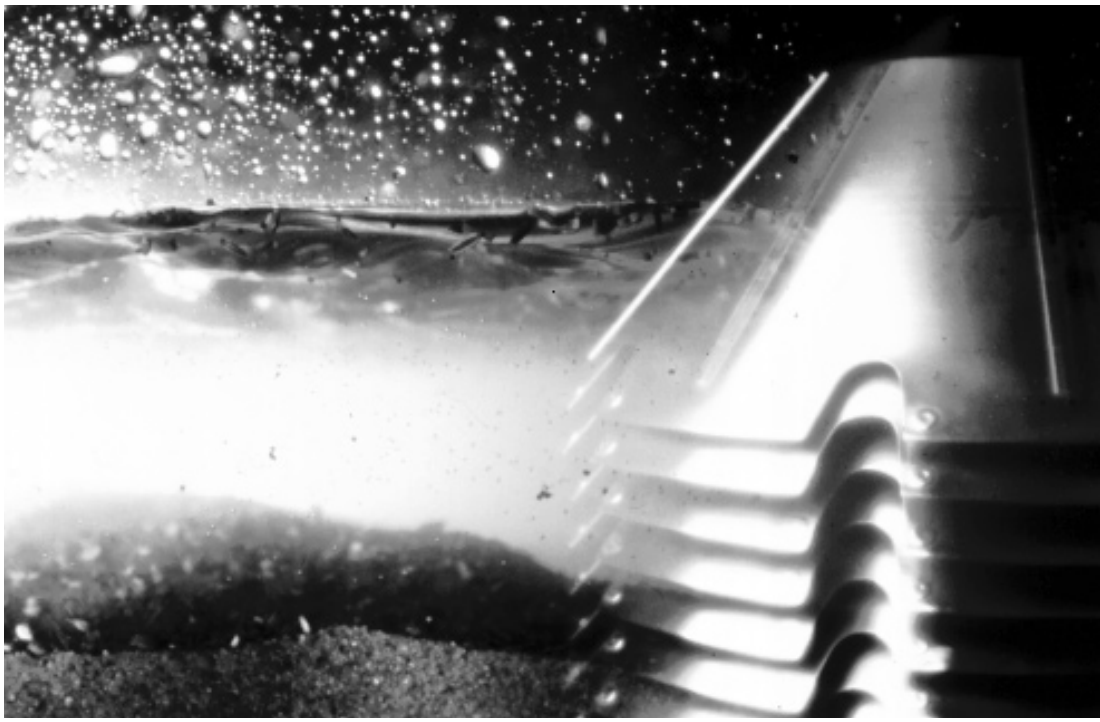
MMPX 303SGP-11



Separator Manual

Product No. 881099-01-04
Book No. 1270065-02 V2

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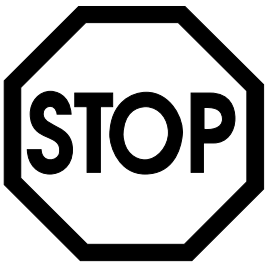
Contents



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.

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1 Read this first

This manual is designed for operators and service engineers working with the Alfa Laval separator MMPX 303SGP-11.

For information concerning the function of the separator, see chapter ‘‘3 Separator Basics” on page 15, and chapter ‘‘8 Technical Reference” on page 137.

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.


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Separator Manual and Spare Parts Catalogue

This separator manual consists of:

Safety Instructions

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

Separator Basics

Read this chapter if you are not familiar with this type of separator. This chapter contains the technical description and function description.

Operating Instructions

This chapter contains operating instructions for the separator only.

Service Instructions

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

Dismantling / Assembly

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

Trouble-tracing

Refer to this chapter if the separator functions abnormally.

If the separator has been installed as part of a processing system always refer to the trouble-tracing part of the system documentation first.

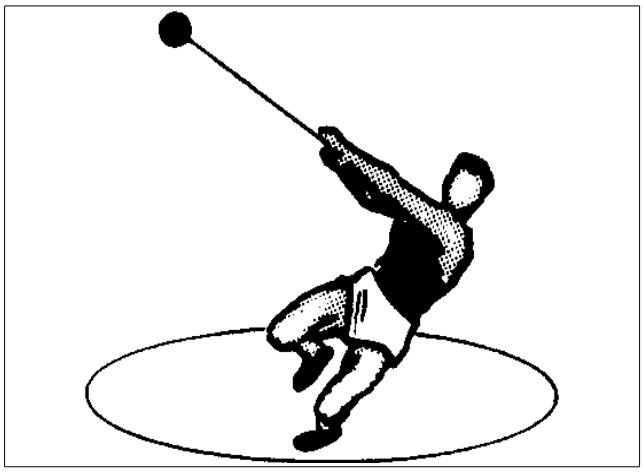
Technical Reference

This chapter contains technical data and drawings concerning the separator.

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 bowl and bowl hood threads must not exceed safety limit. ϕ-mark on bowl hood 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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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 bowl discs and 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.

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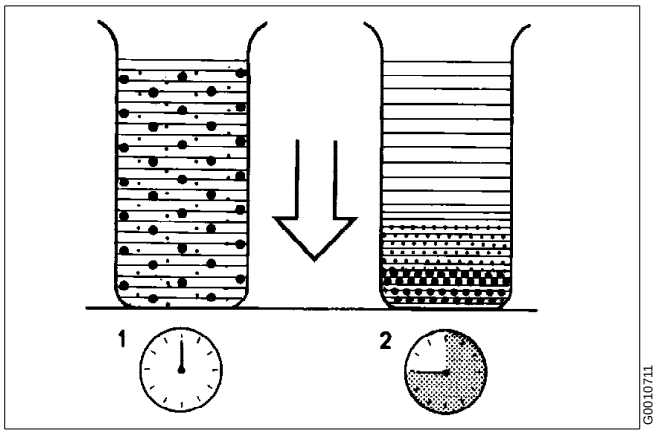
3 Separator Basics

Contents

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

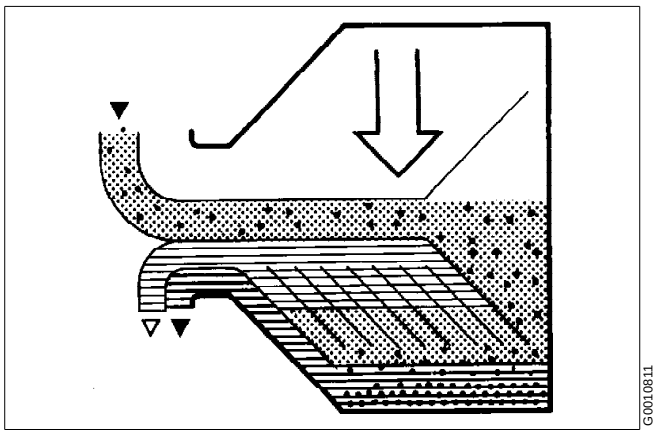
Separation by gravity

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

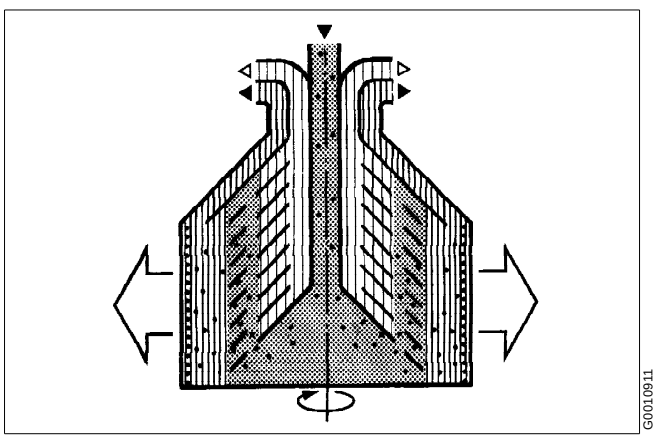
Centrifugal separation

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 separation efficiency is influenced by changes in the viscosity (separating temperature) and in the throughput.

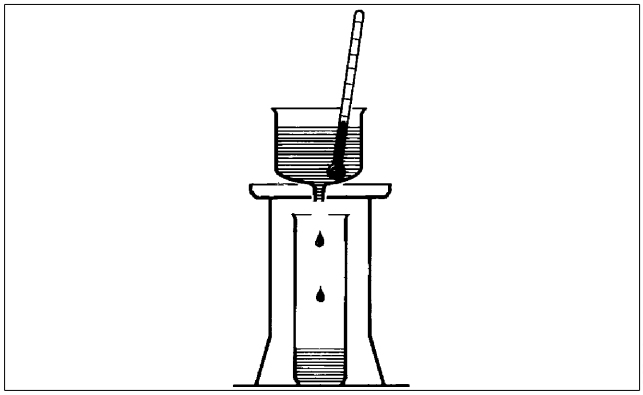


The centrifugal solution

3.1.1 Factors influencing the separation result

Separating temperatures

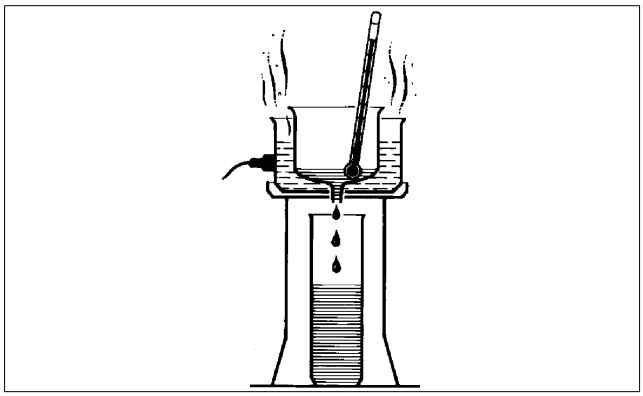
For some types of process liquids (e.g. mineral oils) a high separating temperature will normally increase the separation capacity. The temperature influences oil viscosity and density and should be kept constant throughout the separation.



High viscosity (with low temperature)

Viscosity

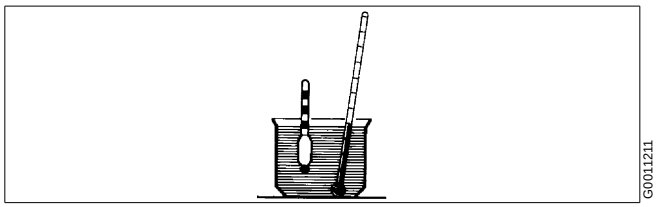
Low viscosity facilitates separation. Viscosity can be reduced by heating.



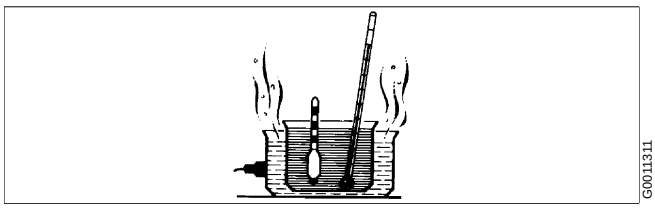
Low viscosity (with high temperature)

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)

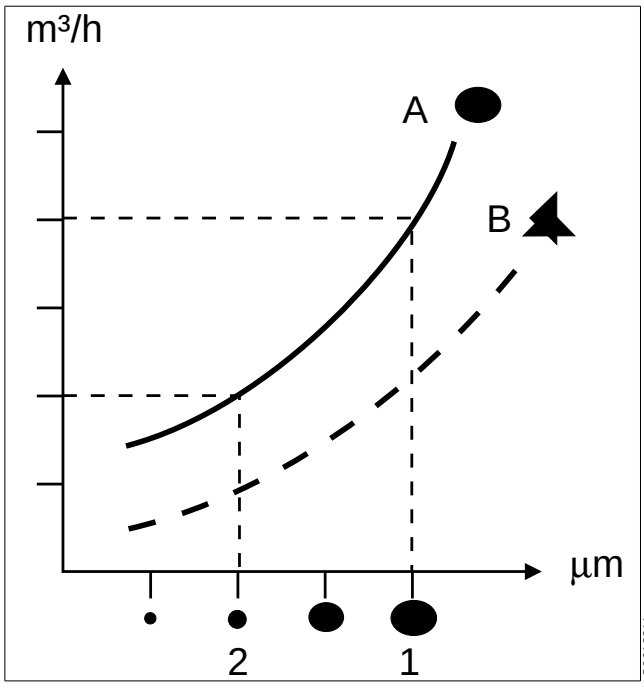
Phase proportions

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

Size and shape of particles

The round and smooth particle (A) is more easily separated out than the irregular one (B).

Rough treatment, for instance in pumps, may cause a splitting of the particles resulting in slower separation. Larger particles (1) are more easily separated than smaller ones (2) even if they have the same density.



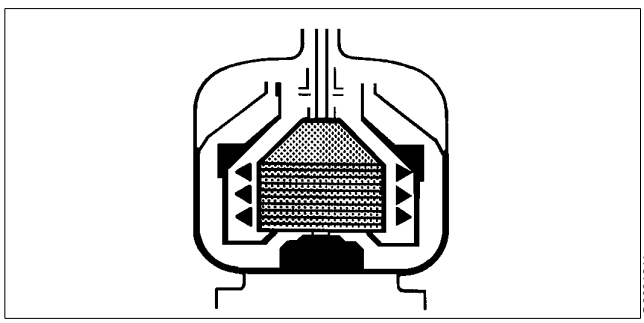
Influence of size and shape

The throughput

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

Sludge space - sludge content

The sediment accumulates along the bowl wall. If the sludge is allowed to fill up the space outside the discs the flow in the bowl is influenced, and the separating efficiency is reduced. In such cases the time between discharge of sediment should be reduced to prevent this effect.



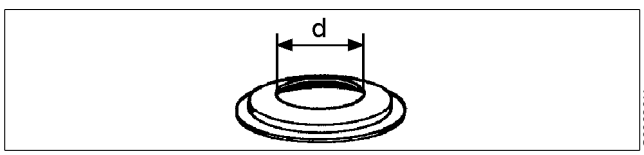
Sludge accumulation

Disc stack

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

Gravity disc

The position of the interface is adjusted by altering the outlet diameter of the heavy liquid phase, that is by exchanging the gravity disc.



Gravity disc diameter sets the oil/water interface

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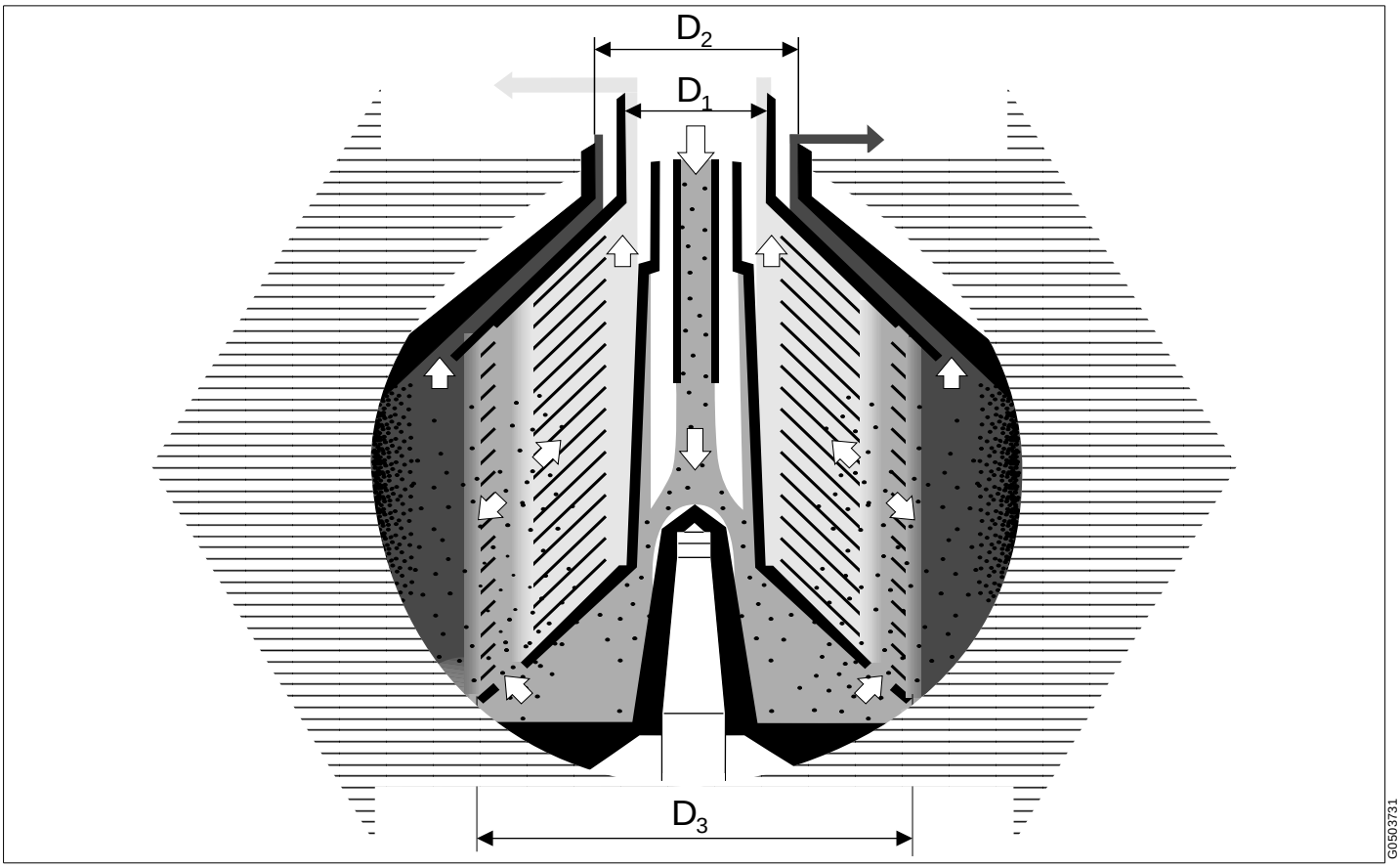
3.1.2 Purification



Centrifugal force

Process liquid

Heavy liquid phase

Light liquid phase

Sediment (solids)

Bowl parts

D1 — D_1 Diameter of inner outlet.

D2 — D_2 Hole diameter of gravity disc.

D3 — D_3 Diameter of interface.

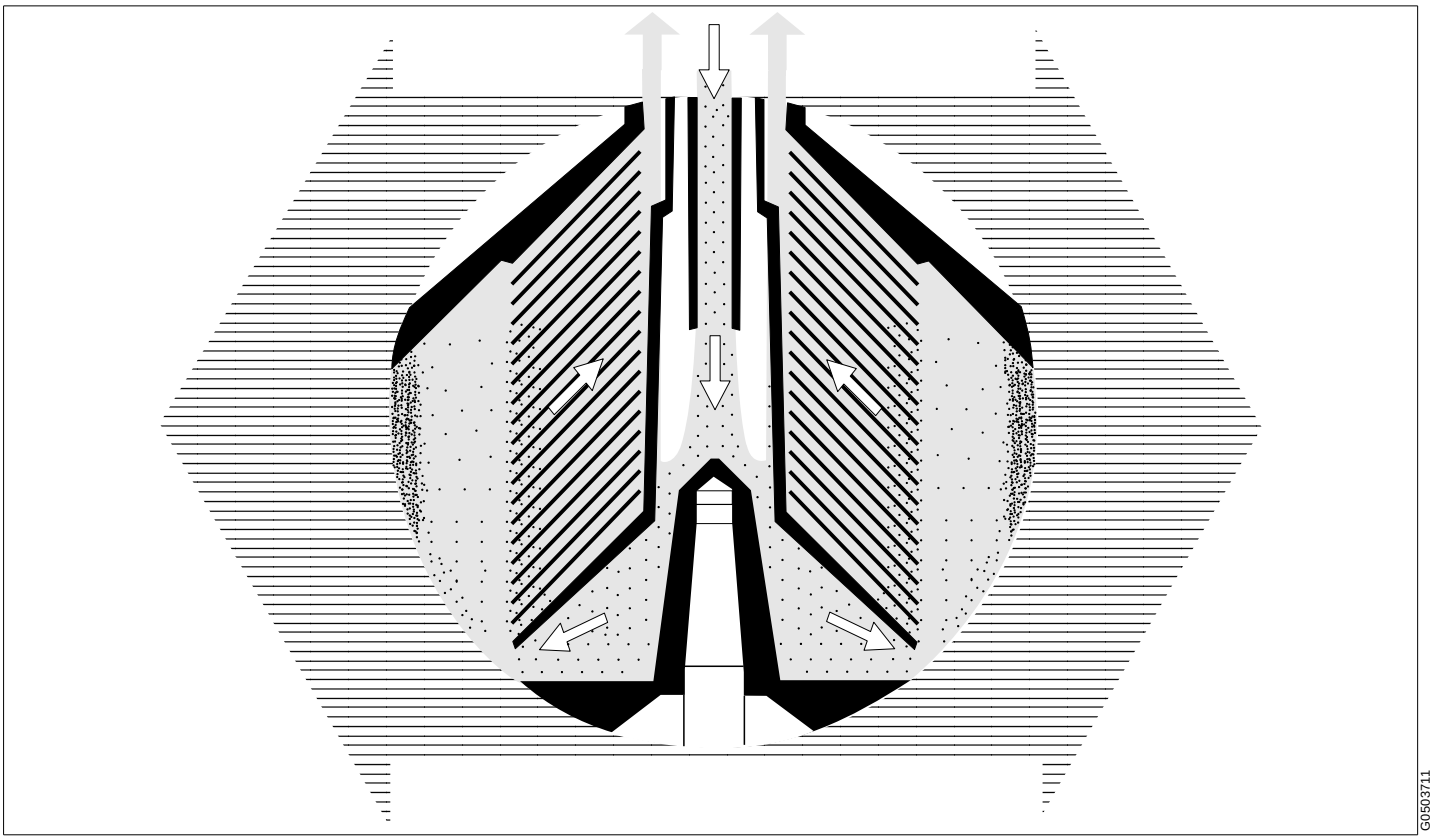
This bowl has two liquid outlets. The process liquid flows through the centre and out under the distributor.

The liquid flows up and is divided among the interspaces between the bowl discs, where the liquid phases are separated from each other by action of the centrifugal force.

The heavy phase and any sediment move along the underside of the bowl discs towards the periphery of the bowl, where the sediment accumulates. The heavy phase proceeds along the upper side of the top disc towards the neck of the bowl hood and leaves the bowl via the gravity disc - *the outer way* (dark coloured in illustration).

The light phase moves along the upper side of the bowl discs towards the bowl centre and leaves the bowl via the hole in the top disc neck - *the inner way* (light coloured in illustration).

3.1.3 Clarification (optional)



Centrifugal force

Process liquid

Bowl parts

Sediment (solids)

This bowl has one liquid outlet.

The process liquid flows through the centre of the distributor.

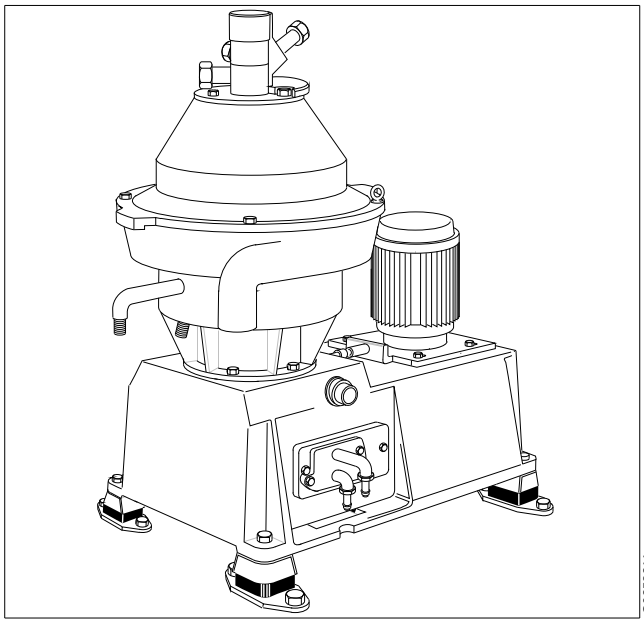
The liquid flows up and is divided among the interspaces between the bowl discs, where the sediment is separated from the liquid by action of the centrifugal force.

The sediment moves along the underside of the bowl discs towards the periphery of the bowl, where it accumulates.

3.2 Design and function

3.2.1 Application

The MMPX 303SGP-11 is a high-speed centrifugal separator intended for marine and land applications. It is specifically designed for cleaning of mineral oils from water and solid particles (sludge). The cleaned oil is discharged continuously, while the sludge is discharged at intervals.



The MMPX 303SGP-11 separator

The separator handles the following types of lubricating oils and low viscosity fuel oils:

- Distillate, viscosity 1,5 - 5,5 cSt/40 °C
- Marine diesel oil, viscosity 13 cSt/40 °C
- Intermediate fuel oil and heavy fuel oil (viscosity 30-380 cSt/50 °C)
- Lubricating oil of R & O type, detergent or steam turbine.

The separator can be operated either as a purifier or as a clarifier. When operated as a purifier the separator discharges the separated water continuously.

When the oil contains only small amounts of water the separator is operated as a clarifier, discharging the water together with the solid particles.

The separator has to be installed together with devices for control of its operation.

DANGER

Disintegration hazards

Use the separator only for the purpose and parameters (type of liquid, rotational speed, temperature, density etc.) specified in chapter “8 Technical Reference” on page 137 and in the Purchase Order documents.

Consult your Alfa Laval representative before any changes outside these parameters are made.

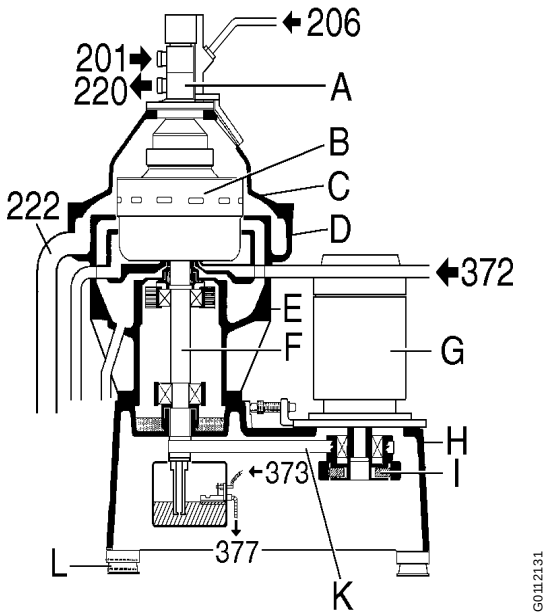
3.2.2 Design

The MMPX 303SGP-11 separator comprises a frame consisting of the frame lower part (H), the intermediate part (E) and the frame top part (D) with a frame hood (C).

The separator bowl (B) is driven by an electric motor (G) via a flat-belt power transmission (K) and bowl spindle (F). The motor drive is equipped with a friction coupling (I) to prevent overload.

The bowl is of disc type and hydraulically operated at sludge discharges. The hollow bowl spindle (F) features an impeller which pumps closing water from a built-in tank to the operating system for sludge discharge.

The main inlets and outlets are shown with their connection numbers in the illustration. The connections are listed in chapter “8 Technical Reference” on page 137, where also the basic size drawing can be found.



Sectional view
Main parts, inlets and outlets

A Inlet and outlet housings
B Bowl
C Frame hood
D Frame top part
E Frame intermediate part
F Bowl spindle
G Electric motor
H Frame lower part
I Friction coupling
K Flat belt
L Frame feet

201 Oil inlet
206 Water seal and displacement water inlet
220 Oil outlet
222 Water/sludge outlet
372 Opening water inlet
373 Bowl closing water
377 Overflow

3.2.3 Outline of function

The separation process takes place in the rotating bowl. Unseparated oil is fed into the bowl through the inlet (201). The oil is cleaned in the bowl and leaves the separator through the outlet (220) via a paring chamber.

Impurities heavier than the oil are collected in the sludge space at the bowl periphery and removed automatically at regular intervals.

Permissible pressures and operating conditions are specified in chapter “8 Technical Reference” on page 137.

The processing parts of the separator are shown in the illustration on next page.

There are no contacting surfaces between process rotating parts (the bowl) and stationary parts (inlet, outlet, feed devices), and the interfacing surfaces are not sealed. As the separation process is carefully balanced regarding pressures and fluid levels, any leakages will not occur as long as the correct running conditions are maintained.

3.2.4 Separating function

Liquid flow

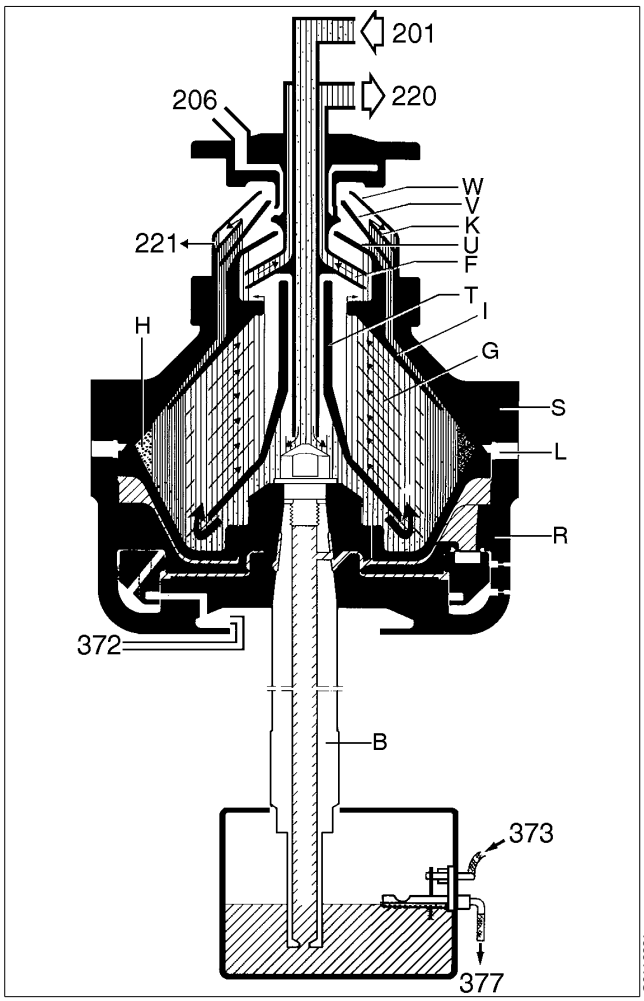
Separation takes place in the separator bowl to which unseparated oil is fed through the inlet pipe (201). The oil is led by the distributor (T) towards the periphery of the bowl.

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

The oil is continuously separated from water and sludge as it will flow towards the center of the bowl. When the cleaned oil leaves the disc stack it rises upwards and enters the paring chamber. From there it is pumped by the paring disc (F) and leaves the bowl through the outlet (220).

Separated sludge and water move towards the bowl periphery. In purification separated water rises along the outside of the disc stack, passes from the top disc channels over the gravity disc (K) and leaves the bowl through a small hole in the heavy phase cover (W) into the common sludge and water outlet (221) of the separator.

Heavier impurities are collected in the sludge space (H) outside the disc stack and are discharged at intervals through the sludge ports (L).



F	*Paring disc*	*201*	*Oil inlet*
G	*Disc stack*	*206*	*Water seal and displacement water inlet*
H	*Sludge space*		
I	*Top disc*	*220*	*Oil outlet*
K	*Gravity disc*	*221*	*Water/sludge outlet*
L	*Sludge ports*	*372*	*Opening water inlet*
R	*Bowl body*	*373*	*Bowl closing water*
S	*Bowl hood*	*377*	*Overflow*
T	*Distributor*		
U	*Paring chamber cover*		
V	*Guiding cone*		
W	*Heavy phase cover*		

Water seal in purification

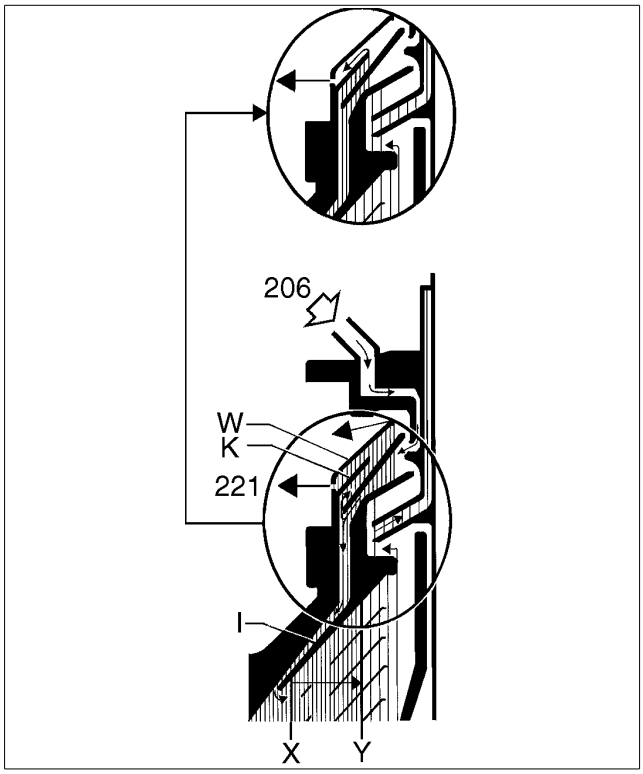
To prevent the oil from passing the outer edge of the top disc (I) and escaping through the water outlet (221), a water seal must be provided in the bowl. This is done by filling the bowl with water through the water inlet (206), before unseparated oil is supplied. When oil feed is turned on the oil will force the water towards the bowl periphery and an interface (X) is formed between the water and the oil. The position of the interface is determined by the inner diameter of gravity disc (K).

Displacement of oil

To avoid oil losses at sludge discharge, displacement water is fed to the bowl.

Prior to a discharge the oil feed is stopped and displacement water added through the water inlet (206). This water changes the balance in the bowl and the interface (X) moves inwards to a new position (Y), increasing the water volume in the sludge space. When the sludge discharge takes place sludge and water alone are discharged.

Sludge discharge occurs while the displacement water is still flowing. A new water seal will therefore establish immediately afterwards. The oil feed is then turned on again.



Principle of liquid seal and displacement water in purification

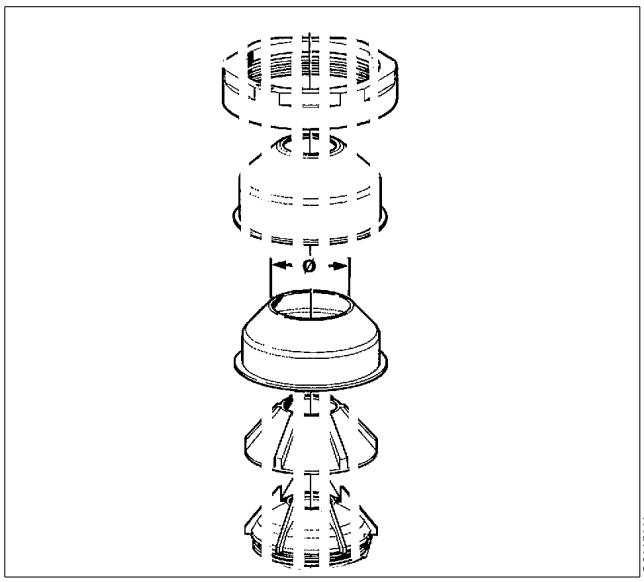
I Top disc
K Gravity disc
W Heavy phase cover
X Normal interface position
Y Interface position just before discharge
206 Water inlet
221 Water outlet

Gravity disc

In the purification mode, the position of the interface (X) can be adjusted by replacing the gravity disc (K) for one with larger or smaller diameter.

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

The correct gravity disc is selected from a nomogram, see “8.6.6 Gravity disc nomogram” on page 166.



Location of gravity disc and clarifier disc

Clarifier disc

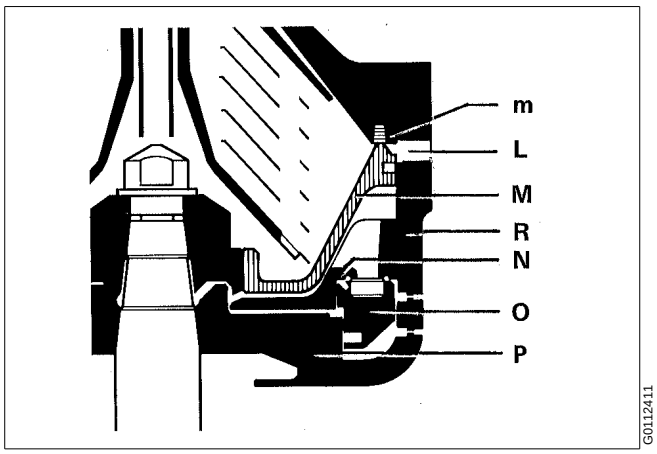
In the clarification mode, the gravity disc is replaced by a clarifier disc which seals off the water outlet. In this case no water seal is required and consequently there is no oil/water interface in the bowl. The clarifier disc is an optional disc with a hole diameter of 40 mm. This disc is not shown in the nomograms.

3.2.5 Sludge discharge function

Sludge is discharged through a number of ports (L) in the bowl wall. Between discharges these ports are covered by the sliding bowl bottom (M), which forms an internal bottom in the separating space of the bowl. The sliding bowl bottom is pressed upwards against a sealing ring (m) by force of the closing water underneath.

The sliding bowl bottom is operated hydraulically by means of operating water supplied to the discharge mechanism from an external freshwater line. Opening water is supplied directly to the operating system in the bowl while closing water is supplied to the built-in closing water tank, and pumped to the operating system through the bowl spindle.

The opening and closing only takes a fraction of a second, therefore the discharge volume is limited to a certain percentage of the bowl volume. This action is achieved by the closing water filling space above the upper distributor ring and pushing the sliding bowl bottom upwards. Simultaneously, the water in the chamber below the operating slide is drained off through the nozzles in the bowl body.



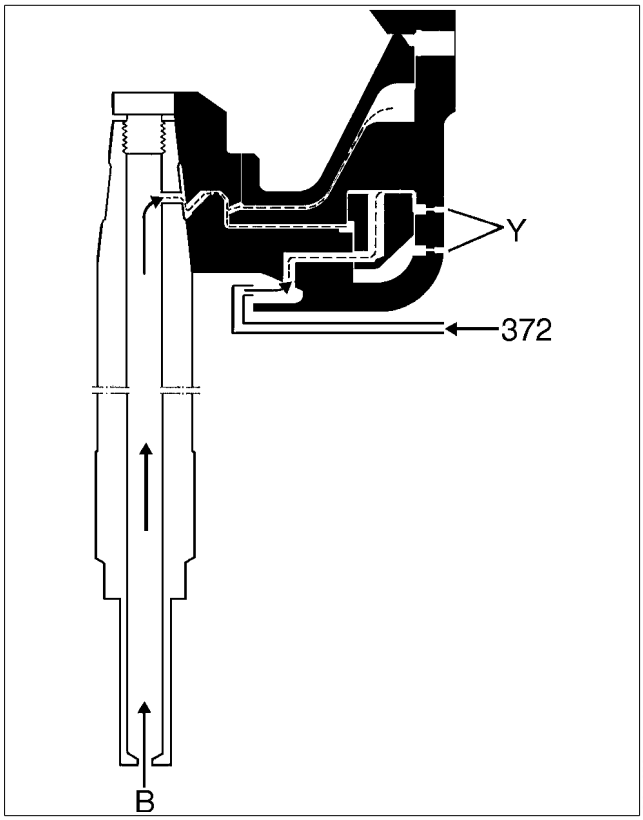
Sludge discharge mechanism
L Sludge ports
M Sliding bowl bottom
m Sealing ring
N Upper distributing ring
O Operating slide
P Lower distributing ring
R Bowl body

Bowl opening

The key event to start a sludge discharge is the downward movement of the operating slide. This is accomplished by supply of opening water (372) to the discharge mechanism. Water is drained off through nozzles (Y) in the bowl body. The sliding bowl bottom is rapidly pressed downwards by the force from the liquid in the bowl, opening the sludge ports.

Bowl closing

After the sludge is discharged the sliding bowl bottom is immediately pressed up and the sludge ports in the bowl wall are closed.



Supply of opening water and closing water
372 Opening water
B Closing and make-up water through bowl spindle
Y Nozzles

3.2.6 Power transmission

Bowl spindle

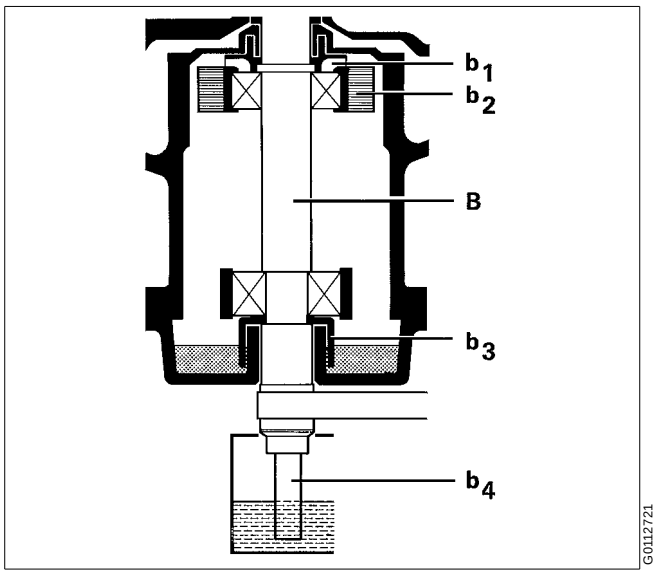
In addition to its primary role in the power transmission system, the bowl spindle also serves as:

- pump for the closing water
- supply pipe for the closing water
- lubricator for spindle ball bearings.

Closing water is pumped through the hollow spindle (B) to the discharge mechanism in the bowl. For this purpose a pump sleeve (b4) is fitted in the lower end.

The two spindle bearings are lubricated with oil mist. An oil pump (b3) creates the oil mist, which is sucked through the upper ball bearing by a fan (b1). Oil is supplied via an oil filling device, which also serves as a level indicator.

Two identical ring-shaped rubber buffers (b2) support the top bearing housing. The buffers are held in place by a buffer holder and form channels through which the recirculated oil passes.

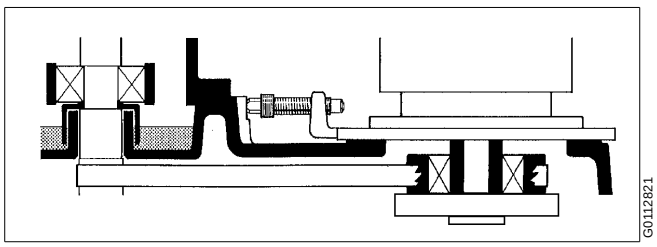


Bowl spindle assembly
B Bowl spindle
b1 Fan
b2 Rubber buffers
b3 Oil pump
b4 Sleeve

Belt drive

The bowl spindle is driven by a flat belt. Adaptation to 50 or 60 Hz power supply is made by selecting the motor belt pulley with the appropriate diameter. A longer belt is needed for the pulley for 50 Hz.

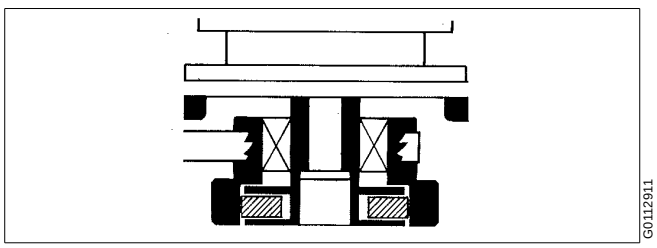
Correct tension is set by means of a spring-loaded belt tightener.



Belt drive

Friction coupling

The friction coupling on the motor pulley ensures gentle start-up and prevents overload of the electric motor. Centrifugal force creates a torque that acts on the pulley through the friction elements.



Friction coupling

3.2.7 Sensors and indicators

Sight glass

The sight glass shows the oil level in the oil sump.

3.3 Definitions

Back pressure	Pressure in the separator outlet.
Clarification	Liquid/solids separation with the intention of separating particles, normally solids, from a liquid 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 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 and inlet/outlet. Renewal of seals in bowl and inlet/outlet.
Major Service (MS)	Overhaul of the complete separator, including bottom part (and activities included in an Intermediate Service). Renewal of seals and bearings in bottom part.
Phase	Light phase: the lighter liquid separated, e.g. oil. Heavy phase: the heavier liquid separated, e.g. water.
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, 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/hour or litres/hour.
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

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

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

4.1.1 Before first start

Technical demands for connections and logical limitations for the separator are listed in chapter “8 Technical Reference” on page 137:

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

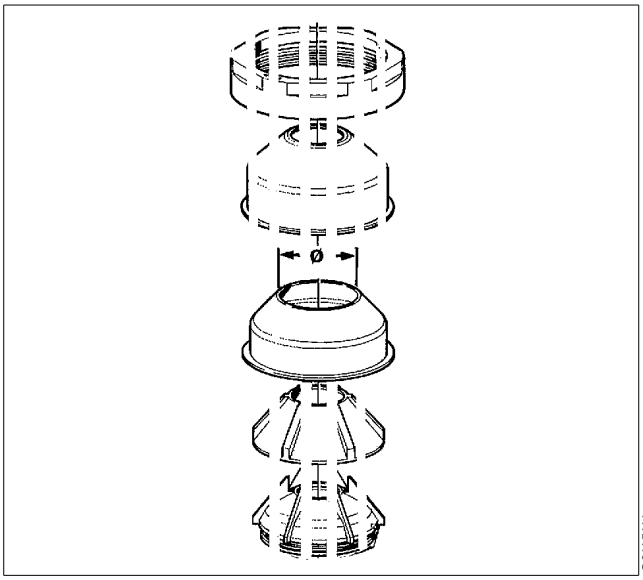
Before first start the following shall be checked:

1. Ensure the machine is installed correctly and that feed lines and drains have been flushed clean.
2. Fill oil in the oil sump. Fill up to the middle of the sight glass. For grade and quality of oil see “8.5.4 Recommended lubricating oils” on page 152.

4.1.2 Selection of gravity disc

The separator is delivered with a set of gravity discs with different diameters for purification operation. The hole diameter of the gravity disc sets the position of the oil/water interface in the separator, see page 27. The separation efficiency can be optimized by selection of the correct diameter for each oil quality.

As a guide the “8.6.6 Gravity disc nomogram” on page 166 can be used. The hole diameter of the first gravity disc to be tried can be read directly from the nomogram.



Location of gravity disc and clarifier disc

The best separation results are obtained by using a gravity disc with as large a hole diameter as possible, which will not cause a broken water seal in the bowl or an emulsification in the water outlet.

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

For operating the separator as a clarifier the diameter of the disc should be 40 mm.

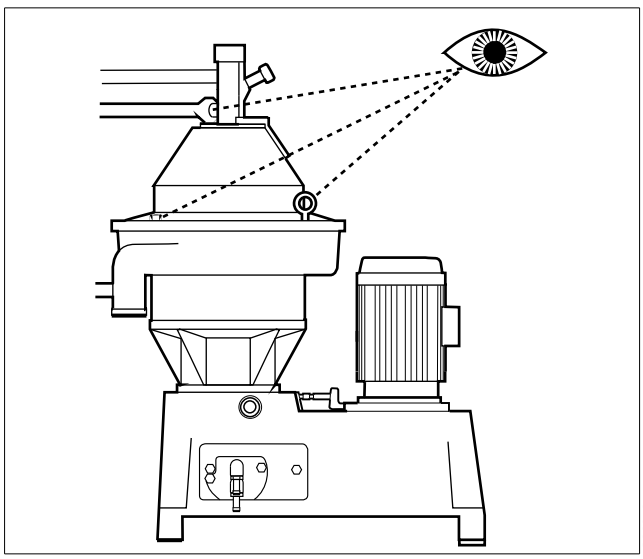
4.1.3 Start after a service

Pay special attention to unusual conditions when starting the separator after a service. Different fault symptoms are listed in chapter “7 Trouble-tracing” on page 125.

4.1.4 Before normal start

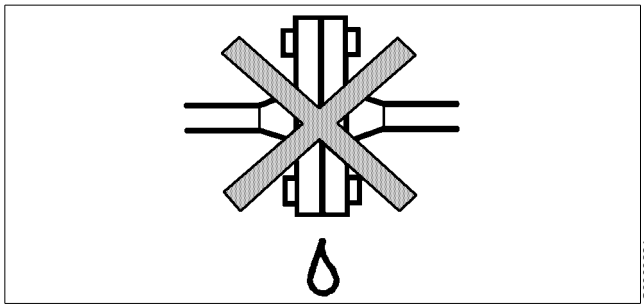
Check these points before every start.

1. Make sure that the bowl is clean and that the separator is properly assembled.
2. Make sure that the bolts of the outlet cover and the frame hood are fully tightened.



Check assembly and tightenings

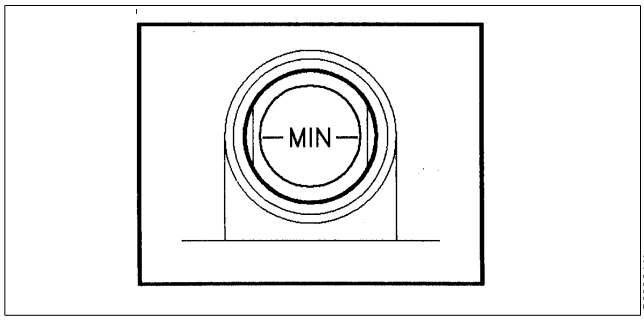
3. Make sure that all couplings and connections are securely tightened to prevent leakage.
4. Make sure that the inlet pipe is tightened.



Check for leakages (not admitted)

5. Read the oil level. The line in the middle of the sight glass shows the **minimum** level. Refill if necessary.

   For grade and quality of oil see ‘‘8.5.4 Recommended lubricating oils” on page 152.



Check the oil level

6. Make sure the direction of rotation of the motor and bowl corresponds to the sign on the frame.

   Remove the safety device A, see illustration. Look through the slot in the frame hood and make a quick start and stop. Correct rotational direction is **clockwise**.

DANGER

Disintegration hazards

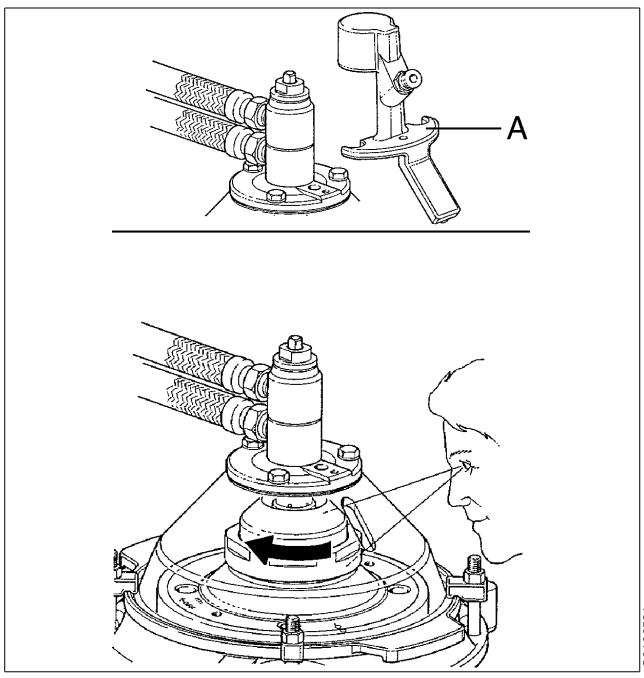
If the direction of rotation is wrong, vital parts could unscrew.

DANGER

Disintegration hazards

After change of feed the sludge discharge interval must be adjusted.

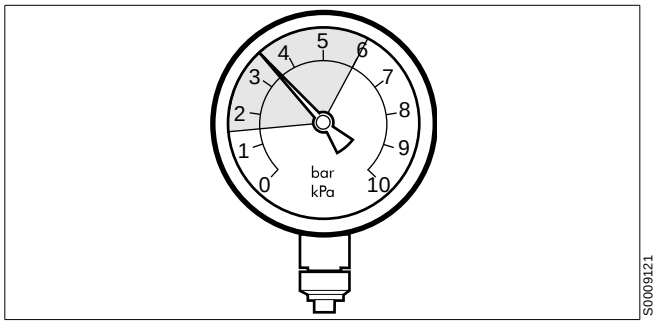
Too long intervals between discharges can result in breakdown.



Check that rotational direction of the bowl is clockwise

4.1.5 Starting and running-up procedure

1. Open the water supply valve(s). Make sure that the water supply is on 150-600 kPa (1,5-6 bar).



Water supply

2. Start the separator.
3. Be alert for unusual noises and conditions.
4. Note the normal occurrence of critical speed periods. Some vibrations occur for short periods during the starting cycle, when the separator passes through its critical speeds. This is normal and passes over without danger. Try to learn the vibration characteristics of the critical speed pattern.

DANGER

Disintegration hazards

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

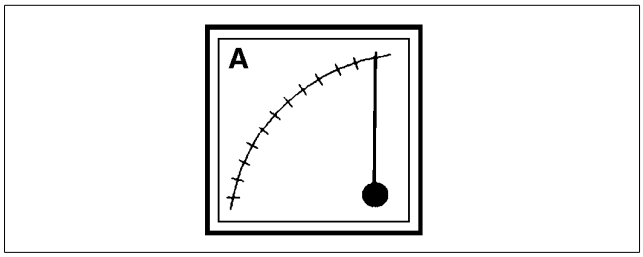
The cause of the vibration must be identified and rectified before the separator is restarted.

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

5. Check the current to the separator motor to ensure that the separator has reached full speed:

   During start, the current reaches a peak and then slowly drops to a low and stable value.

   For normal length of the start-up period see “8.1 Technical data” on page 138.



Current increases during start...

6. For **purification**:

   a. Supply water to form the water-seal. The water should have the same temperature as the process liquid and be supplied quickly.

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

   c. Start the oil feed slowly to avoid breaking the water seal. Then fill the bowl as quickly as possible.

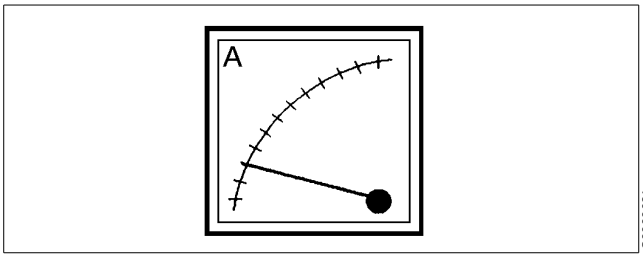
7. For **clarification**:

   a. Start the oil feed with full flow. Fill the bowl as quickly as possible.

8. For both **purification** and **clarification** modes:

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

9. Adjust to desired throughput.



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

4.1.6 Separation

Do regular checks on:

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

4.1.7 Stopping procedure

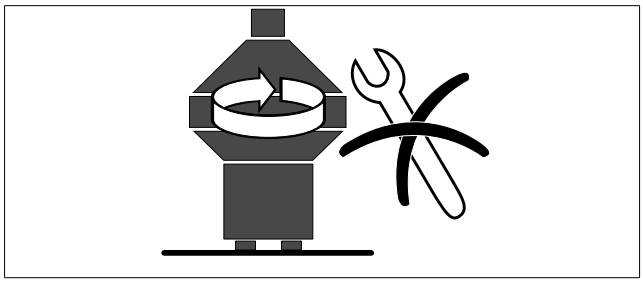
1. Turn off the oil feed.
2. Feed displacement water until water flows out through the water outlet. Then close this feed.
3. Stop the separator.
4. Wait until the separator has come to a complete standstill (13-15 minutes).

   Remove the safety device and look through the slot in the frame hood to see the movement of the bowl.

DANGER

Entrapment hazards

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



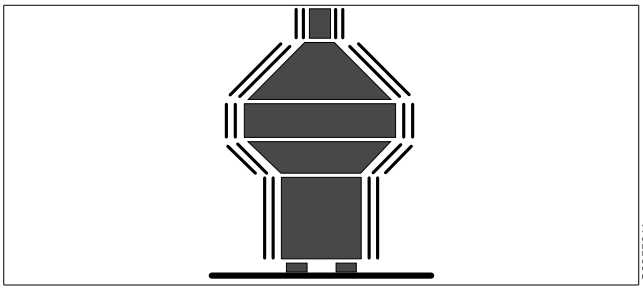
The separator must not be dismantled before standstill

4.1.8 Safety stop

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.

  Evacuate the room. The separator may be hazardous when passing its critical speeds during the run-down.

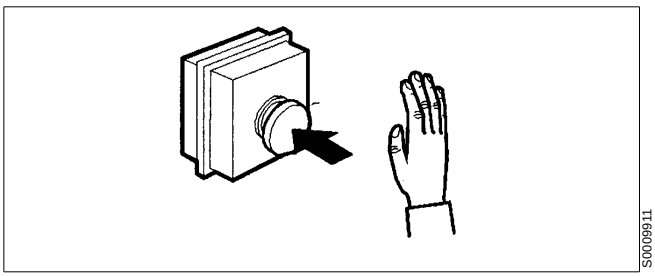


Hazard!

DANGER

Disintegration hazards

Never discharge a vibrating separator.



Push the safety stop!

CAUTION

Disintegration hazards

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

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

5 Service Instructions

Contents

5.1 Periodic maintenance

5.1.1 Introduction

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

DANGER

Disintegration hazards

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

5.1.2 Maintenance intervals

The following directions for periodic maintenance give a brief description of which parts to clean, check and renew at different maintenance intervals.

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

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

Oil change interval is 1500 hours. If the total number of operating hours is less than 1500 hours change oil at least once every year.

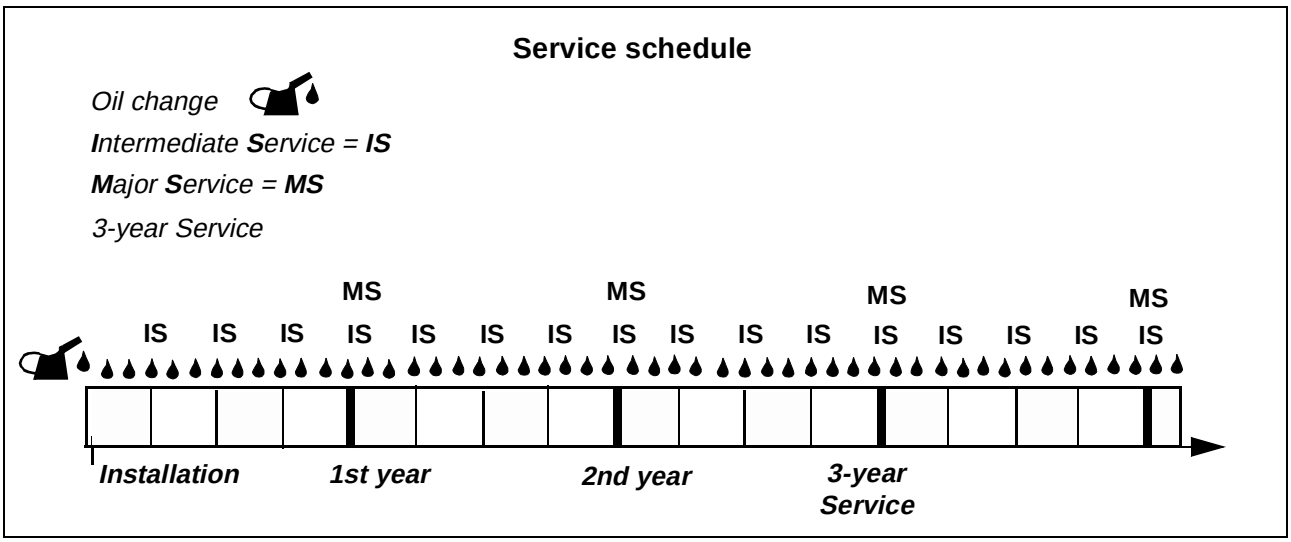
Time of operation between oil changes can be extended from the normal 1500 hours to 2000 hours if a synthetic oil of group D is used.

In seasonal operation change the oil before a new period.

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

MS - Major Service consists of an overhaul of the complete separator every 12 months or 8000 operating hours. An Intermediate Service is performed, and the flat belt, friction elements, seals and bearings in the bottom part are renewed.

3-year service consists of service of the coupling bearings, service of frame intermediate part and renewal of frame feet. The rubber feet get harder with increased use and age.



Other

Check and prelubricate spindle bearings of separators which have been out of service for 6 months or longer. See also “5.10.2 Before shut-downs” on page 77.

NOTE

Do not 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.

5.1.3 Maintenance procedure

At each intermediate and major service, take a copy of the service 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 service log and described in chapter “6 Dismantling/Assembly” on page 79.

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

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

3. Fit all the parts delivered in the service kit while assembling the separator as described in chapter “6 Dismantling/Assembly” on page 79. The assembly instructions have references to check points which should be carried out during the assembly.

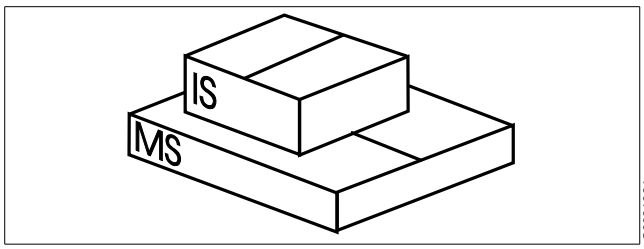
5.1.4 Service kits

Special service kits are available for Intermediate Service (IS) and Major Service (MS).

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

Note that the parts for IS are **not** included in the MS kit.

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



Spare parts kits are available for Intermediate Service and Major 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.

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	36	
Separator bowl Check for vibration and noise		37	
Belt transmission Check for vibration and noise		37	
Oil sump Check	Oil level	36	
Electrical motor Check for heat, vibration and noise See manufacturer’s instructions			

5.2.2 Oil change - monthly

The oil change and check of belt transmission should be carried out every 1500 hours of operation.

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

When the separator is run for short periods, the lubricating oil must be changed every 12 months even if the total number of operating hours is less than 1500 hours (less than 2000 hours if a group D oil is used).

See chapter ‘‘8.5 Lubricants” on page 147 for further information on oil brands etc.

Main component and activity	Part	Page	Notes
Bowl spindle and transmission			
Check	Belt tension	116	
Change	Oil in oil sump	71	

5.2.3 IS - Intermediate Service

Name of plant: Local identification:

Separator: MMPX 303SGP-11 Manufacture No./Year:

Total running hours: Product No.: 881099-01-04

Date: Signature:

Renew all parts included in the Intermediate Service kit (IS) and do the following activities.

Main component and activity	Part	Page	Notes
Inlet and outlet, frame			
Clean and inspect	Threads of inlet pipe	59	
	Paring disc	59	
	Housings and frame hood	-	
Separator bowl			
Clean and inspect	Bowl hood	60	
	Top disc	70	
	Bowl discs	70	
	Distributor	-	
	Nozzles in bowl body	55	
	Sliding bowl bottom	56	
	Discharge mechanism	55	
	Threads on bowl hood and bowl body	60	
	Bowl spindle cone and bowl body nave	58	
Check	Disc stack pressure	62	
	Galling of guide surface	60	
	Corrosion, erosion, cracks	51 - 53	
Power transmission			
Check	Belt and belt tension	116	
Change	Oil in oil sump	71	

Main component and activity	Part	Page	Notes
Electrical motor			
Lubrication (if nipples are fitted)	See sign on motor	-	
Signs and labels on separator			
Check attachment and legibility	Safety label on hood	164	
	Other plates and labels	164	

5.2.4 MS - Major Service

Name of plant:		Local identification:	
Separator:	MMPX 303SGP-11	Manufacture No./Year:	
Total running hours:		Product No.:	881099-01-04
Date:		Signature:	

Renew all parts included in the Intermediate and Major Service kits and do the following activities.

Main component and activity	Part	Page	Notes
Inlet and outlet, frame			
Clean and inspect	Threads of inlet pipe	59	
	Paring disc	59	
	Housings and frame hood	-	
Separator bowl			
Clean and inspect	Bowl hood	60	
	Top disc	70	
	Bowl discs	70	
	Distributor	–	
	Nozzles in bowl body	55	
	Sliding bowl bottom	56	
	Discharge mechanism	55	
	Threads on bowl hood and bowl body	60	
	Bowl spindle cone and bowl body nave	58	
Check	Height of paring disc	63	
	Disc stack pressure	62	
	Galling of guide surface	60	
	Corrosion, erosion, cracks	51 - 53	

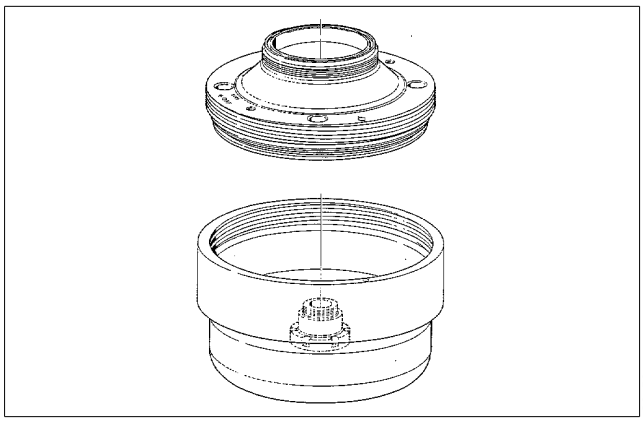
Main component and activity	Part	Page	Notes
Vertical driving device			
Clean and inspect	Oil mist fan	108	
	Oil pump	108	
	Water tank	122	
	Pump sleeve		
	Bowl spindle	99	
	Ball bearing housing indentations	99	
Check	Radial wobble of bowl spindle	64	
Oil sump			
Clean	Oil sump	71	
Change	Oil	71	
Clean and inspect	Oil filling device	121	
Friction coupling			
Clean and inspect	Friction coupling	110	
Electrical motor			
Replace	Bearings[1)]		
Signs and labels on separator			
Check attachment and legibility	Safety label on hood	164	
	Other signs and labels	164	

[1)] See manufacturer's instructions.

5.3 Check points at Intermediate Service

5.3.1 Corrosion

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



Main bowl parts to check for corrosion

DANGER

Disintegration hazard

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

Always contact your Alfa Laval representative if you suspect that the largest depth of a 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.

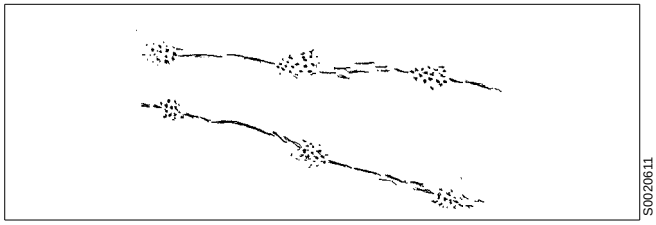
Non-stainless steel and cast iron parts

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 cause a general corrosion. The chloride corrosion is characterised by local damage such as pitting, grooves or cracks. The risk of chloride corrosion is higher if the surface is

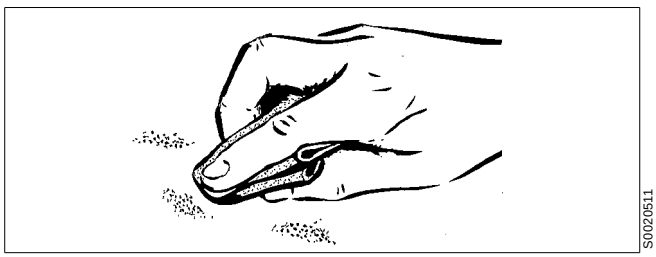
- exposed to a stationary solution,
- in a crevice,
- covered by deposits,
- exposed to a solution that has a low pH value.



Example of chloride corrosion in stainless steel

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

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



Polish corrosion 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.

5.3.2 Erosion

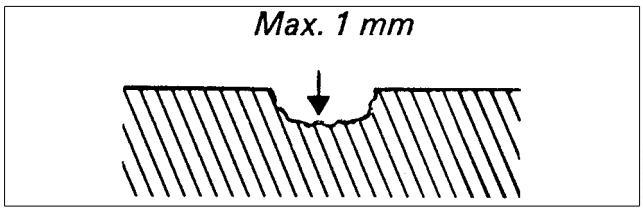
Erosion can occur when particles suspended in the process liquid slide along or strike against a surface. Erosion can become intensified locally by flows of higher velocity.

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.



Maximum permitted erosion

Erosion is characterised by:

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

Parts of the bowl particularly subjected to erosion are:

- The paring disc.
- The top disc.
- The underside of the distributor in the vicinity of the distribution holes and wings.
- The sludge ports.

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

5.3.3 Cracks

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

- Cracks often initiate in areas exposed to high cyclic material stresses. These cracks 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.

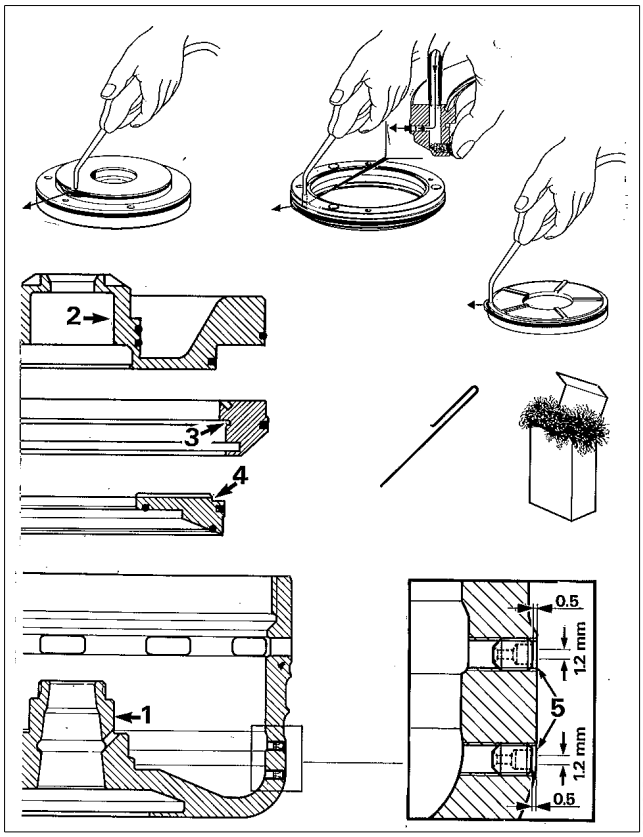
It is particularly important to inspect for cracks in rotating parts.

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

5.3.4 Discharge mechanism

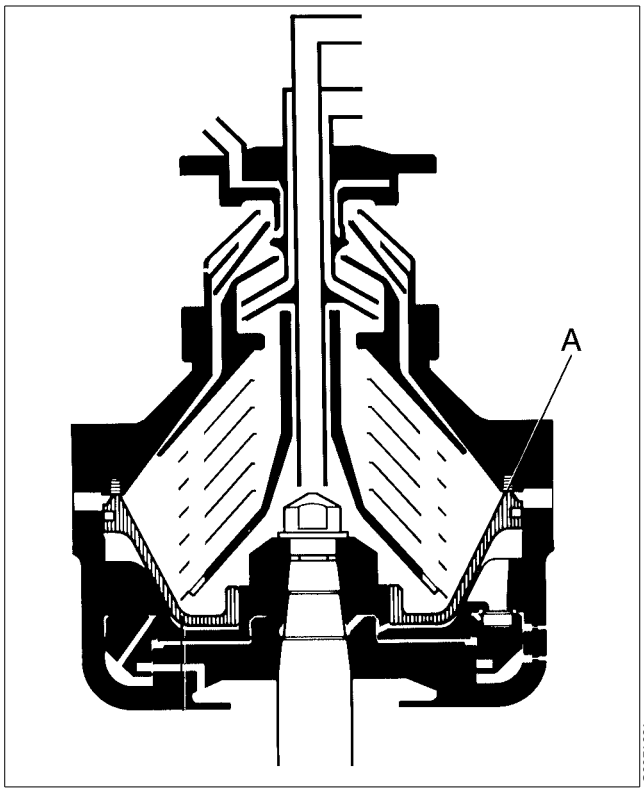
Dirt and lime deposits in the sludge discharge mechanism can cause discharge malfunction or no discharge.

- Thoroughly clean and inspect the parts. Pay special attention to important surfaces (1, 2, 3 and 4). If necessary, polish with steel wool. Apply a thin layer of Molykote D321R spray on all sliding surfaces and polish firmly. The seal rings should be well greased with silicon grease before fitting them.
- Clean nozzles (5) using soft iron wire or similar. Note that lime deposits can with advantage be dissolved in a 10% acetic acid solution.
- Use Loctite 242 on the threads if the nozzles have been removed or replaced.



5.3.5 Bowl hood and sliding bowl bottom

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



A Sealing surface in the bowl between bowl hood and sliding bowl bottom

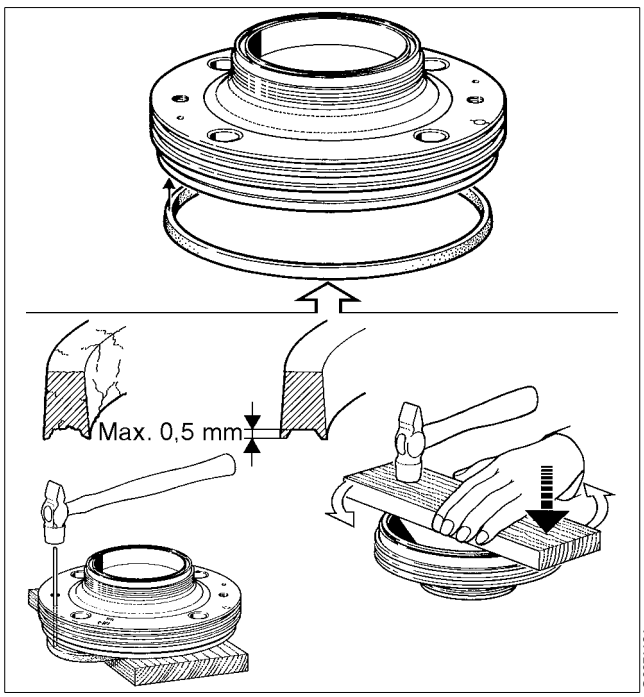
Fit a new bowl hood seal ring at each Intermediate Service (IS) if the old ring is damaged or indented more than 0,5 mm.

Fit a new ring as follows:
Press the ring into the groove with a straight board (1” x 4”), placed across the ring.

NOTE

If a new ring is too narrow, put it into hot water, 70 - 80 °C for about 5 minutes.

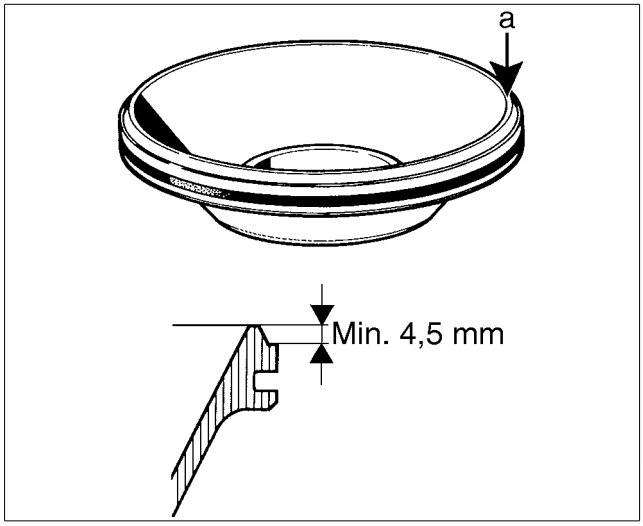
If it is too wide it will recover after drying at 80 - 90 °C for about 24 hours.



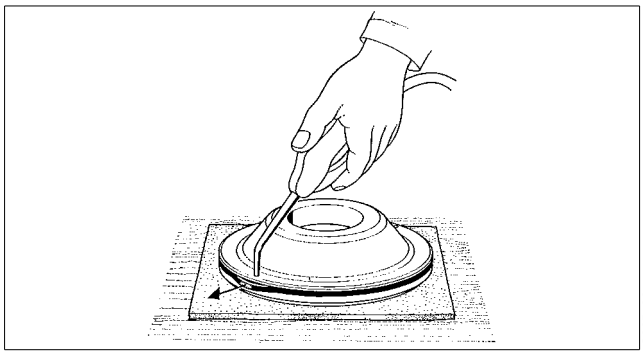
Exchange of seal ring in bowl hood

Check the sealing edge (a) of the sliding bowl bottom.

If damaged through corrosion or erosion or in other ways it can be rectified by turning in a lathe. Minimum permissible height of sealing edge: 4,5 mm.



a Sealing edge on sliding bowl bottom



Removal of seal ring on sliding bowl bottom

5.3.6 Spindle top cone and bowl body nave

Impact marks on the spindle cone or in the bowl body nave may cause the separator to vibrate while running.

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

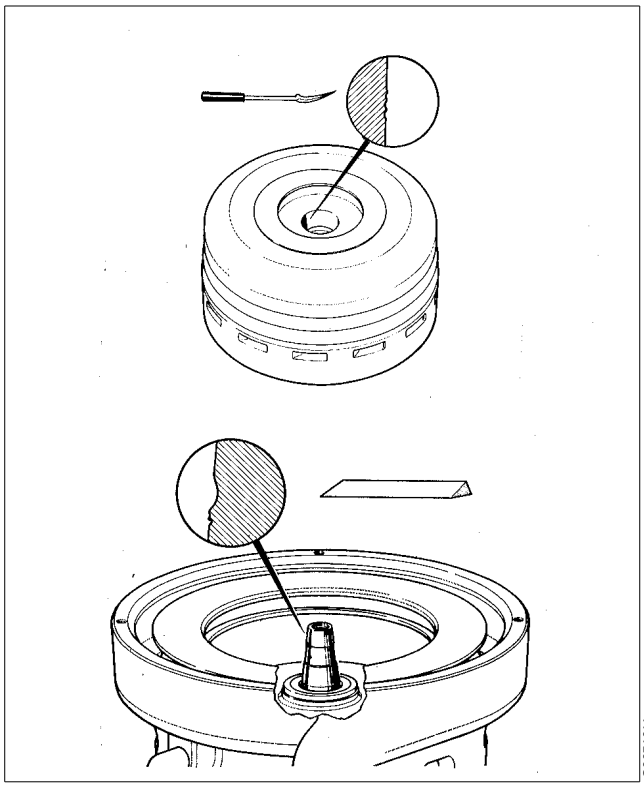
- Remove any impact marks using a scraper and/or a whetstone.

  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 conicity must not be marred.

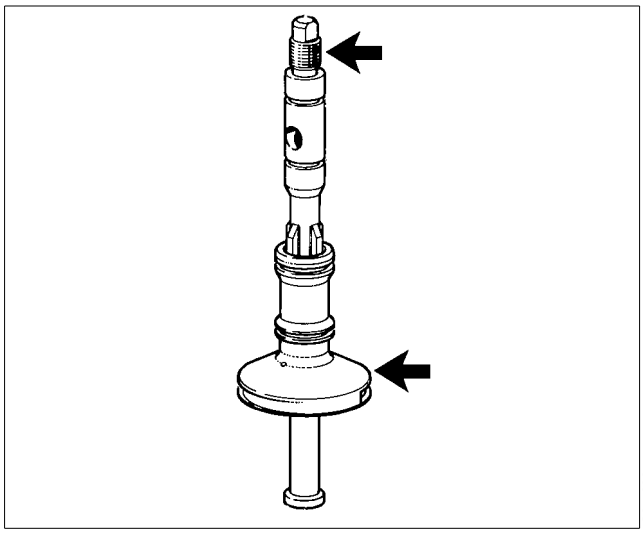


Use whetstone or scraper with great care

5.3.7 Threads of inlet pipe, paring disc

Damage to threads or a broken paring disc can prevent correct tightening of the inlet pipe and cause the paring disc to scrape against the top disc, even though the height adjustment of the paring disc has been made correctly.

1. Examine the threads for damage and rectify if required.
2. Examine the paring disc for damage and to see if the disc walls have parted. If they have, the inlet pipe has to be replaced with a new one.

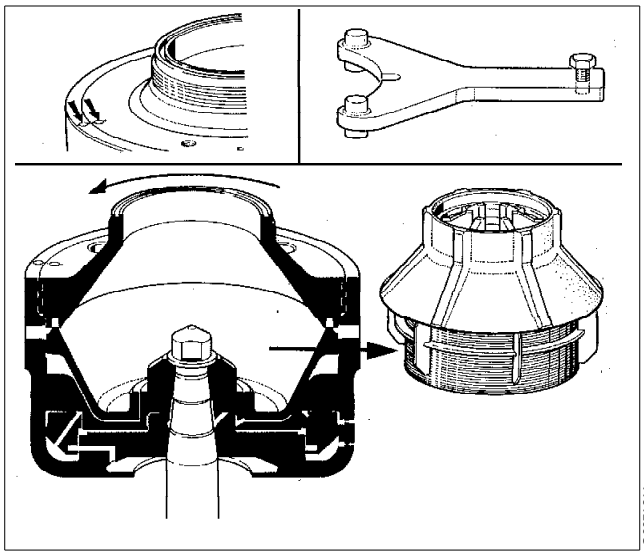


5.3.8 Threads on bowl hood and bowl body

Excessive wear or impact marks on threads and guide surfaces of the bowl hood or bowl body can cause seizure damage.

Examine the thread condition by tightening the bowl hood after removing the disc stack and top disc from the bowl.

When the bowl is new the alignment marks on the bowl hood and the bowl body should be aligned. If not, contact an Alfa Laval representative.

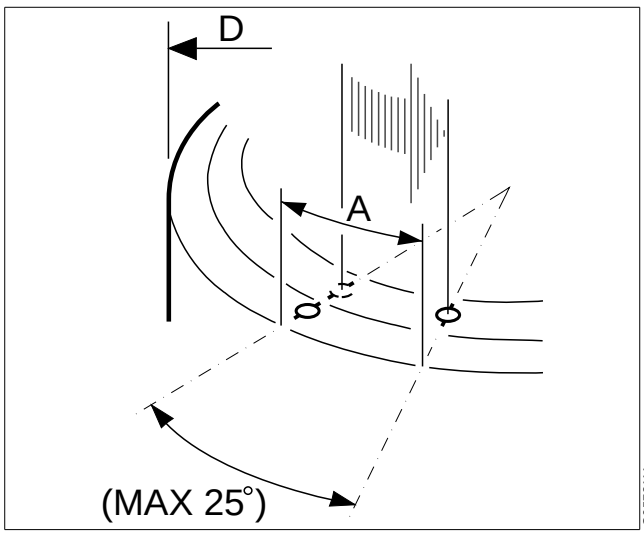


Wear

If thread wear is observed, mark the bowl body at the new position by punching a new alignment mark. If the mark on the bowl hood passes the mark on the bowl body by more than 25°, (A in the illustration) an Alfa Laval representative should be contacted immediately.

The measure A in millimetres (mm) is obtained by calculating bowl outside diameter D times 0,2.

If the marks are illegible, an Alfa Laval representative should be contacted for determination and punching of new alignment marks.



DANGER

Disintegration hazards

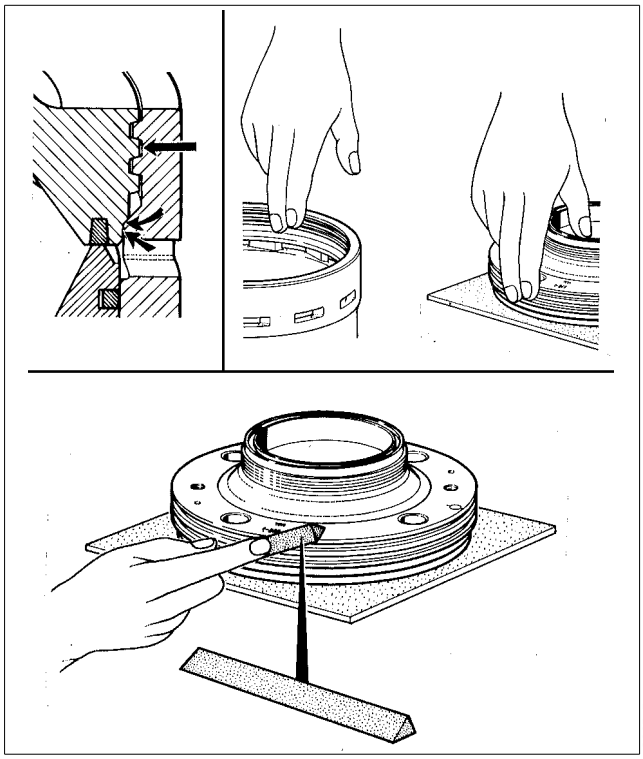
Wear on threads must not exceed safety limit. ϕ mark on bowl hood must not pass ϕ mark on bowl body by more than 25°.

Damage

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

Examine for burrs and protrusions caused by impact.

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



Contact surfaces to inspect on the bowl

CAUTION

Cut hazard

The threads have sharp edges which can cause cuts.

If damage is found, rectify by using a whetstone or fine emery cloth. Recommended grain size: 240.

If the damage is bad, use a fine single-cut file, followed by a whetstone.

After rectifying, the threads have to be primed with Molykote 1000.

5.3.9 Disc stack pressure

The bowl hood exerts a pressure on the disc stack clamping it in place.

NOTE

Insufficient pressure in the disc stack may affect the bowl balance, which in turn will cause abnormal vibration of the separator and shorten the life of ball bearings.

1. Place the bowl hood on the top of the disc stack and tighten it by hand.

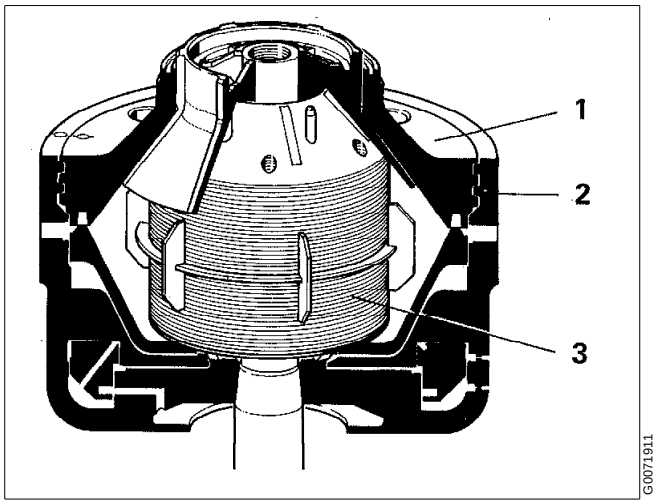
   The assembly mark on the bowl hood should now be positioned at the angle a (see illustration), 30° - 60° ahead of the corresponding mark on the bowl body.

2. If the bowl hood can be tightened by hand without resistance until the marks are in line with each other, an extra disc must be added to the top of the disc stack beneath the top disc.

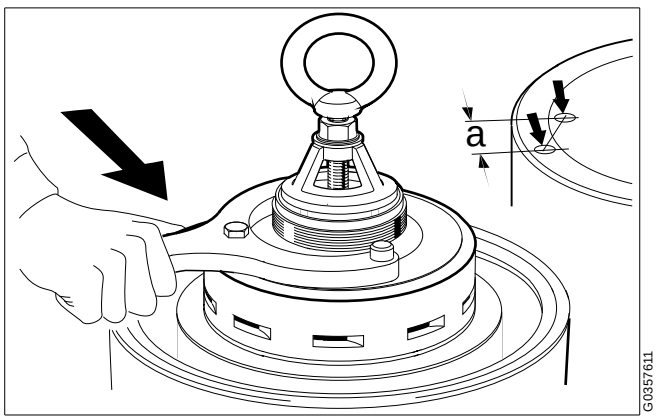
3. If one or more discs have been added re-check the disc stack pressure by repeating the procedure above.

NOTE

The top disc can stick inside the bowl hood and fall when the hood is lifted.



1 Bowl hood
2 Bowl body
3 Disc stack. Number of bowl discs
- below wing insert: 32
- above wing insert: at least 31

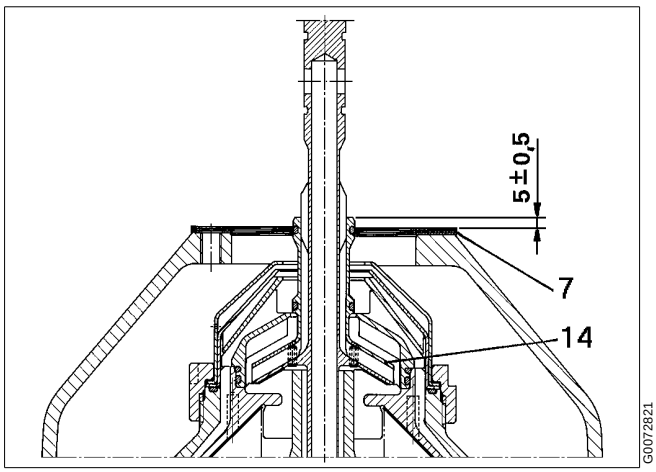


a Angle 30° - 60° between assembly marks before final tightening

5.4 Check points at Major Service

5.4.1 Paring disc height adjustment

The height of the paring disc above the frame hood must be measured if the bowl spindle has been dismantled or if the bowl has been replaced with a new one.

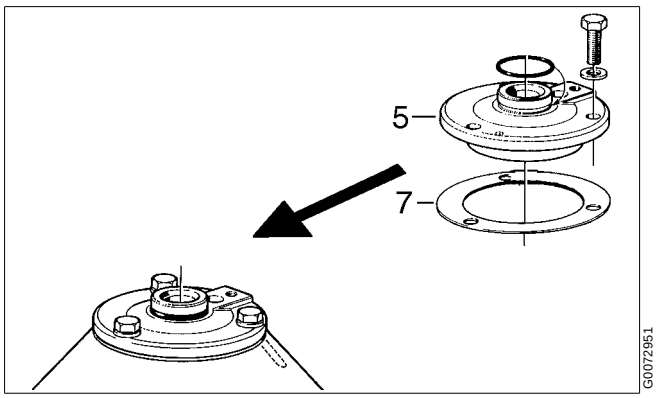


NOTE

Incorrect height position can cause the paring disc (14) to scrape against the paring chamber cover. Pay attention to scraping noise at start-up after service.

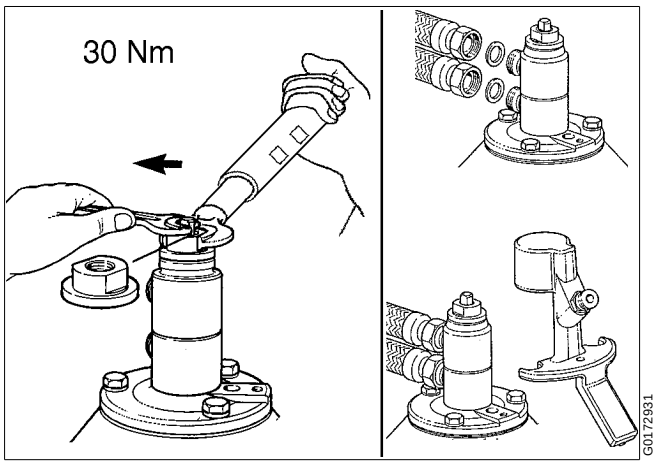
1. Assemble the bowl and frame hood as described in chapter “6.1.2 Inlet/outlet and bowl - assembly” on page 89.

   Before fitting the connecting housing:



2. Measure the distance according to the illustration above. Adjust the distance by adding or removing height adjusting rings (7).
3. Fit the connecting housing (5) and the inlet/ outlet housing. Tighten the nut with 30 Nm.

   Left-hand thread!



4. Rotate the bowl spindle by hand by means of the flat belt. If it does not rotate freely or if a scraping noise is heard, incorrect height adjustment or incorrect fitting of the inlet pipe can be the cause. Remove the parts and readjust.
5. Finally, fit the safety device.

5.4.2 Radial wobble of bowl spindle

The bowl spindle wobble must be measured if the bowl spindle has been dismantled or if rough bowl run (vibration) occurs.

NOTE

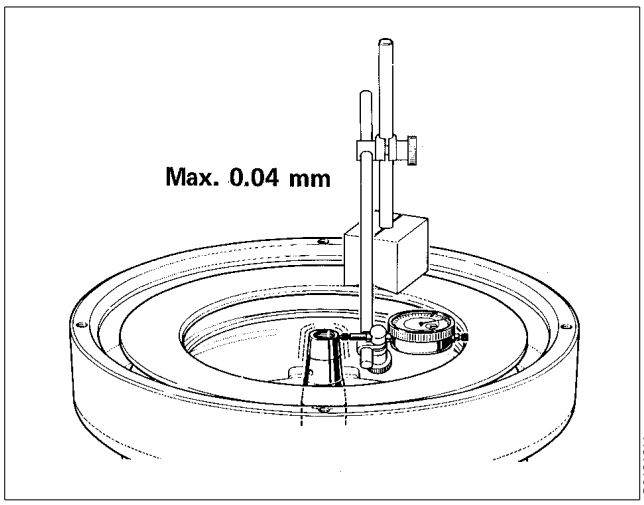
Spindle wobble will cause rough bowl run. This leads to vibration and reduces lifetime of ball bearings.

Check the wobble **before** removing the bowl spindle.

If the bowl spindle has been dismantled check the wobble before installing the bowl.

1. Fit a dial indicator in a support and fasten it in position as illustrated.
2. Remove the water tank from the frame bottom part for access to the flat belt. Use the flat belt to turn the spindle.
3. Permissible radial wobble: max. 0,04 mm.

   If the spindle wobble is more than the maximum permitted value, contact Alfa Laval representatives.
4. Finally fit the water tank to the frame bottom part.



Incorrect belt tension causes displacement of the vertical line of the spindle centre, but does not affect the wobble of the spindle.

5.5 3-year service

Exchange of frame feet

See “6.7.1 Mounting of new frame feet” on page 123.

Friction coupling

Exchange of ball bearings, see ‘‘6.3 Friction coupling” on page 110.

Frame intermediate part

Replace O-ring and gasket, see ‘‘6.2.2 Bowl spindle and frame - assembly” on page 104.

5.6 Lifting instructions

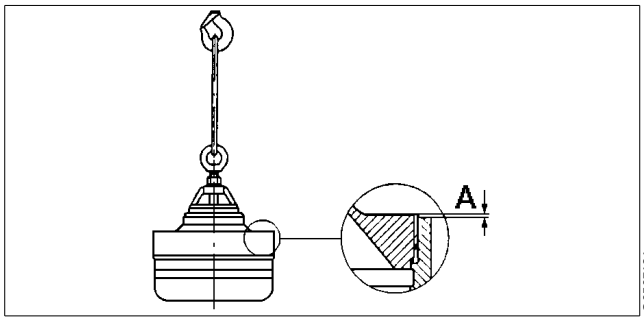
1. Remove the inlet/outlet housings, the frame hood and the bowl according to the instructions in chapter “6.1.1 Inlet/outlet and bowl - dismantling” on page 84.

NOTE

Make sure to remove the cap nut fixing the bowl to the bowl spindle.

Before lifting the bowl, check that the bowl hood has been screwed home into the bowl body. Less than 2 mm of bowl hood threading must remain above the bowl body edge. See illustration.

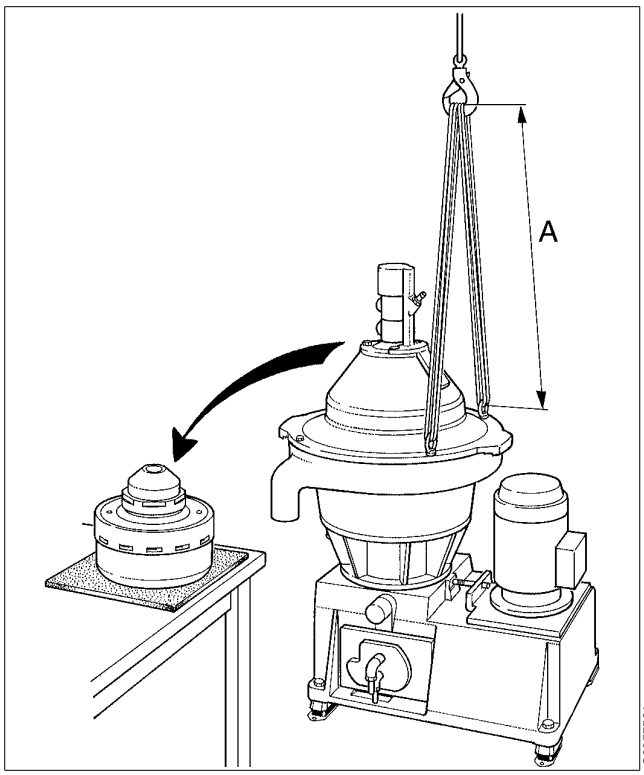
When lifting the bowl, use the compression tool fastened on the distributor.



A <2 mm

2. Disconnect the motor cables.
3. Tighten the frame hood.
4. Fit the lifting eyes. The two eyebolts must be fitted in the holes nearest to the electric motor.
5. Use two endless slings to lift the separator. Length of each sling: minimum 1,5 metres. Thread the slings through the lifting eyes and fit them to the hook of the hoist.
6. Unscrew the foundation bolts.
7. When lifting and moving the separator, obey normal safety precautions for lifting large heavy objects.

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



A minimum 750 mm distance between lifting eye and hook. Use a lifting hook with catch.

8. Remove the lifting eyes afterwards.

WARNING

Crush hazards

Use only the two **special lifting eyes** (M12) for lifting the machine. They are to be screwed into the special threaded holes.

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

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

NOTE

Separator without bowl: Use lifting slings for WLL 300 kg.

Bowl: Use lifting slings for WLL 100 kg.

5.7 Cleaning

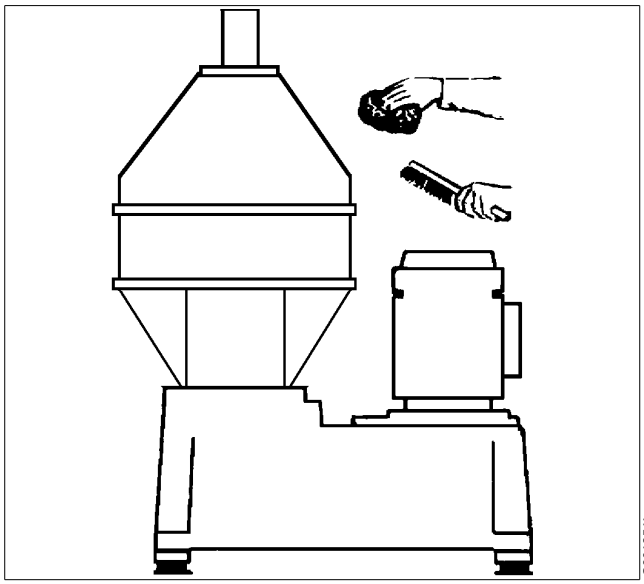
External cleaning

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

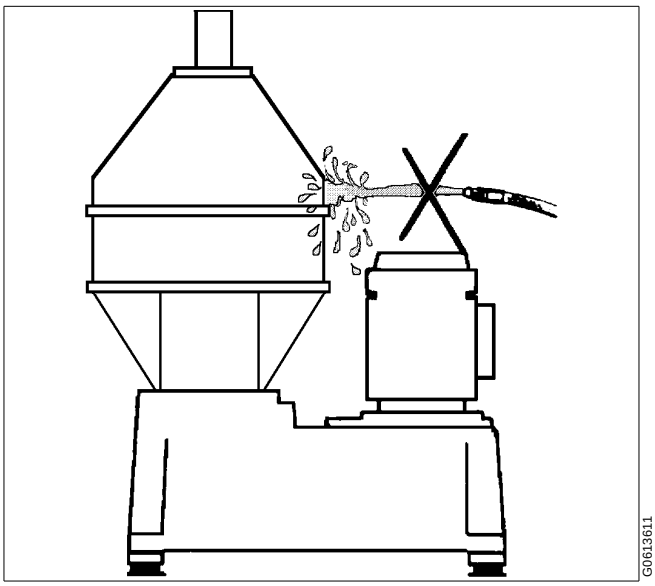
Never wash down a separator with a direct water stream. Totally enclosed motors can be damaged by direct hosing to the same extent as open motors and even more than those, because:

- 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.



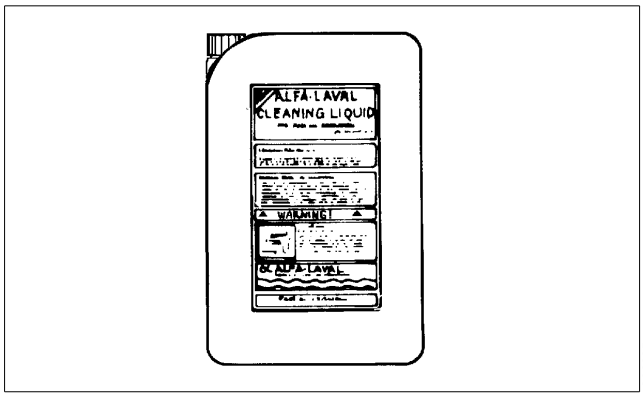
Use a brush and a sponge or cloth when cleaning



Never wash down a separator with a direct water stream or spray

5.7.1 Cleaning agents

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



*Alfa Laval cleaning liquid for **lube oil** and **fuel oil** separators is available in 25-litre plastic containers.*

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.

CAUTION

Skin irritation hazard

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

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

For parts of the driving devices

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

Oiling (protect surfaces against corrosion)

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

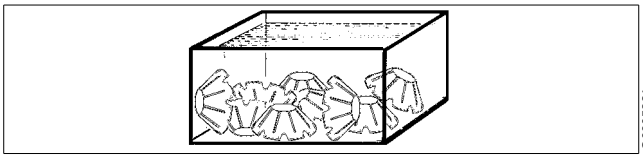
5.7.2 Cleaning of bowl discs

Bowl discs

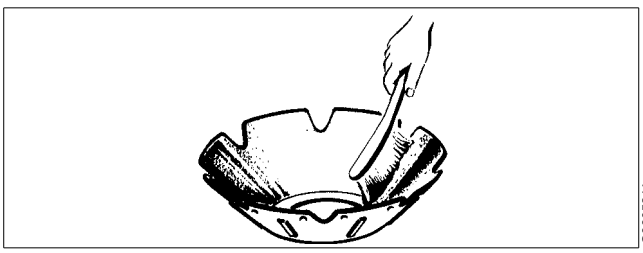
Handle the bowl discs carefully so as to avoid damage to the surfaces during cleaning.

> **NOTE**
>
> Mechanical cleaning is likely to scratch the disc surfaces causing deposits to form quicker and adhere more firmly.
>
> A mild 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

> **WARNING**
>
> **Cut hazards**
>
> The discs have sharp edges that can cause cuts.

5.8 Oil change

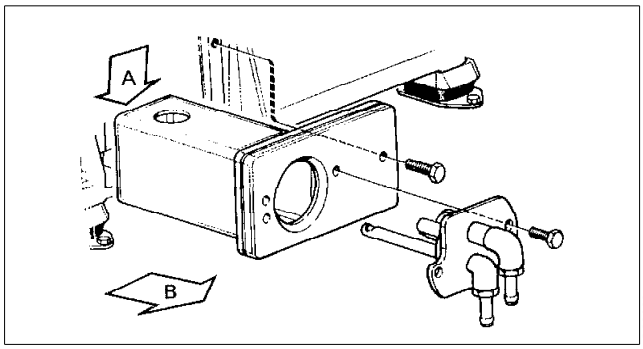
5.8.1 Oil change procedure

NOTE

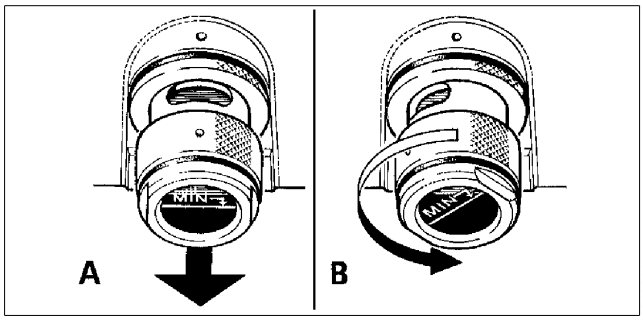
Before adding or renewing lubricating oil in the oil sump, the information concerning different oil groups, handling of oils, oil change intervals etc. given in chapter “8.5 Lubricants” on page 147 must be well known.

The separator should be level and at standstill when oil is filled or the oil level is checked. The MIN-line on the sight glass refers to the oil level at standstill.

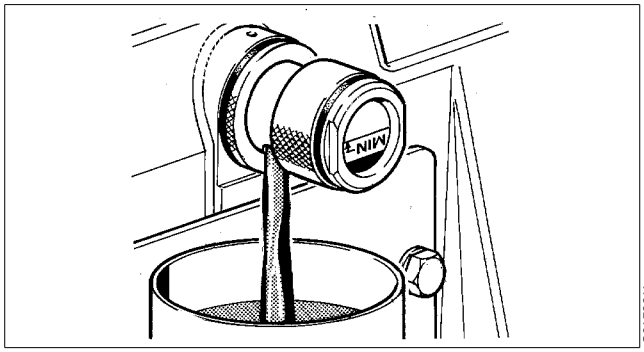
1. Remove the cover and the water tank. Note that the tank must be lowered past spindle end (A) before it can be withdrawn (B).



2. Place a collecting vessel under the drain hole.
3. Pull out (A) the oil filling device and turn it half a turn (B).



4. Collect the oil in the vessel.

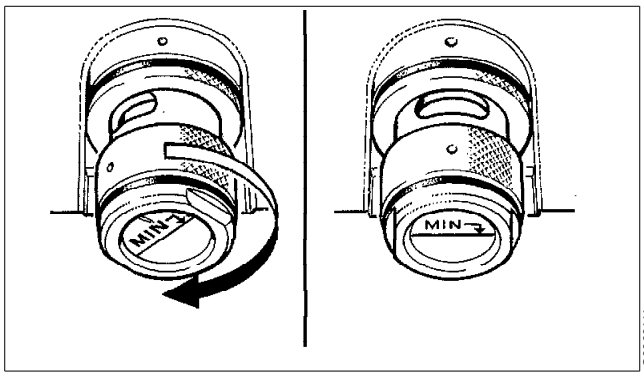


CAUTION

Burn hazards

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

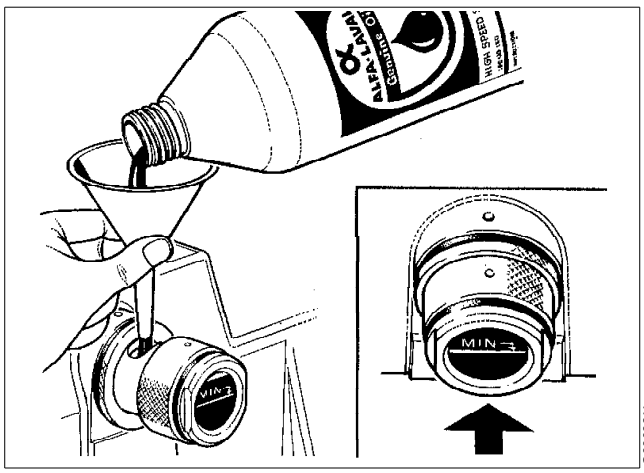
5. Turn the oil filling device back to its normal position (A), the drain hole pointing upwards.



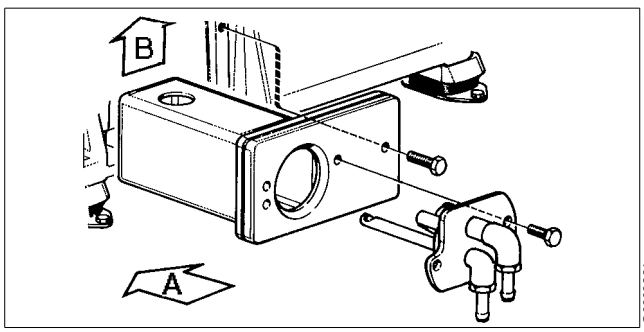
NOTE

When changing from one group of oil to another, the frame housing and the spindle parts must be thorougly cleaned before the new oil is filled.

6. Fill the oil sump in the frame housing with new oil. The oil level should be slightly above middle of the sight glass. Information on volume see “8.1 Technical data” on page 138.
7. Push in the oil filling device.



8. Fit the water tank and the cover.



5.9 Vibration

5.9.1 Vibration analysis

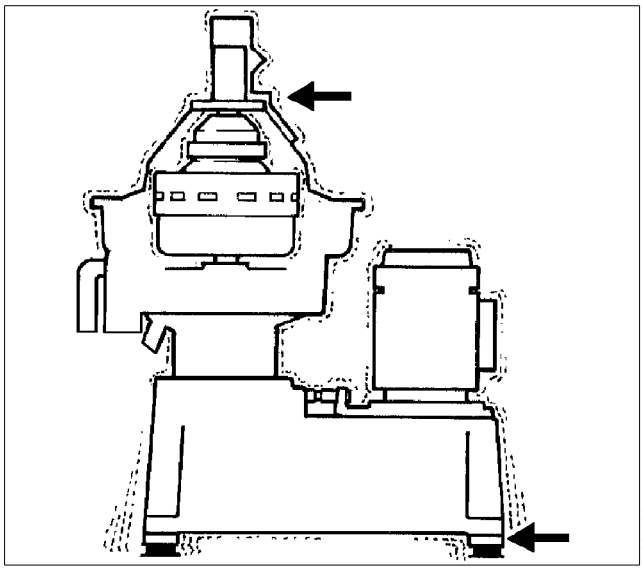
A separator normally vibrates and produces a different sound when passing through its critical speeds during run-up and run-down.

It also vibrates and sounds to some extent when running. It is good practice to be acquainted with these normal conditions.

Excessive vibrations and noise indicate that something is wrong. Stop the separator and identify the cause.

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

The level of vibration of the separator should not exceed 9 mm/s.



Measuring points for vibration analysis

DANGER

Disintegration hazards

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

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

5.10 General directions

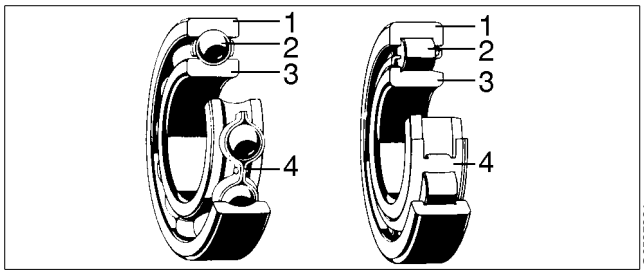
5.10.1 Ball and roller bearings

Specially designed bearings for the bowl spindle

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

Only Alfa Laval genuine spare parts should be used.

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



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

NOTE

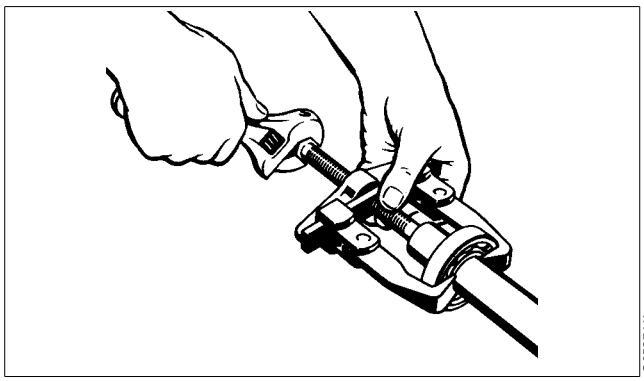
Using an incorrect bearing can cause a serious breakdown with injury to personnel and damage to equipment as a result.

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

Dismantling

Remove the bearing from its seat by using a puller. If possible, let the puller engage the inner ring, then remove the bearing with a steady force until the bearing bore completely clears the entire length of the cylindrical seat.

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



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

NOTE

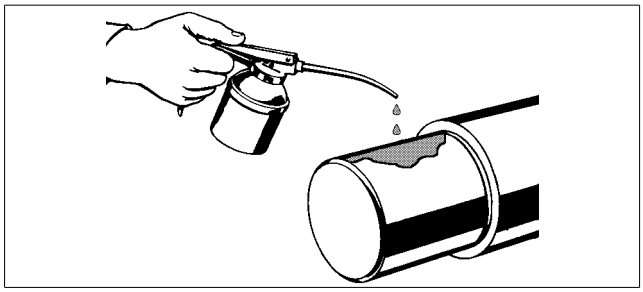
Do not hit with a hammer directly on the bearing.

Cleaning and inspection

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

Assembly

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



Clean and smear the bearing seating before assembly

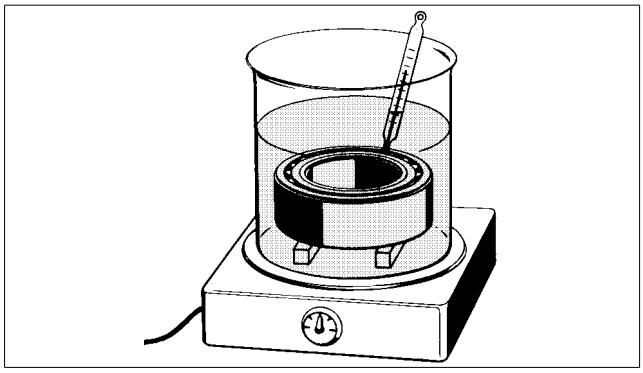
- When assembling ball bearings, the bearings must be heated in oil to maximum 125 °C.

NOTE

Heat the bearing in a clean container with a cover.

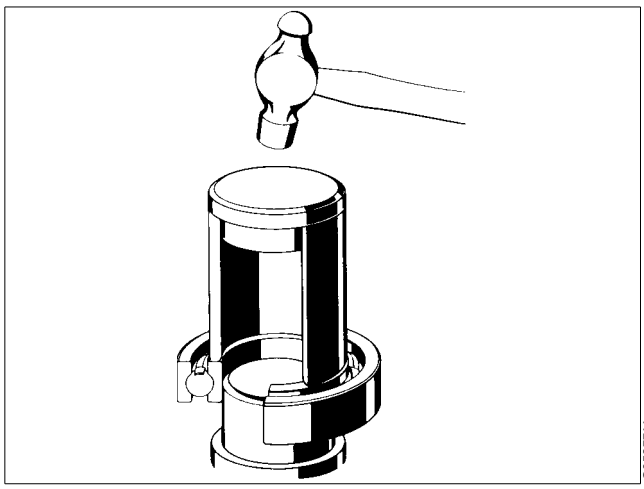
Use only clean oil with a flash point above 250 °C.

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

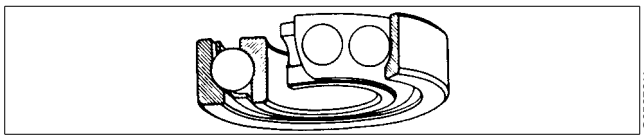
- There are several basic rules for assembling cylindrical bore bearings:
  - Never directly strike a bearing's rings, cage or rolling elements while assembling. A ring may crack or metal fragments break off.
  - Never apply pressure to one ring in order to assemble the other.
  - Use an ordinary hammer.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

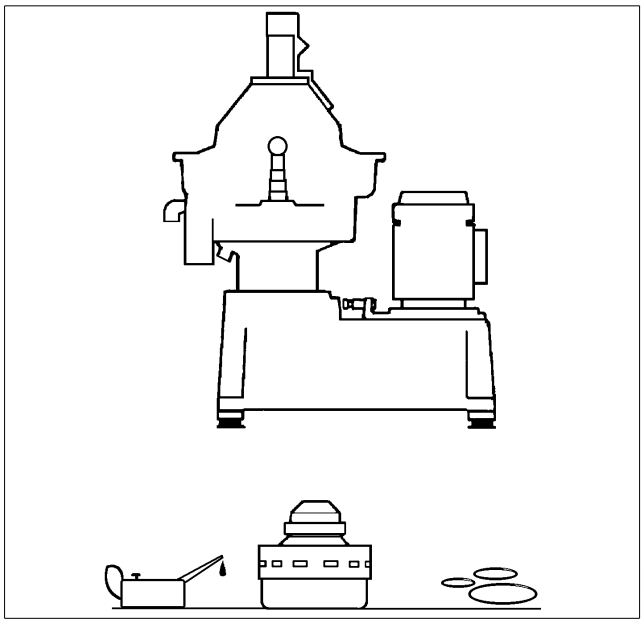


The wide shoulder of the inner race must face the axial load

5.10.2 Before shut-downs

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 79.
- Protect parts in contact with process liquid from corrosion by applying a thin layer of oil.
- Remove the O-rings.
- 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.



Remove the bowl if the separator is left at standstill for more than one week

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.

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 before the separator is put into operation again.

If the shut-down period has been longer than 12 months, a Major Service (MS) should be carried out.

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6 Dismantling/Assembly

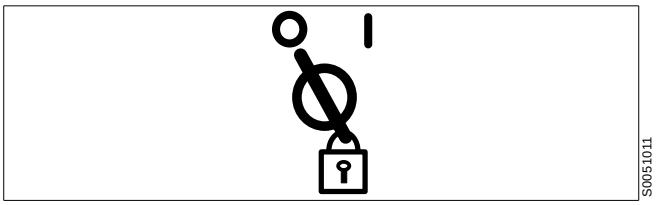
Contents

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**
"5.3.9 Disc stack pressure" on page 62.

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



*Switch off and lock power supply before starting **any** dismantling work.*

Tools

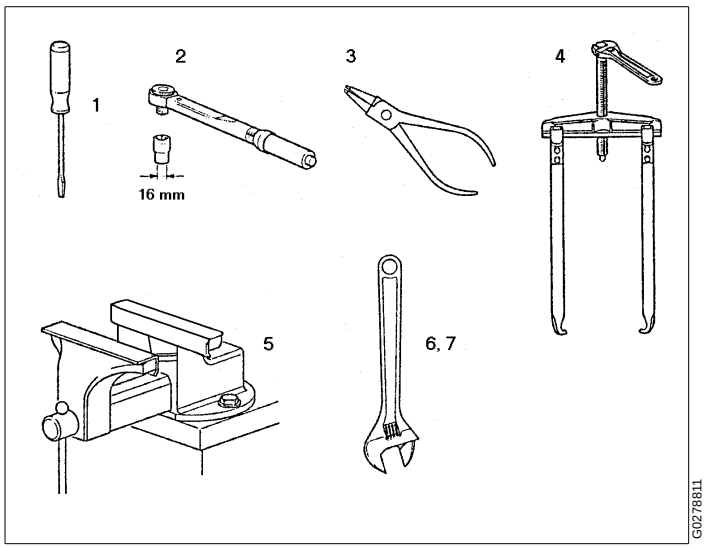
Special tools from the tool kit must be used for dismantling and assembly. The special tools are specified in the *Spare Parts Catalogue.*

Additional tools needed for dismantling but not included in the tool kit are shown here.

For bowl and bowl spindle

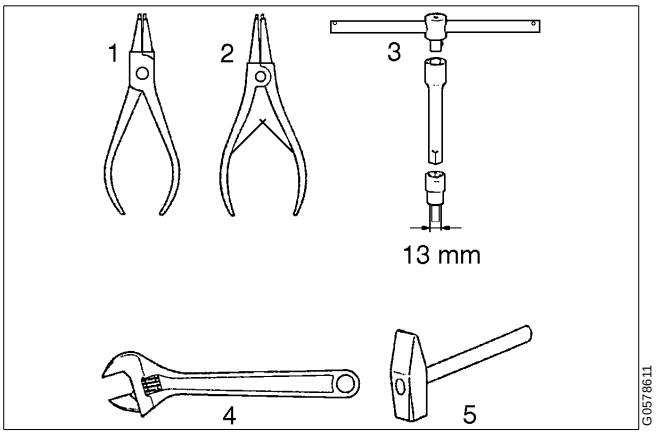
1. *Screw driver*
2. *Torque wrench (50 Nm) with socket 16 mm*
3. *Pliers for internal snap ring*
4. *Ball bearing puller*
5. *Screw vice with copper liners*
6. *Adjustable wrench, length approx. 400 mm*
7. *Adjustable wrench or spanner, width of jaws 24 mm*

Two lifting slings, working load limit (WLL): >300 kg are also needed.



For friction coupling and flat belt

1. *Pliers for internal snap ring*
2. *Pliers for external snap ring*
3. *T-handle, extension rod and socket 13 mm*
4. *Adjustable wrench or spanner, width of jaws 36 mm*
5. *Hammer*



6.1 Inlet/outlet and bowl

DANGER

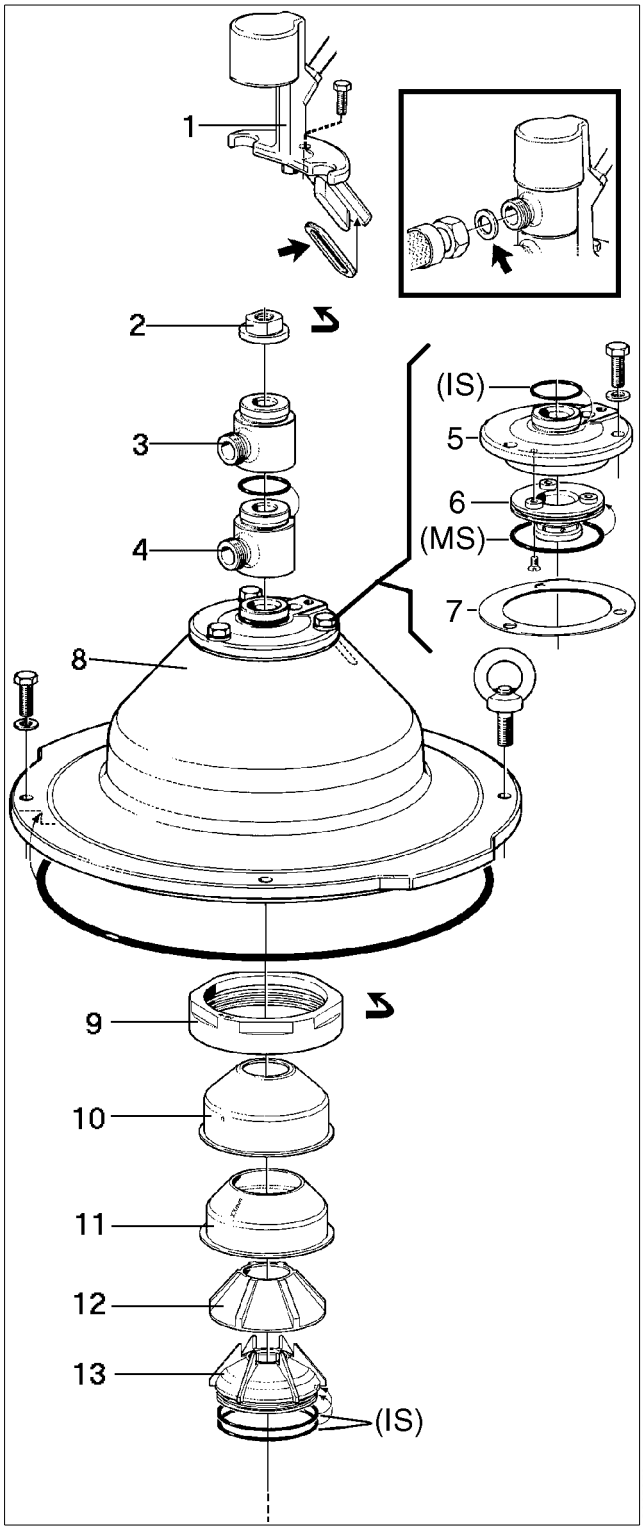
Entrapment hazard

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

1. *Safety device*
2. *Nut*
3. *Inlet housing*
4. *Outlet housing*
5. *Connecting housing**
6. *Insert*
7. *Height adjusting ring*
8. *Frame hood*
9. *Lock ring*
10. *Heavy phase cover*
11. *Gravity disc/Clarifier disc*
12. *Leader cone*
13. *Paring chamber cover*

**The connecting housing is removed from the frame hood top at paring disc adjustment (Major Service).*

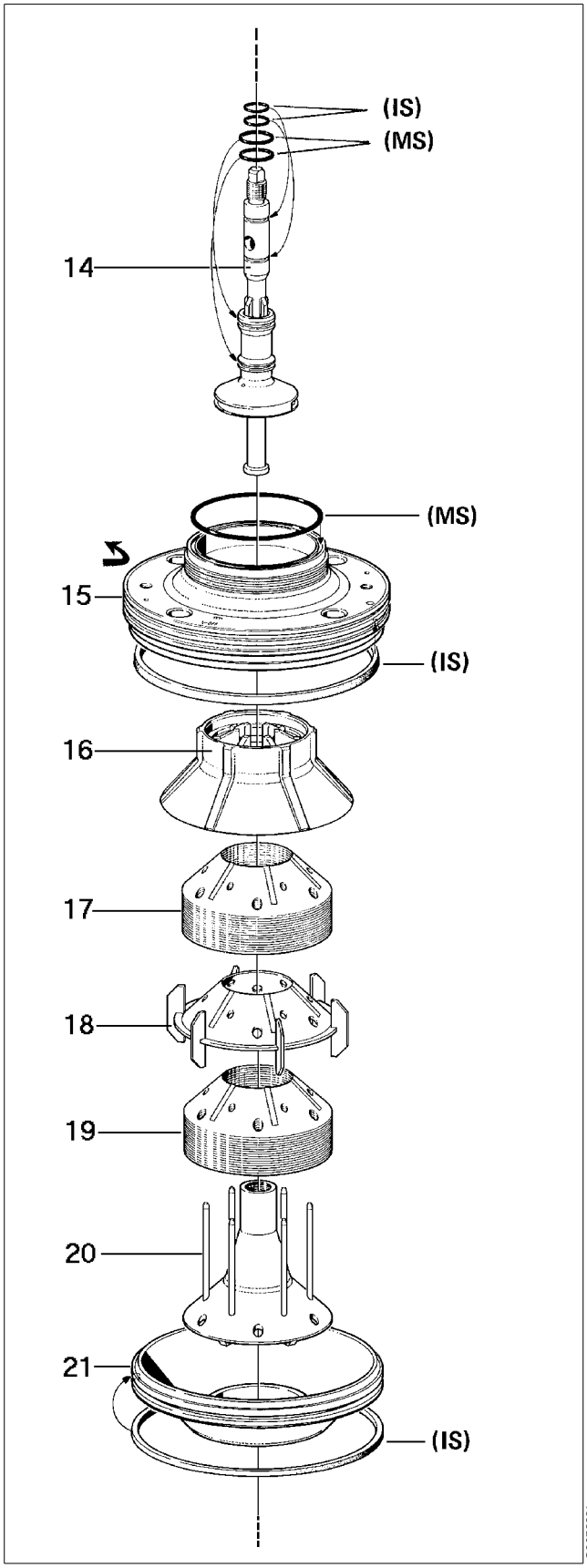
Left-hand thread



14. Inlet pipe
15. Bowl hood
16. Top disc
17. Bowl discs
18. Wing insert
19. Bowl discs
20. Distributor
21. Sliding bowl bottom

Left-hand thread

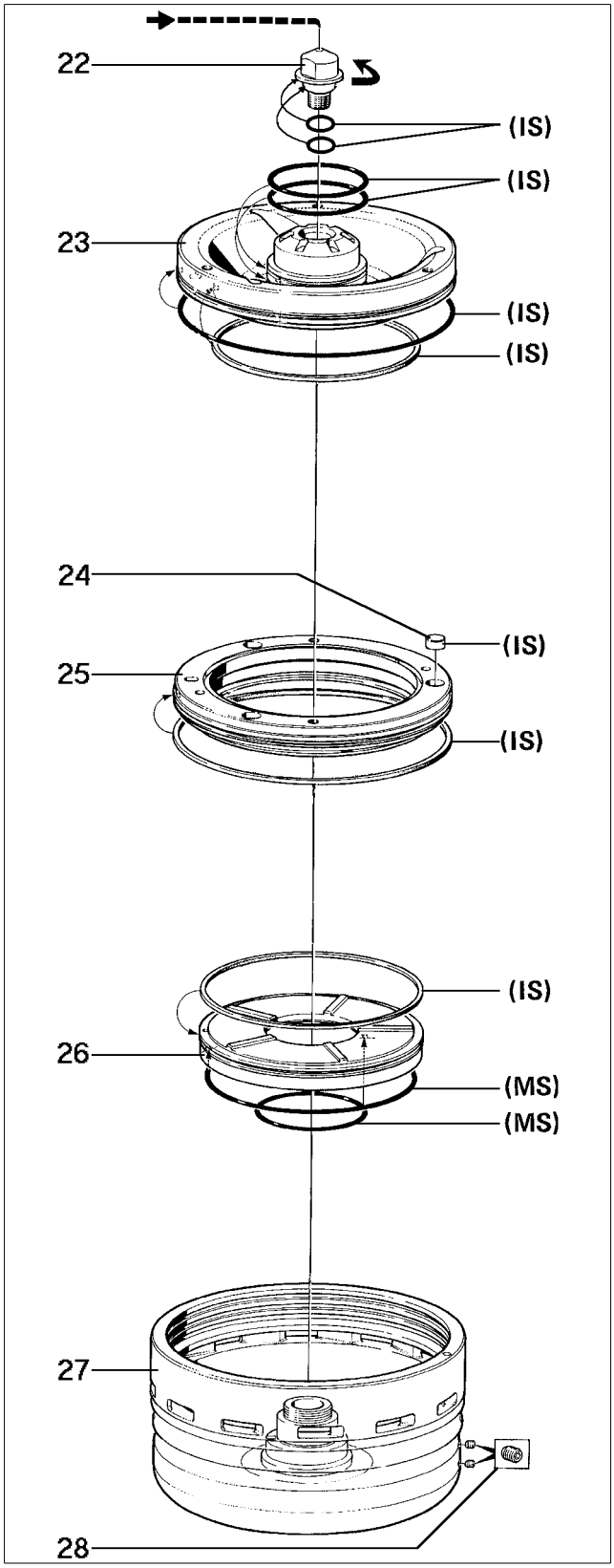
IS Intermediate service kit
MS Major service kit



22. *Cap nut*
23. *Upper distributing ring*
24. *Valve plug*
25. *Operating slide*
26. *Lower distributing ring*
27. *Bowl body*
28. *Nozzle*

Left-hand thread

IS Intermediate service kit
MS Major service kit

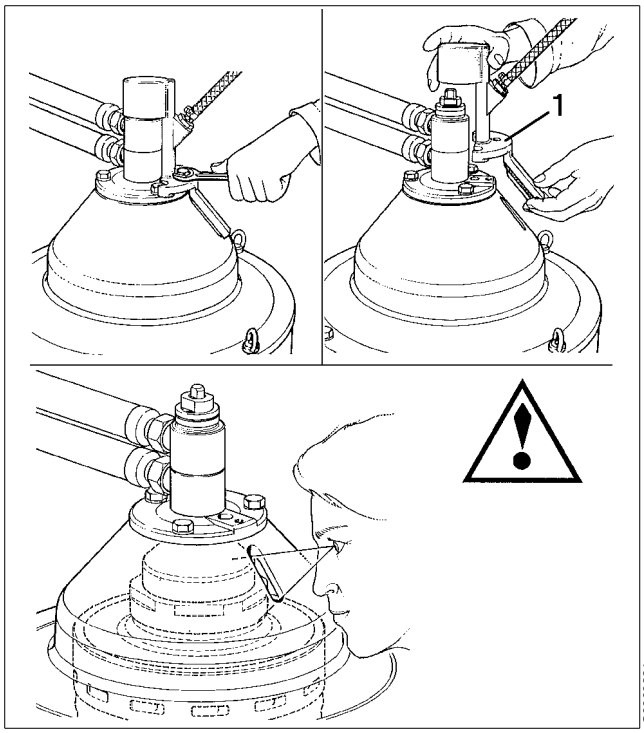


6.1.1 Inlet/outlet and bowl – dismantling

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. Remove safety device (1) and look through the slot in the frame hood to see if the bowl still rotates.



DANGER

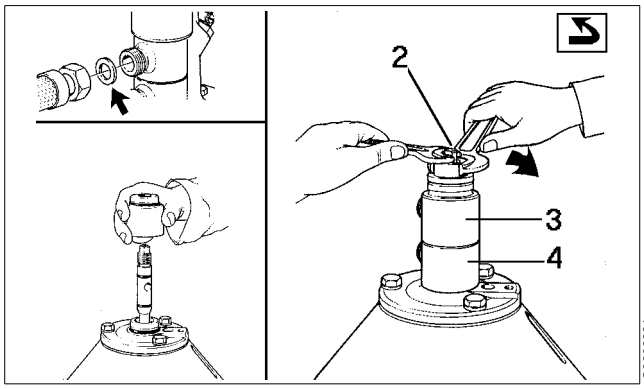
Entrapment hazards

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

The bowl parts can remain very hot for a considerable time after the bowl has come to a standstill.

2. Unscrew nut (2) clockwise and lift off inlet and outlet housings (3, 4) together with the connecting hoses. When removing the connecting hoses, do not drop the washer.

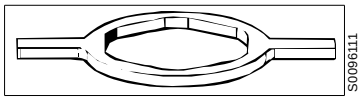
   Left-hand thread!

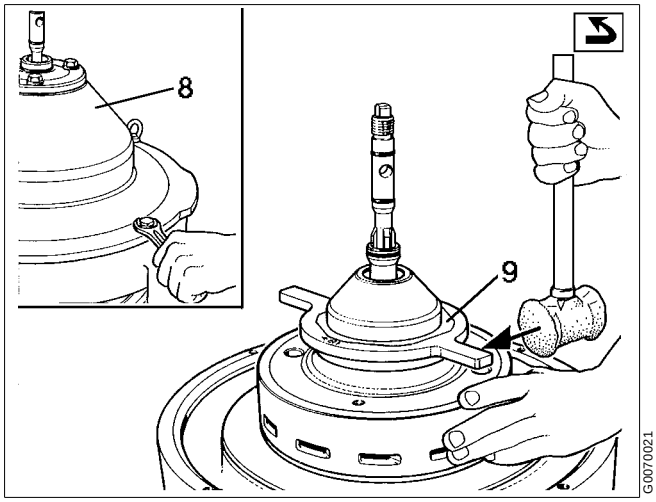


3. Remove the bolts and lift off frame hood (8).

4. Unscrew lock ring (9) clockwise by using the special tool; spanner for lock ring.

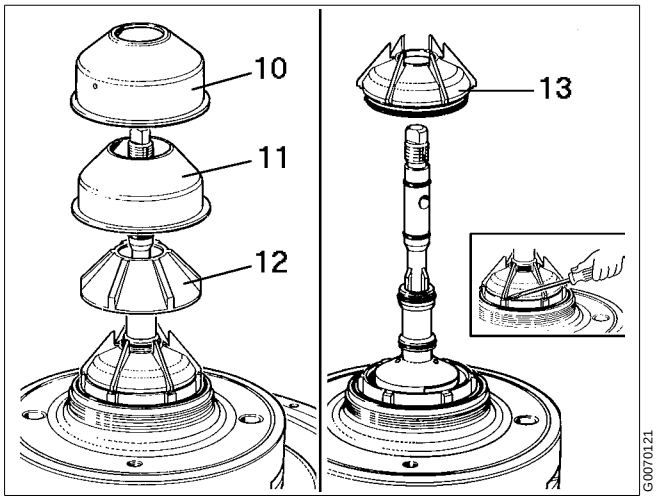
   Left-hand thread!





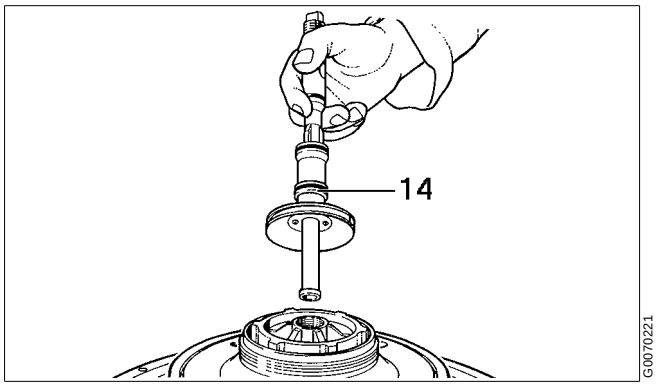
5. Lift off heavy phase cover (10), gravity disc (clarifier disc) (11) and leader cone (12).

> **NOTE**
>
> If the gravity disc has to be replaced owing to changed operating conditions, see “8.6.6 Gravity disc nomogram” on page 166.



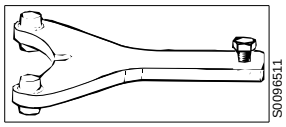
6. Carefully prise loose paring chamber cover (13) by using a screwdriver. Lift off the paring chamber cover.

7. Lift out inlet pipe (14) with the paring disc.

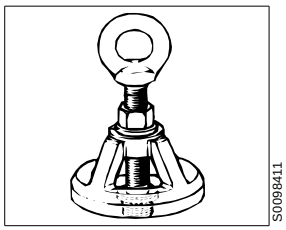


8. Preparations for unscrewing of bowl hood (15):

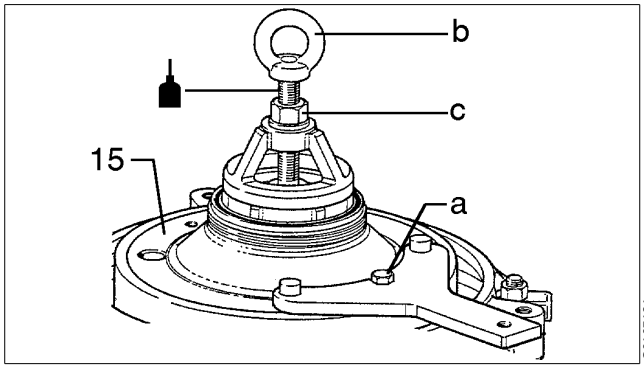
   – Fit the spanner to the bowl hood and secure it with the bolt (a).



   – Fit the compression tool and screw down the central screw (b) until it stops.



   – Compress the disc stack by tightening the nut (c) firmly.



NOTE

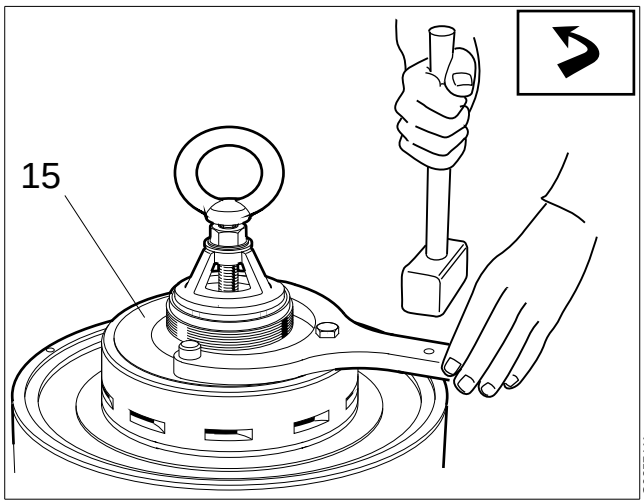
Use the compression tool as instructed.

Use of substitute tools can damage the equipment.

9. Unscrew bowl hood (15) clockwise by using a tin hammer.

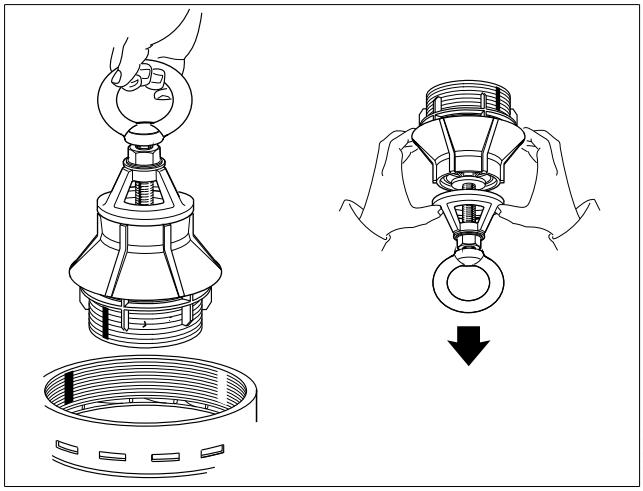
   Left-hand thread!

10. Lift off the bowl hood with the spanner still attached.

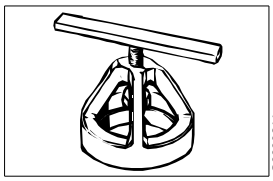


11. Lift out the top disc, the bowl discs with wing insert and the distributor.

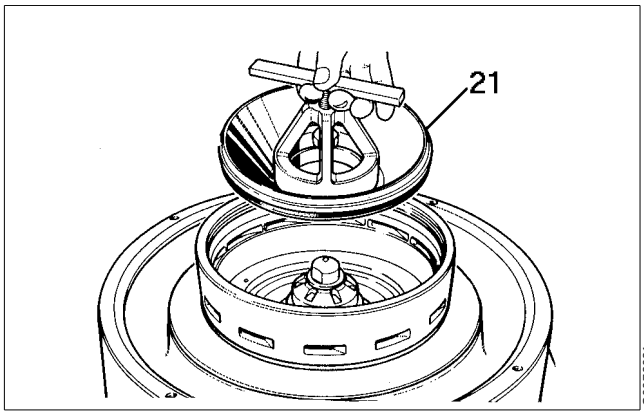
    Screw the nut of the compression tool up against the eye bolt, turn the unit with the tool still attached upside down and hit it against a firm base. This will facilitate loosening of the top disc.



12. Lift out sliding bowl bottom (21) using the special tool.

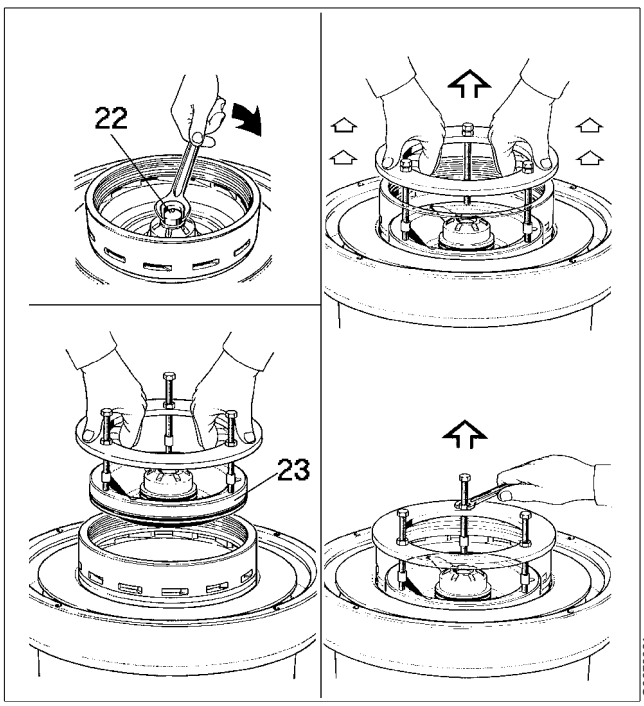


    Ease the sliding bowl bottom off with the central screw of the tool. If necessary, knock on the handle.



13. Unscrew cap nut (22).

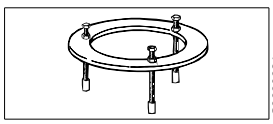
    Left-hand thread



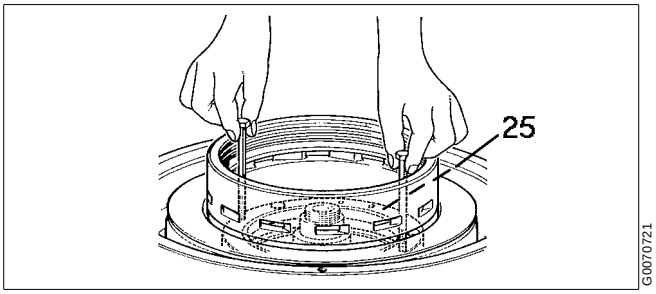
14. Remove upper distributing ring (23) using the special tool.

    Detach the distributing ring either:

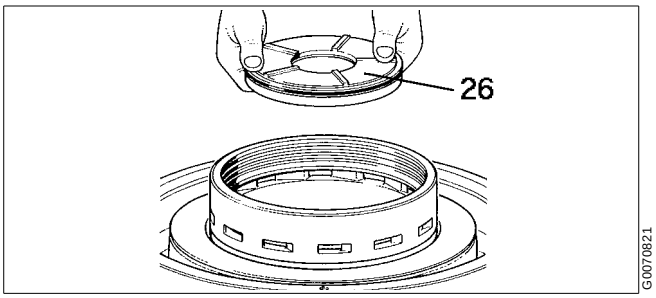
    - by jerking, or
    - by tightening the nuts equally.



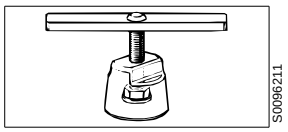
15. Lift out operating slide (25) using the special tool: lifting bolts for operating slide.

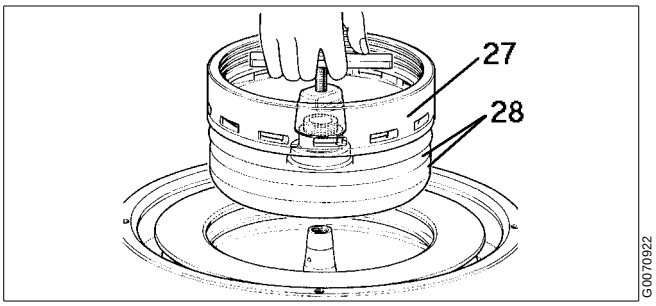


16. Lift out lower distributing ring (26).



17. Lift out bowl body (27) using the special tool.





18. Ease the bowl body off with the central screw of the tool. If necessary, knock on the handle.
19. Soak and clean all parts thoroughly in suitable cleaning agent, see ‘‘5.7.1 Cleaning agents” on page 69.
20. Clean nozzles (28) in bowl body (27) using soft iron wire of maximum 1,2 mm diameter, see “5.3.4 Discharge mechanism” on page 55**.**

NOTE

Dirt and lime deposits in the sludge discharge mechanism can cause discharge malfunction or failing discharge.

21. Remove O-rings and replace them with spares from the intermediate service kit (IS).

6.1.2 Inlet/outlet and bowl – assembly

Make sure that the following check points are carried out before and during assembly of the separator bowl.

- Corrosion
- Erosion
- Cracks
- Bowl spindle cone and bowl body nave
- Threads on bowl hood and bowl body
- Discharge mechanism
- Disc stack pressure
- Inlet pipe and paring disc
- Paring disc height adjustment (normally only at Major Service)

22. *Cap nut*
23. *Upper distributing ring*
24. *Valve plug*
25. *Operating slide*
26. *Lower distributing ring*
27. *Bowl body*
28. *Nozzle*

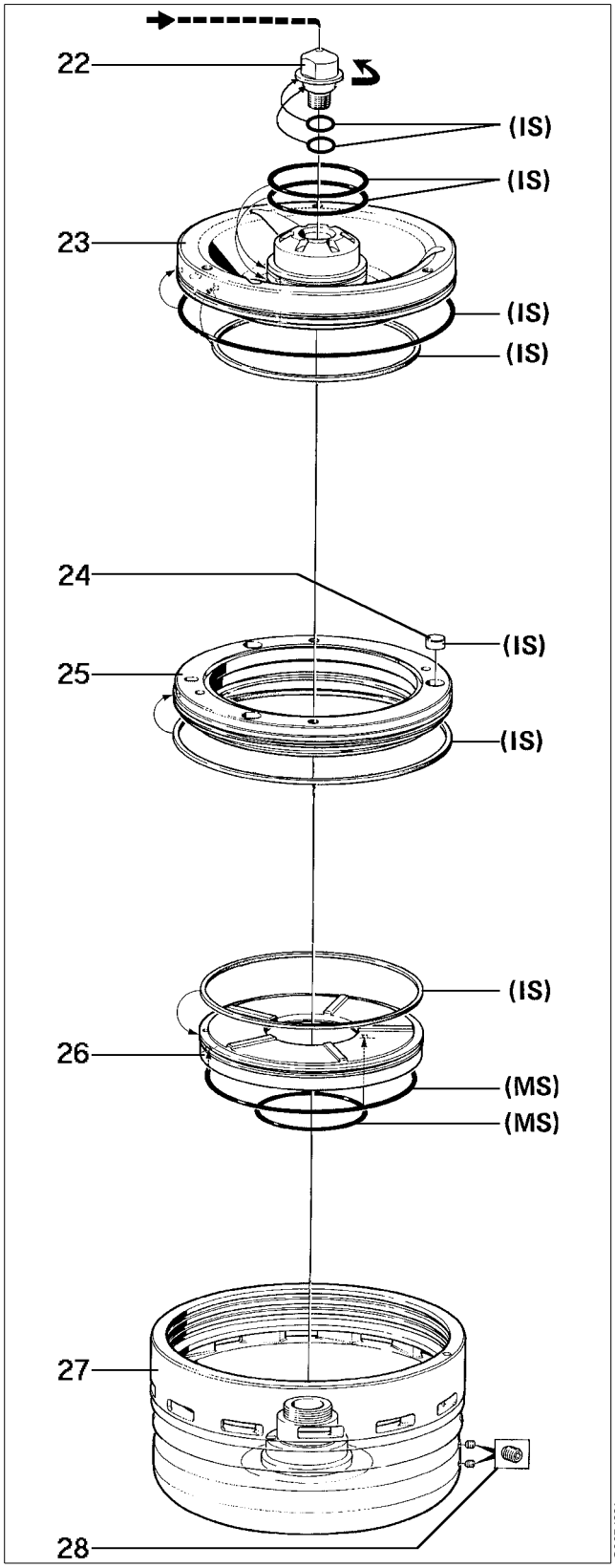
Left-hand thread

IS Intermediate service kit
MS Major service kit

NOTE

Be sure bowl parts are not interchanged.

Out of balance vibration will reduce ball bearing life.



14. Inlet pipe
15. Bowl hood
16. Top disc
17. Bowl discs
18. Wing insert
19. Bowl discs
20. Distributor
21. Sliding bowl bottom

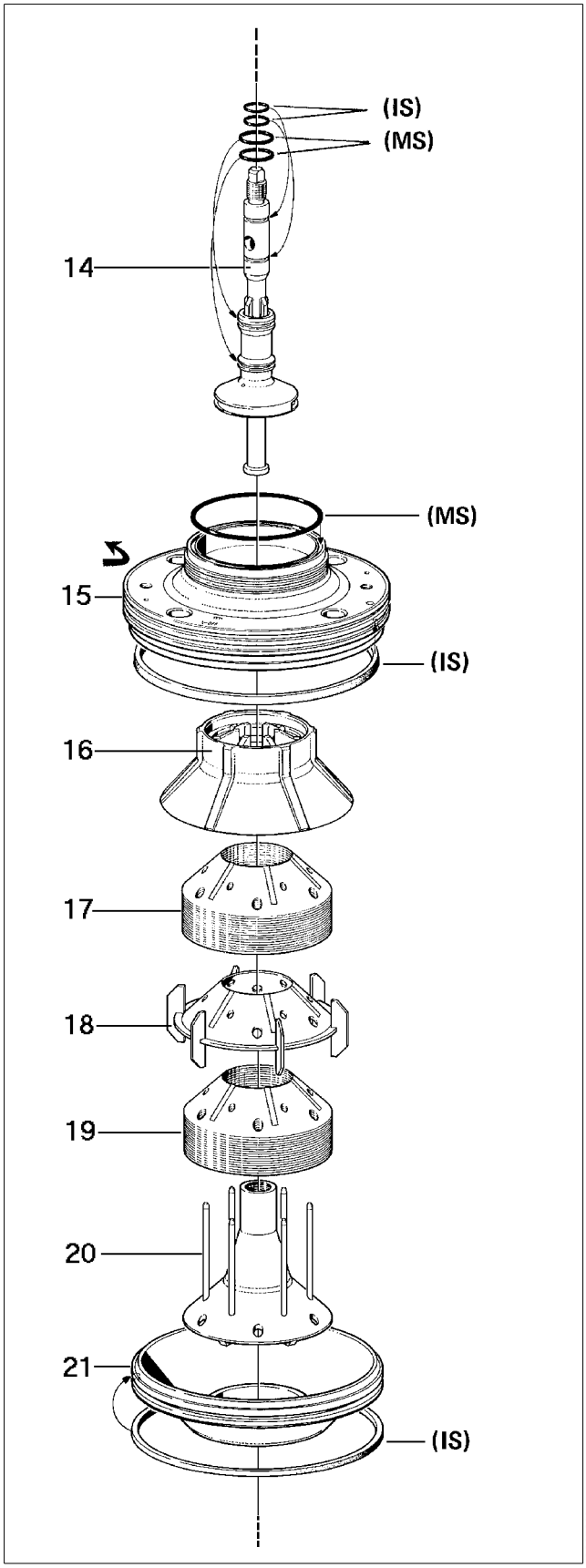
Left-hand thread

IS Intermediate service kit
MS Major service kit

NOTE

Be sure bowl parts are not interchanged.

Out of balance vibration will reduce ball bearing life.

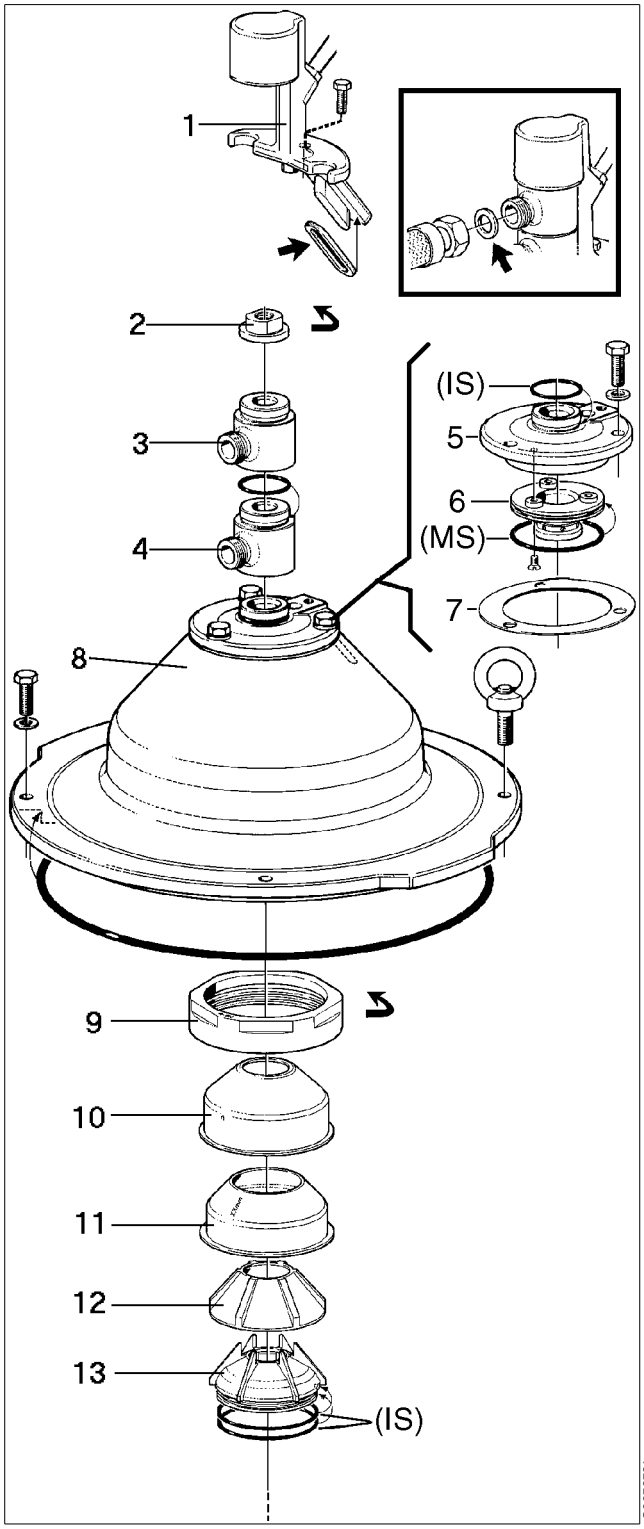


1. *Safety device*
2. *Nut*
3. *Inlet housing*
4. *In/Outlet housing*
5. *Connecting housing**
6. *Insert*
7. *Height adjusting ring*
8. *Frame hood*
9. *Lock ring*
10. *Heavy phase cover*
11. *Gravity disc/Clarifier disc*
12. *Leader cone*
13. *Paring chamber cover*

**The connecting housing is removed from the frame hood top at paring disc adjustment (Major Service).*

Left-hand thread

MS Major service kit
IS Intermediate

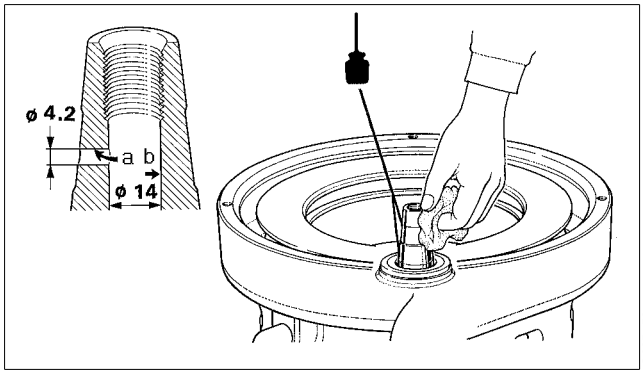


NOTE

Be sure bowl parts are not interchanged.

Out of balance vibration will reduce ball bearing life.

1. Clean the hollow part (b) of the spindle top and the radial hole (a). Wipe clean the spindle top and nave bore in the bowl body. Apply oil to the tapered end of the spindle, smear the oil over the surface and wipe off surplus with a clean cloth.



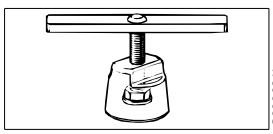
Oil

2. Clean the nozzles in the bowl body, see “5.3.4 Discharge mechanism” on page 55.

✔ **Check point**
“5.3.6 Spindle top cone and bowl body nave” on page 58.

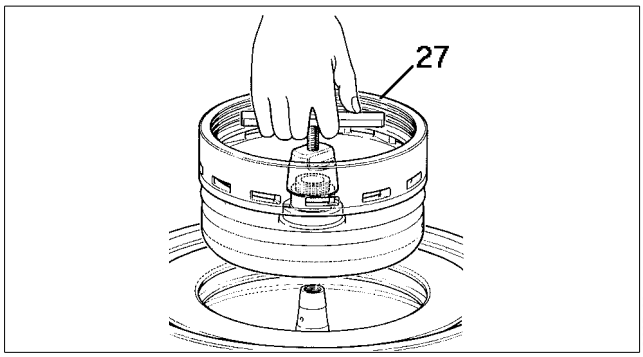
3. Fit the bowl body (27) on the spindle. Avoid damaging the spindle cone.

   – Attach the special lifting tool to the bowl body nave.



   – Screw down the central screw of the tool, then lower the bowl body until the screw rests on the spindle top.

   – Screw up the central screw and the bowl body will sink down on the spindle cone.



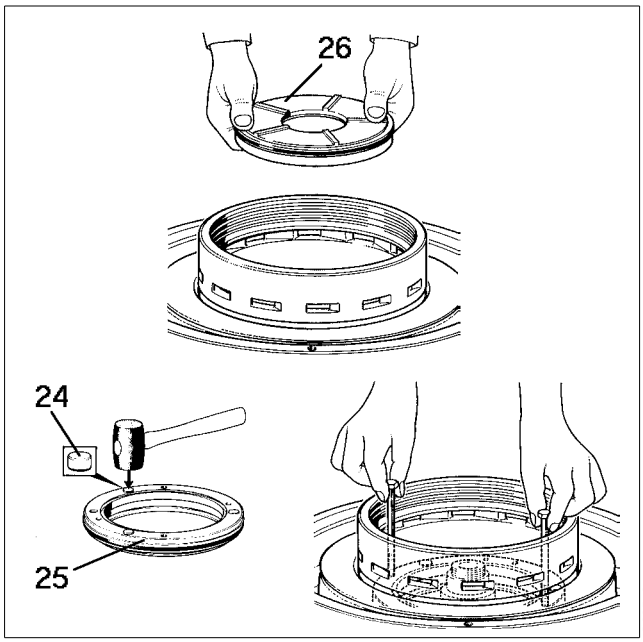
✔ **Check point**
Prepare seal rings and surfaces see “5.3.4 Discharge mechanism” on page 55

4. Place the lower distributing ring (26) in the bowl body.

   Using the lifting bolts fit the operating slide (25).

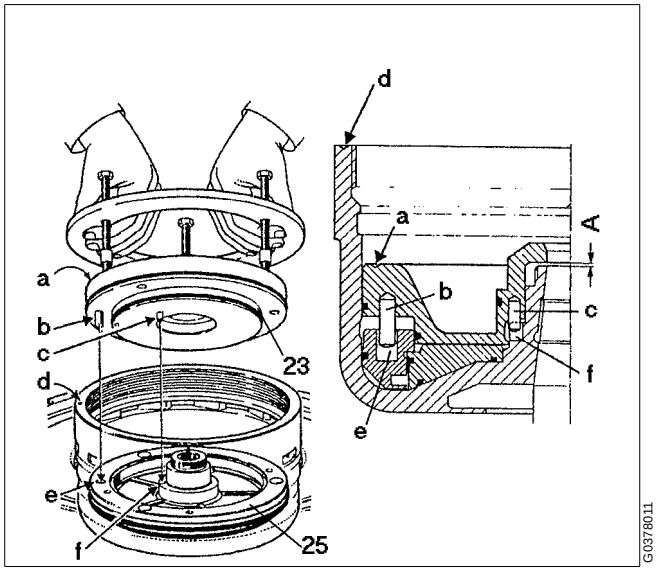
   Make sure that the seal rings lie concentrically in their grooves.

   If replacing valve plugs (24), use a rubber mallet.



5. Before fitting the upper distributing ring (23) into the bowl body, turn the operating slide (25) so that the hole (e) is in line with drill mark (d) and notch (f).

6. Fit the upper distributing ring so that drill mark (a) is in line with drill mark (d) on bowl body. When the distributing ring is in correct position the guide pins (b) and (c) will enter hole (e) and groove (f) respectively.



a. Drill mark
b. Guide pin
c. Guide pin
d. Drill mark
e. Guide hole
f. Guide notch

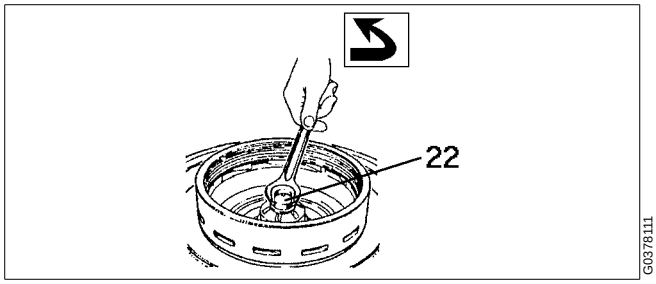
NOTE

The two guide pins (b, c) in the distributing ring have to be fitted properly.

Check the distance “A”. If the play is larger than 2 mm the guide pins have not entered the hole and notch properly.

7. Screw cap nut (22) counter-clockwise onto the spindle. Tighten firmly.

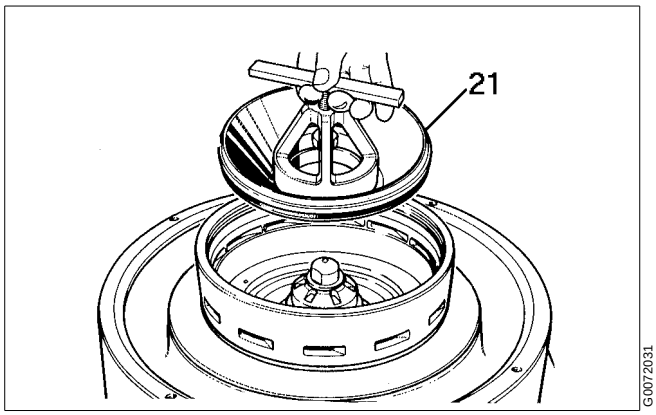
   Left-hand thread!



8. Fit sliding bowl bottom (21).

   Make sure that the square seal ring lies concentrically in its groove.

   Press the sliding bowl bottom down on the upper distributing ring.



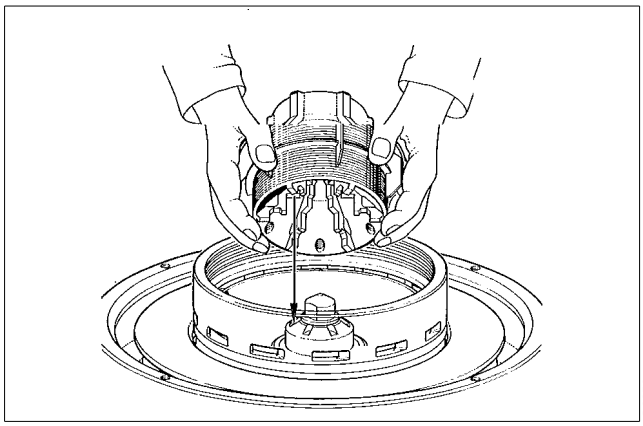
✔ **Check point**

Before assembling the bowl discs, check the threads of the bowl hood and bowl body, see “5.3.8 Threads on bowl hood and bowl body” on page 60.

9. Assemble the bowl discs with wing insert and top discon the distributor. Note the angular positioning (six options).

   Ensure that the pins in the distributor fit properly into the holes of the top disc.

10. Fit the disc stack assembly in the bowl body. Make sure that the cuts in the wings on the underside of the distributor fit properly in the corresponding lugs of the bowl.



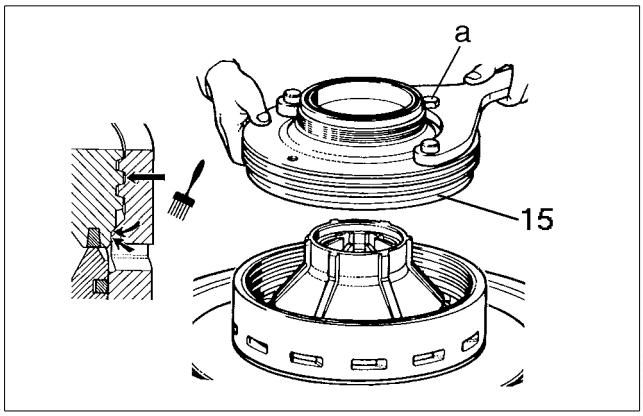
11. Fit bowl hood (15):

   – Apply a thin layer of Molykote Paste 1000 to threads and on contact and locating surfaces.

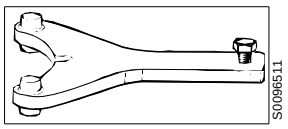
   – Fit the spanner for the bowl hood and secure it with the bolt (a).

   – Screw on the bowl hood by hand.

   Left-hand thread!

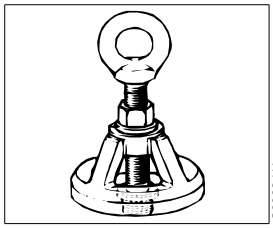


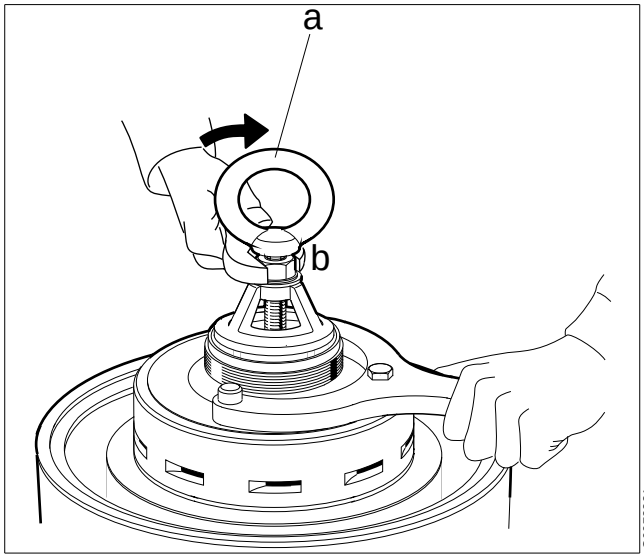
Molykote 1000 Paste
(thin layer to be rubbed into surface)



12. Fit the compressing tool and screw down the central screw (a) until it stops.

    Compress the disc stack by tightening the nut (b) firmly.





NOTE

Use the compression tool as instructed.

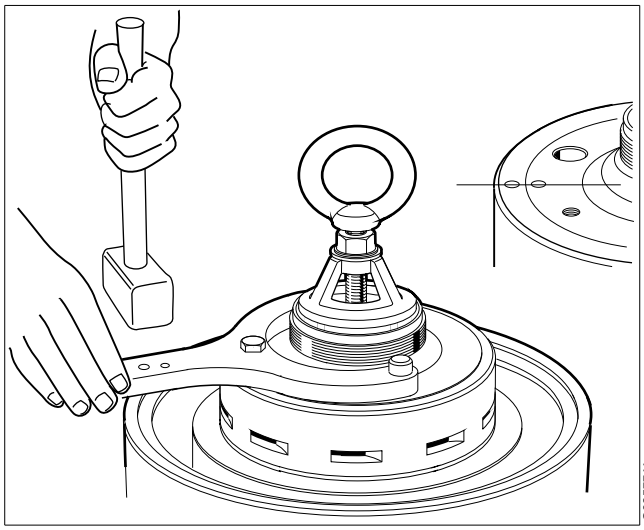
Use of substitute tools can damage the equipment.

✔ **Check point**

"5.3.9 Disc stack pressure" on page 62.

13. Tighten the bowl hood by using a tin hammer.

    Strike the spanner handle until the bowl hood lies tightly against the bowl body. In a new bowl, the assembly marks now will be in line with each other.



DANGER

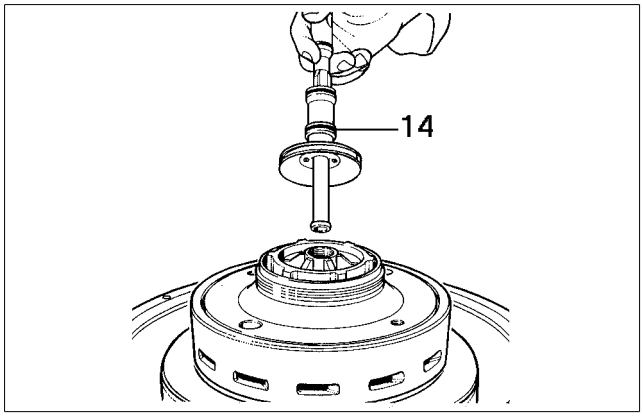
Disintegration hazard

The assembly mark on the bowl hood must never pass the mark on the bowl body by more than 25°.

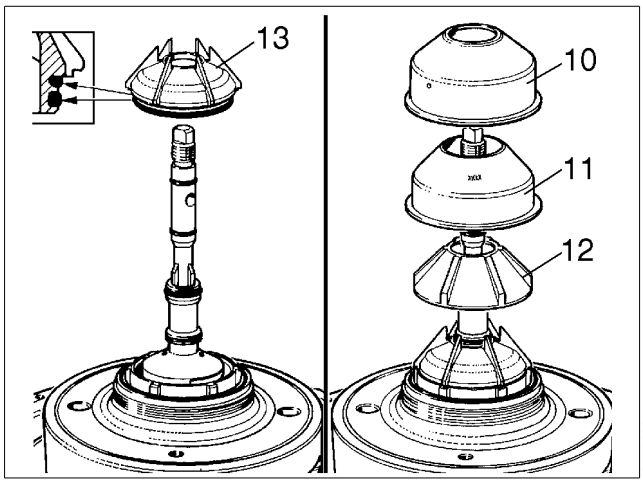
See also "5.3.8 Threads on bowl hood and bowl body" on page 60.

14. Place inlet pipe (14) in the bowl.

✔ **Check point**
"5.3.7 Threads of inlet pipe, paring disc" on page 59.



15. Fit paring chamber cover (13) by pressing it down gently.
16. Assemble leader cone (12), gravity disc/ clarifier disc (11) and heavy phase cover (10).

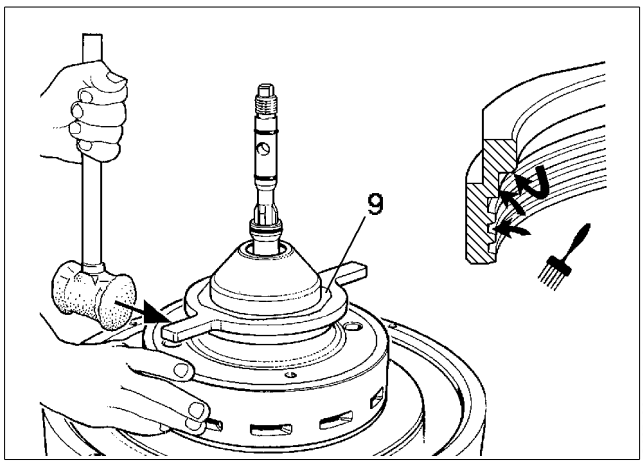


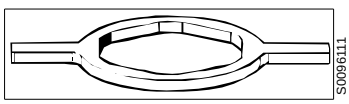
17. Fit lock ring (9).

    Apply a thin layer of Molykote Paste 1000 to the threads and on contact and locating surfaces.

    Left-hand thread!

Molykote 1000 Paste
(thin layer to be rubbed into surface)

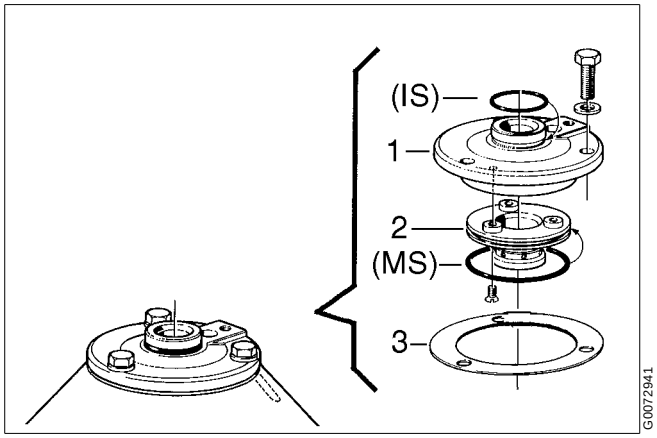




18. Fit frame hood (8). The two eye-bolts must be fitted in the holes nearest to the electric motor.

    In case of Major Service remove the connecting housing and fit a new O-ring on the insert (2).

✔ **Check point**
“5.4.1 Paring disc height adjustment” on page 63. To be performed at Major Service and if the bowl spindle has been dismantled.

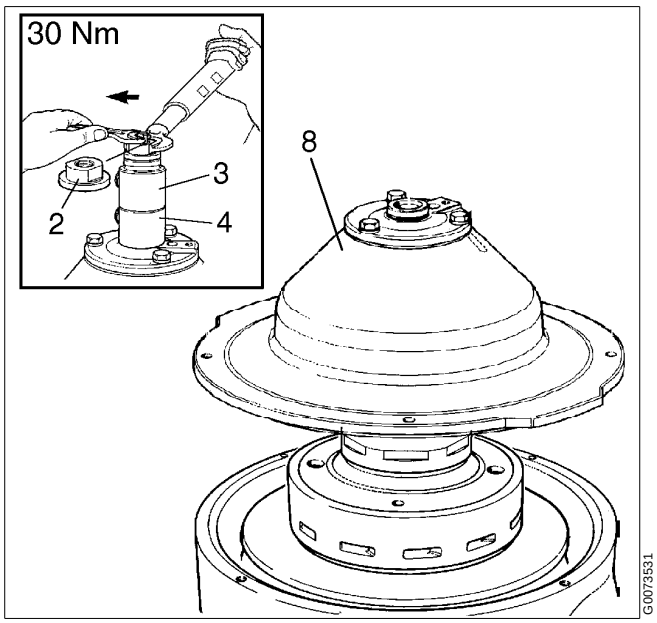


1. Connecting housing
2. Insert
3. Height adjusting ring(s)

19. Fit inlet/outlet housings (3 and 4).

    Tighten nut (2).

    Left-hand thread!



NOTE

To avoid damage on the inlet pipe the tightening torque must not exceed 30 Nm.

Then rotate the bowl by means of the flat belt.

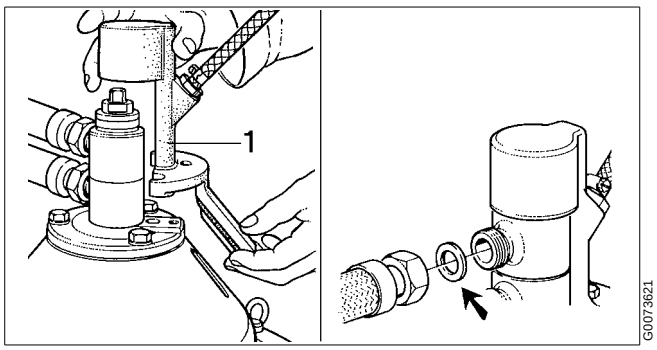
If the bowl does not rotate freely or a scraping noise is heard, incorrect bowl assembly or incorrect height adjustment of the paring disc can be the cause.

20. Make sure that the gasket on the safety device is in position. If not, glue with Loctite 407.

    Fit and secure safety device (1).

21. Fit the connecting hoses if they have been removed. Make sure to fit their gasket rings.

22. Fit the water tank on the frame bottom part if it has been removed.



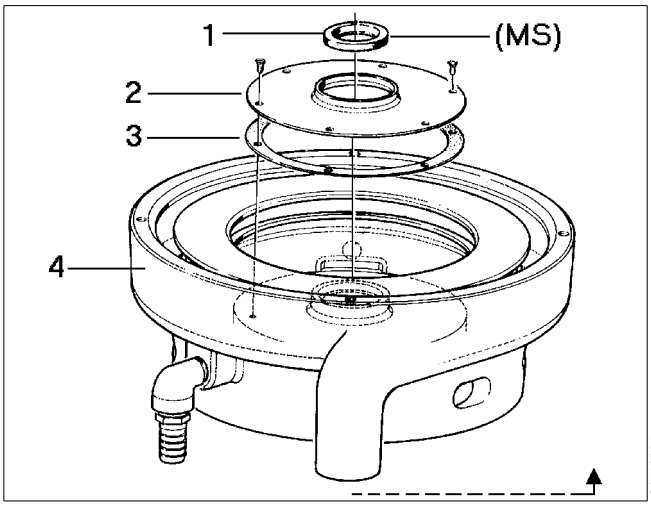
6.2 Bowl spindle and frame

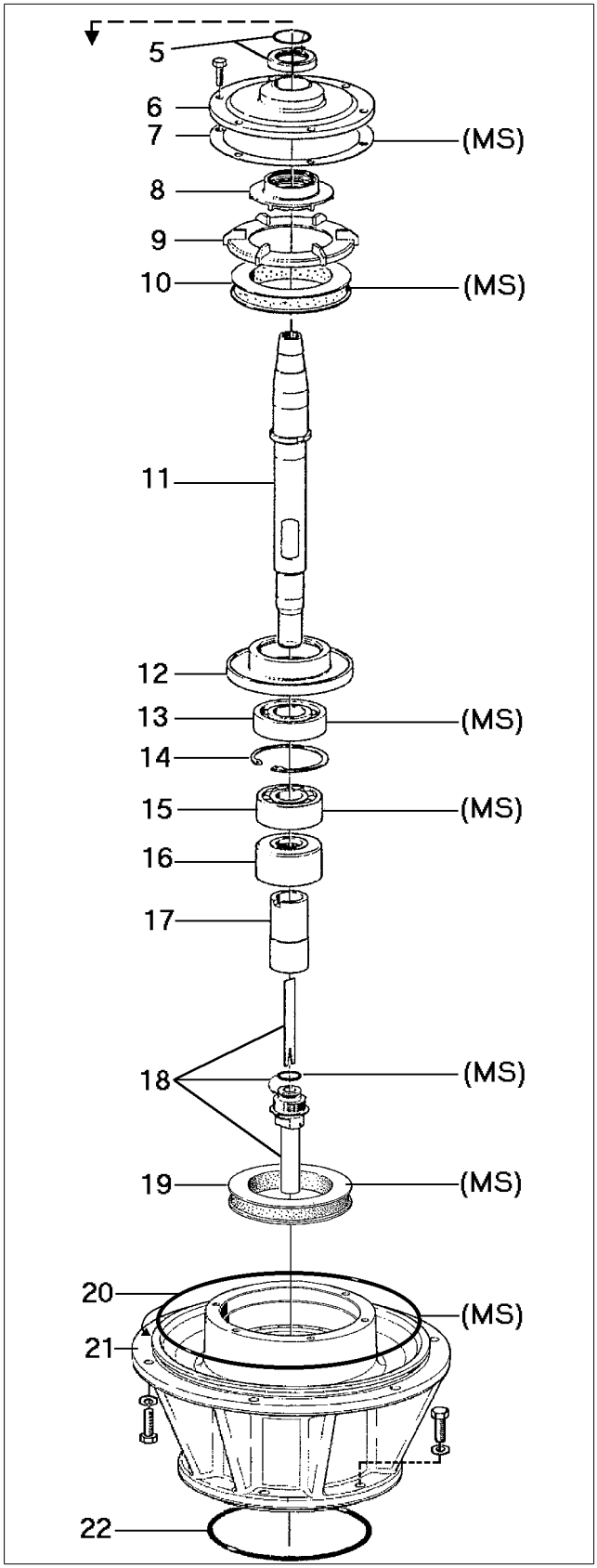
6.2.1 Bowl spindle and frame – dismantling

Before dismantling the bowl spindle, the inlet and outlet housings, frame hood and bowl as well as the flat belt must be removed.

Before dismantling, in the case of Major Service, or if the separator vibrates while running, see

✔ **Check point**
"5.4.2 Radial wobble of bowl spindle" on page 64.

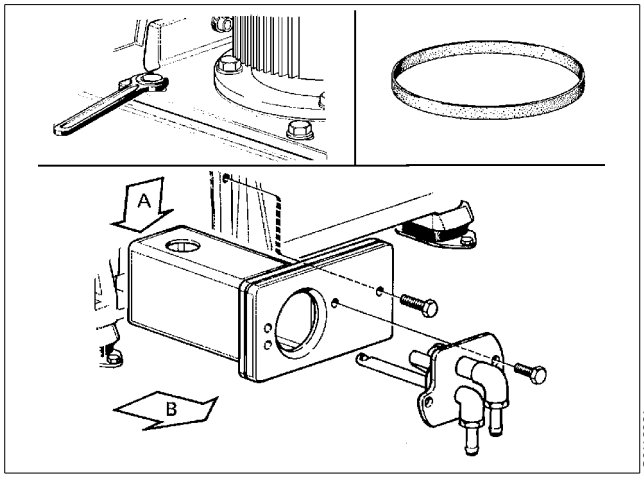




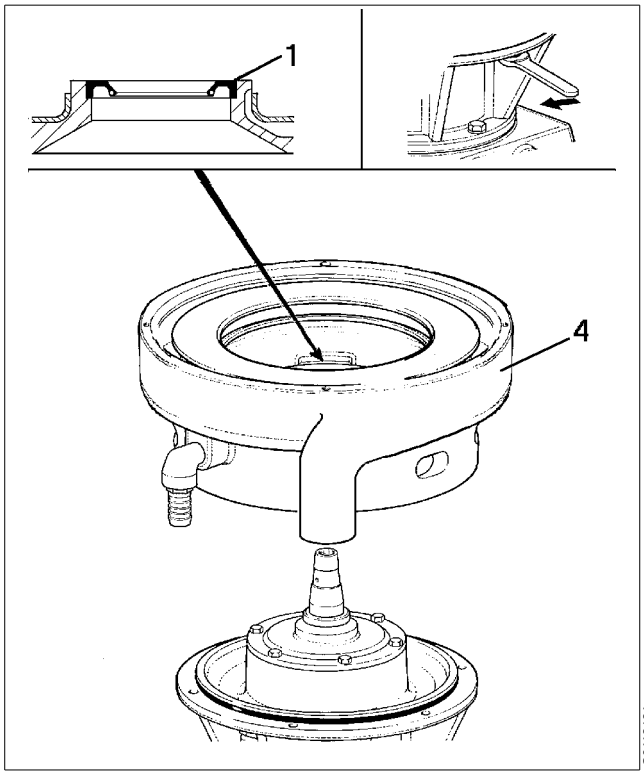
1. *Lip seal ring*
2. *Screen*
3. *Gasket*
4. *Frame, top part*
5. *Deflector ring*
6. *Top bearing cover*
7. *Gasket*
8. *Fan*
9. *Buffer holder*
10. *Rubber buffer*
11. *Bowl spindle*
12. *Ball bearing holder*
13. *Ball bearing*
14. *Snap ring*
15. *Ball bearing*
16. *Oil pump*
17. *Belt pulley*
18. *Pump sleeve*
19. *Rubber buffer*
20. *O-ring*
21. *Frame, intermediate*
22. *O-ring*

MS Parts to be renewed at Major Service

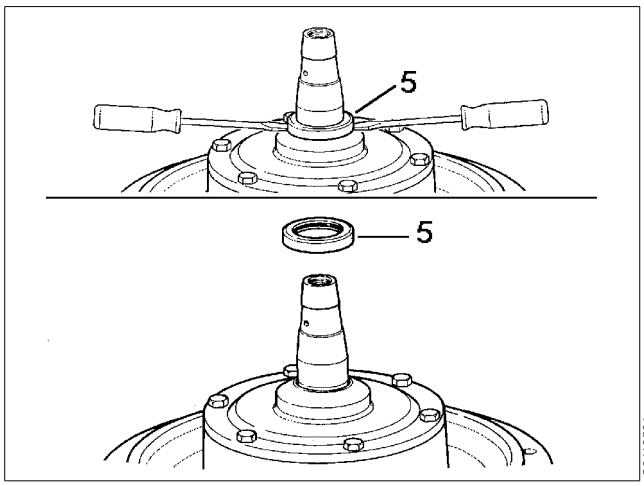
1. Loosen but do not remove the motor adapter screws.
2. Remove the water tank.
3. Remove the flat belt.



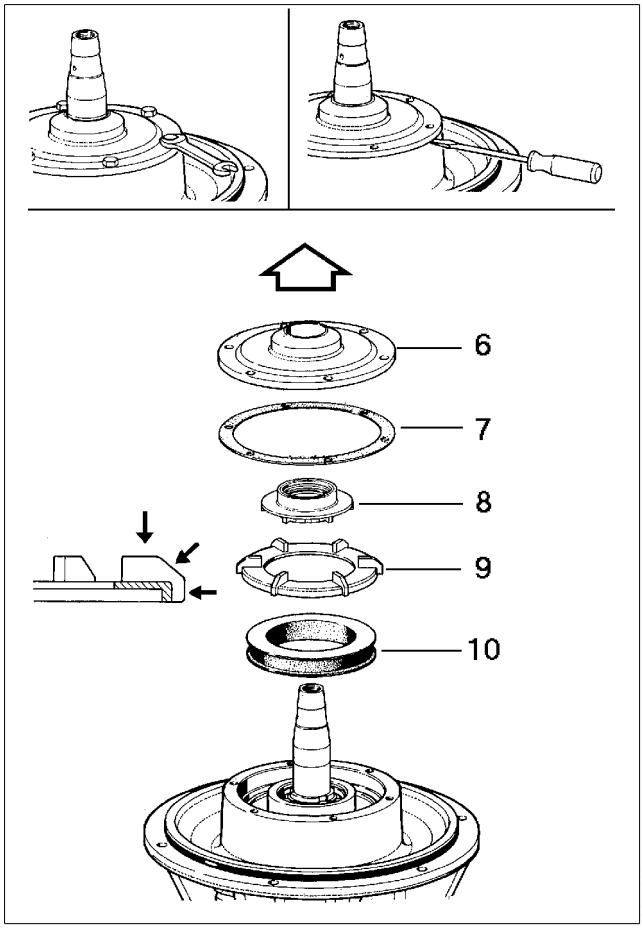
4. Remove the screws and lift off frame top part (4). Lip seal ring (1) must be removed in the case of Major Service, or if found damaged.



5. Clean the bowl spindle cone in place and remove deflector ring (5).



6. Remove, in the following sequence:
   - Top bearing cover (6)
   - Gasket (7)
   - Fan (8)
   - Buffer holder (9)
   - Rubber buffer (10).



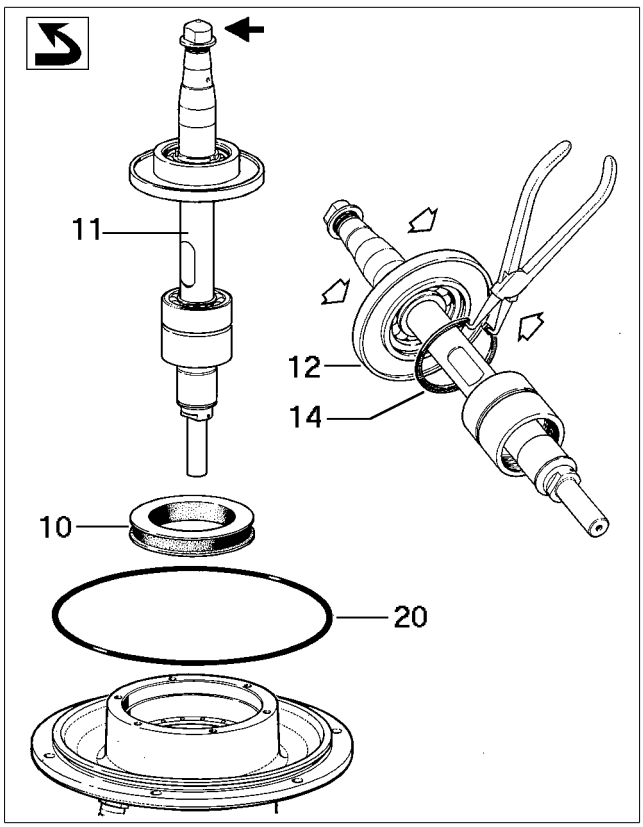
NOTE

Be very careful not to damage the wings of the buffer holder.

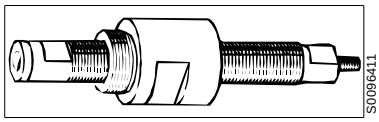
7. Screw the cap nut counter-clockwise (left-hand thread) onto the spindle top to protect the top and bore.

   Lift out spindle assembly (11), rubber buffer (10) and O-ring (20).

   Remove snap ring (14) by using a pair of pliers and pull off ball bearing holder (12).



8. Clamp the bowl spindle (11) in a screw vice. Remove the pump sleeve (18). When turning the spindle upside down there is a risk that the vane in the pump sleeve can slide down partly or entirely into the spindle. Therefore, after unscrewing the sleeve, check that the vane has not been damaged.
9. Remove the belt pulley (17):
10. Lubricate the mounting/dismantling tool.



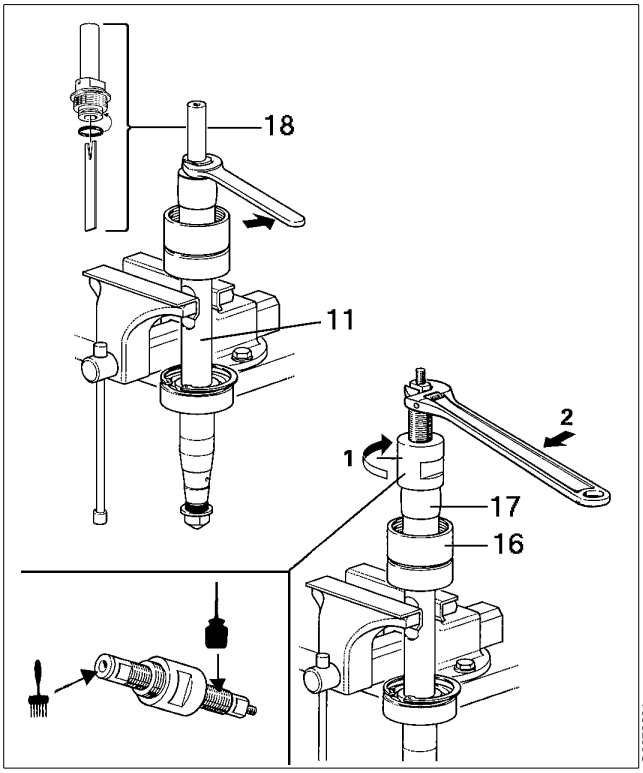
Fit the mounting/dismantling tool and screw it down as far as it will go (1).

Use a long spanner (450 - 650 mm) to press the belt pulley of the spindle (2).

Remove the oil pump (16) by hand.

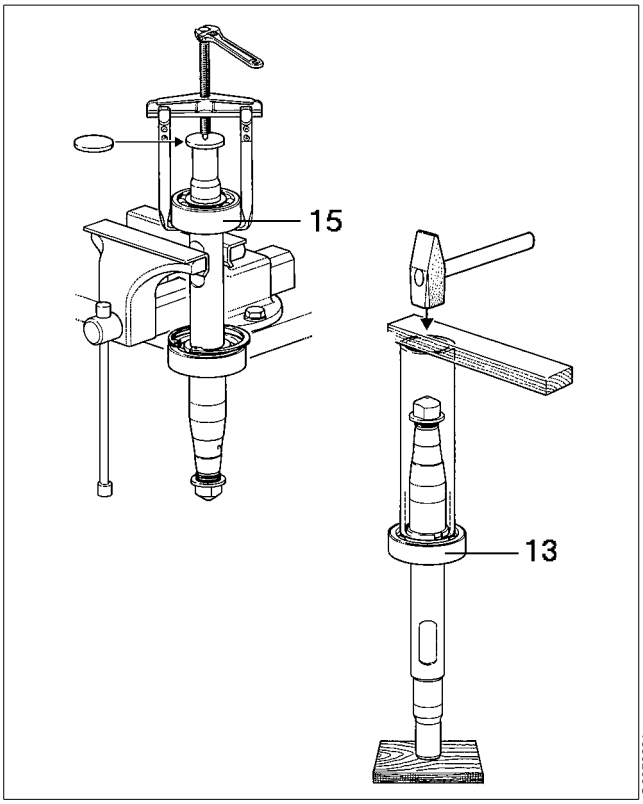
Molykote 1000 Paste (thin layer to be rubbed into surface)

Oil



11. Pull off ball bearing (15) using a puller and thrust washer.

Pull off bearing (13) using the special mounting tool and a hammer.

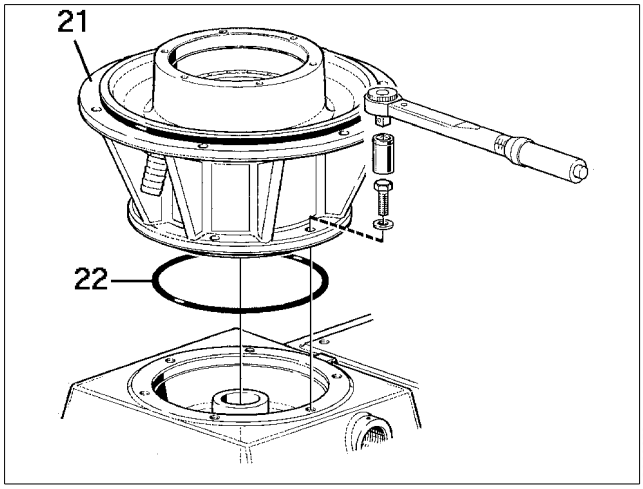


NOTE

Always discard a used bearing.

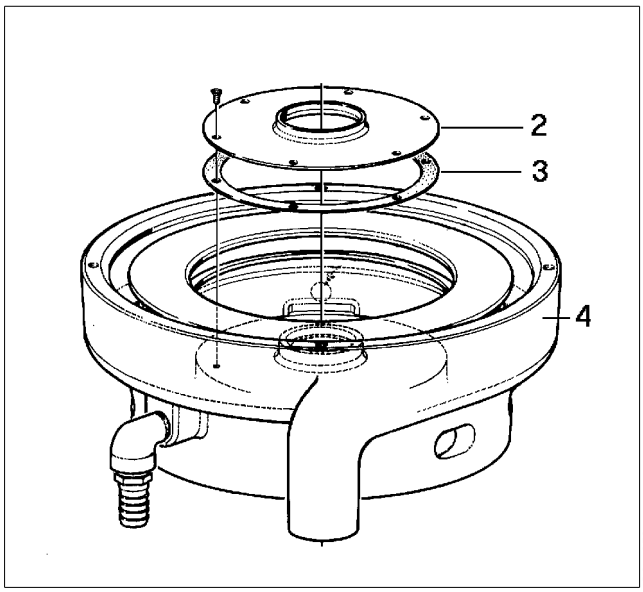
In case of 3-year-service

12. Loosen the screws and lift off the frame intermediate part (21).
13. Discard the O-ring (22).This O-ring is not included in any service kit, but must be ordered separately.



14. Remove the screen (2) from the frame top part (4).

    Discard the gasket (3). This gasket is not included in any service kit, but must be ordered separately.

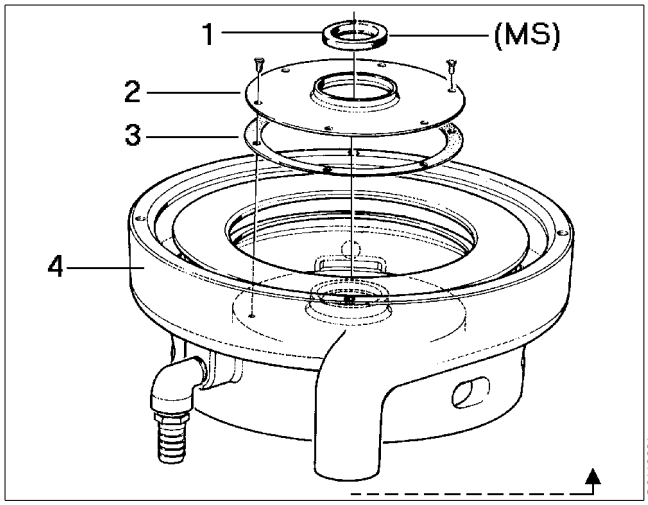


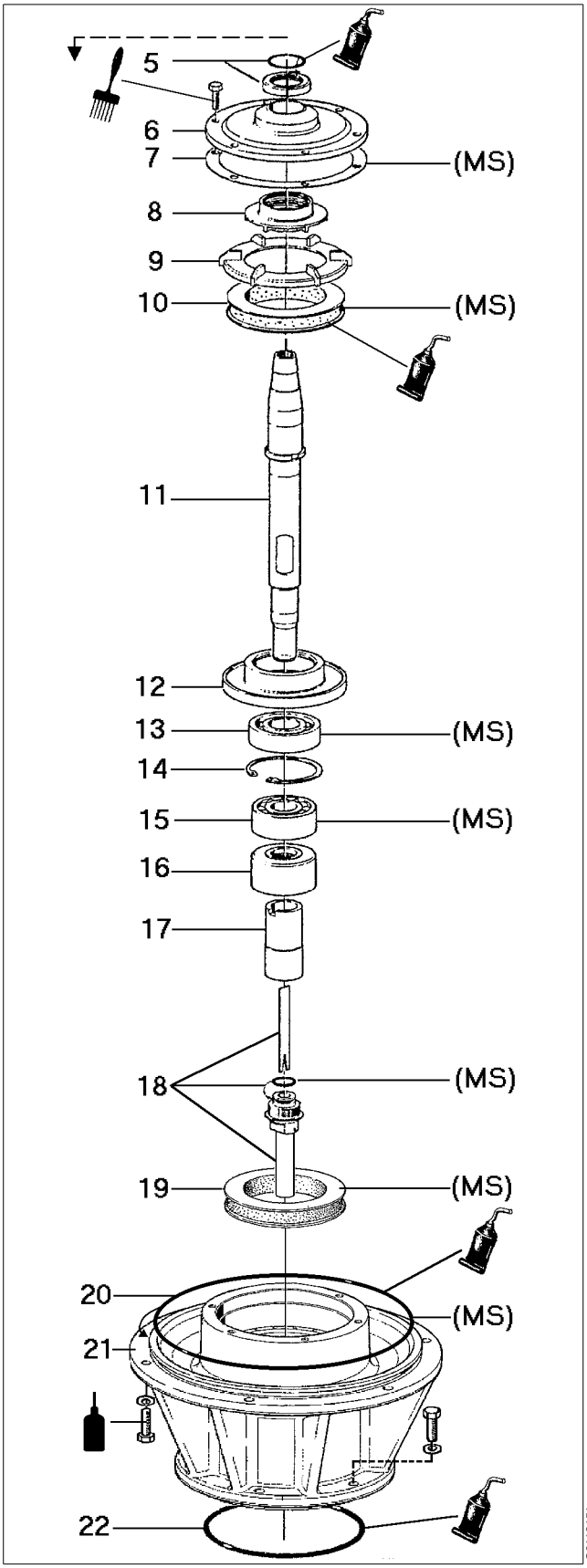
15. Clean the oil sump.
16. Clean all dismantled parts thoroughly in a degreasing agent and check for damage and corrosion.

    Replace all parts supplied in the spare parts kits.

6.2.2 Bowl spindle and frame – assembly

The bowl spindle and frame is assembled in reverse sequence to dismantling.





1.	*Lip seal ring*	13.	*Ball bearing*
2.	*Screen*	14.	*Snap ring*
3.	*Gasket*	15.	*Ball bearing*
4.	*Frame, top part*	16.	*Oil pump*
5.	*Deflector ring*	17.	*Belt pulley*
6.	*Top bearing cover*	18.	*Pump sleeve*
7.	*Gasket*	19.	*Rubber buffer*
8.	*Fan*	20.	*O-ring*
9.	*Buffer holder*	21.	*Frame, intermediate part*
10.	*Rubber buffer*	22.	*O-ring*
11.	*Bowl spindle*		
12.	*Ball bearing holder*		
		MS	*Major service kit*

Loctite 242

Silicone grease (thin layer)

Molykote 1000 Paste
(thin layer to be rubbed into surface)

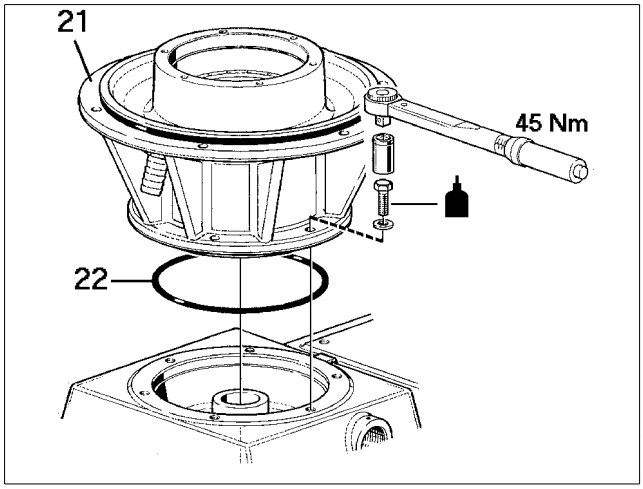
In case of 3-year-service

1. Fit a new O-ring (22) and assemble the frame intermediate part (21).

   Use a torque wrench and tighten the screws lightly crosswise at first. Then tighten all around to **45 Nm.**

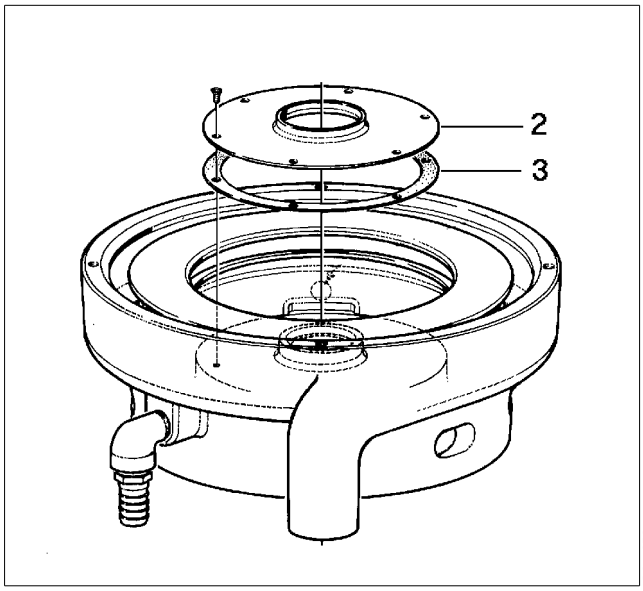
   Secure the screws with Loctite 242.

   Loctite 242



2. Fit a new gasket (3).

   Fit the screen (2).



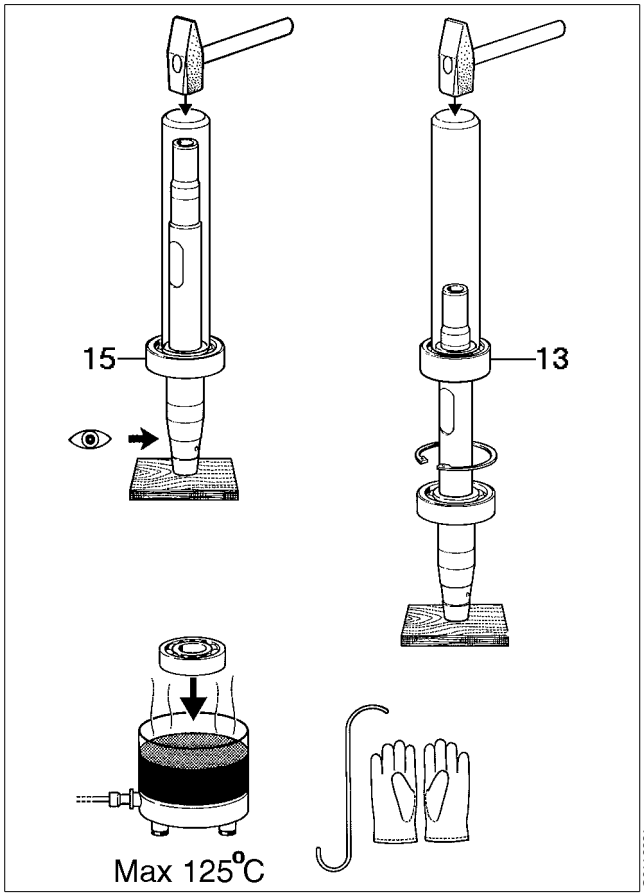
3. Inspect the tapered end and the hollow part of the bowl spindle for wear and clean if necessary. Assemble ball bearings (13 and 15).

   Heat the new ball bearings in oil to maximum 125 °C. Use the special mounting tool from the tool kit.

NOTE

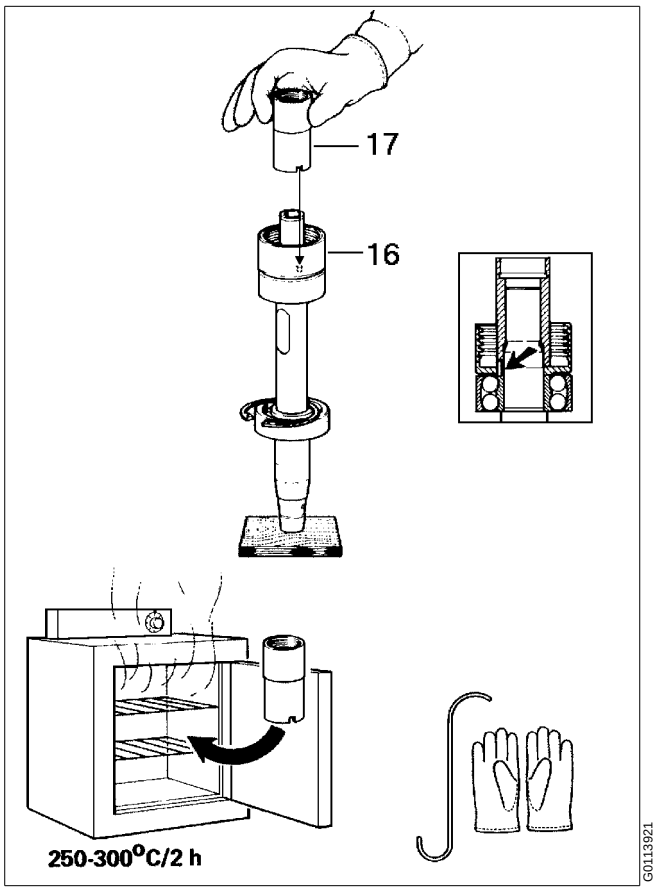
Always fit **new** bearings.

If in doubt how to install roller bearings in a correct way, please see the detailed description in “5.10.1 Ball and roller bearings” on page 74.

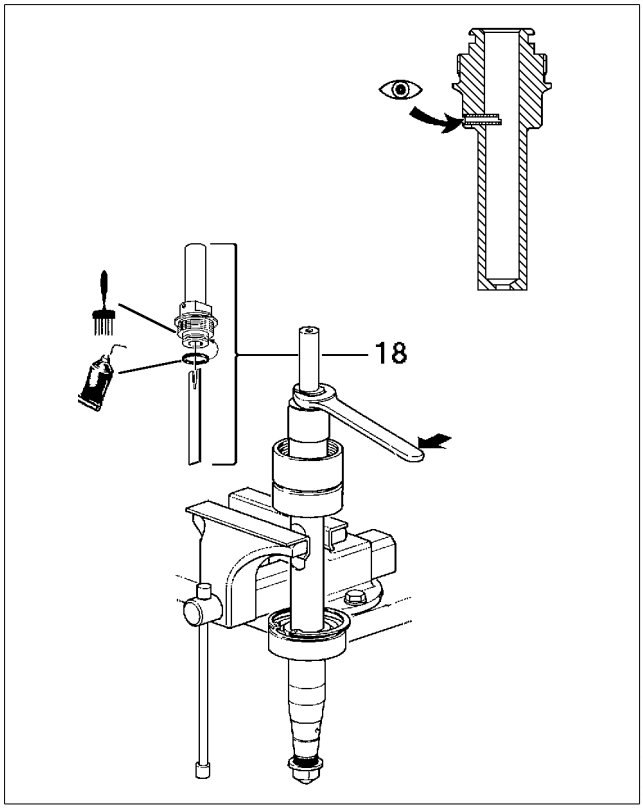


4. Fit oil pump (16) and belt pulley (17). Make sure that the recess in the belt pulley fits over the guide pin in the oil pump.

   Heat the belt pulley in a heating cabinet to 250-300 °C for at least 2 hours before fitting.



5. Check that the radial hole (ϕ 1 mm) in the pump sleeve (18) is clean, and fit the pump.



NOTE

Do not fit the pump sleeve until the belt pulley has cooled down

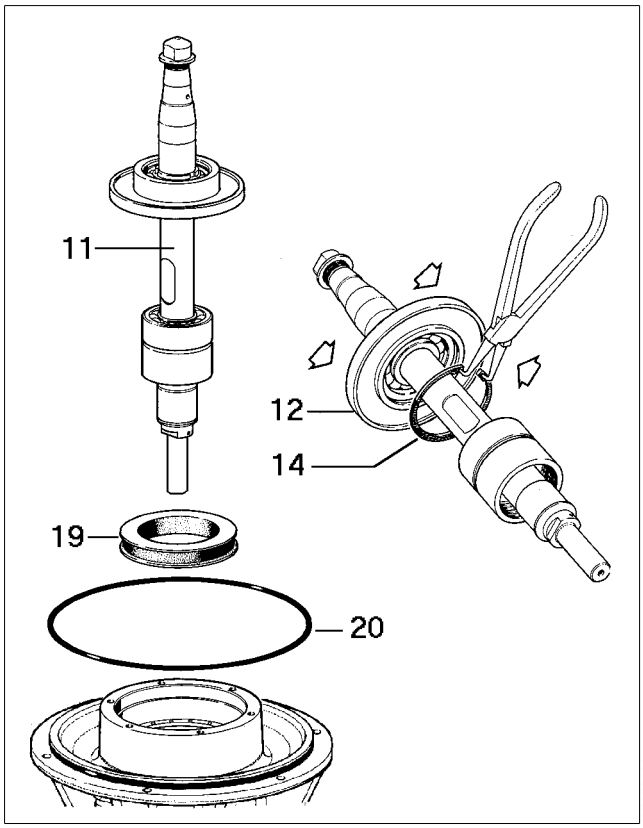
Molykote 1000 Paste
(thin layer to be rubbed into surface).

Silicone grease
(thin layer)

6. Fit ball bearing holder (12) and secure it with snap ring (14).

   Fit O-ring (20) and rubber buffer (19).

   Lower spindle assembly (11) carefully into the separator intermediate frame.



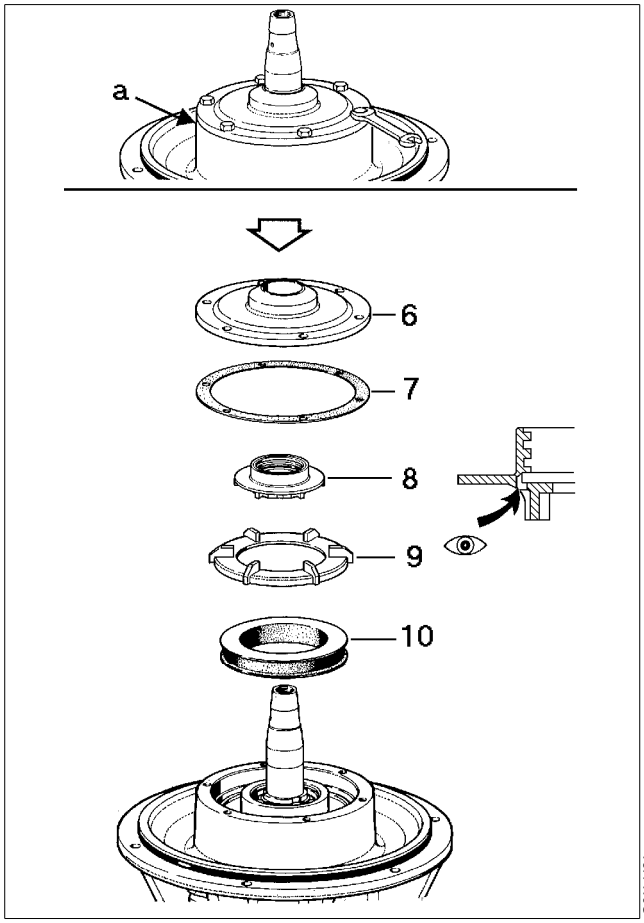
7. Assemble, in the following sequence:

   – Rubber buffer (10)
   – Buffer holder (9)
   – Fan (8)
   – Gasket (7)
   – Top bearing cover (6)

   Make sure that the ϕ 3 mm hole in fan (8) is clean and the lugs in the fan enter the recesses in the bowl spindle.

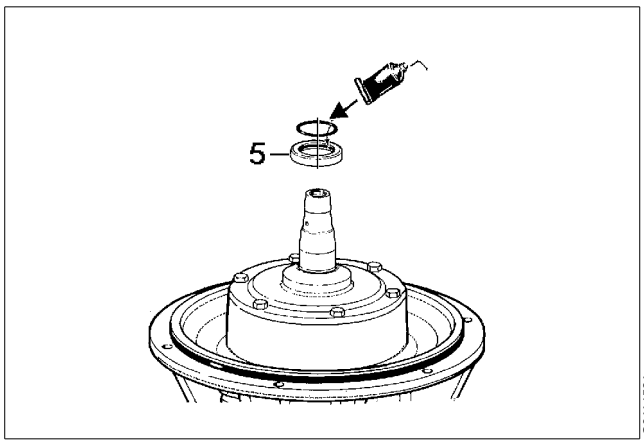
   Before tightening, make sure that there is some play (a) between top bearing cover (6) and the frame. The play will disappear when the screws are tightened.

   Tighten the screws sequentially (not crosswise) in order to successively compress the rubber buffers.



8. Push down deflector ring (5) till it stops.

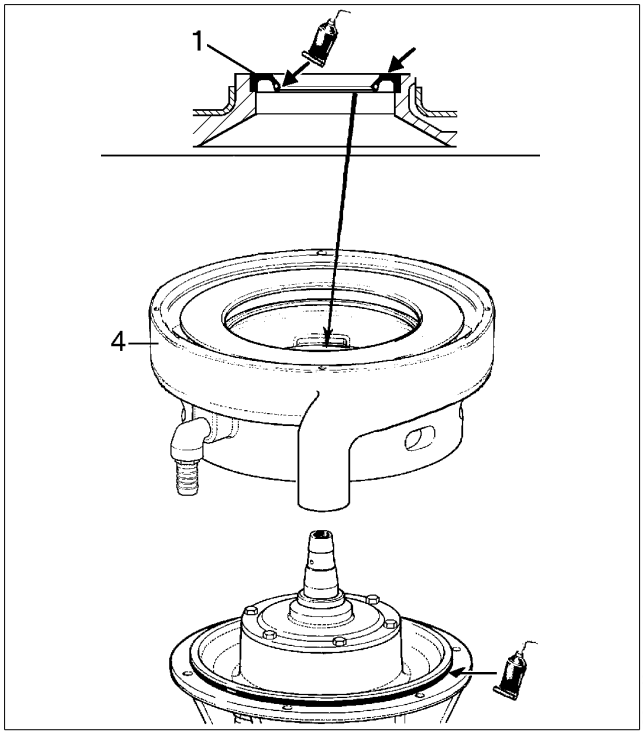
Silicone grease (thin layer)



9. Assemble frame top part (4). If lip seal ring (1) has been removed, fit a new one **before** the frame top part is put in place.

   Make sure the lip seal is turned the correct way. See illustration.

Silicone grease (thin layer)

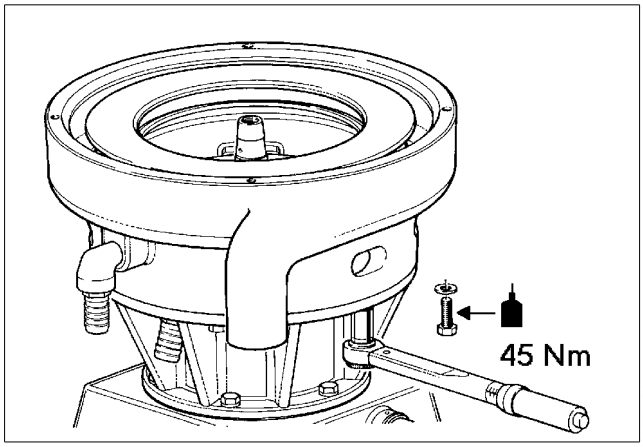


10. Tighten the screws of the top frame using a torque wrench (width across flats 16 mm).

    Tighten the screws slightly crosswise at first. Then tighten all around to **45 Nm**.

    Secure the screws with Loctite 242.

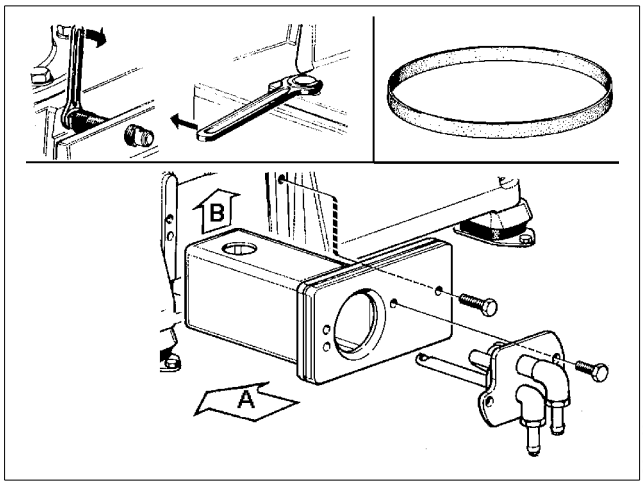
Loctite 242



11. Fit and adjust the flat belt, see “6.4.1 Belt replacement and tightening” on page 116.

✔ **Check point**
“5.4.2 Radial wobble of bowl spindle” on page 64.

12. Fit the water tank and its cover.



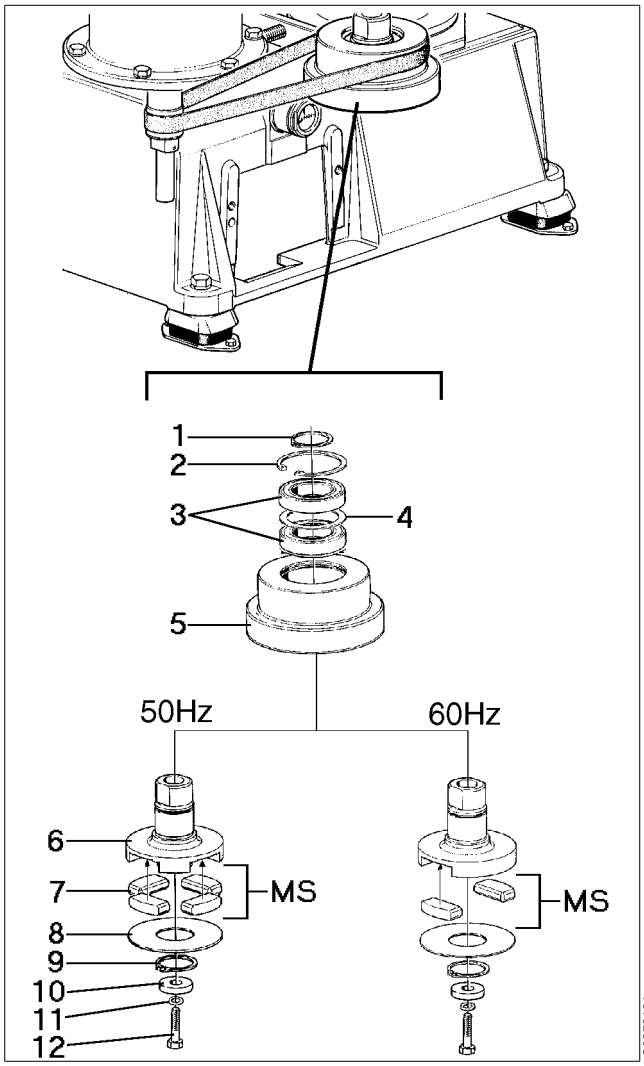
6.3 Friction coupling

If the separator does not attain full speed within about 2 minutes, the friction elements or the coupling may be worn or greasy. The friction elements must then be replaced with new ones or be thoroughly cleaned from grease.

DANGER

Entrapment hazards

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



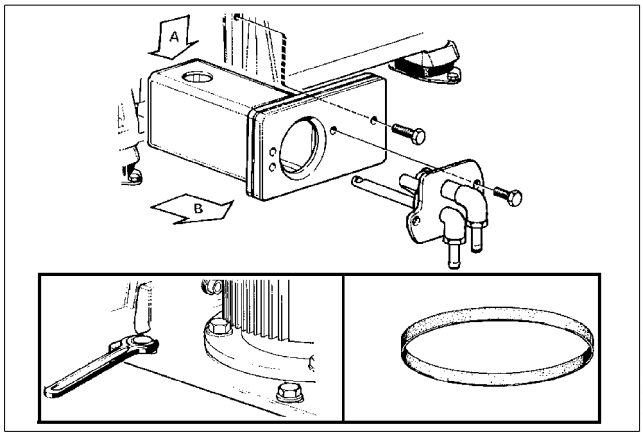
1 Snap ring
2 Snap ring
3 Ball bearings
4 Washer
5 Belt pulley
6 Coupling hub
7 Friction element
8 Cover
9 Snap ring
10 Washer
11 Spring washer
12 Screw

(MS) = Set of friction elements included in the Major Service Kit for 50 Hz or 60 Hz

6.3.1 Friction coupling – dismantling

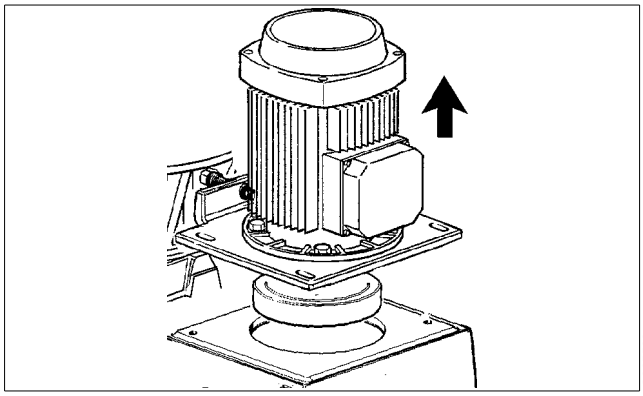
1. Check that the belt tightener is in backward position.
2. Remove the motor adapter screws.
3. Remove the water tank and the flat belt.

   Note that the tank must be lowered past spindle end (A) before it can be withdrawn (B).
4. Remove the flat belt.



5. Remove the electric motor complete with the friction coupling and motor adapter.

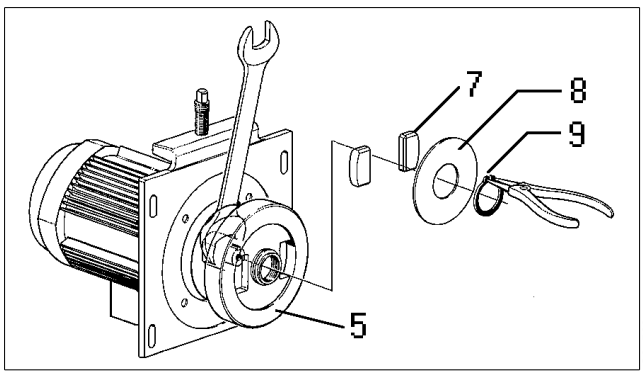
   Weight of motor including adapter and friction coupling is not more than 20 kg.



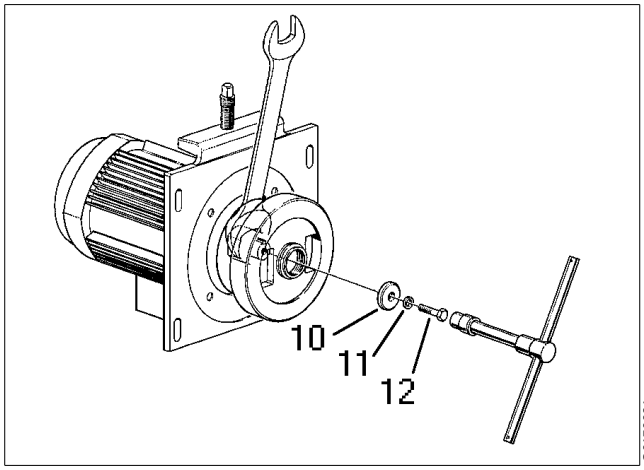
6. Remove snap ring (9), cover (8) and friction elements (7).

   If the friction elements are worn, fit new ones. **Replace all friction elements even if only one is worn.**

   If the friction elements are only greasy: Clean the friction elements and the inside of belt pulley (5) with a degreasing agent.



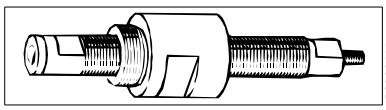
7. Remove the screw (12), spring washer (11) and washer (10) from the friction coupling.

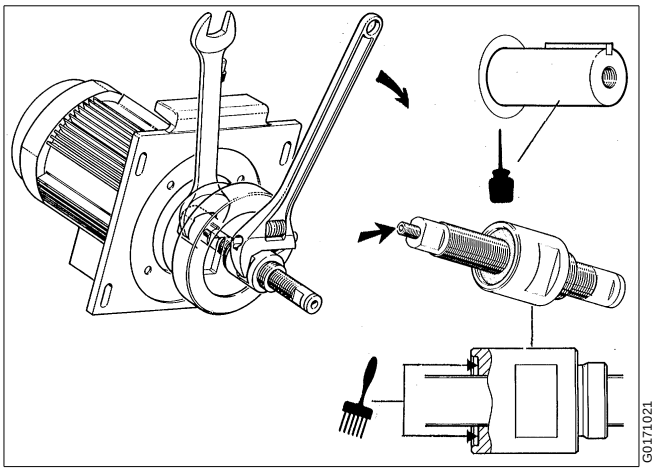


Complete dismantling of the friction coupling

8. Lubricate and fit the special mounting and dismantling tool.

   Ease off the coupling.



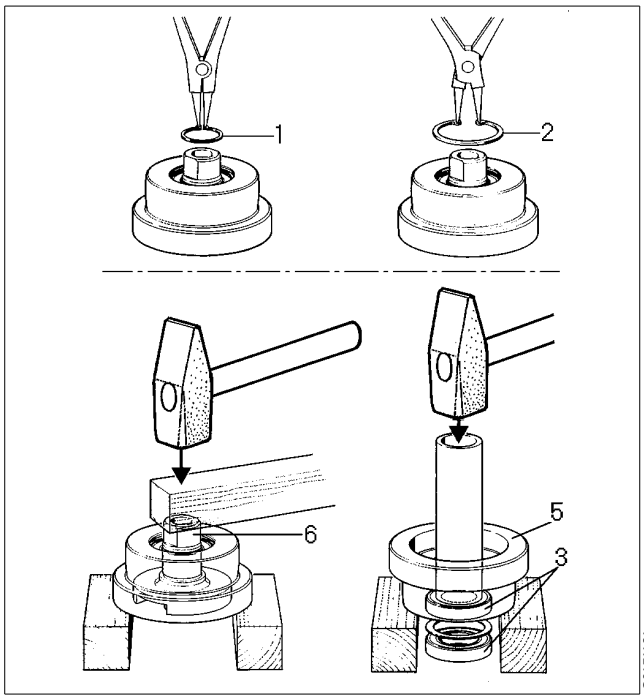


Molykote 1000 Paste
(thin layer to be rubbed into surface)

Oil

9. Remove snap rings (1 and 2) and drive off coupling hub (6). Turn the coupling, i.e. belt pulley (5) with bearings (3), the other way round and drive off the ball bearings and washer by using a tube.

10. Clean all parts in a degreasing agent and replace parts supplied in the spare parts kits.



NOTE

Always discard a used bearing.

6.3.2 Friction coupling – assembly

Before the friction coupling is assembled, examine all parts thoroughly for wear and corrosion.

1. Assemble the new ball bearings in belt pulley (5) by using a tube and a hammer.

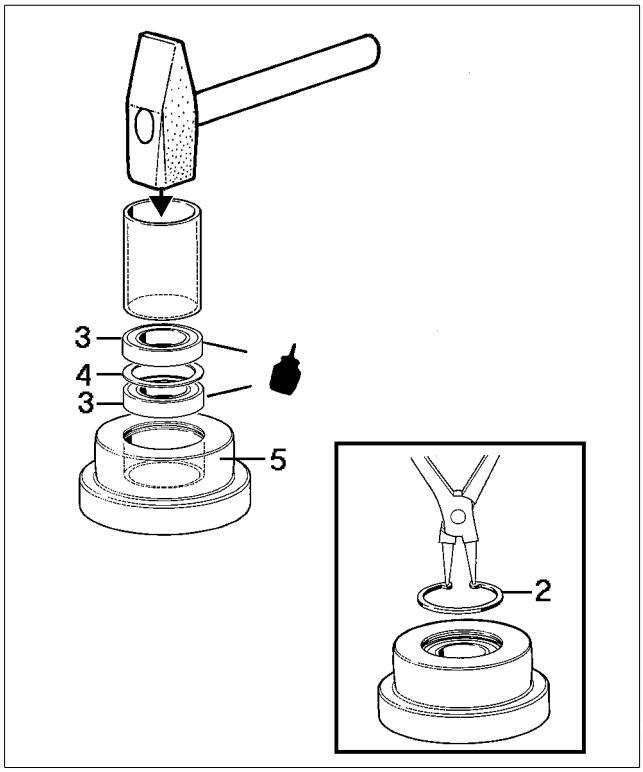
   Apply Loctite 641 on the outer surfaces of ball bearings (3).

   Knock down the bearings carefully (do not forget washer 4) by using the tube which must rest on the outer race of the bearing.

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

   After the assembly of the bearings, fit snap ring (2).

   Loctite 641

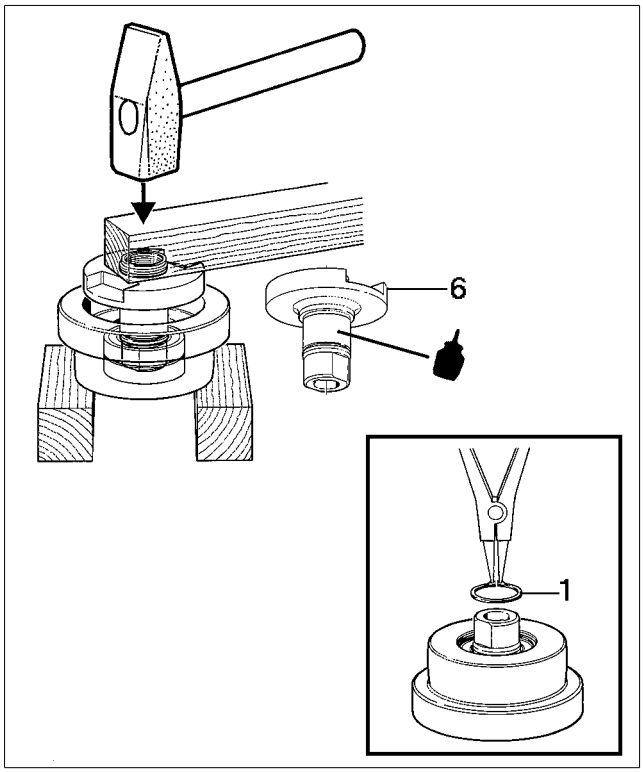


NOTE

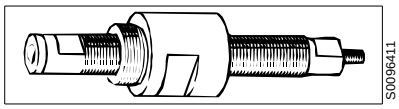
Do not refit used bearings.

2. Apply Loctite 641 on the coupling hub (6) and knock it down into the belt pulley by using a hammer.
3. Fit snap ring (1).

   Loctite 641

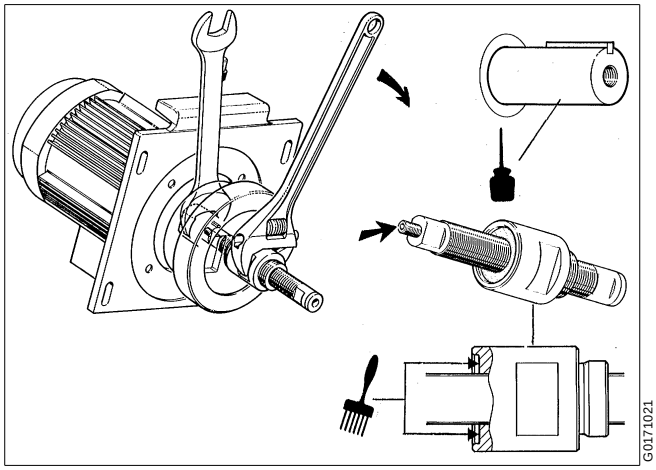


4. Wipe clean the motor shaft and apply a thin oil film on it. Fit the special mounting and dismantling tool to the motor shaft (by means of the small screw on one end of the tool) and press the friction coupling onto the shaft.

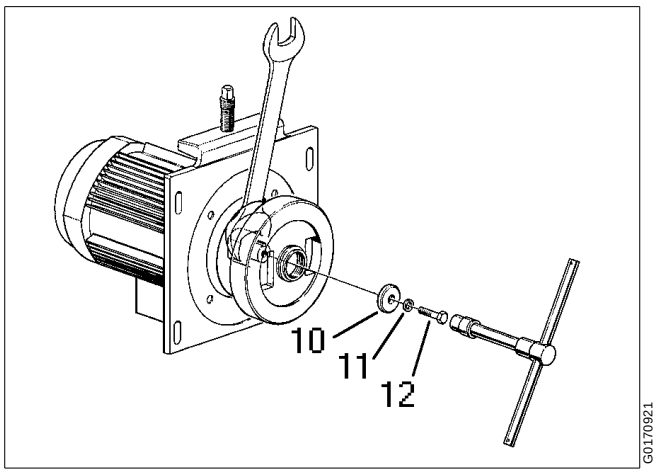


Molykote 1000 Paste
(thin layer to be rubbed into surface)

Oil

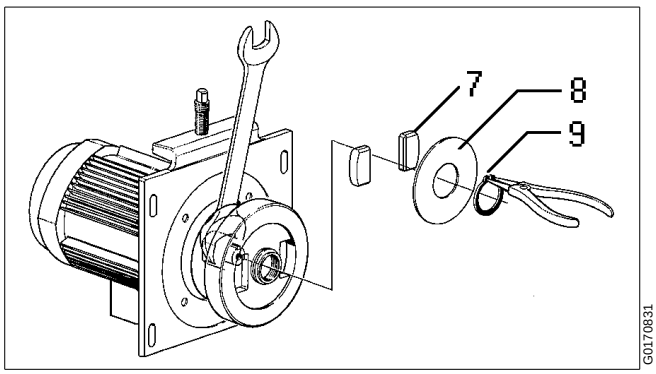


5. Fit the screw (12) with the washer (11) and spring washer (10) to secure the friction coupling.



Assembly of friction elements

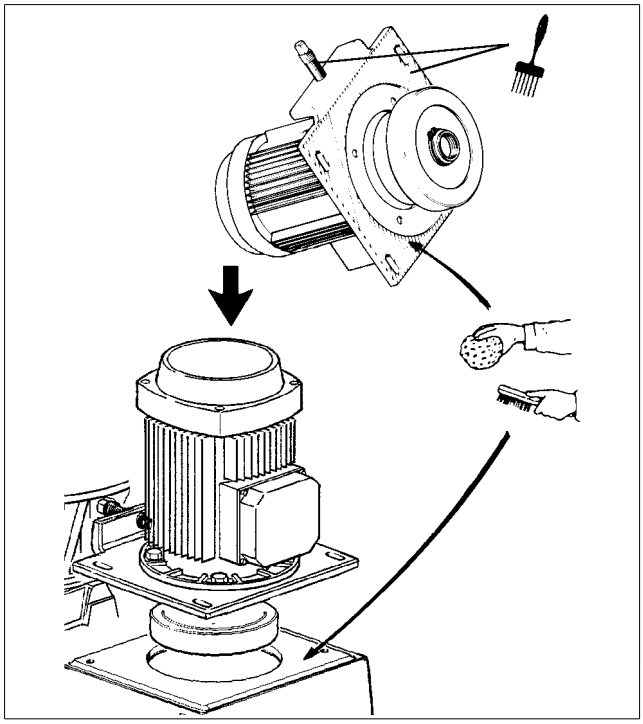
6. Fit new friction elements (7), cover (8) and snap ring (9).
   - A coupling with two friction elements is used for 60 Hz installations.
   - A coupling with four friction elements is used for 50 Hz installations.



7. Degrease and clean the contact surfaces of frame and motor adapter. Lubricate the contact surfaces with Molykote 1000 paste. Then fit the electric motor with adapter and friction coupling in position.

Molykote 1000 Paste
(thin layer to be rubbed into surface)

Also lubricate the threads of the belt tightener with Molykote 1000 paste or similar.



8. Fit and tighten the flat belt, see ‘‘6.4.1 Belt replacement and tightening” on page 116.
9. Install the water tank and the cover.

NOTE

The belt must be re-tightened before starting the separator, see next page.

6.4 Flat belt and tightener

The flat belt must be removed before dismantling of the bowl spindle or the friction coupling. The procedure is the same when replacing the belt at a Major Service.

A new belt must be retightened **twice**:

- 30 minutes after the belt has been installed. The separator **must not** be started until the retightening has been done.
- after approximately 24 hours of operation.

NOTE

Do not start the separator unless the flat belt has been retightened after 30 minutes. If started, the belt may slip and be damaged.

6.4.1 Belt replacement and tightening

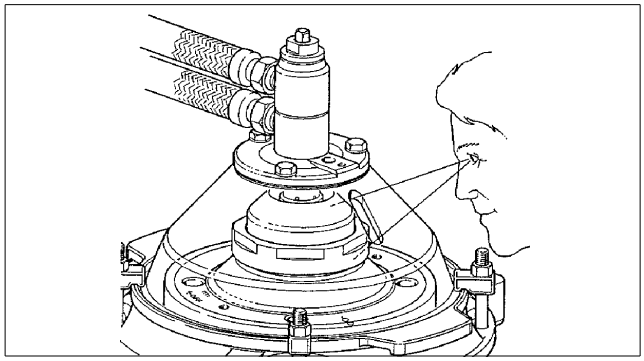
If only tightening of flat belt should be done, only steps 3 and 7-11 have to be performed.

DANGER

Entrapment hazards

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

Look into the slot in the frame hood to see if separator parts are rotating or not.



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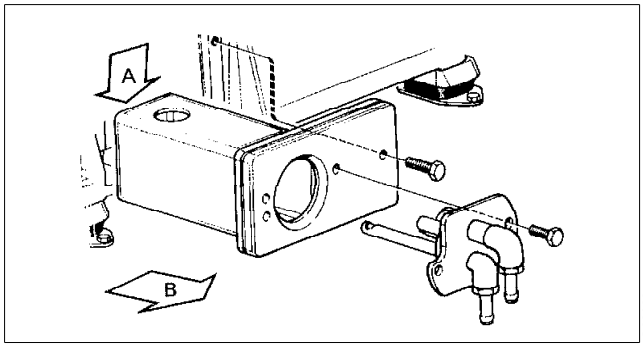
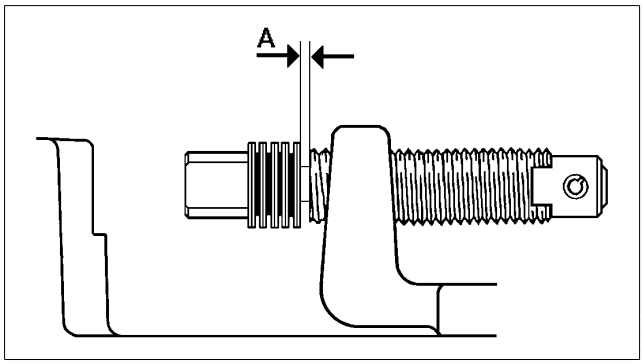
1. Remove the cover and the water tank.
   Note that the tank must be lowered past spindle end (A) before it can be withdrawn (B).



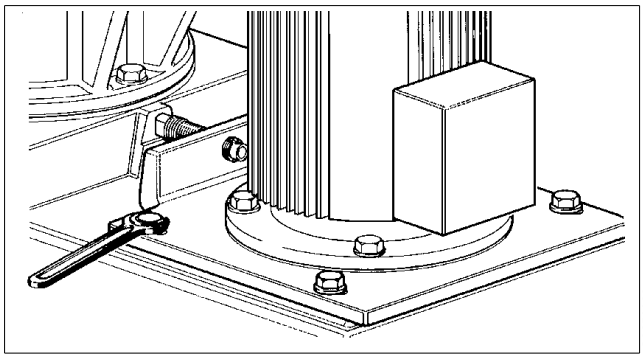
2. Check that the belt tightener is in backward position.



NOTE

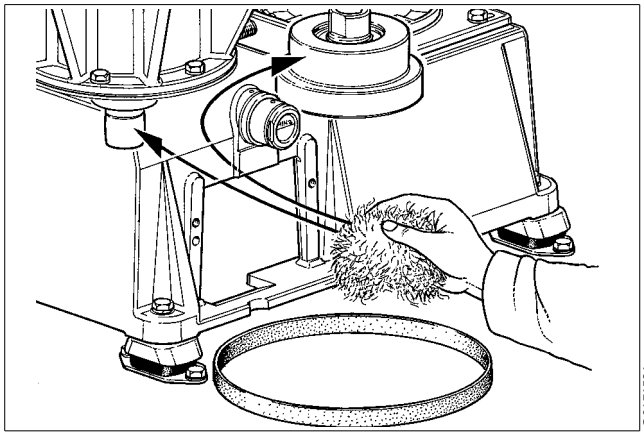
Pay attention to the air gap “A” between the cup springs and the threaded sleeve. The distance “A” must not exceed 0,5 mm. Otherwise a correct belt tightening will be impossible.

3. Loosen but do not remove the motor adapter screws.



4. Remove the existing belt and clean the raceways of the bowl spindle and the friction coupling by using a degreasing agent. Wipe the raceways with a clean rag after cleaning.

   Exercise the greatest possible cleanliness. There must be no dirt, oil or grease on the raceways.

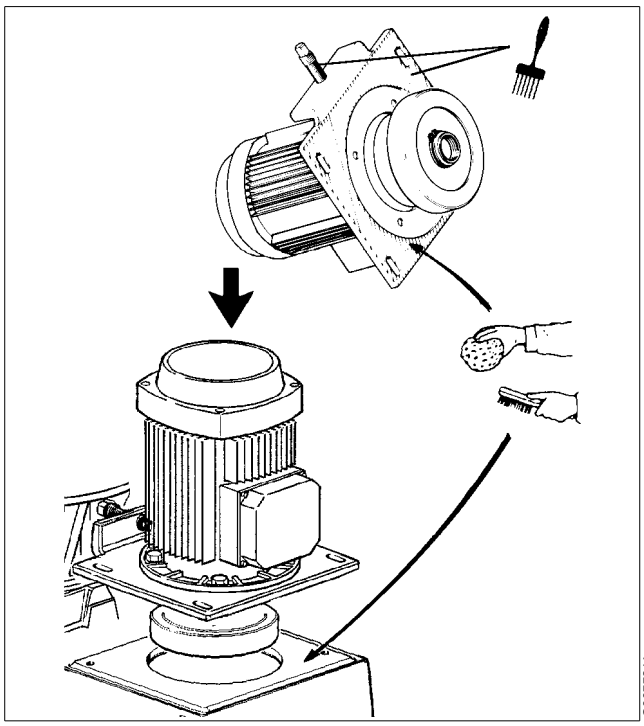


5. Remove the motor adapter screws. Lift the motor together with adapter and friction coupling and check that there is a sufficient film of Molykote 1000 Paste, or an equivalent lubricating paste, between the adapter and the frame surface. Lower the motor after checking. Fit the motor adapter screws but do not tighten them.

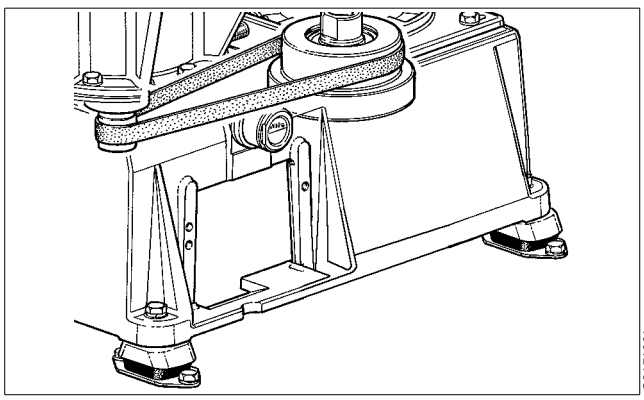
   The weight of motor including adapter and friction coupling is not more than 20 kg.

   The threads of the belt tightener should be lubricated with Molykote 1000 Paste or similar.

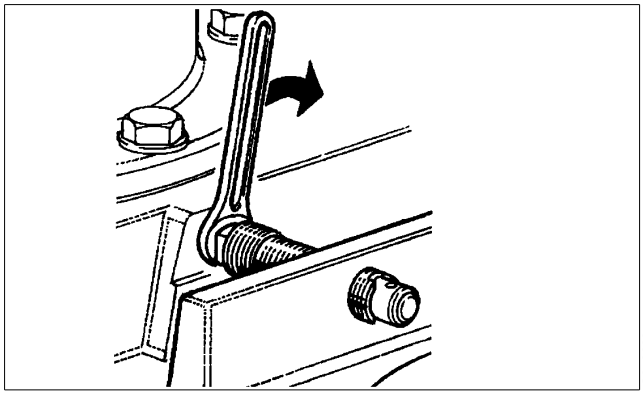
Molykote 1000 Paste
(thin layer to be rubbed into surface)



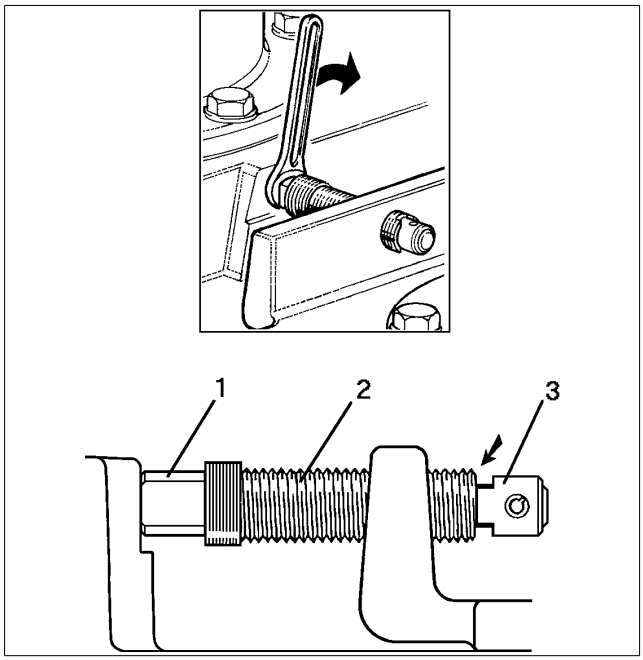
6. Fit a new belt. Start on the motor side. Tighten the belt by moving the motor backwards by hand. Pull the belt around a few turns by hand.



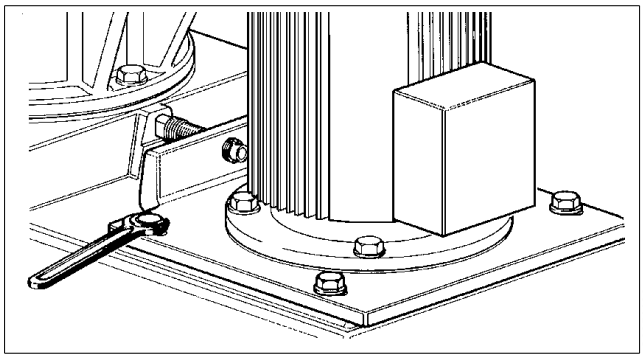
7. Rotate the belt tightener by rotating the shaft until it makes contact with the frame pad.



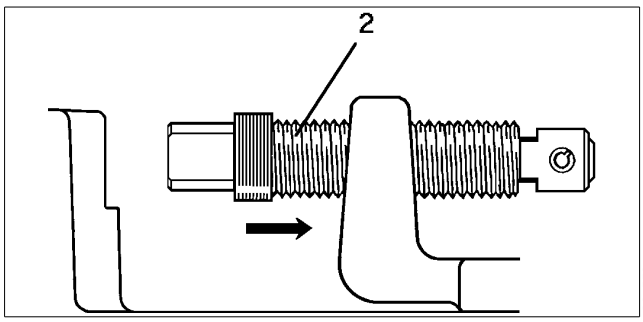
8. Tighten the shaft (1) further until the threaded sleeve (2) and dog (3) are disengaged. “Shake” the motor by hand several times during this operation in order to overcome the friction between the motor adapter and the frame.



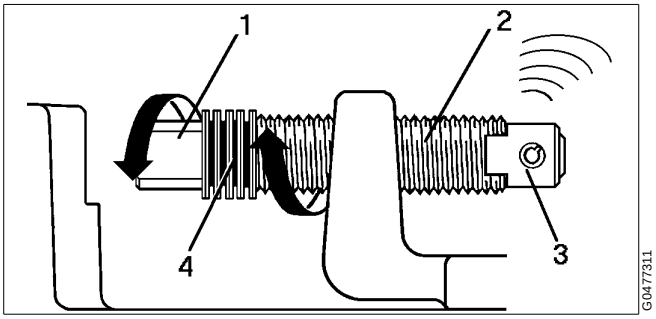
9. Tighten the motor adapter screws.



10. Loosen the belt tightener by rotating the threaded sleeve (2) backwards.



11. Rotate the shaft (1) relative to the threaded sleeve (2) until the sleeve (2) and dog (3) are engaged again with a clicking sound.

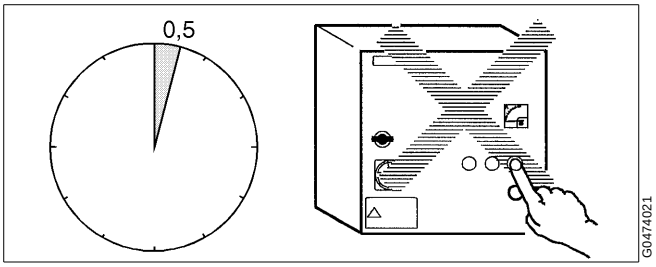


NOTE

If the springs (4) are not decompressed they will loose their tension and correct tightening of belt will be impossible.

12. Let the belt stay in this position for at least 30 minutes **without** starting the separator.

    Then repeat steps 3 and 7-11 above. After this proceed to step 13.



NOTE

Do not start the separator unless the flat belt has been retightened after 30 minutes. If started, the belt may slip and be damaged.

13. Fit the water tank and cover.
14. The separator may now be started.

NOTE

The belt must be retightened when the separator has been in operation approximately 24 hours after the belt change: Repeat steps 3 and 7-11.

6.5 Oil filling device

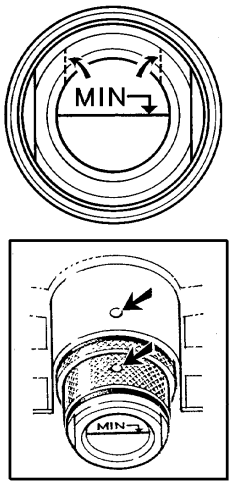
6.5.1 Dismantling/assembly

Drain off the oil, see “5.8 Oil change” on page 71.

Unscrew nipple (4) and pull off the oil filling device. Then unbend the round safety wire (6) and pull off nipple (4).

1. If plate (8) is to be replaced, wipe the sight glass (7) with a degreasing agent.
2. Fit the new plate on the outside of the sight glass. The plate is self-adhesive.
3. Mark the position of the plate relative to the recess in sleeve (1).

Assemble the oil filling device and fit it into the frame. Note that the mark on sleeve (1) must be positioned opposite the mark on the frame. Fill the sump with new oil.



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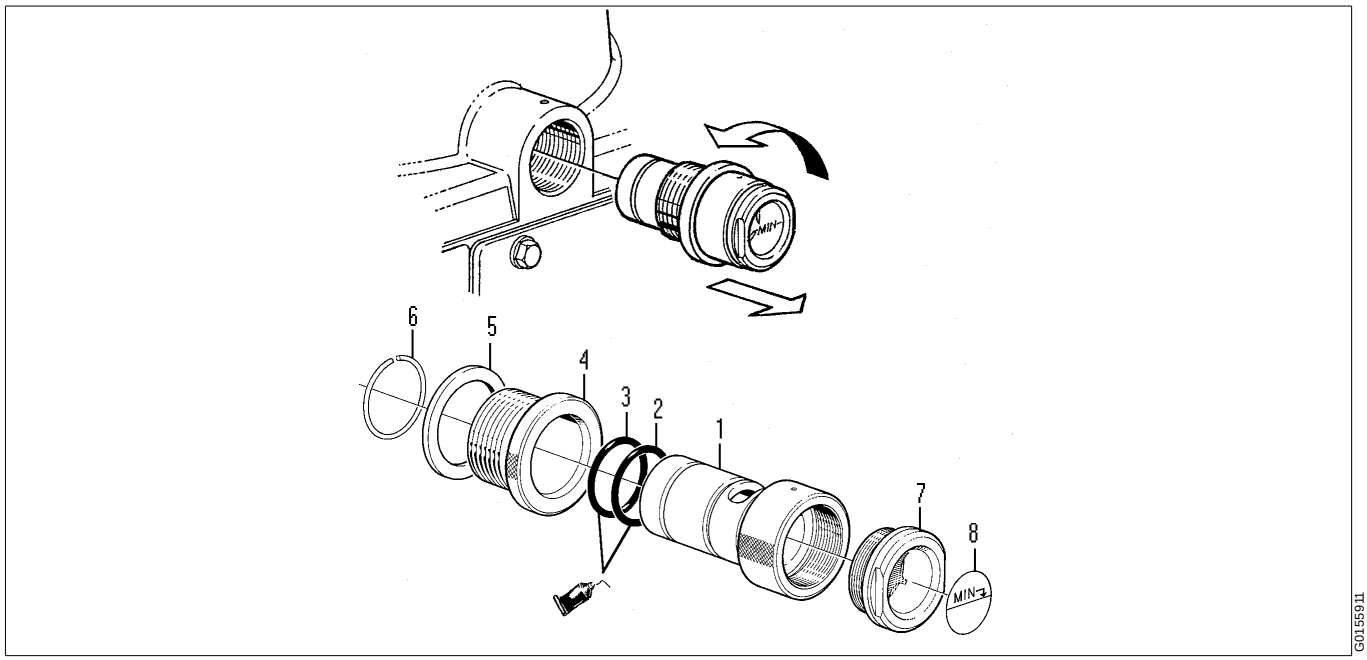

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1	*Sleeve for oil filling*	*5*	*Sealing ring*
2	*O-ring*	*6*	*Round safety wire*
3	*O-ring*	*7*	*Sight glass*
4	*Nipple*	*8*	*Plate*

Silicone grease (thin layer)

6.6 Water tank

Remove the cover (5) with the drain pipes and the water tank (1).

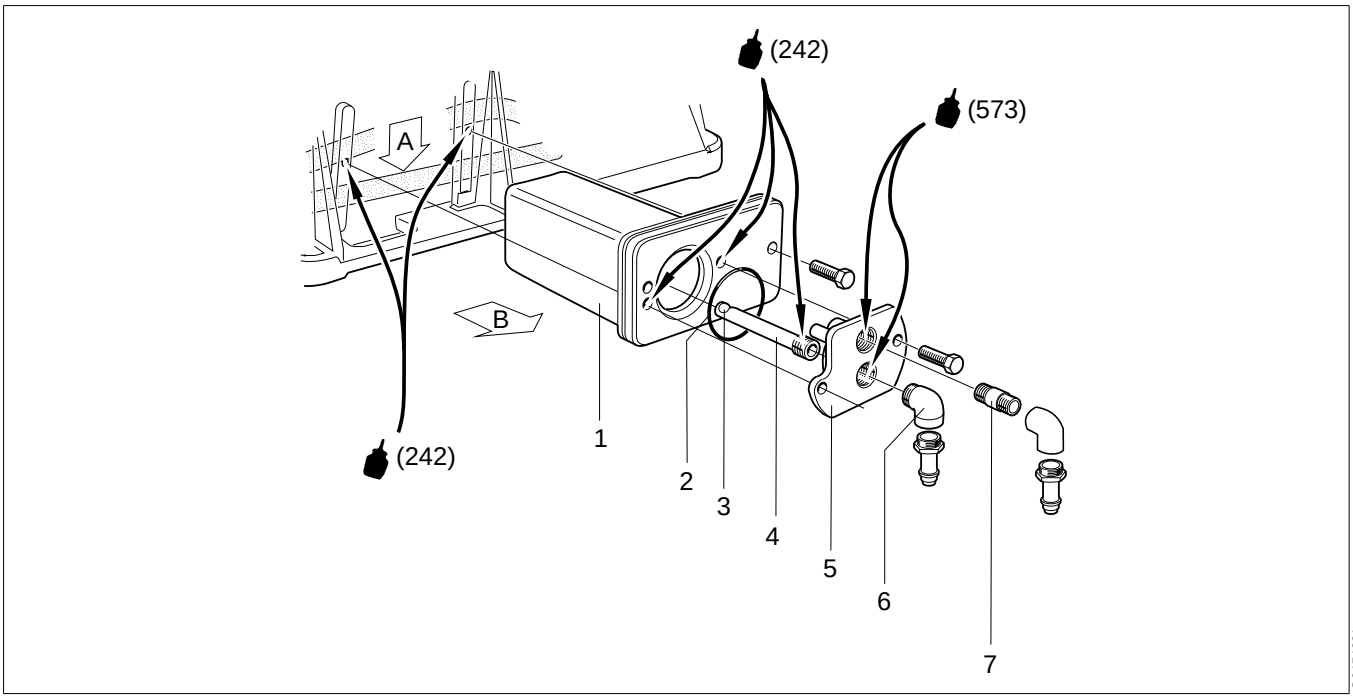
Note that the tank must be lowered past the spindle end (A) before it can be withdrawn (B).

- Check the tank interior and clean out if necessary.
- Check that the pipes are not defective. Replace if necessary.

If the parts fitted on the cover have been removed, it is necessary to fit the parts properly together at assembly.

- Seal the drain pipe and water inlet pipe with Loctite 573.
- Secure the screws with Loctite 242.

The drain pipe opening, (3), should be mounted upwards.



1. *Water tank*
2. *O-ring*
3. *Drain pipe opening (pointing upwards)*
4. *Drain pipe*
5. *Cover*
6. *Elbow coupling*
7. *Pipe*

6.7 Frame feet

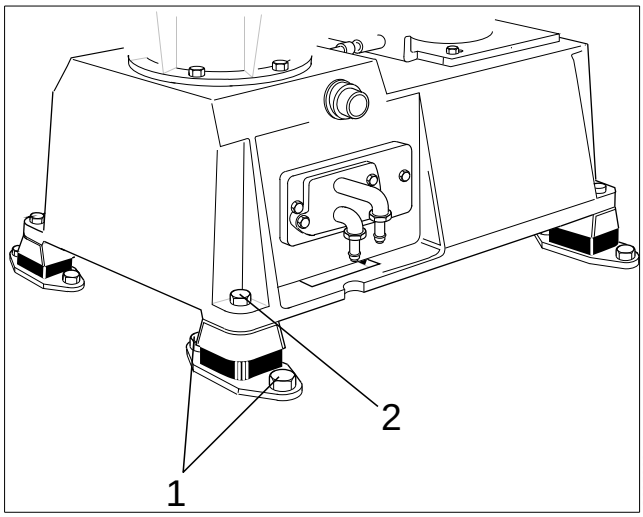
6.7.1 Mounting of new frame feet

When replacing the frame feet, the separator must be lifted.

Remove the bowl before lifting the separator.

Follow “5.6 Lifting instructions” on page 66.

1. Loosen the foundation bolts and lift the separator.
2. Remove the existing frame feet.
3. Mount the new feet.
4. Place the separator in its original position and fasten the foundation bolts.
5. Remove the two lifting eye bolts.
6. Assemble the separator bowl, see “6.1.2 Inlet/outlet and bowl - assembly” on page 89.



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7 Trouble-tracing

Contents

7.1 Trouble-tracing procedure

This chapter applies to trouble-tracing concerning functions of the separator only. It does not include the other equipment in your processing system.

Always start with trouble-tracing instructions in the system documentation, and if required, continue with the instructions below. If the problem still is not solved, contact your Alfa Laval representative.

7.2 MMPX mechanical function

7.2.1 The separator does not start

Possible cause	Action
No power supply to motor.	Check power supply.

7.2.2 Start-up time too long

Possible cause	Action
Friction elements worn or oily.	Fit new friction elements or clean the old ones if they are oily.
Belt tension too loose.	Tighten the belt.
Motor failure.	Repair.
Incorrect power supply (50 Hz instead of 60 Hz).	Use applicable 60 Hz power supply.
Bearing damaged or worn.	Install new bearings.

7.2.3 Starting power too low

See 7.2.2.

7.2.4 Starting power too high

Possible cause	Action
Motor failure.	Repair the motor.
50 Hz pulley running on 60 Hz power supply.	After immediate stop, install correct pulley.
Height position of paring disc incorrect.	Check and adjust.
Bearing damaged or worn.	Install new bearings.

7.2.5 Separator vibrates during starting sequence

NOTE

Some vibration is normal during starting sequence when the separator passes through its critical speeds.

Possible cause	Action
Bowl out of balance due to: – poor cleaning – incorrect assembly – too few discs – insufficiently tightened bowl hood – bowl assembled with parts from other separators.	After safety stop, identify and rectify cause. ⚠ **Incorrectly tightened bowl hood involves fatal danger.**
Height adjustment of paring disc is incorrect.	Check and adjust.
Vibration dampers in frame feet worn out.	Fit new frame feet.
Bowl spindle bent (max. 0,04 mm).	Fit a new bowl spindle.
Top and/or bottom bearing overheated, damaged or worn.	Fit new bearings.
Spindle top bearing rubber buffer defective.	Fit new rubber buffers.

7.2.6 Separator vibrates during normal running

DANGER

Disintegration hazards

Never discharge a vibrating separator.

Possible cause	Action
Uneven sludge deposits in sludge space.	See ‘‘7.4 Purification faults’’ and ‘‘7.5 Clarification faults’’.
Bearing damaged or worn.	Fit new bearings.
Vibration dampers in frame feet worn out.	Fit new frame feet.
Spindle top bearing rubber buffer defective.	Fit new rubber buffers.

7.2.7 Smell

Possible cause	Action
Normal occurrence during start as the friction elements slip.	None.
Belt slips.	Tighten the belt. Check for oily pulleys.
Top and/or bottom bearing overheated.	Fit new bearings.

7.2.8 Noise

Possible cause	Action
Oil level in oil sump is too low.	Read oil level and add oil if necessary.
Height adjustment of paring disc is incorrect.	Check and adjust.
Top and/or bottom bearing damaged or worn.	Fit new bearings.

7.2.9 Speed too high

Possible cause	Action
Incorrect transmission (50 Hz pulley running on 60 Hz power supply).	After immediate stop, install correct transmission.  In the event of overspeed, examine bowl for possible deformation. The separator must not be started without correcting the effects of the fault. Contact your Alfa Laval representative.
Frequency of power supply (50/60 Hz).	Check.

7.2.10 Speed too low

Possible cause	Action
Bowl not closed or leaking.	Dismantle and check.
Friction elements worn or oily.	Fit new friction elements or clean the old ones if they are oily.
Belt tension too loose.	Tighten the belt.
Motor failure/motor bearings.	Repair the motor.
Bearing overheated/damaged or worn.	Fit new bearings.
Incorrect transmission (60 Hz pulley running on 50 Hz power supply).	Make sure that the pulley is intended for 50 Hz power supply.

7.2.11 Water in oil sump

Possible cause	Action
Bowl casing drain obstructed.	Clean. Change oil in oil sump.
Leakage at top bearing.	Fit a new seal ring and change oil in oil sump.
Condensation.	Clean the oil sump. Change oil in oil sump.

7.3 Purification and clarification faults

7.3.1 Liquid flows through bowl casing drain and/or sludge outlet

Possible cause	Action
Sludge discharge or water draining in progress.	None (normal).
Broken water seal.	See ‘‘7.4.3 Oil discharge through water outlet = broken water seal” on page 135.
Displacement water volume too large.	Adjust.
The supply of operating water is not sufficient due to clogged strainer, kinked hose or low water pressure.	Straighten the hose. Clean the strainer. Check the water pressure.
Seal ring on gravity disc/clarifier disc defective.	Fit a new seal ring.
Seal ring in sliding bowl bottom defective.	Install a new seal ring.
Bowl hood seal ring defective or sealing surface of sliding bowl bottom damaged.	Install a new seal ring. Polish the surface on sliding bowl bottom or install a new one.
Valve plugs defective.	Install new valve plugs.
Sludge deposits on operating slide.	Clean the operating slide.
Seal rings in paring disc device defective.	Fit new seal rings.
Bowl speed too low.	Make sure current is on. Retighten the flat belt or inspect motor and power transmission.

7.3.2 Bowl opens unintentionally during operation

Cause	Remedy
Nozzles in bowl body clogged.	Clean the nozzles,
Seal ring in sliding bowl bottom or upper or lower distributing ring defective.	Install a new seal ring or install a new upper or lower distributing ring.
Lime scale deposits in hollow spindle.	Clean the hollow spindle after removing the pump sleeve.
Valve plugs defective.	Install new valve plugs.
Sludge deposits on operating slide.	Clean the operating slide.
Valve for operating water not closing properly. Can result in repeated discharges.	Open and clean the valve.

7.3.3 Bowl fails to open for sludge discharge

Cause	Remedy
The supply of operating water is not sufficient due to clogged strainer, kinked hose or low water pressure.	Straighten the hose. Clean the strainer. Check the water pressure.
Seal ring in operating slide defective.	Install a new seal ring.
Valve for operating water not opening.	Examine the electrical system and correct the fault (open circuit, low voltage, dirt, high voltage).

7.3.4 Unsatisfactory sludge discharge

Cause	Remedy
Sludge deposits in operating system.	Clean the operating system.

7.4 Purification faults

7.4.1 Unsatisfactory separation result

Possible cause	Action
Gravity disc hole too small.	Use a gravity disc with a larger hole.
Incorrect separating temperature.	Adjust temperature.
Throughput too high.	Reduce throughput.
Sludge space in bowl is filled with sludge.	Clean the bowl and shorten time between discharges.
Disc stack clogged.	Clean the bowl discs.
Inlet clogged.	Clean.
Bowl speed too low.	See “7.2.10 Speed too low” on page 131.

7.4.2 Outgoing water contains oil

Possible cause	Action
Gravity disc hole too large.	Use a gravity disc with a smaller hole.
Seal ring under the gravity disc defective.	Fit a new seal ring.
The supply of operating water is not sufficient due to clogged strainer, kinked hose or low water pressure.	Straighten the hose. Clean the strainer. Check the water pressure.

7.4.3 Oil discharge through water outlet = broken water seal

Possible cause	Action
Gravity disc too large.	Use a gravity disc with a smaller hole.
Separation temperature too low.	Increase temperature.
Throughput too high.	Reduce throughput.
The supply of operating water is not sufficient due to clogged strainer, kinked hose or low water pressure.	Straighten the hose. Clean the strainer. Check the water pressure.
Valve(s) in oil outlet line closed.	Open the valve(s) and adjust the back pressure to normal value.
Sealing water volume too small.	Check water supply.
Disc stack clogged.	Clean the bowl discs.
Seal ring on gravity disc/clarifier disc defective.	Fit a new seal ring.
Seal ring in sliding bowl bottom or upper or lower distribution ring defective.	Install a new seal ring.
Bowl hood seal ring defective or sealing surface of sliding bowl bottom damaged.	Install a new seal ring. Polish the surface on sliding bowl bottom or install a new one.
Valve plugs defective.	Install new valve plugs on operating slide.
Bowl speed too low.	See “7.2.10 Speed too low” on page 131.
Bowl incorrectly assembled.	Examine and make correct.

7.5 Clarification faults

7.5.1 Unsatisfactory separation result

Possible cause	Action
Incorrect separating temperature.	Adjust temperature.
Throughput too high.	Reduce throughput.
Feed oil contains water.	a. Check preceding clarifier when operating in series. b. Readjust time between discharges. c. Re-assemble and operate the separator as a purifier.
Sludge space in bowl filled with sludge.	Clean the bowl and shorten time between discharges.
Disc stack clogged.	Clean the bowl discs.
Bowl speed too low.	See “7.2.10 Speed too low” on page 131.

7.5.2 Oil discharge through water outlet

Possible cause	Action
Valve(s) in outlet line closed.	Open the valve(s) and adjust to normal back pressure.
Disc stack clogged.	Clean the bowl discs.
Seal ring under gravity disc is defective.	Fit a new seal ring.
Bowl incorrectly assembled.	Examine and make correct.

8 Technical Reference

Contents

8.1 Technical data

Alfa Laval ref. 556565 rev. 2, 557451 rev. 3

Units according to ISO Standard.

The manufacturer reserves the right to change specifications without notice.

Product number	881099-01-04	
Separator type	MMPX 303SGP-11	
Purpose	– Continuous purification of fuel oil or lubricating oil from solid particles and water. – Continuous clarification of fuel oil or lubricating oil from solid particles. The flash point of the oil to be separated must be >60 °C.	
Hydraulic capacity	Maximum 1,7 m^3/h	
Rated capacity[1)]	1700 litres/hour	
Maximum density	feed sediment	1100 kg/m^3 2631 kg/m^3
Operating liquid	Max. density 1000 kg/m^3 Min. pressure 150 kPa	See also “8.4 Water quality” on page 146.
Feed temperature	Minimum 0 °C Maximum +100 °C	
Ambient temperature	Minimum +5 °C Maximum +55 °C	
Motor	2-pole 2,2 kW standard motor for 3-phase 50 or 60 Hz. Direct on-line start. Y/D-start: maximum 5 seconds in Y position.	
Power consumption	idling	0,8 kW
	running (at max. capacity)	1,8 kW
	max. power consumption	2,8 kW (at starting-up)

1) At the maximum permissible oil density, 991 kg/m^3 at +15 °C.
Density preferably measured at +50 °C and according to ASTM method D 1298-80, corrected to +15 °C according to ASTM tables D 1250-80.

Speed

The prescribed speed of the bowl spindle is stamped on the name plate of the machine. The speed must not be exceeded.

Gear ratio (pulleys): 130:41 (50 Hz), 106:41 (60 Hz)

Maximum speed of rotation, rpm	*50 Hz*	*60 Hz*
Motor shaft Bowl	3000 9510	3600 9305

Starting time 1,8 - 2,3 minutes

Stopping time Running down without brake — min. 13, max. 15 minutes

Maximum running time without flow

empty bowl — 180 minutes

filled bowl — 180 minutes

Sludge and water space volume 0,6 litres net

Discharge volume 1 litre (nominal), fixed

Discharge interval minimum 2 minutes

Required water quality See “8.4 Water quality” on page 146

Lubrication See “8.5 Lubricants” on page 147

Lubricating oil volume 0,5 litre

Sound pressure level 69 dB(A) ISO 3744, at product flow rate 1,5 m^3/h

Vibration level Separator in use — 9 mm/s (RMS)

Weight

Separator without motor — Net weight approx. 210 kg

Motor — Net weight, approx. 16 kg

Complete bowl — Approx. 35 kg

Overhead hoist for 300 kp is required

Shipping data According to “Basic equipment”

Weight — Net 185 kg, gross 235 kg

Volume — 1,06 m^3

Materials	Bowl spindle	stainless steel
	Frame, lower and upper parts	cast iron (“Centriblue” finish[1)])
	Frame hood	cast iron (grey finish[1)])
	Bowl body and hood, disc stack, gravity discs	stainless steel
	Other bowl parts	brass
	Oil paring disc	brass
	Other inlet and outlet parts	stainless steel, brass, cast iron

[1)]An epoxy enamel

NOTE

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

8.2 Connection list

Alfa Laval ref. 557533 rev. 2

Connection No.	Description	Requirements/limit
201	Inlet for process liquid - Permitted temperatures	 Maximum +100 °C minimum 0 °C
206	Inlet for liquid seal and displacement liquid - Quality requirements - Instantaneous flow - Pressure	 Fresh water 5,5 litres/minute 150-600 kPa
220	Outlet for light phase (oil) - Counterpressure	 Maximum 360 kPa
221	Outlet for heavy phase (water)	No counterpressure
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 for discharge liquid - Instantaneous flow - Quality requirements - Pressure - Time	 18 litres/minute See “8.4 Water quality” on page 146 150-600 kPa 1 second per discharge

Connection No.	Description	Requirements/limit
373	Inlet for closing liquid - Instantaneous flow - Quality requirements - Pressure - Consumption	 0,9 litre per minute See ‘‘8.4 Water quality” on page 146 150-600 kPa 0,9 litre per discharge
377	Outlet for operating liquid	open
462	Drain of frame top part, lower	
463	Drain of frame top part, upper	
701	Motor for separator Allowed deviation from nominal frequency (momentarily during maximum 5 seconds	 Maximum ±5% ±10%)

Location of connections on the separator, see
‘‘8.6.1 Basic size drawing” on page 156, and
‘‘8.6.3 Dimensions of connections” on page 158.

8.3 Interface description

Alfa Laval ref. 557469 rev. 1

8.3.1 General

In addition to the “8.2 Connection list” on page 141 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.

8.3.2 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 “8.1 Technical data” on page 138.

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

Normal stop means:

- Stopping of the machine at any time.
- 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 the following conditions:

- The bowl must be kept filled.
- Sludge ejection (sludge discharge) 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.

8.3.3 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.

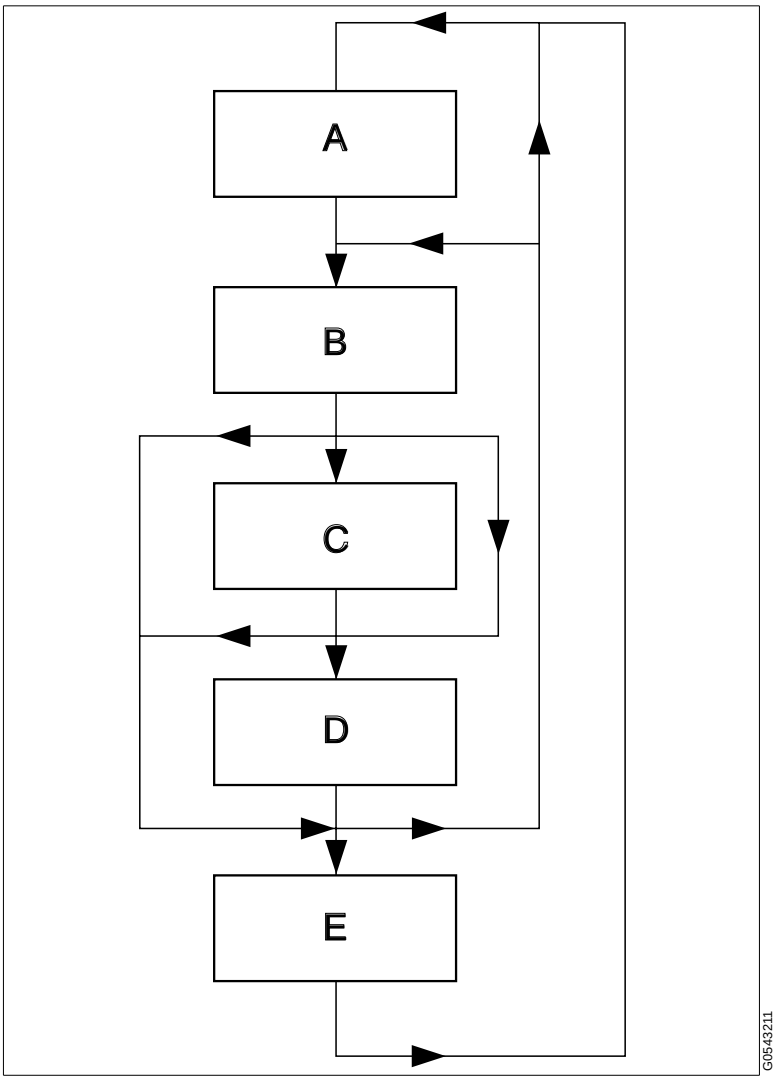
Discharge signal processing

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.

Function graph and running limitations



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

8.4 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 m.

2. Total hardness ≤ 180 mg $CaCo_3$ 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 ≤ 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.

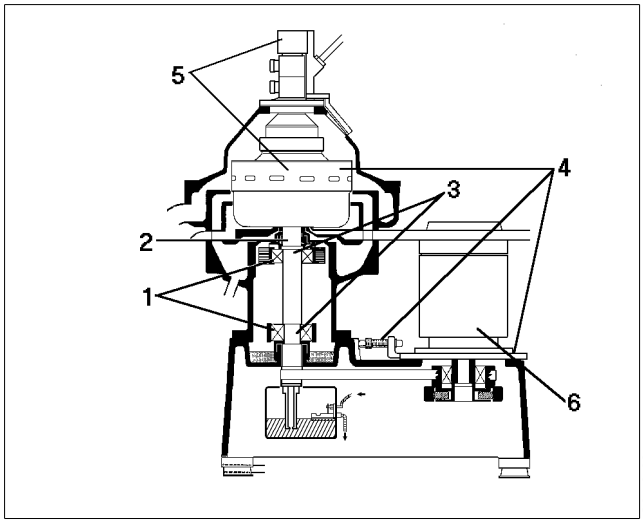
For test methods, contact any Alfa Laval representative.

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.

8.5 Lubricants

Alfa Laval ref. 553216-01 rev. 5



8.5.1 Lubrication chart

	Lubricating points	Lubricants
1	Bowl spindle ball bearings are lubricated by oil mist	Lubricating oil as specified in “8.5.5 Recommended oil brands” on page 153
2	Bowl spindle taper	Lubricating oil, only a few drops for rust protection
3	Buffers of bowl spindle	Lubricating oil
4	Bowl: Some of the guide surfaces, sliding contact surfaces and lock ring joint. Pressure-loaded surfaces Threads of cap nut Screw head joints Tools	Pastes as specified in “8.5.3 Recommended lubricants” on page 150. If not specified otherwise, follow the supplier’s recommendation about method of application
5	Rubber seal rings	Grease as specified in “8.5.3 Recommended lubricants” on page 150
–	Friction coupling ball bearings	The bearings are packed with grease and sealed and need no extra lubrication
6	Electric motor	Follow the manufacturer’s instructions

8.5.2 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 oil sump 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 “8.1 Technical data” on page 138.

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 lubricant manufacturer's instructions.

CAUTION

Skin irritation hazard

Personnel handling the oil must be instructed in its use (e.g. the possible risk of skin irritation, dermatitis). Ask for and follow the instructions from the oil supplier.

Spray should only be used in well ventilated localities.

8.5.3 Recommended lubricants

Alfa Laval ref. 553217-01

Pastes and bonded coatings for non-food applications:

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	Molykotepaste1000 sprayD321 R varnishD321 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:

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	

8.5.4 Recommended lubricating oils

Alfa Laval ref. 553219-09

Two different groups of lubricating oils are approved. They are designated as Alfa Laval lubricating oil groups A and D which are described in “8.5.2 Alfa Laval lubricating oil groups:” on page 148.

The numerical value after the letter in the table states the viscosity grade.

Ambient temperature	Alfa Laval lubricating oil group	Time in operation Oil change interval
between +15 and +45 °C	A/150	1500 h
between +2 and +65 °C	D/220	2000 h

The corresponding commercial oil brands are listed on next page.

Note:

- 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.

Alfa Laval do not accept responsibility for any damage caused by the use of lubricants which deviate from the recommended lubricants listed in this manual.

Alfa Laval lube oil

8.5.5 Recommended oil brands

Alfa Laval lubricating oil group A/150

Alfa Laval ref. 553218-04

List of commercial oil brands:

Viscosity grade VG [1]150
Viscosity index VI [2]>95

Manufacturer	Designation
Alfa Laval	546098-80 20 litres 546098-81 4 litres 546098-82 208 litres 546098-83 1 litre
BP	Bartran 150
Castrol	Alpha ZN 150
Esso/Exxon/Statoil	Teresso 150 Terrestic 150
Mobil	DTE Oil Extra Heavy
Shell	Tellus C150, Tellus 150
Q8/Kuwait/Gulf	Gulf Harmony AW 150
Texaco/Nippon	Regal R&O 150 or Paper Machine oil HD150
Nearest standard	K12-VG 150 GOST 1861-90 ISI/DIS 6743/3A VB 150-DIN 51506

[1] According to ISO 3448/3104

[2] According to ISO 2909

Alfa Laval lubricating oil group D/220

Alfa Laval ref. 553218-08

List of commercial oil brands:

Viscosity grade VG [1] 220
Viscosity index VI [2] >130

Manufacturer	Designation
Alfa Laval	542690-80 20 litres 542690-81 4 litres 542690-82 208 litres 542690-83 1 litre
BP	Enersyn 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

[1] According to ISO 3448/3104

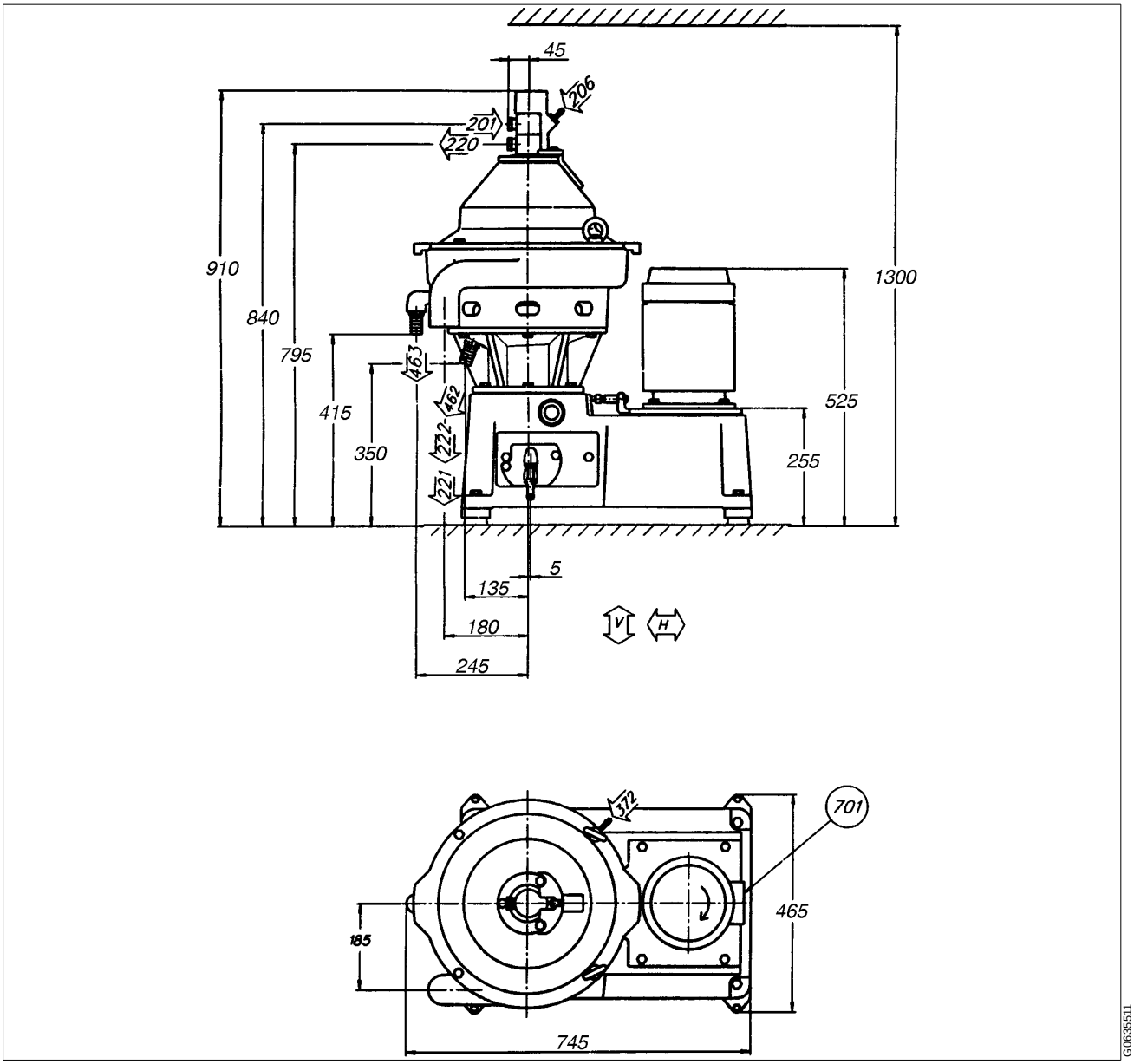
[2] According to ISO 2909

ventas@fdm.com.pe
fdmsac@gmail.com
Movil:959440045

8.6 Drawings

8.6.1 Basic size drawing

Alfa Laval ref. 557494



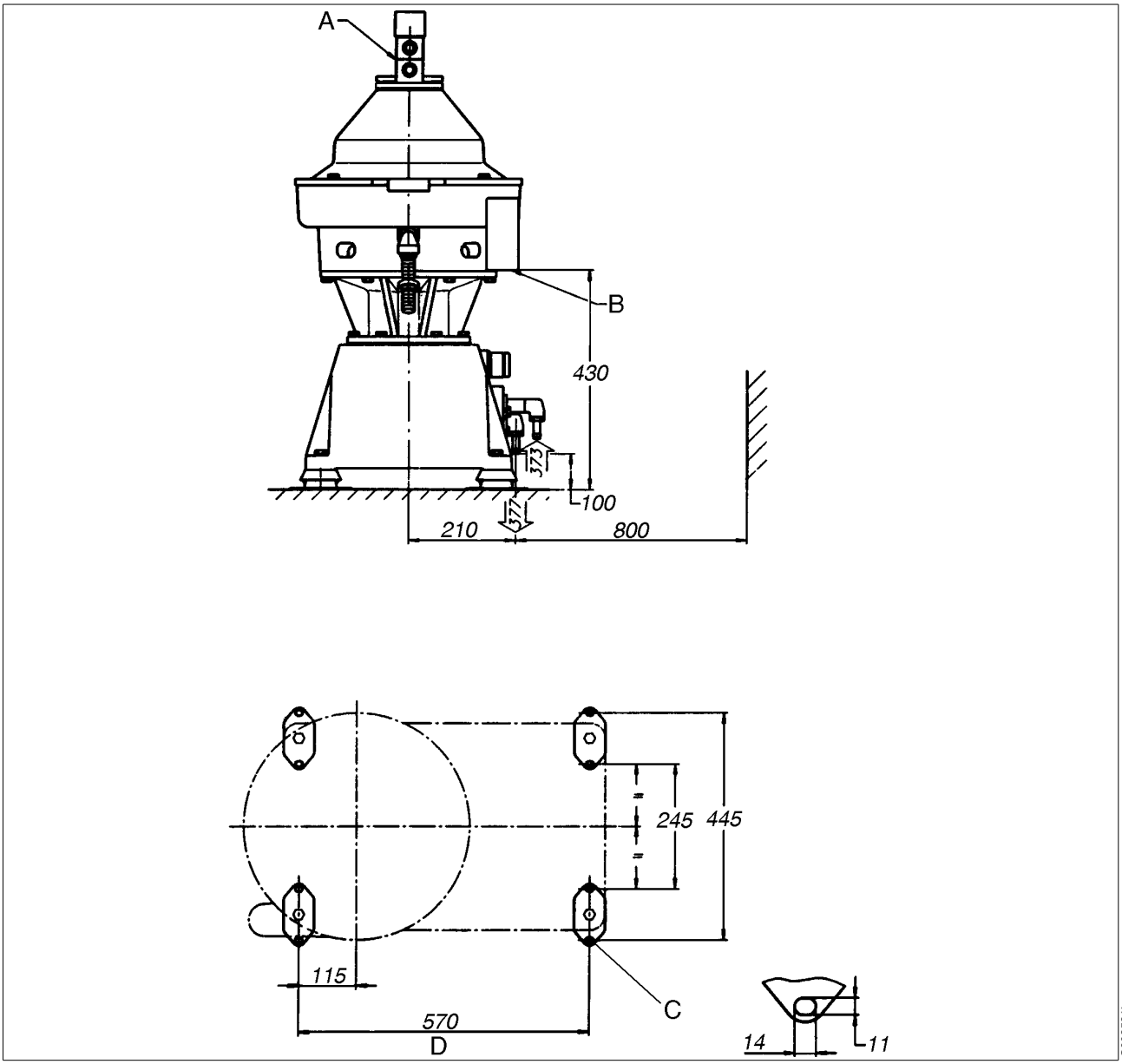
Connections 201 and 220 are turnable

V *Vertical force not exceeding 5 kN/foot*

H *Horizontal force not exceeding 7 kN/foot*

8.6.2 Foundation plan

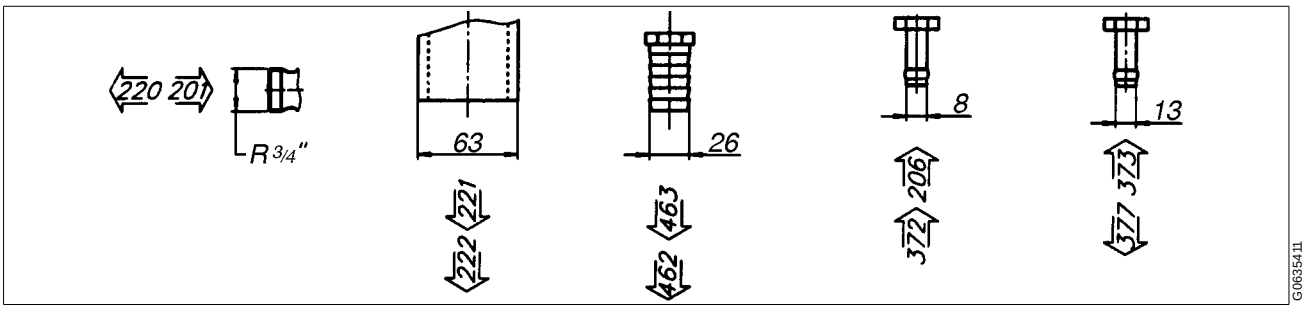
Alfa Laval ref. 557494



A. Maximum horizontal displacement at the inlet/outlet connections during operation: ±20 mm
B. Maximum vertical displacement at the solid phase outlet connection during operation: ±10 mm
C. 8 holes for foundation bolts
D. Service side

8.6.3 Dimensions of connections

Alfa Laval ref. 557494



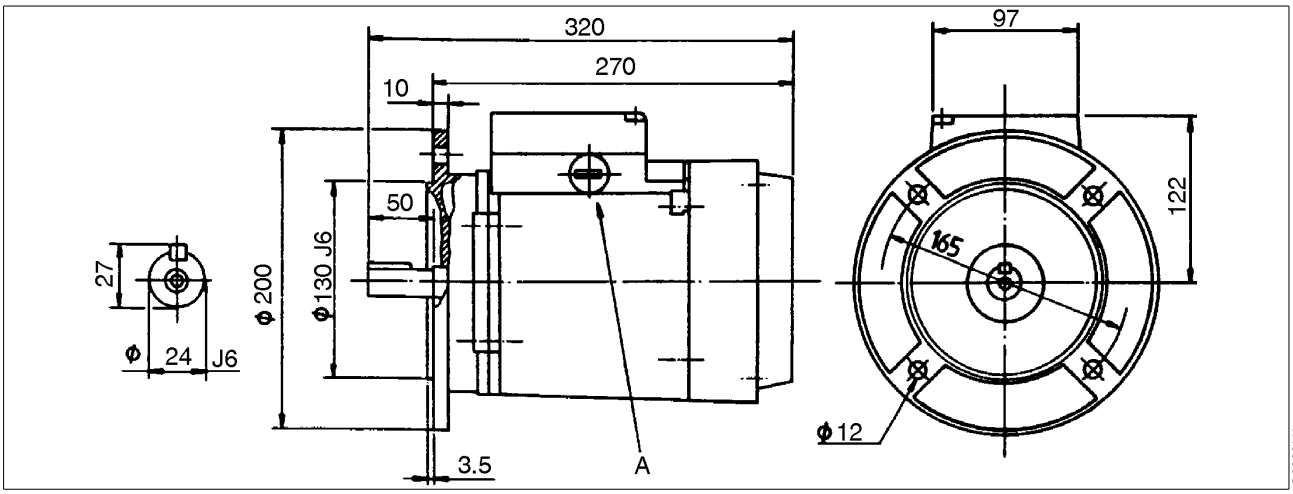
Data for connections see “8.2 Connection list” on page 141

All connections to be installed non-loaded and flexible

ventas@fdm.com.pe
fdmsac@gmail.com
Movil:959440045

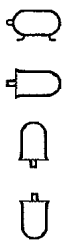
8.6.4 Electric motor

Alfa Laval ref. 551218-00



A. Pg16 (DIN 40430), max. wire area 2,5 mm^2

Manufacturer	ASEA, Denmark
Manufacturers drawing	MK11DdelB3 feb1983
Standards	IEC 34-1, IEC 72-2
Size	90L
Type	MT90L
Weight	16 kg
Poles	2
Insulation class	F
Bearings	DE 6305 C3 NDE 6204 C3
Method of cooling	IC 41 (IEC 34-6)
Specification	TEFC standard motor, marine performance[3)]

Type of mounting (IEC34-7)		Degree of protection (IEC34-5)
	IM 3001	IP 54

Article No.	kW	Speed RPM	Freq. Hz	Voltage V	Current A	Pow.fac cos φ	n%	I_S/I (1	M_S/M (2	Note
551218-01	2,2	2870	50	380Y	4,7	0,87	82	6,5	2,4	
551218-01	2,2	2870	50	220D	8,1	0,87	82	6,5	2,4	
551218-02	2,5	3460	60	440Y	4,6	0,87	82	7	2,4	
551218-03	2,2	2870	50	415Y	4,7	0,80	82	7,5	3,4	
551218-04	2,5	3470	60	575Y	3,4	0,87	84	7	2,6	
551218-05	2,5	3460	60	208Y	9,3	0,89	84	6,5	2,2	

1) I_S/I=starting current/rated current

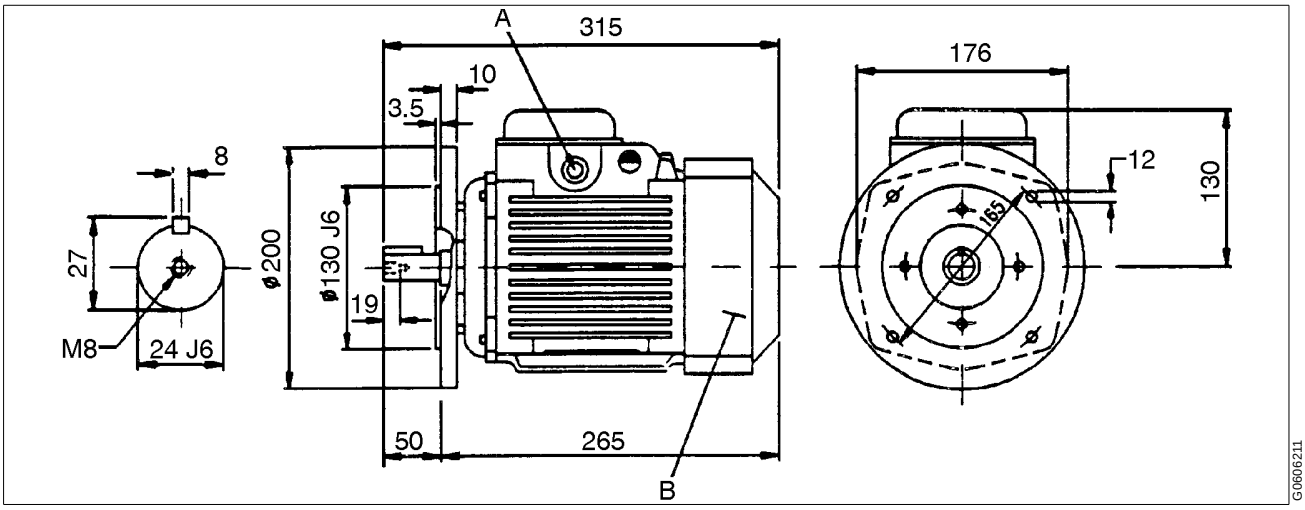
2) M_S/M=starting torque/full load torque

3) According to standards of following Classification Societies:
Lloyds Register of shipping (LRS) (Essential Service)
Det Norske Veritas (DnV)
Germanischer Lloyd (GL)
Bureau Veritas (BV)
American Bureau of shipping (ABS)
Registro Italiano Navale (RINA)
USSR Register of Shipping (RSU

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

ventas@fdm.com.pe
fdmsac@gmail.com
Movil:959440045

Alfa Laval ref. 552807-00



A. Max. cable diameter 16 mm
B. Metal fan cover

Manufacturer	ABB Motors, Spain
Manufacturers drawing	AC60-01 ParteB2
Standards	IEC 34-1, IEC 72
Size	90L
Type	MBT 90 LB
Weight	16 kg
Poles	2
Insulation class	F
Bearings	DE 6205-Z
	NDE 6205-Z
Method of cooling	IC 41 (IEC 34-6)
Specification	Totally enclosed three-phase motor for marine service [3)]

Type of mounting IEC 34-7		Degree of protection IEC 34-5
	IM 3001	IP 55
	IM 3011	IP 55
	IM 3031	IP 55

Article No.	kW	Speed RPM	Freq. Hz	Voltage V	Current A	Pow.fac cos j	I_{st} / I(1	Therm. °C(2	Note
552807-01	2,2	2850	50	220 D 380 Y	8,3 4,8	0,85	6,2		
552807-01	2,5	3420	60	255 D 440 Y	7,9 4,6	0,88	6		
552807-01	2,2	3390	60	220 D	8,3	0,88	4,9		
552807-02	2,2	2870	50	415 Y	4,5	0,86	6,4		
552807-03	2,2	2850	50	440 Y	4,1	0,88	6		
552807-04	2,2	2850	50	200 D	9,1	0,88	6		
552807-05	2,5	3420	60	220 Y 440 Y	9,2 4,6	0,88	6		Y-par Y-ser
552807-06	2,5	3440	60	230 Y 460 Y	9,0 4,5	0,86	6,3		Y-par Y-ser
552807-07	2,5	3420	60	575 Y	3,5	0,88	6		CSA-plated
552807-09	2,2	2850	50	400Y	4,6	0,88	6		

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

2) Thermistors tripping temperature

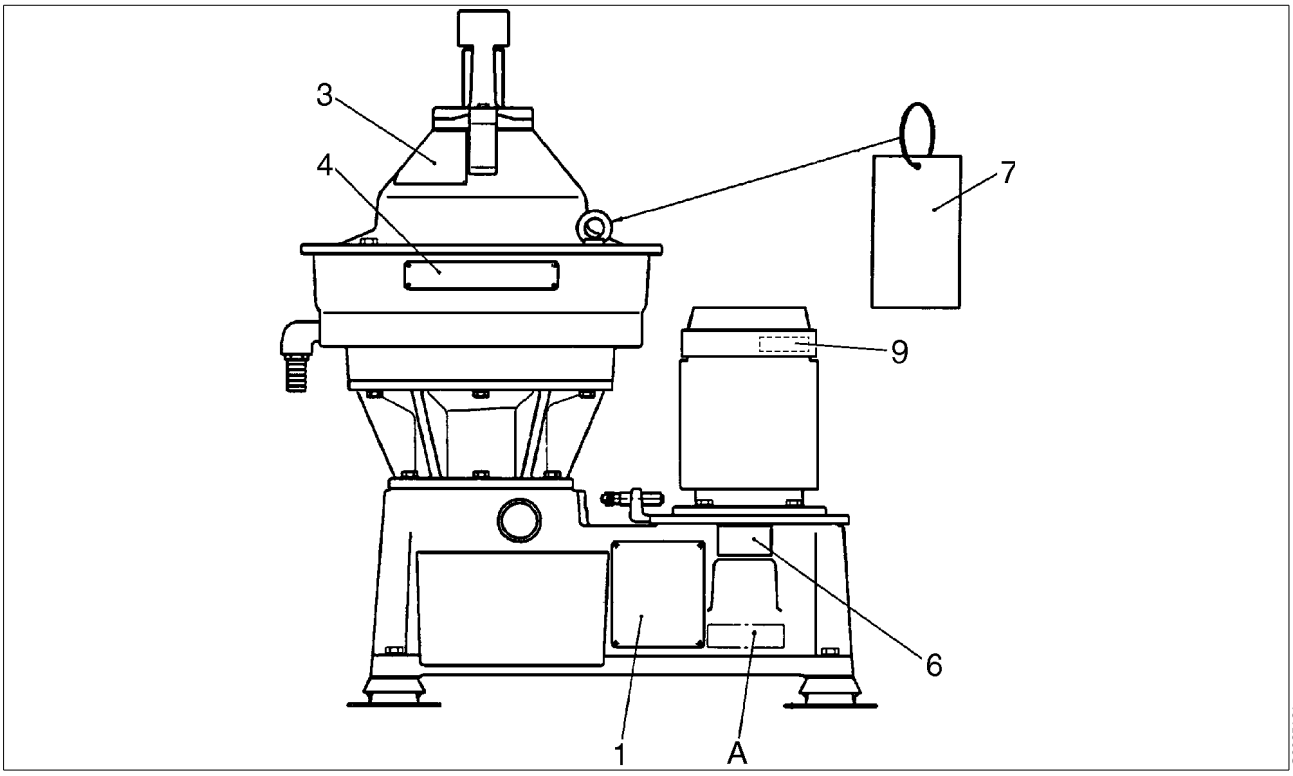
3) The motors can be designed to fulfill requirements of the following Classification Societies:

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 Classific. 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 temperature rise max. 70 °C.

8.6.5 Machine plates and safety labels

Alfa Laval ref. 556430



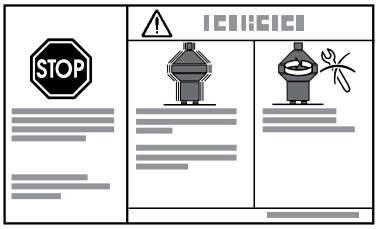
Location of machine plates and safety lables

S0061411

1. Machine plate

Separator	MMPX 303SGP-11
Manufacturing serial No / Year	XXXX
Product No	881099-01-04
Inlet and outlet	544468-01
Bowl	544458-01
Machine bottom part	548009-06/07/08 (50/60/60 Hz)
Max. speed (bowl)	9510 r/min (50 Hz), 9305 r/min (60 Hz)
Direction of rotation (bowl)	←
Speed motor shaft	3000 r/min (50 Hz), 3600 r/min (60 Hz)
El. current frequency	50/60 Hz
Recommended motor power	2,2 kW (50 Hz), 2,2 kW (60 Hz)
Max. density of feed	1100 kg/m^3
Max. density of sediment	2631 kg/m^3
Process temperature min./max.	0/+100 °C

3. Safety label



S0061521

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

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

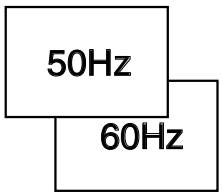
Separator must **stop rotating** before **any** dismantling work is started.

4. Name plate

Alfa Laval

S0063211

6. Power supply frequency



S0063111

7. Label

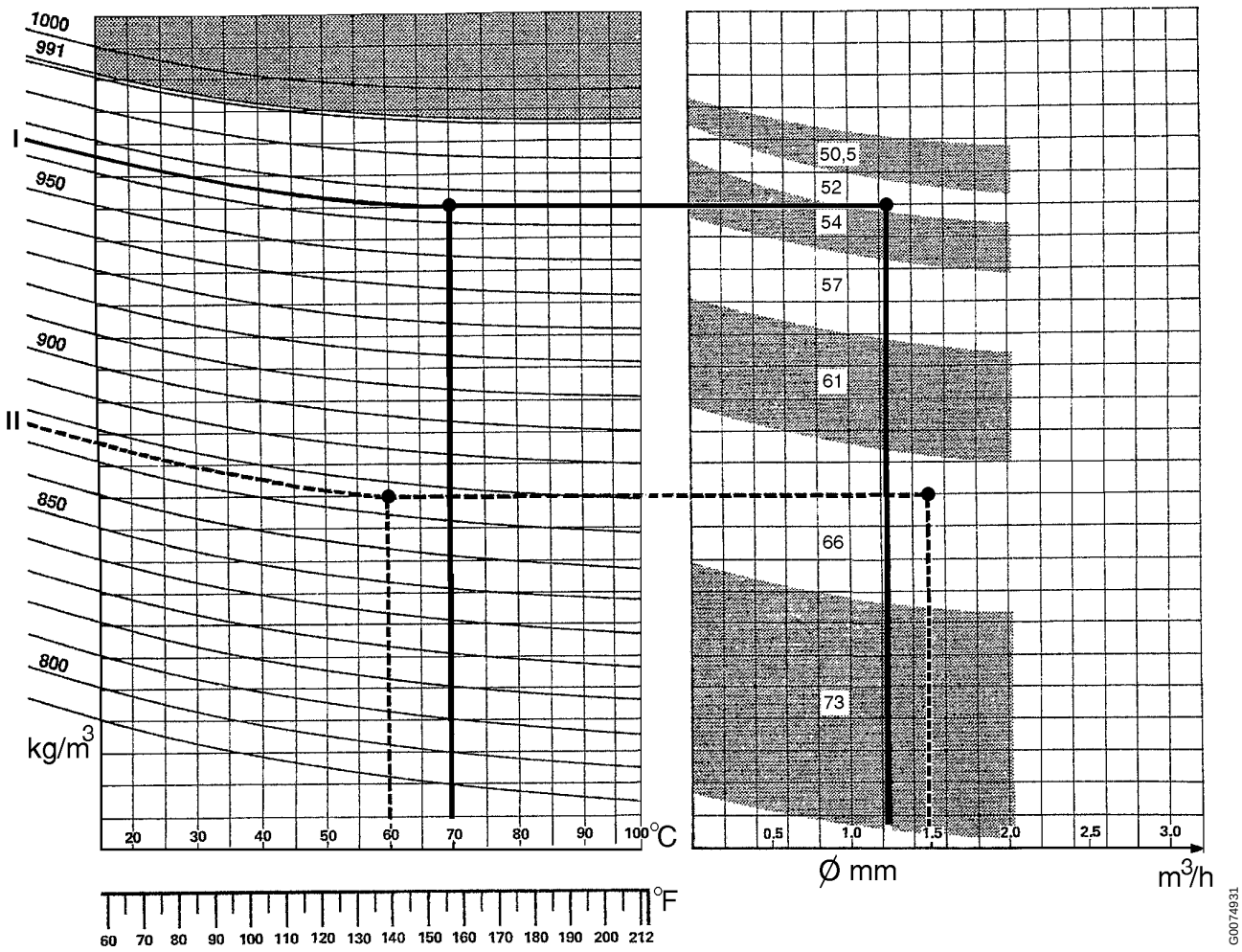
Text on label:

Read the instruction manual before lifting.

9. Space for additional label as specified in the order

A. Space for label indicating representative

8.6.6 Gravity disc nomogram



Oil density, kg/m^3 at 15 ^{o}C

Gravity disc hole diameter, ϕ mm

The nomogram is based on the properties of fresh water.

Example I in nomogram

Reference in graph: _____

Oil density	965 kg/m^3 at 15 °C (60 °F)
Separation temperature	70 °C (158 °F)
Throughput	1,25 m^3/h

From the graphs (heavy line), the correct gravity disc has a hole diameter of 52 mm.

Example II in nomogram

Reference in graph: _ _ _ _ _ _ _

Oil density	875 kg/m^3 at 15 °C (60 °F)
Separation temperature	60 °C (140 °F)
Throughput	1,5 m^3/h

From the graphs (broken line), the correct gravity disc has a hole diameter of 66 mm.

8.7 Storage and installation

8.7.1 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 an 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.

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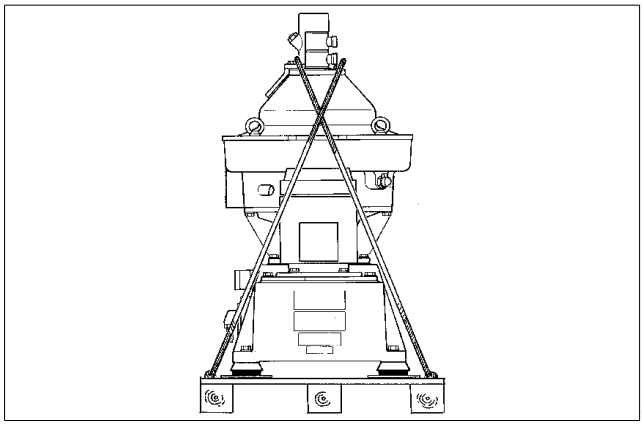
A separator can be delivered with different types of protection:

- Fixed on a pallet.

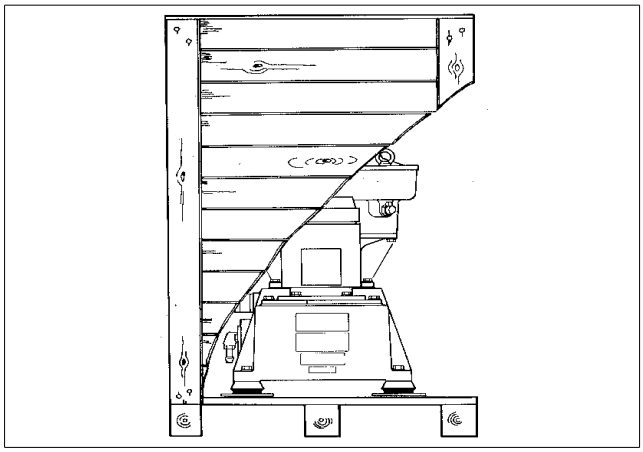
  The separator must be stored in a dry storage room, protected from rain and humidity. It must be well protected from mechanical damage and theft.



Fixed on a pallet

- In a wooden box which is not water tight.

  The separator must be stored in a dry storage room, protected from rain and humidity.

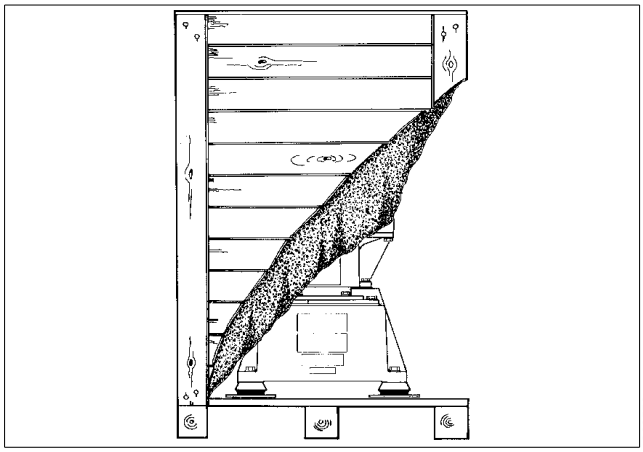


In a wooden box which is not water tight

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

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

  The packaging for outdoor storage is only to special order.



In a special water-resistant box for outdoor storage

Transport

Specification

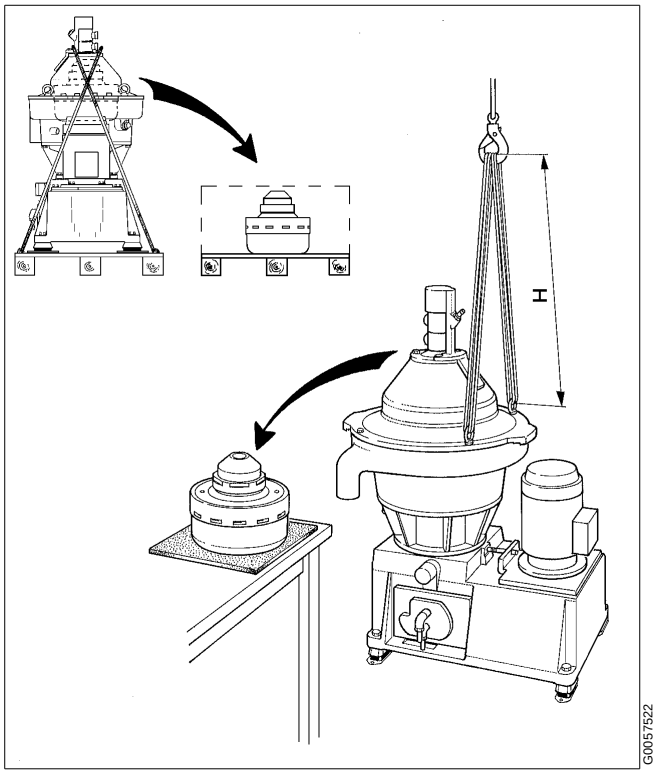
- During transport of the separator, the bowl **must always be removed from the machine and transported separately.**
- When lifting a separator it must always be **hung securely**. See details in chapter “5.6 Lifting instructions” on page 66.

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 dust and dirt.

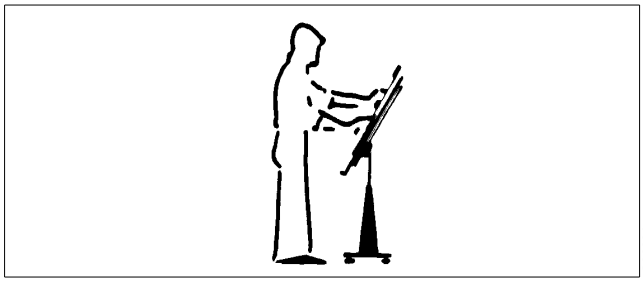


H = minimum 750 mm

8.7.2 Planning of installation

Introduction

The space required for one or more separators can be calculated by consulting “8.6.1 Basic size drawing” on page 156, and instructions for ancillary equipment, electrical and electronic equipment and cables.

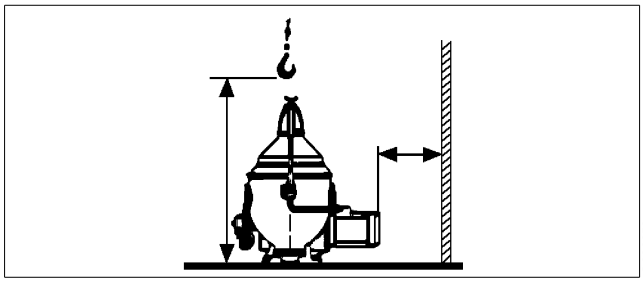


Check the drawings when planning the installation

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 the ‘‘8.6.2 Foundation plan” on page 157 for the service space required with the separator installed.

Recommendation

The spanner for the bowl hood 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 the drawing “8.6.2 Foundation plan” on page 157.

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 oil filling device must not be blocked by floor plate arrangement, etc.

Recommendation

It should be possible to place a portable collecting tray under the oil filling device drain hole.

8.7.3 Foundations

NOTE

When lifting a separator it must always be **hung securely**. See the separate lifting instruction in this book.

Specification

- The separator should be installed at floor level, see ‘‘8.6.2 Foundation plan” on page 157.
- The separator must be installed on a strong and rigid foundation to reduce the influence of vibrations from adjacent machinery.
- The foundation should be provided with a cofferdam.

- Fit the separator frame on the foundation as follows:
  - 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.
  - Tighten the screws.

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