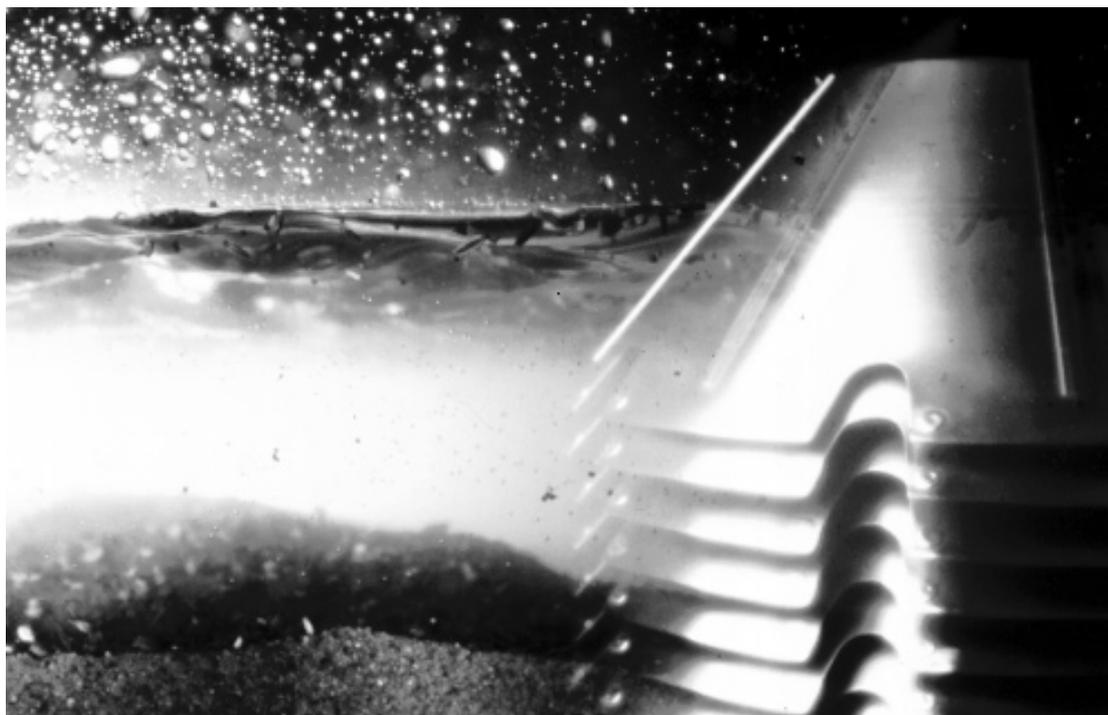


MOPX 309TGT-24



Separator Manual

Product No.
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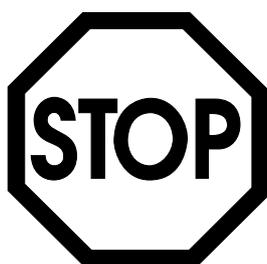
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Study instruction manuals and observe the warnings before installation, operation, service and maintenance.

Not following the instructions can result in serious accidents.

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



1 *Read this first*

This manual is designed for operators and service engineers working with the Alfa Laval separator MOPX 309TGT-24.

For information concerning the function of the separator, see chapter “3 Separator Basics” on page 15 and chapter “8 Technical Reference” on page 183.

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 documentation. In this case, study carefully all the instructions in the system documentation.

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

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.



Separator Manual and Spare Parts Catalogue

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 documentation first.

Technical Reference

This chapter contains technical data concerning the separator and drawings.

Index

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

2 Safety Instructions



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

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

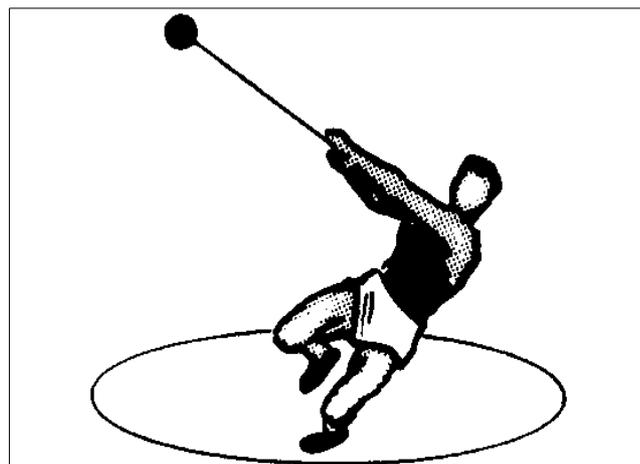
Manufacturing tolerances are extremely fine. Rotating parts are carefully balanced to reduce undesired vibrations that can cause a breakdown. Material properties have been considered carefully during design to withstand stress and fatigue.

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

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

The following basic safety instructions therefore apply:

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



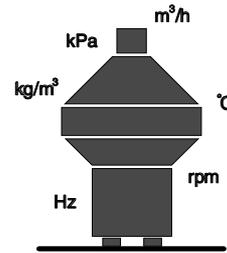


DANGER

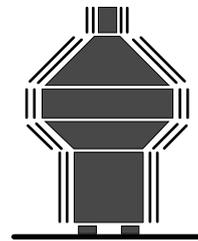


Disintegration hazards

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



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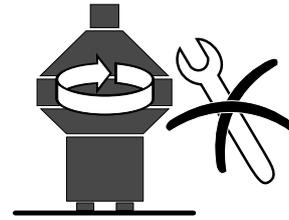
DANGER

Entrapment hazards

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

Electrical hazards

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



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S0051011



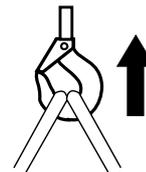
WARNING

Crush hazards

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

Noise hazards

- Use ear protection in noisy environments.



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S0051611



CAUTION

Burn hazards

- Lubrication oil and various machine surfaces can be hot and cause burns.

Cut hazards

- Sharp edges on separator discs and lock ring threads can cause cuts.



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Warning signs in the 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

This type of safety instruction indicates a situation which, if not avoided, could result in **fatal injury** or fatal damage to health.



WARNING

Type of hazard

This type of safety instruction indicates a situation which, if not avoided, could result in **disabling injury** or disabling damage to health.



CAUTION

Type of hazard

This type of safety instruction indicates a situation which, if not avoided, could result in **light injury** or light damage to health.

NOTE

This type of instruction indicates a situation which, if not avoided, could result in damage to the equipment.



3 *Separator Basics*

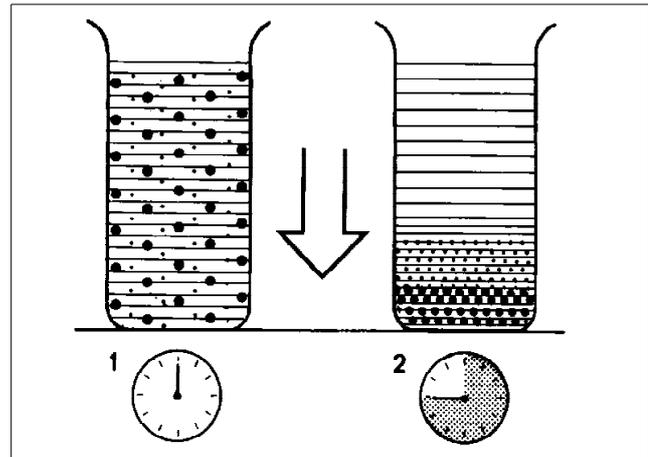
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3.1 Basic principles of separation

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

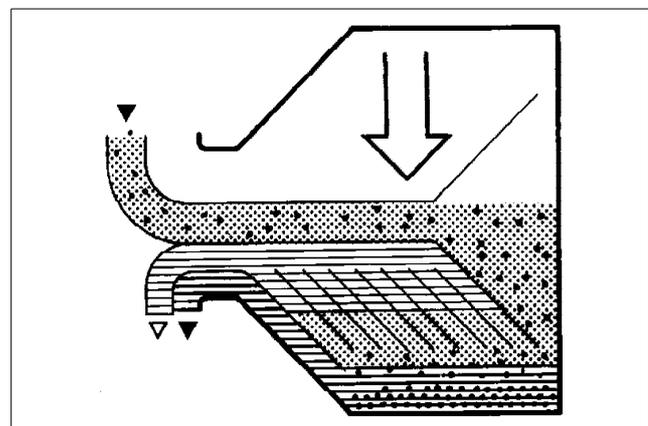
Separation by gravity

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.



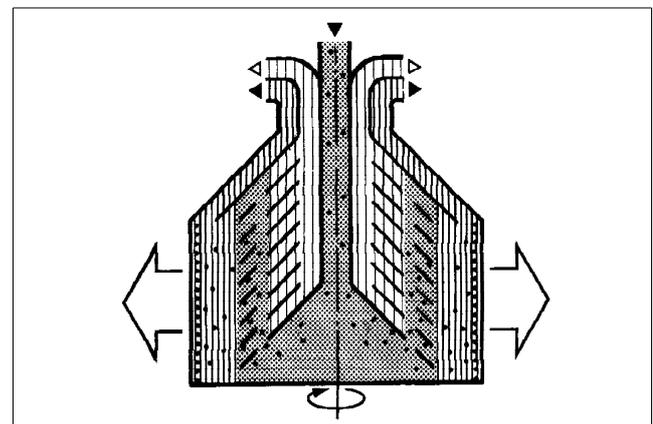
Sedimentation in a settling tank, with outlets making it possible to separate the lighter liquid parts from the heavier

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.



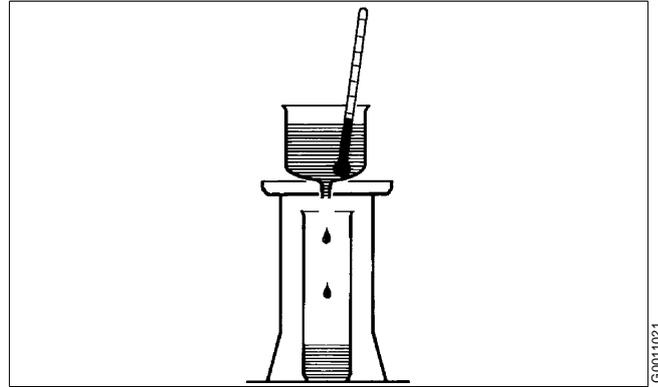
The centrifugal solution

Separating temperatures

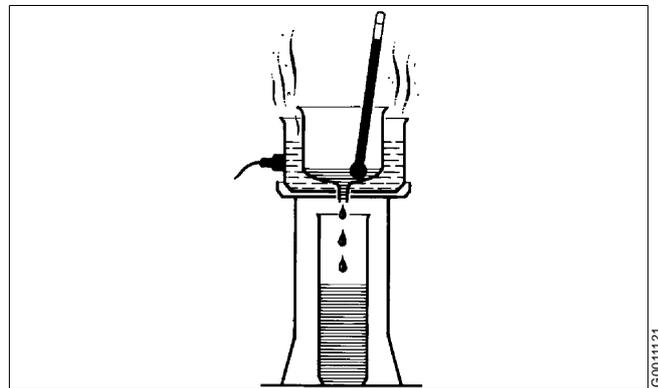
For some types of process liquids (e.g. mineral oils) a high separating temperature will normally increase the separation capacity. The temperature influences oil viscosity and density and should be kept constant throughout the separation.

Viscosity

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



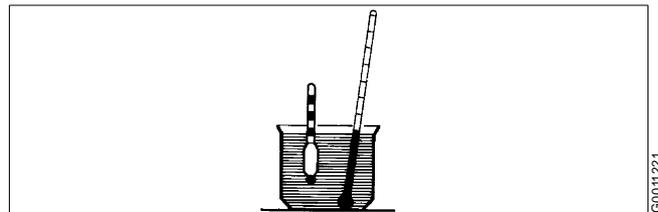
High viscosity (with low temperature)



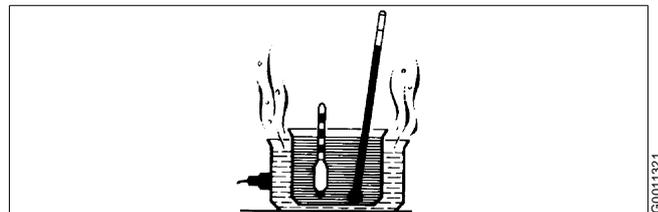
Low viscosity (with high temperature)

Density difference

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)

3.2 Design and function

3.2.1 Overview

The separator comprises a processing part and a driving part. It is driven by an electric motor (10).

Mechanically, the separator machine frame is composed of a bottom part, a top part and a frame hood. The motor is flanged to the frame as shown in the illustration. The frame feet (5) are vibration damping.

The bottom part of the separator contains the horizontal driving device (6), driving shaft with couplings (8, 9), a worm gear (7) and a vertical spindle (3).

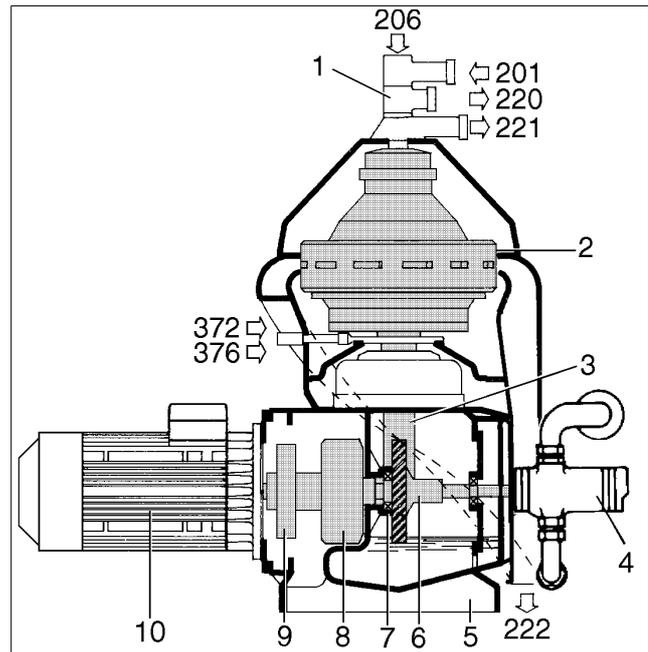
The bottom part also contains an oil bath for the worm gear, a brake and a revolution counter.

The frame top part and the frame hood contain the processing parts of the separator, the inlet, outlets and piping (1).

The liquid is cleaned in the separator bowl (2). This is fitted on the upper part of the vertical spindle and rotates at high speed in the space formed by the frame top part and frame hood. The bowl also contains the discharge mechanism which empties the sludge from the bowl.

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 183.

As option the separator can be equipped with a feed inlet pump (4).



1. Inlet and outlet device
2. Bowl
3. Vertical driving device with bowl spindle
4. Feed inlet pump (option)
5. Frame feet
6. Horizontal driving device
7. Worm gear
8. Friction coupling
9. Elastic coupling
10. Electric motor

201. Unseparated oil inlet
206. Sealing/displacement water inlet
220. Clean oil outlet
221. Water outlet
222. Sludge discharge outlet
372. Bowl opening water inlet
376. Bowl closing and make-up water inlet

3.2.2 Mechanical power transmission

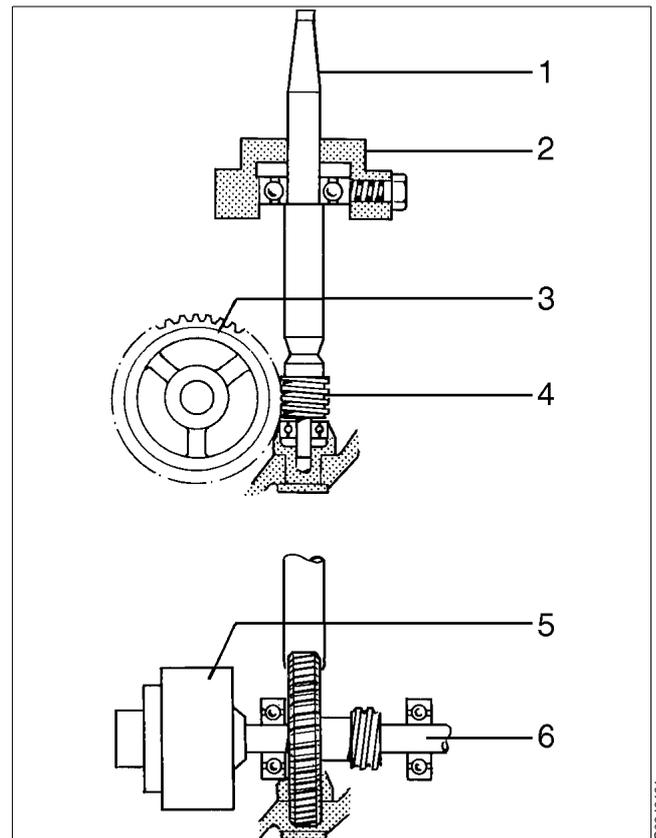
The main parts of the power transmission between motor and bowl are illustrated in the figure.

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 "8.1 Technical data" on page 184.

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.

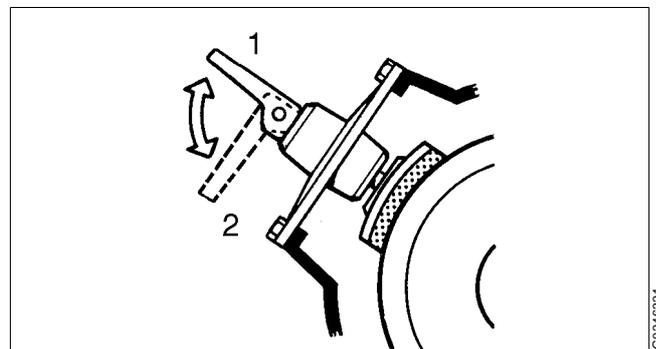


1. Bowl spindle
2. Top bearing and spring casing
3. Worm wheel
4. Worm
5. Friction coupling
6. Worm wheel shaft

3.2.3 Brake

The separator is equipped with a 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.

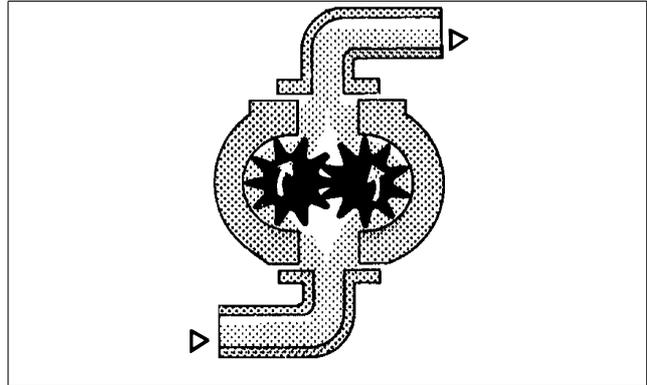
The brake friction pad acts on the outside of the coupling pulley.



Applying (1) and releasing (2) of brake

3.2.4 Feed inlet pump (option)

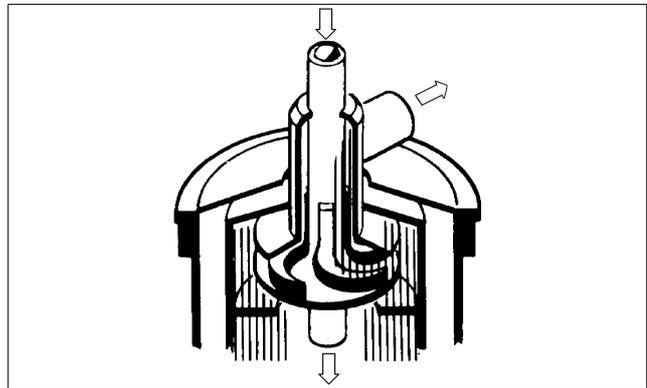
The separator can be equipped with a built-on feed inlet pump of gear type. The pump will be attached to and driven by the horizontal worm wheel shaft.



Feed inlet pump of gear type (option)

3.2.5 Paring disc pump

The paring disc serves as a stationary discharge pump mounted in a chamber in the rotating bowl neck. The paring disc dips radial into the rotating liquid which then is pared out.



Paring disc pump

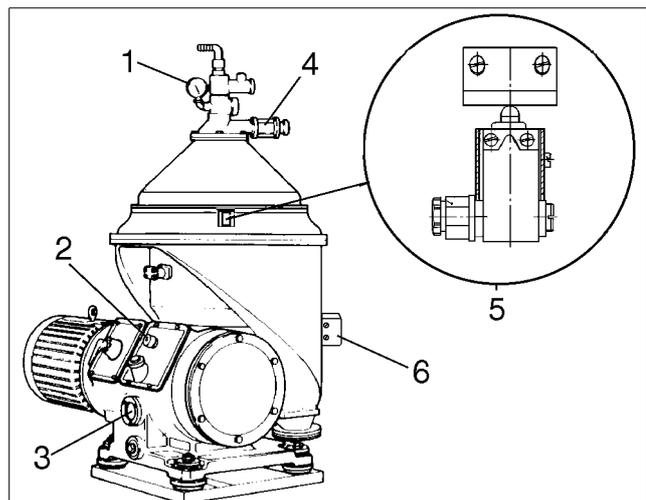
3.2.6 Sensors and indicators

Back pressure gauge (1)

Correct limit for the back pressure in the clean oil outlet can be found in chapter "4.1.5 Running" on page 40 or preferably in the System Manual, if any.

Increasing back pressure in the clean oil outlet can be caused by:

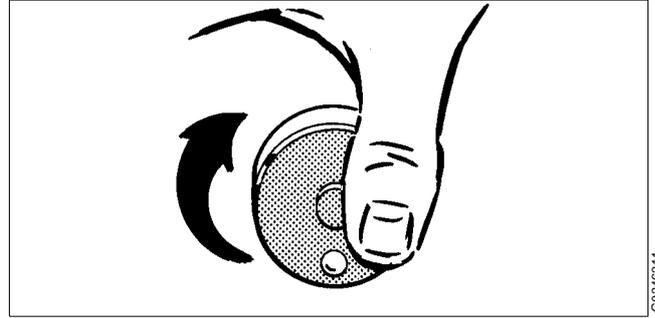
- restriction in the outlet piping, e.g. a buckled or bent pipe,
- increased throughput,
- increased viscosity, decreased separating temperature.



1. Back pressure gauge
2. Revolution counter
3. Oil sight glass
4. Sight glass for separated water outlet
5. Cover interlocking switch (option)
6. Vibration switch (option)

Revolution counter (2)

A revolution counter, which should turn clockwise during operation, 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 183. Refer to name plate for speed particulars.



The revolution counter should turn clockwise

Oil sight glass (3)

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

Sight glass for separated water outlet (4)

The sight glass shows the flow of the separated water and if any oil is escaping through the water outlet. If so, see chapter “7 Trouble-tracing” on page 171.

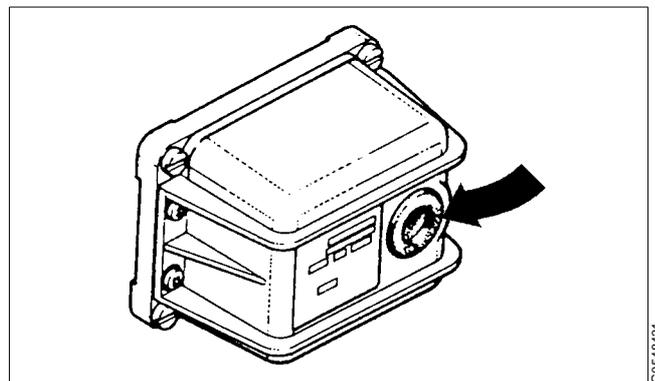
Cover interlocking switch (5, option)

When required, the cover interlocking switch should be connected to the starter equipment so that starting of the motor is prevented when the separator hood is not (completely) closed.

Vibration switch (6, option)

The vibration switch, properly adjusted, trips on a relative increase in vibration.

The vibration switch is sensitive to vibration in a direction perpendicular to its base. It contains a vibration detecting mechanism that actuates a snap-action switch when the selected level of vibration is exceeded. After the switch has tripped it must be reset manually by pressing the button on the switch.



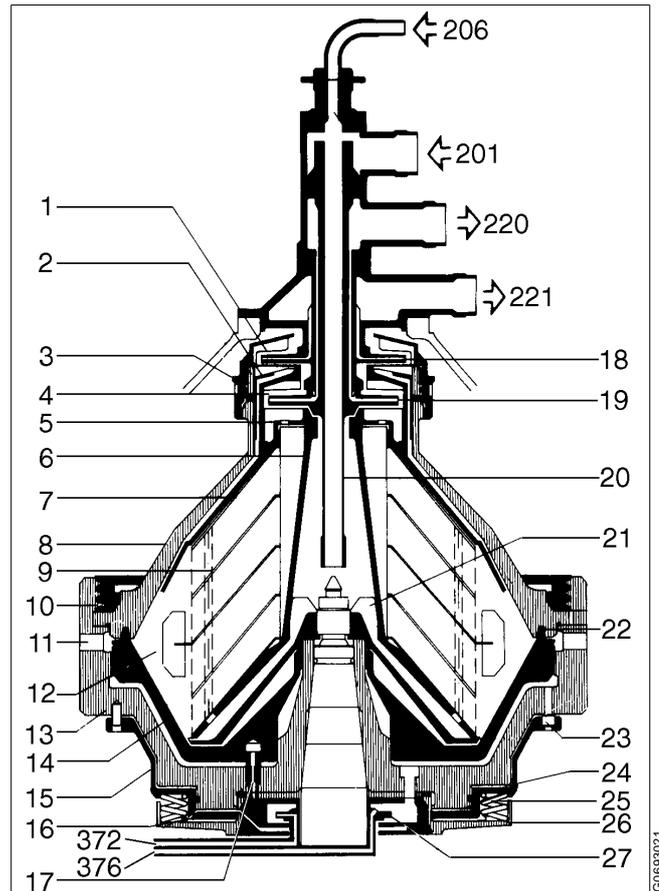
Reset push button on vibration switch

3.2.7 Process main parts

1. Upper paring camber
2. Gravity/clarifier disc
3. Small lock ring (with paring chamber cover)
4. Oil paring chamber
5. Level ring
6. Distributor
7. Top disc
8. Bowl hood
9. Bowl disc stack
10. Large lock ring
11. Sludge port *
12. Sludge space
13. Bowl body
14. Sliding bowl bottom *
15. Operating slide *
16. Nozzle *
17. Nozzle *
18. Upper paring disc (water)
19. Oil paring disc
20. Inlet pipe
21. Distributing cone
22. Bowl hood seal ring *
23. Drain valve plug *
24. Opening chamber *
25. Spring *
26. Spring support *
27. Control paring disc *

201. Unseparated oil inlet
206. Sealing/displacement water inlet
220. Clean oil outlet
221. Water outlet
372. Opening water inlet *
376. Closing and make-up water inlet *

* Parts effecting a sludge discharge



Separator bowl, feed and discharge assembly, control paring disc and liquid flow

Inlet and outlet device

The inlet and outlet device consists of the following parts:

- The inlet (201). This comprises the pipe bend and the long inlet pipe (20) which extends into the middle of the bowl.
- The outlets (220, 221). These comprise the discharge cover and the paring discs (18, 19) which pump the separated oil and water out of the bowl. Each paring disc is located in a paring chamber (1, 4) in the top of the bowl.

The inlet and outlet device is held together by the inlet pipe threading which is fixed to the oil paring disc. O-rings and a seal ring seal the connections between the parts.

The outlet connection housing is fastened to the separator frame hood. Height adjusting rings determine the height position of the paring discs in the paring chambers.

Separator bowl

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

The bowl body (13) and bowl hood (8) are held together by the large lock ring (10). Inside the bowl are the distributing cone (21), the distributor (6) and the disc stack (9). The disc stack is kept compressed by the hood. The sliding bowl bottom (14) forms an internal separate bottom in the bowl.

The bowl top is covered by the paring chamber cover (3). The space between this cover and the top disc (7) is the upper paring chamber with the upper paring disc which pumps the separated water out of the bowl. The oil paring chamber with its paring disc is located inside the upper part of the top disc. From this space the cleaned oil is pumped out of the bowl.

The sludge space (12) is the space between the sliding bowl bottom and the bowl hood in the bowl periphery. It is kept closed by the sliding bowl bottom which seals against a seal ring (22) in the bowl hood.

Sludge discharge mechanism

At intervals decided by the operator, the sliding bowl bottom drops to empty the bowl of sludge.

The sludge discharge mechanism, which controls the sliding bowl bottom, comprises an operating slide (15) and an operating water device. Passive parts are the nozzles (16, 17) and drain valve plugs (23). The operating water device on the underside of the bowl supplies opening (372) and closing/make-up (376) water to the discharge mechanism via the control paring disc (27).

3.3 Separating function

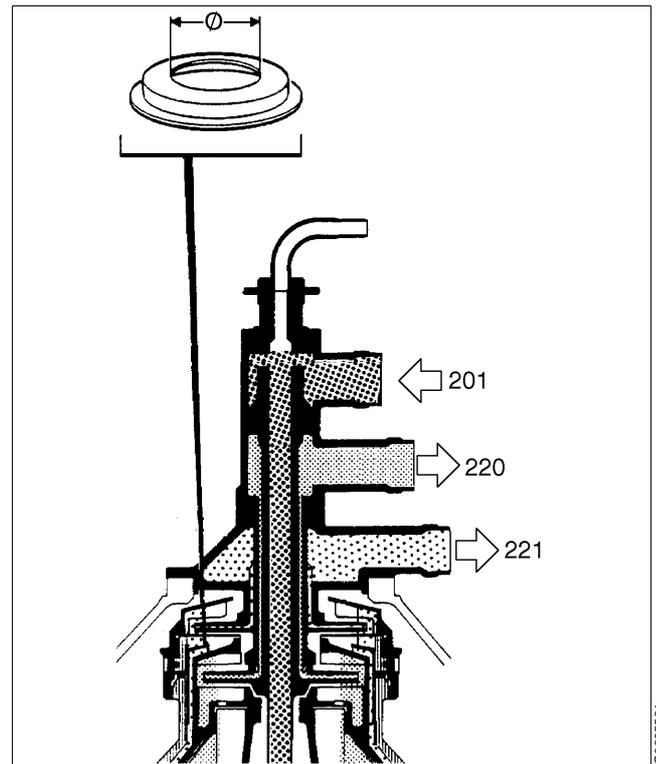
3.3.1 Purifier bowl

Characteristic parts

The illustration shows the characteristic part of the purifier bowl, the gravity disc. The disc should be chosen according to directions in chapter "4.1.2 Selection of gravity disc" on page 35.

The gravity disc determines the interface position in a purifier bowl (see below).

A purifier bowl has two liquid outlets, 220 (oil) and 221 (water).

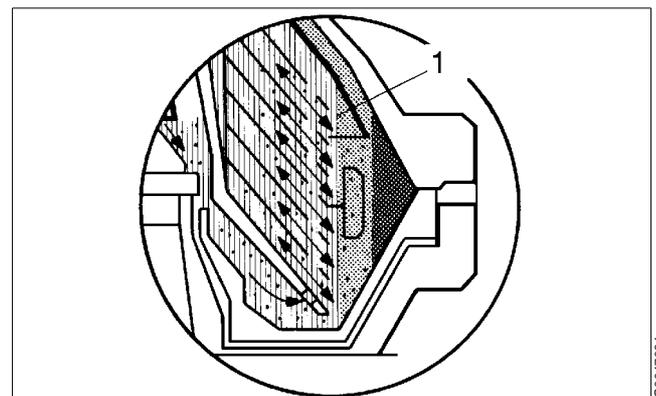


Purifier bowl

Position of interface

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

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

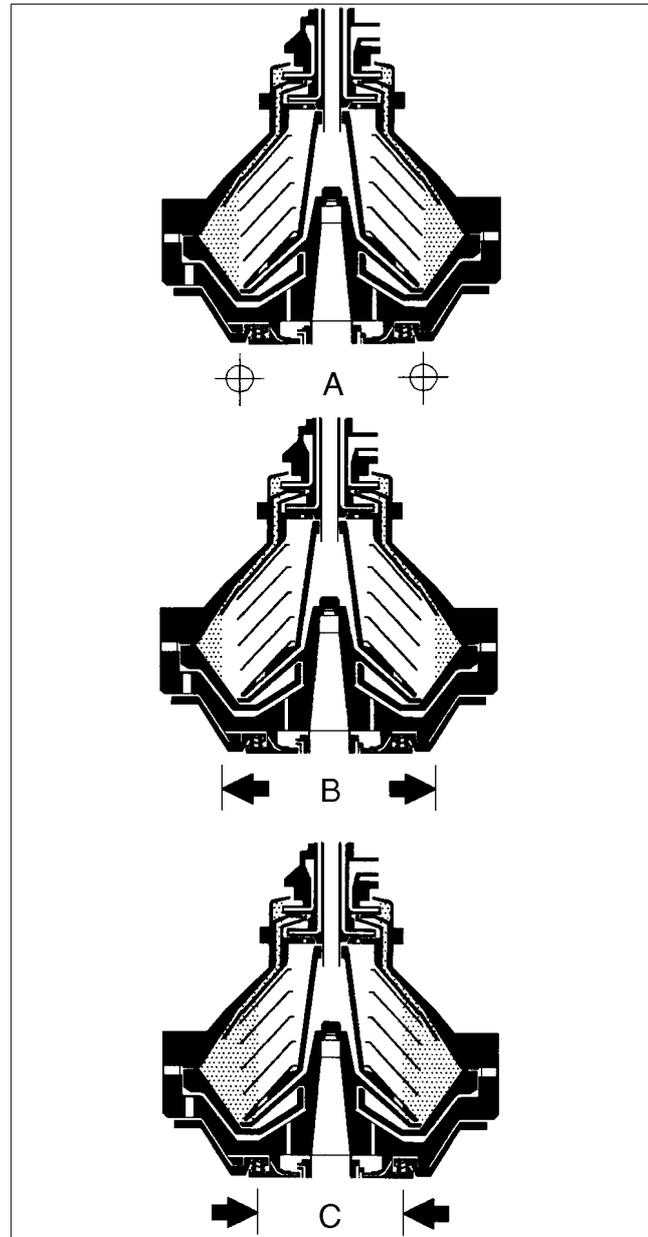


Interface position (1)

A. Correct interface position

B. Wrong interface position - broken water seal

C. Wrong interface position - bad separation



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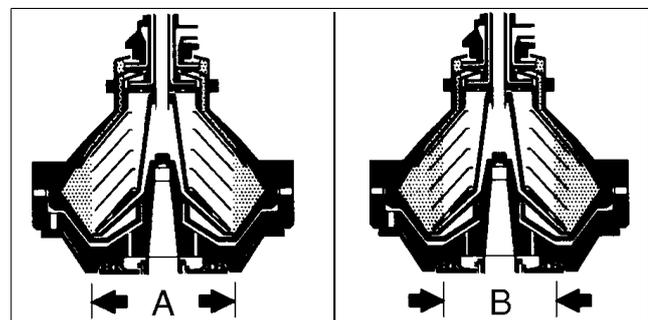
Factors influencing the interface position

1. Oil viscosity, density and throughput

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

A. High viscosity/density/throughput

B. Low viscosity/density/throughput

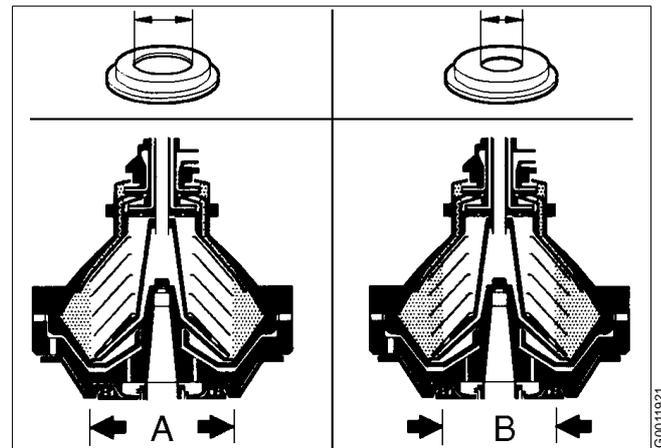


G0011821

2. Gravity disc

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

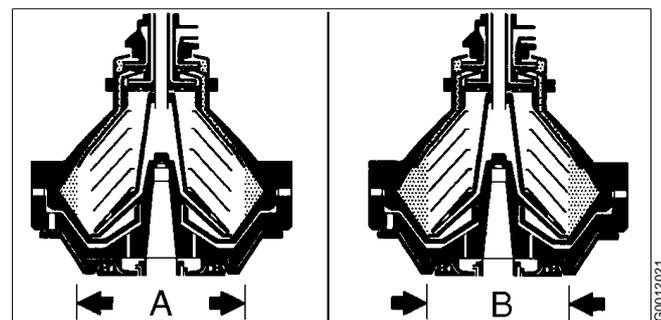
- A. Gravity disc with large hole diameter
- B. Gravity disc with small hole diameter



3. Excessive back pressure

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

- A. Excessive back pressure
- B. Normal back pressure

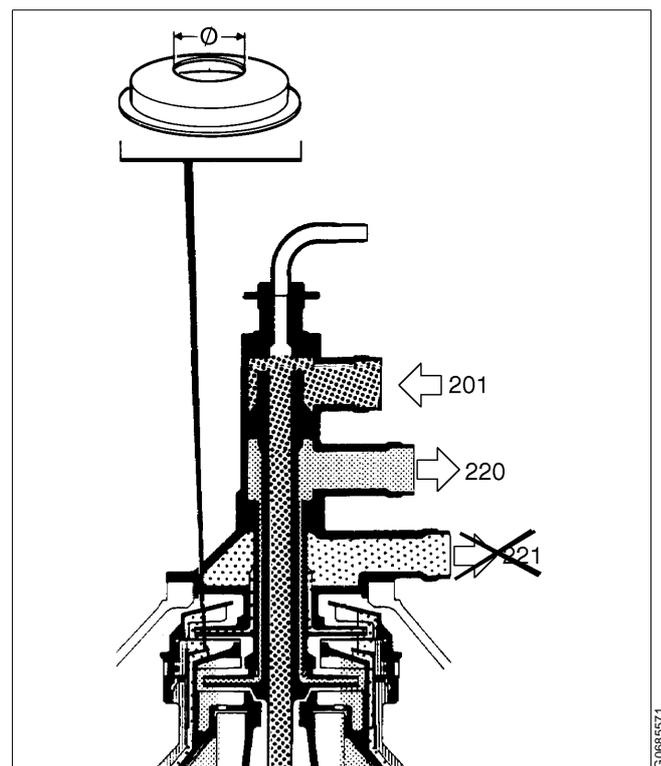


3.3.2 Clarifier bowl

Characteristic parts

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

The clarifier bowl has only one liquid outlet, 220 (oil).



Clarifier bowl

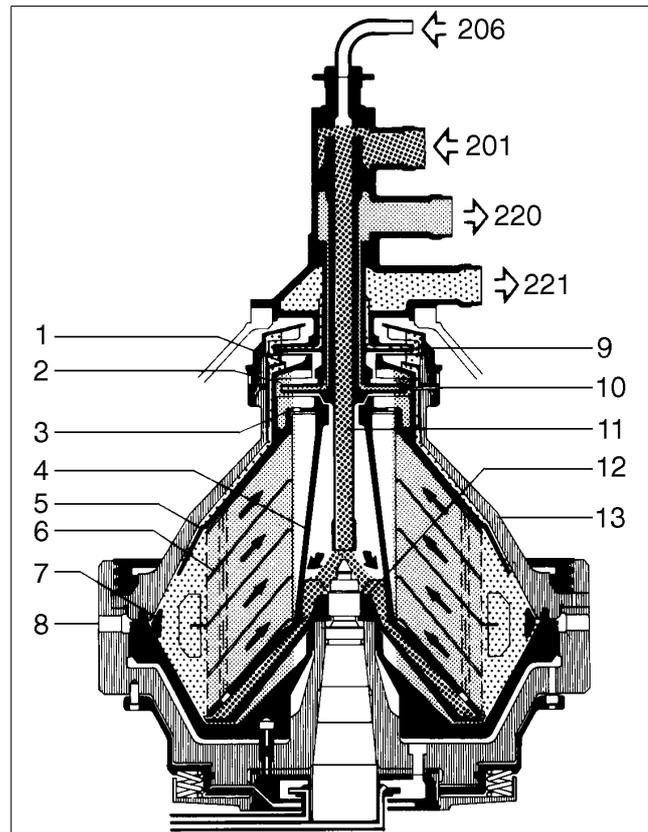
3.3.3 Normal separation

Unseparated oil is fed into the bowl through the inlet pipe (11) and is pumped via the distributor (4) and distributing cone (12) towards the periphery of the bowl.

When the oil reaches slots of the distributor, it will rise through the channels formed by the disc stack (6) where it is evenly distributed.

The oil is continuously cleaned as it travels towards the centre of the bowl. When the cleaned oil leaves the disc stack it rises upwards, flows over the level ring (3) and enters the oil paring chamber (2). From here it is pumped by the non-rotating oil paring disc (10) and leaves the bowl through outlet (220). Separated water, sludge and solid particles, which are heavier than the oil, are forced towards the periphery of the bowl and collected in the sludge space (7). The bowl content is discharged at selected intervals through the sludge ports (8).

At purification the separated water rises along the outside of the top disc (5) over gravity disc (1) and is then pumped out by the non-rotating upper paring disc (9). The water then leaves the bowl through water outlet (221).



Separating principle

1. Gravity/clarifier disc
 2. Oil paring chamber
 3. Level ring
 4. Distributor
 5. Top disc
 6. Bowl disc stack
 7. Sludge space
 8. Sludge port
 9. Upper paring disc (water)
 10. Oil paring disc
 11. Inlet pipe
 12. Distributing cone
 13. Bowl hood
-
201. Unseparated oil inlet
 206. Sealing/displacement water inlet
 220. Clean oil outlet
 221. Water outlet (only at purification)

3.3.4 Sludge discharge cycle

Sludge discharge interval

The MOPX-separator is a total-discharge type separator which completely discharges sludge and water from the bowl.

The appropriate time to be chosen between sludge discharges depends on local conditions because many factors influence accumulation and hardening of sludge between discharges. However, keep the discharge interval within the min. and max. time stated in “8.1 Technical data” on page 184.

Long intervals between sludge discharges can cause accumulation and compaction of sludge. The sludge may then break-up unevenly on discharge and cause the bowl to become unbalanced. If such unbalance is too large, there is risk of serious separator damage and injury to personnel.

Closed bowl (normal operation)

The sliding bowl bottom (2) is pressed upwards by force of the closing water in the closing water space (6) under the sliding bowl bottom which is greater than the force of the process liquid above the sliding bowl bottom.

The operating slide (3) is pressed upwards by the springs (9) and the valve plugs (8) then cover the drain channels (7).

Bowl opens for discharge

Before starting the sludge discharge cycle the oil feed should be cut off.

At purification, displacement water (206) should be added to the bowl before the discharge to avoid oil losses. The oil/water interface (h_1) moves towards the centre of the bowl (h_2).

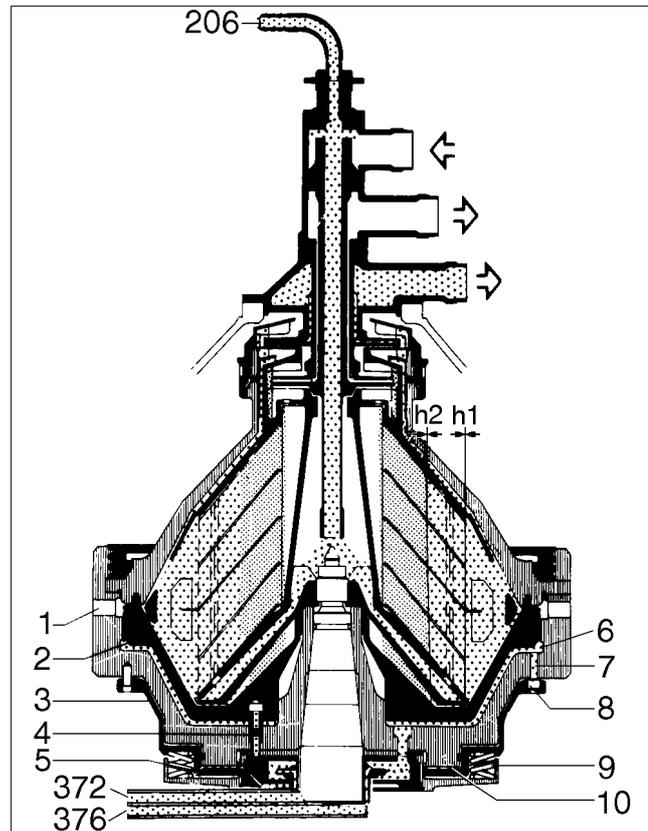
The opening water (372), which is supplied into the space above the operating slide (3), overcomes the force from the springs (9) and the operating slide is pressed downwards. The drain channels (7) open and the closing water is drained. This allows the force on the underside of the sliding bowl bottom (2) to become lower than the force on the upper side. The sliding bowl bottom moves downwards and the bowl opens for a discharge through the sludge ports (1).

Bowl closes after discharge

The opening water supply is closed and the water in the opening chamber (10) is drained through nozzle (5). The springs (9) move the operating slide upwards and the drain channels (7) are closed by the drain valve plugs (8). The closing water (376) is supplied via the nozzle (4) to the closing water space (6) which presses the sliding bowl bottom (2) upwards. The bowl closes and the sludge discharge cycle is complete.

At purification, add sealing water (206) to the bowl before opening the oil supply to the separator.

Bowl closing water should be supplied during the sludge discharge sequence and at intervals during the separation sequence to replace evaporated water.



Separator bowl, feed and discharge assembly, control paring disc and liquid flow

1. Sludge port
2. Sliding bowl bottom *
3. Operating slide *
4. Nozzle *
5. Nozzle *
6. Closing water space
7. Drain channel
8. Drain valve plug
9. Spring *
10. Opening chamber *

206. Sealing/displacement water inlet
 372. Opening water inlet *
 376. Closing and make-up water inlet *

* Parts effecting a sludge discharge

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 a 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.
Intermediate Service (IS)	Overhaul of separator bowl, inlet/outlet and operating water device. Renewal of seals in bowl inlet/outlet and operating water device.
Major Service (MS)	Overhaul of the complete separator, including bottom part (and activities included in an Intermediate Service, if any). Renewal of seals and bearings in bottom part.
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.
Sludge discharge	Ejection of sludge from the separator bowl.
Throughput	The feed of process liquid to the separator per time unit. Expressed in m ³ /h or litres/h.
Viscosity	Fluid resistance against movement. Normally expressed in centistoke (cSt = mm ² /s), at a 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	34
4.1.1	Before first start	34
4.1.2	Selection of gravity disc	35
4.1.3	Ready for start	38
4.1.4	Start	39
4.1.5	Running	40
4.1.6	Normal stop	41
4.1.7	Safety stop	42

4.1 Operating routine

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

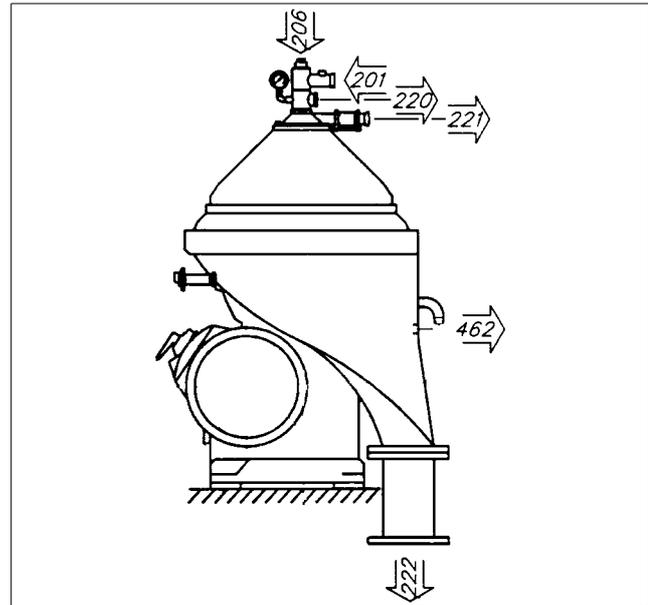
4.1.1 Before first start

Technical demands for connections and logical limitations for the separator is described in the chapter "8 Technical Reference" on page 183 in the documents:

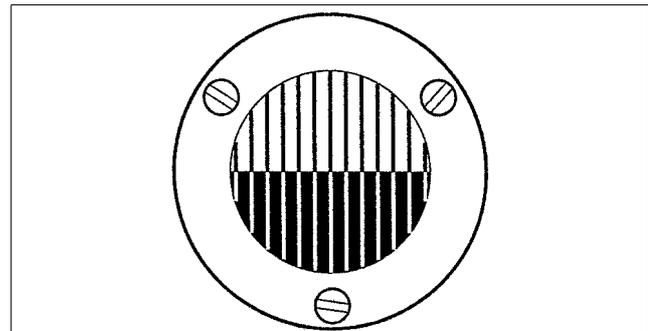
1. Technical data
2. Basic size drawing
3. Connection list
4. Interface description
5. Foundation drawing.

Before first start the following check points shall be checked:

- Ensure the machine is installed correctly and that feed-lines and drains have been flushed clean.
- Fill oil in the gear housing. Fill up exactly to 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 5Lubricants" on page 200.
- Make sure the direction of rotation of the motor corresponds to the sign on the motor, see "8.9.5 Machine plates and safety labels" on page 213.



Explanations of the separator connections are given in "8.3 Connection list, without pump" on page 189 and in "8.5 Connection list, with pump" on page 193



Fill oil in the gear housing

4.1.2 Selection of gravity disc

The separator is delivered with a set of gravity discs.

How to replace a gravity disc is described in “6.3 Bowl hood and disc stack (IS)” on page 110.

Clarification

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

Purification

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

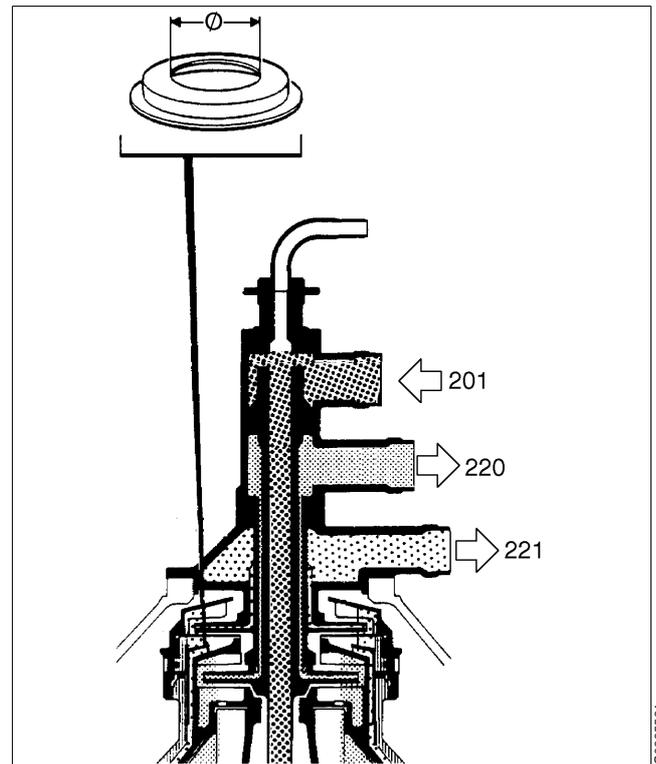
When selecting a gravity disc the general rule is to use the disc having the largest possible hole without causing a break of the water seal.

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

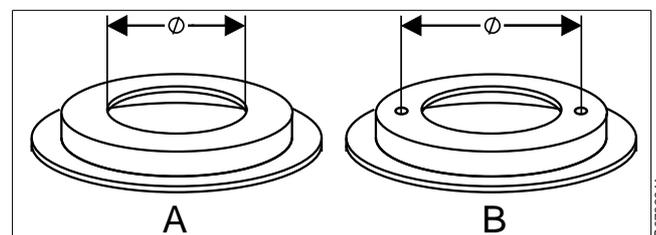
When the heavy phase (water) is wanted more free from the light one (oil), the interface should be placed nearer the bowl centre, however not inside the outer edge of the discs (too small gravity disc), as this would prevent the liquid flow.

For a more detailed description of the interface position, see “3.3.1 Purifier bowl” on page 25.

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



Fit correct gravity disc

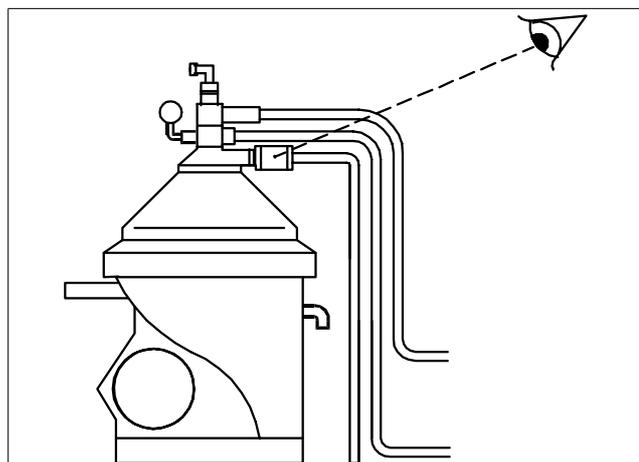


Where to measure the hole diameter of a gravity disc

- A. Gravity disc without small holes
- B. Gravity disc with two small holes

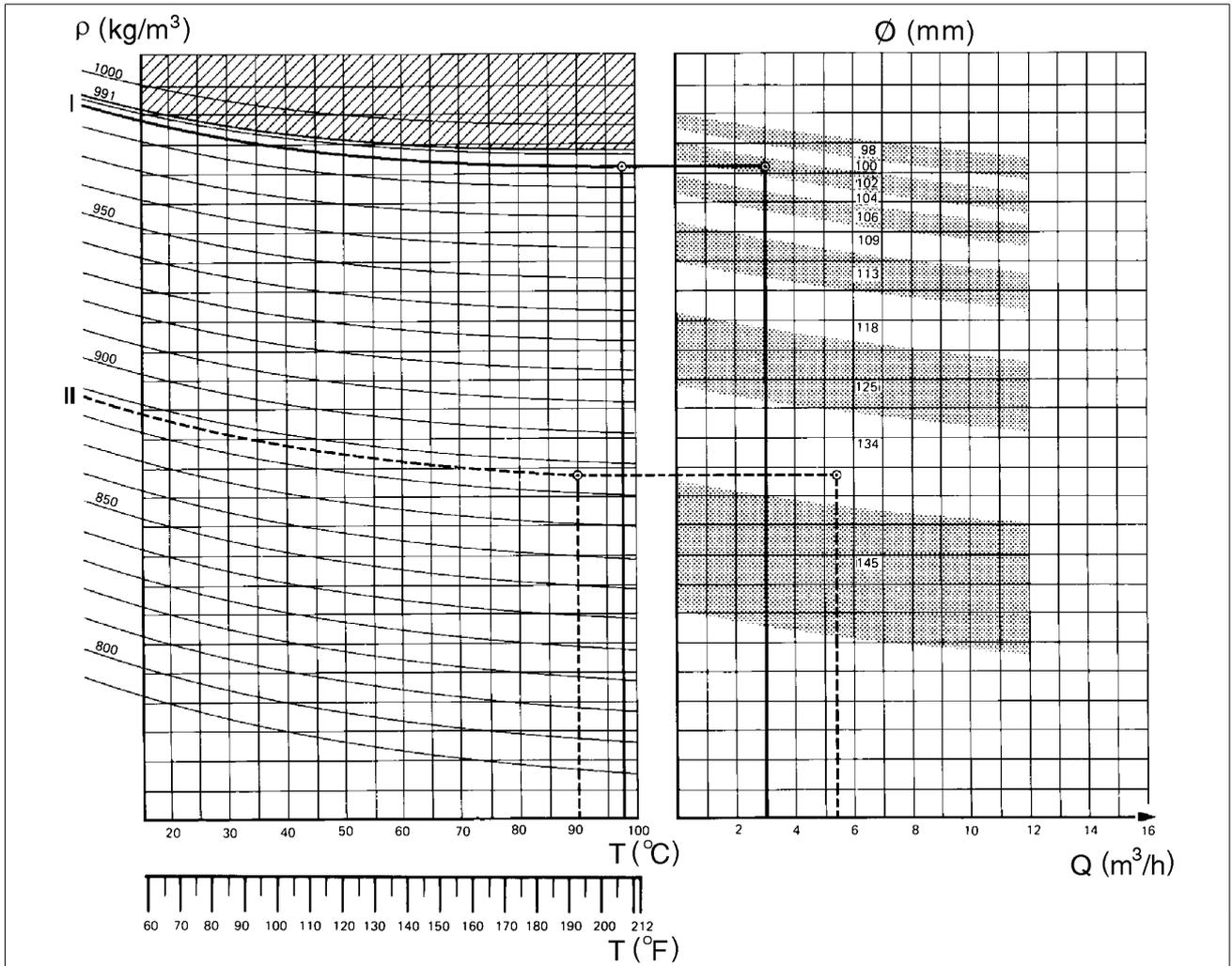
As an aid, use the nomogram on next page to find the correct gravity disc. It can be used when the density of the oil at a temperature of 15 °C is known. However, note that the nomogram is purely theoretical. In practical operation, practice the following general rule:

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



Check if oil flows through the water outlet

How to use the nomogram



Nomogram for MOPX 309

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

ρ = Density of oil in kg/m^3 at 15 °C

Q = Throughput in m^3/h

T = Separating temperature in °C or °F

\varnothing = Gravity disc hole diameter in mm

Example I in nomogram

Reference in graph: _____
 Oil density: 988 kg/m^3 at 15 °C
 Separating temperature: 98 °C
 Throughput: 3 m^3/h

The nomogram indicates that a gravity disc with a hole diameter of 102 mm should be tried.

Example II in nomogram

Reference in graph: _____
 Oil density: 888 kg/m^3 at 15 °C
 Separating temperature: 90 °C
 Throughput: 5,5 m^3/h

The nomogram indicates that a gravity disc with a hole diameter of 134 mm should be tried.

4.1.3 Ready for start

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

1. Check that the bolts of the frame hood are fully tightened.
2. Check that all inlet and outlet connections have been correctly made and properly tightened.

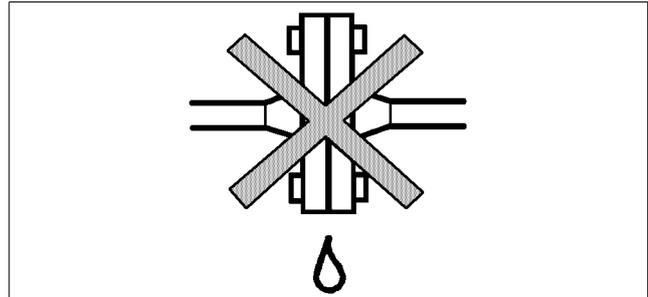


CAUTION

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)

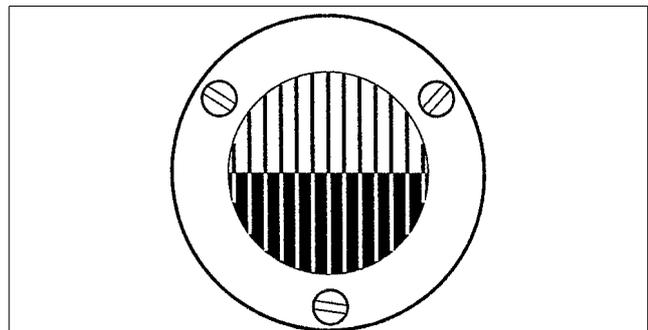
S0009821

3. Check that the oil level is exactly in the middle of the sight glass.
Fill if necessary. See chapter "8.8 5Lubricants" on page 200, for a list of recommended oils.

NOTE

During running the oil level should be slightly below the middle of the sight glass.

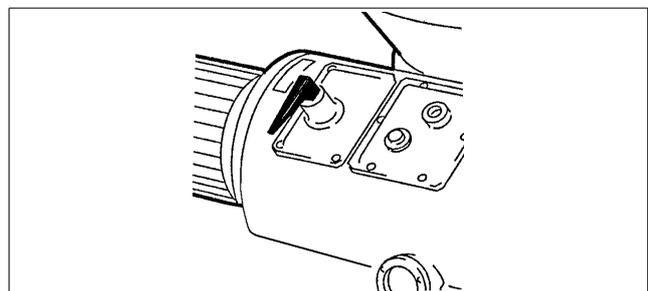
Too much or too little oil can damage the separating bearings.



Check the oil level

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4. Make sure that the brake is released.



Release the brake

G0520111

4.1.4 Start

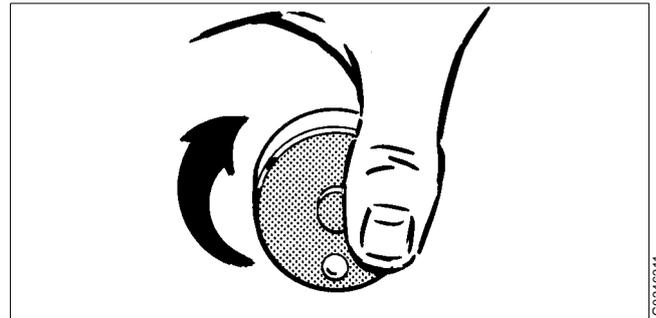
1. Start the separator.
2. Check the direction of rotation of the bowl.
The revolution counter should turn clockwise.



DANGER

Disintegration hazards

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



Check for correct direction of rotation

G0246211

3. 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 without danger. Try to learn the vibration characteristics of the critical speed pattern.

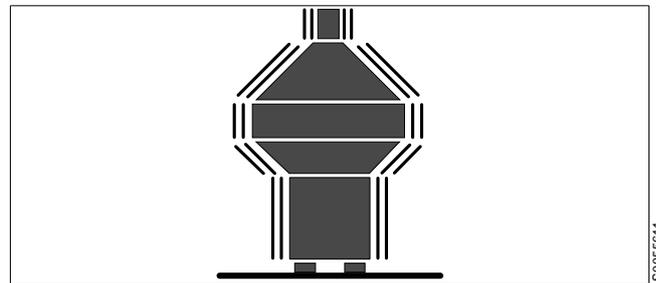


DANGER

Disintegration hazards

When excessive vibration occurs, **keep bowl filled** and **stop** separator.

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.



Check for vibration

S0055611

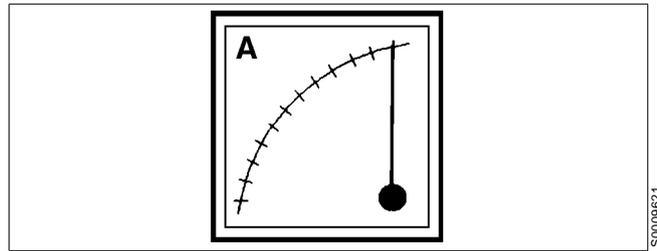
In the trouble-tracing chapter “7.1.1 Separator vibrates” on page 172, a number of causes are described that can create vibration.

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

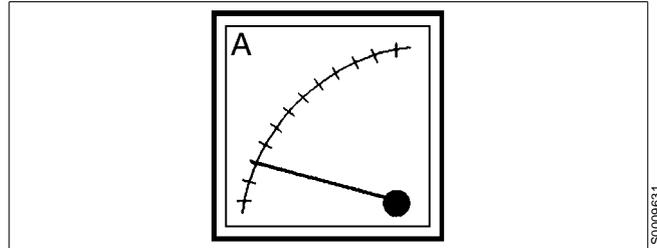
During start, the current reaches a peak and then drops slowly to a low and stable level, which is the normal current during operation.

The time to reach full speed may not exceed the limit given in chapter "8 Technical Reference" on page 183.

5. When running normally, open the closing water valve (connection 376) for approximately 5 seconds to close the bowl.



Current increases when the coupling engages...



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

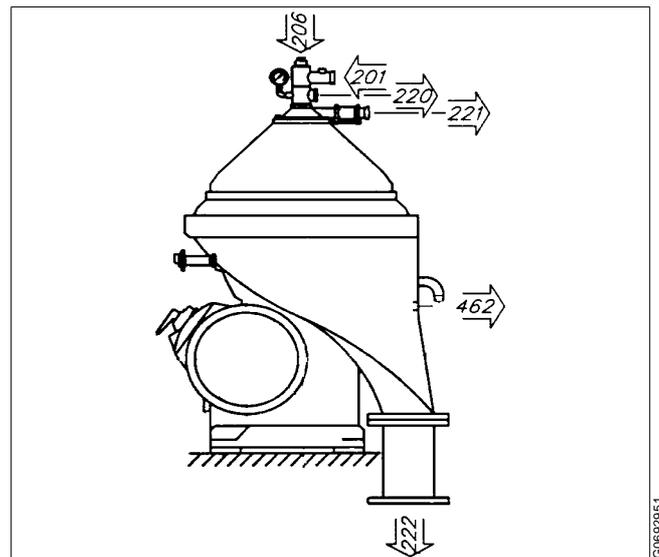
4.1.5 Running

1. Circulate the process liquid through a heater until the desired temperature is obtained.
2. For **purification** mode:
 - a. Supply water (206) to form the liquid seal. Continue until water flows out through the water outlet (221).
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 bar**.

For permissible pressures, temperatures and flows, see section "8.1 Technical data" on page 184.



In- and outlets of the separator

- Adjust to desired throughput.
- Discharge by opening the valve for opening water (connection 372) until a discharge is heard. For max. and min. time for discharge intervals, see chapter "8.1 Technical data" on page 184.

**DANGER****Disintegration hazards**

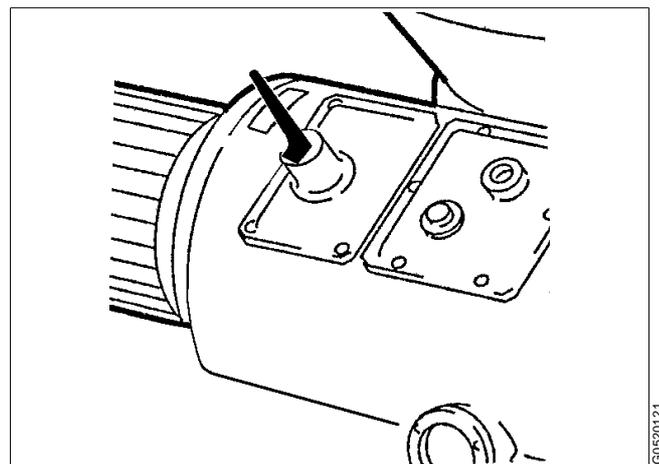
Ensure that correct discharge intervals and cleaning procedures are used.

Unbalance due to improper washing out of solids may lead to contact between rotating and non-rotating parts.

- For daily condition checks, see "5.2.1 Daily checks" on page 49.

4.1.6 Normal stop

- Shut off the feed.
- Carry out a sludge discharge before stopping the separator. Otherwise the bowl must be cleaned manually before the next start up.
- After discharge, supply sealing/displacement water to the bowl and stop the separator with the bowl filled.
- Apply the brake.



The final action, apply the brake

G0520121

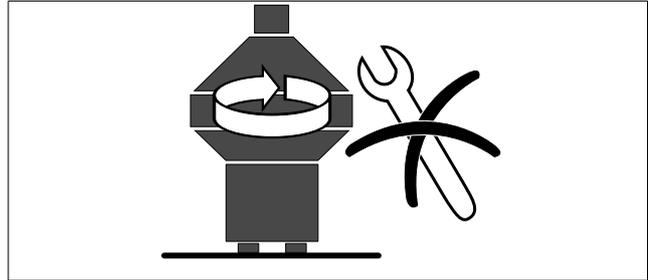
4.1.7 Safety stop



DANGER

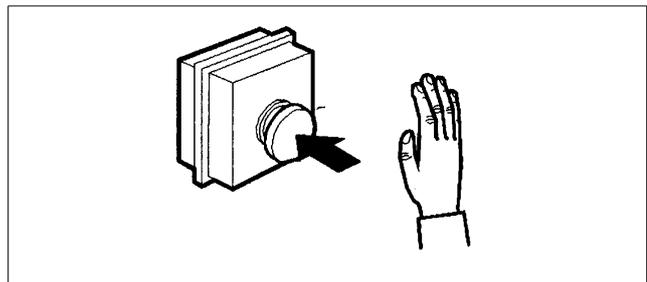
Entrapment hazards

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 parts are rotating or not.



The separator must not be dismantled before standstill

1. If the separator begins to vibrate excessively during operation, stop it immediately by pushing the safety stop. The separator motor is switched off.
Keep the bowl filled during the run-down to minimize the excessive vibration.
2. Evacuate the room. The separator may be hazardous when passing its critical speeds during the run-down.



Push the safety stop if vibration is excessive



DANGER

Disintegration hazards

Do not discharge a vibrating separator.
Out-of-balance vibration can become worse if only part of the sediment is discharged.



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.

5 Service Instructions

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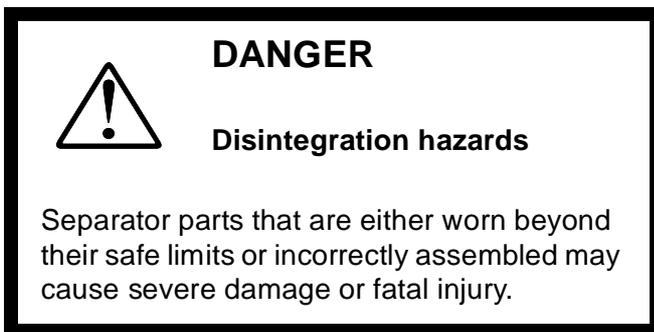
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5.1 Periodic maintenance

5.1.1 Introduction

Periodic (preventive) maintenance reduces the risk of unexpected stoppages and breakdowns. Follow the maintenance logs on the following pages in order to facilitate the periodic maintenance.



5.1.2 Maintenance intervals

The following directions for periodic maintenance give a brief description of which parts 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 **1000-1500 hours** or at least once every year if the total number of operating hours is less than **1000-1500 hours**.

When using a group D oil, time of operation between oil changes can be extended from the normal **1000-1500 hours** to **2000 hours**.

Intermediate Service (IS)

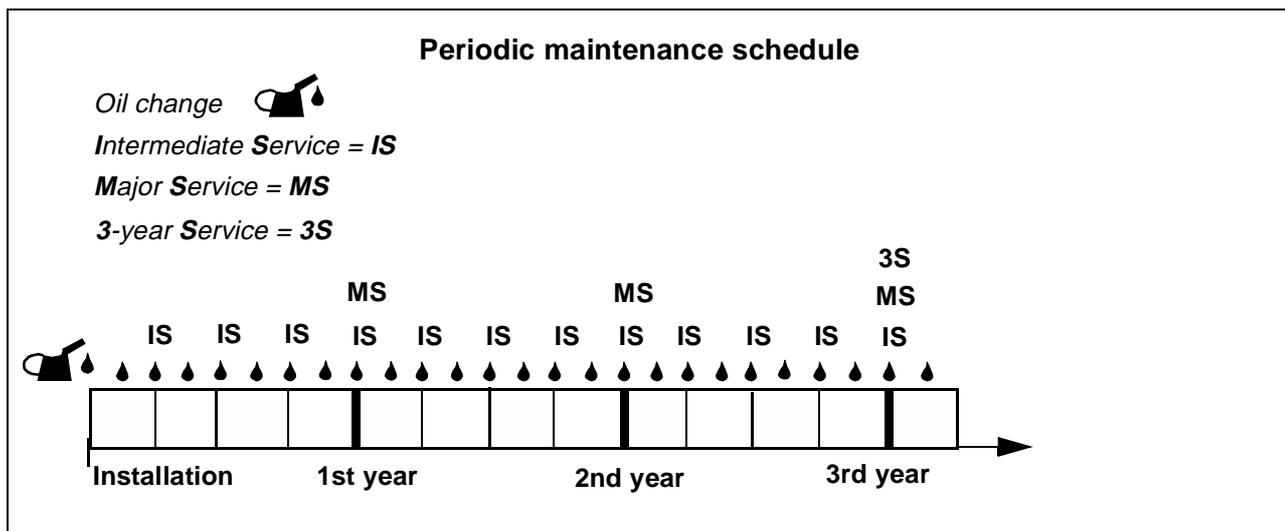
Intermediate Service consists of an overhaul of the separator bowl, inlet/outlet and operating device every **3 months** or **2000 operating hours**. Seals in bowl and gaskets in inlet/outlet device are renewed.

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 lifetime 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 chapter “6 Dismantling/Assembly” on page 103.
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. Fit all the parts delivered in the service kits while assembling the separator as described in chapter “6 Dismantling/Assembly” on page 103. The assembly instructions have references to check points which should be carried out before and during the assembly.

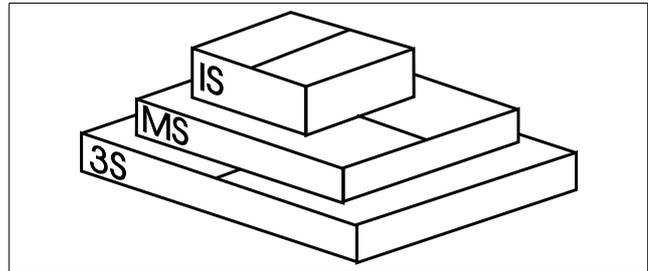
5.1.4 Service kits

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.



DANGER

Disintegration hazards

Use of imitation parts may cause severe damage.

5.2 Maintenance Logs

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	Connecting housing	–	
Separator bowl Check for vibration and noise		97	
Horizontal driving device Worm wheel shaft and gear casing Check for vibration and noise Check Electrical motor Check for heat, vibration and noise	Oil level in gear housing	97 38 1)	

1) See manufacturer's instruction

5.2.2 Oil change

The oil change and check of worm gear should be carried out every **1000-1500^{a)} hours** of operation.

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
Horizontal driving device Worm wheel shaft and gear housing Check Renew	Worm wheel and worm Oil ^{b)} in gear housing	93 96	

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 **1000-1500 hours (2000 h)**.

a) When using a group D oil, time of operation between oil changes can be extended from the normal **1000-1500 hours** to **2000 hours**.

b) See chapter "8.8 5Lubricants" on page 200 for further information.

5.2.3 Intermediate Service (IS)

Name of plant: _____ Local identification: _____
 Separator: MOPX 309TGT-24 Manufacture No./Year: _____
 Total running hours: _____ Product No: 881076-04-03
 Date: _____ Signature: _____

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

Main component and activity	Part	Page	Notes	
Inlet and outlet Clean and inspect	Threads of inlet pipe	67		
	Connecting housing	–		
Separator bowl Clean and check	Upper paring disc	–		
	Gravity/clarifier disc	–		
	Lock ring	68		
	Bowl hood	56		
	Top disc	–		
	Oil paring disc	67		
	Level ring	67		
	Bowl discs	91		
	Distributor	–		
	Distributing cone	–		
	Sliding bowl bottom	71		
	Bowl body	–		
	Bowl spindle cone and bowl body nave	57		
	Operating mechanism	70, 72		
	Check	Corrosion	57	
		Cracks	60	
		Erosion	63	
Galling of guide surface		66		
Renew	Disc stack pressure	61		
	O-rings and sealings	–		

Main component and activity	Part	Page	Notes
Operating device			
Clean and check	Operating paring disc	–	
Renew	O-rings	–	
Horizontal driving device			
Worm wheel shaft and gear housing			
Check	Worm wheel and worm	93	
Renew	Oil in gear housing	96	
Electrical motor			
Lubrication (if nipples are fitted)	See sign on motor	–	
Signs and labels on separator			
Check attachment and legibility	Safety label on hood	213	
	Direction of rotation arrow	213	
	Power supply frequency	213	
Monitoring equipment (option)			
Function check	Vibration switch	73	
	Cover interlocking switch	72	

5.2.4 Major Service (MS)

Name of plant: _____ Local identification: _____
 Separator: MOPX 309TGT-24 Manufacture No./Year: _____
 Total running hours: _____ Product No: 881076-04-03
 Date: _____ Signature: _____

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

Main component and activity	Part	Page	Notes
Inlet and outlet Clean and inspect	Threads of inlet pipe	67	
	Connecting housing	–	
Separator bowl Clean and check	Upper paring disc	–	
	Gravity/clarifier disc	–	
	Lock ring	82, 68	
	Bowl hood	56	
	Top disc	–	
	Oil paring disc	67	
	Level ring	67	
	Bowl discs	91	
	Distributor	–	
	Distributing cone	–	
	Sliding bowl bottom	71	
	Bowl body	–	
	Bowl spindle cone and bowl body nave	57	
	Operating mechanism	70, 72	
	Check	Corrosion	57
Cracks		60	
Erosion		66	
Galling of guide surface		66	
Disc stack pressure		61	
Renew	Oil paring disc height position	84	
	O-rings and sealings	–	

Main component and activity	Part	Page	Notes
Operating device			
Clean and check	Operating paring disc	–	
Check	Height position of operating paring disc	84	
Renew	O-rings	–	
Vertical driving device			
Clean and check	Bowl spindle	–	
	Wear of groove in worm	86	
	Buffer springs and ball bearing housing	76	
	Radial wobble of bowl spindle	75	
Renew	Spindle bearings and O-rings	136	
Horizontal driving device			
Worm wheel shaft and gear housing			
Check	Worm wheel and worm	93	
	Radial wobble of worm wheel shaft	87	
	Axial play of flexible plate	80	
Renew	Bearings, O-rings and sealings	148	
	Oil in gear housing	96	
Brake			
Clean and check	Spring and brake shoe	76	
Renew	Friction pad	75	
Friction coupling			
Clean and check	Worm wheel coupling	–	
Renew	Friction pads	78	
Electrical motor			
Lubrication (if nipples are fitted)	See sign on motor	–	
Signs and labels on separator			
Check attachment and legibility	Safety label on hood	213	
	Direction of rotation arrow	213	
	Power supply frequency	213	
Monitoring equipment (option)			
Function check	Vibration switch	73	
	Cover interlocking switch	72	

Main component and activity	Part	Page	Notes
Feed pump (option)			
Clean and check	Bushings, wear gaskets, flexible coupling, relief/safety valve and impeller shaft	162	
Renew	Lipseal rings	162	

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.

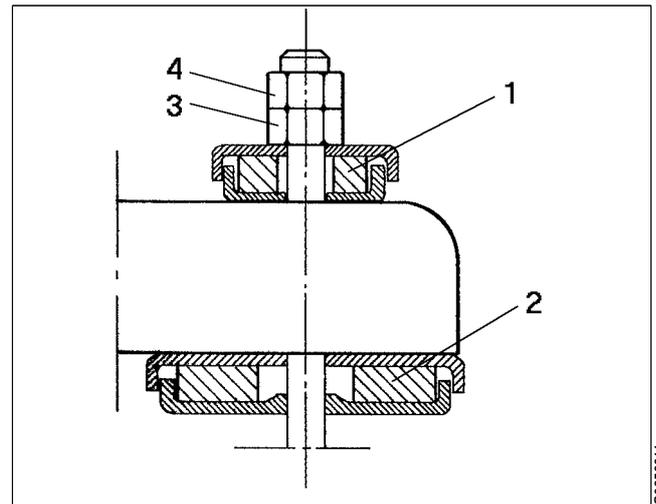
Frame feet, renewal

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 "5.5 Lifting instructions" on page 88.

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*

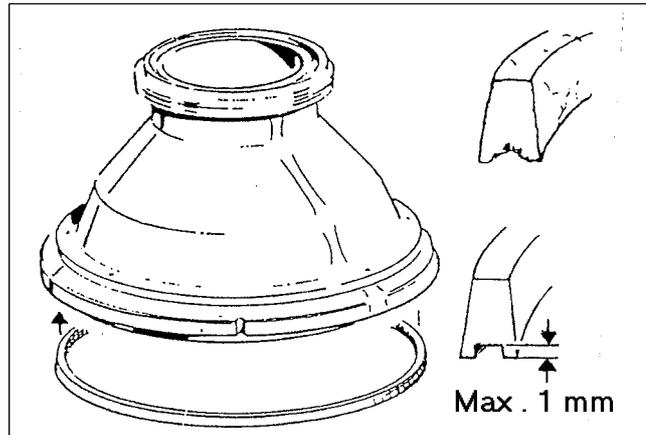
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5.3 Check points at Intermediate Service (IS)

5.3.1 Bowl hood seal ring

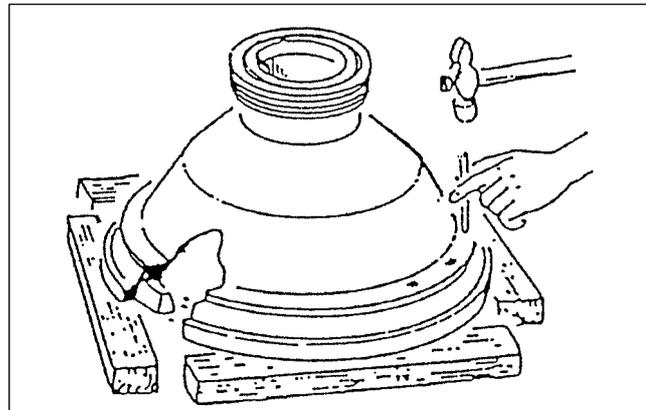
Poor sealing between the bowl hood seal ring and the sealing edge of the sliding bowl bottom will cause a leakage of process liquid from the bowl.

Renew the bowl hood seal ring at each Intermediate Service (IS).



Max. permitted indentation of the seal ring is 1 mm

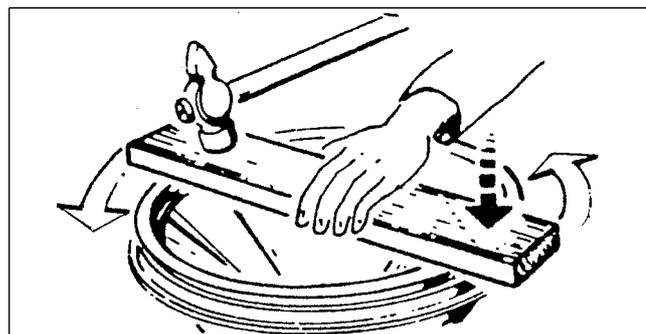
Knock out the old ring by means of a pin inserted in the holes intended for this purpose.



Removal of the seal ring

Fit the new ring as follows:

Press the ring into the groove with a straight wooden board placed across the ring.



Fitting of the seal ring

NOTE

If the new ring is too narrow, place it in hot water (70-80 °C) for about 5 minutes.
If it is too wide, it will shrink after drying in 80-90 °C for about 24 hours.

5.3.2 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.

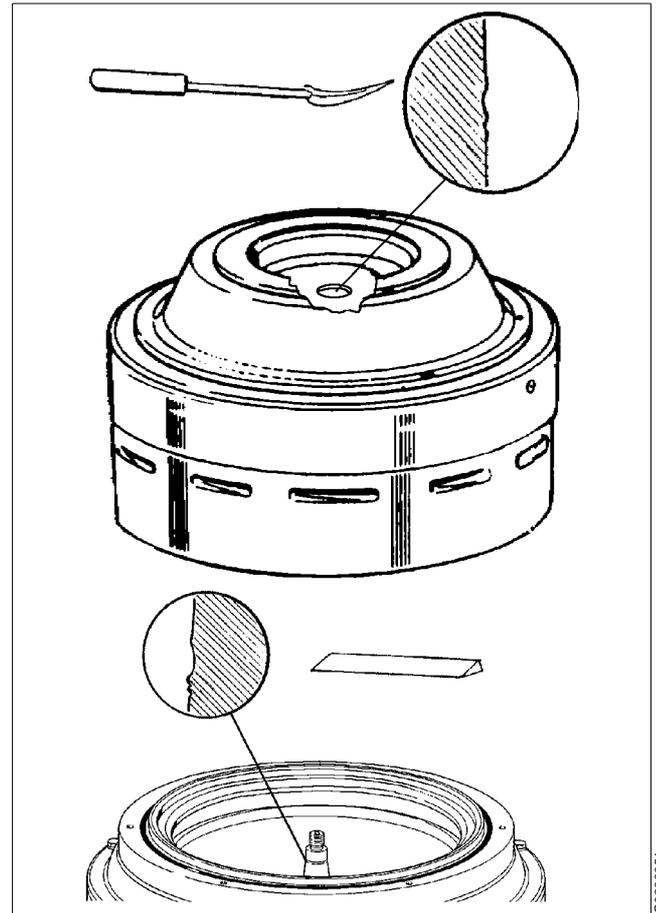
- Remove any impact marks with a scraper and/or whetstone.

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

5.3.3 Corrosion

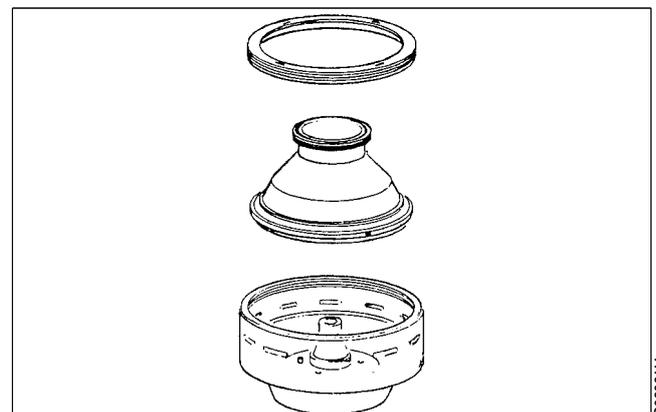
Evidence of corrosion attacks should be looked for and rectified each time the separator is dismantled. Main bowl parts such as the bowl body, bowl hood and lock ring must be inspected with particular care for corrosion damage.



DANGER

Disintegration hazard

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



Main bowl parts to check for corrosion

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.

Non-stainless steel and cast iron parts

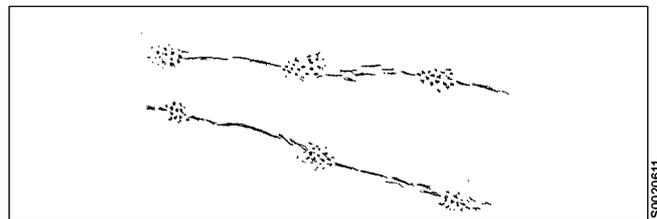
Corrosion (rusting) can occur on unprotected surfaces of non-stainless steel and cast iron. Frame parts can corrode when exposed to an aggressive environment.

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:

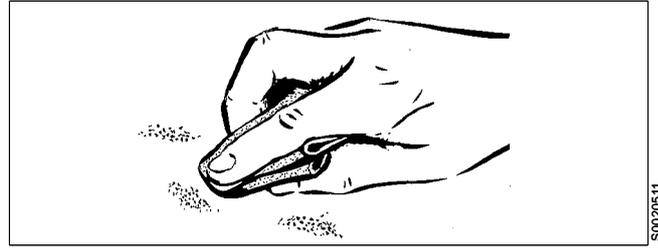
- Exposed to a stationary solution.
- In a crevice.
- Covered by deposits.
- Exposed to a solution that has a low pH value.

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



Example of chloride corrosion in stainless steel

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



Polish corrosion marks to prevent further damage



DANGER

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.

5.3.4 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.



DANGER

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 and especially the pillars between the sludge ports in the bowl wall.

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.

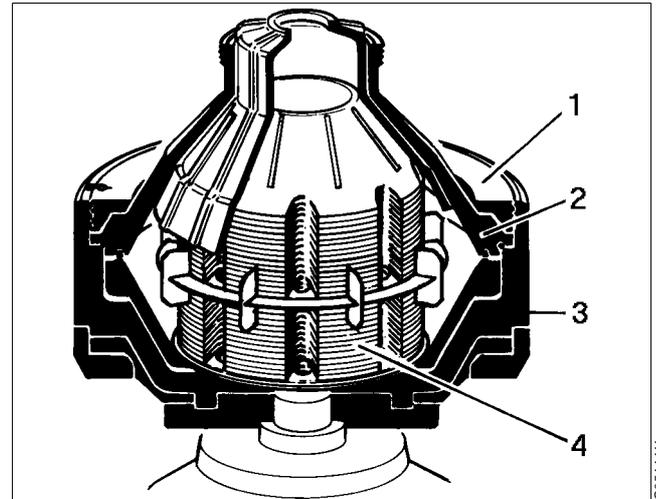
5.3.5 Disc stack pressure

NOTE

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

Insufficient pressure in the disc stack can cause vibration and reduce lifetime of ball bearings.

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.



1. Lock ring
2. Bowl hood
3. Bowl body
4. Disc stack

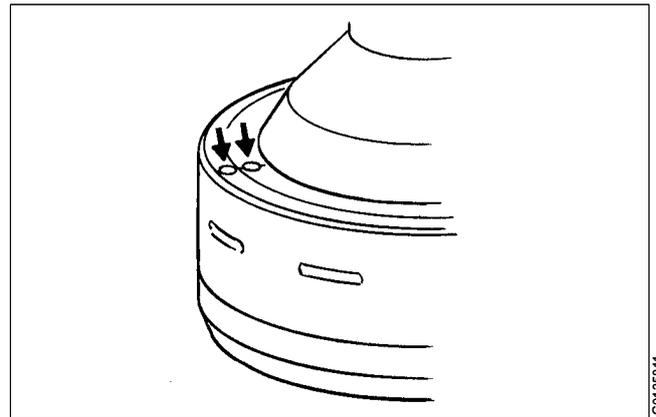
Compress the disc stack by tightening the lock ring, see chapter "6.3.3 Assembly" on page 117.

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 $60^\circ - 90^\circ$ ahead of 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.

If the ϕ -marks do not reach or pass each other, the reason could be an incorrectly assembled bowl or too many discs in the disc stack. Reassemble and check.



ϕ -marks on bowl body and lock ring in line

Complementary check using the compressing tool

With the large lock ring correctly tighten and the compressing tool mounted on the separator bowl, turn the switch to position 1 for compression.

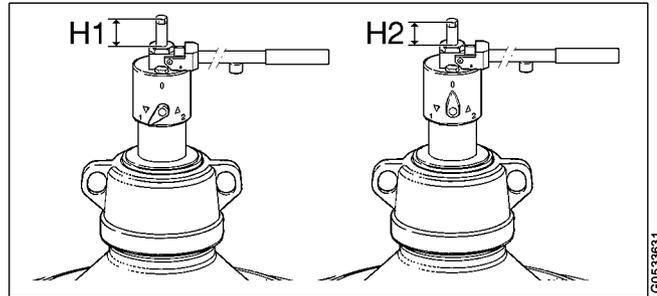
Compress the disc stack by pumping the lever arm until the oil pressure is released through the relief valve.

Measure the height (H1) of the piston rod (see illustration) with the slide callipers depth gauge. Make a note of the reading obtained.

Release the pressure in the compressing tool by turning the switch to position 0. The piston rod will now move downwards slightly when the disc set is released inside the bowl.

Measure once again the height (H2) of the piston rod with the slide callipers and make a note of the reading obtained.

If the difference between H1 and H2 is less than 1,5 mm, the disc stack pressure is correct. If it exceeds 1,5 mm, the number of discs is insufficient. Add one or more discs and repeat the above procedure until the correct disc stack pressure is obtained.



Measure of disc stack pressure with use of a compressing tool

NOTE

An insufficient number of discs will create an imbalance causing vibration.

5.3.6 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.



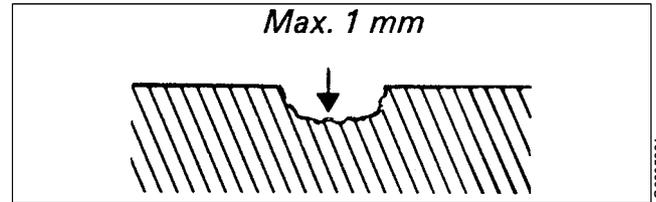
DANGER
Disintegration hazard

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.



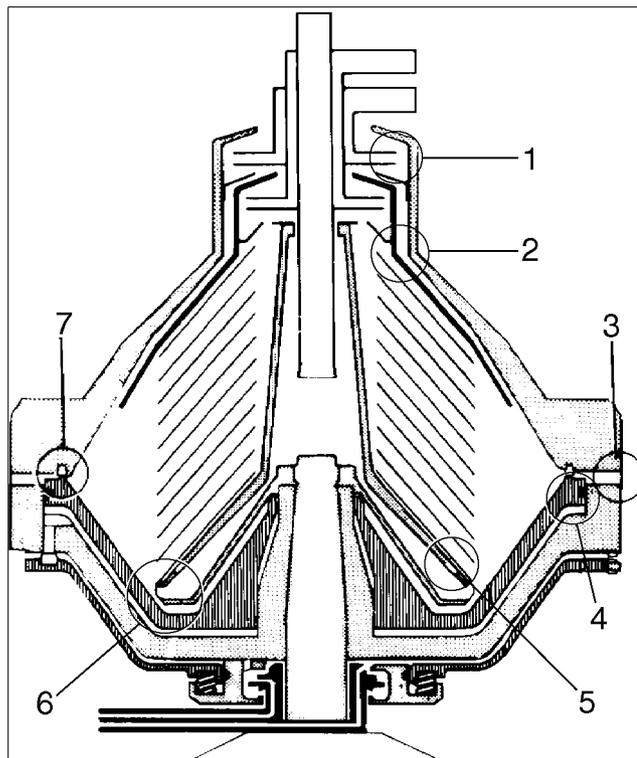
Max. permitted erosion

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Surfaces particularly subjected to erosion are:

1. The upper paring disc.
2. The top disc.
3. The pillars between the sludge ports in the bowl wall.
4. The sealing edge of the bowl body for the seal ring in the sliding bowl bottom.
5. The underside of the distributor in the vicinity of the distribution holes and wings.
6. The surface of the sliding bowl bottom that faces the conical part of the distributor.
7. The sealing edge of the sliding bowl bottom.

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



Surfaces particularly subjected to erosion



DANGER

Disintegration hazard

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

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

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

5.3.7 Guide surfaces

Check surfaces indicated (1) for burrs or galling. Rectify when necessary.

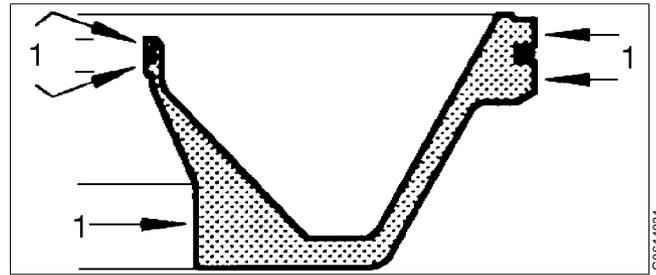
Repair of galling on guide surfaces; see following pages. Before fitting the sliding bowl bottom, clean (**do not** degrease) the contact surfaces (1 and 2). Apply Alfa Laval lubricating paste or Molykote 1000 Paste with a well-cleaned brush on surfaces (1 and 2).

NOTE

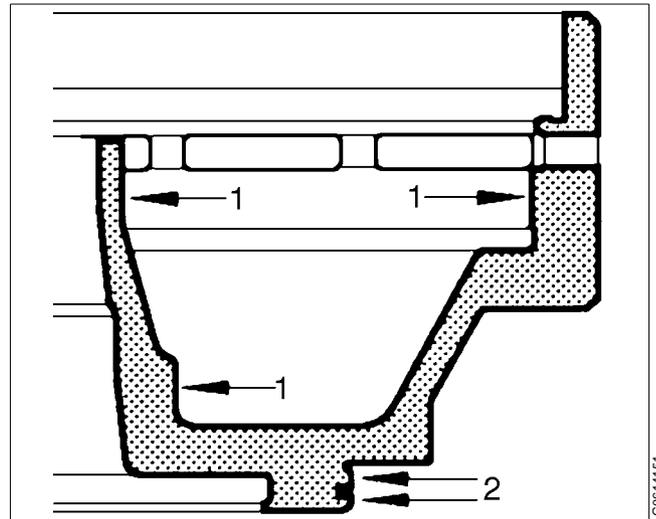
To avoid the risk of galling, the contact surfaces (1) should be primed with a slide lacquer at every Major Service (MS).

The slide-lacquered surfaces will be destroyed if the surfaces are degreased.

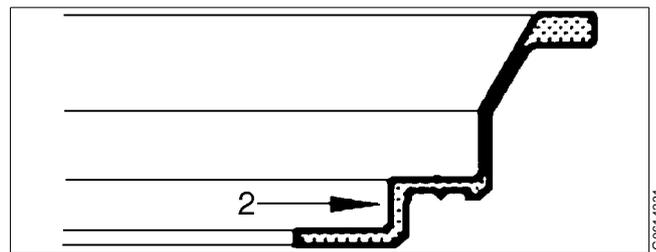
Lubricate the O-ring and the seal ring with silicone grease making sure they are not damaged and lie properly in their grooves.



Sliding bowl bottom



Bowl body



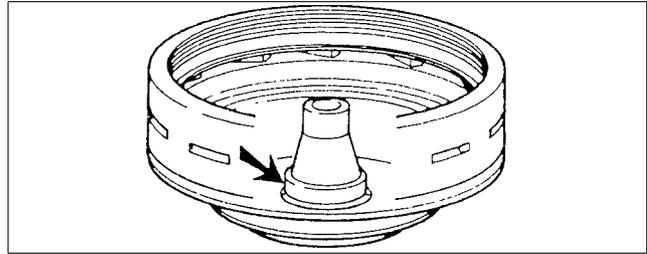
Operating slide

1, 2 =  Alfa Laval lubricating paste or Molykote 1000 Paste.

Repair of galling on guide surfaces

Galling (friction marks) may appear on guide surfaces in the operating system, the bowl body and the sliding bowl bottom. Surfaces subject to repair are indicated by an arrow.

The example below describes the repair of the lower guide surface of the bowl body nave.

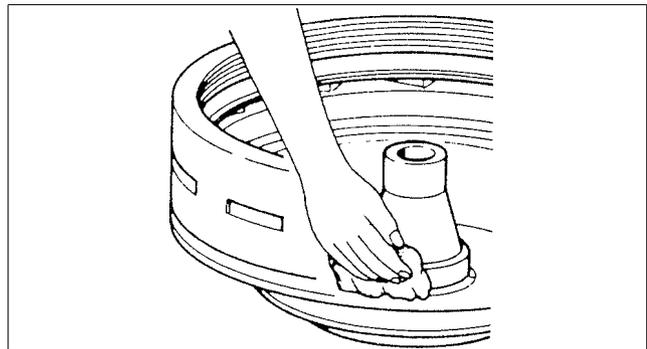


Guide surface in the bowl body

Recommended tools for correction of galling:

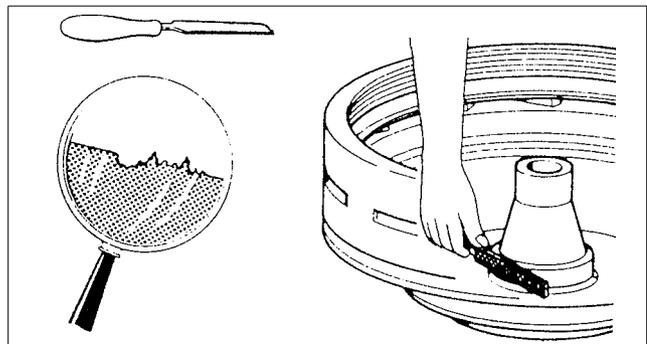
- Emery cloth, 240 grade.
- Hand drilling machine
- Degreasing agent.
- Fibre brush, \varnothing 25mm.
- Fibre brush, \varnothing 50 mm.
- Very fine single-cut file.

1. Clean the surface thoroughly with a degreasing agent, i.e. white spirit. This is important.

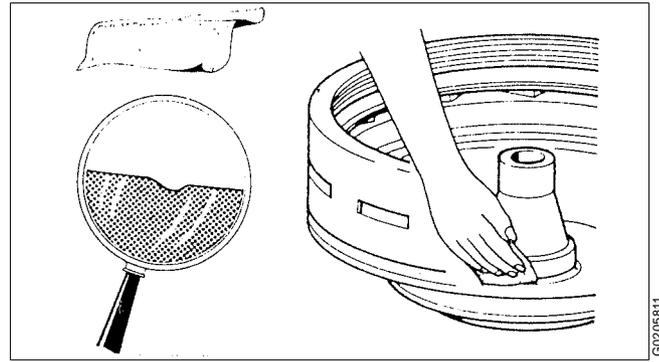


2. If the galling is excessive, first use the fine single-cut file. The file should be used with caution so that the damage is not made worse.

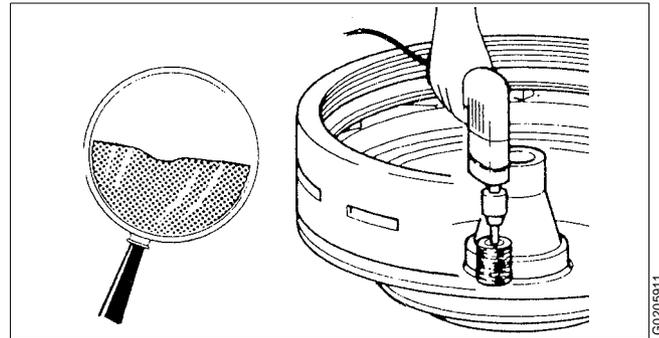
Remove the high spots on the surface. Do not use rotating files or similar. Remove the high spots only - not the undamaged material.



- An emery cloth of 240 grade should be used to smooth the edges and to remove any burnt-in foreign matter.



- Finish off by polishing the damaged spot with the fibre brushes and brush wax. It is recommended that the whole area where galling may occur is polished. Polishing will help smoothen the whole of the damaged area, even in the deepest parts.

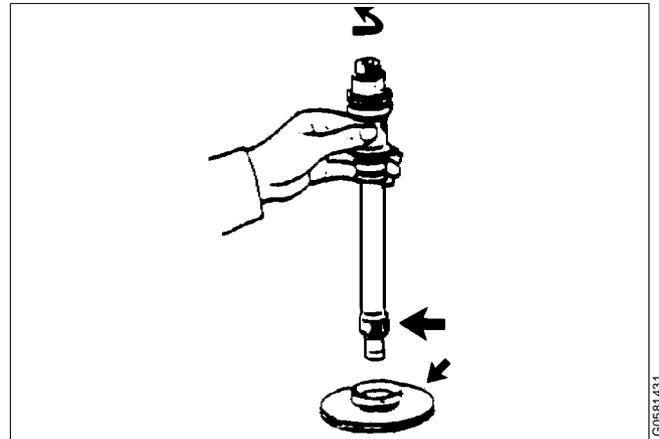


Prime the repaired area with lubricating spray Molykote 321 R. Read the correct procedure under checkpoint. Apply Alfa Laval lubricating paste or Molykote 1000 Paste to the surface after priming.

5.3.8 Inlet pipe and oil paring disc

Damage to the threads and the top surface of level ring may cause the paring disc to scrape against the paring chamber cover even if the height has been adjusted correctly.

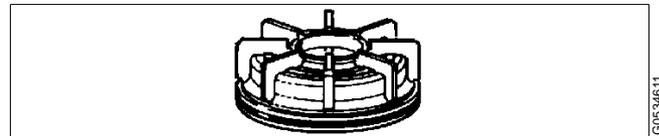
Screw the inlet pipe into the paring disc and check that the inlet pipe turns easily.



Check the threads of the inlet pipe and oil paring disc

5.3.9 Level ring

Remove any burrs on the surface of the level ring with a file as the paring disc rests on that surface during the height position check.



Check the level ring for burrs

5.3.10 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.

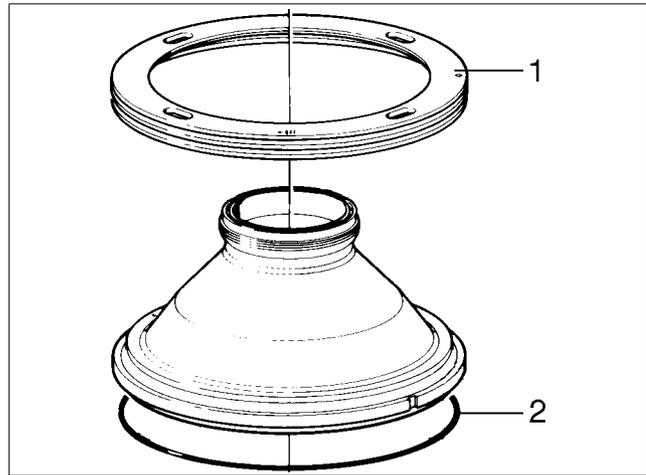
Check the thread condition by tightening the lock ring (1) after removing the disc stack and bowl hood O-ring (2) from the bowl.



DANGER

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.



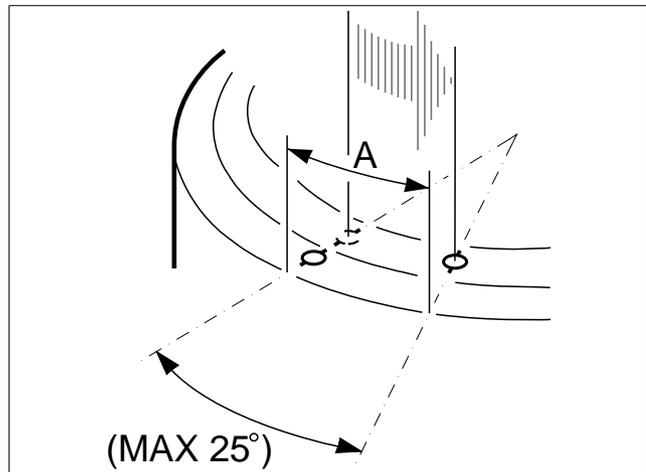
- 1. Lock ring
- 2. O-ring for the bowl hood

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.

If the original ϕ -mark on the lock ring passes the ϕ -mark on the bowl body by more than 25° (which corresponds to **A=100 mm for MOPX 309TGT-24**), an Alfa Laval representative must be contacted immediately.

If the marks become illegible, an Alfa Laval representative should be contacted immediately to inspect thread wear and for determining the position of new alignment marks.



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

Damage

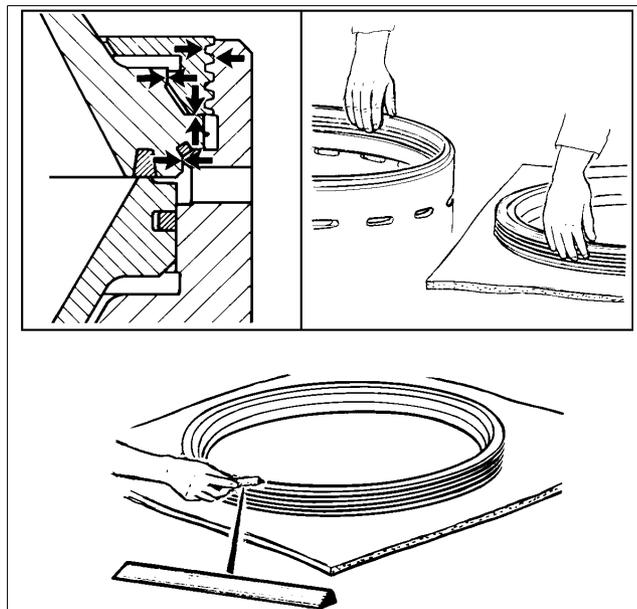
The position of the threads, contact and guide surfaces are indicated by arrows in the illustration.

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.



Clean and check thread, contact and guide surfaces of the lock ring

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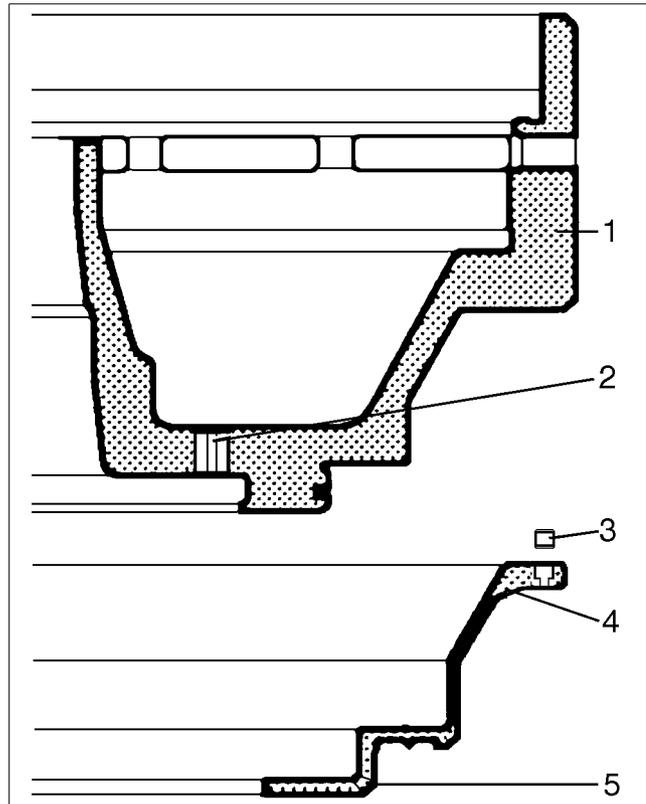
5.3.11 Operating mechanism

Dirt and lime deposits in the operating mechanism may cause poor discharge function or no function at all.

Clean and polish surfaces with steel wool if necessary.

Reasons for dirt or deposits:

- Hard or unclean operating water. Change water supply or install a water softener or a fine filter.
- Sludge has been sucked down into bowl casing and into the operating system. Check the installation and the venting system of both the sludge tank and bowl casing drain.



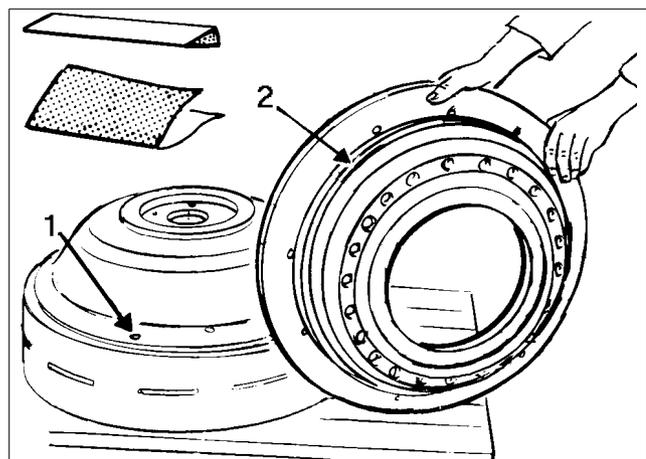
1. Bowl body
2. Nozzle, $\varnothing = 2,5 \text{ mm}$
3. Valve plug
4. Operating slide
5. Nozzle, $\varnothing = 1,1 \text{ mm}$

5.3.12 Operating slide

Poor sealing between the valve plugs on the operating slide and bowl body may prevent complete closing of the bowl.

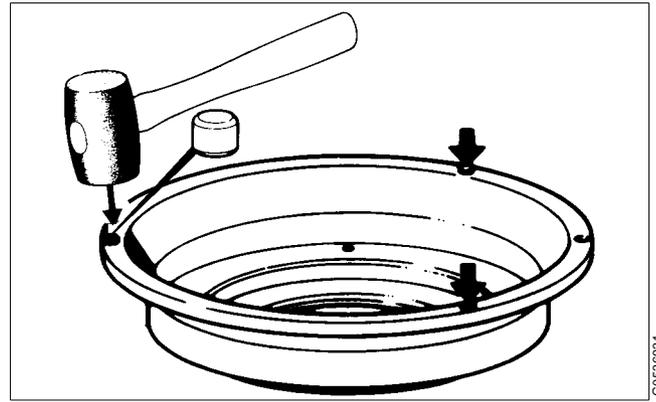
Examine the sealing surfaces (1) of the bowl body in contact with the valve plugs. Remove any marks and lime deposits with a very fine grain emery cloth.

Check the guiding surface (2) in contact with the dosing ring. Remove any marks with a whetstone (grain size 240).



1. Bowl body sealing surfaces in contact with the valve plugs
2. Operating slide guide surface in contact with the dosing ring

Remove all the valve plugs. Tap in the new plugs.
Correct height of plugs: **11,0 mm**.



Tap in new valve plugs

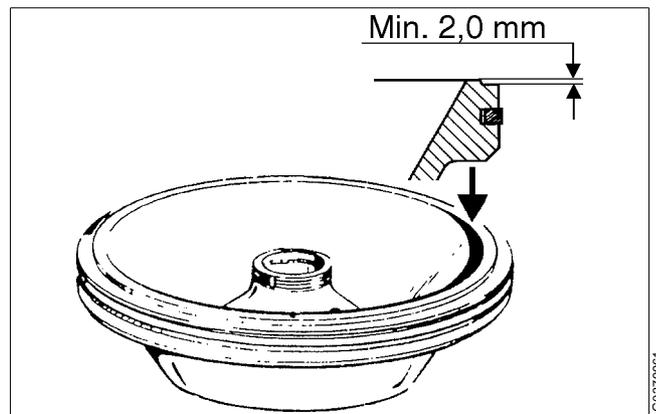
5.3.13 Sliding bowl bottom

Poor sealing between the bowl hood seal ring and the sealing edge of the sliding bowl bottom will cause a leakage of process liquid from the bowl.

Check the sealing edge of the sliding bowl bottom. If damaged either through corrosion or erosion or other means, it can be rectified by turning in a lathe. Permissible reduction of the original profile height (2,5 mm) is **max. 0,5 mm**.

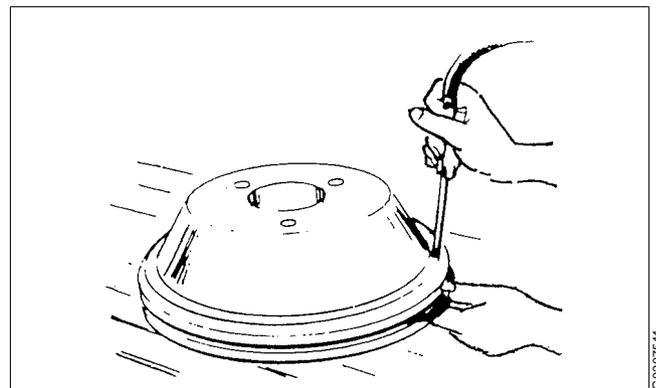
NOTE

Never reduce the height outside the sealing edge to reach the minimum profile height.



Min. height of the profile on sliding bowl bottom

If the seal ring for the sliding bowl bottom is to be replaced, turn the sliding bowl bottom upside down and inject compressed air through the hole on the underside. This will press the ring outwards far enough to be gripped easily.



Removal of the O-ring in sliding bowl bottom using compressed air



WARNING

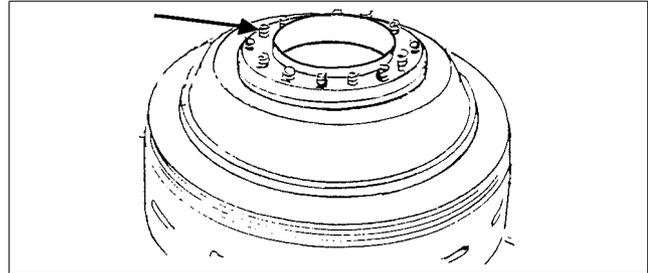
Risk for eye injury

Wear safety goggles.

5.3.14 Springs for operating mechanism

Defective or broken springs may prevent complete closing of the bowl.

Renew those springs which differ from other springs in regard to length or are defective in other respects.



G0378831

Check for defective or broken springs

5.3.15 Worm wheel and worm; wear of teeth

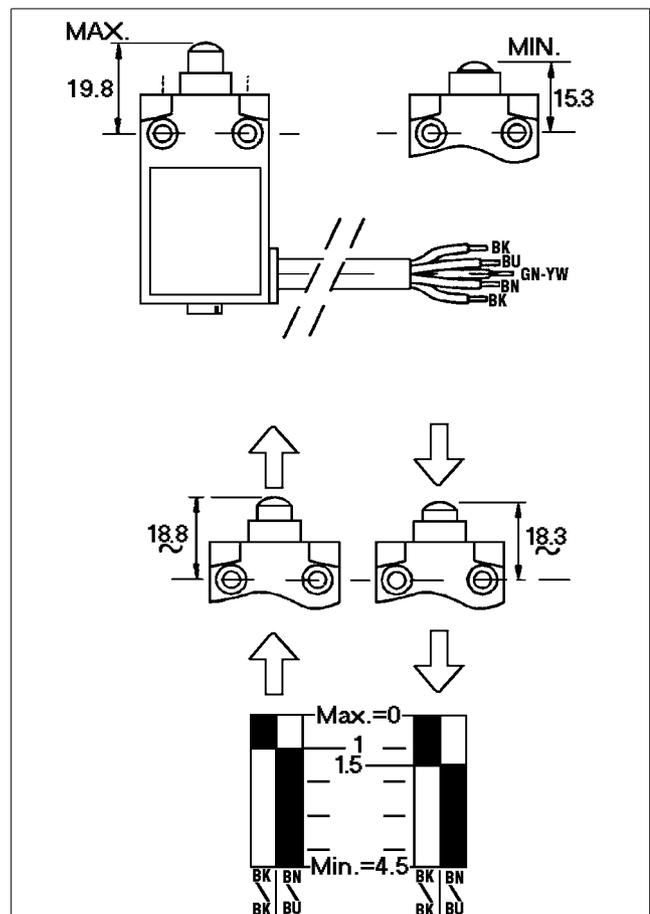
Same as described in “5.7.1 Worm wheel and worm; wear of teeth” on page 93 in this chapter.

5.3.16 Cover interlocking switch (option)

When the button is pushed, check that the brown and blue wires are short-circuited and the two black wires are out-of-circuit.

Check also the reverse when the button not pressed.

See the illustration for exact measurement when the button is operated.



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Measurements for operation range of the cover interlocking switch button

■ Contact closed

□ Contact open

BK Black

BN Brown

BU Blue

GN-YW Green-Yellow

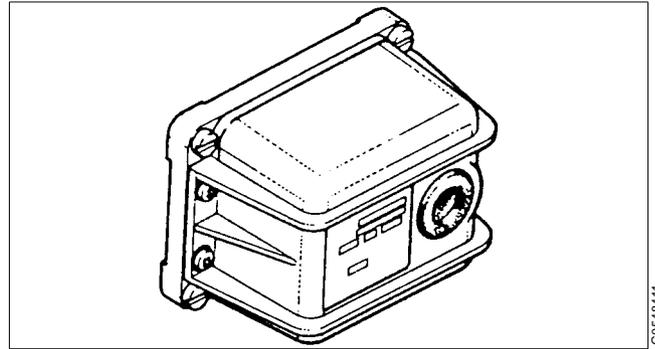
5.3.17 Vibration switch (option)

NOTE

Before carrying out the function check described below, check that a safety stop will not cause serious interruption of the operation.

Knock on the vibration switch cap a number of times within one second (the number is decided by the system parameter settings). If the switch functions correctly, the separator will perform a safety stop.

How to adjust the setpoint is described in chapter “5.8.2 Vibration switch (option)” on page 98.



Vibration switch

G0548411

5.4 Check points at Major Service (MS)

5.4.1 Bowl hood seal ring

Same as described in “5.3.1 Bowl hood seal ring” on page 56.

5.4.2 Bowl spindle cone and bowl body nave

Same as described in “5.3.2 Bowl spindle cone and bowl body nave” on page 57.

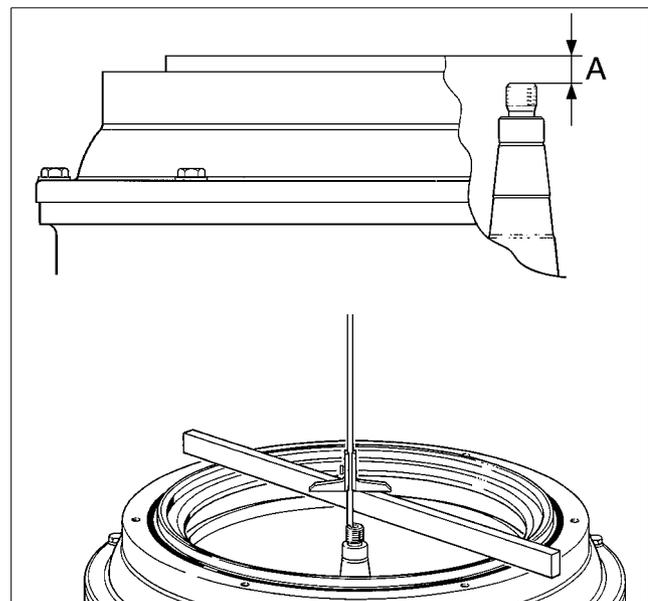
5.4.3 Bowl spindle; height position

If the bowl spindle has been removed, its height position relative to the frame ring must be checked.

- Place a steel ruler across the frame ring. Measure the distance between the spindle top and the underside of the steel ruler with a depth gauge or a graduated ruler.
- The distance (A) should be **24 ±1 mm**.
- The height position is adjusted by adding or removing height adjusting rings inside the bottom bearing housing.

NOTE

Before starting adjustment, tap the spindle top a few times with a tin hammer to ensure that the bottom bearing of the spindle is properly seated in the bottom bearing housing.



Measurement of the bowl spindle height (A)

5.4.4 Bowl spindle; radial wobble

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

NOTE

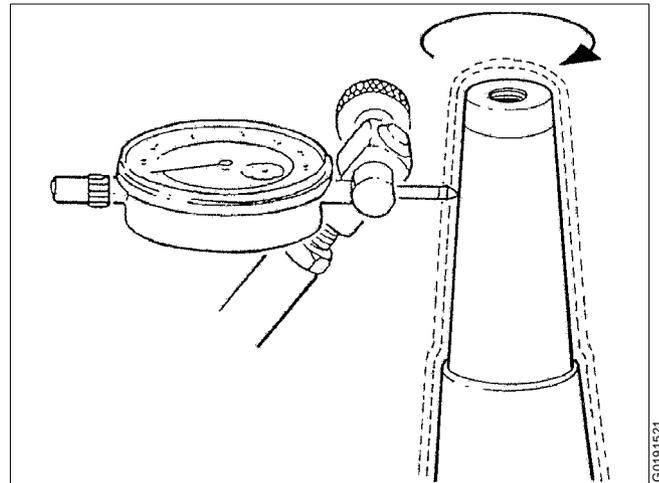
Spindle wobble will cause rough bowl run. This leads to vibration and reduces lifetime of ball bearings.

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.



Measurement of the radial wobble

5.4.5 Brake

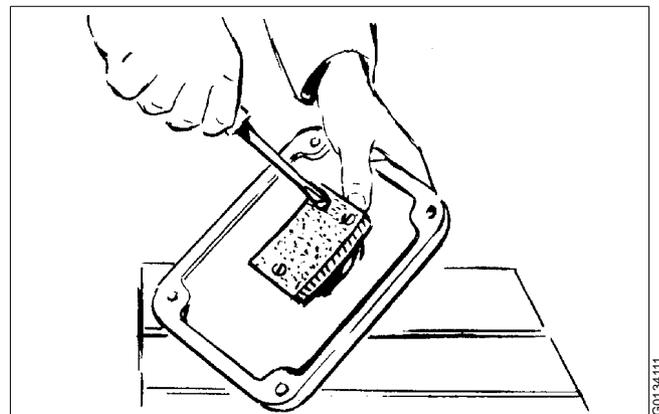
A worn or oily friction pad will lengthen the braking period.

If the friction pad is worn:

- Remove the screws and exchange the friction pad.

NOTE

The screws are slotted in both ends.



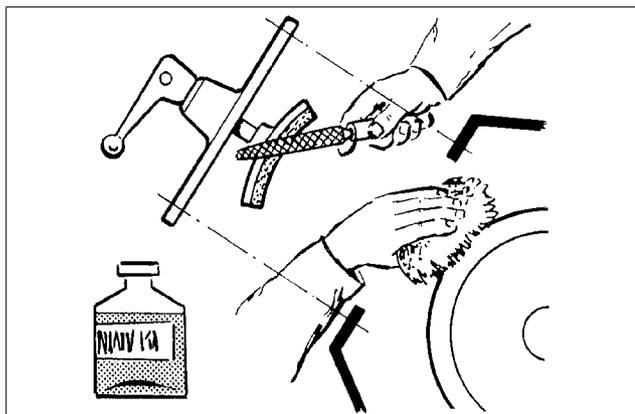
Friction pad is fastened with screws

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.

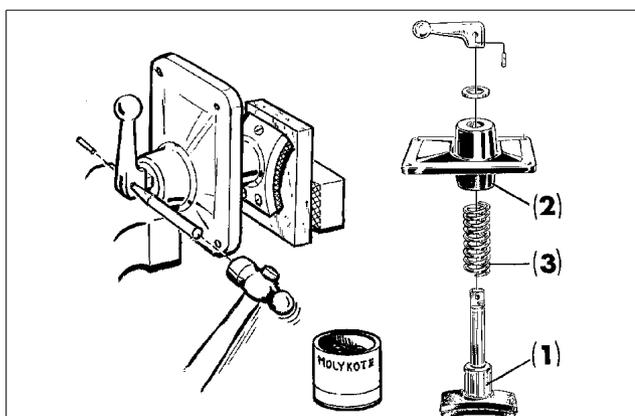


Actions to be taken when the brake friction pad is oily

Checking of spring and brake shoe:

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

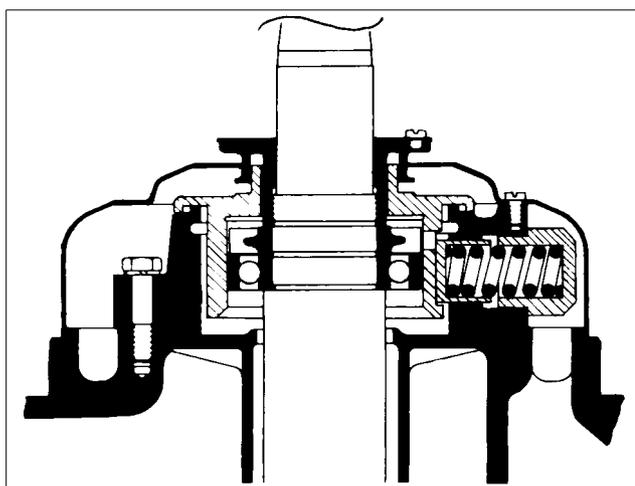
- Remove any rust from the surface (1) of the brake shoe and the corresponding guide surface in the cap (2).
- Rub in Molykote Paste on the surfaces.
- Replace the spring (3) if it has grown weak. This is indicated by chattering from the spring when the brake is in released position.
- Oil the spring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



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

5.4.6 Buffer springs and ball bearing housing

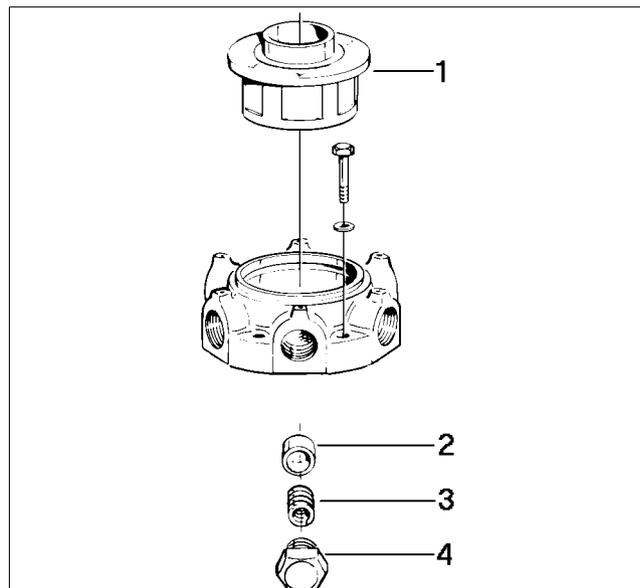
Weakened or broken buffer springs or defective contact surfaces for the buffers on the ball bearing housing may give rise to separator vibration (rough bowl run).



Cut view of ball bearing housing

Top bearing springs

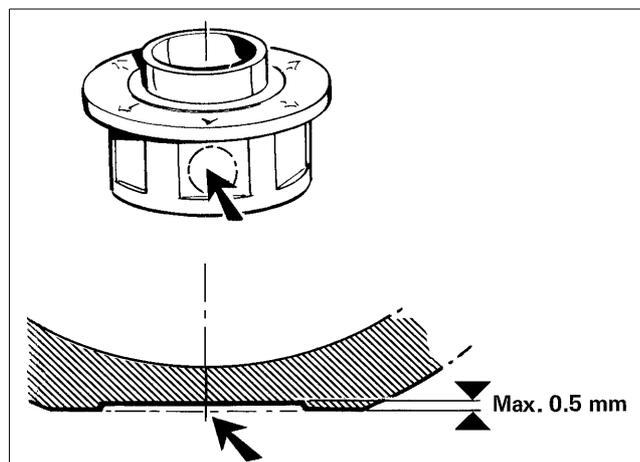
In case of spring fracture, the complete set of springs should be replaced, even if only one spring is broken.



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

5.4.7 Coupling friction pads

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

If the separator does not attain full speed within about 10 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:

- Remove the screws and renew the pads.

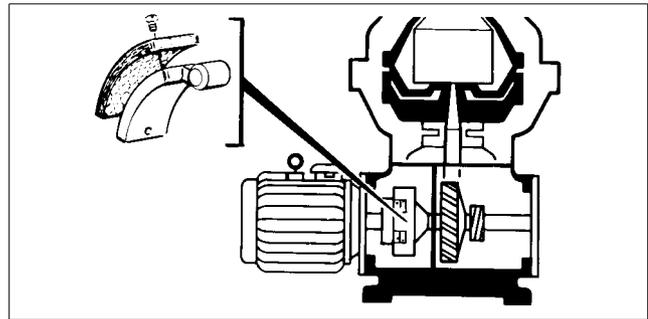
NOTE

The screws are slotted in both ends.

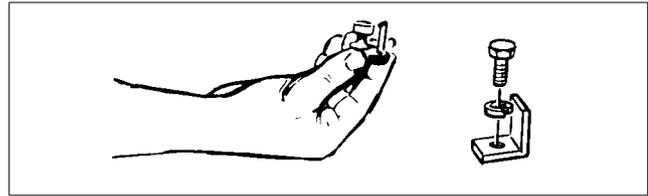
Replace all pads even if only one is worn.

How to renew friction pads without dismantled horizontal driving device.

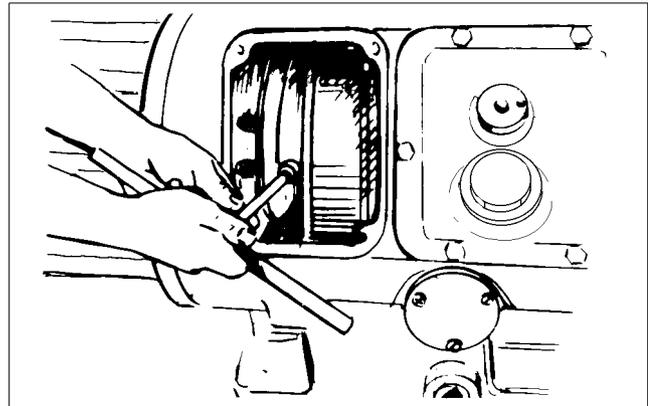
- Remove the brake cap.
- Undo the screws of the holding brackets.
- Remove the holding brackets and friction blocks.
- Remove the screws and renew the pads.



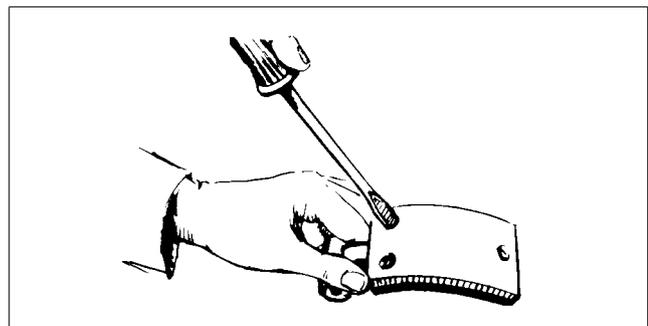
Location of coupling friction blocks



A friction block is fixed with screw, spring washer and holding bracket



Unscrew the holding bracket screws to remove the friction blocks



The screws fix the friction pad to the friction block

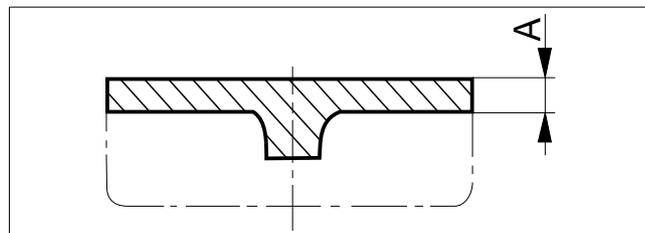
Different friction blocks for different power supply frequencies

If mounting new friction blocks, check that the blocks are correct for the power supply frequency. The measure A is different for 50 and 60 Hz separators

50 Hz: A = **20 mm**

60 Hz: A = **5,5 mm**

The thickness does not include the friction pad.



Measure A is different for 50 and 60 Hz installations

5.4.8 Corrosion

Same as described in “5.3.3 Corrosion” on page 57.

5.4.9 Cracks

Same as described in “5.3.4 Cracks” on page 60.

5.4.10 Disc stack pressure

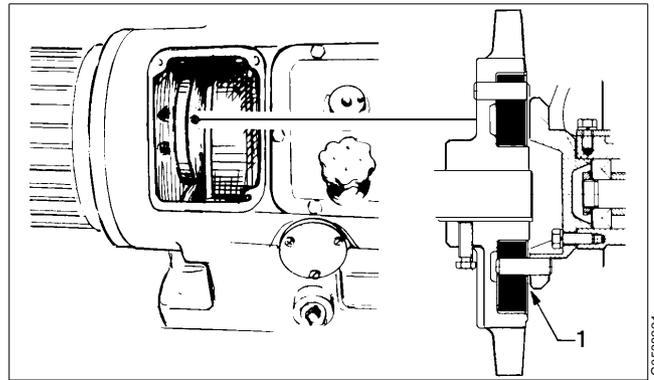
Same as described in “5.3.5 Disc stack pressure” on page 61.

5.4.11 Erosion

Same as described in “5.3.6 Erosion” on page 63.

5.4.12 Flexible plate in coupling

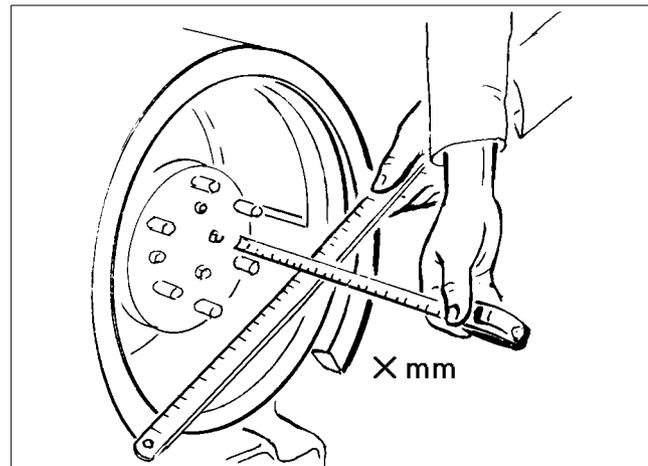
The axial play (1) of the flexible plate should be approximately 2 mm.



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

Check the play as follows:

Measure the distance from the frame ring to the coupling disc of the separator.

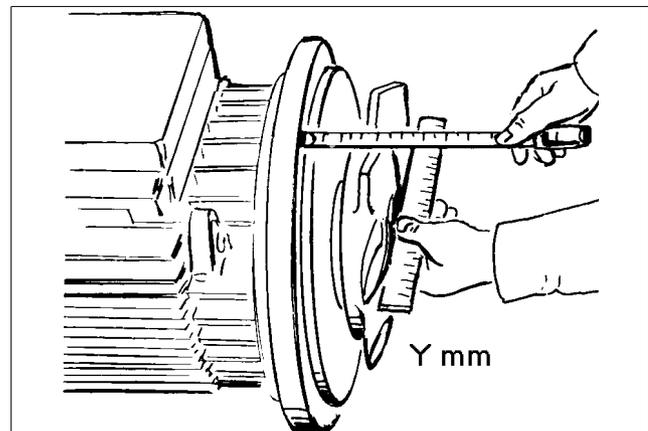


Measurement of distance for coupling in separator frame

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

$$X \text{ mm} - Y \text{ mm} = 2 \text{ mm}$$

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



Measurement of distance for coupling on motor

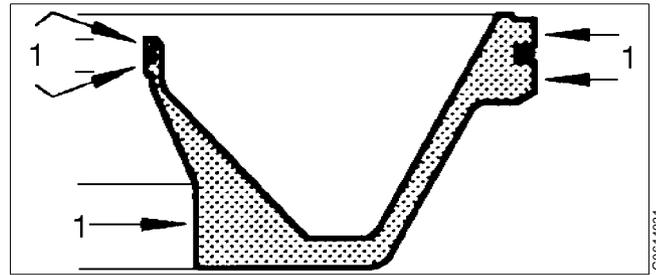
5.4.13 Guide surfaces

Check surfaces indicated (1) for burrs or galling. Rectify when necessary.

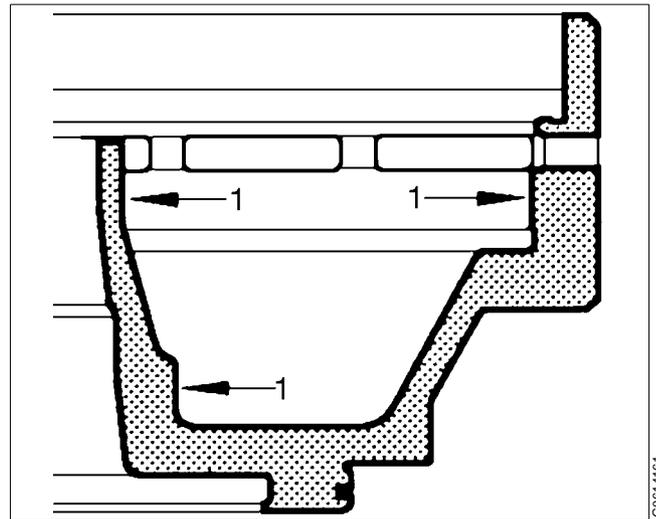
Repair of galling on guiding surfaces, see “5.3.7 Guide surfaces” on page 65.

Treat the guide surfaces with slide lacquer in the following way:

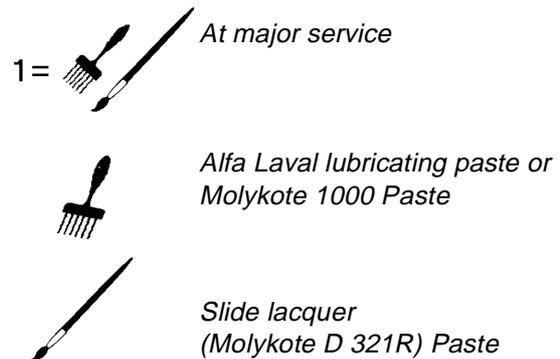
1. Mask the nave hole of the bowl body. Slide lacquer must not enter this hole.
2. Carefully degrease the contact surfaces (1) between the sliding bowl bottom and bowl body. Dry the surfaces well.
3. Apply slide lacquer Molykote D321R with a well cleaned brush. Protect the surfaces which should not be treated.
4. Air-cure the treated surfaces for 15 minutes.
5. Use a smooth fibre brush to polish to an even, homogeneous contact film.
6. Apply slide lacquer a second time.
7. Air-cure the lacquer for a further 15 minutes.
8. Polish the film to a shiny surface. The film should look like well-polished leather when properly done.
9. Finish the treatment by lubricating the contact surfaces (A) with Alfa Laval lubricating paste or Molykote 1000 Paste. Use a well-cleaned brush. Rub it into the surface, do not leave any excessive paste.
10. Lubricate the O-ring and the seal ring with silicone grease and check that they lie properly in their grooves.



Sliding bowl bottom



Bowl body



5.4.14 Inlet pipe and oil paring disc

Same as described in “5.3.8 Inlet pipe and oil paring disc” on page 67.

5.4.15 Level ring

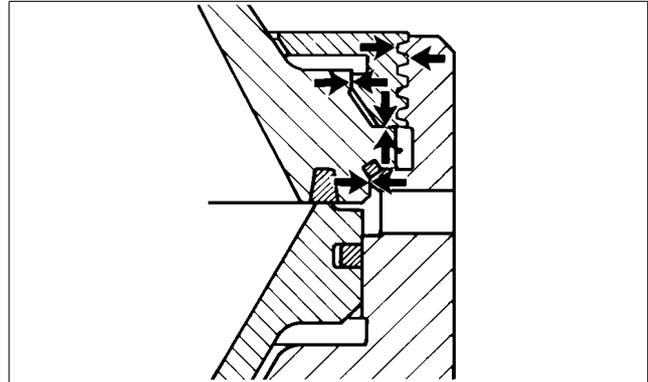
Same as described in section “5.3.9 Level ring” on page 67.

5.4.16 Lock ring; priming

The arrows indicate positions of threads, guide and contact surfaces to be primed.

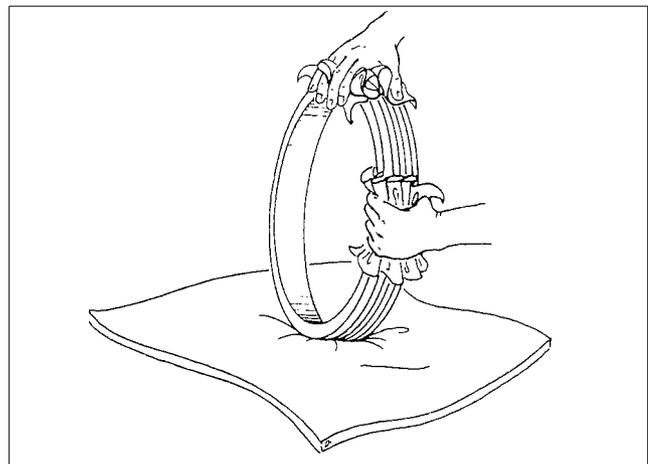
Recommended agents for priming procedure:

- Degreasing agent
- Lubricating spray Molykote 321 R
- Hand drilling machine
- 2 fibre brushes

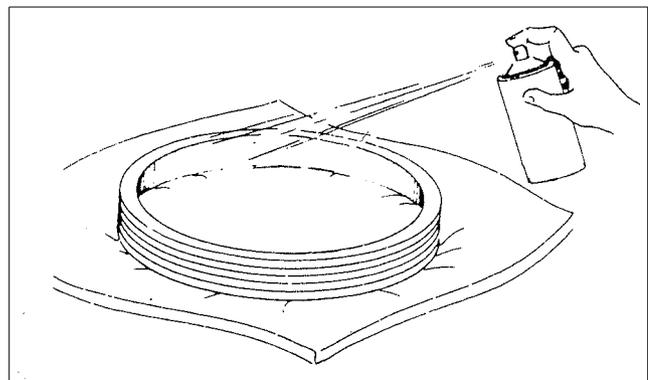


Threads, guide and contact surfaces to be primed

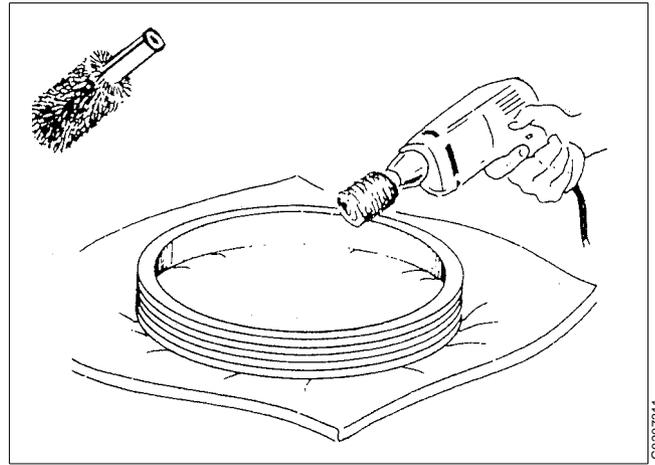
1. Clean the lock ring thoroughly with a degreasing agent and wipe it off.



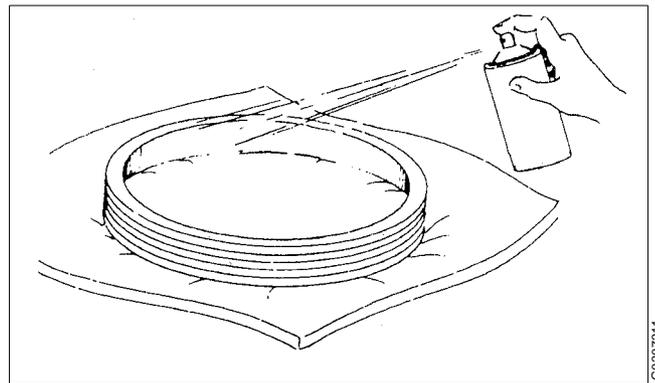
2. Spray the threads, guide and contact surfaces with slide lacquer Molykote 321 R. Let the lacquer air-cure for about 15 minutes.



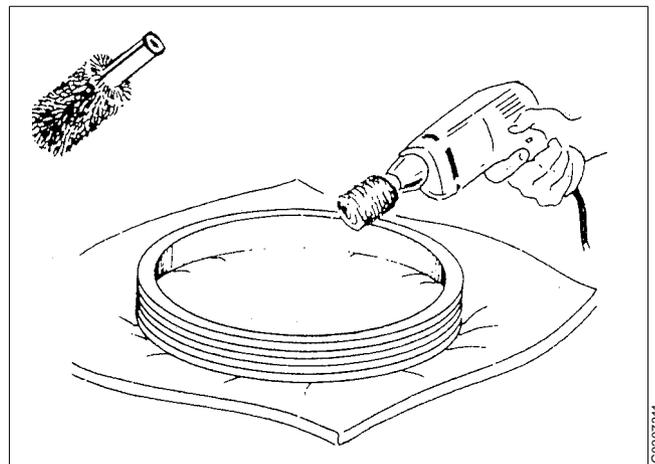
- Use a fibre brush to polish the slide lacquer into the surface. The black spray will look like well-polished leather when properly done.



- Spray the lock ring a second time and let it dry for about 15 minutes.



- Polish the slide lacquer to a black shiny surface which can now last about a year. Proceed in the same way with the threads of the bowl body and with the guide surfaces of the bowl hood and bowl body.



5.4.17 Lock ring; wear and damage

Same as described in section “5.3.10 Lock ring; wear and damage” on page 68.

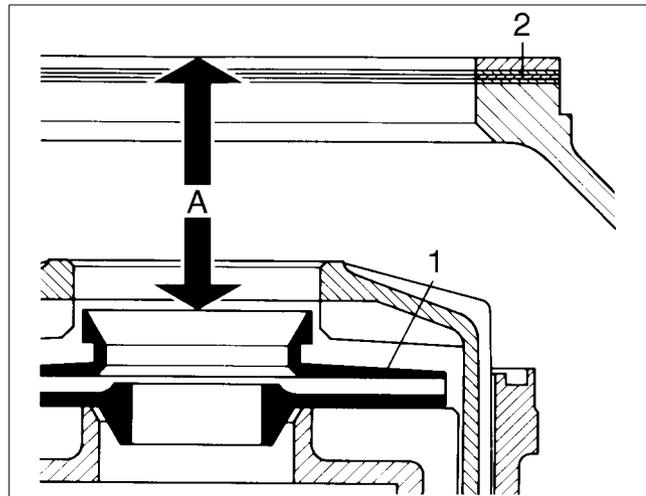
5.4.18 Oil paring disc; height position

The height position of the oil paring disc (1) should be checked if the bowl spindle has been removed or the bowl has been replaced.

- Assemble the bowl without upper paring disc, gravity disc and paring chamber cover.
- Tighten the large lock ring until the bowl hood is in close contact with the bowl body.
- Put the frame hood in place and tighten it to the frame ring.
- Measure the distance A according to the figure. The distance should be **67 ±0,5 mm**.
- Adjust the distance by adding or removing height adjusting rings (2).

With inlet and outlet parts mounted:

- Revolve the worm wheel shaft by hand. If it turns heavily or if a scraping noise is heard, wrong height adjustment or wrong fitting of the inlet pipe may be the cause.



Measurement of distance A

5.4.19 Operating mechanism

Same as described in section “5.3.11 Operating mechanism” on page 70.

5.4.20 Operating paring disc; height position

If the bowl spindle has been removed or the bowl has been replaced, the height position of the operating device relative to the bowl spindle top must be checked.

Correct measure (A) is $176 \pm 0,5$ mm.

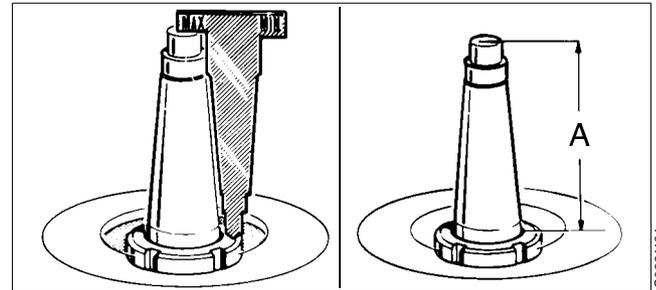
- The operating water device should be assembled and fitted.
- Support the templet on the spindle top with the measurement indication 175,5 facing the spindle.

There should be a small gap between the lower end of the templet and the top face of the ring nut (1), otherwise the paring disc position is too high.

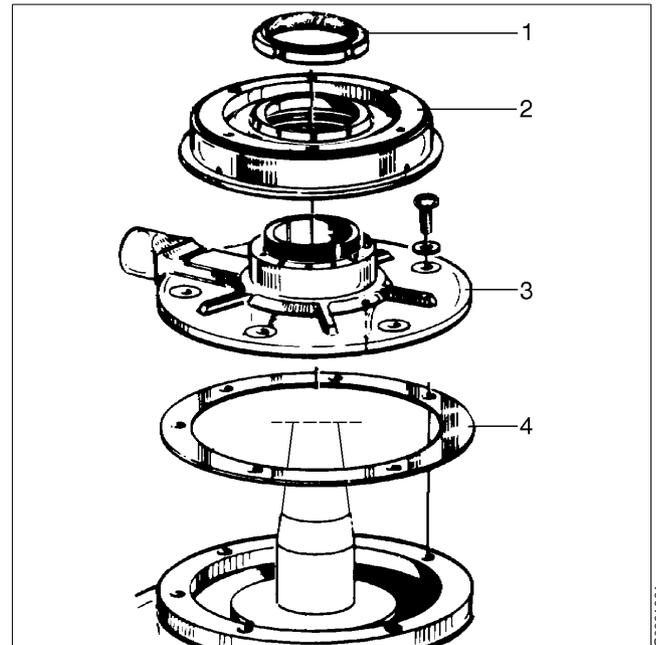
- Turn the templet so that the measurement indication on the other side (176,5) faces the spindle and the templet lower end supports on the paring disc.

There should be a small gap between the templet tongue and the spindle top, otherwise the paring disc position is too low.

- The height position is adjusted by adding or by removing height adjusting rings (4) under the distributing cover (3).
- After adjustment rotate the spindle. If a scraping noise is heard, re-adjust.



Measurement of distance A



1. Ring nut
2. Paring disc assembly
3. Distributing cover
4. Height adjusting ring(s)

5.4.21 Operating slide

Same as described in section “5.3.12 Operating slide” on page 70.

5.4.22 Sliding bowl bottom

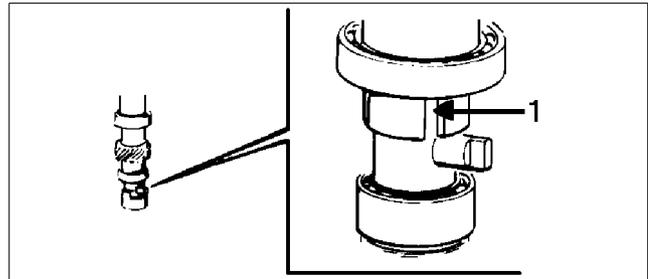
Same as described in section “5.3.13 Sliding bowl bottom” on page 71.

5.4.23 Springs for operating mechanism

Same as described in “5.3.14 Springs for operating mechanism” on page 72.

5.4.24 Worm; wear of groove

Renew the worm if the wear in the groove (1) which receives the conveyor exceeds **3-4 mm**.



Measurement of wear in groove (1)

5.4.25 Worm wheel and worm; wear of teeth

Same as described in section “5.7.1 Worm wheel and worm; wear of teeth” on page 93.

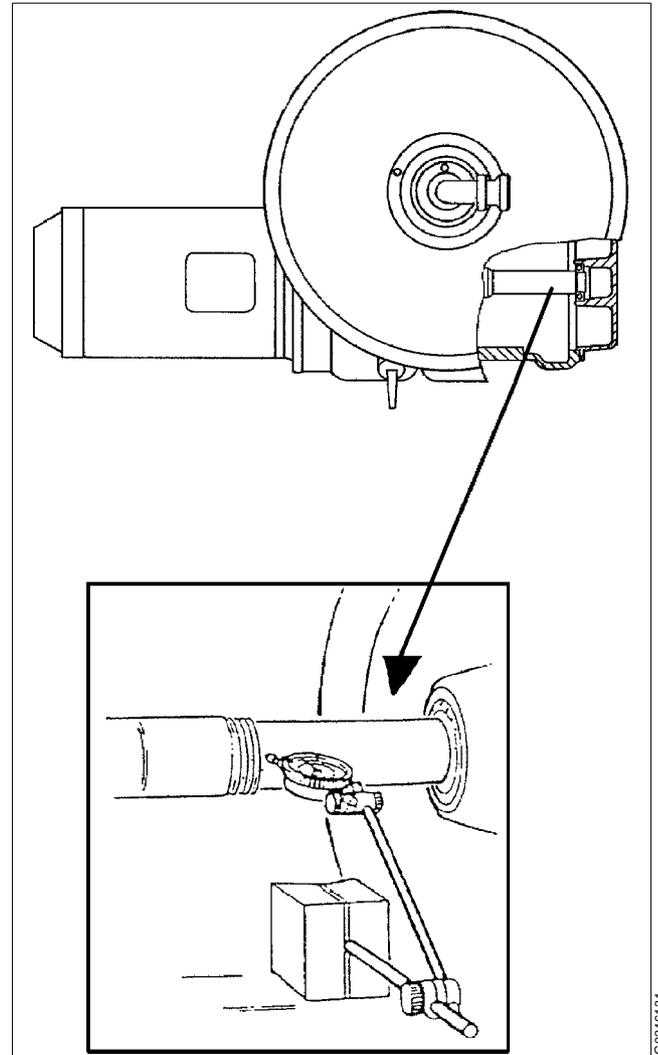
5.4.26 Worm wheel shaft; radial wobble

Excessive wobble on the worm wheel shaft may cause vibration and noise.

Clamp a dial indicator in a magnetic support and fasten it to the surface for the worm wheel guard. Turn the worm wheel shaft by hand.

Permissible radial wobble is **maximum 0,10 mm**.

If the wobble is larger, the worm wheel shaft must be removed from the frame for closer examination. Get in touch with your Alfa Laval representative as the worm wheel shaft may need to be replaced.



Measurement of the radial wobble

5.4.27 Cover interlocking switch (option)

Same as described in “5.3.16 Cover interlocking switch (option)” on page 72.

5.4.28 Vibration switch (option)

Same as described in “5.3.17 Vibration switch (option)” on page 73.

5.5 Lifting instructions

Attach three endless slings or cables to the lifting eyes (the screws must be tightened with spanner).

Length of each sling must be **min. 2 metres**.

NOTE

Machine weight without frame hood and bowl is approx. **850 kg**.

Do not lift the separator unless the frame hood and bowl have been removed.



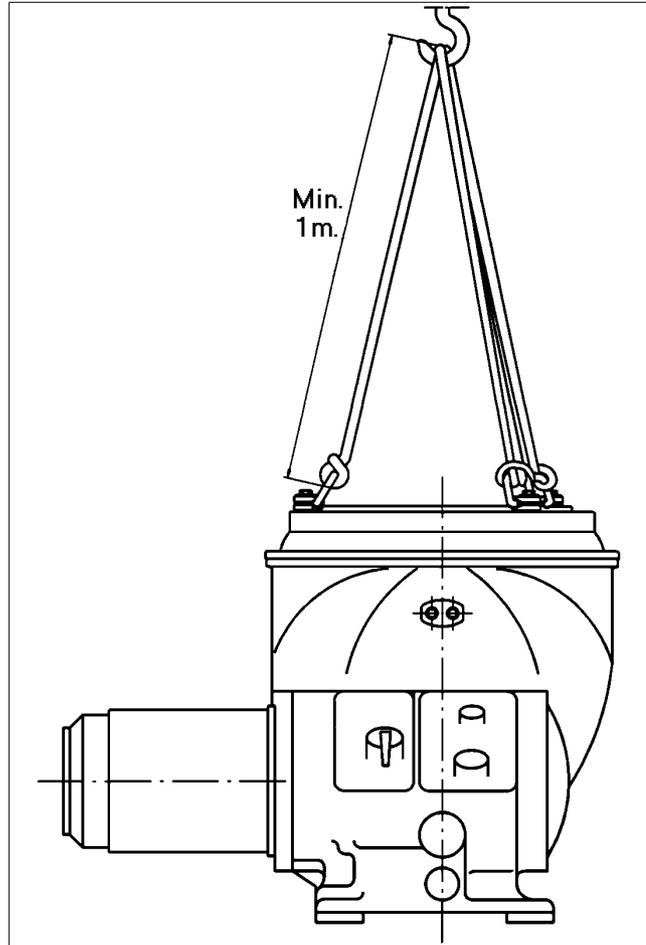
WARNING

Crush hazards

Use only the three **special lifting eyes** (M16) for lifting the machine. They are to be screwed into the special threaded holes normally covered by the frame hood.

Other holes are **not** dimensioned for lifting the machine.

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



Lift the separator with the frame hood and bowl removed

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

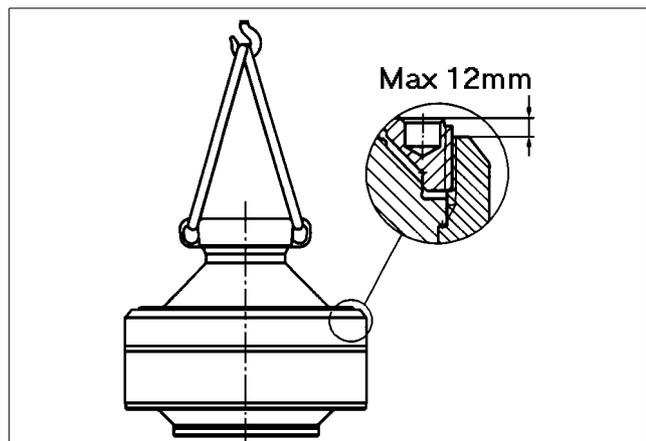
NOTE

Check that the lock ring is properly tightened.

The height of the lock ring above the bowl body must not exceed **12 mm**.

Weight to lift is approx. **300 kg**.

When lifting the bowl out of the separator frame, the cap nut fixing the bowl to the bowl spindle and the screws fixing the bowl body to the operating water device must first be removed.



The lock ring must be properly tightened when lifting the bowl

5.6 Cleaning

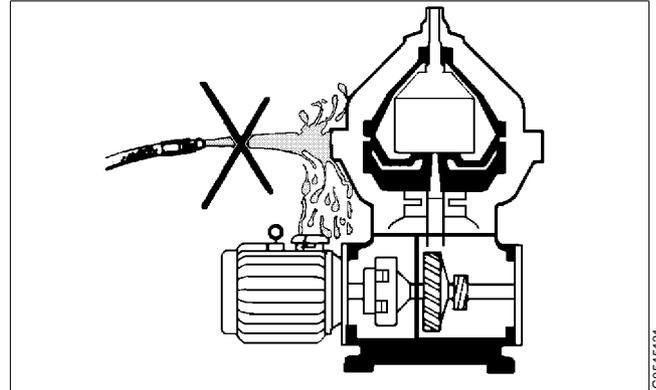
5.6.1 External cleaning

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.

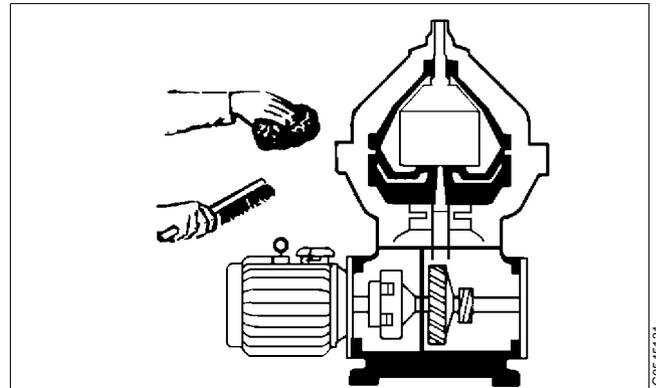
Never wash down a separator with a direct water stream. Totally enclosed motors can be damaged by direct hosing to the same extent as open motors and even more than those, because:

- Many 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



Use a sponge or cloth and a brush when cleaning

5.6.2 Cleaning agents

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

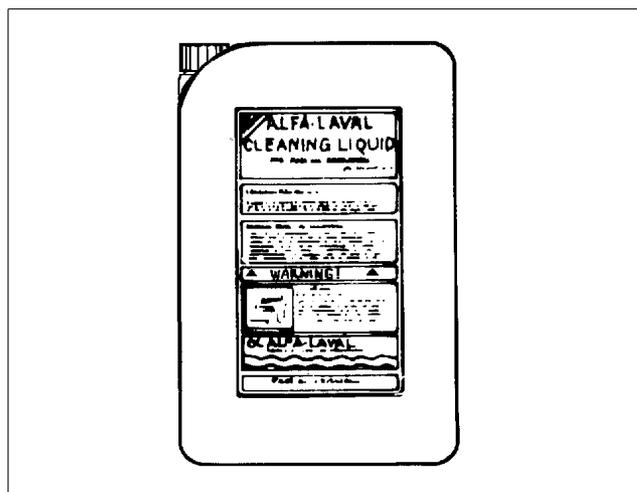
For separator bowl, inlet and outlet

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 for 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.



Alfa Laval cleaning liquid for fuel and lube oil separators

S0008511



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 operating mechanism

Use 10% acetic acid solution to dissolve lime deposits. The acid should be heated to 80 °C.

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.

5.6.3 Cleaning of bowl discs

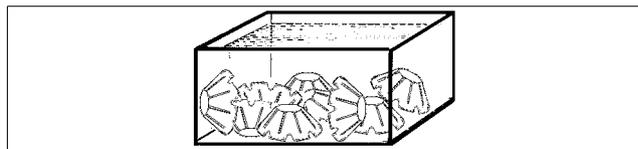
Handle the bowl discs carefully so as to avoid damage to the surfaces during cleaning.

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.



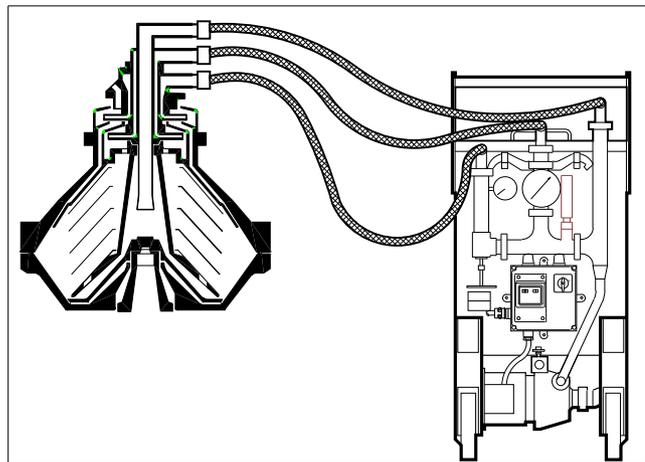
Put the discs one by one into the cleaning agent



Clean the discs with a soft brush

5.6.4 CIP-system

Alfa Laval has developed a CIP (Cleaning-In-Place) system specifically designed for cleaning the bowl and with the inlet and outlets of lube and fuel oil separators without the need of dismantling.



CIP Unit connected to separator

G0038031

5.7 When changing oil

5.7.1 Worm wheel and worm; wear of teeth

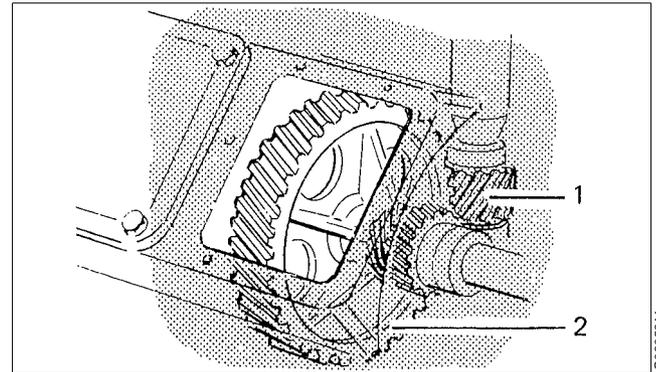
To check at each oil change

Check the teeth of both the worm wheel and worm for wear. Examine the contact surfaces and compare the tooth profiles with the “Tooth appearance examples” on page 95. The gear may operate satisfactorily even when worn to some degree.

- Replace both worm wheel and worm at the same time, even if only one of them is worn.
- To avoid damaging the teeth when lifting the bowl spindle: push the worm wheel to one side first.

Position the spindle in correct place before fitting the worm wheel.

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 “8.1 Technical data” on page 184 for correct number of teeth.



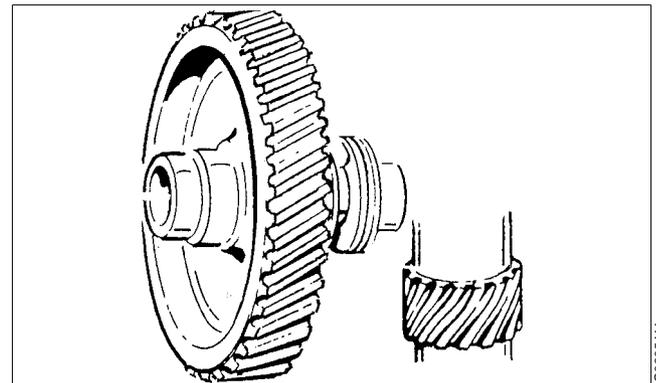
1. Worm
2. Worm wheel



DANGER

Disintegration hazards

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



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

NOTE

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

Important!

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.

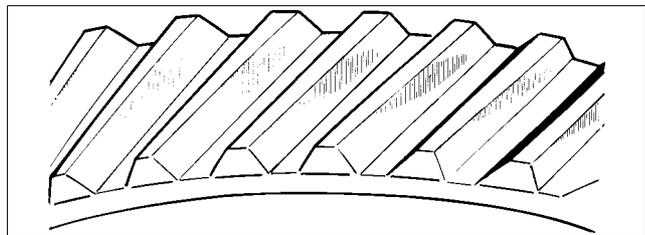
For further information, see chapter “8.8 5Lubricants” on page 200.

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.

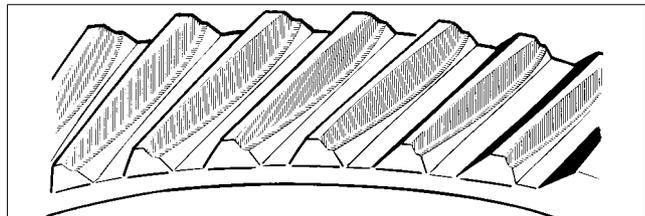


Satisfactory teeth

Worn teeth:

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

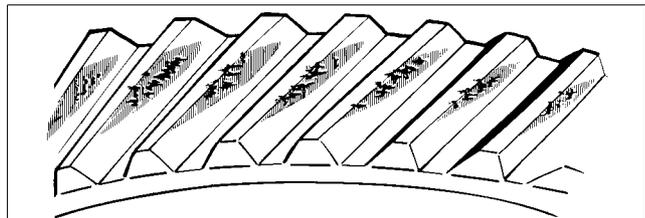
- the wear is uniform over the whole of the flank of a tooth
- and all teeth are worn in the same way.



Worn teeth

Spalling:

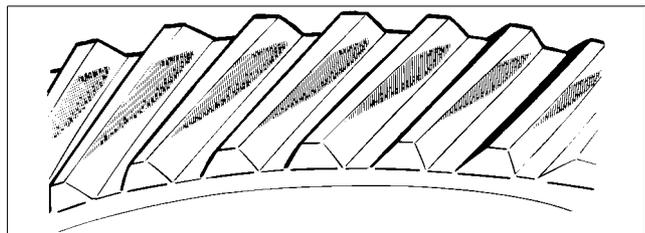
Small bits of the teeth have broken off, so-called spalling. This is generally caused by excessive load or improper lubrication. Damage of this type need not necessitate immediate replacement, but careful checking at short intervals is of imperative importance.



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 of imperative importance.

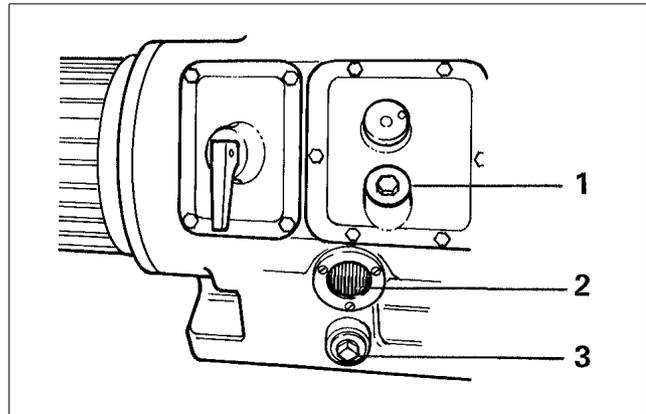


Pitting

5.7.2 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 5Lubricants" on page 200 must be well known.



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

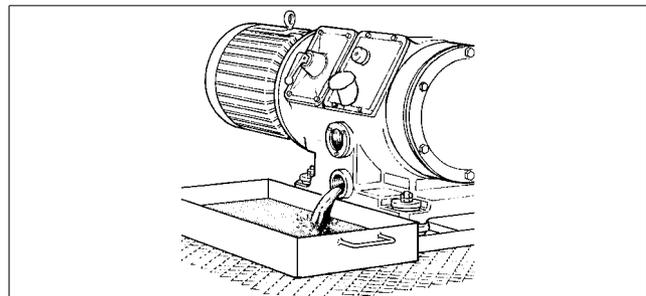
1. Place a collecting tray under the drain hole, remove the drain plug and drain off the oil.



CAUTION

Burn hazards

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



Burn hazards: The drained oil can be hot

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

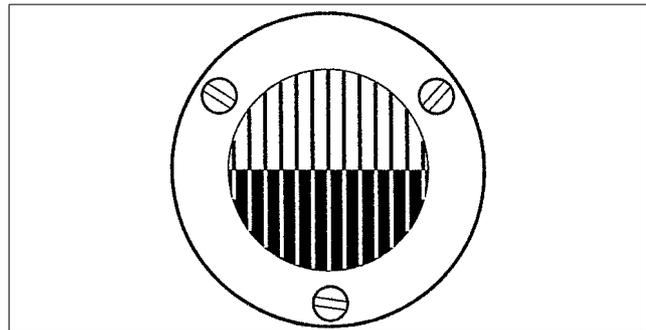
Oil volume: approx. **12 litres**.

Suitable oil brands can be found in "8.8.2 Recommended lubricating oils" on page 202.

NOTE

During operation the oil level must be slightly below the middle of the sight glass.

If the oil level is too high, the lifetime of the rolling bearings will be reduced due to high temperature.



The oil level must not be above the middle of the sight glass

5.8 Vibration

5.8.1 Vibration analysis

Excessive vibration or noise indicates that something is incorrect. Stop the separator and identify the cause.

Use vibration analysis instrument to periodically check and record the level of vibration. See the illustration where to take measurements.

NOTE

The level of vibration should not exceed **11,2 mm/s** at full speed.

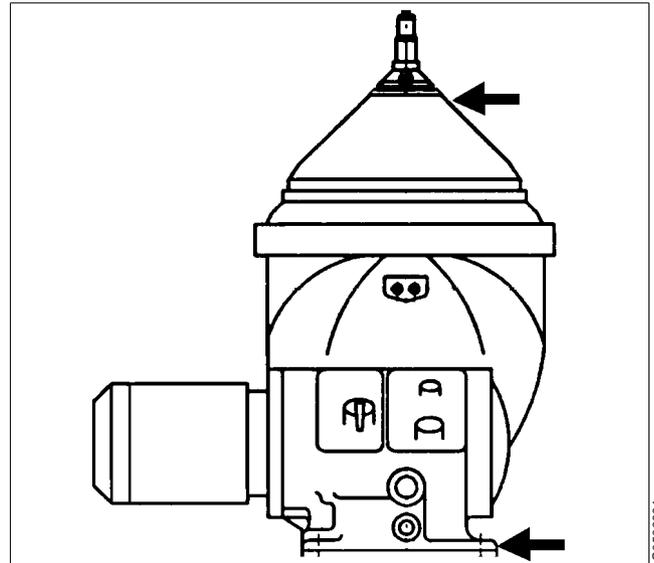


DANGER

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.



Measuring points for vibration analysis

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5.8.2 Vibration switch (option)

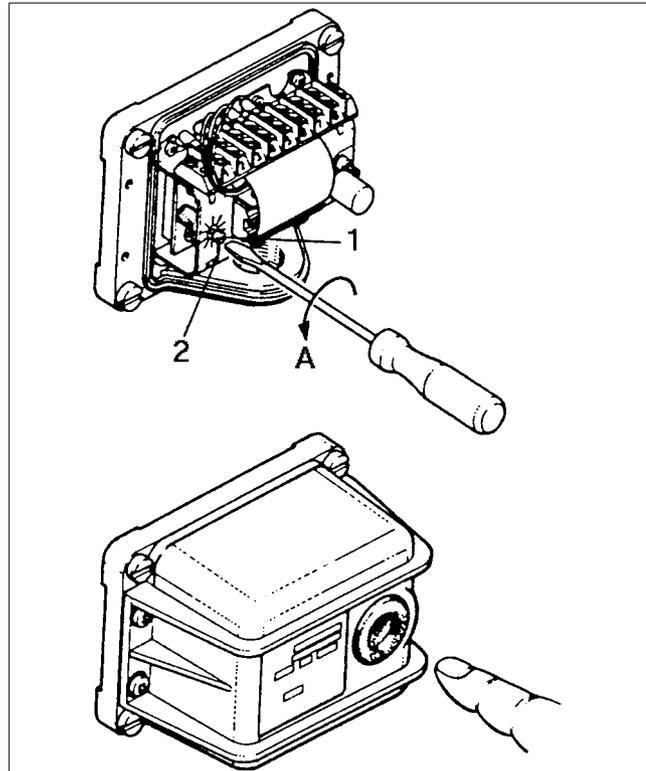
Adjustment of setpoint

The vibration switch is adjusted with the separator in operation. The cover must be removed to gain access to the setpoint adjusting screw (1).

1. Back-off the setpoint adjusting screw counter-clockwise (A) two or three turns. Press the reset button. If the armature does not remain in the reset position, turn the adjusting screw another turn or two until the armature stays in position when the reset button is pressed.
2. Now turn the adjusting screw slowly clockwise until the armature rocks. Mark this position with a line immediately in front-of the adjusting screw pointer (2).
3. Back-off the adjusting screw counter-clockwise a three-quarter turn. Press the reset button. If the armature now rocks, turn the adjusting screw counter-clockwise another quarter turn and so on until the armature remains in the reset position.
4. Refit the cap and fasten with the screws.

NOTE

Further adjustment may become necessary if alarm occurs due to vibration from surrounding equipment.



Setpoint adjustment

1. Adjusting screw
2. Pointer
- A. Direction of increased set point (admit higher vibration)

5.9 Common maintenance directions

5.9.1 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.

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.

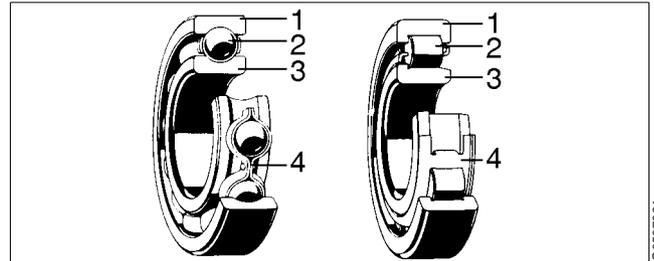
Dismantling

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.

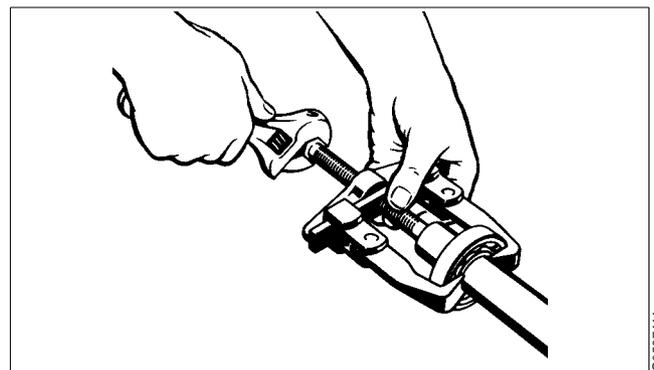
The puller should be accurately centered during dismantling; otherwise, it is easy to damage the seating.

NOTE

Do not hit with a hammer directly on the bearing.



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



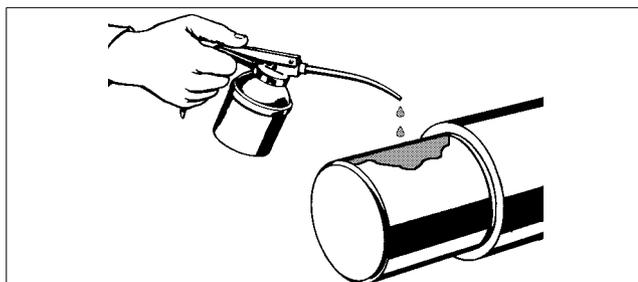
For bearings where no driving-off sleeve is included in the tool kit, use a puller when removing bearings

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.

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 oil the bearing seating on shaft (spindle) or alternatively in housing, with a thin oil.
- When assembling ball bearings, the bearings must be heated in oil to **max. 125 °C**.



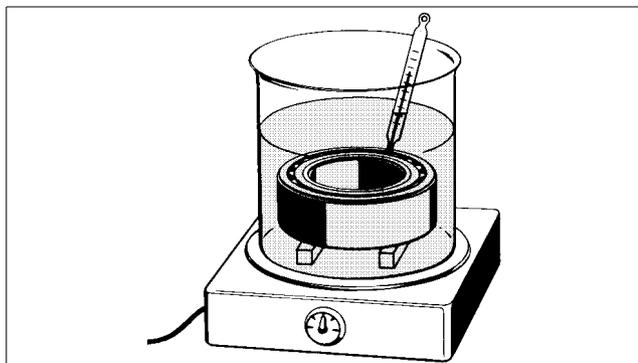
Clean and lightly oil the bearing seating before assembly

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.



The bearing must not be in direct contact with the container

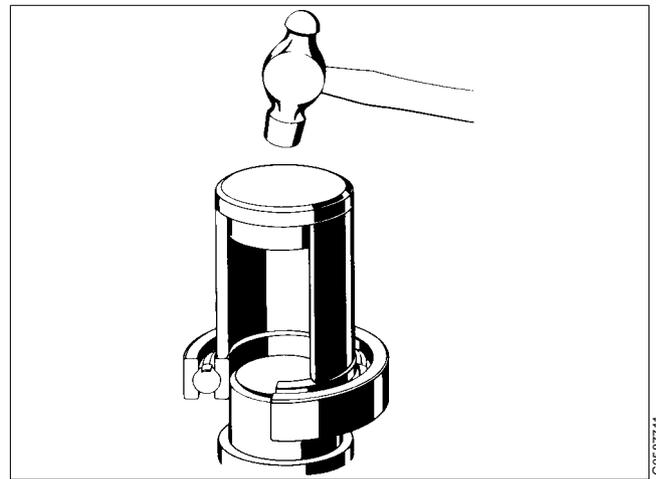


WARNING

Burn hazards

Use protective gloves when handling the heated bearings.

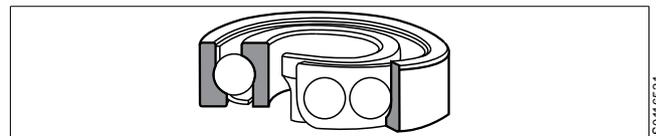
- There are several basic rules for assembling cylindrical bore bearings:
 - Never directly strike a bearing's rings, cage or rolling elements while assembling. A ring may crack or metal fragments break off.
 - Never apply pressure to one ring in order to assemble the other.
 - Use an ordinary hammer. 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

Angular contact ball bearings

Always fit single-row angular contact ball bearings with the wide shoulder of the inner race facing the axial load (upwards on a bowl spindle).



The wide shoulder of the inner race must face the axial load

5.9.2 Before shutdowns

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

- Remove the bowl, according to instructions in chapter “6 Dismantling/Assembly” on page 103.

NOTE

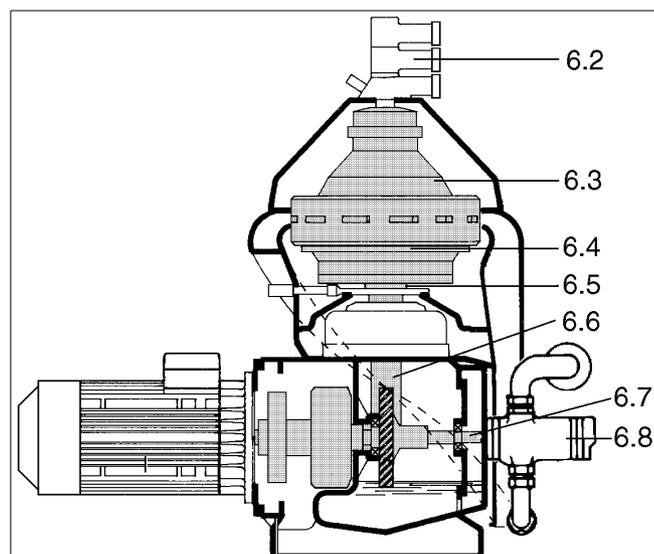
The bowl must not be left on the spindle during standstill for more than one week.

Vibration in foundations can be transmitted to the bowl and produce one-sided loading of the bearings. The resultant indentations in the ball bearing races can cause premature 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.
- 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. If the shut-down period has been longer than 12 months, a Major Service (MS) should be carried out.

6 Dismantling/Assembly

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6.1 Introduction

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 45.

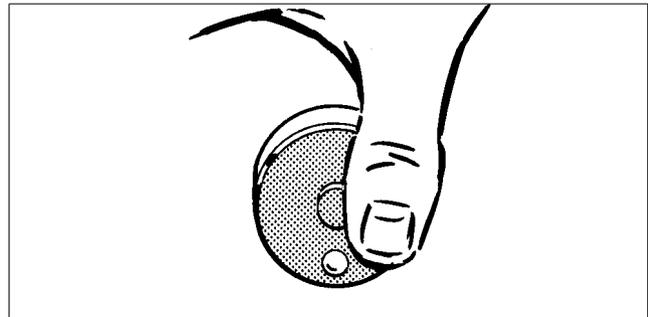


DANGER

Entrapment hazard

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

The frame hood and heavy bowl parts must be lifted by hoist. Position the hoist directly above the bowl centre. Use an endless sling and a lifting hook with catch.

These parts must be handled carefully.

Do not place parts directly on the floor, but on a clean rubber mat, fibreboard or a suitable pallet.

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 three 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

“5.3.5 Disc stack pressure” on page 61.

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 box 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.

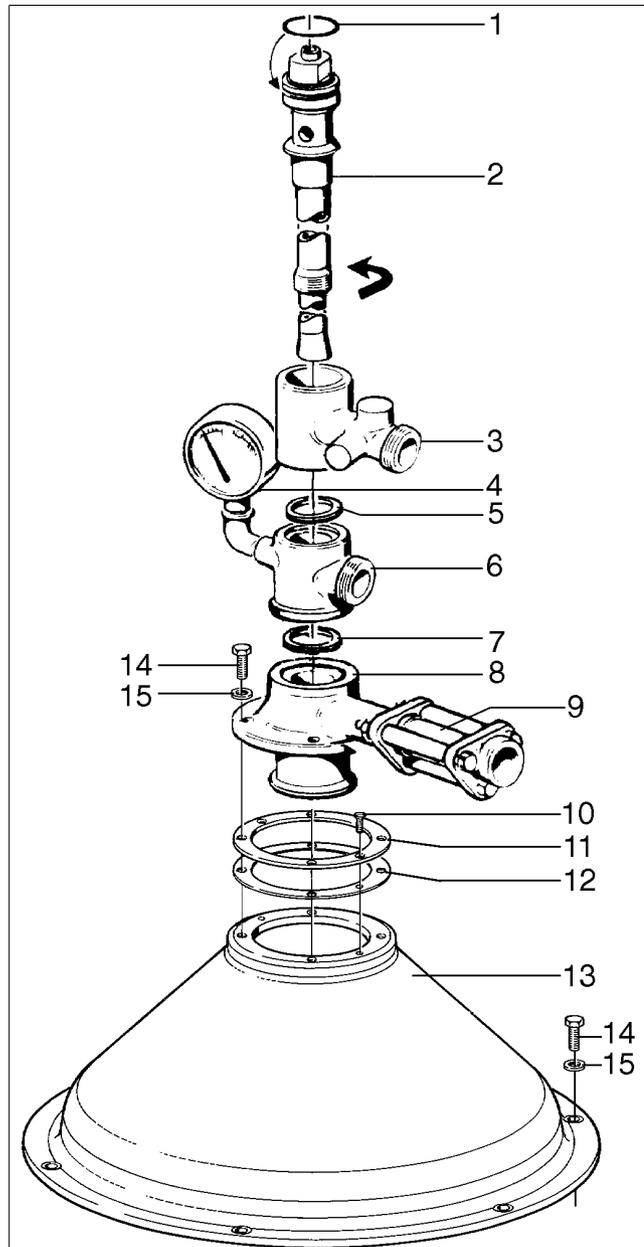
NOTE

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

6.2 Inlet/outlet, frame hood (IS)

6.2.1 Exploded view

1. O-ring
2. Inlet pipe
3. Support
4. Pressure gauge with ball valve
5. Rectangular ring
6. Support
7. Rectangular ring
8. Connecting housing
9. Sight glass
10. Screw
11. Protecting washer
12. Height adjusting ring(s)
13. Frame hood
14. Screw
15. Washer



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6.2.2 Dismantling



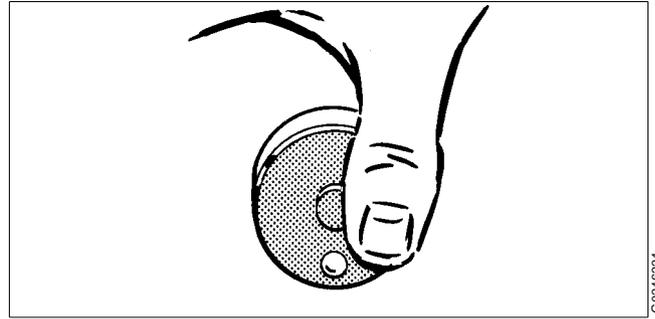
DANGER

Entrapment hazards

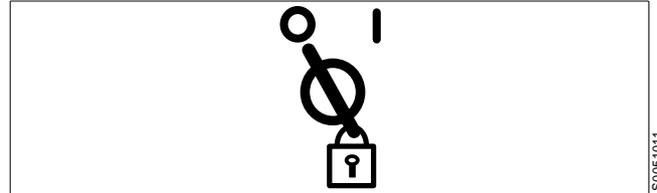
1. Make sure that rotating parts have come to a **complete standstill** before starting **any** dismantling work.

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.



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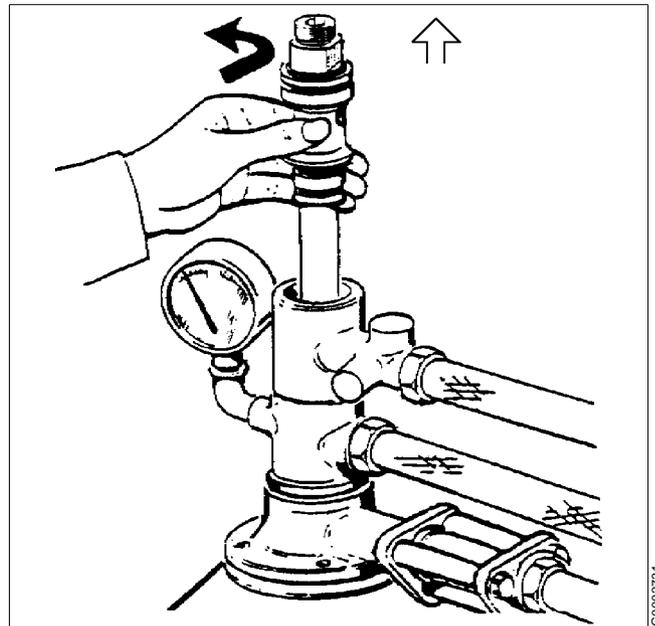
S0051011

The frame hood and the heavy bowl parts must be lifted by means of a hoist. Position the hoist exactly above the bowl centre. Use an endless sling and a lifting hook with catch.

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.

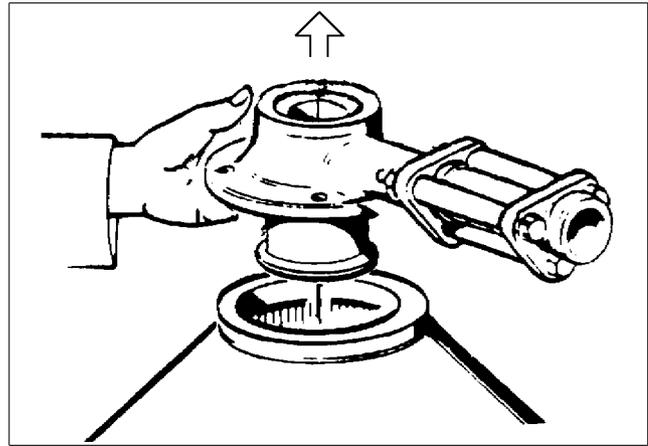
1. Disconnect and remove the hose for liquid seal/displacement water.
2. Unscrew the inlet pipe and lift out carefully.

Left-hand thread!



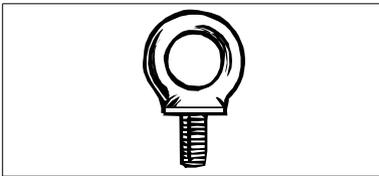
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3. Remove the inlet and outlet piping supports and the connecting housing. Take care of the rectangular rings.

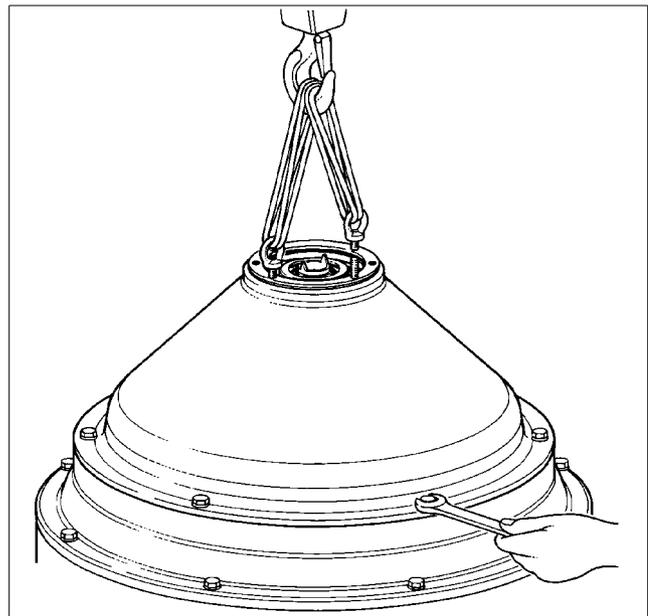


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4. Remove the six screws for the frame hood and lift it off by using the two lifting eyes.



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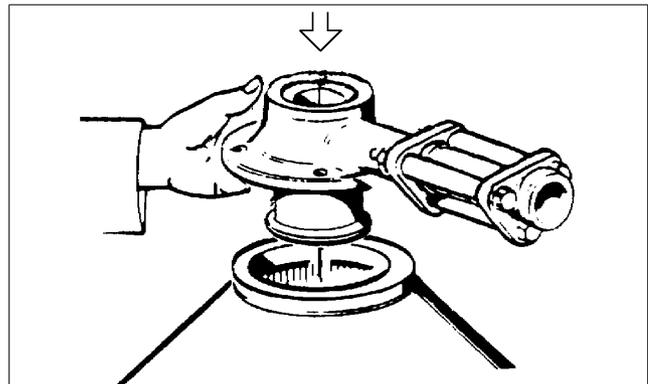
6.2.3 Assembly

1. Put the frame hood in place and tighten it with the six screws.

✓ Check point

“5.4.18 Oil paring disc; height position” on page 84 (only when Major Service).

2. Fit the connecting housing and the inlet and outlet piping supports. The rectangular rings situated in between should be lubricated.



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3. Lubricate the O-ring of the inlet pipe.
Fit the inlet pipe and tighten it firmly.

Left-hand thread!

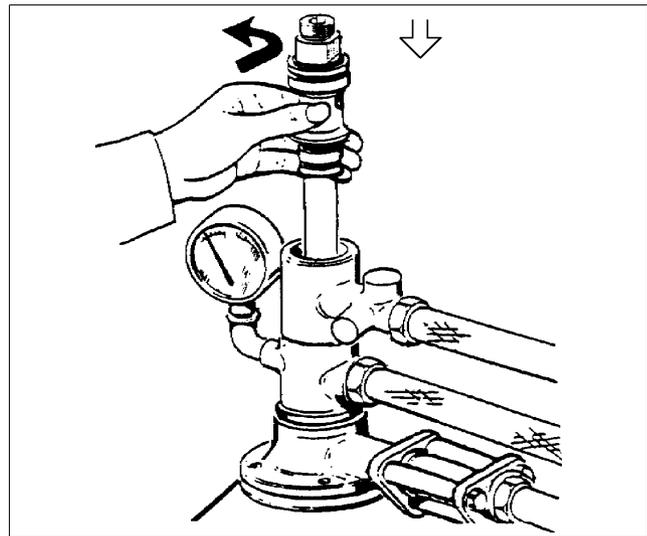
4. Connect the displacement/liquid seal water hose.



DANGER

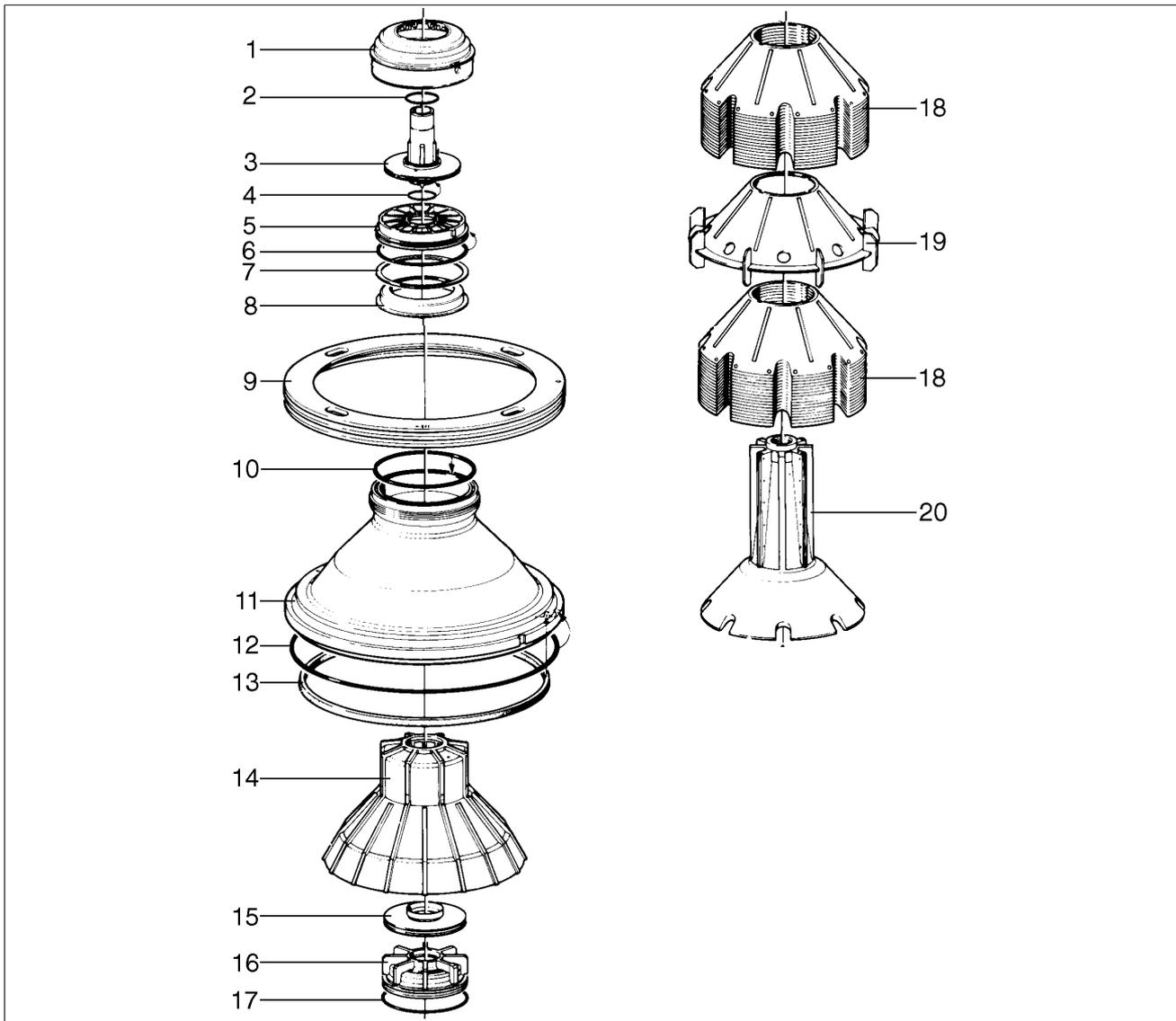
Disintegration hazards

When power cables have been connected, always check direction of rotation, see "4.1.3 Ready for start" on page 38. If incorrect, vital rotating parts could unscrew causing disintegration of the machine.



6.3 Bowl hood and disc stack (IS)

6.3.1 Exploded view



1. *Paring chamber cover (small lock ring)*
2. *O-ring*
3. *Upper (water) paring disc*
4. *O-ring*
5. *Sleeve with wings*
6. *O-ring*
7. *Gasket*
8. *Gravity/clarifier disc*
9. *Lock ring*
10. *O-ring*

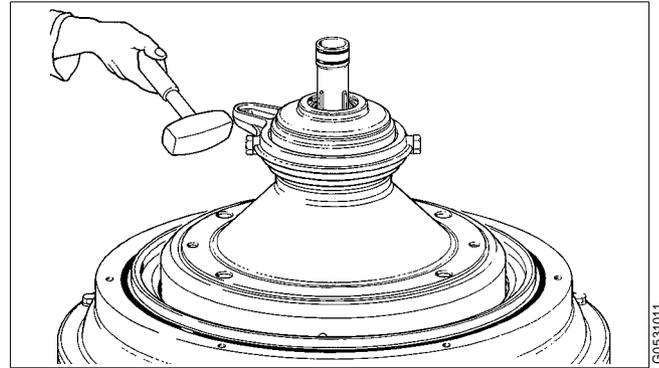
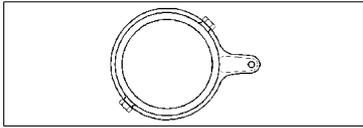
11. *Bowl hood*
12. *O-ring*
13. *Seal ring*
14. *Top disc*
15. *Oil paring disc*
16. *Level ring*
17. *O-ring*
18. *Bowl disc*
19. *Wing insert*
20. *Distributor*

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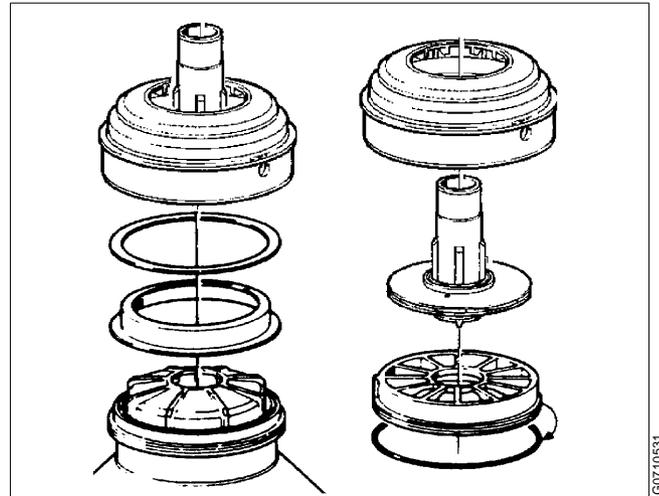
6.3.2 Dismantling

1. Unscrew the paring chamber cover using the spanner.

Left-hand thread!



2. Remove the paring chamber cover, gasket and gravity/clarifier disc. Force out the sleeve with wings and the upper paring disc from the cover.



3. Apply the brake and unscrew the lock ring as described below.

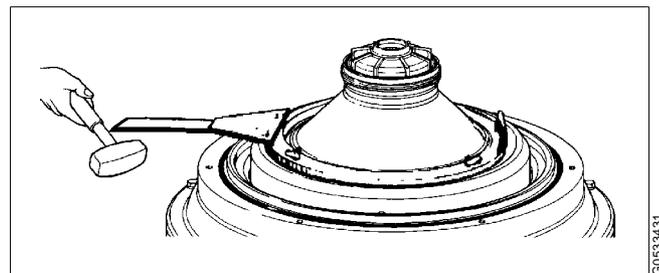
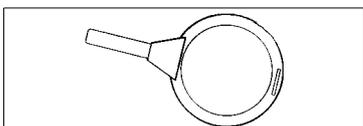
NOTE

Use an Alfa Laval compressing tool (optional) to reduce shocks to bearings and thread wear minimized when unscrewing the large lock ring.

Unscrewing lock ring without using a compressing tool

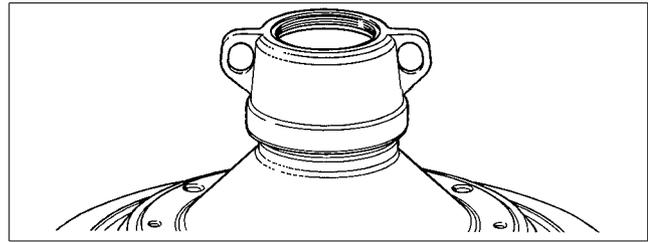
- a. Unscrew the lock ring using the spanner.

Left-hand thread!



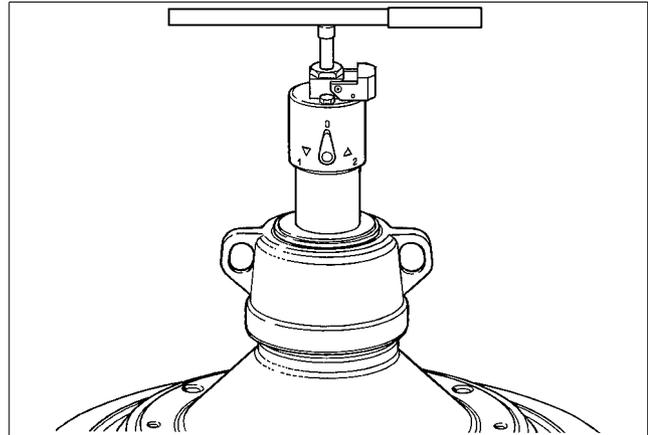
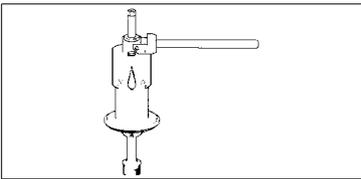
Unscrewing lock ring with a compressing tool

- a. Fit the lifting tool on the bowl hood.



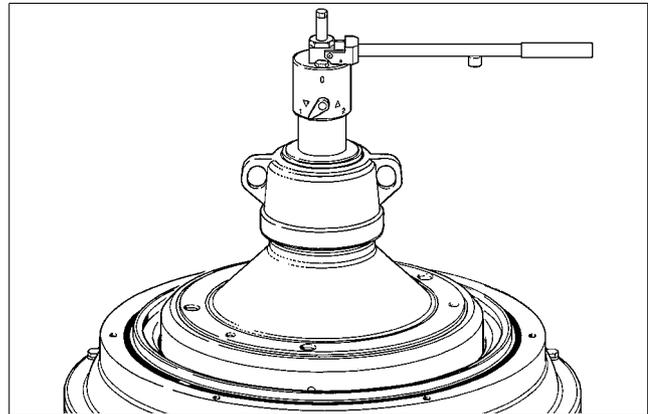
- b. Fit the compressing tool by screwing the pillar of the tool into the threads of the distributor using the lever.

The switch on the compressing tool should be in position 0.



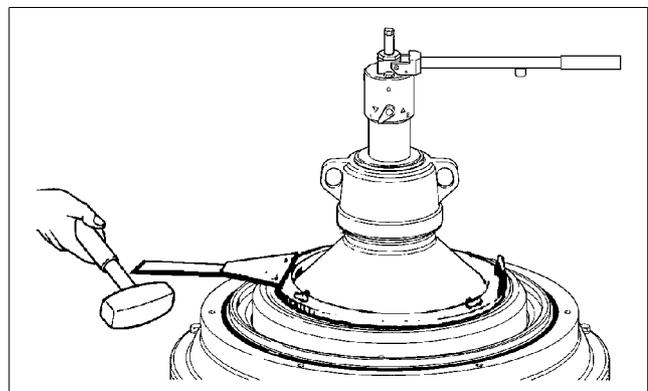
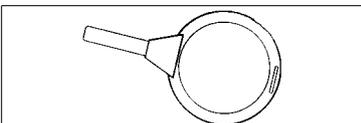
- c. Turn the switch to position 1 for compression.

Compress the disc stack by pumping the lever until the oil pressure is released through the relief valve.

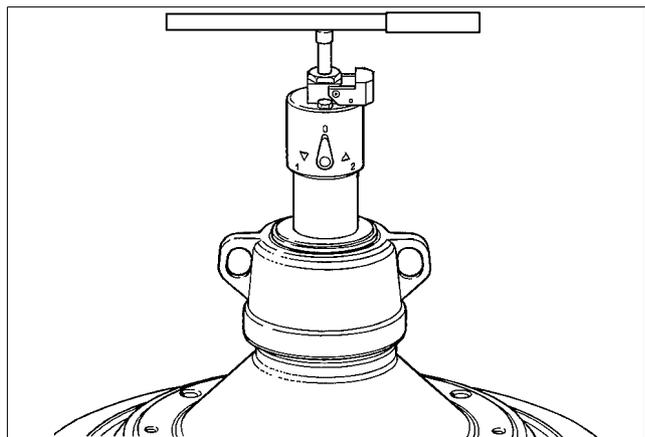


- d. Unscrew the large lock ring using the spanner.

Left-hand thread!



- e. Release the pressure in the compressing tool and remove it from the lifting tool.



- 4. Remove the lock ring.

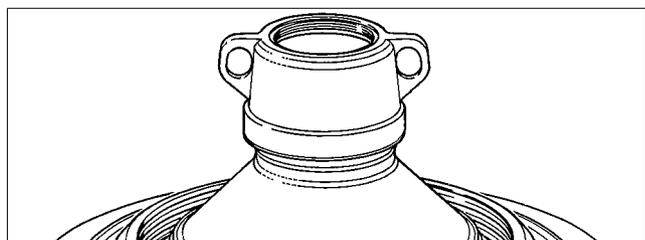
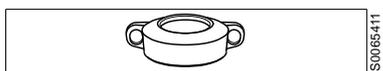
NOTE

The lock ring must be kept lying horizontally or it may become distorted. Even slightest distortion could make it impossible to refit.

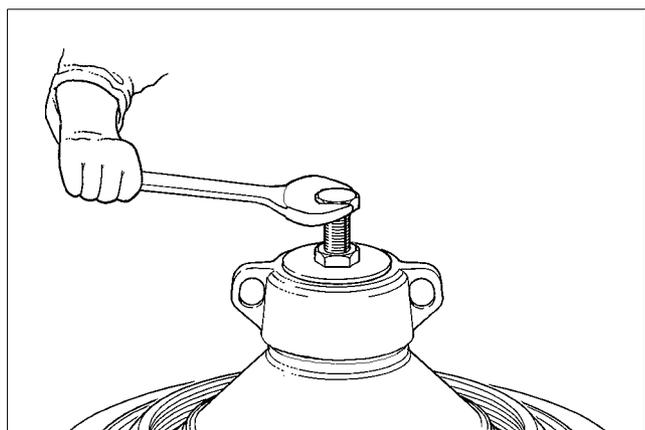
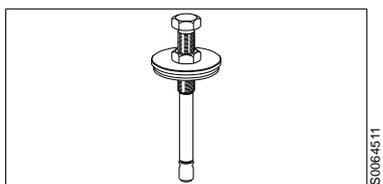
- 5. Separate the bowl hood from the bowl body as described below before lifting off the bowl hood.

Separating bowl hood without using a compressing tool

- a. Fit the lifting tool on the bowl hood.



- b. Screw the spindle plate into the lifting tool. Unscrew the spindle a few turns if the plate is not in contact with the lifting tool.



- c. Screw home the spindle until the bowl hood loosens from the bowl body.
- d. Remove the spindle plate from the lifting tool.

Separating bowl hood with a compressing tool

- a. Remove the lifting tool from the bowl hood.
- b. Fit the compressing tool by screwing the pole of the tool into the threads of the distributor using the lever.

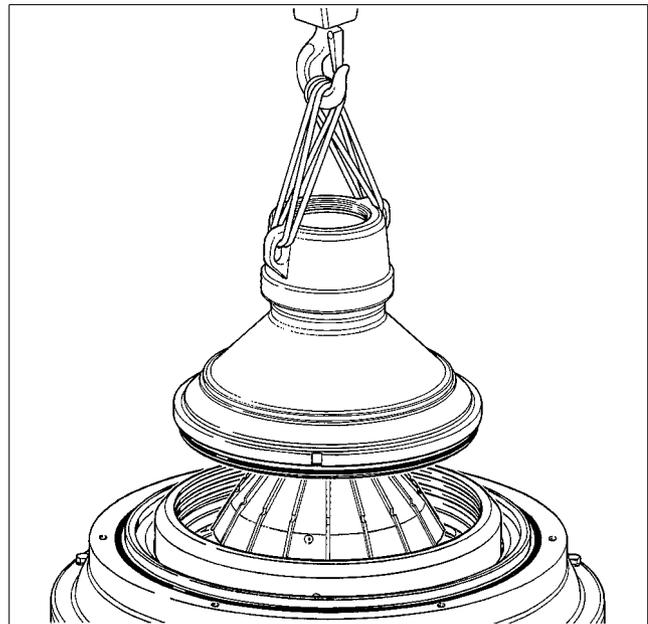
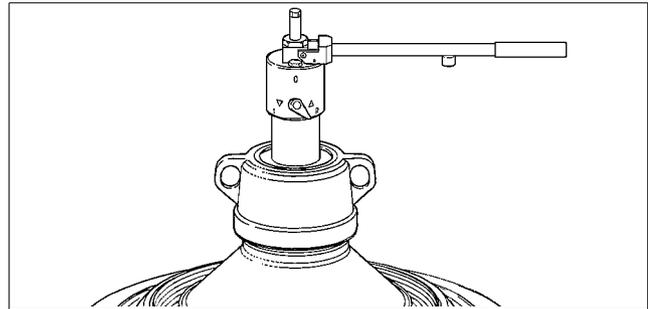
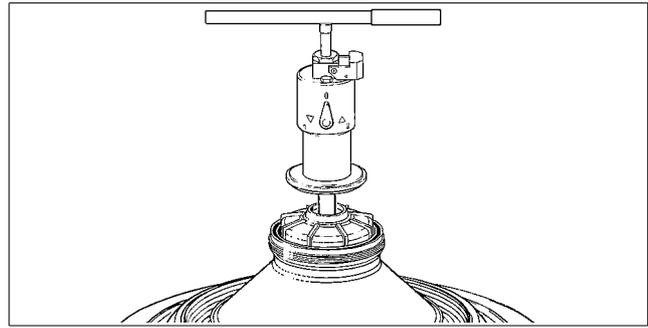
The switch on the compressing tool should be in position 0.

- c. Fit the lifting tool on the bowl hood.
- d. Turn the switch to position 2 for expansion.

Separate the bowl hood from the bowl body by pumping the lever.

- e. Remove the lifting tool and the compressing tool. Then refit the lifting tool.

6. Lift off the bowl hood using a hoist. Be careful not to scratch the bowl hood seal ring.

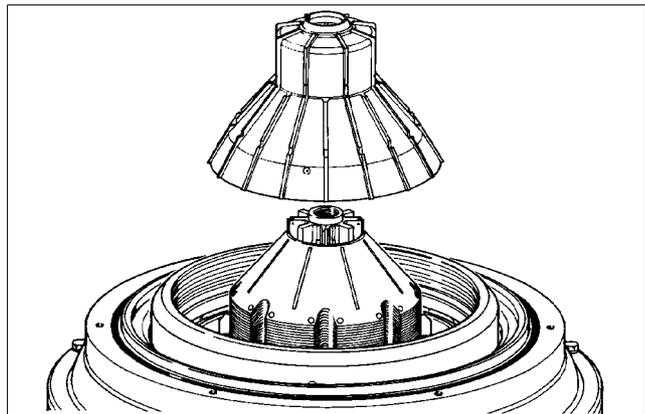


CAUTION

Crush hazards

If the top disc is stuck into the bowl hood, remove it now before it accidentally falls out.

7. Remove the top disc.

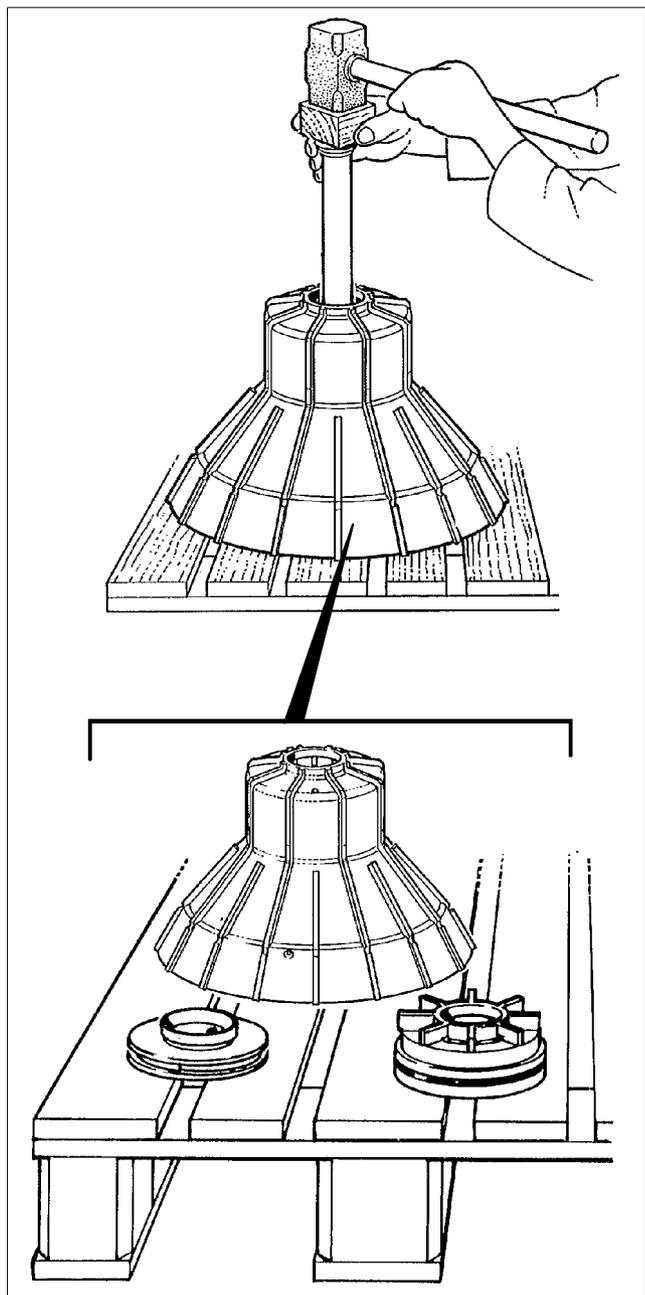


G0537711

8. Screw the inlet pipe into the paring disc located above the level ring inside the top disc.

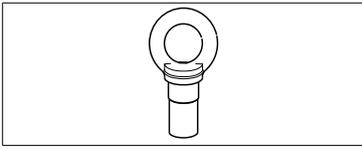
Left-hand thread!

Place the top disc onto wooden blocks to act as protection for the top disc edge and for falling level ring. Place a piece of wood between the tin hammer and the inlet pipe and then force out the level ring and the paring disc carefully from the top disc.

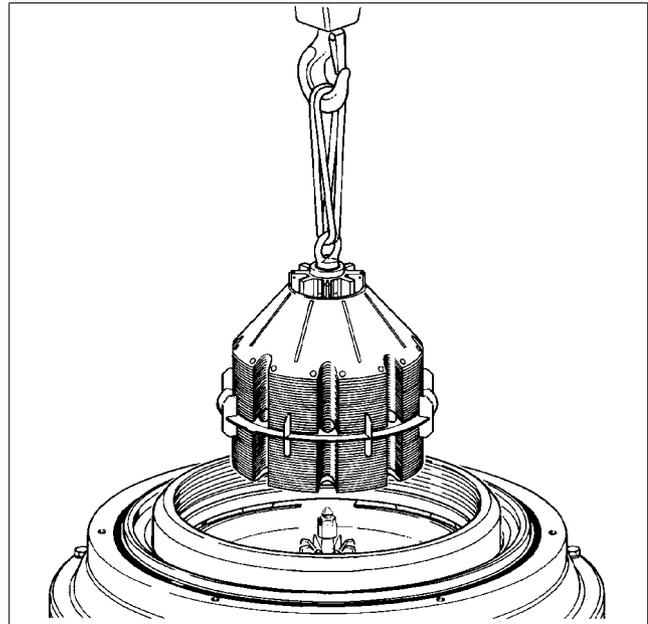


G0689611

9. Fit the lifting tool into the distributor and lift the distributor with disc stack out of the bowl body using a hoist.



10. Remove deposits and clean all parts thoroughly in a suitable cleaning agent. See chapter "5.6 Cleaning" on page 89.



6.3.3 Assembly

✓ Check point

“5.3.3 Corrosion” on page 57,
“5.3.4 Cracks” on page 60,
“5.3.6 Erosion” on page 63,
“5.3.10 Lock ring; wear and damage” on page 68.

1. Assemble the discs one by one on the distributor. The distributor has one guide rib for the correct positioning of the discs.



CAUTION

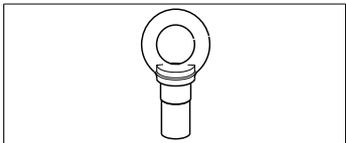
Cut hazard

Sharp edges on the separator discs may cause cuts.

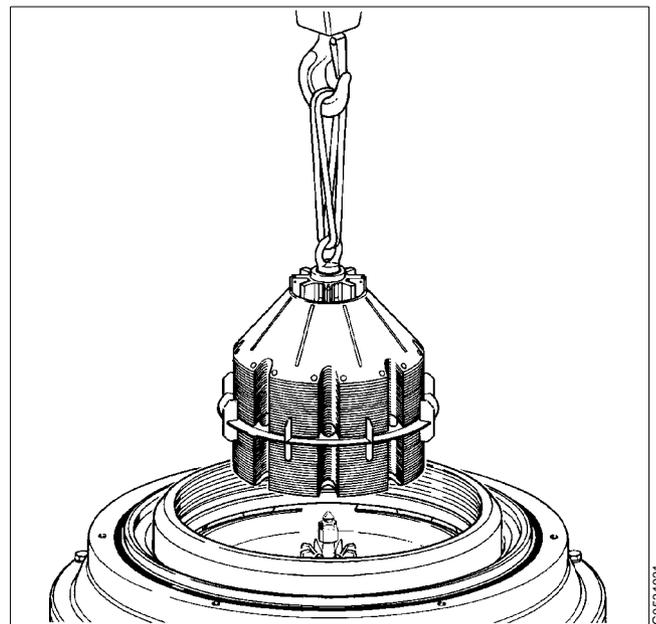
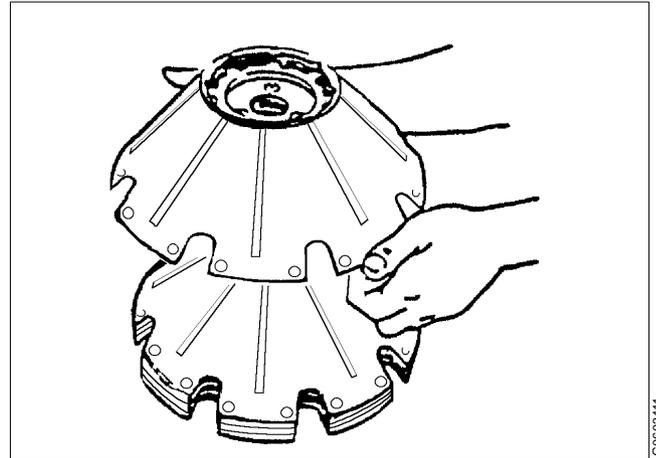
For correct number of discs above and below the wing insert when the machine was new, see the *Spare Parts Catalogue*.

The number of bowl discs above the wing insert may be increased to adjust the disc stack pressure.

2. Fit the lifting tool to the distributor and lift the distributor with disc stack into the sliding bowl bottom using a hoist.



Check that the guide pins in the distributing cone fit into the recesses on the underside of the distributor.

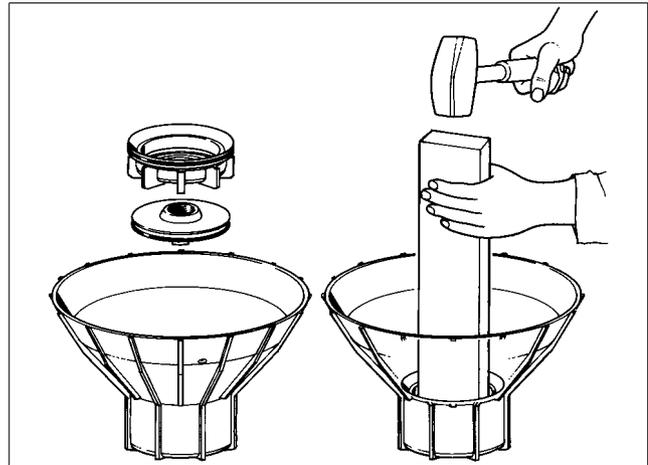


✓ **Check point**

“5.3.9 Level ring” on page 67.

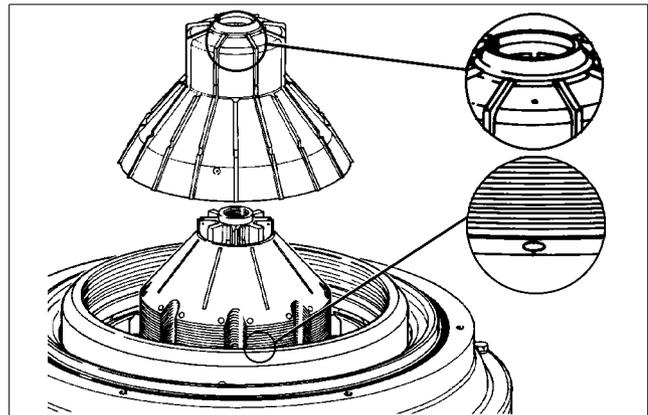
3. Fit the oil paring disc and level ring with the O-ring into the top disc.

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



G0532111

4. Fit the top disc onto the distributor. The drilled assembly mark on the top disc must face the guide lug on the bowl body.



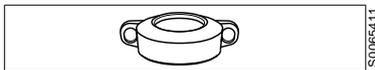
G0531721

✓ **Check point**

“5.3.1 Bowl hood seal ring” on page 56.

5. Fit the lifting tool to the bowl hood and lift it using a hoist. Check that the O-ring and the seal ring of the bowl hood are properly fitted and lubricated.

Lower the bowl hood straight down onto the disc stack, otherwise it may get stuck. Be careful not to scratch the bowl hood seal ring.



S0065411

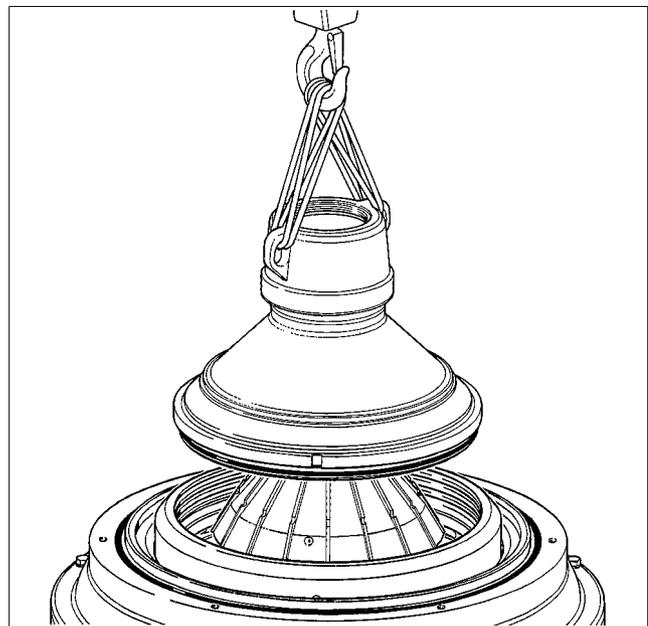
In set of tools **without** compressing tool.



S0067611

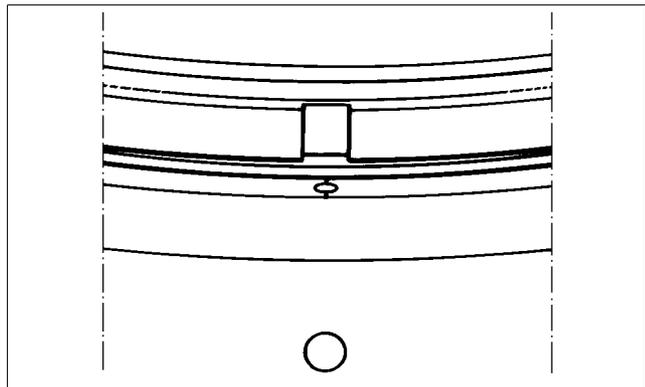
In set of tools **with** compressing tool.

For correct position of bowl hood, see next illustration.



G0539911

6. Check that the guide recess on the bowl hood enters the guide lug in the bowl body.



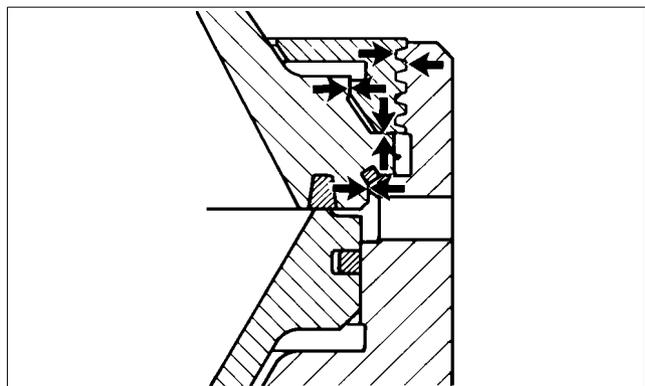
G0535621

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

✓ **Check point**

“5.4.16 Lock ring; priming” on page 82 (only when Major Service).

9. Tighten the lock ring.



G0581211

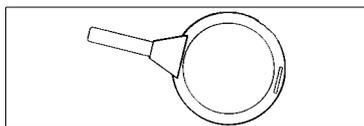
NOTE

Use an Alfa Laval compressing tool (optional) to reduce shocks to bearings and thread wear minimized when tightening the large lock ring

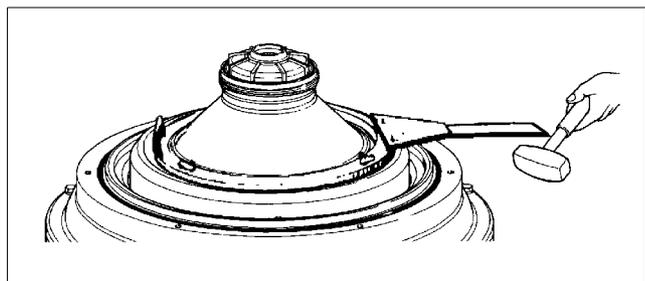
Tightening of lock ring without using a compressing tool

- a. Tighten the lock ring using the spanner for lock ring.

Left-hand thread!



S0066911



G0533441

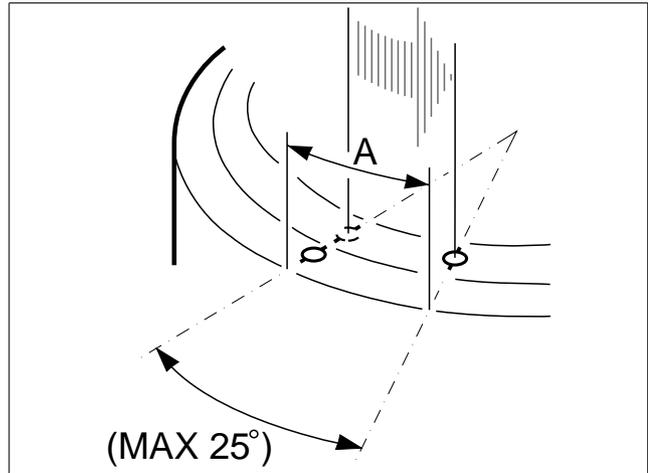
- b. Tighten until the assembly marks are at least in line.

✓ **Check point**

“5.3.5 Disc stack pressure” on page 61.

NOTE

The assembly marks must never pass each other more than 25° which corresponds to $A=100$ mm.



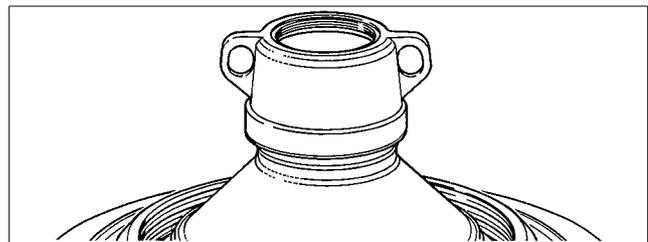
G0578131

Tightening of lock ring using a compressing tool

- a. Fit the lifting tool onto the bowl hood.



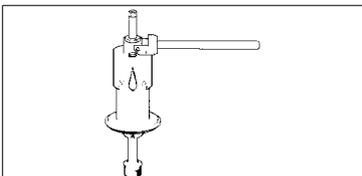
S10067611



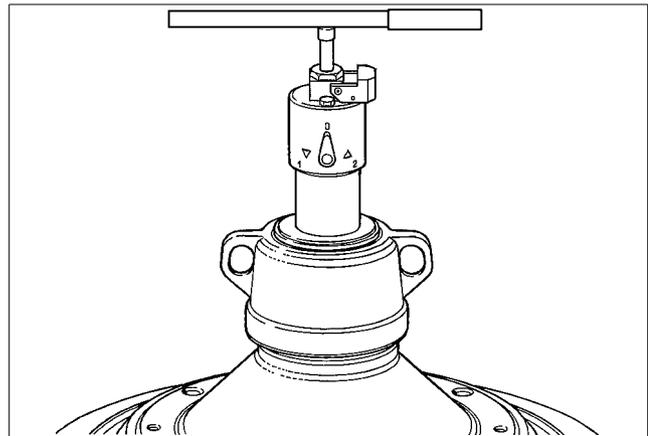
G0631211

- b. Fit the compressing tool by screwing the pole of the tool into the threads of the distributor by the lever arm.

The switch on the compressing tool, should be in position 0.



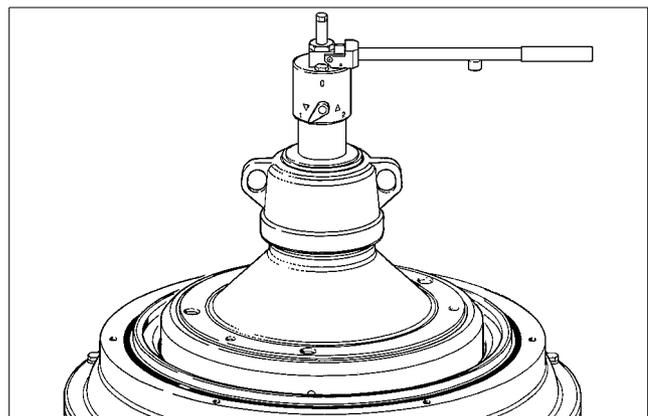
S10067811



G0631311

- c. Turn the switch to position 1 for compression.

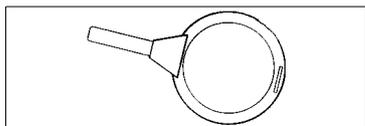
Compress the disc stack by pumping with the lever arm until the oil pressure is released through the relief valve.



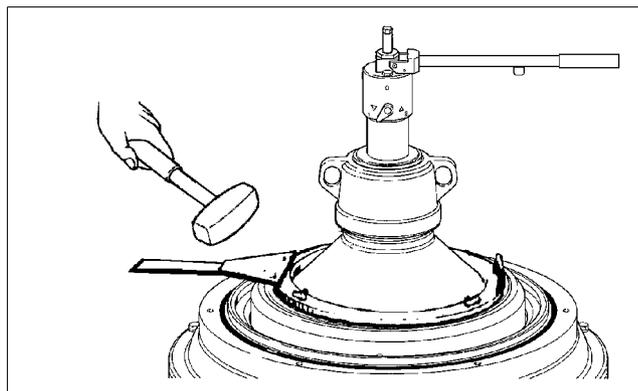
G0533621

- d. Tighten the lock ring using the spanner for lock ring.

Left-hand thread!



S0066911



G0531431

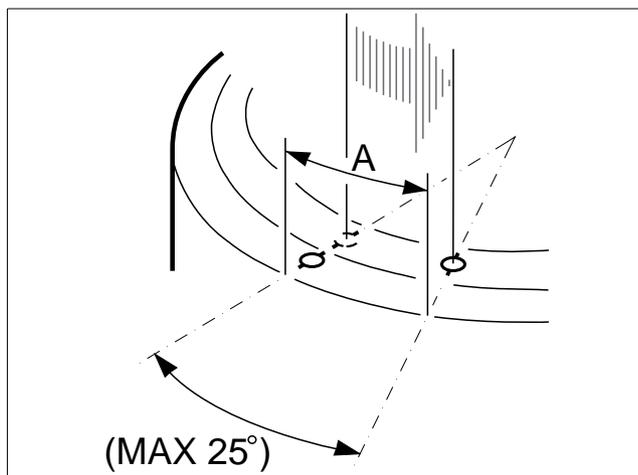
- e. Tighten until the assembly marks are in line.

✓ **Check point**

“5.3.5 Disc stack pressure” on page 61.

NOTE

The assembly marks must never pass each other more than 25° which corresponds to **A=100 mm**.



G0578131

- f. Release the pressure in the compressing tool by turning the switch to position 0 and then remove the compressing and lifting tools.

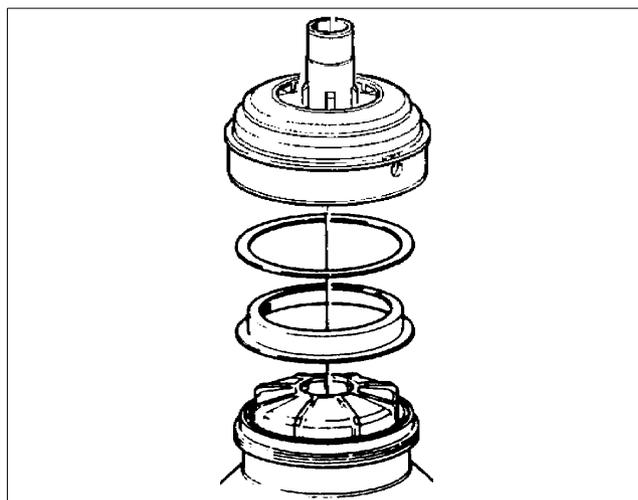
10. Fit the gravity/clarifier disc and gasket.

If the gravity disc has two drilled holes, check that they are free from dirt.

11. Fit the upper (water) paring disc and the sleeve with wings in the paring chamber cover.

✓ **Check point**

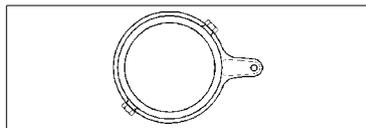
“5.3.8 Inlet pipe and oil paring disc” on page 67.



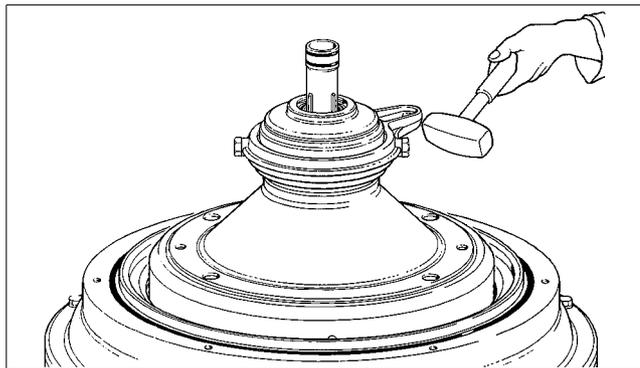
G0710541

12. Fit and tighten the paring chamber cover using the spanner.

Left-hand thread!



SD064711

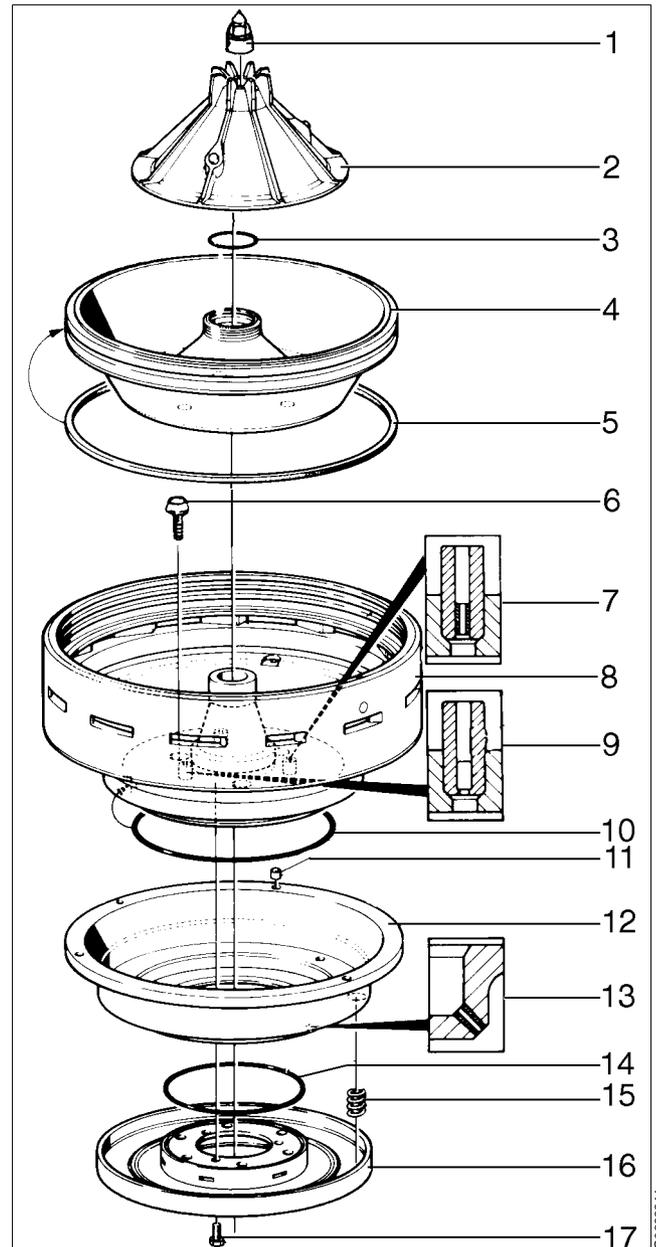


G0531021

6.4 Bowl body and operating mechanism (IS)

6.4.1 Exploded view

1. Cap nut
2. Distributing cone
3. O-ring
4. Sliding bowl bottom
5. Rectangular ring
6. Screw
7. Nozzle, 2,5 mm
8. Bowl body
9. Plug
10. O-ring
11. Valve plug
12. Operating slide
13. Nozzle, 1,1 mm
14. O-ring
15. Spring
16. Spring holder
17. Screw

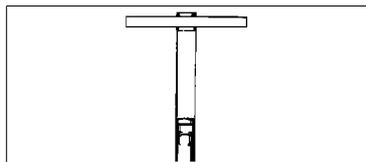


G0692211

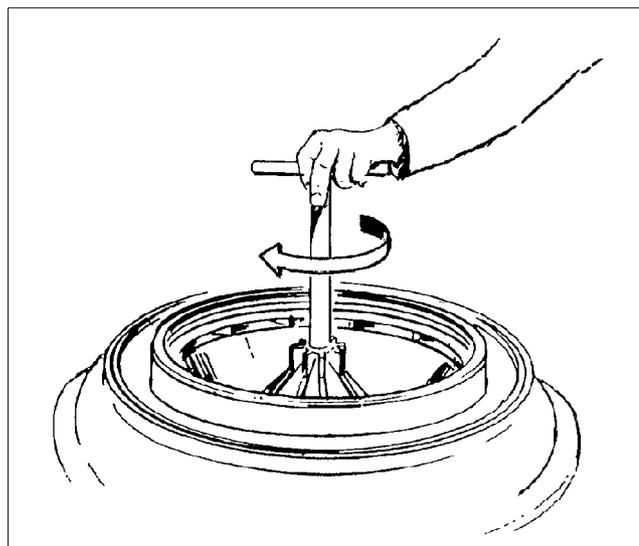
6.4.2 Dismantling

1. Unscrew and remove the cap nut.

Left-hand thread!

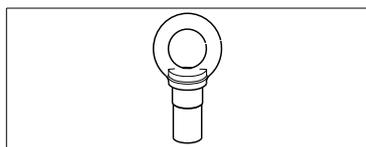


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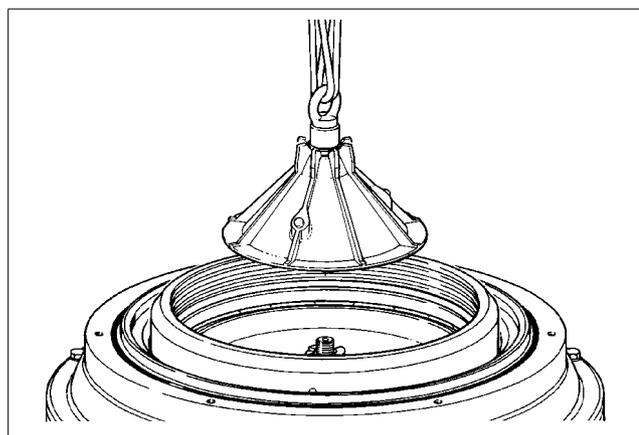


G0669711

2. Fit the lifting tool into the distributing cone and lift it out.

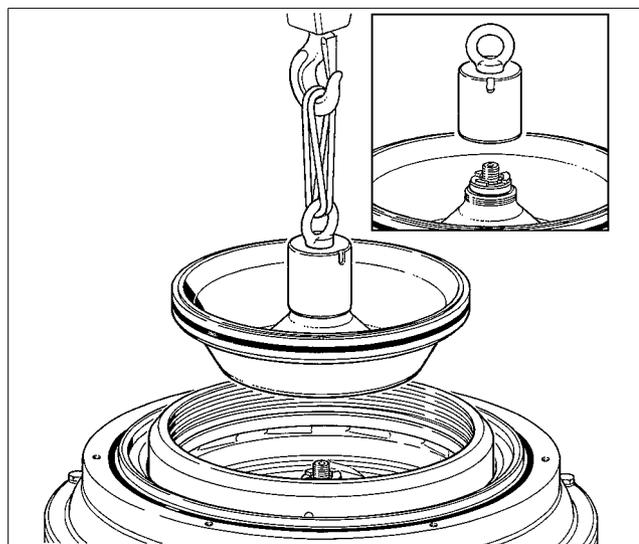


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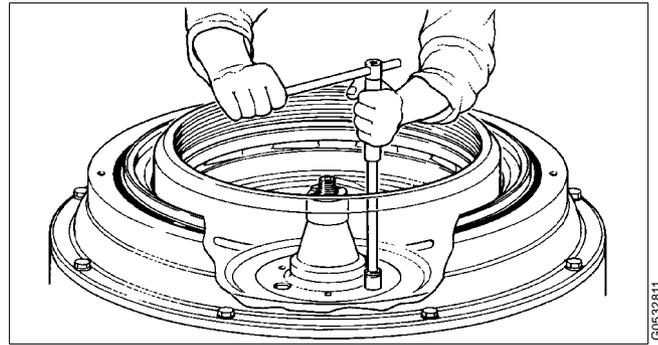
G0532721

3. Fit the lifting tool onto the sliding bowl bottom and lift it out by a hoist.

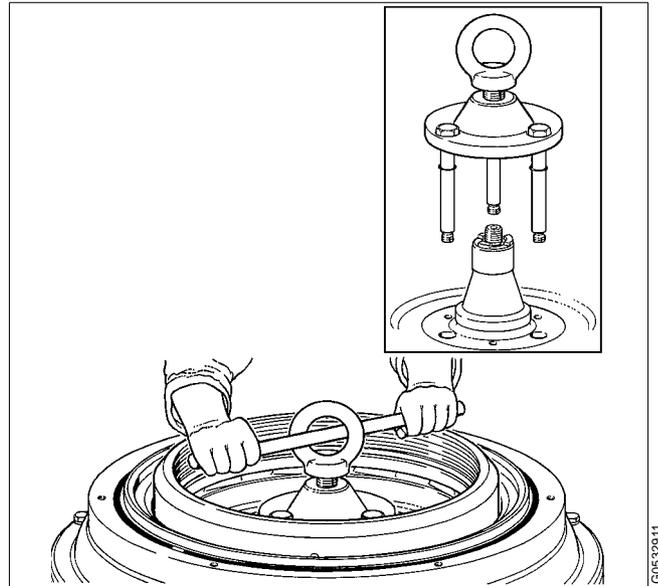


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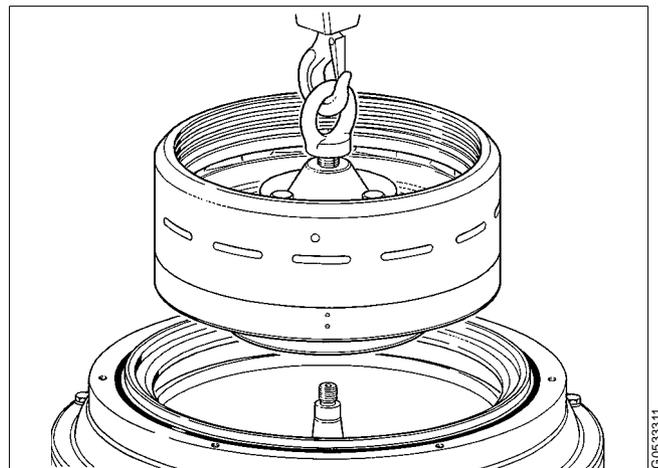
4. Unscrew the three screws in the bottom of the bowl body.



5. Fit the lifting tool into the bowl body bottom with the three screws.
6. Release the bowl body from the spindle by using the lifting tool as a puller. Turn the handle at top of the lifting tool until the bowl body comes loose from the spindle taper. Turn the handle two more turns in order to avoid damaging the paring disc device.



7. Lift out the bowl body using a hoist.



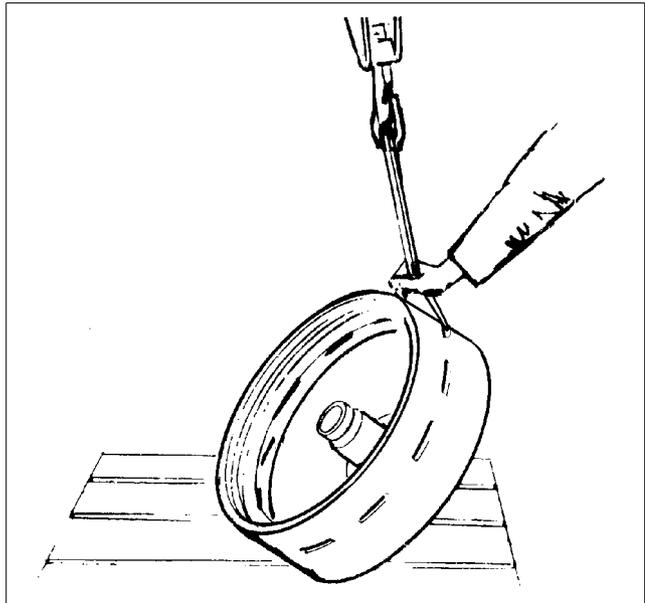
8. Thread a strap through two sludge ports and turn the bowl body upside down using a hoist.



WARNING

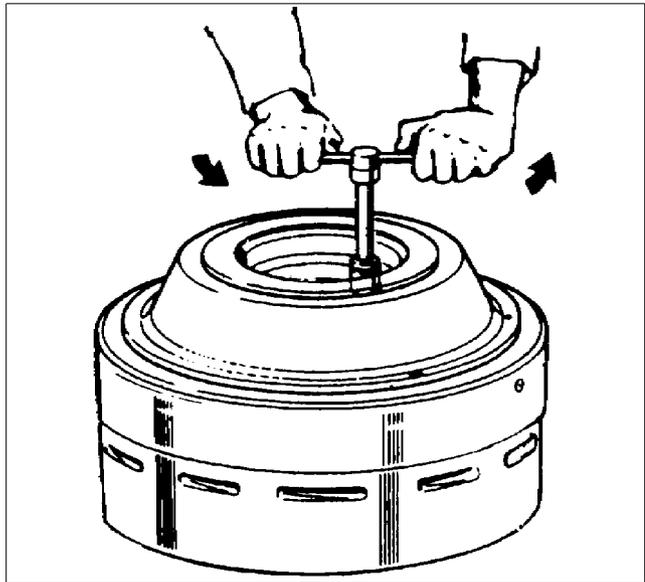
Crush hazards

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



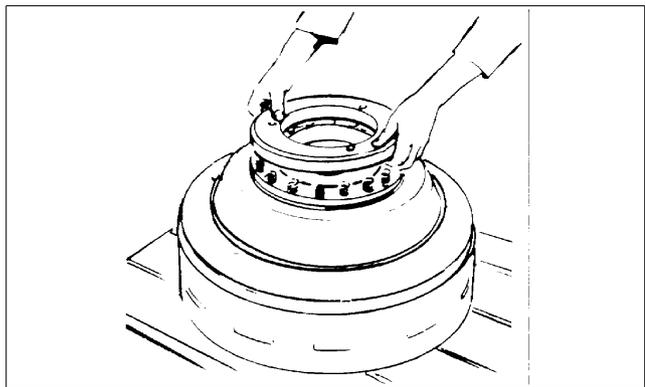
G0615621

9. Loosen the screws for the spring holder successively a little at a time. Remove the screws.



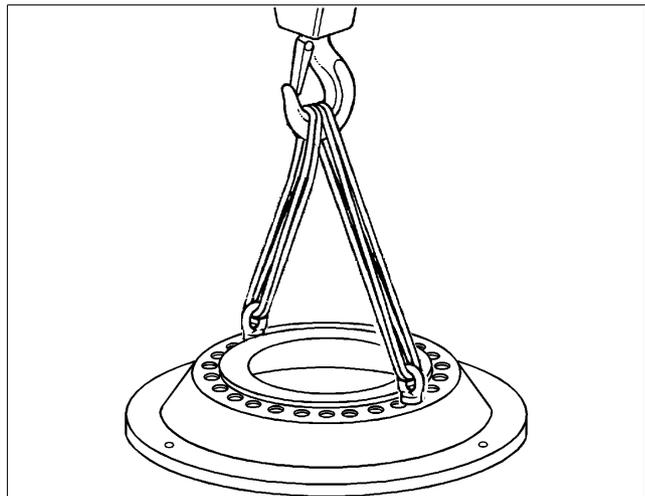
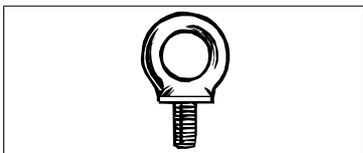
G0689011

10. Remove the spring holder and the springs.

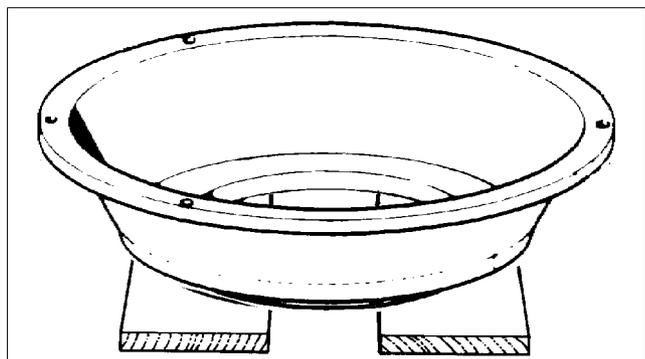


G0004451

- Fit two lifting eyes ($\frac{1}{2}$ "-13 UNC) into the operating slide and lift it off from the bowl body.



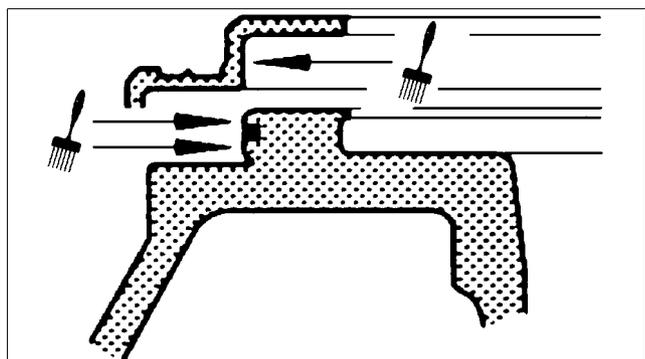
- Place the operating slide with the valve plugs facing upwards
- Remove any thick deposits in the frame hood and clean all other parts thoroughly in a suitable cleaning agent. See chapter "5.6 Cleaning" on page 89.



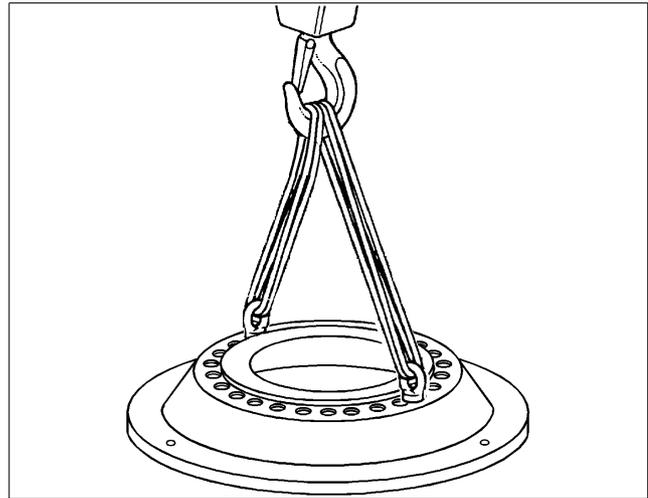
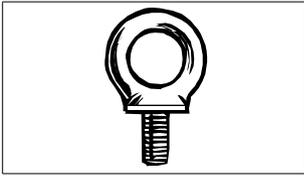
6.4.3 Assembly

✓ Check point

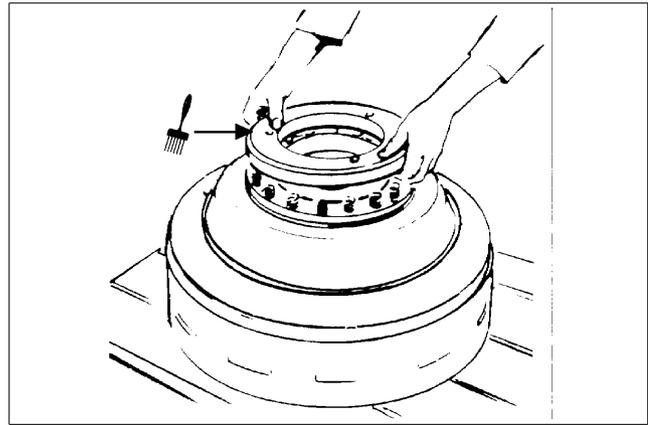
- "5.3.3 Corrosion" on page 57,
 - "5.3.4 Cracks" on page 60,
 - "5.3.6 Erosion" on page 63,
 - "5.3.7 Guide surfaces" on page 65,
 - "5.3.11 Operating mechanism" on page 70,
 - "5.3.12 Operating slide" on page 70,
 - "5.3.13 Sliding bowl bottom" on page 71,
 - "5.3.14 Springs for operating mechanism" on page 72.
- Lubricate the guide surfaces of the bowl body and operating slide with lubricating paste. See chapter "8.8 5Lubricants" on page 200.



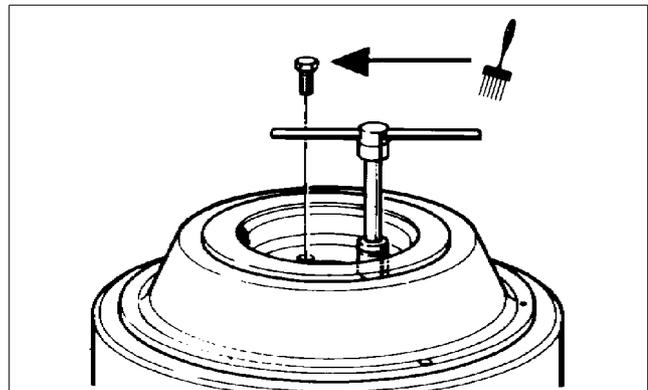
- Fit the operating slide onto the bowl body.
Check that the guide pin in the bowl body enters the hole in the operating slide.



- Lubricate the guide surfaces and O-ring of the spring holder. See chapter "8.8 5Lubricants" on page 200.
Fit the springs and support.

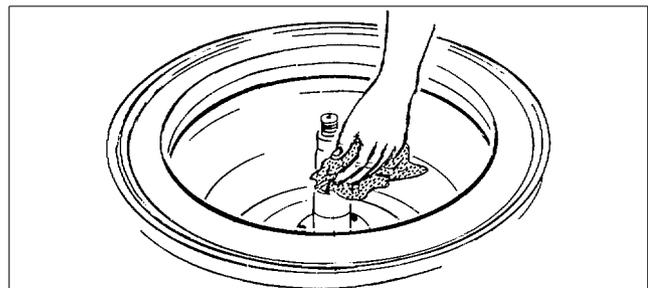


- Lubricate and then tighten the three screws for the spring holder successively by hand a little at a time.



- Wipe off the spindle top and nave bore in the bowl body. Lubricate the tapered end of the spindle and wipe it off with a clean cloth.

- ✓ **Check point**
"5.3.2 Bowl spindle cone and bowl body nave" on page 57.



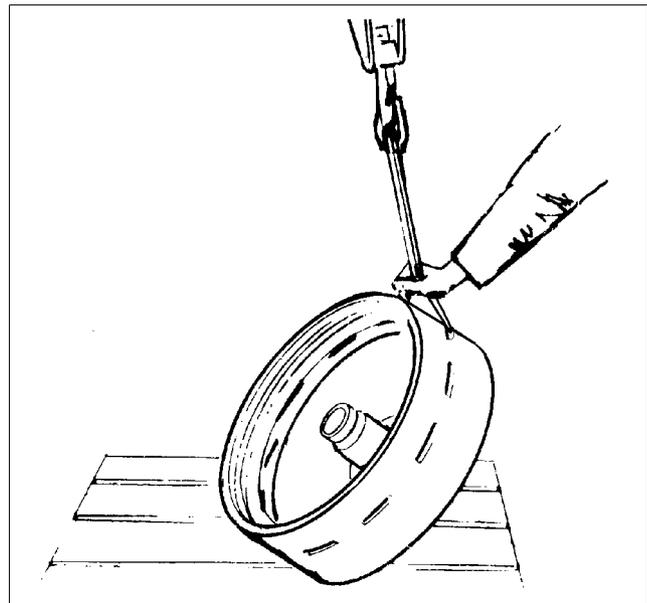
- Turn the bowl body using a hoist to its upright position with a strap threaded through two sludge ports.



WARNING

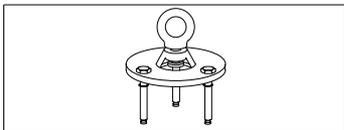
Crush hazards

Support bowl body when turning to prevent it from rolling.

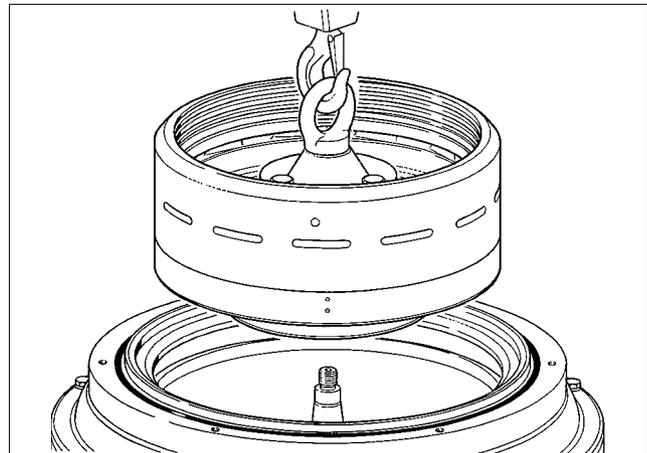


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- Fit the lifting tool into the bowl body bottom with the three screws.
Turn the handle at the top of the lifting tool so that the central screw is home.

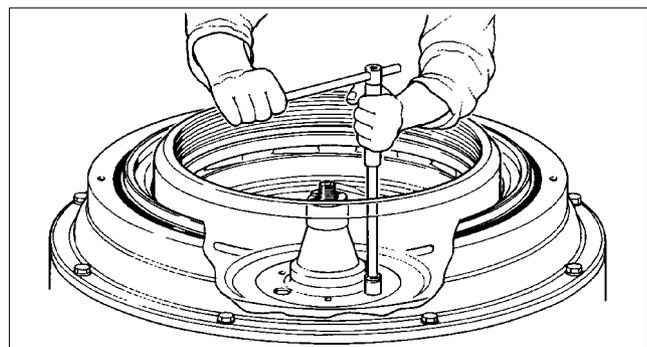


S0064611



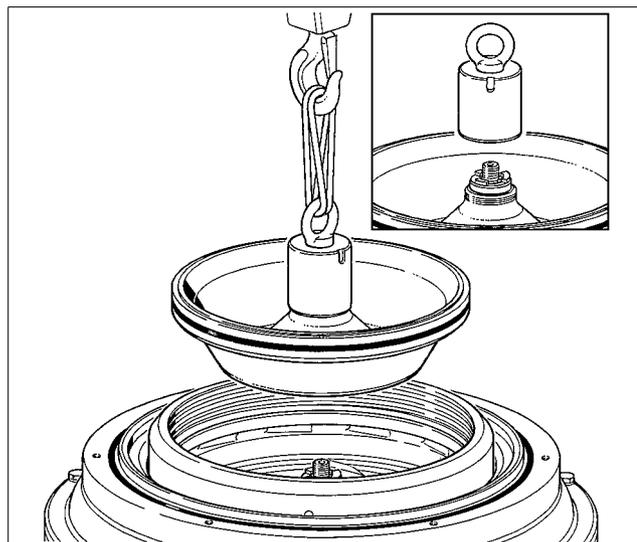
G053341

- Lower the bowl body using a hoist until the central screw rests on the spindle top. Then screw up the central screw so that the bowl body sinks down onto the spindle.
Remove the tool.
- Rotate the bowl body and align it so that the three screw holes in the bowl body bottom are exactly above the three holes in the distributing ring.
Tighten the three screws firmly.



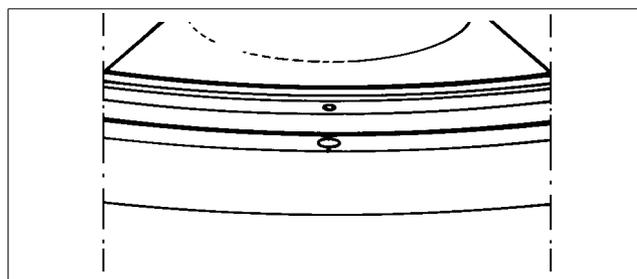
G052811

10. Lubricate the guide surfaces of the bowl body and sliding bowl bottom with lubricating paste. See chapter “8.8 5Lubricants” on page 200.
11. Fit the lifting tool to the sliding bowl bottom and lift it into the bowl body using a hoist.
For correct position of the sliding bowl bottom, see next illustration.



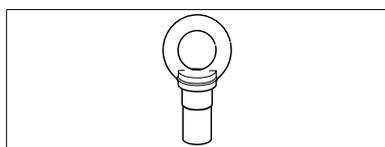
G0533211

12. Bring the assembly mark on the sliding bowl bottom in line with the guide lug on the bowl body to ensure that the sliding bowl bottom enters into the correct position.

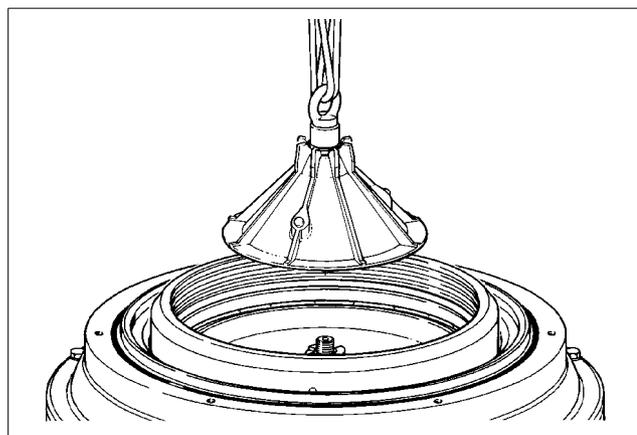


G0535711

13. Fit the distributing cone into the bowl body.
Check that the guide pins on the underside of the distributing cone enter the recesses in the sliding bowl bottom.

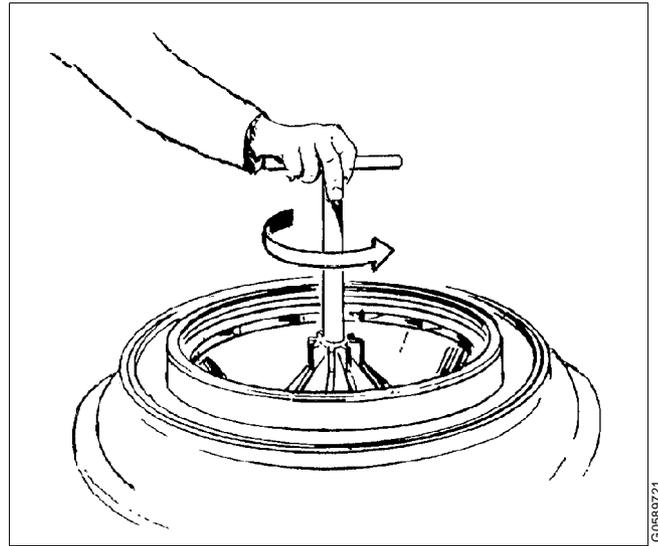


S0064911



G0532721

14. Screw on the cap nut and tighten firmly.
Left-hand thread!



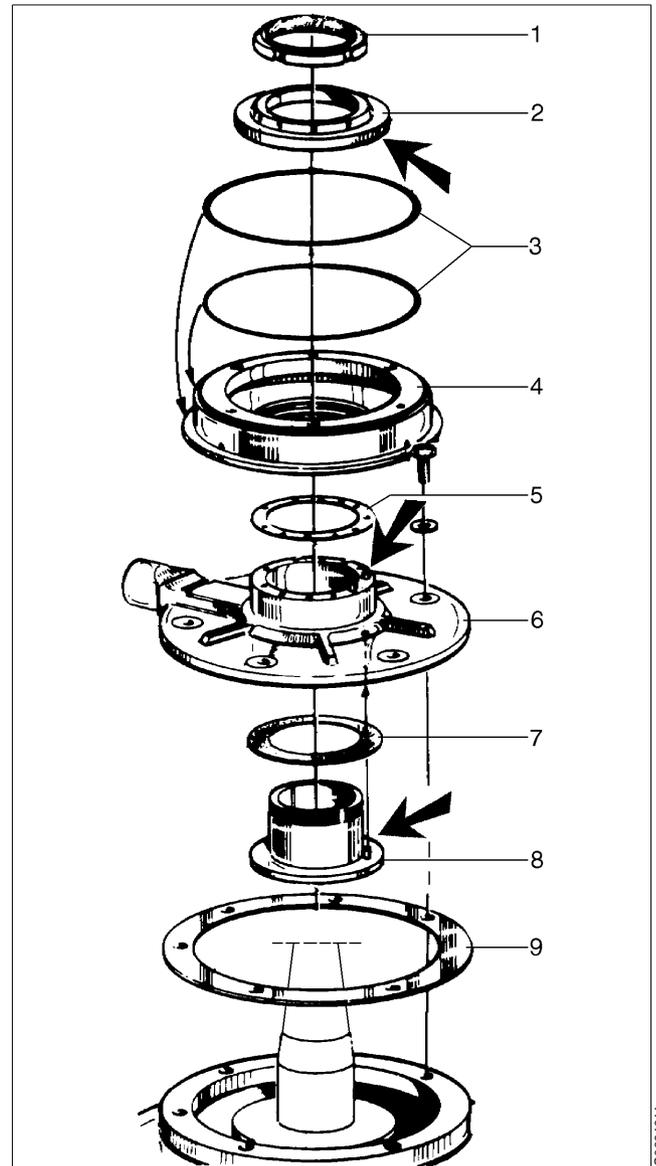
G0589721

6.5 Operating water device (IS)

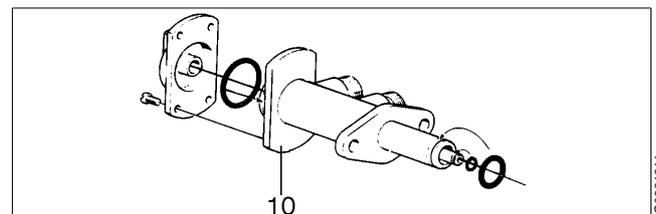
6.5.1 Exploded view

1. Ring nut
2. Operating paring disc
3. O-ring
4. Distributing ring
5. Gasket
6. Distributing cover
7. Gasket
8. Sleeve
9. Height adjusting ring
10. Operating device

 Guide



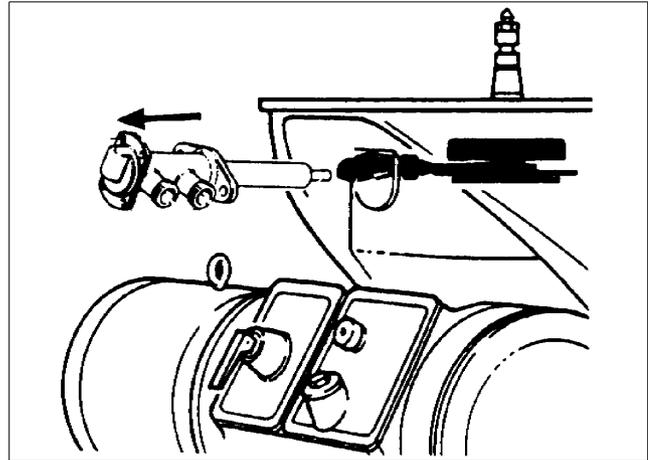
G0691811



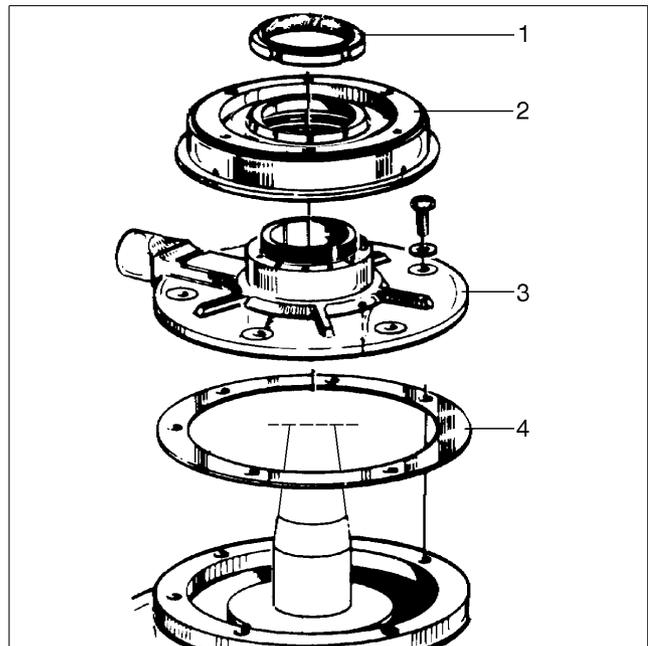
G0691811

6.5.2 Dismantling

1. Disconnect the water hoses to the operating water inlet device.
2. Loosen and pull out the device from the distributing cover.



3. Ease off the ring nut (1).
4. Lift out the paring disc assembly (2).
5. Unscrew the screws fixing the distributing cover (3) and lift it out.
6. Dismantle the parts in the sequence appearing from the illustration on previous page.
7. Remove deposits and clean all parts thoroughly in a suitable cleaning agent. Pay special attention to the channels. See chapter "5.6 Cleaning" on page 89.
8. Check the parts for damage and corrosion.



6.5.3 Assembly

1. Assemble the parts in the sequence appearing from the illustration on page 133. See also following text.

Ensure the parts are placed in the positions defined by the guides.

2. Fit the height adjusting ring(s) (4) and distributing cover (3) including the sleeve.
3. Fasten the distributing cover with the six screws.
4. Fit the paring disc assembly (2) and tighten the ring nut (1).

1. *Ring nut*
2. *Paring disc assembly*
3. *Distributing cover*
4. *Height adjusting ring*

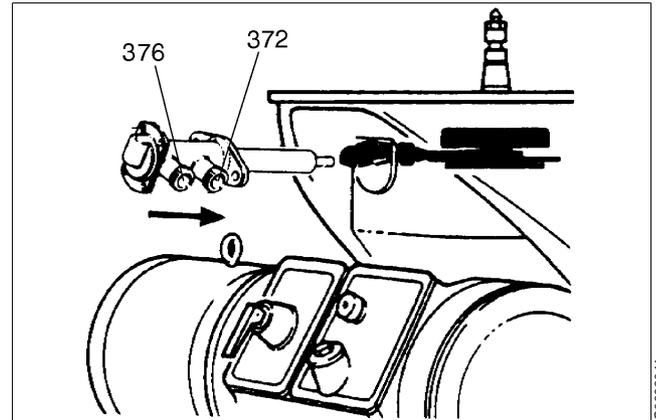
✓ **Check point**

“5.4.20 Operating paring disc; height position”
on page 85. Only at Major Service (MS).

5. Fit the operating water inlet device into the distributing cover.
6. Connect the water hoses to the device.

372. Opening water inlet

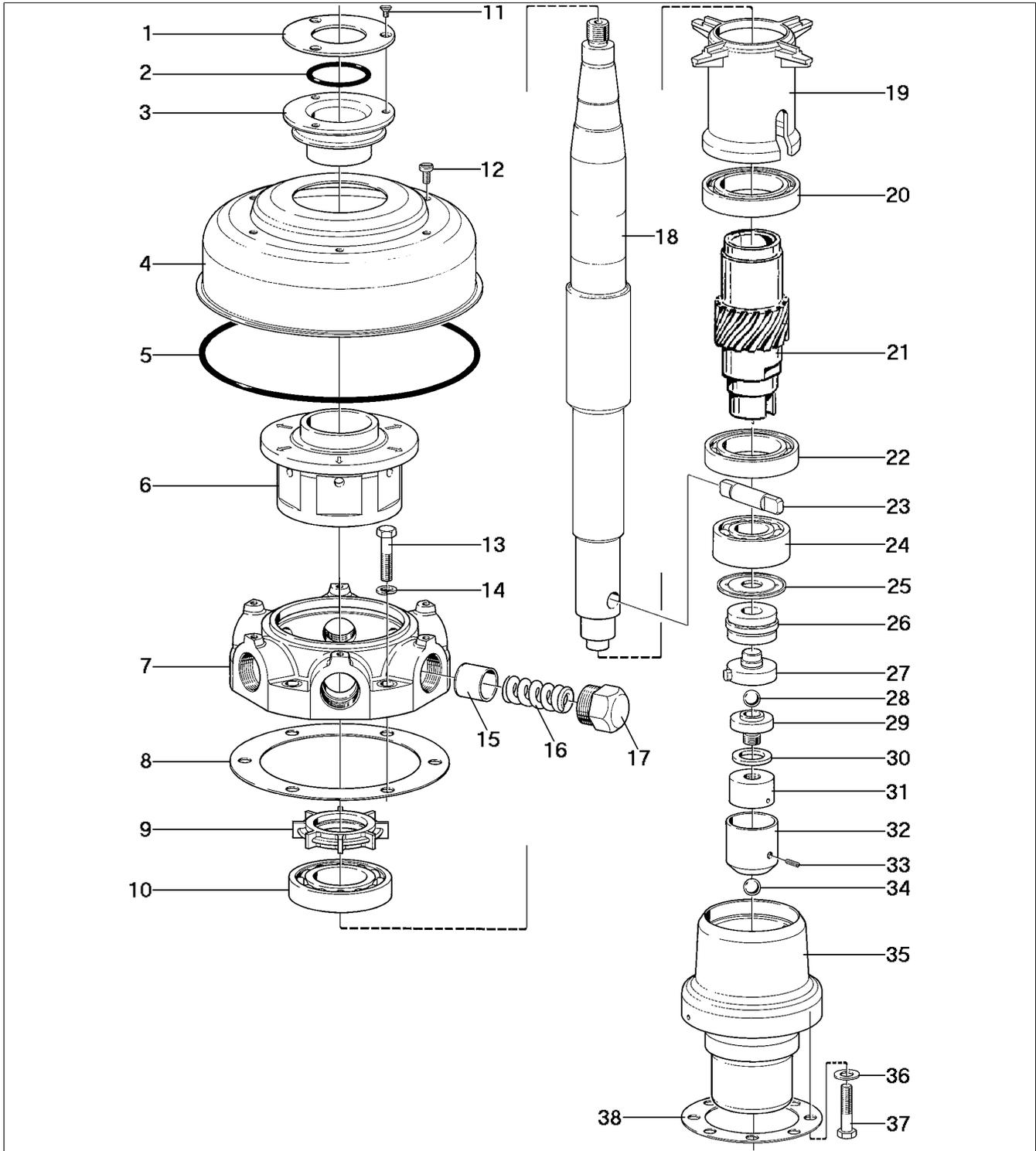
376. Closing and make-up water inlet



G0692041

6.6 Vertical driving device (MS)

6.6.1 Exploded view



G05-46421

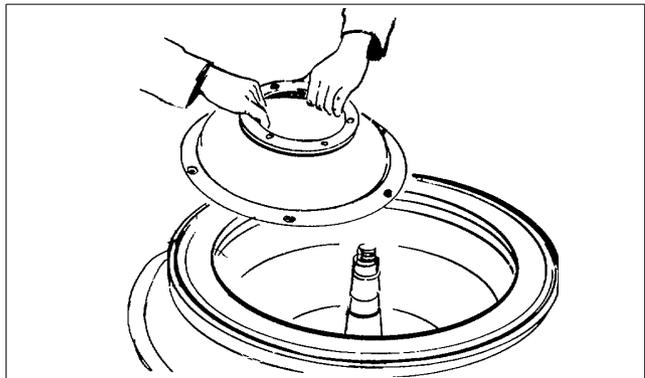
1. *Protecting plate*
2. *O-ring*
3. *Protecting collar*
4. *Guard*
5. *O-ring*
6. *Ball bearing housing*
7. *Spring casing*
8. *Gasket*
9. *Oil fan*
10. *Ball bearing*
11. *Screw*
12. *Screw*
13. *Screw*
14. *Spring washer*
15. *Buffer*
16. *Spring*
17. *Buffer plug*
18. *Bowl spindle*
19. *Stop sleeve*
20. *Ball bearing*
21. *Worm*
22. *Ball bearing*
23. *Conveyor*
24. *Ball bearing*
25. *Spacing washer*
26. *Ball bearing*
27. *Washer*
28. *Ball*
29. *Support ring*
30. *Height adjusting ring*
31. *Spacing sleeve*
32. *Bottom sleeve*
33. *Slotted pin*
34. *Ball*
35. *Bottom bearing housing*
36. *Washer*
37. *Screw*
38. *Gasket*

6.6.2 Dismantling

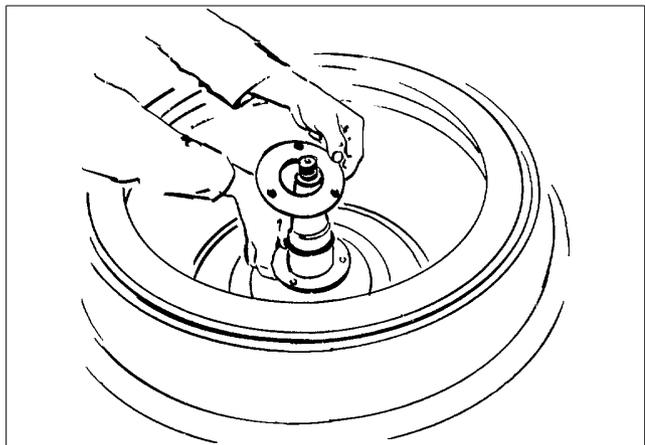
NOTE

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.

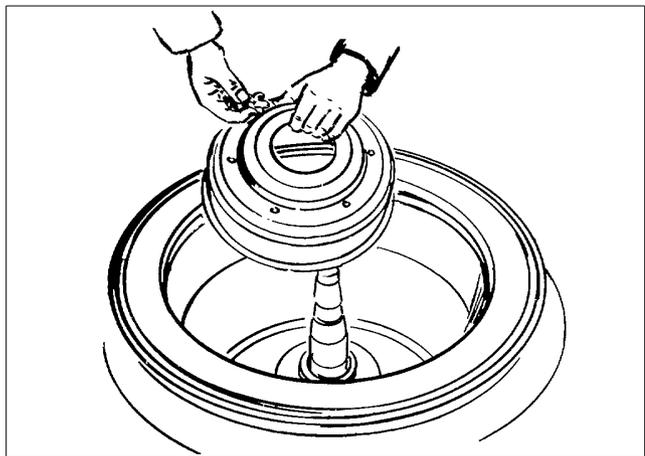
1. Unscrew the six screws and remove the hood and O-ring.



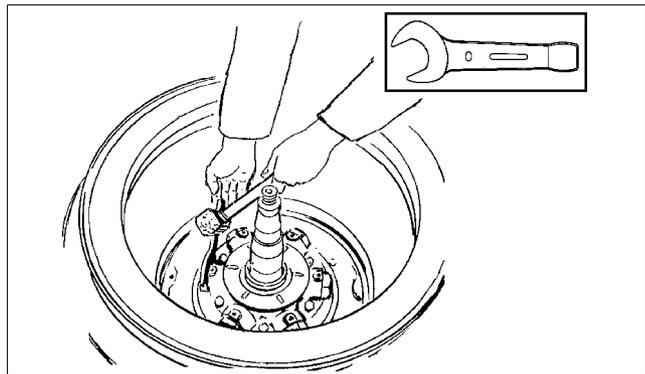
2. Unscrew the three screws and remove the protecting plate, O-ring and protecting collar.



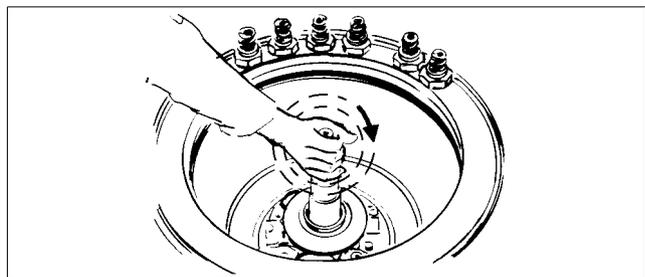
3. Unscrew the six screws and remove the guard and O-ring.



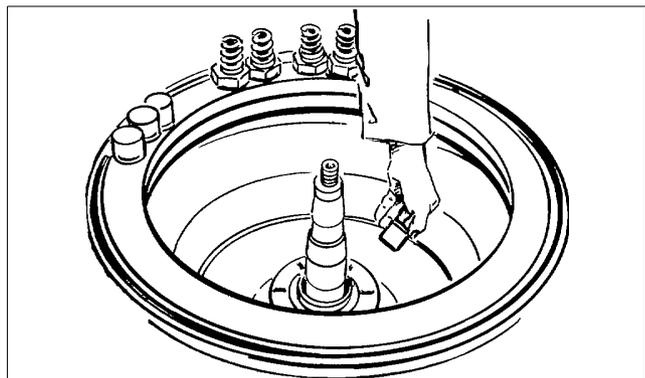
4. Loosen (but do not remove) the six screw plugs for the buffers with a spanner and a hammer.



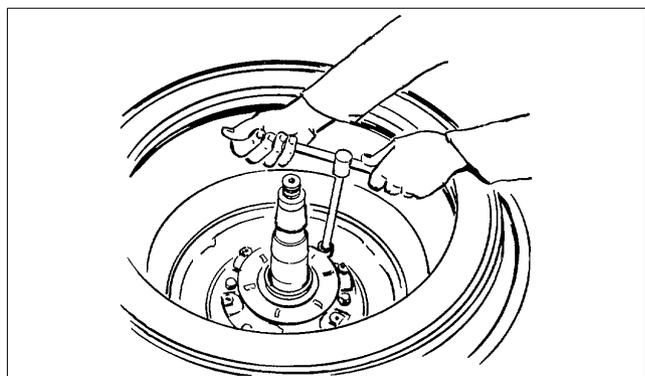
5. Unscrew the six screw plugs and remove the springs. Move the spindle top a few turns in a circle while pressing outwards. This will disengage buffers from the ball bearing housing.



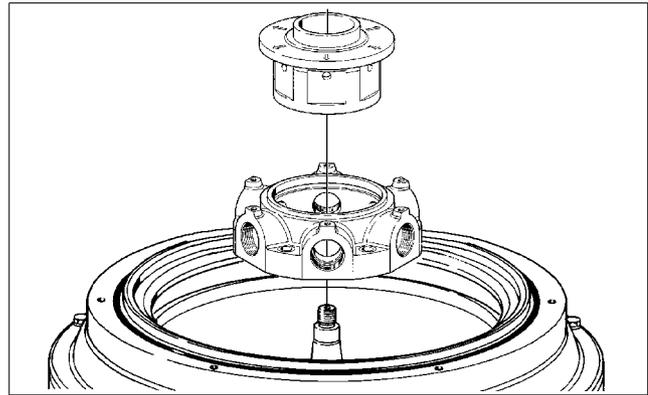
6. Remove the six buffers from the spring casing.



7. Unscrew the six screws holding the spring casing.



- 8. Prize out the ball bearing housing from the spring casing with a screw driver.
- 9. Remove the spring casing and gasket.



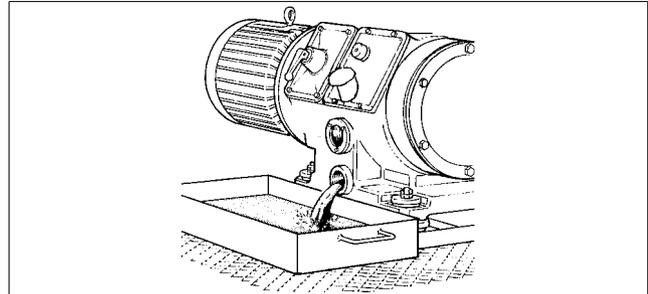
- 10. Drain the oil from the worm gear housing.



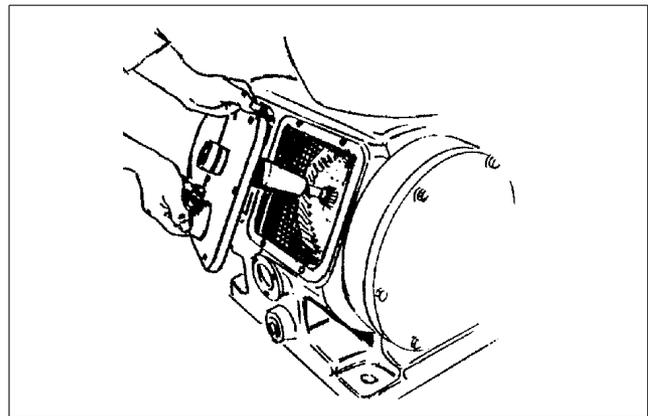
CAUTION

Burn hazards

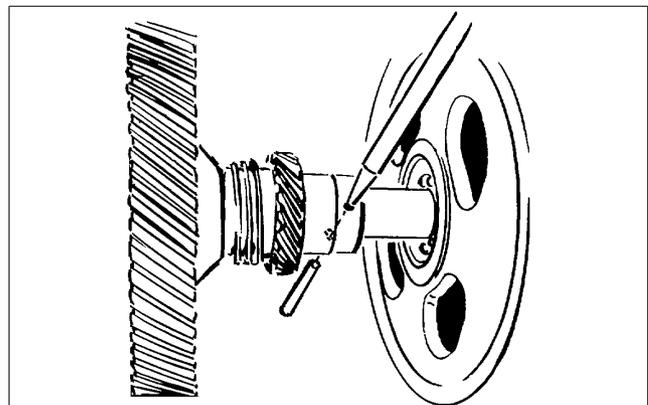
Lubricating oil and various machine surfaces can be hot and cause burns.



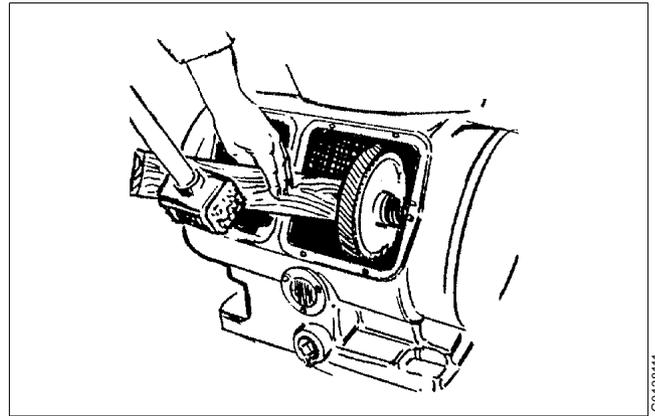
- 11. Remove the brake cover and revolution counter cap and their gaskets.



- 12. Knock out the taper pin from the worm wheel stop ring.

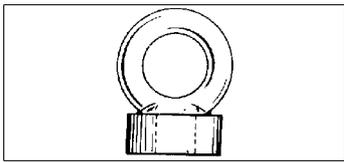


13. Push the worm wheel to one side before removing the spindle. If worm wheel is stuck use a piece of wood to loosen it.

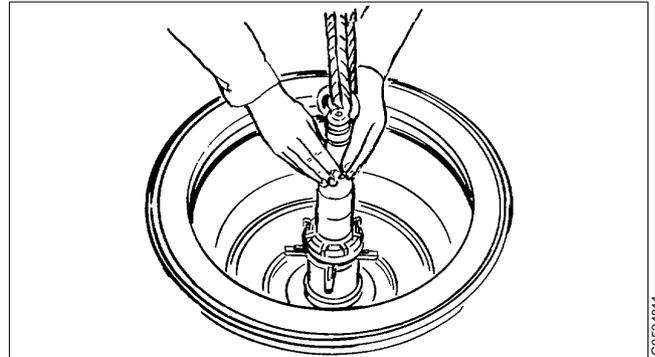


G0128111

14. Fit the lifting tool onto the spindle and lift out using the hoist.



S0066811

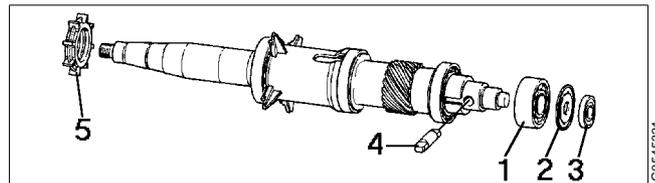


G0524811

15. Pull off the ball bearing (1) together with the spacing washer (2) and upper ball race (3) for the axial bottom ball bearing.

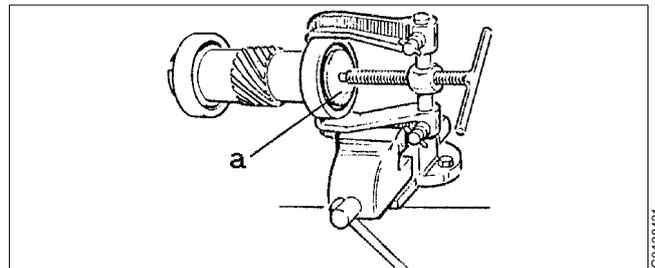
16. Remove the conveyor (4) for worm.

17. Remove the oil fan (5).



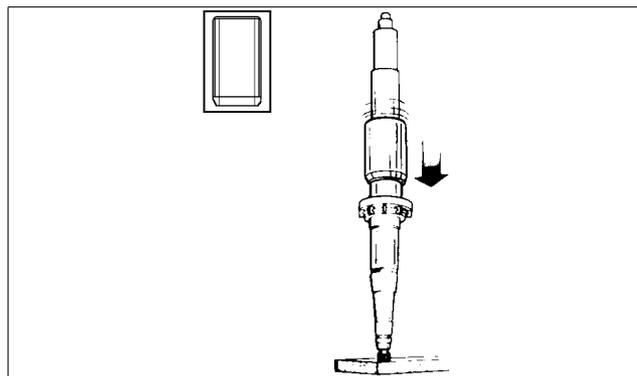
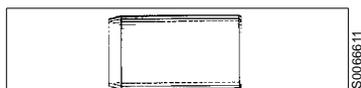
G0545321

18. Remove the worm and stop sleeve from the spindle. Pull off ball bearings from the worm. Use a washer (a) as a support for the puller.

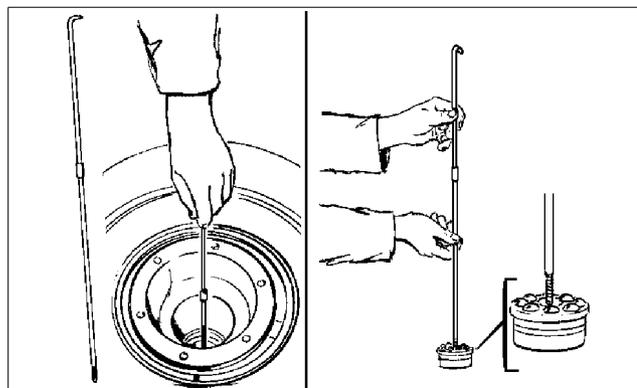
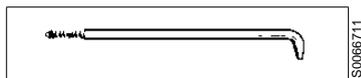


G0128421

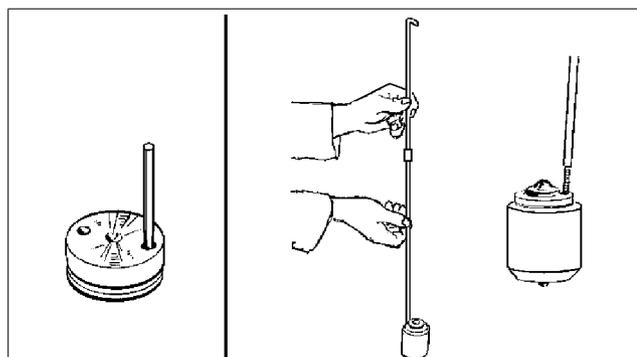
19. Drive off the top ball bearing from the sleeve spindle with the driving-off sleeve. Use a wooden plank or similar as a soft base for the spindle top.



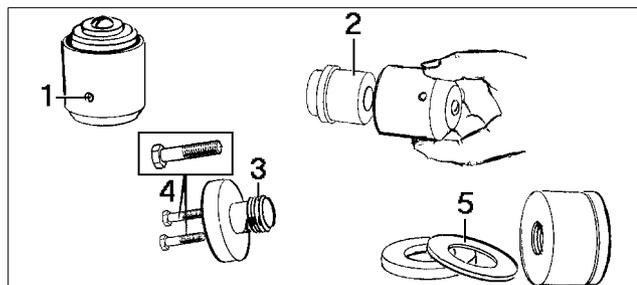
20. Lift out the axial bottom ball bearing and the washer beneath using the lifting pin.



21. Lift out the bottom sleeve using the lifting pin.



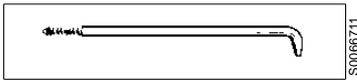
22. Knock the slotted pin (1) out of the spacing sleeve (2) and remove it. Unscrew support plug (3) using two screws (4) with threads 1/4"-20 UNC to make height adjusting ring (5) accessible.



23. Remove deposits and clean all parts thoroughly in a suitable cleaning agent. See chapter "5.6 Cleaning" on page 89.

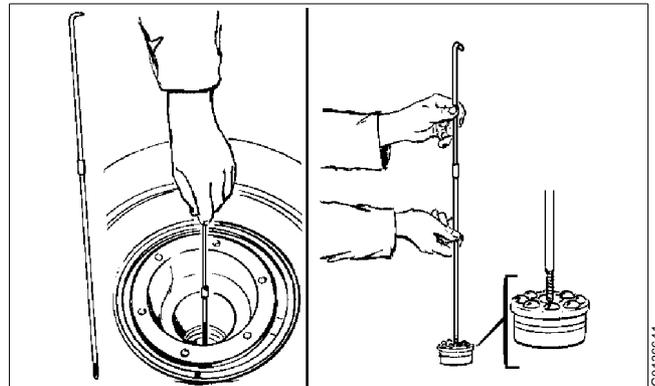
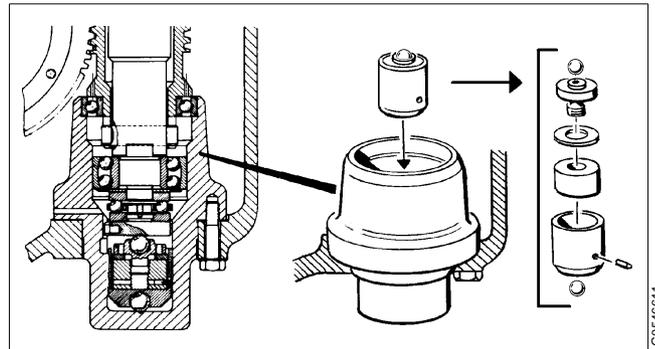
6.6.3 Assembly

1. Fit the bottom sleeve with mounted parts (rings and sleeve) into the bottom bearing housing. Use the lifting pin.



Check that one ball is fitted both on top and bottom of the bottom sleeve.

2. Fit the washer and the ball bearing onto the bottom sleeve.



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



WARNING

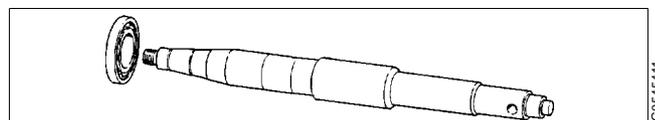
Burn hazards

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 “5.9.1 Ball and roller bearings” on page 99.

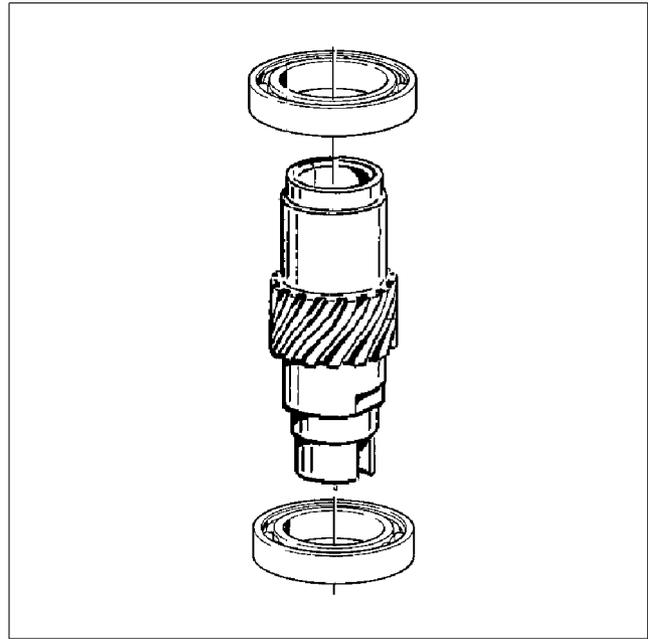
3. Heat the ball bearing and fit it on the spindle.



✓ **Check point**

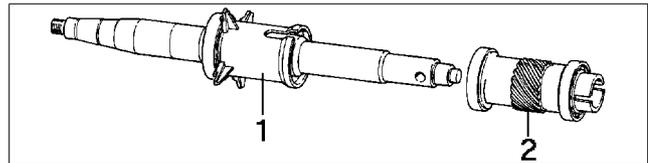
“5.4.24 Worm; wear of groove” on page 86.

4. Heat the two ball bearings and fit them on the worm.



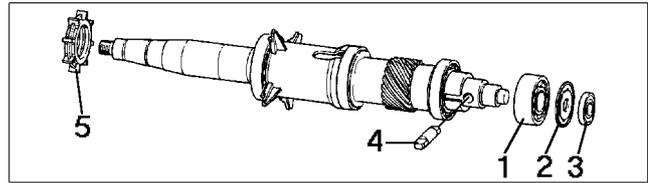
G0602011

5. Fit the stop sleeve (1) and the worm (2) on the spindle.



G0546221

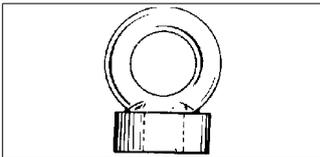
6. Fit the ball bearing (1) on the spindle. Then fit the spacing washer (2) and upper ball race (3) for the axial bottom bearing. The ball race must be heated.



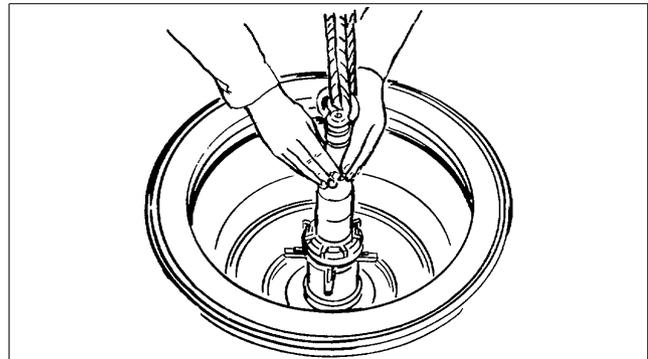
G0545321

7. Fit the conveyor (4) and the oil fan (5).

8. Fit the lifting tool to the spindle and lift it using a hoist.

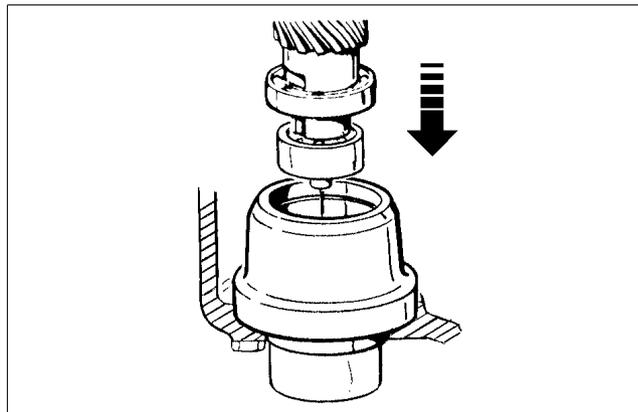


S0066811



G0624811

9. Carefully lower the spindle into the frame and guide the spindle into the right position in the bottom bearing housing so the ball bearings enter their seats. If the ball bearings do not completely enter their seats, tap the spindle top gently with a tin hammer.

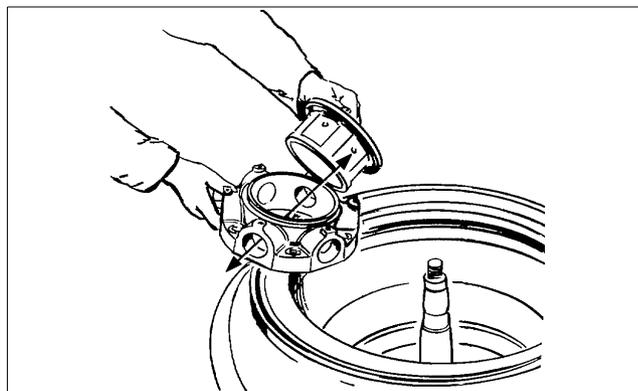


G0133311

✓ **Check point**

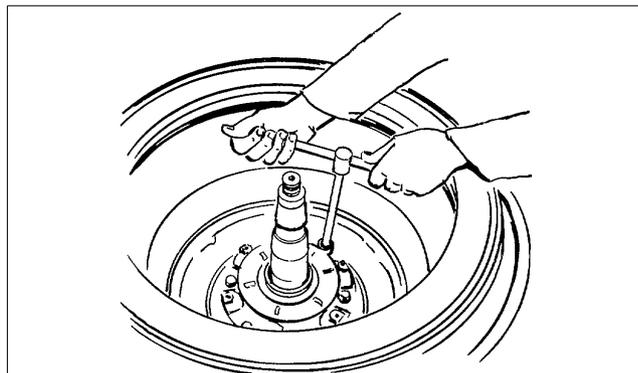
“5.4.6 Buffer springs and ball bearing housing” on page 76.

10. Fit the spring casing with gasket and ball bearing housing. Position the flat surfaces of the ball bearing housing in front of the buffer holes in the spring casing.



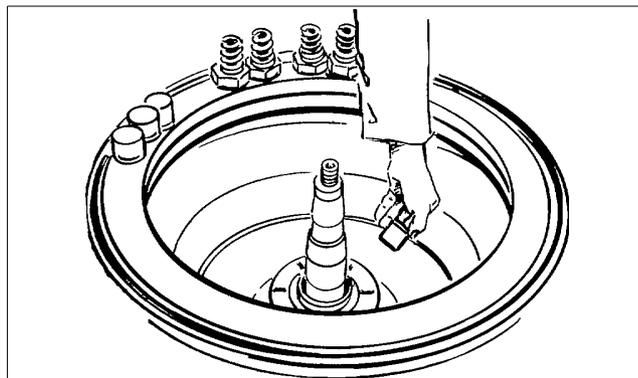
G0524921

11. Tighten the six screws for the spring casing.



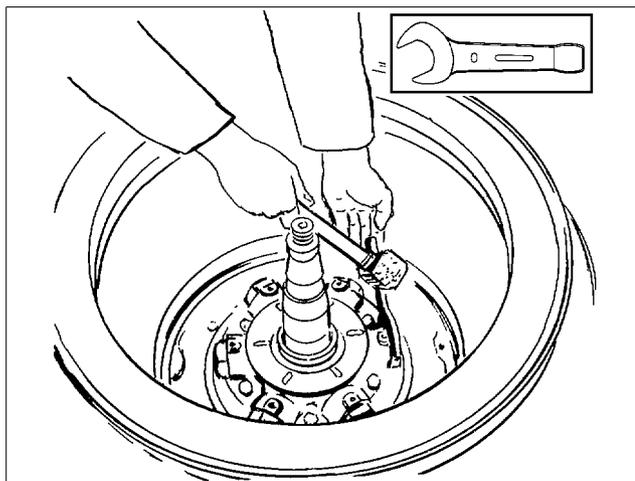
G0132421

12. Fit the buffers, springs and screw plugs.

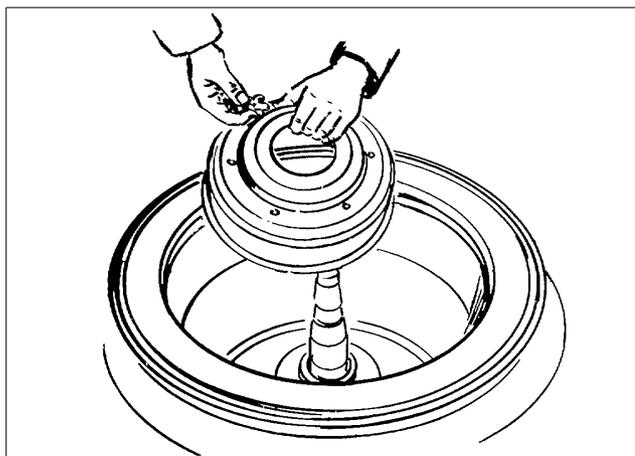


G0522421

13. Tighten the six screw plugs.



14. Fit the guard with O-ring and tighten the six screws.

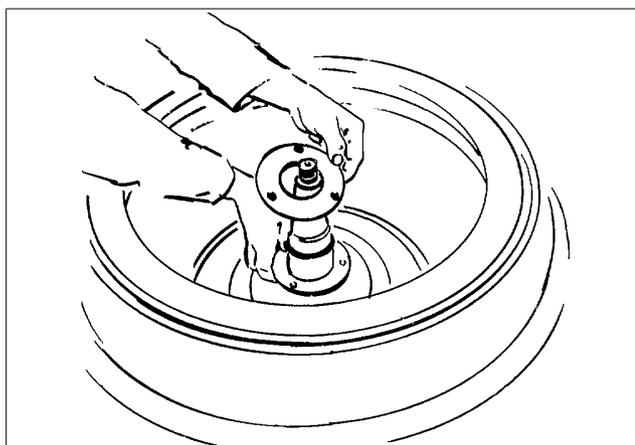


15. Fit the protecting collar with O-ring and protecting plate.

NOTE

Check that the protecting collar is in the bottom position before tightening the protecting plate.

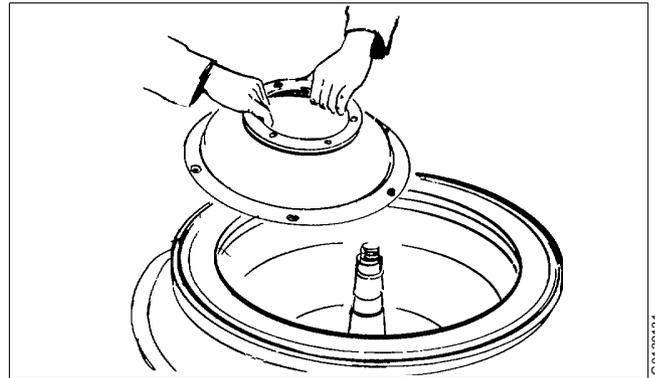
Tighten the three screws for the protecting plate.



16. Fit the hood with O-ring and tighten the six screws.

✓ **Check point**

“5.4.3 Bowl spindle; height position” on page 74.



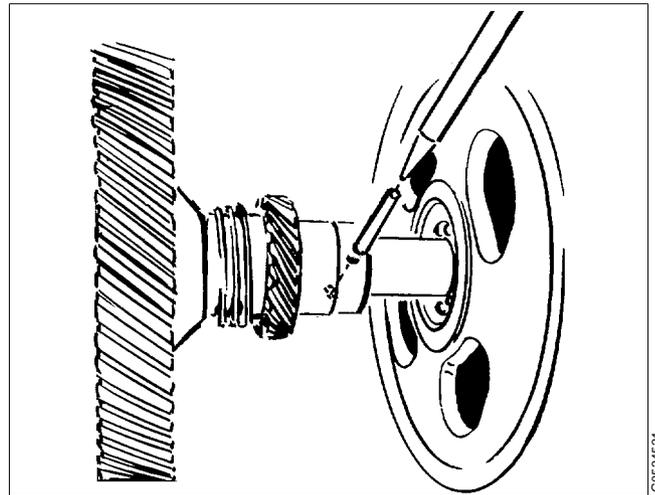
G0139131

17. Match the worm wheel with the teeth in the worm of the bowl spindle. Knock the taper pin into the worm wheel stop ring.

✓ **Check points**

“5.4.26 Worm wheel shaft; radial wobble” on page 87,

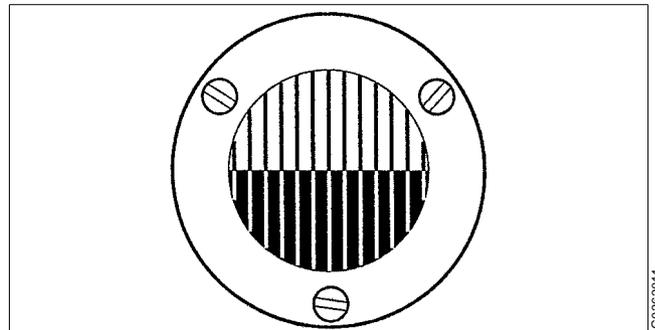
“5.4.4 Bowl spindle; radial wobble” on page 75.



G0524521

18. Pour oil into worm gear housing. The oil level should be exactly in the middle of the sight glass.

For correct oil volume and recommended oil brands, see chapter “8.8 5Lubricants” on page 200.

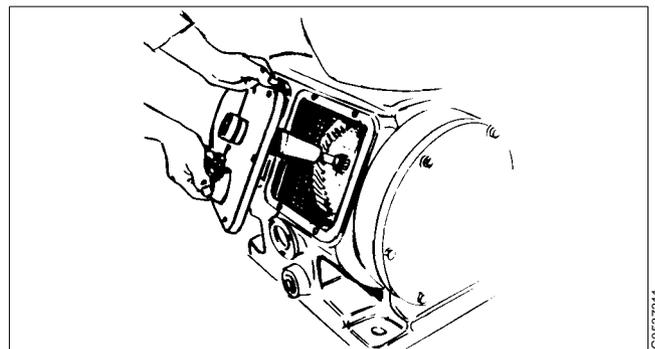


G0262011

✓ **Check point**

“5.4.5 Brake” on page 75.

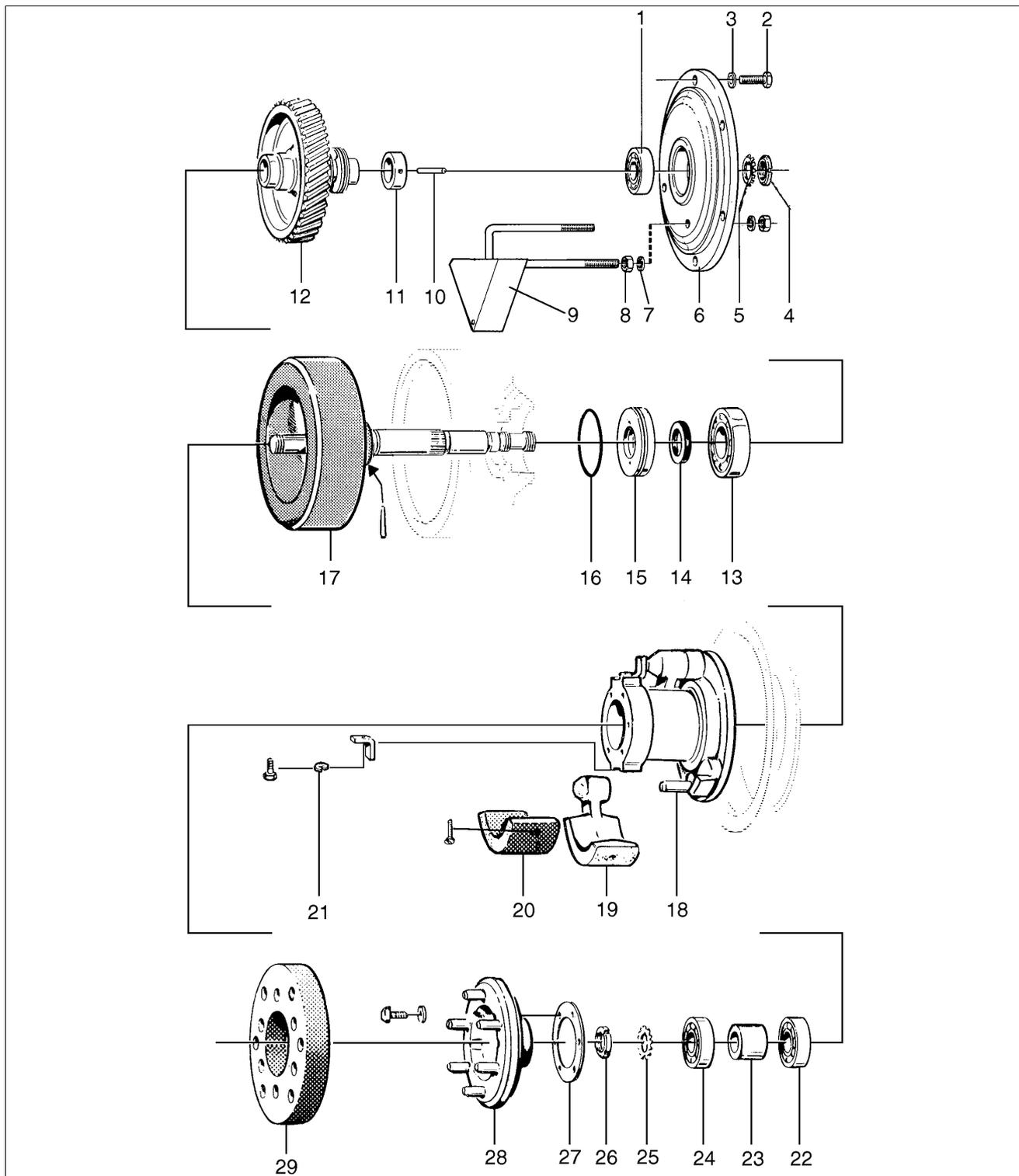
19. Fit the brake cover and revolution counter cap and their gaskets.



G0537311

6.7 Horizontal driving device (MS)

6.7.1 Exploded view



G0591221

1. *Ball bearing*
2. *Screw*
3. *Spring washer*
4. *Round nut*
5. *Lock washer*
6. *Bearing shield*
7. *Spring washer*
8. *Nut*
9. *Oil shield*
10. *Taper pin*
11. *Stop ring*
12. *Worm wheel*
13. *Ball bearing*
14. *Sealing ring*
15. *Sealing washer*
16. *O-ring*
17. *Worm-wheel shaft with coupling drum*
18. *Nave*
19. *Friction block*
20. *Friction pad*
21. *Holding bracket*
22. *Ball bearing*
23. *Spacing sleeve*
24. *Ball bearing*
25. *Lock washer*
26. *Round nut*
27. *Gasket*
28. *Coupling disc*
29. *Elastic plate*

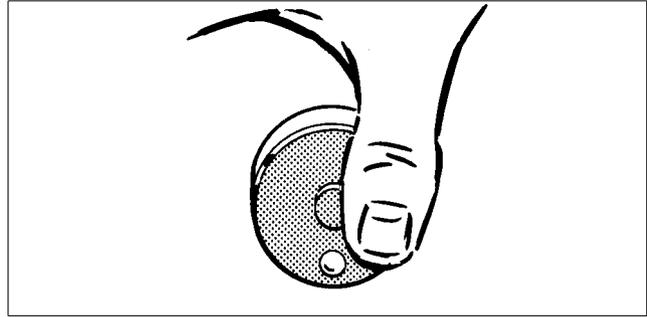
6.7.2 Dismantling



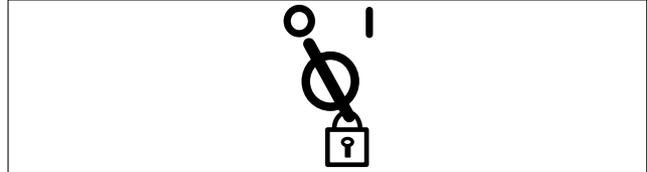
DANGER

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.



G0246221



S0051011

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 1-3 below are already done. Proceed then with point 4.

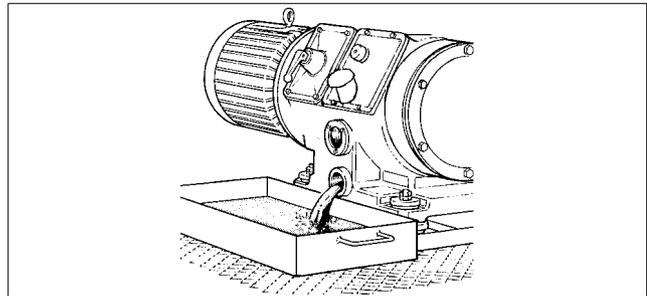
1. Drain the oil from the worm gear housing.



CAUTION

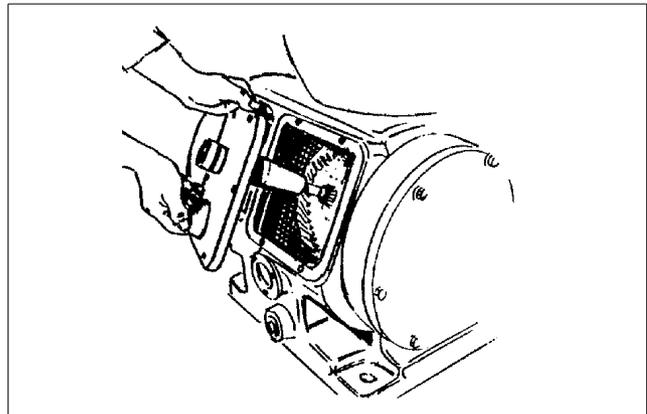
Burn hazards

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



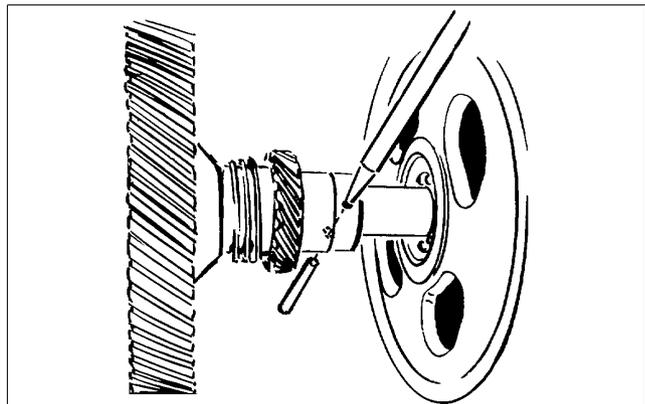
G0035921

2. Remove the brake cover and revolution counter cap and their gaskets.



G0127911

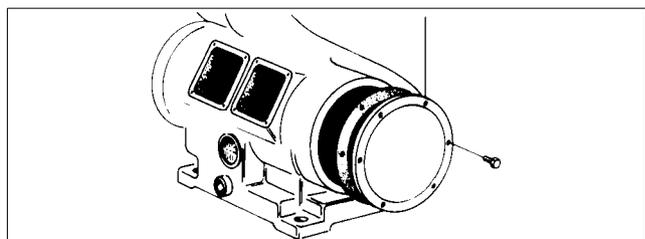
3. Knock out the taper pin from the worm wheel stop ring.



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

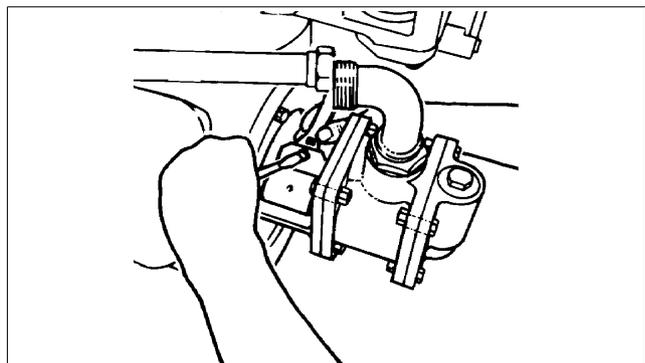
Separator with no built-on pump

- a. Remove the bearing shield and gasket.

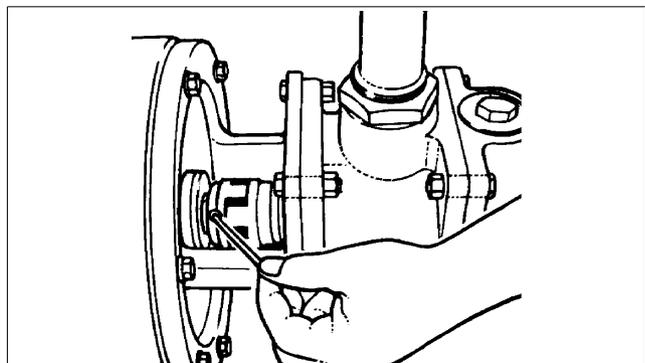


Separator with built-on pump

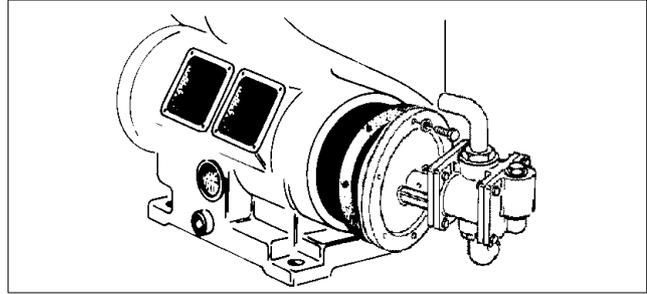
- a. Remove the pipe connections from the pump.
- b. Remove the sleeve halves over the coupling.



- 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.

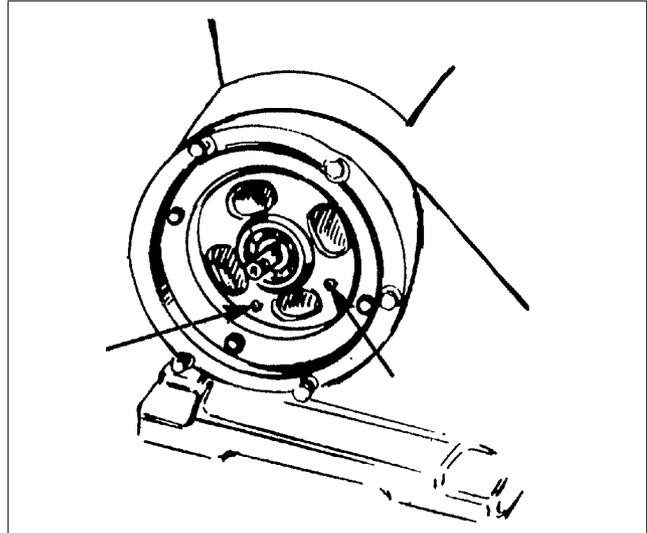


d. Remove the pump assembly and gasket.



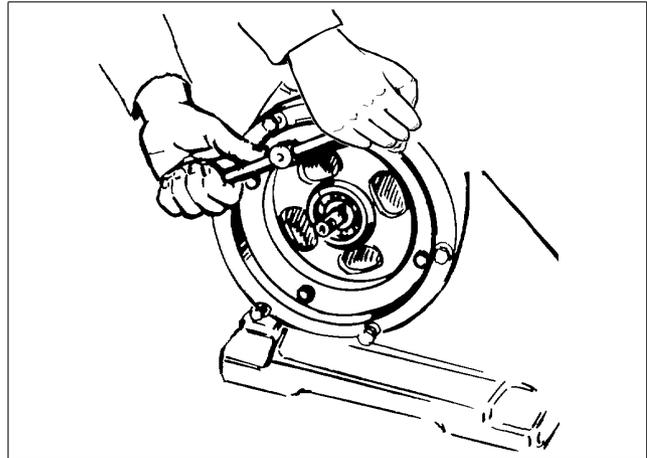
G0538031

5. Unscrew the two nuts holding the oil shield. The shield can not be removed from the housing before the bearing shield is moved.



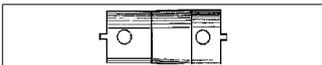
G0602911

6. Unscrew the four screws for the bearing shield and remove it together with the oil shield.

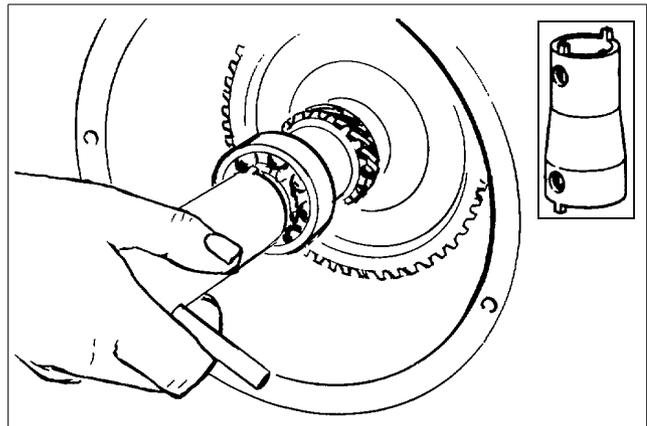


G0525621

7. Unscrew and remove the round nut and lock washer.

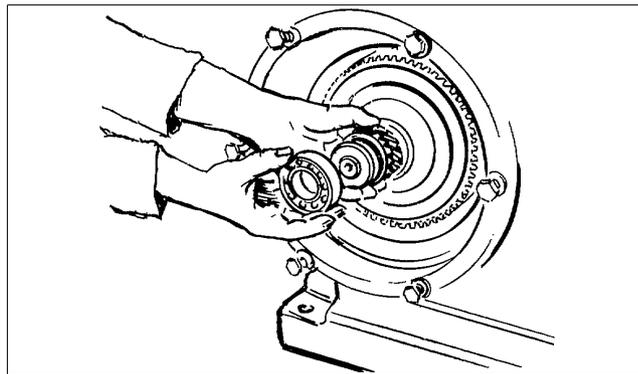


S0066411

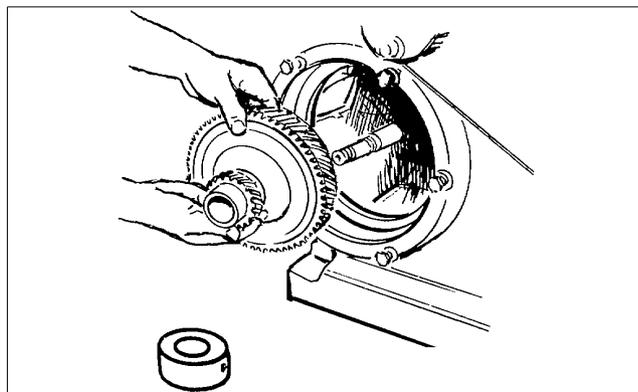


G0525421

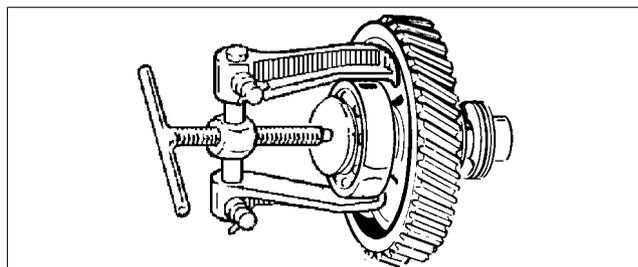
8. Remove the ball bearing.



9. Remove the stop ring and worm wheel with ball bearing.

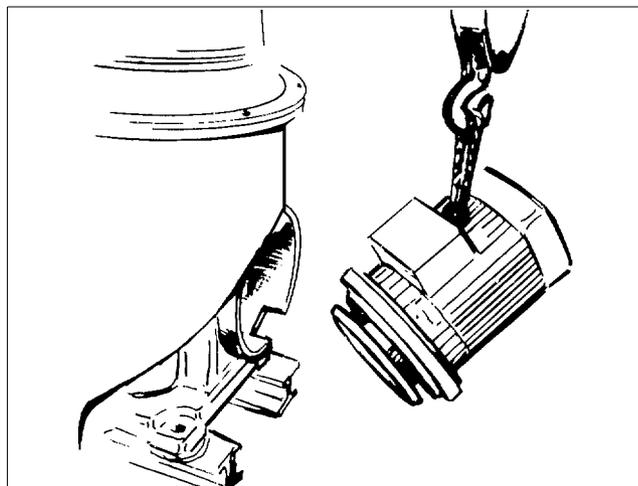


10. Pull off the ball bearing from the worm wheel. Use a washer as a support for the puller.

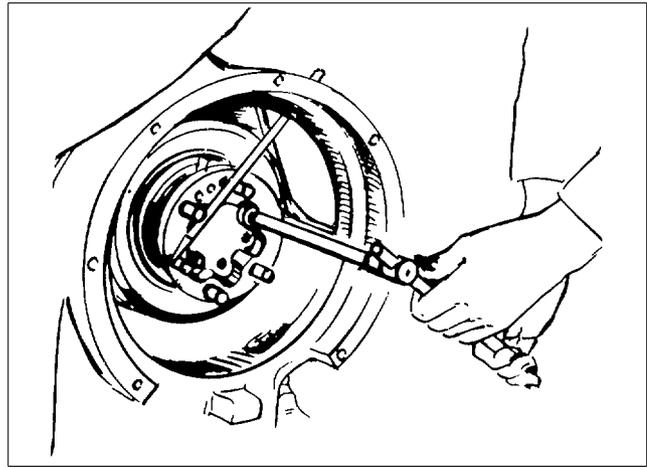


11. Disconnect the motor cables. Note the positions of cables in the terminal box to re-connect correctly (for correct direction of rotation).

12. Remove the electric motor using a hoist.

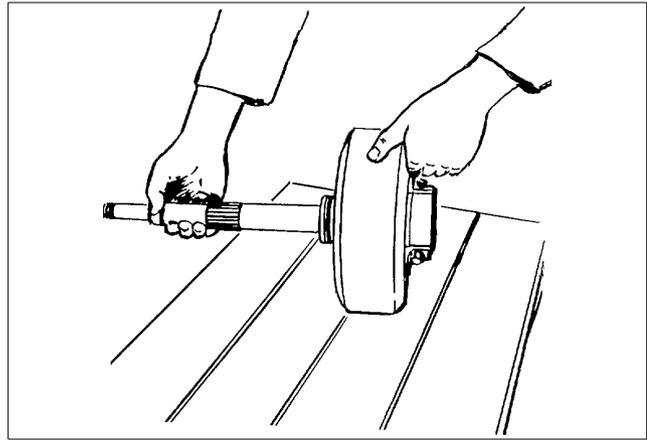


13. Remove the flexible plate and unscrew the six screws for the coupling disc and remove it.



G0524711

14. Remove the worm wheel shaft with friction clutch pulley.

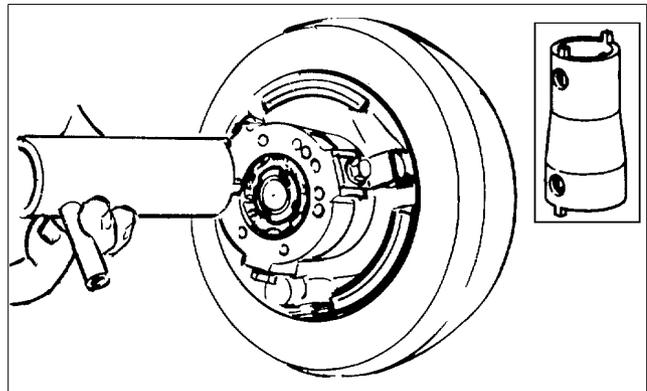


G0522111

15. To dismantle the nave, unscrew the round nut with the pin spanner and remove the lock washer.

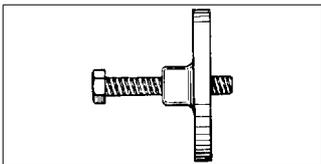


S0066411

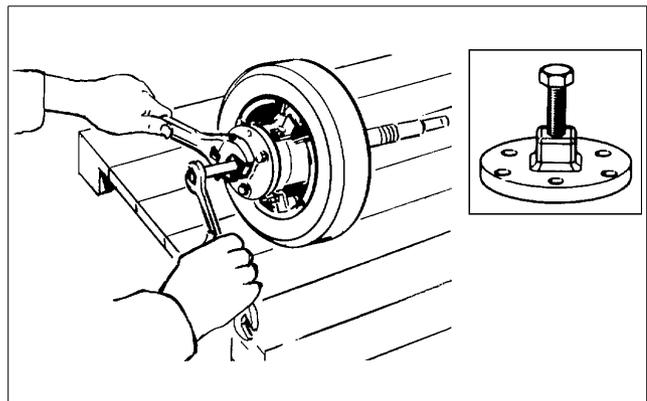


G0522021

16. Pull off the nave with the puller and remove the friction blocks.

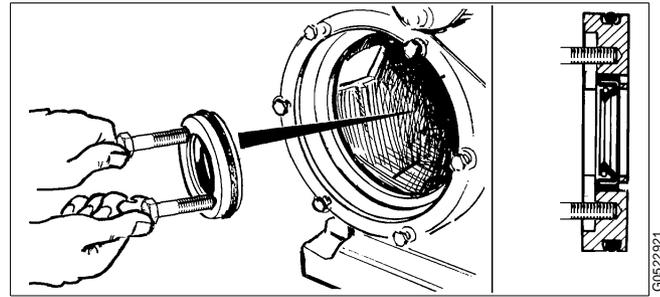


S0065511



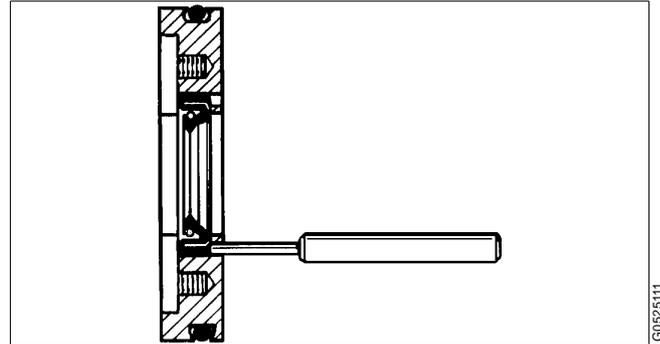
G0525021

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



G0522921

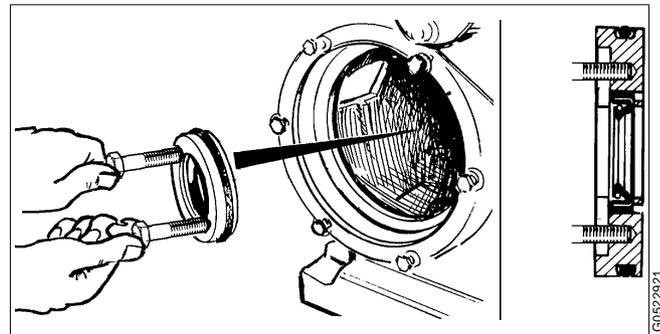
- Remove the sealing ring from the sealing washer.
- Remove deposits and clean all parts thoroughly in a suitable cleaning agent. See chapter "5.6 Cleaning" on page 89.



G0525111

6.7.3 Assembly

- 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.

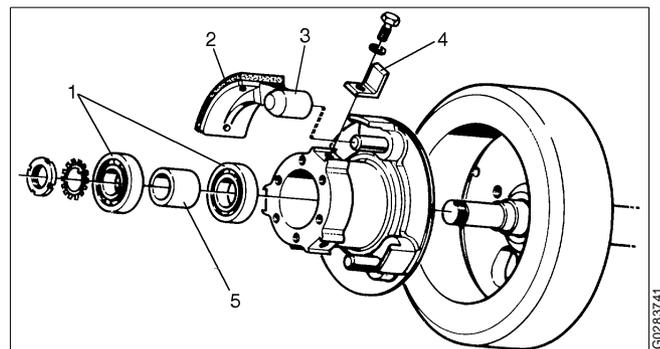


G0522921

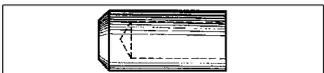
✓ Check point

"5.4.7 Coupling friction pads" on page 78.

- Fit the friction blocks (3) with pads (2) on the nave and lock them with holding brackets (4). Lubricate the ball bearings. For recommended lubricants, see chapter "8.8 5Lubricants" on page 200.
- Fit the ball bearings (1) and spacing sleeve (5) with the driving on sleeve tool to force the ball bearings into their correct positions.

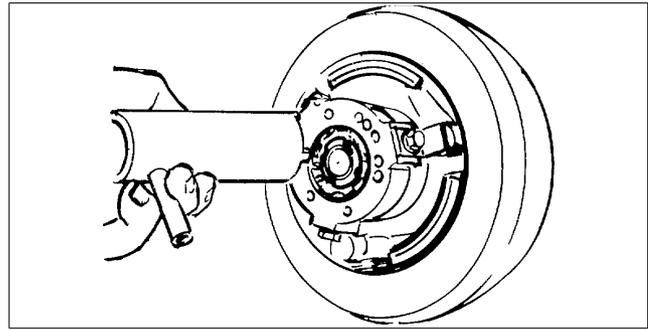


G0283741

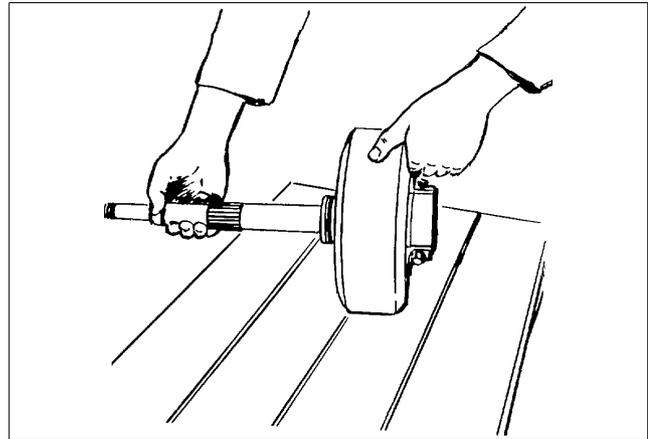


S0066311

4. Tighten the round nut with the pin spanner and secure it with the lock washer.



5. Fit the worm wheel shaft.

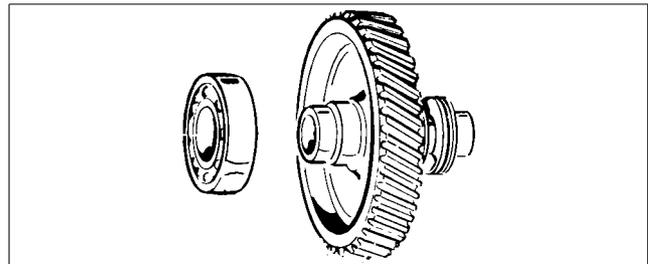


✓ **Check point**

“5.7.1 Worm wheel and worm; wear of teeth”
on page 93.

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

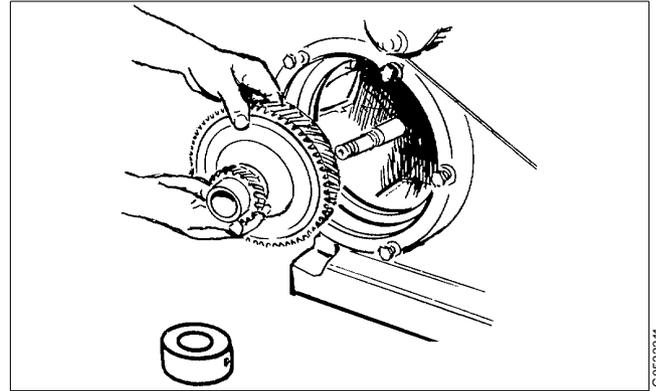
Burn hazards

Use protective gloves when handling the heated bearings.

NOTE

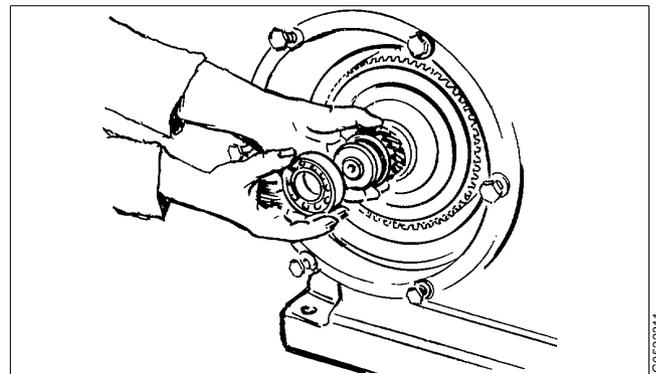
If any doubt how to mount roller bearings in a correct way, see the detailed description in chapter “5.9.1 Ball and roller bearings” on page 99.

7. Fit the worm wheel with the ball bearing and fit the stop ring.



G0522311

8. Fit the ball bearing.

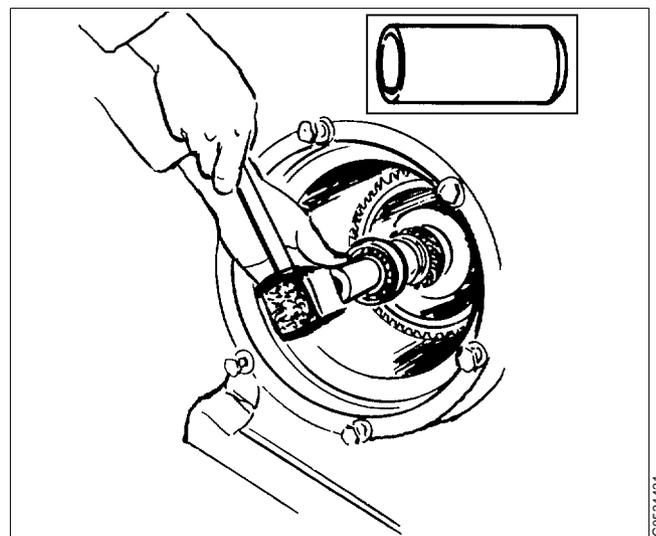


G052311

9. Knock the ball bearing into its seat with the driving-on sleeve tool.

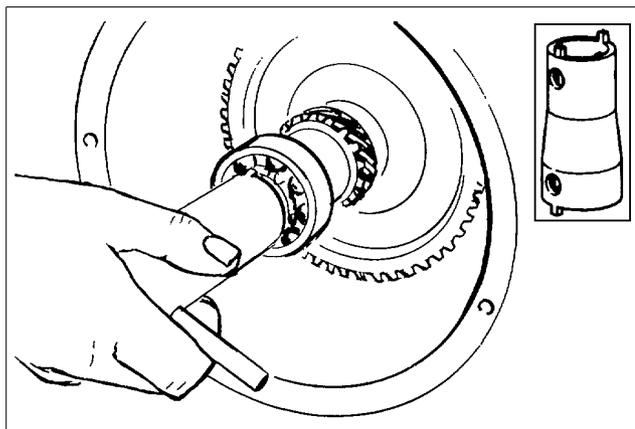
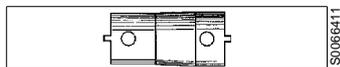


S0066311



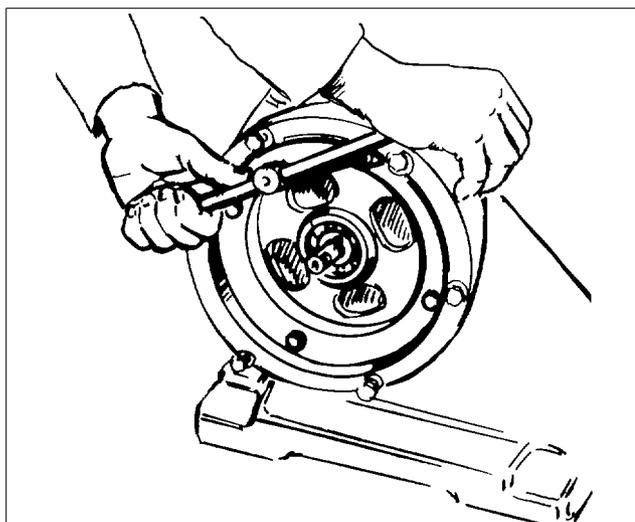
G0524421

10. Tighten the round nut with the pin spanner and secure it with the lock washer.



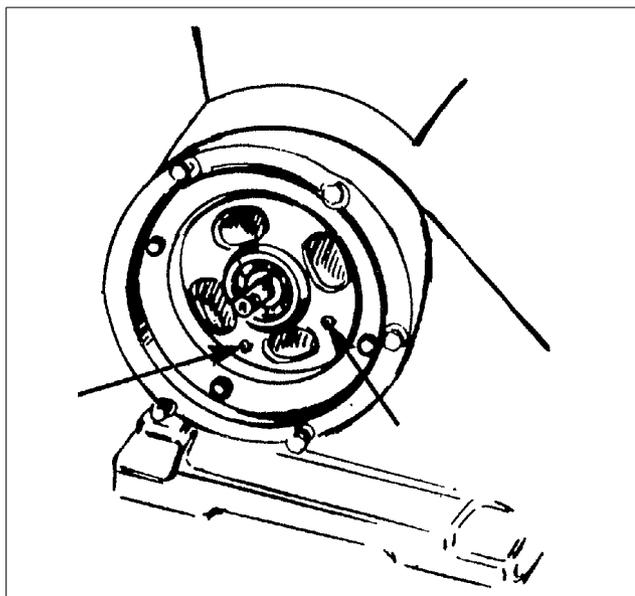
G0625421

11. Fit the bearing shield together with the oil shield. Tighten the four screws for the bearing shield.



G0525511

12. Tighten the two nuts holding the oil shield in the bearing shield.



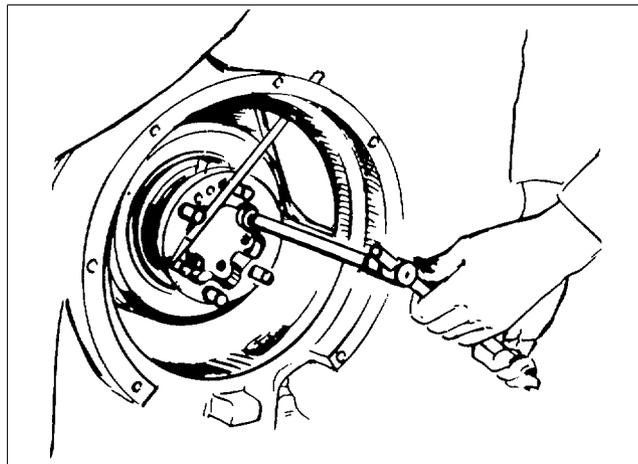
G0602911

13. Fit the coupling disc with gasket and tighten the six screws. If necessary, use the driving-on sleeve.

14. Fit the flexible plate.

✓ **Check point**

“5.4.12 Flexible plate in coupling” on page 80.



G0524711

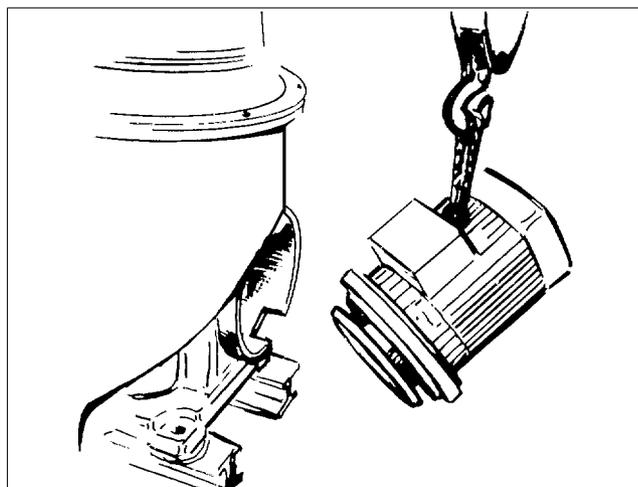
15. Fit the electric motor.



DANGER

Disintegration hazards

When power cables have been connected, always check direction of rotation, see “4.1.3 Ready for start” on page 38. If incorrect, vital rotating parts could unscrew causing disintegration of the machine.



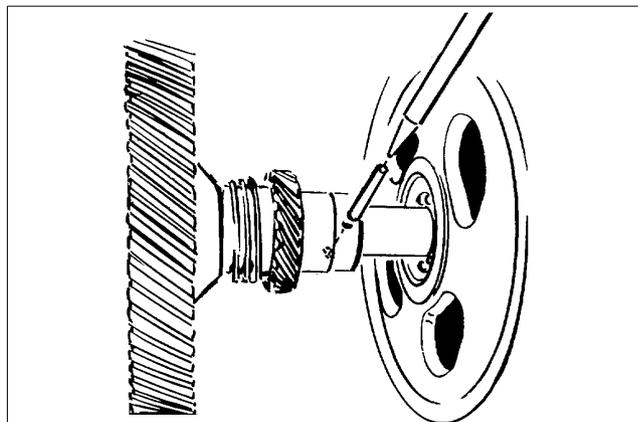
G0524631

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 “6.6.3 Assembly” on page 143.

16. Match the worm wheel with the teeth in the worm of the bowl spindle. Knock the taper pin into the worm wheel stop ring.

✓ **Check point**

“5.4.26 Worm wheel shaft; radial wobble” on page 87.

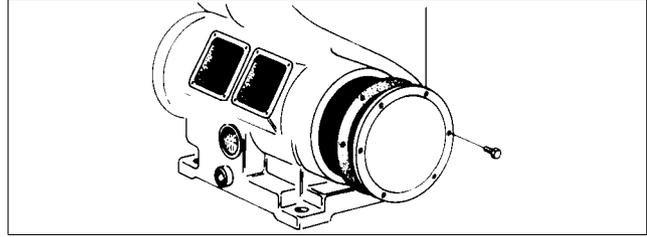


G0524621

17. Fit the bearing shield/built-on pump.

Separator with no built-on pump

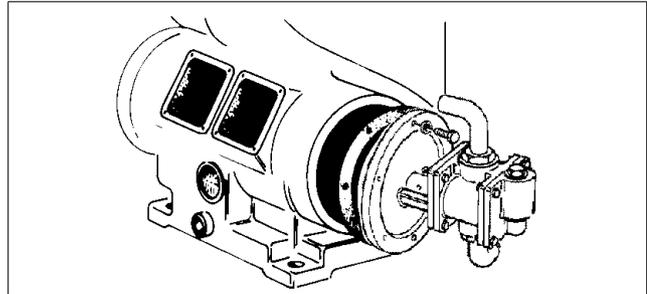
- a. Fit the gasket and bearing shield. The parts can be fitted only in one position because of the asymmetrical positioned screw holes.



G0538021

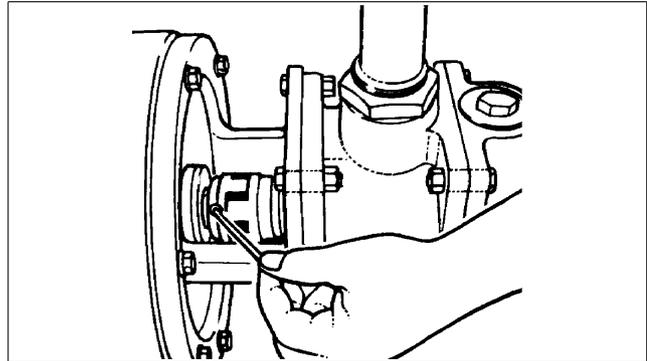
Separator with built-on pump

- 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.



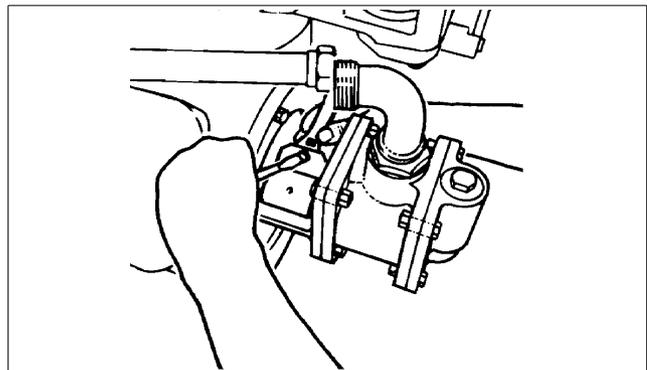
G0538031

- 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.



G0662311

- d. Mount the sleeve halves over the coupling.
e. Refit the pump connections.

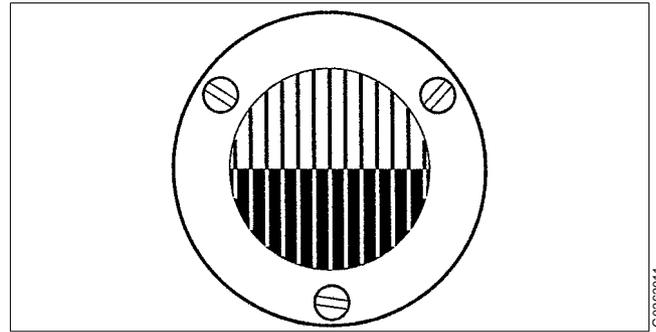


G0662131

18. Pour oil into worm gear housing. The oil level should be exactly in the middle of the sight glass.

Oil volume: Approx. **12 litres**.

For recommended oil brands, see chapter “8.8 5Lubricants” on page 200.

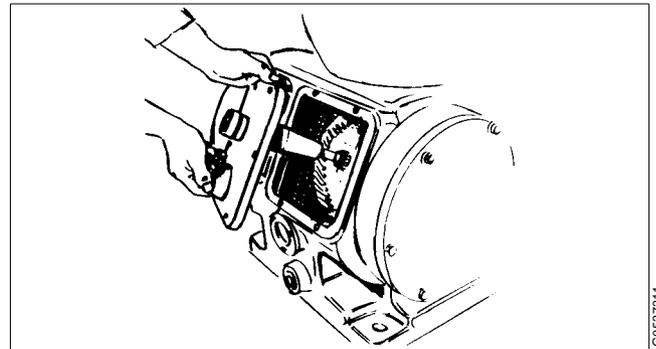


G0262011

✓ **Check point**

“5.4.5 Brake” on page 75.

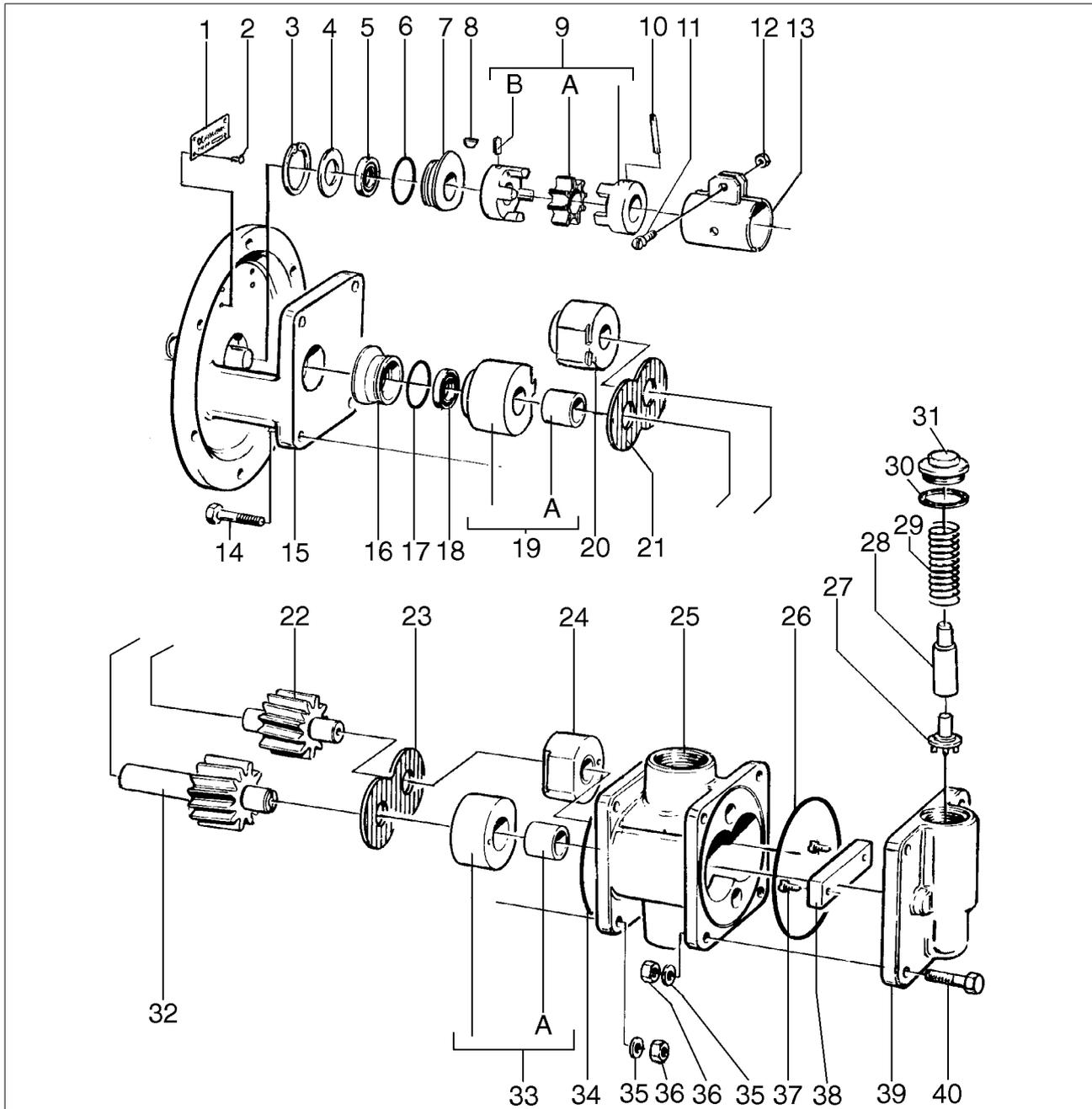
19. Fit the brake cover and revolution counter cap and their gaskets.



G0537311

6.8 Feed pump (MS) (option)

6.8.1 Exploded view



G0662721

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

* Not included in all pumps

6.8.2 Dismantling

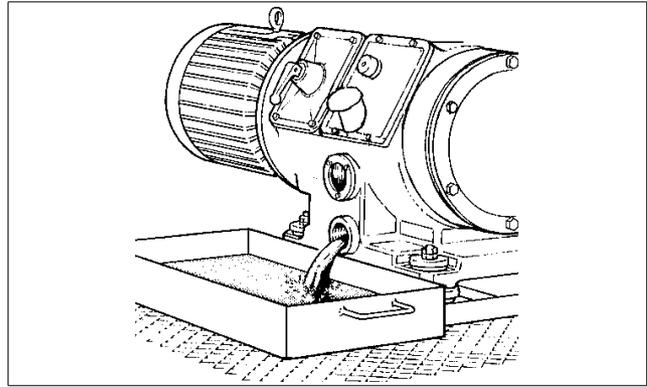
1. Drain the oil from the worm gear housing.



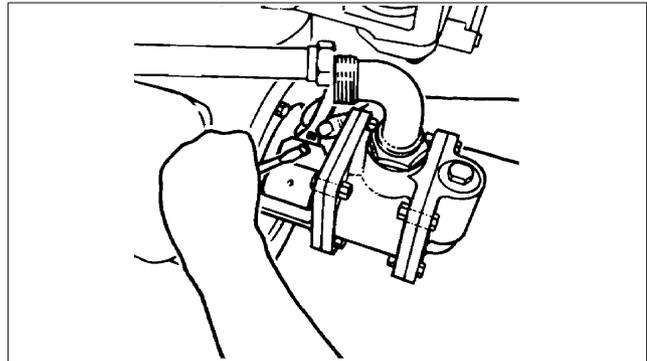
CAUTION

Burn hazards

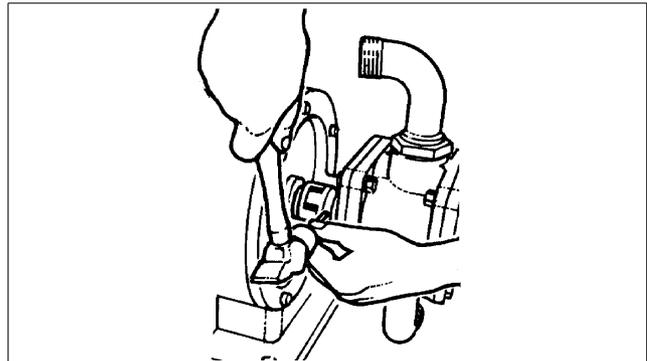
Lubricating oil and various machine surfaces can be hot and cause burns.



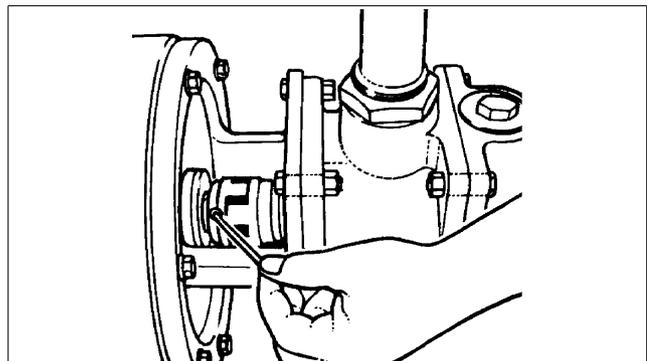
2. Remove the pipe connections from the pump.
3. Remove the sleeve halves over the coupling.



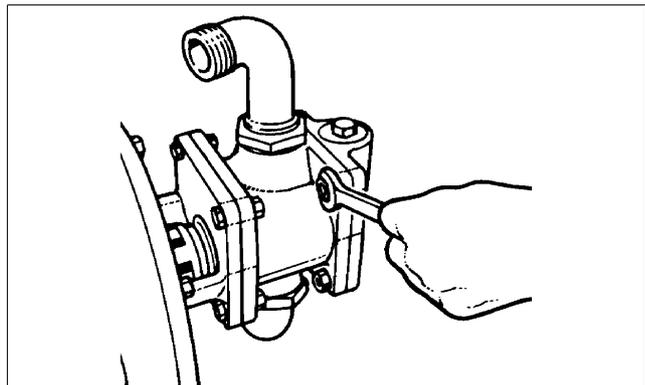
4. Drive out the tubular spring pin, positioned in the coupling half nearest the pump.
Turn the coupling drum by hand until the pin is in a convenient position.



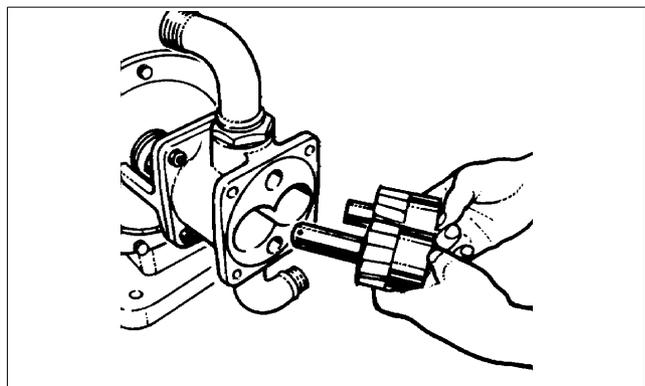
5. Slacken (do not remove) the stop screw positioned in the other coupling half with a hexagon wrench.



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

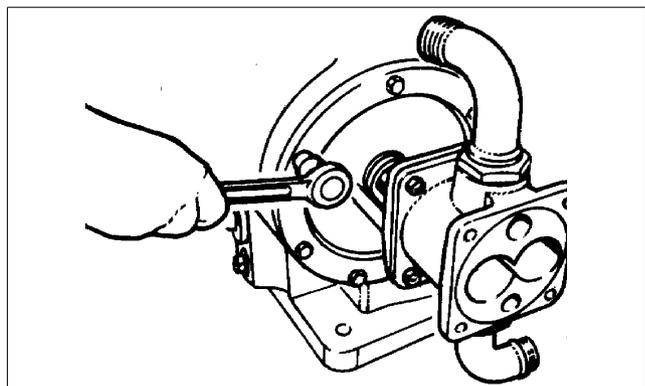


7. Insert two screws (3/8"-16 UNC) into the centre hole of the impeller shafts. Use the screws as a handle to withdraw the impellers.



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.



6.8.3 Cleaning and inspection

1. Remove deposits and clean all parts thoroughly in a suitable cleaning agent. See chapter "5.6.2 Cleaning agents" on page 89.
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)

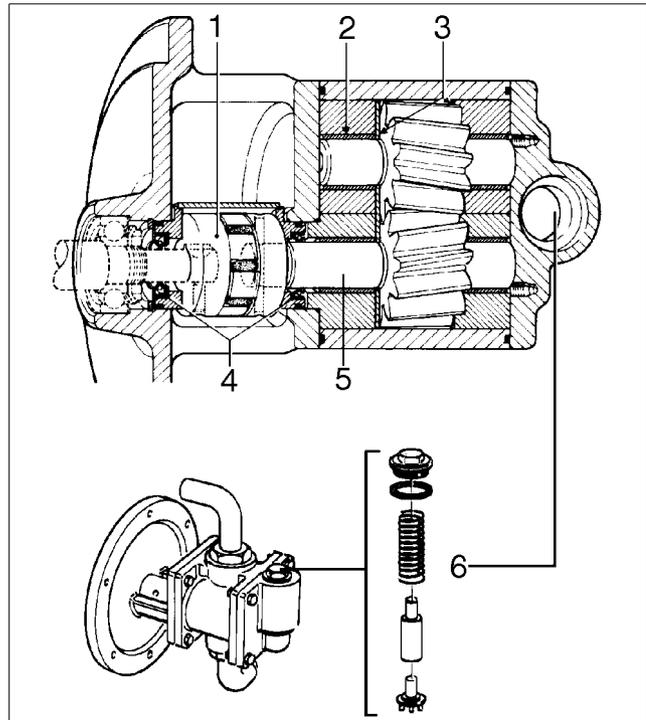
Renew the wear gaskets if any surface is rough, cracked or dented by the impellers.

Relief/safety valve (6)

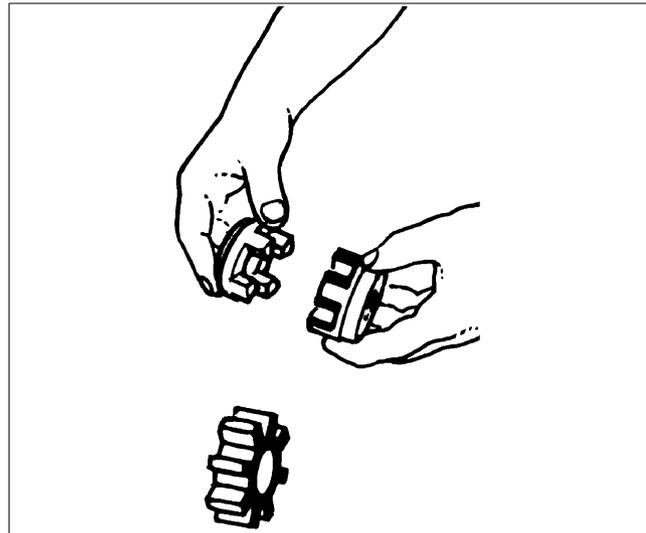
Examine the sealing surfaces on the valve cone and valve seat in the shield. Grind or renew if necessary.

Flexible coupling (1)

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



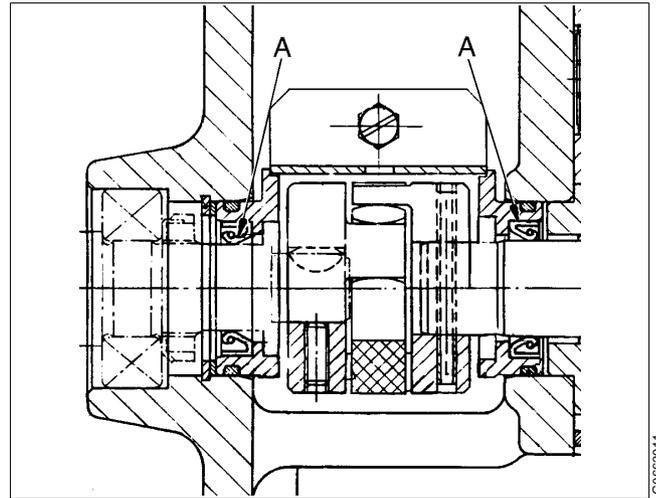
1. *Flexible coupling*
2. *Bushing*
3. *Wear gasket*
4. *Lipseal ring*
5. *Impeller shaft*
6. *Relief/safety valve*



Lipseal rings (4)

Renew the lipseal rings at MS-service.

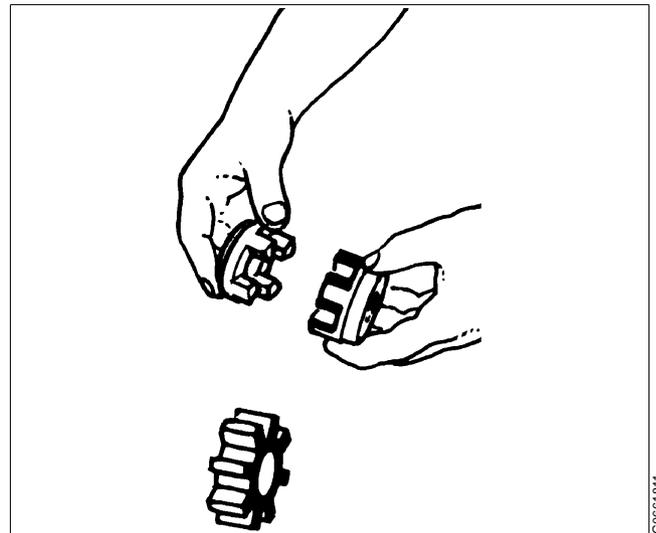
Note: Turn the rings the right way round, see pos. A in the illustration.



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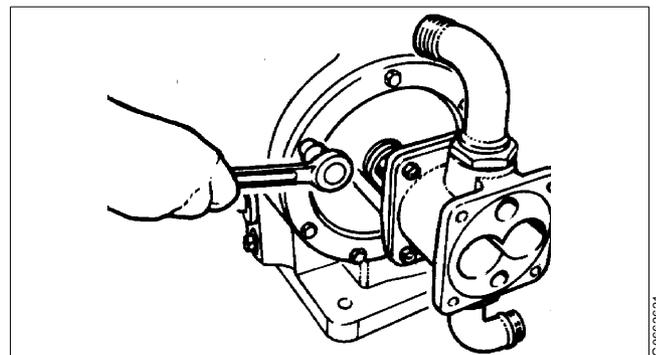
6.8.4 Assembly

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.



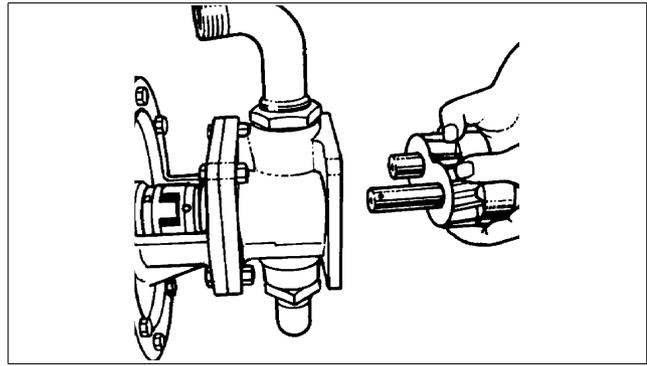
G0661811

4. Tighten the bearing shield screws.



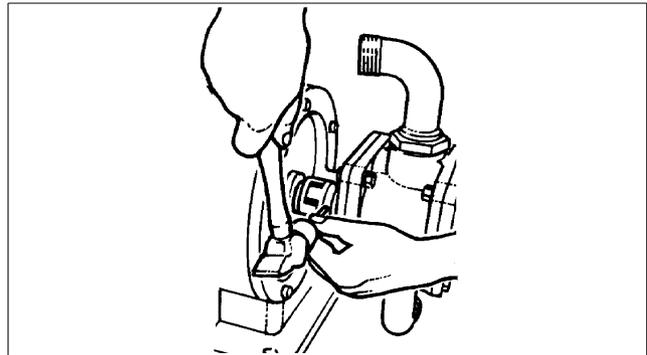
G0662621

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



G0662011

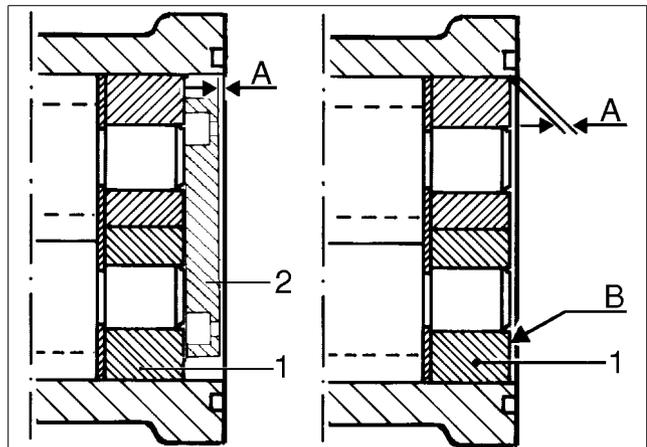
6. Drive in the tubular spring pin.



G0662221

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

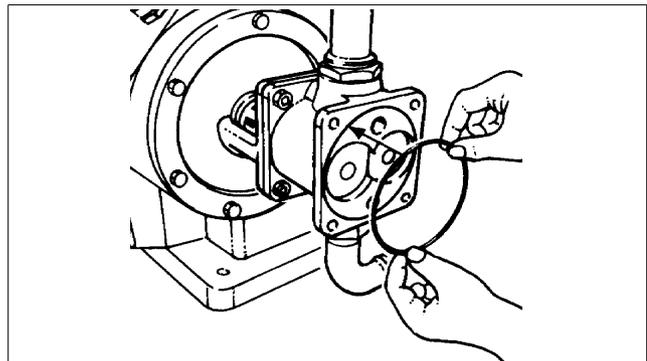
The total axial play (A) must be **0,1 - 0,3 mm**. If the play is too large even though the wear gaskets have been renewed, it can be compensated by adding a brass leaf liner. If the play is too small, grind off the bearing (1).



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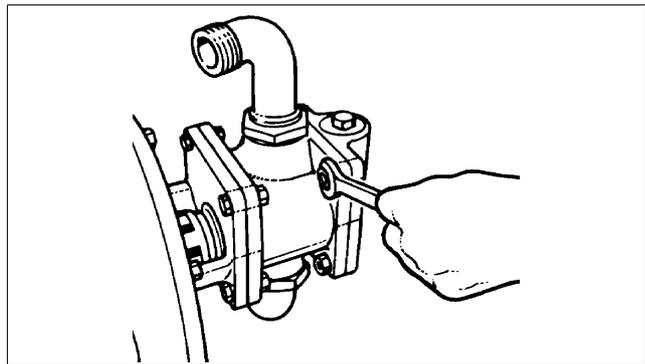
- A. Axial play = 0,1 - 0,3 mm
 B. Where to insert the liner
 1. Bearing
 2. Spacer (not included in all pumps)

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



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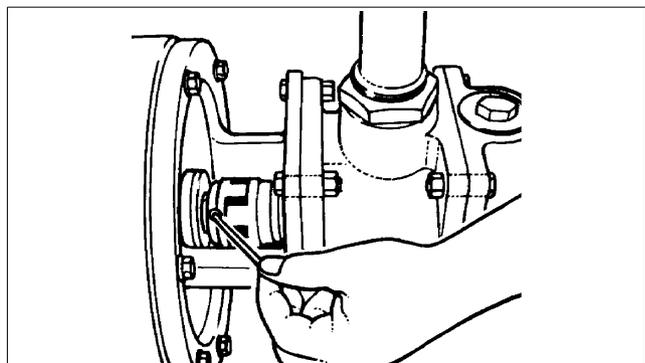
9. Fit the pump shield. (Four screws, four washers and four nuts.)



G0662411

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

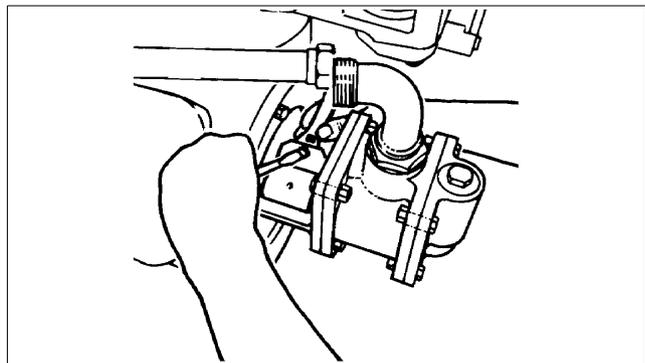
Tighten the stop screw in the coupling half nearest the separator frame with a hexagon wrench. Check that the holders for the lipseal rings are located so that the sleeve halves can easily be fitted.



G0662311

11. Mount the sleeve halves over the coupling.

12. Refit the pipe connections.

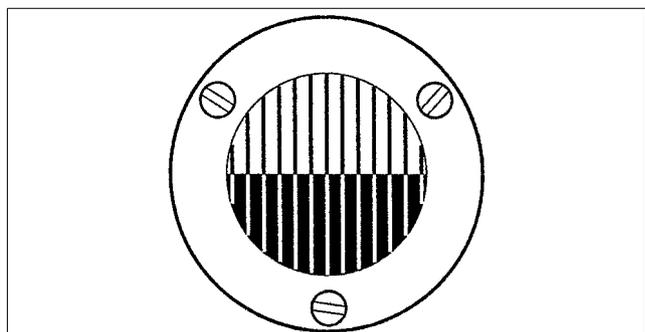


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13. Pour oil into worm gear housing. The oil level should be exactly in the middle of the sight glass.

Oil volume: Approx. **12 litres**.

For recommended oil brands, see chapter "8.8 5Lubricants" on page 200.



G0262011

7 *Trouble-tracing*

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7.1 Mechanical functions

7.1.1 Separator vibrates

NOTE

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



DANGER

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 - incorrect disc stack compression - bowl assembled with parts from other separators	Dismantle the separator and check the assembly and cleaning. Check the number of bowl discs, compare with the number in <i>Spare Parts Catalogue</i> . If necessary, rebalance the bowl.	117
Uneven sludge deposits in the sludge space	Dismantle and clean the separator bowl	111
Height adjustment of the oil paring disc is incorrect	Stop the separator, measure and if necessary adjust the height	84
Bowl spindle bent (max 0,04 mm)	Renew the bowl spindle	75
Bearing is damaged or worn	Renew all bearings	136, 148
Vibration damping rubber cushions are worn out	Renew all rubber cushion	55
Spindle top bearing spring broken	Renew all springs	136

7.1.2 Smell

Cause	Corrective actions	Page
Normal occurrence during start while the friction blocks are slipping	None	–
Brake is applied	Release the brake	–
Oil level in gear housing too low	Check oil level and add oil if necessary	38

7.1.3 Noise

Cause	Corrective actions	Page
Oil level in gear housing too low	Check oil level and add oil if necessary	38
Height adjustment of the oil paring disc is incorrect	Stop the separator, measure and adjust the height	84
Worm wheel and worm are worn	Renew worm wheel and worm	93
Bearing is damaged or worn	Renew all bearings	136, 148
Incorrect play between coupling pulley and elastic plate	Adjust the play	80

7.1.4 Speed too low

Cause	Corrective actions	Page
Brake is applied	Release the brake	–
Coupling friction pads are oily or worn	Clean or renew friction pads	78
Bowl is leaking or not closed	Dismantle the bowl and check	110
Motor failure	Repair the motor	–
Bearing is damaged	Renew all bearings	136, 148
Incorrect gear transmission (60 Hz gear for 50 Hz power supply)	Stop and change the gear transmission to suit the power supply frequency	93, 136, 148
Incorrect coupling friction blocks (60 Hz blocks for 50 Hz power supply)	Change the friction blocks to suit the power supply frequency	78

7.1.5 Starting power too high

Cause	Corrective actions	Page
Incorrect friction blocks (50 Hz blocks for 60 Hz power supply)	 DANGER Stop immediately and change the friction blocks to suit the power supply frequency	78
Wrong direction of rotation	Change electrical phase connections to the motor	–
Brake is applied	Release the brake	–

7.1.6 Starting power too low

Cause	Corrective actions	Page
Incorrect friction blocks (60 Hz blocks for 50 Hz power supply)	Stop immediately and change the friction blocks to suit the power supply frequency	78
Coupling friction pads are oily or worn	Clean or renew friction pads	78
Motor failure	Repair the motor	–

7.1.7 Starting time too long

Cause	Corrective actions	Page
Brake is applied	Release the brake	–
Coupling friction pads are oily or worn	Renew or clean friction pads	78
Height position of oil paring disc or operating device is incorrect	Stop, check and adjust the height	78, 85
Motor failure	Repair the motor	–
Bearing is damaged or worn	Renew all bearings	136, 148

7.1.8 Retardation time too long

Cause	Corrective actions	Page
Brake friction pad is worn or oily	Renew or clean friction pad	75

7.1.9 Water in worm gear housing

Cause	Corrective actions	Page
Bowl casing drain obstructed	Clean the casing and the drains properly. The drains have connection Nos. 462 and 463 on the <i>Basic size drawing</i> . Solve the reason for obstruction. Clean worm gear housing and change oil.	93 187, 191
Leakage at top bearing	Renew seal ring and change oil	136, 96
Condensation	Clean worm gear housing and change oil	96

7.2 Separating functions, purification and clarification

7.2.1 Liquid flows through the bowl casing drain and/or sludge outlet

Cause	Corrective actions	Page
Sludge discharge or water draining in progress	None (normal)	–
The water line is obstructed or the water pressure/flow is too low	Check water pressure/flow: Closing water pressure, 20-30 kPa Closing water flow, min. 18 litres/minute	–
Channels in operating water device are clogged	Clean the operating water device	133
Gasket at the gravity/clarifier disc defective	Renew the gasket	110
Paring chamber cover (small lock ring) defective	Renew the paring chamber cover	110
Seal ring in the bowl hood defective	Renew the seal ring	110
Sealing edge of the sliding bowl bottom defective	Smoothen sealing edge of the sliding bowl bottom or renew it	71
Valve plugs are defective	Renew all valve plugs	70
Bowl speed too low	See section “7.1.4 Speed too low” on page 173 in this chapter	–

7.2.2 Bowl opens accidentally during operation

Cause	Corrective actions	Page
Strainer in the operating water supply is clogged	Clean the strainer	–
No water in the operating water system	Check the operating water system and make sure the valve(s) are open	–
Water connections to the separator are incorrectly fitted	Correct	–
Nozzle in the operating slide is clogged	Clean the nozzle. Carry out an Intermediate Service (IS)	124
Square-sectioned ring in sliding bowl bottom is defective	Renew the square-sectioned ring. Carry out an Intermediate Service (IS)	71
Valve plugs are defective	Renew all plugs. Carry out an Intermediate Service (IS)	70
Supply valve for opening water is leaking	Rectify the leak	–

7.2.3 Bowl fails to open for sludge discharge

Cause	Corrective actions	Page
Strainer in the operating water supply is clogged	Clean the strainer	–
Supply valve for opening water is closed	Open	
Seal rings in operating water device defective	Renew the seal rings	133
Water flow too low	Check the opening water flow; min. 18 litres/minute	–
Seal ring in the operating slide is defective	Renew the seal ring. Carry out an Intermediate Service (IS)	123

7.2.4 Unsatisfactory sludge discharge

Cause	Corrective actions	Page
Valve plugs in the operating slide too high	Renew with correct valve plugs	70
Sludge deposits in the operating system	Check and clean the operating system	123, 133

7.2.5 High pressure in oil outlet

Cause	Corrective actions	Page
Throughput too high	Adjust	–
Valve(s) in oil outlet line closed	Open the valve(s) and adjust the oil outlet pressure to 1,5 bar	–

7.3 Separating functions, purification only

7.3.1 Unsatisfactory separation result

Cause	Corrective actions	Page
Gravity disc hole too small	Use a disc with larger hole	35
Incorrect separation temperature	Adjust	–
Throughput too high	Adjust	–
Disc stack is clogged	Clean disc stack	91
Sludge space in bowl is filled	Clean and reduce the time between sludge discharges	91
Bowl speed too low	See “7.1.4 Speed too low” on page 173	–

7.3.2 Outgoing water contains oil

Cause	Corrective actions	Page
Gravity disc hole too large	Use a disc with smaller hole	35
The water line is obstructed or the water pressure/flow is too low	Check water flow: Closing water flow, min. 23litres/minute	–
No or insufficient sealing/displacement water supply (206)	Rectify the water supply	–
O-rings on the upper (water) paring disc are defective	Renew the O-rings	110
Gasket/O-ring at the gravity disc or paring chamber cover is defective	Renew the gasket/O-ring	110

7.3.3 Oil discharges through water outlet (broken water seal)

Cause	Corrective actions	Page
Gravity disc hole too large	Use a disc with smaller hole	35
Incorrect separation temperature	Adjust	–
Throughput too high	Adjust	–
The water line is obstructed or the water pressure/flow is too low	Check water pressure/flow: Closing water pressure, 20-30 kPa Closing water flow, min. 18 litres/minute	–
No or insufficient sealing/displacement water supply (206)	Rectify the water supply	–
Valve(s) in oil outlet line is closed	Open the valve(s)	–
Sealing water volume is too small	Check the water supply flow (min. 23 litres/minute)	–
Gasket/O-ring at the gravity disc or paring chamber cover is defective	Renew the gasket/O-ring	110
Disc stack is clogged	Clean the disc stack	110
Bowl hood seal ring defective or the sealing surface of sliding bowl bottom is damaged	Renew the seal ring. Polish the surface on sliding bowl bottom or renew it	110
Rectangular seal ring in sliding bowl bottom is defective	Renew the seal ring	123
Bowl speed to low	Check that the brake is released. Examine the motor and power transmission including the gear ratio	93, 148
Bowl is incorrectly assembled	Check the assembly	110

7.4 Separating functions, clarification only

7.4.1 Unsatisfactory separation result

Cause	Corrective actions	Page
Incorrect separation temperature	Adjust	–
Throughput too high	Adjust	–
Feed oil contains water	<ol style="list-style-type: none"> 1. Check preceding purifier when operating in series 2. Reduce the time between discharges 3. Operate the separator as purifier 	– – 35
Bowl disc stack is clogged	Clean the disc stack	106
Sludge space in bowl is filled	Clean and reduce the time between discharges	110
Bowl speed too low	Check that the brake is released. Examine the motor and power transmission including the gear ratio	110

7.4.2 Oil discharges through water outlet

Cause	Corrective actions	Page
Valve(s) in oil outlet line is closed	Open the valve(s)	–
Bowl disc stack is clogged	Clean the disc stack	110
O-rings on the upper (water) paring disc are defective	Renew the O-rings	110
Bowl is incorrectly assembled	Check the assembly	110

7.5 Vibration switch (option)

7.5.1 Vibration switch does not reset

Cause	Corrective actions	Page
Dirt or iron chips on magnets	Clean magnets	–
Leaf spring broken	Return to Alfa Laval for repair	–
Reset coil open	Check for continuity and proper coil resistance	–

7.5.2 Impossible to adjust setpoint setting to obtain tripping

Cause	Corrective actions	Page
Incorrect air gap between hold-down magnet (lower) and armature in switch	Readjust the air gap with the stop pin screw	–

7.5.3 Vibration switch does not reset

Cause	Corrective actions	Page
Defective switch	Replace and verify by manually moving the armature to the latched (tripped) position and listen for an audible click. Verify contact by performing a continuity check	–
Incorrect position	Check that the switch plunger is just free of the armature when in the set (un-tripped) position	–

8 *Technical Reference*

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8.1 Technical data

Alfa Laval ref. 557299

NOTE

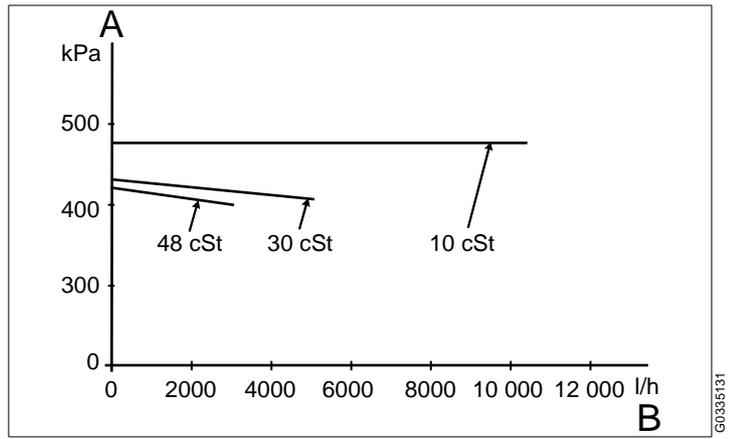
The separator is a component operating in an integrated system including a monitoring system. If the technical data in the system description do not agree with the technical data in this instruction manual, the data in the system description shall apply.

Product number	881076-04-03
Separator type	MOPX 309TGT-24
Application	<p>Purification or clarification of low and high viscosity fuel oils and lubricating oils.</p> <p>The flash point of the oils to be separated must be min. 60 °C.</p> <p>Intended for both land and marine applications.</p>
Density of operating water, max.	1 000 kg/m ³
Pressure of operating water, max.	200 kPa
Density of sediment/feed, max.	1 498/1 100 kg/m ³
Hydraulic capacity, max.	11 800 litres/hour
Process capacity	<p>Maximum oil flow at the maximum permissible oil density 991 kg/m³ at 15 °C.</p> <p>The density is preferably measured at 50 °C according to ASTM method D 1298-80 and corrected to 15 °C according to ASTM tables D 1250-80.</p>
Feed temperature, min./max.	0/100 °C
Ambient temperature, min./max.	5-15/55 °C The min. temperature is dependent of the used oil type. See "8.8.2 Recommended lubricating oils" on page 202.
Bowl speed, max.	5175/5142 r/min., 50/60 Hz
Motor shaft speed, max.	1500/1800 r/min., 50/60 Hz
Revolution counter	118-125 / 142-150 r/min., 50/60 Hz
No. of teeth;	
- on worm, 50 Hz	20
- on worm, 60 Hz	21
- on worm wheel, 50 Hz	69
- on worm wheel, 60 Hz	60
Lubricating volume	approx. 12 litres

Motor power rating	11	kW
Power consumption, max.	16	kW (at starting up)
Power consumption, normal	6/8,7	kW (idling/at max. capacity)
Discharge volume, nominal	13,5	litres fixed discharge volume
Discharge interval, min./max.	1/240	minutes
Bowl volume	13	litres
Starting time	3-4	minutes
Stopping time with brake	4-7	minutes
Max. running time without flow;		
- empty bowl	180	minutes
- filled bowl	180	minutes
Sound power level	–	Bel(A) ISO 3744, 4,5 m ³ /h
Sound pressure level	83	dB(A) ISO 3744, 4,5 m ³ /h
Vibration level, separator in use, max.	11,2	mm/s (RMS)
Weight of separator (without motor)	1 060	kg
Weight of bowl	220	kg

The materials in contact with process fluid (excluding seals and O-rings) are brass, bronze and stainless steel. Cast iron frame. Intended for both land and marine applications.

Oil inlet pump, built-on (option)	<i>Capacity</i>	<i>50 Hz</i>	<i>60 Hz</i>
	Pump No.	(lit/h)	(lit/h)
	538721-87	2 420	2 900
	538721-84	3 630	4 350
	538721-85	4 350	5 220
	538721-83	5 760	6 920
	538721-81	8 540	10 250
	Suction lift:	Max. 40 kPa	
	Delivery head:	Max. 150 kPa	
Oil outlet paring disc pump	Delivery head:	400-475 kPa, depending of flow and viscosity	

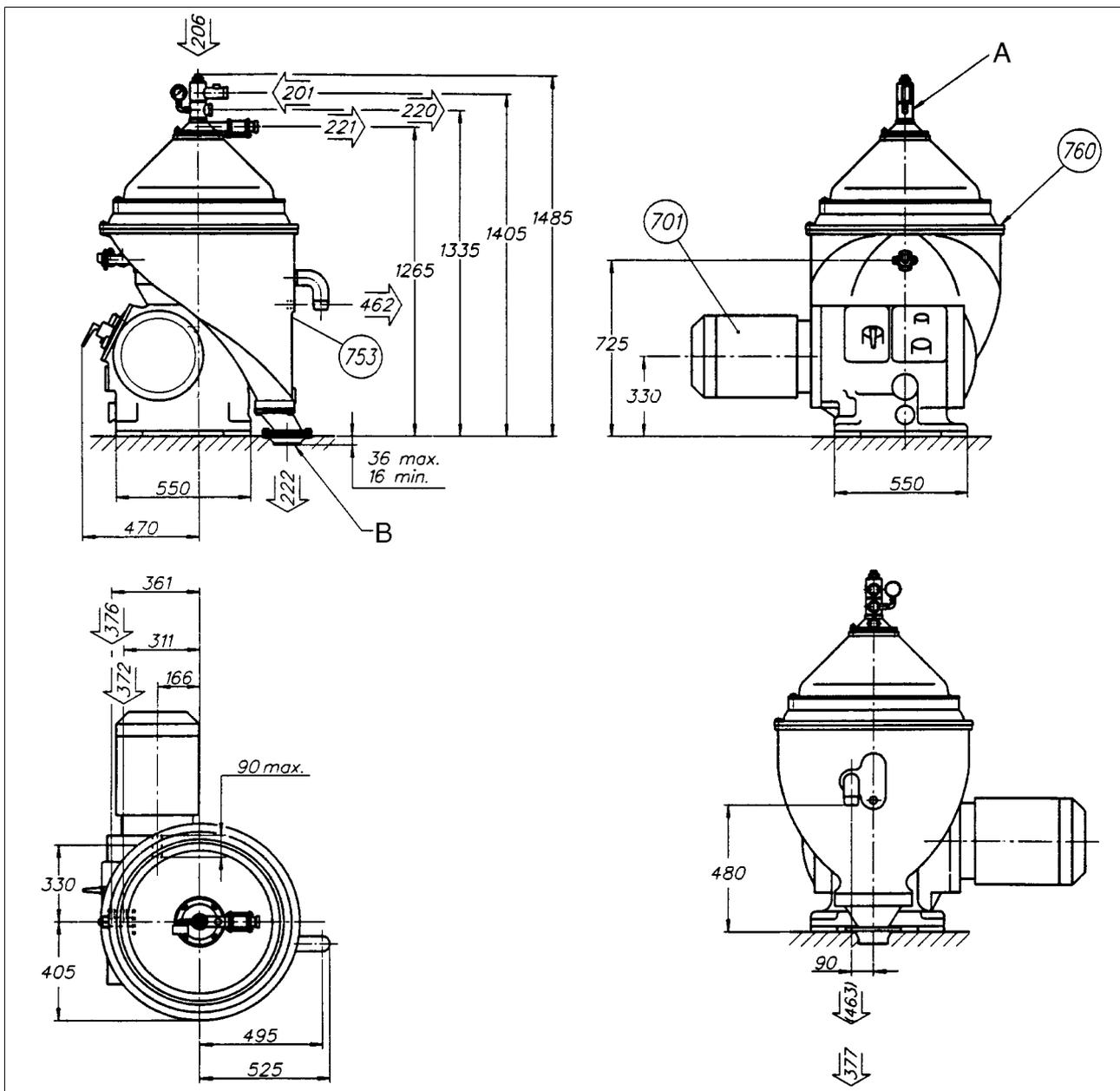


- A. Back pressure in kPa
 B. Flow in m^3/h

8.2 Basic size drawing, without pump

8.2.1 Separator excl. connections

Alfa Laval ref. 558575



A. Maximum horizontal displacement at the in/outlet connections during operation ± 15 mm.

B. Maximum vertical displacement at the sludge connection during operation ± 10 mm.

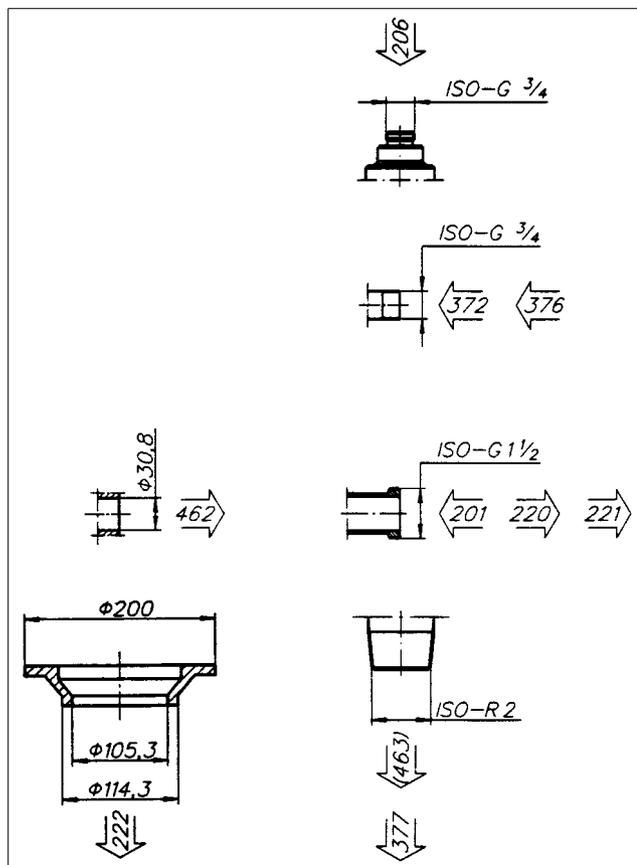
For description of the connection numbers, see "8.3 Connection list, without pump" on page 189 and "8.6 Interface description" on page 195.

8.2.2 Dimensions of connections

Alfa Laval ref. 558575

Data for connections, see chapter "8.3 Connection list, without pump" on page 189.

All connections to be installed non-loaded and flexible.



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8.3 Connection list, without pump

Alfa Laval ref. 557297 rev. 2

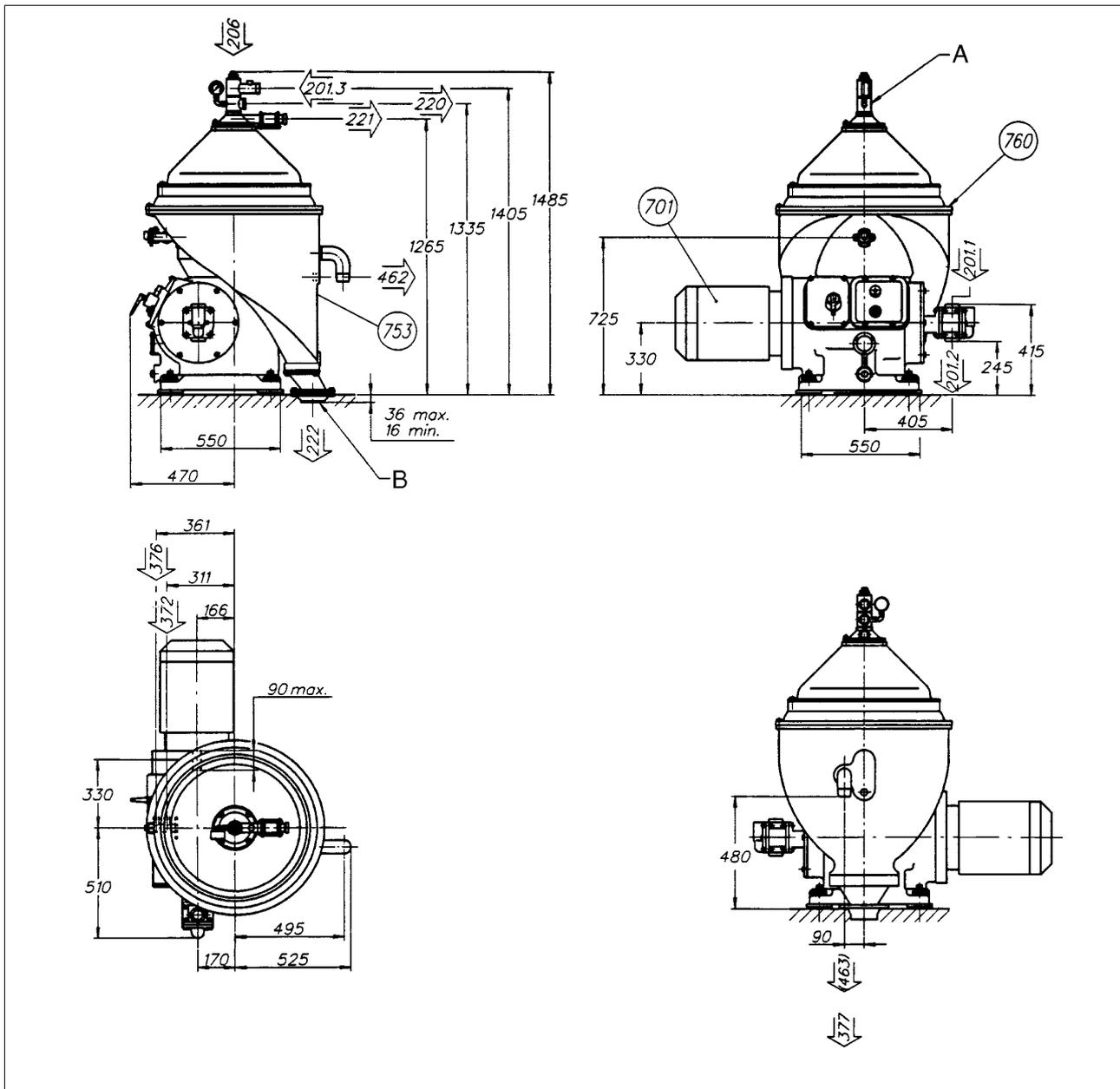
Connection No.	Description	Requirements/limits
201	Inlet for product - Allowed temperature	Min. 0 °C, max. 100 °C
206	Inlet to liquid seal and displacement liquid, water - Instantaneous flow - Pressure (Min./Max.)	Fresh water 18 litre/minute 200/600 kPa
220	Outlet for light phase (oil) - Counter pressure	0 - 400 kPa
221	Outlet for heavy phase (water)	
222	Outlet for solid phase	The outlet after the separator should be installed in such a way that you can not fill the frame top part with sludge. (Guidance of sludge pump or open outlet)
372	Inlet of discharge liquid - Instantaneous flow - Time - Pressure (Min./Max.)	See demand in chapter "8.7 Water quality" on page 199 23 litres/minute 3 seconds/discharge 200/600 kPa
376	Inlet for make-up liquid - Pressure (Min./Max.)	See demand in chapter "8.7 Water quality" on page 199 22/32 kPa
372 + 376	Discharge and make-up liquid - Consumption	2,4 litres/discharge

Connection No.	Description	Requirements/limits
377 (463)	Outlet for operating liquid (discharge and make-up liquid) Drain of frame top part, upper	
462	Drain of frame top part, lower	
701	Motor for separator - Allowed frequency variation	$\pm 5\%$ (momentarily 10% during a period of maximum 5 seconds)
753	Vibration sensor (delivered as option) <ul style="list-style-type: none"> - Type - Vibration measurement range - Switch rating, resistive load max. - Reset coil power supply max. 14 W 	See "8.6 Interface description" on page 195 and "8.9.6 Vibration sensor (option)" on page 215 Mechanical switch 0 to 4,5 g from 0 to 300 Hz 5 A 12 V DC 2 A 24 V DC 1 A 48 V DC 0,5 A 120 V DC 7 A 460 V AC 50/60 Hz 48 V DC
760	Cover interlocking switch (delivered as option)	See "8.6 Interface description" on page 195 and "8.9.7 Cover interlocking switch (option)" on page 215
	<ul style="list-style-type: none"> - Type - Switch rating, resistive load max. 	Mechanical switch 3 A 500 V

8.4 Basic size drawing, with pump

8.4.1 Separator excl. connections

Alfa Laval ref. 559747 rev. 0



A. Maximum horizontal displacement at the in/outlet connections during operation ± 15 mm.

B. Maximum vertical displacement at the sludge connection during operation ± 10 mm.

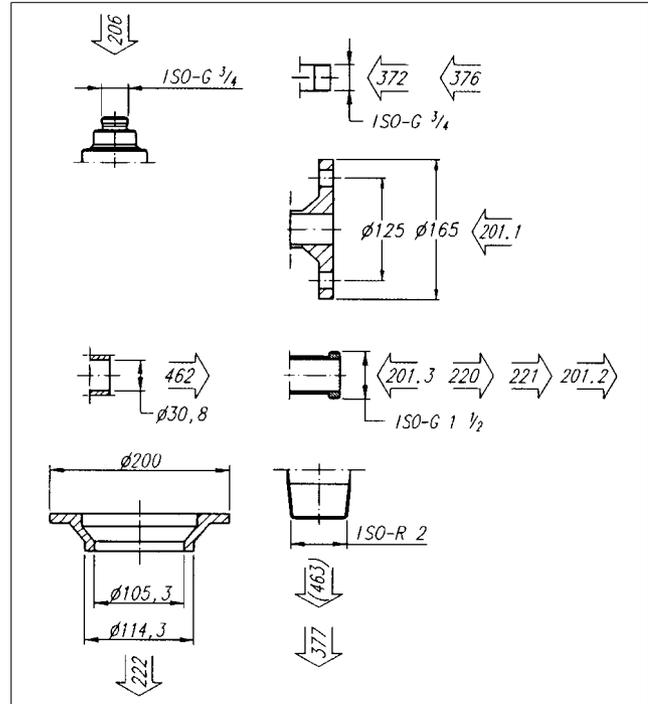
For description of the connection numbers, see "8.5 Connection list, with pump" on page 193 and "8.6 Interface description" on page 195.

8.4.2 Dimensions of connections

Alfa Laval ref. 559747 rev. 0

Data for connections, see chapter "8.5
Connection list, with pump" on page 193.

All connections to be installed non-loaded and
flexible.



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8.5 Connection list, with pump

Alfa Laval ref. 557312, rev. 2

Connection No.	Description	Requirements/limits
201.1	Inlet for product to pump - Allowed temperature	Min. 0 °C, max. 100 °C
201.2	Outlet for process liquid from pump	
201.3	Inlet for process liquid to separator - Allowed temperature	Min. 0 °C, max. 100 °C
206	Inlet to liquid seal and displacement liquid, water – Instantaneous flow – Pressure (Min./Max.)	Fresh water 18 litre/minute 200/600 kPa
220	Outlet for light phase (oil) – Counter pressure	0 - 400 kPa
221	Outlet for heavy phase (water)	
222	Outlet for solid phase	The outlet after the separator should be installed in such a way that you can not fill the frame top part with sludge. (Guidance of sludge pump or open outlet)
372	Inlet of discharge liquid – Instantaneous flow – Time – Pressure (Min./Max.)	See demand in chapter “8.7 Water quality” on page 199 23 litres/minute 3 seconds/discharge 200/600 kPa
376	Inlet for make-up liquid – Pressure (Min./Max.)	See demand in chapter “8.7 Water quality” on page 199 22/32 kPa

Connection No.	Description	Requirements/limits
372 + 376	Discharge and make-up liquid – Consumption	2,4 litres/discharge
377 (463)	Outlet for operating liquid (discharge and make-up liquid) Drain of frame top part, upper	
462	Drain of frame top part, lower	
701	Motor for separator - Allowed frequency variation	± 5% (momentarily 10% during a period of maximum 5 seconds)
753	Vibration sensor (delivered as option) – Type – Vibration measurement range – Switch rating, resistive load max.	See “8.6 Interface description” on page 195 and “8.9.6 Vibration sensor (option)” on page 215 Mechanical switch 0 to 4,5 g from 0 to 300 Hz 5 A 12 V DC 2 A 24 V DC 1 A 48 V DC 0,5 A 120 V DC 7 A 460 V AC 50/60 Hz
760	Cover interlocking switch (delivered as option)	See “8.6 Interface description” on page 195 and “8.9.7 Cover interlocking switch (option)” on page 215
	– Type – Switch rating, resistive load max.	Mechanical switch 3 A 500 V

8.6 Interface description

Alfa Laval ref. 557138, rev. 3

8.6.1 General

In addition to the Connection List this document describes limitations and conditions for safe control, monitoring and reliable operation.

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

8.6.2 Definitions

Stand still (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 technical data.

The start procedure continues until full speed has been reached and a stabilization period has passed (about 1 minute).

Normal stop means:

- Stopping of the machine at any time with brake applied.
- The bowl must be kept filled.

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.
- Sludge ejection must not be made.
- 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.

8.6.3 Component description and signal processing

Separator motor 701

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

Vibration sensor 753 (option)

The vibration sensor is an acceleration sensitive instrument with a mechanical switch.

Signal Processing

The vibration sensor gives an open contact when the vibration exceeds the preset value.

If too high vibration occurs the separator must be stopped with automatic Safety Stop.

Cover interlocking switch 760 (option)

The cover of the separator can be equipped with an interlocking switch as option.

When the cover is closed the interlocking circuit in the control system is closed and the separator could be started.

Signal Processing

The circuit is closed when the frame hood of the separator is closed.

The interlocking switch should be connected so that starting of the motor is prevented when the separator hood is not closed.

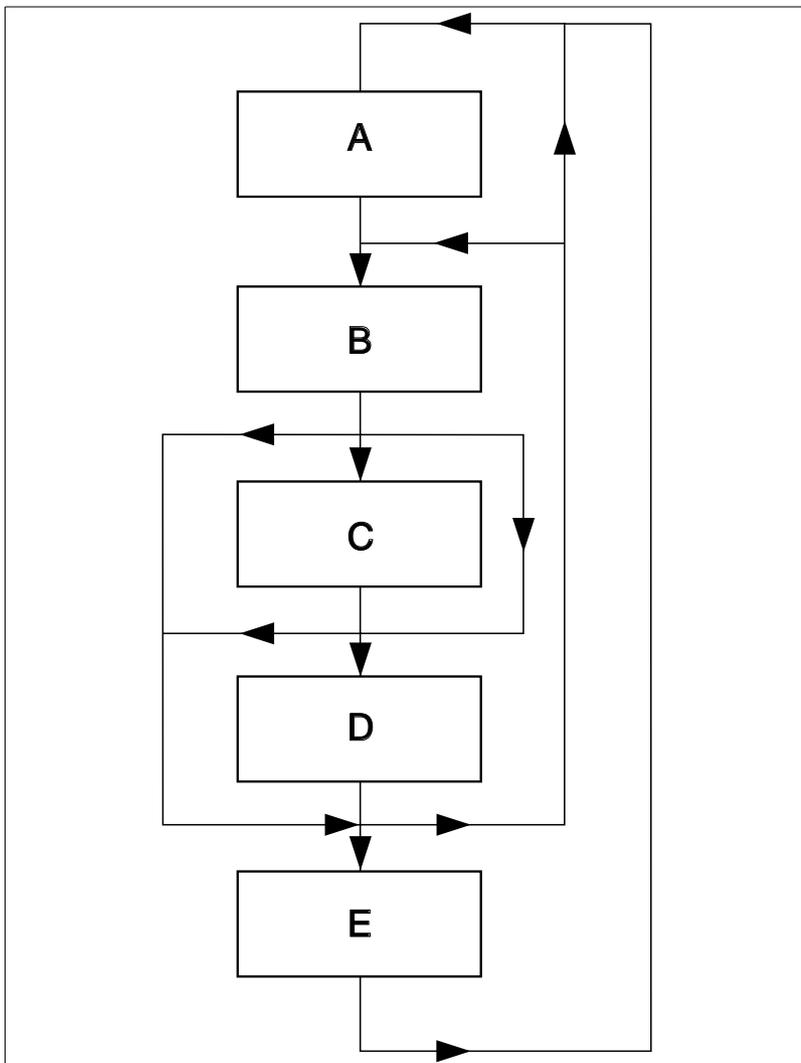
Discharge

Signal processing

The control system shall contain a memory function for registration of the number of initiated discharges.

At indication of the absence of a discharge, the operator or the control system must initiate a new discharge. At indication of the absence of two consecutive sludge discharges, an alarm must be given and action must be taken.

8.6.4 Function graph and running limitations



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

8.7 Water quality

Alfa Laval ref. 553406 rev.3

Specific requirements regarding the quality of water

Water is used in the separator for several different functions: Discharge-mechanisms, liquid seals, as cooling media and for flushing.

Bad quality of the water can with time cause erosion, corrosion and/or operating problems in the separator and must therefore be treated to meet certain demands.

The following requirements are of fundamental importance.

1.1 Turbidity-free water, solids content < 0,001% of volume.

Deposits must not be allowed to form in certain areas in the separator.

1.2 Max particle size 50 μ m.

2. Total hardness \leq 180 mg CaCO₃ per litre.

Chalk deposits can build-up if the water is hard (corresponds to 10 °dH or 12,5 °E). Increased operating temperature accelerates the chalk built-ups.

3. Chloride content \leq 100 ppm NaCl (equivalent to 60mg Cl/l).

Chloride ions contribute to corrosion on the separator surfaces in contact with the operating water, including the spindle. Corrosion is a process that is accelerated by increased separating temperature, low pH, and high chloride ion concentration. A chloride concentration above 60 mg/l is not recommended.

4. pH > 6

Increasing acidity (lower pH) increases corrosion; this is accelerated by increased temperatures and high chloride ion content.

For test methods, contact any Alfa Laval representative.

If these demands cannot be met, the water should be pretreated according to Alfa Laval's recommendations.

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

Alfa Laval ref.

8.8 5Lubricants

8.8.1 Lubrication chart, general

Alfa Laval ref. 553216-01

Lubricating points	Lubricants
Bowl spindle ball bearings and buffers are lubricated by oil mist	Lubricating oil as specified in "8.8.2 Recommended lubricating oils" on page 202
Bowl spindle taper	Lubricating oil (only a few drops for rust protection)
Buffers of bowl spindle	Lubricating oil
Bowl: Sliding contact surfaces and pressure loaded surfaces such as lock rings, threads of lock rings, bowl hood, and cap nut	Pastes as specified in "8.8.4 Recommended lubricants" on page 206 If not specified otherwise, follow the supplier's recommendation about method of application
Rubber seal rings	Grease as specified in "8.8.4 Recommended lubricants" on page 206
Friction coupling ball bearings	The bearings are packed with grease and sealed and need no extra lubrication
Electric motor (if nipples are fitted)	Follow manufacturer's instructions.

Alfa Laval Lubricating Oil Groups:

- **Group A oil:** a high quality gear oil on paraffin base with stable AW (anti wear) additives.
- **Group B oil:** a high quality gear oil on paraffin base with stable EP (extreme pressure) additives.
- **Group D oil:** a synthetic base oil with additives stable at high operating temperatures.

Do not mix different oil brands or oils from different oil groups.

Always use clean vessels when handling lubricating oil.

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

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

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

NOTE

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

NOTE

Check the oil level before start. Top up when necessary. Oil volume see "4.1.3 Ready for start" on page 38.

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

Applying, handling and storing of lubricants

Always be sure to follow lubricants manufacturer's instructions.

8.8.2 Recommended lubricating oils

Alfa Laval ref. 553219-15

Two different groups of lubricating oils are approved for this separator.

They are designated as Alfa Laval lubricating oil groups A and D.

The numerical value after the letter states the viscosity grade.

The corresponding commercial oil brands are found in chapter "8.8.3 Recommended oil brands" on page 203.

Ambient temperature °C	Alfa Laval lubricating oil group	Time in operation Oil change interval
between +15 and +60	A/320	1 000 - 1 500 h
between -10 and +60	D/220	2 000 h
between ±0 and +60	D/320	2 000 h

Note:

- In a new installation or after change of gear transmission, change oil after 200 operating hours and clean the gear housing.
- When the separator is operated for short periods, lubricating oil must be changed every 12 months even if the total number of operating hours is less than stated in the recommendations above.
- Check and prelubricate spindle bearings on separators which have been out of service for 6 months or longer.
- In seasonal operation: change oil before every operating period.

8.8.3 Recommended oil brands

Alfa Laval lubricating oil group A/320

Alfa Laval ref. 553218-11

Viscosity grade VG (ISO 3448/3104) 320

Viscosity index VI (ISO 2909) >95

Manufacturer	Designation
Alfa Laval	546099-80 20 litres
	546099-81 4 litres
	546099-82 208 litres
	546099-83 1 litre
BP	Bartran 320
Castrol	Alpha ZN 320
Esso Standard Oil/ Svenska Statoil/Exxon	Nuto 320 Teresso 320 Terrestic 320
Lubmarine/Beijer (ELF Brand designation according to ELF)	Polytelis 320
Mobil	DTE Oil AA Gencirc TQ 320
Q8/Kuwait (Gulf)	Harmony AW 320
Shell	Tellus C 320 Vitrea 320 Tellus 320
Texaco/Caltex	Regal R&O 320 Paper Machine HD 320

Alfa Laval lubricating oil group D/220

Alfa Laval ref. 553218-08

Viscosity grade VG (ISO 3448/3104) 220

Viscosity index VI (ISO 2909) >130

Manufacturer	Designation
Alfa Laval	542690-80 20 litres
	542690-81 4 litres
	542690-82 208 litres
	542690-83 1 litre
BP	Energol HTX 220
Castrol	Alpha Syn T 220
Chevron	Ultragear 220
Esso/Exxon/Statoil	Terrestic SHP 220, Teresso SHP 220
Lubmarine/ELF	Epona SA 220
Mobile (Engen)	SHC 630
Q8/Kuwait /Gulf	Schumann 220
Shell	Paolina 220

Alfa Laval lubricating oil group D/320

Alfa Laval ref. 553218-06

Viscosity grade VG (ISO 3448/3104) 320

Viscosity index VI (ISO 2909) >130

Manufacturer	Designation
Alfa Laval Separation AB	542690 - blue
Castrol	Alpha Syn T 320
Lubmarine/Beijer (ELF Brand designation according to ELF)	Epona SA 320
Optimol Ölwerke	Optigear HT 320
Q8/Kuwait	Schumann 320
Chevron	Ultragear 320
Esso/EXXON/Standard Oil/ Svenska Statoil	Terrestic SHP 320
Mobil	SHC 632
Shell	(Delima HT 320)* (Paolina 320)

() = available in a few countries

* These oils must be used when the frame temperature is about 80 °C.

If you can't measure the temperature: about 80 °C is reached when you can touch the lower frame surface for a short time only.

8.8.4 Recommended lubricants

Pastes and bonded coatings for non-food applications

Alfa Laval ref. 553217-01

Manufacturer	Designation	Alfa Laval No.	Application
Gleitmolybdän	Gleitmo 805 K or 805 K varnish 901 Gleitmo Paste G rapid	537086-04	All pressure loaded surfaces
Dow Corning	Molykote paste 1000 spray D321 R varnish D321 R	537086-02 535586-01 535586-02	
Rocol	Antiscuffing paste (ASP)		
Klueber	Wolfracoat C paste		
Russian Standard	VNII NP 232 Gost 14068-90		

Silicone grease

Manufacturer	Designation	Alfa Laval No.
Dow Corning	Molykote 111 compound 100 g 25 g	539474-02 539474-03
Gleitmolybdän	Silicone paste 750	
Wacker	Silicone Paste P (vacuum paste)	

Greases for ball and roller bearings

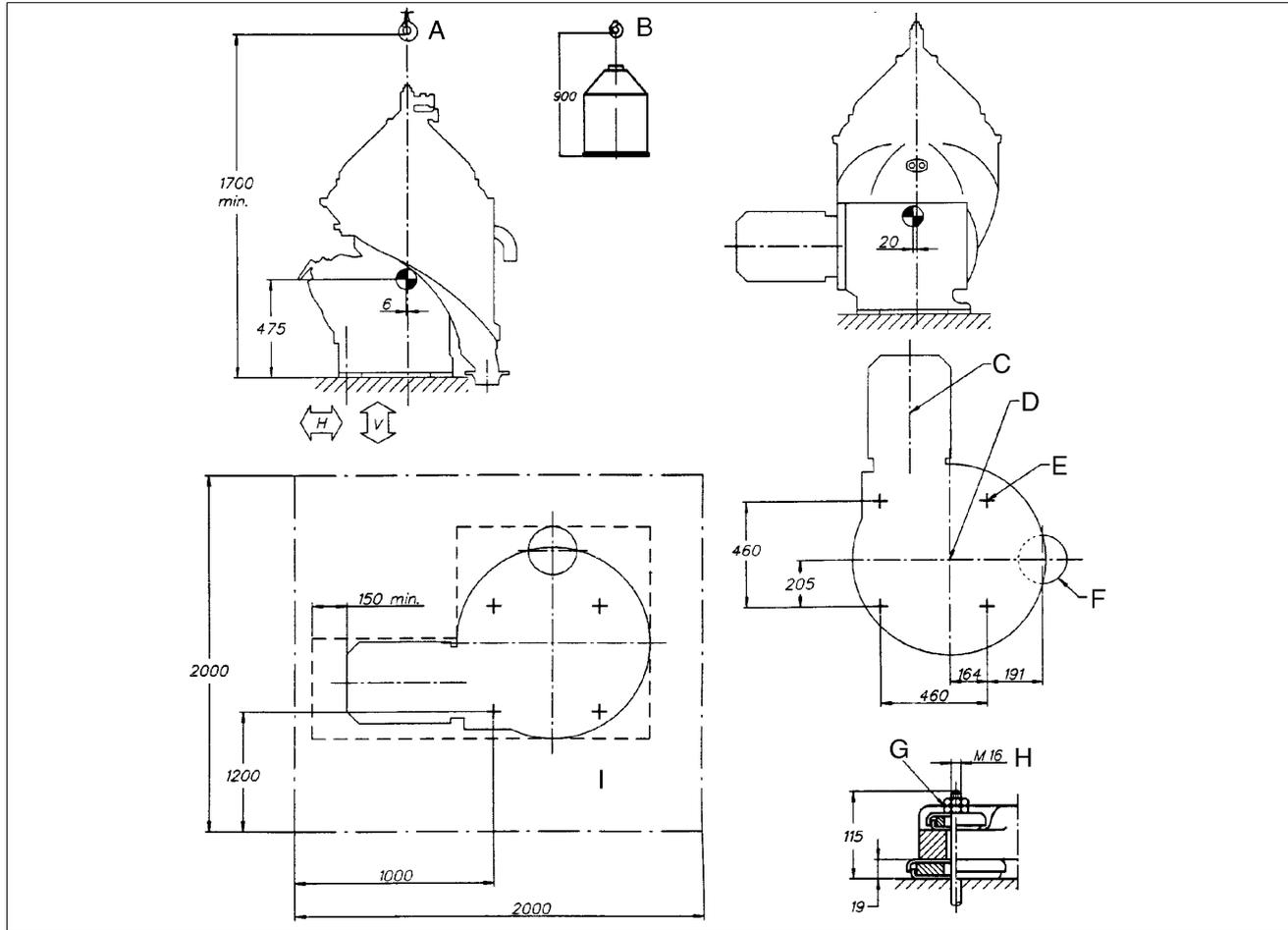
Alfa Laval ref. 554900-01

Manufacturer	Designation	Alfa Laval No.
BP	Energrease MMEP2 Energrease LS2	
Castrol	Spheerol SW2 EP Spheerol EPL2	
Chevron	Duralith grease EP2	
Exxon	Beacon EP2	
Mobil	Mobilith SHC 460 Mobilux EP2	
Gulf	Gulflex MP2	
Q8	Rembrandt EP2	
Shell	Cailithia EP Grease T2 Alvania EP Grease 2 or R.A	
SKF	LGEP2 or LGMT2	
Texaco	Multifak AF B2 Multifak premium 2,3	
Russian Standard	Fiol 2M, Litol 24 TU 38.201.188	

8.9 Other drawings

8.9.1 Foundations

Alfa Laval ref. 557258



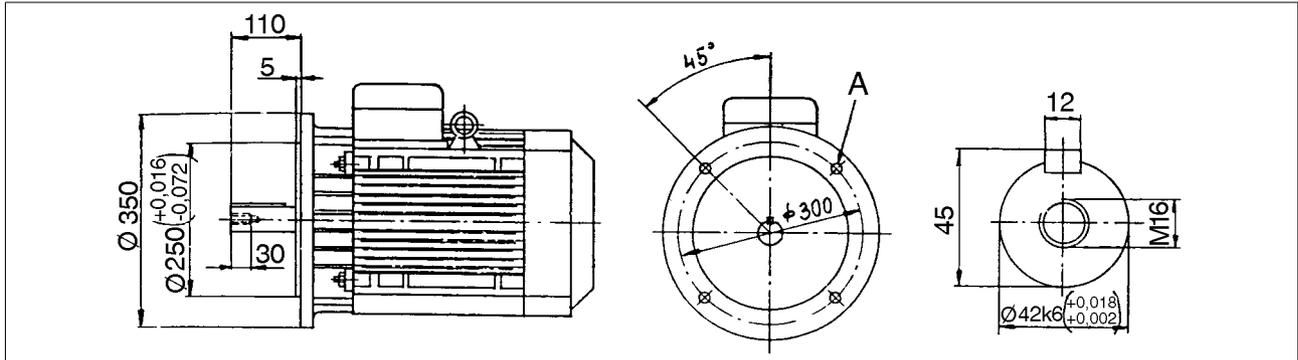
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- | | |
|--|--|
| <p>A. Min. lifting capacity 1000 kg
Recommended speed for lifting:
Low speed 0,5-1,5 m/min.
High speed 2-6 m/min.</p> <p>B. Max. height of largest component incl. lifting tool</p> <p>C. Centre of motor</p> <p>D. Centre of separator bowl</p> <p>E. 4 holes Ø 17 for anchorage</p> <p>F. Hole Ø 110 for sediment outlet</p> <p>G. Tightening torque 20 Nm.
Locked with lock nut</p> <p>H. Minimum property class 8.8</p> <p>I. Service side</p> | <p>----- Recommended free floor space for unloading when doing service</p> <p>----- Min. access area for overhead hoist. No fixed installations within this area.</p> <p>● Centre of gravity (without motor)</p> <p>⌞V⌞ Vertical force not exceeding 20 kN/foot</p> <p>⌞H⌞ Horizontal force not exceeding 20 kN/foot</p> <p>Total static load max. 15 kN</p> |
|--|--|

8.9.2 Electric motor (land application)

Alfa Laval ref. 539827

Note! This motor is for land application only



A = Four holes diameter 18 mm

Manufacturer	Not fixed
Standards	IEC 72-2, 34-1, CENEL/2B
Size	160M
Poles	4
Degree of protection	IP44
Method of cooling	IC 41 (IEC 34-6)
Specification	Totally enclosed fan-cooled three-phase induction motor

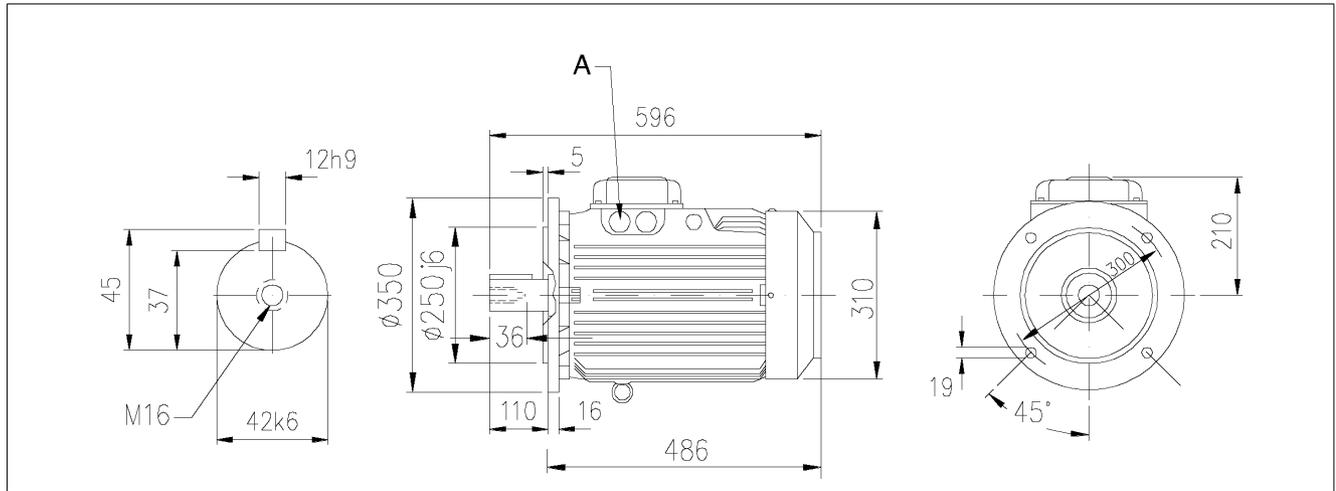
Article No.	Output kW	Freq Hz	Voltage V
539827-10	11	60	220D
539827-11	11	60	380D
539827-12	11	60	440D
539827-13 ¹⁾	11	60	575D
539827-15	11	50	400D
539827-17	11	60	460D
539827-18	11	60	220D parallel 440D series

Article No.	Output kW	Freq Hz	Voltage V
539827-20 ¹⁾	11	60	460D
539827-21	11	50	200D
539827-22	11	50	220D
539827-23	11	50	380D
539827-24	11	50	415D
539827-25	11	50	500D
539827-26	11	50	660D
539827-27	11	60	200D

¹⁾ In accordance with the rules of CSA.

8.9.3 Electric motor (marine application)

Alfa Laval ref. 552813 rev. 2



A. 4 x Pg29. Max cable diameter 29 mm

- Manufacturer** ABB Motors
- Manuf. drawing** 3GZV 1000 007-4
- Standards** IEC 34-series, 72,79 and 85
- Size** 160M
- Type** M2AA 160M-4
- Weight** 62 kg
- Poles** 4
- Insulation class** F
- Bearings** DE 6209-2Z/C3 –
NDE 6209-2Z/C3
- Method of cooling** IC 41 (IEC 34-6)
- Spec.** Totally enclosed three-phase motor for marine service ³⁾

Type of mounting		Degree of protection
	IM 1001	
	IM 3001	IP 55
	IM 3011	IP 55
	IM 3031	IP 55

Article No	Output kW	Speed RPM	Freq Hz	Voltage V	Current A	Pow.fac cos φ	I_{st} / I ¹⁾	Therm ²⁾ °C	Note
552813-01	11,5	1445	50	200 D	44,5	0,85	5,6		
552813-02	11,5	1445	50	220 D	40,5	0,85	5,6		
552813-03	11,5	1445	50	380 D	23,5	0,85	5,6		
552813-04	11,5	1445	50	415 D	21,5	0,85	5,6		
552813-05	11,5	1445	50	440 D	20,5	0,85	5,6		
552813-06	11,5	1445	50	500 D	18,9	0,85	5,6		
552813-07	13	1745	60	220 D 440 D	47 23,5	0,85	5,6		D-ser D-par
552813-08	13	1745	60	230 D 460 D	45 22,5	0,85	5,6		D-ser D-par
552813-09	13	1745	60	575 D	18	0,85	5,6		CSA-plated
552813-10	11,5 13	1445 1745	50 60	380 D 440 D	23,5 23,5	0,85	5,6		
552813-111	11,5	1440	50	690Y 400D	12,9 22,5	0,85	5,6		
552813-12	13	1740	60	460D	22,5	0,85	5,6		
552813-13	13	1740	60	460D	21,5	0,85	5,6		

1) I_{st} / I = starting current /rated current at direct on line starting.

2) Thermistors tripping temperature if applicable

3) The motors can be designed to fulfill requirements of following Classification Societies:

Lloyds Register of shipping (LRS) (Essential Service)
 Det Norske Veritas (DnV) (Essential Service)
 Germanischer Lloyd (GL) (Essential Service)
 Bureau Veritas (BV) (Essential Service)
 American Bureau of shipping (ABS) (Essential Service)
 Registro Italiano Navale (RINA) (Essential Service)
 USSR Register of Shipping (RSU) (Essential Service)
 Japanese Classification Society (NKK) (Essential Service)

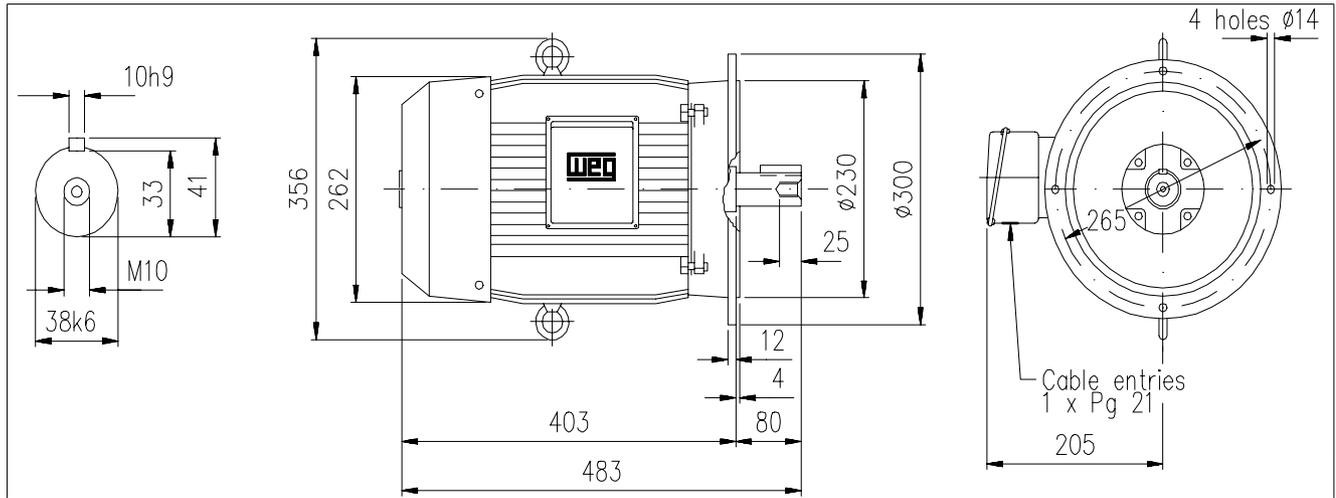
Required classification society must always be specified when ordering. Factory test certificate to be enclosed at the delivery.

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

8.9.4 Electric motor (Brazil)

Alfa Laval ref. 552943

Note! This motor is for local use in Brazil only



Manufacturer	WEG, Brazil	Poles	4
Manuf. drawing	003.10/03 1990	Insulation class	3
Standards	IEC 34-1, IEC 72	Bearings	DE 6308-Z – NDE 6207-Z
Size	IEC 132 M	Method of cooling	IC 41 (IEC 34-6)
Type	WEG132 M	Spec.	Totally enclosed fan cooled induction motor
Weight	68 kg		

Article No.	Output kW	Speed RPM	Freq Hz	Voltage V	Current A	Pow. fa c cos φ	I_{st} / I ¹⁾	Therm ²⁾ °C	Note
552943-01	11	1750	60	380 D	23	0,86	8,2		

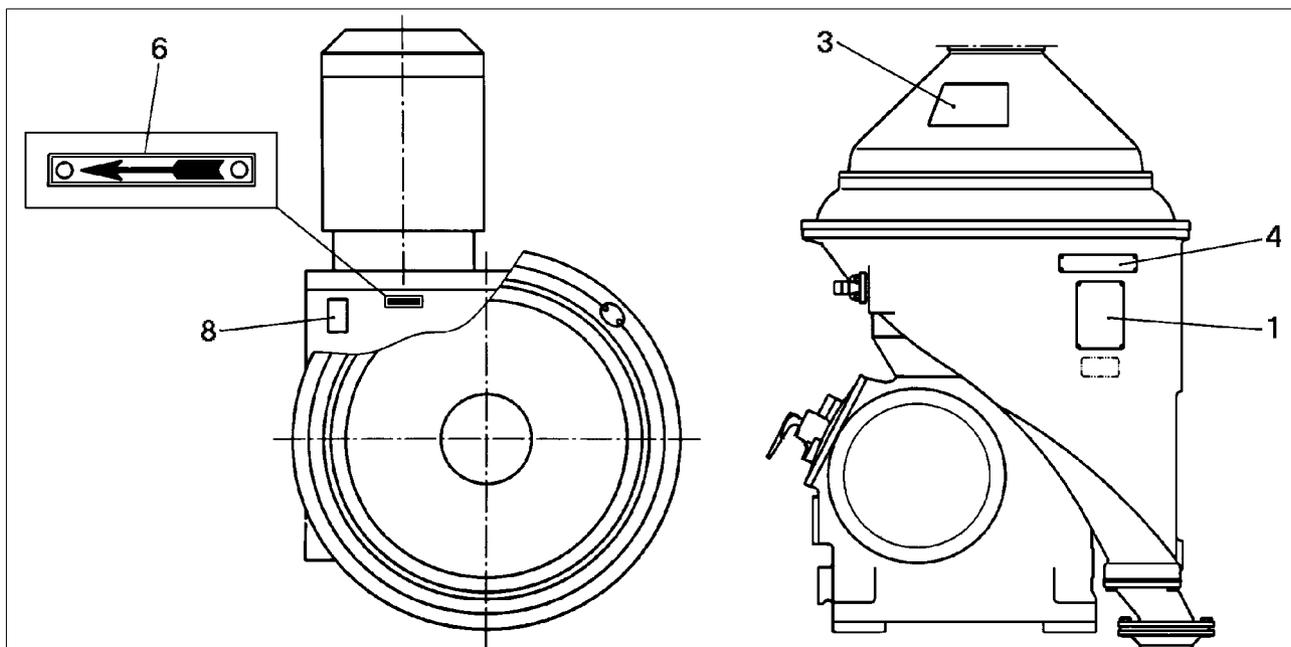
1) I_{st} / I = starting current / rated current at direct on line starting.

2) Thermistors tripping temp.

Type of mounting	Degree of protection
	IM 1001
	IM 3001
	IM 3011
	IM 3031
	IP 54

8.9.5 Machine plates and safety labels

Alfa Laval ref. 554651



S0061411

1. Machine plate

Separator	MOPX 309TGT-24
Manufacturing serial No./ Year	XXXX
Product No.	881076-04-03
Machine top part	557303-02
Bowl	544721-11
Machine bottom part	540225-09/10 (50/60 Hz, without pump) 540225-44/45 (50/60 Hz, with pump)
Max. speed (bowl)	5175 r/min. (50 Hz), 5142r/min. (60 Hz)
Direction of rotation (bowl)	←
Speed motor shaft	1500 r/min. (50 Hz), 1800 r/min. (60 Hz)
El. current frequency	50/60 Hz
Recommended motor power	11 kW
Max. density of feed	1100 kg/m ³
Max. density of sediment	1498 kg/m ³
Max. density of operating liquid	1000 kg/m ³
Process temperature min./max.	0/100 °C

3. Safety label

Text on label:

DANGER

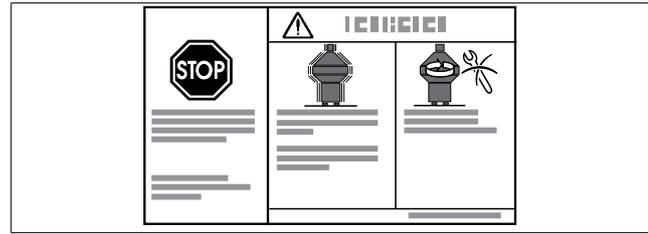
Read the instruction manuals **before** installation, operation and maintenance. Consider inspection intervals.

Failure to strictly follow instructions can lead to fatal injury.

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

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

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



S0061521

4. Name plate

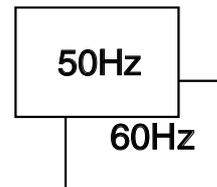


S0063211

6. Arrow

Indicating direction of rotation of horizontal driving device.

8. Power supply frequency

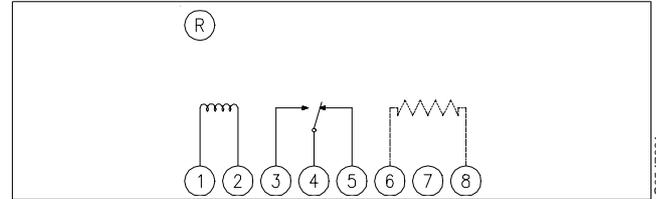


S0063111

8.9.6 Vibration sensor (option)

Alfa Laval ref. 557311 rev. 1

Type:	Mechanical velocity	
Switch rating, voltage:	Max. 460 V AC	
Reset coil:	24 V DC, 48 V DC, 117 V AC 60 Hz	
Vibration measurement range:	0 to 4,5 g from 0 to 300 Hz	
Switch rating, resistive load, max.:	5 A	12 V DC
	2 A	24 V DC
	1 A	48 V DC
	0,5 A	120 V DC
	7 A	460 V AC, 50/60 Hz



Interconnection diagram

1-2 Reset coil

3 No

4 Common

5 NC

6-8 Heater

R Reset button

For other technical information see chapter "8.6 Interface description" on page 195.

8.9.7 Cover interlocking switch (option)

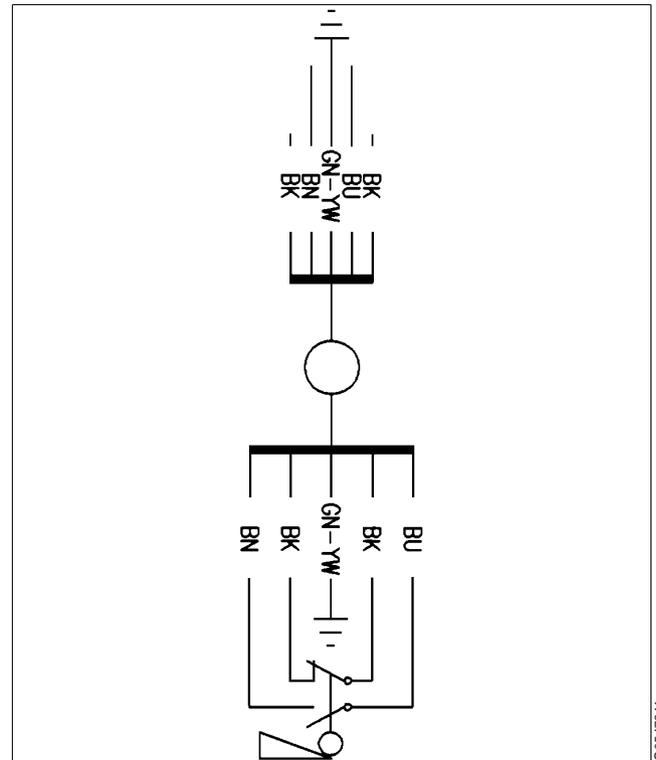
Alfa Laval ref. 557311 rev. 1

Switch rating

	AC (VA)	DC (W)
12 V	75	7
24 V	200	7
48 V	280	9
127 V	500	13
230 V	550	—

For other technical information see chapter "8.6 Interface description" on page 195.

BK	Black
BN	Brown
BU	Blue
GN-YW	Green-Yellow



Interconnection diagram

8.10 Storage and installation

8.10.1 Introduction

Most of the installation instructions are *Specifications*, which are compulsory requirements. These specifications are sometimes completed with non-compulsory *Recommendations*, which could improve the installation quality.

Additional installation information, such as drawings, connection lists and interface description, can be found previous in this chapter.

8.10.2 Storage and transport of goods

Storage

Specification

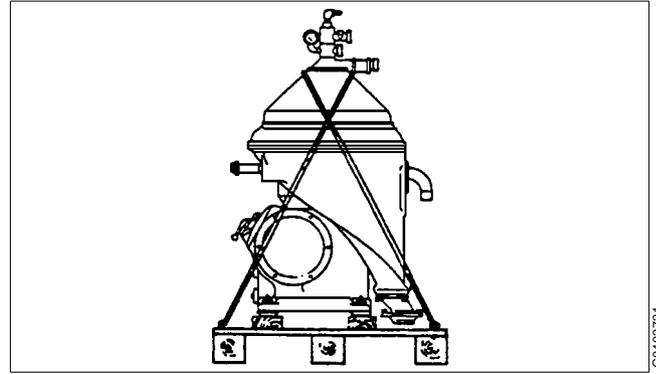
Upon arrival to the store, **check all components and keep them:**

1. Well stored and protected from mechanical damage and theft.
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:

- 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.

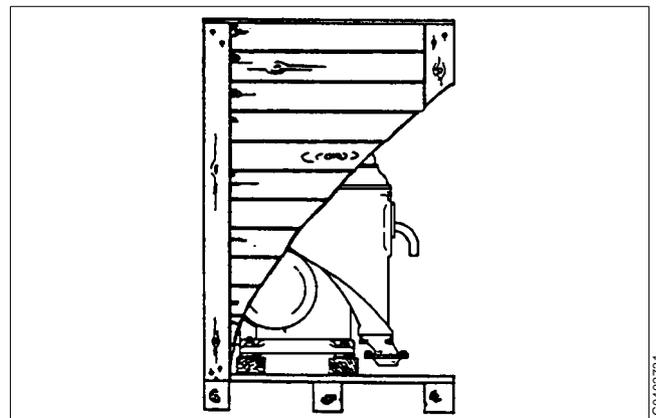


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Fixed on a pallet

- In a wooden box which is not water tight.

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



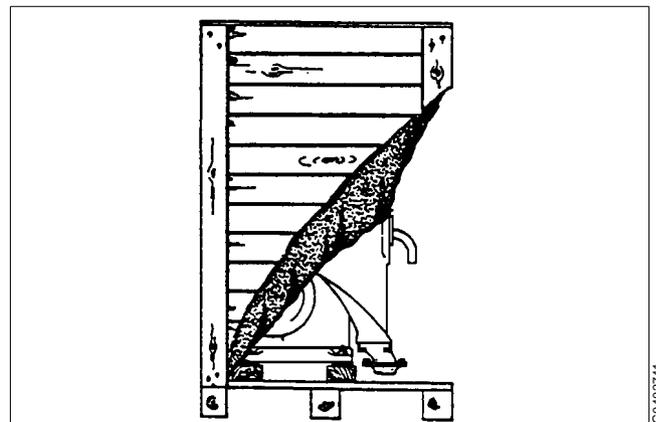
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In a wooden box which is not water tight

- 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.



G0402741

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 “5.5 Lifting instructions” on page 88.



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.

8.10.3 Planning of installation

Introduction

The space required for one or more separators can be calculated by consulting the drawings in the chapters “8.2 Basic size drawing, without pump” on page 187, “8.4 Basic size drawing, with pump” on page 191, “8.9.1 Foundations” on page 208 and instructions for ancillary equipment, electrical and electronic equipment and cables.

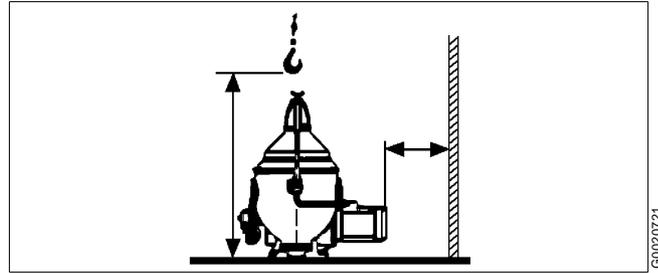


Check the drawings when planning the installation

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 chapter “8.9.1 Foundations” on page 208 for the service space required with the separator installed.

Recommendation

- The spanner for the large lock ring should have sufficient space to make a complete turn without touching any of the ancillary equipment surrounding the separator.

Lifting height for transport of bowl

Specification

- A minimum height is required to lift the bowl, bowl parts and the bowl spindle, see chapter “8.9.1 Foundations” on page 208.

Recommendation

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

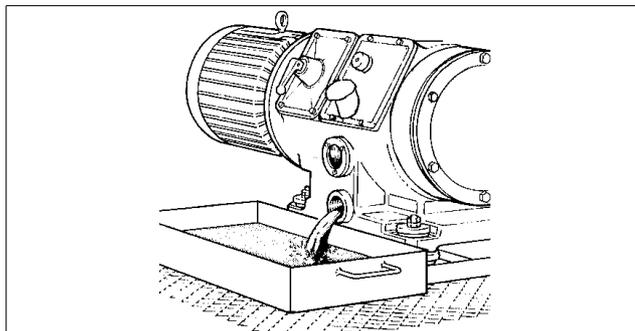
Space for oil changing

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

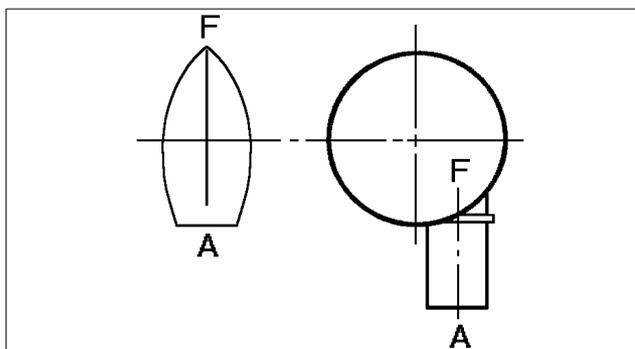
8.10.4 Foundations

NOTE

When lifting a separator it must always be **hung securely**. See chapter “5.5 Lifting instructions” on page 88.

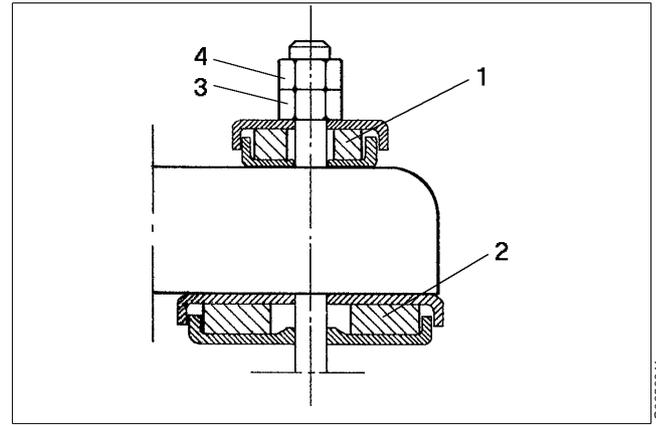
Specification

- The separator should be installed at floor level, see chapter “8.9.1 Foundations” on page 208.
- When a separator is installed on a ship, 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. The electric motor should preferably be pointing aft.
- 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.



F = Forward
A = Aft

- Fit the separator frame on the foundation as follows:
 - Place the separator frame without cushions in position.
 - 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.
 - Fit height adjusting washers required.
 - Check that the separator frame is horizontal and that all feet rest on the foundation.
 - 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.
 - Tighten nut (3) with **20 Nm**. Hold firmly and secure with the lock nut (4). Repeat for the other frame feet.



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

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