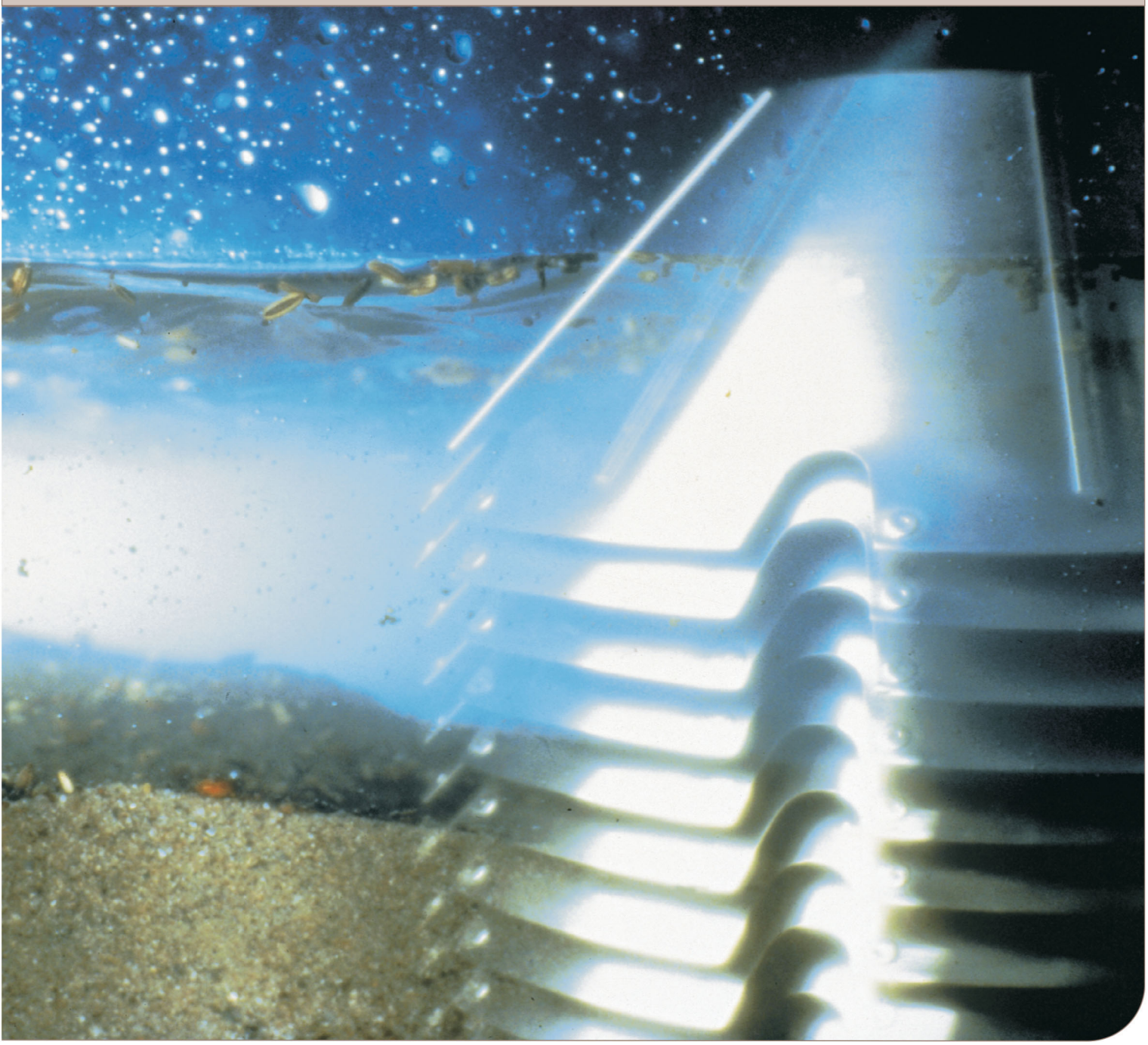
Separator manual

High speed separator

MAB 206S-24



Product No. 881240-22-15/0
Book No. 9033314-02 Rev. 2

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The original instructions are in English

Contents

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

Not following the instructions can result in serious accidents.

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

1 Read this first

This manual is designed for operators and service engineers working with the Alfa Laval separator MAB 206S-24.

For information concerning the function of the separator, see “3 Separator basics” on page 17, and “4 Operating instructions” on page 31.

If the separator has been delivered and installed by Alfa Laval as part of a processing system, this manual is a part of the System manual. In this case, study carefully all the instructions in the System manual.

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

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Separator Manual and Spare Parts Catalogue

This Separator manual consists of:

Safety instructions

Pay special attention to the safety instructions for the separator. Not following the safety instructions can cause accidents resulting in damage to equipment and serious injury to personnel.

Separator basics

Read this chapter if you are not familiar with this type of separator.

Operating instructions

This chapter contains operating instructions for the separator only.

Service instructions

This chapter gives instructions for daily checks, cleaning, oil changes, servicing and check points.

Dismantling / Assembly

This chapter contains step-by-step instructions for dismantling and assembly of the separator for service and repair.

Trouble-tracing

Refer to this chapter if the separator functions abnormally.

If the separator has been installed as part of a processing system always refer to the Trouble-tracing part of the System Manual first.

Technical reference

This chapter contains technical data concerning the separator and drawings.

This chapter contains an alphabetical list of subjects, with page references.

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

G0010421

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.

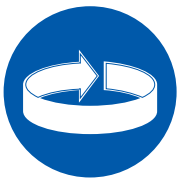
The following basic safety instructions therefore apply:

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

S0151211

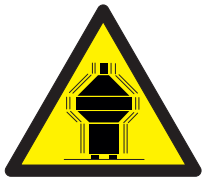
Disintegration hazards

- When power cables are connected, always check direction of motor rotation. If incorrect, vital rotating parts could unscrew.



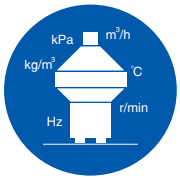
S01512F1

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



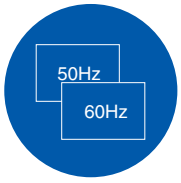
S01512N1

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



S01512P1

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



S01512L1

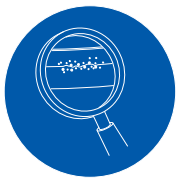
- Welding or heating of parts that rotate can seriously affect material strength.

S01512J1

- Wear on the large lock ring thread must not exceed safety limit. ϕ-mark on lock ring must not pass opposite ϕ-mark by more than specified distance.

S01512G1

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



S01512H1

Entrapment hazards

- Do NOT stand on the separator or parts of.

Entrapment hazards

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

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

S0151201

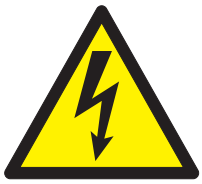
- To avoid accidental start, switch off and lock power supply before starting **any** dismantling work.

  Assemble the machine **completely** before start. **All** covers and guards must be in place.

S0151261

Electrical hazard

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



S0151271

Crush hazards

- Use correct lifting tools and follow lifting instructions.

S01512M1

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

S01512Y1

Noise hazards

- Use ear protection in noisy environments.

S0151291

Burn hazards

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

S01512A1

Skin irritation hazards

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

S01512D1

Cut hazards

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

S01512B1

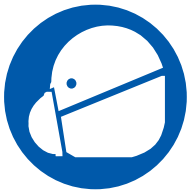
Flying objects

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

S01512C1

Health hazard

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



S01512V1

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

Type of hazard

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

WARNING

Type of hazard

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

CAUTION

Type of hazard

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

NOTE

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

2.2 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, from where it can neither be seen nor heard, the power isolation device shall be equipped with an interlocking device. This is to prevent a remote start command which could result in some liquid being fed to the separator when it is shut down for service.

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

3 Separator basics

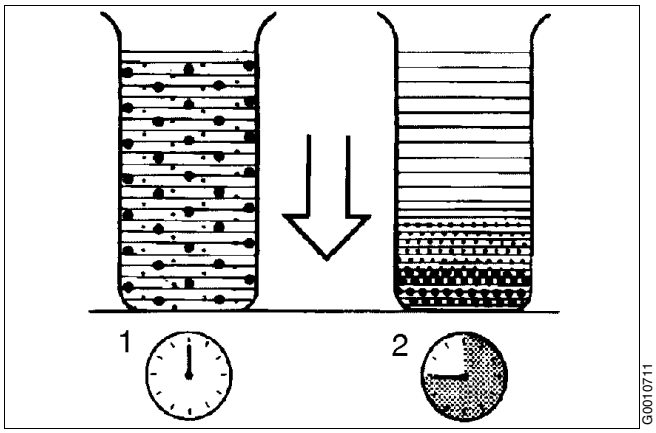
Contents

3.1 Basic principles of separation

3.1.1 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.



Sedimentation by gravity

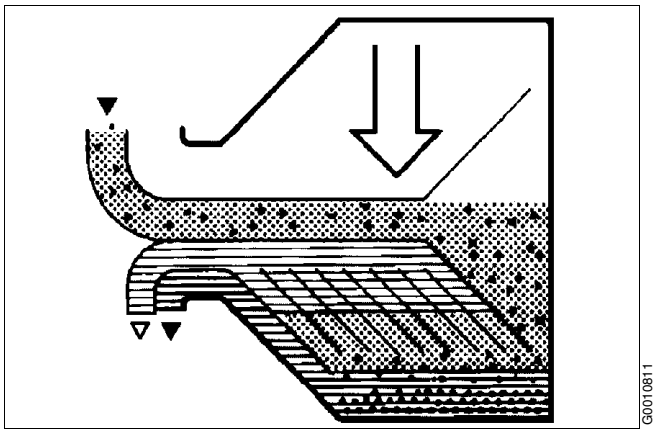
Separation by gravity

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

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

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

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



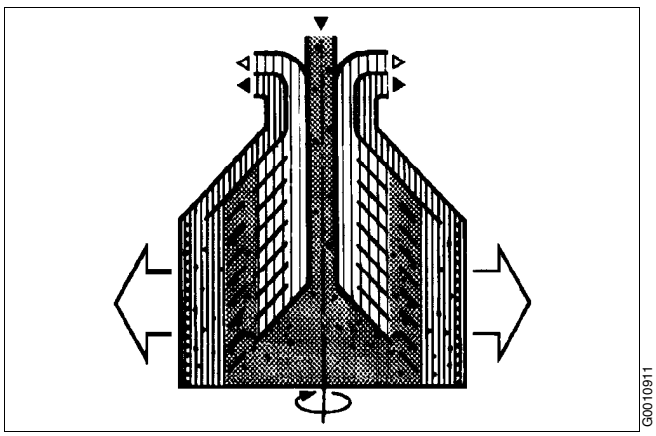
Sedimentation in a settling tank, with outlets making it possible to separate the lighter liquid parts from the heavier

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 centrifugal solution

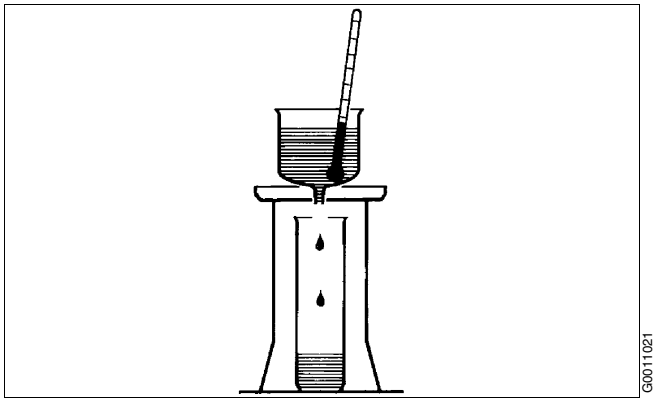
3.1.2 Factors influencing the separation result

Separating temperature

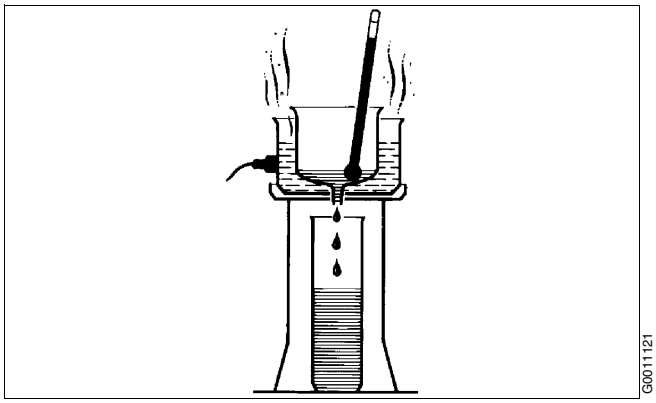
For some types of process liquids (e.g. mineral oils) a high separating temperature will normally increase the separation capacity. The temperature influences oil viscosity and density and should be kept constant throughout the separation.

Viscosity

Low viscosity facilitates separation. Viscosity can be reduced by heating.



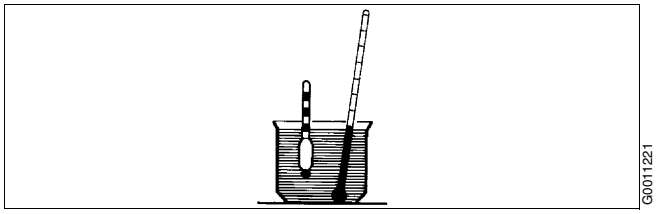
High viscosity (with low temperature)



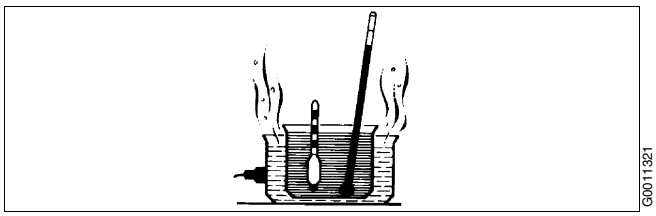
Low viscosity (with high temperature)

Density difference (specific gravity ratio)

The greater the density difference between the two liquids, the easier the separation. The density difference can be increased by heating.



High density (with low temperature)



Low density (with high temperature)

Phase proportions

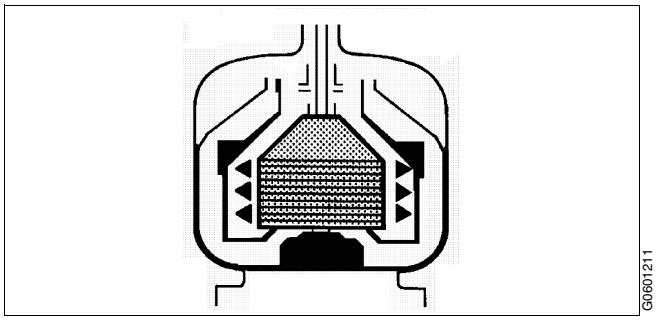
An increased quantity of water in oil will influence the separating result through the optimum transporting capacity of the disc stack.
An increased water content in the oil can be compensated by reducing the throughput in order to restore the optimum separating efficiency.

The throughput

The throughput sets the time allowed for the separation of water and sediment from the oil. A better separation result can often be achieved by reducing the throughput, i.e. by increasing the settling time.

Sludge space - sludge content

Sediment will accumulate on the inside periphery of the bowl. When the sludge space is filled up the flow inside the bowl is influenced by the sediment and thereby reducing the separating efficiency. In such cases the time between cleaning should be reduced to suit these conditions.



Sludge accumulation

Disc stack

A neglected disc stack containing deformed discs or discs coated with deposits will impair the separating result.

3.2 Design

3.2.1 Overview

The separator comprises a processing part and a driving part. It is driven by an electric motor (6).

Mechanically, the separator machine frame is composed of a bottom part, a top part and a collecting cover. The motor is flanged to the frame as shown in the illustration. The frame feet have vibration damping.

The bottom part of the separator contains the horizontal driving device (1), driving shaft with couplings, a worm gear and a vertical spindle.

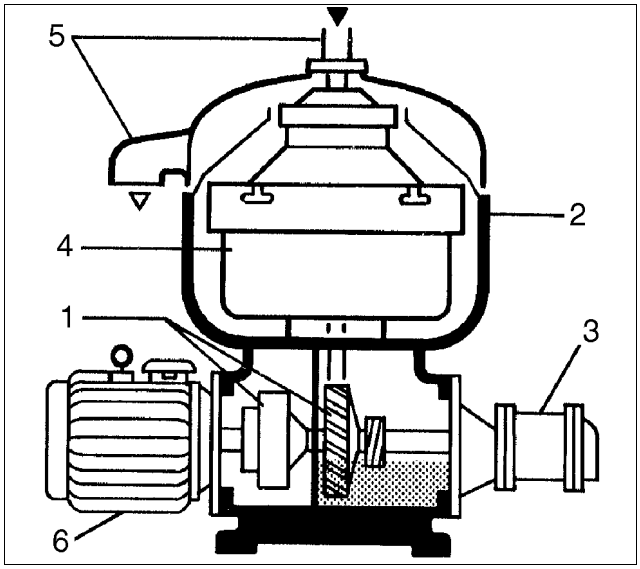
The bottom part also contains an oil bath for the worm gear, a brake and a revolution counter, indicating speed.

If the separator is equipped with a built-on inlet pump (3), it is attached to the driving spindle and located on the side of the bottom part.

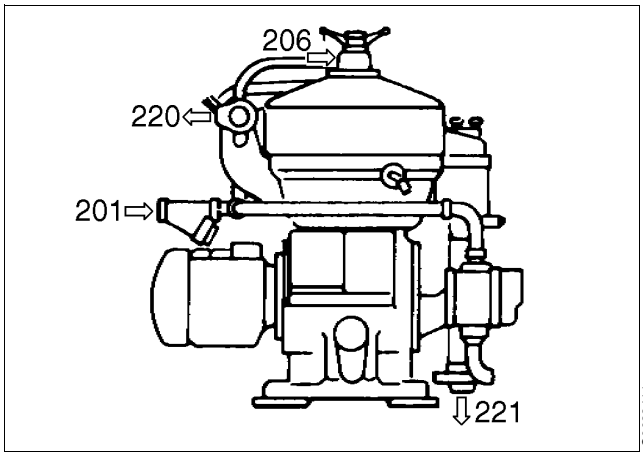
The frame top part (2) and the collecting cover contain the processing parts of the separator, the inlet and outlets, piping and bowl (4).

The liquid is cleaned in the separator bowl (4). This is fitted on the upper part of the vertical spindle and rotates at high speed inside the space formed by the frame top part and collecting cover.

The main inlets and outlets are shown with connection numbers in the illustration. These numbers correspond with the numbers used in the connection list and the basic size drawing which can be found in chapter “8 Technical reference” on page 155.



1. *Horizontal driving device, friction coupling and worm gear*
2. *Frame top part*
3. *Inlet pump of gear type (option)*
4. *Separator bowl*
5. *Inlet / outlet*
6. *Electric motor*

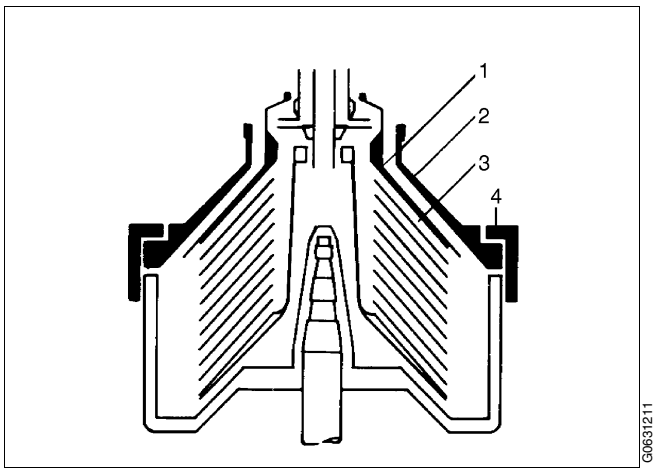


Inlet and outlet connections

201 Feed inlet
206 Water inlet for liquid seal
220 Outlet for light phase (oil)
221 Outlet for heavy phase (water)

3.2.2 Bowl disc stack

The large lock ring (4) is holding the bowl parts together. It also compresses the disc stack (3). The disc stack pressure is important for bowl balance. Too low pressure can cause out of balance vibration.



1. *Top disc*
2. *Bowl hood*
3. *Disc stack*
4. *Large lock ring*

3.2.3 Power transmission

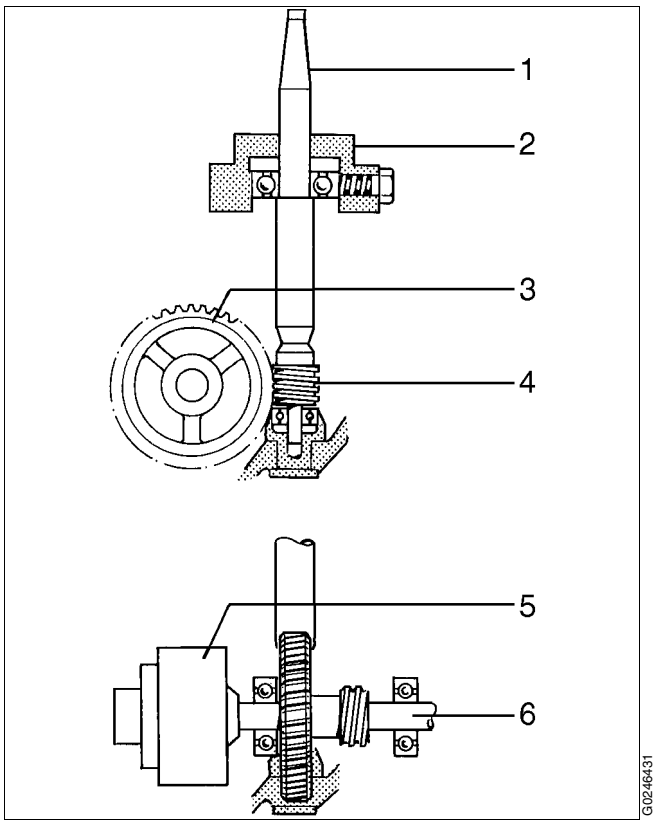
The main parts of the power transmission between motor and bowl are illustrated in the figure.

The friction coupling ensures a gentle start and acceleration and at the same time prevents overloading of the worm gear and motor.

The worm gear has a ratio which increase the bowl speed several times compared with the motor speed. For correct ratio see chapter “8 Technical reference” on page 155.

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 casing.

The worm wheel runs in a lubricating oil bath. The bearings on the spindle and the worm wheel shaft are lubricated by the oil splash produced by the rotating worm wheel.

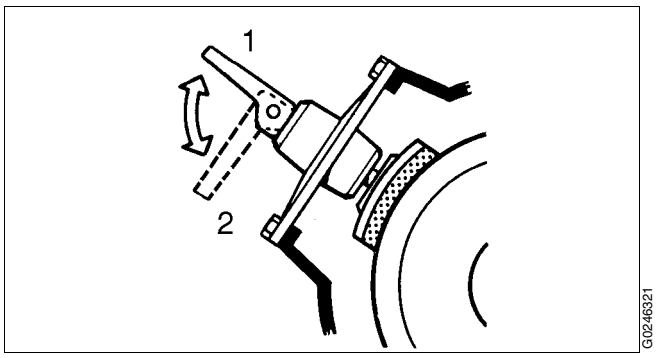


1. *Bowl spindle*
2. *Top bearing and spring casing*
3. *Worm wheel*
4. *Worm*
5. *Friction coupling*
6. *Worm wheel shaft*

3.2.4 Brake

The separator is equipped with a hand operated brake to be used when stopping the separator. The use of the brake reduces the retardation time of the bowl and critical speeds will therefore be quickly passed.

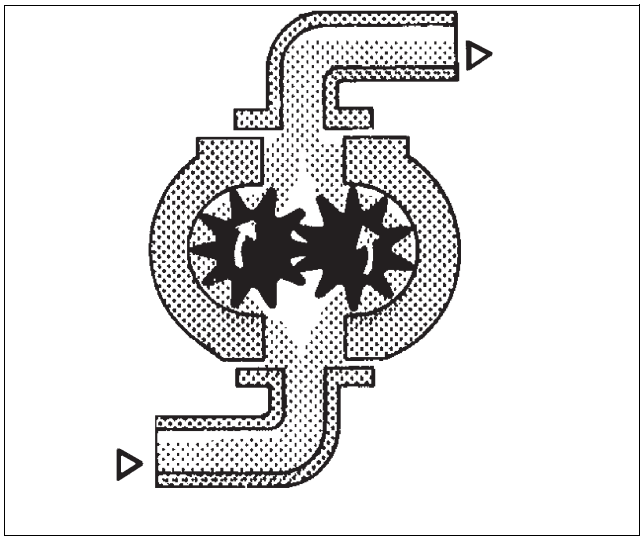
The brake lining acts on the outside of the coupling drum.



Applying (1) and releasing (2) of brake

3.2.5 Inlet pump (option)

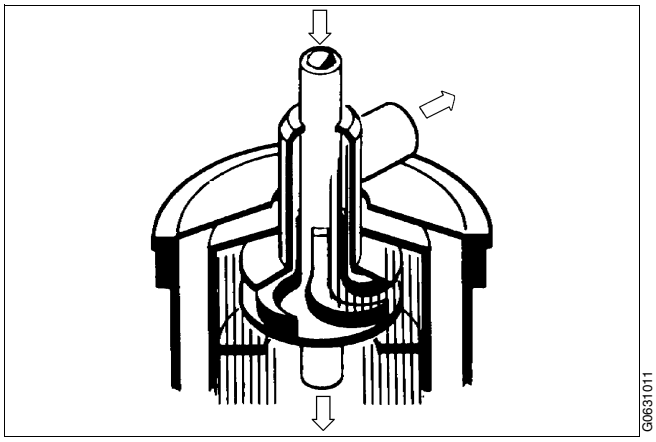
The separator can be equipped with a built-on pump of gear type. The pump will be attached to the horizontal driving spindle and located on the side of the separator. This pump is the feed inlet pump.



Gear pump

3.2.6 Paring disc

The paring disc serves as a stationary pump wheel mounted in a chamber in the rotating bowl neck. The paring disc dips radial into the rotating liquid ring and pares out the liquid. The paring disc is used as a discharge pump.

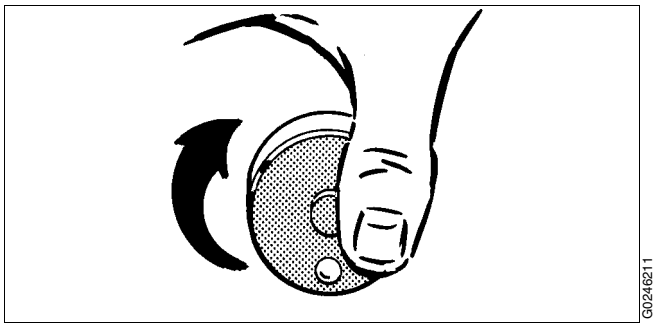


Paring disc

3.2.7 Sensors and indicators

Revolution counter

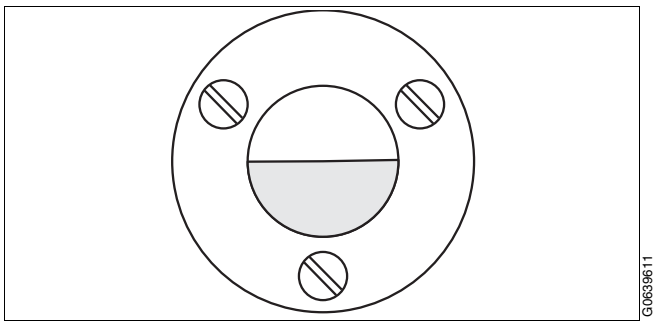
A revolution counter indicates the speed of the separator and is driven from the worm wheel shaft. The correct speed is needed to achieve the best separating results and for reasons of safety. The number of revolutions on the revolution counter for correct speed is shown in chapter “8 Technical reference” on page 155. Refer to name plate for speed particulars.



Revolution counter

Oil sight glass

The sight glass shows the oil level in the worm gear housing.



Sight glass - oil level

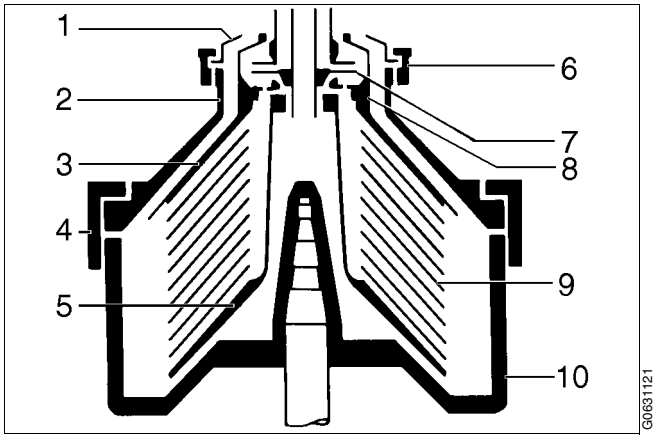
Water outlet sightglass

The water outlet has a sightglass with a lamp for illumination.

3.3 Separating function

3.3.1 Bowl

The bowl body (10) and bowl hood (2) constituting the bowl casing are held together by the large lock ring (4). In the bowl are the distributor (5) and the disc stack (9) through which the process liquid (oil/water) is passed and where the separation takes place. Uppermost in the disc stack lies the top disc (3). In the separator the top disc neck forms a discharge chamber from which the processed, light liquid (oil) is discharged by a paring disc (7). The heavy liquid phase (water) leaves the bowl through the gravity disc (1), which is clamped to the bowl hood by the small lock ring (6).



Bowl parts:

1. *Gravity disc*
2. *Bowl hood*
3. *Top disc*
4. *Large lock ring*
5. *Distributor*
6. *Small lock ring*
7. *Paring disc*
8. *Level ring*
9. *Bowl disc stack*
10. *Bowl body*

3.3.2 Purifier bowl

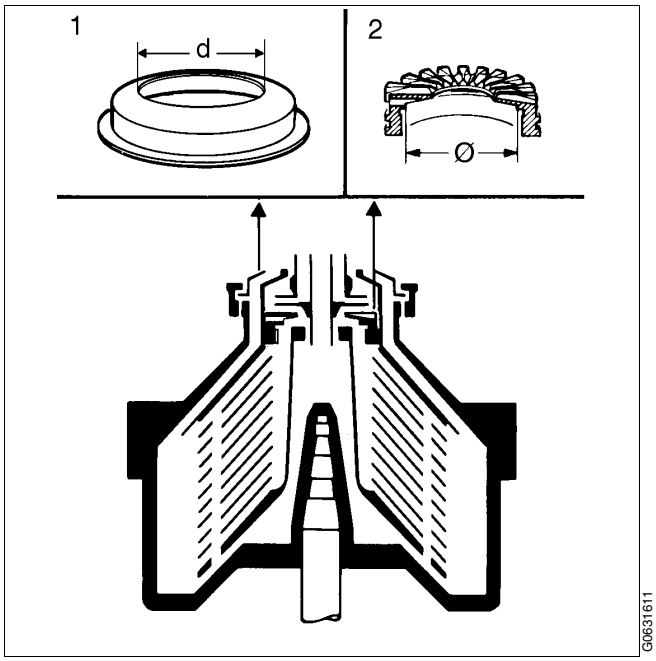
Characteristic parts

The illustration shows characteristic parts of the purifier bowl:

1. The gravity disc, which should be chosen according to directions in chapter “4.1.2 Selection of gravity disc” on page 33.

2 The level ring having the smallest hole diameter Ø.

A purifier bowl has two liquid outlets, see next illustration.



Purifier bowl

Process flow

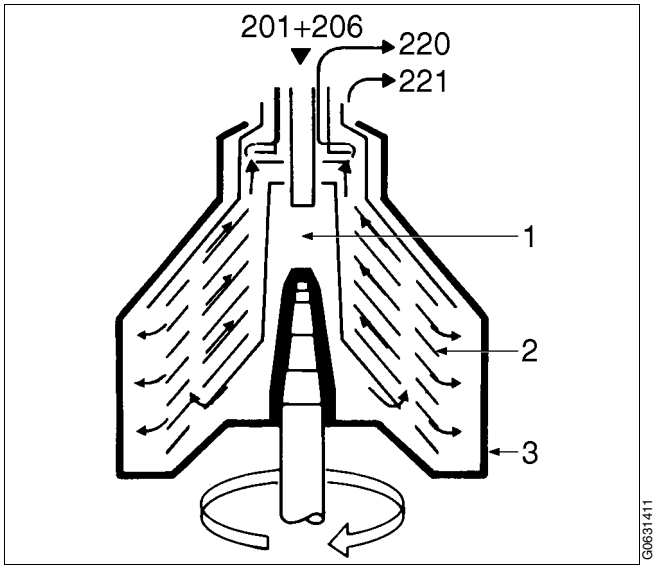
Unseparated oil (201) is fed into the bowl through the inlet pipe and is pumped via the distributor (1) towards the periphery of the bowl.

When the oil reaches the holes in the distributor, it rises through the channels formed by the disc stack (2) where it is evenly distributed.

The liquid phases are separated from each other by action of the centrifugal force. The heavy phase (water) and any solids move along the underside of the bowl discs towards the periphery of the bowl, where the solids settle on the bowl wall (3).

The heavy phase flows along the upper side of the top disc towards the neck of the bowl hood and leaves the bowl via the gravity disc the outer way (221).

The light phase (oil) flows along the upper side of the bowl discs towards the bowl centre and leaves the bowl via the level ring and is then pumped out of the bowl through outlet (220) by the paring disc.

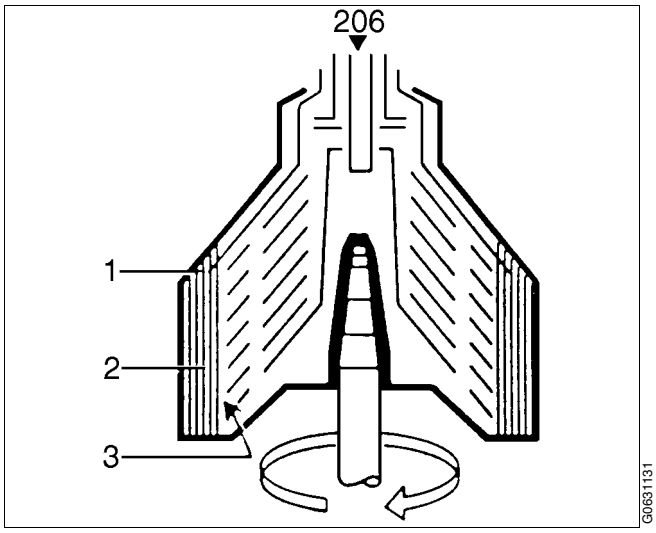


Flow in a purifier bowl

1. Distributor
2. Disc stack
3. Wall in bowl body
201. Feed inlet
206. Water inlet for liquid seal
220. Outlet for light phase (oil)
221. Outlet for heavy phase (water)

Liquid seal

To prevent the oil from passing the outer edge (1) of the top disc and escaping the outer way with the water, a liquid seal (2) must be provided in the bowl. For this reason the bowl must be filled with water through water inlet (206) before the process liquid is supplied. The latter will then force the water towards the bowl periphery. An interface (3) will form between the water and the oil.



Provided water seal in bowl

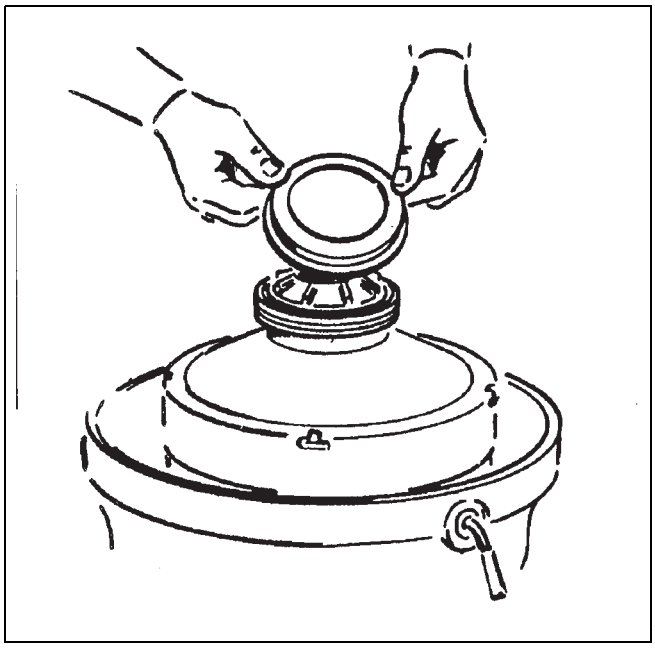
Position of interface

In a purifier bowl the position of the interface should be located between the disc stack edge and the outer edge of the top disc.

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

The gravity disc is located inside the bowl hood. A gravity disc with a larger hole will move the interface towards the bowl periphery, whereas a disc with a smaller hole will place it closer to the bowl centre.

The gravity disc should be chosen according to directions in chapter “4.1.2 Selection of gravity disc” on page 33.



Gravity disc

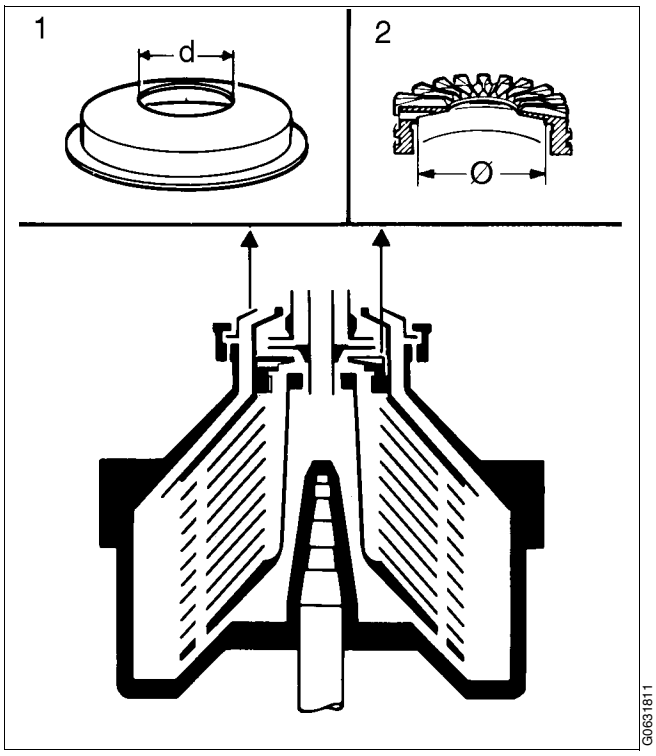
3.3.3 Clarifier bowl

Characteristic parts

The illustration shows characteristic parts of the clarifier bowl:

1. The gravity disc having the smallest hole diameter (d).
2. The level ring having the largest hole pitch diameter (Ø).

The clarifier bowl has one liquid outlet, see next illustration.

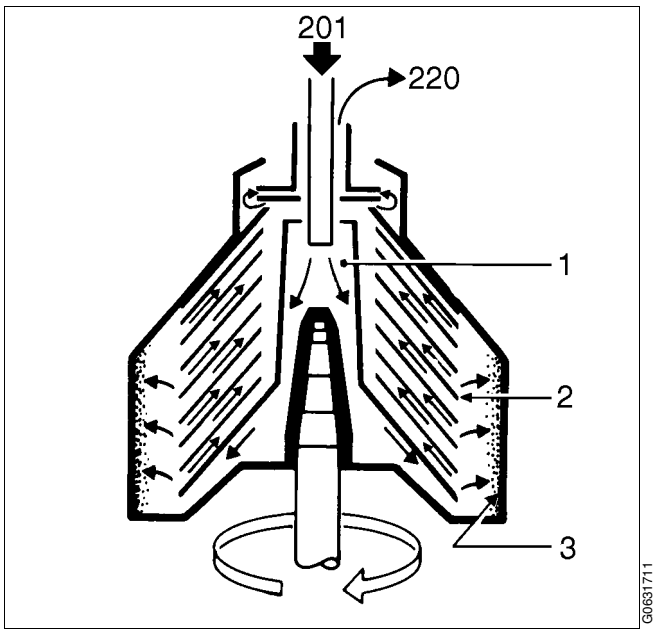


Clarifier bowl

Process flow

The process liquid (201) flows through the distributor (1) to the interspaces between the bowl discs in the disc stack (2). Through the action of the centrifugal force the heavy particles move along the underside of the discs towards the bowl periphery, where they settle on the bowl wall (3). The liquid proceeds towards the bowl centre and discharges through the bowl hood (220).

The separation is influenced by changes in the viscosity (rise in separating temperature) or in the throughput.



Flow in a clarifier bowl

1. Distributor
2. Disc stack
3. Wall in bowl body
201. Feed inlet
220. Feed outlet

3.4 Definitions

Back pressure Pressure in the separator outlet.

Clarification Liquid/solids separation with the intention of separating particles, normally solids, from a liquid (oil) having a lower density than the particles.

Clarifier disc An optional disc, which replaces the gravity disc in the separator bowl, in the case of clarifier operation. The disc seals off the heavy phase (water) outlet in the bowl, thus no liquid seal exists.

Counter pressure See Back pressure.

Density Mass per volume unit. Expressed in kg/m^3 at specified temperature, normally at 15 °C.

Gravity disc Disc in the bowl hood for positioning the interface between the disc stack and the outer edge of the top disc. This disc is only used in purifier mode.

Interface Boundary layer between the heavy phase (water) and the light phase (oil) in a separator bowl.

Purification Liquid/liquid/solids separation with the intention of separating two intermixed and mutually insoluble liquid phases of different densities. Solids having a higher density than the liquids can be removed at the same time. The **lighter** liquid phase (oil), which is the major part of the mixture, shall be purified as far as possible.

Sediment (sludge) Solids separated from a liquid.

Throughput The feed of process liquid to the separator per time unit.
Expressed in m^3/or lit/h.

Viscosity Fluid resistance against movement. Normally expressed in centistoke (cSt = mm^2/sec), at specified temperature.

Water seal Water in the solids space of the separator bowl to prevent the light phase (oil) from leaving the bowl through the heavy phase (water) outlet, in purifier mode.

4 Operating instructions

Contents

4.1 Operating routine

These instructions is related only to the separator itself. If the separator is a part of a system or module follow also the instructions for the system.

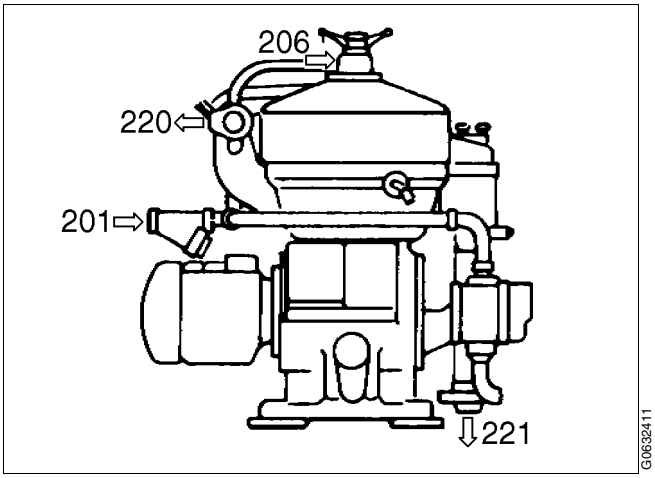
4.1.1 Before first start

Technical demands for connections and logical limitations for the separator is described in the chapter “8 Technical reference” on page 155 in the documents:

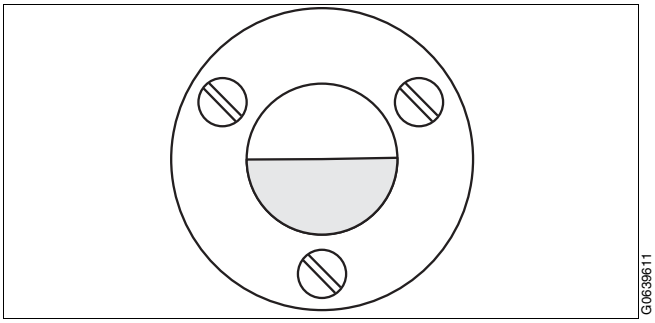
1. Technical data
2. Basic size drawing
3. Connection list
4. Interface description
5. Foundation drawing.

Before first start the following check points shall be checked:

- Motors equipped with regreasing nipples: When starting the motor for the first time, or after long storage of the motor, apply the specified quantity of grease until new grease is forced out of the grease outlet.
- Ensure the machine is installed correctly and that feed-lines and drains have been flushed clean.
- Fill oil in the gear housing. Fill up to slightly above the middle of the sightglass. Use the correct grade of oil. The separator is delivered without oil in the worm gear housing. For grade and quality, see “8.8 Lubricants” on page 167.



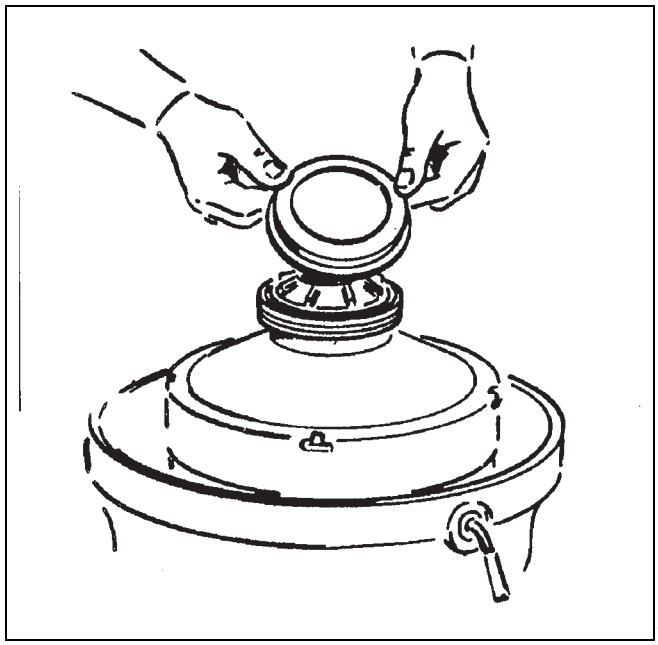
Explanations of the separator connections are given in “8.4 Connection list, without pump” on page 161 *and in* “8.6 Connection list, with pump” on page 163



Sight glass - oil level

4.1.2 Selection of gravity disc

The separator is delivered with a set of gravity discs.



Gravity disc

Clarification

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

Purification

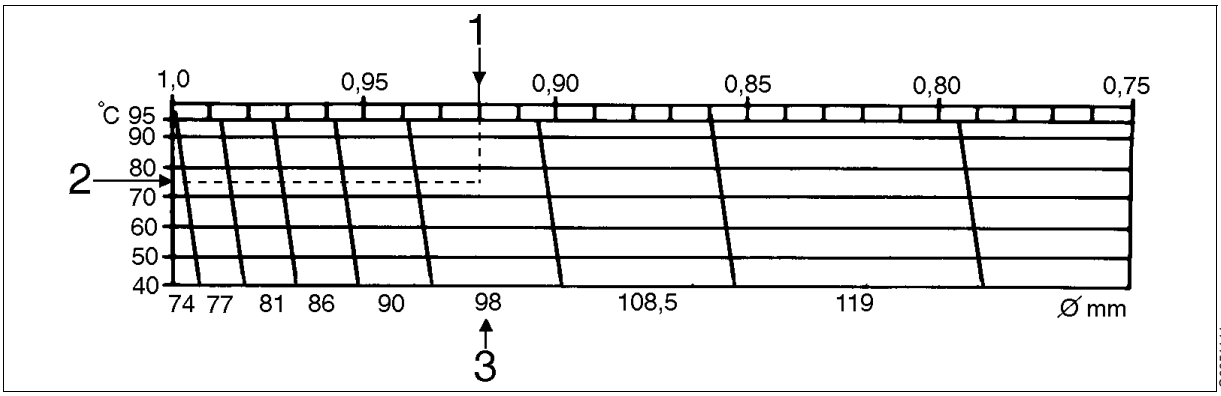
When running the separator as a purifier, the diameter of the gravity disc sets the position of the oil-water interface in the separator. The separation efficiency can be optimized by selection of the correct diameter for each process.

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

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

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

As an aid, use the nomogram below to find the correct gravity disc. However, note that the nomogram is purely theoretical. In practical operation the general rule is the above mentioned.



Nomogram for MAB 206

Example:

Oil density = 0,92 (ref. 1)

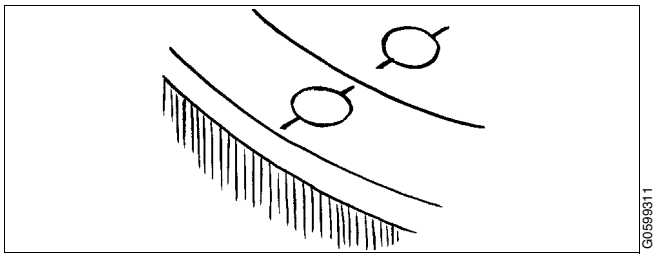
Separating temperature = 75 °C (ref. 2)

The nomogram indicates that a gravity disc with a hole diameter of 98 mm should be tried (ref. 3).

4.1.3 Before normal start

Check following points before each start:

1. Ensure the bowl is clean and that the separator is properly assembled.



Check that the separator is properly assembled

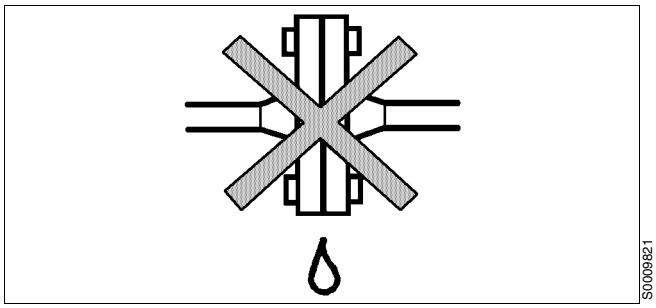
2. Make sure that all inlet and outlet couplings and connections have been correctly made and are properly tightened to prevent leakage.

CAUTION

Burn hazards

Make sure that hose connections and flange couplings are properly assembled and tightened.

Escaping hot liquid can cause burns.



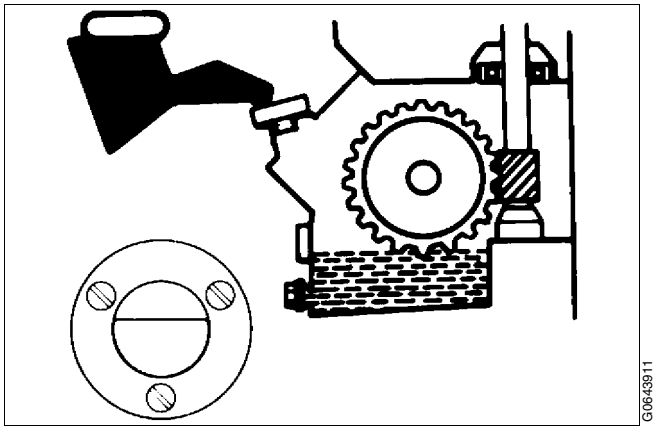
Check for leakages (not admitted)

3. Check that the bolts of the outlet cover and the hooks and screws for the frame hood are fully tightened.
4. Read the oil level. The middle of the sight glass indicates the **minimum** level. Refill if necessary up to slightly above the middle of the sightglass. For grade and quality, see “8.8 Lubricants” on page 167.

NOTE

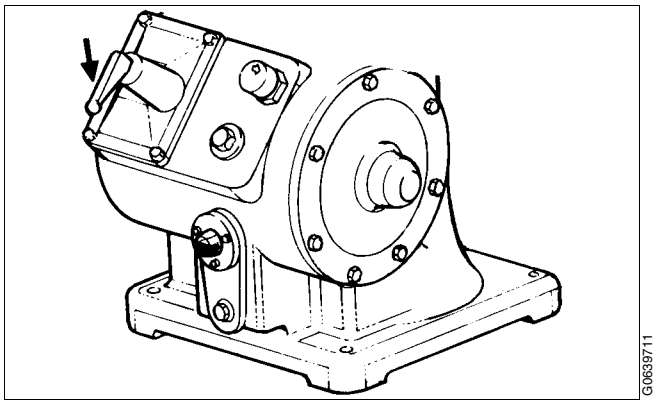
During running the oil level is normally barely visible in the lower part of the sight glass.

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



Check the oil level and refill if necessary

5. Release the brake.



Release the brake

6. Make sure the direction of rotation of the motor corresponds to the sign on the motor, see “8.10 Machine plates and safety labels” on page 179.

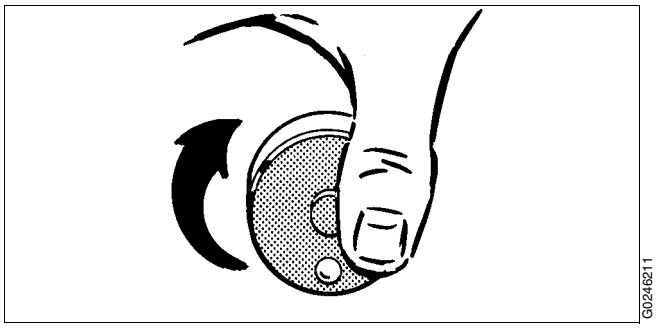
WARNING

Disintegration hazards

When power cables have been connected, always check direction of rotation. If incorrect, vital rotating parts could unscrew.

4.1.4 Starting and running-up procedure

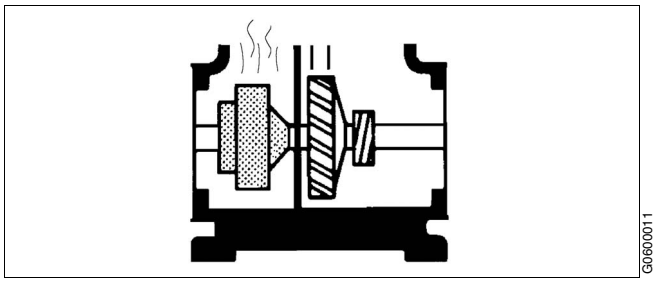
1. After starting the separator, visually check to be sure that the motor and separator have started to rotate.
2. Check the direction of rotation. The revolution counter should run clockwise.



Check for correct direction of rotation

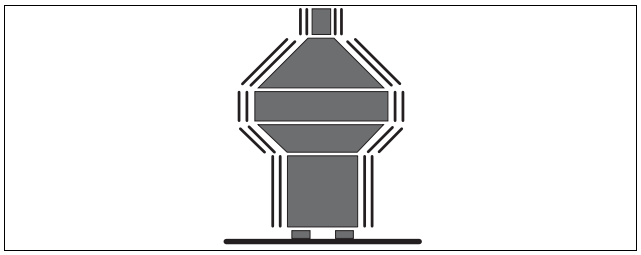
3. Be alert for unusual noises or conditions.

   Smoke and odour may occur at the start when friction pads are new.



Check for smell

4. Check the separator for vibration. Some vibration can occur for short periods during the starting cycle when the separator passes through its critical speeds. This is normal and passes over without danger. Try to learn the vibration characteristics of the critical speed pattern.



Check for vibration

WARNING

Disintegration hazards

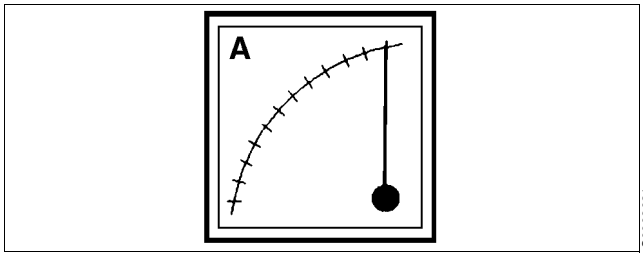
If excessive vibration occurs, **stop** the separator and **keep bowl filled** with liquid during rundown.

The cause of the vibration must be identified and rectified before the separator is restarted. Excessive vibration may be due to incorrect assembly or insufficient cleaning of the bowl.

In the trouble-tracing chapter “7.1.5 Separator vibrates” on page 148, a number of causes are described that can create vibration.

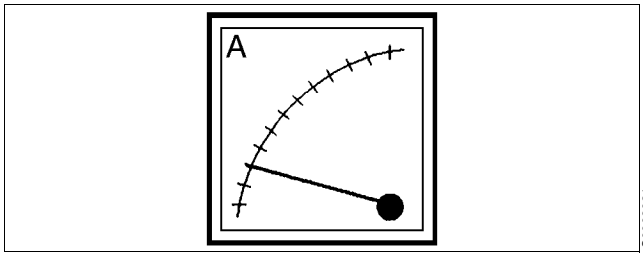
Check, if possible, the current consumption of the motor starter to ensure that the separator has reached full speed.

During start the current reaches a peak and then drops slowly. When the friction coupling engages, the current slowly increases again before decreasing to a low and stable level, which is the normal current during running.



Current increases when the coupling engages...

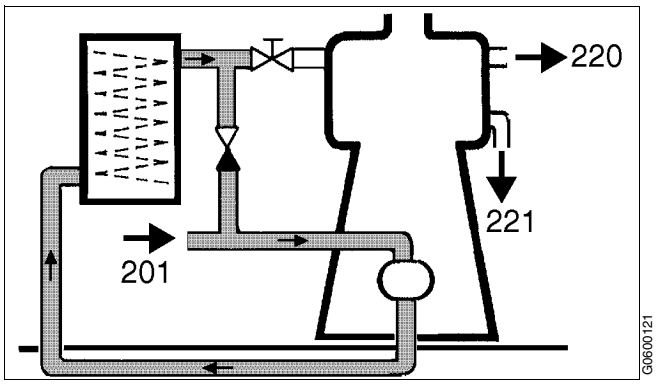
The time to reach full speed may not exceed the limit given in chapter “8.2 Technical data” on page 159.



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

4.1.5 At full speed

1. Circulate process liquid through heater until desired temperature is obtained.



Heat up the process liquid to separation temperature by circulation through a heater

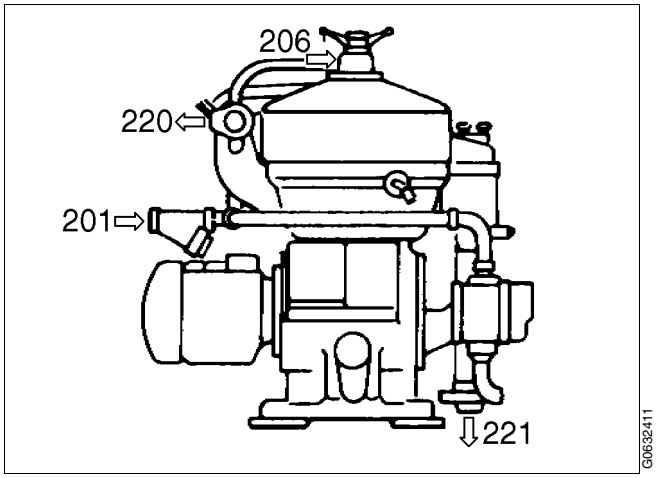
2. For **purification** mode:
   a. Supply water (206) to form the liquid seal. Continue until water flows out through the water outlet (221).

      Note: The water should have the same temperature as the process liquid and be supplied quickly.

   b. When the oil has reached the desired temperature, start the oil feed slowly to avoid breaking the liquid seal.
3. For **clarification** mode:
   a. Start the oil feed with full flow. Fill the bowl as quickly as possible.
4. For both **purification** and **clarification** mode:

   Check the separator inlet and outlet pressures.

   Adjust the oil outlet pressure to 1,5-2 bar. For permissible pressures, see section “8.2 Technical data” on page 159.
5. Adjust to desired throughput.



In- and outlets of the separator

4.1.6 During operation

Do regular checks on:

- oil inlet temperature (if applicable)
- water collecting tank level
- sound/vibration of the separator
- back pressure
- oil level in worm gear housing
- leakages
- motor current.

4.1.7 Stopping procedure

1. Turn off the oil feed.
2. Feed sealing water to empty the bowl from oil. Stop the feed when water flows out through the water outlet.
3. Stop the separator.
4. Pull the brake (1).

   Wait until the separator has come to a complete standstill (2-5 minutes).

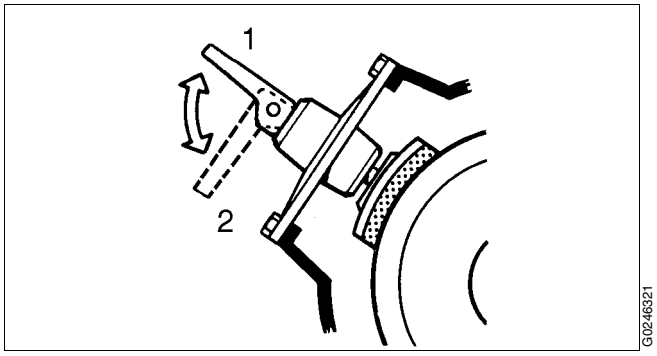
   Release the brake (2).
5. Manual cleaning should be carried out before next start up. See “4.2.1 Removal of separated sludge” on page 43.

WARNING

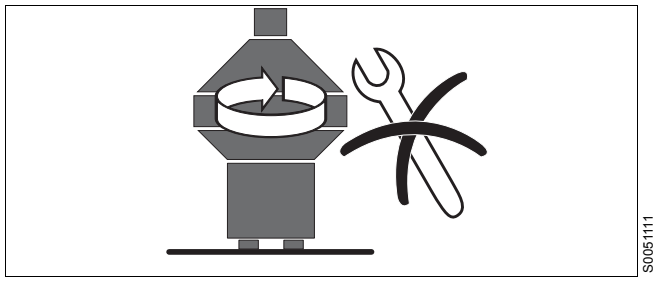
Entrapment hazards

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

The revolution counter and the motor fan indicate if the separator is rotating or not.



Applying (1) and releasing (2) of brake



Never start the dismantling of the separator before it has come to a complete standstill

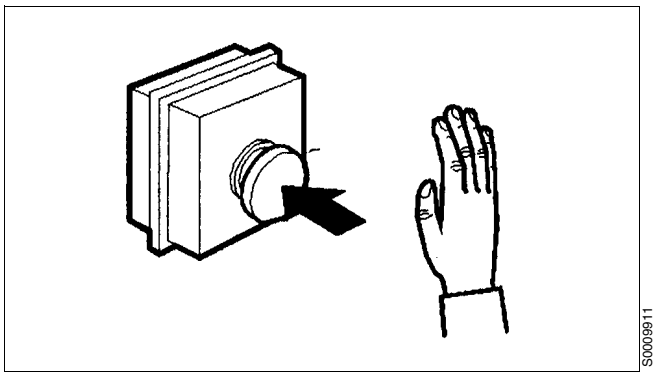
4.1.8 Safety stop

The safety stop is always installed according to local safety regulations. It is often a button placed on the wall near the separator or on the control equipment.

The following should happen automatically:

- The bowl is kept filled with liquid until standstill.
- The separator motor is switched off.

Evacuate the room. The separator may be hazardous when passing resonance frequencies during the run-down.



Safety stop

CAUTION

Disintegration hazards

After a safety stop the cause of the fault must be identified.

If all parts have been checked and the cause remains unclear, contact Alfa Laval for advice.

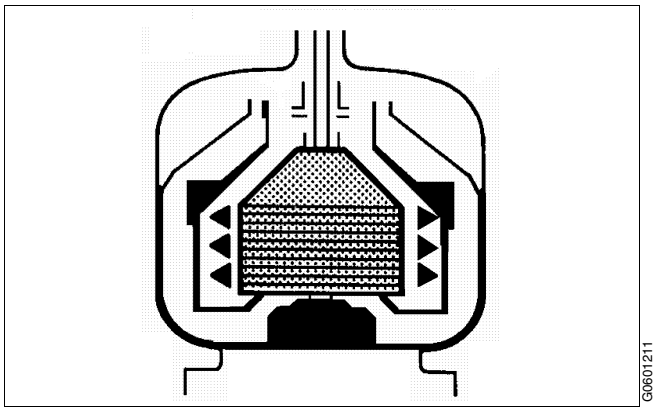
4.2 Cleaning the bowl

The separated sludge is accumulating on the inside surface of the separator bowl. How often the separator needs to be cleaned, depends on the amount of sediment entering the separator. High solids content or high throughput has the consequence that the cleaning need to be done more often.

Intervals for a specific case must be based on experience.

Information about sludge content in the feed can be achieved either by using a lab centrifuge or to run the separator for 2 - 3 hours and then stop and open the bowl to check the amount of sludge.

Then prolong or shorten the time between stop and cleaning.



Sludge accumulation

4.2.1 Removal of separated sludge

The dismantled parts must be handled carefully. Do not place parts directly on the floor, but on a clean rubber mat, fibreboard or a suitable pallet.

Remove the sludge collected on the inside of the bowl as follows:

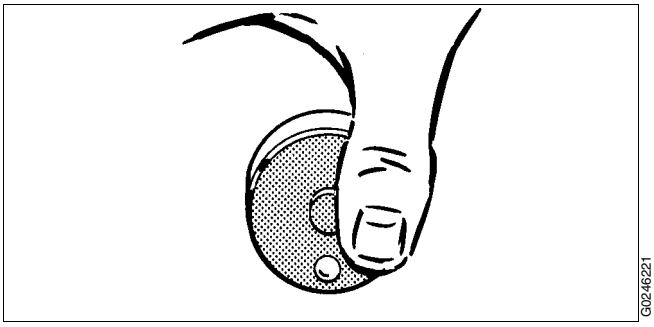
1. Stop the separator.

WARNING

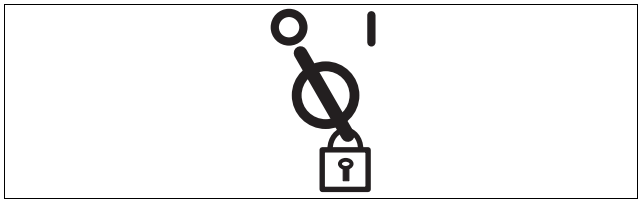
Entrapment hazards

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

  The revolution counter and the motor fan indicate if the separator is rotating or not.
- To avoid accidental start, switch off and lock power supply before starting **any** dismantling work.



Check that the separator has stopped completely

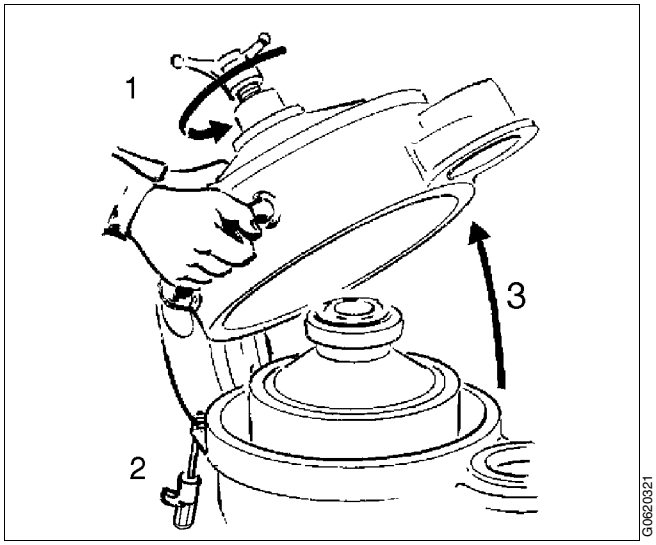


Lock the power supply

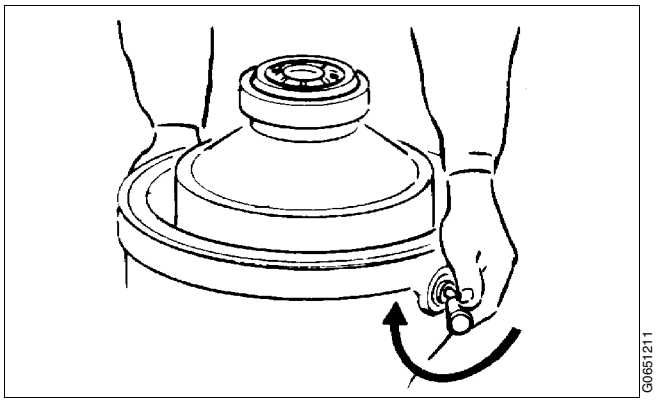
If starting to dismantle the separator before complete standstill the oil paring disc and the top of the bowl will probably be damaged.

2. Slacken the knob (1).

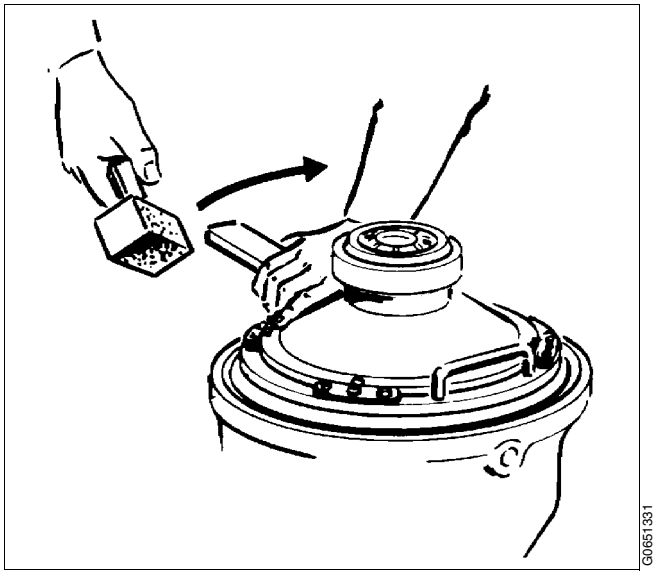
   Left-hand thread!
3. Loosen the clamp bolts (2) and open the collecting cover (3).



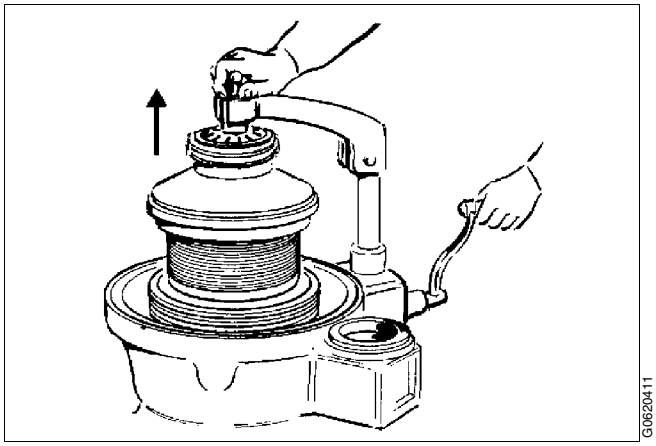
4. Lock the bowl from rotating with the two lock screws.



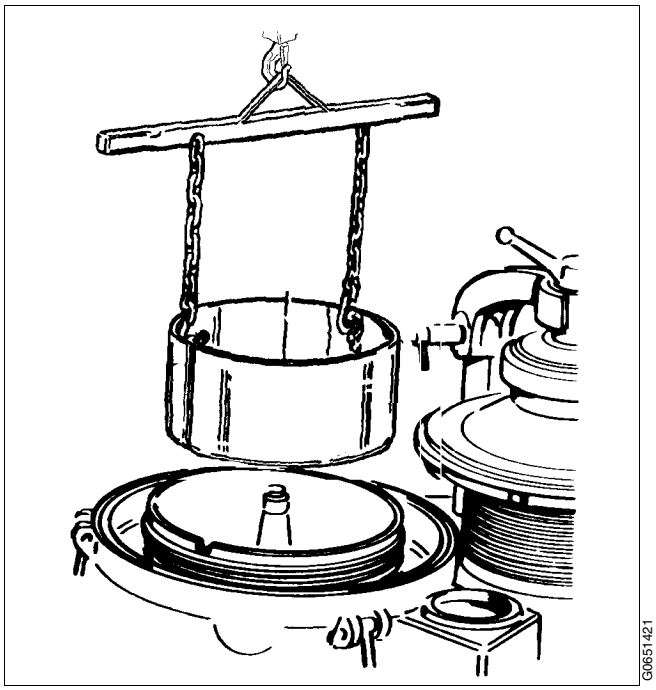
5. Unscrew the large lock ring.
   Left-hand thread!



6. Lift up the bowl hood, disc stack and distributor by using the lifting device.

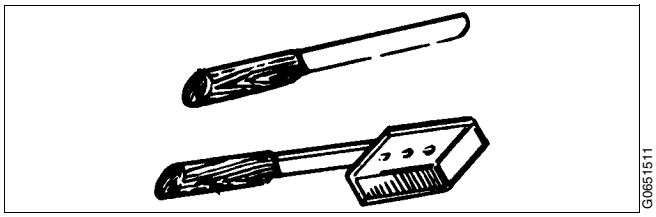


7. Lift out the sludge basket using the special lifting tool.



8. Remove deposits and clean all parts thoroughly in a suitable cleaning agent. See chapter “5.5 Cleaning” on page 85.

   When removing sludge, preferably use the sludge knife and sludge scoop included in the tool kit.



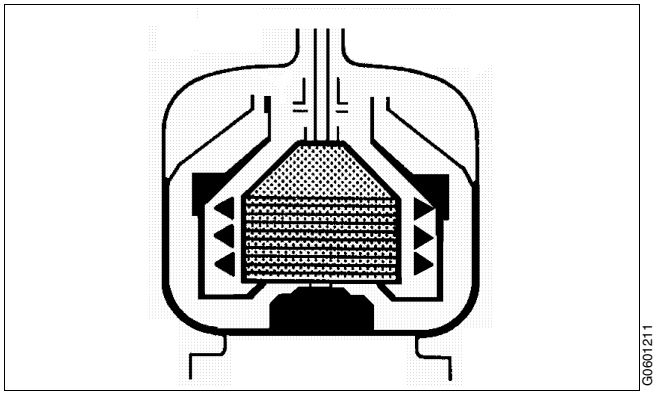
Alternative cleaning method of the disc stack

When the sediment is not sticky, the disc stack can be cleaned by “hurling”.

1. Clean the other bowl parts.
2. Assemble the bowl, close and lock the collecting cover as described in “4.2.2 Assembling the bowl” on page 46.
3. Run up to full speed without liquid feed.
4. After “hurling” either continue separation or stop and open the bowl and remove the sediment.

If the sediment adheres firmly, dissolve it by submerging the distributor and the disc stack in a suitable detergent.

If “hurling” has no effect, clean the discs one by one as described in “5.5.3 Cleaning of bowl discs” on page 88.



Disc stack in bowl cleaned by ‘hurling’

4.2.2 Assembling the bowl

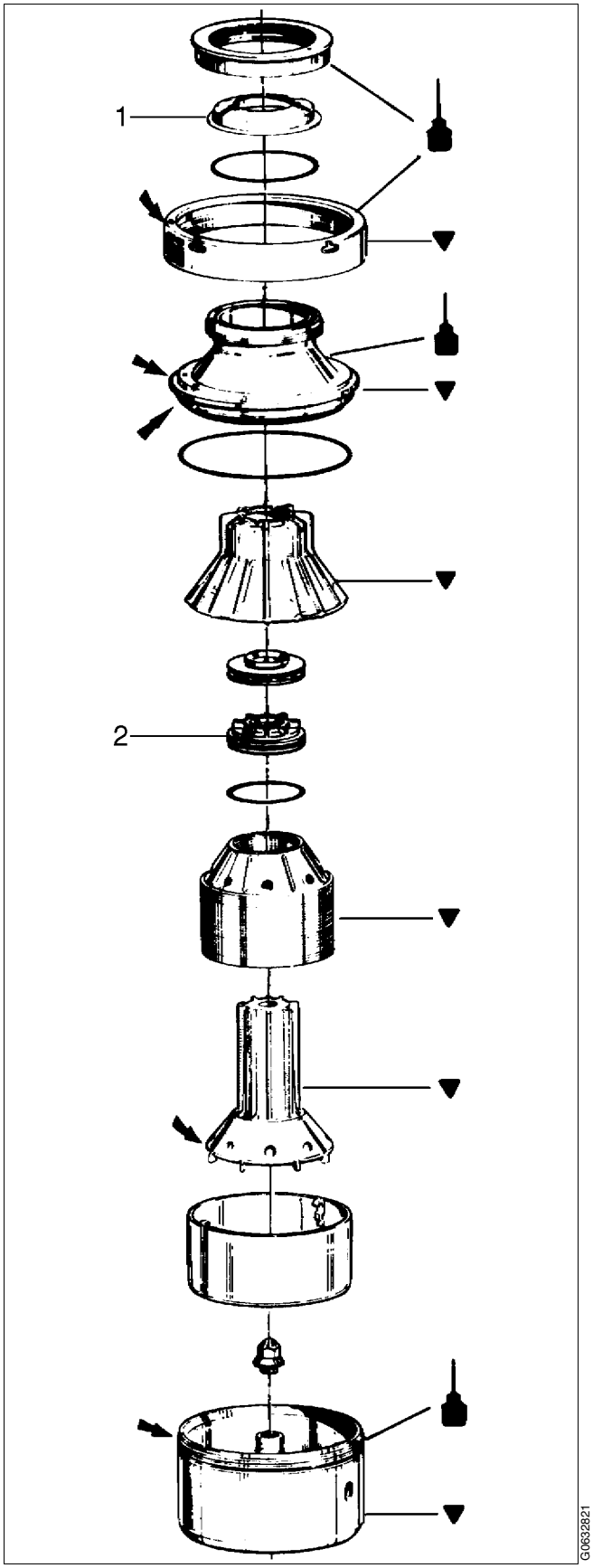
Each bowl constitutes a balanced unit. Exchange of any major part necessitates rebalancing of the bowl. To prevent mixing of parts, e.g. in an installation comprising of several machines of the same type, the major bowl parts carry the machine manufacturing number or its last three digits.

NOTE
Be sure bowl parts are not interchanged. Out of balance vibration will reduce ball bearing life.

The arrows indicate positions of guides on the bowl parts

Lubrication needed

Balanced parts. Exchange necessitates rebalancing of bowl.



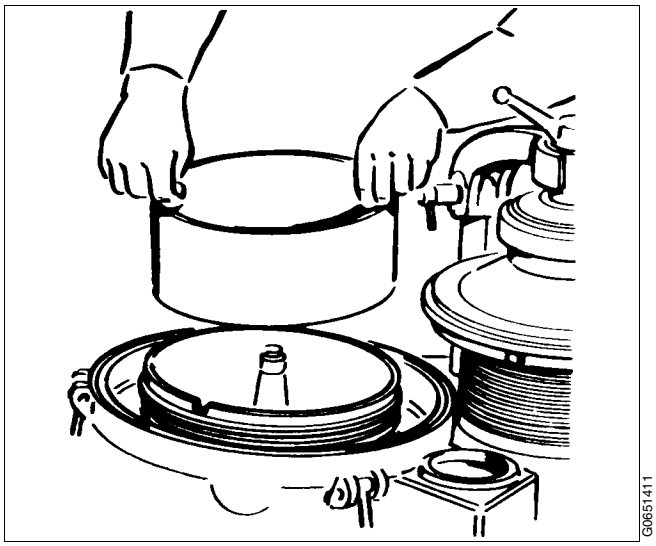
Purifier bowl

1. *Gravity disc with hole diameter according to the nomogram, see* “4.1.2 Selection of gravity disc” on page 33.
2. *Level ring with smallest hole pitch diameter*

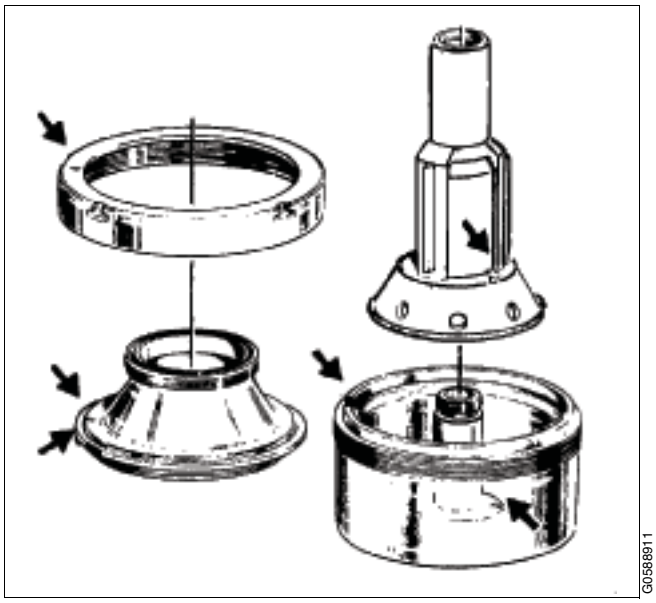
Clarifier bowl

1. *Gravity disc with smallest hole diameter*
2. *Level ring with largest hole pitch diameter*

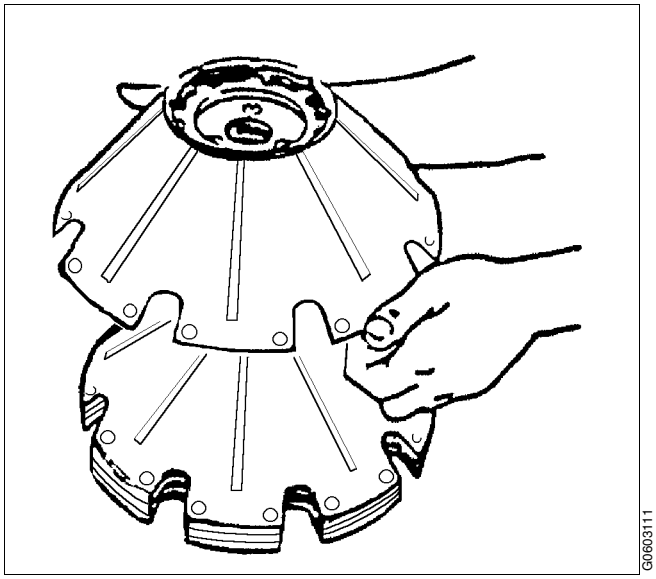
1. Fit the cleaned sludge basket.



2. During the assembly, bring the bowl parts into positions defined by the guides.



3. If the discs have been removed from the distributor, assemble them one by one onto the distributor. The distributor has one guide rib for the correct positioning of the discs.



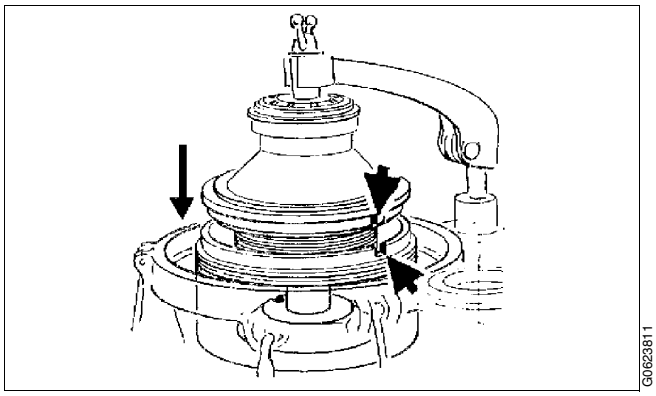
CAUTION

Cut hazard

Sharp edges on the separator discs may cause cuts.

4. Place the top disc and bowl hood upon the disc stack.
5. Lubricate the O-ring in bowl hood with silicone grease.
6. Lower the parts down into the bowl body using the lifting device. Make sure that the guides for bowl hood and bowl body are in correct position.

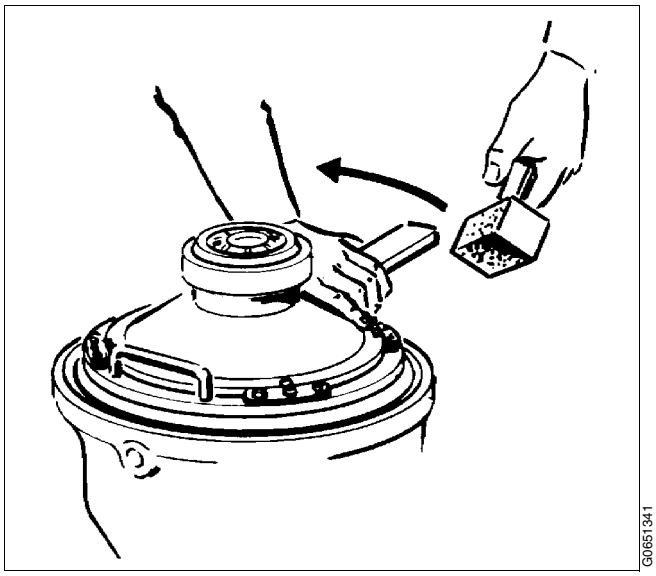
   Also check that the distributor and bowl body are bring in position defined by guides.



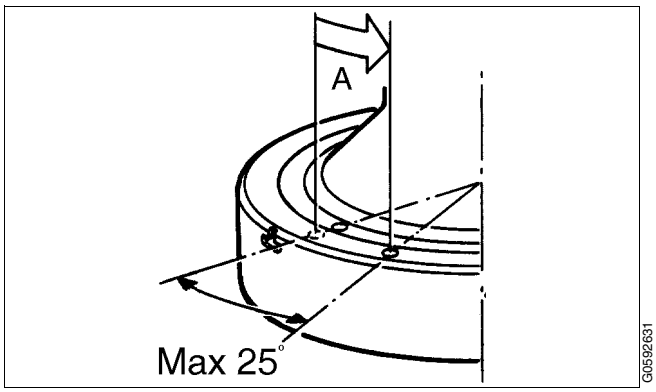
✔ **Check point**
"5.3.5 Lock ring; wear and damage" on page 69.

7. Lubricate the lock ring threads, contact and guide surfaces with lubricating paste.
8. Tighten the lock ring.

   Left-hand thread!



9. Tighten until the assembly marks are at least in line.

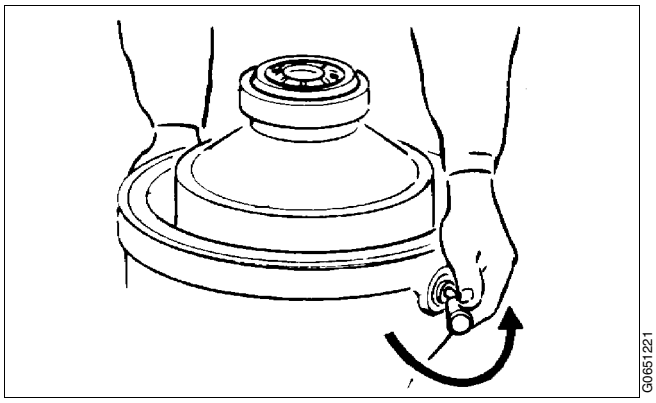


✔ **Check point**
"5.3.4 Disc stack pressure" on page 68.

NOTE

The assembly marks must never pass each other more than 25° which corresponds to A=60 mm.

10. Slacken the two lock screws.



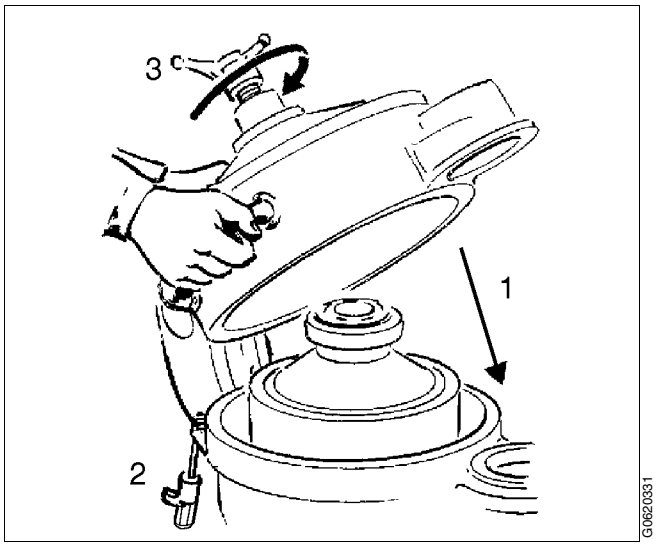
NOTE

The two lock screws must be fully released to prevent risk for damage to bowl body.

11. Lower the collecting cover (1) and tighten it with the clamp bolts (2).
12. Press down the inlet pipe by the knob (3) and turn it until pipe thread engages with paring disc thread.

    Left-hand thread!

    Then let up the knob and tighten it firmly.



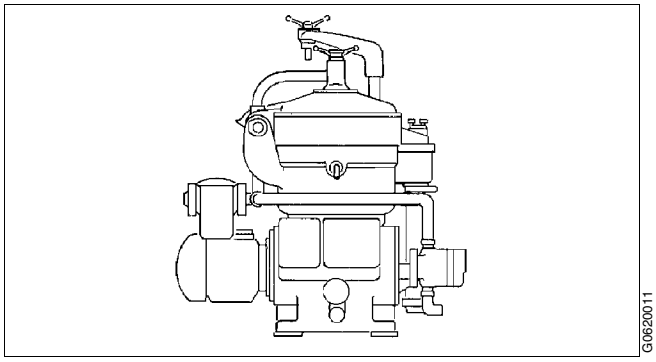
5 Service instructions

Contents

5.1 Periodic maintenance

5.1.1 Introduction

Periodic (preventive) maintenance reduces the risk of unexpected stoppages and breakdowns. Maintenance schedules are shown on the following pages in order to facilitate periodic maintenance.



Periodic maintenance prevent stoppages

WARNING

Disintegration hazards

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

5.1.2 Maintenance intervals

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

The maintenance logs for each maintenance interval later in this chapter give detailed enumeration of the check points that must be done.

Daily checks consist of minor check points to carry out for detecting abnormal operating conditions.

Oil change

The oil change interval is every **1500 hours** or at least once every year if the total number of operating hours is less than **1500 hours**.

When using a group D oil, time of operation between oil changes can be extended from the normal **1500 hours** to **2000 hours**.

Intermediate Service (IS)

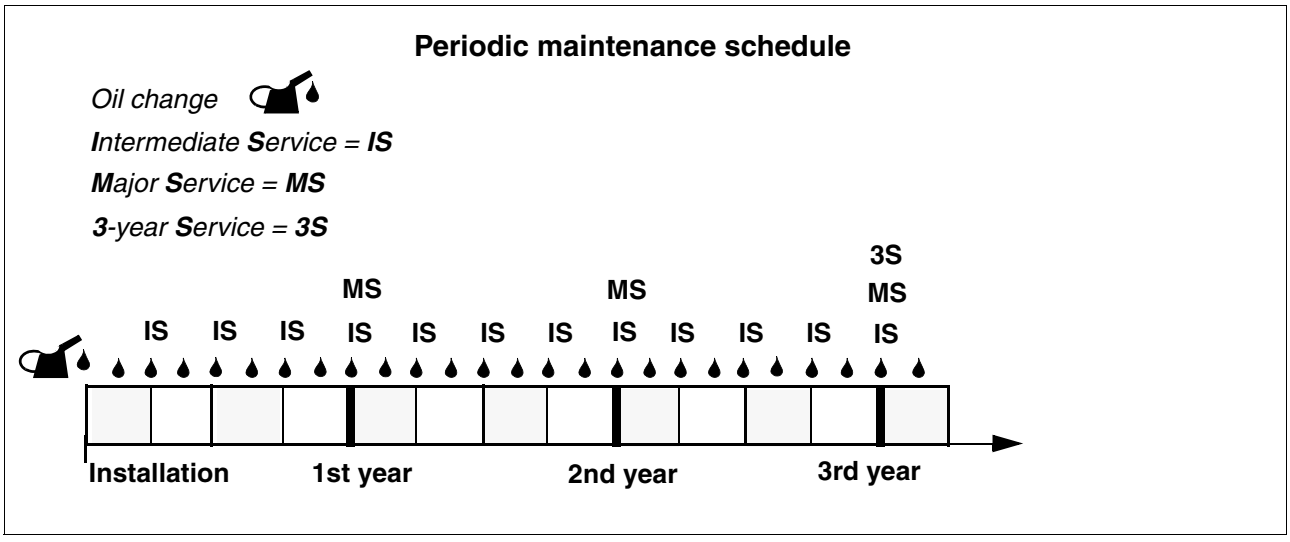
Intermediate Service consists of an overhaul of the separator bowl, inlet/outlet and operating device every **3 months** or **2000 operating hours**. Seals in bowl and gaskets in inlet/outlet device are renewed.

Major Service (MS)

Major Service consists of an overhaul of the complete separator and includes an Intermediate Service every **12 months** or **8000 operating hours**. Seals and bearings in the bottom part are renewed.

3-year Service (3S)

3-year Service consists of an overhaul of the complete separator. The service should be coordinated with a Major Service. Compared with the Major Service additional spare parts with longer life time have to be renewed.



5.1.3 Maintenance procedure

At each Intermediate and Major Service, take a copy of the maintenance log and use it for notations during the service.

An Intermediate and Major Service should be carried out in the following manner:

1. Dismantle the parts as mentioned in the maintenance log and described in “6 Dismantling/Assembly” on page 97.

   Place the separator parts on clean, soft surfaces such as pallets.

2. Inspect and clean the dismantled separator parts according to the maintenance log.

3. Renew the spare parts which are recommended in chapter “6 Dismantling/Assembly” on page 97.

4. Carry out the referred check points mentioned in the assembly instructions.

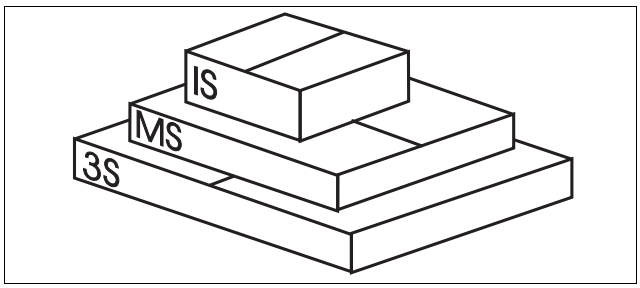
5.1.4 Service kits

Special service kits are available for Intermediate Service (IS), Major Service (MS) and 3-year Service (3S).

For other services the spare parts have to be ordered separately.

Note that the parts for IS are **not** included in the MS kit and parts for IS & MS are not included in the 3S kit.

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



Kits are available for Intermediate Service, Major Service and 3-year Service

NOTE

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

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

WARNING

Disintegration hazards

Use of imitation parts may cause severe damage.

5.2 Maintenance logs

Keep a log of inspection and maintenance performed. Parts repeatedly replaced should be given special consideration. The cause of repeated failures should be determined and corrected. Discuss your problems with an Alfa Laval representative and, when necessary, request a visit by an Alfa Laval service engineer.

Rate of corrosion and erosion and notification of cracks should also be a part of this log. Note the extent of damage and date the log entries so that the rate of deterioration can be observed.

5.2.1 Daily checks

The following steps should be carried out daily.

Main component and activity	Part	Page	Notes
Inlet and outlet			
Check for leakage	Collecting cover and connecting housing	-	
Separator bowl			
Check for vibration and noise		90	
Worm wheel shaft and gear casing			
Check for vibration and noise			
Check	Oil level in gear housing	35	
Electrical motor			
Check for heat, vibration and noise		1)	

1) See manufacturer's instruction

5.2.2 Oil change

The oil change and check of worm gear should be carried out every **1500**[1] **hours** of operation.

When the separator is running for short periods, the lubricating oil must be changed every **12 months** even if the total number of operating hours is less than **1500 hours (2000 h)**.

Note: In a new installation, or after replacement of gear, change the oil after **200 operating hours** and clean the gear housing.

Main component and activity	Part	Page	Notes
Worm wheel shaft and gear housing			
Check	Worm wheel and worm	71	
Renew	Oil[2] in gear housing	57	

1) When using a group D oil, time of operation between oil changes can be extended from the normal **1500 hours** to **2000 hours**.

2) See chapter “8.8 Lubricants” on page 167 for further information.

5.2.3 Intermediate Service (IS)

Name of plant: Local identification:

Separator: MAB 206S-24 Manufacture No./Year:

Total running hours: Product No: 881240-22-15/0

Date: Signature:

Main component and activity	Part	Page	Notes
Inlet and outlet			
Clean and inspect	Threads of inlet pipe	70	
	Connecting housing	-	
	Inlet device	70	
Renew	Seal rings	-	
Separator bowl			
Clean and check	Lock ring	69	
	Bowl hood	-	
	Top disc	-	
	Oil paring disc	70	
	Gravity disc	-	
	Bowl discs	88	
	Distributor	-	
	Bowl body	-	
Check	Corrosion	64	
	Erosion	66	
	Cracks	67	
	Disc stack pressure	68	
Renew	O-rings and sealings	-	

Main component and activity	Part	Page	Notes
Worm wheel shaft and gear housing			
Clean and check	Worm wheel and worm	71	
Renew	Oil in gear housing	57	
Electrical motor			
Lubrication (if nipples are fitted)	See sign on motor	-	
Signs and labels on separator			
Check attachment and readability, replace if needed	Safety label on collecting cover	179	
	Direction of rotation arrow	179	
	Power supply frequency	179	

Note: Renew all parts included in the Intermediate Service kit (IS).

5.2.4 Major Service (MS)

Name of plant: Local identification:

Separator: MAB 206S-24 Manufacture No./Year:

Total running hours: Product No: 881240-22-15/0

Date: Signature:

Main component and activity	Part	Page	Notes
Inlet and outlet			
Clean and inspect	Threads of inlet pipe	70	
	Connecting housing	-	
	Inlet device	70	
Renew	Seal rings	-	
Separator bowl			
Clean and check	Lock ring	69	
	Bowl hood	-	
	Top disc	-	
	Oil paring disc	70	
	Gravity disc	-	
	Bowl discs	88	
	Distributor	-	
	Bowl body	-	
Check	Corrosion	64	
	Erosion	66	
	Cracks	67	
	Disc stack pressure	68	
	Height position of paring disc	77	
Renew	O-rings and sealings	-	

Main component and activity	Part	Page	Notes
Vertical driving device			
Clean and check	Bowl spindle	75	
Check	Buffers	84	
	Ball bearing housing indentations	84	
	Radial wobble of bowl spindle	76	
Renew	Ball bearings and top bearing springs	84	
Worm wheel shaft and gear housing			
Clean and check	Worm wheel and worm	71	
Check	Axial play of coupling disc	78	
Renew	Bearings and O-rings	124	
	Oil in gear housing	57	
Brake			
Clean and check	Spring and brake shoe	-	
Renew	Friction pad	82	
Friction coupling			
Clean and check	Friction coupling	80	
Renew	Friction pads	80	
	Lipseal ring	124	
Electrical motor			
Lubrication (if nipples are fitted)	See sign on motor	-	
Signs and labels on separator			
Check attachment and readability, replace if needed	Safety label on collecting cover	179	
	Direction of rotation arrow	179	
	Power supply frequency	179	
Pump (option)			
Clean and check	Bushings, wear gaskets, flexible coupling, relief/safety valve and impeller shaft	138	
Renew	Lipseal rings	138	

Note: Renew all parts included in the Intermediate Service kit (IS) and Major Service kit (MS).

5.2.5 3-year Service (3S)

The 3-year service should be carried out in conjunction with a Major Service (MS). The extent of the 3-year service is the same as for a major service plus renewing of parts included in the 3-year Service kit (3S).

NOTE

Renew all parts included in the Intermediate Service kit (IS), Major Service kit (MS) and 3-year Service kit (3S).

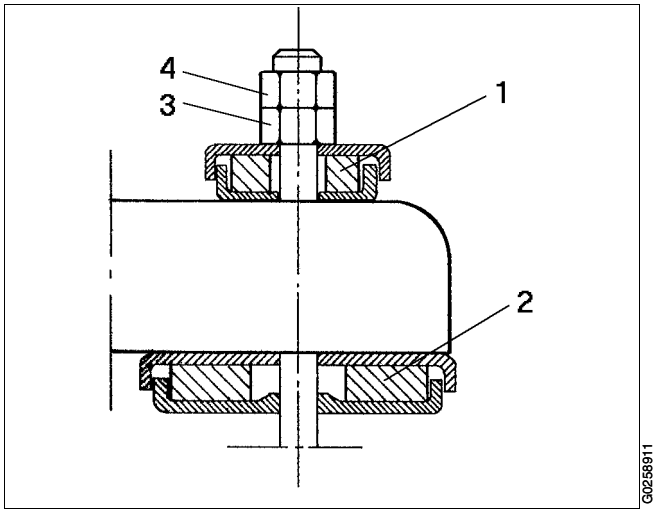
The 3S kit consists among other parts of vibration dampers for renewal of frame feet. How to renew the frame feet is described below.

Frame feet, renewal

1. Disconnect pipes, hoses and cables connected to the separator.
2. Remove the nuts (3, 4).
3. Lift the separator.

> **NOTE**
>
> When lifting a separator it must always **hang securely**. See separate instruction in chapter "5.8 Lifting instructions" on page 96.

4. Renew the vibration dampers (1, 2).
5. Lower the frame. Check that the bolts do not press against the edges of the holes.
6. Tighten the nut (3) to **20 Nm**.
7. Hold the nut (3) firmly and secure with the lock nut (4).
8. Connect the previously disconnected pipes, hoses and cables.



1. Vibration damper, upper
2. Vibration damper, lower
3. Nut
4. Lock nut

5.3 Check points at Intermediate Service (IS)

5.3.1 Corrosion

Evidence of corrosion attacks should be looked for and rectified each time the separator is dismantled. Main bowl parts such as the bowl body, bowl hood and lock ring must be inspected with particular care for corrosion damage.

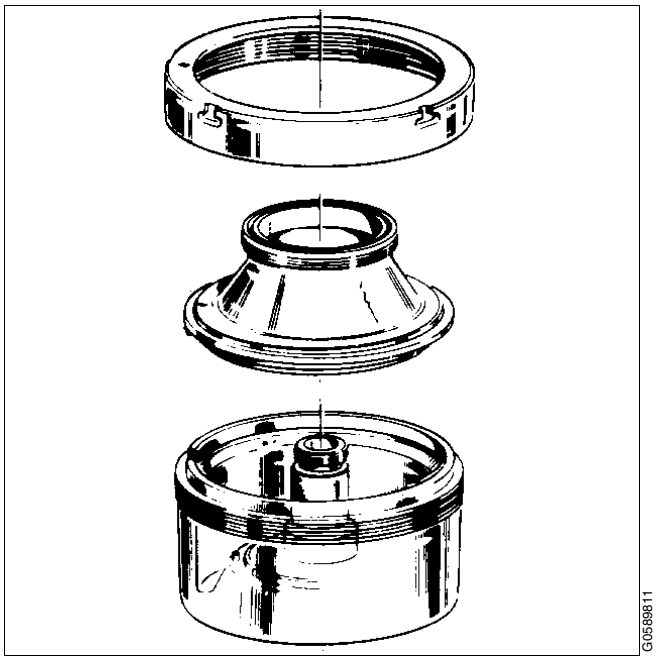
WARNING

Disintegration hazard

Inspect regularly for corrosion damage. Inspect frequently if the process liquid is corrosive.

Always contact your Alfa Laval representative if you suspect that the largest depth of the corrosion damage exceeds **1,0 mm** or if cracks have been found. Do not continue to use the separator until it has been inspected and given clearance for operation by Alfa Laval.

Cracks or damage forming a line should be considered as being particularly hazardous.



Main bowl parts to check for corrosion

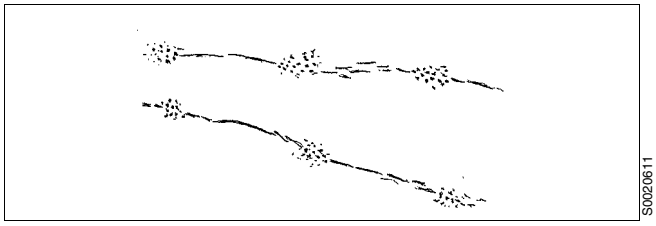
Non-stainless steel and cast iron parts

Corrosion (rusting) can occur on unprotected surfaces of non-stainless steel and cast iron. Frame parts can corrode when exposed to an aggressive environment.

Stainless steel

Stainless steel parts corrode when in contact with either chlorides or acidic solutions. Acidic solutions causes a general corrosion. The chloride corrosion is characterised by local damage such as pitting, grooves or cracks. The risk of chloride corrosion is higher if the surface is:

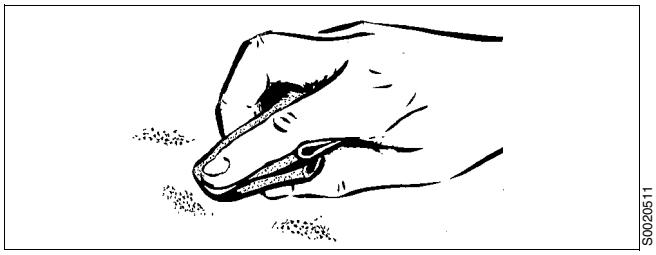
- Exposed to a stationary solution.
- In a crevice.
- Covered by deposits.
- Exposed to a solution that has a low pH value.



Example of chloride corrosion in stainless steel

Corrosion damage caused by chlorides on stainless steel begins as small dark spots that can be difficult to detect.

- Inspect closely for all types of damage by corrosion and record these observations carefully.
- Polish dark-coloured spots and other corrosion marks with a fine grain emery cloth. This may prevent further damage.



Polish corrosion spots

WARNING

Disintegration hazard

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

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

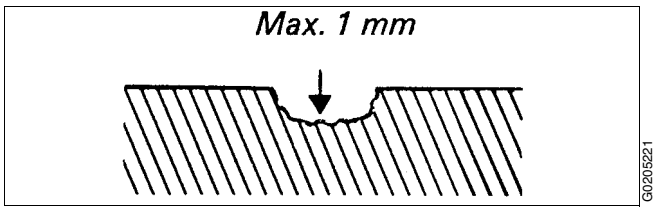
Replace the part if corrosion can be suspected of affecting its strength or function.

Other metal parts

Separator parts made of materials other than steel, such as brass or other copper alloys, can also be damaged by corrosion when exposed to an aggressive environment. Possible corrosion damage can be in the form of pits and/or cracks.

5.3.2 Erosion

Erosion can occur when particles suspended in the process liquid slide along or strike against a surface. Erosion can become intensified locally by flows of higher velocity.



Maximum depth of damage

WARNING

Disintegration hazard

Inspect regularly for erosion damage. Inspect frequently if the process liquid is erosive.

Always contact your Alfa Laval representative if the largest depth of any erosion damage exceeds **1,0 mm**. Valuable information as to the nature of the damage can be recorded using photographs, plaster impressions or hammered-in lead.

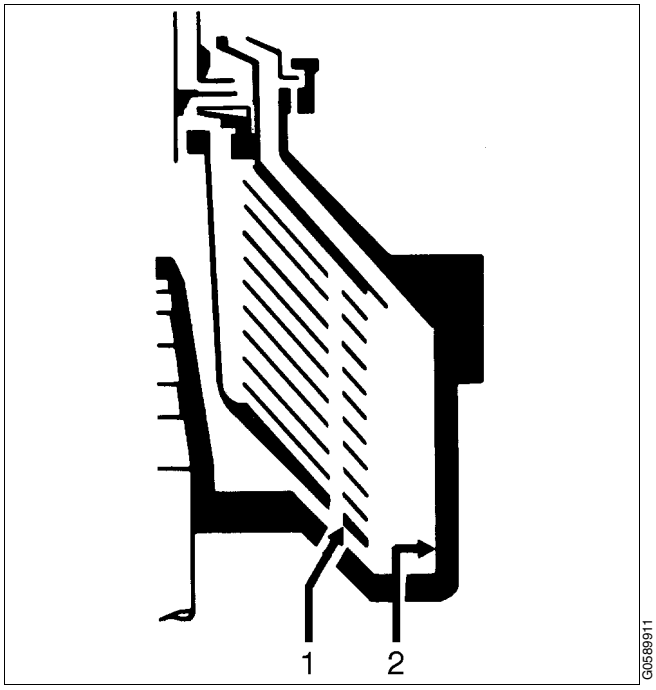
Erosion is characterised by:

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

Surfaces particularly subjected to erosion are:

1. The underside of the distributor in the vicinity of the distribution holes and wings.
2. The internal surface of the bowl body that faces the conical part of the distributor.

Look carefully for any signs of erosion damage. Erosion damage can deepen rapidly and consequently weaken parts by reducing the thickness of the metal.



Erosion check points

WARNING

Disintegration hazard

Erosion damage can weaken parts by reducing the thickness of the metal.

Replace the part if erosion can be suspected of affecting its strength or function.

5.3.3 Cracks

Cracks can initiate on the machine after a period of operation and propagate with time.

- Cracks often initiate in an area exposed to high cyclic material stresses. These are called fatigue cracks.
- Cracks can also initiate due to corrosion in an aggressive environment.
- Although very unlikely, cracks may also occur due to the low temperature embrittlement of certain materials.

The combination of an aggressive environment and cyclic stresses will speed-up the formation of cracks. Keeping the machine and its parts clean and free from deposits will help to prevent corrosion attacks.

WARNING

Disintegration hazard

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

Always replace a part if cracks are present.

It is particularly important to inspect for cracks in rotating parts.

Always contact your Alfa Laval representative if you suspect that the largest depth of the damage exceeds **1,0 mm**. Do not continue to use the separator until it has been inspected and cleared for operation by Alfa Laval.

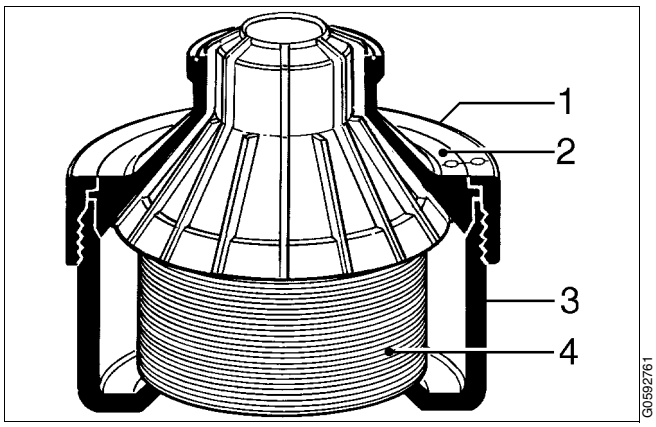
5.3.4 Disc stack pressure

The lock ring (1) should press the bowl hood (2) firmly against the bowl body (3). The hood in turn should exert a pressure on the disc stack (4), clamping it in place.

NOTE

Ensure that the disc stack pressure is sufficient to maintain bowl balance.

Insufficient pressure in disc stack can cause out of balance vibration and reduced lifetime of ball bearings.



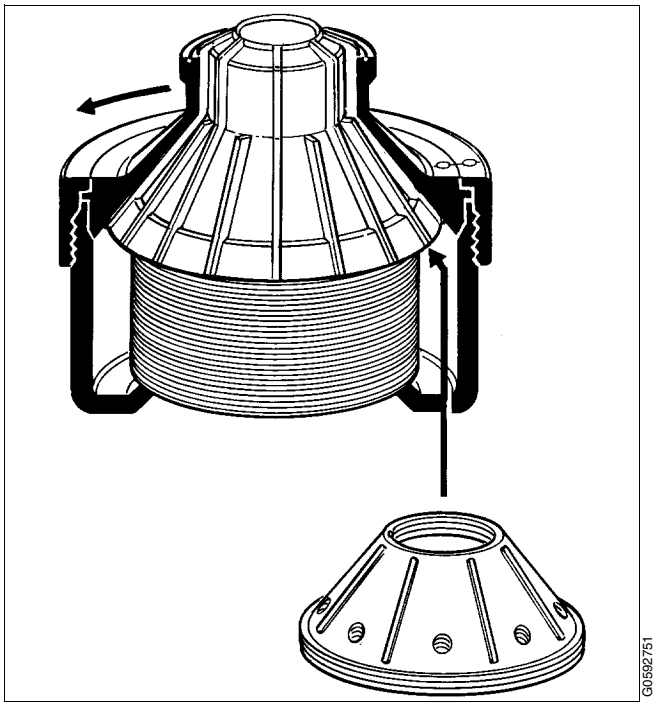
Disc stack pressure check

Compress the disc stack by tightening the lock ring, see chapter “6.2.4 Assembly” on page 106.

Correct pressure is obtained when it is possible to tighten the lock ring so far by hand that the ϕ-mark on the lock ring is positioned 60° - 90° before the mark on the bowl body.

To achieve this, add an appropriate number of discs to the top of the disc stack beneath the top disc.

Then advance the lock ring by giving the spanner handle some blows till the ϕ-marks are passed and the bowl is fully assembled.



Add discs to achieve correct disc stack pressure

5.3.5 Lock ring; wear and damage

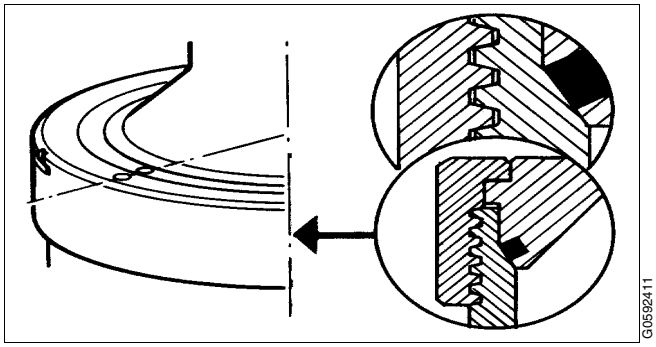
Excessive wear or impact marks on threads, guide and contact surfaces of the lock ring, bowl hood and bowl body may cause hazardous galling.

Check the thread condition by tightening the lock ring after removing the disc stack and bowl hood O-ring from the bowl.

WARNING

Disintegration hazards

Wear on large lock ring thread must not exceed safety limit. The ϕ-mark on lock ring must not pass opposite ϕ-mark by more than the specified distance.



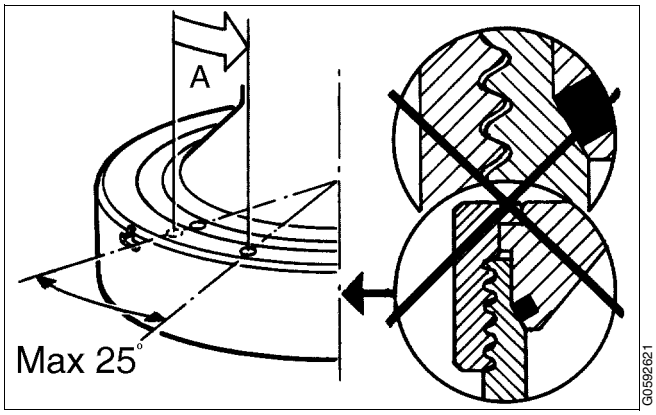
Wear of lock ring

In a new bowl the alignment marks on the lock ring and the bowl body are exactly opposite each other.

If thread wear is observed, mark the bowl body at the new position of the alignment mark on the lock ring by punching in a new alignment mark.

Contact Your Alfa Laval representative

- If the original mark on the lock ring passes the corresponding mark on the bowl body by more than **25**° (which corresponds to A=
- **60 mm**).
- If the alignment marks become illegible. The thread wear need to be inspected and the new position of alignment marks determined.



The ϕ-mark on the lock ring must not pass the ϕ-mark on the bowl body by more than 25°

Damage

Clean the threads, contact and guide surfaces with a suitable degreasing agent.

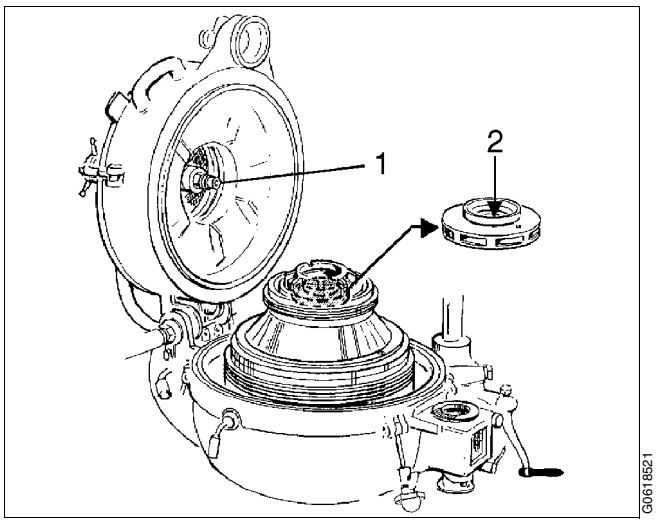
Check for burrs and protrusions caused by impact. Watch your fingers for sharp edges.

If damage is established, rectify using a whetstone or fine emery cloth (recommended grain size 240).
If the damage is considerable, use a fine single-cut file, followed by a whetstone.

5.3.6 Inlet pipe and oil paring disc

1. Check treads of inlet pipe (1) and of oil paring disc (2) for damage and wear.

   Check the seal rings.

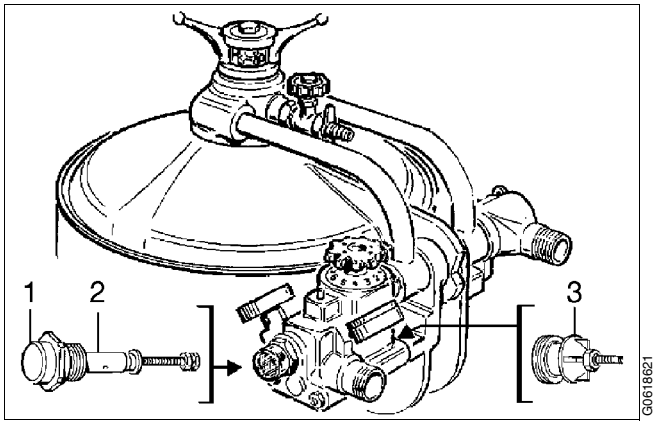


Location of inlet pipe (1) and oil paring disc (2)

5.3.7 Inlet device

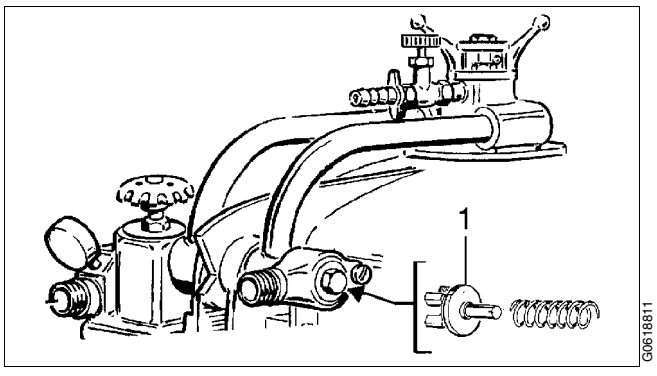
1. Check the flow indicator (2) if clogged. Clean the sight glass (1).

   Check the reducing valve cone (3) for scratches and play.



1. *Sight glass*
2. *Flow indicator*
3. *Reducing valve*

2. Check the non-return valve cone (1) for scratches and play.



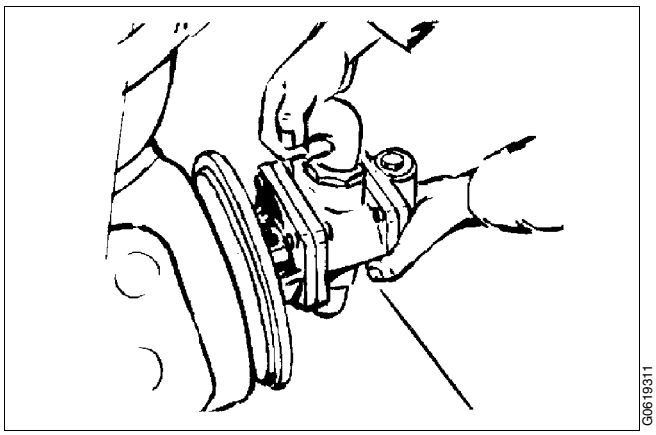
Valve cone (1) in the non-return valve

5.3.8 Worm wheel and worm; wear of teeth

Check the teeth of worm wheel and worm for wear.

To allow inspection when further dismantling is not intended, remove the bearing shield or pump (if fitted) to uncover the worm gear.

Note: If the separator is equipped with a built-on pump, see “6.3 Vertical driving device (MS)” on page 112 how to remove and fit the pump.

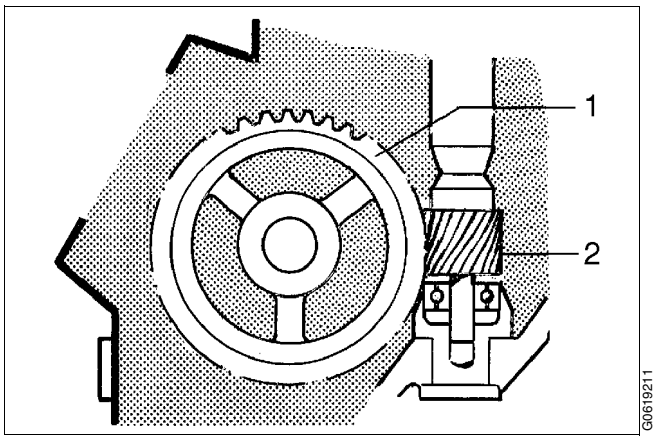


Remove the bearing shield or pump (if fitted) for check of worm gear

Examine the contact surfaces of the gear and compare with “ Tooth appearance examples” in the end of this section. The gear may operate satisfactorily even when worn to some degree.

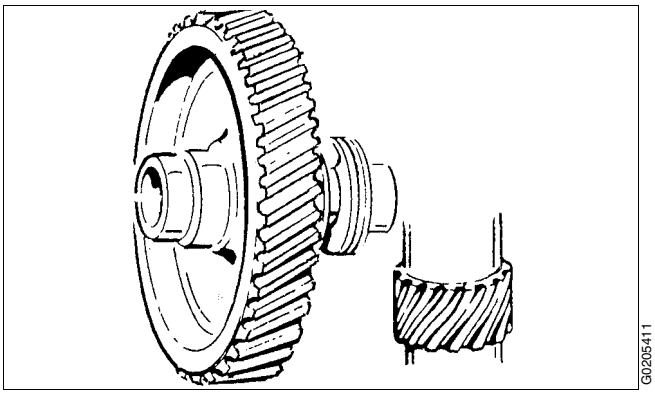
NOTE

Replace both worm wheel and worm at the same time, even if only one of them is worn.



1. Worm wheel
2. Worm (part of bowl spindle)

When replacing the gear, always make sure that the new worm wheel and worm have the same number of teeth as the old ones. See chapter “8.2 Technical data” on page 159 for correct number of teeth.



Check the gear ratio (number of teeth) when replacing the gear

WARNING

Disintegration hazards

Check that gear ratio is correct for power frequency used. If incorrect, subsequent overspeed may result in a serious breakdown.

NOTE

Presence of metal chips in the oil bath is an indication that the gear is wearing abnormally.

When using mineral-type oil in the worm gear housing, the presence of black deposits on the spindle parts is an indication that the oil base has deteriorated seriously or that some of the oil additives have precipitated. If pits are found on the worm gear, the cause could be that the additives are not suitable for this purpose.

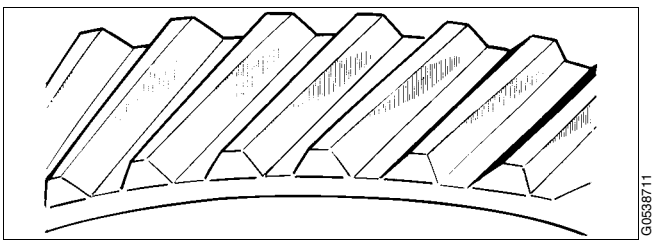
In all these cases it is imperative to change to a high-temperature oil. See chapter “8.8 Lubricants” on page 167.

Tooth appearance examples

Satisfactory teeth:

Uniform wear of contact surfaces. Surfaces are smooth.

Good contact surfaces will form on the teeth when the gear is subjected to only moderate load during its running-in period.

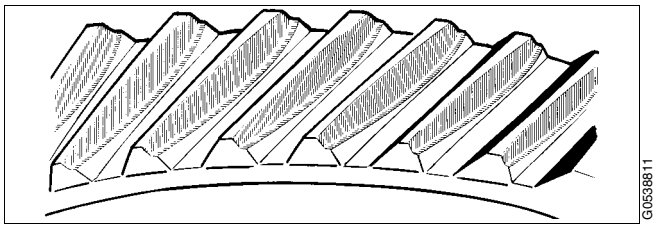


Satisfactory teeth

Worn teeth:

Permissible wear is as a rule 1/3 of the thickness of the upper part of a tooth, provided that

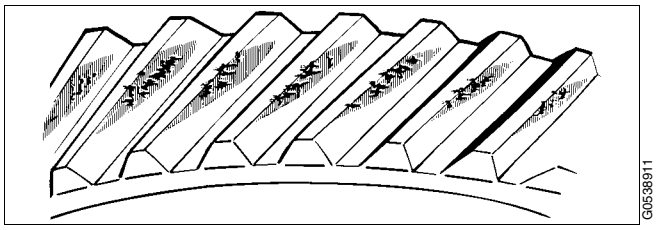
- the wear is uniform over the whole of the flank of a tooth
- and all teeth are worn in the same way.



Worn teeth

Spalling:

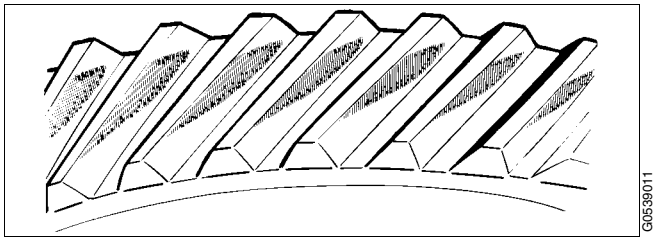
Small bits of the teeth have broken off, so-called spalling. This is generally due to excessive load or improper lubrication. Damage of this type need not necessitate immediate replacement, but careful checking at short intervals is imperative.



Spalling

Pitting:

Small cavities in the teeth, so-called pitting, can occur through excessive load or improper lubrication. Damage of this type need not necessitate immediate replacement, but careful check at short intervals is imperative.



Pitting

5.4 Check points at Major Service (MS)

5.4.1 Corrosion

Same as described in “5.3.1 Corrosion” on page 64.

5.4.2 Erosion

Same as described in “5.3.2 Erosion” on page 66.

5.4.3 Cracks

Same as described in “5.3.3 Cracks” on page 67.

5.4.4 Disc stack pressure

Same as described in “5.3.4 Disc stack pressure” on page 68.

5.4.5 Lock ring; wear and damage

Same as described in “5.3.5 Lock ring; wear and damage” on page 69.

5.4.6 Bowl spindle cone and bowl body nave

Impact marks on the spindle cone or in the bowl body nave may cause poor fit and out-of-balance vibrations.

The bowl spindle and the nave should also be checked if the bowl spindle has been dismantled or if the bowl runs roughly.

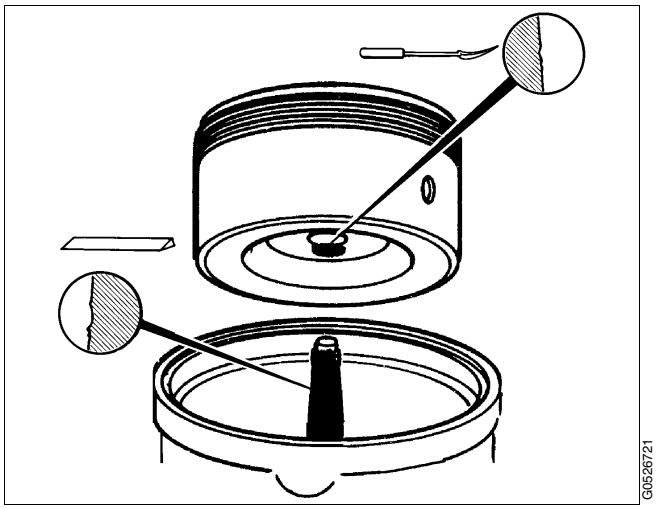
Corrosion may cause the bowl to stick firmly to the spindle cone and cause difficulties during the next dismantling.

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

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

Finish with polishing paper (e.g. No 600).

NOTE
Always use a scraper with great care. The cone shape must not be deformed.



Remove impact marks from the nave and cone

5.4.7 Radial wobble of bowl spindle

The bowl spindle wobble should be checked if the bowl spindle has been dismantled or if rough bowl running (vibration) occurs.

NOTE

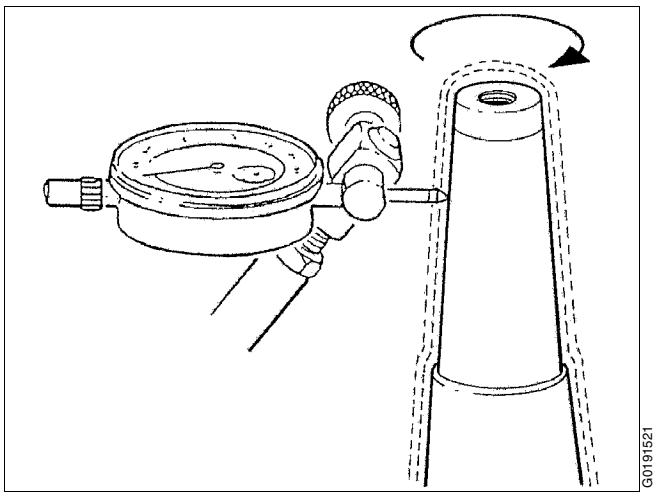
Spindle wobble will cause rough bowl run. This leads to vibration and reduces lifetime of ball bearings.

Check the wobble before mounting the bowl.

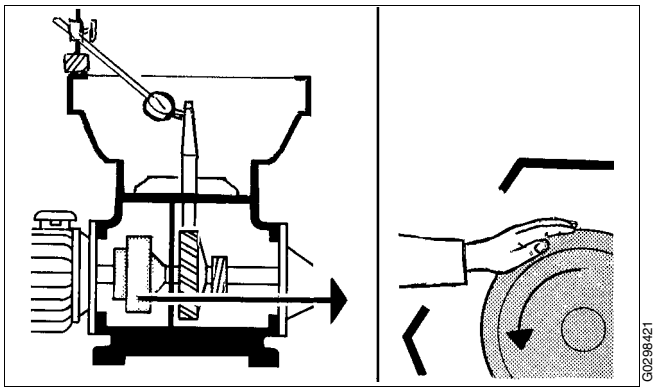
Before measuring, make sure that the buffer plugs are properly tightened.

- Fit a dial indicator in a support and fasten it to the frame.
- Remove the brake cover to get access to the coupling drum. Use the coupling drum to revolve the spindle manually.
- Measure the wobble at the top of the tapered end of the spindle. Permissible radial wobble is **maximum 0,04 mm**.
- If wobble is too large, renew all the ball bearings on the spindle.

Measure wobble after assembly. If it is still excessive, the spindle is probably damaged and must be replaced, contact your Alfa Laval representative.



Measurement of radial wobble



Rotate the spindle by hand

5.4.8 Inlet pipe and oil paring disc

Same as described in “5.3.6 Inlet pipe and oil paring disc” on page 70.

5.4.9 Inlet device

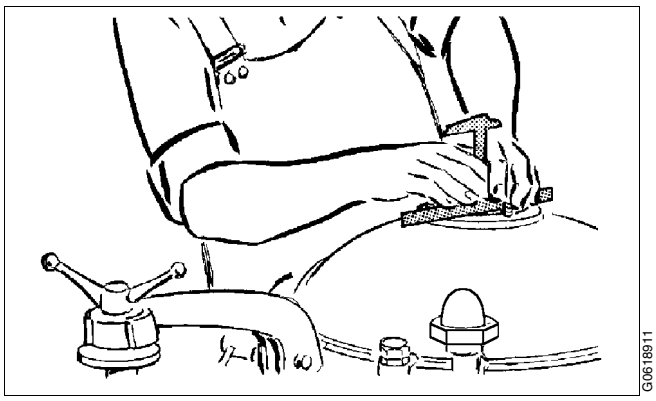
Same as described in “5.3.7 Inlet device” on page 70.

5.4.10 Height position of oil paring disc

Incorrect height position may cause the oil paring disc to scrape against the paring chamber.

Check up after replacing or mounting parts that may affect the height position.

1. Assemble the bowl, leaving out the small lock ring and the gravity disc.
2. Tighten the large lock ring until the bowl hood is in close contact with the bowl body.
3. Remove the connection housing. Lower the hood and clamp it with the hinged bolts.

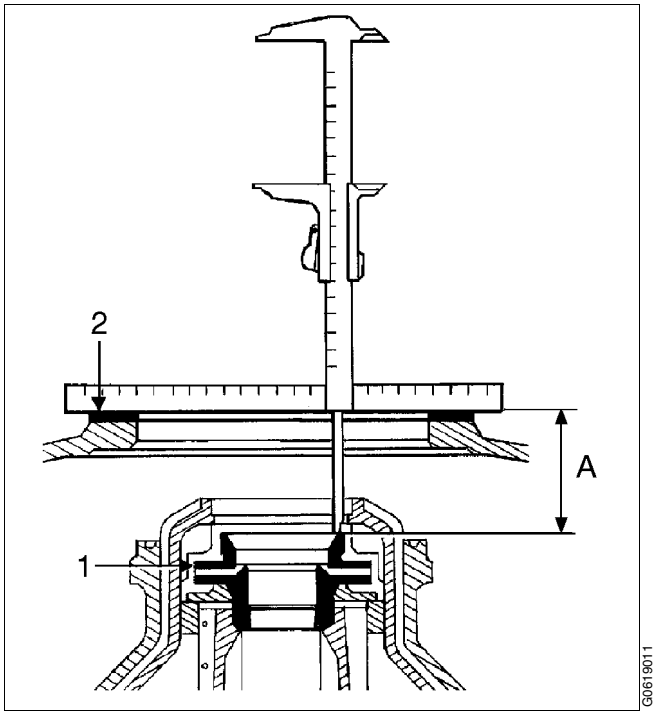


Use a slide calliper and steel ruler for measuring

4. Measure distance A according to figure. The distance shall be **68,0 ±0,5 mm.**

   The distance is adjusted by adding or removing height adjusting rings (2).

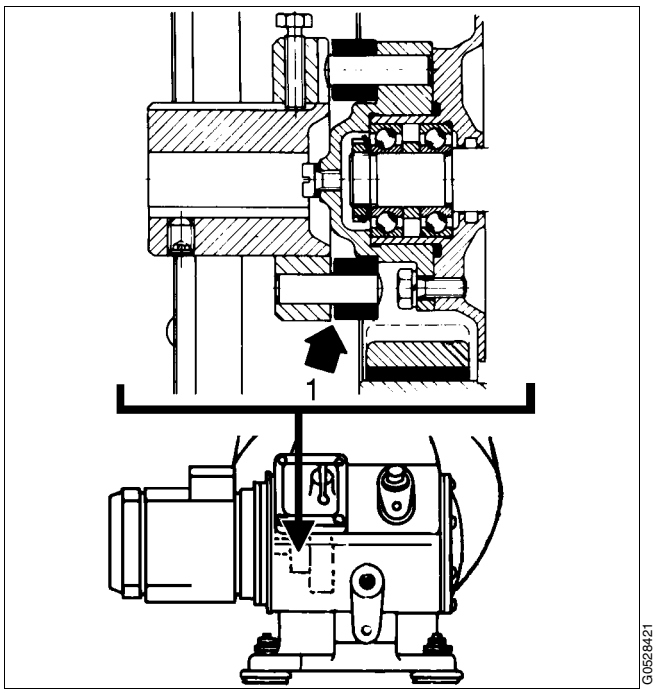
   After height adjustment the worm wheel should be revolved by hand. If the shaft turns heavily or a scraping noise is noticed, the height adjustment is wrong and needs re-checking.



Measurement of the height position of paring disc (1)

5.4.11 Flexible plate in coupling

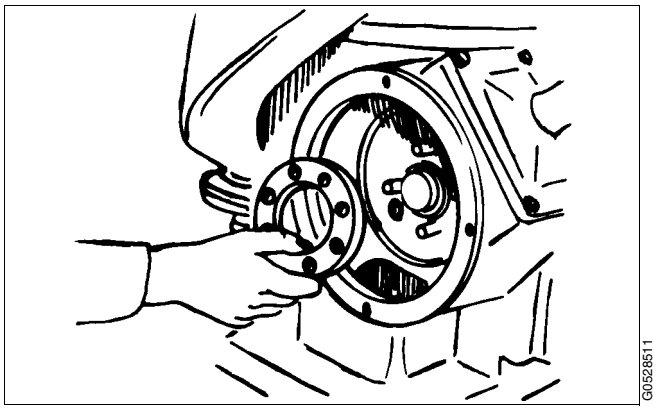
The axial play (1) of the flexible plate should be approximately **2 mm**.



Location of the axial play (1) in the flexible coupling

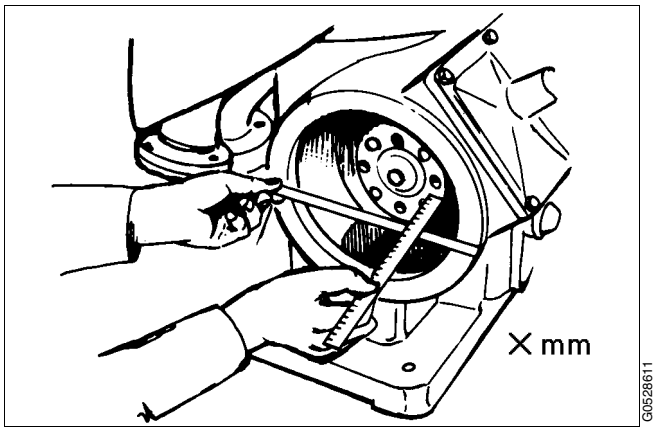
Check the play as follows:

Fit the elastic plate in its place in the coupling disc of the separator. Make sure that good contact is obtained.



The elastic plate must be fitted

Measure the distance from the frame ring (or motor adapter) to the coupling disc of the separator.

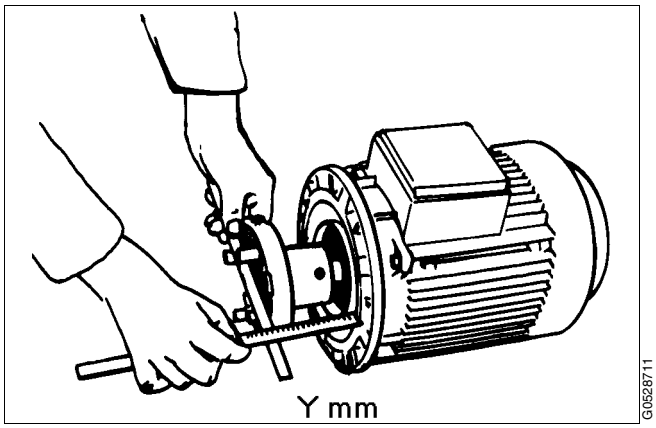


Measure of distance for coupling in separator frame

Measure the distance from the motor coupling disc to the motor flange.

X mm - Y mm **= 2 mm.**

If required, adjust the position of the motor coupling disc.



Measure of distance for coupling on motor

5.4.12 Coupling friction pads

Worn or oily pads in the coupling will cause a long acceleration period.

CAUTION

Inhalation hazard

When handling friction blocks/pads use a dust mask to make sure not to inhalate any dust.

Do not use compressed air for removal of any dust. Remove dust by vacuum or wet cloth.

See Safety instructions for environmental issues regarding correct disposal of used friction blocks/pads.

If the separator does not attain full speed within about 2 minutes or the bowl lose speed during operation, the friction pads of the coupling may be worn or oily.

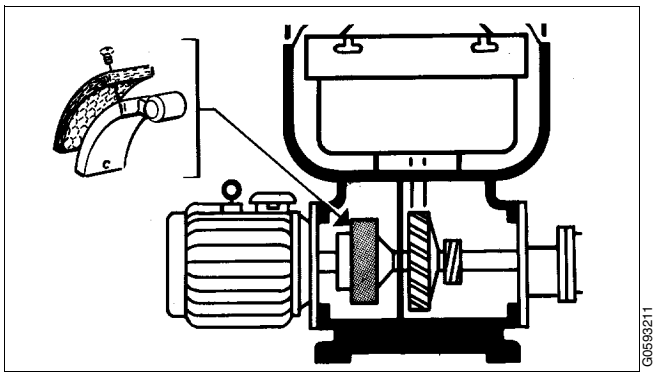
Check the pads. If the pads are oily:

- Clean the pads and the inside of the coupling drum with a suitable degreasing agent. Roughen the friction surfaces of the pads with a coarse file.

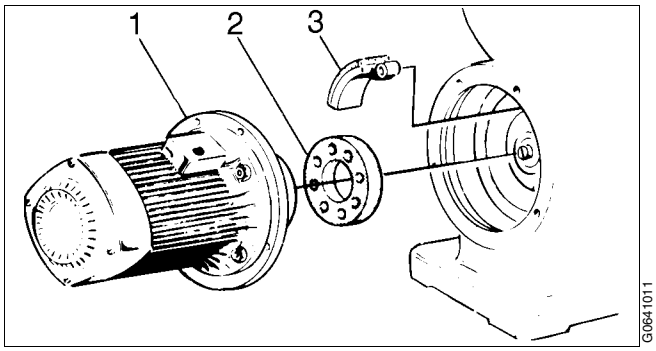
If the pads are worn, they have to be renewed:

- Remove the
  - electric motor (1)
  - elastic plate (2)
  - friction blocks (3).

  If disconnecting the motor cables, note the positions of cables in the terminal box to reconnect correctly (for correct direction of rotation).



Location of coupling friction blocks



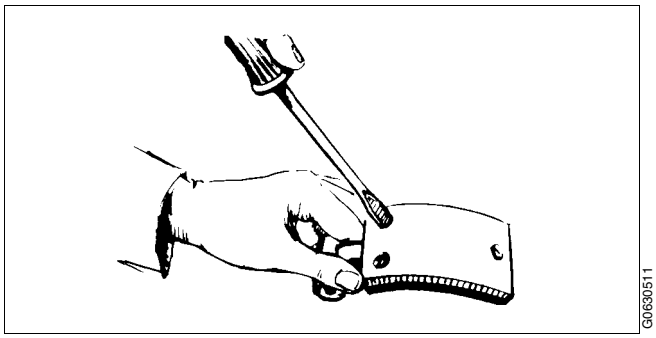
1. *Electric motor*
2. *Elastic plate*
3. *Friction block*

- Remove the screws and renew the pads.

NOTE

The screws are slotted in both ends.

Replace all pads even if only one is worn.



Three screws fix the friction pad to the friction block

WARNING

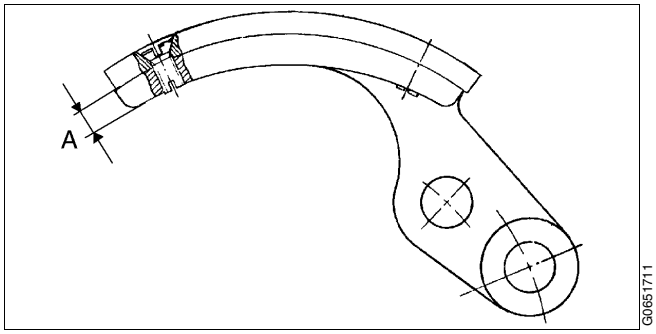
Disintegration hazards

When power cables have been connected, always check direction of rotation. If incorrect, vital rotating parts could unscrew causing disintegration of the machine.

Various types of friction blocks

If mounting new friction blocks, check that the blocks are correct for the power supply frequency and if the separator is supplied with a built-on pump or not.

Measure (mm)	With pump		With no pump	
	50 Hz	60 Hz	50 Hz	60 Hz
A	17	9	9	6



Measure A is different for 50 and 60 Hz installations and if a built-on feed pump is fitted or not

5.4.13 Brake

A worn or oily friction pad will lengthen the braking period.

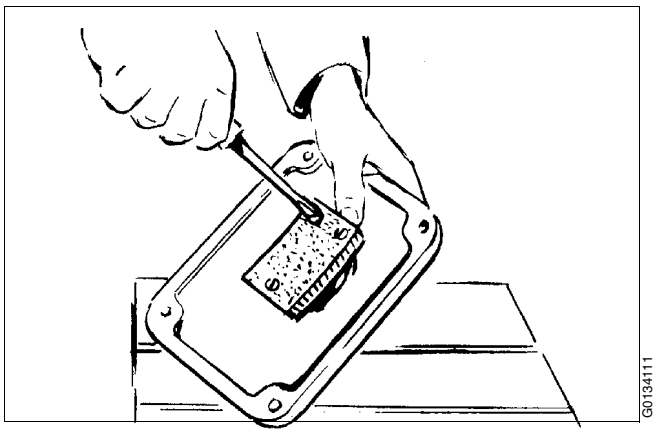
CAUTION

Inhalation hazard

When handling friction blocks/pads use a dust mask to make sure not to inhalate any dust.

Do not use compressed air for removal of any dust. Remove dust by vacuum or wet cloth.

See Safety instructions for environmental issues regarding correct disposal of used friction blocks/pads.



Friction pad is fastened with screws

If the friction pad is worn:

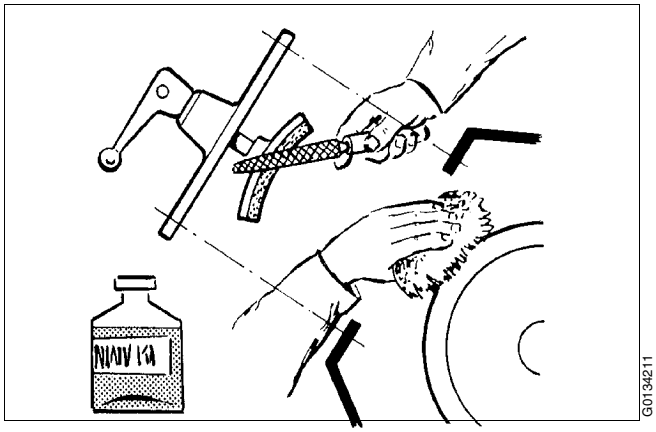
- Remove the screws and exchange the friction pad.

NOTE
The screws are slotted in both ends.

If the friction pad is oily:

- Clean the friction pad and the coupling drum with a suitable degreasing agent.
- Roughen the friction surface of the friction pad with a coarse file.

NOTE
Identify the cause of oily friction pad. If oil is leaking from the gear housing, renew the sealing ring between the two parts.

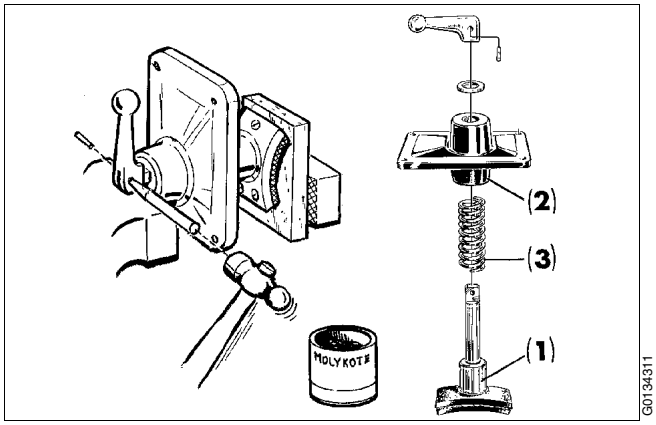


Measurements when the friction pad is oily

Checking of spring and brake shoe:

Formation of rust on brake parts may cause the brake to jam.

- Remove any rust from the surface (1) of the brake shoe and the corresponding guide surface in the cap (2).
- Rub in Molykote Paste on the surfaces.
- Replace the spring (3) if it has been weak. This is indicated by chattering from the spring when the brake is in released position.
- Oil the spring when assembling.



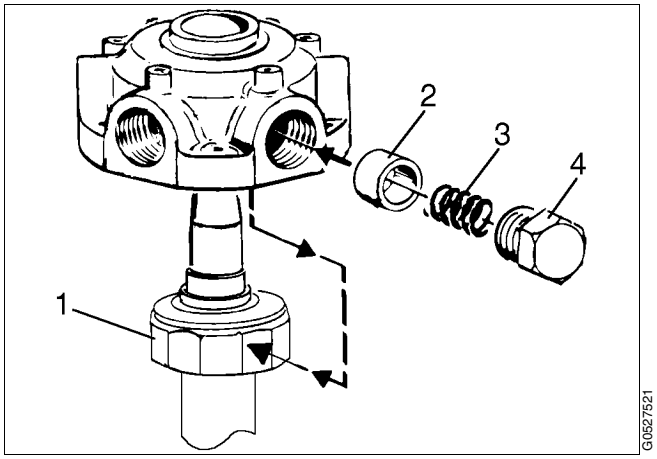
1. *Contact surface on the brake shoe for the spring*
2. *Guide surface in the cap for the brake shoe*
3. *Spring*

5.4.14 Buffer springs and ball bearing housing

Weakened or broken buffer springs or defective contact surfaces for the buffers on the ball bearing housing may give rise to separator vibration (rough bowl run).

Top bearing springs

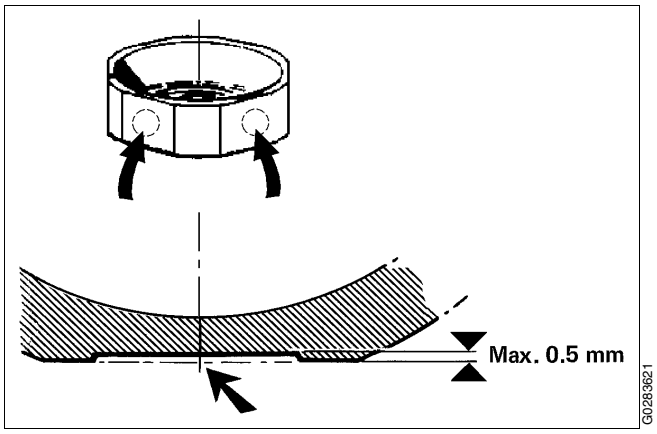
In case of spring fracture, the complete set of springs should be replaced, even if only one spring is broken.



1. *Ball bearing housing*
2. *Radial buffer*
3. *Buffer spring*
4. *Screw plug*

Ball bearing housing

Examine the contact surface for the buffers on the ball bearing housing. In case of defects (indentations deeper than **0,5 mm**), renew the housing as well as buffers and springs.



Max. permitted indentations made by radial buffers

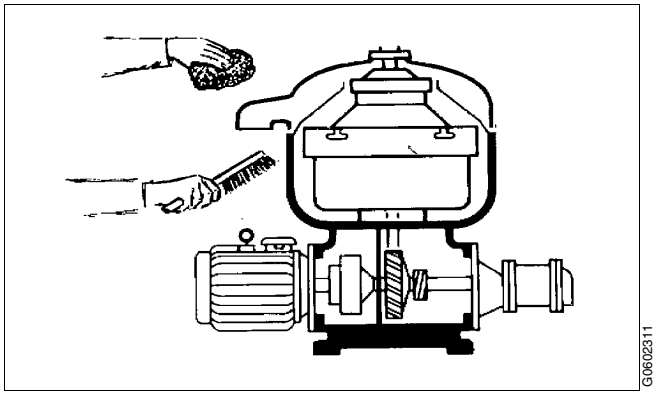
5.4.15 Worm wheel and worm; wear of teeth

Same as described in “5.3.8 Worm wheel and worm; wear of teeth” on page 71.

5.5 Cleaning

5.5.1 External cleaning

The external cleaning of the frame and motor should be restricted to brushing, sponging or wiping while the motor is running or is still hot.



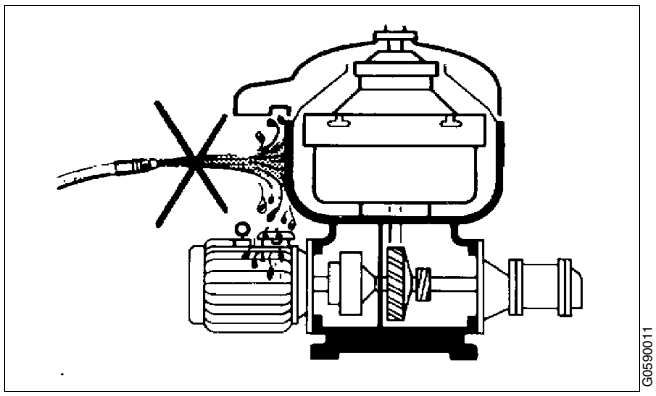
Use a sponge or cloth and a brush when cleaning

Never wash down a separator with a direct water stream.

Totally enclosed motors can be damaged by direct hosing to the same extent as open motors and even more than those, because:

- Some operators believe that these motors are sealed, and normally they are not.
- A water jet played on these motors will produce an internal vacuum, which will suck the water between the metal-to-metal contact surfaces into the windings, and this water cannot escape.
- Water directed on a hot motor may cause condensation resulting in short-circuiting and internal corrosion.

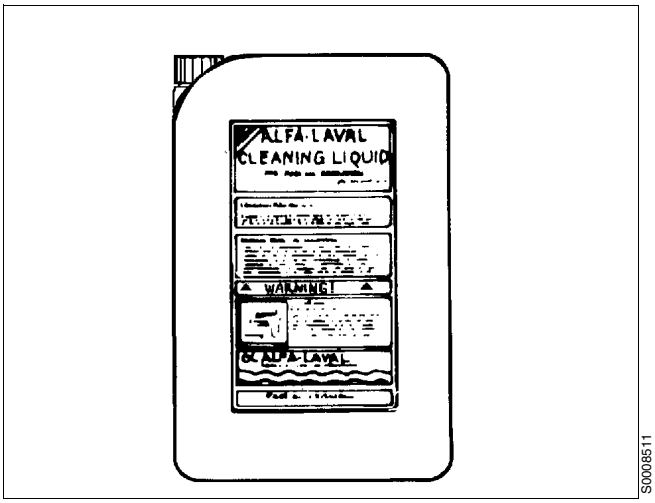
Be careful even when the motor is equipped with a protecting hood. Never play a water jet on the ventilation grill of the hood.



Never wash down a separator with a direct water stream or playing a water jet on the motor

5.5.2 Cleaning agents

When using chemical cleaning agents, make sure you follow the general rules and supplier's recommendations regarding ventilation, protection of personnel, etc.



Alfa Laval cleaning liquid for separators

For separator bowl, inlet and outlet

A chemical cleaning agent must dissolve the deposits quickly without attacking the material of the separator parts.

- For cleaning of **lube oil** separators the most important function of the cleaning agent is to be a good solvent for the gypsum in the sludge. It should also act as a dispersant and emulsifier for oil. It is recommended to use **Alfa Laval cleaning liquid for lube oil separators** which has the above mentioned qualities. Note that carbon steel parts can be damaged by the cleaning agent if submerged for a long time.
- **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.

  Alfa Laval cleaning liquid of fuel oil separators has been developed for this purpose. The liquid is water soluble, non-flammable and does not cause corrosion of brass and steel. It is also gentle to rubber and nylon gaskets in the separator bowl.

  Before use, dilute the liquid with water to a concentration of 3-5%. Recommended cleaning temperature is 50-70 °C.

CAUTION

Skin irritation hazard

Read the instructions on the label of the plastic container before using the cleaning liquid.

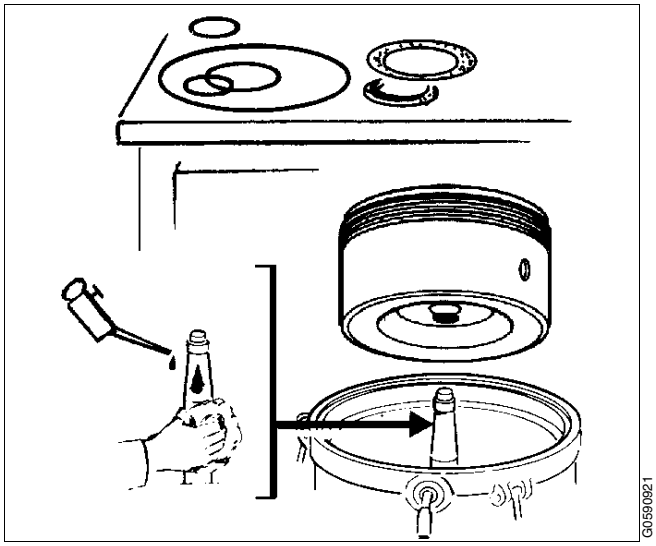
Always wear safety goggles, gloves and protective clothing as the liquid is alkaline and dangerous to skin and eyes.

For parts of the driving devices

Use white spirit, cleaning-grade kerosene or diesel oil.

Oiling (protect surfaces against corrosion)

Protect cleaned carbon steel parts against corrosion by oiling. Separator parts that are not assembled after cleaning must be wiped and coated with a thin layer of clean oil and protected from dust and dirt.



Oil parts to protect from corrosion

5.5.3 Cleaning of bowl discs

Bowl discs

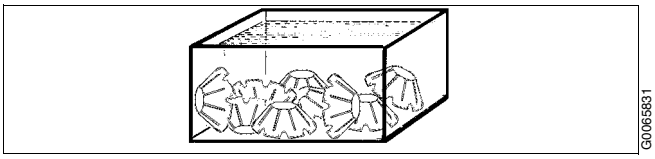
Handle the bowl discs carefully so as to avoid damage to the surfaces during cleaning.

NOTE

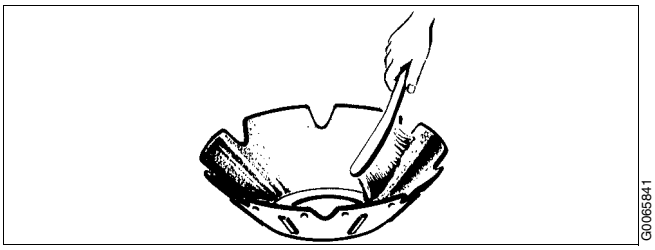
Mechanical cleaning is likely to scratch the disc surfaces causing deposits to form quicker and adhere more firmly.

A gentle chemical cleaning is therefore preferable to mechanical cleaning.

1. Remove the bowl discs from the distributor and lay them down, **one by one**, in the cleaning agent.
2. Let the discs remain in the cleaning agent until the deposits have been dissolved. This will normally take between two and four hours.
3. Finally clean the discs with a **soft** brush.



Put the discs one by one into the cleaning agent



Clean the discs with a soft brush

5.6 When changing oil

Check at each oil change

Check the teeth of both the worm wheel and worm for wear. Compare with the illustrations in “5.3.8 Worm wheel and worm; wear of teeth” on page 71.

5.6.1 Oil change procedure

NOTE

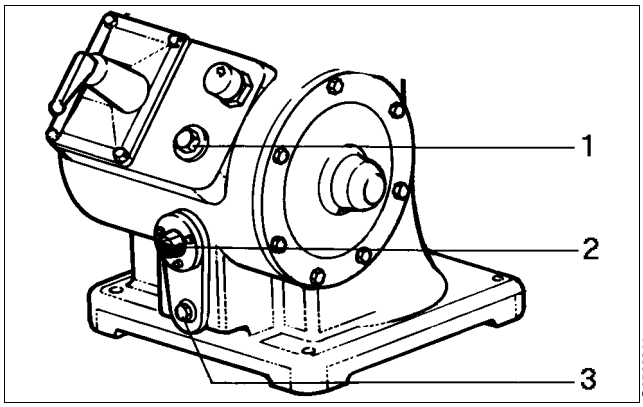
Before adding or renewing lubricating oil in the worm gear housing, the information concerning different oil groups, handling of oils, oil change intervals etc. given in chapter “8.8 Lubricants” on page 167 must be well known.

1. Place a collecting tray under the drain hole, remove the drain plug and drain off the oil.

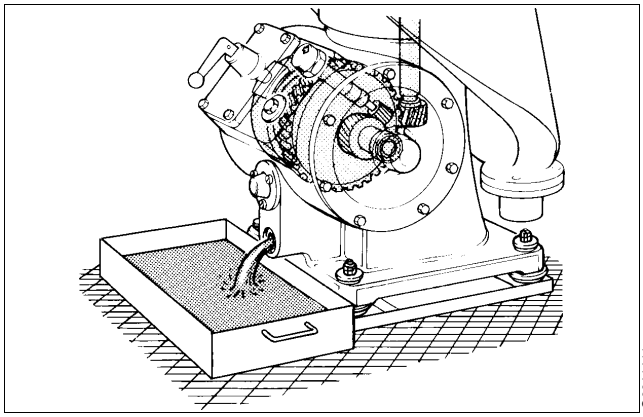
CAUTION

Burn hazards

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



1. Oil filling plug
2. Sight glass
3. Oil drain plug



Burn hazards: The drained oil can be hot

2. Fill new oil in the worm gear housing. The oil level should be slightly above the middle of the sight glass.

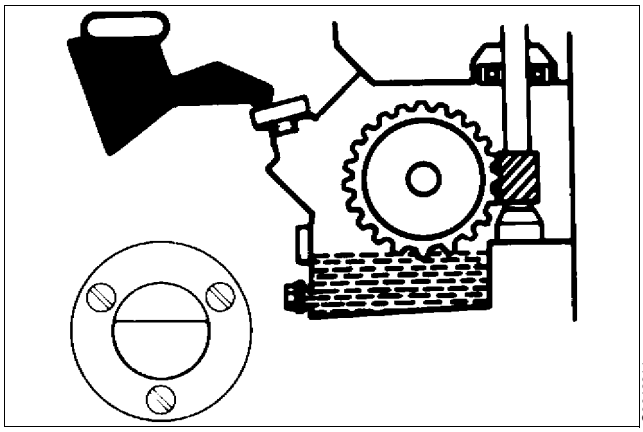
   Oil volume: Approx. **4 litres**

   For oil brands, see “8.8.2 Recommended lubricating oils” on page 168.

NOTE

During operation the oil level is normally just visible in the lower part of the sight glass.

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



Fill new oil in the worm gear housing

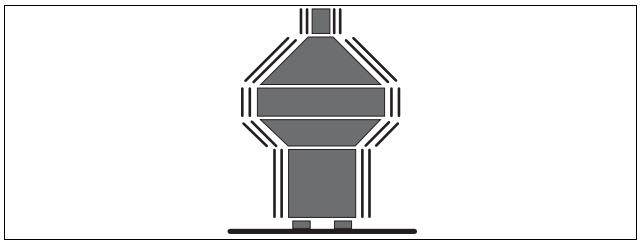
5.7 Common maintenance directions

5.7.1 Vibration

Vibration or noise often indicates that something is incorrect.

Use vibration analysis instrument to periodically check and record the level of vibration.

The level of vibration should not exceed maximum for separator in use. Stop the separator and identify the cause.



Vibration

NOTE

The level of vibration should not exceed **9 mm/sec** at full speed.

WARNING

Disintegration hazards

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

The cause of the vibration must be identified and corrected before the separator is restarted. Excessive vibration can be due to incorrect assembly or poor cleaning of the bowl.

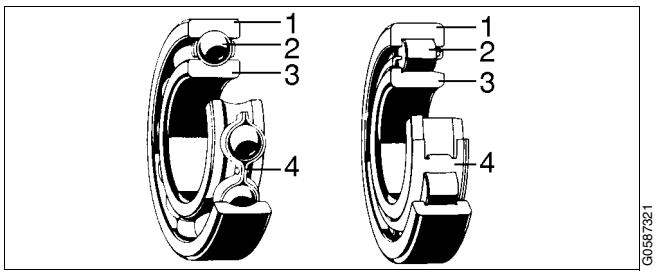
5.7.2 Ball and roller bearings

Special-design bearings for the bowl spindle

The bearings used for the bowl spindle are special to withstand the speed, vibration, temperature and load characteristics of high-speed separators.

Only Alfa Laval genuine spare parts should be used.

A bearing that in appearance looks equivalent to the correct may be considerably different in various respects: inside clearances, design and tolerances of the cage and races as well as material and heat treatment.



1. Outer race
2. Ball/roller
3. Inner race
4. Cage

NOTE

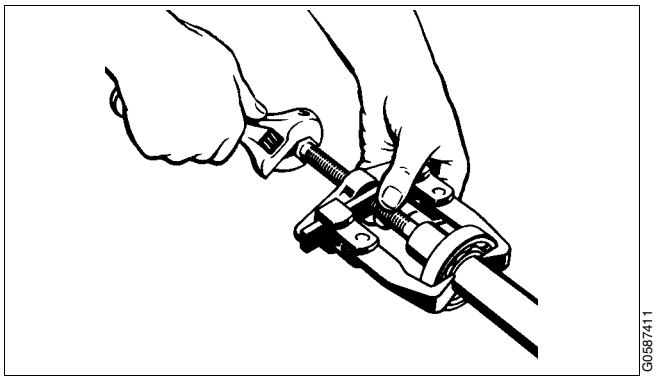
Using an incorrect bearing can cause a serious breakdown with damage to equipment as a result.

Do not re-fit a used bearing. Always replace it with a new one.

Dismantling

For bearings where no driving-off sleeve is included in the tool kit, remove the bearing from its seat by using a puller. If possible, let the puller engage the inner ring, then remove the bearing with a steady force until the bearing bore completely clears the entire length of the cylindrical seat.

The puller should be accurately centered during dismantling; otherwise, it is easy to damage the seating.



For bearings where no driving-off sleeve is included in the tool kit, use a puller when removing bearings

NOTE

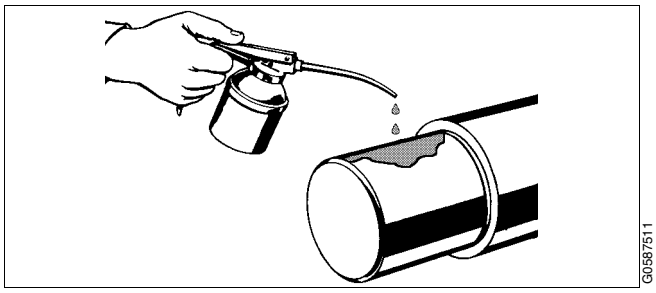
Do not hit with a hammer directly on the bearing.

Cleaning and inspection

Check shaft (spindle) end and/or bearing seat in the housing for damage indicating that the bearing has rotated on the shaft (spindle) and/or in the housing respectively. Replace the damaged part(s), if the faults cannot be remedied by polishing or in some other way.

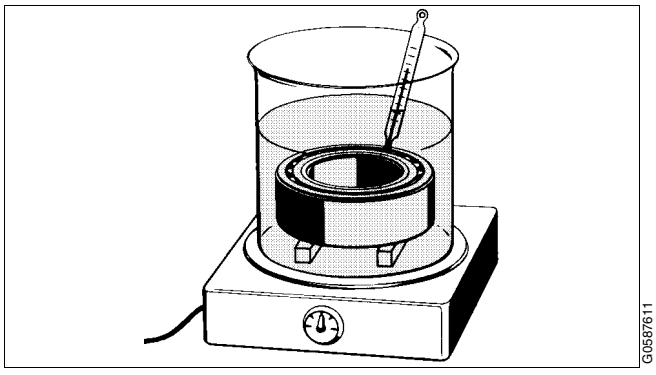
Assembly

- Leave new bearings in original wrapping until ready to fit. The anti-rust agent protecting a new bearing should not be removed before use.
- Use the greatest cleanliness when handling the bearings.
- To facilitate assembly and also reduce the risk of damage, first clean and then lightly smear the bearing seating on shaft (spindle) or alternatively in housing, with a thin oil.



Clean and smear the bearing seating before assembly

- When assembling ball bearings, the bearings must be heated in oil to **max. 125 °C**.



The bearing must not be in direct contact with the container

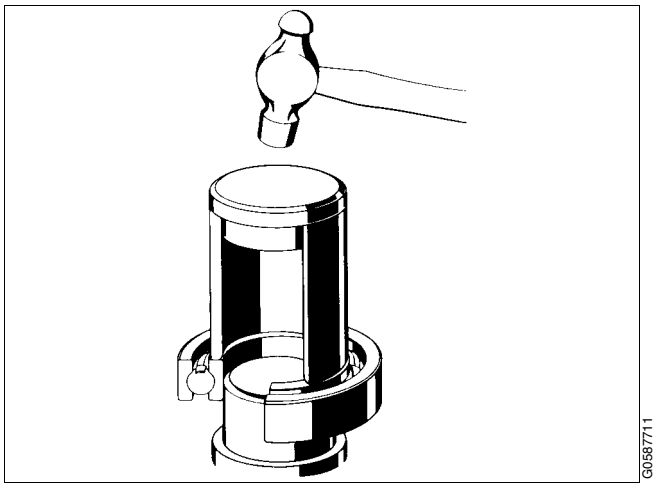
NOTE

Heat the bearing in a clean container.

Use only clean oil with a flash point **above 250 °C**.

The bearing must be well covered by the oil and not be in direct contact with the sides or the bottom of the container. Place the bearing on some kind of support or suspended in the oil bath.

- There are several basic rules for assembling cylindrical bore bearings:
  - Never directly strike a bearing's rings, cage or rolling elements while assembling. A ring may crack or metal fragments break off.
  - Never apply pressure to one ring in order to assemble the other.
  - Use an ordinary hammer. Hammers with soft metal heads are unsuitable as fragments of the metal may break off and enter the bearing.
  - Make sure the bearing is assembled at a right angle to the shaft (spindle).
- If necessary use a driving-on sleeve that abuts the ring which is to be assembled with an interference fit, otherwise there is a risk that the rolling elements and raceways may be damaged and premature failure may follow.



Use a driving-on sleeve for bearings that are not heated

5.7.3 Before shutdown

Before the separator is shutdown for a period of time, the following must be carried out:

- Remove the bowl, according to chapter “6 Dismantling/Assembly” on page 97.

NOTE

The bowl must not be left on the spindle during standstill for more than one week.

Vibration in foundations can be transmitted to the bowl and produce one-sided loading of the bearings. This can cause bearing failure.

- Protect cleaned carbon steel parts against corrosion by oiling. Separator parts that are not assembled after cleaning must be wiped and protected against dust and dirt.
- Protect the spindle taper from corrosion by lubricating it with oil.

For storage see “8.11 Storage and installation” on page 181.

5.7.4 Before start-up

- If the separator has been shut-down for more than 3 months but less than 12 months, an Intermediate Service (IS) has to be made. In addition to IS-service: Lubricate the top bearing with 10 mil. of lubricating oil.
- If the electric motor is equipped with grease nipples; pre-lubricate according to the instructions in “5.7.5 Lubrication of electric motor” on page 95 and/or the manufacturers information. See “8.8 Lubricants” on page 167 for type of grease.

  If the motor has no grease nipples, it is permanently lubricated. No action is needed.
- If the shut-down period has been longer than 12 months, a Major Service (MS) should be carried out.

5.7.5 Lubrication of electric motor

For motors equipped without permanently lubricated bearings, correct lubrication interval and recommended type of grease can be found in the manufacturer's instructions.

Manual lubrication

Regreasing while motor is running:

- Remove grease outlet plug or open closing valve if fitted.
- Be sure that the lubrication channel is open.
- Press the specified amount of grease into the bearing.
- Let the motor run 1-2 hours to ensure that all excess grease is forced out of the bearing. Close the grease outlet plug or closing valve if fitted.

Regreasing while motor is at standstill:

Regrease motors while running. If this is not possible, lubrication can be carried out while the machine is at a standstill.

- In this case, use only half the quantity of grease, then run the motor for a few minutes at full speed.
- When the motor has stopped, press the rest of the specified amount of grease into the bearing.

After 1-2 running hours close grease outlet plug or closing valve if fitted.

5.8 Lifting instructions

Alfa Laval ref. 557990, rev. 1

Attach two endless slings or cables to the separator frame as illustrated.

NOTE

Machine weight without bowl is approx. **500 kg**.

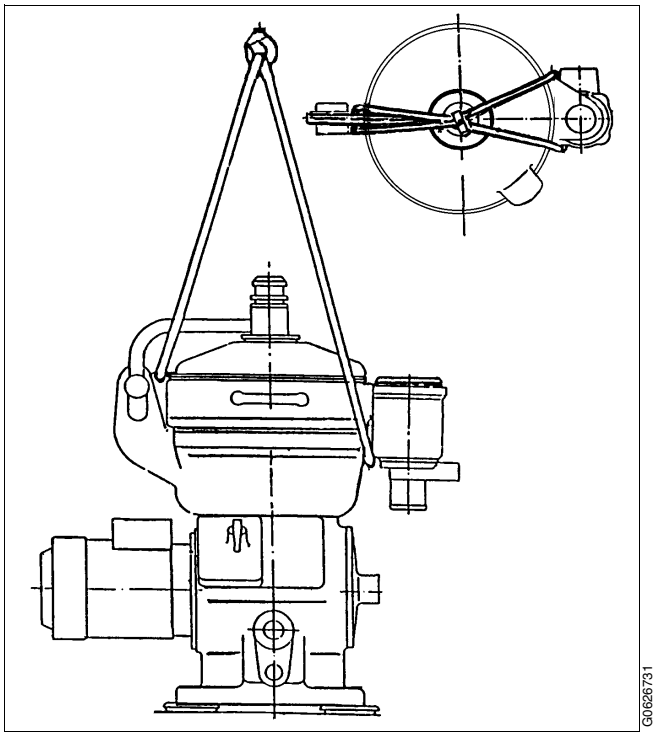
Do not lift the separator unless the bowl has been removed.

WARNING

Crush hazards

Lift the separator in no other way than illustrated.

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



Lift the separator with the bowl removed

When lifting the bowl, use the special lifting tool fastened on the bowl hood.

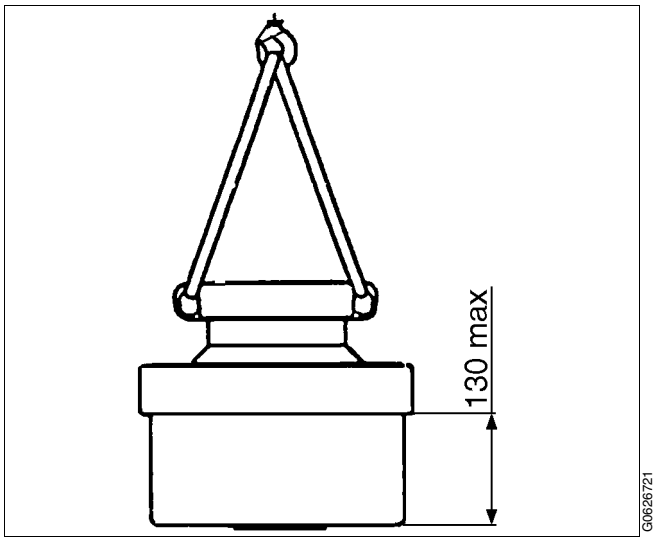
NOTE

Check that the lock ring is properly tightened.

The distance between the lock ring and the bottom part of the bowl body must not exceed **130 mm**, see illustration.

Weight to lift is approx. **70 kg**.

When lifting the bowl out of the separator frame, the cap nut fixing the bowl to the bowl spindle must first be removed.



The lock ring must be properly tightened when lifting the bowl

6 Dismantling/Assembly

Contents

6.1 General

6.1.1 General directions

The separator must be dismantled regularly for cleaning and inspection.

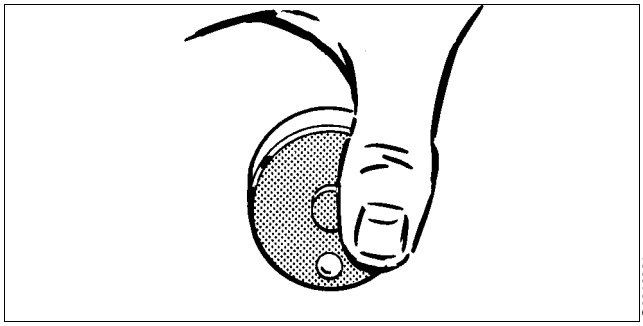
The recommended intervals are stated in chapter “5.1.2 Maintenance intervals” on page 52.

WARNING

Entrapment hazards

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

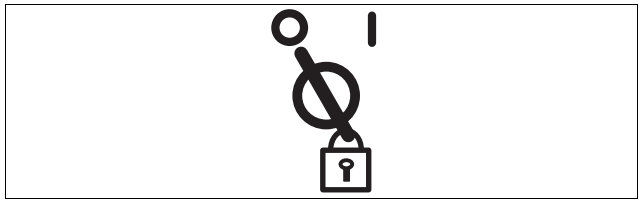
The revolution counter and the motor fan indicate if separator parts are rotating or not.



The revolution counter indicates if the separator still is rotating

To avoid accidental start, switch off and lock the power supply.

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



Switch off and lock the power supply before starting the dismantling

NOTE

Never interchange bowl parts

To prevent mixing of parts, e.g. in an installation comprising several machines of the same type, the major bowl parts carry the machine manufacturing number or its last tree digits.

6.1.2 References to check points

In the text you will find references to the Check Point instructions in chapter 5. The references appear in the text as in the following example:

✔ **Check point**
"5.3.4 Disc stack pressure" on page 68.

In this example, look up check point Disc stack pressure in chapter 5 for further instructions.

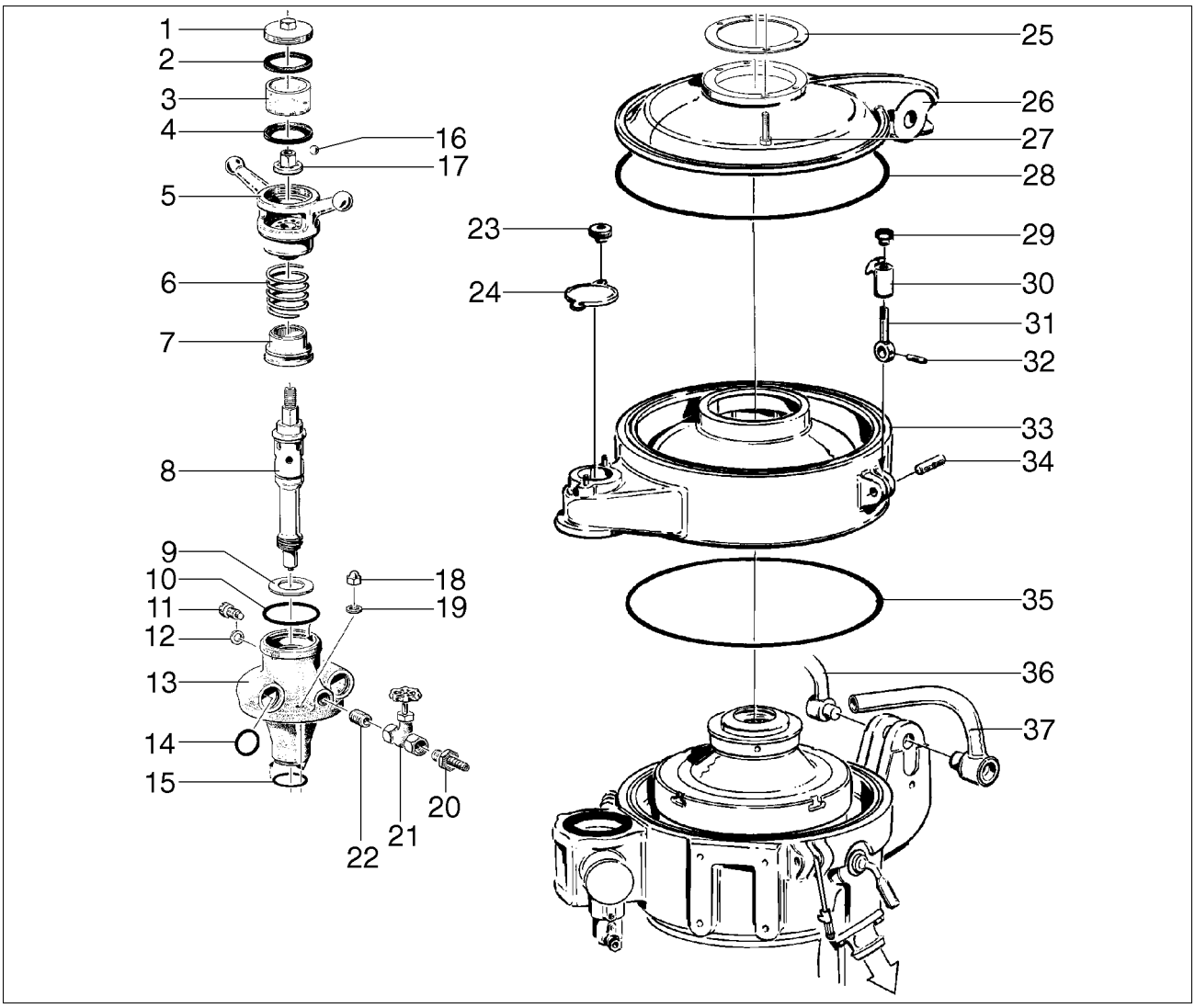
6.1.3 Tools

Special tools from the tool kit must be used for dismantling and assembly. The special tools are specified in the *Spare Parts Catalogue* and are shown as illustrations together with the dismantling/assembly instructions.

NOTE
When lifting parts without weight specifications, always use lifting straps with the working load limit (WLL) of at least **300 kg**.

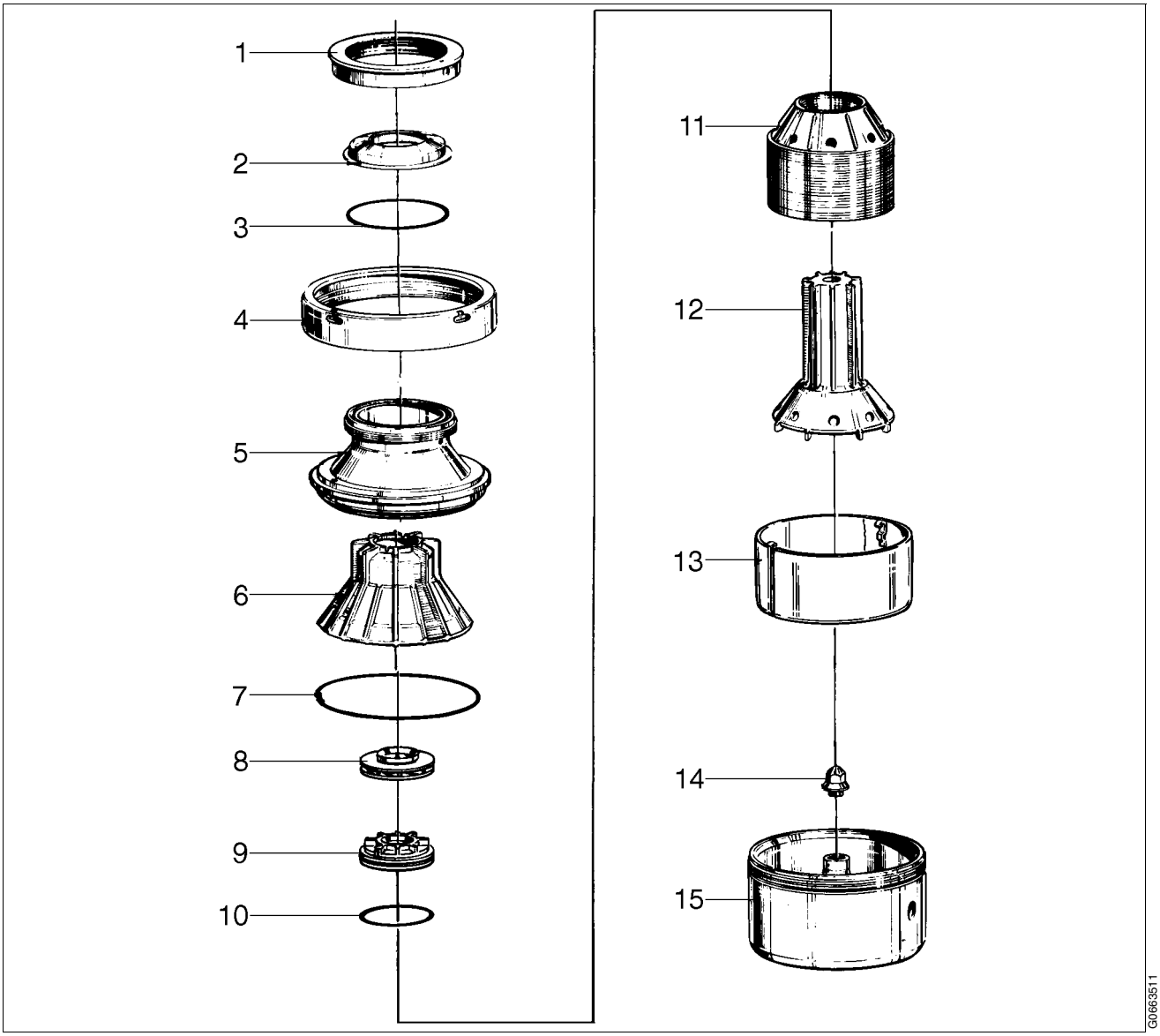
6.2 Inlet/outlet, collecting cover and bowl (IS)

6.2.1 Exploded view, inlet/outlet and collecting cover



1. Cover
2. Seal ring
3. Glass tube
4. Seal ring
5. Knob
6. Spring
7. Sleeve
8. Inlet pipe
9. Washer
10. Seal ring
11. Screw
12. Packing
13. Housing
14. Seal ring
15. Seal ring
16. Ball
17. Nut
18. Nut
19. Washer
20. Hose nipple
21. Needle valve
22. Nipple
23. Knob
24. Cover
25. Height adjusting ring
26. Top cover
27. Screw
28. Seal ring
29. Nut
30. Clamping shoe
31. Hinged bolt
32. Pin
33. Collecting cover
34. Hinged pin
35. Seal ring
36. Angle pipe
37. Angle pipe

6.2.2 Exploded view, bowl

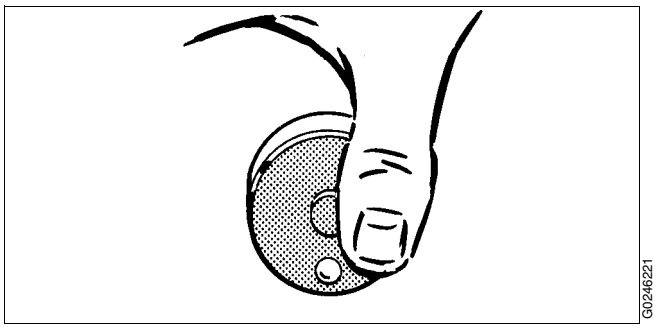


1. *Lock ring, small*
2. *Gravity disc*
3. *Seal ring*
4. *Lock ring, large*
5. *Bowl hood*
6. *Top disc*
7. *Seal ring*
8. *Paring disc*
9. *Level ring*
10. *Seal ring*
11. *Bowl disc*
12. *Distributor*
13. *Sludge basket*
14. *Cap nut*
15. *Bowl body*

6.2.3 Dismantling

1. Be sure the bowl has stopped rotating.

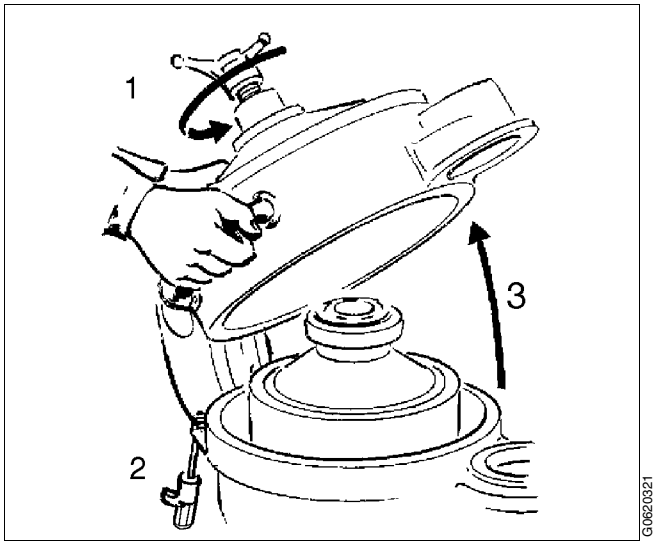
   If starting to dismantle before complete standstill the oil paring disc and the top of the bowl will probably be damaged.



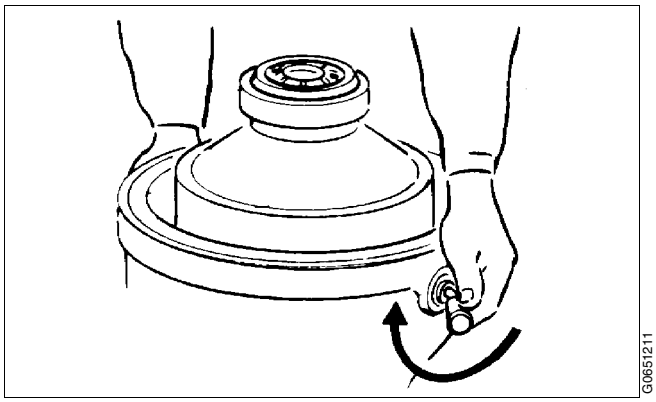
2. Slacken the knob (1).

   Left-hand thread!

3. Loosen the clamp bolts (2) and open the collecting cover (3).

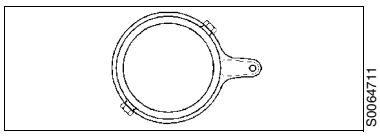


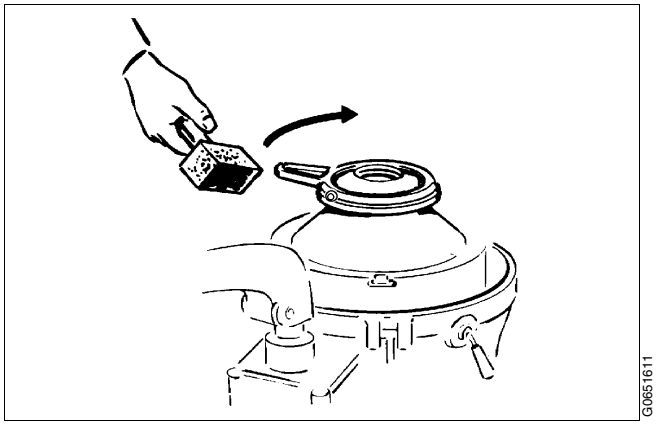
4. Lock the bowl from rotating with the two lock screws.



5. Unscrew the small lock ring by using the special spanner.

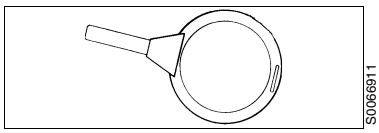
   Left-hand thread!

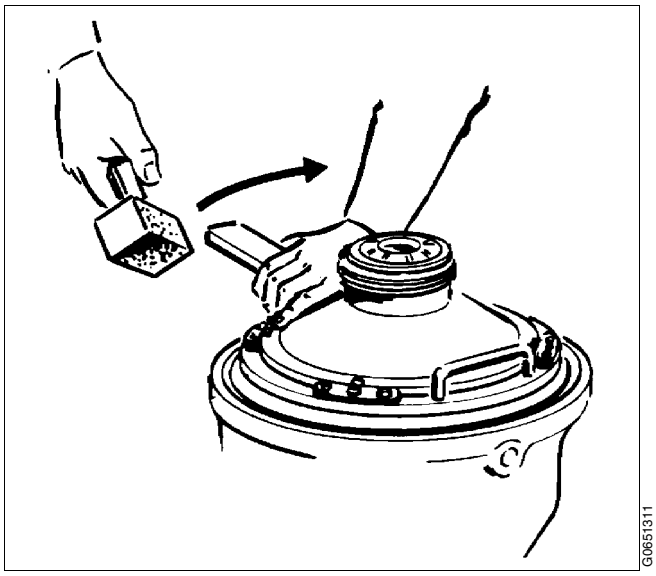




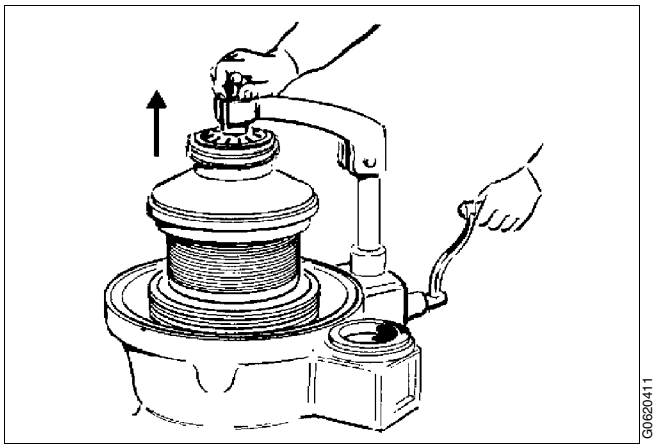
6. Unscrew the large lock ring by using the special spanner and a tin hammer.

   Left-hand thread!

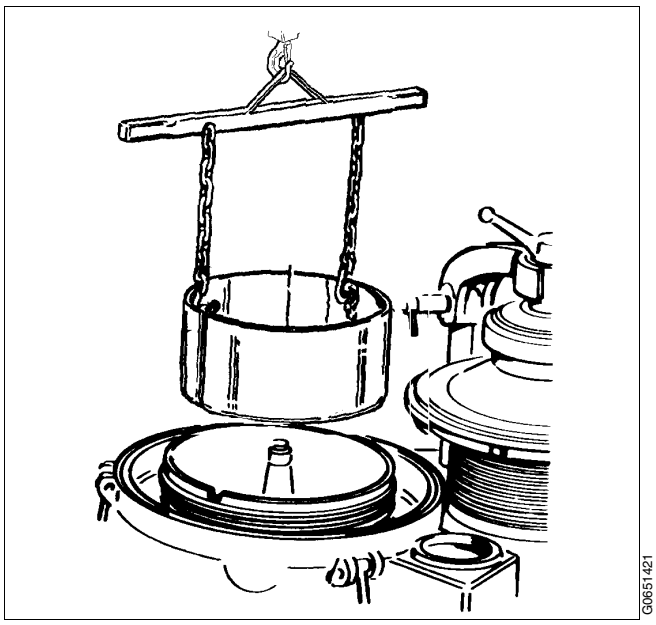




7. Lift up the bowl hood, disc stack and distributor by using the lifting device.



8. Lift out the sludge basket using the special lifting tool.

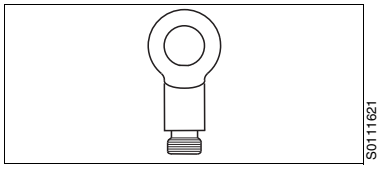


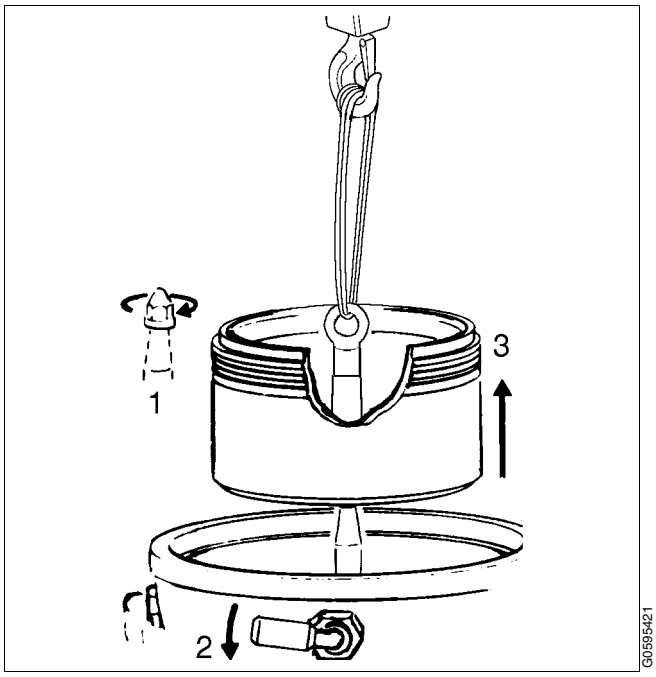
9. Unscrew the cap nut (1).

   Left-hand thread!

10. Release the lock screws (2).

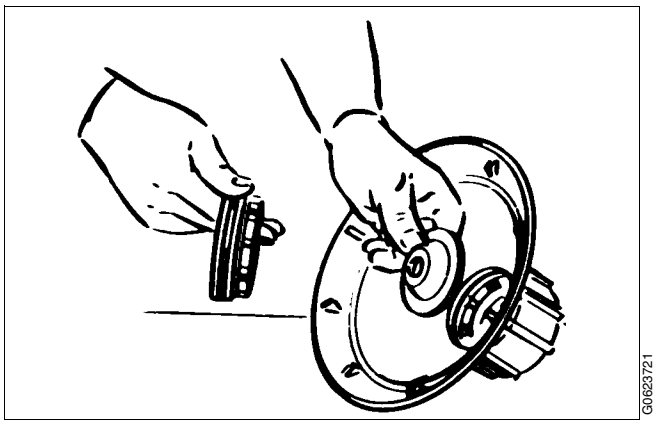
11. Lift out the bowl body using the special lifting tool (3).





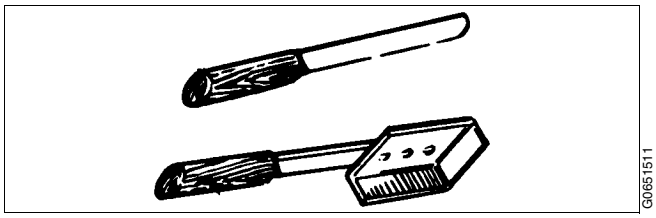
1. Unscrew the cap nut
2. Release the lock screw
3. Lift the bowl body from the spindle

12. Remove the level ring and the oil paring disc from the top disc.



13. Remove deposits and clean all parts thoroughly in a suitable cleaning agent. See chapter “5.5.2 Cleaning agents” on page 86.

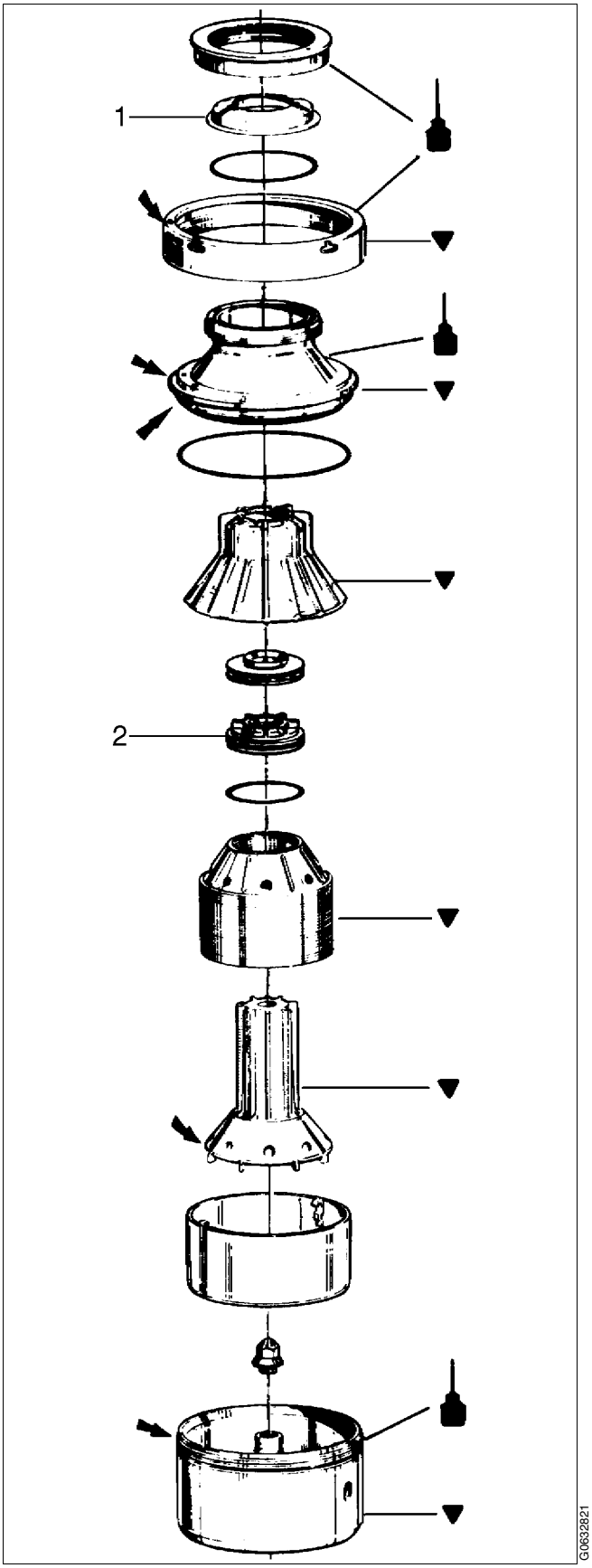
    When removing sludge, preferably use the sludge knife and sludge scoop included in the tool kit.



6.2.4 Assembly

Each bowl constitutes a balanced unit. Exchange of any major part necessitates rebalancing of the bowl. To prevent mixing of parts, e.g. in an installation comprising of several machines of the same type, the major bowl parts carry the machine manufacturing number or its last three digits.

NOTE
Be sure bowl parts are not interchanged. Out of balance vibration will reduce ball bearing life.



The arrows indicate positions of guides on the bowl parts

Lubrication needed

Balanced parts. Exchange necessitates rebalancing of bowl.

Purifier bowl

1. *Gravity disc with hole diameter according to the nomogram, see* “4.1.2 Selection of gravity disc” on page 33
2. *Level ring with smallest hole pitch diameter*

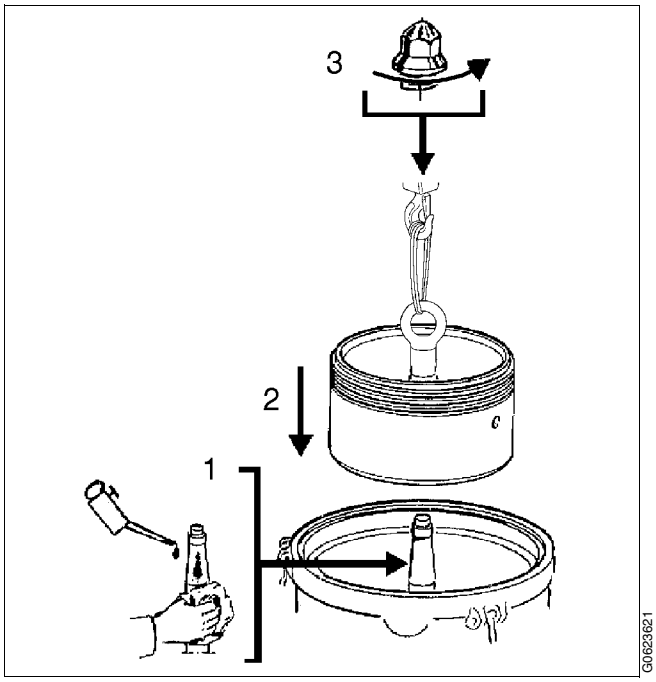
Clarifier bowl

1. *Gravity disc with smallest hole diameter*
2. *Level ring with largest hole pitch diameter*

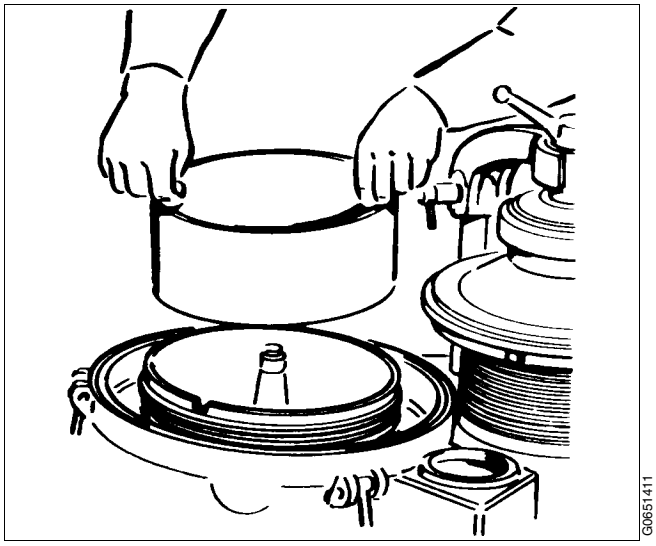
✔ **Check point**

“5.3.1 Corrosion” on page 64,
“5.3.2 Erosion” on page 66,
“5.3.3 Cracks” on page 67,
“5.3.5 Lock ring; wear and damage” on page 69,
“5.3.6 Inlet pipe and oil paring disc” on page 70,
“5.3.7 Inlet device” on page 70,

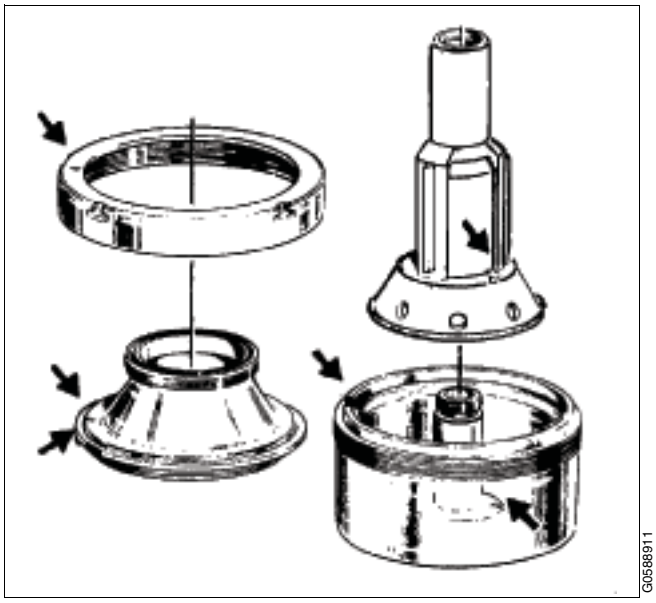
1. Wipe off the spindle top and nave bore in the bowl body. Lubricate the tapered end of the spindle and wipe off with a clean cloth (1).
2. Fit the bowl body carefully onto the spindle (2).
3. Tighten the cap nut (3).
   Left-hand thread!



4. Fit the cleaned sludge basket.



5. During the assembly, bring the bowl parts into positions defined by the guides.

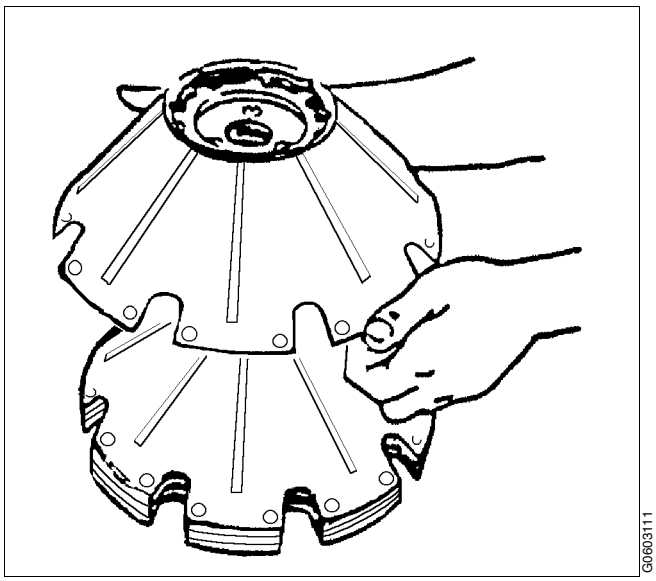


6. If the discs have been removed from the distributor, assemble them one by one onto the distributor. The distributor has one guide rib for the correct positioning of the discs.

CAUTION

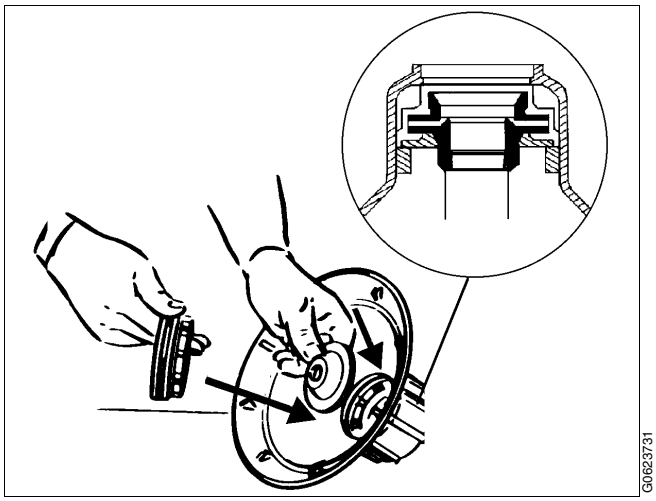
Cut hazard

Sharp edges on the separator discs may cause cuts.



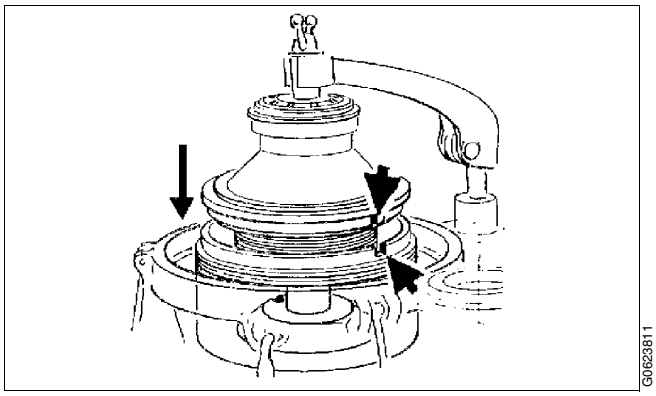
7. Fit the oil paring disc and level ring with O-ring into the top disc. First lubricate the O-ring with silicone grease.

   Make sure that the paring disc is positioned in the right direction, see illustration.



8. Place the top disc and bowl hood upon the disc stack.
9. Lubricate the O-ring in bowl hood with silicone grease.
10. Lower the parts down into the bowl body using the lifting device. Make sure that the guides for bowl hood and bowl body are in correct position.

    Also check that the distributor and bowl body are bring in position defined by guides.

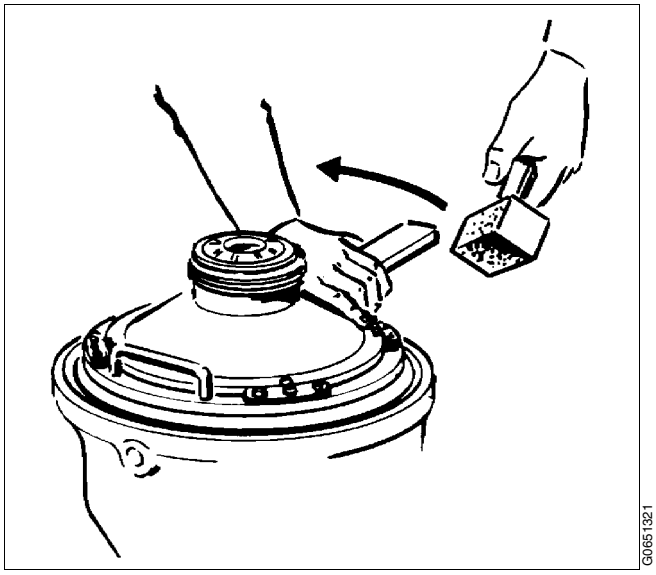


✔ **Check point**

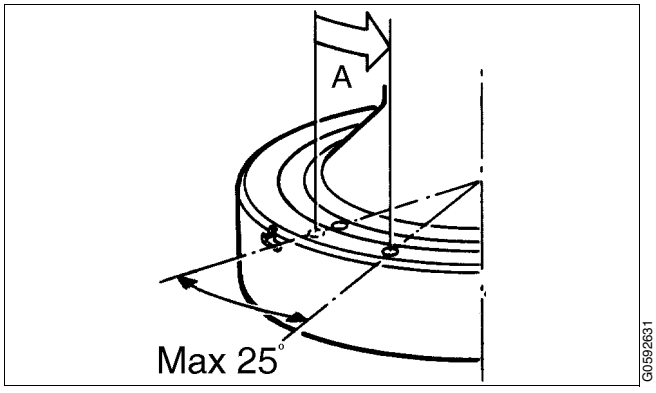
"5.3.5 Lock ring; wear and damage" on page 69.

11. Lubricate the lock ring threads, contact and guide surfaces with lubricating paste.
12. Tighten the lock ring.

    Left-hand thread!



13. Tighten until the assembly marks are at least in line.



✔ **Check point**

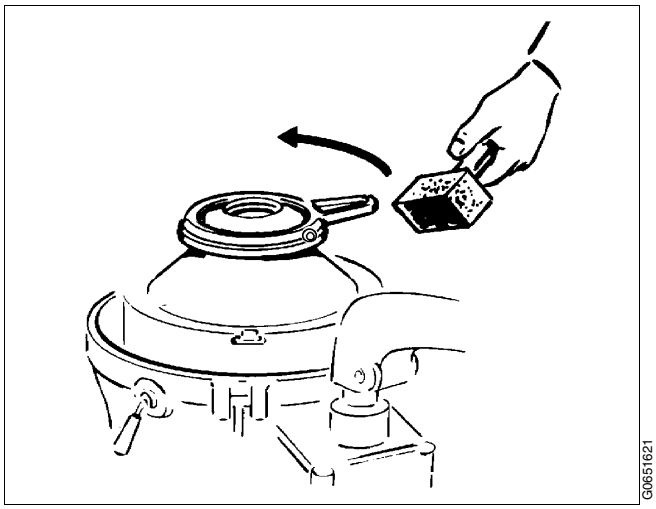
"5.3.4 Disc stack pressure" on page 68.

NOTE

The assembly marks must never pass each other more than **25°** which corresponds to A=**60 mm**.

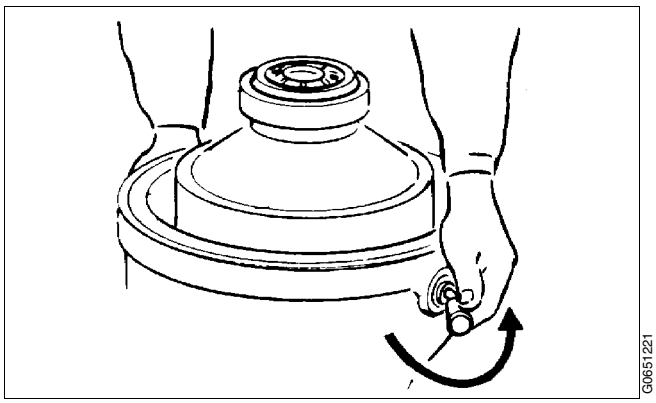
14. Fit the gravity disc/clarifier disc and tighten the lock ring using the special spanner.

    Left-hand thread!



15. Slacken the two lock screws holding the bowl body.

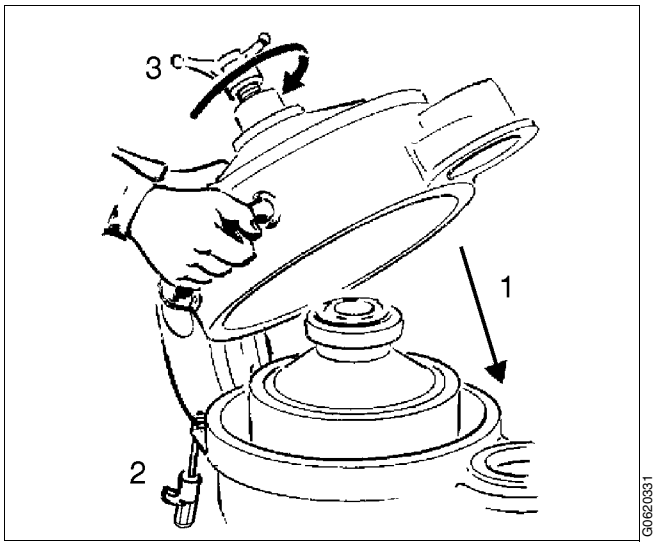
> **NOTE**
>
> The two lock screws must be fully released to prevent risk for damage to the bowl body.



16. Lower the collecting cover (1) and tighten it with the clamp bolts (2).
17. Press down the inlet pipe by the knob (3) and turn it until pipe thread engages with paring disc thread.

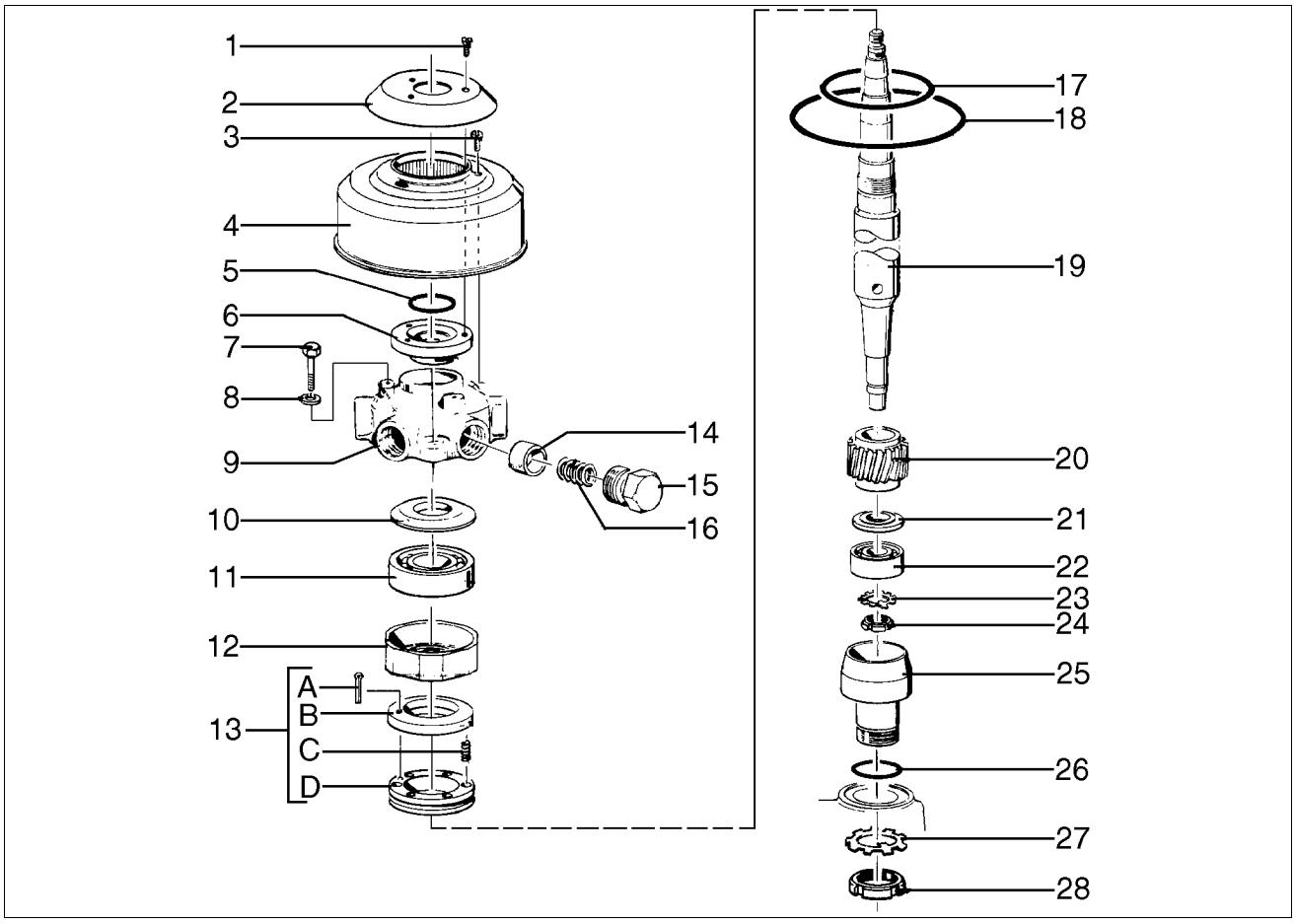
    Left-hand thread!

    Then let up the knob and tighten it firmly.



6.3 Vertical driving device (MS)

6.3.1 Exploded view



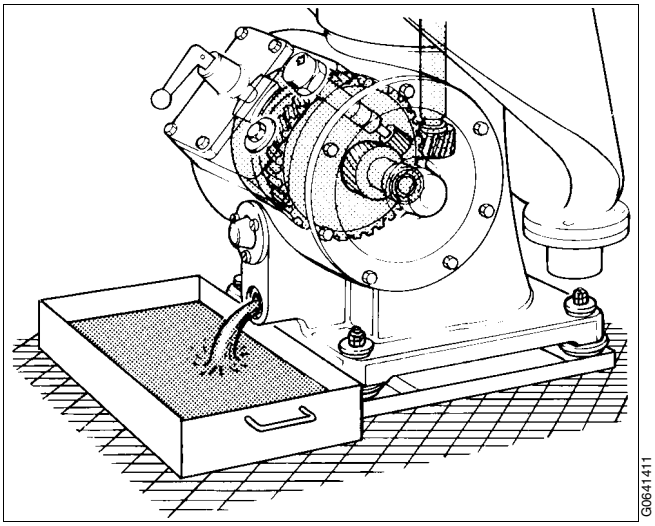
1. Screw
2. Protecting plate
3. Screw
4. Protecting guard
5. O-ring
6. Protecting collar
7. Screw
8. Spring washer
9. Spring casing
10. Deflector
11. Ball bearing
12. Ball bearing housing
13. Axial buffer
13A. Split pin
13B. Wear ring
13C. Spring
13D. Spring support
14. Buffer
15. Screw plug
16. Spring
17. O-ring
18. O-ring
19. Bowl spindle
20. Worm
21. Spacing washer
22. Ball bearing
23. Lock washer
24. Round nut
25. Bushing
26. O-ring
27. Lock washer
28. Round nut

6.3.2 Dismantling

NOTE

Clean the space in the bowl casing thoroughly before starting to dismantle the bowl spindle to prevent contaminations falling down into the oil gear housing.

1. Drain the oil from the worm gear housing.



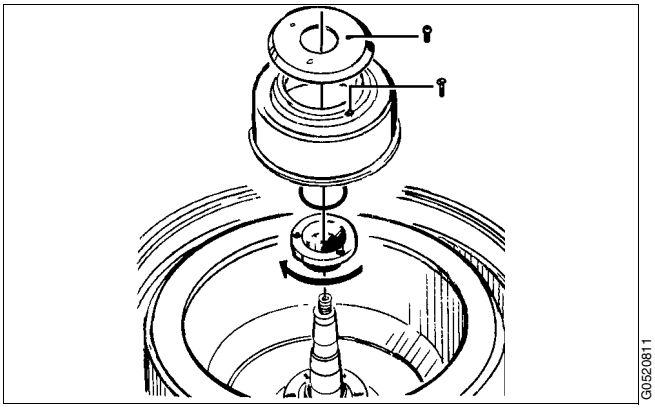
CAUTION

Burn hazards

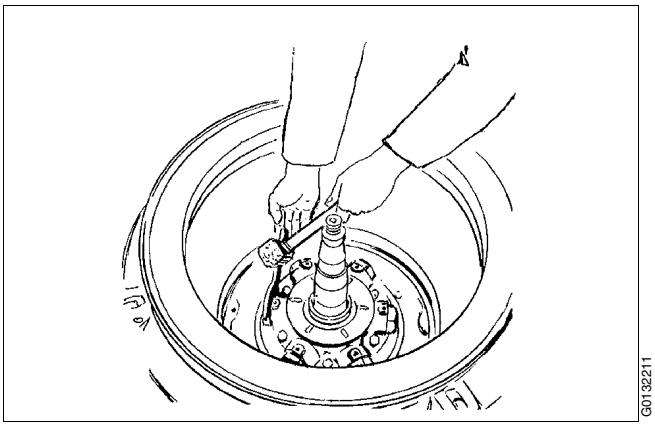
Lubricating oil and various machine surfaces can be hot and cause burns.

2. Unscrew and remove the protecting plate and the protecting guard.
3. Remove the O-ring and unscrew the protecting collar with e.g. a drift.

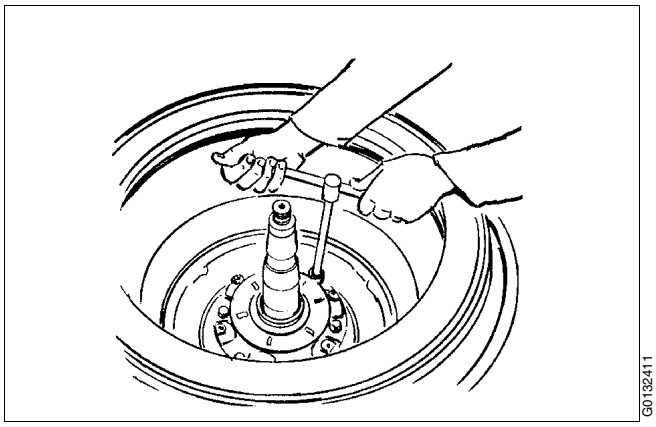
   Left-hand thread!



4. Unscrew the screw plugs a little, not completely.



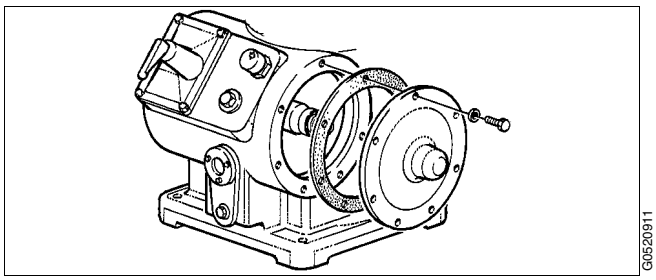
5. Unscrew the screws of the spring casing.



6. Remove the bearing shield/built-on pump.

Separator with no built-on pump

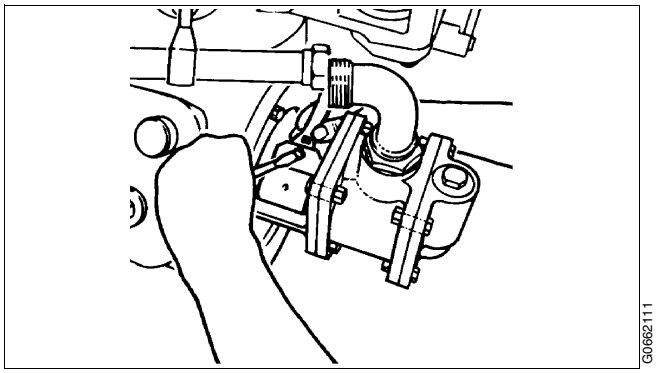
a. Remove the bearing shield and gasket.



Separator with built-on pump

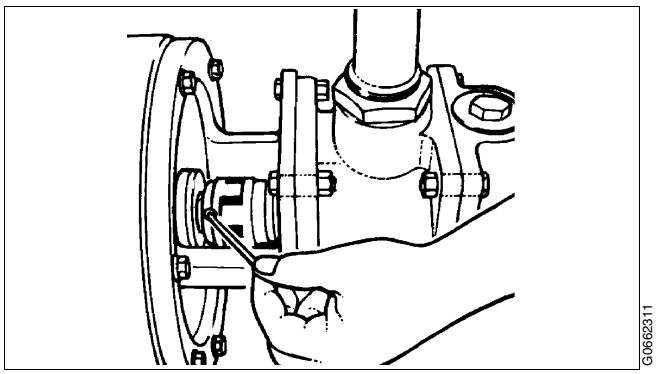
a. Remove the pipe connections from the pump.

b. Remove the sleeve halves over the coupling.

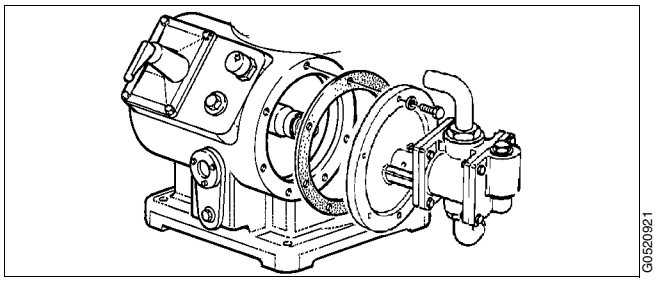


c. Slacken (do not remove) the stop screw positioned in the coupling half nearest the separator frame. Use a hexagon wrench.

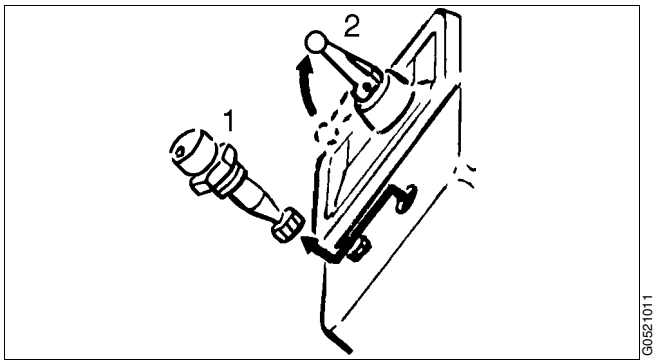
   Turn the coupling drum by hand until the stop screw is in a convenient position.



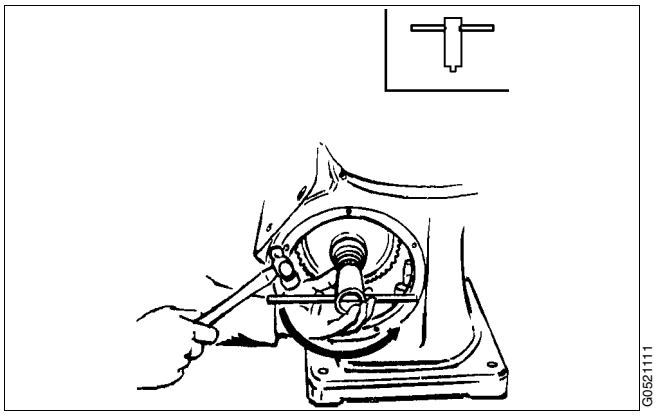
d. Remove the pump assembly and gasket.



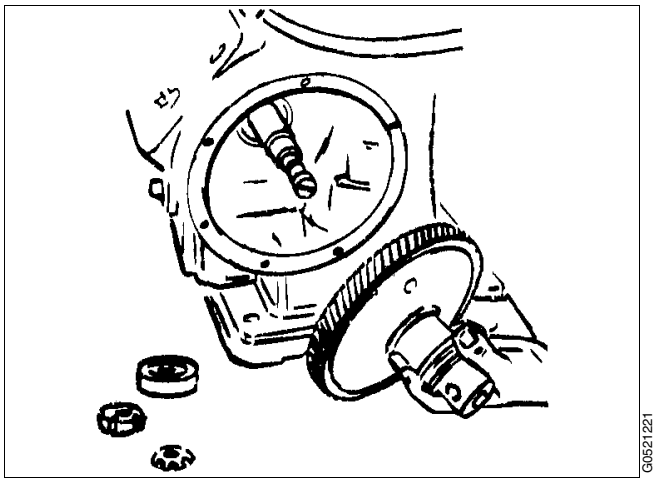
7. Remove the revolution counter (1). Apply the brake (2).



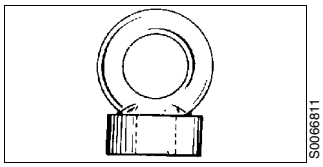
8. Remove the round nut and lock washer at the worm wheel shaft.

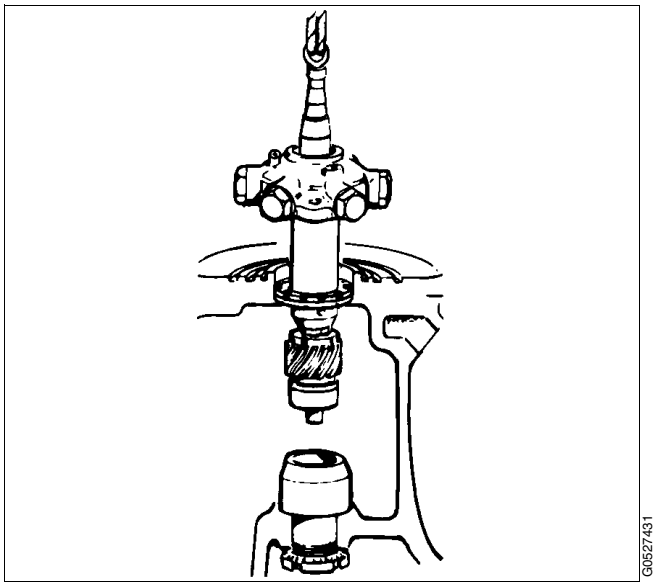


9. Remove the ball bearing and worm wheel fitted on the shaft.



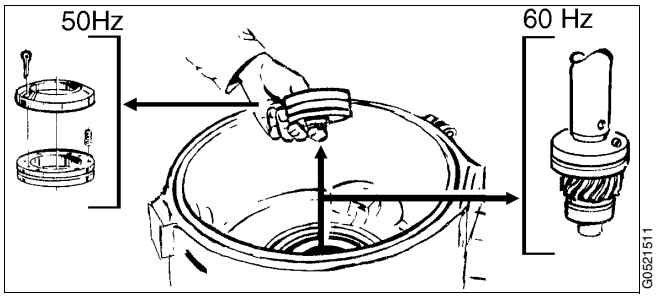
10. Lift out the bowl spindle by using the special lifting tool.



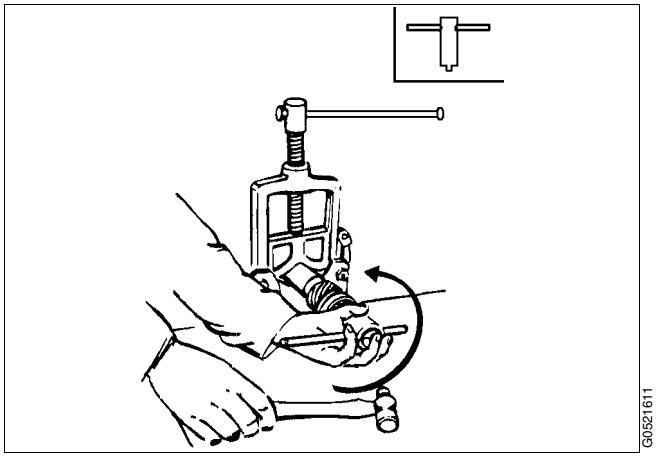


11. If a **50 Hz** separator, remove the axial buffer from the frame.

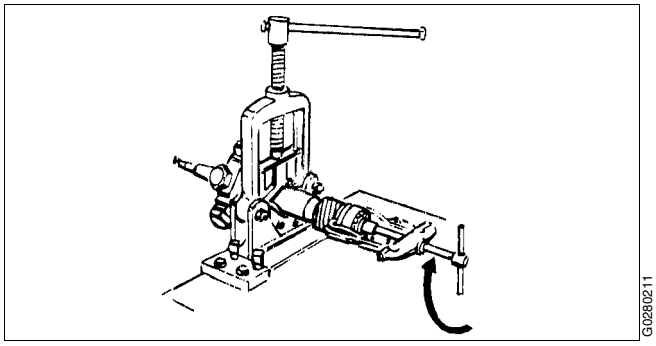
    For **60 Hz** separators, the buffer can be removed from the spindle after the worm has been knocked off.



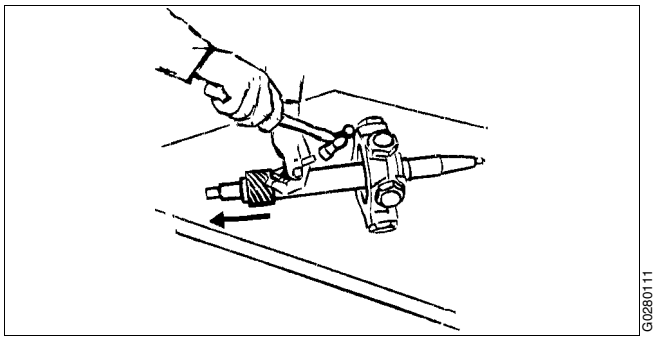
12. Clamp the bowl spindle in a screw vice, protected with copper liners.
13. Remove the round nut and lock washer for the bottom bearing on spindle.



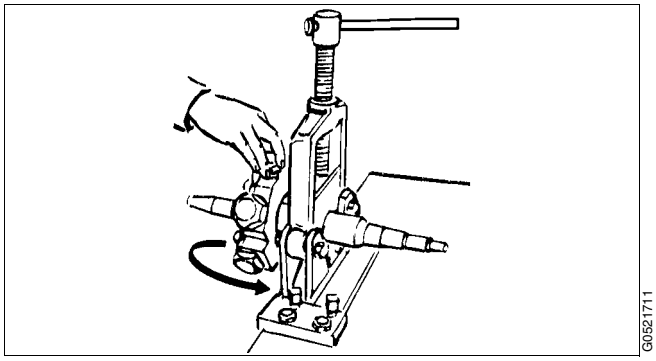
14. Pull off the ball bearing together with the spacing washer.



15. Knock off the worm using a hammer and a **soft** drift.
16. If a **60 Hz** separator, remove the axial buffer.

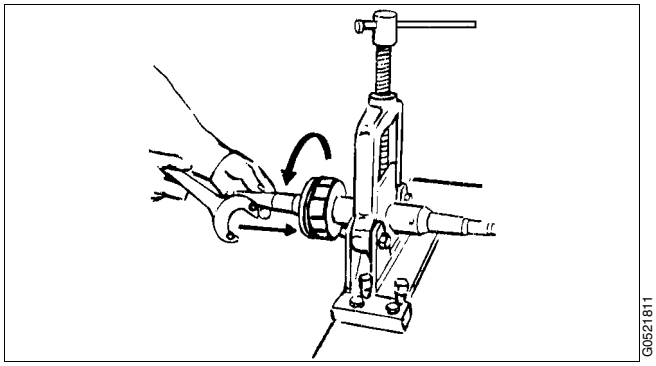


17. Remove the screw plugs, springs and buffers. Then remove the spring casing.

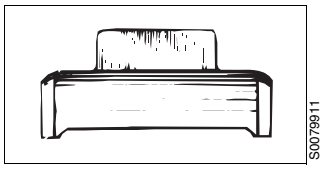


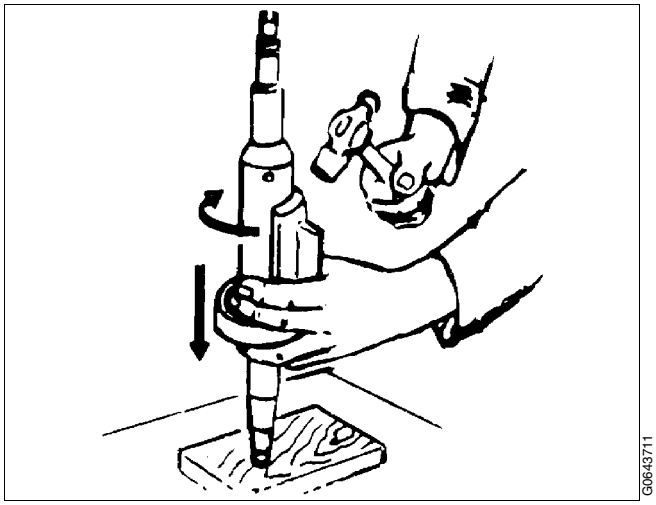
18. Unscrew the deflector and remove the ball bearing housing.

    Left-hand thread!



19. Knock off the ball bearing.





20. Clean all dismantled parts thoroughly in a degreasing agent and check for damage and corrosion.

6.3.3 Assembly

When mounting ball bearings on the spindle as described below, the bearings must be heated in oil to **max 125 °C**.

WARNING

Burn hazards

Use protective gloves when handling the heated bearings.

NOTE

If any doubt how to mount roller bearings in a correct way, see the detailed description in chapter “5.7.2 Ball and roller bearings” on page 91.

✔ **Check point**

“5.4.14 Buffer springs and ball bearing housing” on page 84.

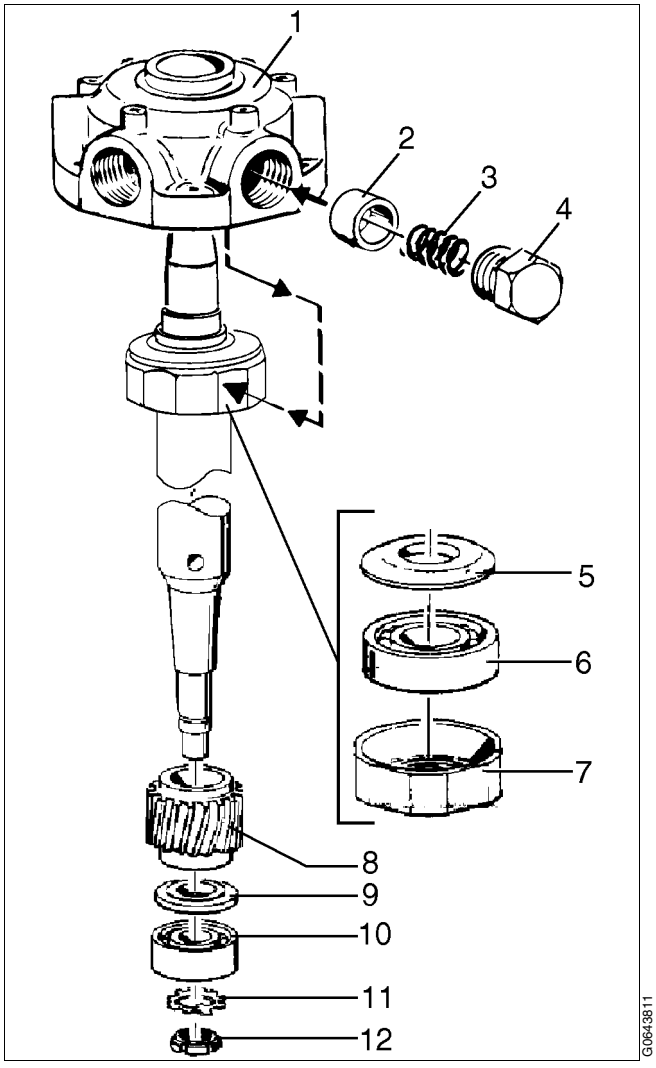
1. Mount the upper ball bearing (6) onto the spindle. Make sure it enters its seat.
2. Fit the bearing housing (7) and tighten the deflector (5).

   Left-hand thread!
3. Fit the spring casing (1), buffers (2), springs(3) and plugs (4).

   Make sure the buffers come to rest against the flats of the ball bearing housing.

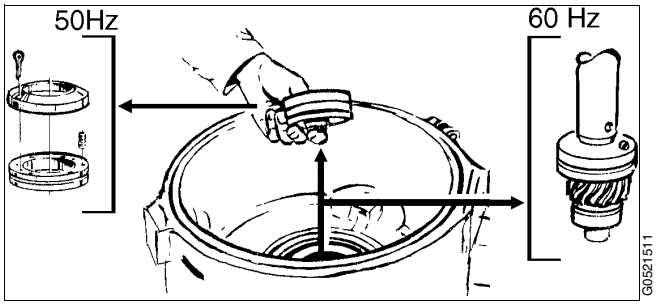
   The final tightening of the plugs is preferably done when the spindle has been placed in the frame.
4. Fit the worm (8), spacing washer (9) and bottom ball bearing (10).

   Note: For **60 Hz** separators, the axial buffer must be mounted on the spindle before the worm and ball bearing are mounted, see next illustration.



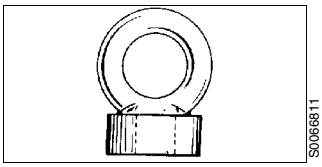
5. Finally fit the lock washer (11) and tighten the round nut (12).

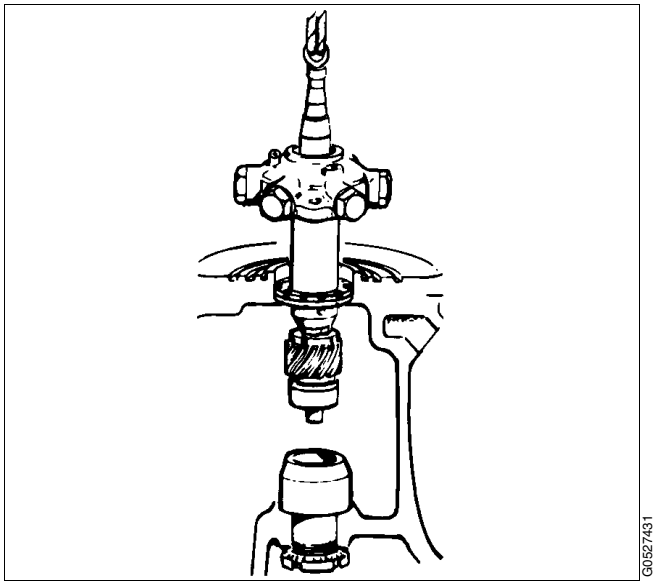
6. For **50 Hz** separators, fit the axial buffer in the frame.



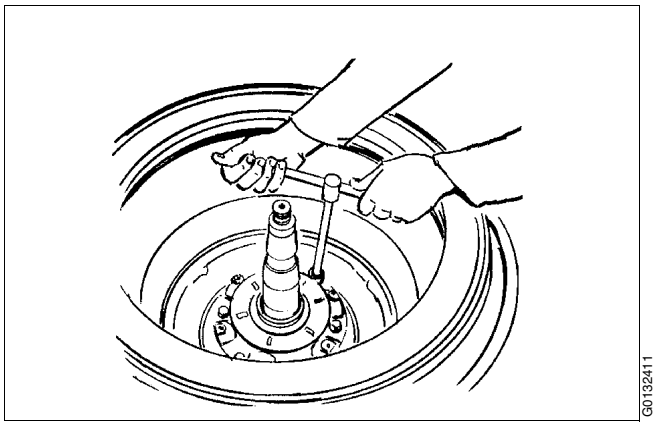
7. Carefully lower the spindle into the frame.

   Guide the bearing into the bottom bushing. If it does not completely enter its seat, tap the spindle top with a tin hammer.

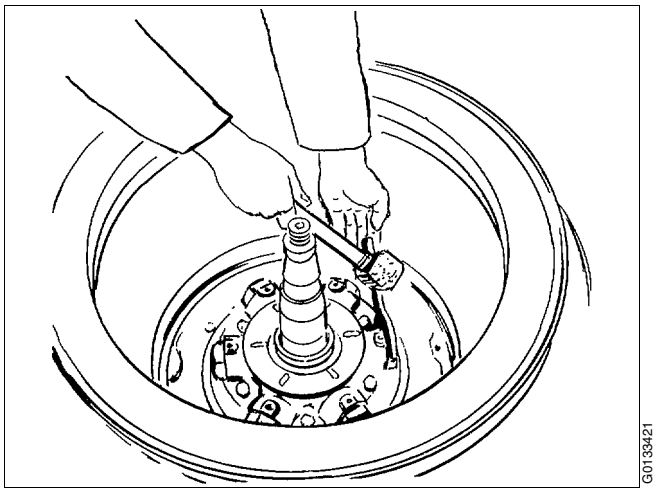




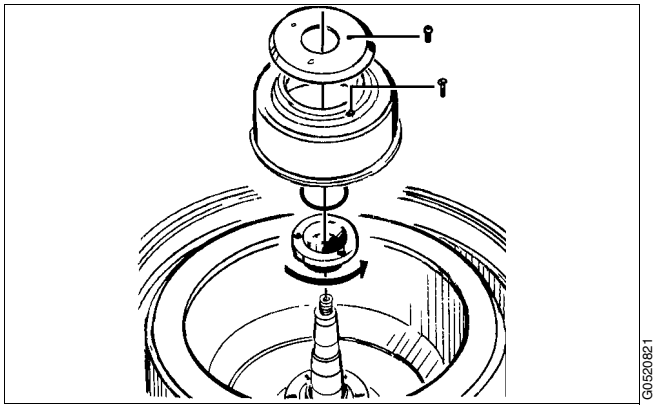
8. Tighten the screws of the spring casing.



9. Tighten the buffer plugs.

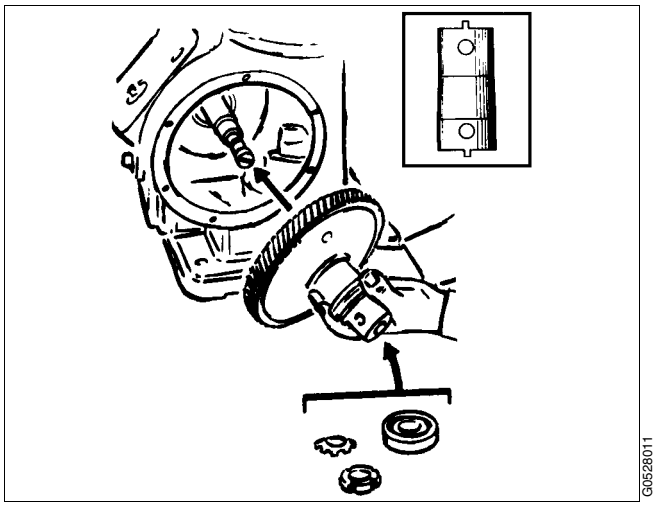


10. Screw the protecting collar onto the spindle.
    Left-hand thread!
    Fit its O-ring, guard and protecting plate.



11. Fit the worm wheel with ball bearing onto the shaft. Match the worm wheel with the teeth in the worm of the bowl spindle.
12. Fit the ball bearing and lock washer onto the shaft and tighten the round nut.

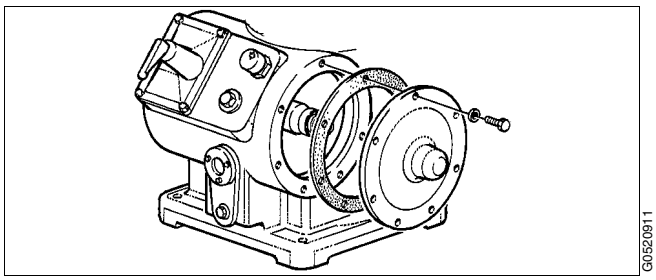
✔ **Check point**
“5.4.7 Radial wobble of bowl spindle” on page 76.



13. Fit the revolution counter.
14. Fit the bearing shield/built-on pump.

Separator with no built-on pump

a. Fit the gasket and bearing shield. The parts can be fitted only in one position because of the asymmetrical positioned screw holes.



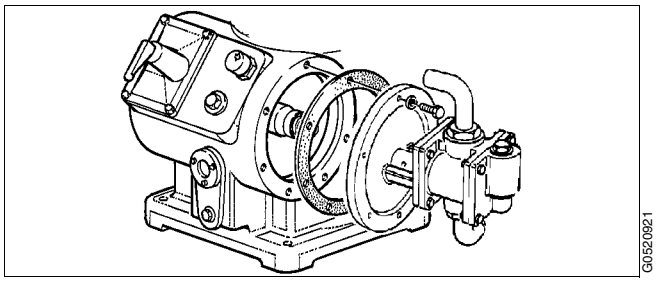
Separator with built-on pump

a. Check that the key for the pump coupling half is fitted in the keyway in the worm wheel shaft.

b. Fit the gasket and pump assembly.

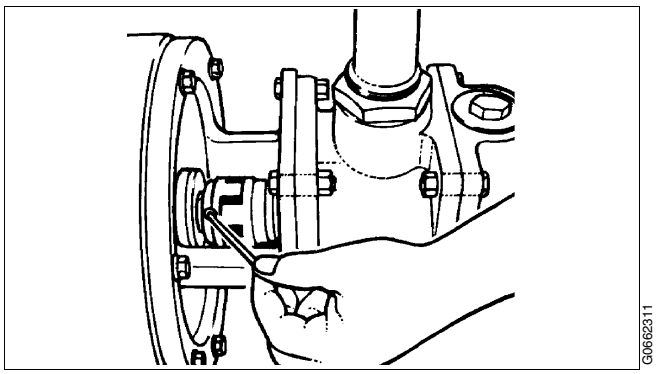
   Be careful that the lipseal ring is not damaged by the shaft end and by the key in shaft.

   Check that the key is facing the keyway in the coupling half.



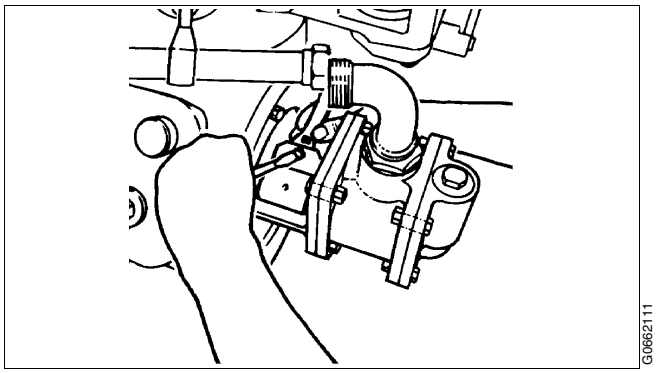
c. Check that the clearance on each side of the coupling flexible element is **2 mm**.

   Tighten the stop screw in the coupling half with a hexagon wrench. Check that the holders for the lipseal rings are located so that the sleeve halves can easily be fitted.



d. Mount the sleeve halves over the coupling.

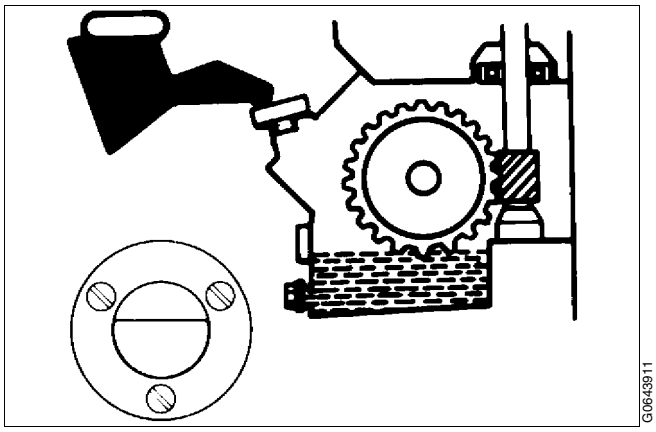
e. Refit the pump connections.



15. Pour oil into worm gear housing. The oil level should be slightly above the middle of the sight glass.

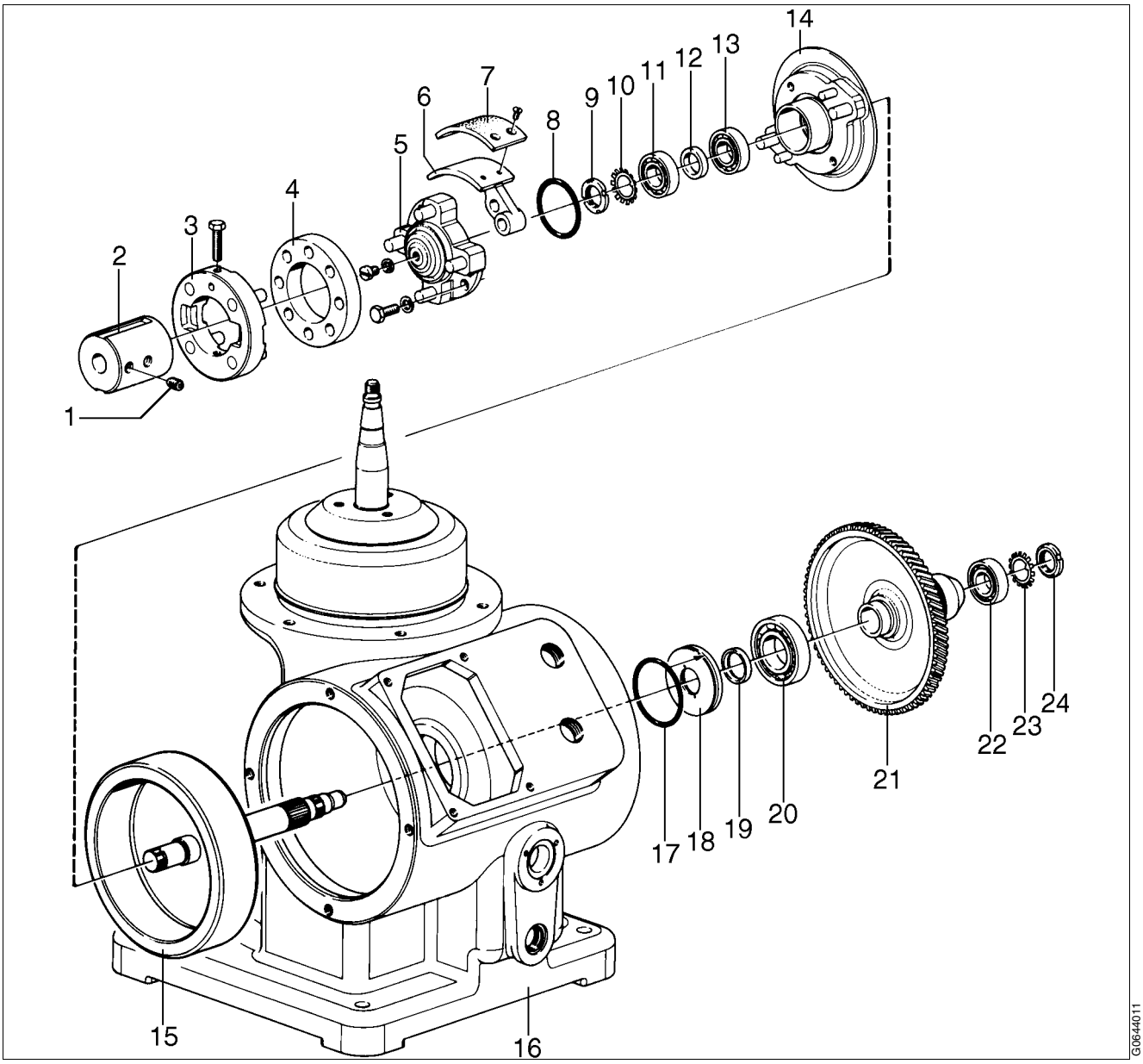
    For correct oil volume and recommended oil brands, see chapter “8.8 Lubricants” on page 167.

✔ **Check point**
“5.4.13 Brake” on page 82.



6.4 Horizontal driving device (MS)

6.4.1 Exploded view



1. Screw
2. Coupling nave
3. Coupling disc
4. Elastic plate
5. Coupling disc
6. Friction block
7. Friction pad
8. O-ring
9. Round nut
10. Lock washer
11. Ball bearing
12. Spacing ring
13. Ball bearing
14. Nave
15. Worm wheel shaft
16. Frame
17. O-ring
18. Sealing washer
19. Seal ring
20. Ball bearing
21. Worm wheel
22. Ball bearing
23. Lock washer
24. Round nut

6.4.2 Dismantling

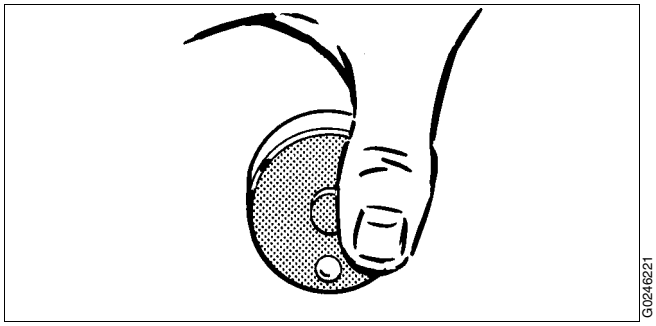
WARNING

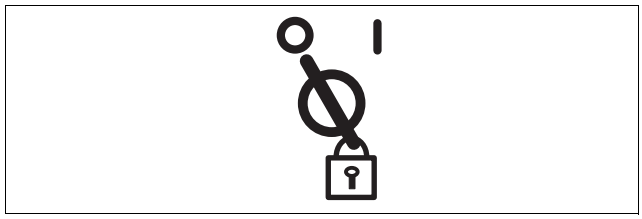
Entrapment hazards

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

   The revolution counter and the motor fan indicates if separator parts are rotating or not.

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





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

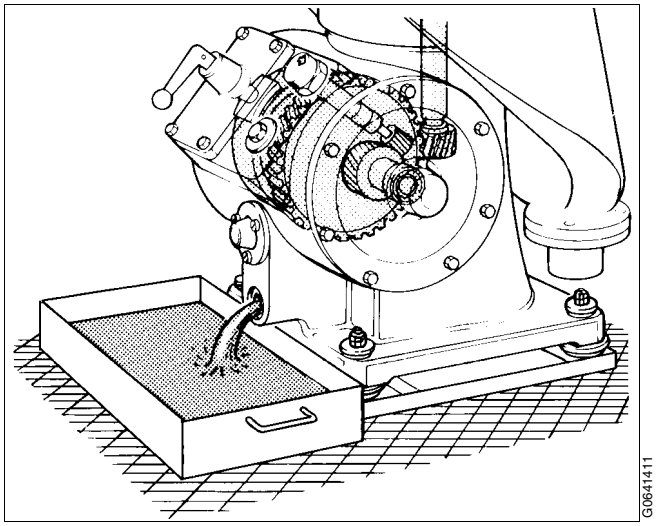
If the bowl spindle has been removed according to earlier description, points 1-5 below are already done. Proceed then with point 6.

1. Drain the oil from the worm gear housing.

CAUTION

Burn hazards

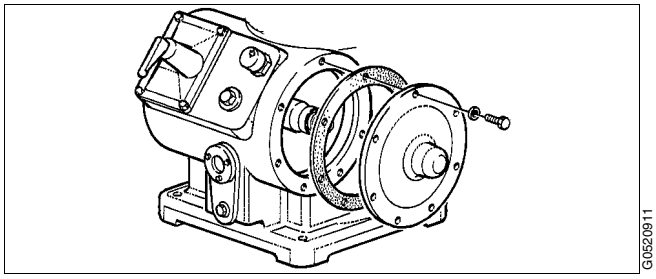
Lubricating oil and various machine surfaces can be hot and cause burns.



2. Remove the bearing shield/built-on pump.

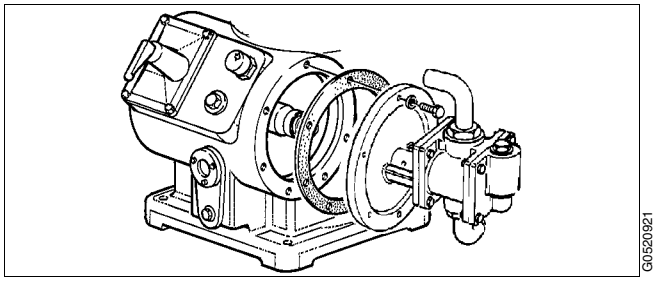
Separator with no built-on pump

a. Remove the bearing shield and gasket.

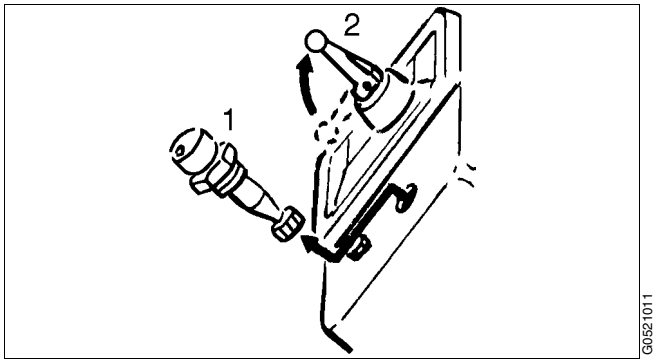


Separator with built-on pump

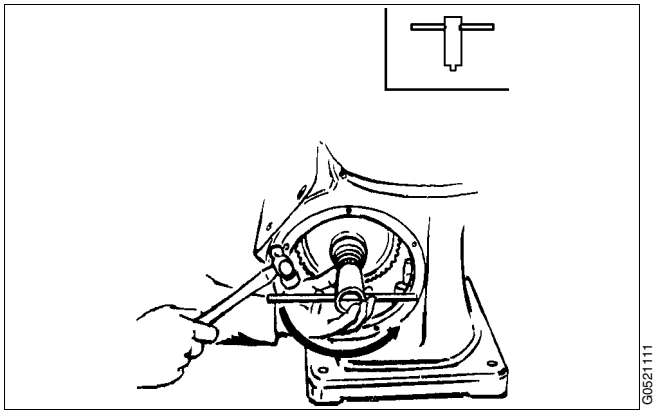
a. Remove the pump assembly. See the dismantling instruction for the vertical driving device on page 115 for a detailed description.



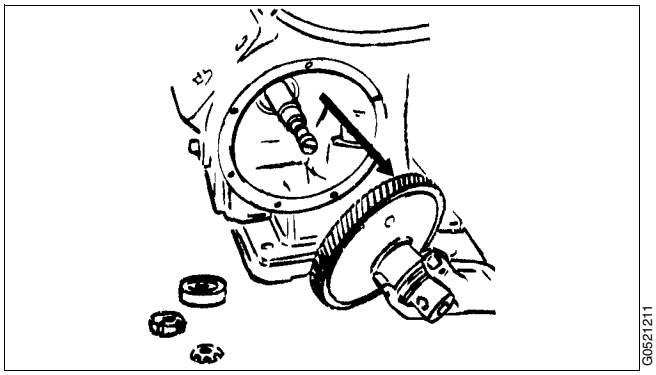
3. Remove the revolution counter (1).
   Apply the brake (2).



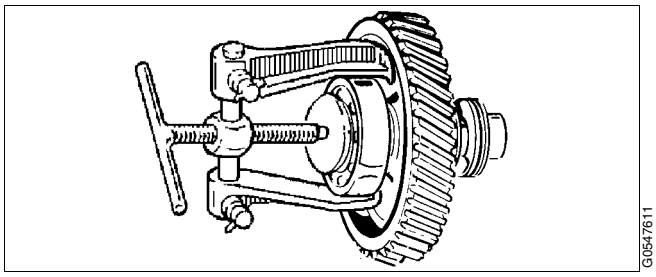
4. Remove the round nut and lock washer at the worm wheel shaft.



5. Remove the ball bearing and worm wheel fitted on the shaft.

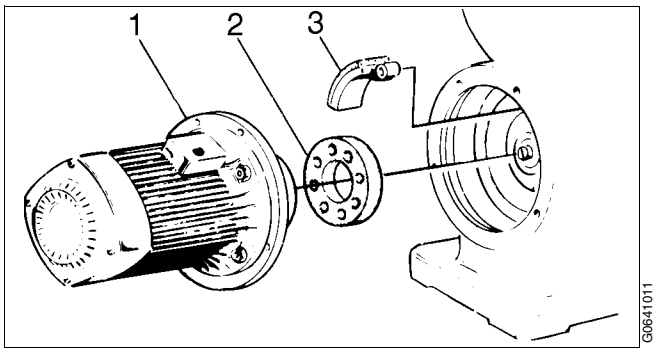


6. Pull off the ball bearing from the worm wheel. Use a washer as a support for the puller.

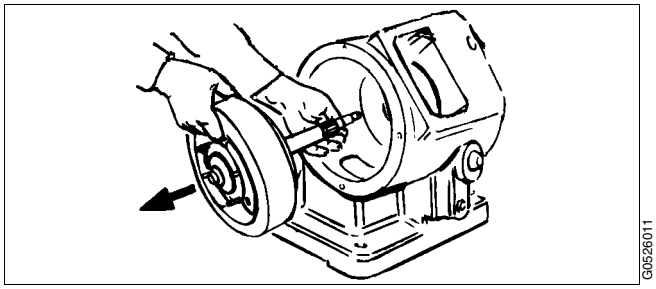


7. Remove:
   - the electric motor (1)
   - the elastic plate (2)
   - the friction blocks (3).

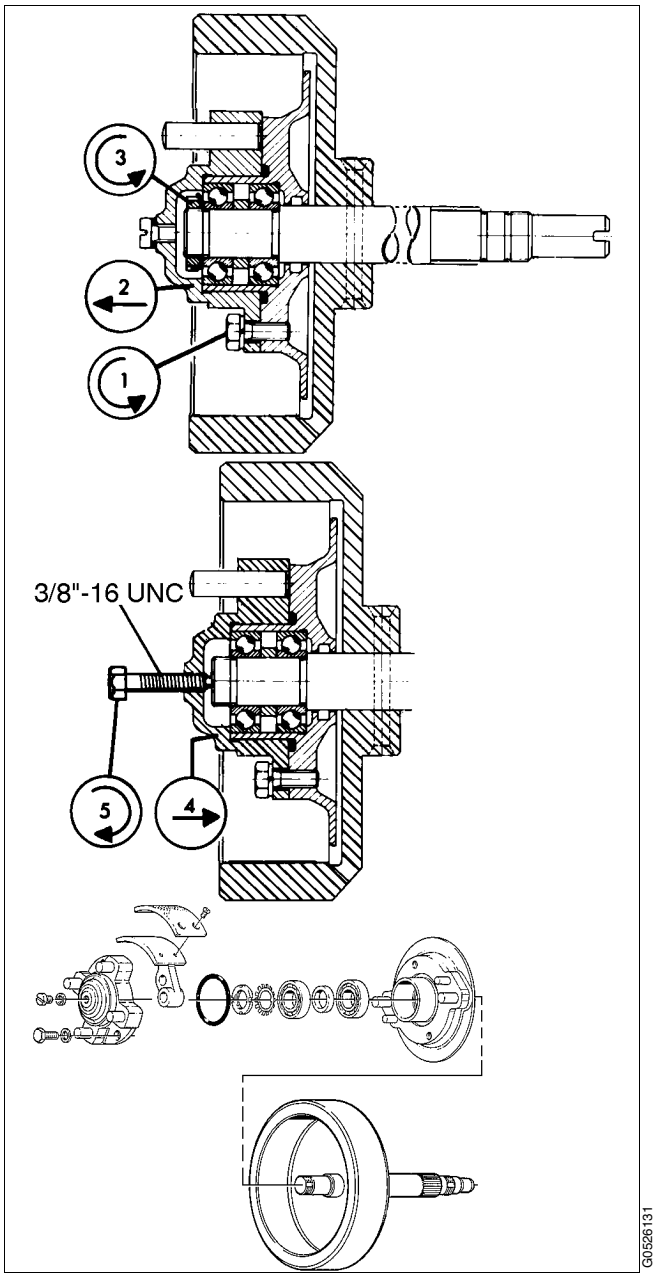
   If disconnecting the motor cables, note the positions of cables in the terminal box to reconnect correctly (for correct direction of rotation).



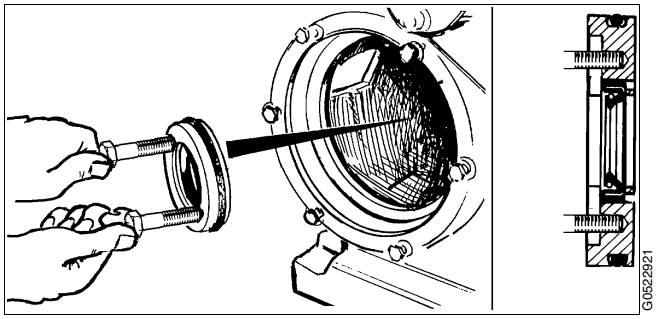
8. Lift out the worm wheel shaft.



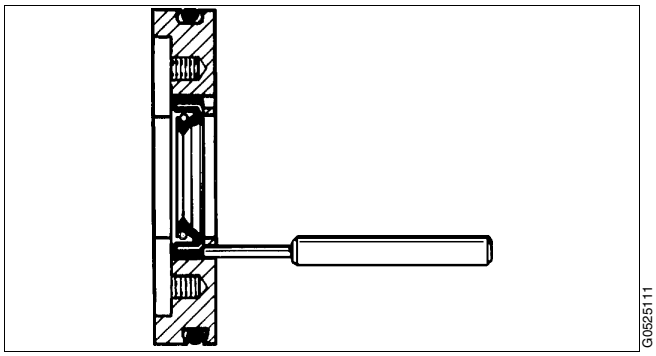
9. Dismantle the nave in the following way:
   - remove the screws (1) and then the coupling disc (2)
   - unscrew the round nut (3) and remove the lock washer
   - put the coupling disc in place (4) again and pull off the nave with a 3/8” - 16 UNC screw (5).



10. Remove the sealing washer using two screws with threads 1/4”-20 UNC screw.

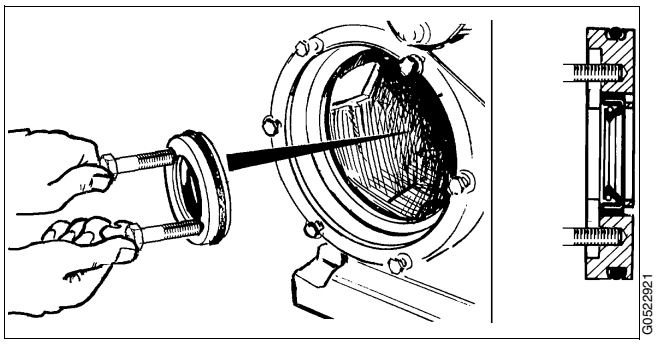


11. Remove the seal ring by using a drift.
12. Remove deposits and clean all parts thoroughly in a suitable cleaning agent. See chapter “5.5 Cleaning” on page 85.



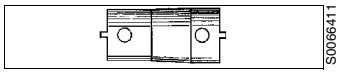
6.4.3 Assembly

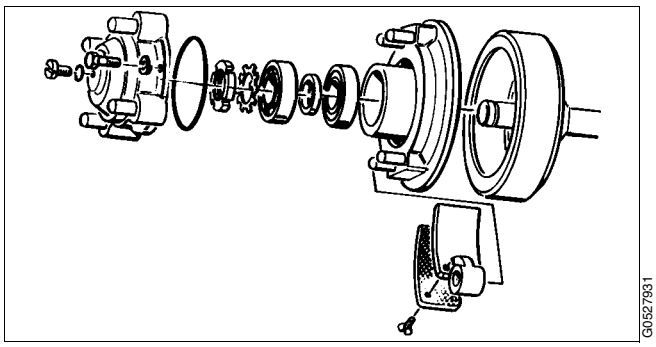
1. Lubricate the O-ring on the sealing washer periphery and the sealing ring with silicone grease. Fit the sealing washer in frame and check that the sealing ring is fitted in the correct direction, as illustrated.



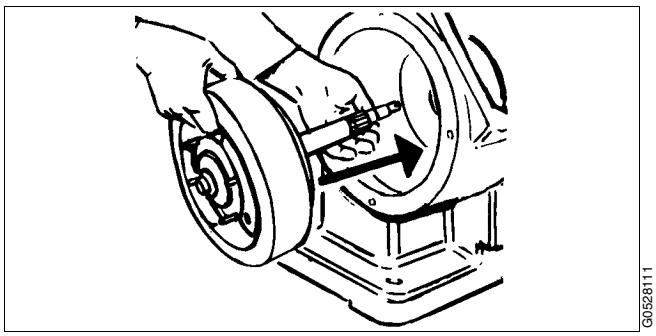
✔ **Check point**
"5.4.12 Coupling friction pads" on page 80.

2. Apply ball bearing grease into the bearings (fill about 1/3 of the free volume in each bearing). Note that no grease must be packed in the nave proper, as superfluous grease might ooze out of the nave and adhere to the friction blocks.
3. Fit the nave, bearings and spacing sleeve, lock washer and the round nut.





4. Fit the O-ring onto the nave and fasten the coupling disc. Put the friction blocks in place inside the coupling drum.
5. Fit the worm wheel shaft.



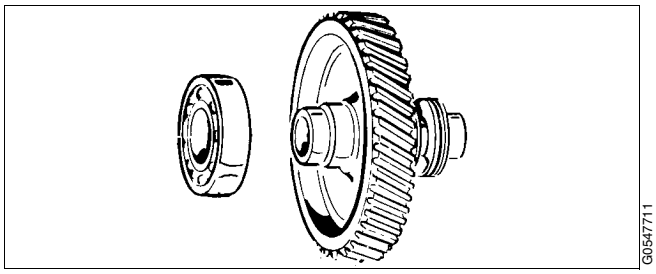
NOTE

Before fitting the worm wheel, mount the bowl spindle into the separator frame if removed (see separate description).

✔ **Check point**
“5.3.8 Worm wheel and worm; wear of teeth” on page 71.

6. Heat the ball bearing and fit it on the worm wheel.

   When mounting the ball bearings on the worm wheel and shaft, the bearings must be heated in oil to max. 125 °C.



WARNING

Burn hazards

Use protective gloves when handling the heated bearings.

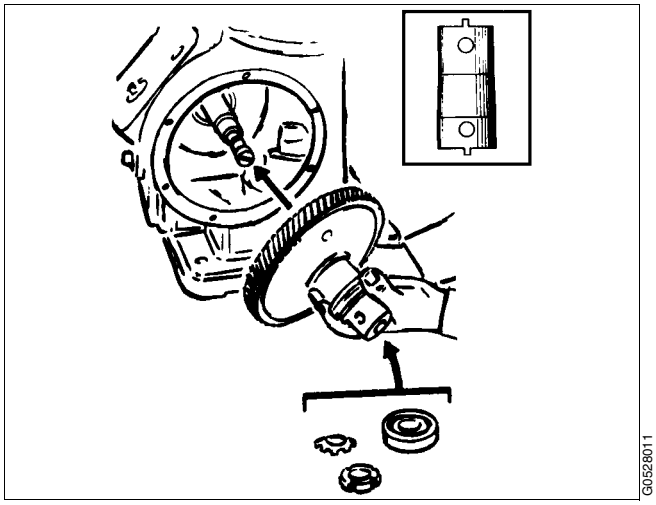
NOTE

If any doubt how to mount roller bearings in a correct way, see the detailed description in chapter “5.7.2 Ball and roller bearings” on page 91.

The remaining description in this section implies that the bowl spindle is mounted in the frame. If not, proceed with the assembly instruction for the vertical driving device in chapter “6.3.3 Assembly” on page 119.

7. Fit the worm wheel with the ball bearing onto the shaft. Match the worm wheel with the teeth in the worm of the bowl spindle.
8. Fit the ball bearing and lock washer onto the shaft and tighten the round nut.

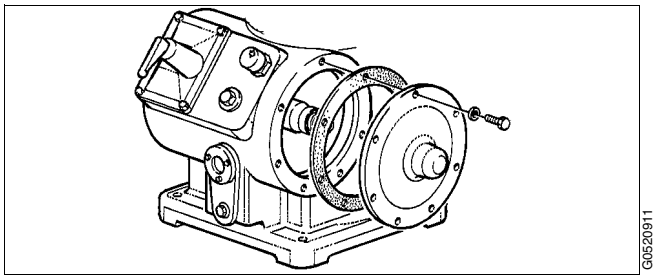
✔ **Check point**
“5.4.7 Radial wobble of bowl spindle” on page 76.



9. Fit the revolution counter.
10. Fit the bearing shield/built-on pump.

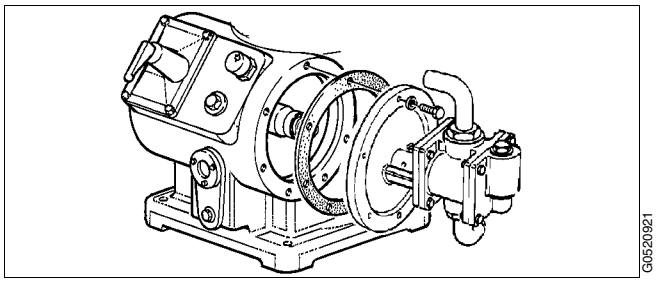
Separator with no built-on pump

a. Fit the gasket and bearing shield. The parts can be fitted only in one position because of the asymmetrical positioned screw holes.



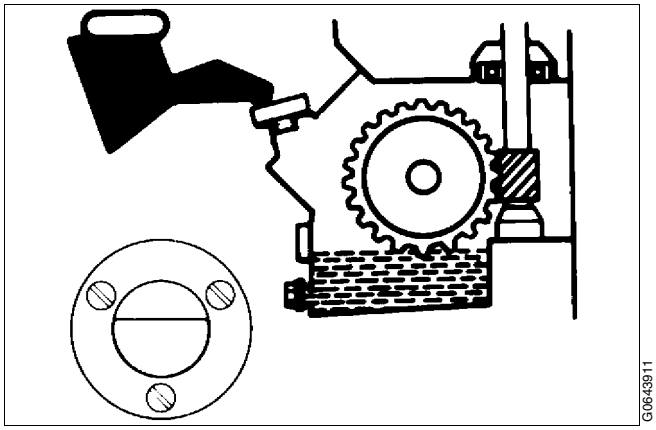
Separator with built-on pump

a. Fit the gasket and pump assembly. See the assembly instruction for the vertical driving device on page 122 for a detailed description.



11. Pour oil into worm gear housing. The oil level should be slightly above the middle of the sight glass.

    For correct oil volume, see chapter “8.2 Technical data” on page 159. For recommended oil brands, see chapter “8.8.3 Recommended oil brands” on page 169.

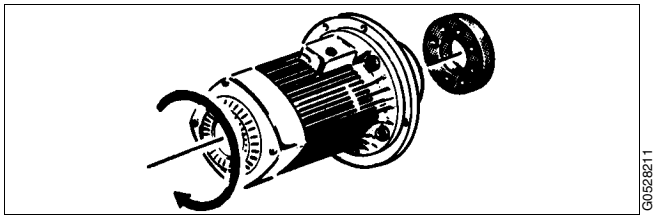


✔ **Check point**
“5.4.13 Brake” on page 82.

12. Fit the elastic plate.

✔ **Check point**
“5.4.11 Flexible plate in coupling” on page 78.

13. Fit the electric motor.



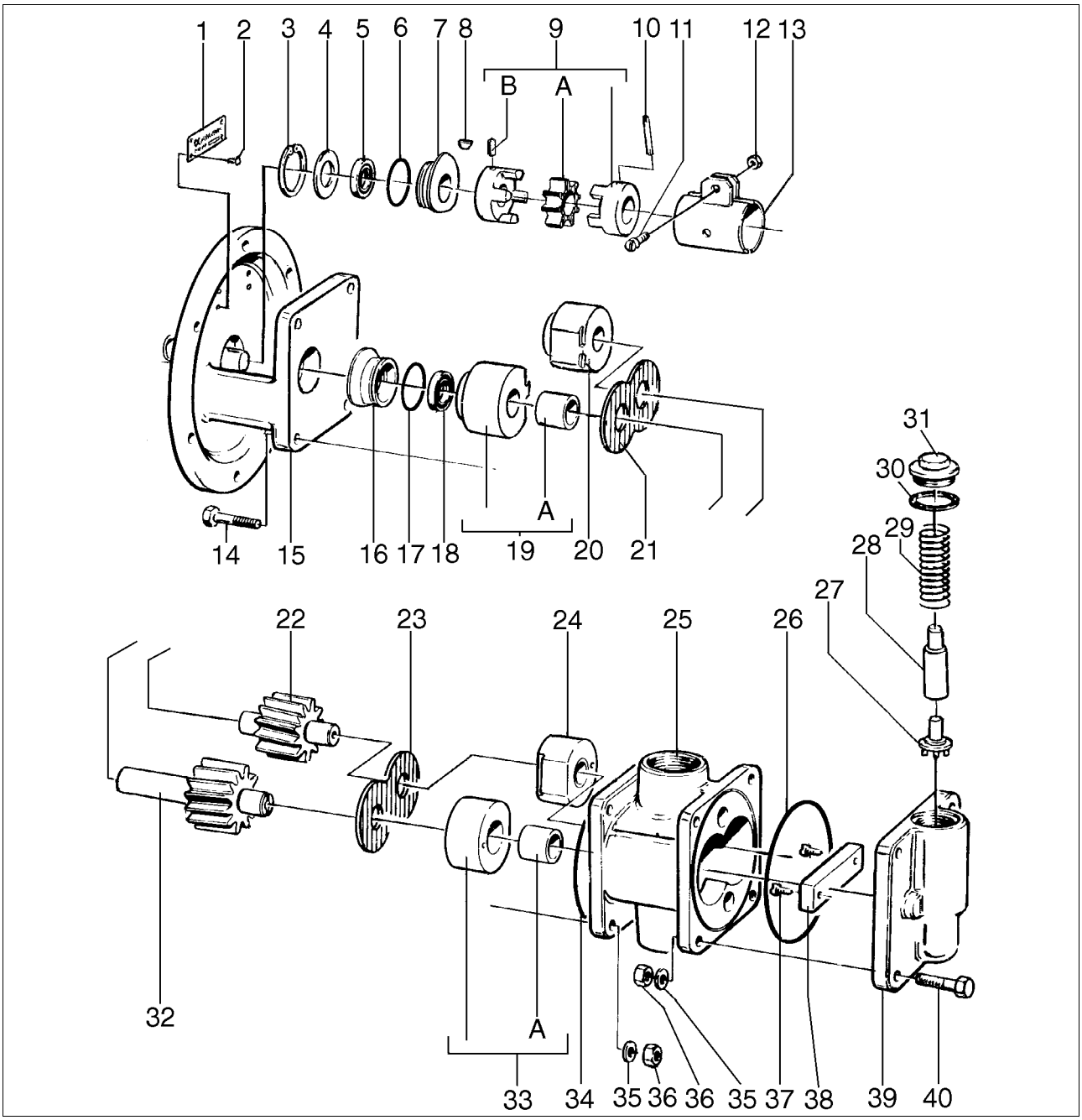
WARNING

Disintegration hazards

When power cables have been connected, always check direction of rotation. If incorrect, vital rotating parts could unscrew causing disintegration of the machine.

6.5 Feed pump (option)

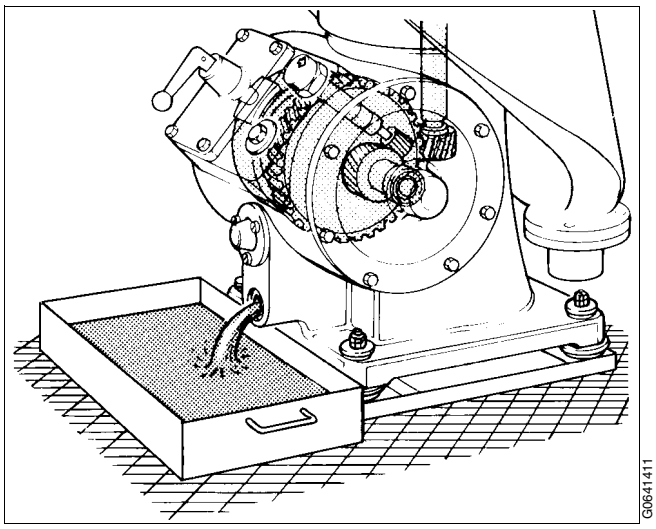
6.5.1 Exploded view



1. Plate
2. Drive screw
3. Snap ring
4. Washer
5. Seal ring
6. O-ring
7. Sleeve
8. Key
9. Flexible coupling
9A. Tooth rim (flexible element)
9B. Stop screw
10. Tubular spring pin
11. Screw
12. Nut
13. Sleeve half
14. Screw
15. Bearing shield
16. Sleeve
17. O-ring
18. Seal ring
19. Bearing
19A. Bushing
20. Bearing
21. Wear gasket
22. Impeller
23. Wear gasket
24. Bearing
25. Pump housing
26. O-ring
27. Valve cone
28. Guide pole
29. Spring
30. Gasket
31. Cover
32. Impeller
33. Bearing
33A. Bushing
34. O-ring
35. Washer
36. Nut
37. Screw
38. Spacer
39. Shield
40. Screw

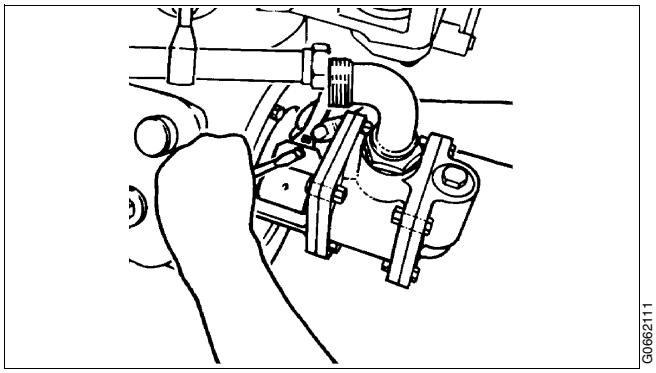
6.5.2 Dismantling

1. Drain the oil from the worm gear housing.



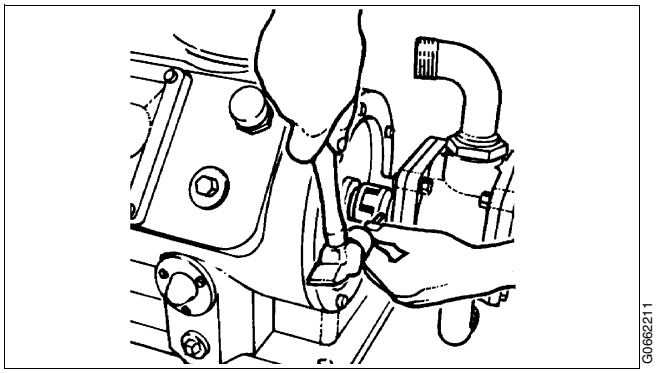
> **CAUTION**
>
> **Burn hazards**
>
> Lubricating oil and various machine surfaces can be hot and cause burns.

2. Remove the pipe connections from the pump.
3. Remove the sleeve halves over the coupling.

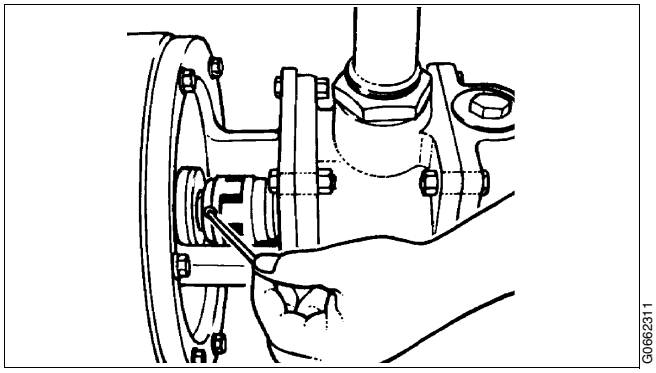


4. Drive out the tubular spring pin, positioned in the coupling half nearest the pump.

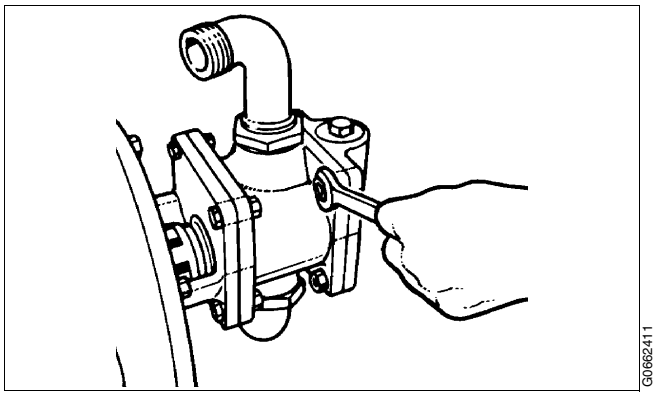
   Turn the coupling drum by hand until the pin is in a convenient position.



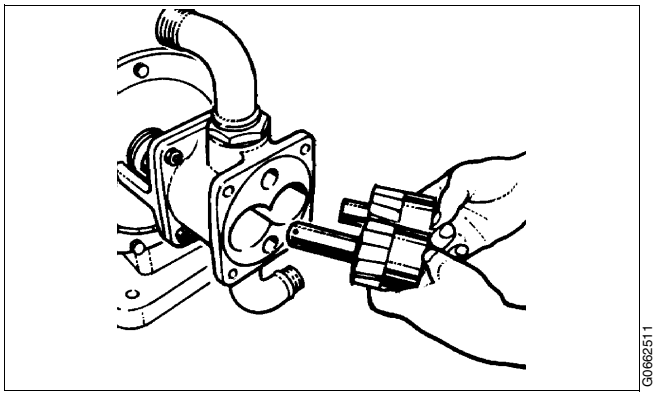
5. Slacken (do not remove) the stop screw positioned in the other coupling half with a hexagon wrench.



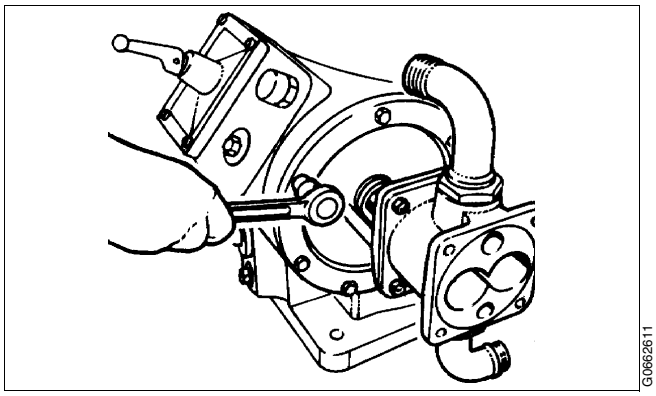
6. Undo the four screws holding the pump shield and remove the shield.



7. Insert two screws (3/8”-16 UNC) into the centre hole of the impeller shafts. Use the screws as a handle to withdraw the impellers.



8. Slacken the screws for the bearing shield, but do not remove them.
9. Remove the coupling by pulling the complete pump outwards a short distance until the coupling can be loosened from the worm wheel shaft. Take care not to damage the lipseal ring.



6.5.3 Cleaning and inspection

1. Remove deposits and clean all parts thoroughly in a suitable cleaning agent. See chapter “5.5.2 Cleaning agents” on page 86.
2. Examine following parts:

Bushings (2)

Renew the bushings if they are scratched or there is a play between any impeller shaft and a bushing.

Impeller shafts (5)

Check the impeller shafts for grooves. Polish or renew if necessary.

Wear gaskets (3)

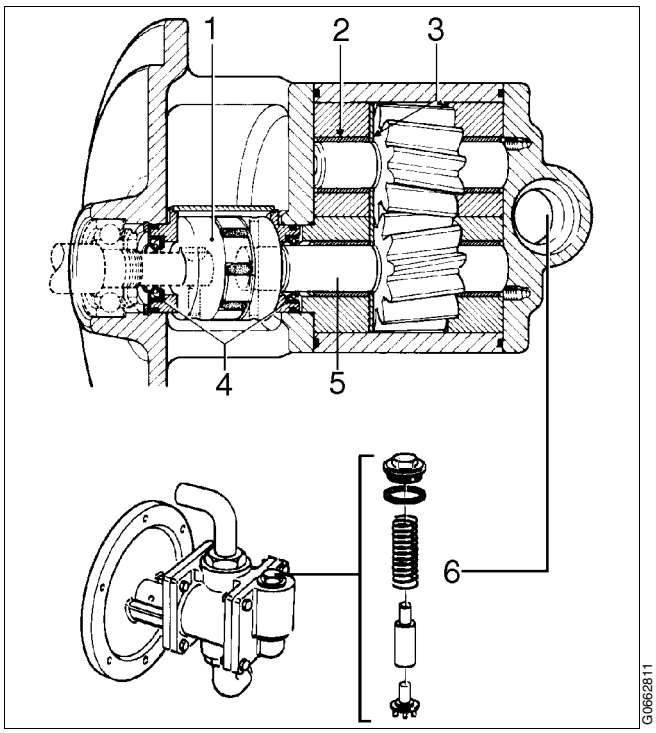
Renew the wear gaskets if any surface is rough, cracked or dented by the impellers.

Relief/safety valve (6)

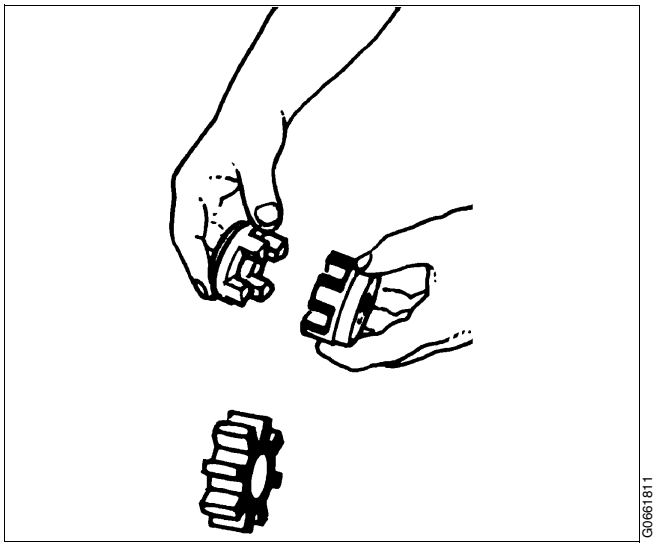
Examine the sealing surfaces on the valve cone and valve seat in the shield. Grind or renew if necessary.

Flexible coupling (1)

Dismantle and examine the coupling parts. If necessary, renew the flexible element or the complete coupling.



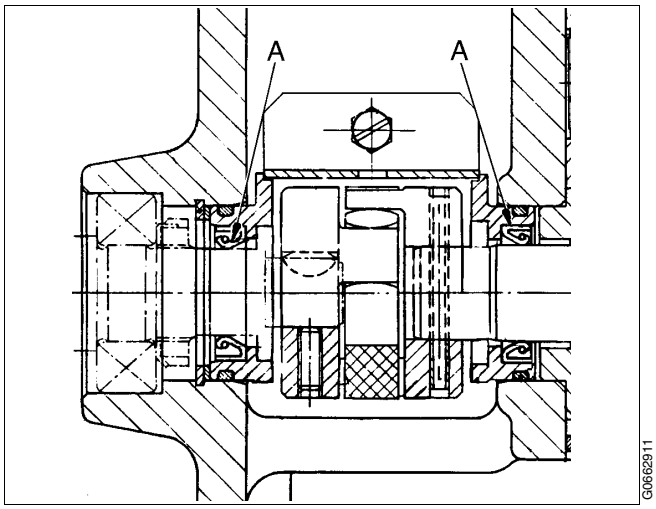
1. *Flexible coupling*
2. *Bushing*
3. *Wear gasket*
4. *Lipseal ring*
5. *Impeller shaft*
6. *Relief/safety valve*



Lipseal rings (4)

Renew the lipseal rings at MS-service.

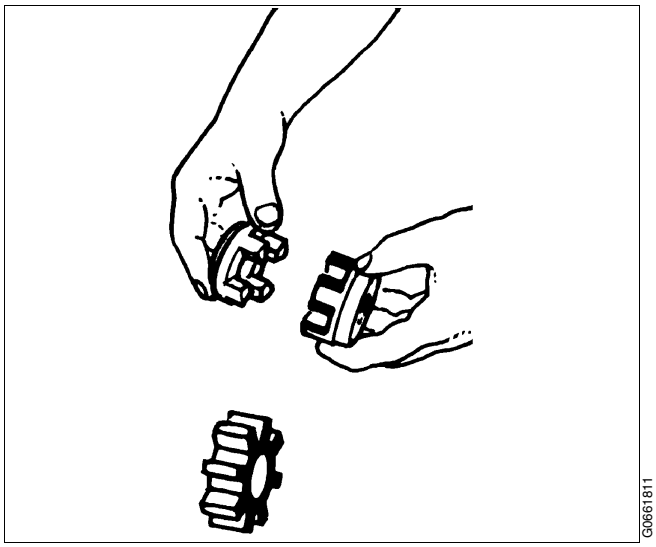
Note: Turn the rings the right way round, see pos. A in the illustration.



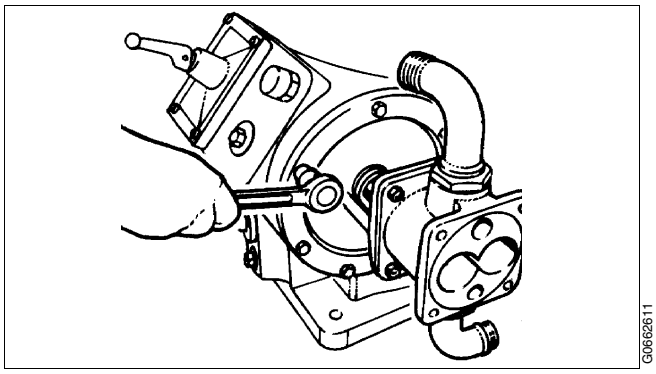
6.5.4 Assembly

1. Check that the lipseal rings are correctly mounted, see description in the “Cleaning and inspection”-section above.
2. Assemble the coupling.

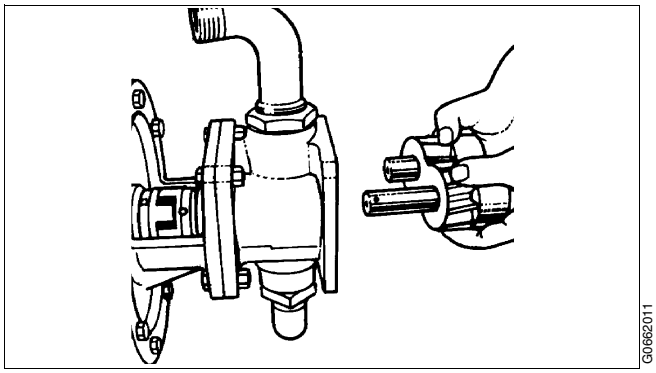
   The parts must not be pushed together too hard. The flexible element is provided with projections to ensure that the correct clearance is maintained in the coupling, and these must not be deformed.
3. Fit the coupling in position on the worm wheel shaft with the keyway facing the key.



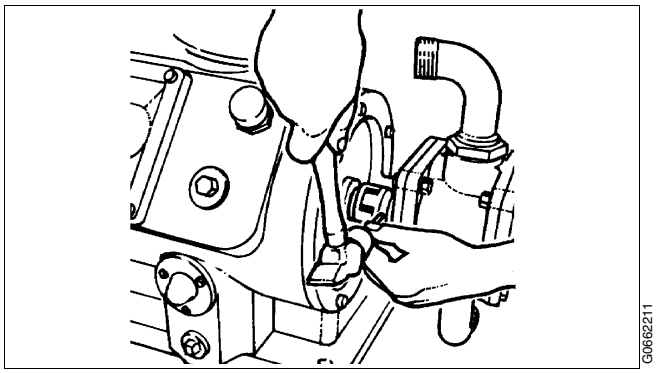
4. Tighten the bearing shield screws.



5. Refit the impellers. Check that the hole for the tubular pin is exactly opposite the corresponding hole in the coupling.



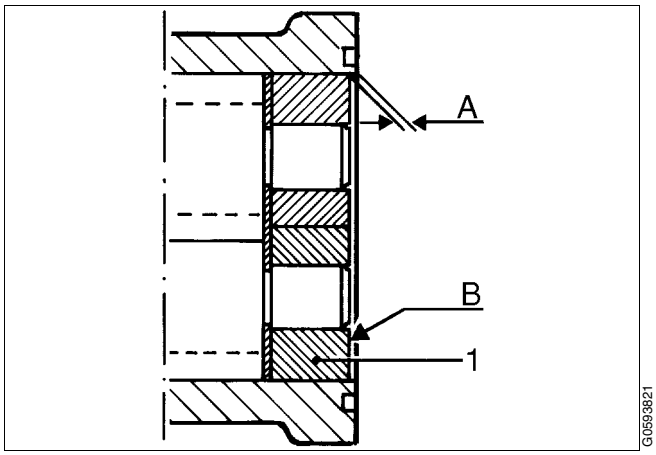
6. Drive in the tubular spring pin.



7. Check the axial play with a liner (B).

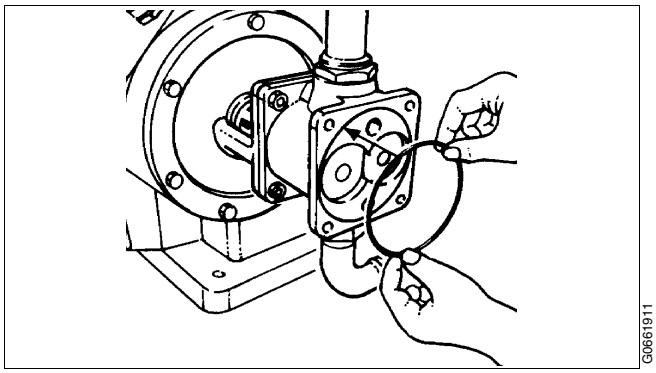
   The total axial play (A) must be **0,1 - 0,3 mm**. If the play is too large even though the wear gaskets have been renewed, it can be compensated by adding a brass leaf liner.

   If the play is too small, grind off the bearing (1).

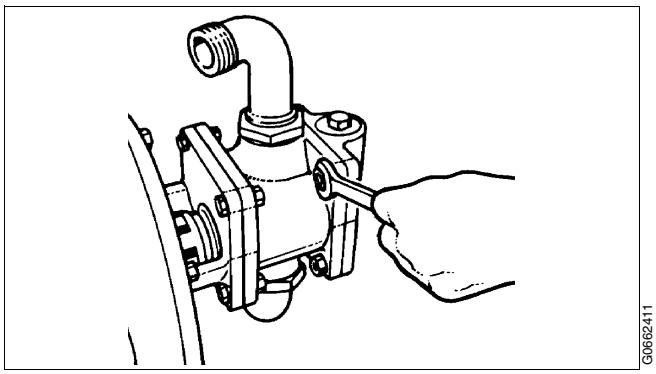


A. Axial play = 0,1 - 0,3 mm
B. Where to insert the liner
1. Bearing

8. Fit the O-ring on the pump housing.

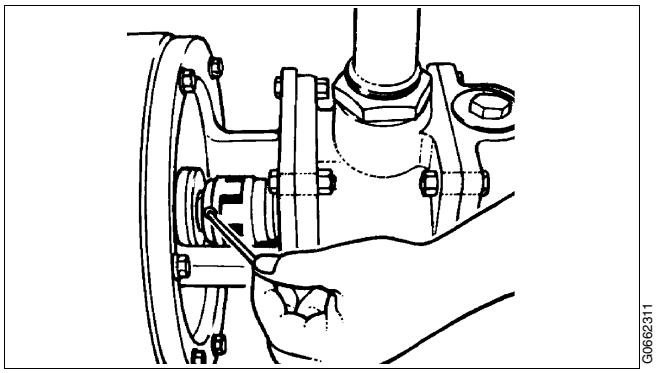


9. Fit the pump shield. (Four screws, four washers and four nuts.)

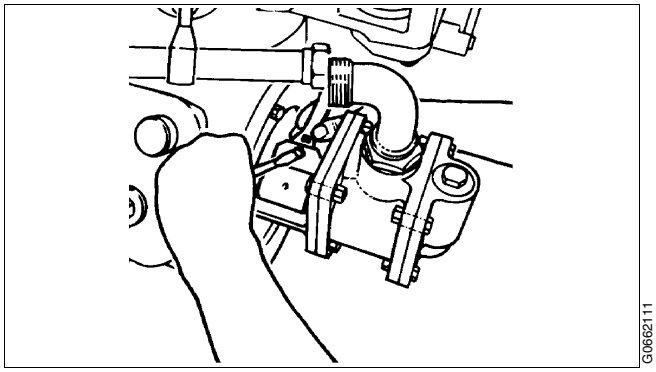


10. Check that the clearance on each side of the coupling flexible element is **2 mm**.

    Tighten the stop screw in the coupling half nearest the separator frame with a hexagon wrench. Check that the holders for the lipseal rings are located so that the sleeve halves can easily be fitted.

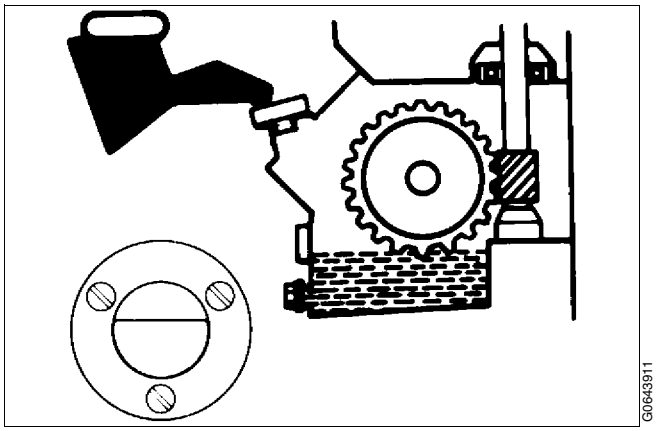


11. Mount the sleeve halves over the coupling.
12. Refit the pipe connections.



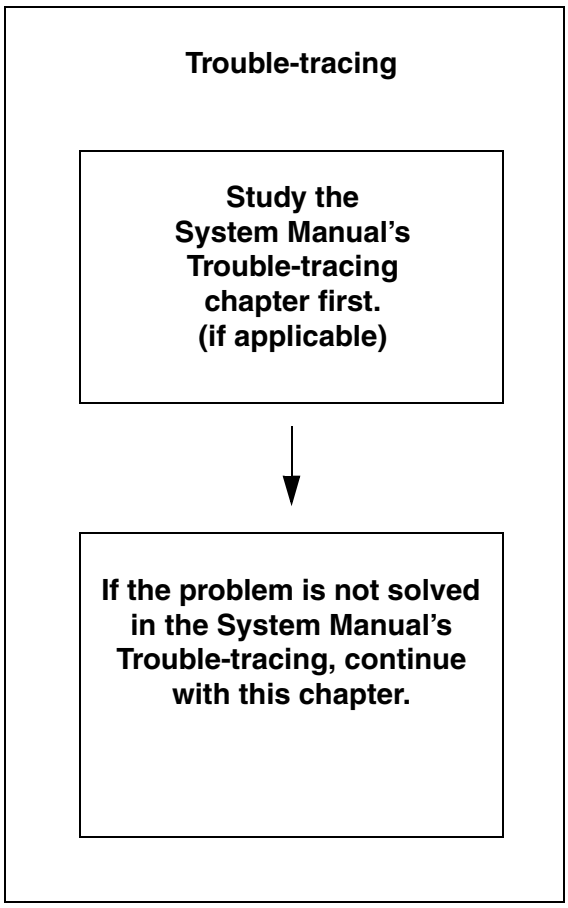
13. Pour oil into worm gear housing. The oil level should be slightly above the middle of the sight glass.

    For correct oil volume, see chapter “8.2 Technical data” on page 159. For recommended oil brands, see chapter “8.8.3 Recommended oil brands” on page 169.



7 Trouble-tracing

Contents



7.1 Mechanical function

7.1.1 The separator does not start

Cause	Corrective actions	Page
No power supply to the motor	Check the power supply	-
Bowl lock screws stops the rotation	Release the lock screws	46

7.1.2 Start-up time too long

Cause	Corrective actions	Page
Brake is applied	Release the brake	35
Coupling friction pads are worn or oily	Renew or clean the friction pads	80
Motor failure	Repair the motor	-
Incorrect power supply (50 Hz instead of 60 Hz)	Use correct power supply, see the machine plate	-
Bearing is damaged or worn	Renew all bearings	97
Height position of oil paring disc is incorrect	Stop, check and adjust the height	77

7.1.3 Starting power too low

Cause	Corrective actions	Page
Motor failure	Repair the motor	-
Coupling friction pads are oily or worn	Clean or renew the friction pads	80
Incorrect coupling friction blocks (60 Hz blocks for 50 Hz power supply)	Stop immediately and change the friction blocks to suit the power supply frequency	80

7.1.4 Starting power too high

Cause	Corrective actions	Page
Bowl lock screws stops the rotation	Release the lock screws	46
Brake is applied	Release the brake	35
Motor failure	Repair the motor	-
Gear is worn out	Replace the worm wheel and worm	124
Bearing is damaged or worn	Renew all bearings	97
Incorrect transmission (50 Hz gear and 60 Hz power supply)	⚠ **DANGER: Disintegration hazard** STOP immediately! Install correct transmission. Contact your local Alfa Laval representative, the bowl must be inspected.	124
Incorrect coupling friction blocks (50 Hz blocks for 60 Hz power supply)	⚠ **DANGER: Disintegration hazard** STOP immediately and change the friction blocks to suit the power supply frequency.	80
Wrong direction of rotation	Change electrical phase connections to the motor	-

7.1.5 Separator vibrates

NOTE

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

WARNING

Disintegration hazards

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

The cause of the vibration must be identified and corrected before the separator is restarted. Excessive vibration may be due to incorrect assembly or poor cleaning of the bowl.

Cause	Corrective actions	Page
Bowl out of balance due to: – poor cleaning – incorrect assembly – too few discs – insufficiently tightened bowl hood – bowl assembled with parts from other separators	Dismantle the separator and check the assembly and cleaning	97
Vibration dampers in frame feet worn out	Fit new vibration dampers	62
Bowl spindle bent (**max. 0,04 mm**)	Fit a new bowl spindle	76
Top and/or bottom bearing(s) on bowl spindle is damaged or worn	Fit new bearings	112
Top bearing springs defective	Fit new springs	112
Uneven sludge deposits in the sludge space	Dismantle and clean the separator bowl	42
Bearing(s) on horizontal driving device is damaged or worn	Fit new bearings	124
Height adjustment of the oil paring disc is incorrect	Stop the separator, measure and if necessary adjust the height	77

7.1.6 Smell

Cause	Corrective actions	Page
Normal occurrence during start as the (new) friction blocks slip	None	-
Brake is applied	Release the brake	35
Overheated bearing	Renew the bearings	97
Oil level in gear housing is too high or too low	Check the oil level and remedy if necessary	89

7.1.7 Noise

Cause	Corrective actions	Page
Oil level in the gear housing is too low	Stop and read the oil level, add oil if necessary	89
Damaged or worn bearing	Renew the bearings	97
Coupling friction pads are worn	Renew the friction pads	80
Height adjustment of the oil paring disc is incorrect	Stop the separator, measure and if necessary adjust the height	77
Worm wheel and worm are worn	Renew the worm wheel and worm	124
Incorrect play between the coupling pulley and elastic plate	Adjust the play	78

7.1.8 Speed too low

Cause	Corrective actions	Page
Brake is applied	Release the brake	35
Coupling friction pads are oily or worn	Clean or renew the friction pads	80
Motor failure	Repair the motor	-
Damaged or worn bearing	Renew the bearings	97
Incorrect gear transmission (60 Hz gear for 50 Hz power supply)	Stop and change the gear transmission to suit the power supply frequency	71

7.1.9 Stopping time too long

Cause	Corrective actions	Page
Brake friction pad is worn or oily	Renew or clean the brake friction pad	82

7.1.10 Water in oil sump

Cause	Corrective actions	Page
Bowl casing drain is obstructed	Clean the worm gear housing and change the oil	89
Leakage at the top bearing	Fit a new seal ring and change the oil	89, 112
Condensation	Clean the worm gear housing and change the oil	89

7.1.11 Liquid flows through bowl casing drain

Cause	Corrective actions	Page
Broken water seal	Stop the feed and feed water to create a new water seal	39
Too high throughput	Reduce the feed	-
The supply of liquid seal water is not sufficient due to clogged strainer, kinked hose or low water pressure	Straighten the hose or clean the strainer	-
Seal ring under the gravity/clarifier disc is defective	Fit a new seal ring	100
Bowl hood seal ring is defective	Fit a new seal ring	100
Bowl speed is too low	Make sure current is on and brake is off. Inspect motor and power transmission	35, 71

7.2 Purification faults

7.2.1 Unsatisfactory separation result

Cause	Corrective actions	Page
Gravity disc hole is too small	Use a gravity disc with a larger hole	33
Incorrect separating temperature	Adjust the temperature	-
Throughput too high	Reduce the throughput	-
Sludge space in the bowl is filled	Empty the sludge basket in the bowl	42
Disc stack is clogged	Clean the bowl discs	42
Bowl speed is too low	See “7.1.8 Speed too low” on page 150	-

7.2.2 Outgoing water contaminated by oil

Cause	Corrective actions	Page
Gravity disc hole is too large	Use a gravity disc with a smaller hole	33
Seal ring under the gravity disc is defective	Fit a new seal ring	100

7.2.3 Broken water seal

Cause	Corrective actions	Page
Gravity disc is too large	Use a gravity disc with a smaller hole	33
Separation temperature is too low	Increase the temperature	-
Throughput too high	Reduce the throughput	-
Sealing water volume is too small	Supply more sealing water	39
Seal ring under the gravity disc is defective	Fit a new seal ring	100
Disc stack is clogged	Clean the bowl discs	42
Bowl speed is too low	See “7.1.8 Speed too low” on page 150	-
Bowl is incorrectly assembled	Examine and re-assemble	100

7.3 Clarification faults

7.3.1 Unsatisfactory separation result

Cause	Corrective actions	Page
Separating temperature is too low	Adjust the temperature	-
Throughput is too high	Reduce the throughput	-
Feed oil contains water	Re-assemble and operate the separator as a purifier	33
Disc stack is clogged	Clean the bowl discs	42
Sludge space in the bowl is filled	Empty the sludge basket	42
Bowl speed is too low	See “7.1.8 Speed too low” on page 150	-

7.3.2 Oil discharge through water outlet

Cause	Corrective actions	Page
Valve(s) in outlet line is closed	Open the valve(s) and adjust to normal back pressure	39
Disc stack is clogged	Clean the bowl discs	42
Seal ring under the gravity disc is defective	Fit a new seal ring	100
Bowl is incorrectly assembled	Examine and re-assemble	100

8 Technical reference

Contents

8.1 Product description

Alfa Laval ref. 9025210, rev. 0

Product number:	881240-22-15
Separator type:	MAB 206S-24
Application:	Mineral oil
Technical Design:	Purifier/clarifier with solid-wall separator bowl and collecting cover in aluminium. Sealings available in NITRILE Intended for marine- and land applications.
Directives and standards	See “8.1.1 Declaration” on page 157
Restrictions:	Feed temperature: 0° C to +100° C Ambient temperature: +5° C to +55° C Not to be used for liquids with flashpoint below 60° C The separator should be installed in such a way that the centre line of the electric motor is parallel with the centre line of the ship. Risk for corrosion and erosion has to be investigated in each case by the application centre.

8.1.1 Declaration

Alfa Laval ref. 591985, rev. 8

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

Manufacturer:.....

Manufacturer address:.....

Separator type:.....

Product specification:.....

Configuration number:.....

Serial number:.....

Declaration of Incorporation of Partly Completed Machinery

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

Designation	Description
2006/42/EC	Machinery Directive

To meet the requirements the following standards have been applied:

Designation	Description
EN 60204-1	Electrical equipment of machines, part 1: General requirements
EN ISO 12100	Safety of machinery - General principles for design - Risk assessment and risk reduction
ISO 3744	Acoustics - Determination of sound power levels of noise sources using sound pressure

EU Declaration of Conformity

The machinery complies with the following Directives:

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

To meet the requirements the following standards have been applied:

Designation	Description
EN 61000-6-2	Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity for industrial environments
EN 61000-6-4	Electromagnetic compatibility (EMC) - Part 6-4: Generic standards - Emission standard for industria1l environments

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

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

Signed for and on behalf of: .....

Place: .....

Date of issue: .....

Signature: .....

Name: .....

Function: .....

8.2 Technical data

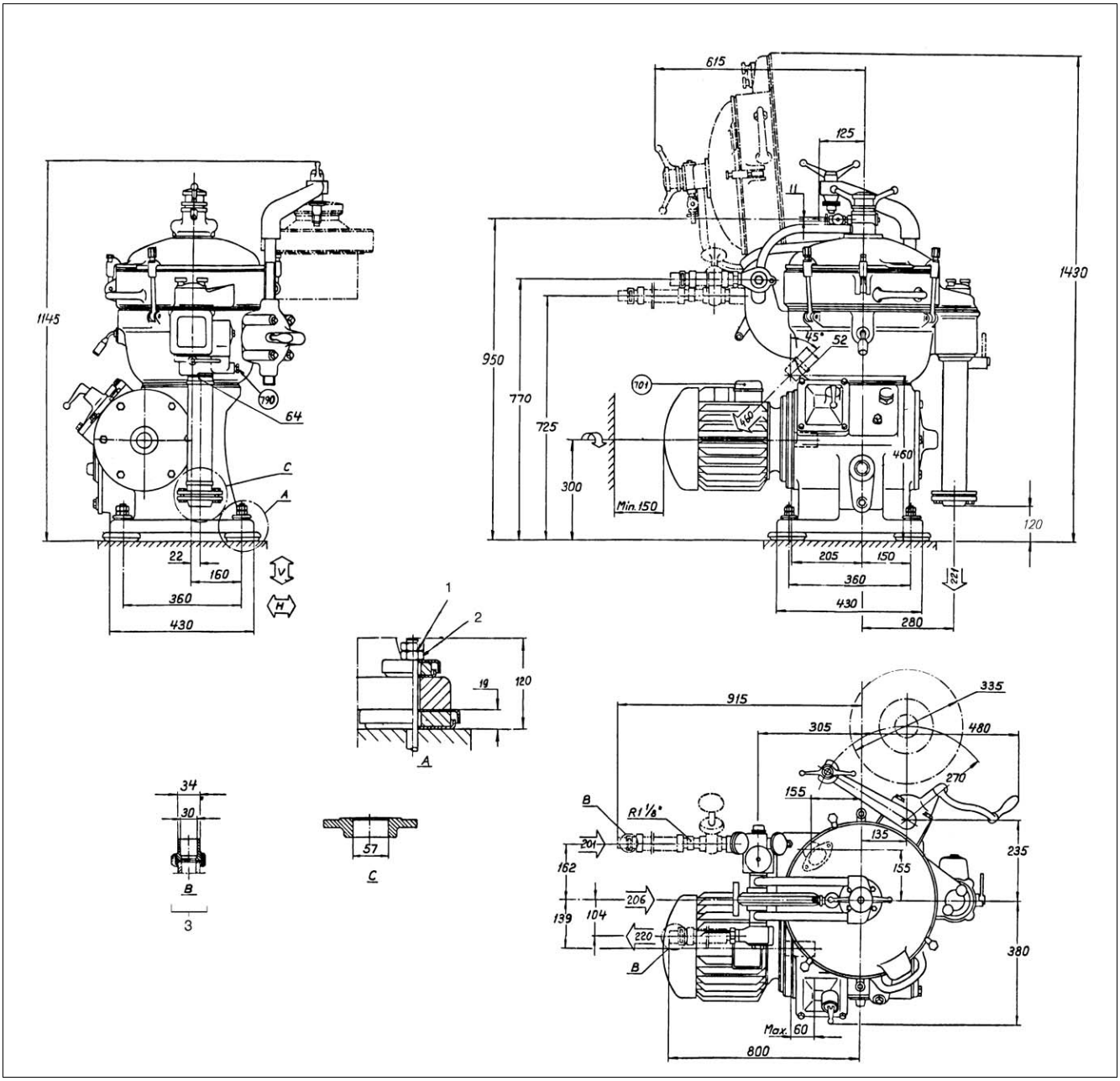
Alfa Laval ref. 557968 rev. 3

Bowl speed max	8423 / 8400 r/min
Speed motor shaft max	1500 / 1800 r/min.
Gear ratio	73:13 / 70:15
Hydraulic capacity	10,6 m^3/h
Max. density of sediment/feed	1600 / 1100 kg/m^3
Feed temperature	0 / 100 min./max. °C
Weight of separator	334 kg (without motor)
Motor power	5,5 kW (recomended without pump)
Motor power	11-13 kW (recomended with pump)
Jp reduced to motor shaft	26,8 kg/m^2 50Hz
Jp reduced to motor shaft	18,5 kg/m^2 50Hz
Power consumption	3,3 / 8 kW (idling/at max. capacity)
Max. power consumption	10 / 12 (at starting up 5,5/12 kW)
Starting time	1,2 / 2 minutes (min./ max.)
Stopping time with brake	3 / 4 minutes (min./ max.)
Stopping time without brake	24 minutes (average)
Max. running time empty bowl	480 minutes
Max. running time filled bowl, without flow	480 minutes
Sound power/sound press. Level	9 / 75 Bel(A) /dB(A)
Max. vibration level sep. in use	9 mm/sec(r.m.s)
Bowl max. inner diameter	282 mm
Bowl volume	5,8 litres
Bowl weight	65 kg
Bowl body material	AL 111 2377 02

There are other material than stainless steel in contact with process liquid.

8.3 Basic size drawing, without pump

Alfa Laval ref. 9025213 rev. 0



1. *Screw 5/8-11 UNC*
2. *Tightening torque 20 Nm locked with lock nut*
3. *Deviation from centre of outer connection of flexible tube = 12 mm*

Data for connections see "8.4 Connection list, without pump" on page 161.

All connections to be installed non-loaded and flexible.

Vertical force not exceeding 12 kN/foot.

Horizontal force not exceeding 12 kN/foot.

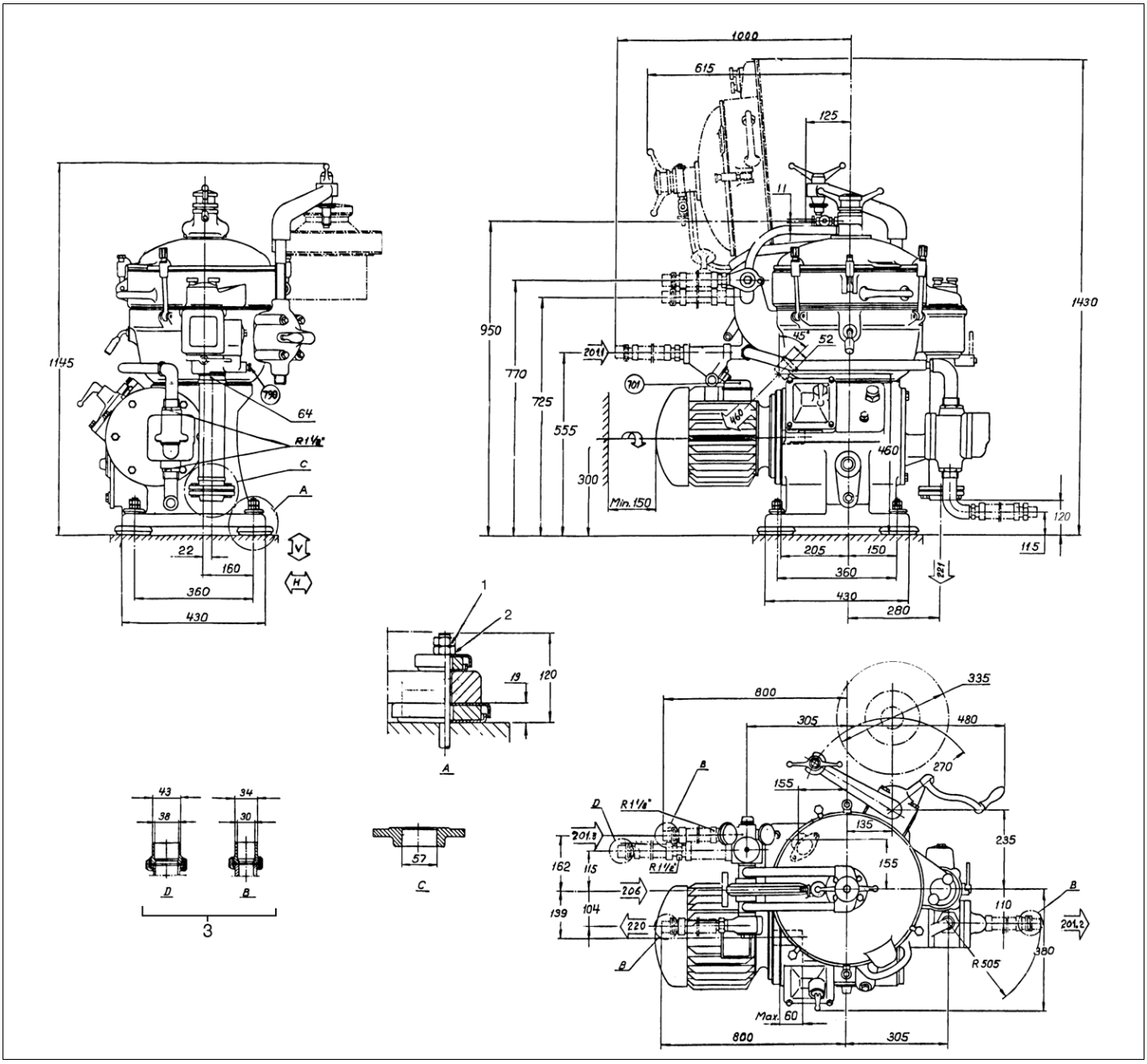
8.4 Connection list, without pump

Alfa Laval ref. 9025214 rev. 0

Connection No.	Description	Requirements/limit
201	Inlet for process liquid - Allowed temperatures	 Min. 0 °C, Max. 100 °C
206	Inlet for liquid seal	Fresh water, approx 5,8 litres (depending on gravity disc)
220	Outlet for light phase	Max. 250 kPa
221	Outlet for heavy phase (water)	No counter pressure
460	Drain of frame	
701	Motor for separator - Max. deviation from nominal frequency	 ±5%
790	Lighting for heavy phase (water) outlet Available type of electric bulb:	 115 V, 25 W 230 V, 25 W

8.5 Basic size drawing, with pump

Alfa Laval ref. 9025212 rev. 0



1. *Screw 5/8-11 UNC*
2. *Tightening torque 20 Nm locked with lock nut*
3. *Deviation from centre of outer connection of flexible tube = 12 mm*

Data for connections see "8.6 Connection list, with pump" on page 163*.*

Vertical force not exceeding 12 kN/foot.

Horizontal force not exceeding 12 kN/foot.

All connections to be installed non-loaded and flexible.

8.6 Connection list, with pump

Alfa Laval ref. 9025215 rev. 0

Connection No.	Description	Requirements/limit
201.1	Inlet for process liquid (to pump) - Allowed temperatures	 Min. 0 °C, Max. 100 °C
201.2	Outlet for process liquid (from pump to heater)	
201.3	Inlet for process liquid (from heater to separator)	
206	Inlet for water seal	Fresh water, approx. 5,8 litres (depending on gravity disc)
220	Outlet for light phase	Max. 250 kPa
221	Outlet for heavy phase (water)	No counter pressure
460	Drain of frame	
701	Motor for separator - Max. deviation from nominal frequency	 ±5%
790	Lighting for heavy phase (water) outlet Available type of electric bulb:	 115 V, 25 W 230 V, 25 W

8.7 Interface description

Alfa Laval ref. 9025217 rev. 0

8.7.1 General

In addition to the Connection List this description informs about limitations and conditions for safe control, monitoring and reliable operation.

At the end of the document a function graph and running limitations are to be found.

8.7.2 Definitions

Ready for start means:

- The machine is assembled correctly.
- All connections are installed according to Connection List, Interconnection Diagram and Interface Description.

Start means:

- The power to the separator is on.
- The acceleration is supervised to ensure that a certain speed has been reached within a certain time. See “8.2 Technical data” on page 159.

Normal stop means:

- Stopping of the machine at any time with feed or safety/backup liquid with brake applied.

Safety stop means:

The machine must be stopped in the quickest and safest way due to vibrations or process reasons.

Comply to following conditions:

- The bowl must be kept filled.
- The machine must not be restarted before the reason for the Safety stop has been investigated and action has been taken.

In case of emergency condition in the plant, the machine must be stopped in a way that is described in EN 418.

8.7.3 Component description and signal processing

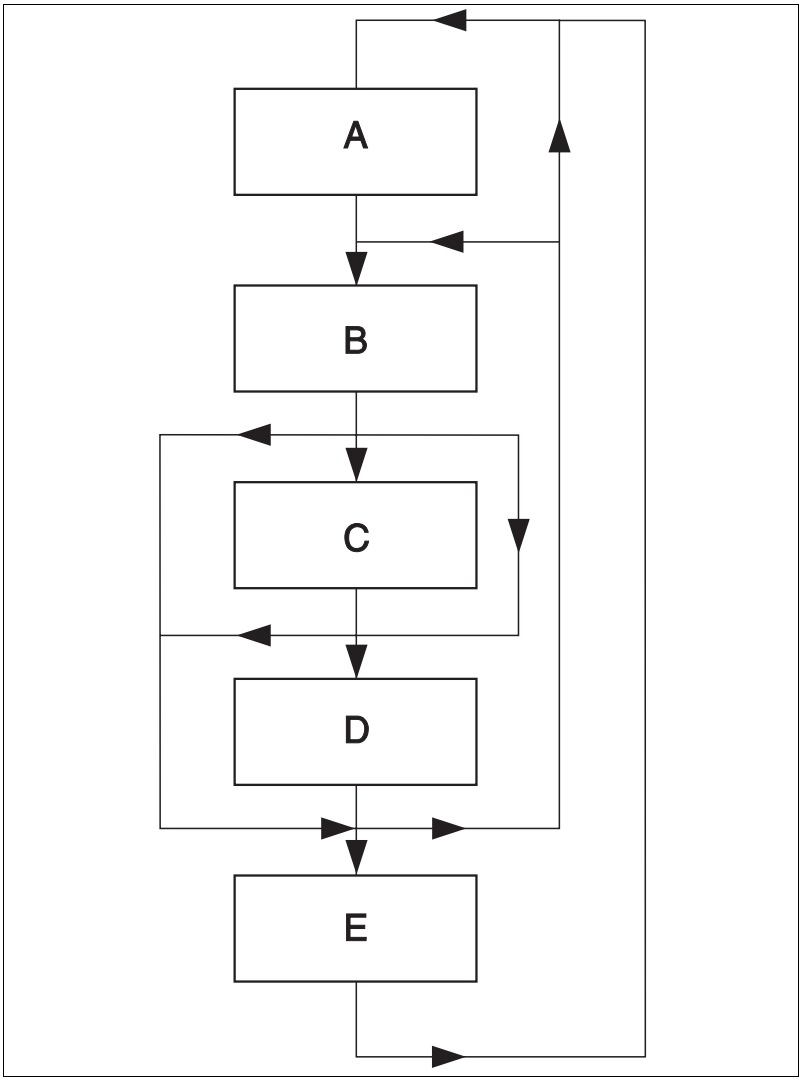
Separator motor 701

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

Lighting 790

The heavy phase (water) outlet is equipped with an electric fitting and must be connected to a full isolated transformer.

8.7.4 Function graph and running limitations



A. Stand still
B. Starting mode
C. Running mode
D. Stop mode
E. Safety stop mode

8.8 Lubricants

8.8.1 Lubrication chart, general

Alfa Laval ref. 553216-02, rev. 3

CAUTION!

Check the oil level before start.
Top up when necessary.
Do not overfill.

NOTE!

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

Lubricating points	Type of lubricant	Interval
The oil bath. Bowl spindle bearings are lubricated by oil mist from the oil bath.	Lubricate with oil. For information on type of lubricant see Recommended lubricating oils. For information on lubricating oil volume see Technical data.	For information on oil change interval see Recommended lubricating oils.
Bowl spindle taper	Lubricating oil, only a few drops for rust protection.	At assembly.
Bowl: Sliding contact surfaces, thread of lock nut and cap nut.	Lubricate with paste. For information on pastes see Recommended lubricants.	At assembly.
Rubber seal rings	Lubricate with grease. For information on grease see Recommended lubricants.	At assembly.
Friction clutch bearings	Lubricate with grease. Fill the space between the bearings to one third with ball bearing grease.	At assembly.
Electric motor	Follow manufacturer's instructions.	Follow manufacturer's instructions.
Threads	Lubricating oil, if not otherwise stated.	At assembly.

8.8.2 Recommended lubricating oils

Alfa Laval ref. 553219-03, rev. 3

Selection of lubricating oil

Select lubricating oil type with regards to ambient temperature.

Ambient temperature (°C)	**Oil type** (see Recommended oil brands)	**Oil change interval (operating hours)**
Between +5 and +45 and Frame temperature below 80 °C.	553218 01 – Mineral lubricating oil CKC 220 (Alfa Laval oil group A) or 553218 02 – Mineral lubricating oil CKE 220 (Alfa Laval oil group B)	1500
Between +2 and +65	553218 03 – Synthetic lubricating oil PAO CKE 220 (Alfa Laval oil group D)	2000

Oil change interval

Oil change interval is dependent on operating conditions.

Operating conditions	**Oil change interval**
In a new installation. After change of gear transmission.	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.

8.8.3 Recommended oil brands

Alfa Laval ref. 553218-01, rev. 6

Mineral lubricating oil CKC 220 (Alfa Laval oil group A)

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

Recommended oil brands

Manufacturer	Designation
BP	Castrol Ultra 220 Castrol Alpha SP 320
Chevron	Clarity Machine oil 220 Rando HD 220 Paper Machine oil 220
ExxonMobil	Mobil DTE oil BB
Q8/Kuwait Petroleum	Wagner 220
Shell	Morlina S2 B 220
Statoil/Fuchs	LubeWay XA 220
Total	Cirkan ZS 220

Requirements

- Viscosity grade (ISO 3448/3104) VG 220 / Viscosity index (ISO 2909) VI > 90.
  The oil must have the correct viscosity grade. No other viscosity grade than specified should be used.
- The oil must be endorsed for worm gear with bronze worm wheel.
- The oil must follow the requirements in one of the standards below.

Standard	Designation
ISO 12925-1	ISO-L-CKC to CKT 220
DIN 51517 part 3 (German standard)	DIN 51517 – CLP 220
DIN 51524 part 2 (German standard)	DIN 51524 – HLP 220
DIN 51524 part 3 (German standard)	DIN 51524 – HVLP 220

NOTE

The use of other lubricants than the recommended is done on the exclusive responsibility of the user or oil supplier.

Mineral lubricating oil CKE 220 (Alfa Laval oil group B)

Alfa Laval ref. 553218-02, rev. 7

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

Recommended oil brands

Manufacturer	Designation
Bel-Ray	100 Gear Oil Extreme Pressure 220
BP	Castrol Alpha SP 220 Castrol Optigear BM 220
Chevron	Clarity Machine Oil 220 Meropa Ultra Gear 220 Meropa 220
ExxonMobil	Spartan EP 220 Mobilgear 600 XP 220
Q8/Kuwait Petroleum	Goya 220
Shell	Omala S2 G 220
Statoil/Fuchs	LoadWay EP 220
Total	Carter EP 220 Lubmarine Epona Z 220

Requirements

- Viscosity grade (ISO 3448/3104) VG 220 / Viscosity index (ISO 2909) VI > 90.
  The oil must have the correct viscosity grade. No other viscosity grade than specified should be used.
- The oil must be endorsed for worm gear with bronze worm wheel.

The oil must follow the requirements in one of the standards below.

Standard	Designation
ISO 12925-1, (ISO 6743/6)	ISO-L-CKC/CKD/CKE/CKT 220
DIN 51517 part 3	DIN 51517 - CLP 220

NOTE

The use of other lubricants than the recommended is done on the exclusive responsibility of the user or oil supplier.

Synthetic lubricating oil PAO CKE 220 (Alfa Laval oil group D)

Alfa Laval ref. 553218-03 rev. 8

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

Recommended oil brands (general demands)

Manufacturer	Designation
BP	Castrol Alphasyn HTX 220 Castrol Alphasyn EP 220 Castrol Alphasyn HG 220 Castrol Optigear Synthetic A 220
Chevron	Pinnacle EP 220 Meropa Synthetic EP 220 (H2)
ExxonMobil	Mobil SHC 630
Q8/Kuwait Petroleum	Schumann 220
Shell	Morlina S4 B 220
Statoil/Fuchs	Mereta 220
Total	Carter SH 220 Lubmarine Epona SA 220

Recommended oil brands (special hygienic demands)

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

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

Manufacturer	Designation
Fuchs	Cassida Fluids GL 220

Requirements

Standard	Designation
ISO 12925-1, (ISO 6743/6)	ISO-L-CKC/CKD/CKE/CKT 220
DIN 51517 part 3	DIN 51517 - CLP 220

NOTE

The use of other lubricants than the recommended is done on the exclusive responsibility of the user or oil supplier.

8.8.4 Recommended lubricants

Alfa Laval ref. 553217-01, rev. 14

Lubricant recommendation for hygienic and non-hygienic applications

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

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

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

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

Part No	Quantity	Designation	Manufacturer	Remark
537086-02	1000 g	Molykote 1000 Paste	Dow Corning	-
537086-03 537086-06	100 g 50 g	Molykote 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 (7 Jan 2004)
-	-	Molykote TP 42	Dow Corning	-
561764-01	50 g	Geralyn 2	Fuchs Lubritech	NSF Registered H1 (3 sep 2004)
-	-	Geralyn F.L.A	Fuchs Lubritech	NSF Registered H1 (2 Apr 2007) German §5 Absatz 1 LMBG approved
554336-01	55 g	Gleitmo 1809	Fuchs Lubritech	-
-	-	Gleitmo 805	Fuchs Lubritech	DVGW (KTW) approval for drinking water (TZW prüfzeugnis)
-	-	Klüberpaste 46 MR 401	Klüber	White; contains no lead, cadmium, nickel, sulphur nor halogens.
-	-	Klüberpaste UH1 84-201	Klüber	NSF Registered H1 (26 Aug 2005)
-	-	Klüberpaste UH1 96-402	Klüber	NSF Registered H1 (25 Feb 2004)
-	-	252	OKS	NSF Registered H1 (23 July 2004)
-	-	Foodlube Multi Paste	Rocol	NSF Registered H1 (13 Apr 2001)

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

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

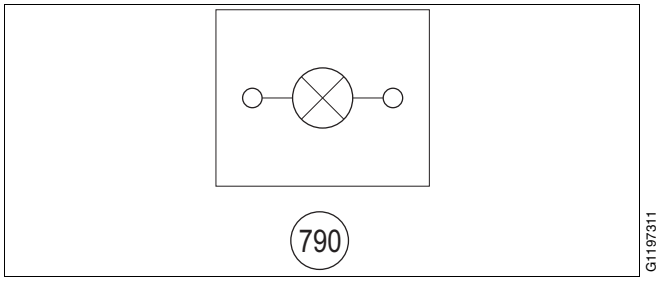
Grease for ball and roller bearings in electric motors

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 EP 2	Shell	-
-	-	LGEP 2	SKF	-
-	-	LGMT 2	SKF	-
-	-	LGFP 2	SKF	NSF Registered H1 (17 Aug 2007)
-	-	Multis EP2	Total	-

8.9 Electric components

8.9.1 Interconnection diagram

Alfa Laval ref. 9025216, rev. 0



790. Lighting

8.9.2 Electric motor

For information regarding motor specifications, see motor plate.

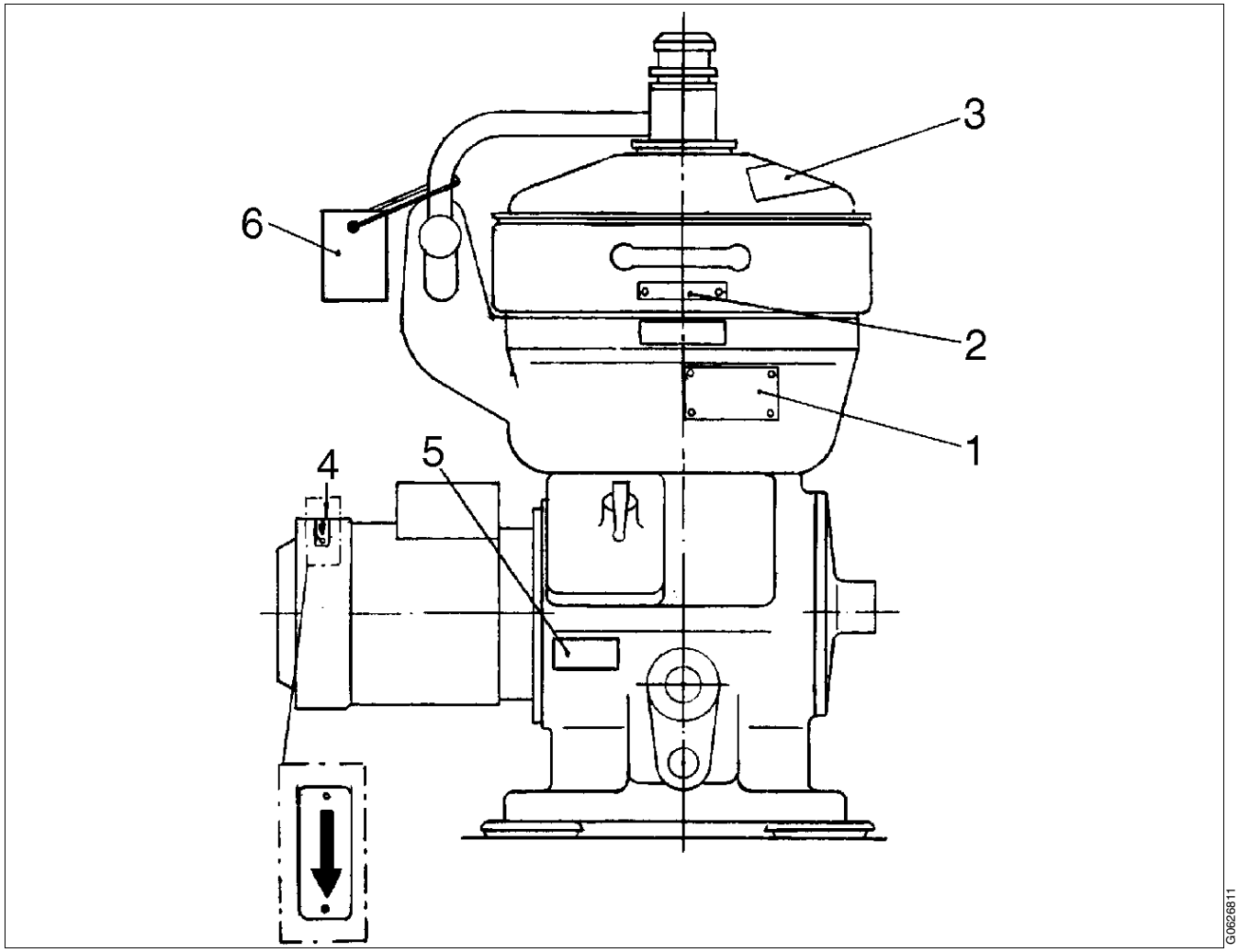
For further information see motor manufacturer's documentation.

NOTE

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

8.10 Machine plates and safety labels

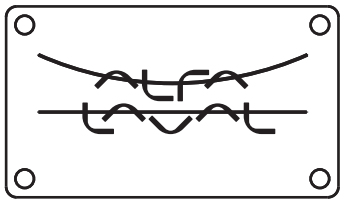
Alfa Laval ref. 557975 rev. 0



1. Machine plate

Separator	MAB 206S-24
Manufacturing serial No / Year	XXXX
Product No	881240-22-15
Frame	
Bowl	
Max. speed (bowl)	
Direction of rotation (bowl)	
Speed motor shaft	
El. current frequency	
Recommended motor power	
Max. density of feed	
Max. density of sediment	
Process temperature min./max.	

2. Name plate



S0063211

3. 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 occur, **stop** separator and **keep bowl filled** with liquid during rundown.

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

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

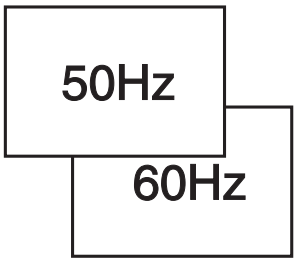
S00690N1

4. Arrow

Indicating direction of rotation of horizontal driving device.

S00682

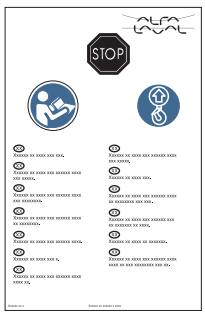
5. Power supply frequency



S0063111

6. Stop, follow lifting instruction

This transport label is not permanently fixed to the separator.



S0069111

8.11 Storage and installation

8.11.1 Storage and transport of goods

Storage

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.

Specification

Upon arrival to the store, **check all components and keep them:**

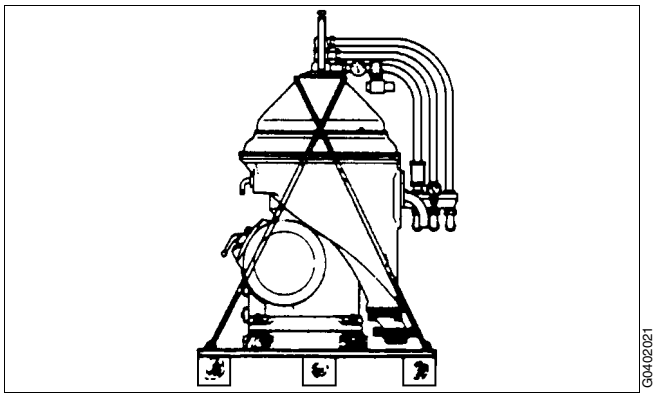
1. Well stored and protected from mechanical damage.
2. Dry and protected from rain and humidity.
3. Organized in the store in such a way that the goods will be easily accessible when installation is about to take place.

A separator can be delivered with different types of protection as described below.

The illustrations show an other separator type than this book is intended for.

- Fixed on a pallet.

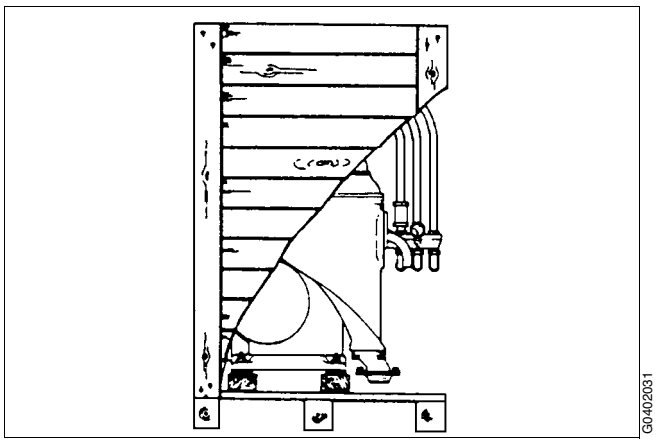
  The separator must be stored in a storage room well protected from mechanical damage and theft and also dry and protected from rain and humidity.



Fixed on a pallet

- In a wooden box which is not water tight.

  The separator must be stored dry and protected from rain and humidity.

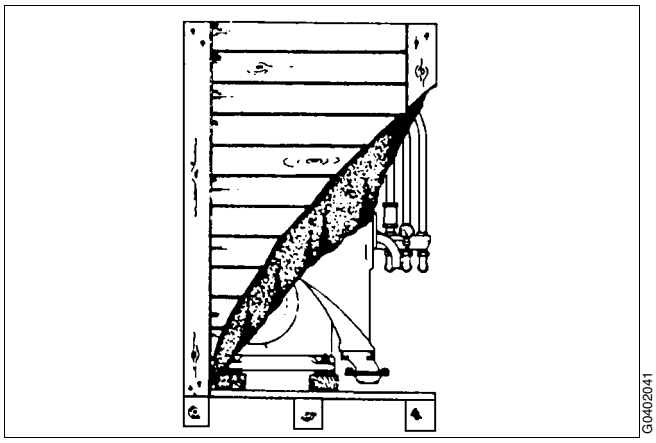


In a wooden box which is not water tight

- In a special water-resistant box for outdoor storage.

  The separator and its parts have been treated with an anti-corrosion agent. Once the box has been opened, store dry and protected from rain and humidity.

  The packaging for outdoor storage is only to special order.



In a special water-resistant box for outdoor storage

Transport

Specification

- During transport of the separator, the frame hood and bowl **must always be removed from the machine.**
- When lifting a separator it must always be **hung securely**. See chapter “5.8 Lifting instructions” on page 96.

WARNING

Crush hazards

Use correct lifting tools and follow lifting instructions.

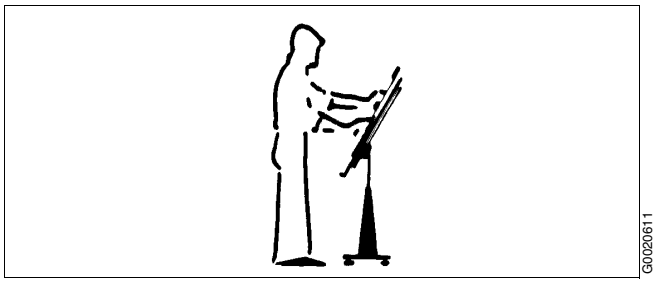
- During erection, all inlets and outlets to separators and accessories must be covered to be protected from dirt and dust.

8.11.2 Planning and installation

Introduction

The requirements for one or more separators can be established by consulting the following documents in this chapter:

- Basic size drawing
- Connection list
- Interface description
- Interconnection drawing
- Foundation drawing
- Lifting drawing

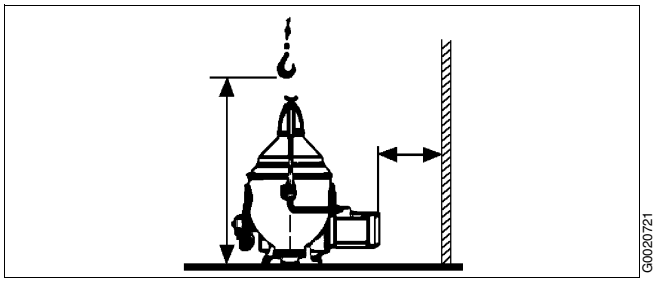


Check the drawings when planning the installation

Important measurements

Important measurements are the minimum lifting height for lifting tackle, shortest distance between driving motor and wall, free passage for dismantling and assembly, maintenance and operation.

Plan your installation with sufficient room for the controls and operation so that instruments are easily visible. Valves and controls must be within convenient reach. Pay attention to space requirements for maintenance work, work benches, dismantled machine parts or for a service trolley.



Suitable space must be obtained for the maintenance work

Space for separator

The separator shall be placed in such a way that suitable space for maintenance and repair is obtained.

Specification

- See “8.3 Basic size drawing, without pump” on page 160 or “8.5 Basic size drawing, with pump” on page 162 for the service space required for removal of electric motor.

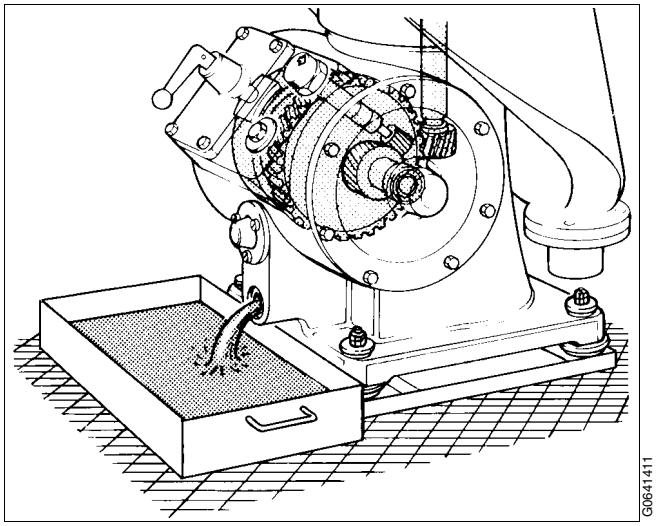
Space for oil changing

Specification

- The plug for gearbox oil draining must not be blocked by floor plate arrangement, etc.

Recommendation

- It should be possible to place a portable collecting tray under the gearbox drain plug for changing oil.



Place the separator in such a way that makes the oil change easy

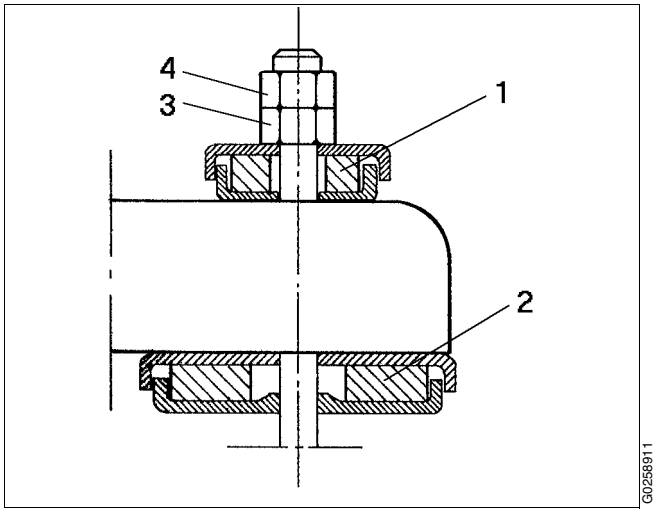
8.11.3 Foundations

Specification

- The separator should be installed at floor level, see “8.3 Basic size drawing, without pump” on page 160 or “8.5 Basic size drawing, with pump” on page 162**.**
- The separator must be installed on a strong and rigid foundation to reduce the influence of vibrations from adjacent machinery.
- The foundation should be provided with a cofferdam.

Fit the separator frame on the foundation as follows:

1. Place the separator frame without cushions in position.
2. Check that the bolts do not press against the edges of the holes, otherwise the elasticity of the mounting of the separator frame will be impeded.
3. Check that the separator frame is horizontal and that all feet rest on the foundation.
4. Fit height adjusting washers required.
5. Lift the separator frame, fit the vibration dampers (1, 2), lower and check that the bolts do not press against the edges of the holes.
6. Tighten the nut (3) with **20 Nm**.
7. Hold the nut (3) firmly and secure with the lock nut (4).
8. Repeat for the other frame feet.



1. *Vibration damper, upper*
2. *Vibration damper, lower*
3. *Nut*
4. *Lock nut*