool

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



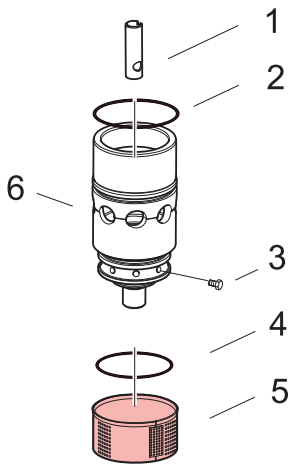
G1046021

A. Bottom bearing holder

17. Dismantling the bottom bearing holder (when necessary).

    a. Unscrew the screw (3).

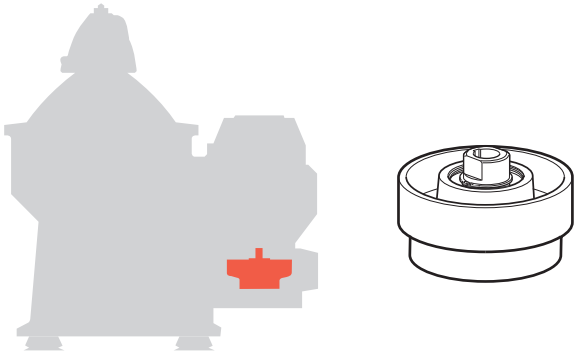
    b. Remove the pipe (1), O-rings (2), (4) and strainer (5).



G1015731

1. Pipe
2. O-ring
3. Screw
4. O-ring
5. Strainer
6. Bottom bearing holder

6.3.6 Centrifugal clutch



G0864711

Entrapment hazard

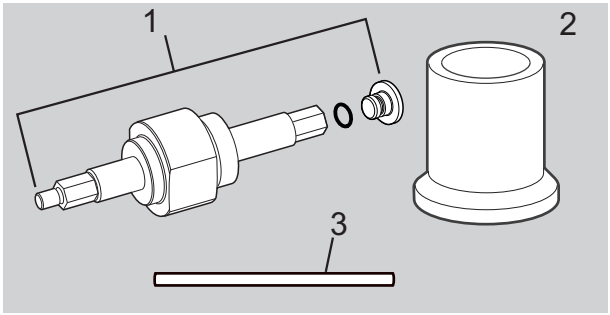
To avoid accidental start, switch off and lock-out power supply before starting any dismantling work.

Make sure that machine has come to a complete standstill before starting any dismantling work (takes about 30 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.

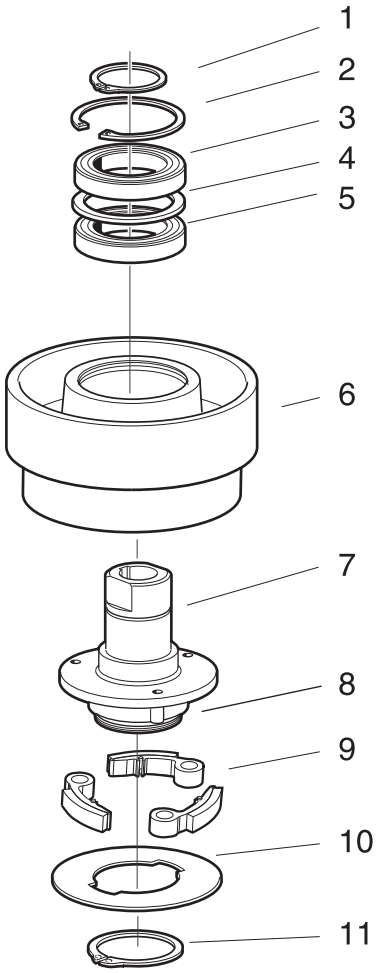
50 Hz = 5 Friction blocks
60 Hz = 3 Friction blocks

The illustration shows 50 Hz



G0865081

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



G0865111

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)*
10. *Cover*
11. *Snap ring*

If belt cover and drive belt have not been removed, proceed with this before removing the motor. **See page 82**

1. Removing the motor.

   a. Disconnect the electrical cables.

Electrical hazard

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

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

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

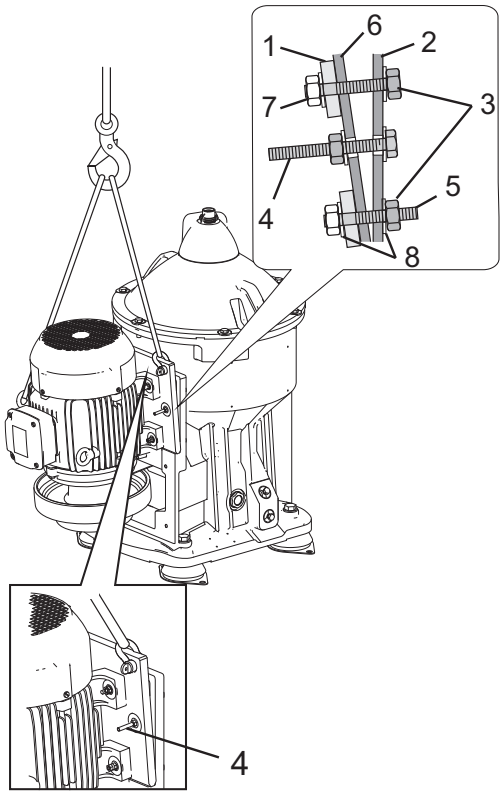
   Weight of motor with coupling and adaptor plate: approx. *159* kg.

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.

Crush hazard

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

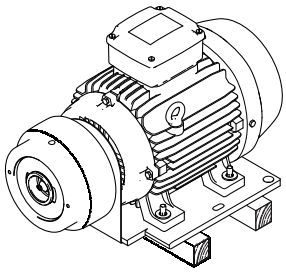
Do not unscrew the motor nuts (7).



G08646C1

1. *Motor foot*
2. *Separator frame*
3. *Stud bolt nuts*
4. *Tilting screw*
5. *Stud bolt*
6. *Adaptor plate*
7. *motor nut*
8. *Washer*

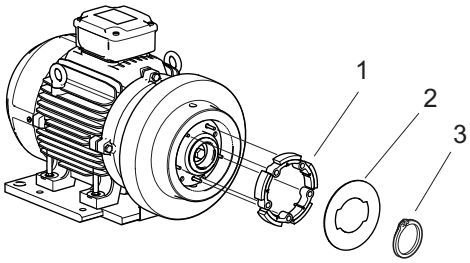
d. Lower the motor onto a suitable pallet.



G1067721

2. Removing the friction blocks.

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



G08652h1

1. Friction blocks (5=50 Hz)
2. Cover
3. Snap ring

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.

NOTE

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

3. Checking the condition of the friction blocks. **[o]**

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.

If the blocks are worn:

Fit new friction blocks.

NOTE

Replace all blocks, even if only one is worn.

NOTE

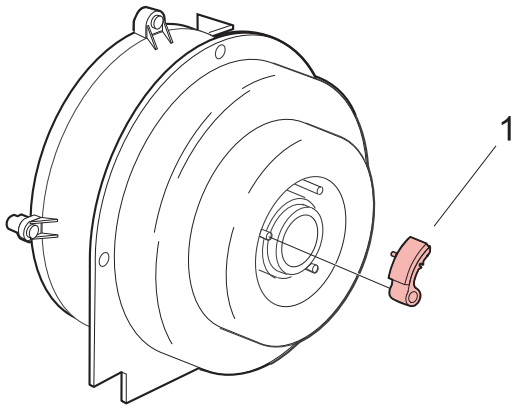
Be sure that the pins on the back of the blocks project into the grooves in the clutch hub.

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

NOTE

Make sure that there is no oil on the pads.

b. If only friction block service is to be done, proceed to fitting the friction blocks on page 120.



G08653c1

1. Friction block

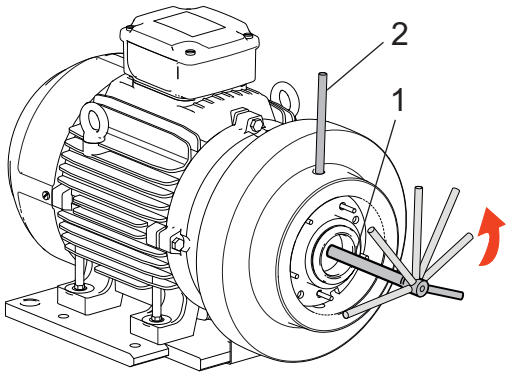
4. Removing the coupling from the motor (complete dismantling of centrifugal clutch).

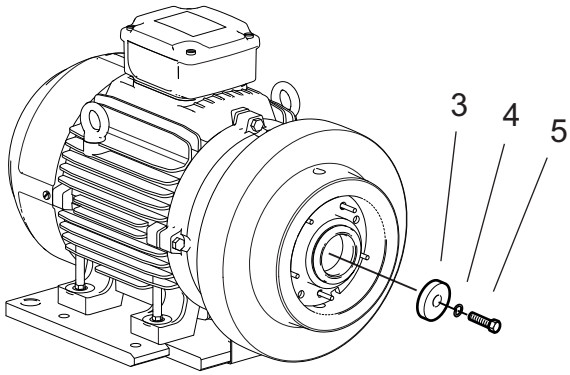
   a. Attach a socket with extension rod and handle (1) to the screw.
   Use the rod (2) to prevent the coupling from rotating when removing the screw.

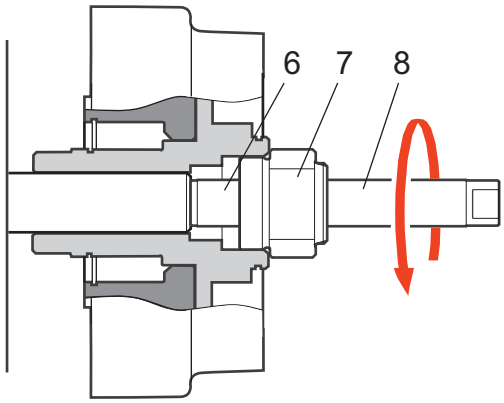
   Remove the screw (5), spring washer (4) and washer (3).

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

   c. Ease off the friction coupling.







G1046141

WARNING

Crush hazard

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

NOTE

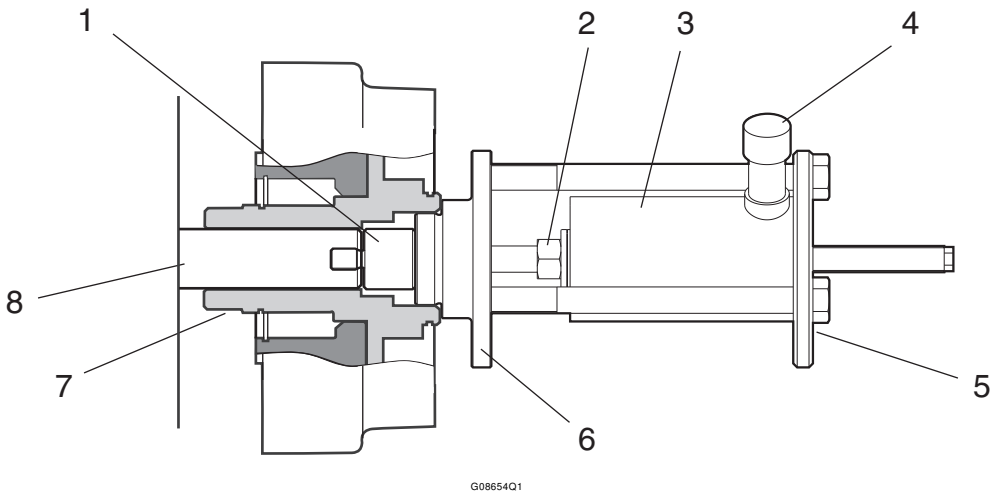
See dismantling with optional hydraulic puller tool on page 103 (if purchased).

1. *Socket with extension rod and handle*
2. *Rod*
3. *Washer*
4. *Spring washer*
5. *Screw*
6. *Brass plug*
7. *Flat area for spanner*
8. *Puller tool*

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

NOTE

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



1. *Sleeve*
2. *Nut*
3. *Hydraulic cylinder*
4. *Hydraulic oil inlet*
5. *Plate*
6. *Holder*
7. *Coupling nave*
8. *Motor shaft*

a. Fit the sleeve (1) to the stud bolt.

   Fit the stud bolt with sleeve to the motor shaft (8).

b. Fit the holder (6) to the coupling nave (7).

c. Fit nut (2) and sleeve to the stud bolt as shown.

d. Fit hydraulic cylinder (3) as shown.

e. Fit the plate (5) and fasten with screws through plate and holder.

f. Attach the hose from the hand pump to the hydraulic oil inlet (4).

Ease off the friction coupling by pumping the handle on the pump until stop.

Release pressure on the hand pump and adjust the nut on the stud bolt.

Repeat until coupling is loose.

Crush hazard

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

6. Dismantling of the coupling assembly.

   a. Remove the snap rings (1).

CAUTION

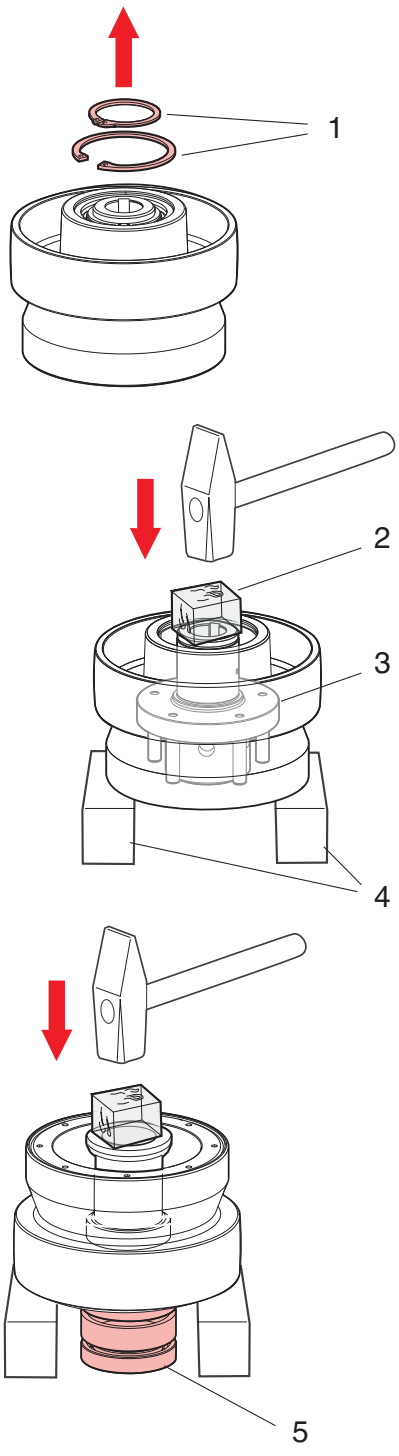
Flying objects
Risk for accidental release of snap ring.
Wear safety goggles.

   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.



1. *Snap ring*
2. *Wooden support*
3. *Coupling hub*
4. *Support*
5. *Ball bearing*

6.4 Actions before assembly

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.

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.

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

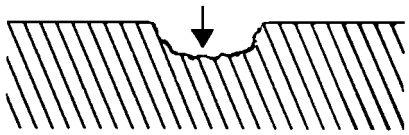
6.4.2 Inspection for corrosion

[i], [o]

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).



G0205241

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.

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

[i], [o]

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

Disintegration hazard

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

Always replace a part if cracks are present.

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

Disintegration hazards

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

[i], [o]

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

Erosion is characterised by:

a. Burnished traces in the material.

b. Dents and pits having a granular and shiny surface.

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

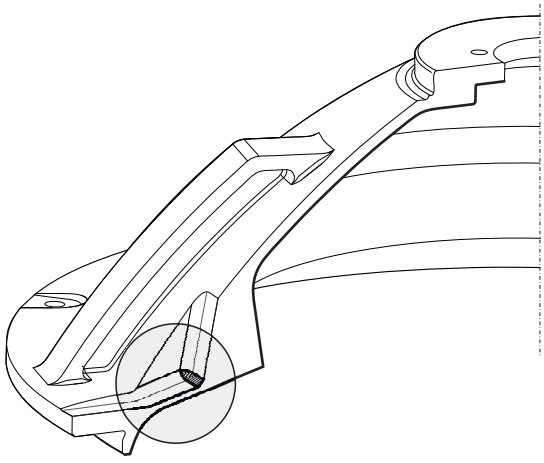
NOTE

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.

NOTE

Pay extra attention at the groove.



G1034011

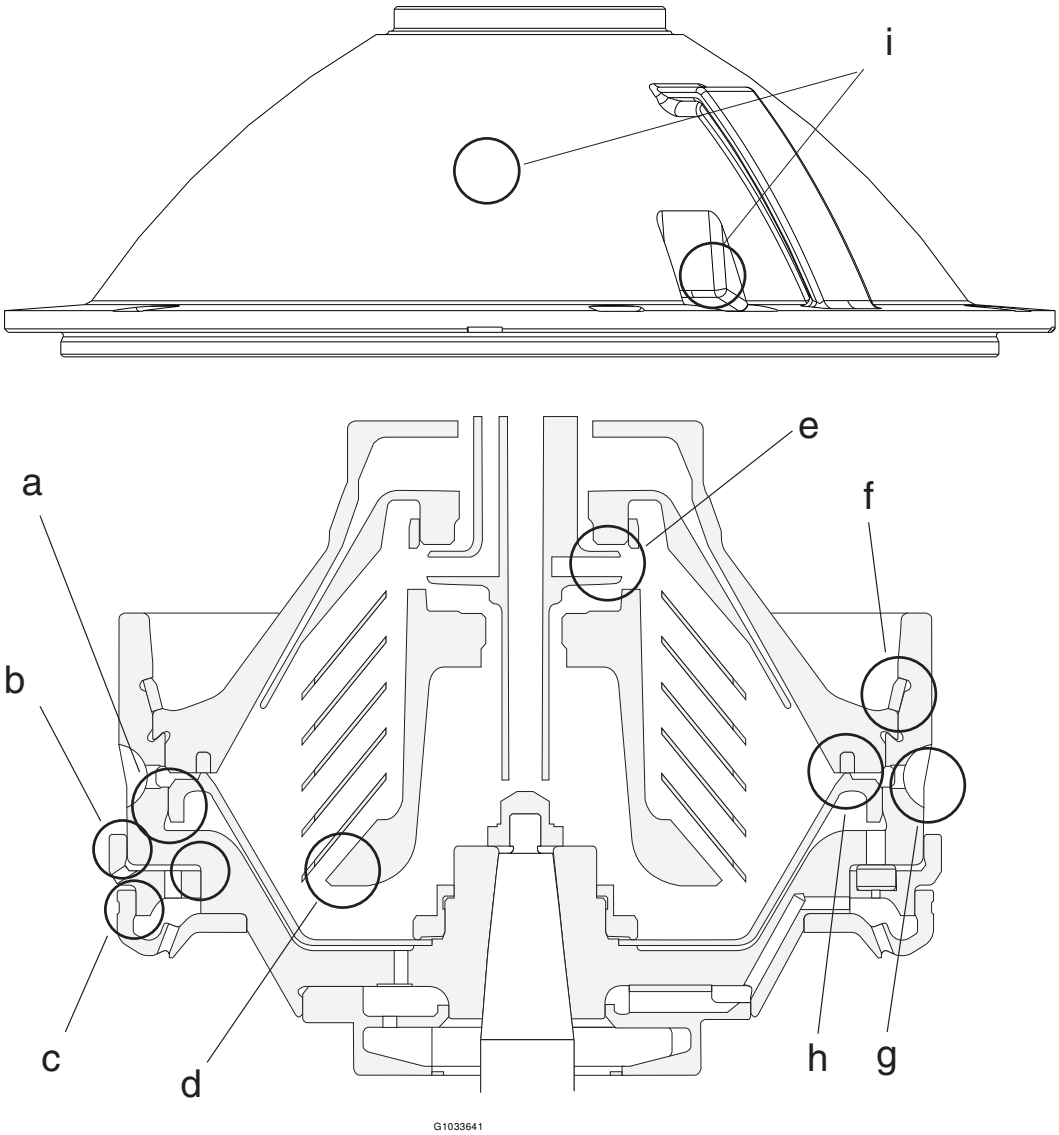
3. Replace parts if erosion is suspected.

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. Groove in frame hood. (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 6.7 Lifting instructions on page 180.

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

b. Remove the separator. See 6.7 Lifting instructions on page 180.

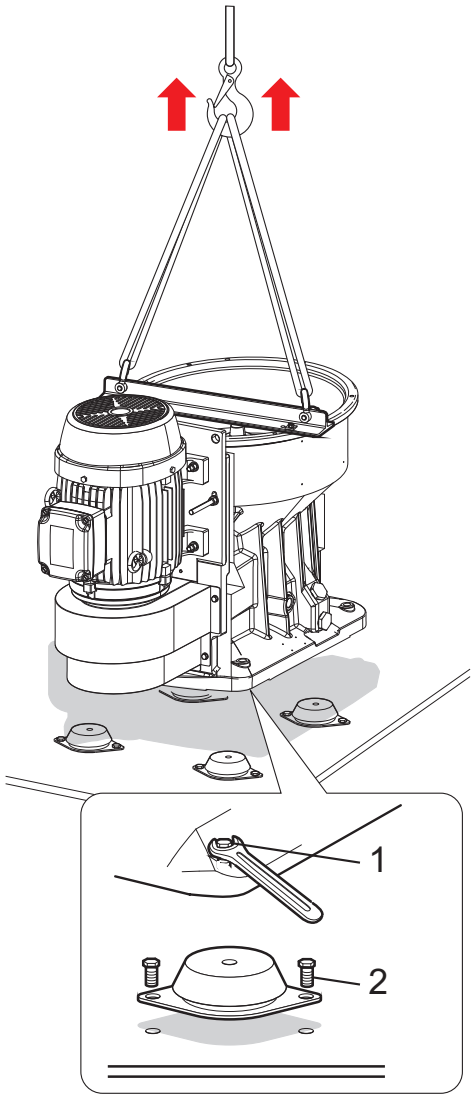
c. Remove the existing screws (2), washers and frame feet.

NOTE

Discard the old frame feet, screws and washers.

d. Fit the new feet, screws and washers.

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



G08744A1

6.4.6 Change of motor bearings

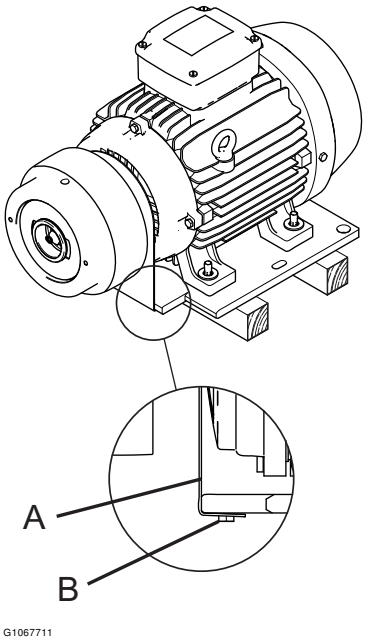
1. Remove motor according to instructions on page 98.

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.



A. Guard
B. Screw

4. Dismantle the coupling according to instructions in chapter 6.3.6 Centrifugal clutch

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

6. Assembly:

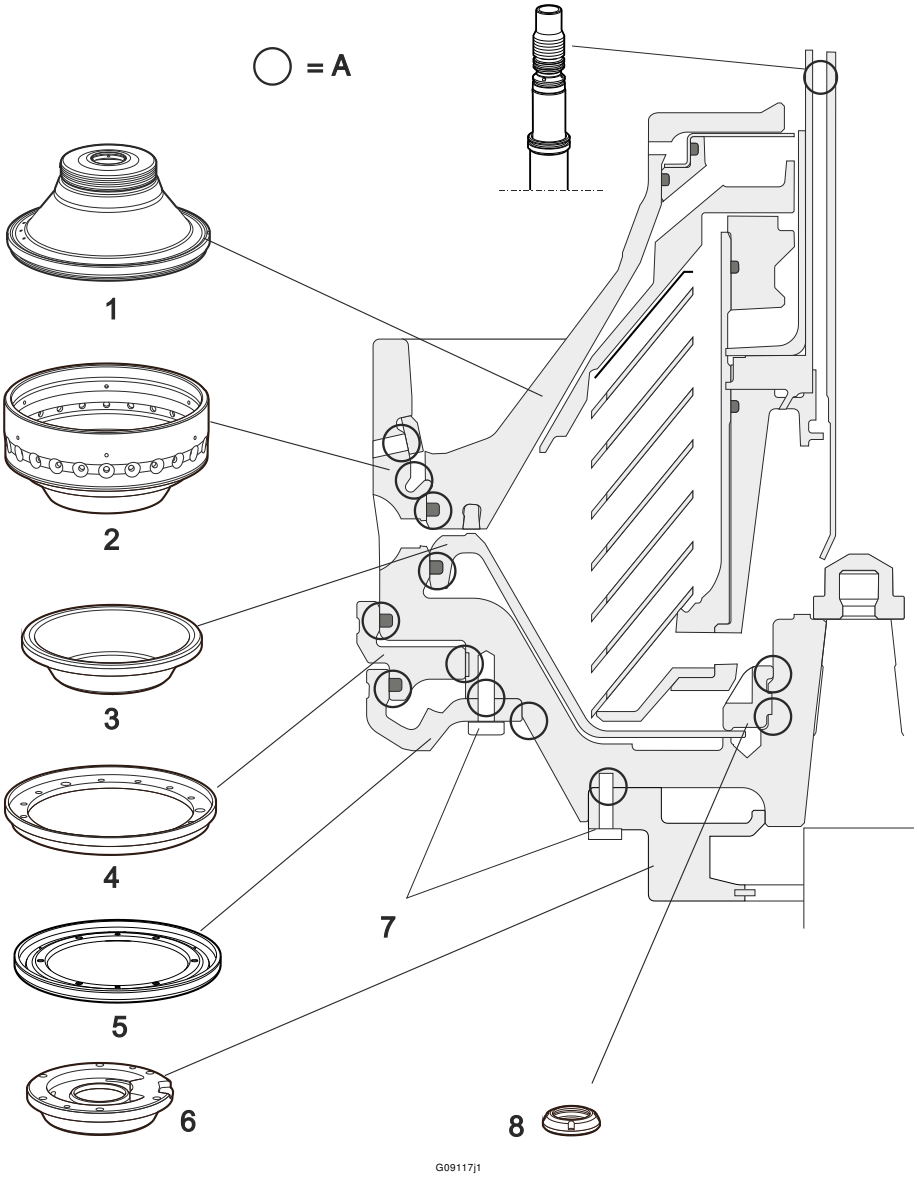
   a. Fit the guard (A) to adaptor plate, motor shaft going through guard and secure with the two screws (B).

   b. Assembly complete coupling to the motor, see page 118.

   c. Assembly motor to frame, see page 122

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.



A. Molykote 1000
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

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.

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

   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

   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). **[o]**

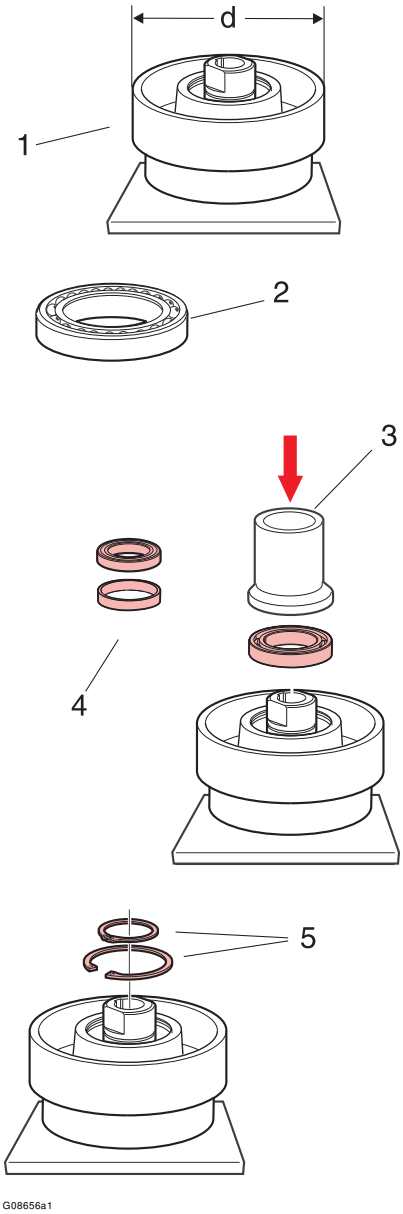
   c. Press the ball bearings (2) down one at a time into the coupling hub, preferably using a hydraulic press. Place the spacing ring (4) between them.

   NOTE

   Never re-fit used ball bearings.

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

   d. Fit the snap rings (5). **[o]**



1. *Belt pulley*
2. *Ball bearing*
3. *Mounting tool*
4. *Spacing ring*
5. *Snap ring*

2. Fitting the coupling to the motor.

NOTE

Make sure that the key (1) is in place on the motor shaft.

NOTE

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

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

b. Apply lubricating paste to the tool threads (2). Keep the threads lubricated.

NOTE

Left hand thread!

c. Remove the brass plug (3).

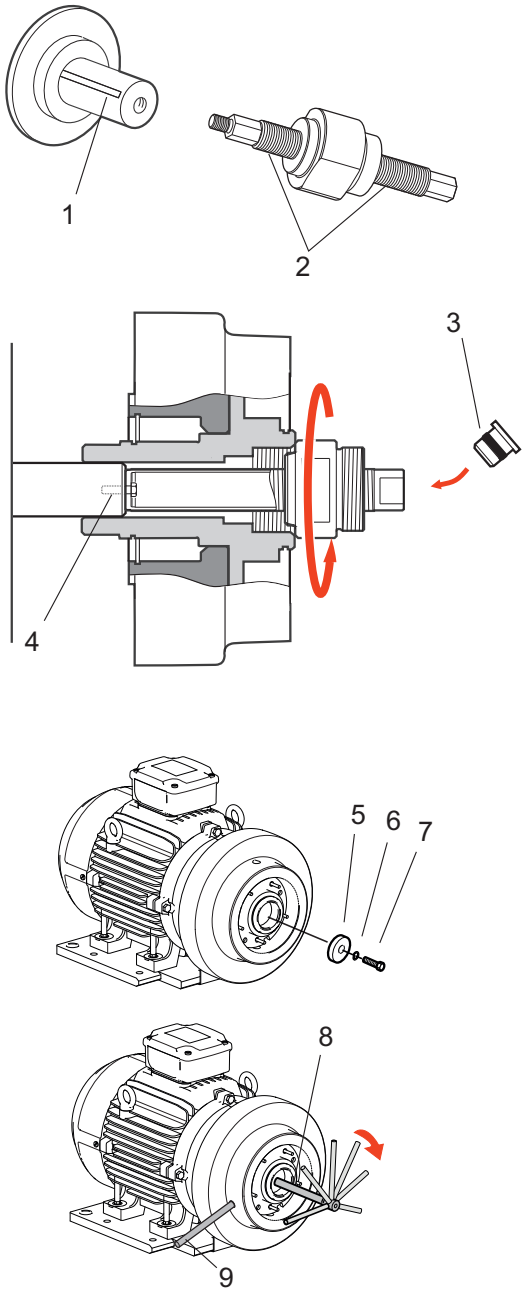
d. Fasten the sleeve of the tool to the motor shaft with the screw (4) on the tool.

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

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.



G1046121

1. *Key*
2. *Threads*
3. *Brass plug*
4. *Screw*
5. *Washer*
6. *Spring washer*
7. *Screw*
8. *Socket with extension rod, and handle*
9. *Rod*

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

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. Fit the sleeve (7) to the stud bolt.

Fit the stud bolt (2) with sleeve to the motor shaft (6).

c. Screw the holder (3) to the coupling nave.

d. Fit hydraulic cylinder as shown.

e. Fit the sleeve and secure with the nut (5).

f. Attach the hose from the hand pump to the hydraulic oil inlet (4)

g. Fit the friction coupling by pumping the handle on the pump until stop

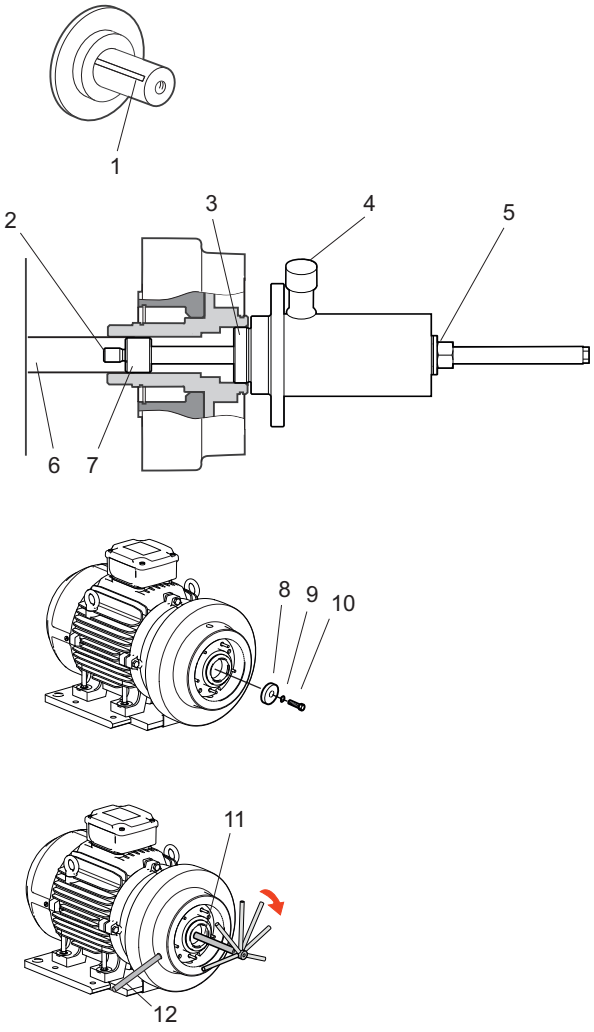
h. Release pressure on the hand pump and adjust the nut on the stud bolt

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

j. Remove the hydraulic tool.

k. Install and tighten the washer (8), spring washer (9) and screw (10).

l. Attach a socket with extension rod and handle (11) to the screw. Fit rod (12) inside the hole in coupling hub and hold steady when tightening screw.



G1046131

1. Key
2. Stud bolt
3. Holder
4. Hydraulic oil inlet
5. Nut
6. Motor shaft
7. Sleeve
8. Washer
9. Spring washer
10. Screw
11. Socket with extension rod, and handle
12. Rod

4. 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.

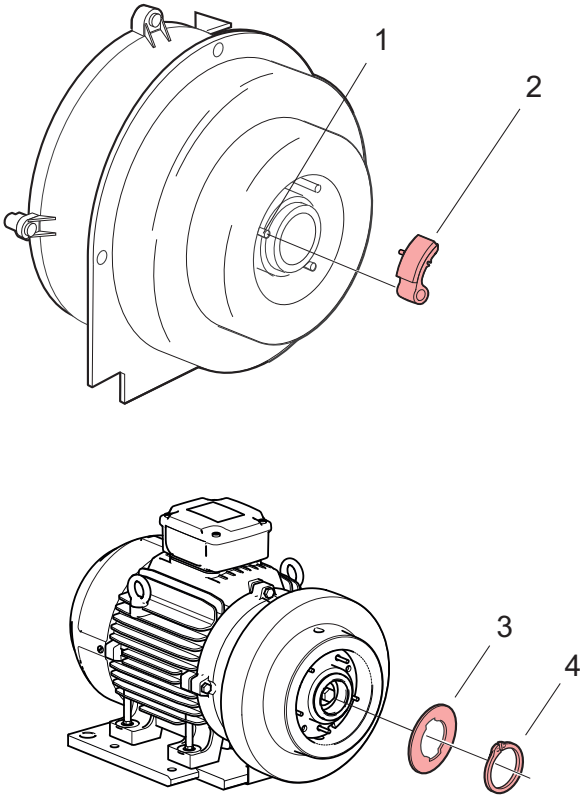
   NOTE

   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.



G08652i1

1. Guide pin
2. Friction block
3. Cover
4. Snap ring

5. 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 page 118.

   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).

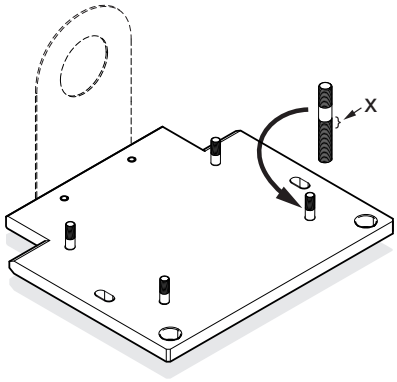
   i. Tighten the four stud bolt nuts (3) on separator frame side to secure adaptor plate to separator frame.

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

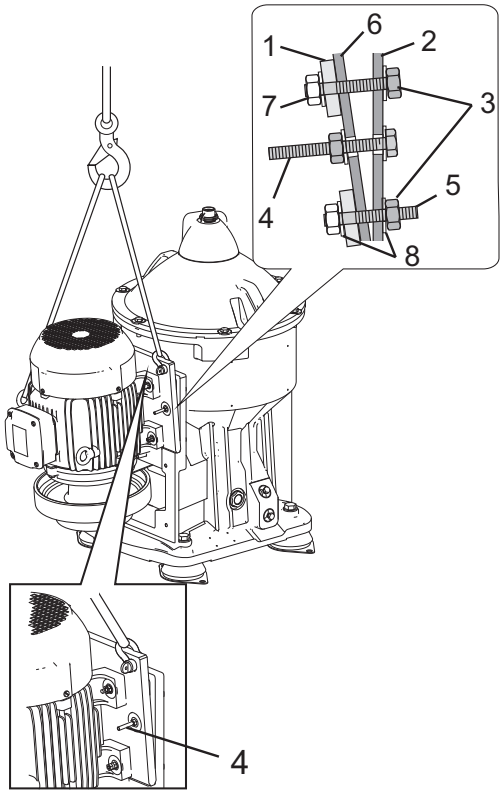
   k. Tighten the bolt nuts (7) slightly.

   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.



G08646h1



G08646c1

1. *Motor foot*
2. *Separator frame*
3. *nut*
4. *Clamping screw*
5. *Stud bolt*
6. *Adaptor plate*
7. *Motor stud bolt nut*
8. *Washer*

6. Fitting the motor.

a. Fit a lifting sling to the motor and adaptor plate. Use a 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 set on the ledge.

WARNING

Crush hazard

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

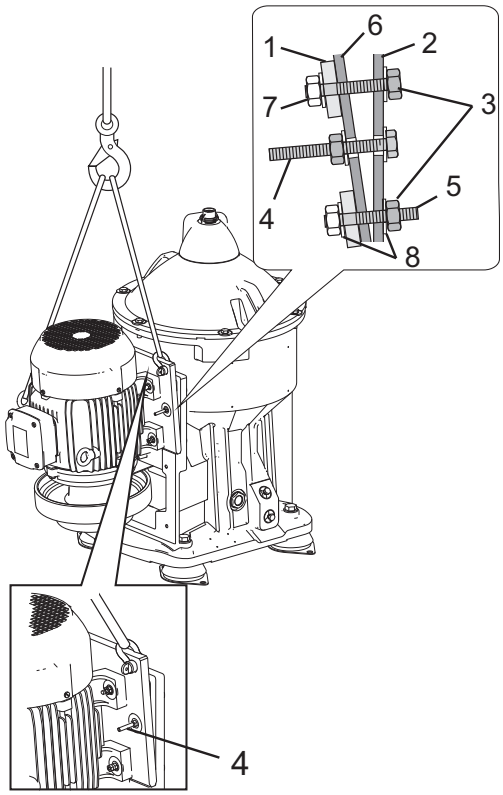
c. Fit the two tilting screws (4) and tighten until motor is in a slightly leaning position.

d. Connect the electrical cables.

WARNING

Electrical hazard

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



G08646c1

1. *Motor foot*
2. *Separator frame*
3. *nut*
4. *Tilting screw*
5. *Stud bolt*
6. *Adaptor plate*
7. *Motor stud bolt nut*
8. *Washer*

NOTE

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

If carrying out a complete machine assembly, continue with Driving device **instructions on page** 125.

7. 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.

NOTE

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

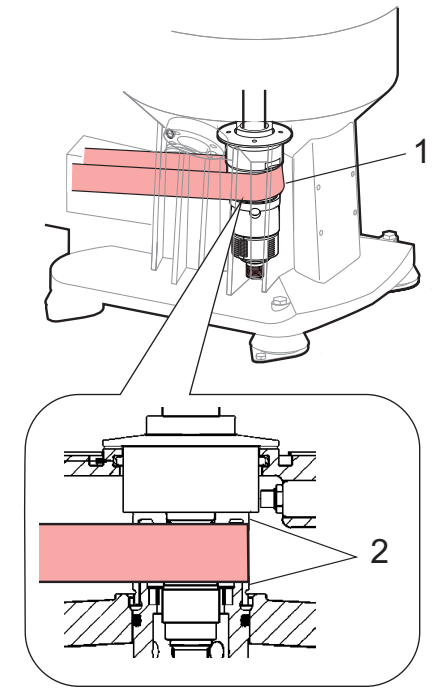
b. Fit the flat belt to the motor belt pulley.

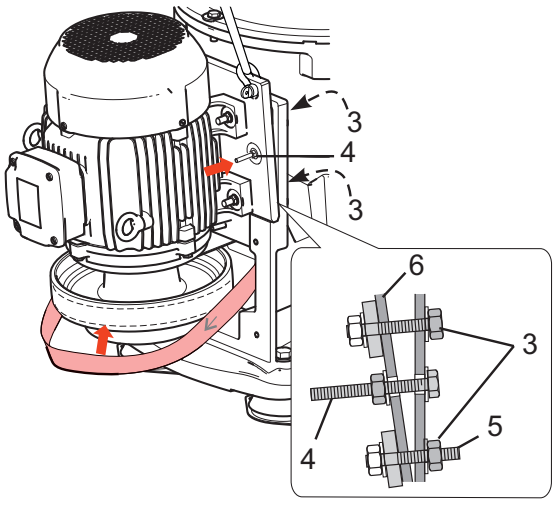
c. Tighten the two tilting screws (4).

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.





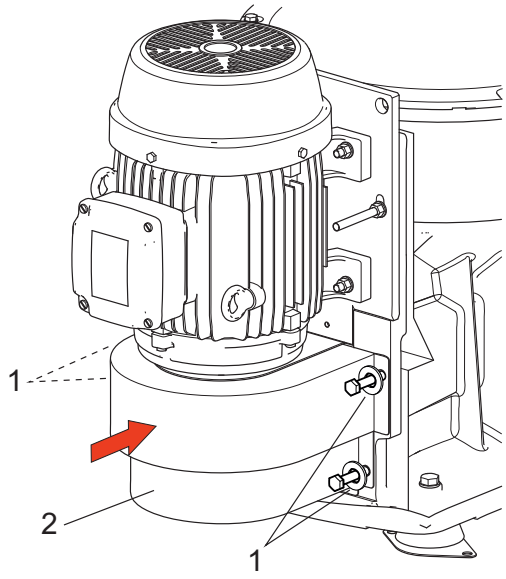
G08646e1

1. *Flat belt*
2. *Clearance*
3. *stud bolt nut*
4. *Tilting screw*
5. *Stud bolt*
6. *Adaptor plate*

8. Fitting the belt cover.

   a. Fit the belt cover.

   b. Tighten the screws.



G1045941

1. Screw
2. Belt cover

6.5.2 Driving device

1. Assembling the bottom bearing holder (where necessary)

NOTE

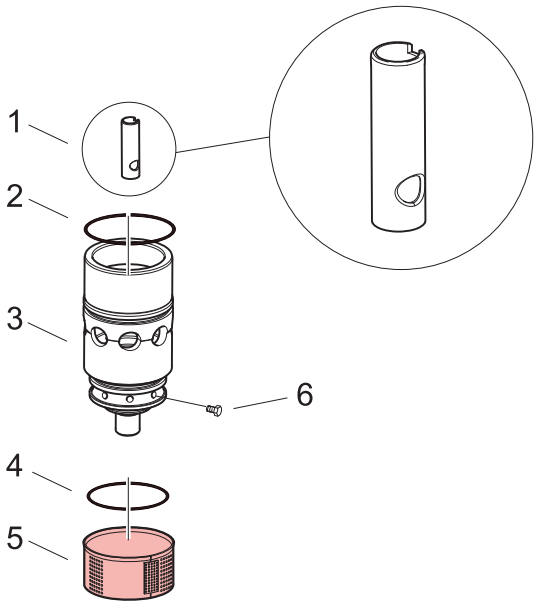
Clean the pipe and strainer before fitting.

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.



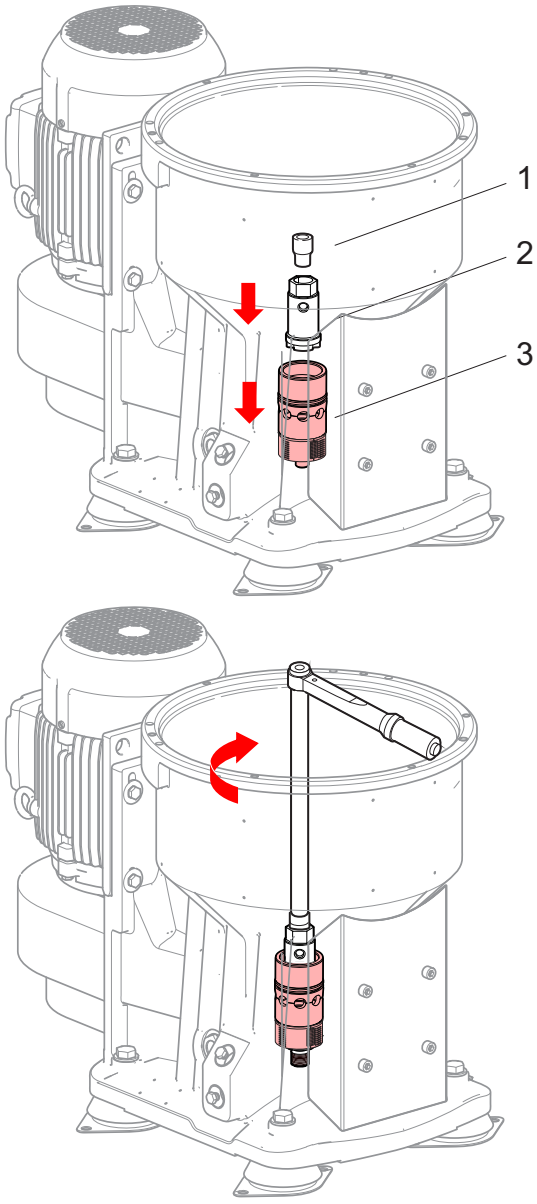
1. *Pipe*
2. *O-ring*
3. *Bottom bearing holder*
4. *O-ring*
5. *Strainer*
6. *Screw*

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 into the bottom bearing housing.

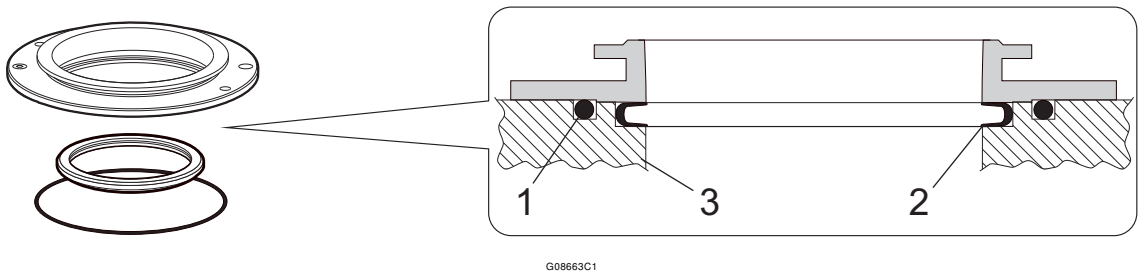
   c. Tighten the holder to a torque of *200 Nm*.



G10157A1

1. Socket
2. Tool
3. Bottom bearing holder

3. Fitting the labyrinth ring holder.



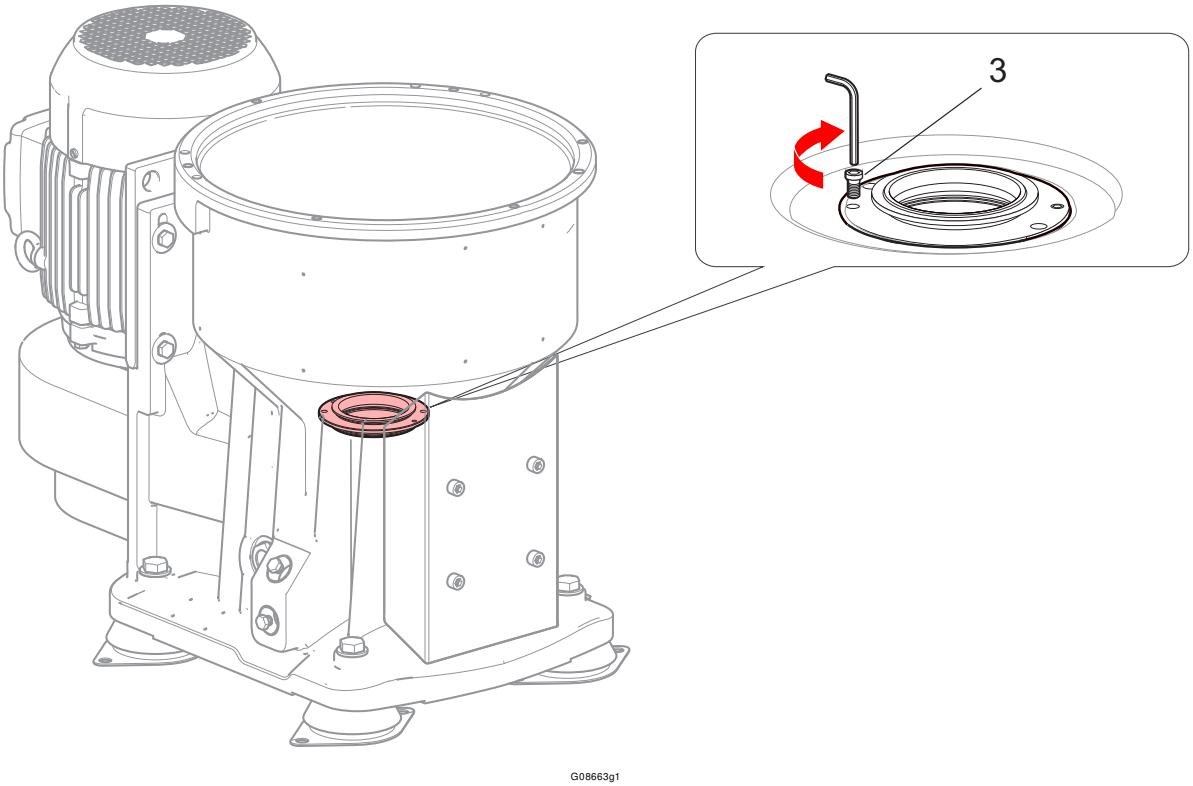
1. O-ring
2. Labyrinth-ring
3. Separator frame

a. Make sure surfaces are clean from dirt.

b. Lubricate and fit the O-ring (1). **[o]**

c. Lubricate and fit the labyrinth ring (2). **[o]**

d. Fit the labyrinth ring holder into the frame. Fit and tighten the screws (3).



3. Screw

4. Fitting the ball bearing to the top bearing seat. **[o]**

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

   WARNING

   Burn hazard
   Use protective gloves when handling any heated parts.

   b. Drop some oil onto the bearing and fit the bearing (2) into the top bearing seat.

   NOTE

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

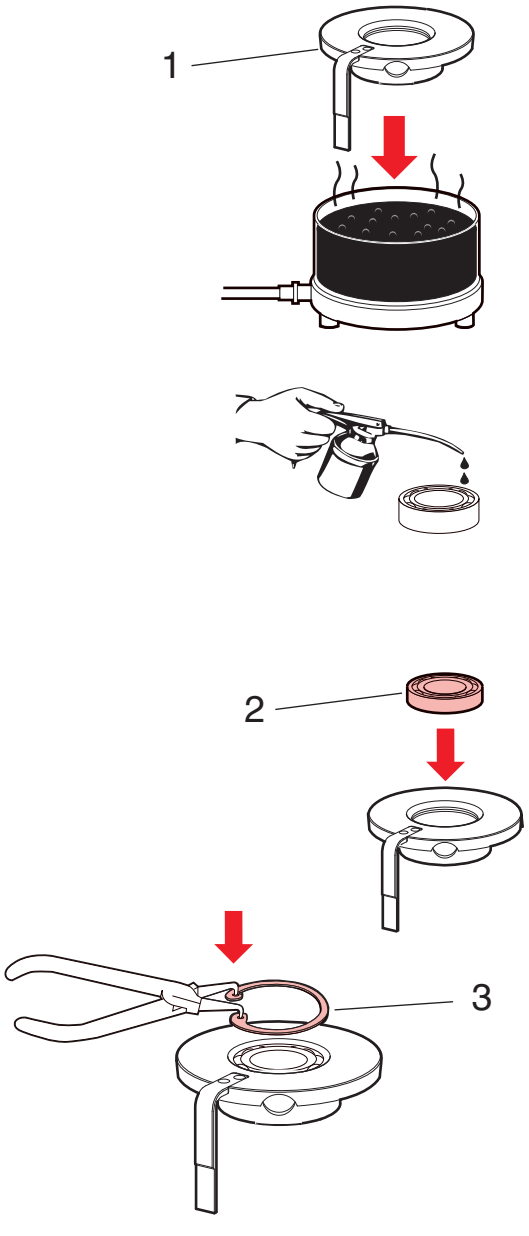
   c. Fit the snap ring (3).

   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.



1. Top bearing seat
2. Ball bearing
3. Snap ring

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

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

WARNING

Burn hazard

Use protective gloves when handling any heated parts.

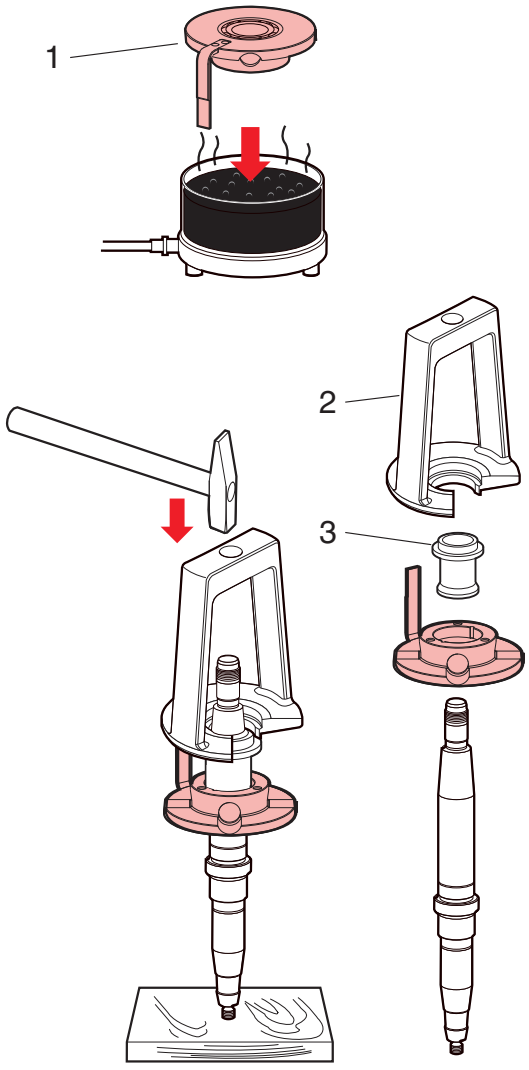
   b. Wipe off the spindle and fit the top bearing seat to the spindle using the sleeve (3) and puller (2).

NOTE

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

NOTE

Be careful not to damage the vibration indicator



G0984881

1. *Top bearing seat*
2. *Puller*
3. *Sleeve*

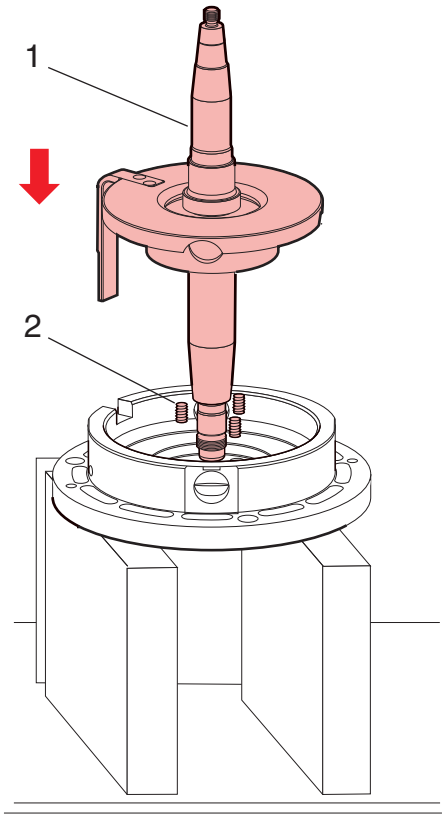
6. Fitting the top bearing housing.

   a. Fit the axial springs (2) to the top bearing housing. **[o]**

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

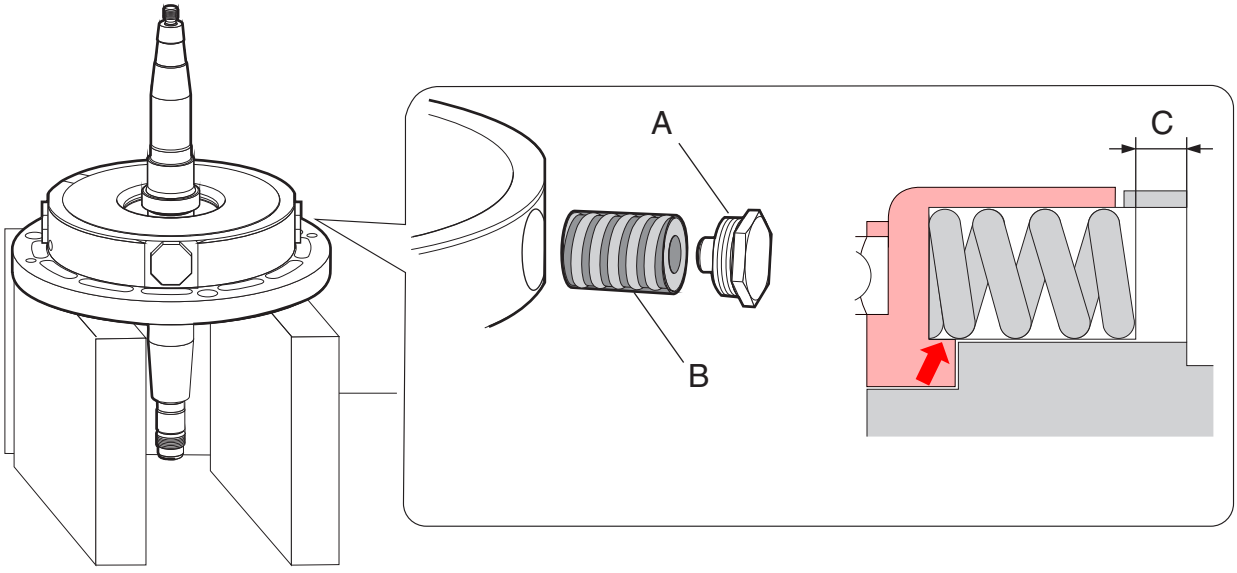
   c. Lubricate the threads (A) and both ends of the composite springs (B) with oil before assembly.

   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. **[o]**



G0866661

1. Bowl spindle
2. Axial spring



G0866681

A. Threads
B. Composite spring
C. Distance to check for fitted spring.

7. Fitting the spindle pulley.

   a. Screw on the cap nut on the spindle.

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

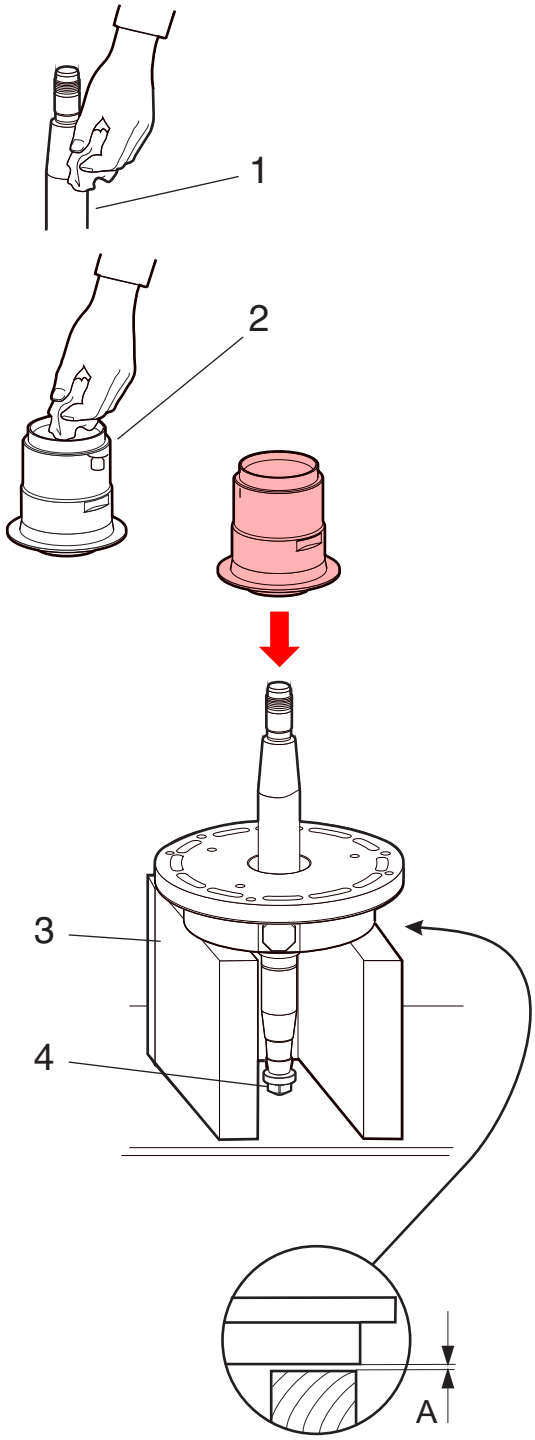
NOTE

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.



G0866771

1. Spindle
2. Spindle pulley
3. Support
4. Cap nut
A. Minimum 1 mm

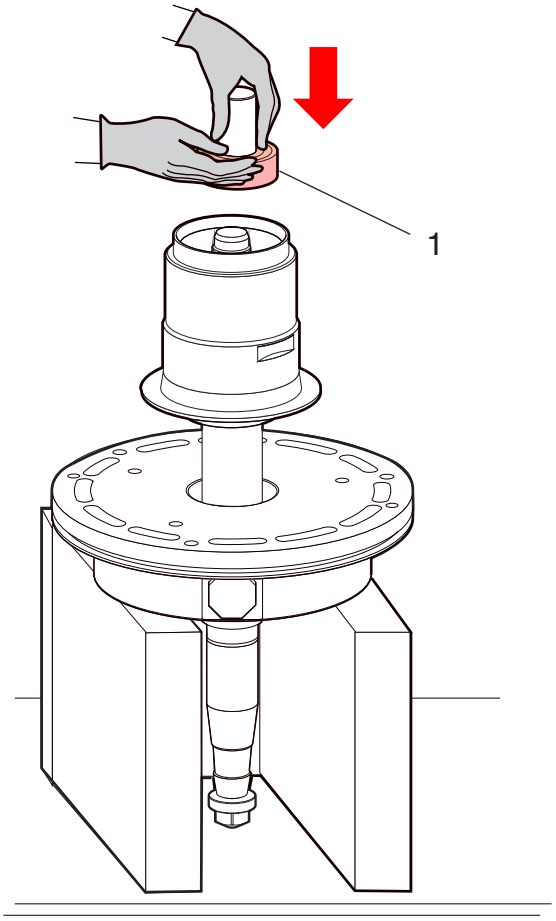
8. Fitting the self-aligning roller bearing. **[o]**

   a. Lubricate the bearing with clean oil.

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

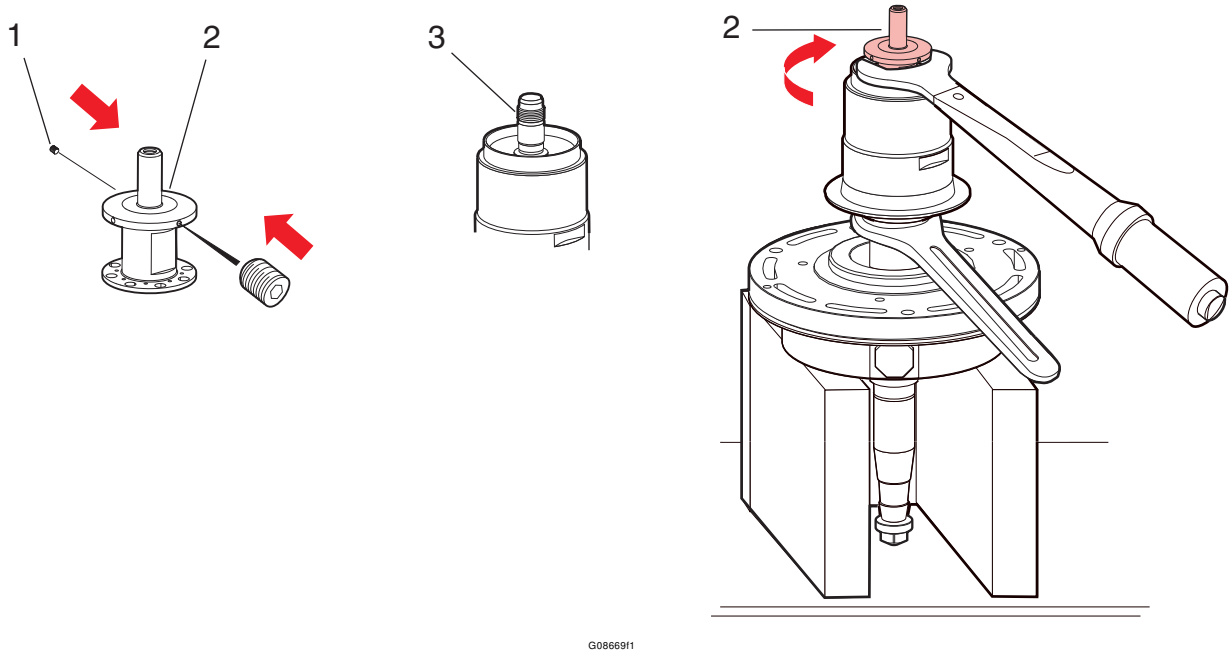
NOTE

Always fit a new bearing.



1. Bearing

9. Fitting the oil mist generator.



G08669f1

1. *Nozzle*
2. *Oil mist generator*
3. *Threads*

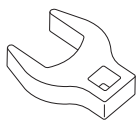
NOTE

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*.



G08669g1

Crowfoot wrench head

10. Fitting the fan.

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

NOTE

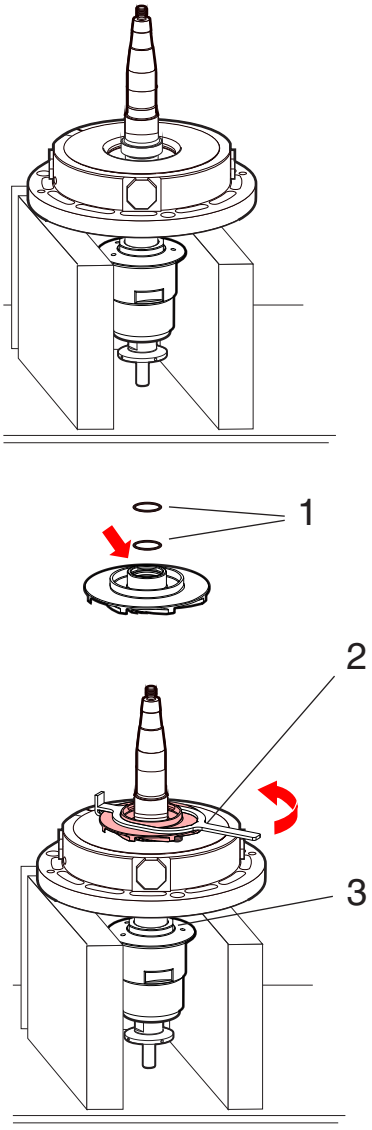
Ensure that the spindle is seated against the inner ring of the ball bearing.

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

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).



G09240o1

1. *O-ring*
2. *Spanner*
3. *Key-grip*

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

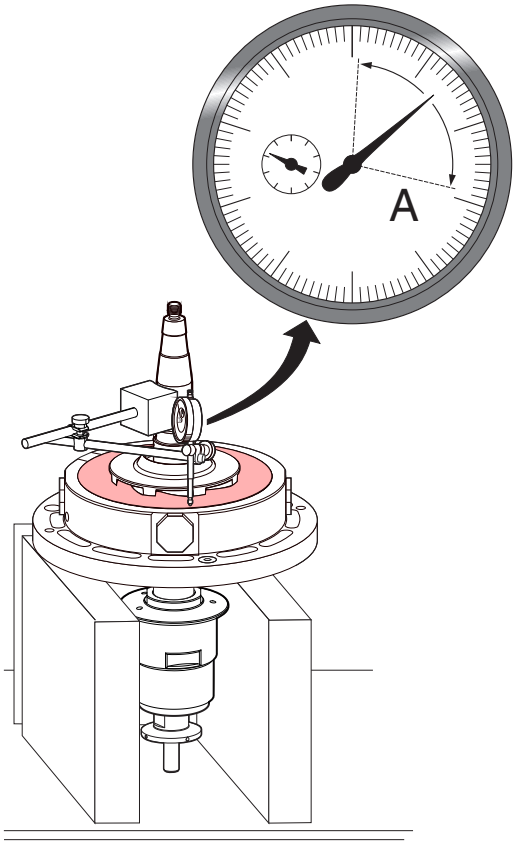
    b. Turn the spindle 360°.

    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.

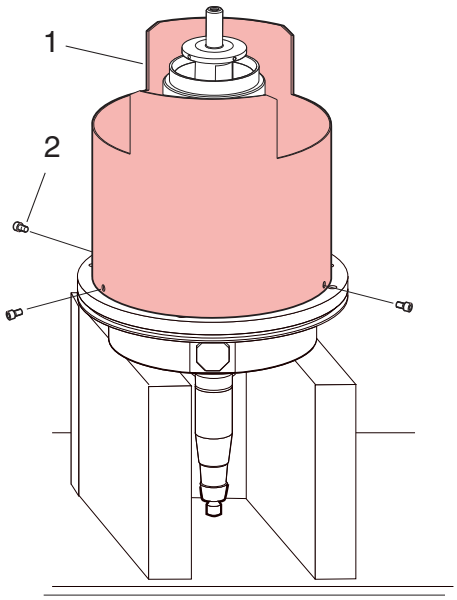


G09240N1

12. Fitting the air deflector.

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

    b. Tighten screws (2).



G08592A1

1. Air deflector
2. Screw

13. Lowering the spindle assembly into the frame.

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

WARNING

Crush hazard

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

NOTE

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

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

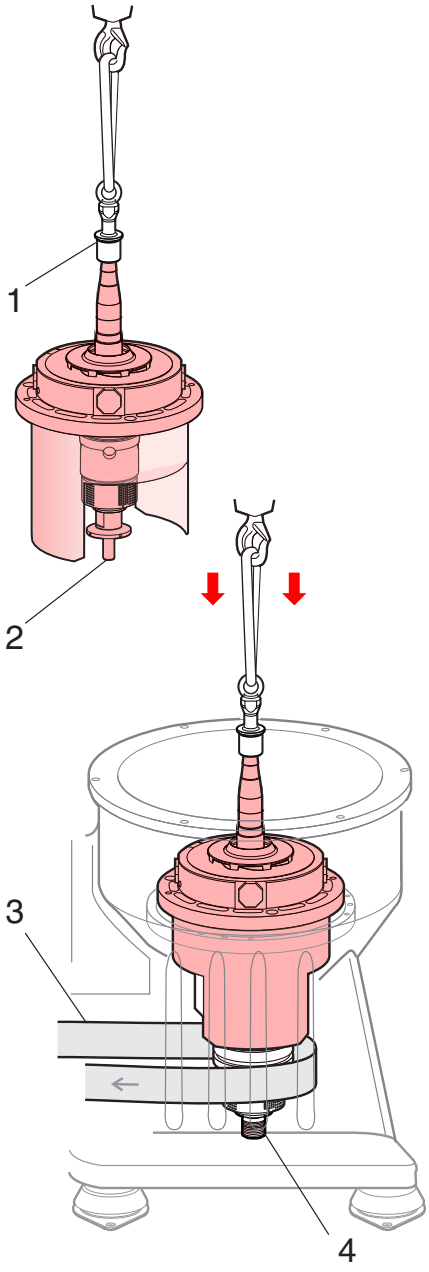
NOTE

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 the spindle does not enter the bearing holder correctly, (gap between frame



G08679D1

1. *Lifting tool*
2. *Oil mist generator*
3. *Flat belt*
4. *Bottom bearing holder*

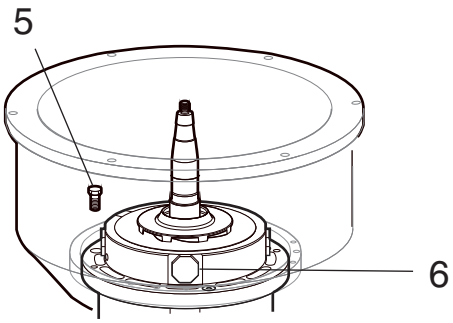
and bearing housing), lift spindle and rotate before lowering it again.

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.



G08679E1

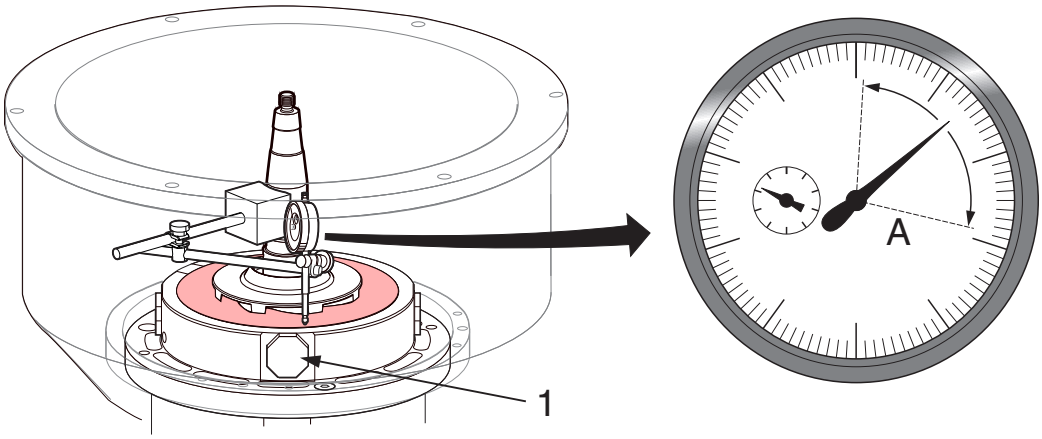
5. Screw
6. Plug

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.

NOTE

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

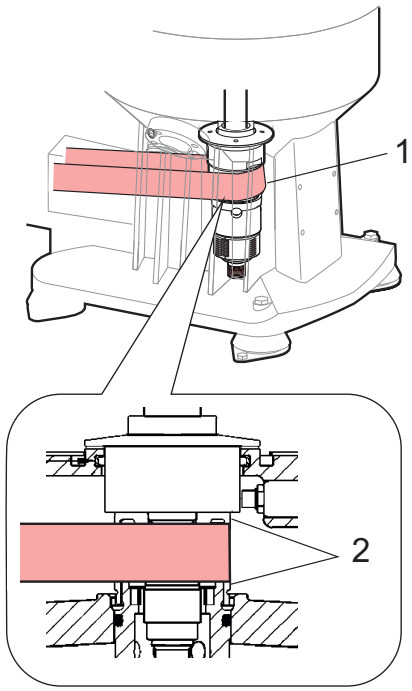
b. Fit the flat belt to the motor belt pulley.

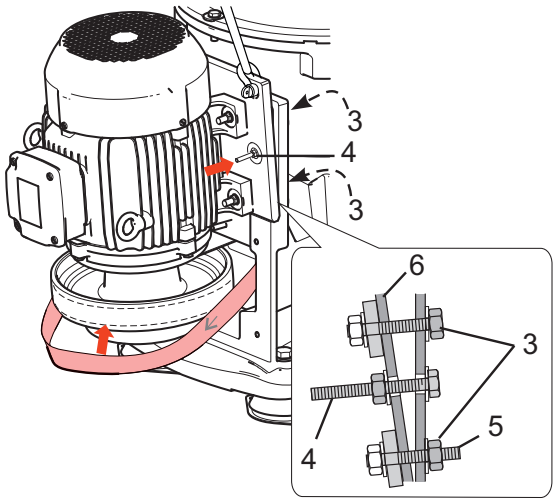
c. Tighten the two tilting screws (4).

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.

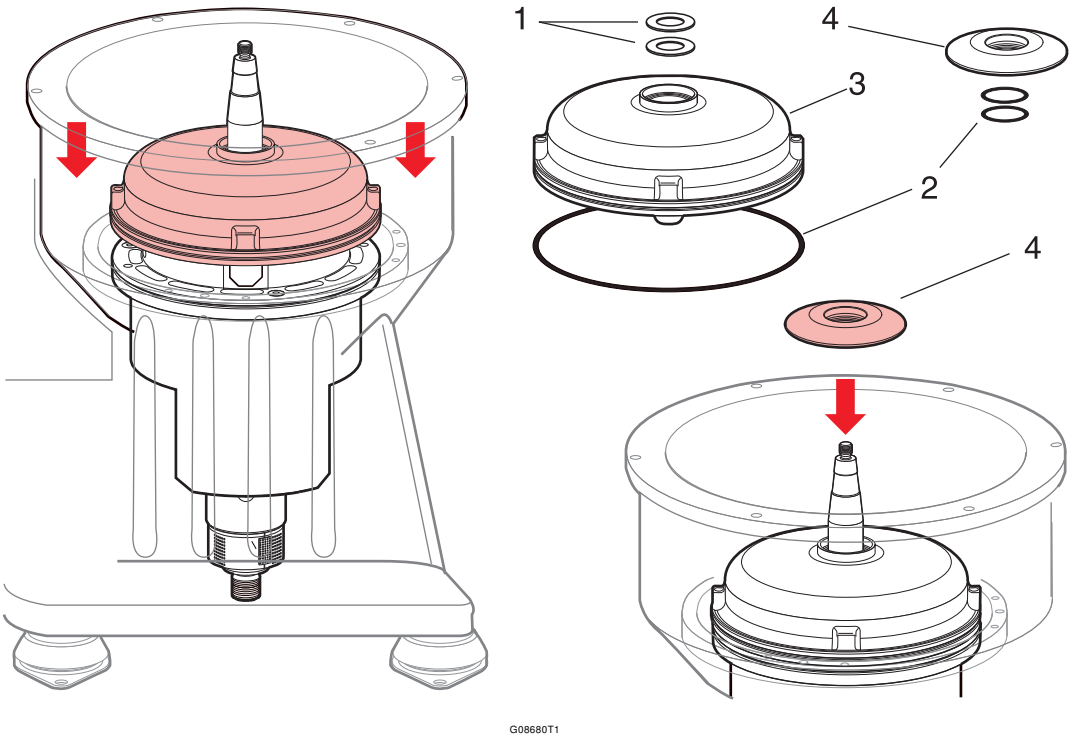




G08646e1

1. *Flat belt*
2. *Clearance*
3. *Nut*
4. *Tilting screw*
5. *Stud bolt*
6. *Adaptor plate*
7. *Separator frame*

16. Fitting the neck bearing cover and deflector ring.



1. *Seal ring*
2. *O-rings*
3. *Neck bearing cover*
4. *Deflector ring*

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

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. **[o]**

NOTE

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

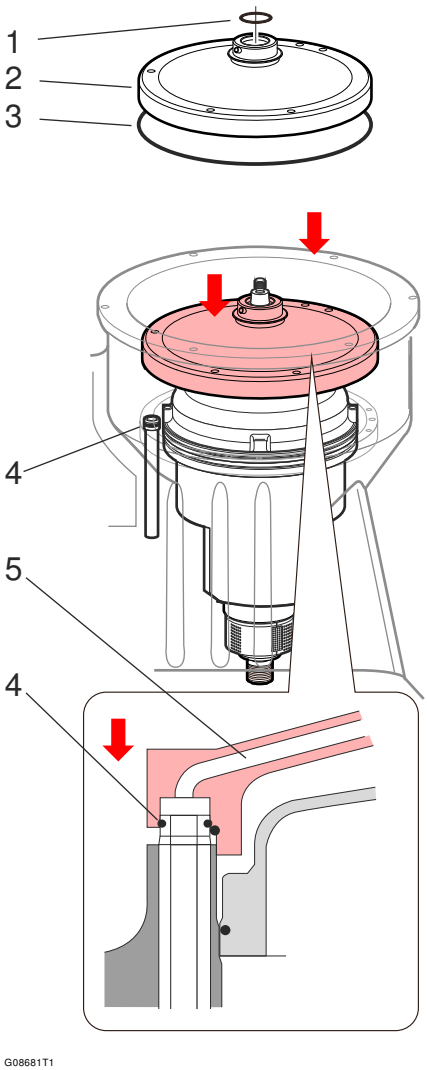
b. Lubricate with oil and fit the seal ring (1) and O-ring (3) into the operating water cover (2). **[o]**

Renew the O-ring (4). **[o]**

c. Fit the operating water cover. Fit washers and tighten the screws.

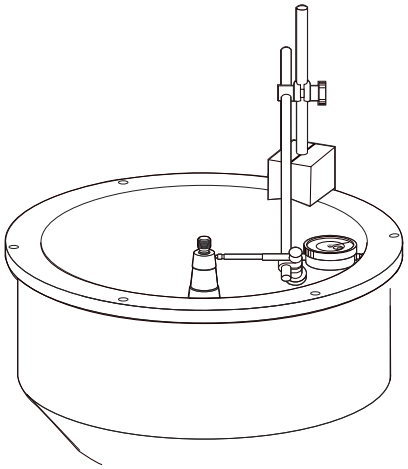
NOTE

The water pipe in the frame should enter the hole in the cover.

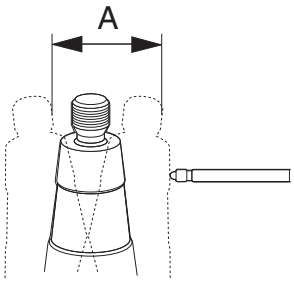


1. *Seal ring*
2. *Operating water cover*
3. *O-ring*
4. *O-ring*
5. *Operating water channel*

18. Measuring the radial wobble of the bowl spindle.



G0858721



A=max. 0,04 mm

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

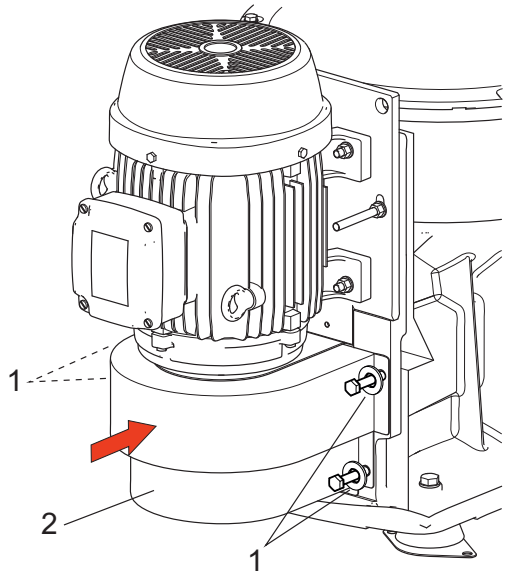
NOTE

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 (2).

    b. Tighten the screws (1).



G1045941

1. Screw
2. Belt cover

20. Fill oil in the oil sump.

NOTE

The separator should be level when oil is filled.

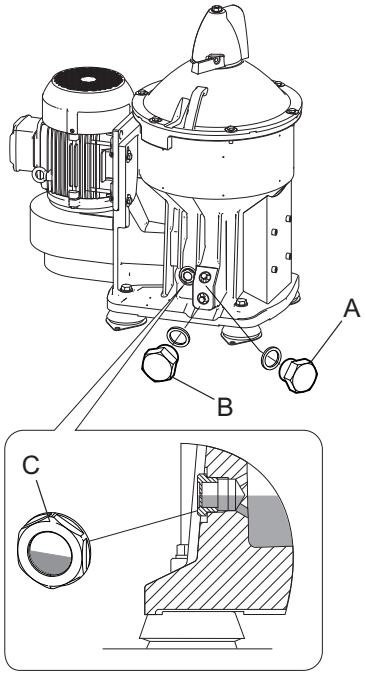
a. Fit new washer and refit the drain plug (B). **[i]**

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 194

NOTE

For grade and quality of oil see 6.6.6 Lubricating oils on page 179**.**

c. Refit the plug (A) with new washer. **[i]**



G1041391

A. Plug
B. Drain plug
C. Sight glass

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.

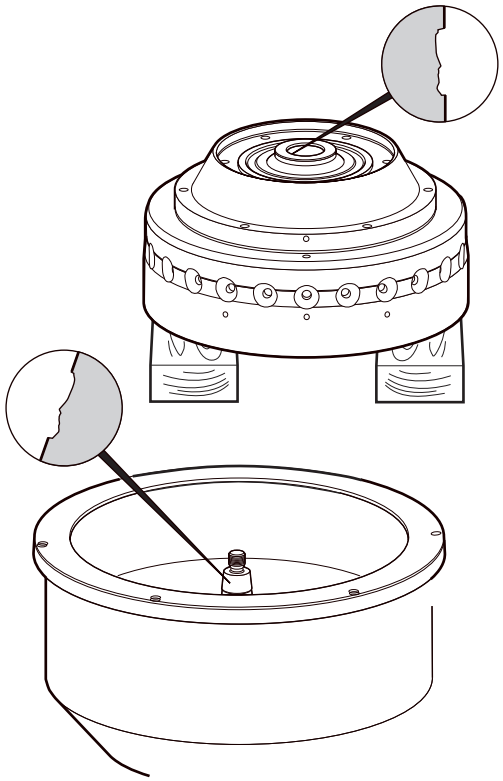
   CAUTION

   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.



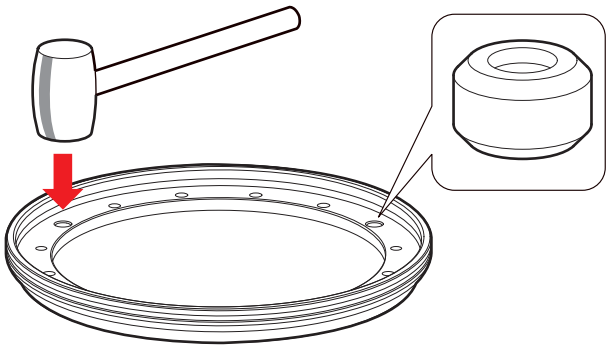
G0874621

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.

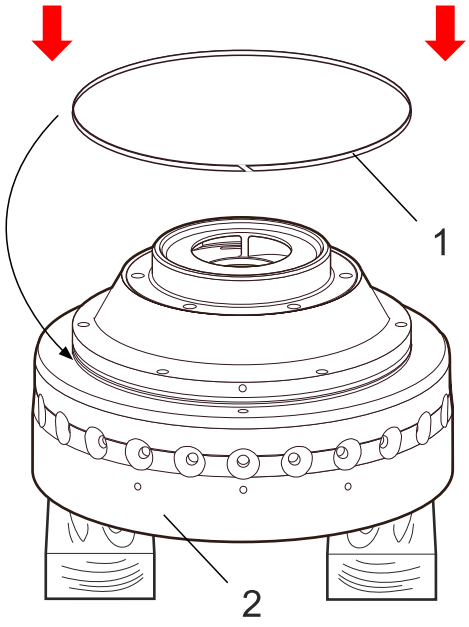


G0874871

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.

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.



G08610p1

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).

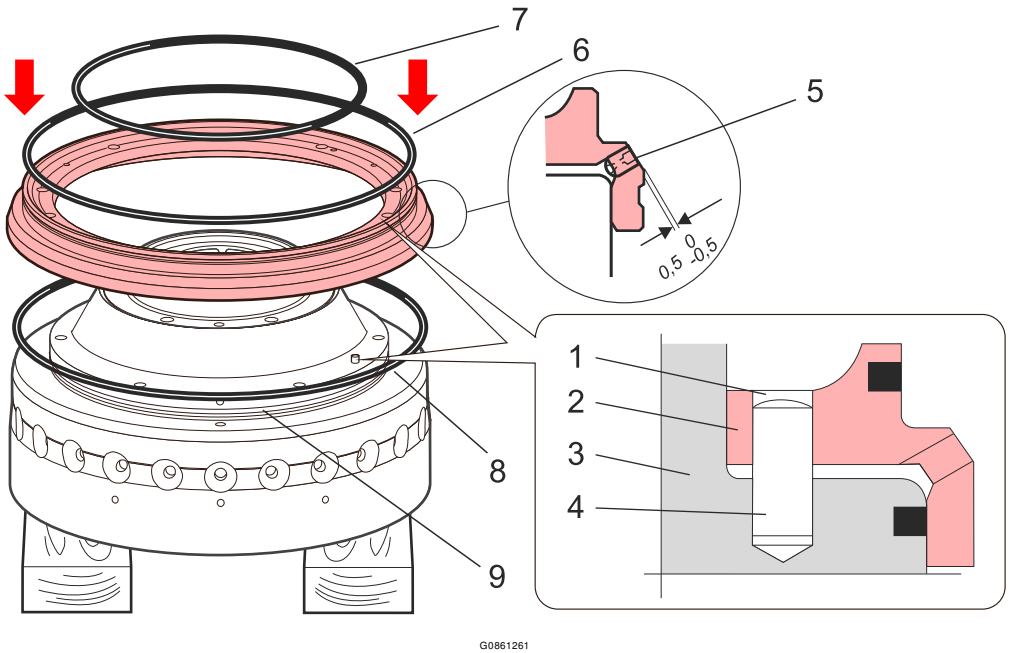
NOTE

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

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.



1. *Alignment hole*
2. *Operating slide*
3. *Bowl body*
4. *Guide pin*
5. *Nozzle*
6. *Rectangular ring*
7. *O-ring*
8. *Rectangular ring*
9. *Guide ring*

5. Fitting the operating slide holder.

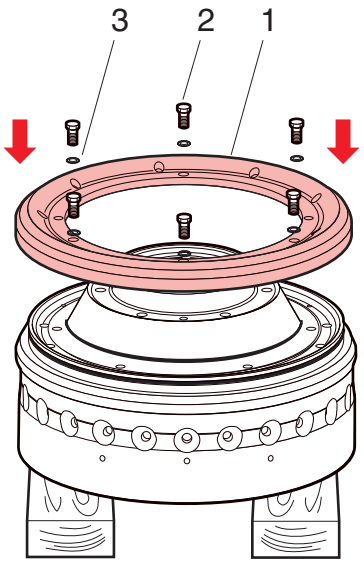
   a. Fit the holder (1) over the operating slide.

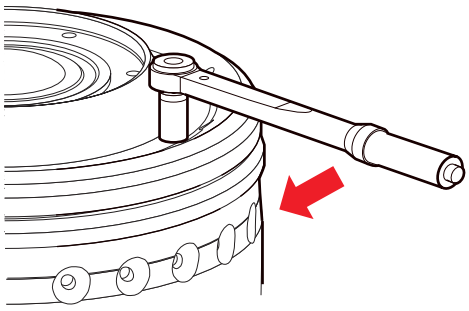
   b. Apply a thin layer of molykote grease and fit and tighten new screws (2) and washers (3) to a torque of *30 ± 2 Nm*. **[i], [o]**

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.





G0861351

1. Holder
2. Screw
3. Washer

6. Fitting the operating water ring.

a. Assemble the seal ring (5) into the operating water ring (2). **[i], [o]**

NOTE

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

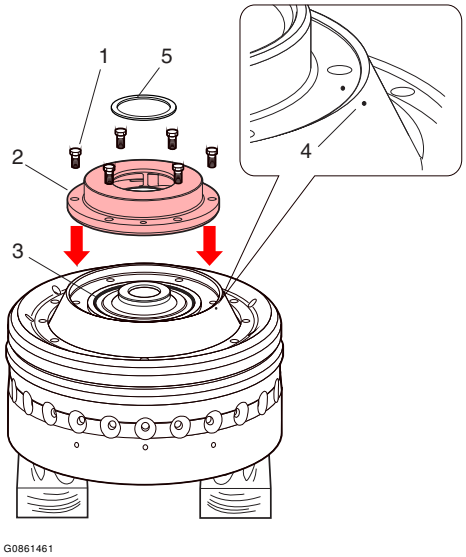
b. Apply a thin layer of silicone grease and fit the O-ring (3). **[i], [o]**

c. Fit the ring (2) with screws (1) 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*.



1. *Screw*
2. *Operating water ring*
3. *O-ring*
4. *Drill mark*
5. *Seal ring*

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.

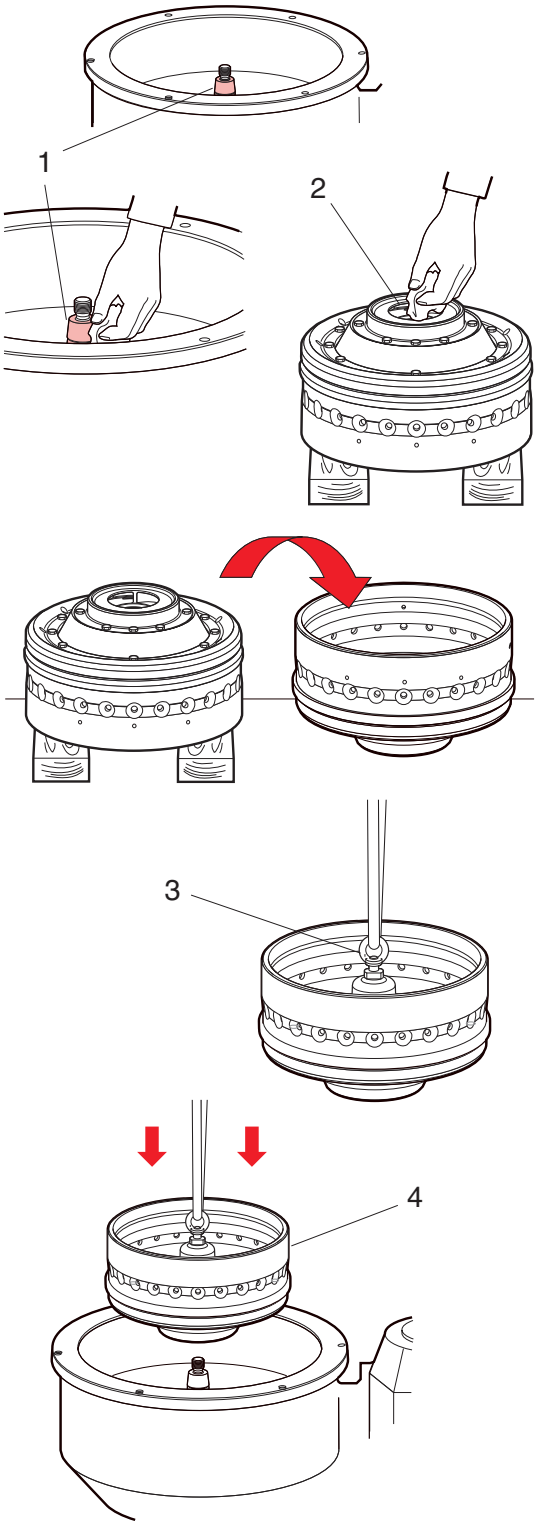
Crush hazard

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.



G0861741

1. Spindle taper
2. Nave bore
3. Lifting tool
4. Bowl body

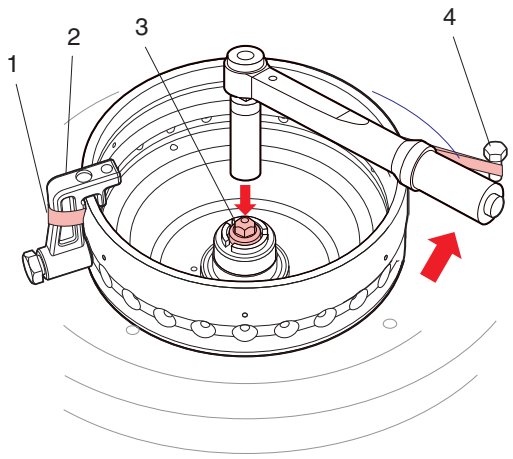
8. Fitting and tightening the cap nut.

   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!



G0861891

1. *Sling*
2. *Clamp*
3. *Cap nut*
4. *Screw*

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.

Crush hazard

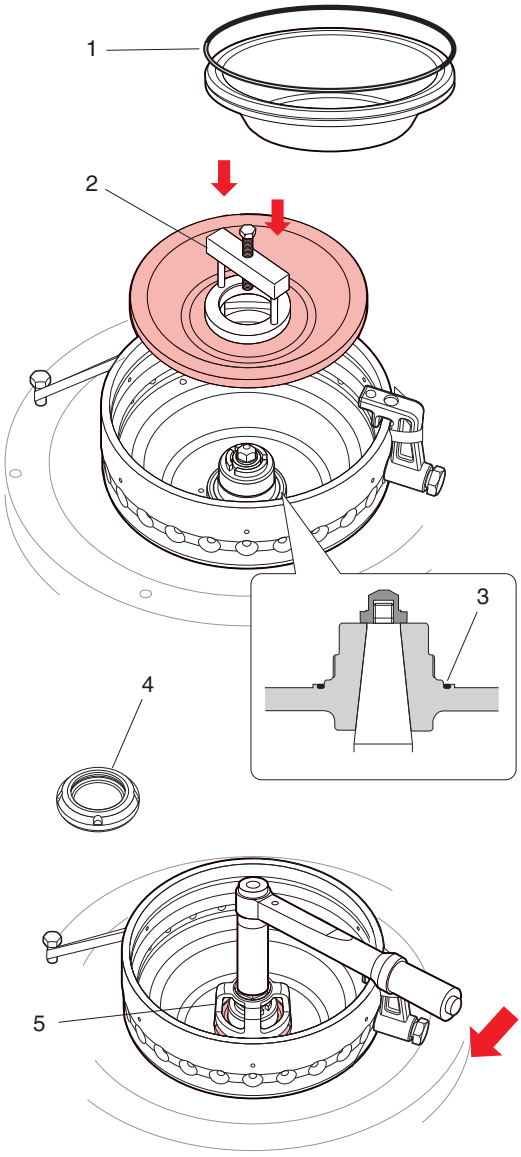
The ring on the lifting tool must be pushed down against the discharge slide, otherwise it may come loose from the tool.

d. Remove the lifting tool.

e. Fit the nut (4).

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.



1. *Rectangular ring*
2. *Lifting tool*
3. *O-ring*
4. *Nut*
5. *Spanner for nut*

10. Assembly of the disc stack.

a. Fit the discs (1) one by one onto the distributor. The distributor has a guide rib (4) for the correct positioning of the bowl discs. Always end with the disc without caulks.

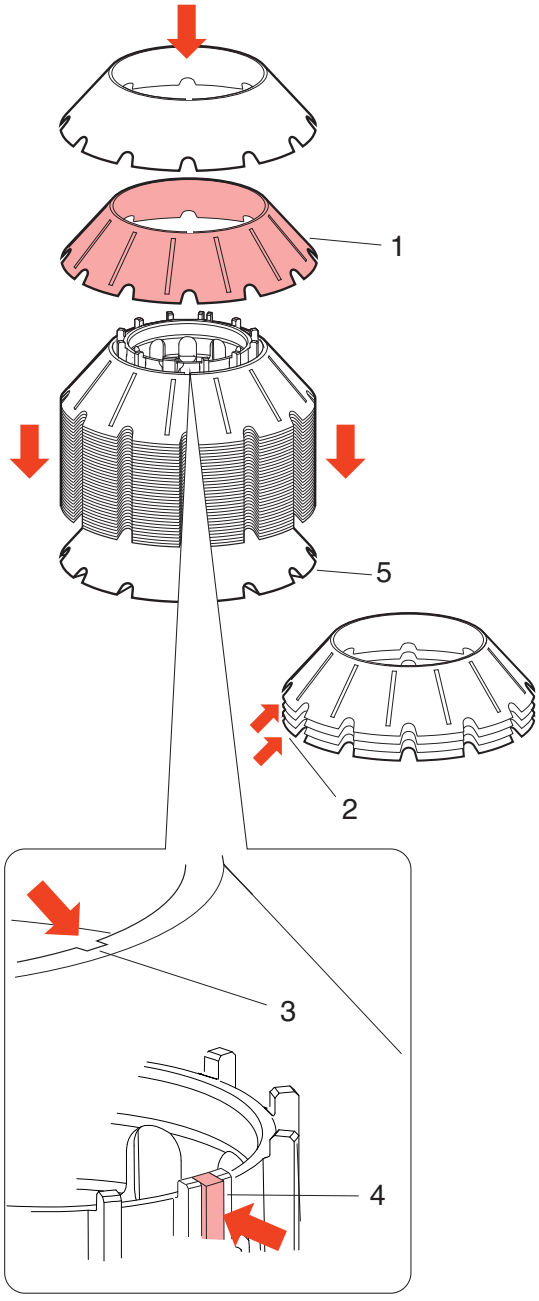
WARNING

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

CAUTION

Cut hazard

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



G08620E1

1. *Bowl disc*
2. *Sharp edge*
3. *Recess on bowl disc*
4. *Guide rib on distributor*

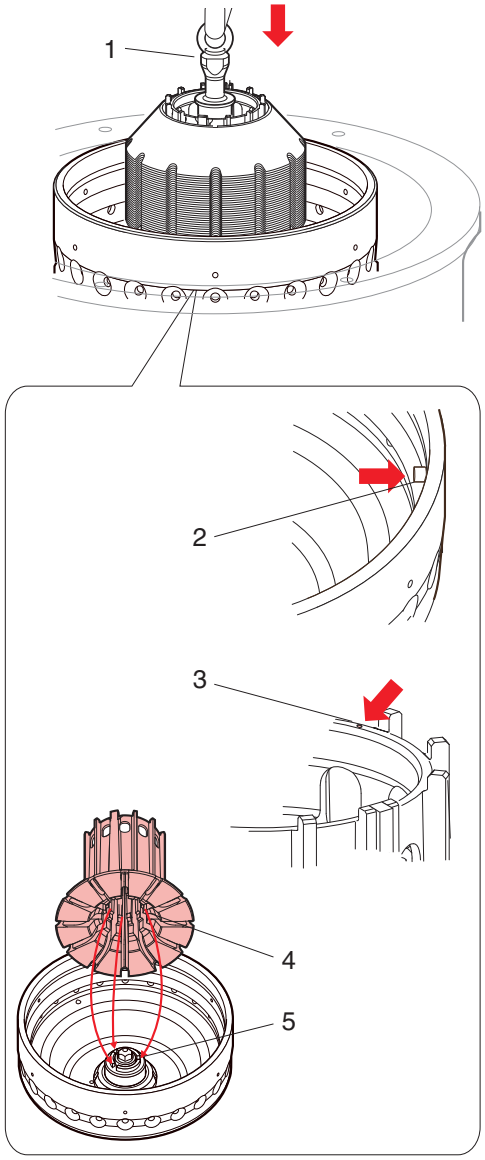
11. Fitting the disc stack assembly to the bowl body.

    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.



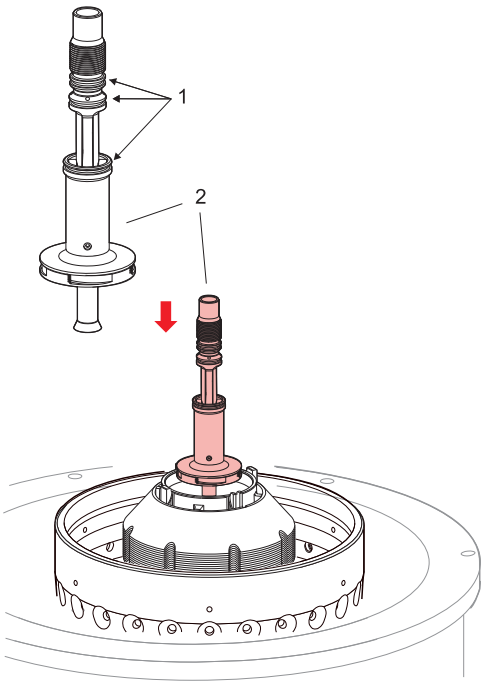
G08621D1

1. *Lifting tool*
2. *Guide pin on bowl body*
3. *Drill mark on distributor*
4. *Guide ribs inside the distributor*
5. *Recesses on bowl body nave*

12. Fitting the inlet and outlet pipe.

    a. Apply a thin layer of silicone grease to the O-rings and fit the O-rings (1)**[i], [o]** to the pipe.

    b. Carefully lower the inlet and outlet pipe (2) assembly into the top of the distributor.



G08622p1

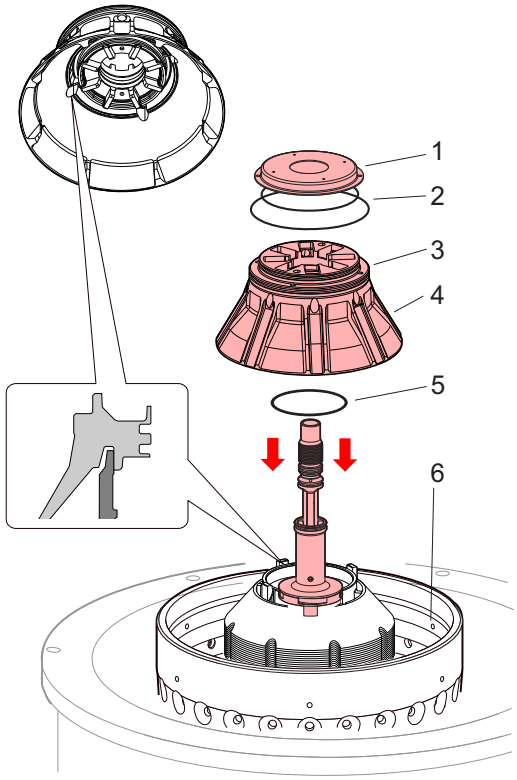
1. O-rings
2. Inlet and outlet pipe

13. Fitting the top disc.

    a. Fit the O-rings (2) **[i], [o]** and gravity disc (1) to the top disc (4).

    b. Lower the top disc. Make sure that the drill mark (3) corresponds to the guide lug (6) inside the bowl body.

       The guide rib on the distributor should enter one of the larger recesses on the top disc.



1. *Gravity disc*
2. *O-rings*
3. *Drill mark*
4. *Top disc*
5. *O-ring*
6. *Guide lug*

14. Fitting the bowl hood.

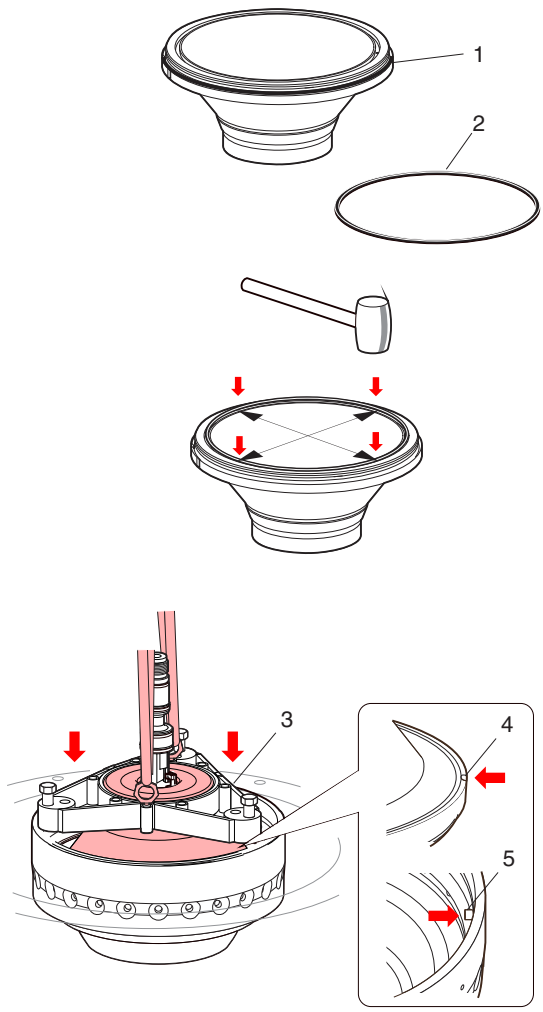
    a. Apply a thin layer of silicone grease and fit the O-ring (1). **[i], [o]**

    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. Lower the bowl hood so that its recess (4) fits into the guide pin (5) in the bowl body.

    e. Remove the compressing tool.



G08624D1

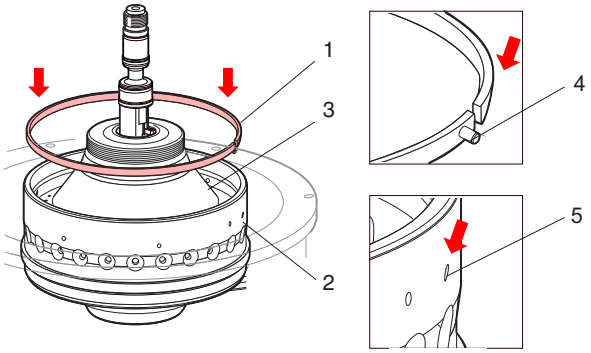
1. *O-ring*
2. *Seal ring*
3. *Lifting tool*
4. *Recess in bowl hood*
5. *Guide pin on bowl body*

15. Fitting the lock ring.

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).

NOTE

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



G08625d1

1. *Lock ring*
2. *Bowl body*
3. *Bowl hood*
4. *Guide pin*
5. *Hole for guide pin*

16. Checking the disc stack pressure. **[i]**

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) (i)

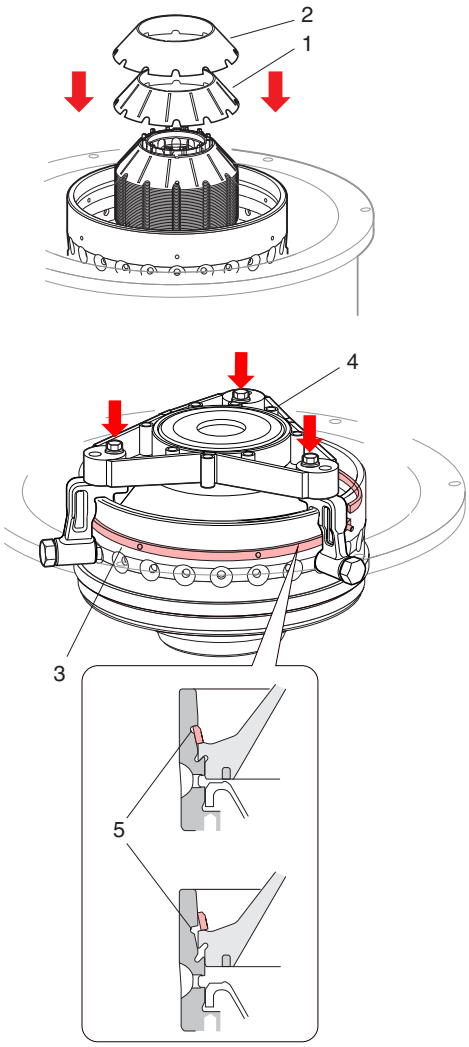
a. Set torque wrench to 18 Nm. Tighten the screws with washers on the compressing tool (4) until the lock ring (3) enters the groove. If lock ring does not enter the groove, increase torque value in increments from 18 to 33 Nm, according to the table below.

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



G08749g1

1. *Bowl disc*
2. *Disc without caulks*
3. *Lock ring*
4. *Compressing tool screw with washer*
5. *Groove*

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 bowl disc and re-check disc stack pressure (1a-1b).

NOTE

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

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

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

- Remove one of the bowl discs and re-check disc stack pressure (1a-1b).

NOTE

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

17. 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.

NOTE

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 4,5 mm.

If the lock ring gap is greater than 4,5 mm, the lock ring is damaged and must be replaced with a new one immediately.

WARNING

Health hazard

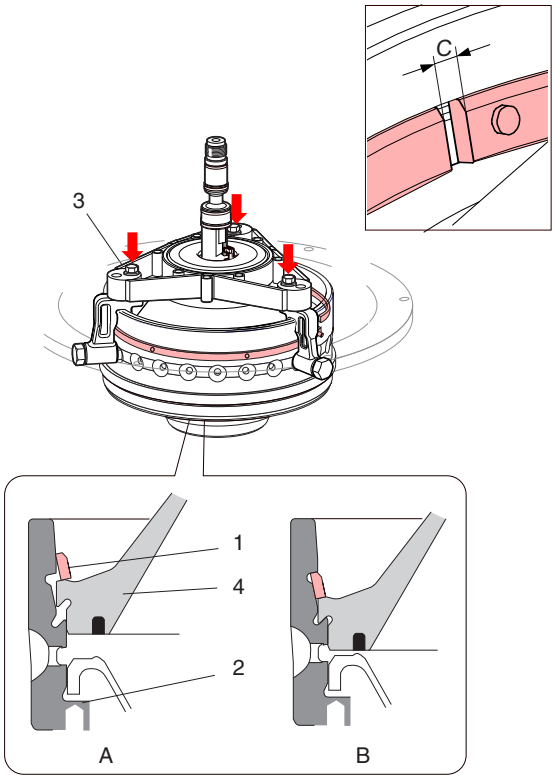
Welding of the lock ring is not allowed, as this can seriously affect the material strength. If the lock ring is either worn beyond the safety limits or incorrectly assembled it may cause severe damage or fatal injury.

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.



G08625g1

1. *Lock ring*
2. *Bowl body*
3. *Compressing tool screw with washer*
4. *Bowl hood*

A. Before compressing
B. Lock ring in position
C. Gap

6.5.4 In- and outlet device

1. Fitting the frame hood **[i], [o]**.

   a. Apply a thin layer of silicone grease (a) to the O-ring and fit the O-ring onto the frame hood. **[i], [o]**.

   b. Lower the frame hood (1).

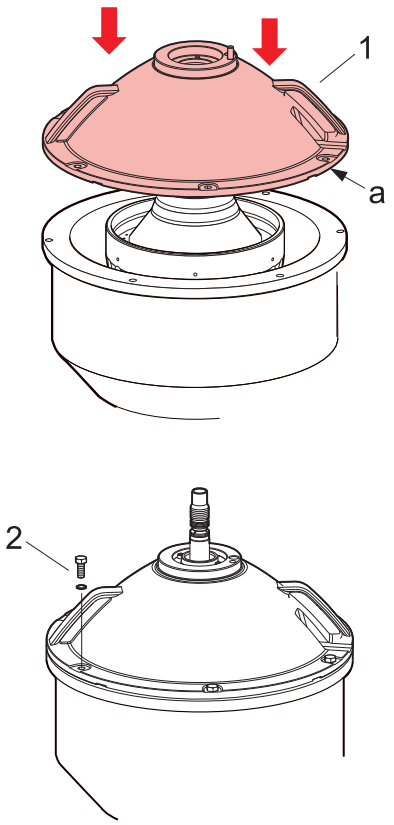
   NOTE

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

   NOTE

   Make sure that the support ring (normally not removed and mounted on the frame hood) is fitted with its lug into corresponding groove on the pipe.

   c. Fit and tighten the screws and washers (2).



1. Frame hood
2. Screws and washers

2. Control measurement of paring disc height. **[o]**

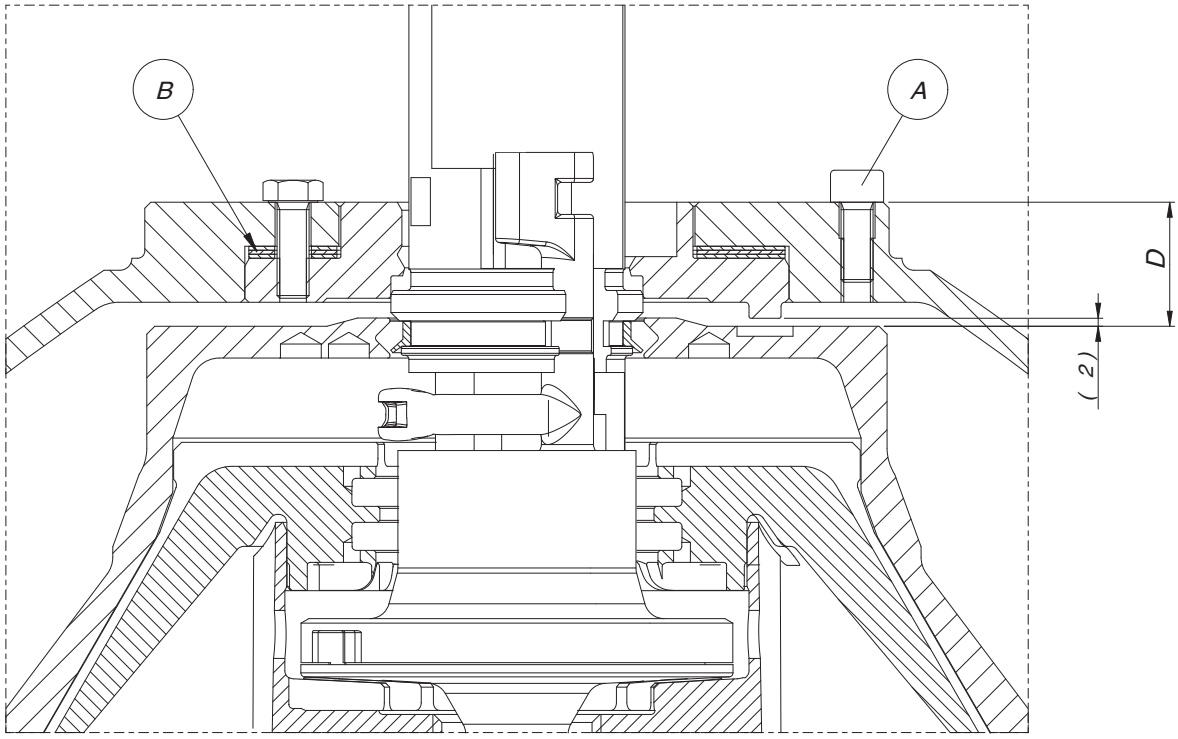
   a. Remove the guide screw (A).

   b. Measure the distance **D** through the screw hole.

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

      - 29 ± 0,5 mm, 3 rings
      - 28 ± 0,5 mm, 2 rings
      - 27 ± 0,5 mm, 1 ring

   c. Refit the guide screw (A)



A. Guide screw
B. Height adjusting rings

3. Fitting the connecting housing.

   a. Lubricate the inlet pipe thread.

   b. Fit the connecting housing (1) over the inlet/outlet pipe.

NOTE

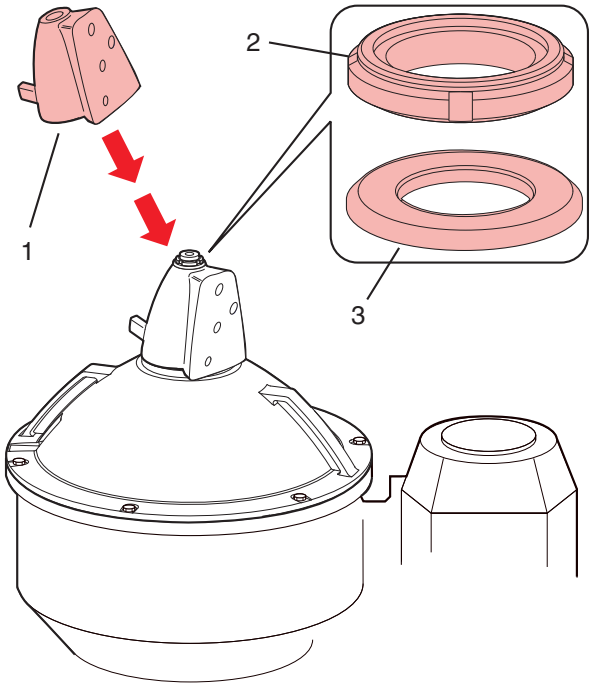
Make sure that the screw, on top of the frame hood, enters the guide hole at the underside of the connecting housing.

   c. Lubricate the lock nut threads.

   d. Fit the washer (3) and the lock nut (2) using the hook spanner.

NOTE

Fine threads on the pipe. Make sure that the lock nut has entered the pipe threads correctly before tightening with the hook spanner.



1. Connecting housing
2. Lock nut
3. Washer

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).

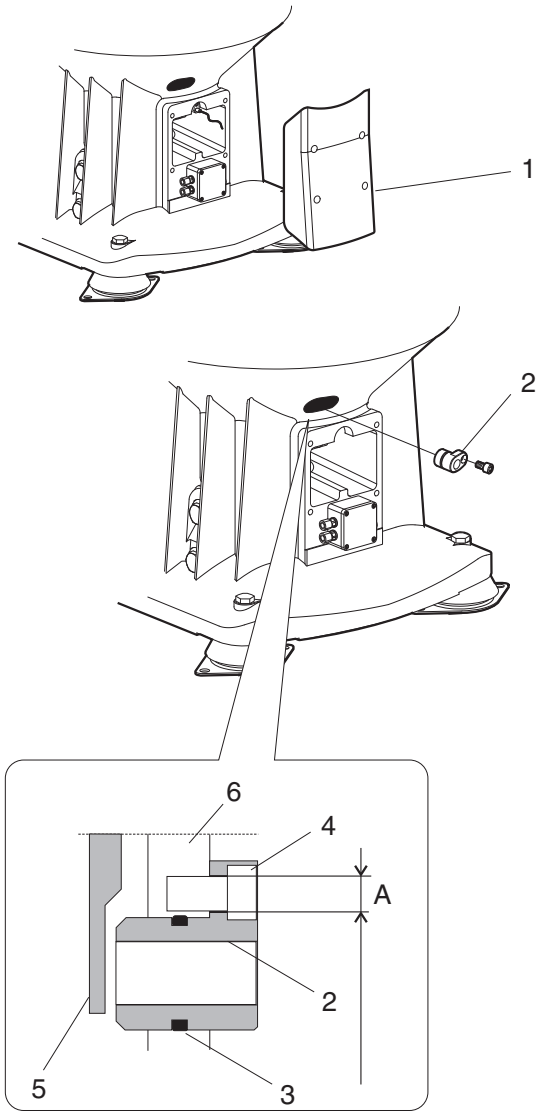
      Fit the screw (4) into the holder and mount the holder into the separator frame (6).

NOTE

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

NOTE

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



G08734G1

1. *Cover*
2. *Sensor holder*
3. *O-ring*
4. *Screw M8*
5. *Sensor arm*
6. *Frame*

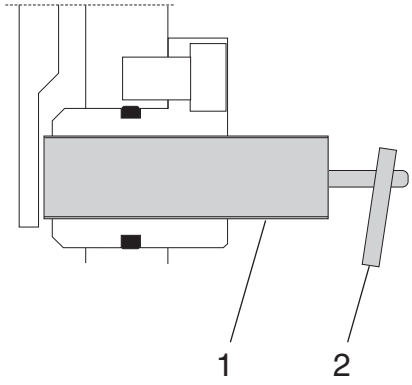
A. *M10*

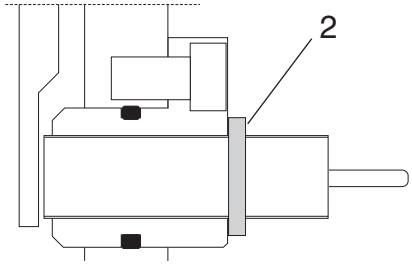
2. Adjusting the unbalance sensor

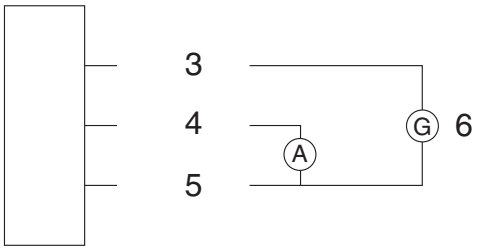
   a. Fit the sensor (1) into the holder. Do not forget the nut (2).

   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 page).







G08734H1

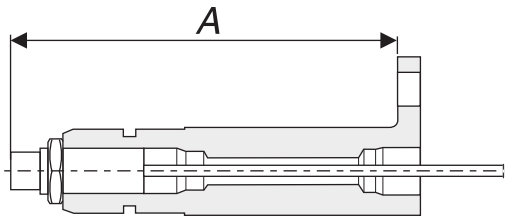
1. Sensor
2. Nut
3. + = brown or red
4. J = black or white
5. OV = blue
6. 24 V DC

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 4.4 Sensors (optional) on page 34.



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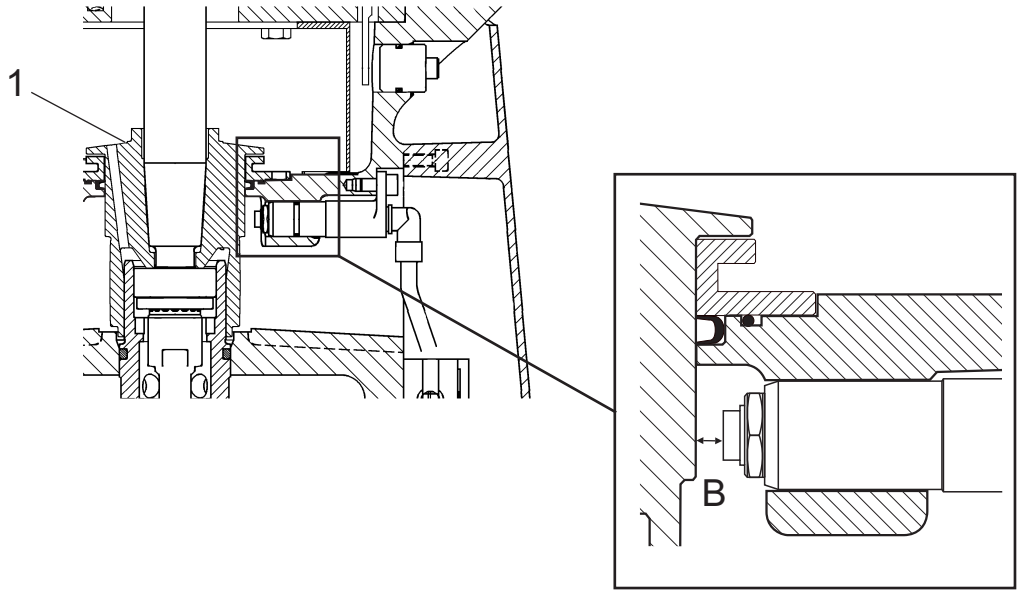
A. Speed sensor distance

NOTE

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

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



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1. Spindle belt pulley
B. Distance between sensor and pulley

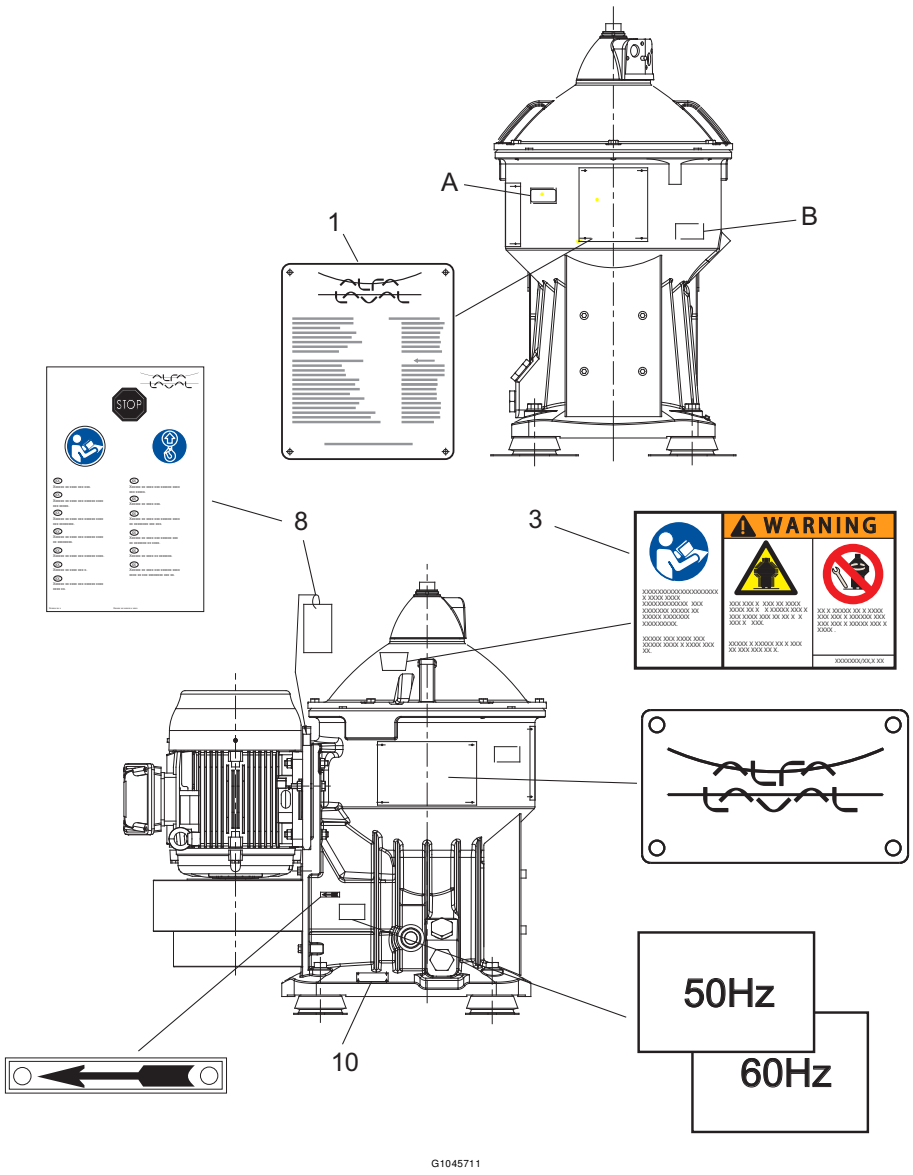
NOTE

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

6.5.7 Actions after assembly

6.5.7.1 Control of machine plates and safety labels

1. Check that the following signs are attached.**[o]**.



1. Machine plate
3. Safety label
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.

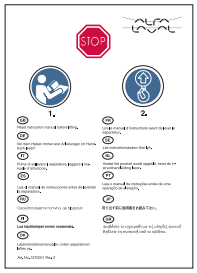
Failure to strictly follow instructions can lead to fatal injury.

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.

6.6 Oil change

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

6.6.1 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.

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

Check the oil level before start. Top up when necessary. For correct oil volume, see “Lubricating oil” in the table on page 194.

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.

6.6.2 Check oil level

1. Check that oil level can be seen in the sight glass.

6.6.3 Oil change procedure

1. Remove the oil filling plug (A).
2. Place a vessel under the drain plug (B).
3. Remove the drain plug.

CAUTION

Burn hazard

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

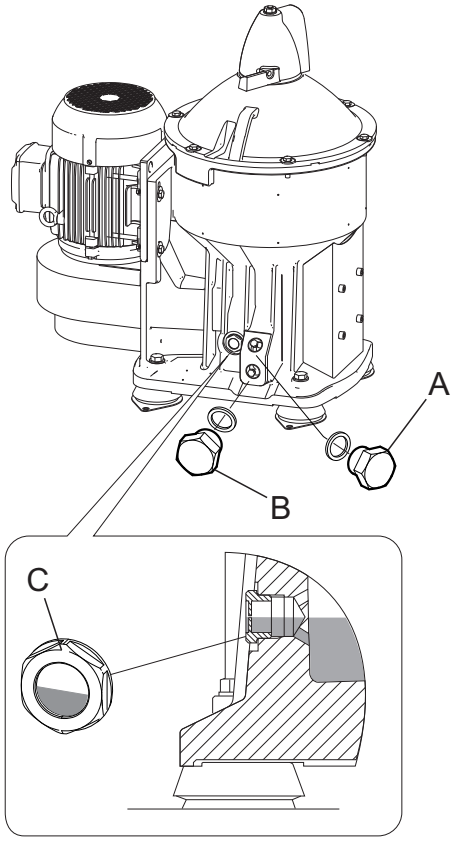
4. Collect the oil in the vessel.
5. Fit and tighten the drain plug (B).
6. Fill with new oil filler hole (A).

NOTE

For grade and quality of oil, see 6.6.6 Lubricating oils on page 179**.**

For correct oil volume, see “Lubricating oil” in the table on page 194**.**

7. Check the oil sight glass for correct oil level.
8. Fit and tighten the plug (A)



G1041391

A. Oil fill plug
B. Oil drain plug
C. Sight glass

6.6.4 Lubrication chart

Alfa Laval ref. 567329 02 Rev. 2

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

Do not check the oil level when separator is running.

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

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.

6.6.5 Recommended lubricants

Lubricant recommendation for hygienic and non-hygienic applications

Alfa Laval ref. 553217 01 Rev. 14

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)
-	-	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)

Always follow the lubrication recommendations of the bearing manufacturer.

Grease for ball and roller bearings in electric motors

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	-

6.6.6 Lubricating oils

Alfa Laval ref. 567330 01 Rev. 7

Selection of lubricating oil for belt drive HSS

Select lubricating oil type with regards to ambient temperature.

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

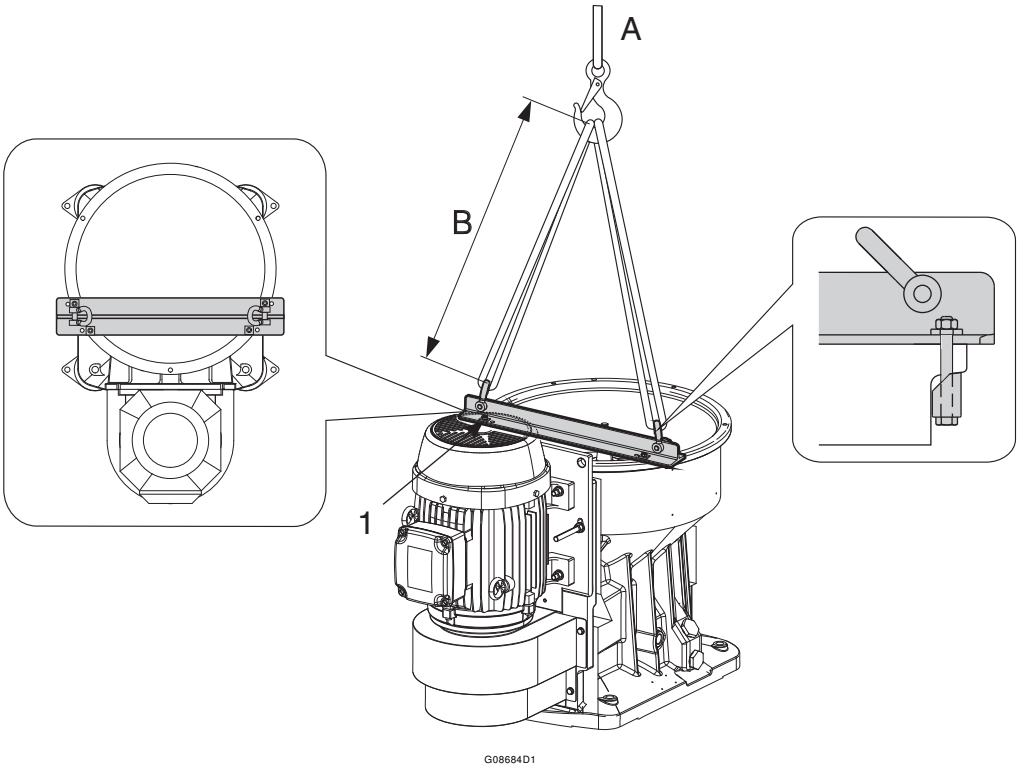
Other information

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

6.7 Lifting instructions

Alfa Laval ref. 9004228 Rev. 0

6.7.1 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 6.3 Dismantling on page 57.

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

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.

Crush hazard

Never lift the separator by the motor adapter plate.

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

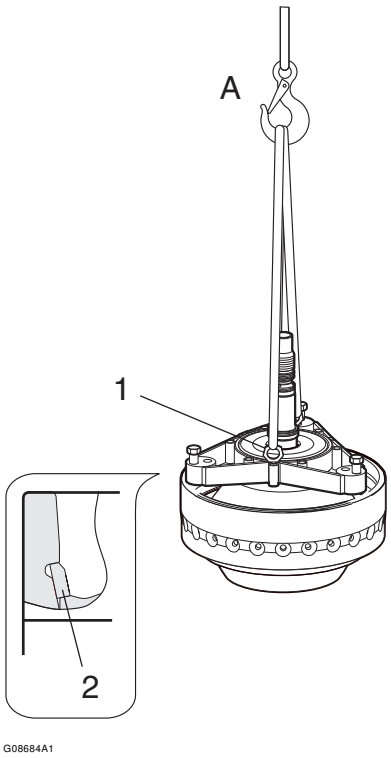
6.7.2 Lifting the bowl

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

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

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.



A. Weight to lift: 75 kg
1. Lifting eye, Tightening torque 40±5 Nm
2. Lock ring (Make sure that lock ring is fitted.)

7 Fault finding

These fault finding instructions are for the separator only. If a fault occurs, study the System Documentation fault finding section (if applicable).

7.1 Mechanical functions

7.1.1 Separator vibration

Disintegration 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.

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

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

7.1.2 Smell

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

7.1.3 Noise

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

7.1.4 Speed too low

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

7.1.6 Starting power too high

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

7.1.7 Starting power too low

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

7.1.8 Starting time too long

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

7.2 Separating functions

7.2.1 Bowl opens accidentally during operation

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

7.2.2 Bowl fails to open for sludge discharge

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

7.2.3 Unsatisfactory separation result

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

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 ring leaking	Renew operating water ring

8 Technical reference

8.1 Product description

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:	881203 09 03
Commercial name:	P646
Application:	Cleaning of fuel oil and lubrication oil.
Technical Design:	Intended for marine- and land installations. Total discharge. Centrilock® lock ring.
Directives and standards:	8.1.1 Declaration - EU on page 190.
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, max. 4 hours.
Maximum allowed density of operating liquid:	1000 kg/m^3.
Viscosity max.:	700 cSt at 50 °C.
Max. light phase density, mineral oil/fresh water separation:	991 kg/m^3 at 15 °C.

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

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

Remote restart allowed under certain conditions, see Interface description.

8.1.1 Declaration - EU

Alfa Laval ref. 589764 Rev. 12

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

Manufacturer: Alfa Laval Technologies AB
Manufacturer address: Alfa Laval Technologies AB, Box 74. SE-221 00 Lund - 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 fulfilled: 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 :2014	Centrifuges - Common safety requirements
EN 60204-1 :2018	Safety of machinery - Electrical equipment of machines. Part 1: General requirements
EN ISO 12100 :2010	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 63000:2018	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 Technologies AB, Box 74. SE-221 00 Lund, 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 Technologies AB

Place: .....

Date of issue: .....

Signature: .....

Name: .....

Function: .....

Entity: .....

8.1.2 Declaration - UK

Alfa Laval ref. 589764 Rev. 12

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

Manufacturer: Alfa Laval Technologies AB
Manufacturer address: Alfa Laval Technologies AB, Box 74. SE-221 00 Lund - 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:

Supply of Machinery (Safety) Regulations 2008
The following essential requirements are applied and fulfilled: 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 :2014	Centrifuges - Common safety requirements
EN 60204-1 :2018	Safety of machinery - Electrical equipment of machines. Part 1: General requirements
EN ISO 12100 :2010	Safety of machinery - General principles for design - Risk assessment and risk reduction

UK Declaration of Conformity

The machinery complies with the following Regulations:

Electromagnetic Compatibility Regulations 2016
The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012

To meet the requirements the following standards have been applied:

Designation	Description
EN IEC 63000:2018	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 Technologies AB, Box 74. SE-221 00 Lund, 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 regulationsmentioned above, in order to fulfill the UK-requirements.

Signed for and on behalf of: Alfa Laval Technologies AB

Place: .....

Date of issue: .....

Signature: .....

Name: .....

Function: .....

Entity: .....

8.2 Technical data

Alfa Laval ref. 9023485 Rev. 1

General technical data

Description	Value	Unit
Motor power		
- 50 Hz	11	kW
- 60Hz	11	kW
Jp reduced to motor		
- 50 Hz	9.85	kgm^2
- 60 Hz	6.87	kgm^2
Gear ratio		
- 50 Hz	3.03:1	-
- 60 Hz	2.53:1	-
Alarm levels for vibration monitor, connection 752, 1st	0.3	mm
Alarm levels for vibration monitor, connection 752, 2nd	0.45	mm
Discharge interval	2-240	minute
Maximum density of operating liquid	1000	kg/m^3
Maximum density of sediment	1400	kg/m^3
Maximum density of feed	1100	kg/m^3
Minimum ratio of density	0.797	
Maximum ratio of density	0.977	
Feed temperature	0 to +100	°C
Maximum running time without flow, bowl empty	60	minute
Maximum running time without flow, bowl filled	60	minute
Bowl material	AL 111 2377-02	-

Operating data

Description	Value	Unit
Bowl speed, synchronous		
- 50 hz	9090	r/min
- 60 Hz	9108	r/min
Motor speed, synchronous		
- 50 hz	3000	r/min
- 60 hz	3600	r/min
Maximum allowed speed	9340	r/min
Maximum power consumption, start-up	17	kW
Power consumption idling	3.5	kW
Power consumption at maximum capacity	9.2	kW
Minimum starting time	1.5	minute
Maximum starting time	2.5	minute
Minimum stopping time	18	minute
Maximum stopping time	35	minute
Sound power level (uncertainty)	9.1 (0.3)	Bel(A)

Description	Value	Unit
Sound pressure level (uncertainty)	76 (3)	dB(A)
Maximum vibration level, separator in use	9.1	mm/s (r.m.s.)

Volume and capacity data

Description	Value	Unit
Bowl liquid volume	4.3	litre
Discharge volume (fixed)	4	litre
Sludge volume, efficient	0.63	litre
Sludge volume, total	1.6	litre
Lubricating oil volume	2.8	litre

Weight information

Description	Value	Unit
Motor drive weight	159	kg
Bowl weight	76	kg
Weight of separator (total)	550	kg

8.3 Connection list

Alfa Laval ref. 9023480 Rev. 1

Connection No.	Description	Requirements/limits
201	Inlet for process liquid Inlet pressure:	 See 8.6.4 Performance data in- and outlet device.
206	Inlet for liquid seal and displacement liquid Flow set value Quality requirements	 13,5 - 16,5 litres/minute See 8.5 Demand specification water.
220	Outlet for light phase Max. counter pressure	 See 8.6.4 Performance data in- and outlet device.
222	Outlet for solid phase Discharge volume Interface	 See 8.2 Technical data. The outlet from the sludge cover must always be arranged to prevent the cover from being filled up with sludge.
(221)	Outlet for heavy phase	
(377)	Outlet for operating liquid	
(463)	Drain of frame top part, upper	
375	Inlet for discharge and make-up liquid Quality requirements Max density Pressure Make-up liquid - Flow (momentary) - Interval - Time Discharge liquid - Flow - Time Closing liquid - Flow - Time Start-up closing liquid - Flow - Time	 See 8.5 Demand specification water. 1000 kg/m^3 Min. 150 kPa < 80 °C 2,8 litres/minute See 8.6.5 Operating water interface. See 8.6.5 Operating water interface. 11 litres/minute See 8.6.5 Operating water interface. 2,8 litres/minute See 8.6.5 Operating water interface. 11 litres/minute See 8.6.5 Operating water interface.
462	Drain of frame top section, lower.	Should be possible to drain liquids by gravity.

Connection No.	Description	Requirements/limits
701	Motor for separator Allowed frequency variation: (momentarily during 5 seconds)	 ± 5% ± 10%
740	Speed sensor for bowl spindle Type Supply voltage, nominal With sensor activated (near metal) With sensor not activated (far from metal) Number of pulses per revolution	See 8.4 Interface description Inductive promixly switch 8 V Less or equal to 1,2 mA. More or equal to 2,1 mA. 1
752	Position transducer for bearing holder, (Unbalance sensor) - Type - Supply voltage - Operation range (mild steel) - Output current analog - Load resistance, R_L	See 8.4 Interface description Inductive analogue sensor 15 to 30 V DC 3,5 mm ± 0,25 mm 4 to 20 mA 1 kOhm max.

8.4 Interface description

Alfa Laval ref. 9022452 Rev. 1

8.4.1 Scope

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

8.4.2 References

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

- Interconnection Diagram
- Connection List
- Technical Data

Standards referred to are:

- EN ISO 13850 Safety of machinery - Emergency stop equipment, functional aspects - 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:

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

8.4.4 Goal

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

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

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

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

8.4.5 Description of separator modes

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

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

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

Stand still means:

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

Starting means:

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

Running means:

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

Stopping means:

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

8.4.6 Remote start

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

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

8.4.7 Handling of connection interfaces

Electrical connections

701 Separator motor.

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

There shall be an emergency stop circuit designed according to EN 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.

740 Speed sensor

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

Signal processing in *STARTING*:

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

Signal processing in *RUNNING*:

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

Signal processing in *STOPPING*:

- *STAND STILL* shall be indicated when no pulses are detected within 30 seconds.
- Stopping the separator when alarm for speed monitoring system failure is active, shall cause a timer controlled stop. (See “Stop time” in 8.2 Technical data on page 194.)

752 Unbalance sensor (optional).

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 on page 194 should be set.

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

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

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

Signal processing in *STARTING*:

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

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

Signal processing in *RUNNING*:

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

Signal processing in *STOPPING*:

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

Signal processing in *NORMAL STOP*:

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

Fluid connections

Complementary information is given in the document Connection List.

201 Inlet

Processing in *STAND STILL*:

- Shall be closed.

Processing in *STARTING*:

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

Processing in *RUNNING*:

- Could be closed or open.

Processing in *CLEANING*:

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

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

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

Processing in *SAFETY STOP*:

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

206 Inlet for conditioning and displacement liquid

- According to process

220, 221 and 222 Outlets

Processing in *STAND STILL*:

- Could be closed or open.

Processing in other modes:

- Shall be open.

375 Inlet for discharge and make-up liquid

Processing in all modes:

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

Signal processing in *STARTING*:

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

Signal processing in *PRODUCTION*:

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

Signal processing in *CLEANING*:

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

Signal processing in *NORMAL STOP*:

- Discharges should not be made.

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

- Discharges should not be made.

8.5 Demand specification water

Alfa Laval ref. 574487 Rev. 2

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

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

NOTE

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

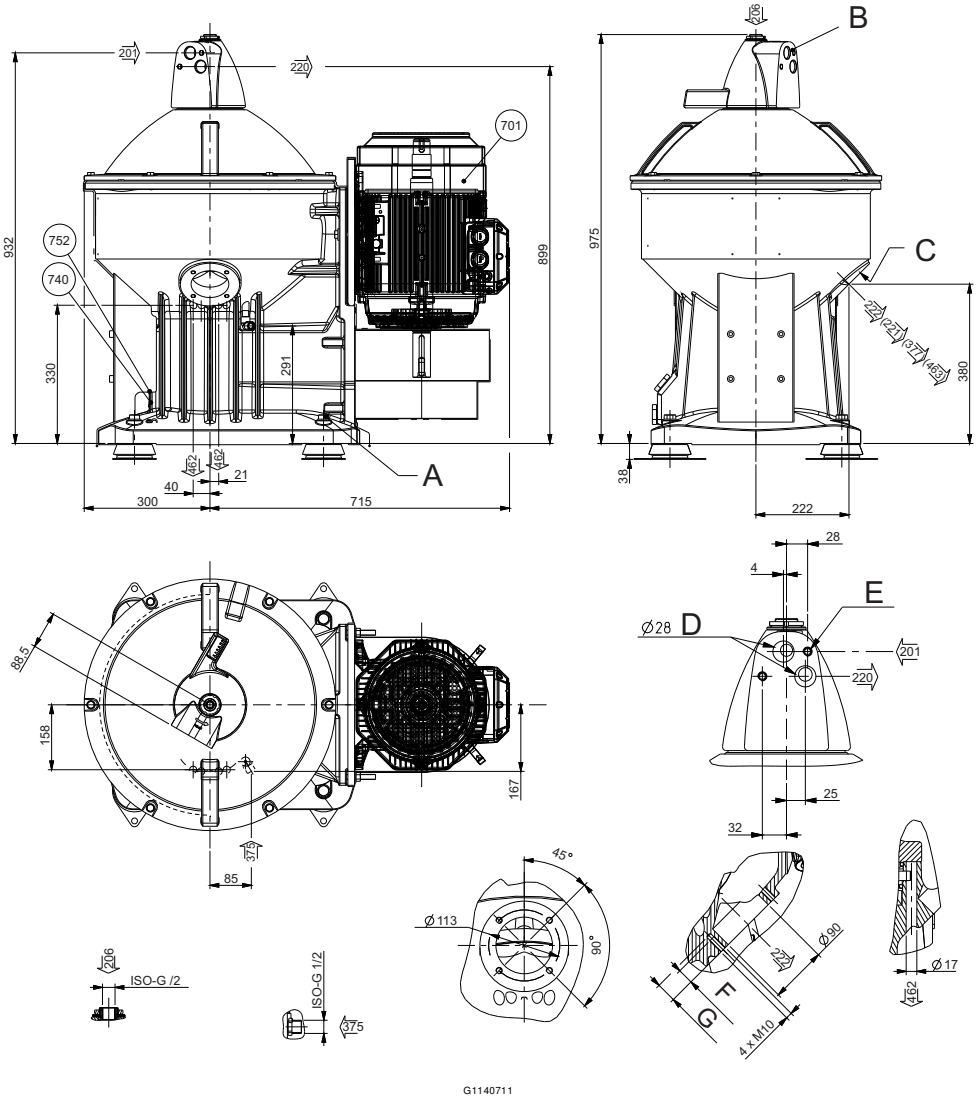
The following conditions must be fulfilled:

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. 9023476 Rev. 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. depth 45
E. 2 holes M10, thread depth 30
F. 25 min.
G. 32 max.

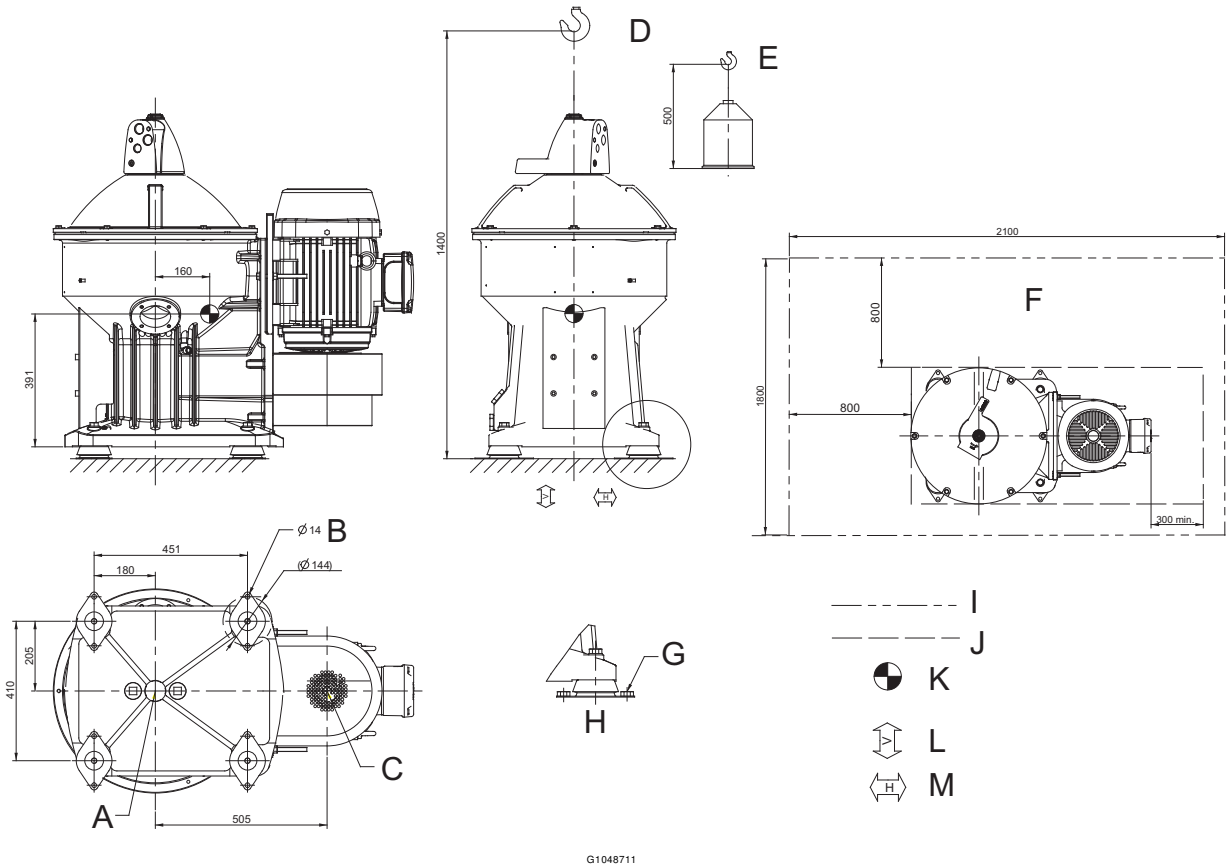
Connection house, with connections 201, 220 and 206, turnable in 60° steps all around.

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. 9004227 Rev. 1

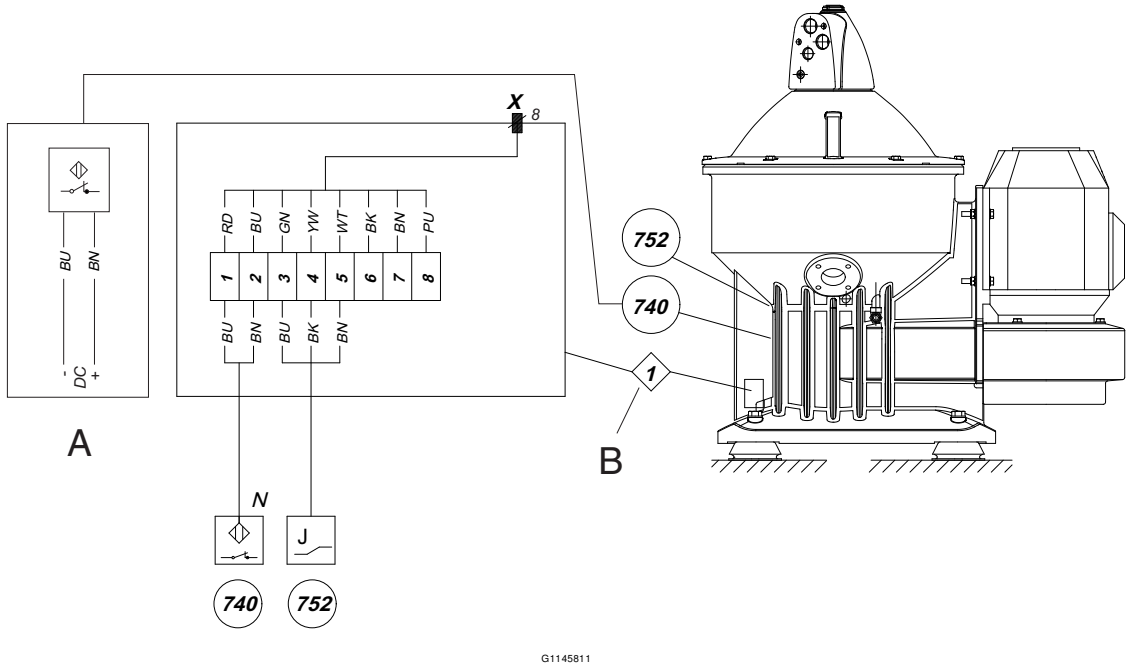


A. Centre of separator bowl
B. 8 holes ø14 for foundation bolt.
C. Centre of motor
D. Max. height of largest component incl. lifting tool
E. Min. lifting capacity required during service: 300 kg.
F. Service side
G. Foundation bolt
H. Installation according to stated foundation force. Foundation turnable 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. 9022427 Rev. 0



A:	Wiring without junction box	Wiring of connector “X”:	Wire colour codes:
B:	Junction box	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

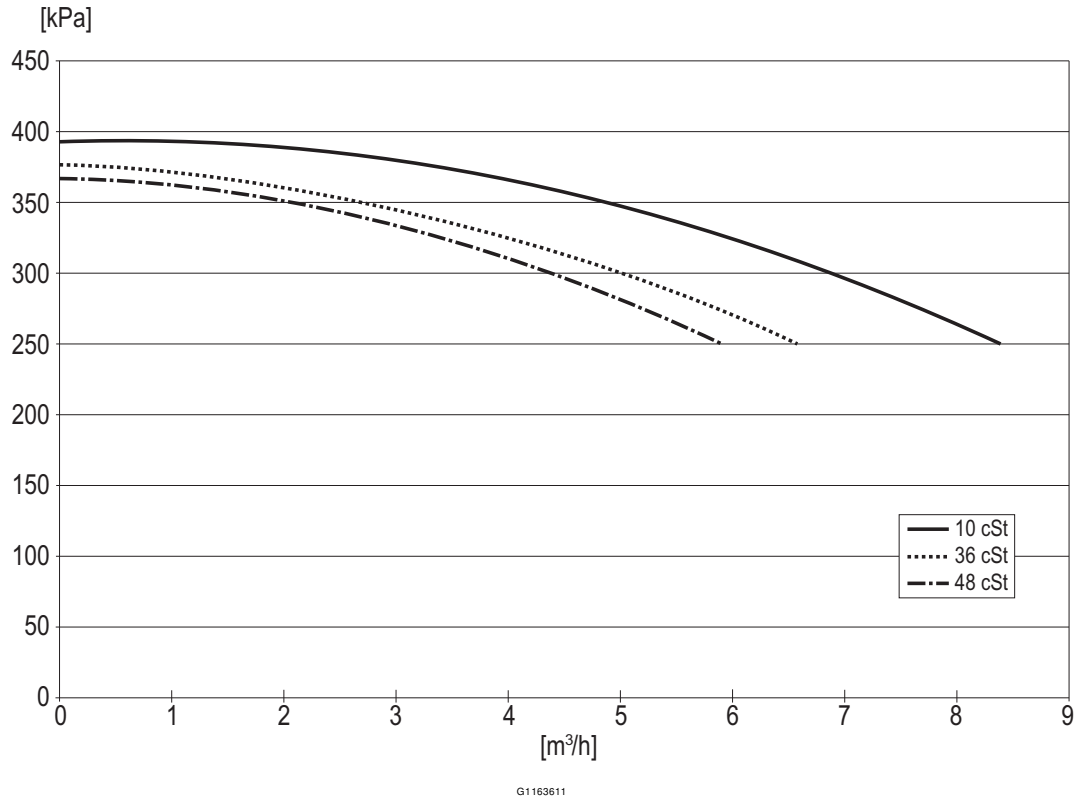
Area acc. to AWG 18

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

8.6.4 Performance data in- and outlet device

Alfa Laval ref. 9023593 Rev. 0

Maximum light phase counter pressure as a function of throughput and viscosity.



8.6.5 Operating water interface

Alfa Laval ref. 9026396 Rev. 1

Proposed operation of operating water interface.

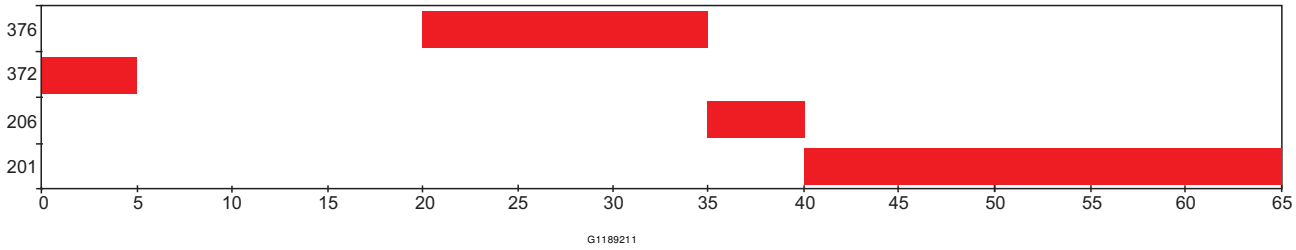
Connection numbers refer to operation of the corresponding ancillary valves. Connections 372 and 376 converge to become connection 375 of the separator.

Information about the flows through connections 206 and 375 see: .

Closing the bowl and supplying liquid seal after start-up:

1. Close the operating slide valves by supplying discharge water (connection 372) for 5 seconds.
2. Pause for 15 seconds.
3. Close the bowl by supplying make-up water (connection 376) for 15 seconds.
4. Apply liquid seal by opening connection 206 for 5 seconds.
5. Open the feed (connection 201)

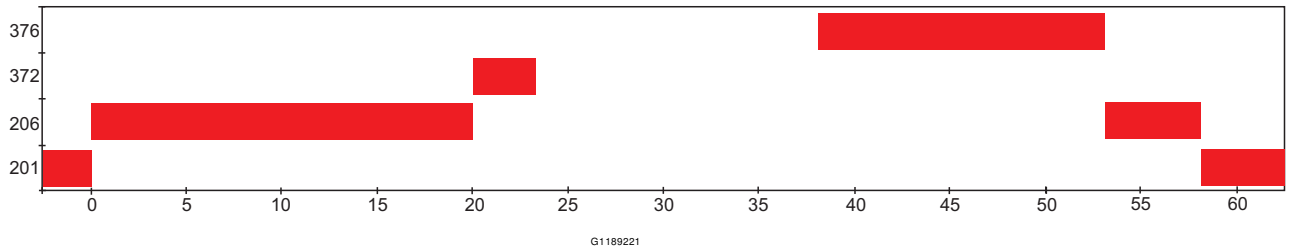
Start-up sequence illustrated graphically:



Performing a discharge:

1. Close the feed (connection 201).
2. Perform a displacement (of the interface) by opening connection 206 for 20 seconds.
3. Initiate a discharge by supplying discharge water (connection 372) for 3 seconds.
4. Pause for 15 seconds.
5. Close the bowl by supplying make up water (connection 376) for 15 seconds.
6. Apply liquid seal by opening connection 206 for 5 seconds.
7. Open the feed (connection 201).

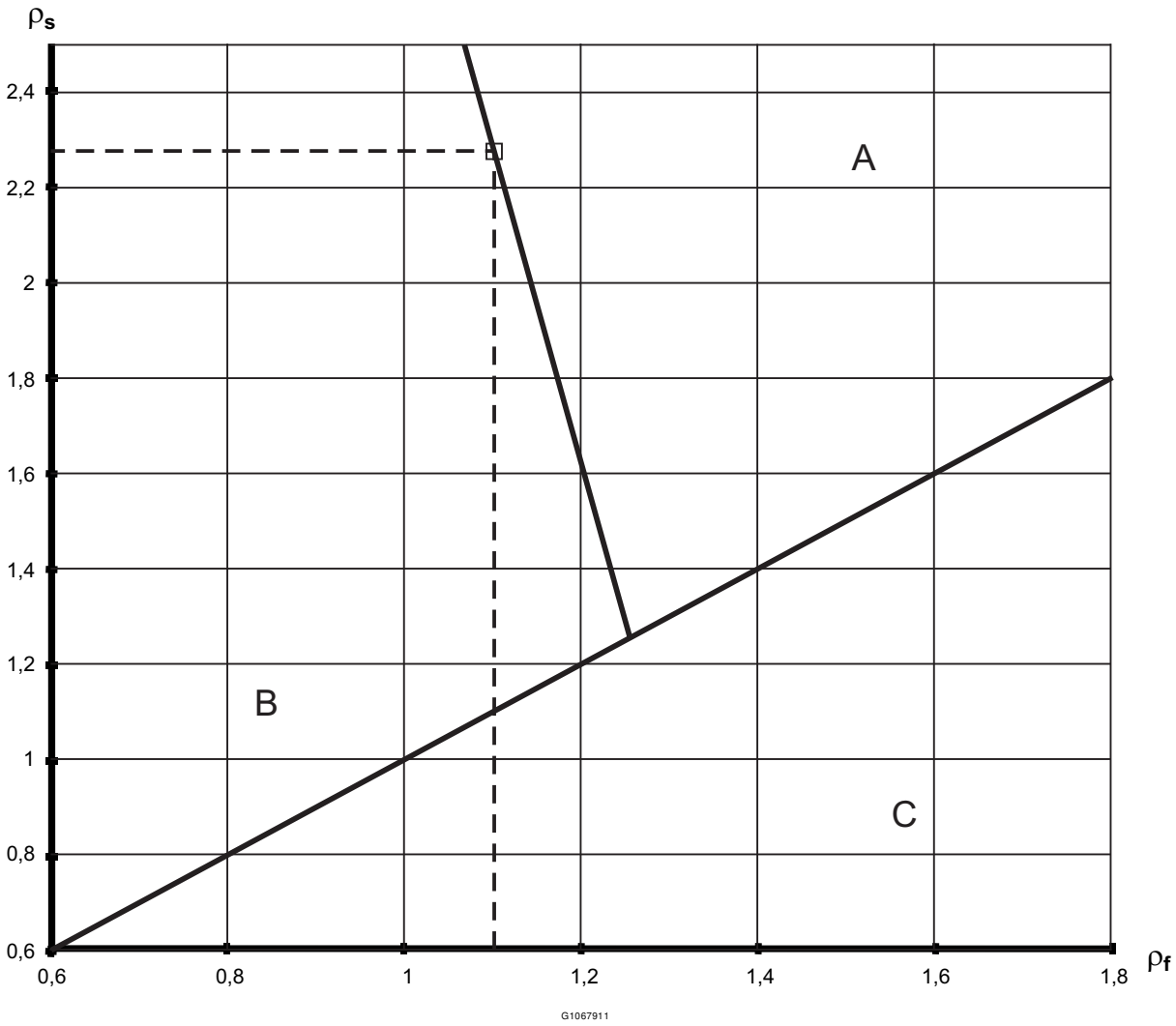
Discharge sequence illustrated graphically:



During the separating process the make-up water supply volume is maintained by opening connection 376 for 1 seconds every 5 minutes.

8.6.6 PX sealing diagram

Alfa Laval ref. 9009985 Rev. 4



A. No sealing
B. Operational envelope
C. Non physical

Separator bowl number: 9006109-01, 9006111-01, 9017343-01, 9023414-01, 9023415-01, 9020188–01

Separator bowl speed: 9090 r/min

References density for Feed: 1100 kg/m^3

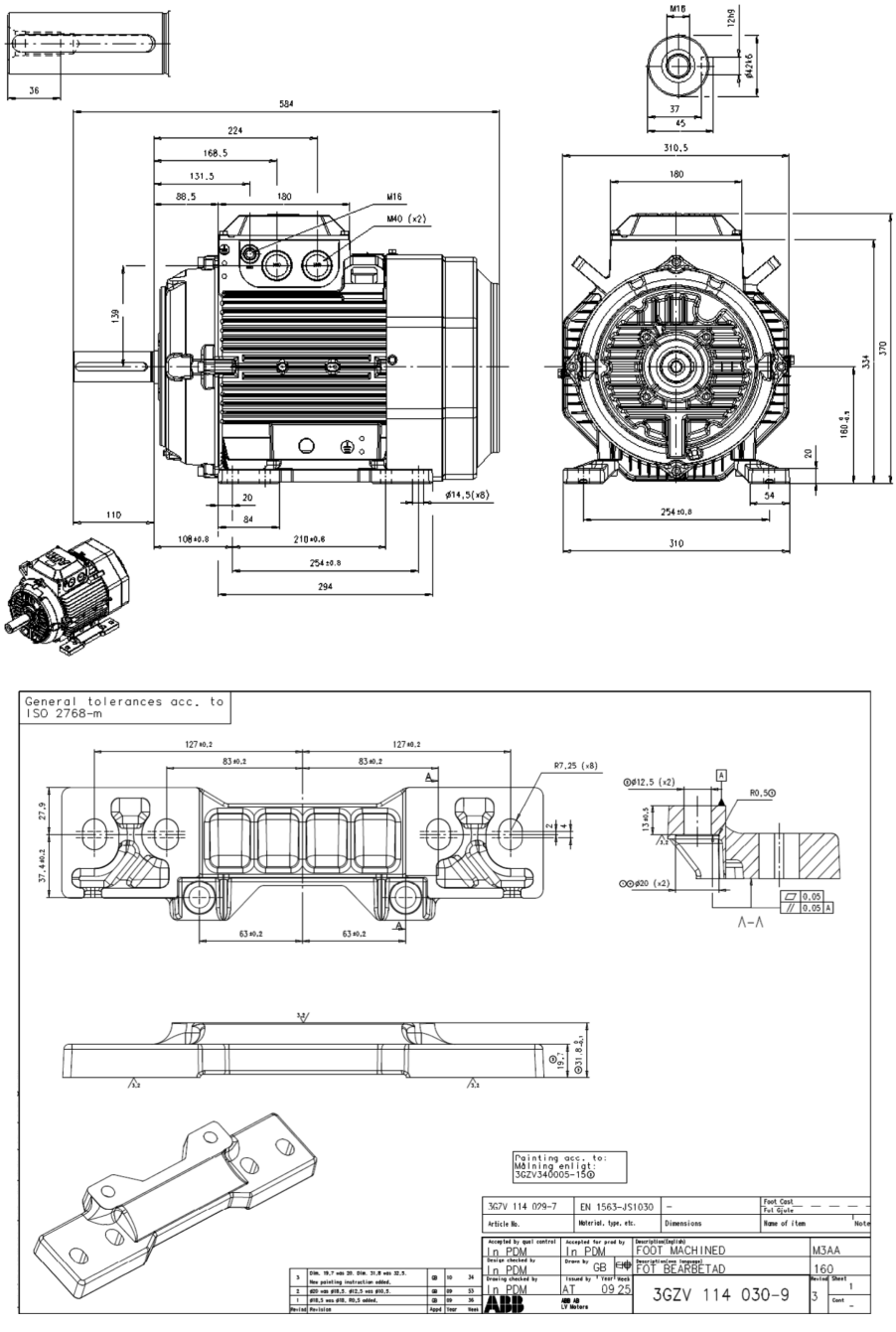
References density for Wet solids: 2270 kg/m^3

NOTE

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

8.6.7 Electric motor

Alfa Laval ref. 599720 Rev. 7



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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.

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.

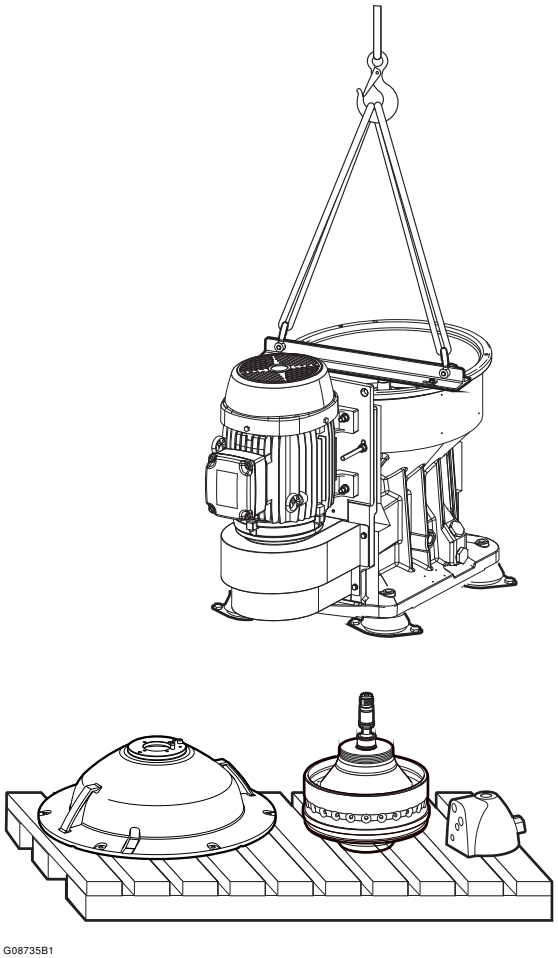
9.2.1 Transport

1. When lifting the separator, make sure that tools and lifting devices are fastened securely. See 6.7.1 Lifting the separator on page 180.

Crush hazard
Use correct lifting tools and follow lifting instructions.

2. When lifting the bowl see 6.7.2 Lifting the bowl on page 182.

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



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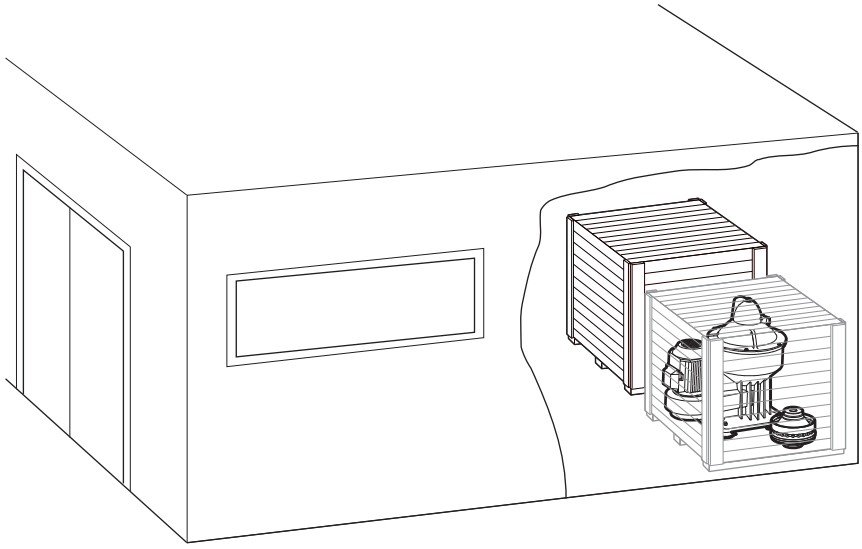
9.2.2 Protection and storage of goods

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.



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

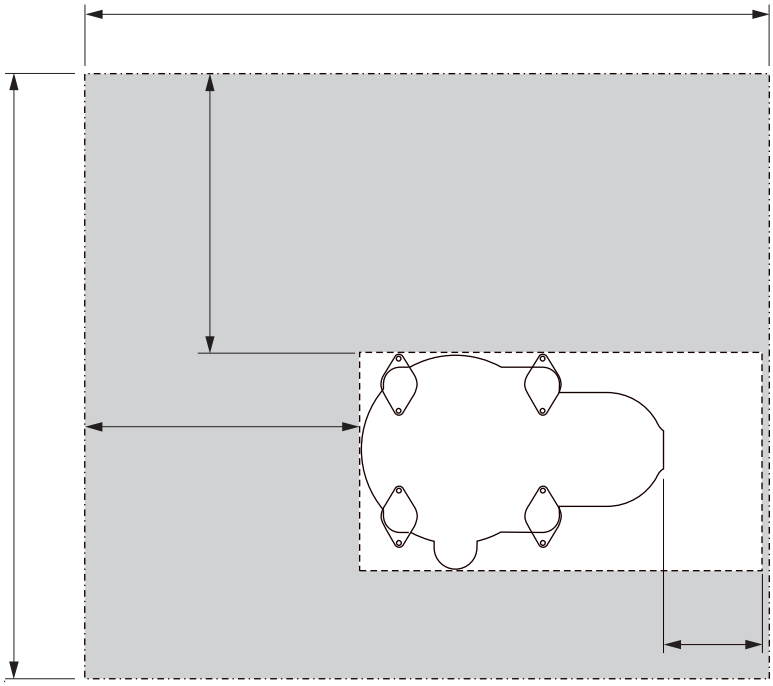
4. If the storage time exceeds 12 months, the equipment must be inspected every 6 months and, if necessary, the protection be renewed.

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



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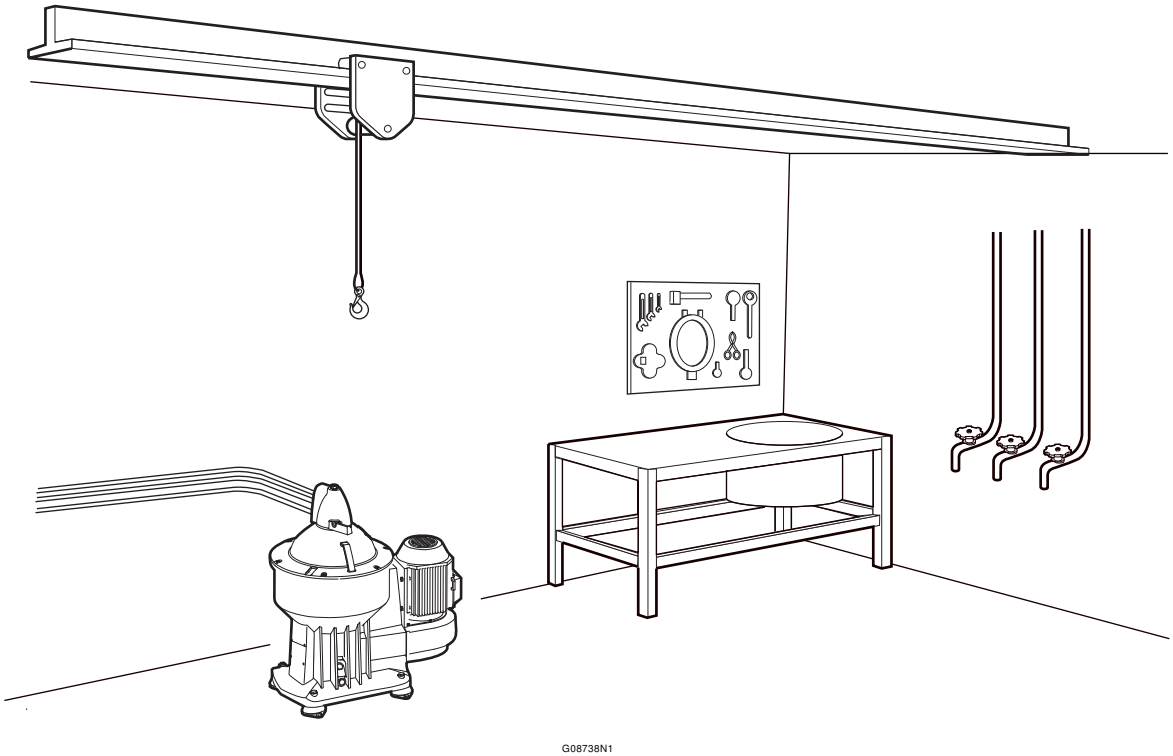
Important measurements are:

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

For more detailed information, see 8.6.1 Basic size drawing on page 208 and 8.6.2 Foundation drawing on page 209.

9.3.2 Maintenance service



A work bench should be installed in the separator room.

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

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

NOTE

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

See 8.6.2 Foundation drawing on page 209.

9.3.3 Connections to surrounding equipment

Local safety regulations

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

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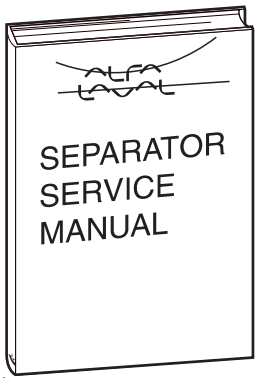
Service media

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



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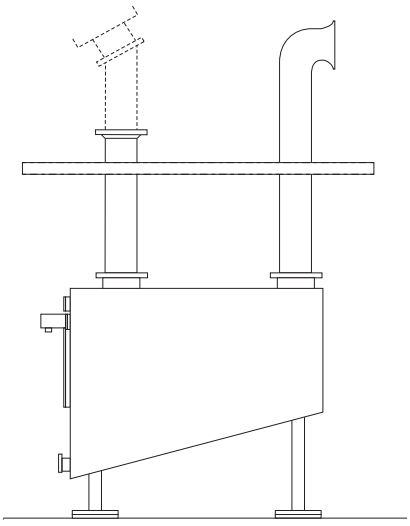
Sludge discharge tank

If the sediment from the separator is discharged into a tank, this tank must be sufficiently ventilated. The connection between the separator and the tank must be of the size and configuration specified. If the solids are discharged from the separator bowl casing into a closed system, ensure that this system cannot be overfilled or closed in such a way that the solids cannot leave the bowl casing. This could cause a hazardous situation.



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9.4 Storage at out of operation

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

Preferred alternative - Run every month:

Start the separator at least ones 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 ones 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 9.2.2 Protection and storage of goods on page 219.

9.5 Before start-up

If the separator has been out of operation for:

3 months or longer

- Pre-lubricate the spindle bearings

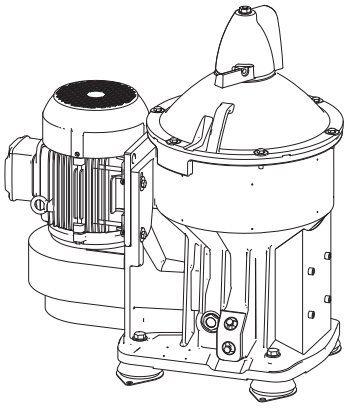
6 months or longer

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

18 months or longer

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

See 6.6.4 Lubrication chart on page 174.



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