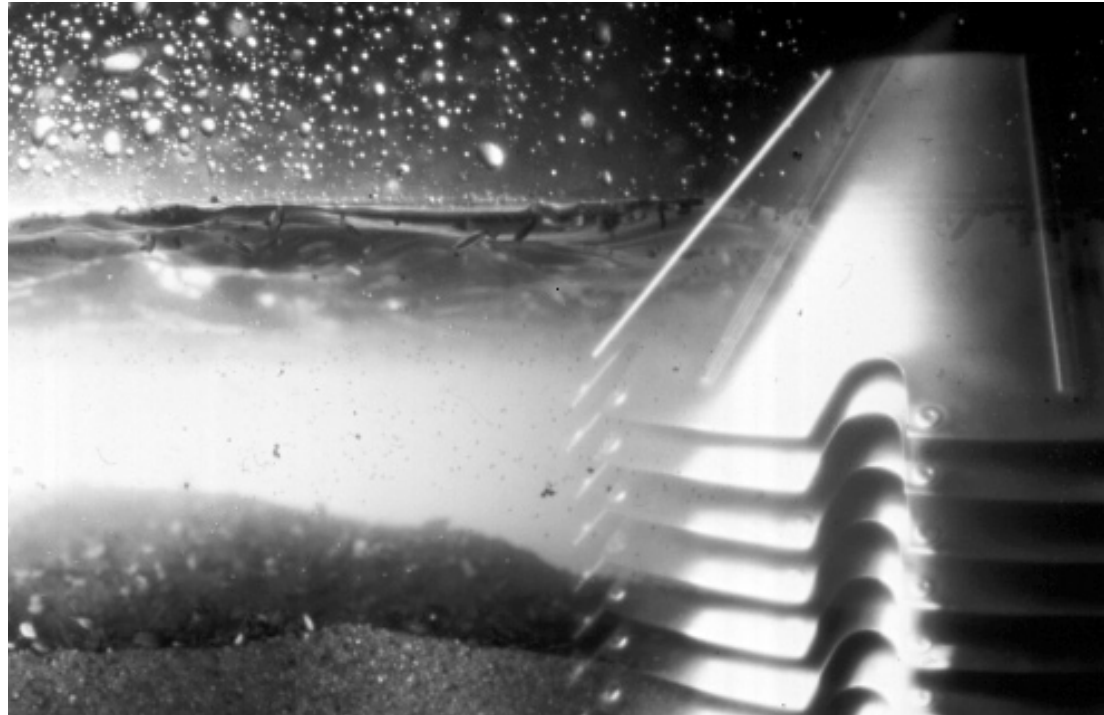


AFPX 517XGV-14CG



Separator Manual

Product No.
Book No.

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

Not following the instructions can result in serious accidents.

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



1 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

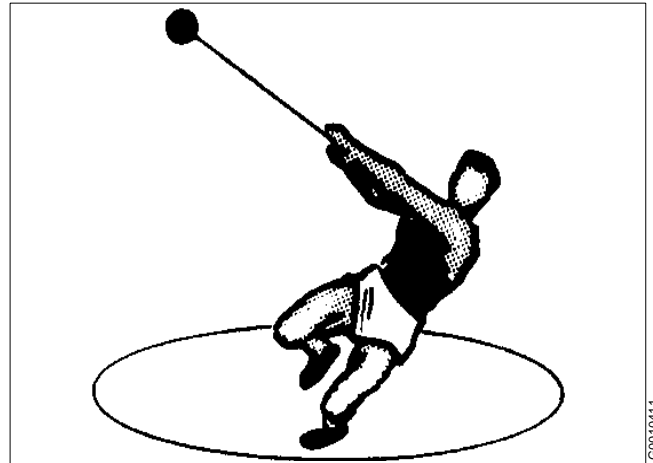
Manufacturing tolerances are extremely fine. Rotating parts are carefully balanced to reduce undesired vibrations that can cause a breakdown. Material properties have been considered carefully during design to withstand stress and fatigue.

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.**



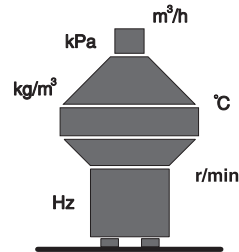
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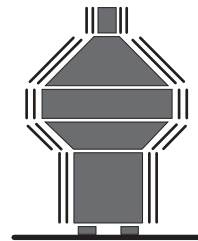
DANGER

Disintegration hazards

- Use the separator only for the purpose and parameter range specified by Alfa Laval.
- If excessive vibration occurs, **stop** separator and **keep bowl filled** with liquid during rundown.
- When power cables are connected, always check direction of motor rotation. If incorrect, vital rotating parts could unscrew.
- Check that the gear ratio is correct for power frequency used. If incorrect, subsequent overspeed may result in a serious break down.
- Welding or heating of parts that rotate can seriously affect material strength.
- Wear on the large lock ring thread must not exceed safety limit. ϕ -mark on lock ring must not pass opposite ϕ -mark by more than specified distance.
- Inspect regularly for **corrosion** and **erosion** damage. Inspect frequently if process liquid is corrosive or erosive.



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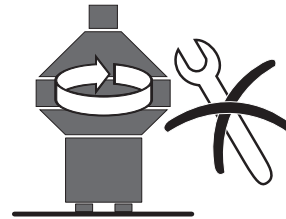
DANGER

Entrapment hazards

- Make sure that rotating parts have come to a **complete standstill** before starting **any** dismantling work.
- To avoid accidental start, switch off and lock power supply before starting **any** dismantling work.
- Assemble the machine **completely** before start. **All** covers and guards must be in place.

Electrical hazards

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



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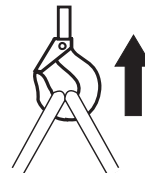
WARNING

Crush hazards

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

Noise hazards

- Use ear protection in noisy environments.



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S0051611



CAUTION

Burn hazards

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

Cut hazards

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



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Warning signs in the text

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



DANGER

Type of hazard

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



WARNING

Type of hazard

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



CAUTION

Type of hazard

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

NOTE

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



2 Separator Basics

Contents

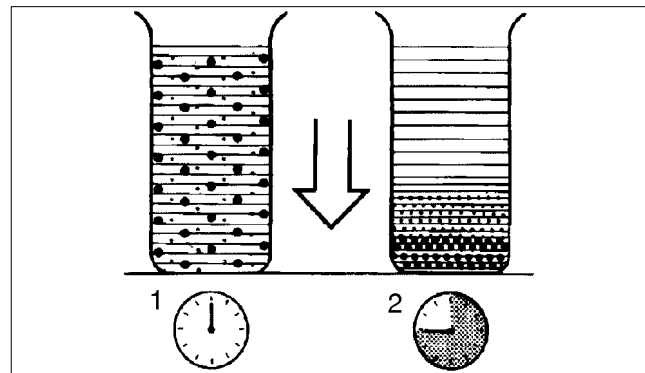
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2.1 Basic principles of separation

2.1.1 Introduction

The purpose of separation can be:

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



Sedimentation by gravity

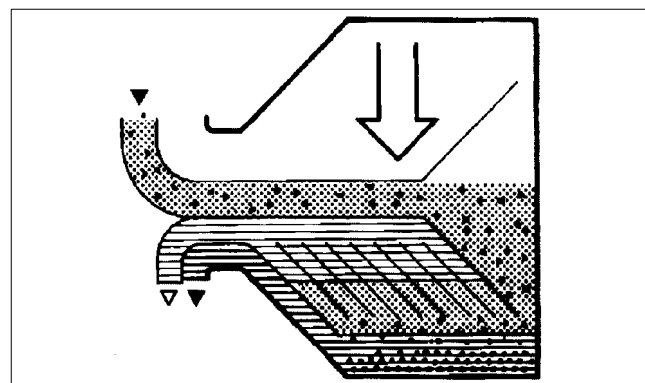
2.1.2 Separation by gravity

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

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

Continuous separation and sedimentation can be achieved in a settling tank having 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

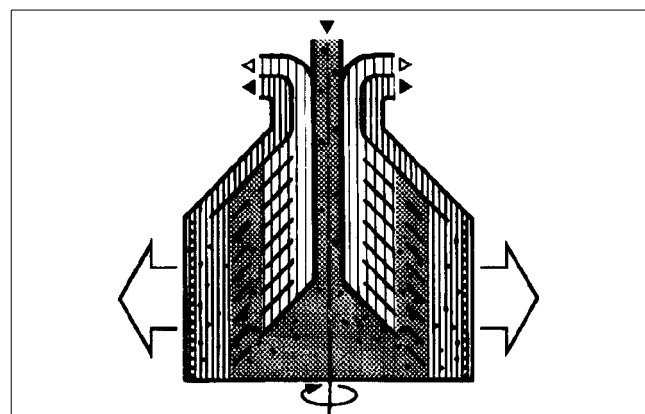
2.1.3 Centrifugal separation

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

Separation and sedimentation is continuous and happens very quickly.

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

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



The centrifugal solution

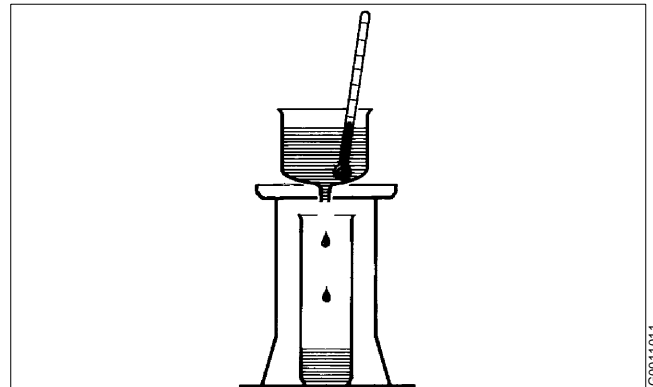
2.1.4 Separating temperatures

Separating temperatures

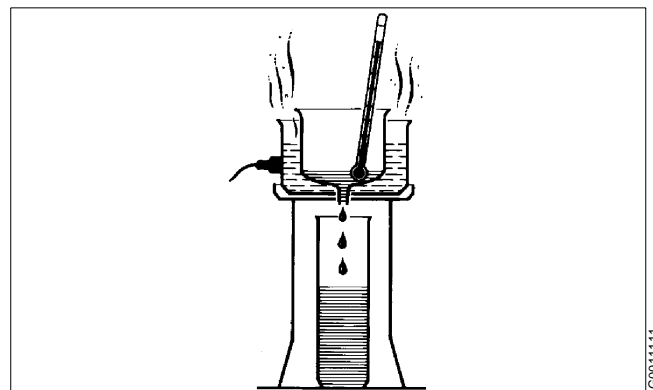
For some types of process liquids (e.g. mineral oils) a high separating temperature will normally increase the separation capacity. The temperature influences oil viscosity and density and should be kept constant throughout the separation.

Viscosity

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



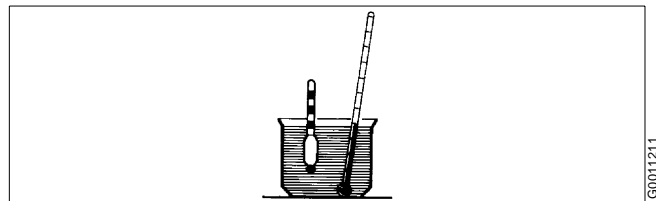
High viscosity (with low temperature)



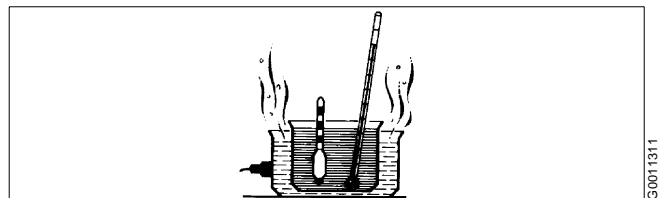
Low viscosity (with high temperature)

Density difference

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



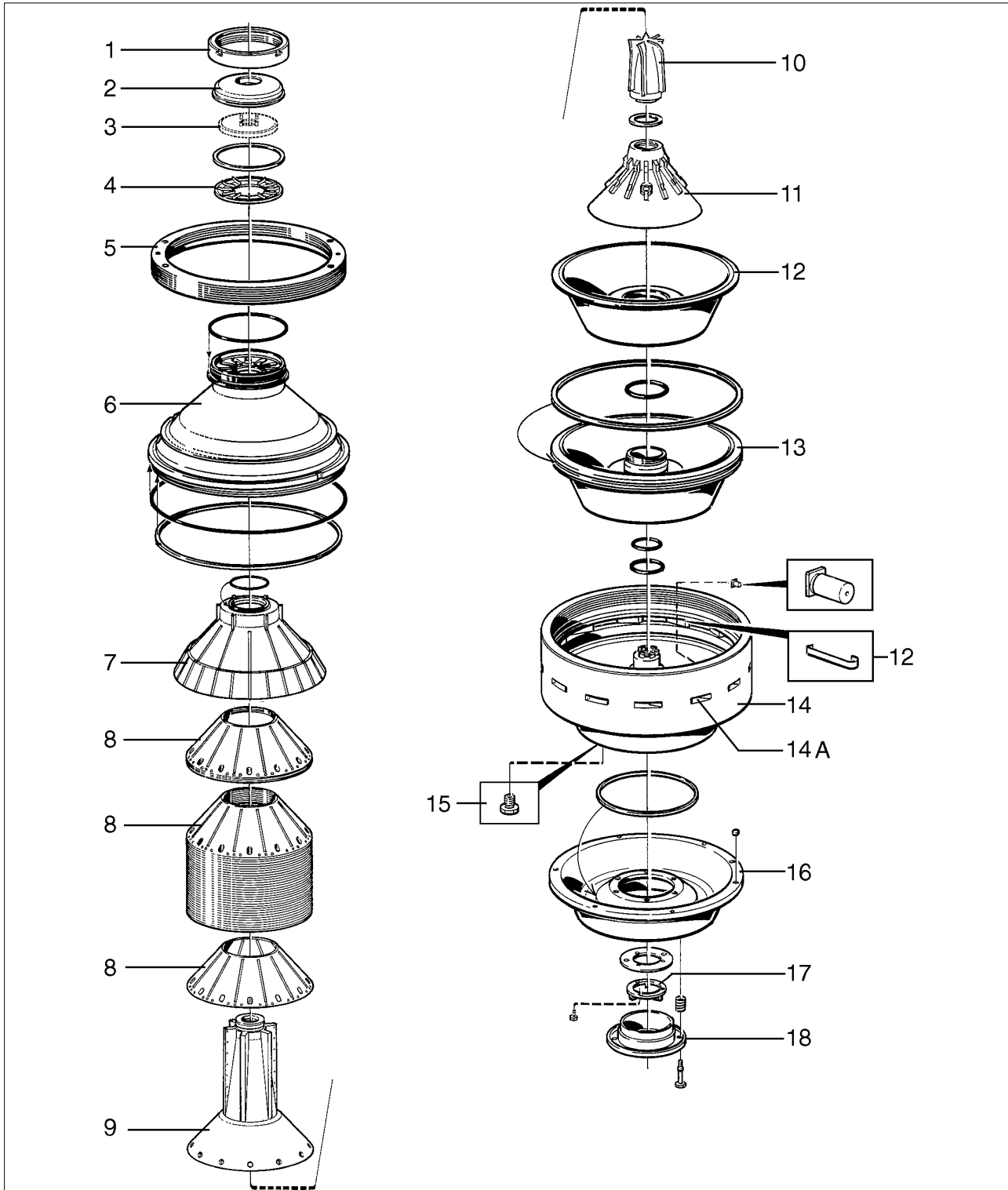
High density (with low temperature)



Low density (with high temperature)

2.2 Mechanical function

2.2.1 Bowl



Purifier bowl

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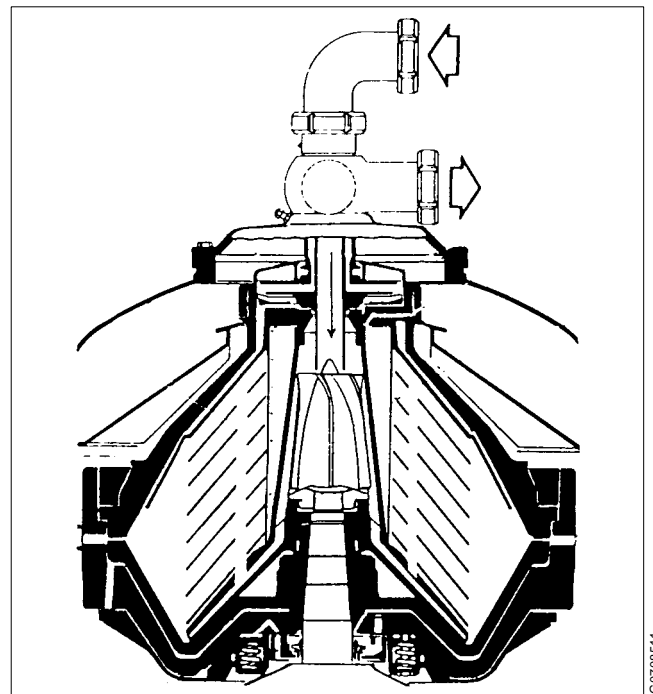
- | | |
|---|---|
| 1. Lock ring, small
(left-hand threaded) | 10. Cap nut (left-hand threaded) |
| 2. Paring chamber cover | 11. Distributing cone |
| 3. Paring disc for heavy phase | 12. Lining (erosion protection) |
| 4. Gravity disc | 13. Sliding bowl bottom* |
| 5. Lock ring, large
(left-hand threaded) | 14. Bowl body |
| 6. Bowl hood | 14a. Sediment port* |
| 7. Top disc | 15. Draining nozzle (3 pcs) for
operating water* |
| 8. Bowl discs | 16. Operating slide* |
| 9. Distributor | 17. Sleeve with wings (conveyor)* |
| | 18. Spring support with springs* |

The parts by which the sediment ejections are effected are marked with an asterisk (*) in the list above.

The bowl body (14) and the bowl hood (6) which make up the casing of the bowl are held together by the large lock ring (5).

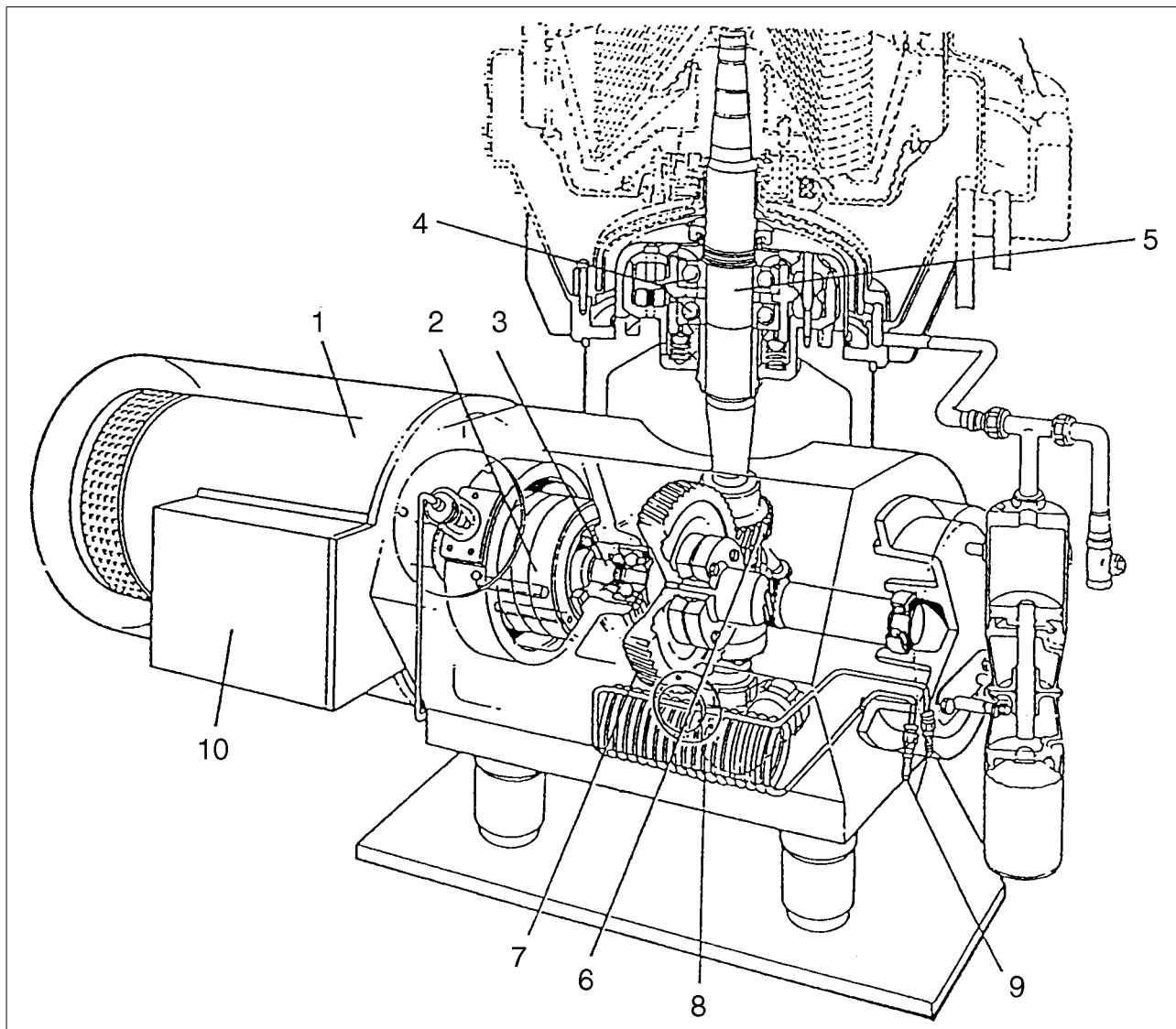
Housed in the bowl are the distributor (9), the distributing cone (11) and the disc set (8), where the separation takes place. Uppermost in the disc set is the top disc (7).

Replacement of certain parts necessitates rebalancing of the bowl.



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2.2.2 Power transmission



G0567641

- | | | |
|---|--|--------------------|
| <ul style="list-style-type: none"> 1. Electric motor (Note! Special motor with built-in thermistors, used for separators with flexible coupling) 2. Flexible coupling 3. Worm wheel shaft 4. Top bearing 5. Bowl spindle | <ul style="list-style-type: none"> 6. Worm 7. Worm wheel 8. Cooling coil for oil bath 9. Cooling water inlet/ outlet for coil 10. Box for electric and thermistor connections | <p>} Worm gear</p> |
|---|--|--------------------|

The motor (1) rotates the bowl through the coupling (2) and the worm gear (6, 7). The worm gear serves to adapt the bowl speed to the motor speed. The number of revolutions of the bowl is a few times higher than that of the motor.

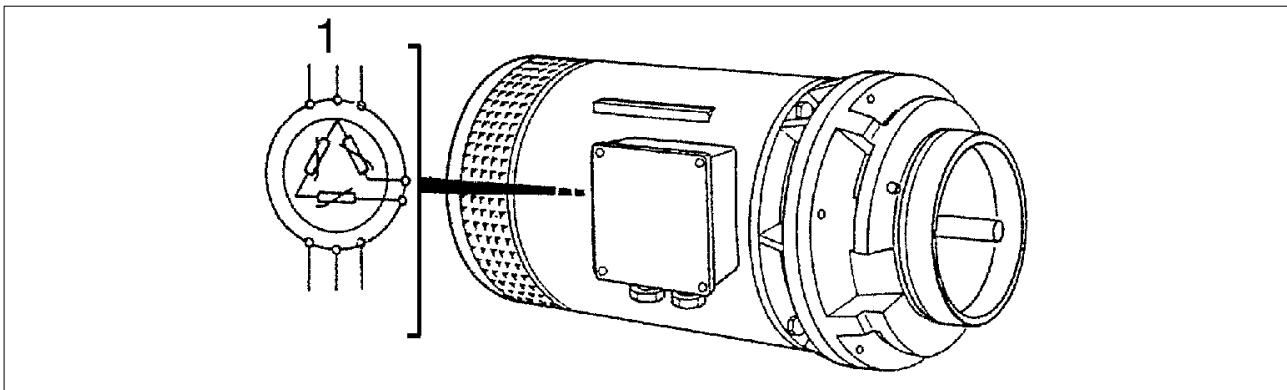
The bearings on the bowl spindle (5) and the worm wheel shaft (3) are lubricated by the oil mist produced by the worm wheel (7), which dips into the oil bath in the worm gear housing.

The worm gear has been specially designed to operate at a low sound level.

To keep the oil temperature low, a cooling coil is installed in the worm gear housing for some machines.

The oil is cooled by the water flowing through the coil (8).

2.2.3 Motor and starter



1. *Thermistors*

Run-up period: Y-connected
Operation: D-connected

This separator has a flexible coupling and for this reason the motor must be able to endure long run-up times.

The motor supplied with the separator has some extra features compared with a standard three phase motor with the same kW rating. It has a higher class of insulation, a higher rotor resistance and larger iron masses. These features counteract the temperature rise in the motor when starting. Furthermore, the motor is provided with thermal sensors in the form of thermistors in the stator windings. The thermistors must be connected to a special tripping device in the starter.

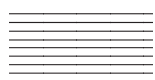
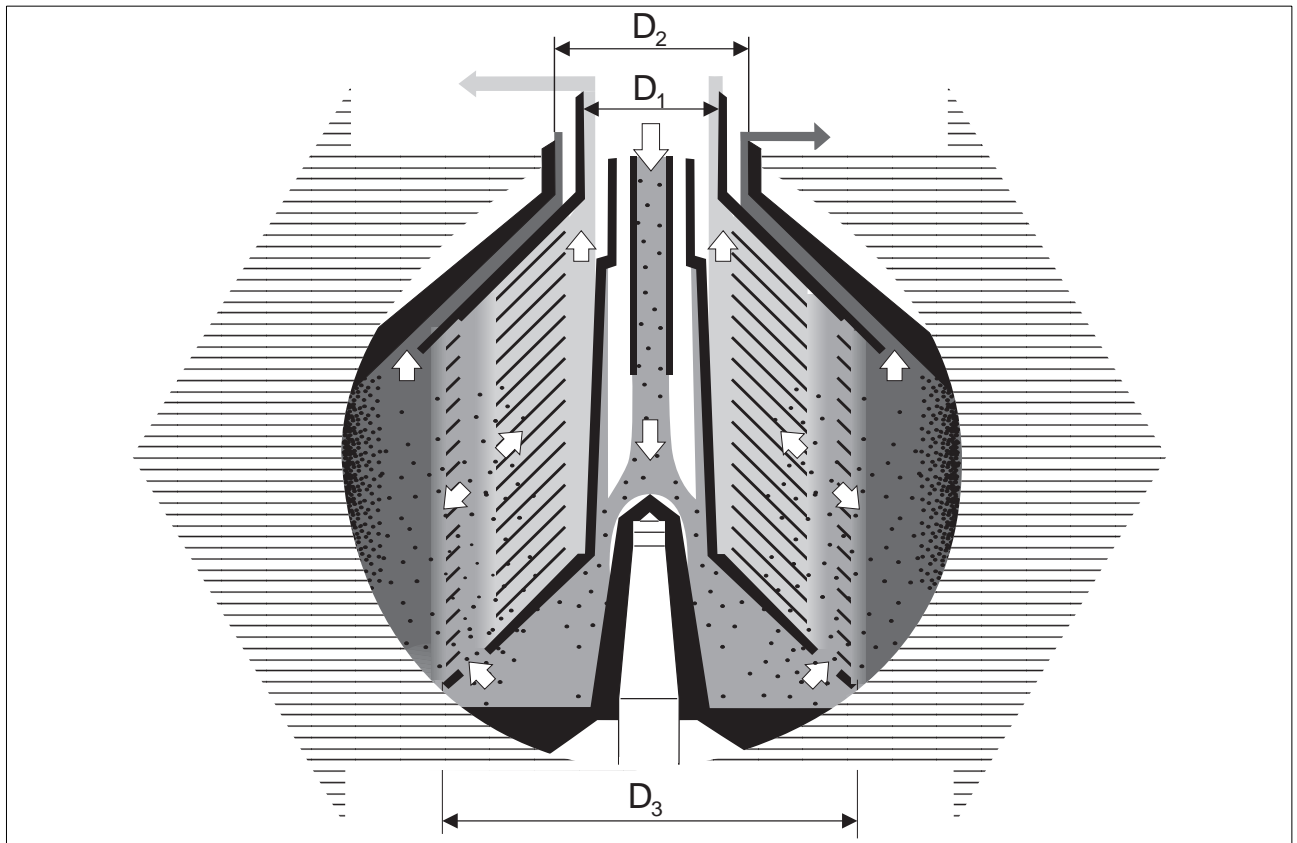
These motors have been designed by Alfa Laval as "Control-torque motors" - abbreviated to **CT motors**.

The overload protection (e.g. in the form of bimetal relays) in the starter must be connected into the D circuit. The protection must be inoperative during the run-up period.

Notice that the sediment discharge process will produce an increase in current consumption.

2.3 Separating function

2.3.1 Normal separation



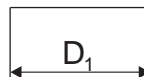
Centrifugal force



Bowl parts



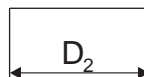
Process liquid



D_1 Diameter of inner outlet



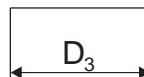
Heavy liquid phase



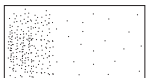
D_2 Diameter of outer outlet (same as inner diameter of gravity disc)



Light liquid phase



D_3 Diameter of interface



Sediment (solids)

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Purificator bowl (two liquid outlets)

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

When the liquid reaches slots in the base of the distributor, it will rise through the channels formed by the disc stack where it is evenly distributed and 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 in the sediment space. 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 the illustration on previous page).

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 the illustration on previous page).

Liquid seal

In the purificator bowl the liquid seal prevents the light liquid phase from passing the other edge of the top disc, thus eliminating discharge through the outer path. The liquid seal is formed automatically by the movement of the heavy phase towards the periphery of the bowl. The dividing surface between light and heavy phases is called the interface. The location of the interface will be affected by the relative difference in density between the phases, but is also dependent on outer and inner inlet diameters (D_2 and D_1 , respectively).

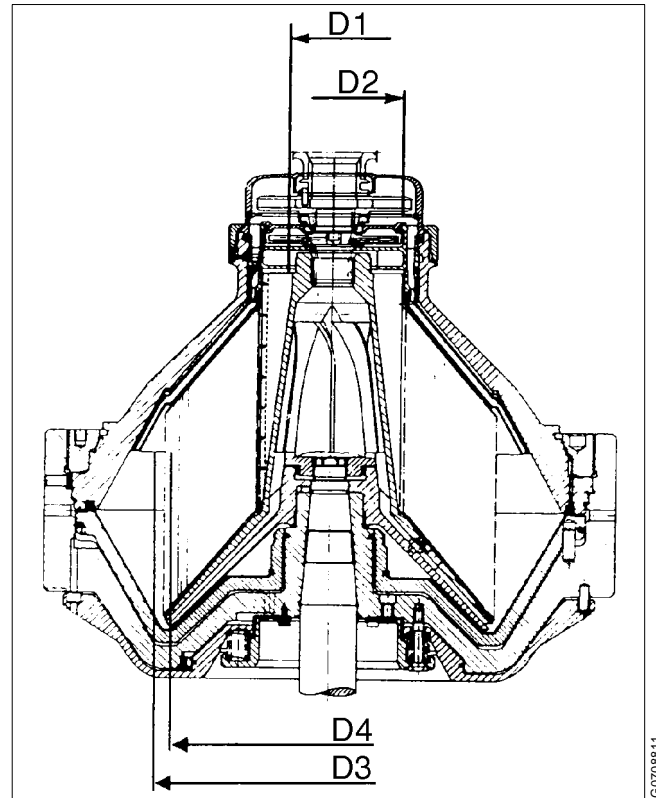
Setting the interface

The purificator bowl is adjusted for separating liquid mixtures of varying density by altering the diameter of the heavy phase outlet (D_2). A number of gravity discs for this purpose are included in the machine delivery.

The location of the interface depends on which phase must be the cleanest one, but also on the ratio between light and heavy phases.

If the light phase must contain less of the heavy phase, the interface is to be located nearer the periphery D_3 of the bowl by fitting a gravity disc with a **larger** hole.

If the heavy phase must contain less of the light phase, the interface is to be located nearer the centre D_4 of the bowl by fitting a gravity disc with a **smaller** hole. The interface must not be located inside the distributing holes of the bowl discs as untreated liquid could then be discharged through the light phase outlet.

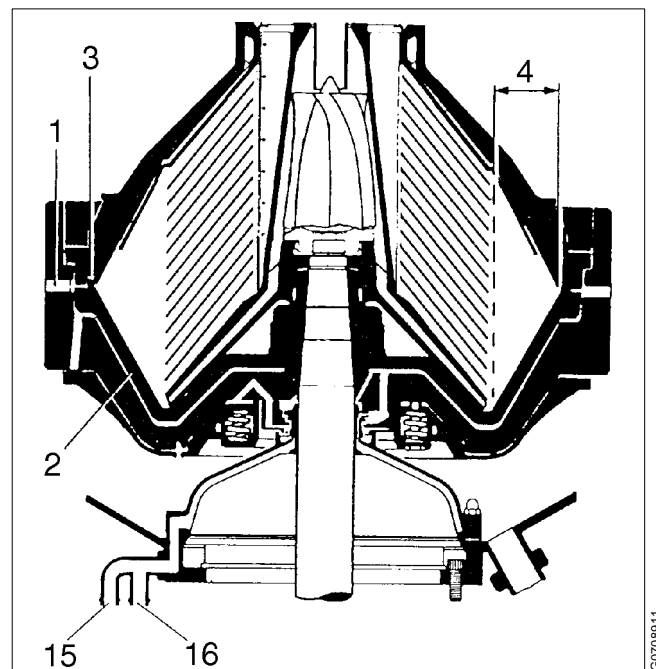


2.4 Sediment discharge function

2.4.1 General information

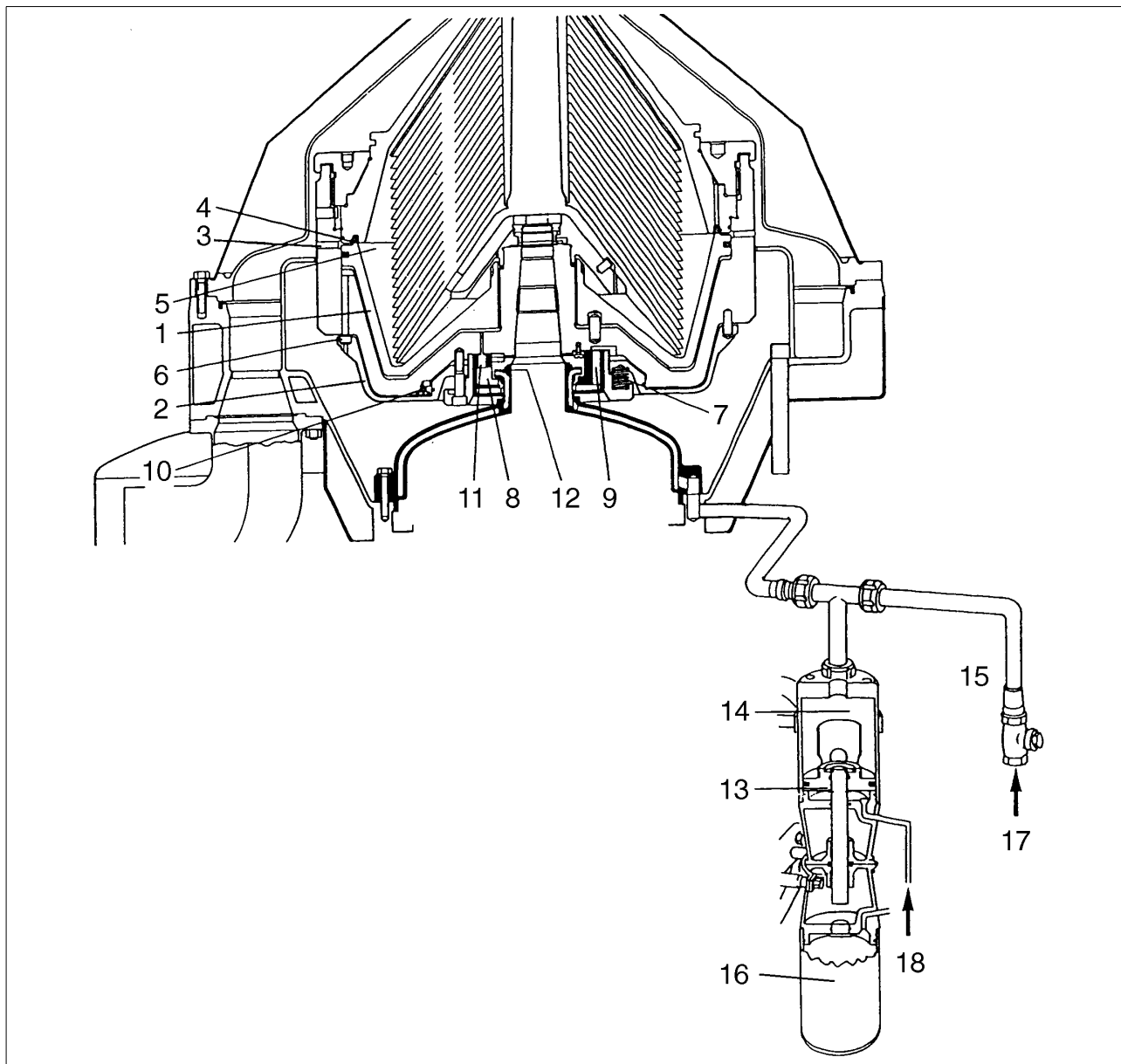
The sediment ejection takes place through a number of ports (1) in the bowl wall. Between ejections the sediment ports are closed by a large valve slide called the sliding bowl bottom (2), which forms an international bottom in the separating space. The sliding bowl bottom is forced upwards against a seal ring (3) by the operating liquid pressure acting on its underside.

When the sediment space has been partly filled, operating water is fed to the ejecting mechanism, the sliding bowl bottom opens for a moment, and the sediment is thrown out through the ports.



1. Sediment ports (slots)
2. Sliding bowl bottom
3. Seal ring
4. Sediment space
15. Operating water connection
16. Operating water connection

2.4.2 Operating water system



Bowl

- 1. Sliding bowl bottom
- 2. Operating slide
- 3. Sediment ports
- 4. Seal ring
- 5. Sediment space
- 6. Valve plugs
- 7. Coil springs
- 8. Closing water chamber
- 9. Opening water channel (discharge)
- 10. Drain nozzle
- 11. Closing water channel
- 12. Control paring disc

OWM (Operating water module)

- 13. Piston
- 14. Operating water chamber
- 15. Check valve
- 16. Pressure chamber
- 17. Inlet for operating water
- 18. Inlet for compressed air (from reducing valve)

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The sediment discharge takes place through a number of ports (3) in the bowl wall. Between discharges these ports are closed by the sliding bowl bottom (1), which constitutes an internal bottom in the separating space. The sliding bowl bottom is held against a seal ring (4) by the water acting on its underside. The pressure is produced during the rotation because of the centrifugal force and increases with the distance from the axis of rotation of the bowl. The operating water exerts an upward pressure exceeding the counter-acting downward pressure from the process liquid because the underside of the sliding bowl bottom has a larger pressure surface than its upper side.

The space below the sliding bowl bottom is kept closed by valve plugs (6) seated in an operating slide (2). This slide is forced upwards by coil springs (7). A constant water level is held in the operating water chamber (8) by means of a paring disc (12).

- When a discharge shall be effected the solenoid valve(s) opens and the compressed air forces the piston forwards. Water is now supplied in such quantity that water flows over the edge of operating water chamber and onwards through the channel (9) to the upper side of the operating slide.
- The slide is forced downwards by the liquid pressure created between the operating slide and the bowl body thereby opening the valve plugs enabling the closing water under the sliding bowl bottom to escape.
- The sliding bowl bottom is pressed downwards, uncovering the ports in the bowl wall so that the sediment is discharged.
- The water on the upper side of the operating slide is drained off through a nozzle (10).
- When water has been sufficiently drained through the nozzle, the coil springs again force the operating slide upwards, closing the valve plugs. The sliding bowl bottom is forced upwards by the operating water supply. Thus the bowl is closed.
- The low pressure water is supplied during the whole cycle.
- The operating water now presses the PX-OWM piston back into its end position by means of the operating water pressure. The discharge is completed.

2.5 Factors influencing the separating result

2.5.1 Viscosity and density

See “2.1.4 Separating temperatures” on page 13.

2.5.2 Size and shape of particles

The round and smooth particles (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 out than smaller ones (2) even if they have some density.

2.5.3 Phase proportions

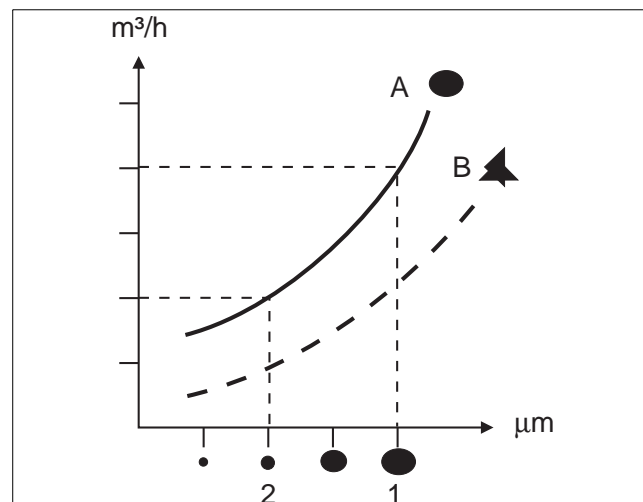
An increased quantity of heavier phase in a process liquid will influence the separating result through the optimum transporting capacity of the disc set. An increased concentration in the process liquid can be compensated by reducing the throughput in order to restore the optimum separating efficiency.

2.5.4 Optimum output

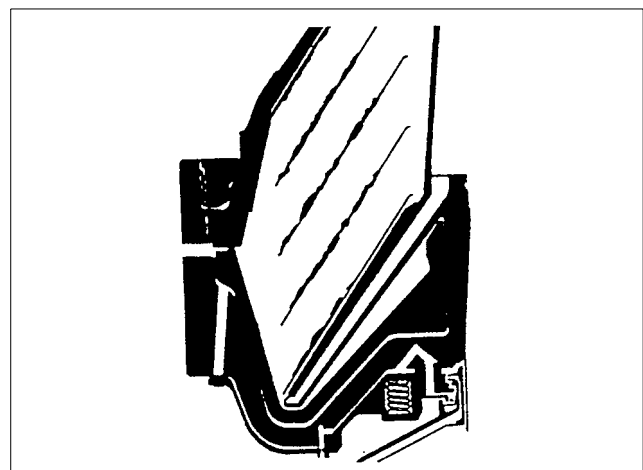
The optimum output depends on the separating ability and the sediment space volume of the bowl relative to the concentration, particle size, differential density and viscosity of the process liquid.

2.5.5 Properties of the sediment

Some types of sediment can through adhesion from deposits in the bowl, thereby reducing the separating efficiency. In such cases the cleaning programme after separation must be adjusted.



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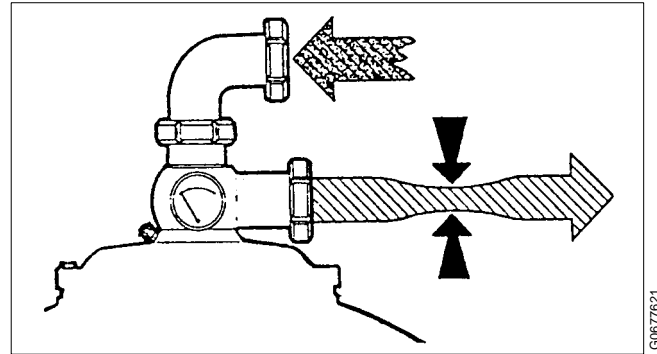
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2.5.6 Disc stack

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

2.5.7 Back pressure regulation

Be careful not to select too high a back pressure when setting it, as otherwise there will be a risk of leakage from the distributor (unseparated process liquid) into the paring chamber (separated liquid) or from the paring chamber into the frame hood. Too low a back pressure is, however, unfavorable too if you want to prevent air from intermingling with the treated liquid (via the paring chamber).



2.5.8 Gravity disc (for purifier /concentrator)

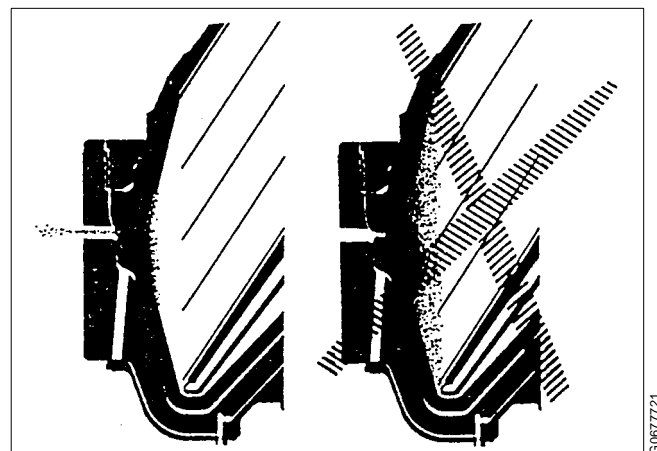
The position of the interface is adjusted by altering the outlet opening of the heavy liquid phase, that is by exchanging the gravity disc.

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.

See also “ Setting the interface” on page 21.

2.5.9 Sediment ejection

With a high content of solid in the process liquid ejection is required at shorter intervals. An overfilled sediment space impairs the quality of the treated liquid.



2.6 Interval between sediment ejections

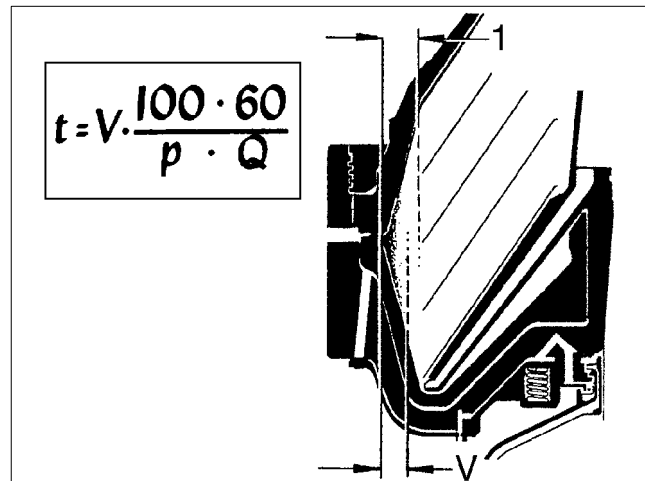
If the solids content of the process liquid expressed in percent by volume of wet sediment is known or can be established (for instance in a test-tube centrifuge), the formula below can serve as a guidance for the selection of sediment ejection intervals.

t = Theoretic maximum time in minutes between two ejections.

p = Percent by volume of wet sediment in the process liquid.

Q = Throughput in litres/hour.

V = The sediment volume (in litres or dm^3) which may be allowed to accumulate in the bowl without impairing the separating result or without packing too firmly. As a rule, "V" should be maximum three quarters of the sediment space volume, calculated from the outer edge of the top disc. Sediment space volume – see "7.1 Technical data" on page 162.



1. Total sediment space volume
V. Allowed sediment volume

2.7 Bowl cleaning (washing)

2.7.1 Introduction

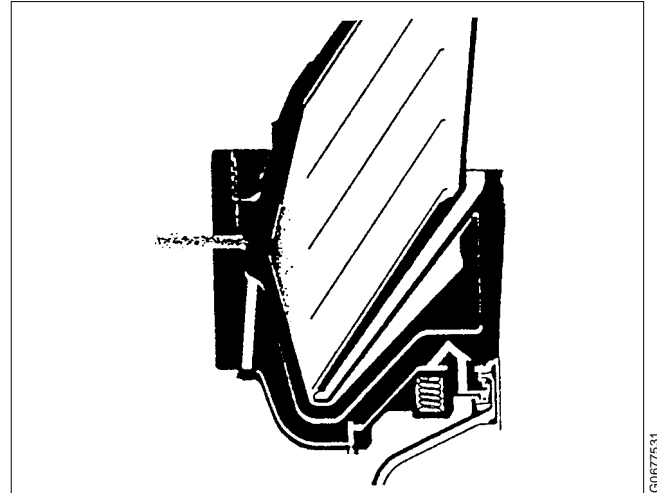
The bowl need not be dismantled after every run. It can be adequately cleaned by rinsing or circulation washing before being stopped.

In some cases it will do to shut off the process liquid feed, supply a rinsing liquid, e.g. water, instead, and execute 5 to 10 sediment ejections.

In other cases the bowl must be cleaned by circulation washing before being stopped, i.e. by circulating various rinsing and cleaning liquids through the machine according to a fixed programme. During the various washing stages the bowl must be emptied several times.

As the washing procedure can vary from case to case depending on the type of detergent, temperatures, and the solids content in the process liquid, the washing programme cannot be determined in advance but must be found out through practical experiments in each particular case.

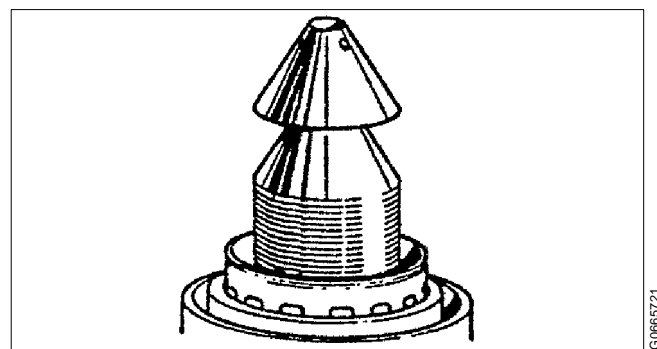
To save detergent, it may be preferable to execute only small ejections during the washing stages proper, whereas only large ejections should, as a rule, be performed during the rinsing stages.



G00677531

2.7.2 Check on cleaning

The bowl should be dismantled and the cleaning checked approx. 3 – 4 days after the first operation with product. Repeat the check after a further 14 days. If the results are favourable the bowl can be left untouched until a small overhaul is due.



G00665721

2.8 Definitions

Back pressure	Pressure in the separator outlet.
Concentration	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 heavier liquid phase (water), which is the major part of the mixture, shall be concentrated as far as possible.
Counter pressure	See Back pressure.
Density	Mass per volume unit. Expressed in kg/m ³ at specified temperature, normally at 15 °C.
Gravity disc	Disc in the bowl hood for positioning the interface between the disc stack and the outer edge of the top disc. This disc is only used in purifier mode.
Interface	Boundary layer between the heavy phase (water) and the light phase (oil) in a separator bowl.
Intermediate Service (IS)	Overhaul of separator bowl, inlet/outlet and operating water device. Renewal of seals in bowl inlet/outlet and operating water device.
Major Service (MS)	Overhaul of the complete separator, including bottom part (and activities included in an Intermediate Service, if any). Renewal of seals and bearings in bottom part.
Sediment (sludge)	Solids separated from a liquid.
Sediment discharge	Ejection of sediment from the separator bowl.
Throughput	The feed of process liquid to the separator per time unit. Expressed in m ³ /or lit/h.
Viscosity	Fluid resistance against movement. Normally expressed in centistoke (cSt = mm ² /sec), at specified temperature.

3 *Operating Instructions*

Contents

3.1	Operating routine	30
3.1.1	Before first start	30
3.1.2	Selection of gravity disc	31
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3.1.4	Start	33
3.1.5	Running	34
3.1.6	Normal stop	35
3.1.7	Emergency stop	36

3.1 Operating routine

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

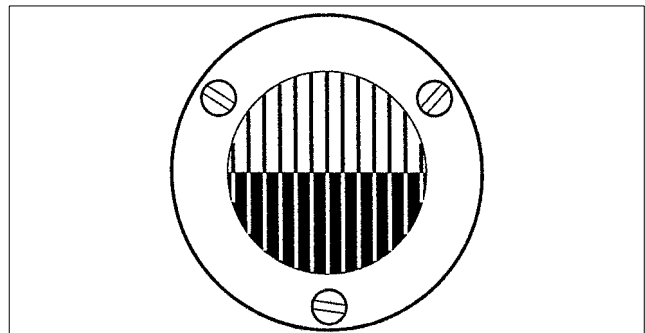
3.1.1 Before first start

Technical demands for connections and logical limitations for the separator is described in the chapter "7 Technical Reference" on page 161 in the documents:

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

Before first start the following check points shall be carried out:

- Ensure the machine is installed correctly and that feed lines and drains have been flushed clean.
- Fill oil in the gear housing. Fill up to the middle of the sightglass. Use the correct grade of oil. The separator is delivered without oil in the worm gear housing. For grade and quality, see "7.6 Lubricants" on page 180.



Fill oil in the gear housing

3.1.2 Selection of gravity disc

The separator is delivered with a set of gravity discs.

How to replace a gravity disc is described in “5.4 Separator bowl” on page 90.

The diameter of a gravity disc sets the position of the interface between heavy and light phases in the separator. The separation efficiency can be optimized by selection of the correct diameter for each process.

When selecting a gravity disc the general rule is to use the disc having a hole making the heavy phase as clean as possible.

The heavier or more viscous the light phase the smaller the diameter should be.

When the heavy phase is wanted more free from the light one, the interface should be placed nearer the bowl centre.

For a more detailed description of the interface position, see “Setting the interface” on page 21.

In practical operation, practice the following general rule:

1. Fit a gravity disc of middle size.
2. Run the separator.
3. Observe the content of the heavy phase by taking a sample.
 - If too much heavy phase in the sample, stop the separator and fit the next **smaller** gravity disc.
4. Repeat steps 1-3 above until having the gravity disc with a hole diameter giving the most clean heavy phase.

NOTE

A too small hole diameter will result in losses of heavy phase through the light phase outlet.

3.1.3 Ready for start

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

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

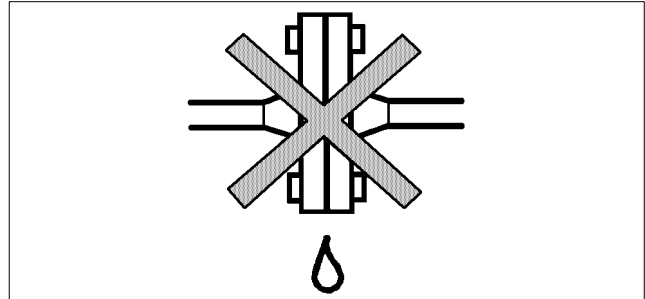


CAUTION

Burn hazards

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

Escaping hot and/or corrosive liquid can cause skin injuries.



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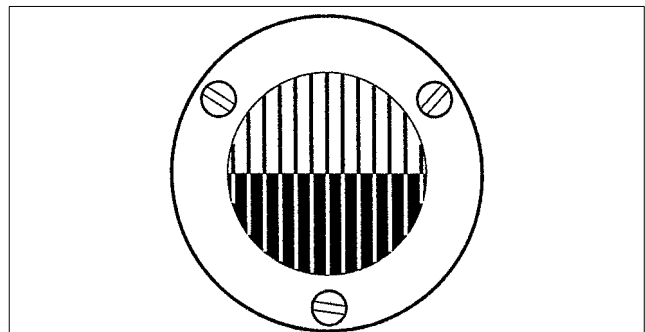
Check for leakages (not admitted)

3. Check that the oil level is in the middle of the sight glass.
Fill if necessary. See chapter "7.6 Lubricants" on page 180 for a list of recommended oils.

NOTE

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

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




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Check the oil level

4. Make sure that the brake is released.

3.1.4 Start

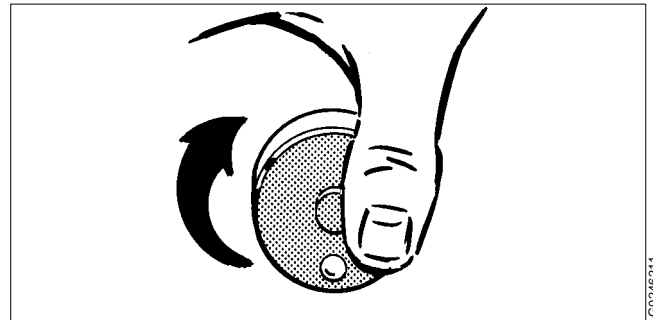
1. Start the separator.
2. Check the direction of rotation of the bowl.
The revolution counter should turn clockwise.



DANGER

Disintegration hazards


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



Check for correct direction of rotation

G0246211

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

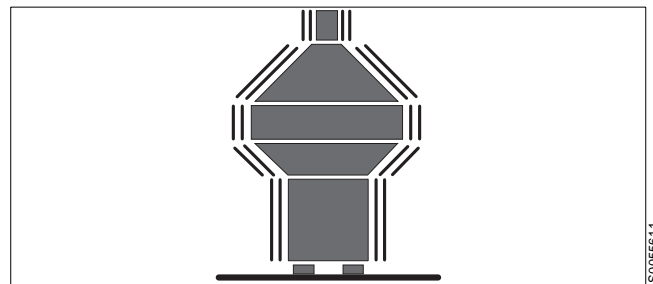


DANGER

Disintegration hazards

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

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



Check for vibration

S005611

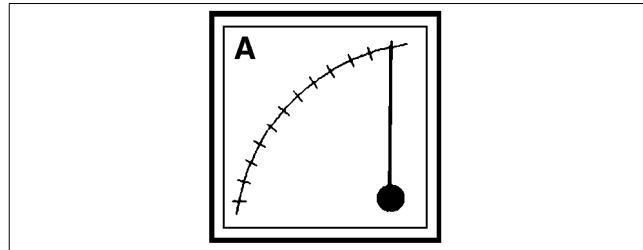
In the trouble-tracing chapter “6.2.3 Separator vibrates” on page 153, a number of causes are described that can create vibration.

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

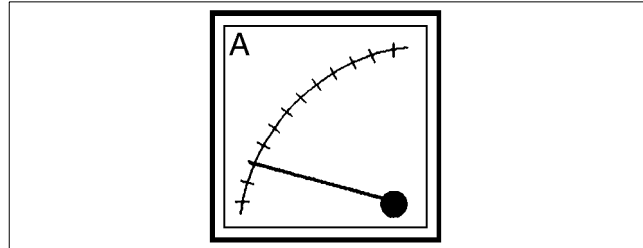
During start, the current reaches a peak and then drops slowly to a low and stable level, which is the normal current during operation.

The time to reach full speed may not exceed the limit given in chapter "7 Technical Reference" on page 161.

5. When running normally, open the make-up liquid valve (connection 375) to close the bowl.



Current increases when the coupling engages...



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

3.1.5 Running

1. When the process liquid conditions are correct, start the feed (201).
2. Adjust to desired throughput.
3. Check the separator inlet and outlet pressures.
Adjust the outlet pressure (back pressure).
For permissible pressures, temperatures and flows, see section "7.1 Technical data" on page 162 and "7.3 Connection list" on page 168.
4. Discharge by opening the valve for discharge liquid (connection 375) until a discharge is heard. For max. and min. time for discharge intervals, see chapter "7.1 Technical data" on page 162.



DANGER

Disintegration hazards

Ensure that correct discharge intervals and cleaning procedures are used.

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

3.1.6 Normal stop

1. Shut off the feed.
2. Carry out a sediment discharge before stopping the separator. Otherwise the bowl must be cleaned manually before the next start up.
3. Stop the separator with the bowl filled.
4. Apply the brake.

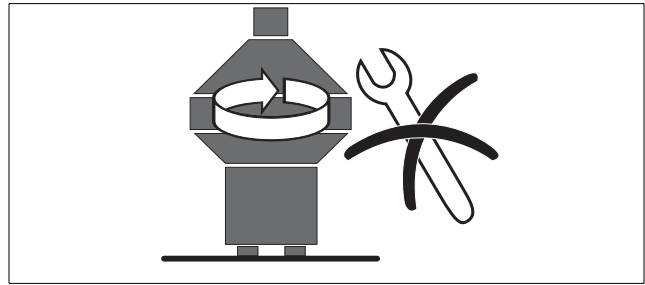
3.1.7 Emergency stop



DANGER

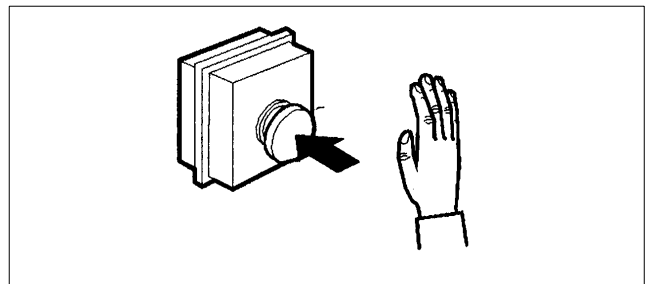
Entrapment hazards

Make sure that rotating parts have come to a **complete standstill** before starting **any** dismantling work. The revolution counter and the motor fan indicate if the separator parts are rotating or not.



The separator must not be dismantled before standstill

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



Push the emergency stop if excessive vibration



DANGER

Disintegration hazards

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



CAUTION

Disintegration hazards

After an emergency stop the cause of the fault must be identified.

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

4 Maintenance Directions


Contents

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4.1 Periodic maintenance

4.1.1 Introduction

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



DANGER

Disintegration hazards

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

4.1.2 Maintenance intervals

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

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

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

Oil change

The oil change interval is every **1000-1500 hours** or at least once every year if the total number of operating hours is less than **1000-1500 hours**.

Intermediate Service (IS)

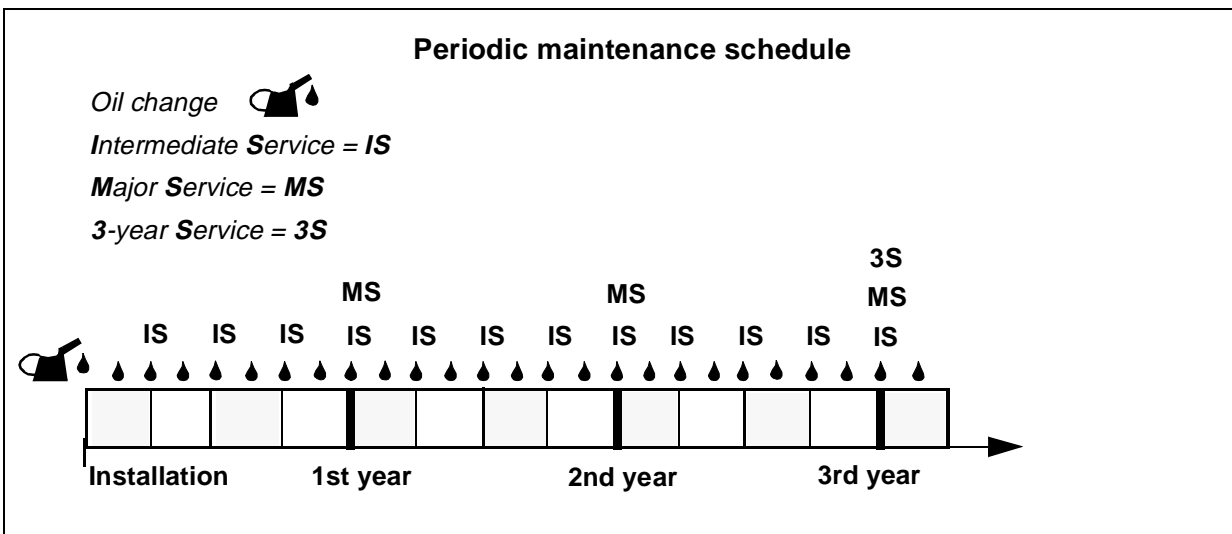
Intermediate Service consists of an overhaul of the separator bowl, inlet/outlet and operating device every **3 months** or **2000 operating hours**. Seals in bowl and gaskets in inlet/outlet device are renewed.

Major Service (MS)

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

3-year Service (3S)

3-year Service consists of renewing the frame feet. The feet get harder with increased use and age.



4.1.3 Maintenance procedure

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

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

1. Dismantle the parts as mentioned in the maintenance log and described in chapter “5 Dismantling – Assembly” on page 81.
Place the separator parts on clean, soft surfaces such as pallets.
2. Inspect and clean the dismantled separator parts according to the maintenance log.
3. Fit all the parts delivered in the service kit while assembling the separator. The assembly instructions have references to check points which should be carried out before and during the assembly.

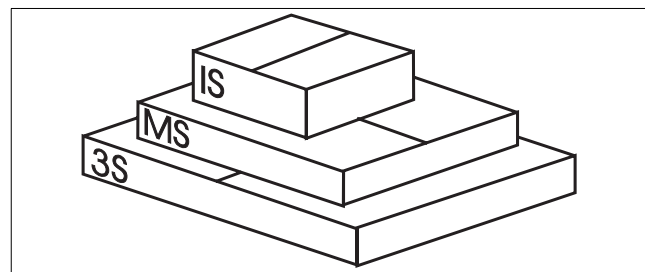
4.1.4 Service kits

Special service kits are available for Intermediate Service (IS) and Major Service (MS), as well as for servicing the frame feet (3S).

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

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

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



Kits are available for Intermediate Service, Major Service and for servicing the frame feet

NOTE

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

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



DANGER

Disintegration hazards

Use of imitation parts may cause severe damage.

4.2 Maintenance Logs

4.2.1 Oil change

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

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

Main component and activity	Part	Notes
Horizontal driving device		
Worm wheel shaft and gear housing		
Check	Worm wheel and worm	
Renew	Oil ^{a)} in gear housing	

When the separator is running for short periods, the lubricating oil must be changed every **12 months** even if the total number of operating hours is less than **1000-1500 hours (2000 h)**.

a) See chapter "7.6 Lubricants" on page 180 for further information.

4.2.2 Intermediate Service (IS)

Name of plant: _____ Local identification: _____
 Separator: AFPX 517XGV-14CG Manufacture No./Year: _____
 Total running hours: _____ Product No: 881118-04-01
 Date: _____ Signature: _____

Main component and activity	Part	Notes
Inlet and outlet Clean and inspect	Threads of inlet pipe Connecting housing	
Separator bowl Clean and check Check Renew	Lock ring Bowl hood Top disc Paring disc Bowl discs Distributor Distributing cone Sliding bowl bottom Bowl body Guide surfaces Bowl spindle cone and bowl body nave Operating mechanism Corrosion Cracks Erosion and wear liners Galling of guide surface Disc stack pressure O-rings and sealings	

Main component and activity	Part	Notes
Operating liquid device Clean and check Renew	Operating liquid device O-rings	
Horizontal driving device Worm wheel shaft and gear housing Check Renew Electrical motor Check Lubrication (if nipples are fitted)	Worm wheel and worm Oil in gear housing Electric cables See sign on motor	
Signs and labels on separator Check attachment and legibility	Safety label on hood Direction of rotation arrow Power supply frequency	
Monitoring equipment Function check	Vibration sensor Cover interlocking switch Speed sensor	

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

4.2.3 Major Service (MS)

Name of plant: _____ Local identification: _____
 Separator: AFPX 517XGV-14CG Manufacture No./Year: _____
 Total running hours: _____ Product No: 881118-04-01
 Date: _____ Signature: _____

Main component and activity	Part	Notes
<p>Inlet and outlet</p> <p>Clean and inspect</p> <p>Renew</p>	<p>Threads of inlet pipe</p> <p>Connecting housing</p> <p>Sealing rings in cyclone and pipe connections</p>	
<p>Separator bowl</p> <p>Clean and check</p> <p>Check</p> <p>Renew</p>	<p>Lock ring</p> <p>Bowl hood</p> <p>Top disc</p> <p>Paring disc</p> <p>Bowl discs</p> <p>Distributor</p> <p>Distributing cone</p> <p>Sliding bowl bottom</p> <p>Bowl body</p> <p>Guide surfaces</p> <p>Bowl spindle cone and bowl body nave</p> <p>Operating mechanism</p> <p>Corrosion</p> <p>Cracks</p> <p>Erosion and wear liners</p> <p>Galling of guide surface</p> <p>Disc stack pressure</p> <p>Height position of paring disc</p> <p>O-rings and sealings</p>	

Main component and activity	Part	Notes
Operating liquid device Clean and check Check Renew	Operating liquid device Height position O-rings	
Vertical driving device Clean and check Check Renew	Bowl spindle Radial wobble of bowl spindle Spindle bearings, sealings and rubber buffers	
Horizontal driving device Worm wheel shaft and gear housing Check Renew Brake Check/renew Flexible coupling Check Electrical motor Check Lubrication (if nipples are fitted)	Worm wheel and worm Radial wobble of worm wheel shaft Bearings, O-rings and sealings Oil in gear housing Brake lining Axial play of elastic plates Electric cables See sign on motor	
Signs and labels on separator Check attachment and legibility	Safety label on hood Direction of rotation arrow Power supply frequency	
Monitoring equipment Function check	Vibration sensor Cover interlocking switch Speed sensor	

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

4.2.4 3-year Service (3S)

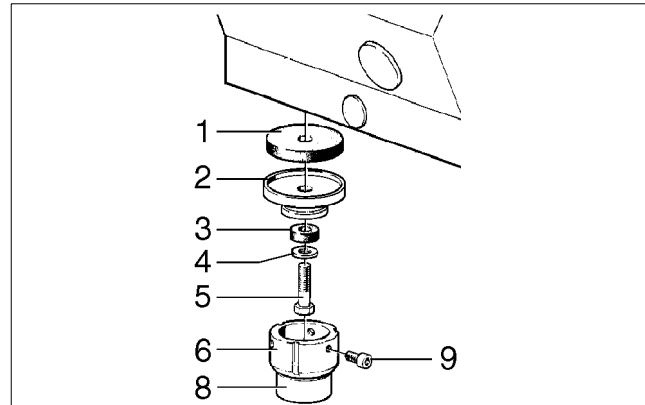
Renew the frame feet as described below. The 3-year service should be carried out in conjunction with a Major Service (MS). The extent of the 3-year service is the same as for a Major Service plus renewing the parts included in the 3-year service kit (3S).

Frame feet, renewal

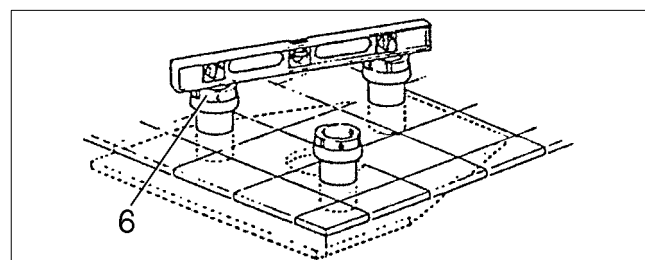
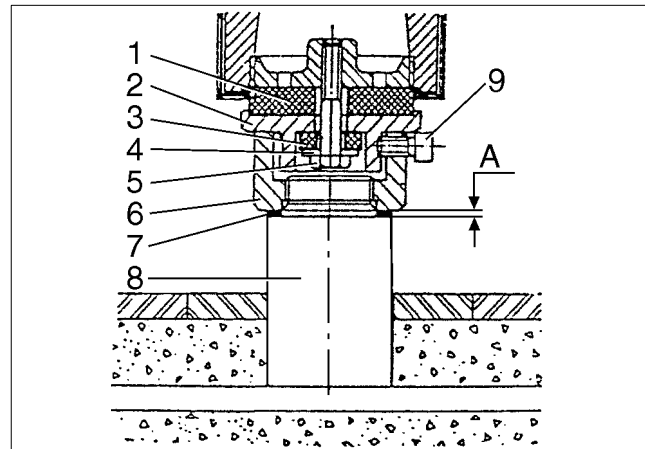
NOTE

Before starting the procedure below, first read the chapter "4.4 Lifting instruction" on page 68. Here directions are given which parts that first must be removed before lifting and also which lifting tool that must be used.

1. Disconnect pipes, hoses and cables connected to the separator and electric motor.
2. Remove the set screws (9), three for each foundation foot.
3. Lift the separator. Follow the directions in the *Lifting instructions* referred to above.
4. Unscrew the screw (5) which is locked with Loctite and then renew the two rubber cushions (1, 3).
5. Apply Loctite 242 on the screw thread (5) and tighten it with **40 Nm**.
6. Level against the upper face of the three holders (6). Screw the holders to compensate for inclination, if any. Any gap between a holder and a foundation foot (8) must be eliminated by adding or removing one or more adjusting washers (7). Note that the total thickness (A) of the adjusting washers for one foot must not exceed corresponding 4 washers.
7. After all rubber cushions have been renewed lower the separator into the three holders.



1. Rubber cushion
2. Frame foot
3. Rectangular ring
4. Washer
5. Screw
6. Holder
7. Adjusting washer
8. Foot on foundation plate
9. Set screw
- A. Thickness of adjusting washers (max. 4 pcs)



Level against the upper face of the holders (6)

8. Tighten the set screws (9), first by hand (or by a hand tool, if necessary) until all of them are in contact with the frame feet (2).

Then tighten the set screws with **100 Nm**.

NOTE


Tighten the set screws before mounting the bowl or cyclone.

9. Connect the previously disconnected pipes, hoses and cables.

4.3 Check points at Intermediate Service (IS)

4.3.1 Corrosion

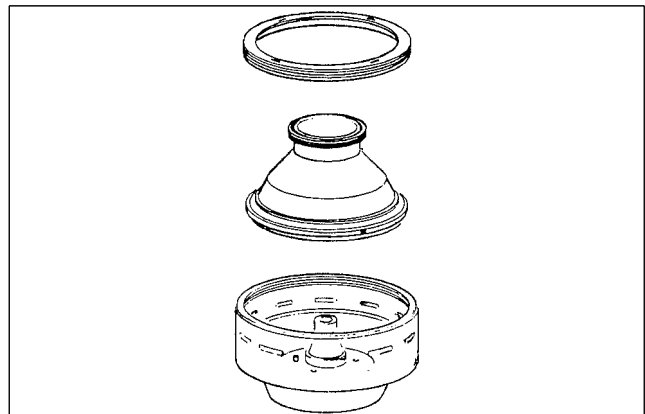
Evidence of corrosion attack should be looked for and rectified each time the separator is dismantled. Main bowl parts such as the bowl body, bowl hood and lock ring must be inspected with particular care for corrosion damage.



DANGER

Disintegration hazard

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



Main bowl parts to check for corrosion

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

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

Non-stainless steel and cast iron parts

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

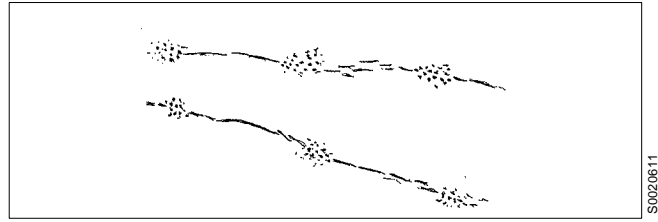
Stainless steel

Stainless steel parts corrode when in contact with either chlorides or acidic solutions. Acidic solutions cause 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:

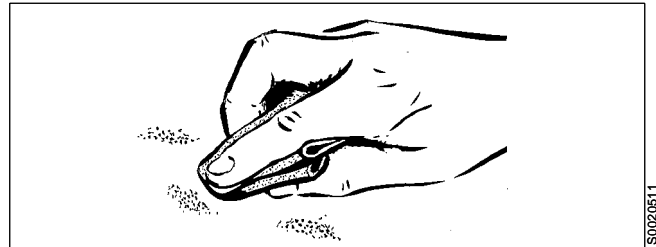
- Exposed to a stationary solution.
- In a crevice.
- Covered by deposits.
- Exposed to a solution that low pH.

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

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



Example of chloride corrosion in stainless steel



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.

Renew 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.

4.3.2 Erosion and wear liners

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



DANGER

Disintegration hazard

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

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

Erosion is characterised by:

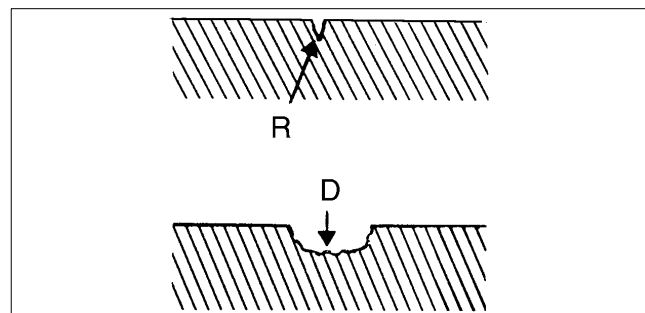
- Burnished traces on the material.
- Dents and pits having a granular and shiny surface.

Surfaces particularly subjected to erosion are:

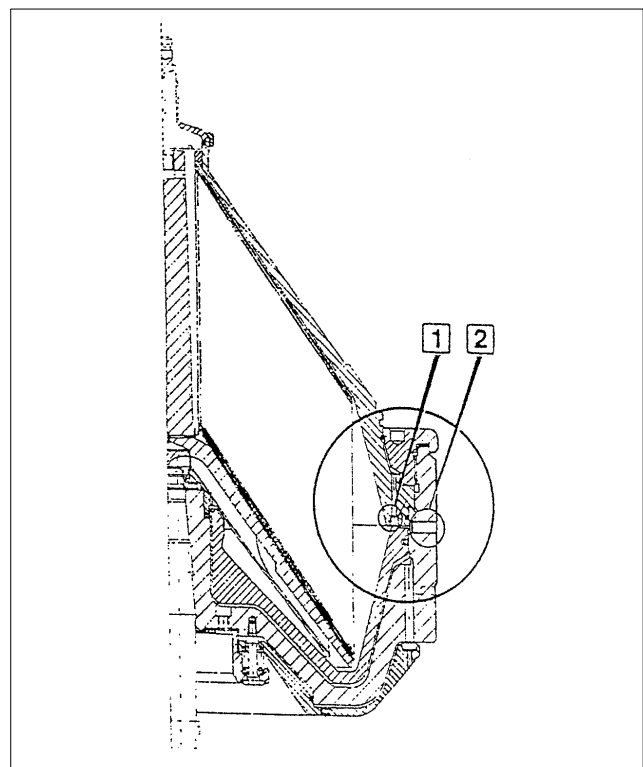
1. The sealing edge of the sliding bowl bottom, and the seal ring in the bowl hood.
2. The bowl wall portions ("pillars") between the sludge ports in the bowl body.

Other parts are:

- The upper paring disc.
- The top disc.
- The underside of the distributor in the vicinity of the distribution holes and wings.
- The surface of the sliding bowl bottom that faces the conical part of the distributor.



- R. Smallest permissible radius is 1 mm
D. Largest permissible depth is 1 mm



Surfaces particularly subjected to erosion

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



DANGER

Disintegration hazard

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

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

Renew the part if erosion is suspected of affecting its strength or function.

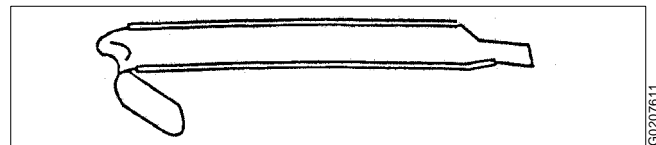
Wear liners in the bowl

The wear liners protect both the wall pillars in the bowl body and the sliding bowl bottom. They must be replaced before the liners have been perforated by erosion.

Wear liners in wall pillars

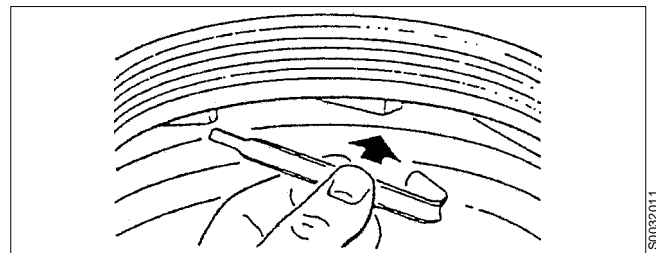
The wear liners are made of stainless steel according to the adjoining illustration.

1. Remove the old liner and place the new liner blank in the wall pillar.

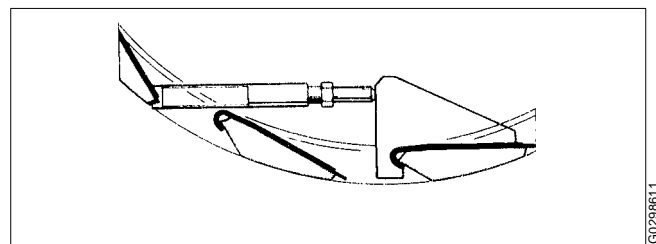


G0207611

2. Fasten the mounting tool between the wall pillars as shown in the illustration. Clamp the wear liner with the tool.

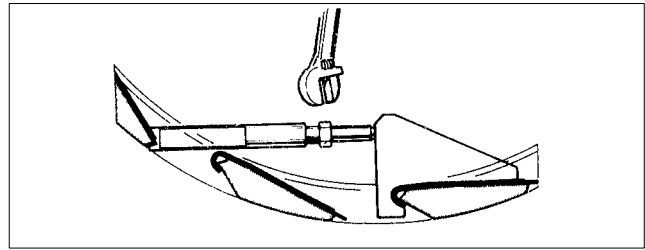


S0032011



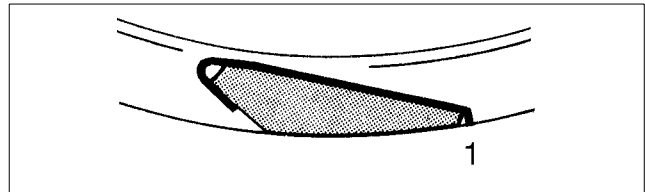
G0298611

3. Tighten the tool nut with a spanner until the liner is firmly pressed to its seat.



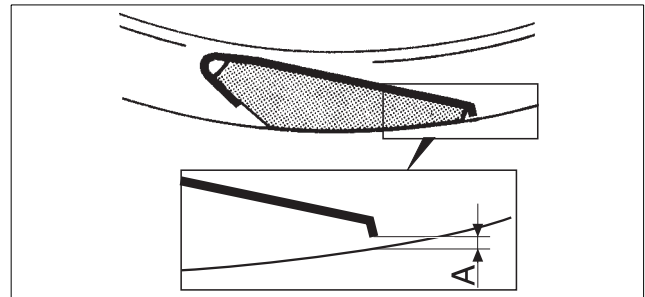
G0298711

4. Bend the shank (1) at right angles to the outside of the bowl wall using a drift.



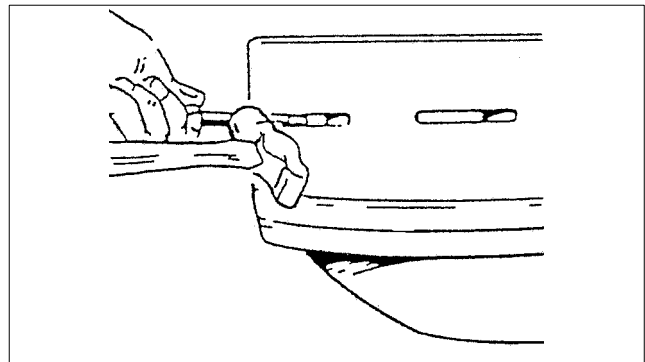
G0298821

5. Back off the nut of the tool and remove it.
6. Remove the liner and cut the shank so that it ends 0,5-1,5 mm (A) from the bowl wall.



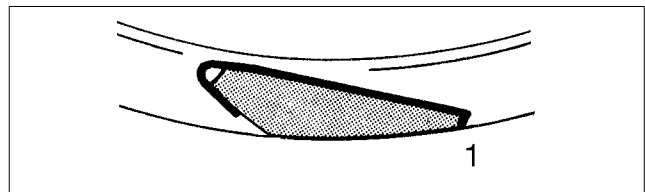
G0298831

7. Fit the wear liner in the wall pillar and clamp it with the tool. Knock the shank flat against the wall of the pillar.



S0031811

8. Remove the tool and check that the wear liner is well attached and that the shank (1) does not protrude beyond the bowl periphery. Fit the other liners as described above.



G0298821

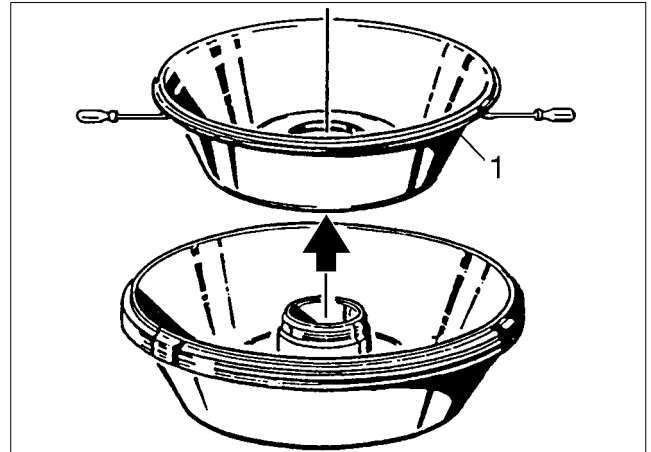
Wear liner in sliding bowl bottom

If the erosion lining (1) is to be removed, remove it by using two screw drivers or similar, see the illustration.

NOTE

Normally the wear liner will be destroyed when removed.

When renewing the wear liner also renew the O-ring outside the sliding bowl bottom nave.



G0728861

4.3.3 Cracks

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

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

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



DANGER

Disintegration hazard

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

Always replace a part if cracks are present.

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

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

4.3.4 Lock ring joint

Seizure damage

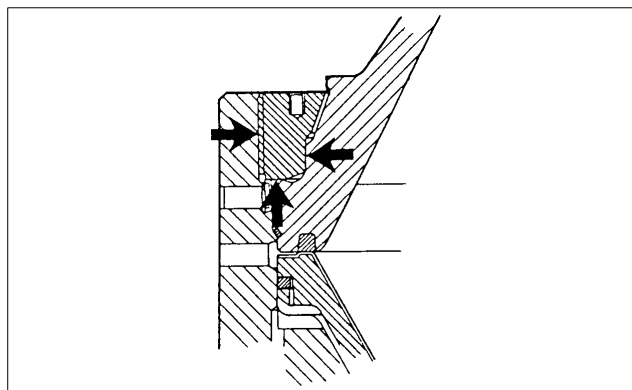
Impact marks and similar scores on lock ring, bowl hood or body can cause seizure damage.

Check threads as well as contact- and guiding surfaces – see arrows.

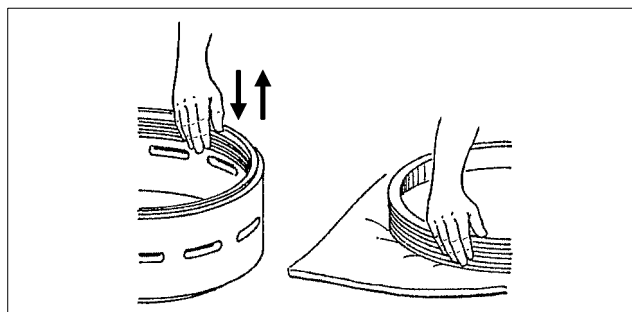
An obvious sign of seizure damage is when the lock ring does not fit with the main guide.

Note! Never force any parts together. It can be very time-consuming and expensive to repair these defects. Careful handling is therefore of utmost importance.

Check the parts for seizure damages by letting your fingers lightly slide over the area to be inspected. Note, however, that these damages are very sharp and easily cut your fingers. Therefore, always use a piece of cloth or gloves when making this inspection.



G073211



G0518421

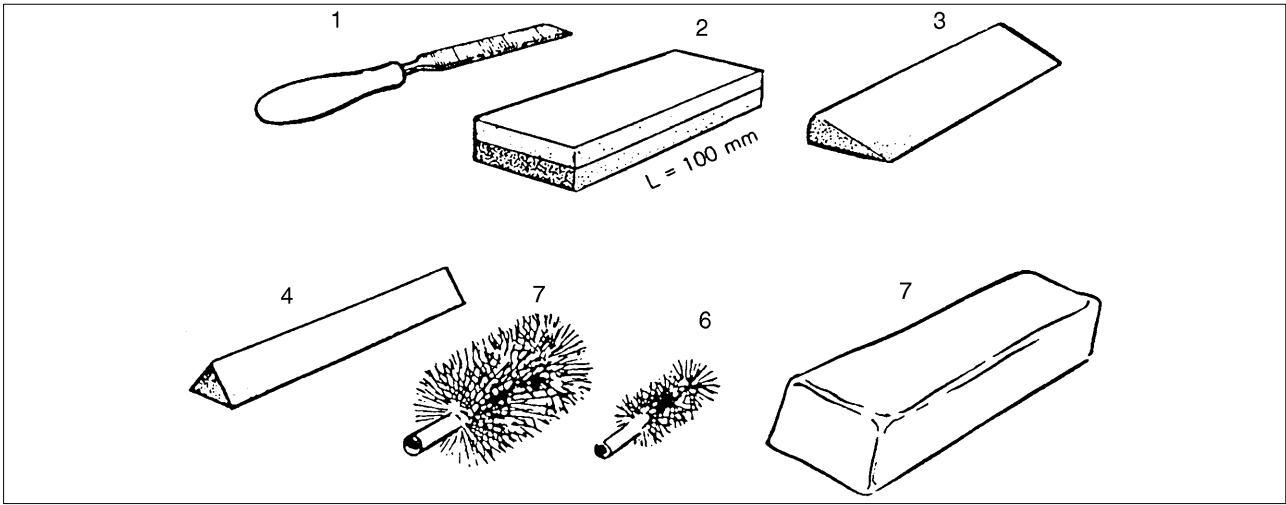


CAUTION

Cutting hazard

Separator lock ring threads could have sharp edges and can cause cuts.

If damage has occurred due to seizure or other reasons, use the following to repair the damage:



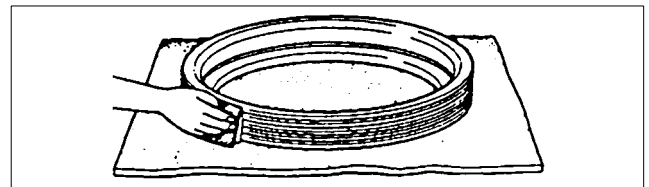
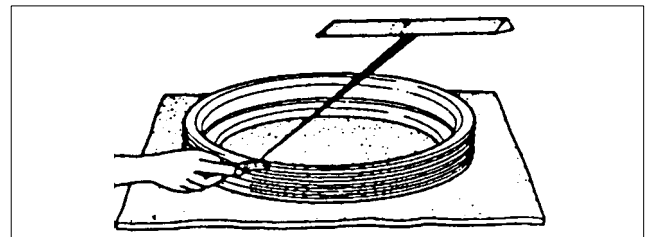
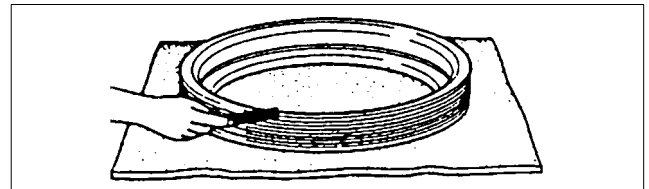
- | | |
|--|--|
| 1. Very fine-cut file (single-cut) | 4. File type whetstone (grain size: 240) |
| 2. Combination whetstone (grain size: 120 / 400) | 5. Fibre brush (Ø 50 mm) |
| 3. Knife type whetstone (grain size: 240) | 6. Fibre brush (Ø 25 mm) |
| | 7. Brush wax (grain size: 600) |

If the seizure damage is heavy, first use a fine and single-cut file, but moderately. Otherwise the damage may get worse.

Note! When possible, avoid using the file.

Then use a whetstone. The location of the damage decides which one of the above whetstones should be chosen.

A fine-grain emery cloth must be used if whetstones are not available.



G0652711

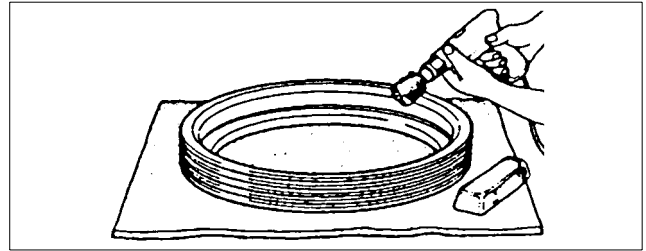
G0652821

G0652921

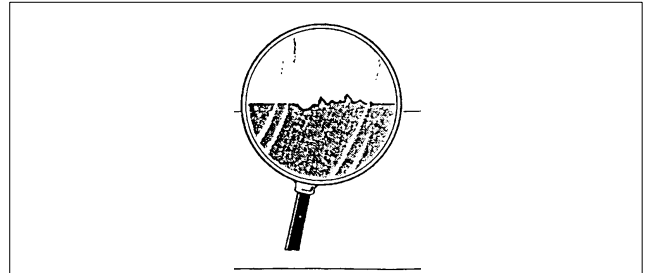
G0653021

Accomplish the remedying by polishing the damaged spot with the fibre brushes and brush wax. It is recommended to polish the whole area where seizure damage might occur.

The least possible material removed, however so much, that no residues of the damage are left above the original surface, which smoothly joints the remedied spot.

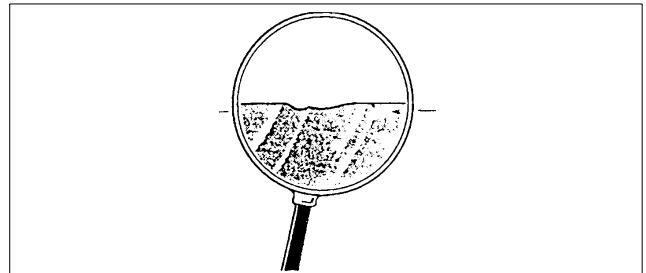


G0653121



G0653211

Damage before remedy

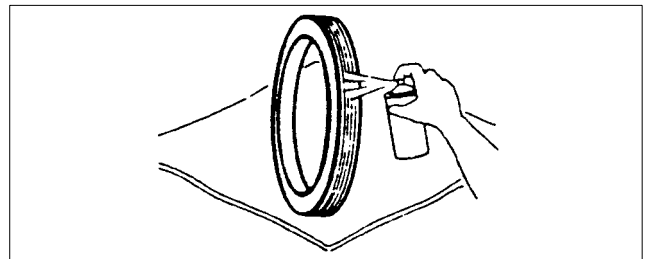


G0653311

After remedy

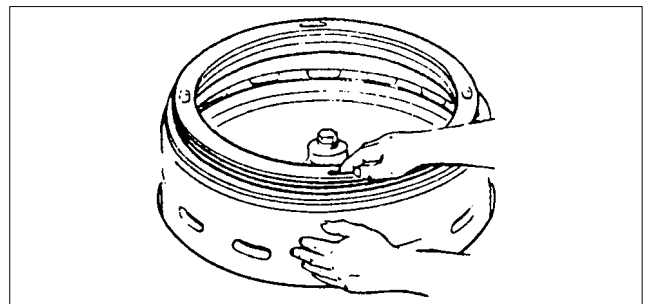
Lubrication

When assembling the bowl: Prevent future seizure damage by following the instructions in the chapter "4.3.9 Lubrication points" on page 62.



G0705211

Before final mounting of the bowl parts check as a precaution that the lock ring turns easily on the bowl body threads. To this end the ring should be screwed on by hand without using the spanner.



G0705311

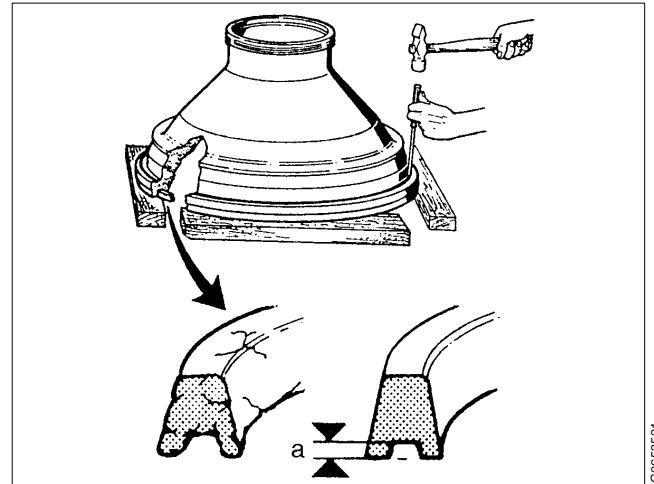
4.3.5 Bowl hood

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

Replace the bowl hood seal ring if it has fissures or pores, deep scratches or indentations made by coarse solid particles.

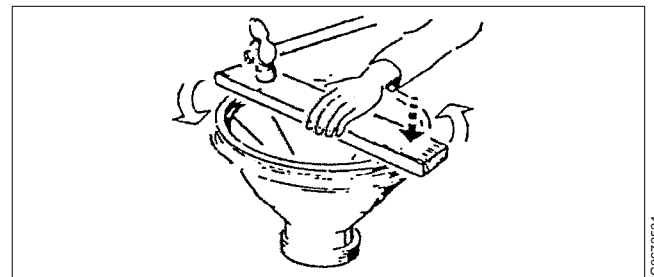
The ring should be replaced also when its sealing surface is depressed by more than 1 mm, even though acceptable in other respects.

The ring is removed by striking it with a drift.



When fitting a new seal ring in bowl hood:

If a new seal ring of nylon (polyamide) proves too wide when mounted, this is due to absorption of moisture. It will recover correct dimensions after drying for about 24 hours at a temperature of 80 – 90 °C for 5 minutes approx.

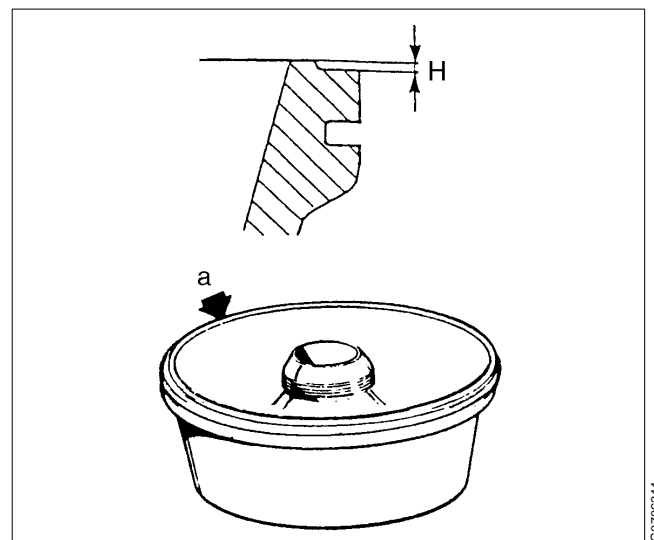


4.3.6 Sliding bowl bottom

Also 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, provided that suitable equipment is available.

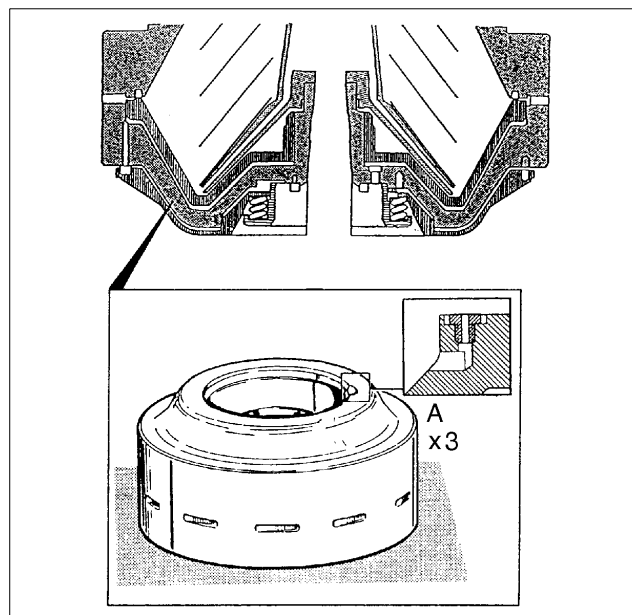
Profile height (H) at least 2,0 mm.

If the sliding bowl bottom is fitted with an erosion lining, and only this is damaged, change only this.



4.3.7 Discharge mechanism

Dirt and lime deposits in the discharge mechanism may cause bad discharging function or none at all.

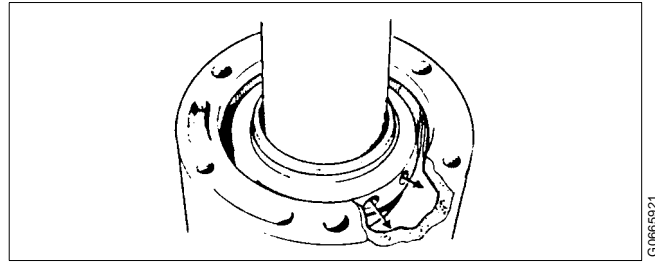


A. Nozzle

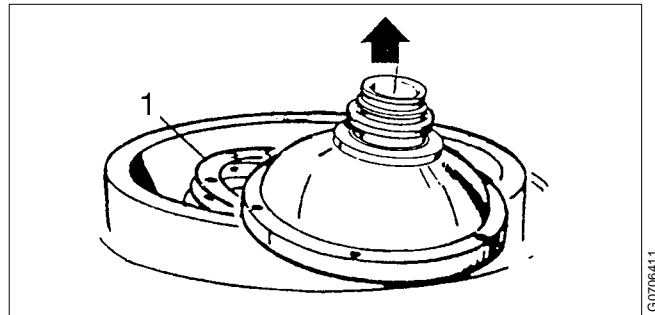
G0706311

Nozzles, ducts

Clean all nozzles and ducts with a soft iron wire or the like. Remove deposits on other surfaces with steel wool.

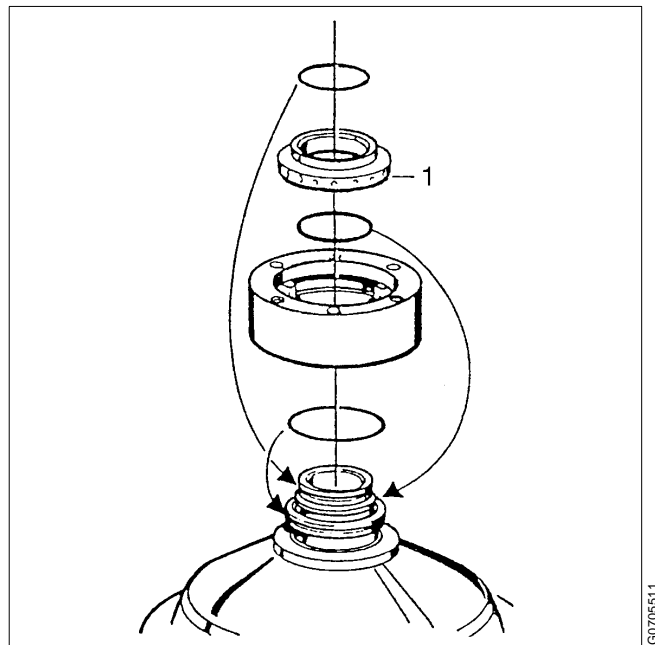


G0665921



G0706411

1. Height adjusting ring



G0706511

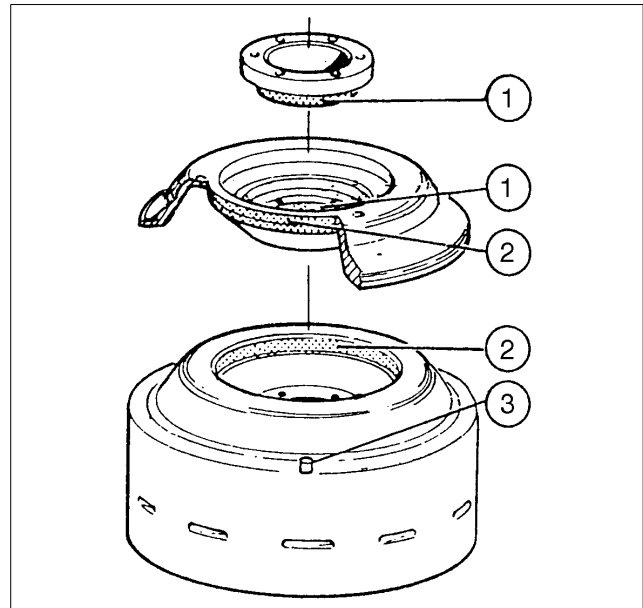
1. Control paring disc

Guiding surfaces etc.

Examine the guiding surfaces (1) of spring support and operating slide respectively. Remove any marks with whetstone (grain size 240). Lubricate the surfaces with Molykote.

Polish sealing surfaces (2) of operating slide and bowl body with steel wool.

Inspect guide pin (3) for the operating slide. If worn (eroded) so much as to jeopardize the polar guidance of the slide, replace it.



Springs, valve plugs

Defective or broken springs as well as poor sealing between the valve plugs of operating slide and the bowl body may prevent complete closing of the bowl.

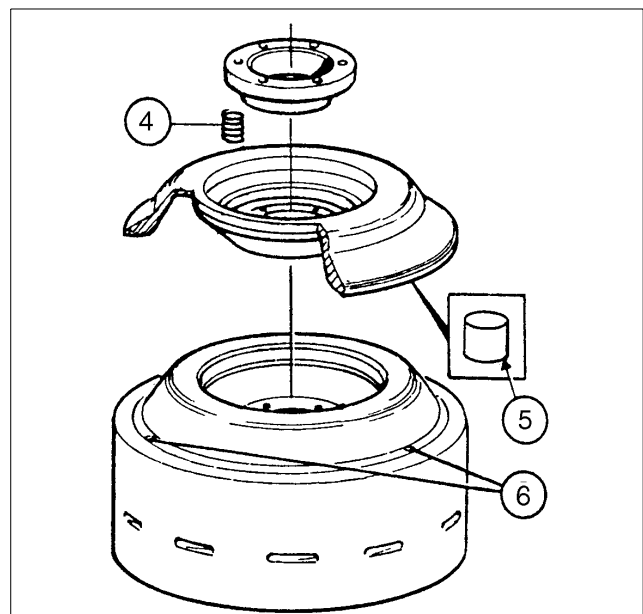
If one or more springs (4) differ appreciably from the other ones in regard to length or which seem to be defective in other respects, replace all springs.

Check the sealing surface (5) of the six valve plugs. Replace all plugs even if only one of them is defective (scratches, pores).

When changing plugs:

- Check that they are the same height.
- Check that all plugs touch the bowl.

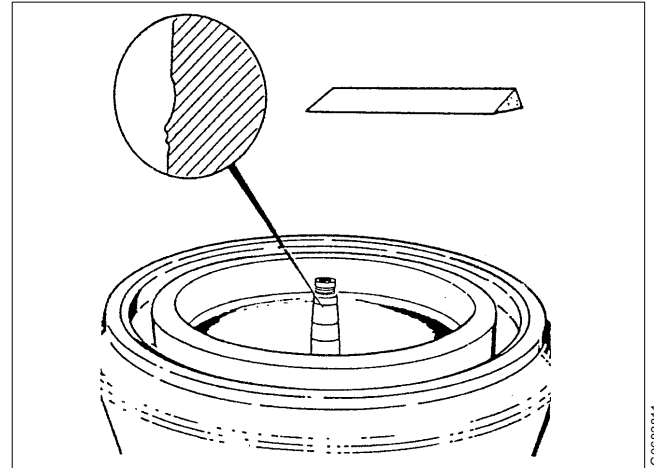
Examine the six sealing surfaces (6) of the bowl body in contact with the valve plugs. Remove any marks and lime deposits with a very fine-grain emery cloth.



4.3.8 Bowl body nave – Bowl spindle cone

Impact marks and similar on the spindle cone and / or in the nave may cause bad bowl run.

Clean spindle cone with a suitable defatting agent. Remove any impact marks on cone with an oil-stone.

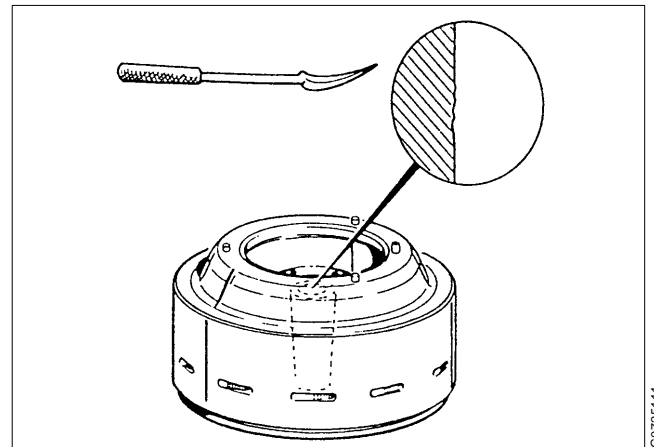


G0682811

Clean bowl body nave with a suitable defatting agent. Remove any impact marks on nave with a scraper.

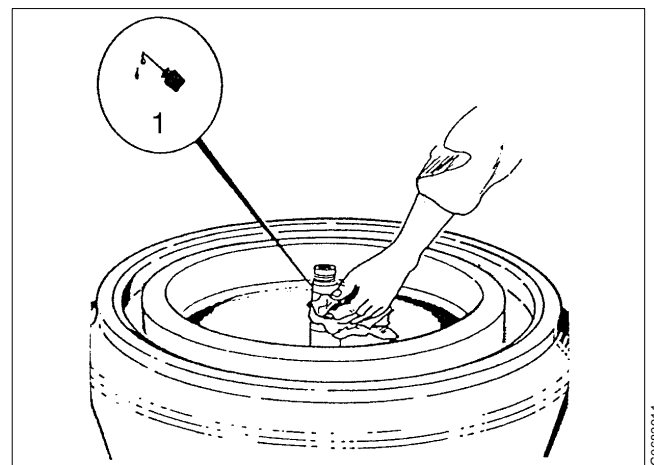
NOTE

Always use the scraper with great care. The conical shape must not be marred.



G0725111

Whenever fitting the bowl body on the spindle first apply a few drops of oil (1) to the spindle cone for corrosion protection reasons and then wipe it with a clean cloth.

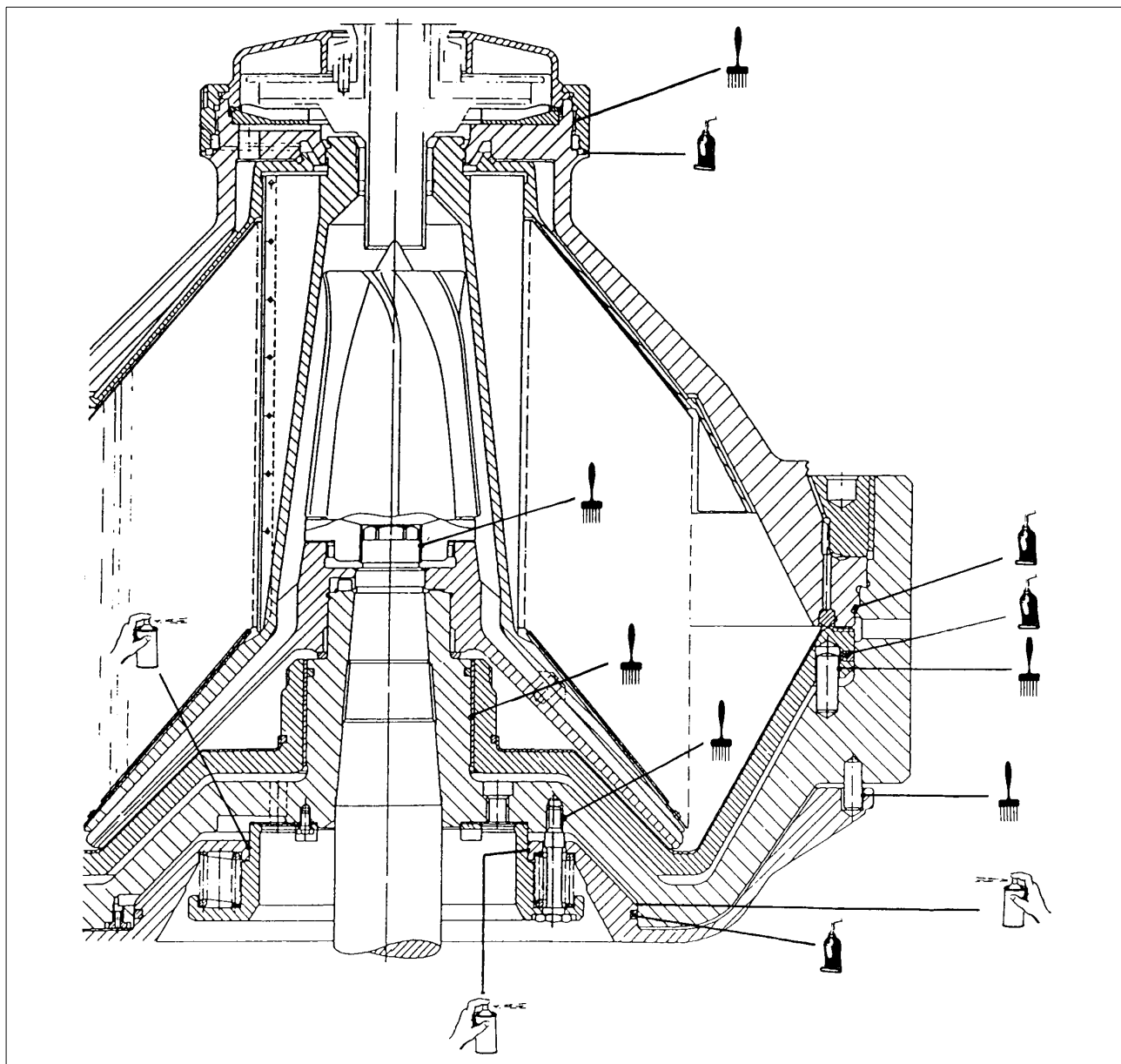


G0682811

4.3.9 Lubrication points

Lock ring joint

Degrease lock ring threads, contact and locating surfaces. Prime and lubricate the threads and surfaces stated according to any of the alternatives given in chapter "7.6 Lubricants" on page 180. The alternative with spray-lubrication is recommended in first place.



G0738511

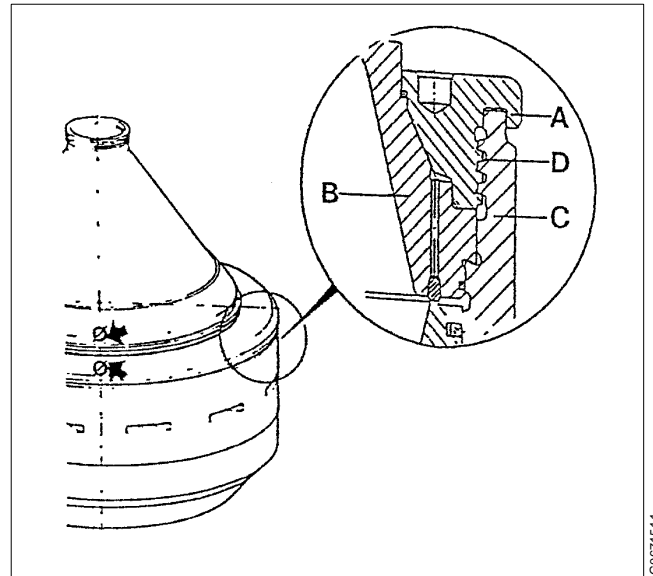
4.3.10 Threads of large lock ring and bowl body

- The purpose of the lock rings (A) is to keep the bowl hood (B) securely in position against the bowl body (C) during operation. No play is permissible here. The threads (D) on the lock ring joint must not be worn to such an extent that the security of the lock ring joint is jeopardized.

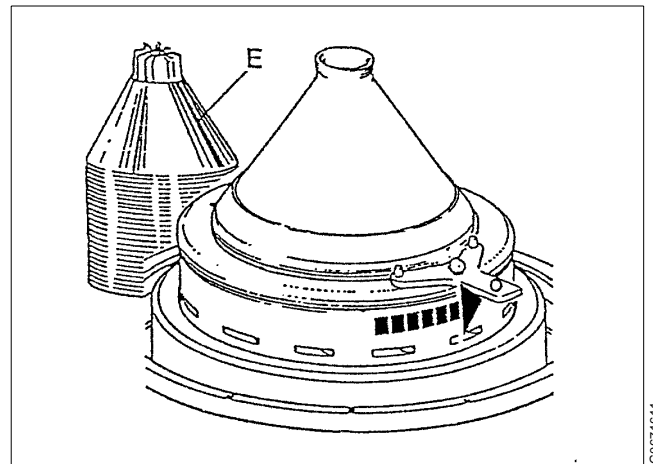
Excessive wear of these threads may involve risk of personal injury or damage of the equipment.

Note! By using the hydraulic disc compression tool, thread wear is reduced to a minimum.

- When the bowl is new the Ø-marks (see arrow) on bowl hood and lock ring are positioned exactly opposite each other. After some time, due to thread wear, these marks will pass each other when the lock ring is properly tightened.
- To check the thread wear, the threads of lock ring and bowl body must be properly cleaned and lubricated first. Remove the disc stack (E) and tighten the lock ring with a few blows of a lead hammer until it is fully tightened. The position of the lock ring relative to the bowl body and hood has now been established. If the Ø-marks are exactly opposite each other, proceed to the chapter "4.3.11 Disk stack pressure" on page 65.



G0671511

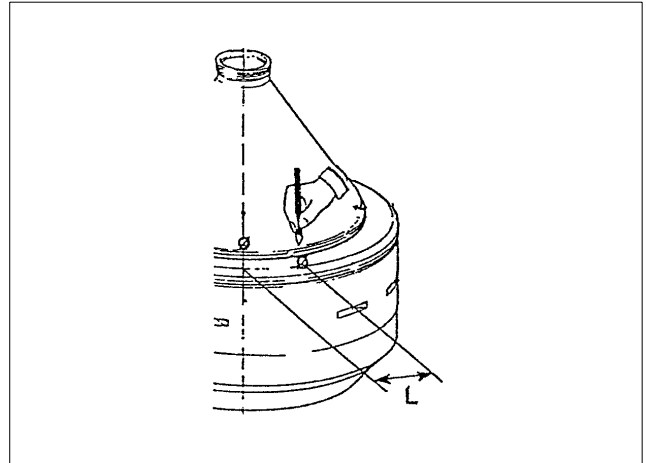


G0671611

3. If the Ø-mark on the large lock ring has passed the Ø-mark on the bowl hood, mark the position of the lock ring mark with a felt-tipped marker pen on the bowl hood. This mark indicates the actual position of the lock ring by which the bowl hood is attached to the bowl body. This mark is needed for the following disc stack pressure check.

Measure the distance "L" between the Ø-marks.

- If the distance "L" is less than 150 mm proceed to the chapter "4.3.11 Disk stack pressure" on page 65.
- If the distance "L" exceeds 150 mm, the bowl must not be used! Get in touch with an Alfa Laval representative.



G0671711



DANGER

Disintegration hazard

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

4.3.11 Disk stack pressure

This check will ensure that the number of discs in the bowl is correct, so that two conditions have been fulfilled:

- The disc stack pressure is sufficient.
- Bowl hood and bowl body are securely attached to each other.

NOTE

Ensure that the disc stack pressure is sufficient to maintain bowl balance. Insufficient pressure in the disc stack can cause vibration and reduce life of ball bearings.

Assumptions:

- The wear on the lock ring joint has been checked. (See “4.3.10 Threads of large lock ring and bowl body” on page 63).
- The position of the Ø-mark on the lock ring has been marked with a marker pen (only applies if the Ø-marks are *not* exactly opposite each other).
- All parts of the bowl have been cleaned.
- The sliding bowl bottom and distributing cone are in place.

Procedure:

Insert the complete disc stack in the bowl. The distributor fits into the guide pin and locked so that it cannot be turned in relation to the bowl body.

Remove the lifting eye from the distributor. Place the bowl hood in position. Make sure that the groove in the hood fits into the guide pin in the bowl body. The bowl hood should drop down over the guide pin. Don't remove the bowl hood lifting tool.

Place the large lock ring on the bowl. Fit the lock ring tool on the lock ring and tighten the lock ring by hand.

Fit the hydraulic disc compression tool. The valve on the tool should point upwards – “Unloaded position”. Use the handle to tighten the piston rod in the distributor.

Set the valve on the tool into the left position. Pump until no resistance can be felt in the handle. The disc stack has now been compressed by the hydraulic tool against the bowl hood and the axial force of the disc stack against the lock ring joint is thus unloaded.

Tighten the large lock ring by hand, then with a few blows of a lead hammer until it is tight. Pump again and tighten the ring finally with blows of the lead hammer until it is fully tightened.

- If the Ø-mark positions are as in “4.3.10 Threads of large lock ring and bowl body” on page 63, proceed to instructions for “Pressure checking” below.
- If the Ø-mark positions are *not* as in “4.3.10 Threads of large lock ring and bowl body” on page 63, the reason could be an incorrectly assembled bowl or too many discs in the disc stack. The bowl hood is not attached to the bowl body.

Dismantle the bowl and check that it is correctly assembled. If it is, then remove one or more discs and repeat the above described procedure.

Pressure checking

The position of the Ø-marks are now according to chapter "4.3.10 Threads of large lock ring and bowl body" on page 63.

- The condition that the Ø-marks are exactly opposite each other has been fulfilled, or
- the condition that the Ø-mark is exactly opposite the felt-pen mark has been fulfilled.

Pump a few strokes until no resistance is felt in the handle.

Measure the height (H_1) of the piston rod (see illustration) with the depth gauge of a slide callipers. Make a note of the reading obtained.

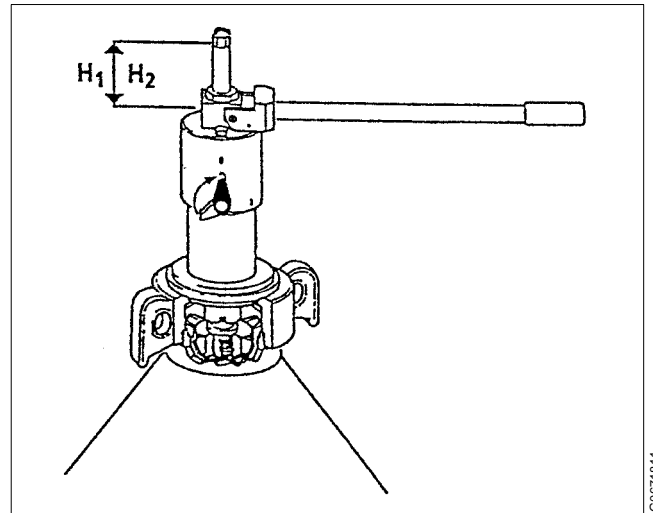
Set the valve on the tool in the upwards position – "Unloaded position". The piston rod will now move down slightly when the disc set is released inside the bowl.

Measure once again the height (H_2) of the piston rod with the slide callipers and make a note of the reading obtained.

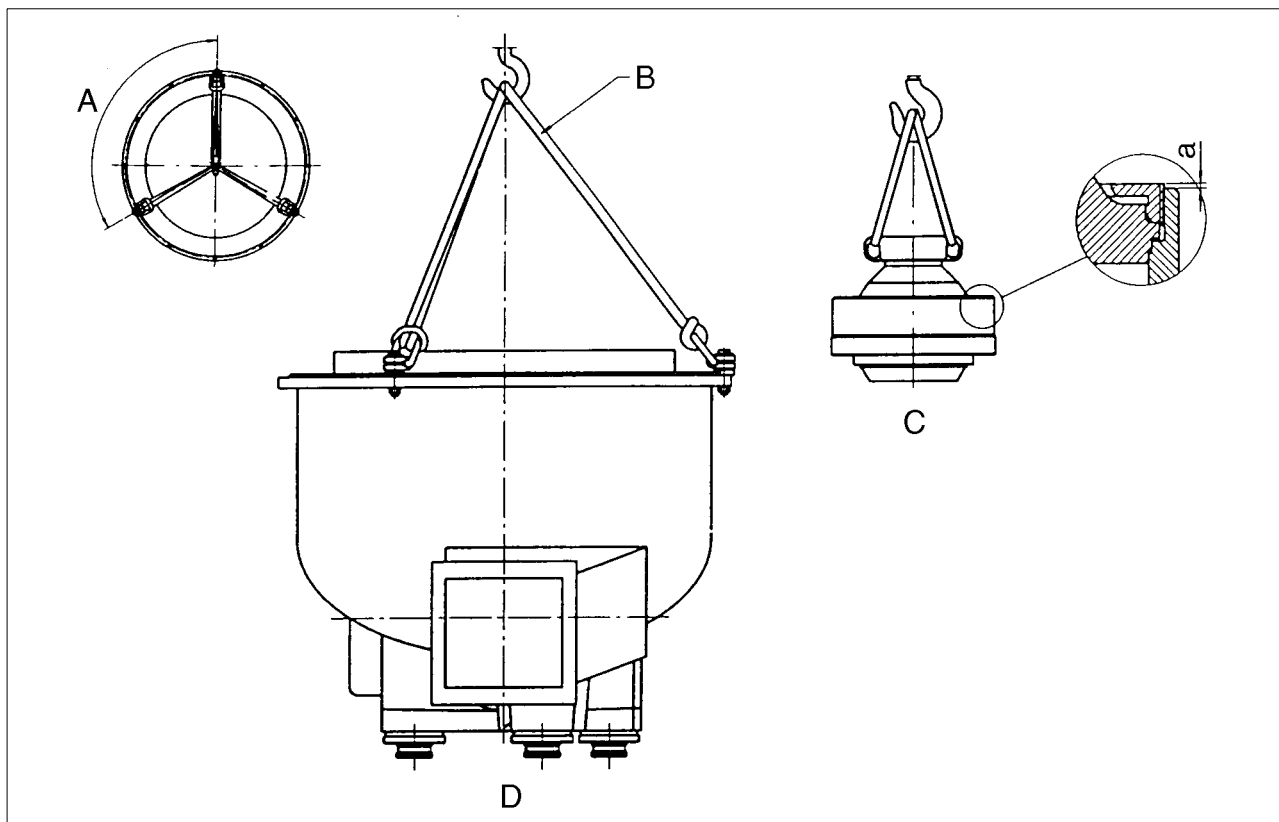
If the height difference $H_1 - H_2$ is less than 2 mm, the disc stack pressure is correct.

If the height difference exceeds 2 mm, the number of discs is not sufficient. Add one or more discs and repeat the above described check until correct disc stack pressure is obtained.

An insufficient number of discs permits the disc stack to wobble and cause unbalance in the bowl when running, resulting in vibration that cannot be eliminated by balancing.



4.4 Lifting instruction

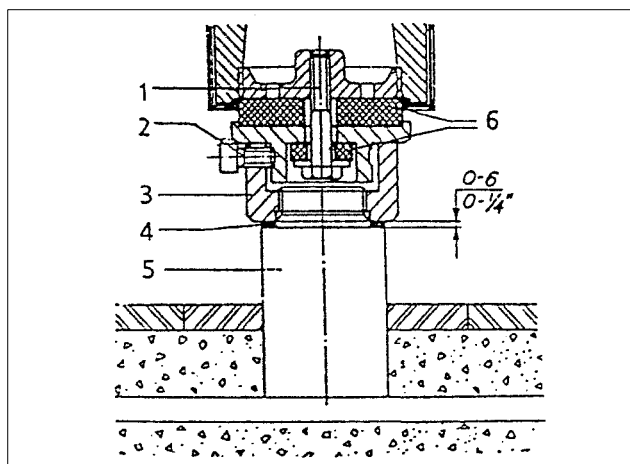


- A. 3 x 120°
- B. 3 slings
- C. Weight to lift = 850 kg
- D. Weight to lift = 1000 kg
- a. Max. 4 mm


Remove in order stated:

- Inlet / outlet
- Frame hood
- Cyclone
- Motor
- Bowl

Loosen the set screws (2). Screw the three lifting eyes on the frame – see illustration – and lift the separator. For checking the tightening of screws (1) or for checking and replacing vibration dampers (6) the separator must be lifted approx. 0,5 m.



1. Screw and washer
2. Set screw
3. Holder
4. Adjusting washer
5. Foundation foot
6. Vibration damper

	<p>WARNING</p> <p>Crush hazard</p> <p>Use correct lifting tools and follow lifting instructions.</p> <p>Do <i>not</i> work under hanging load.</p>
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4.5 Cleaning

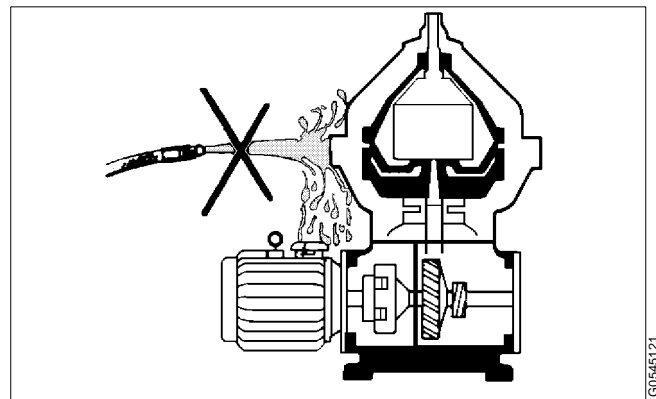
4.5.1 External cleaning

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

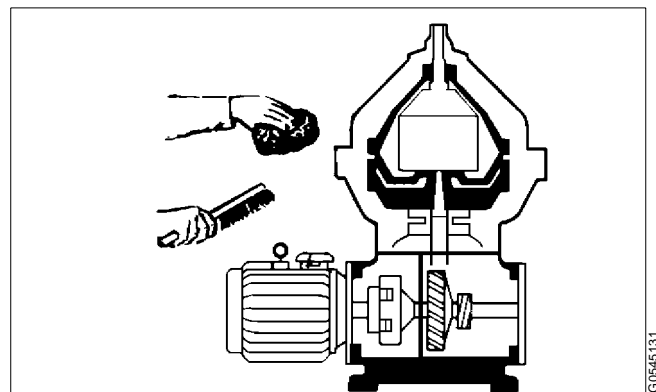
Never wash down a separator with a direct water stream. Totally enclosed motors can be damaged by direct hosing to the same extent as open motors and even more than those, because:

- 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 (if any).



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




Use a sponge or cloth and a brush when cleaning

4.5.2 Cleaning agents

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

For separator bowl, inlet and outlet

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

	CAUTION Skin irritation hazard
<p>Read the instructions on the label of the container before using the chemical cleaning agent.</p> <p>Always wear safety goggles, gloves and protective clothing as the liquid is alkaline and dangerous to skin and eyes.</p>	

For operating mechanism

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

For parts of the driving devices

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

Oiling (protect surfaces against corrosion)

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

4.5.3 Cleaning of bowl discs

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

NOTE

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

A gentle chemical cleaning is therefore preferable to mechanical cleaning.

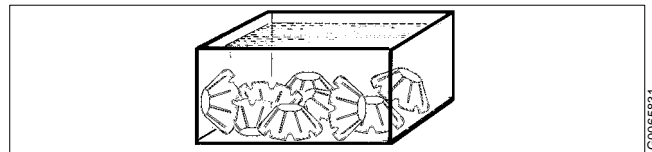


CAUTION

Cutting hazard

The bowl discs have sharp edges and can cause cuts.

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

4.6 When changing oil

4.6.1 Worm wheel and worm; wear of teeth

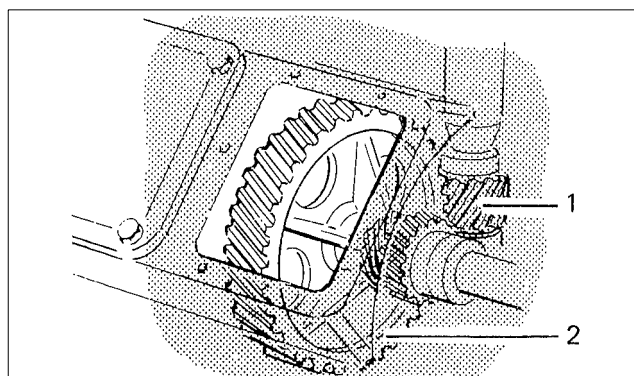
To check at each oil change

Check the teeth of both the worm wheel and worm for wear. Examine the contact surfaces and compare the tooth profiles with the “Tooth appearance examples” on page 74. The gear may operate satisfactorily even when worn to some degree.

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


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

When replacing the gear, always make sure that the new worm wheel and worm have the same number of teeth as the old ones. See chapter “7.1 Technical data” on page 162 for correct number of teeth.



1 Worm
2 Worm wheel

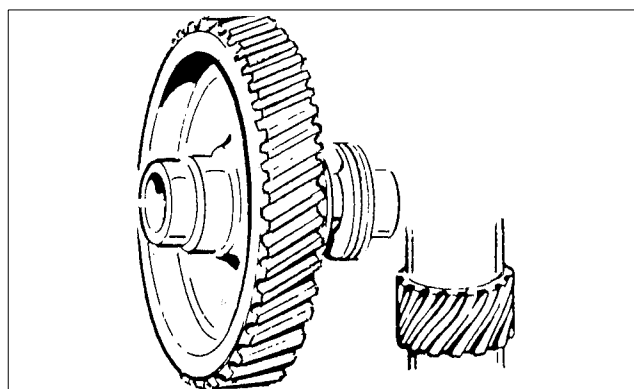
G0205311



DANGER

Disintegration hazards

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



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

G0205411

NOTE

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

Important!

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

In all these cases it is imperative to change to a high-temperature oil.

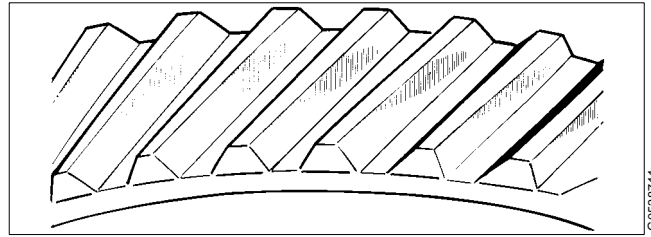
For further information, see chapter “7.6 Lubricants” on page 180.

Tooth appearance examples

Satisfactory teeth:

Uniform wear of contact surfaces. Surfaces are smooth.

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

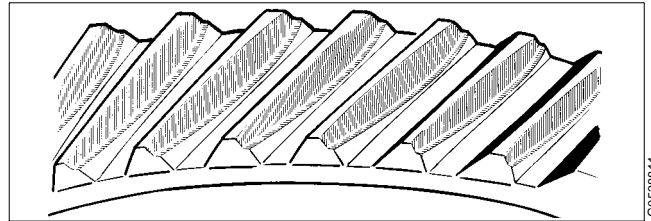


Satisfactory teeth

Worn teeth:

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

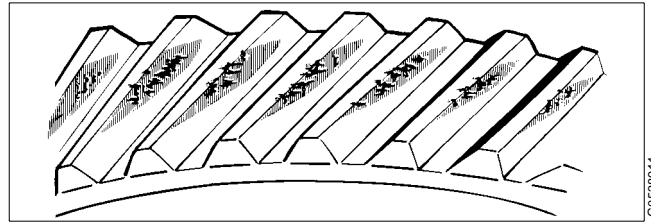
- the wear is uniform over the whole of the flank of a tooth
- and all teeth are worn in the same way.



Worn teeth

Spalling:

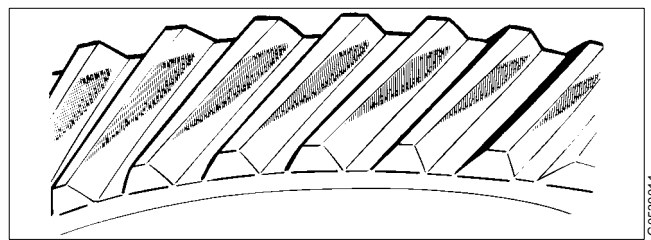
Small bits of the teeth have broken off, so-called spalling. This is generally caused by excessive load or improper lubrication. Damage of this type may not necessitate immediate replacement, but careful checking at short intervals is of imperative importance.



Spalling

Pitting:

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

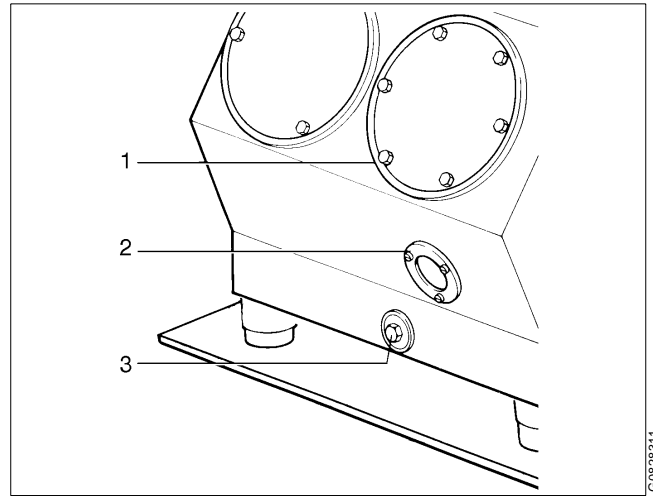


Pitting

4.6.2 Oil change procedure

NOTE

Before adding or renewing lubricating oil in the worm gear housing, the information concerning different oil groups, handling of oils, oil change intervals etc. given in chapter “7.6 Lubricants” on page 180 must be well known.



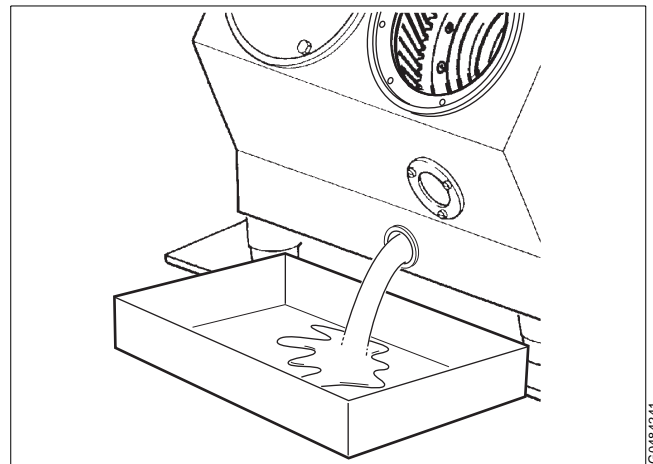
- 1. Cover
- 2. Sight glass
- 3. Oil drain plug

1. Place a collecting tray under the drain hole, remove the cover (1) and the drain plug (3) and then drain off the oil.

CAUTION

Burn hazard

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



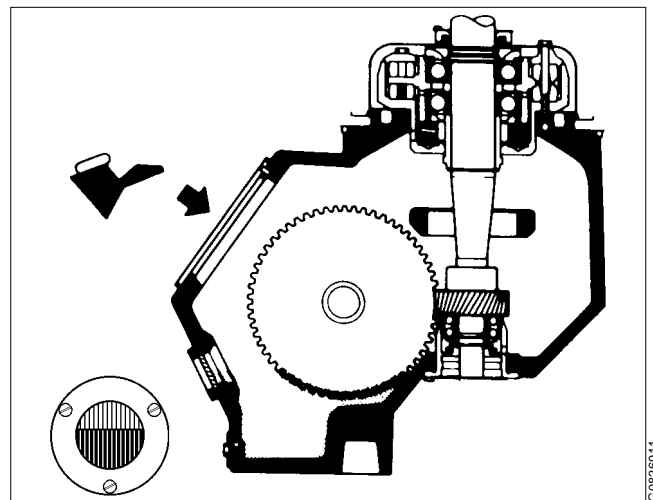
Burn hazards: The drained oil may be hot

2. Fill new oil in the worm gear housing. The oil level should be slightly above middle of the sight glass.
Oil volume: Approx. **13 litres**.
Suitable oil brands can be found in “7.6.4 Recommended lubricants” on page 184.

NOTE

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

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



The oil level should be slightly above middle of the sight glass

4.7 Vibration

4.7.1 Vibration analysis

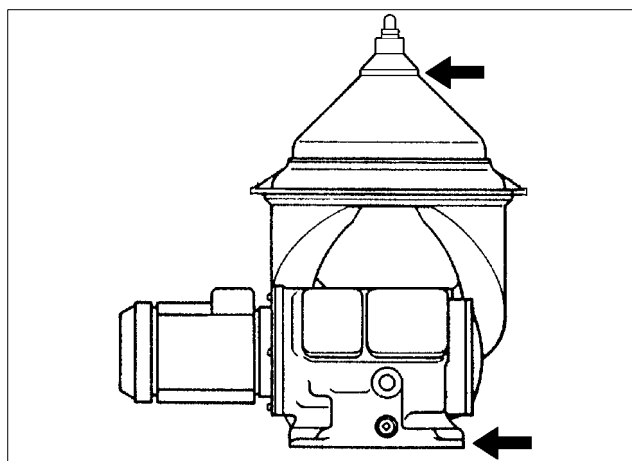
A separator normally vibrates and produces a different sound when passing through its critical speeds during run-up and run-down.

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

G0120431



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.

4.8 Common maintenance directions

4.8.1 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.

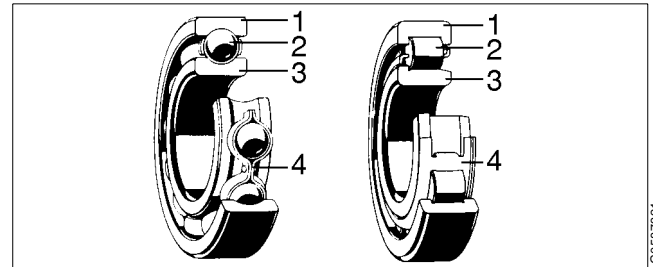
Only Alfa Laval genuine spare parts should be used.

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.

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.



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

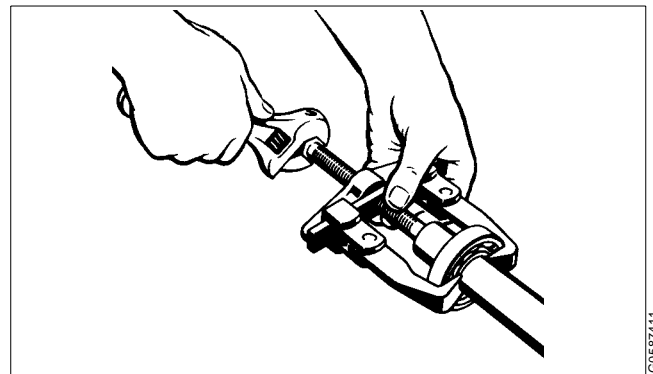
Dismantling

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 centred during dismantling; otherwise it is easy to damage the seating.

NOTE

Do not hit with a hammer directly on the bearing.



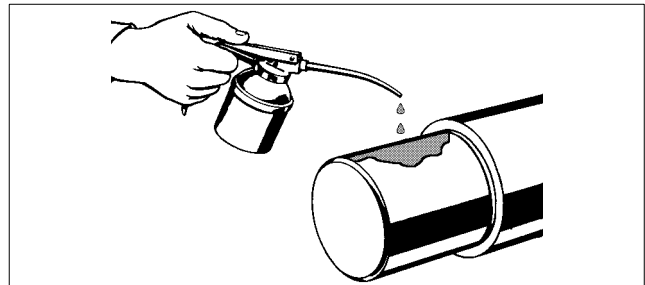
For bearings where no driving-off sleeve is included in the tool kit, use a puller when removing bearings

Cleaning and inspection

Check shaft (spindle) end and/or bearing seat in the housing for damage indicating that the bearing has rotated on the shaft (spindle) and/or in the housing respectively. Replace the damaged part, 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

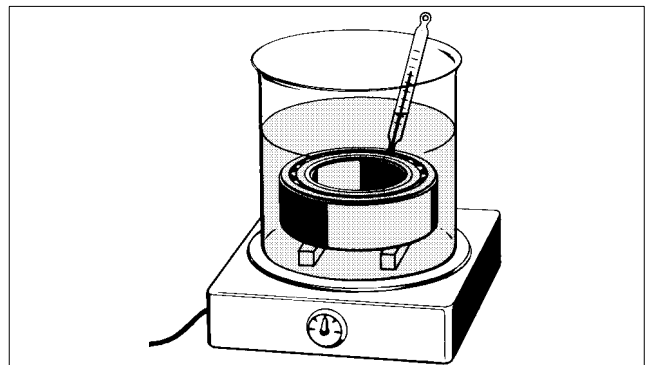
- When assembling ball bearings, the bearings must be heated in oil to maximum 125 °C.

NOTE

Heat the bearing in a clean container with a cover.

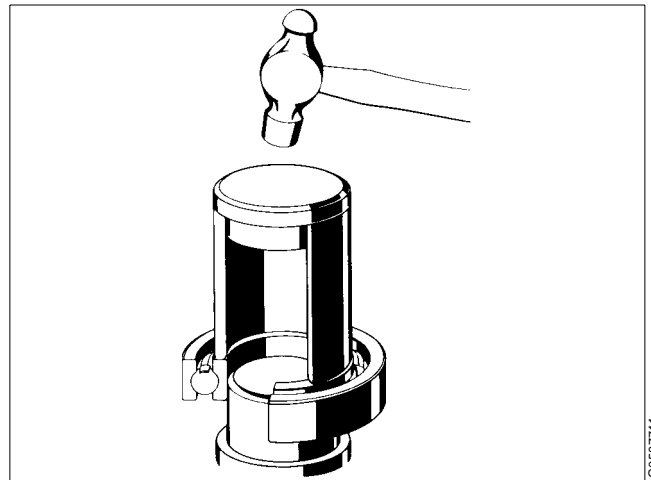
Use only clean oil with a flash point above 250 °C.

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

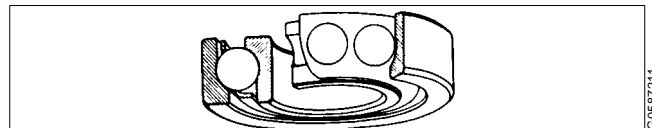
- There are several basic rules for assembling cylindrical bore bearings:
 - Never directly strike a bearing's rings, cage or rolling elements while assembling. A ring may crack or metal fragments break off.
 - Never apply pressure to one ring in order to assemble the other.
 - Use an ordinary hammer.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

4.8.2 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 “5 Dismantling – Assembly” on page 81.

NOTE

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

Vibration in foundations can be transmitted to the bowl and produce one-sided loading of the bearings. The resultant indentations in the ball bearing races can cause premature bearing failure.

- Protect cleaned carbon steel parts against corrosion by oiling. Separator parts that are not assembled after cleaning must be wiped and protected against dust and dirt.

If the separator has been shut-down for more than 3 months but less than 12 months, an Intermediate Service (IS) has to be made 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.

5 Dismantling – Assembly

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5.1 Introduction

5.1.1 General directions

The separator must be dismantled regularly for cleaning and inspection.

The recommended intervals are stated in chapter “4.1.2 Maintenance intervals” on page 38.

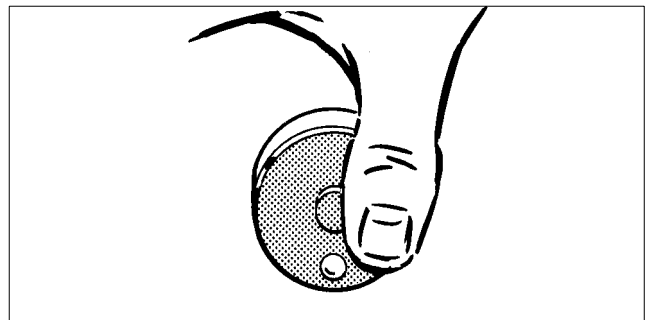


DANGER

Entrapment hazard

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

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



The revolution counter indicates if the separator still is rotating

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

These parts must be handled carefully.

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

NOTE

Never interchange bowl parts

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

5.1.2 Tools

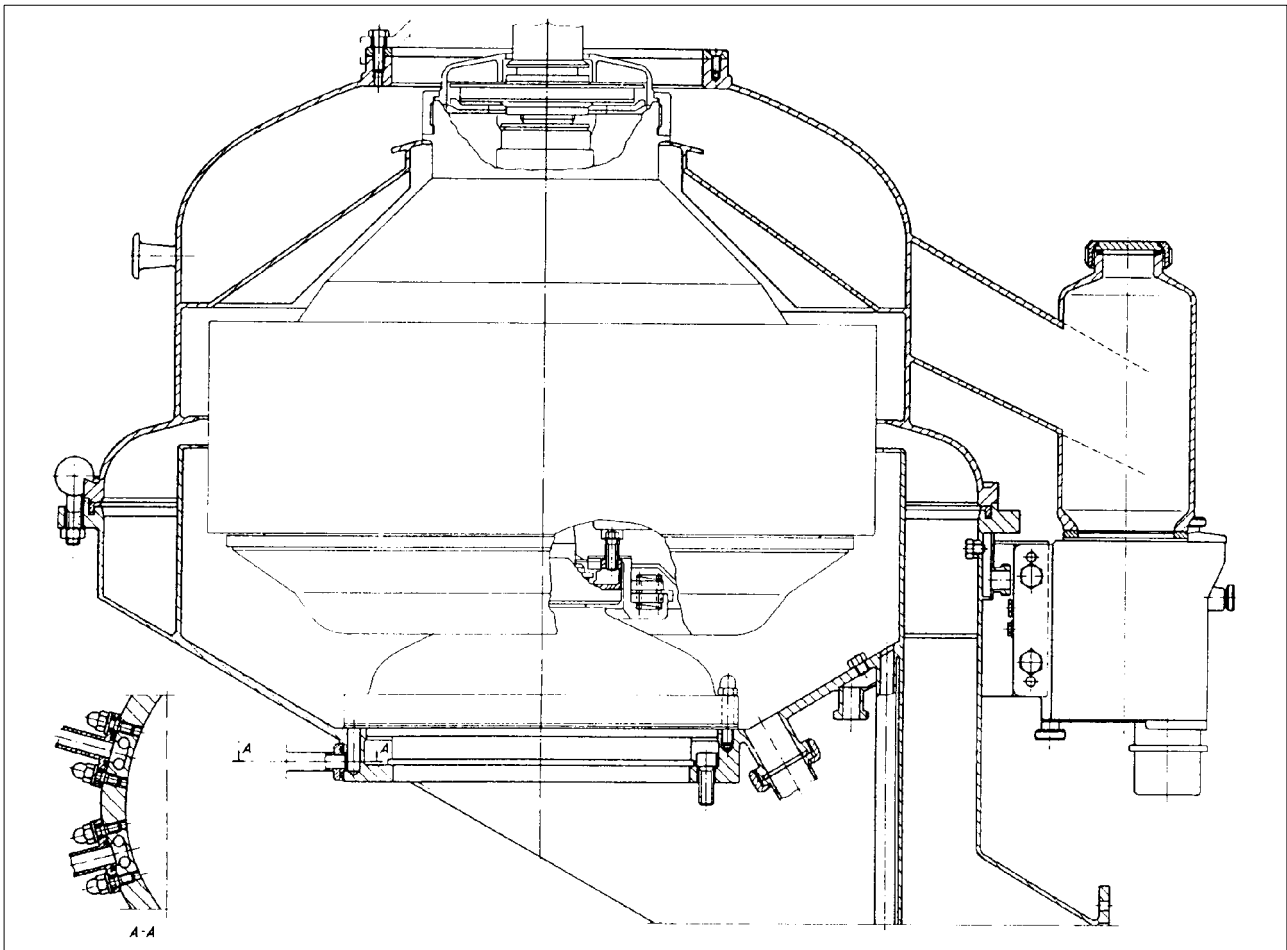
Special tools from the tool kit must be used for dismantling and assembly. The special tools are specified in the *Spare Parts Catalogue* and are shown as illustrations together with the dismantling/assembly instructions.

5.1.3 Tightening of screws

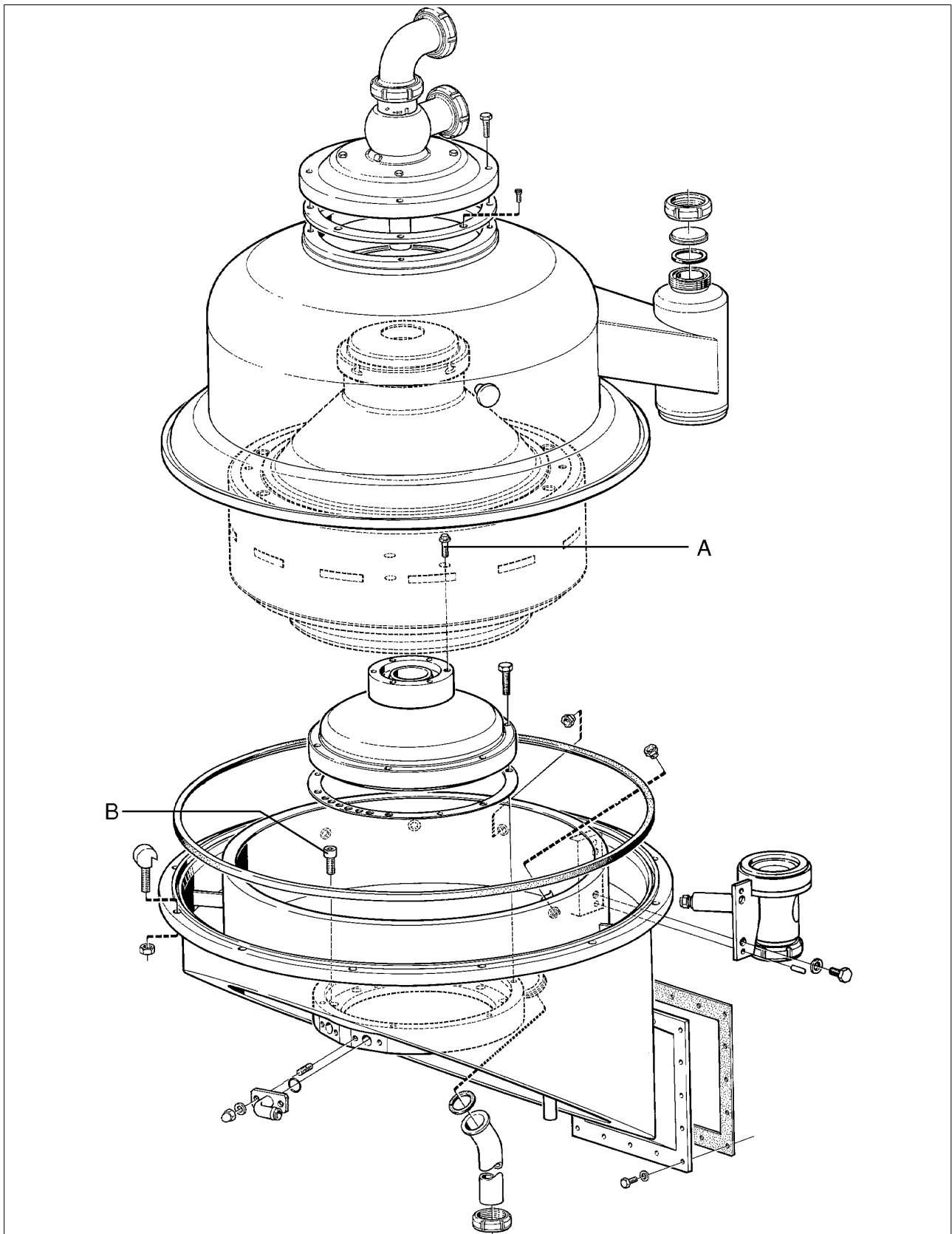
When tightening screws, use the torques stated in the table below unless otherwise stated. The figures apply to oiled, stainless screws tightened with a torque wrench.

METRIC THREAD	
Thread	Torque (stainless steel)
	Nm
M6	7
M8	18
M10	35
M12	64
M16	157
M20	304
M24	500

5.2 Machine top part



G0738311



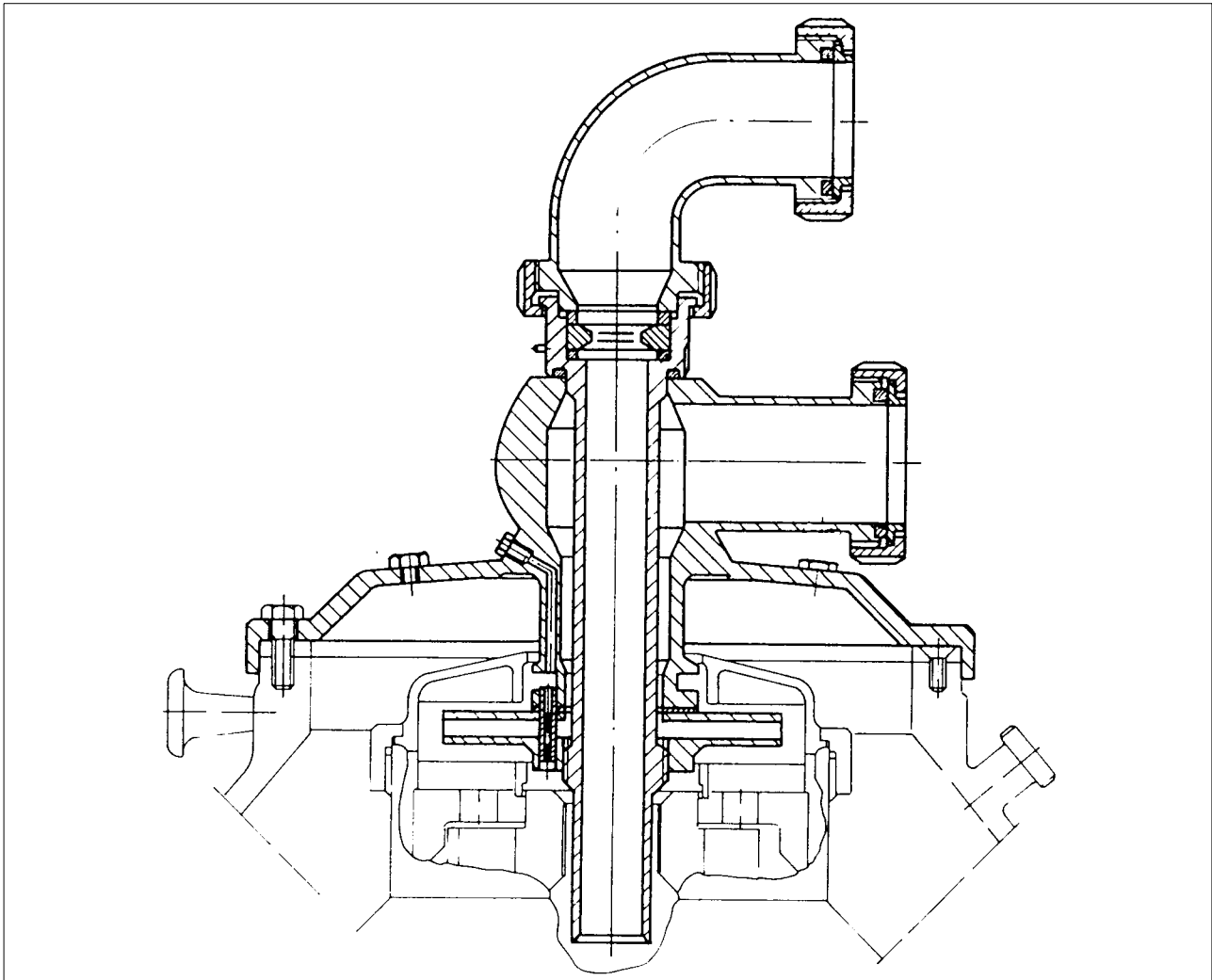
G0738011

A. To be tightened with 40 Nm

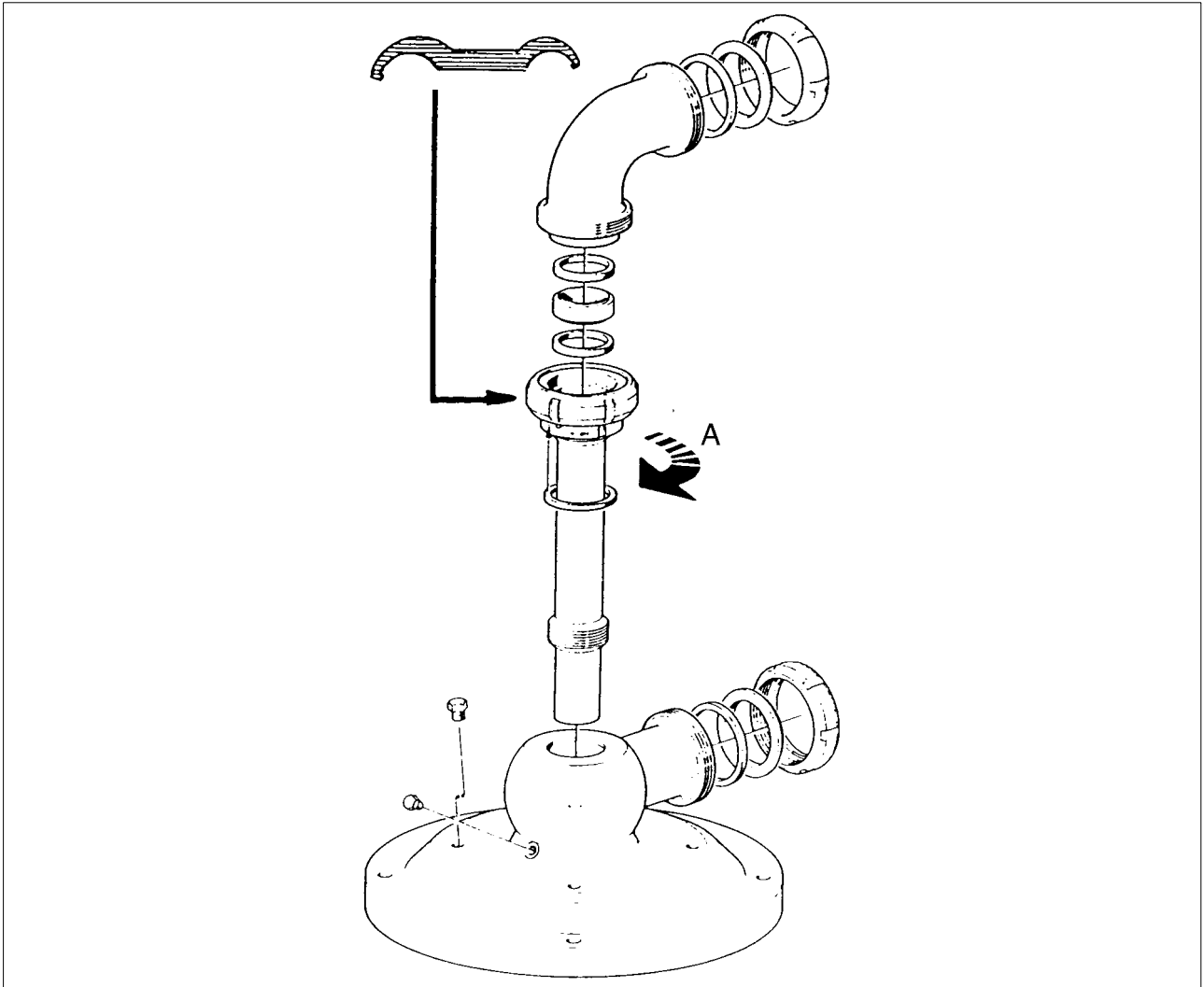
B. Thread locked with Loctite 270

5.3 Inlet / Outlet

5.3.1 Cut view



5.3.2 Dismantling



G0738411

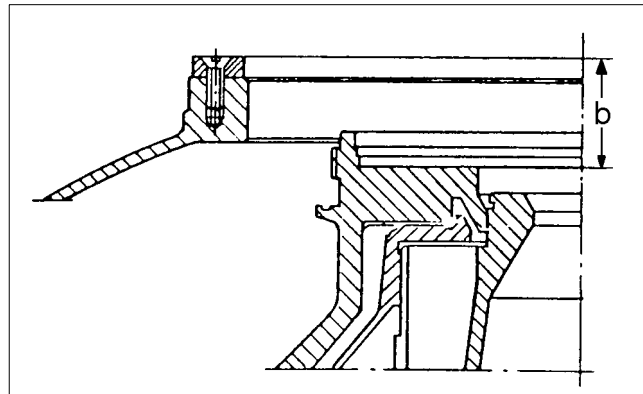
A. OFF
Left-hand thread!

5.3.3 Assembly

Height position

If the bowl is replaced or the bowl spindle stripped, the height position must be checked. Any adjustment is made by means of one or more height adjusting rings.

The tolerances are narrow, and it is important, therefore, that parts should be well cleaned and free of burrs.

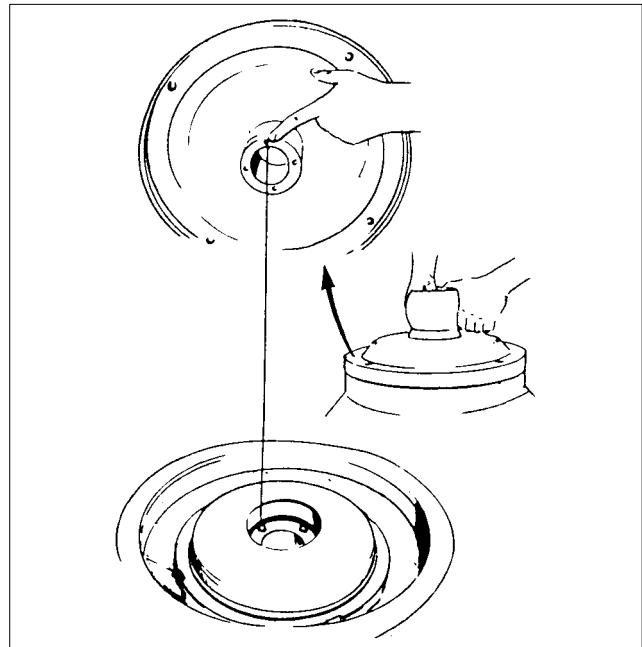


$$b = 74,5 \pm 0,7 \text{ mm}$$

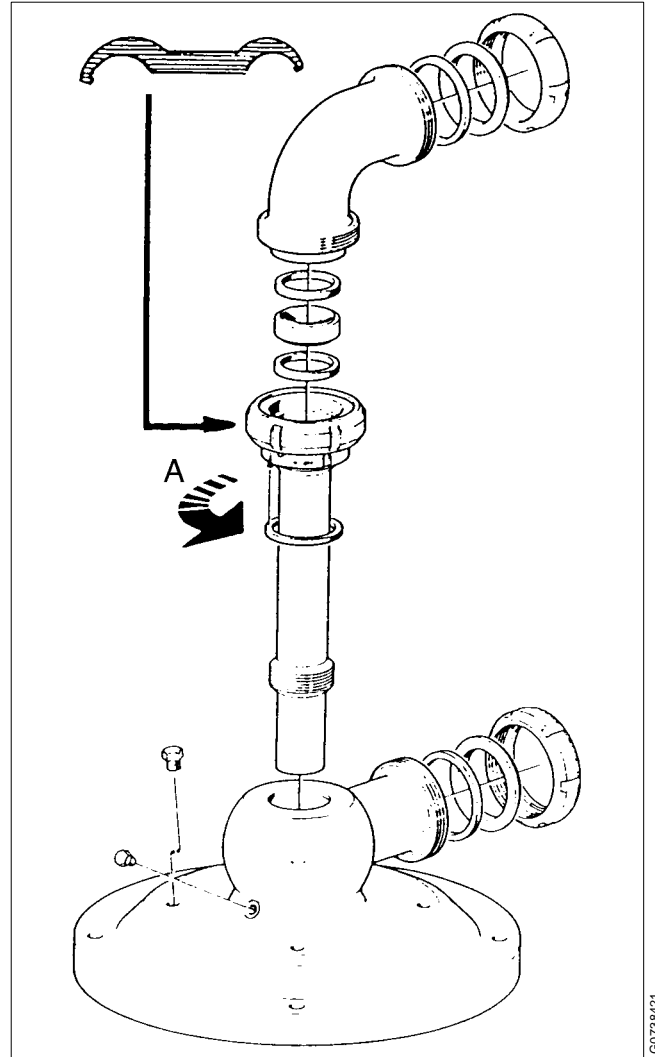
NOTE

Recheck the height position in immediate connection with the start. Stop the machine immediately if a scraping noise occurs.

Fit the outlet cover. Check that the guide dowels in the paring disc fit into the holes in the cover.

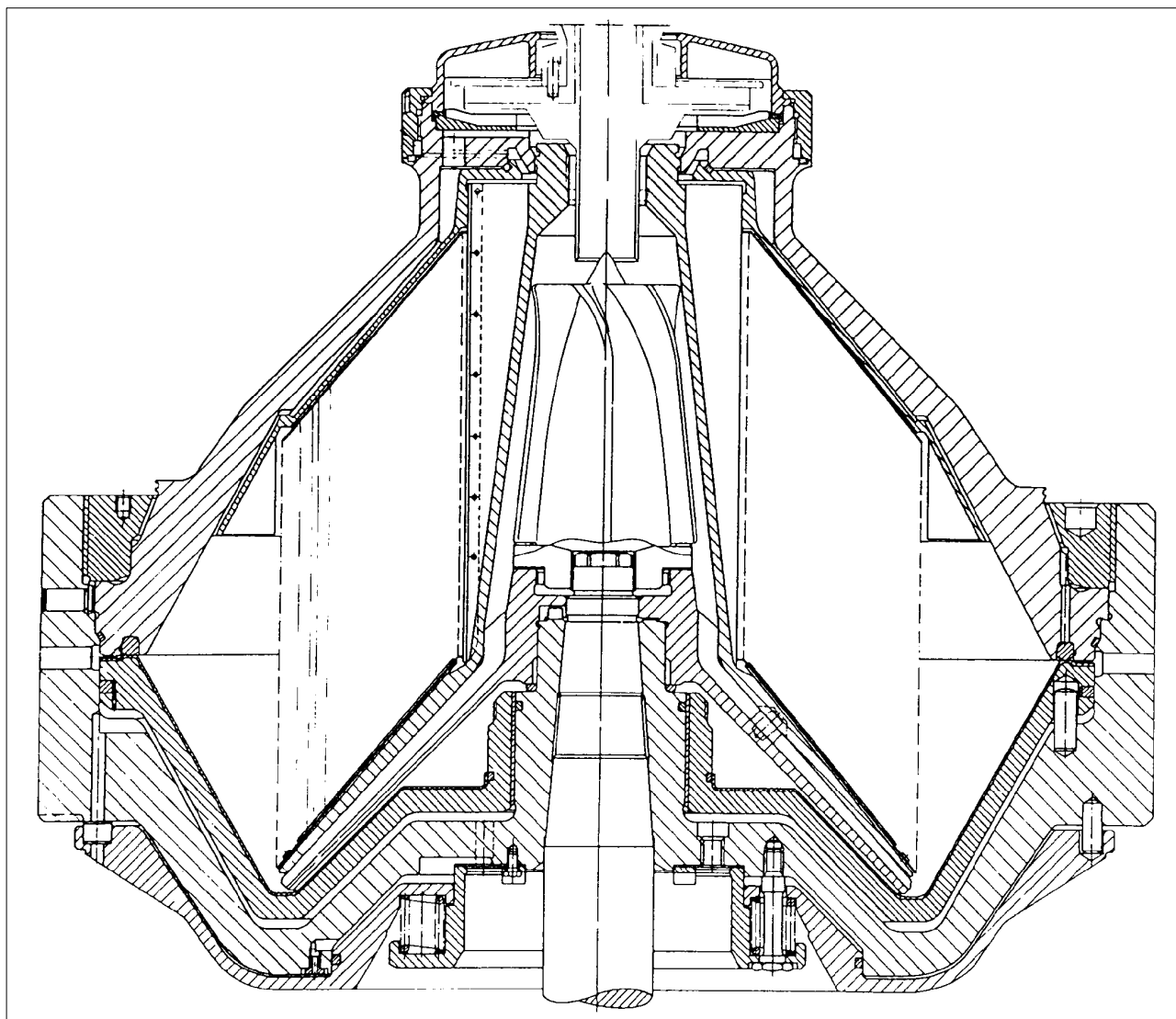


- A. OFF
Left-hand thread!



5.4 Separator bowl

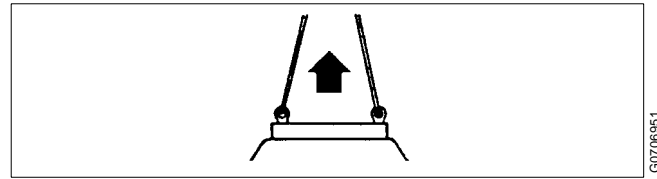
5.4.1 Cut view



G0731321

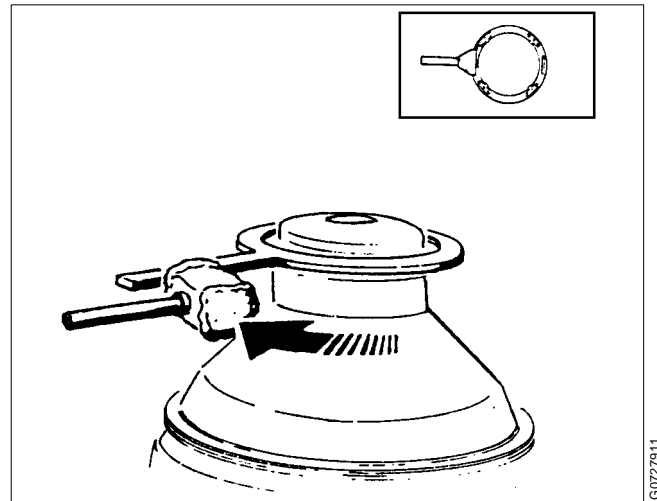
5.4.2 Dismantling

1. Remove the frame hood.



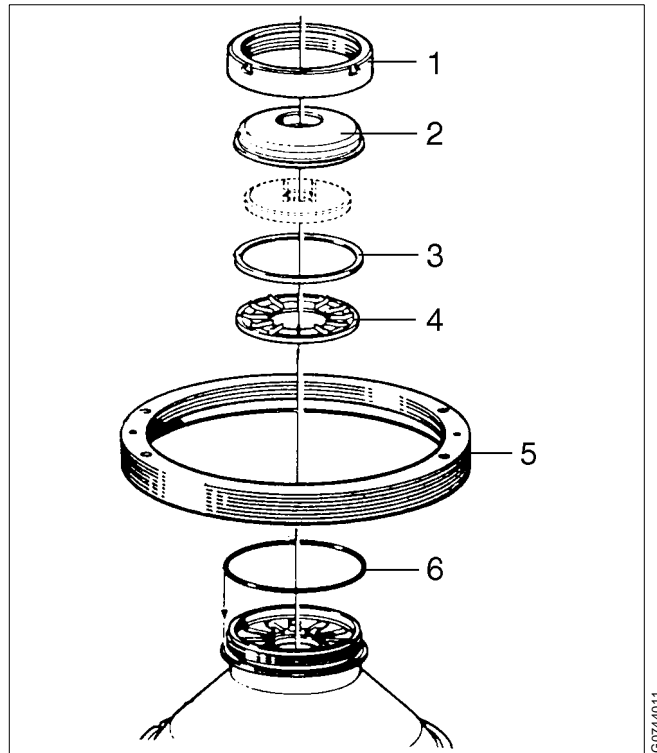
G0708951

2. Unscrew the small lock ring clockwise.
Left-hand thread!



G0727911

3. Dismantle the components according to the picture.

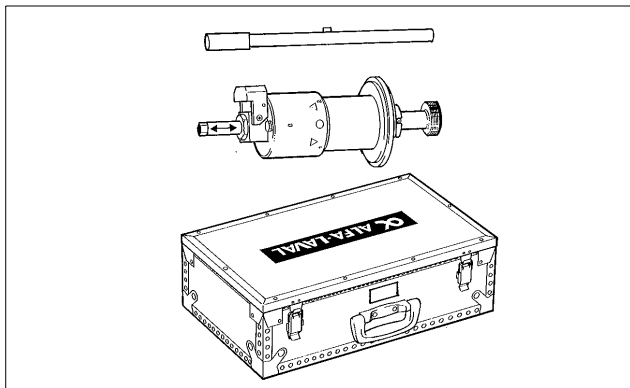


G0744011

1. *Small lock ring*
2. *Paring chamber top part*
3. *Gasket*
4. *Gravity disc*
5. *Large lock ring*
6. *Seal ring*

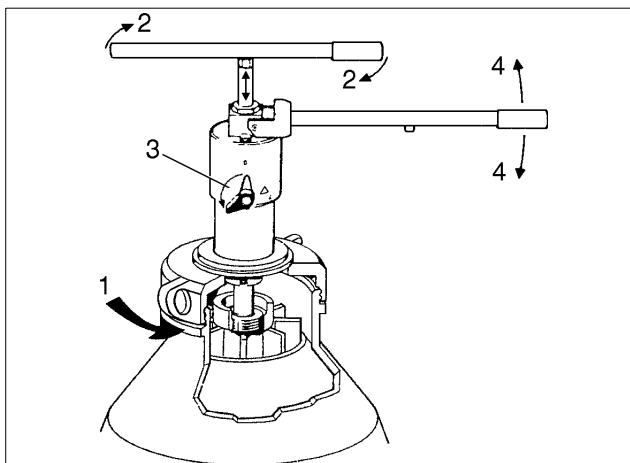
4. Before unscrewing the large lock ring neutralize the disc stack pressure in following way:

Compressing tool



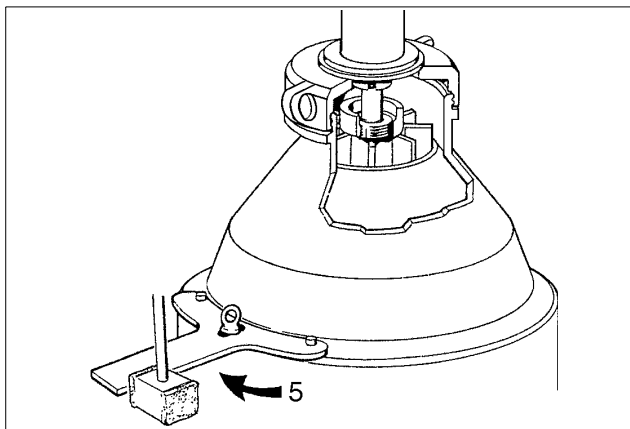
G0125911

- a. Carry out operations 1 – 3. Pump until full pressure is obtained, operation 4.



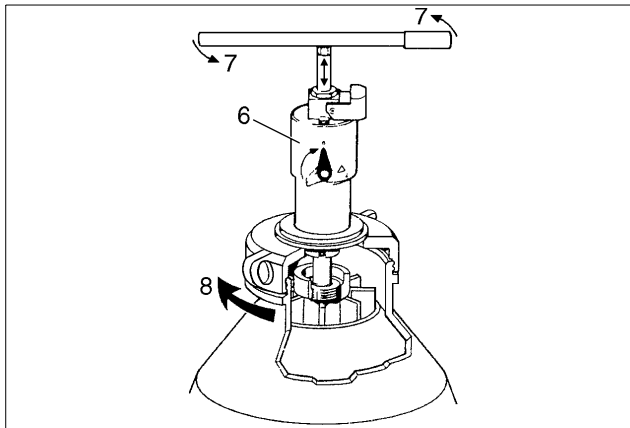
G0581911

- b. Undo the lock ring by hammering (5).



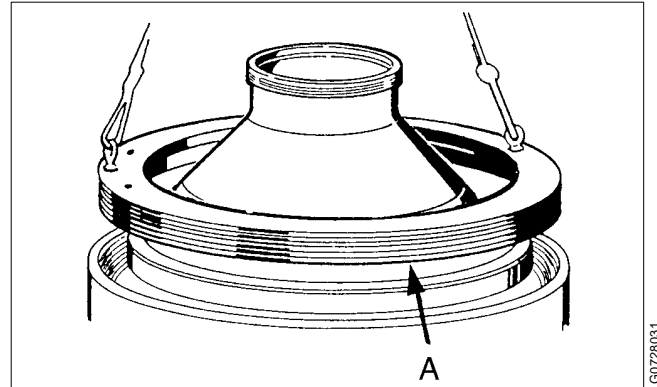
G0682211

- c. Undo and remove tools, operations 6 – 8.



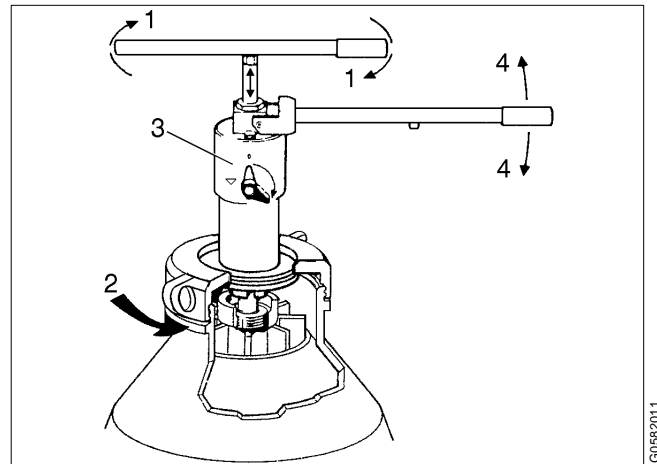
G0682111

- d. **Note!** Take care not to damage the contact surface A.



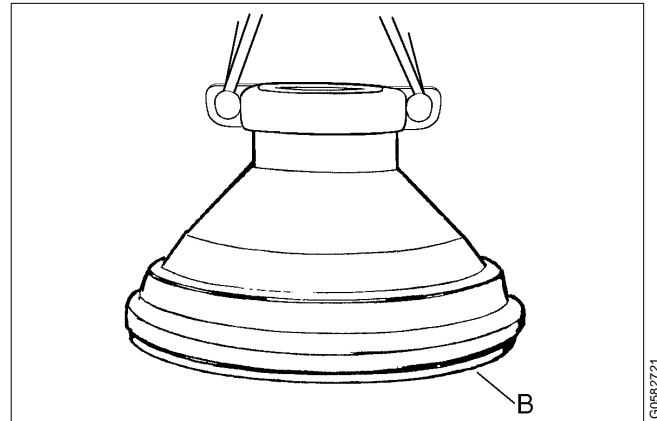
G0728031

- e. If necessary, press off the bowl hood with the tool (1 – 4).
Note! The compressing tool is fitted before the lifting ring.




G0582011

5. Remove the compressing tool and lift the bowl hood with the lift ring. *Never* lift the bowl hood with the compressing tool in place. Check that seal B is undamaged.



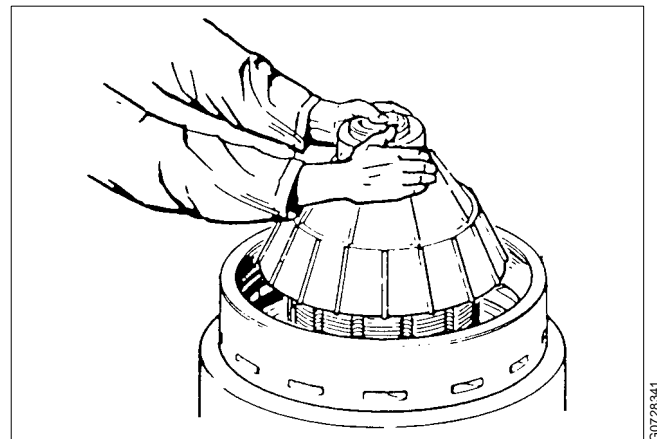
G0582721

6. Remove the top disc.



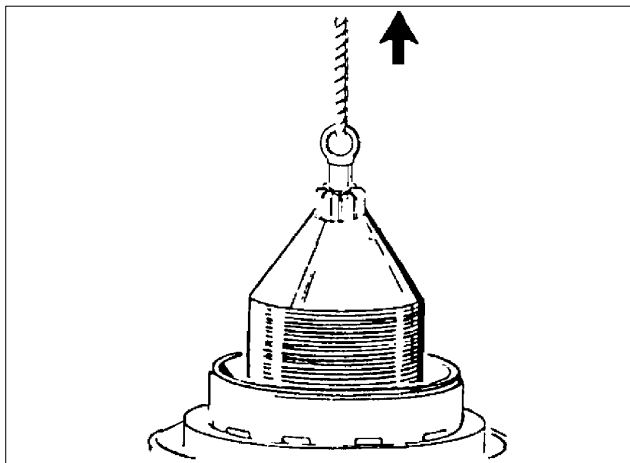
WARNING

If the top disc is stuck inside the bowl hood, loosen it with a soft drift before removing the bowl hood. If left in place, it can fall down while being lifted.




G0728341

7. Lift up the distributor and disc stack.



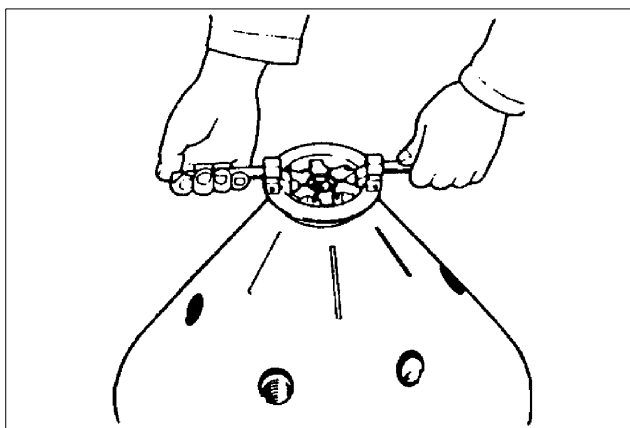
G0569521

8. If the discs are to be removed, use the special tool.



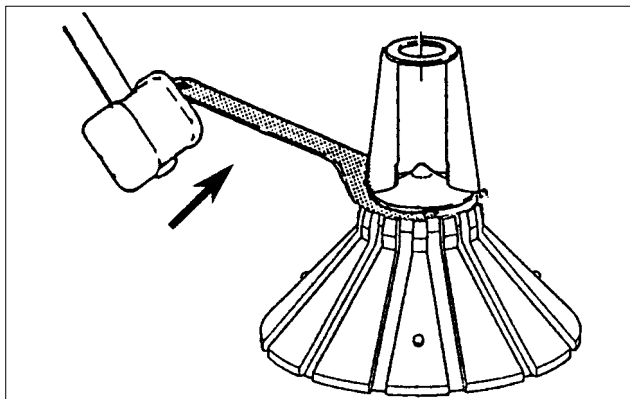
CAUTION
Cutting hazard

Separator disc stack discs and lock ring threads have sharp edges and can cause cuts.



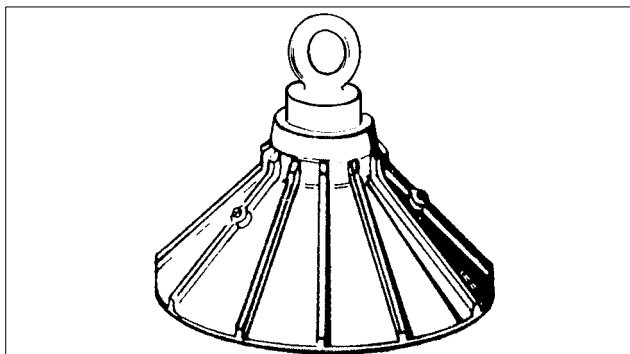
G0569611

9. Remove the cap nut (left hand thread). Put the heel of the tool in one of the holes, not on a wing.



G0728511

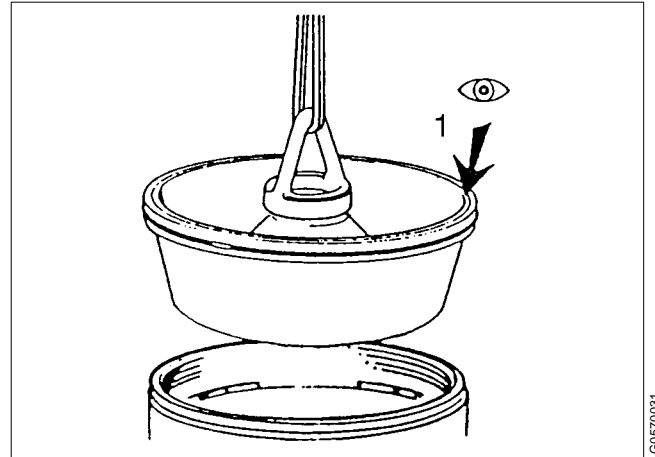
10. Push out the distributor cone with the tool.



G0582511

11. Lift the sliding bowl bottom.

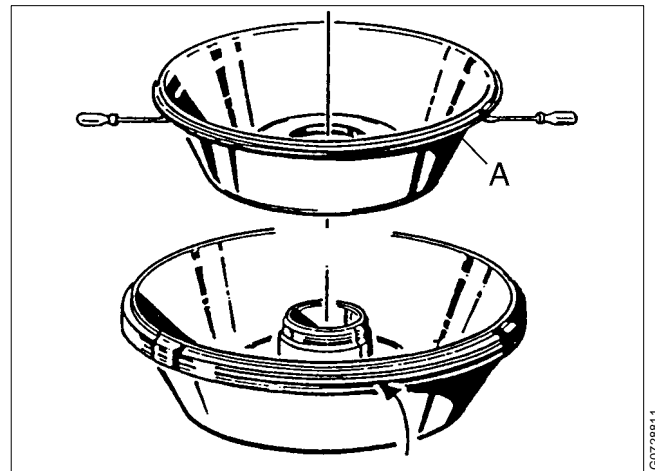
The sliding bowl bottom edge (1) seals against the bowl hood. Check for erosion.



G0570031

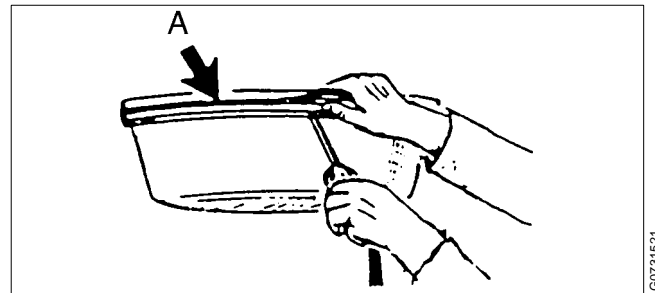
12. If the erosion lining should be renewed, remove it by using two screwdrivers or similar.

Note! The erosion lining will normally be destroyed when removed.



G0728811

13. If seal ring (A) of sliding bowl bottom should be replaced and compressed air is available, inject compressed air through the hole on the underside. This will press the ring out of the groove far enough to make it easily to grasp.

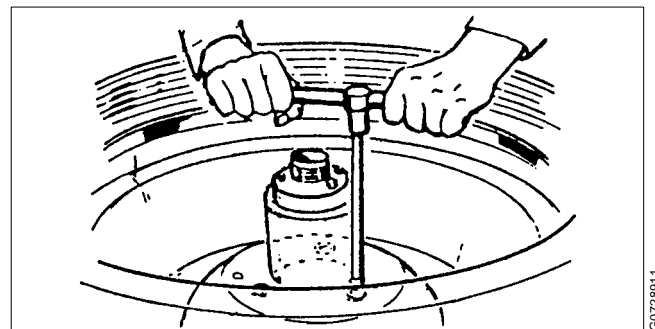


G0731521

**WARNING**

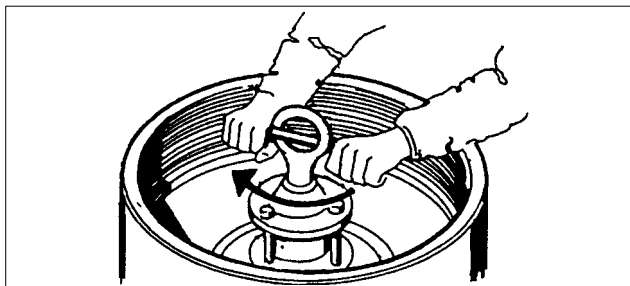
Risk of injury. Use safety goggles.

14. Unscrew the 3 screws in the bowl body (10 mm allen).



G0728911

15. Fit the lifting tool and push the bowl body free from the bowl spindle.

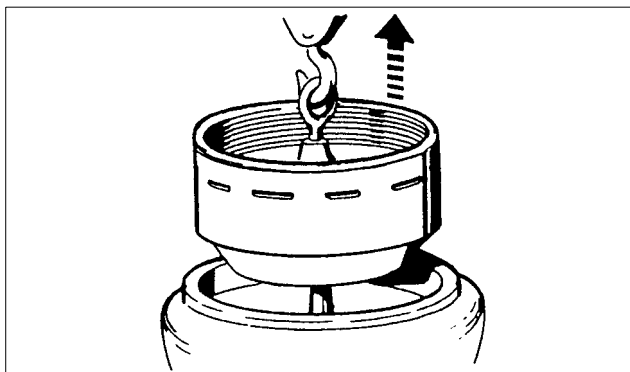


G0729011

16. Lift up the bowl body.

NOTE

Handle the bowl body carefully. If it is roughly handled, the ejection mechanism may be damaged.



G0729111

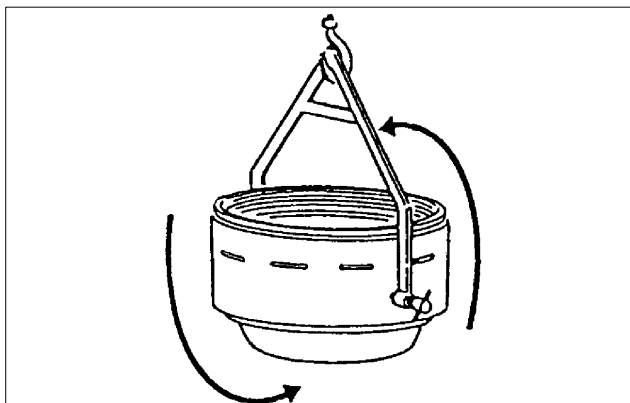
17. Remove the bowl body lifting tool. Turn the bowl body using the turning tool, see the illustration.



WARNING

Crushing hazard

Risk for jamming injury when turning the bowl body.



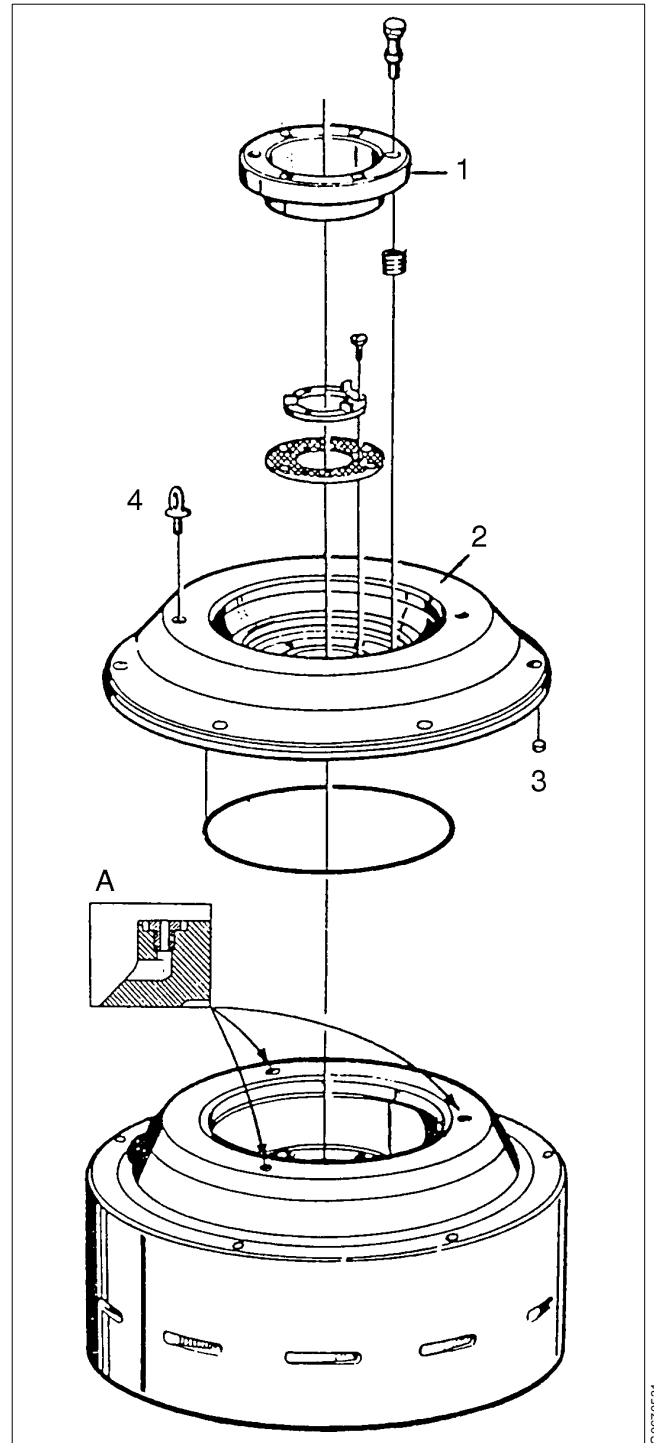
G0570211

18. Remove screws, spring holder and springs.

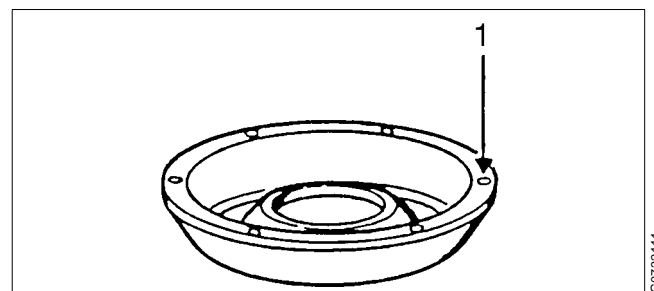
Note! Remove the screws in the spring holder carefully and alternately. The springs are heavily compressed. Remove the operating slide. Use lifting eyes.

1. Spring holder
 2. Operating slide
 3. Valve plug
 4. Lifting eye (M12) *
- A. Nozzle width over flats = 11 mm

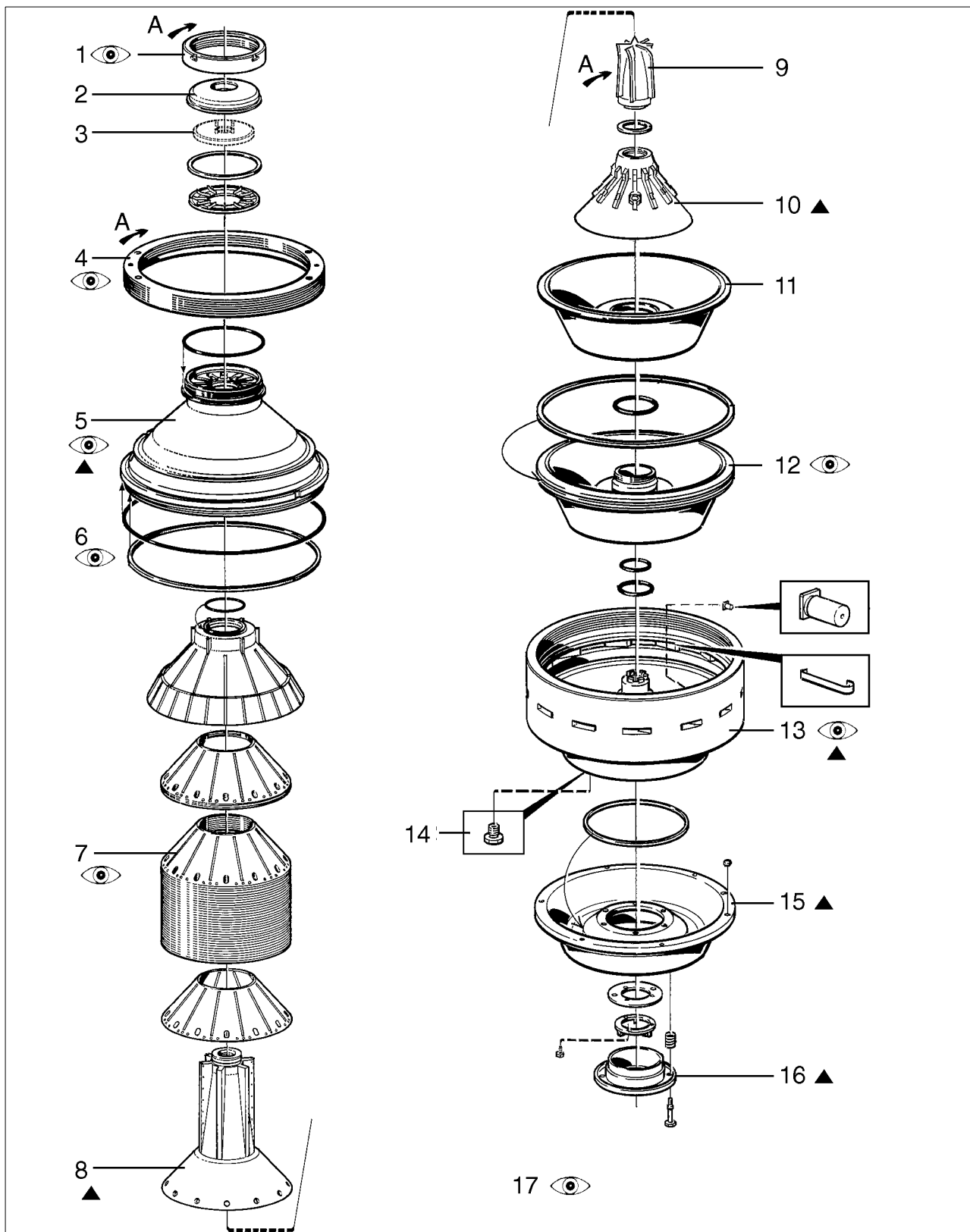
*) The threaded holes for the lifting eyes are normally plugged. Remove the plugs before fitting the lifting eyes. Don't forget to remount the plugs when assembling the bowl again.



19. Lay down the slide with the valve plugs (1) upwards. If any of the plugs are damaged, change all of them.



5.4.3 Check points



G0737621

A. OFF

👁 Check

▲ Exchange necessitates rebalancing – send the complete bowl to an Alfa Laval representative

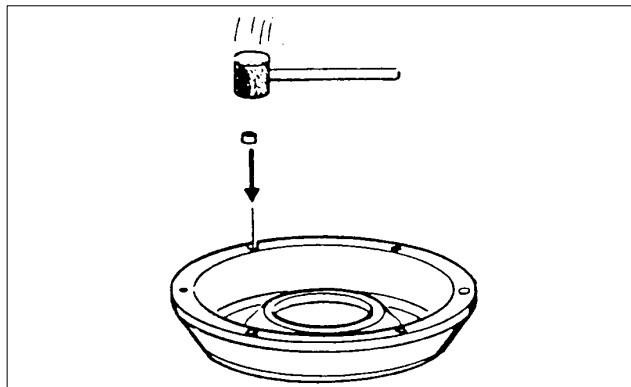
1. *Lock ring, small*
2. *Paring chamber*
3. *Paring disc*
4. *Lock ring, large*
5. *Bowl hood*
6. *Seal ring*
7. *Disc stack*
8. *Distributor*
9. *Cap nut*
10. *Distributing cone*
11. *Erosion lining*
12. *Sliding bowl bottom*
13. *Bowl body*
14. *Nozzle x 3*
15. *Operating slide*
16. *Spring support*
17. *Ejection mechanism*

NOTE

Detailed Check points for the parts illustrated can be found in “4.3 Check points at Intermediate Service (IS)” on page 48.

5.4.4 Assembly

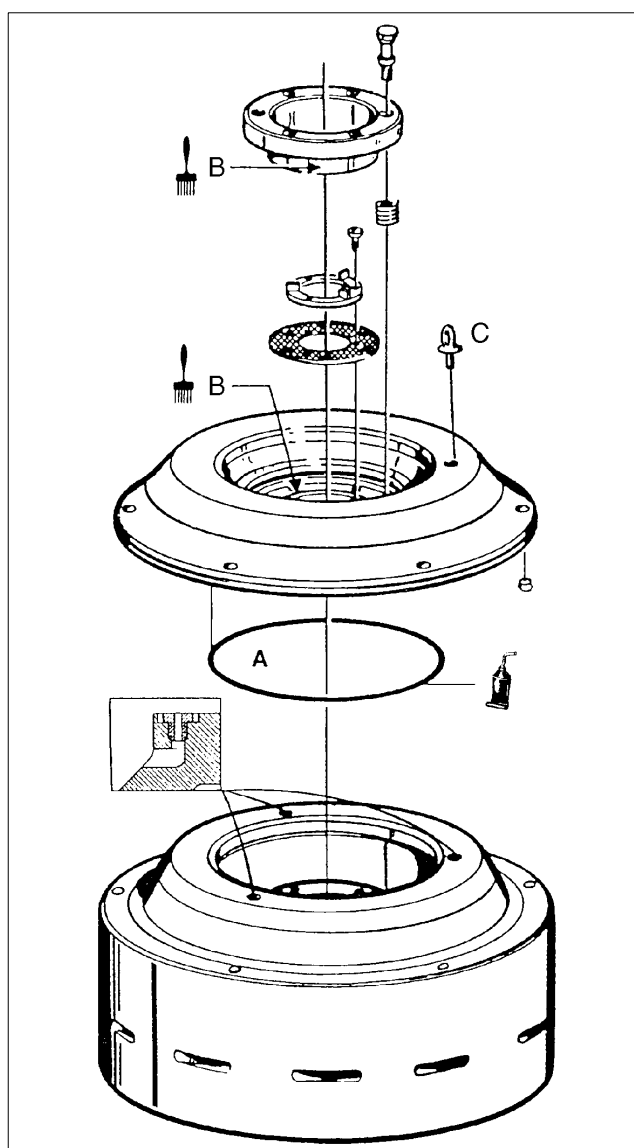
1. Knock in the new plugs with a rubber hammer so that the sealing surface is not damaged.



G057152.1

2. Screw together the bowl according to the picture. Tighten the spring holder screws alternately.


Note: The groove for the square ring (A) has to be well cleaned. The discharge may fail if the square ring does not seal properly.



G067055.1

- A. Square ring
- B. Molykote
- C. Lifting eye, M12

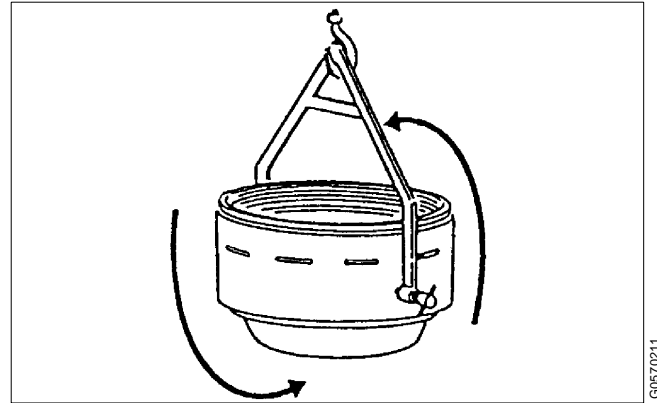
3. Turn the bowl body.



WARNING

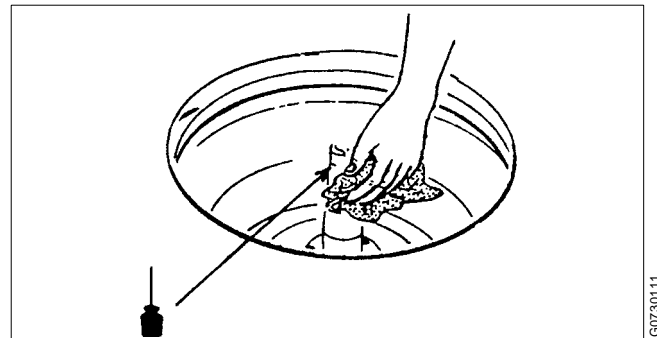
Crushing hazard

Risk for jamming injury when turning the bowl body.



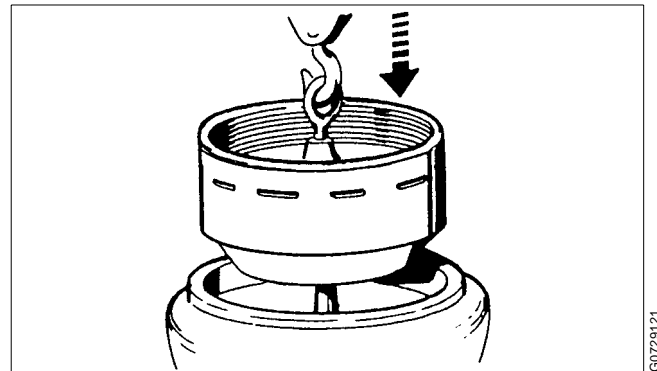
G0570211

4. Clean spindle cone and nave bore in bowl body. Lubricate cone sparsely and wipe it with a clean cloth.



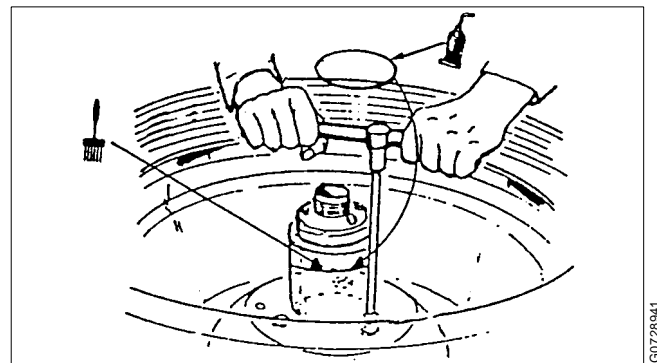
G0730111

5. Lower the bowl body onto the spindle cone carefully.



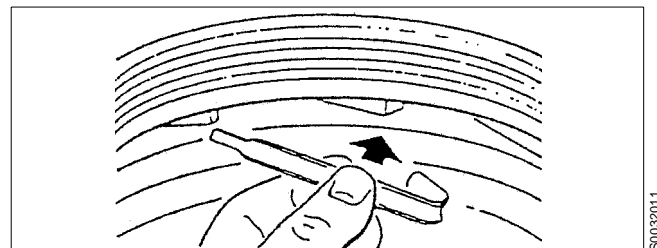
G0729121

6. Lubricate with Molykote 1000 Universal Paste. Fit the O-ring and gasket. Tightening torque **40 Nm**.



G0728841

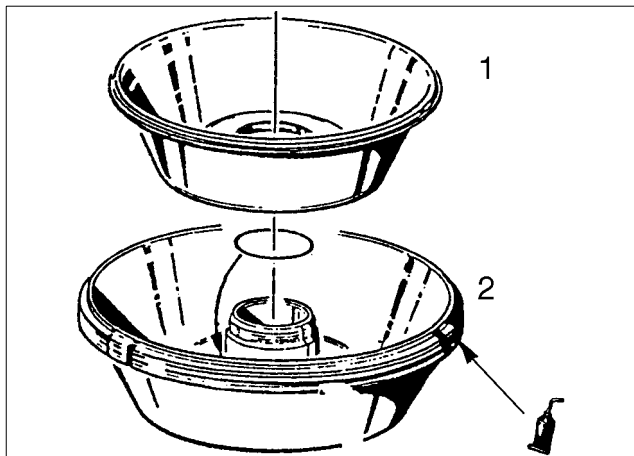
7. Fitting of erosion (wear) liners in sediment ports – see special instruction – “4.3.2 Erosion and wear liners” on page 50.



S0032011

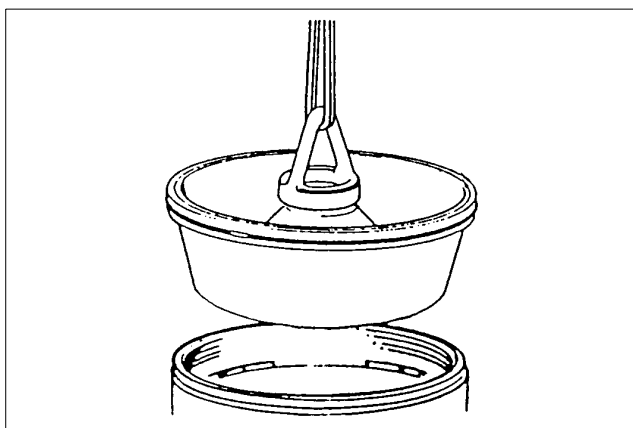
8. Fitting of erosion (wear) liner in sliding bowl bottom – see special instruction – “4.3.2 Erosion and wear liners” on page 50.

9. Grease and fit the sealing ring.

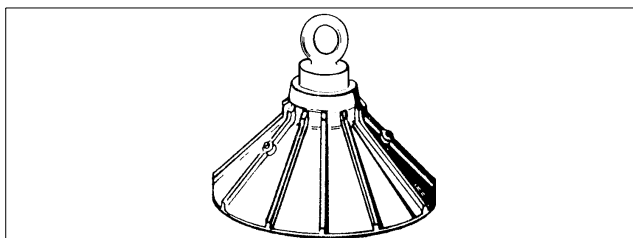


1. Erosion lining
2. Sliding bowl bottom

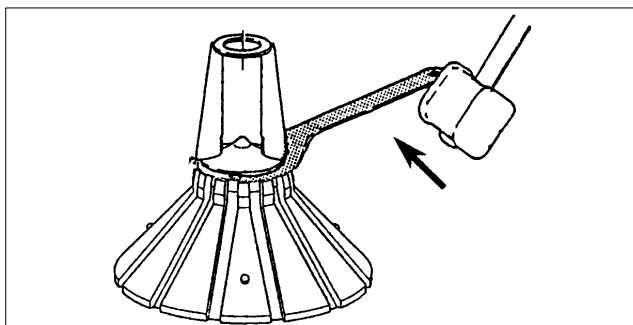
10. Fit the sliding bowl bottom.



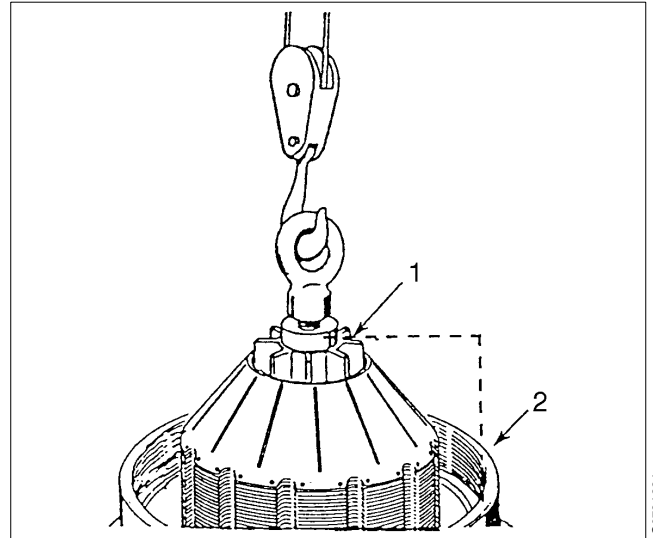
11. Fit the distributor cone. Check that the guide key fits in place in the bowl body.



12. Fit the gasket and tighten the cap nut.

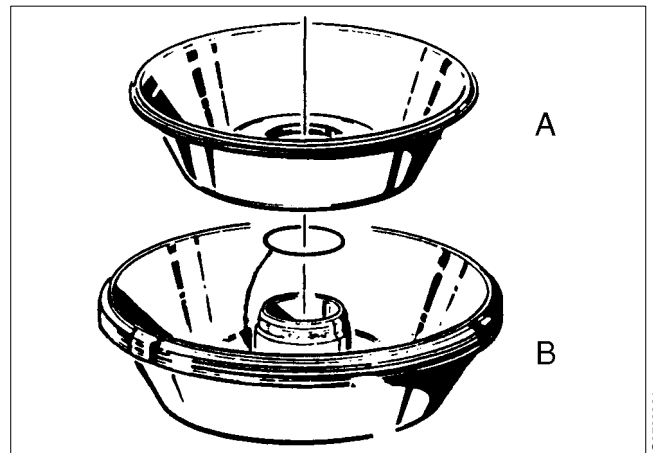


13. Lower the distributor and disc stack. Check that the drill mark on the distributor sits in front of the guide key on the bowl body.



1. Drill mark
2. Guide key

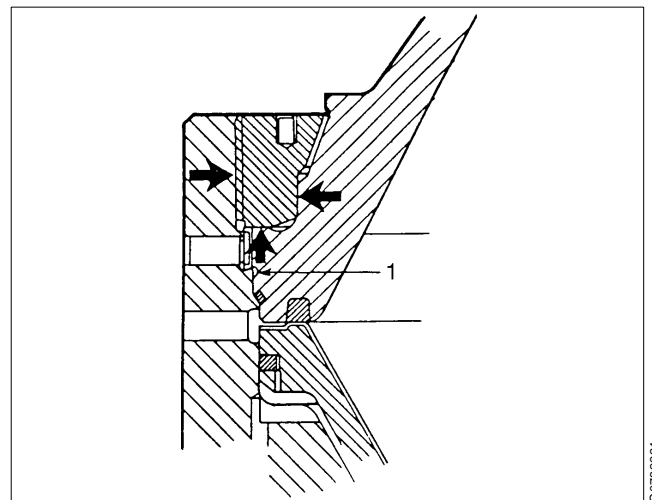
14. Fit the top disc on top of the disc stack. Check that the guide pin is positioned in front of the guide key.



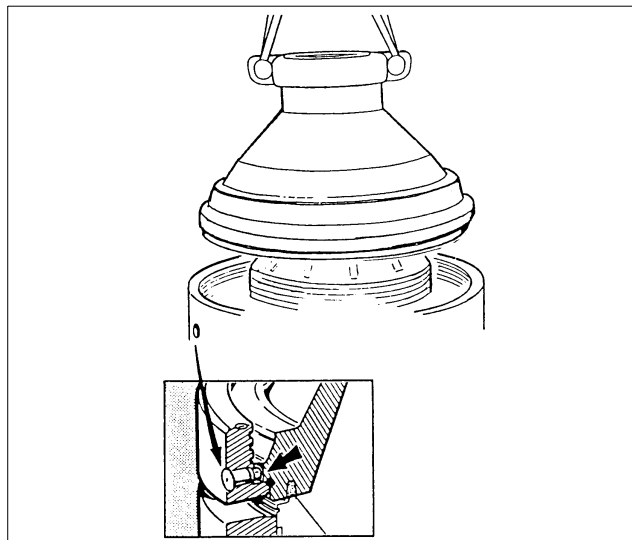
- A. Guide pin
B. Guide key

15. Inspect and lubricate threads as well as contact and guiding surfaces (indicated by an arrow).

Make certain that the surfaces (1) of the so-called dovetail slot are well cleaned.

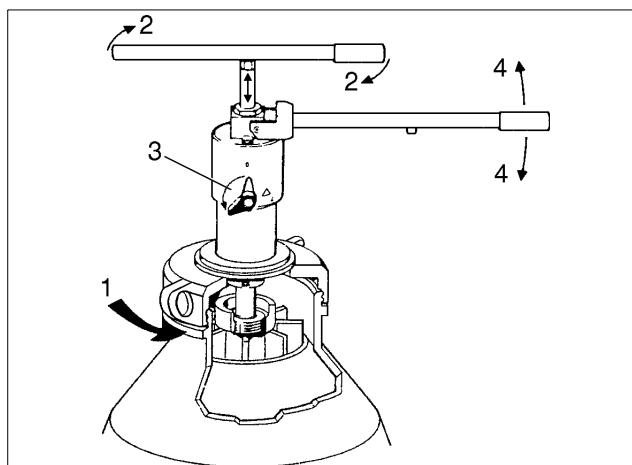


16. Fit the bowl hood. The guide key in the bowl body should fit in the groove in the hood.



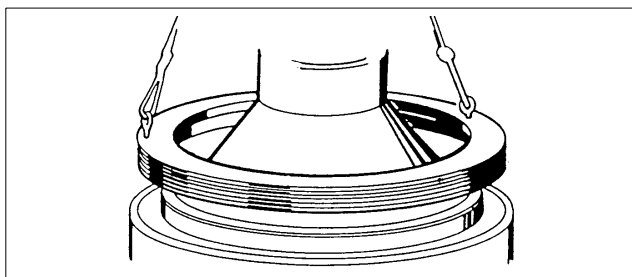
G0728231

17. Compress the disc stack. Pump until full pressure is achieved.



G0681911

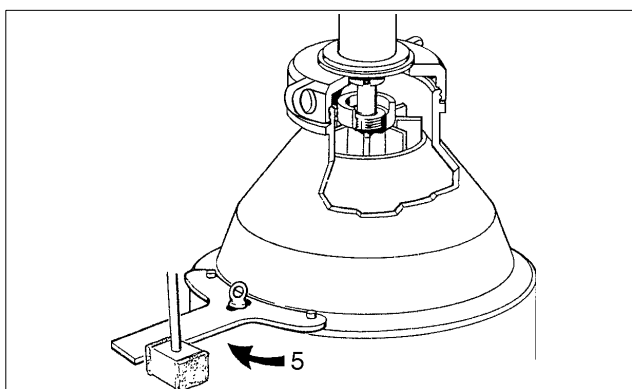
18. Lift the lock ring by using eye bolts and a hoist and lower it gently onto the bowl body.



G0732311

19. Fit the lock ring spanner and tighten the lock ring by hand until it stops. Finally hit the spanner handle a few blows (5).

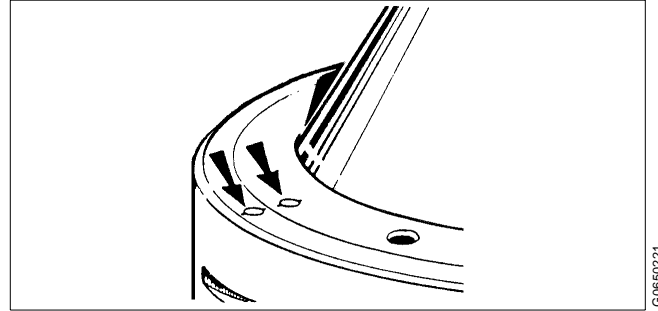
Left-hand thread!



G0682211

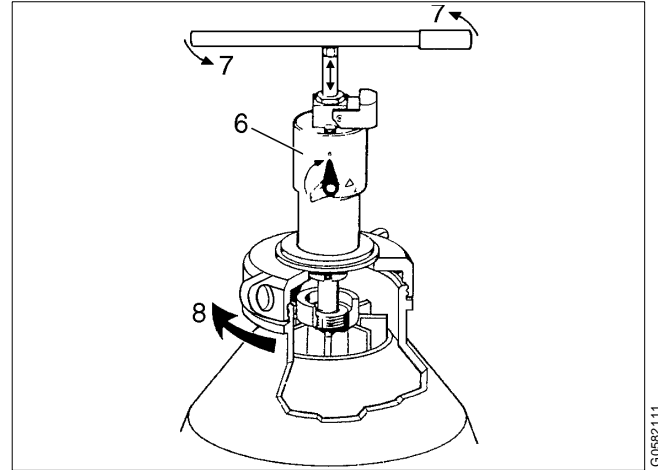
20. The marks ϕ on lock ring and bowl should now be right in front of each other.

Note! If marks \emptyset are not aligned and the distance between them does not exceed 20 – 30 mm, the ring may be advanced by knocking lightly on the spanner handle until alignment is obtained.



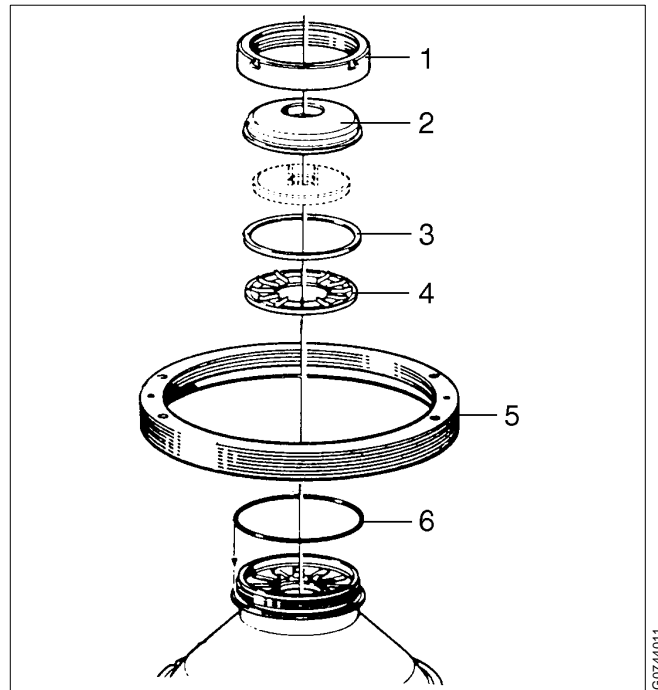
G0650221

21. Undo and remove the tool, operation 6 – 8.



G0682111

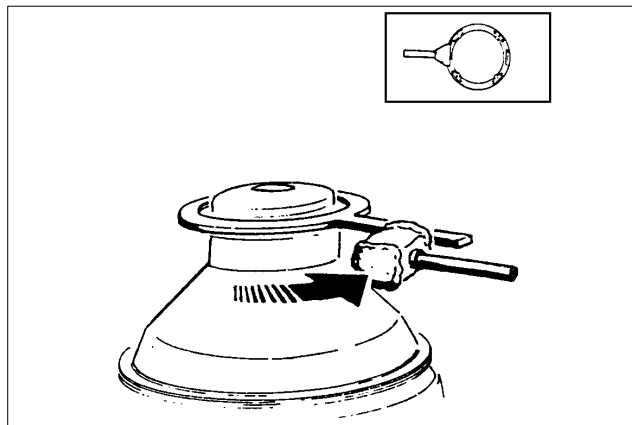
22. Fit parts according to the illustration.



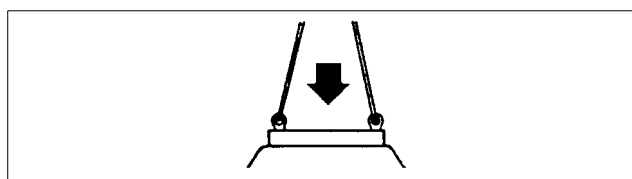
G0744011

1. Small lock ring
2. Paring chamber top part
3. Gasket
4. Gravity disc
5. Large lock ring
6. Seal ring

23. Tighten the small lock ring.
Left-hand thread!

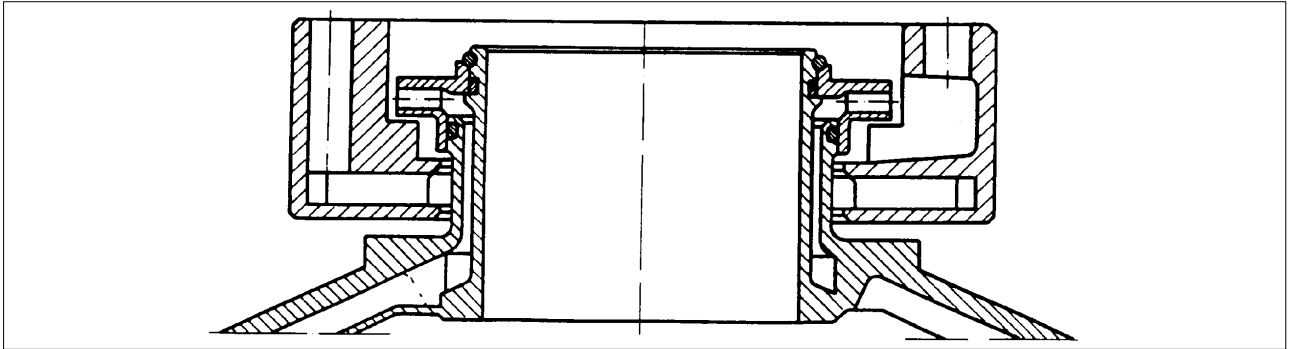


24. Fit the frame hood.



5.5 Paring disc device for operating water

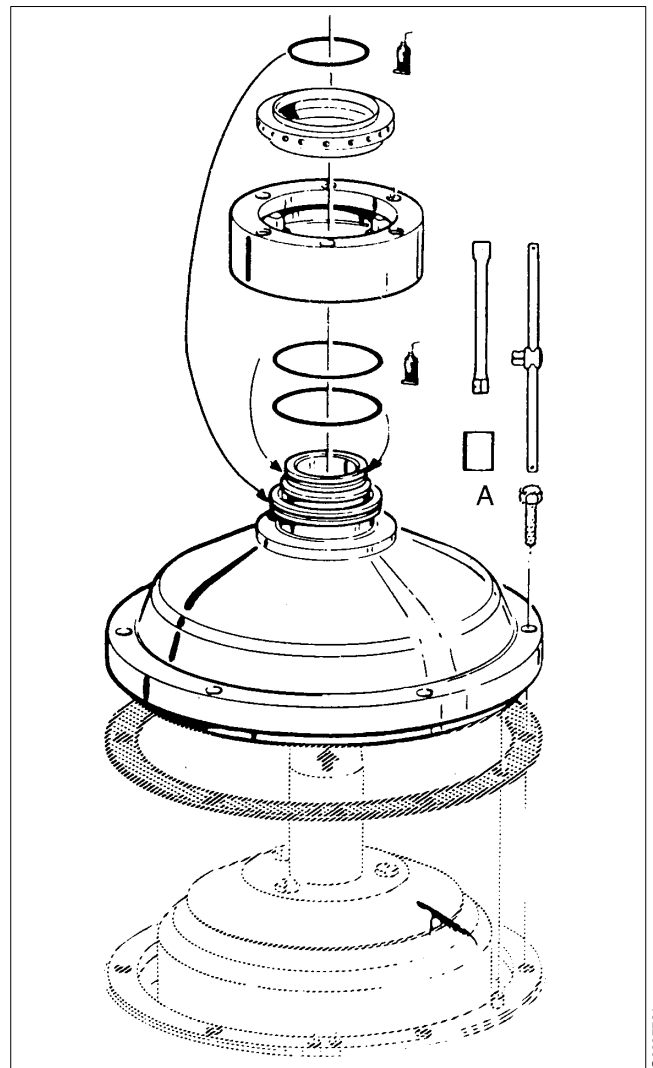
5.5.1 Views



G0462631



At assembly, lubricate the O-rings with grease of silicone type.

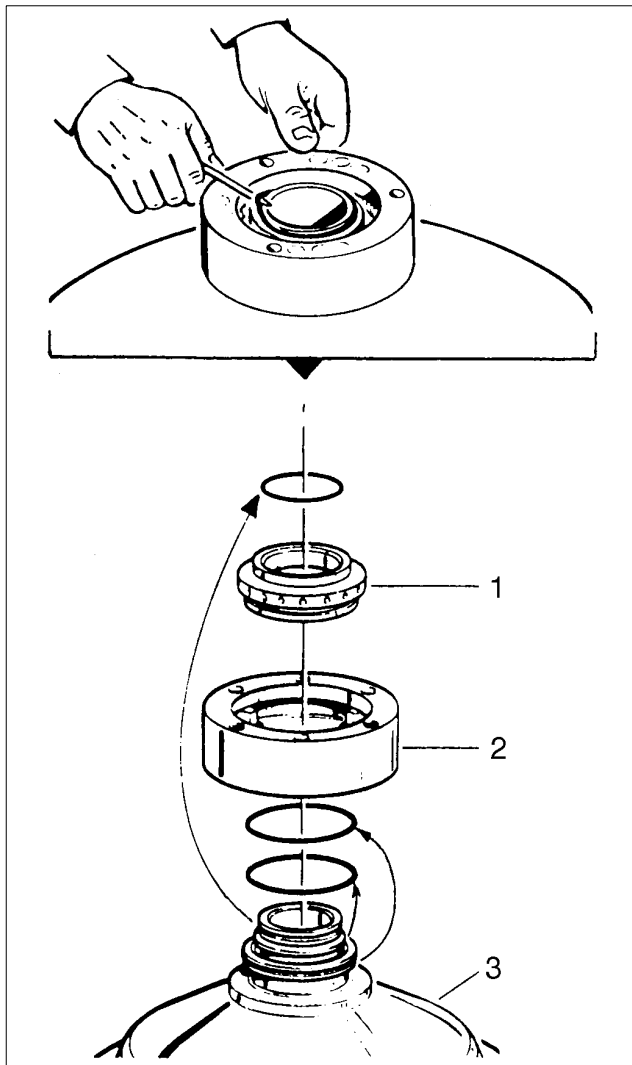


G0697721

A. Width over flats 19 mm

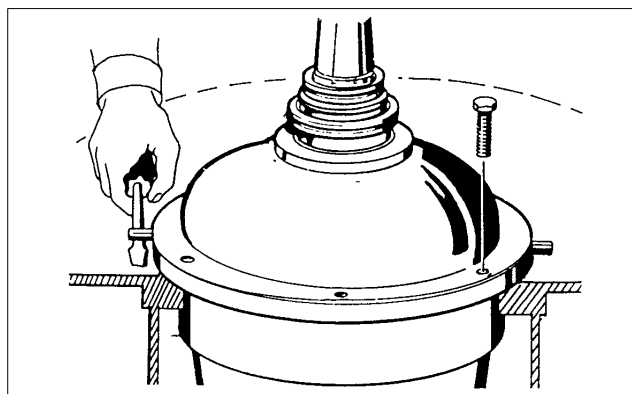
5.5.2 Dismantling

1. Knock carefully on the control paring disc with a soft drift, so that the O-ring is unloaded. Remove the O-ring with a small screw driver, as shown in the picture. Remove the control paring disc by pulling the distributor ring.

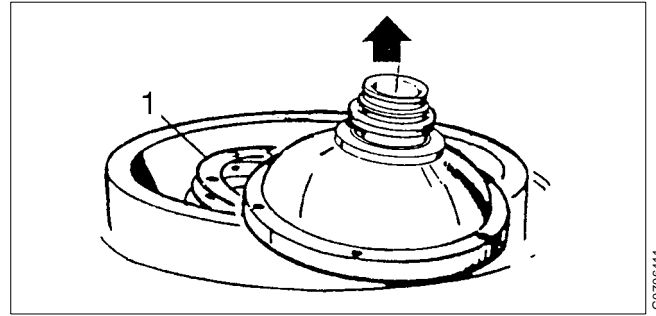


1. Control paring disc
2. Distributing ring
3. Distributing cover

2. Remove the distributor cover as the picture shows.



3. Lift off the distributor cover. Remove the height adjusting rings. Note the number.



1. Height adjusting ring

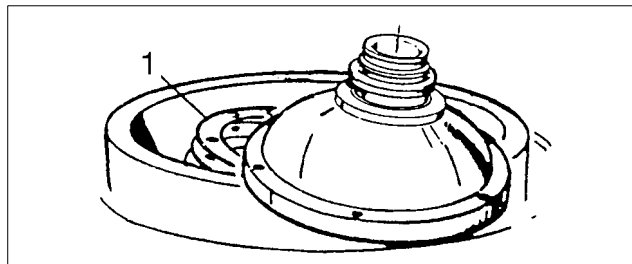
Ducts

Clean all ducts with a soft iron wire or the like. Remove deposits on other surfaces with steel wool.

- Dirt and lime deposits in the ejection mechanism may cause bad ejecting function or none at all.

5.5.3 Assembly

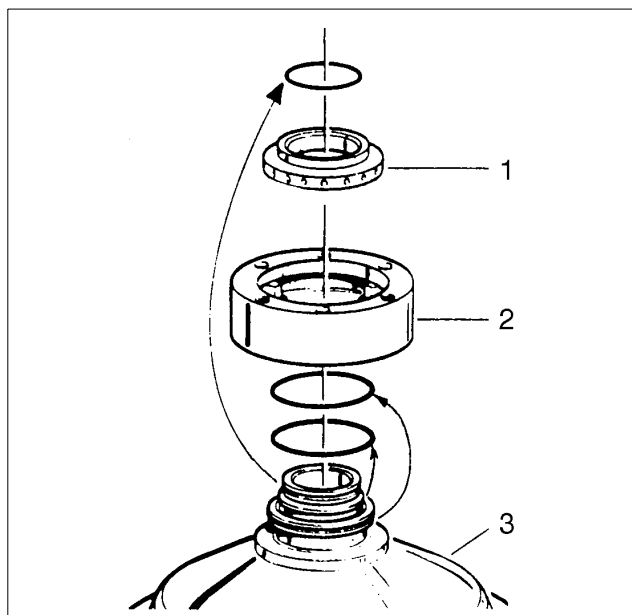
1. Replace the height adjusting rings, the same number as were removed.
2. Fit the distributor cover in correct position.



G0706421

1. *Height adjusting ring*

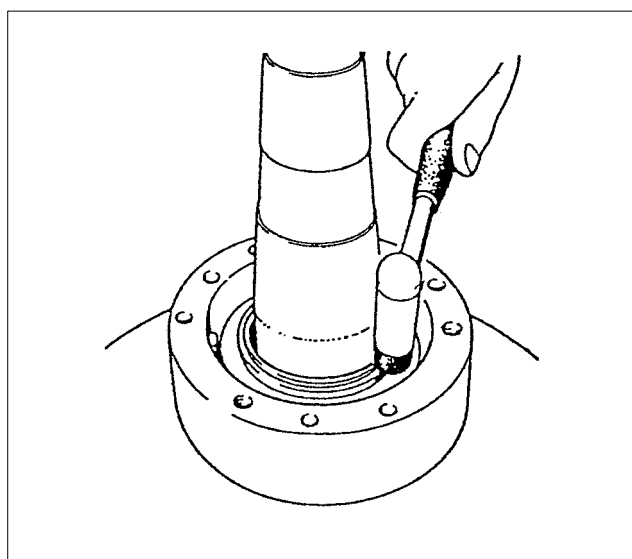
3. Fit the paring disc arrangement according to the picture. Press down the control paring disc when the upper O-ring is fitted.



G0463151

1. *Control paring disc*
 2. *Distributing ring*
 3. *Distributing cover*

4. If it is difficult to press down the control paring disc in position by hand, knock it down cautiously by means of a plastic hammer.
5. Check that the uppermost O-ring (locking the paring disc) lies properly in its groove without being twisted.
6. In order to ensure a good sealing between the control paring disc and the O-rings, jerk a few times in the distributing ring after assembly.



G0673011

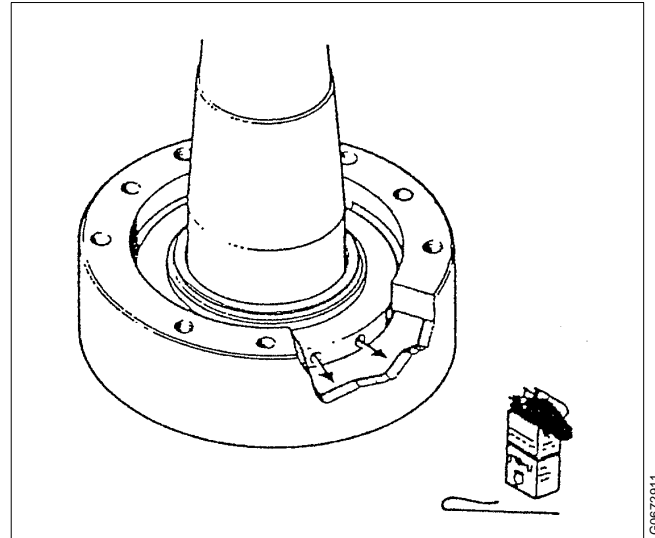
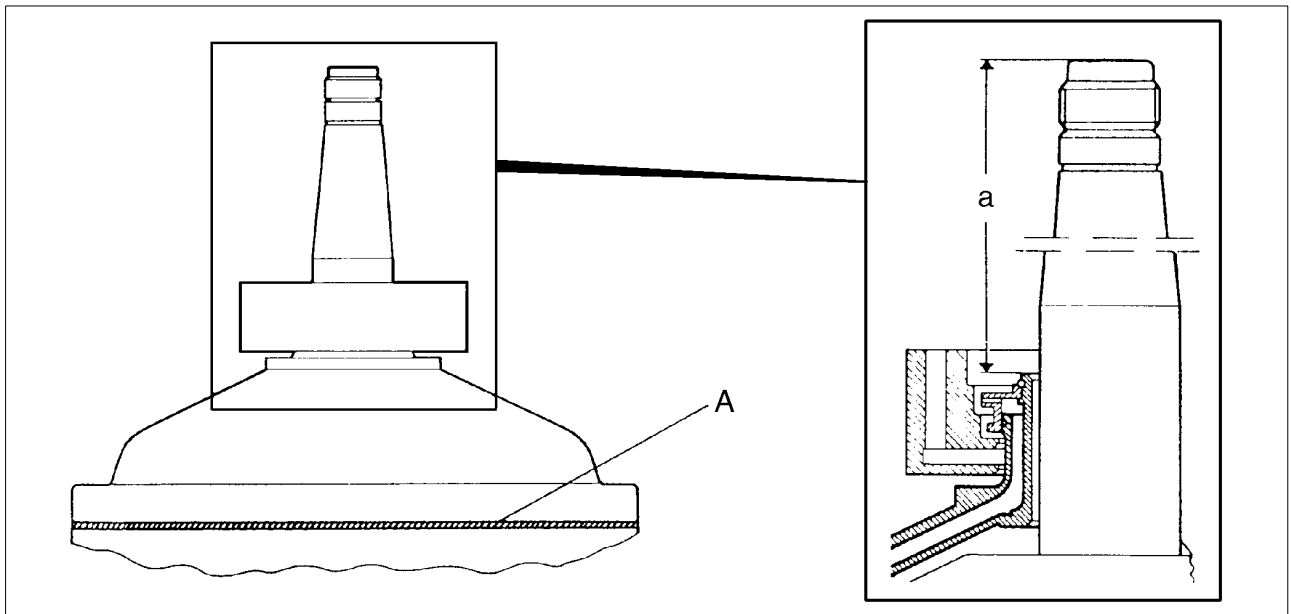
Rechecking water flow:

When the solenoid valve for make-up water is open, there should be weak water jets.

At operation the make-up water consumption is zero when the water pressure is less than 50 kPa (0,5 bar).

At discharge the water jets should be strong (1,5 – 3 litres / discharge).

Finally, when the machine is completely assembled, make a test run to make sure that the discharge function is in order.

**Height adjustment**

A. Height adjusting rings

a. $225 \pm 0,5$ mm

Check the height position after each assembly.

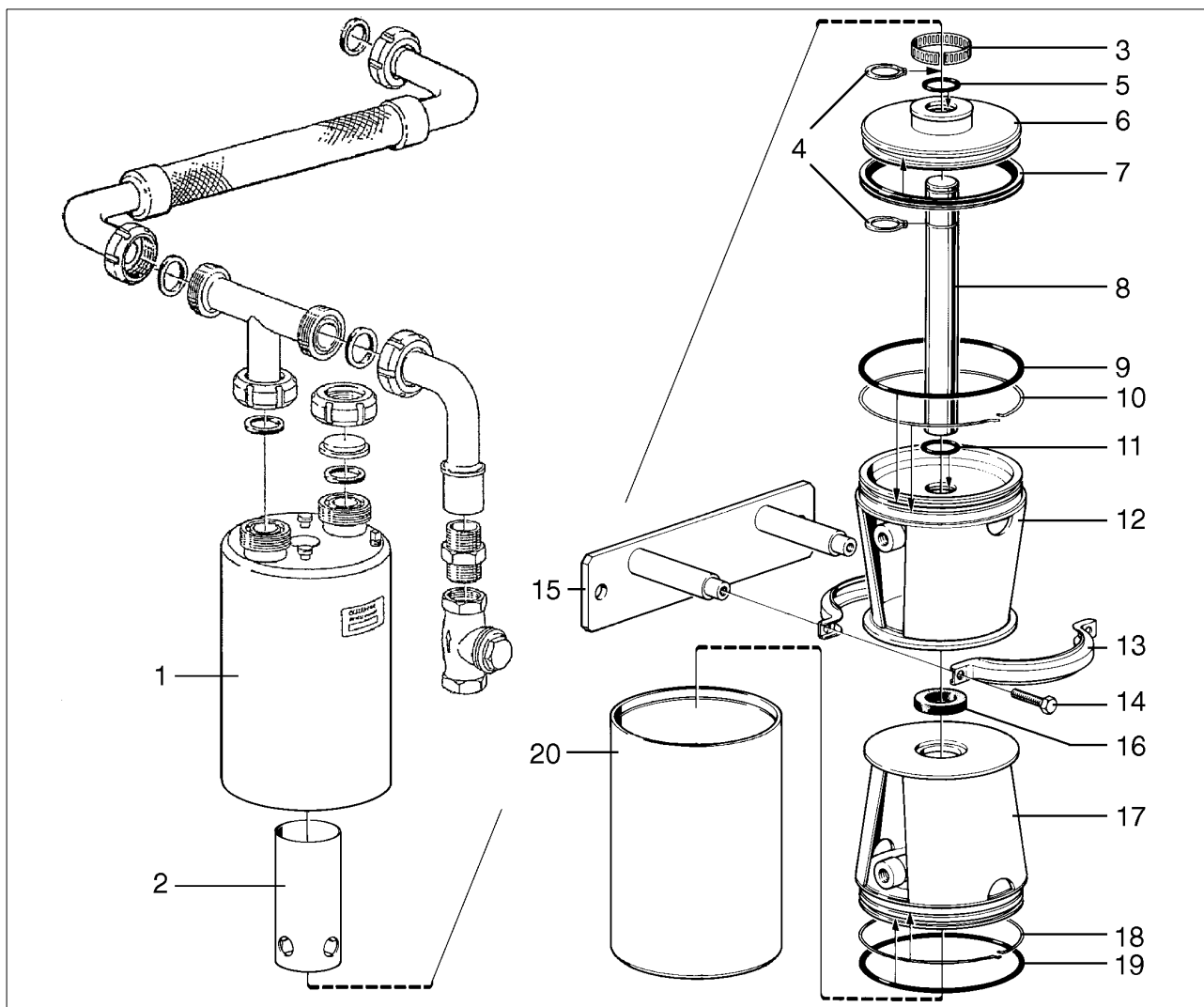
Use two steel rules or a depth gauge.

Any adjustment is made by means of one or more height adjusting rings A (1,0 mm thickness).

Note! Recheck the height position when the bowl has been mounted on the spindle by rotating the bowl by hand and make sure that it moves freely. A scraping noise may be an indication of incorrect positioning – readjust!

5.6 Operating water module (OWM)

5.6.1 Exploded view



1. Cylinder, upper

2. Distance pipe

3. Tolerance ring

4. Snap ring

5. O-ring

6. Piston

7. Piston seal ring

8. Piston rod

9. O-ring

10. Locking wire, upper

11. O-ring

12. Intermediate part, upper

13. Clamp half

14. Screw

15. Holder

16. Washer

17. Intermediate part, lower

18. Locking wire, lower

19. O-ring

20. Cylinder, lower

G0828711

5.6.2 Dismantling

If required, the OWM unit should be dismantled according to the procedure below:

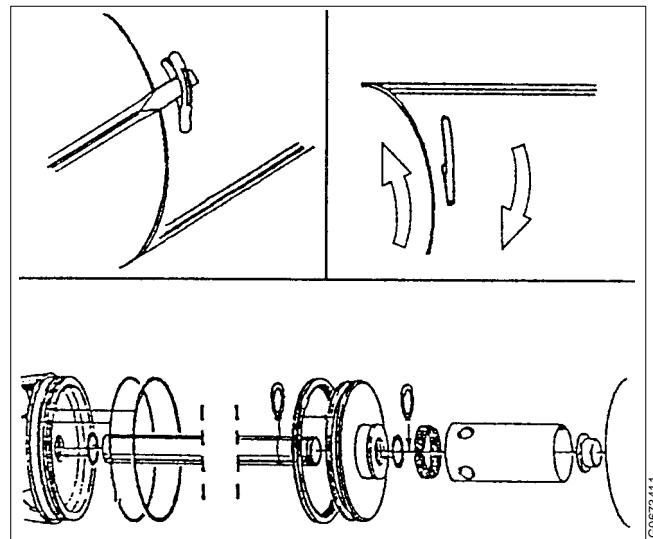
The figures within brackets refer to the exploded view on page 112.

1. Remove the connections for operating water, compressed air and electricity.
2. Remove the OWM unit from the separator frame.
3. Turn the upper cylinder (1) relative to the intermediate part (12) until the end of the locking wire (10) appears.
4. Use a screw driver and release the end of the locking wire from the OWM housing.
Then turn the cylinder anti-clockwise relative to the intermediate part. The locking wire is thereby forced out.

NOTE

Be careful to keep the cylinder straight against the intermediate part.

5. Pull off the cylinder and the piston (6).
6. Pull out the piston from the cylinder.



5.6.3 Check points

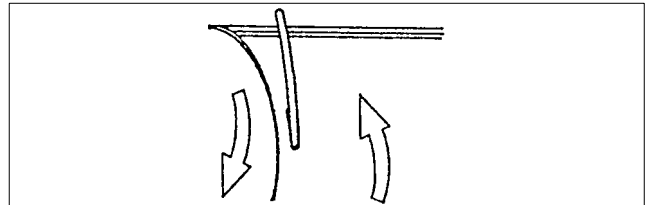
Clean and check the condition of the dismantled parts.

- Check cylinder, piston and rod for scratches and scuffing marks.
- Check condition of piston seal ring (7) and O-rings.
- Check the snap rings (4) of the piston for corrosion.

Renew O-rings and necessary parts.

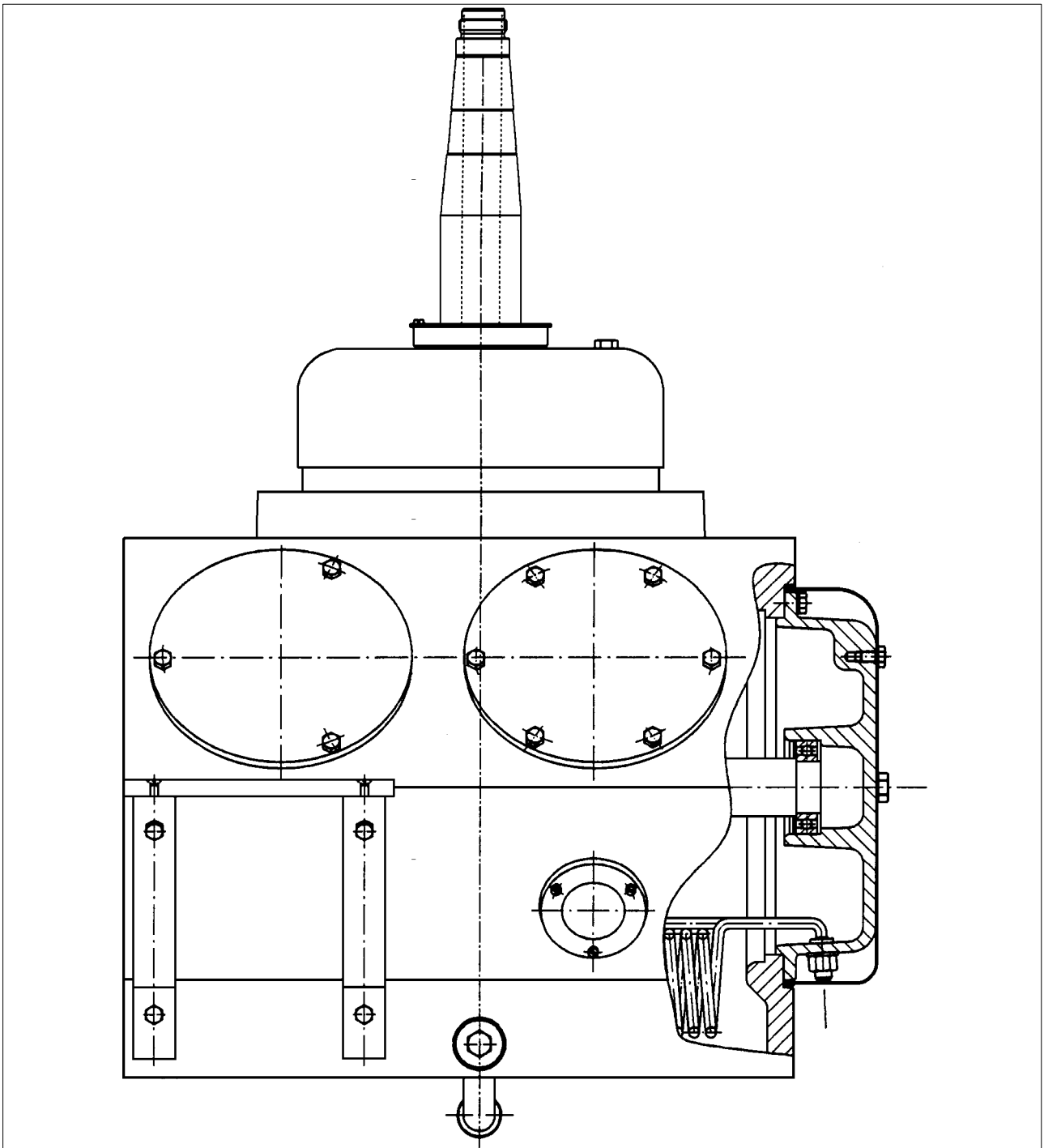
5.6.4 Assembly

1. Fill the seal ring groove of the piston against the cylinder wall with silicone grease.
2. Lubricate the cylinder wall with silicone grease.
3. Lubricate all O-rings with silicone grease.
4. Assemble the OWM unit opposite to dismantling.
5. Secure the cylinder to the intermediate part with the locking wire by turning the cylinder clock-wise relative to the intermediate part. Push the end of the locking wire into the groove, using a screw driver.
6. Fit all connections.

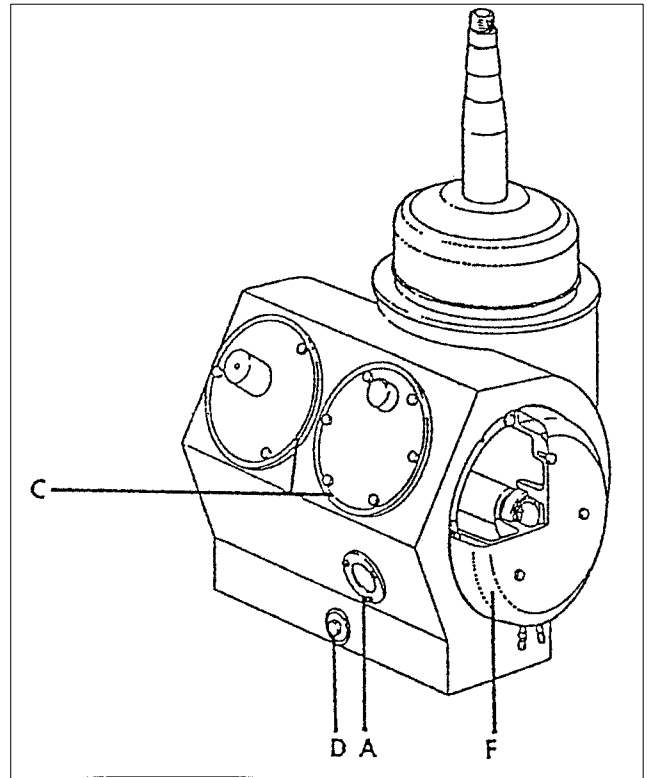


G0675011

5.7 Frame parts

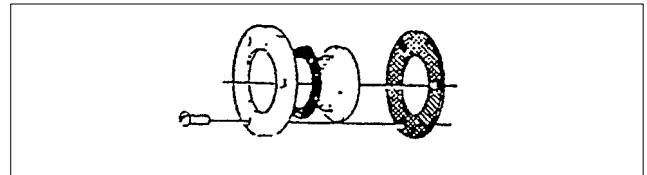


G0462811



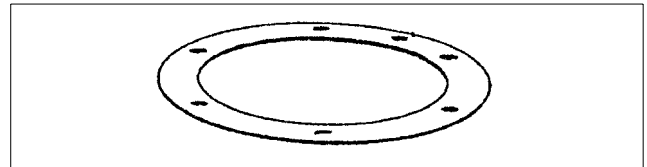
G0673811

A Oil gauge glass



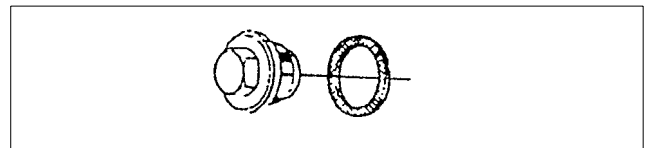
G0673511

C Gasket for brake protecting cover and worm wheel guard



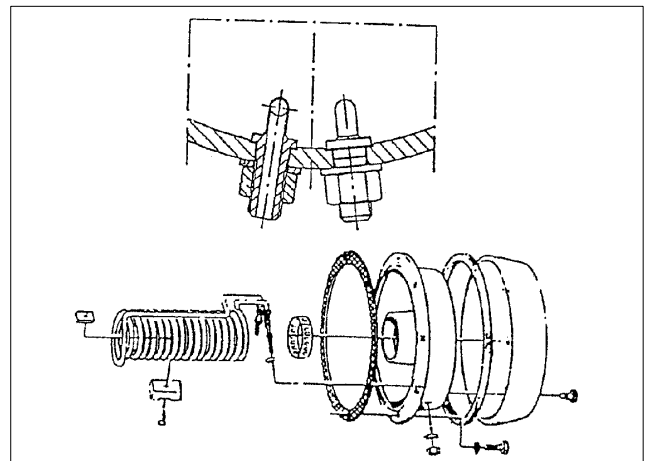
G0673611

D Oil drain plug



G0673711

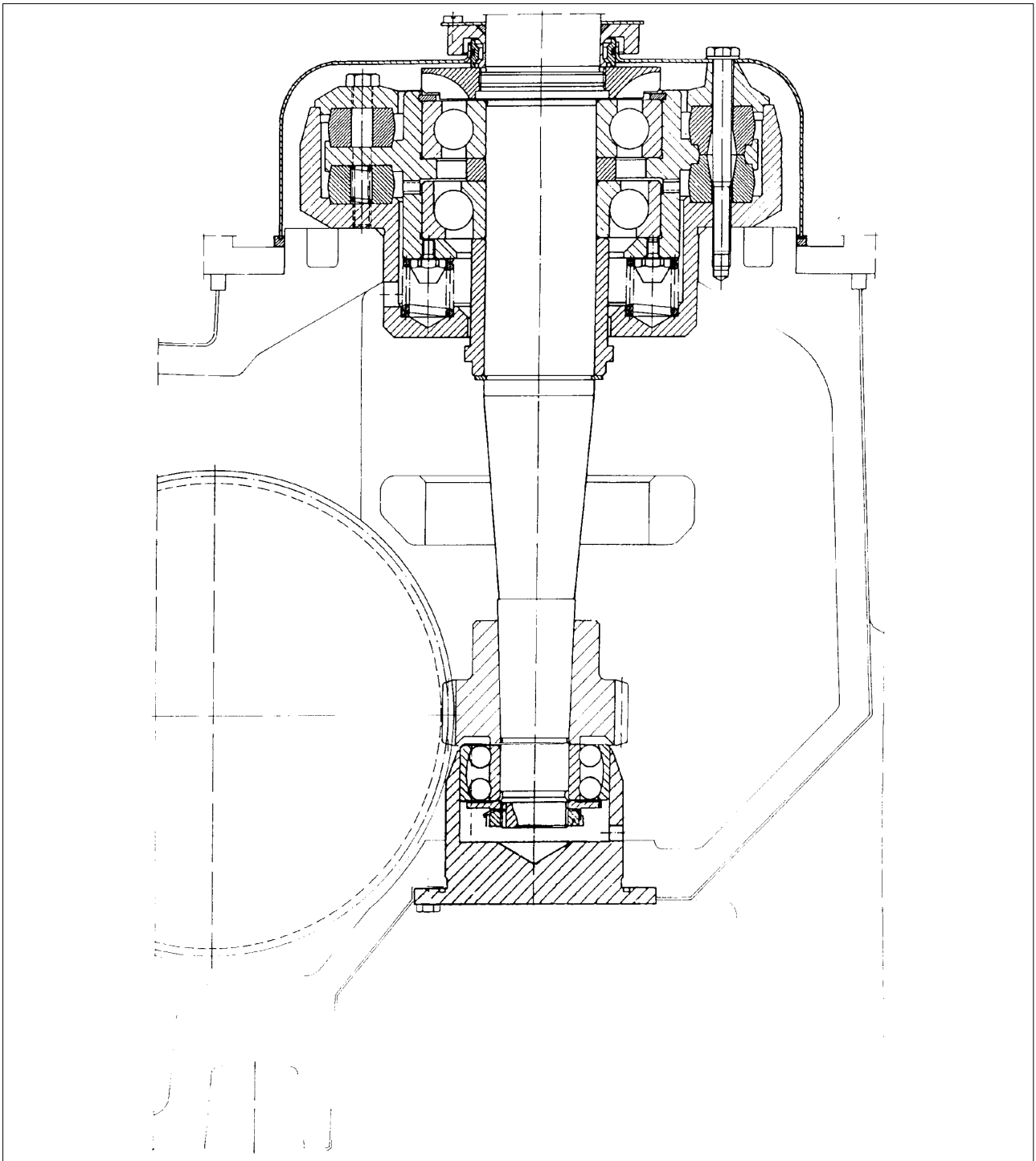
F Cooling coil
Bearing shield



G0673911

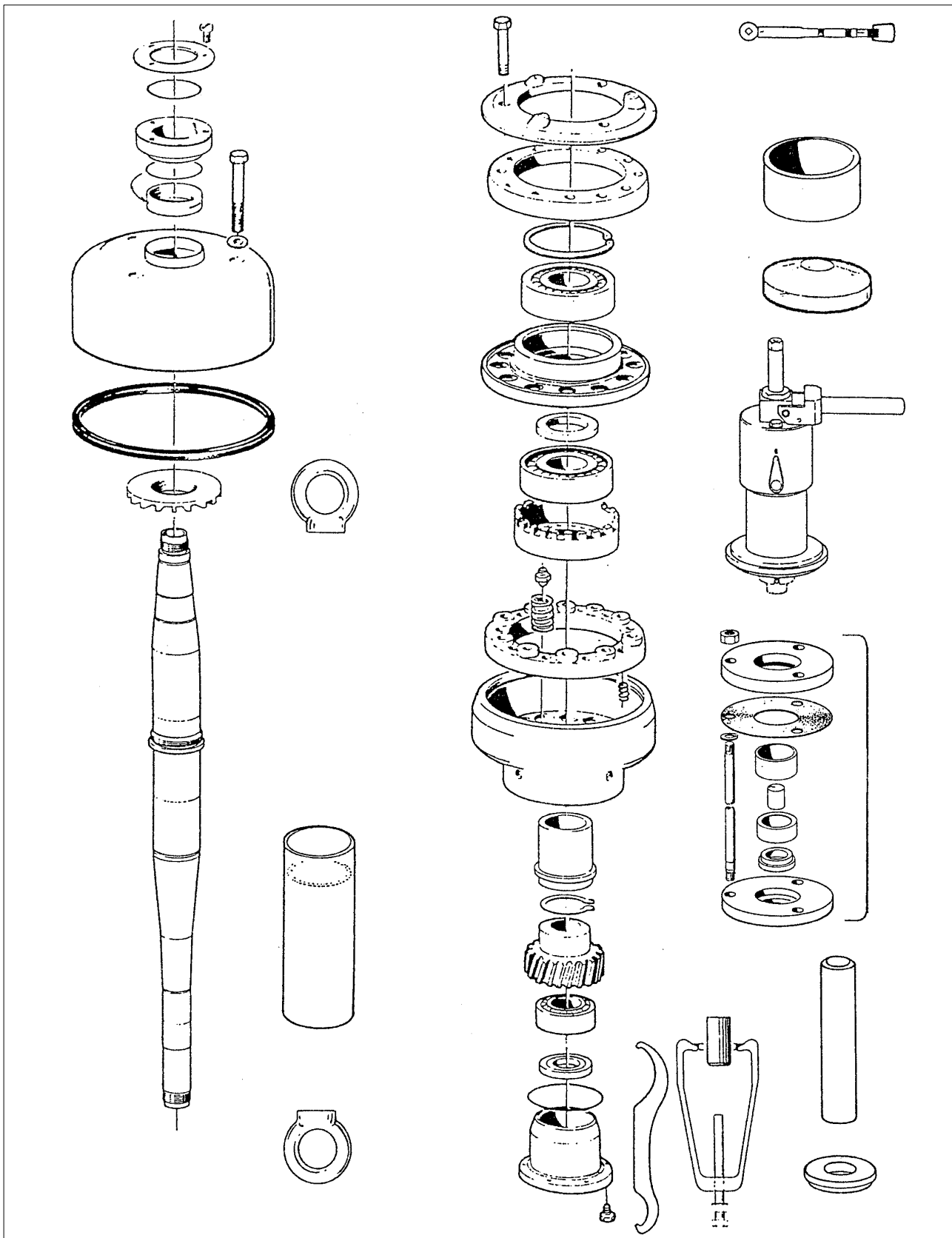
5.8 Vertical driving device

5.8.1 Cut view



G0674021

5.8.2 Exploded view

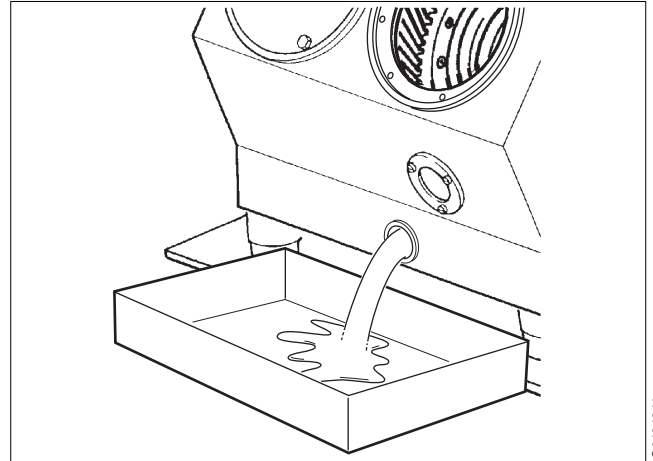


G0683111

5.8.3 Dismantling

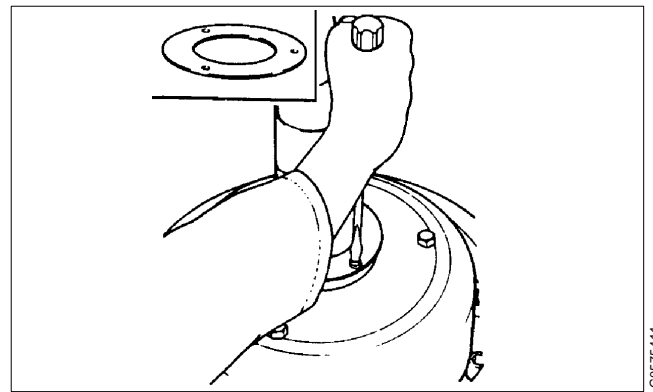
Drain off oil from worm gear housing. The assembly is then accessible after the following parts have been removed in the order stated:

- Outlet
- Frame hood
- Inlet
- Bowl and paring disc device for operating water



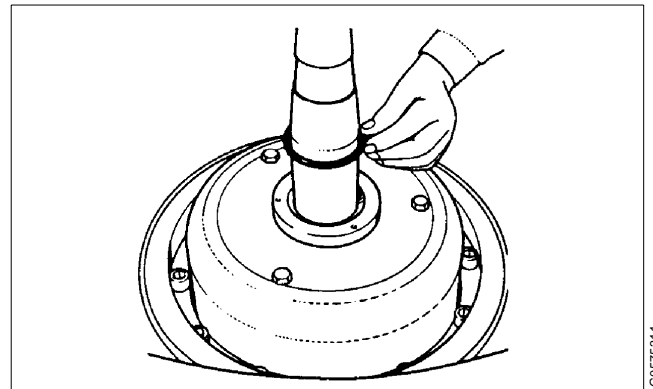
G0484241

1. Unscrew the three screws and remove the protecting plate.



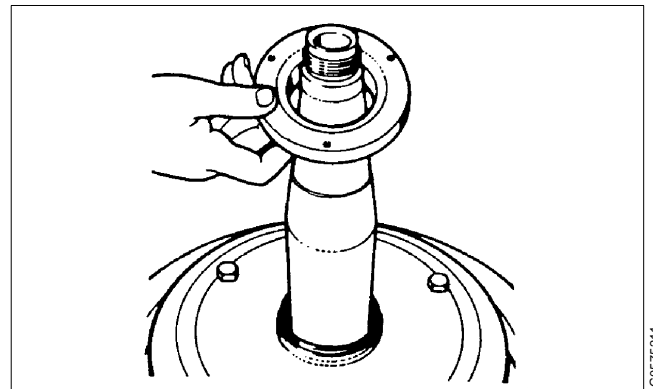
G0575411

2. Remove the O-ring fitted above the protecting collar.



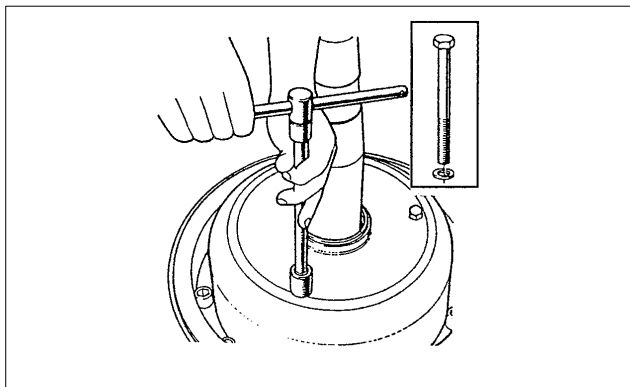
G0575311

3. Remove the protecting collar, just pull – there are no threads.



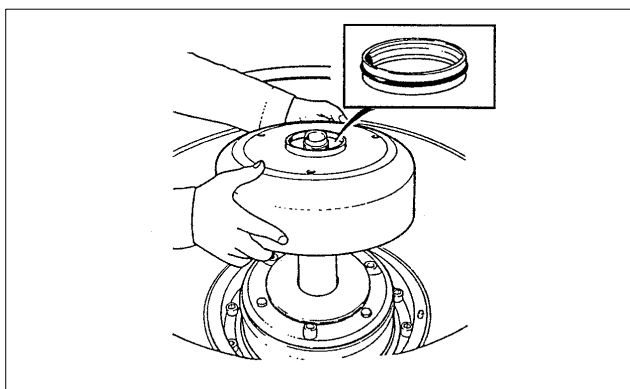
G0575211

4. Unscrew the three screws and remove the guard.



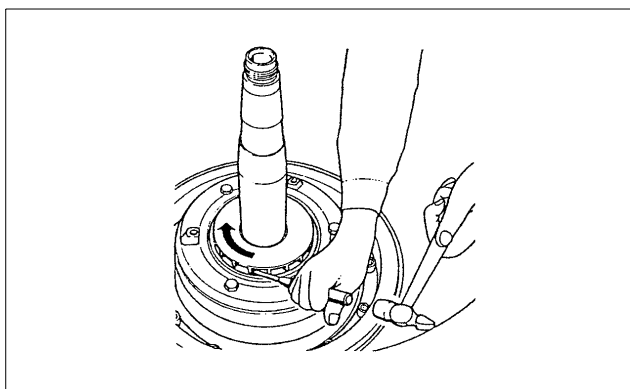
G0674111

5. Remove the seal ring fitted in the guard.



G0674211

6. Hit with light blows on the wings of the oil fan.
Left-hand thread!
 Remove the fan.

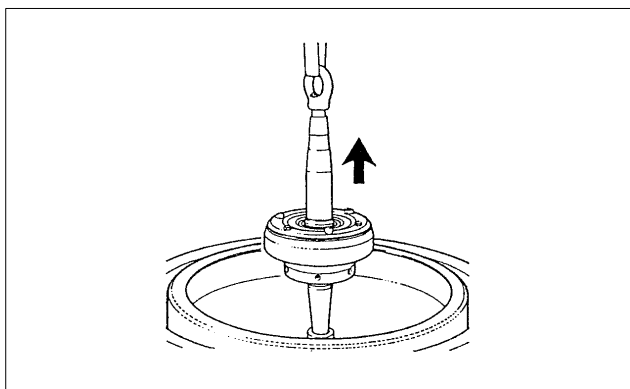


G0674311

7. To avoid damaging the teeth when lifting the bowl spindle, lift slowly and with great care.

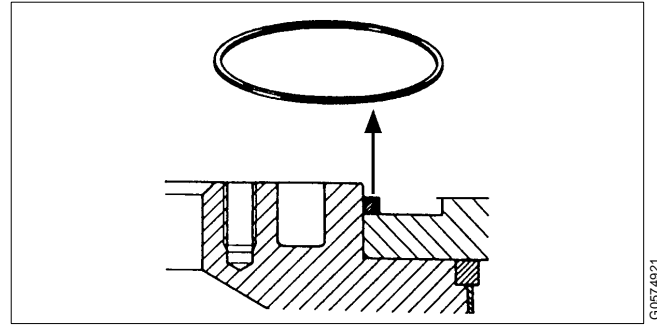
NOTE

Never lift anything but the vertical driving device with the spindle lifting eye!

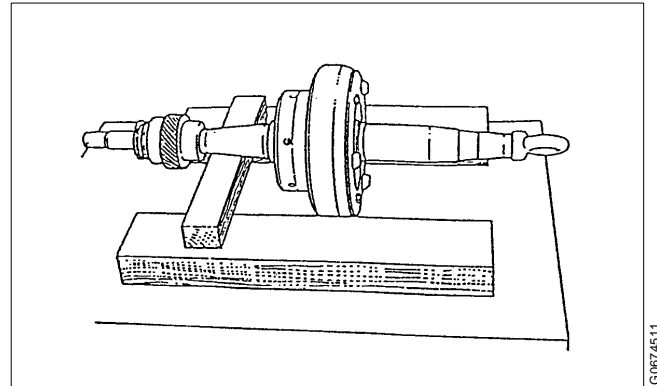


G0674411

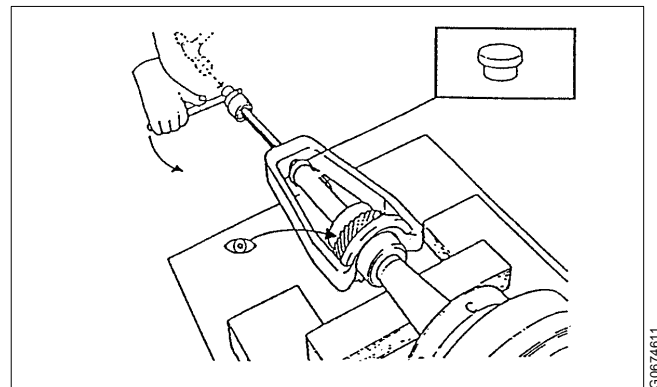
8. Remove the seal ring.



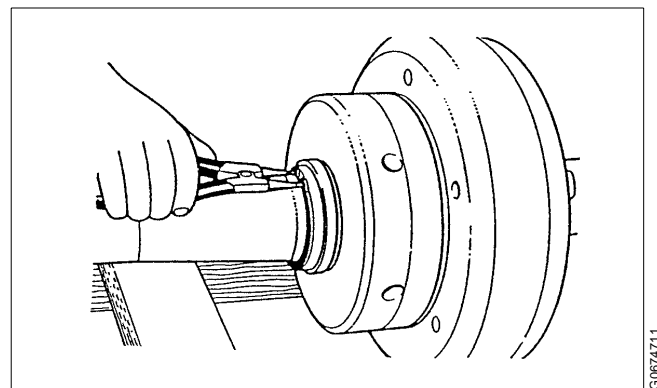
9. Make a wooden support to be used during certain sub-operations.



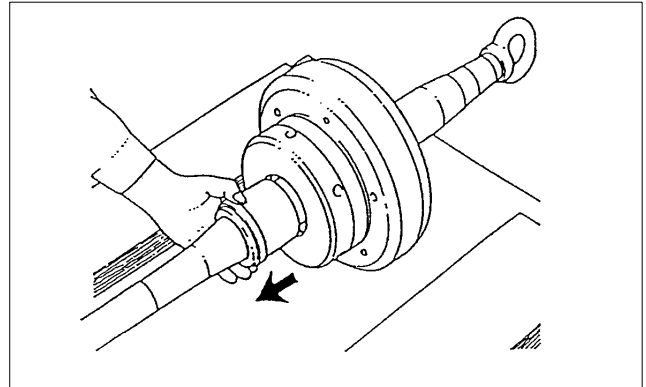
10. Pull off the ball bearing and the worm. Now and then hit on the head of the centre screw.
Wear of teeth, see “4.6.1 Worm wheel and worm; wear of teeth” on page 72.



11. Remove the snap ring.

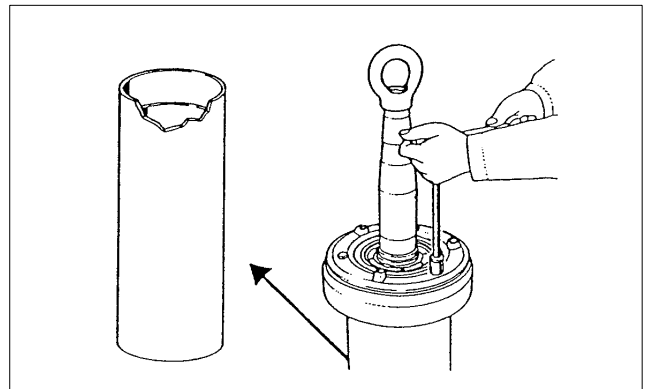


12. Just pull – there are no threads.



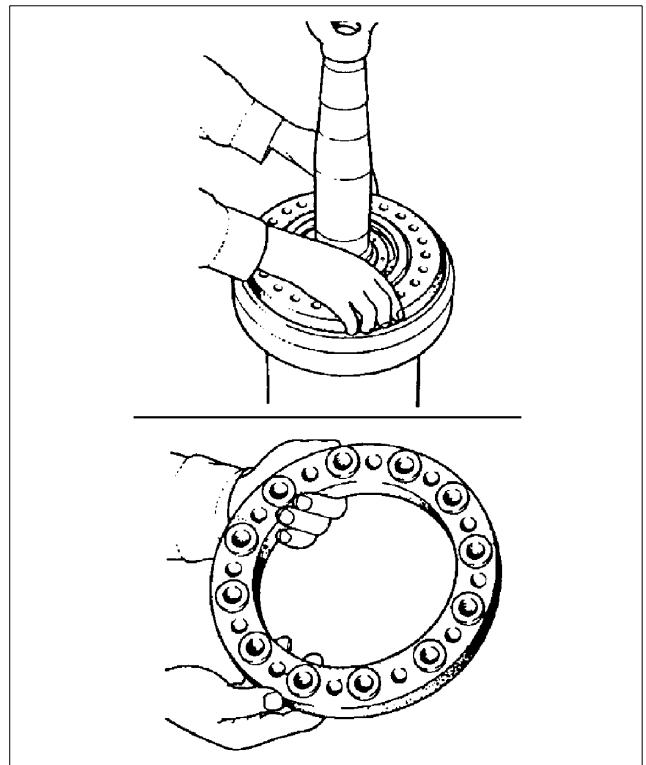
G0674811

13. Place the spindle in the tube included in the set of tools. Loosen the screws of the top bearing cover alternately and a little at a time. Remove the cover.



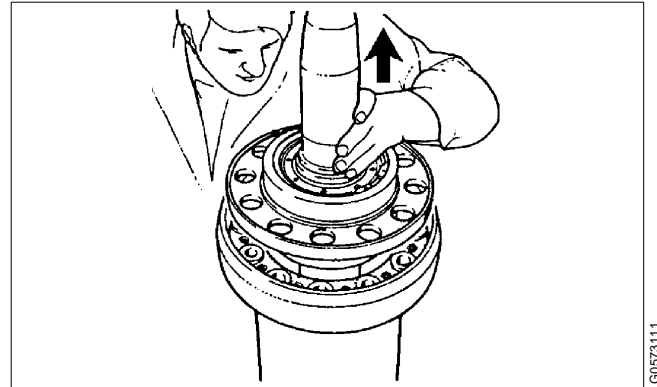
G0674911

14. Remove the upper rubber buffer (not provided with springs).



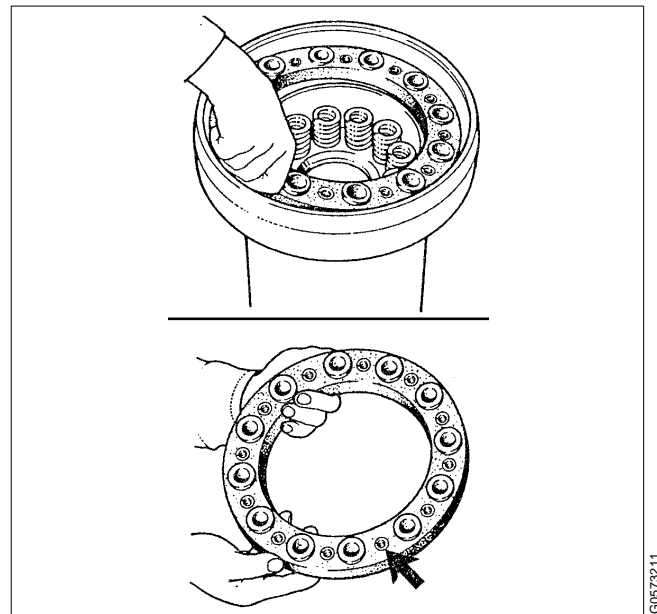
G0673011

15. Lift the spindle out of the spring support.



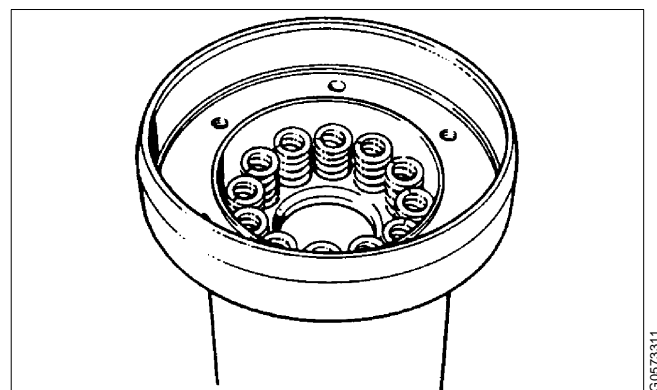
G0573111

16. Remove the lower rubber buffer (provided with springs).

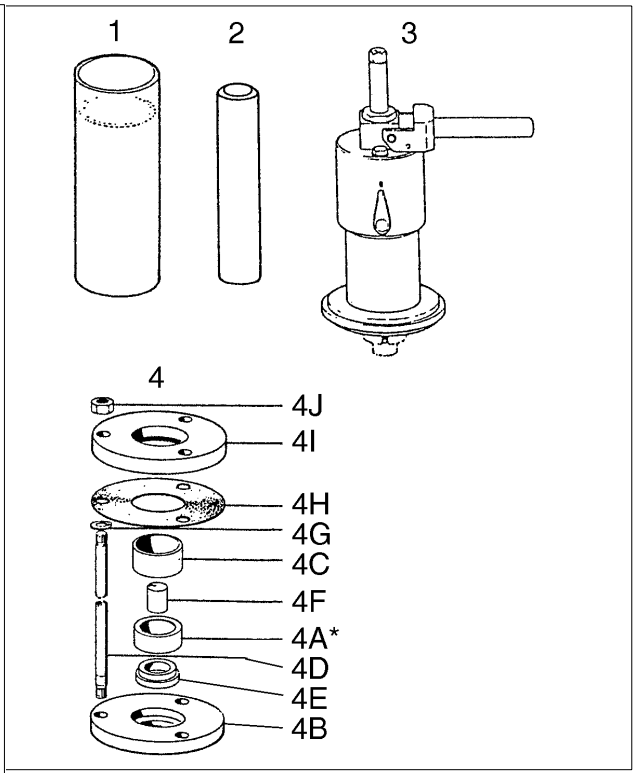
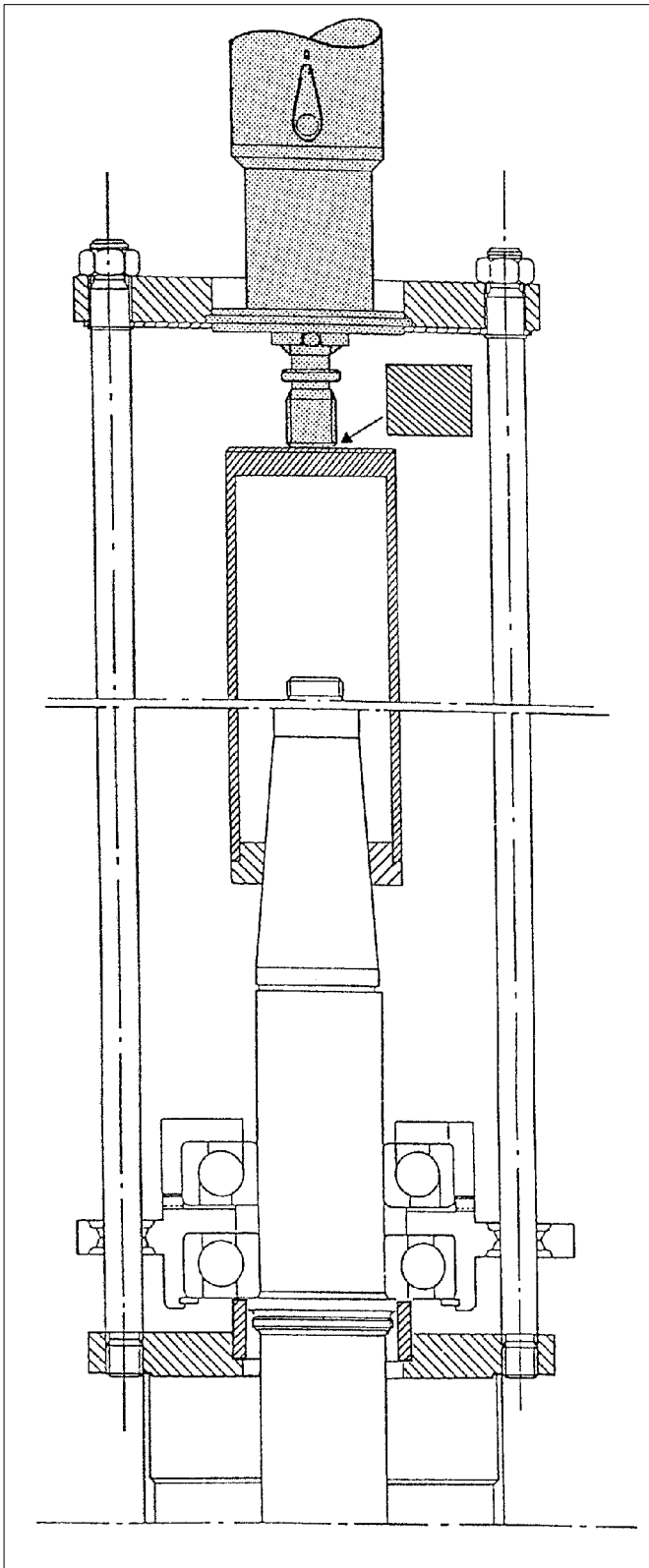


G0573211

17. Remove the springs.



G0573311



Tools:

- 1. Tube
- 2. End tube
- 3. Compression tool
- 4. Dismantling and assembly tool

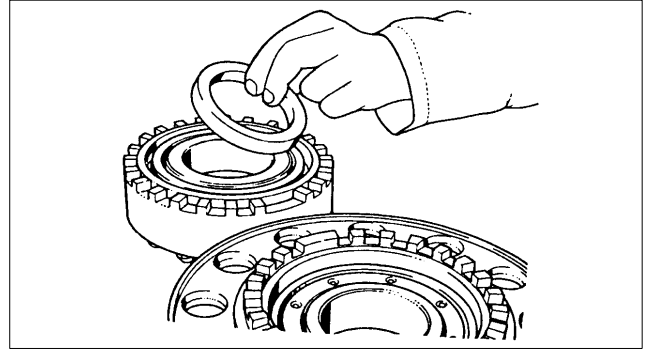
** Not used at dismantling*

18. Disassembly of top bearings support from the spindle:

- Arrange the tube (1) on a firm support. Fill the tube with rags to protect the spindle from damage when pressing out.
- Fit the bottom plate (4B) on the tube (1).
- Fit the sleeve (4C) with inside diameter \varnothing 90 mm on the bottom plate (4B).
- Place the spindle (S) upside down in the bottom plate (4B). Check that the inner race of the ball bearing is in contact with the face of the sleeve (4C).
- Mount the three rods (4D) by fitting them through the holes in the top bearing support (T) and screwing them into the bottom plate (4B).
- Fit the support ring (4E) on the spindle (S).
Note! The inside diameter of this ring is tapered.
- Fit the end tube (2) over the spindle (S) and let it rest on the support ring (4E).
- Check that the retaining rings (4G) have been fitted. Then fit the washer (4H) for the compression tool (3) onto the rods (4D).
- Fit the compression tool (3).
Note! The piston must be in the top position.
- Fit the top plate (4I) and secure the assembly with the three nuts (4J).
- Arrange the handle of the compression tool (3) in Pos. 2 and then pump until the piston has reached the bottom position.
- Bring the handle into pos. 1 and pump until the piston reaches its upper position.
- Place the spacer (4F) between piston and end tube (2).
- Set the handle to Pos. 2 again and continue to pump until the cartridge is released from the ball bearings.

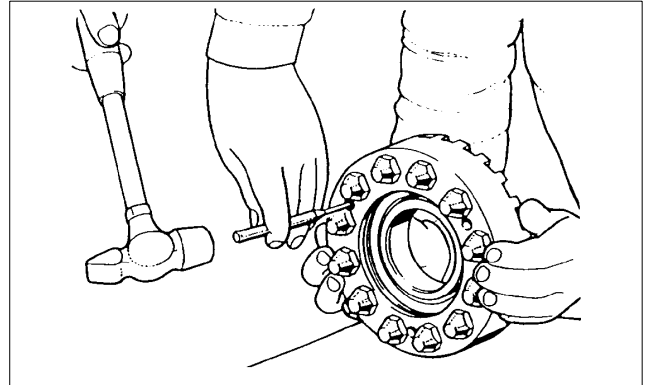
Note! Pump slowly during the final stage of pressing out to avoid damage to the spindle when this is released.

19. The parts knocked-loose are the upper and lower ball bearing housings and the spacing sleeve.



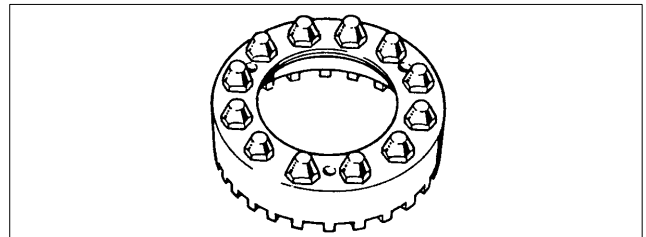
G0573411

20. Force out the ball bearing.




G0573521

21. Check the guide pins. Replace any damaged pins but do not loosen the others.



G0573611

22. Remove the snap ring.

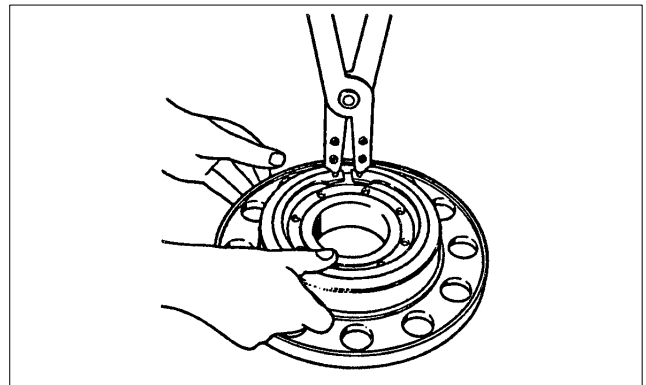


WARNING

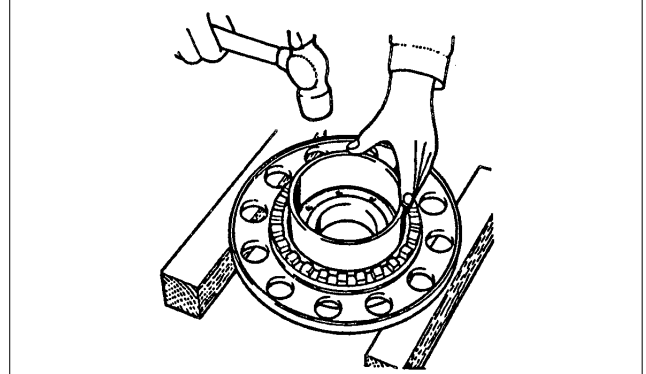
Risk for eye injury

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

23. Force out the ball bearing.



The bottom bearing housing should normally remain sitting in the frame. It should be dismantled only when it is necessary to replace it, when its O-ring must be replaced or when the separator is to be reconditioned.



G0573711


5.8.4 Assembly

Note!

- The deep groove ball bearing is to be fitted in the upper housing and the angular contact ball bearing in the lower one.
- Before fitting the bearings, wipe off the bearing seats of the spindle and apply some oil to the seats.
- See “4.8.1 Ball and roller bearings” on page 77.

Fitting the deep groove ball bearing

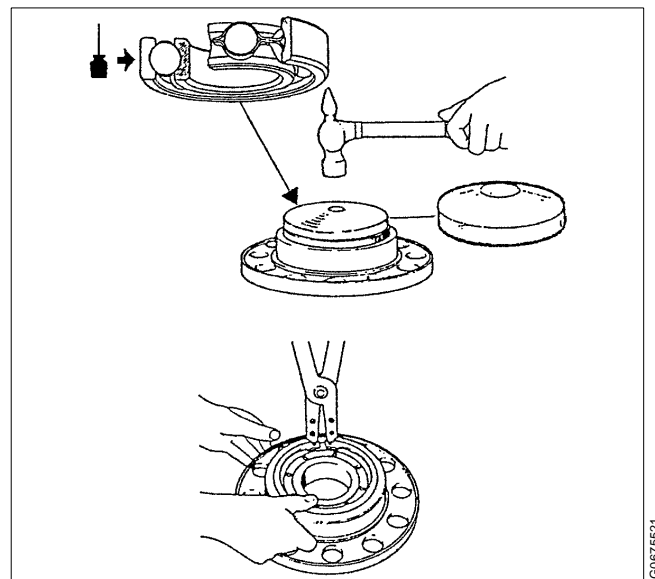
1. Lock the upper ball bearing with the snap ring.



WARNING

Risk for eye injury by flying snap ring

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

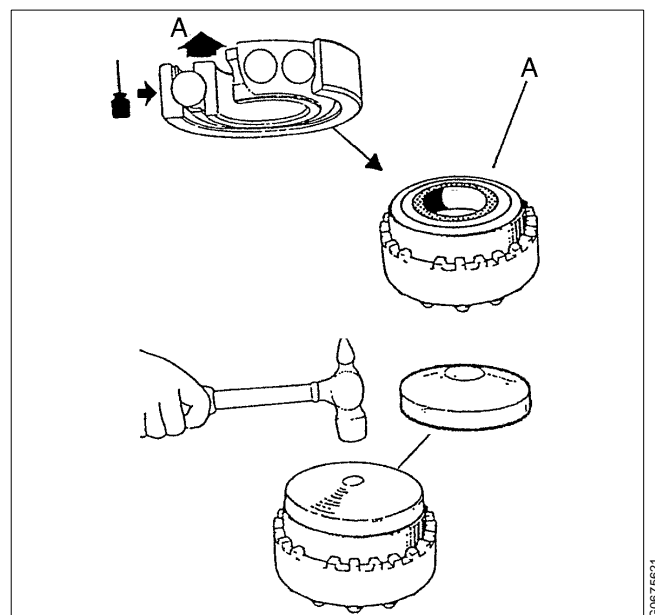


G0675521

Fitting the angular contact ball bearing

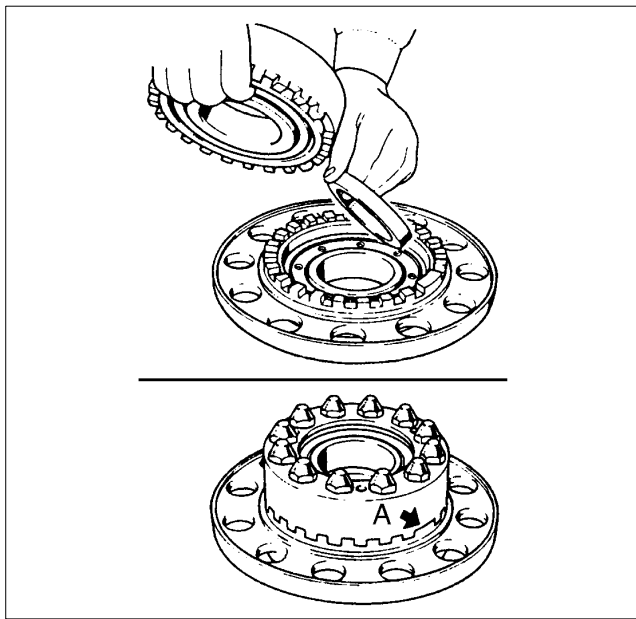
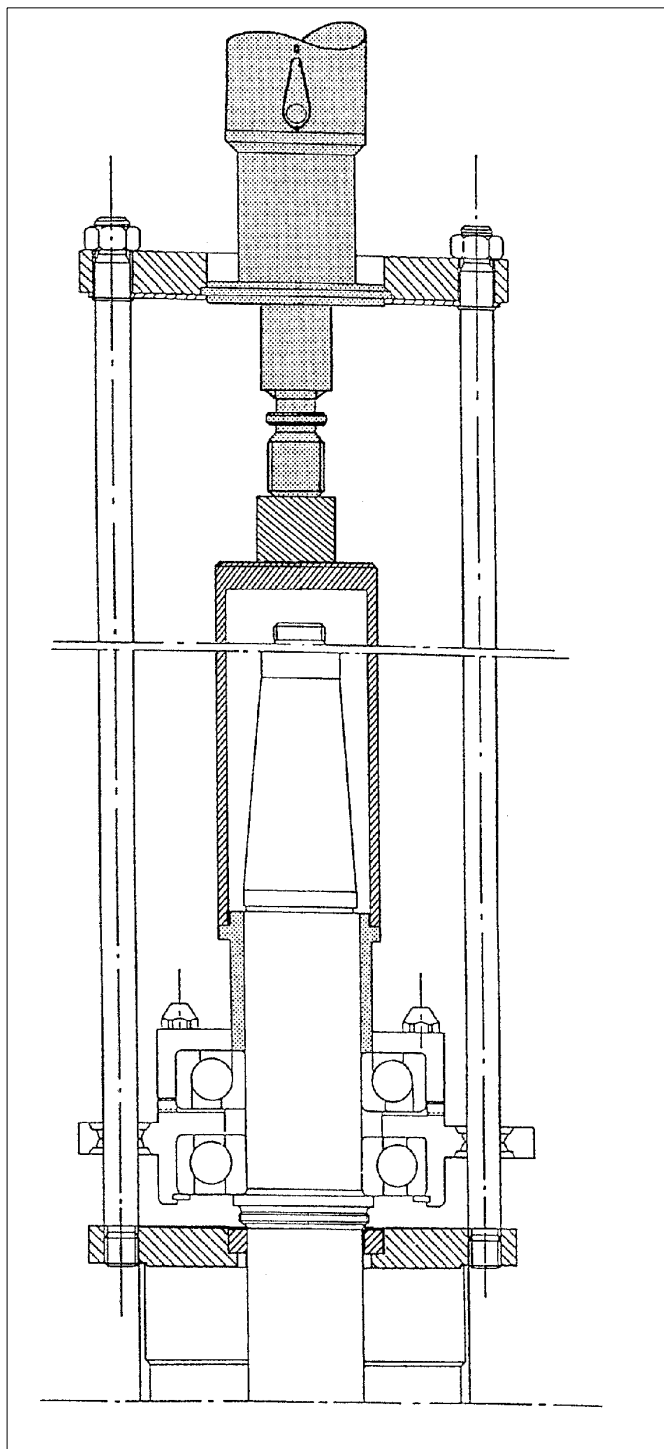
2. Apply the mounting washer and force the ball bearing in position.

Important: Turn the angular contact ball bearing the right way – the *wide* shoulder of the *inner* race must face upwards (A). A bearing of this kind turned upside down cannot carry any load. It collapses when loaded resulting in breakdown of the machine.

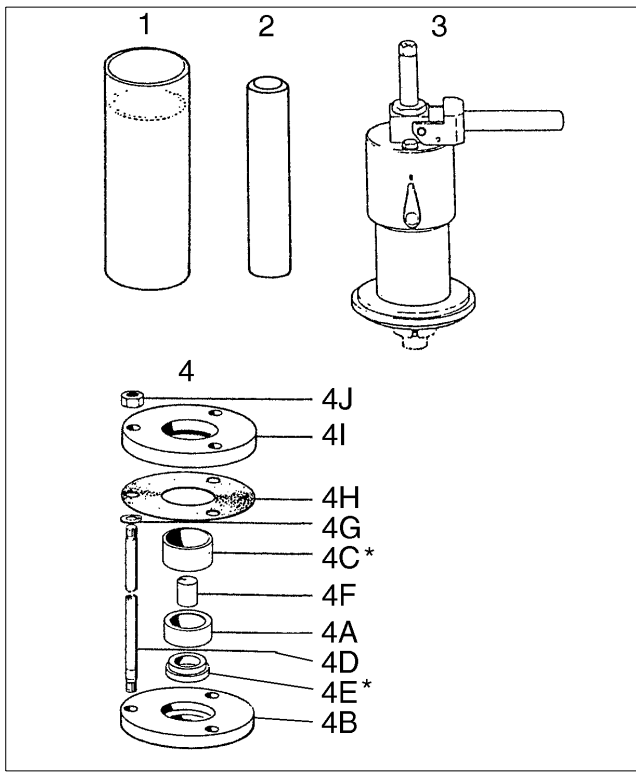


G0675621

3. Assemble the two housings and the space sleeve into a unit.
One tooth (A) and the corresponding recess is wider than the others.



G0574121



G0675931

Tools:

1. Tube
2. End tube
3. Compression tool
4. Dismantling and assembly tool

* Not used at assembly

G0675711

4. Assemble the top bearings on the vertical drive:
- Arrange the tube (1) on a firm support.
 - Fit the bottom plate (4B) on the tube (1).
 - Fit the ring (4A) with inside diameter \varnothing 77 mm in the bottom plate (4B).
 - Place the spindle (S) upside down in the bottom plate (4B). **Note!** The collar on the spindle (S) must be resting on the ring (4A).
 - Fit the ball bearing housing (T) onto the spindle (S). **Note!** The top bearing is to be mounted upside down. See illustration.
 - Mount the sleeve (R), which must be in contact with the inner race of the ball bearing.
 - Fit the end tube (2) on the sleeve (R).
 - Screw the three rods (4D) into the bottom plate (4B).
 - Check that the retaining rings (4G) have been fitted. Fit washer (4H), compression tool (3) and top plate (4I). Secure the assembly by tightening the three nuts (4J).

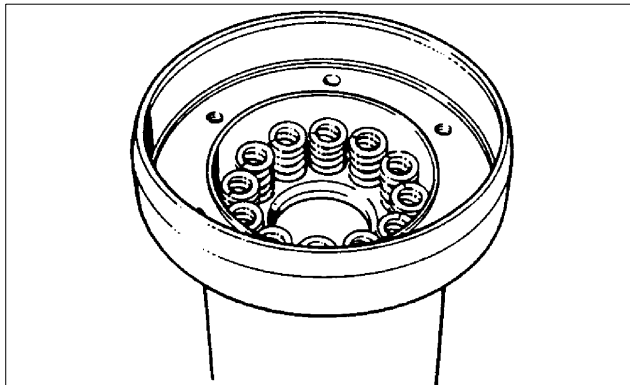
Arrange the handle of the compression tool (3) in Pos. 2 and pump until the piston has reached the bottom position.

Move the handle to Pos. 1. Pump up the piston into the top position.

Place the spacer (4F) between end tube (2) and piston of the compression tool (3). Bring the handle to Pos. 2 and continue compressing until the inner race of the ball bearing is in contact with the collar on the spindle (S).

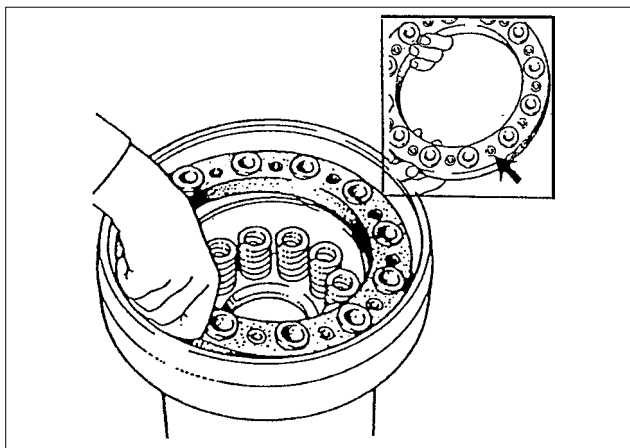
Remove the tool and continue with the mounting of the other parts for the vertical drive.

5. Fit the top bearing support in the tube end and put the springs in place.



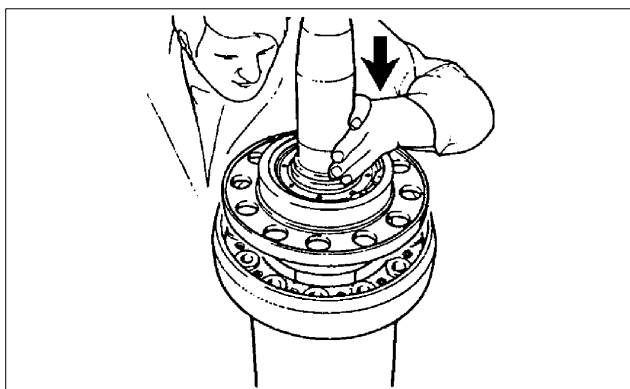
G0573311

6. Mount the rubber buffer with springs.



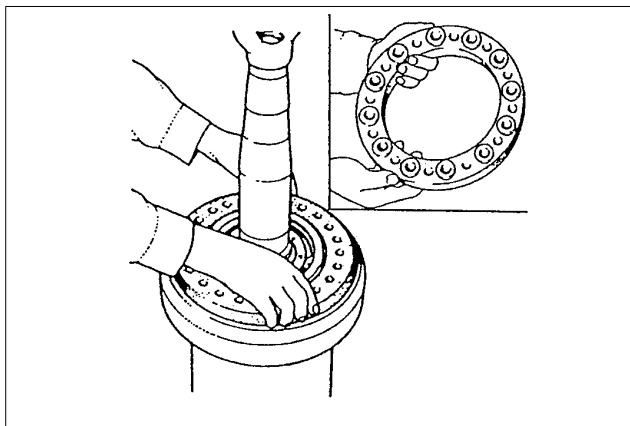
G0676021

7. Pour a few drops of oil in the ball bearings (of the same quality as is used in the worm gear housing).
8. Lower the spindle into the top bearing support. Ascertain that the guide pins enter the springs.



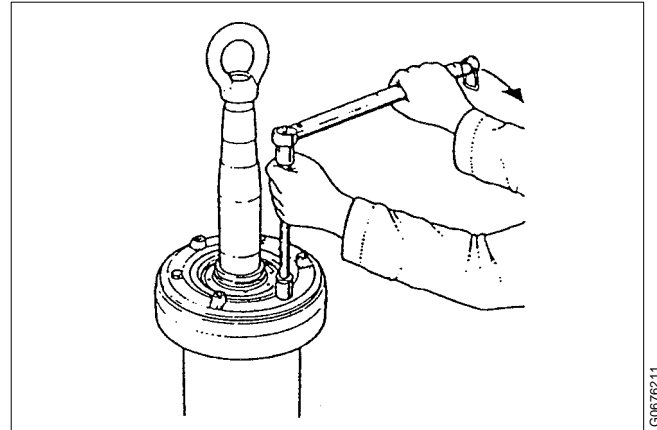
G0573131

9. Mount the rubber buffer without springs.

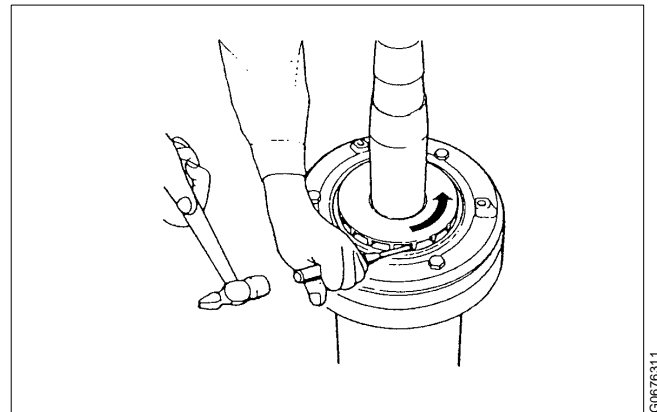


G0676111

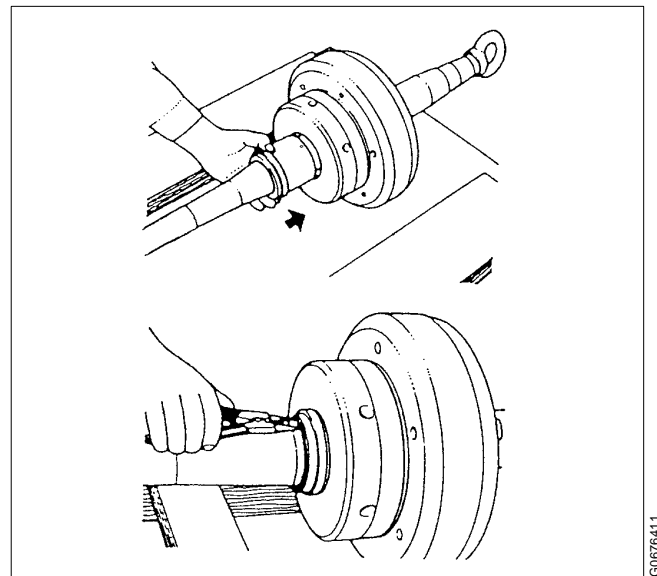
10. Mount the cover and tighten its screws alternately, a little at a time. Do not use pneumatic tools.
Final tightening torque: **60 Nm**.



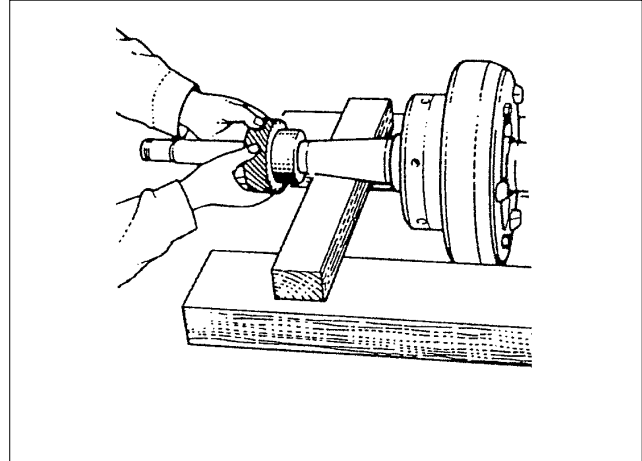
11. Hit with light blows on the wings of the oil fan.
Left-hand thread!



12. Lay down the spindle, fit the sleeve and lock it with the snap ring.



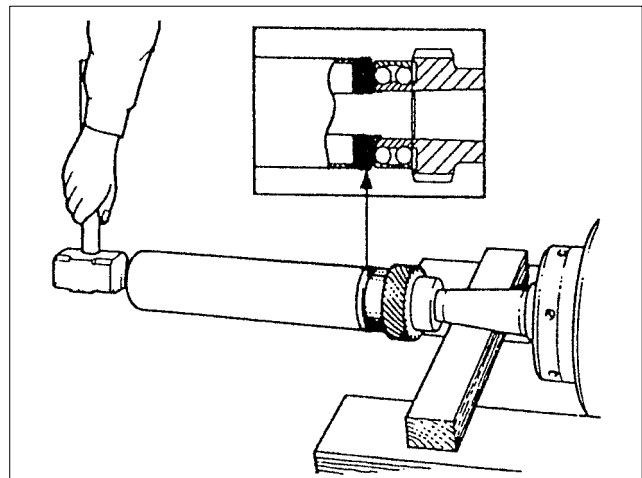
13. Make sure that the conical surfaces inside the worm and on the spindle are clean and free from oil before the worm is fitted.



G0676511

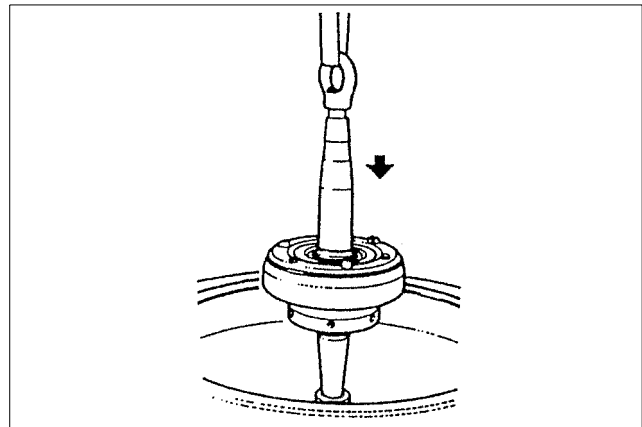
14. Wipe off and grease the bearing seat before fitting the ball bearing.

Heat the bearing in oil or in a heating cabinet. Fit the bearing. When it has cooled, fit the ring and the driving-on tool as shown in the illustration and hit it a few times to ascertain that the bearing is in the correct position.



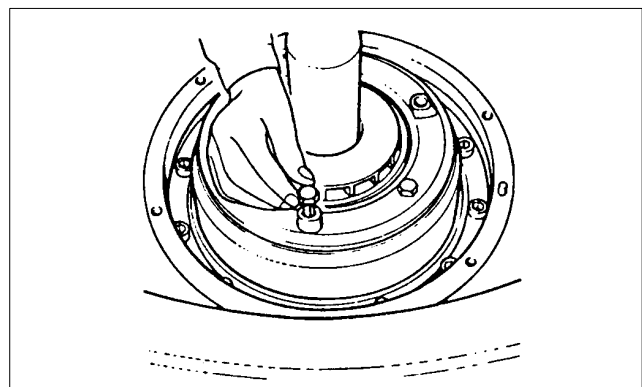
G0676731

15. To avoid damaging the teeth, the spindle should be lowered with great care. Guide the bearing into the bottom bearing housing. If it does not quite bottom in its seat, knock lightly on the spindle top with a tin hammer. Wait, however, to knock it down entirely until next suboperation is carried out.



G0676811

16. Make sure that the ball bearing housings are in their correct angular position by means of one of the screws that fastens the top bearing. Then lower the spindle to the bottom.



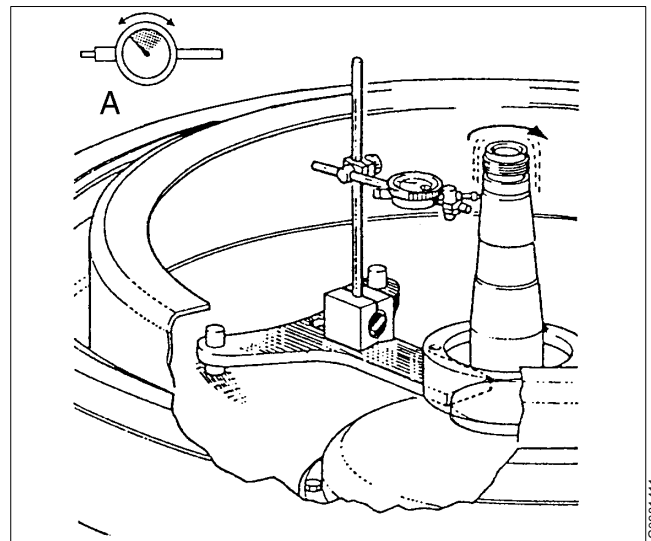
G0574811

17. Check the radial wobble of the bowl spindle.

NOTE

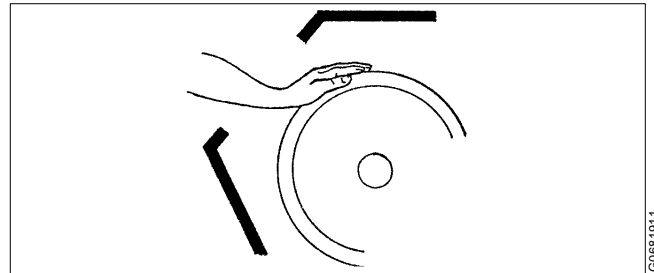
Spindle wobble will cause rough bowl running. This leads to vibration and reduces lifetime of ball bearings.

- Set up a dial indicator on a magnetic stand. Use the key for the large lock ring as a support for the stand, see the illustration.
- Use the coupling drum to revolve the spindle manually.
- Measure the wobble at the top of the tapered end of the spindle. Permissible radial wobble is **maximum 0,05 mm**.



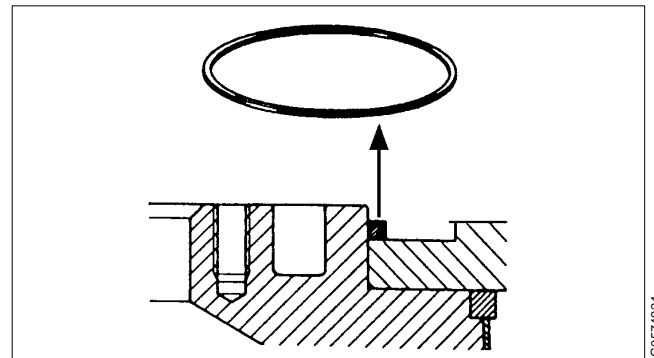
Measurement of the radial wobble

A. Max. permissible radial wobble = 0,05 mm

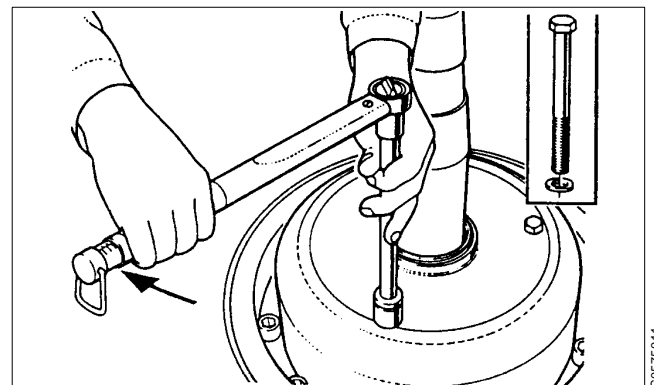


Remove the coupling cover and revolve the spindle manually by turning the coupling drum

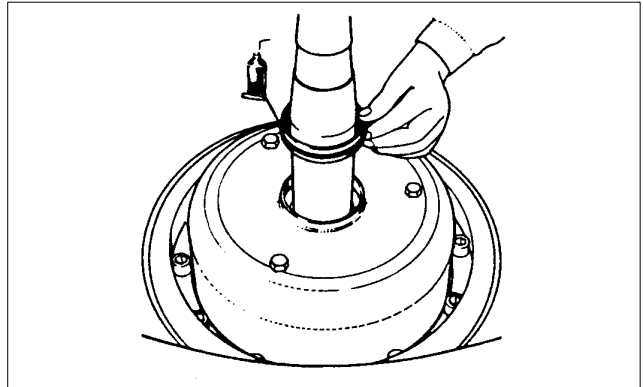
18. Fit the seal ring. Lower the guard into position.



19. Fit new seal rings under the screw heads. Tighten the screws alternately, a little at a time. Do not use pneumatic tools. Final tightening torque: **40 Nm**.

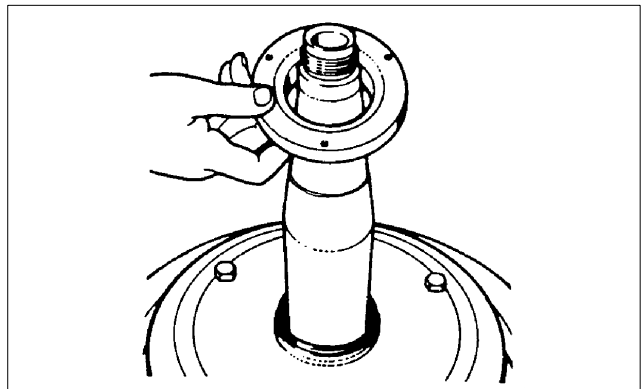


20. Fit the seal.



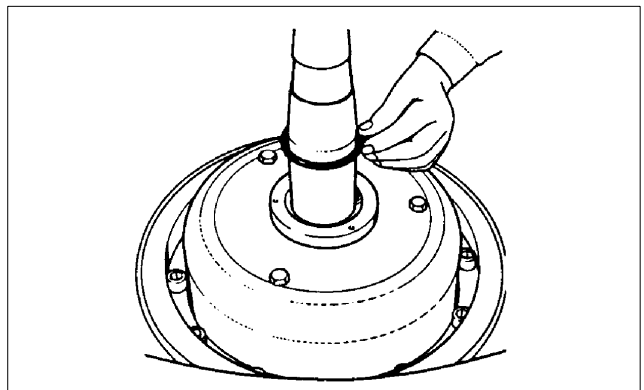
G0575321

21. Fit the protecting collar and push it *firmly* down against the oil fan.



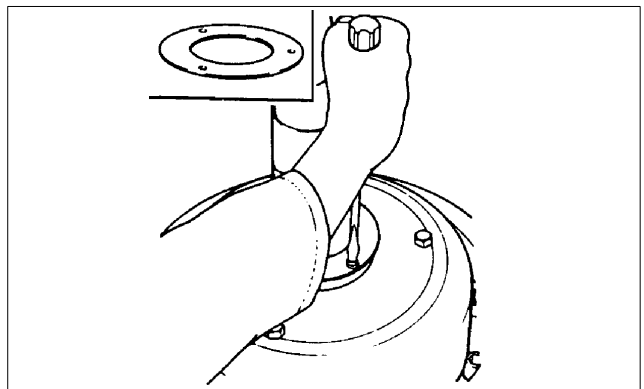
G0575211

22. Fit the O-ring dry – do not grease.



G0575311

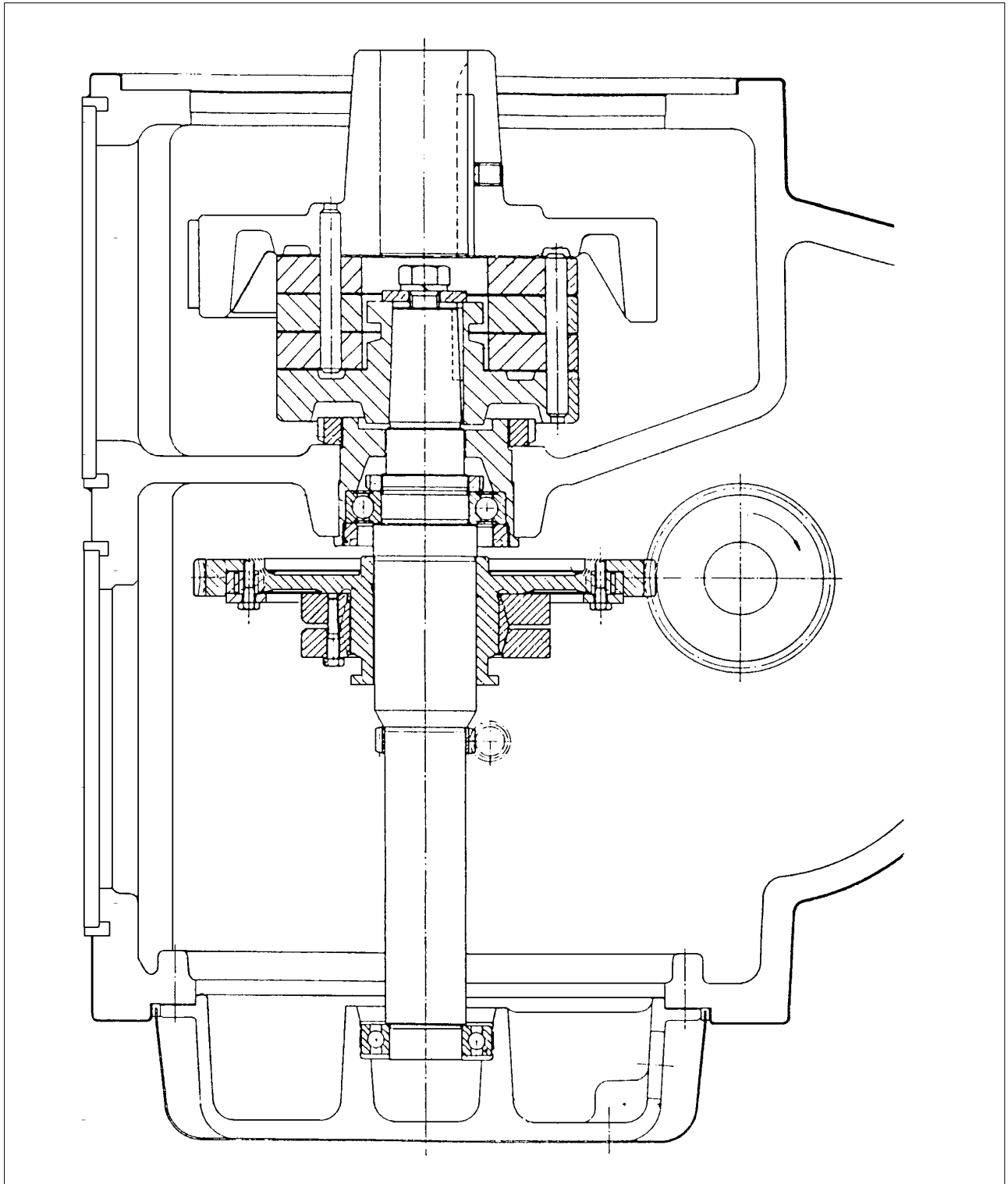
23. Fit the protecting plate and tighten the screws.



G0575411

5.9 Horizontal driving device

5.9.1 Cut view



G0464511

5.9.2 Dismantling

The horizontal driving device is dismantled as follows. It will be easiest to loosen the clamping of the worm wheel if the bowl and spindle are still fitted in the machine.

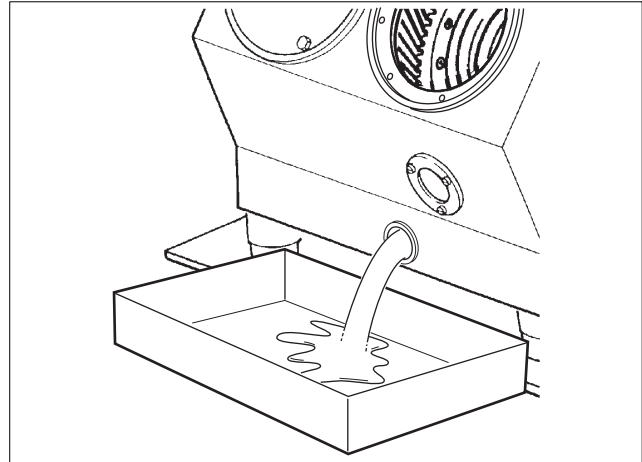
1. Drain off oil from worm gear housing.



CAUTION

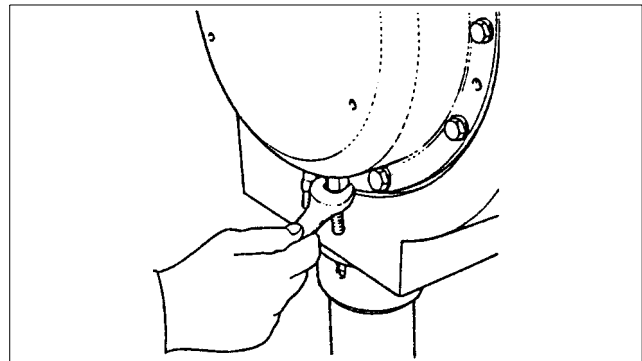
Burn hazards

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



G0484241

2. Remove the worm wheel guard with the revolution counter.
3. Remove the brake cover.
4. Disconnect the cooling water connections. Remove the bearing shield cover.
5. Remove the nuts and washers of the cooling coil and press the two tube ends into the bearing shield.



G0797911

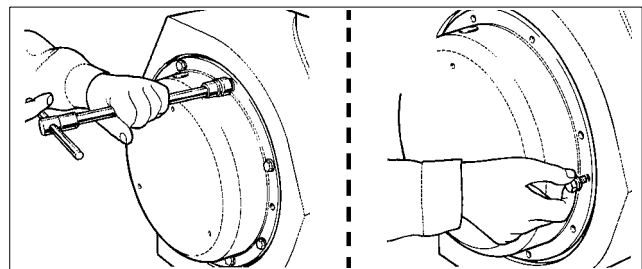
6. Remove the bearing shield: ease it off by means of two of the fastening bolts.



CAUTION

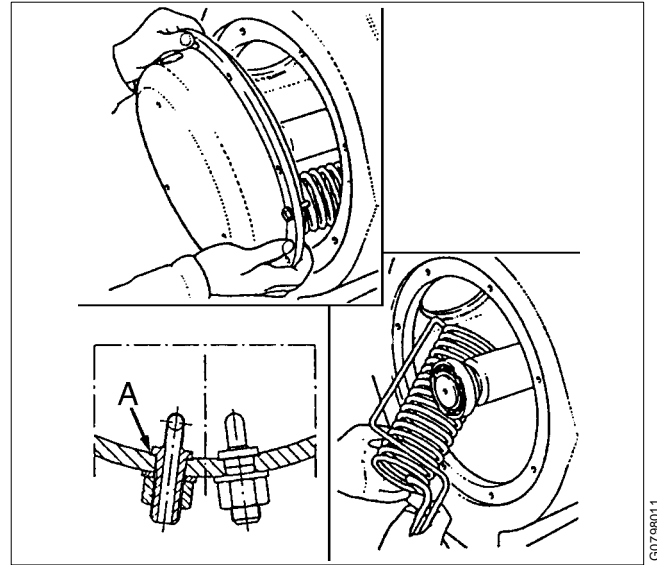
Crush hazard

The shield is quite heavy (15 kg cast iron). Hold the shield firmly or use two longer screws as guide pins so as not to drop it during dismantling.

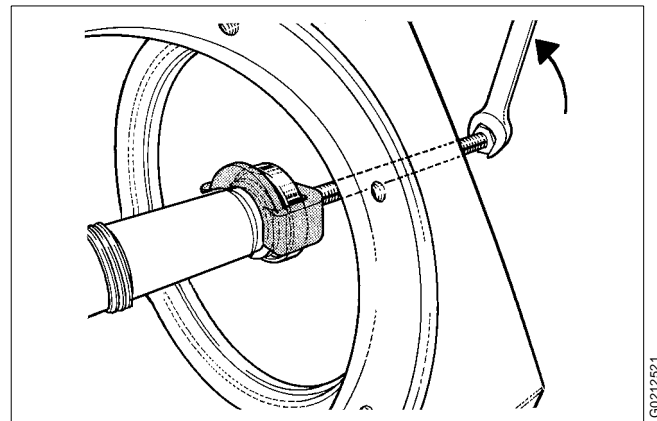


G0212421

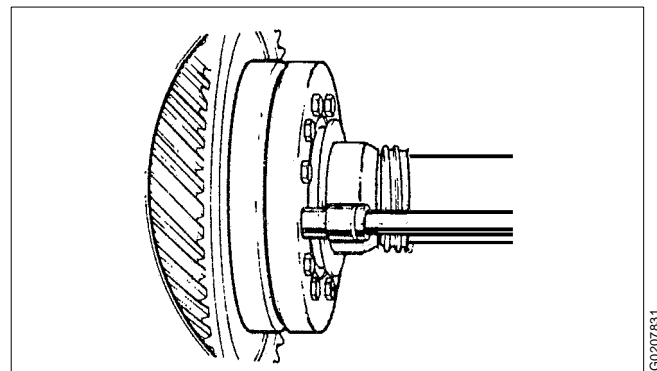
7. Lift out the cooling coil and take care of the gaskets (A).



8. Fit the puller tool and pull off the ball bearing.



9. Loosen the clamp screws uniformly and successively around the clamping rings in the order stated. In the first round, do not loosen them more than 1/4 turn to avoid wryness in the clamping rings. Do not screw out the clamp screws entirely.
10. Remove the clamping element and the worm wheel.



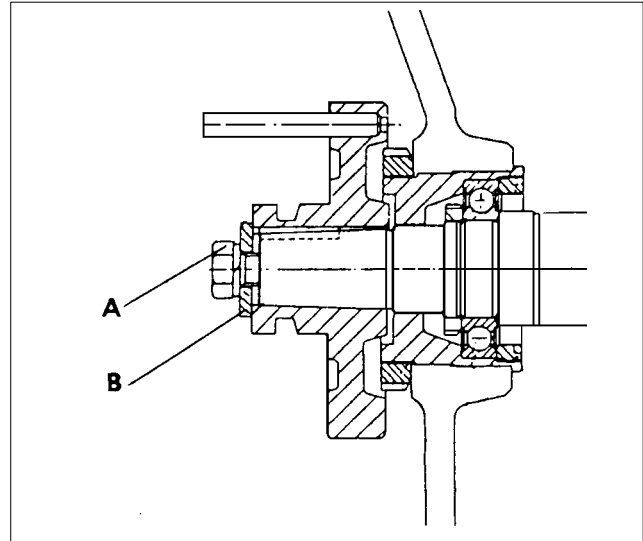
CAUTION

Crush hazard

The worm wheel is quite heavy. Hold it firmly when dismantling. Risk for jamming injury.

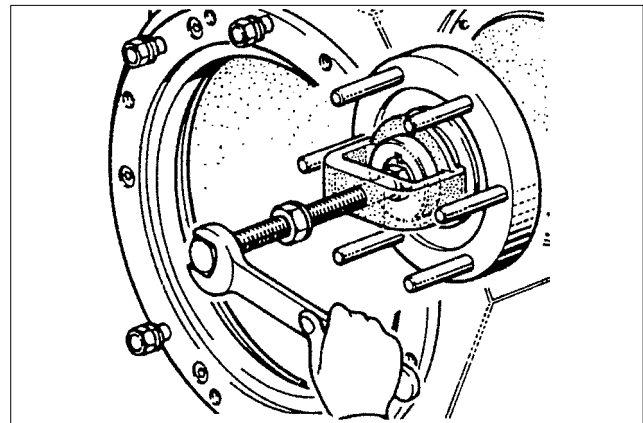
11. Remove the motor. See chapter “5.12.2 Removing the motor” on page 149.
12. Remove the rubber discs from the coupling.

13. Unscrew the centre screw (A) and remove the plain washer (B). Then tighten the screw (A) again to protect the shaft during next operation.



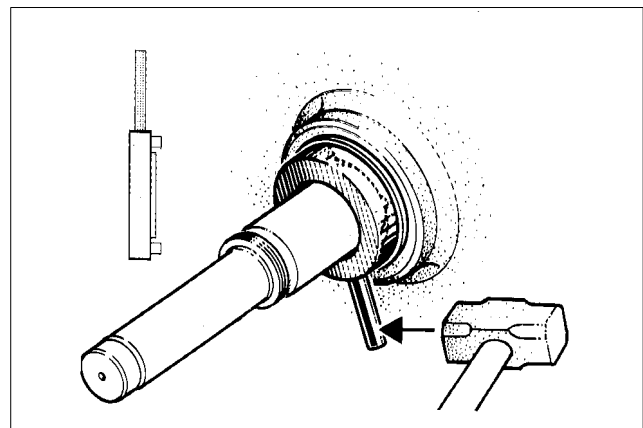
G0462711

14. Fit the puller tool and pull off the coupling.



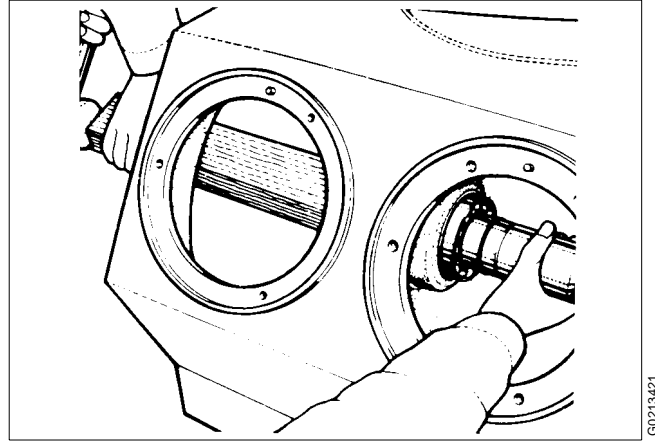
G0484411

15. Remove the lock ring. Use the pin spanner or a drift.
Left-hand thread.

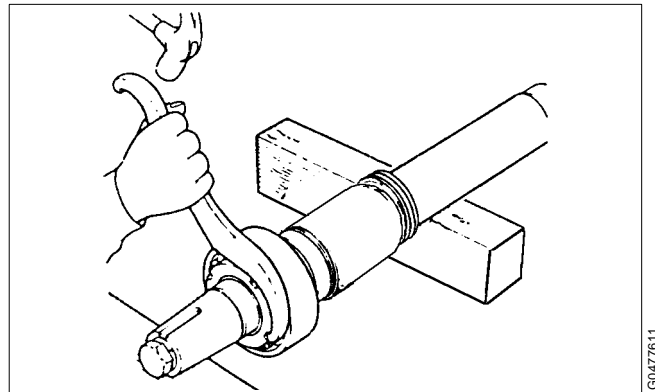


G0192311

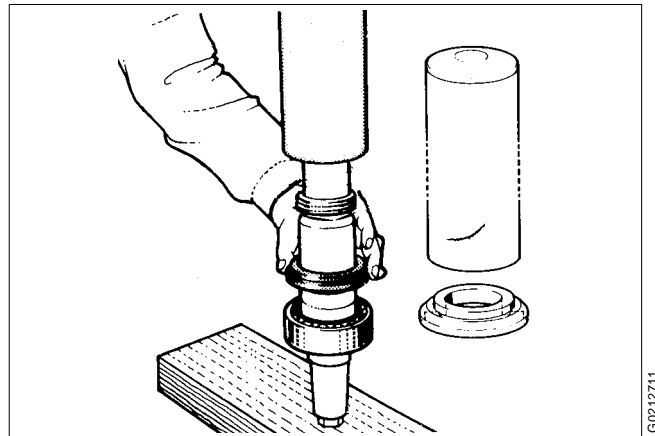
16. Knock loose the worm wheel shaft from the motor side with a piece of wood and a tin hammer.



17. Screw off the round nut.

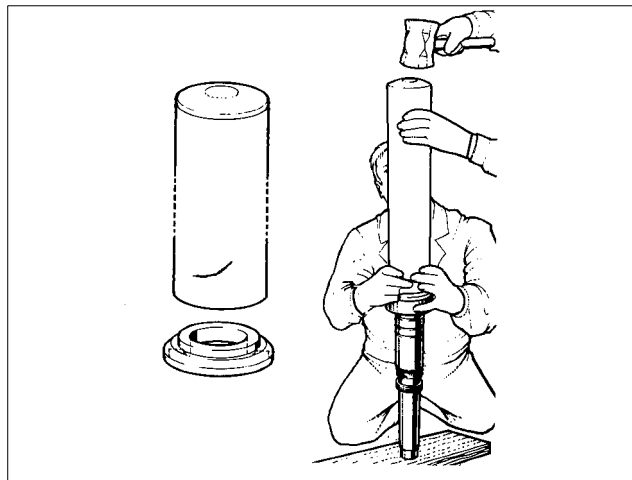


18. Remove the ball bearing. Position the smaller sleeve against the *inner* race of the ball bearing. Put a piece of paper or cloth inside the tube in order to avoid damage on the shaft.



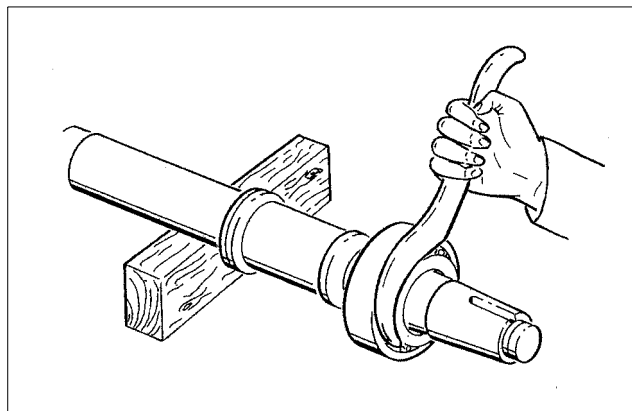
5.9.3 Assembly

1. Clean and oil the bearing seat on the worm wheel shaft.
2. Mount the ball bearing by using the tools illustrated. Use the larger sleeve which acts against the *inner* race of the ball bearing.



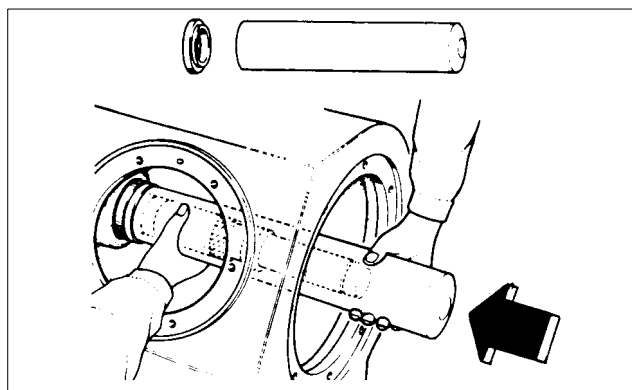
G0192411

3. Screw the round nut onto the shaft.



G0191611

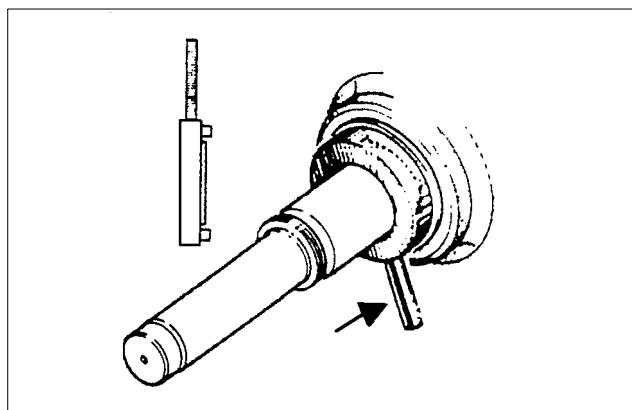
4. Clean the bearing seat in the frame. Apply some oil on the outer race of the ball bearing and force the worm wheel shaft into position. Use the sleeve which acts against the *outer* race of the ball bearing. Use a tin hammer.



G0213521

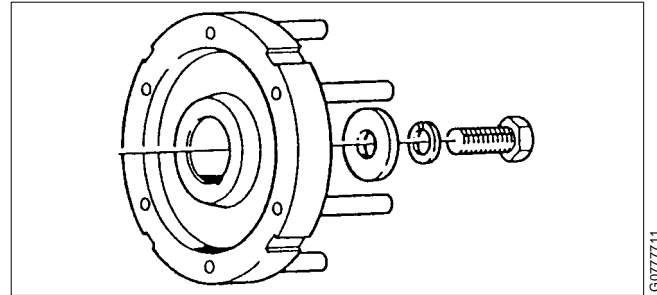
5. Mount the lock ring. Use the pin spanner or a drift.

Left-hand thread.

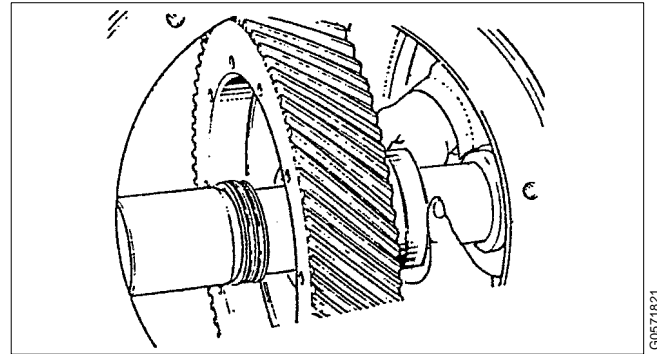


G0246011

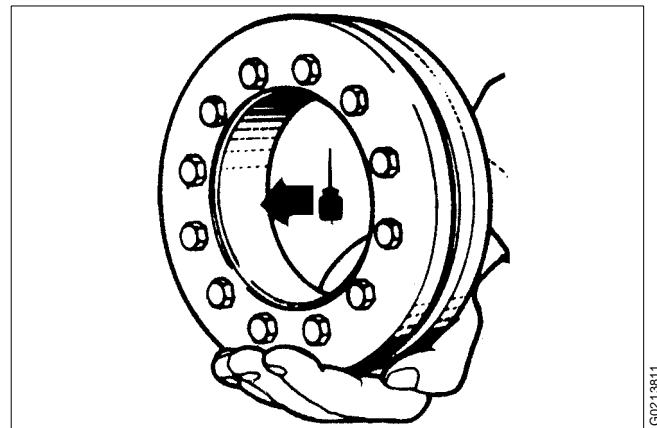
6. Fit the coupling disc. Note the key. Fit the centre screw (with spring washer and plain washer) and tighten it. Fit the elastic plates.
7. Before fitting the worm wheel and the clamping element clean all surfaces thoroughly with a clean cloth. Push the worm wheel on the shaft as far as possible.
8. Oil the inner surface of the clamping element. The oil must be of the same quality as is used in the worm gear housing. Slip the clamping element onto the worm wheel.
9. First tighten the three clamp screws A, B and C, but only so little that the clamping element just sticks on the worm wheel shaft. Then tighten the clamp screws uniformly and successively around the clamping ring in the order (1 – 12) stated in the figure. Tightening torque 29 Nm. Do not tighten crosswise. This must be repeated several turns around until full torque on every screw is reached. Check continuously that the clamping rings remain plane parallel.



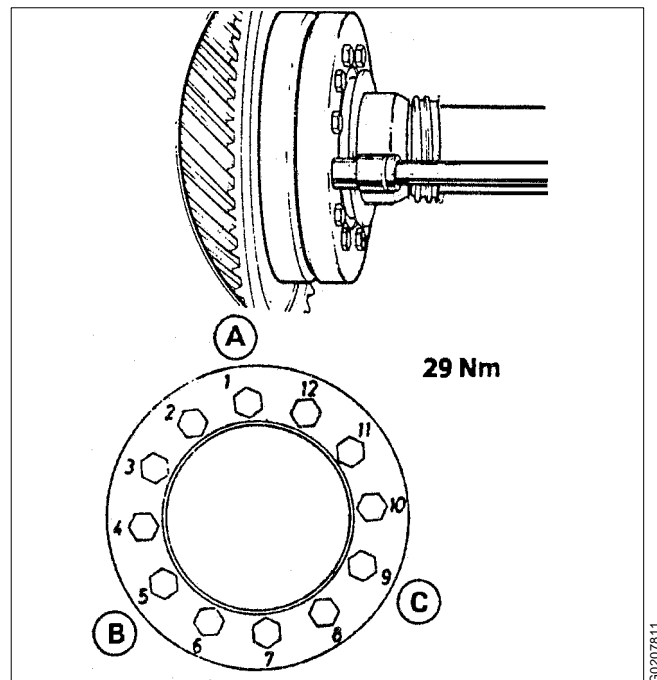
G0777711



G0571821

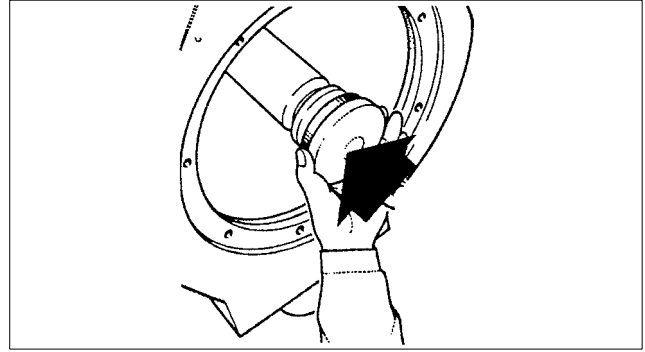


G0213811



G0207811

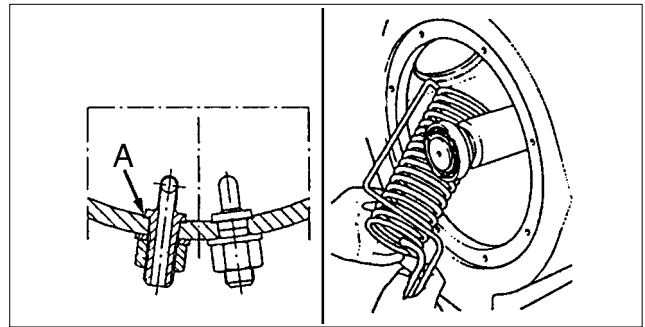
10. Mount the bearing. Apply the mounting washer and hit a few blows on the latter to ascertain that the bearing is in correct position. Use a tin hammer.



G046611

11. Make certain that the worm gear housing and the magnet of the cooling coil have been properly cleaned.

Fit new gaskets (A) onto the cooling coil tubes and insert the coil.



G0798021

12. Clean the bearing seat in the end shield.

Fit the gasket on the bearing shield and fit the shield. If necessary, force the shield into position by tightening the screws in the shield, or knock carefully with a tin hammer against the central part of the shield.

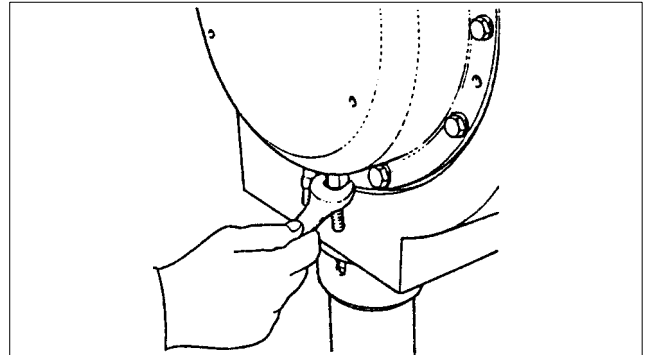
13. Fit the bearing shield cover and the nuts and washers of the cooling coil connections.

14. Fill oil before the worm wheel guard is mounted. Quantity and quality: Se Lubrication schedule.

15. Fit the gasket and the worm wheel guard.

16. Fit the motor. Fit the seal strip and the protection cap of the motor.

17. Fit the gasket and the brake cover.



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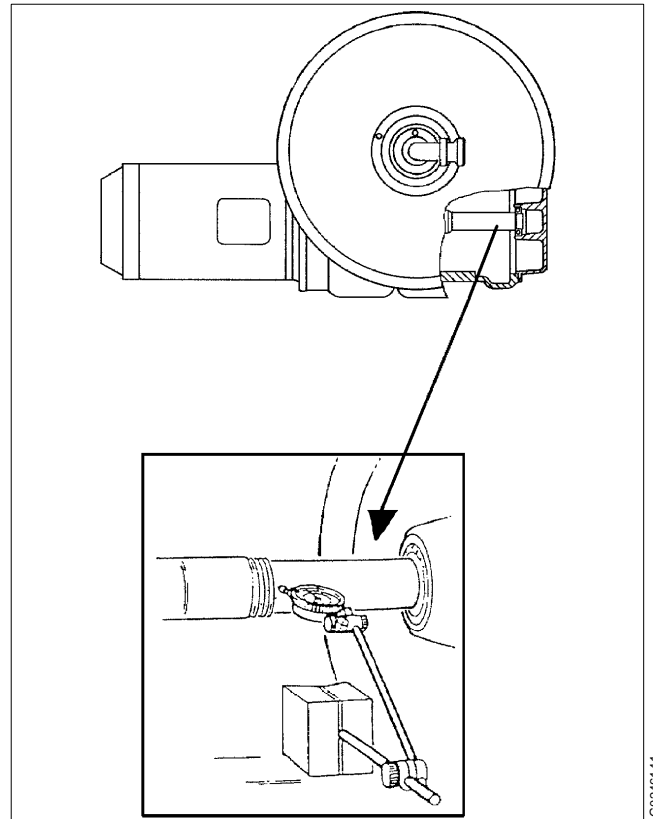
5.9.4 Radial wobble of worm wheel shaft

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

Clamp a dial indicator in a magnetic support and fasten the latter to the plane for the worm wheel guard (the gasket should be removed). Revolve the worm wheel shaft by hand.

Max. permissible radial wobble is 0,1 mm

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



G0246141

5.10 Remote controlled brake (pneumatic)

5.10.1 Changing brake lining – Checking for formation of rust

Checking for formation of rust

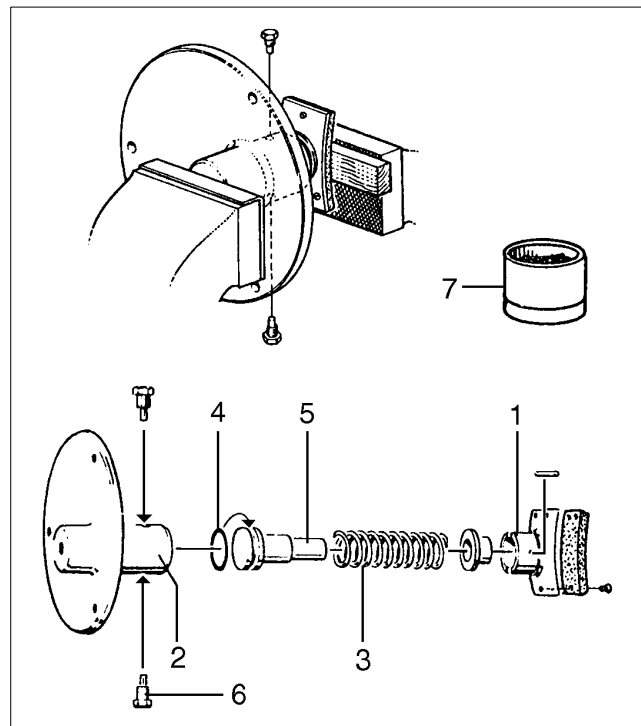
- Formation of rust on the brake parts may cause the brake to jam.

Remove any rust and brake dust from surface of the brake shoe (1) and the corresponding guiding surface in the cover (2). Rub the surfaces for instance with Molykote Paste 1000. Replace the spring (3) if it has lost its stiffness. Oil the spring when mounting.

Inspect O-ring (4) as well as piston (5) and its cylinder. Rub the cylinder for instance with Molykote Paste 1000.

NOTE

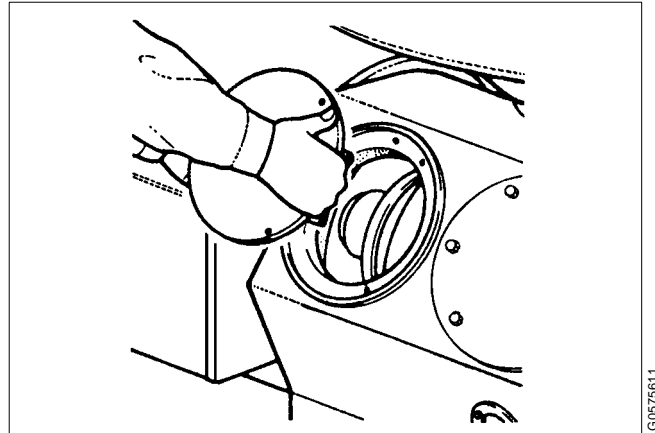
When assembling depress the brake shoe entirely in the brake cover before tightening set screws (6), otherwise the set screws may jam the brake shoe.



Supply compressed air to check the brake function.

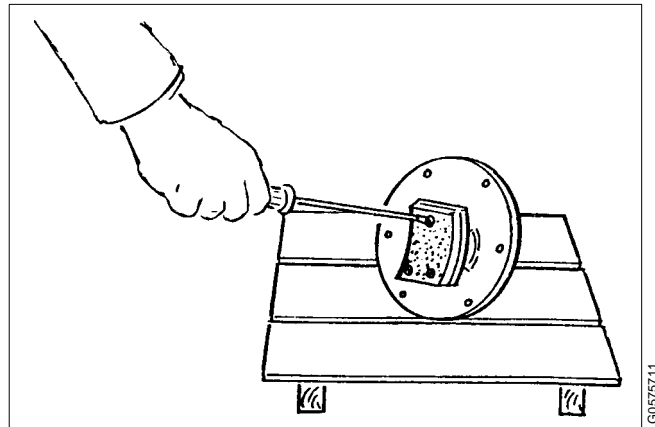
Changing brake lining

- A worn lining will lengthen the braking period.
1. Remove the brake cover.



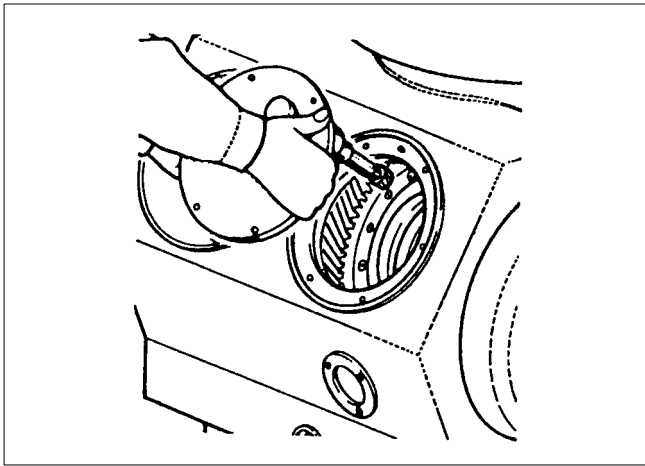
G0575611

2. Remove the screws and exchange the lining.
Note! The screws are slotted at both ends.

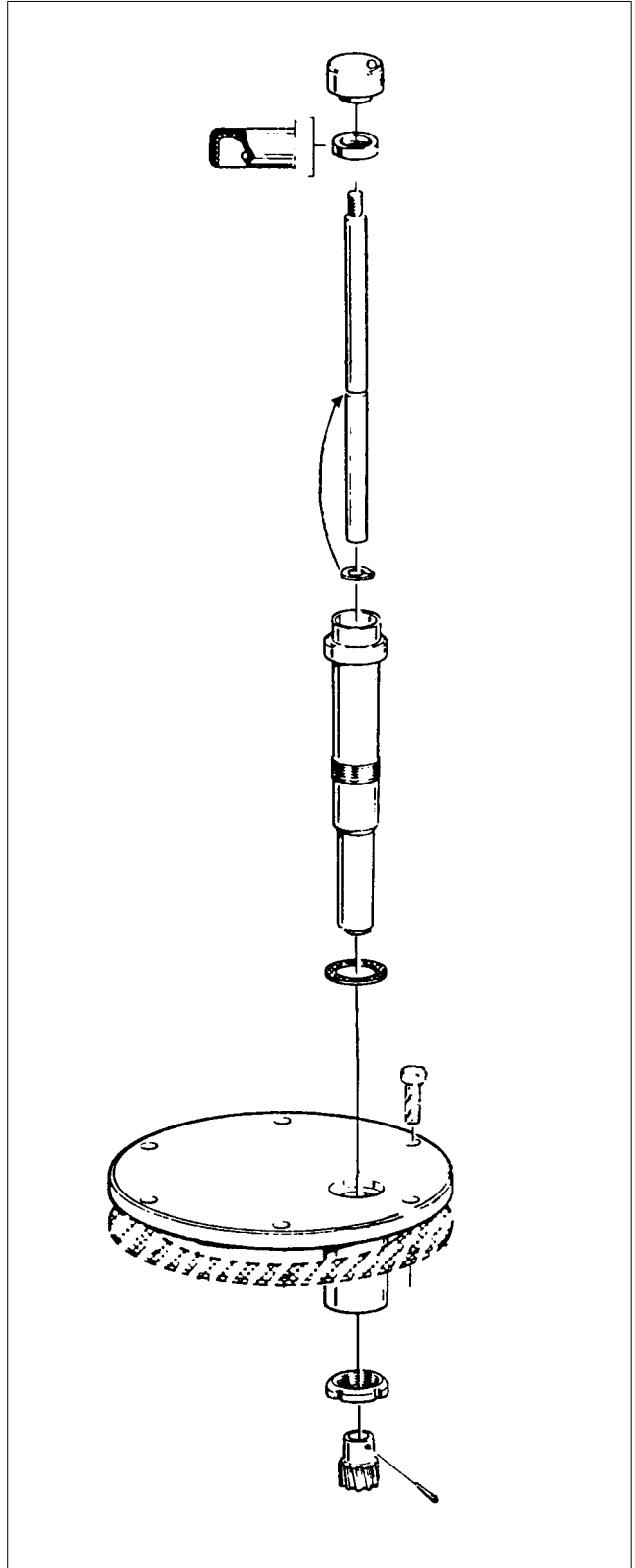


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5.11 Worm wheel guard (with revolution counter)

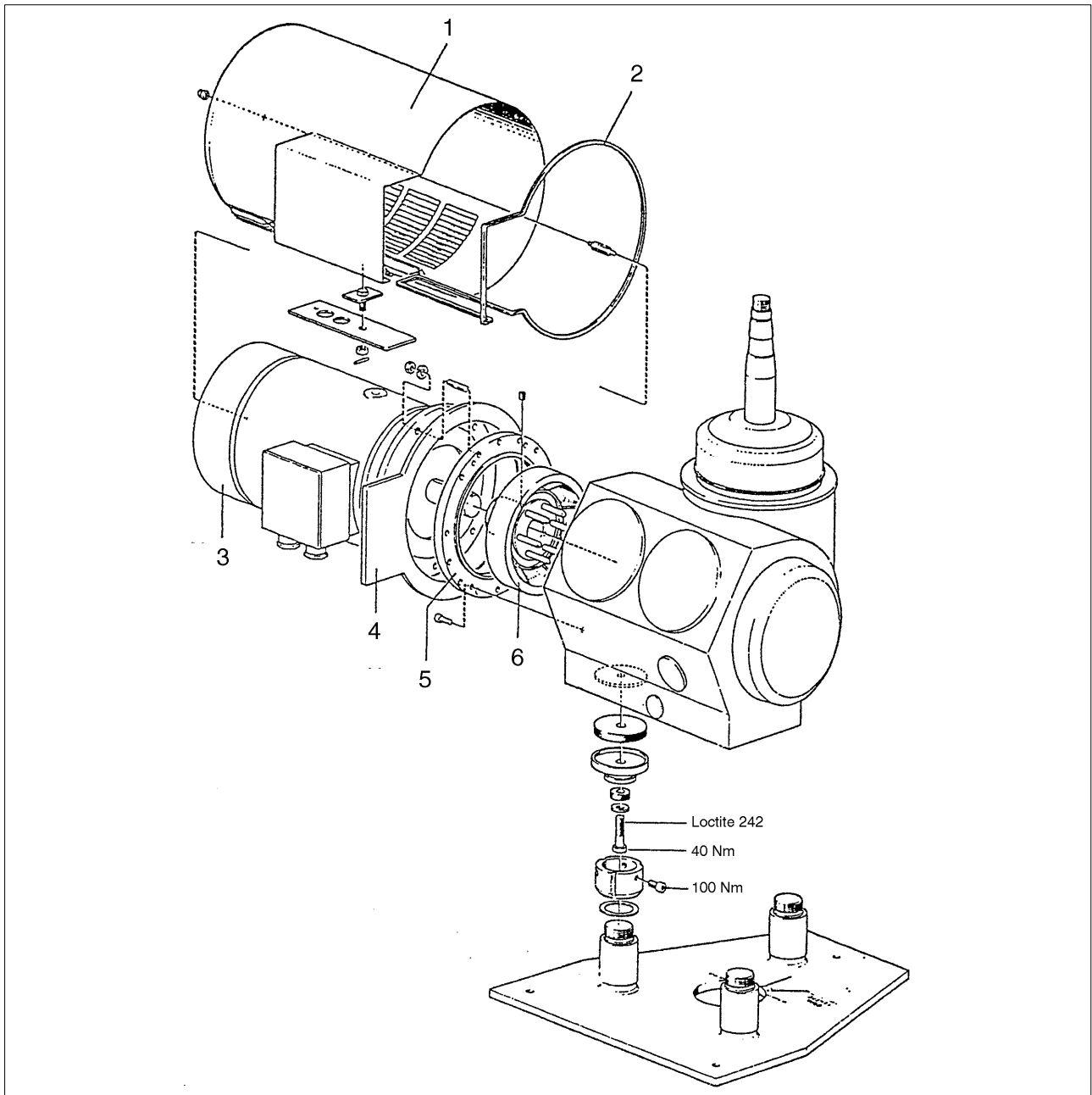


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5.12 Parts for mounting of motor and foundation feet



1. Protection cap
2. Seal strip
3. Motor
4. Cover
5. Motor adapter
6. Brake pulley

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5.12.1 Mounting the foundation feet

Check the vibration dampers and replace them when necessary, all at the same time. Apply Loctite 242 on the screws (1) and tighten them. Tightening torque **40 Nm**. The dampers must be replaced at least every second year.

Level against the upper face of the three holders (3). When necessary screw the holders so as to compensate for the inclination. Any gap between a holder and the foundation foot must be filled with one or more adjusting washers (4).

Lower the frame on to the foundation feet.

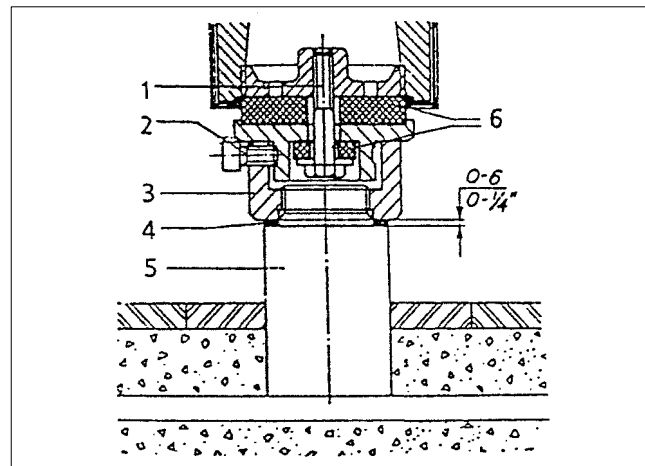
Tighten the set screws (2) by hand (or by a hand tool, if necessary) until all of them are in contact with the frame feet, then tighten them with a tightening torque of **100 Nm**. Mount the bowl and check that the frame is horizontal by means of a spirit level placed on the outer frame rim. Make a new adjustment if necessary.

NOTE

Tighten the set screws (2) before mounting the bowl or the cyclone.

Mount in the order stated

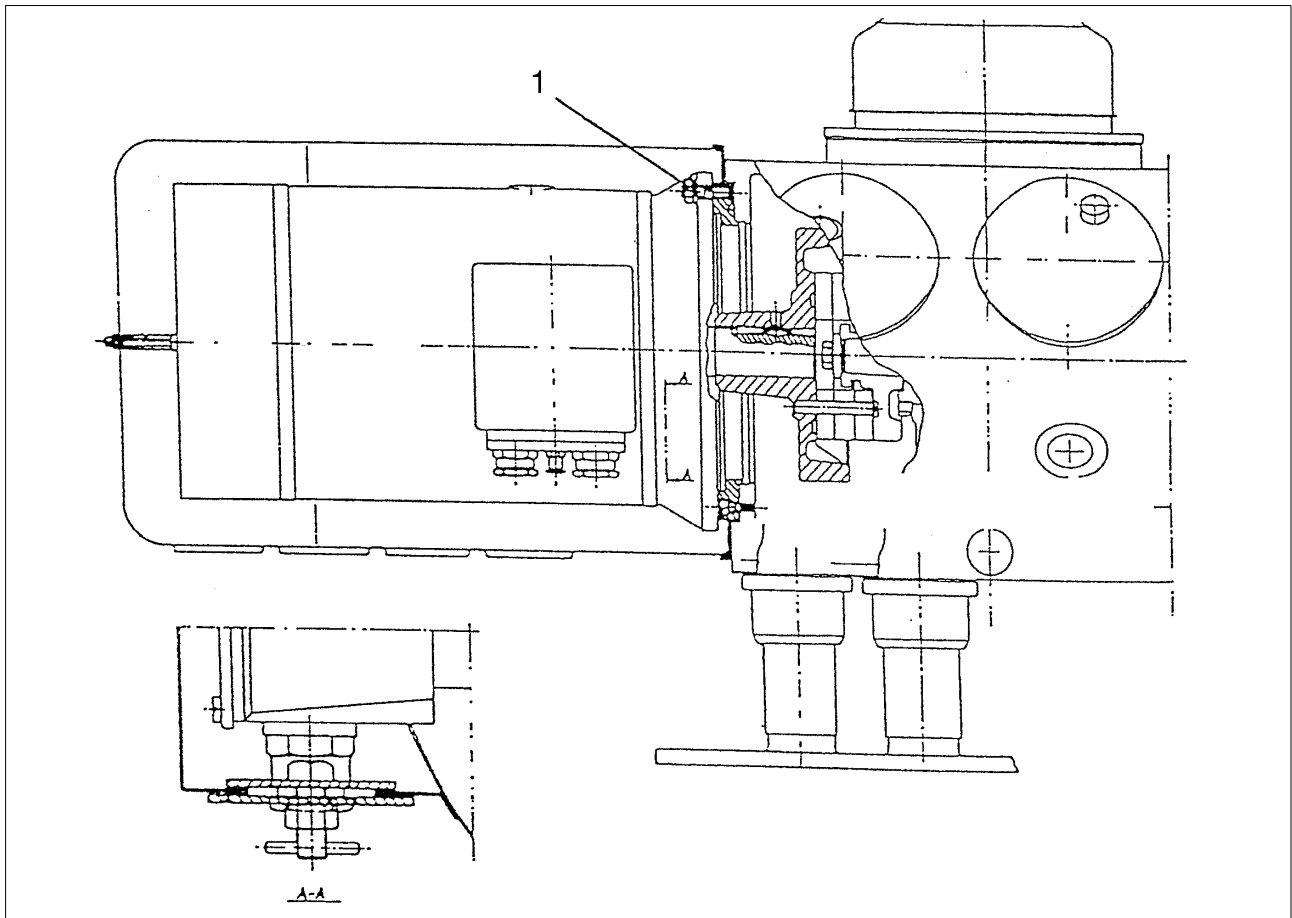
- Bowl
- Motor with protecting cap
- Cyclone
- Frame hood
- Inlet / Outlet



1. Screw and washer
2. Set screw
3. Holder
4. Adjusting washer
5. Foundation foot
6. Vibration damper

G0683811

5.12.2 Removing the motor



1. Position of screws to be adapted to make of motor

- Remove motor cover.
- Disconnect the electric cables to the motor.
- Fit the lifting eye on top of the motor and tighten it securely.
- Hook up the motor in a hoist. Use a lifting sling between the lifting hook and the lifting eye. Stretch the lifting sling with the hoist.
- Loosen and undo the six nuts fixing the motor flange to the separator frame.
- Pull out the motor with coupling pulley (brake pulley) from the separator frame and lift it away.



DANGER

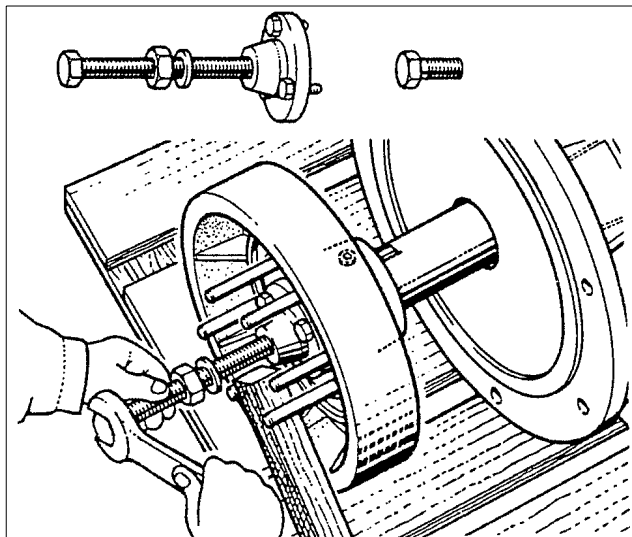
Disintegration hazard

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

5.12.3 Motor coupling

Dismantling

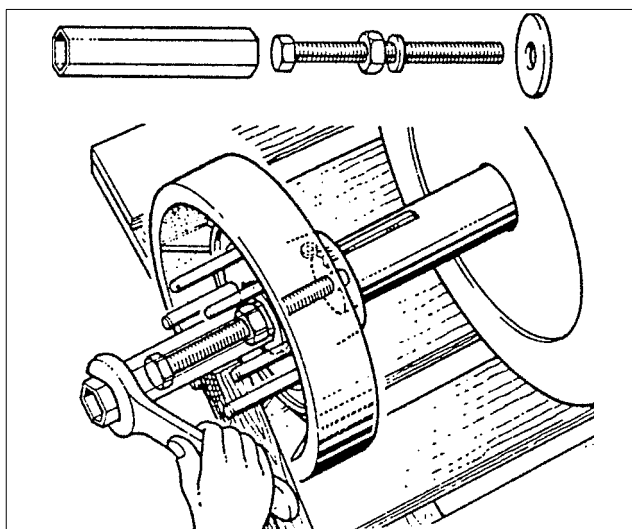
Loosen the lock screw. Apply some grease on the centre screw of tool. Mount a M20 screw on motor shaft. The screw will serve as a support when pulling off the coupling. (The screw from the worm wheel shaft may be used, then don't forget to remount it).



Assembly

Fit washer in coupling disc. Lubricate motor shaft, for instance with Molykote paste 1000. Knock the coupling on to the motor shaft as far as possible by means of a piece of wood and a hammer. Screw home the nut on the mounting tool (the centre screw of the dismantling tool) and screw it into the motor shaft.

Apply some grease on the washer ahead of the nut and press the coupling into position by tightening the nut using the socket sleeve and a screw wrench. Lock it with the lock screw.



6 *Trouble-tracing*

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6.1 Introduction

If the separator has been installed as a part of a processing system always study the trouble-tracing part (if any) in the system documentation first.

If the problem is not solved, continue with this chapter.

6.2 Mechanical functions

6.2.1 Smell

Cause	Corrective actions
Motor failure/switching from Y to D too early	Repair/renew the motor/Y-D switch
Bearing is damaged	Renew
Oil level in gear housing is too low	Check oil level and add oil if necessary

6.2.2 Noise

Cause	Corrective actions
Oil level in gear housing is too low	Check oil level and add oil if necessary
Height adjustment of the outlet paring disc is incorrect	Stop the separator, measure and adjust the height
Worm wheel and worm are worn	Renew worm wheel and worm
Bearing is damaged or worn	Renew
Incorrect play between elastic plates in coupling	Adjust the play

6.2.3 Separator vibrates

NOTE

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



DANGER

Disintegration hazards

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

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

Cause	Corrective actions
Bowl out of balance due to: <ul style="list-style-type: none"> - poor cleaning - incorrect assembly - incorrect disc stack compression - bowl assembled with parts from other separators 	Dismantle the separator and check the assembly and cleaning. Check the number of bowl discs, compare with the number in <i>Spare Parts Catalogue</i> . If necessary, rebalance the bowl.
Uneven sediment deposits in the sediment space	Dismantle and clean the separator bowl
Height adjustment of the outlet paring disc is incorrect	Stop the separator, measure and if necessary adjust the height
Bowl spindle bent (max 0,04 mm)	Renew the bowl spindle
Bearing is damaged or worn	Renew
Vibration damping rubber cushions are worn out	Renew all rubber cushion

6.2.4 Starting power too high

Cause	Corrective actions
Wrong direction of rotation	Change electrical phase connections to the motor
Motor failure/switching from Y to D too early	Repair/renew the motor/Y-D switch

6.2.5 Starting power too low

Cause	Corrective actions
Motor failure	Repair/renew the motor

6.2.6 Speed too low

Cause	Corrective actions
Bowl is leaking or not closed	Dismantle the bowl and check
Motor failure	Repair/renew the motor
Bearing is damaged	Renew
Incorrect gear transmission (60 Hz gear for 50 Hz power supply)	Stop and change the gear transmission to suit the power supply frequency

6.2.7 Starting time too long

Cause	Corrective actions
Height position of outlet paring disc or operating device is incorrect	Stop, check and adjust the height(s)
Motor failure/switching from Y to D too early	Repair/renew the motor/Y-D switch
Bearing is damaged or worn	Renew

6.2.8 Water in worm gear housing

Cause	Corrective actions
Bowl casing drain is obstructed	Clean the casing and the drains properly. The drains have connection Nos. 462 and 463, illustrated on page 166. Solve the reason for obstruction. Clean worm gear housing and change oil.
Leakage at top bearing	Renew seal ring and change oil
Condensation	Clean worm gear housing and change oil

6.3 Separating functions

6.3.1 Unsatisfactory separation result

Cause	Corrective actions
Gravity disc hole is too small	Use a disc with larger hole
Incorrect separation temperature	Adjust
Throughput is too high	Adjust
Bowl disc stack is clogged	Clean the disc stack
Sediment space in bowl is filled	See "6.3.11 Bowl clogged with sediment"
Bowl speed is too low	Examine the motor and power transmission including the gear ratio, see "6.2.6 Speed too low"

6.3.2 Bowl fails to open for sediment discharge

Cause	Corrective actions
Operating water supply is obstructed	Check the water supply
Seal rings in operating water device are defective	Renew the seal rings
Discharge water pressure/flow is too low	Check the discharge water pressure/flow. Compare with the recommended values in the chapter "7.3 Connection list" on page 168.
Seal ring in the operating slide is defective	Renew the seal ring. Carry out an Intermediate Service (IS)

6.3.3 Outgoing heavy phase contains light phase

Cause	Corrective actions
Gravity disc hole is too large	Use a disc with smaller hole
Incorrect separation temperature	Adjust
Throughput is too high	Adjust
The closing water line is obstructed or the water pressure/flow is too low, which give rise to leakage through the sediment ports	Check for correct values in the "7.3 Connection list" on page 168
Valve(s) in light phase outlet line is closed	Open the valve(s)
Gasket/O-ring at the gravity disc is defective	Renew the gasket/O-ring
Disc stack is clogged	Clean the disc stack
Bowl hood seal ring is defective or the sealing surface of sliding bowl bottom is damaged	Renew the seal ring. Polish the surface on sliding bowl bottom or renew it
Rectangular seal ring in sliding bowl bottom is defective	Renew the seal ring
Bowl speed is too low	Check that the brake is released. Examine the motor and power transmission including the gear ratio
Bowl is incorrectly assembled	Check the assembly

6.3.4 Outgoing light phase contains heavy phase

Cause	Corrective actions
Gravity disc hole is too small	Use a disc with larger hole
Valve(s) in heavy phase outlet is too small	Open the valves
Throughput is too high	Adjust
Sediment space in bowl is filled	Clean and reduce the time between sediment discharges

6.3.5 Bowl opens accidentally during operation

Cause	Corrective actions
Strainer in the operating water supply is clogged	Clean the strainer
No water in the operating water system	Check the operating water system and make sure the valve(s) are open
Water connections to the separator are incorrectly fitted	Correct
Square-sectioned ring in sliding bowl bottom is defective	Renew the square-sectioned ring. Carry out an Intermediate Service (IS)
Valve plugs are defective	Renew all plugs. Carry out an Intermediate Service (IS)
Sediment deposits on the operating slide	Clean the operating slide
Seal ring in operating slide is defective	Renew the seal ring

6.3.6 Unsatisfactory sediment discharge

Cause	Corrective actions
Sediment hard packed due to long discharge interval	Shorten the discharge interval
Valve plugs in the operating slide are worn or too high	Renew with correct valve plugs
Sediment deposits in the operating system	Check and clean the operating system

6.3.7 Liquid flows through the bowl casing drain and/or sediment outlet

Cause	Corrective actions
Sediment discharge or liquid draining in progress	None (normal)
The closing water line is obstructed or the water pressure/flow is too low or too high	Check closing water pressure/flow. Compare with the recommended values in the chapter "7.3 Connection list" on page 168.
Channels in operating water device are clogged	Clean the operating water device
Seal rings in the operating water device are defective	Renew the seal rings
O-ring under the paring chamber cover is defective	Renew the O-ring
Paring chamber cover is defective	Renew the paring chamber cover
Seal ring in the bowl hood is defective	Renew the seal ring
Sealing edge of the sliding bowl bottom (wear liner) is defective	Smoothen sealing edge of the sliding bowl bottom (wear liner) or renew it
Operating slide of bowl jams due to poor lubrication, defective seal ring, burrs or deformation	Dismantle and check
Operating slide springs are defective	Renew the springs
Valve plugs are defective	Renew all valve plugs
Sliding bowl bottom jams - seal ring is defective	Renew the seal ring
Bowl speed too low	See "6.2.6 Speed too low"

6.3.8 Too much process liquid in sediment

Cause	Corrective actions
Discharge interval is too short	Prolong the discharge interval
Bowl is leaking	See "6.3.7 Liquid flows through the bowl casing drain and/or sediment outlet"

6.3.9 High pressure in clean liquid outlet

Cause	Corrective actions
Throughput is too high	Adjust
Valve(s) in clean liquid outlet line is throttled too much	Adjust the back pressure

6.3.10 Air intermingles with the cleaned liquid

Cause	Corrective actions
Back pressure in the clean liquid outlet is too low	Adjust the back pressure
Outlet paring disc is defective	Renew the paring disc

6.3.11 Bowl clogged with sediment

Cause	Corrective actions
Sediment is too viscous	Discharge more frequently
Sediment tank is overfilled	Empty the sediment tank and clean the bowl casing in frame

7 *Technical Reference*

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7.1 Technical data

Alfa Laval ref. 556629, rev. 1

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.

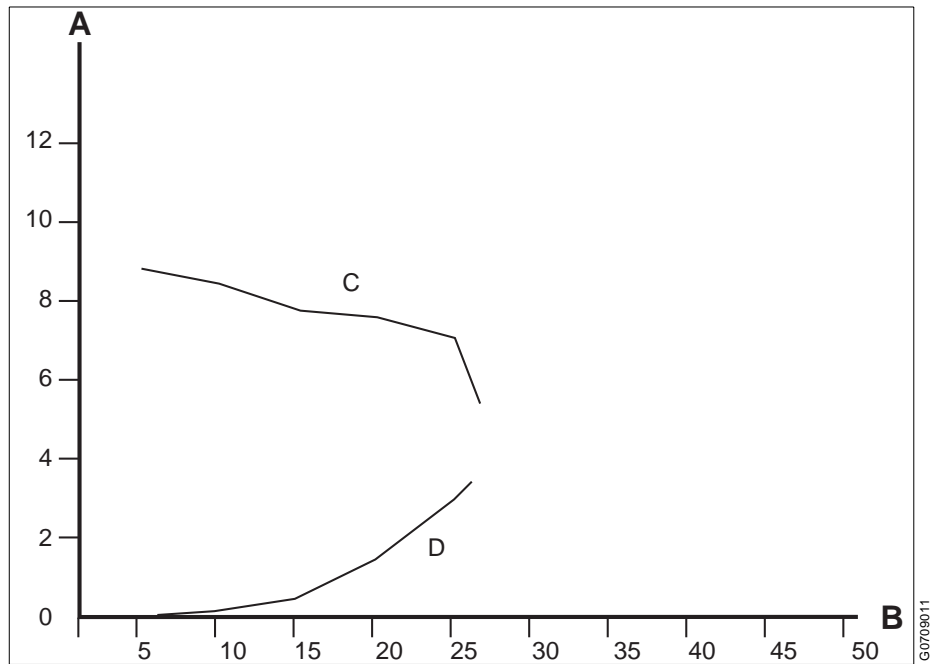
Bowl speed, max.	4136 / 4135	r/min 50 Hz / 60 Hz
Speed motor shaft, max.	1500 / 1800	r/min 50 Hz / 60 Hz
Gear ratio	91:33 85:37	50 Hz 60 Hz
Revolution counter	118 – 125 / 142 – 150	50 Hz / 60 Hz
Hydraulic capacity	50	m ³ /h
Min. / max. discharge volume	15 / 35	litres variable discharge
Min. discharge interval	1	minute
Ambient temperature	+5 – +45	°C min. / max.
Feed temperature	0 / 100	°C min. / max.
Max. density of sediment / feed	2071 / 1100	kg/m ³
Max. density of operating liquid	1000	kg/m ³
Max. pressure of operating liquid	50	kPa
Max. running time, empty bowl	120	minutes
filled bowl	120	minutes
Motor power	37	kW
Power consumption	10 / 37	kW (idling / at max. capacity)
Max. power consumption	–	kW (at starting up)
Lubricating oil volume	13	litres
Starting time	–	minutes (min. / max.)
Stopping time with brake	22 / 25	minutes (min. / max.)
Stopping time without brake	–	minutes (average)
Sound power / sound press. level	– / 83	Bel (A) / dB (A)
Vibration level, max.	7,1 / 9,0	mm/s (new sep./sep. in use)
Bowl weight	820	kg
Weight of separator	1775	kg (without motor)

Outlet paring disc capacity

Paring disc: $\varnothing = 210$ mm
Wing height: 12 mm

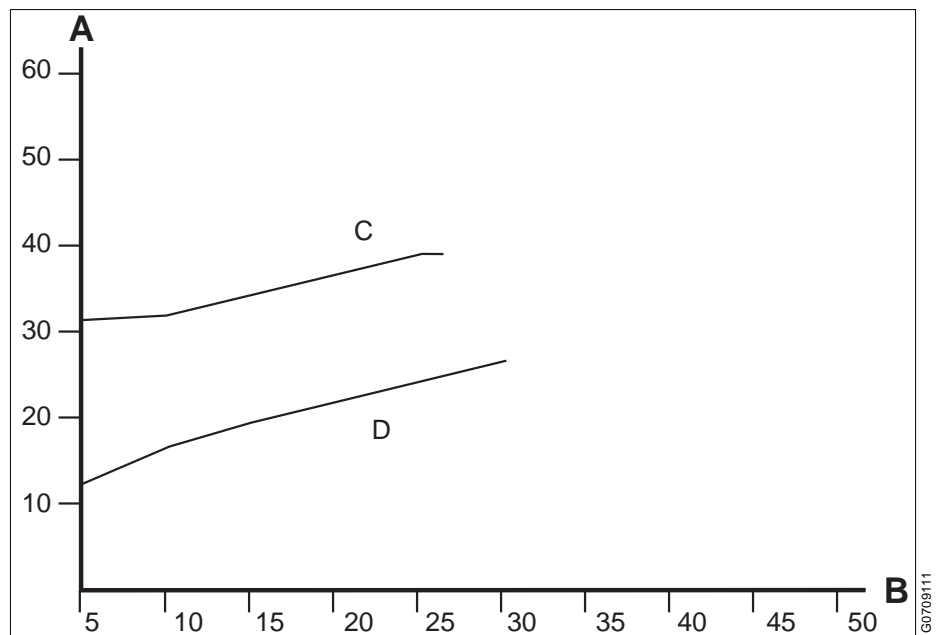
Gravity disc: $\varnothing = 200$ mm

Throttling washer in feed tube: $\varnothing = 20$ mm



- A. Pressure (bar)
- B. Flow (m³/hour)
- C. Overflow to light phase outlet
- D. Inlet pressure (bar)

Power consumption for above paring disc



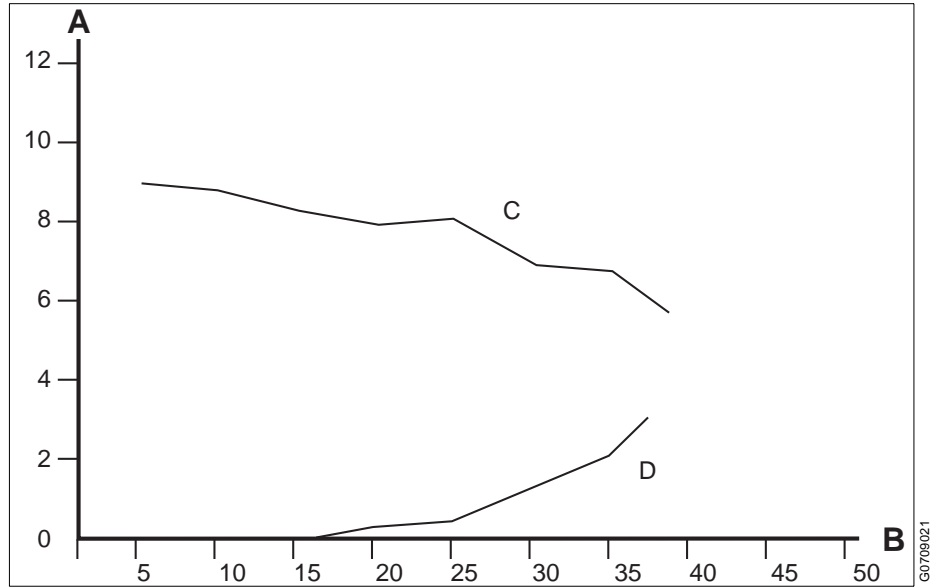
- A. Power (kW)
- B. Flow (m³/hour)
- C. Max. back pressure
- D. No back pressure

Outlet paring disc capacity

Paring disc: $\varnothing = 210$ mm
Wing height: 12 mm

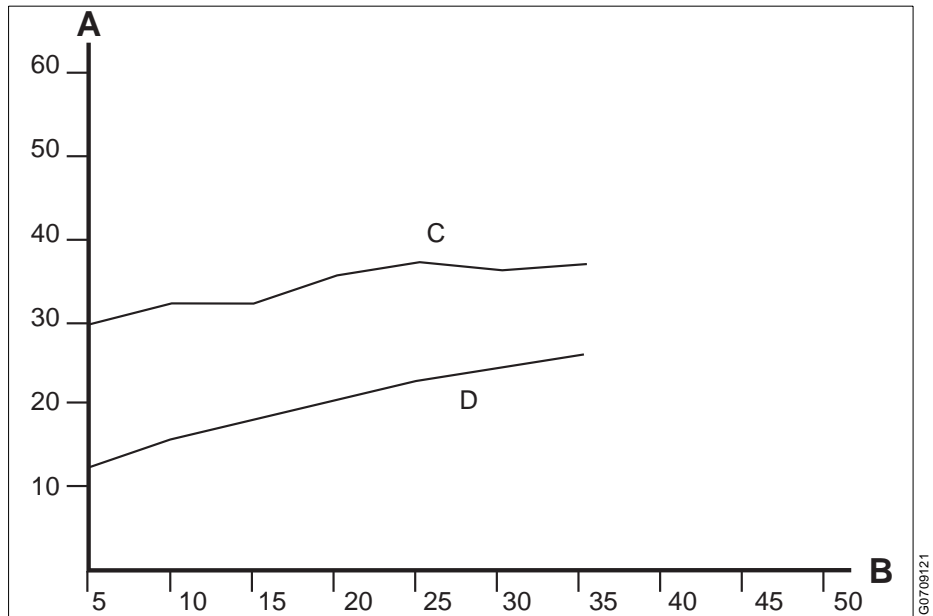
Gravity disc: $\varnothing = 200$ mm

Throttling washer in feed tube: $\varnothing = 25$ mm



- A. Pressure (bar)
- B. Flow (m³/hour)
- C. Overflow to light phase outlet
- D. Inlet pressure (bar)

Power consumption for above paring disc



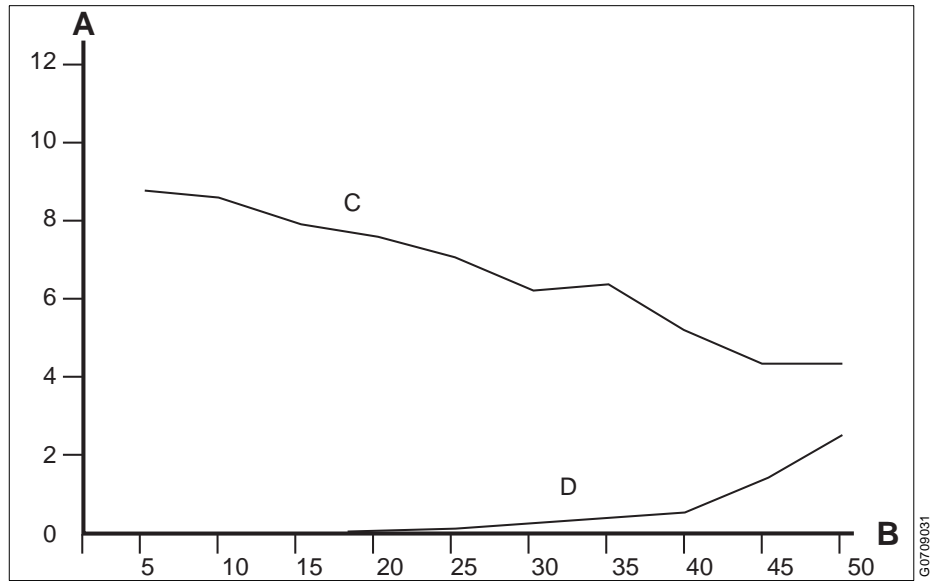
- A. Power (kW)
- B. Flow (m³/hour)
- C. Max. back pressure
- D. No back pressure

Outlet paring disc capacity

Paring disc: $\varnothing = 210$ mm
Wing height: 12 mm

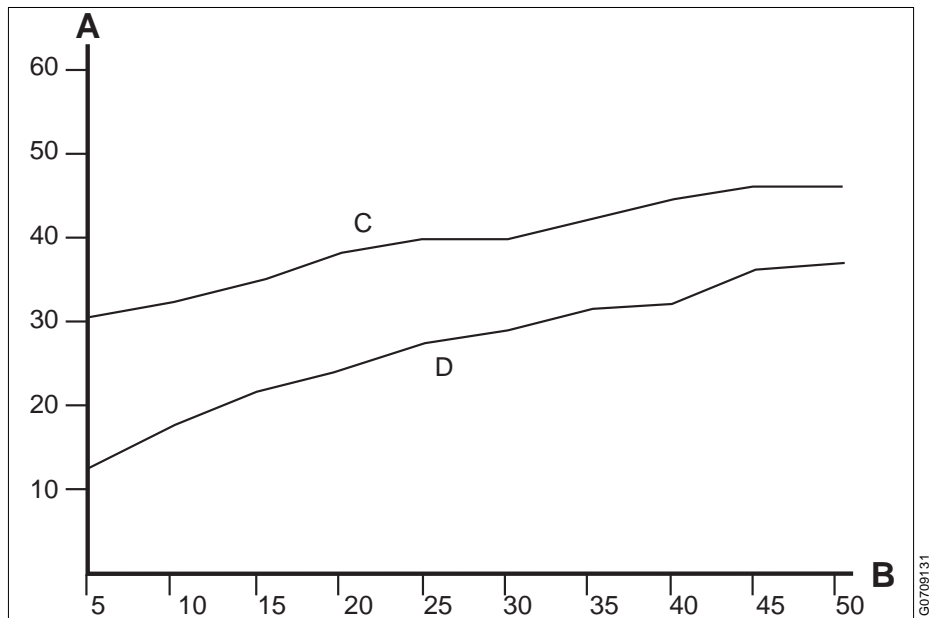
Gravity disc: $\varnothing = 200$ mm

Throttling washer in feed tube: $\varnothing = 30$ mm



- A. Pressure (bar)
- B. Flow (m³/hour)
- C. Overflow to light phase outlet
- D. Inlet pressure (bar)

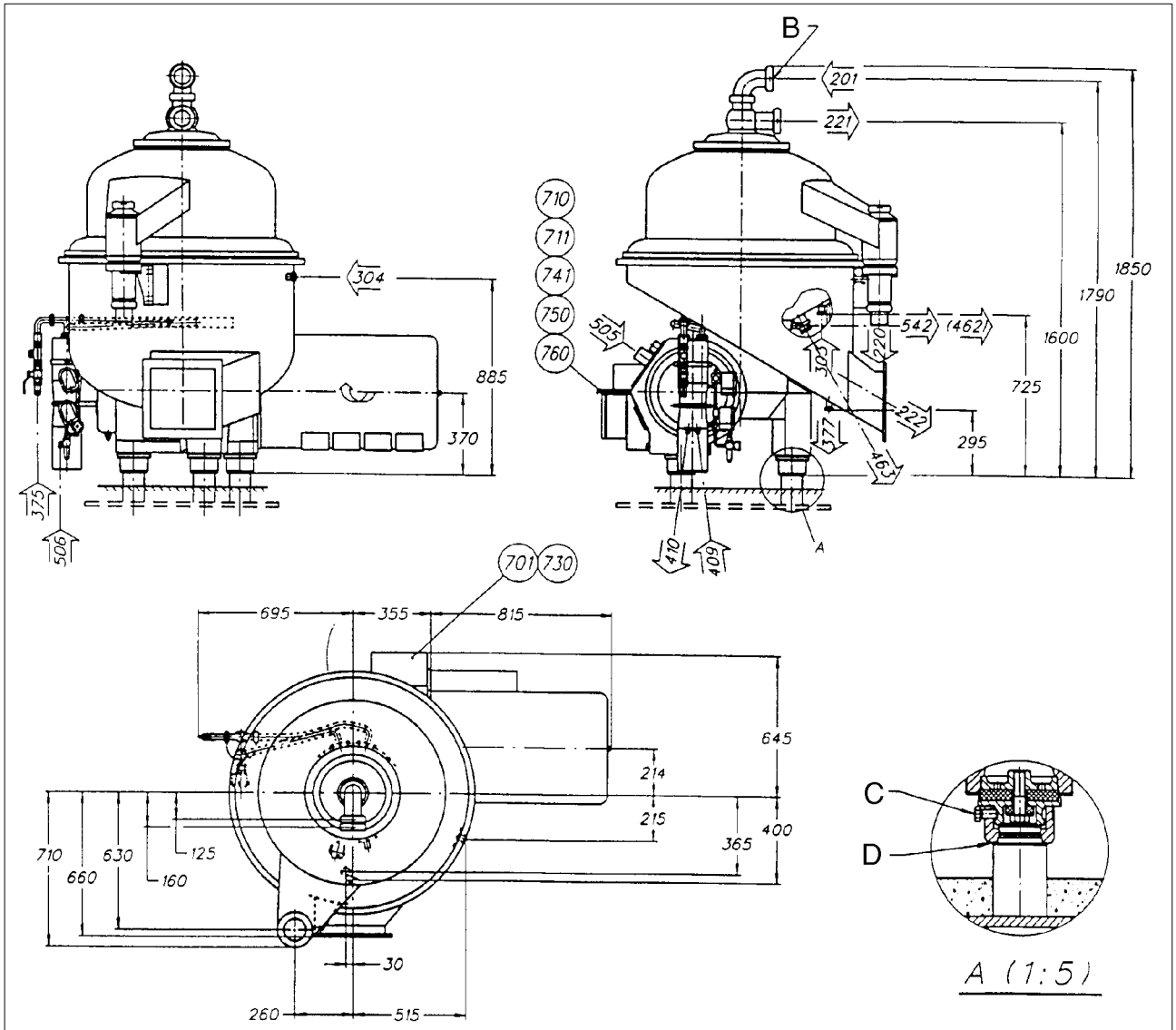
Power consumption for above paring disc



- A. Power (kW)
- B. Flow (m³/hour)
- C. Max. back pressure
- D. No back pressure

7.2 Basic size drawing

Alfa Laval ref. 556618, rev. 0



B. Maximum horizontal displacement at the in/outlet connections during operation is ± 20 mm

C. Tightening torque **100 Nm**

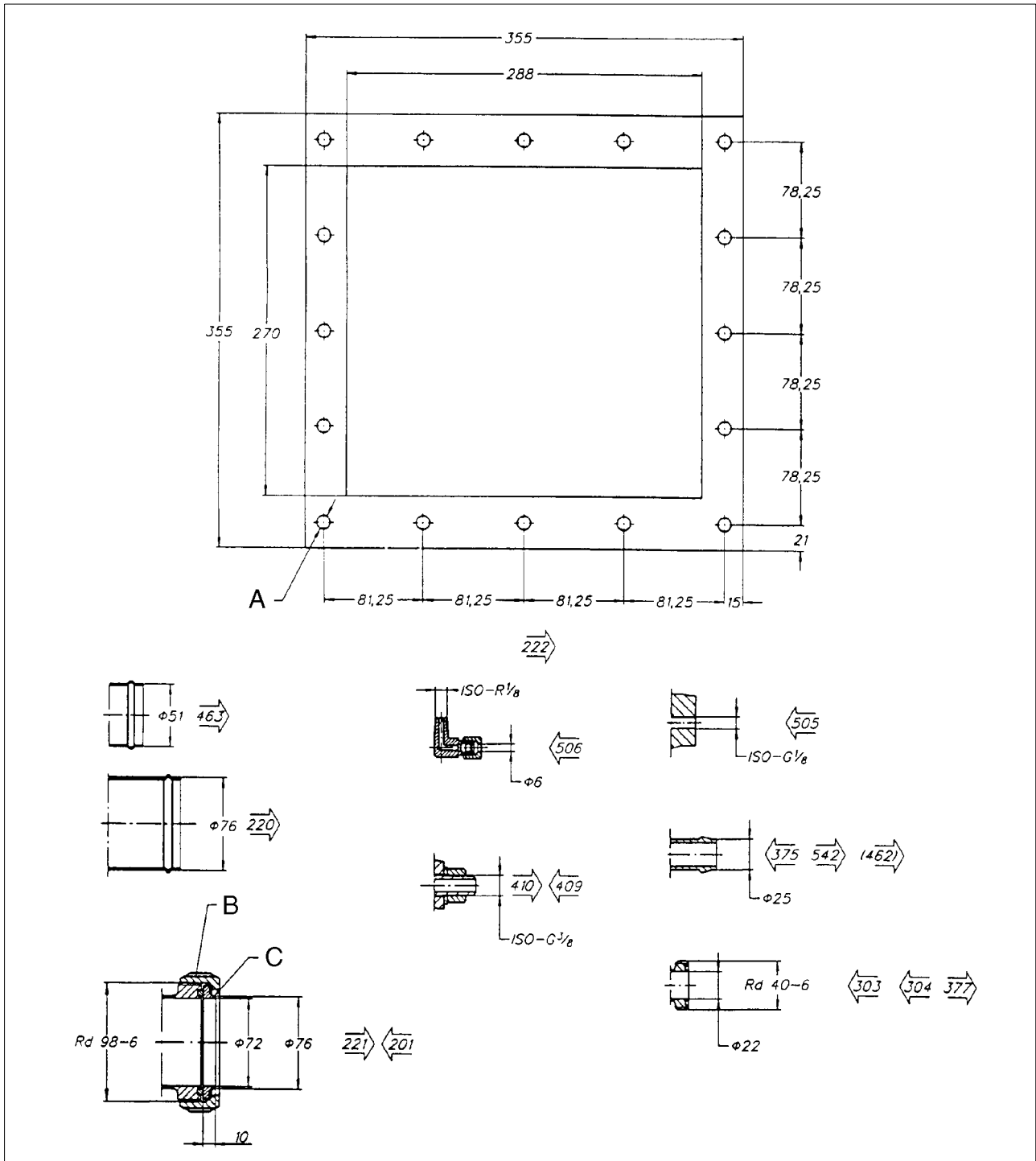
D. Adjusting washers max. 4 pieces per foot

Connections 201 and 221 are turnable 360°

All connections to be installed non-loaded and flexible

For description of the connection numbers, see "7.3 Connection list" on page 168

G0737711



- A. 16 holes, \varnothing 11 mm
- B. Nut, DN 76, SMS 1148
- C. Stainless steel

All connections to be installed non-loaded and flexible

Data for connections, see chapter
 "7.3 Connection list" on page 168

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Connection No.	Description	Requirements/limits
375	Inlet of discharge and make-up liquid - Max. density - Make-up liquid - Pressure - Flow (momentary) * - Consumption * - Discharge liquid - Consumption *	See demand in chapter “7.5.1 Operating liquid” on page 178 1000 kg/m ³ 25 - 40 kPa 10 m ³ /hour 10 - 100 litres/hour 1,5 - 3 litres/discharge
377	Outlet for operating liquid	
409	Inlet to lubricating oil cooler - Flow	100 litres/hour
410	Outlet from lubricating oil cooler	
(462)	See connection No. 542 (common outlet)	
463	Drain of frame top part, upper	
506	Compressed air for OWM - Pressure - Consumption	See demand in chapter “7.5.2 Compressed air” on page 179. 300 - 400 kPa 5 Nlitres/discharge
542 (462)	Ventilation, frame bottom part. Drain of top part, space below liquid seal.	
701	Motor for separator - Deviation from nominal frequency, max.	± 5% (momentarily 10% during a period of max. 5 seconds)
710	Pneumatic discharge valve for OWM - Type Power supply, AC : 24 V 48 V 110 V Power supply, DC : 24 V Effect, nominal: 23 W 20 W 20 W 20 W Effect, inrush: - 65 VA 65 VA 65 VA Effect, holding: - 44 VA 44 VA 44 VA	See “7.4 Interface description” on page 172 3-way (3/2) direct activated

Connection No.	Description	Requirements/limits
711	Pneumatic discharge valve for OWM-TWIN - Type Power supply, AC : 24 V 48 V 110 V Power supply, DC : 24 V Effect, nominal: 19,7 W 16,7 W 16,7 W 16,7 W Effect, inrush: - 51 VA 51 VA 51 VA Effect, holding: - 35 VA 35 VA 35 VA	See "7.4 Interface description" on page 172 2-way (2/2) direct activated
730	Temperature sensor for motor Type: PTC thermistor, 190 °C	
741	Speed sensor - Type - Supply voltage, nominal Current consumption: - With sensor activated (near metal) - With sensor not activated (far from metal) - Number of pulses per revolution - Other technical data	Inductive proximity sensor 8 V DC ≤ 1 mA ≥ 3 mA 4 The secondary switching device for speed indicating and alarm functions must be capable of handling pulses with a duration of 0,5 ms See "7.4 Interface description" on page 172
750	Vibration sensor - Type - Sensitivity (f=80 Hz, $R_L \geq 1$ M Ω) - Frequency range - Internal impedance	See "7.4 Interface description" on page 172 Velocity transducer 100 mV/mm/s 10 - 2000 Hz 4 k Ω $\pm 5\%$

Connection No.	Description	Requirements/limits																		
760	Cover interlocking switch - Type - Switch rating, resistive load, max. <table style="margin-left: 40px;"> <thead> <tr> <th style="text-align: left;">AC</th> <th style="text-align: left;">DC</th> <th></th> </tr> </thead> <tbody> <tr> <td>12 V</td> <td>75 VA</td> <td>7 W</td> </tr> <tr> <td>24 V</td> <td>200 VA</td> <td>7 W</td> </tr> <tr> <td>48 V</td> <td>280 VA</td> <td>9 W</td> </tr> <tr> <td>127 V</td> <td>500 VA</td> <td>13 W</td> </tr> <tr> <td>230 V</td> <td>550 VA</td> <td>–</td> </tr> </tbody> </table>	AC	DC		12 V	75 VA	7 W	24 V	200 VA	7 W	48 V	280 VA	9 W	127 V	500 VA	13 W	230 V	550 VA	–	See “7.4 Interface description” on page 172 Mechanical switch
AC	DC																			
12 V	75 VA	7 W																		
24 V	200 VA	7 W																		
48 V	280 VA	9 W																		
127 V	500 VA	13 W																		
230 V	550 VA	–																		

* For guidance only. Based on estimates and unverified calculations.

7.4 Interface description

Alfa Laval ref. 556718, rev. 1

7.4.1 General

In addition to the Connection list on page 168, 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.

7.4.2 Definitions

Ready for start means:

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

Start means:

- The power to the separator motor is on.
- The acceleration is supervised to ensure that a certain speed has been reached within a certain time. See "7.1 Technical data" on page 162.

The start procedure continues until the Y-D switch-over has been made and a stabilization period has passed (about 1 minute).

Normal stop means:

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

Safety stop means:

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

Comply to following conditions:

- Sediment ejection must not be made.
- The machine must not be restarted before the reason for the safety stop has been investigated and action has been taken.

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

7.4.3 Component description and signal processing

Separator motor (701)

The separator is equipped with a 3-phase Y-D started motor. The motor is of control torque type and built for a long starting time. The starting equipment must be dimensioned for at least twice the rated current of the motor and the overload relay must only be connected in the D-line.

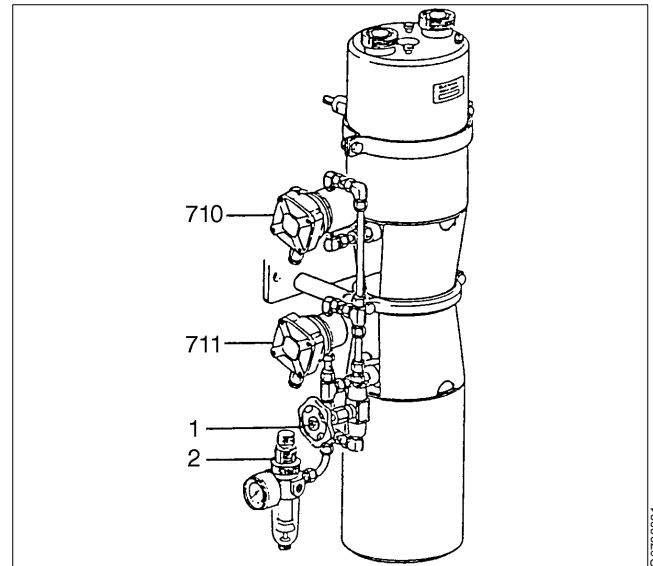
Solenoid valves (710 & 711)

The operating water module (OWM) is equipped with two explosion-proof solenoid valves. One of them (710) is a 3-way valve and is activated every time a discharge sequence is initiated.

The second valve (711) is a 2-way valve and is activated during the large discharge sequence. This valve is by-passing the needle valve (1) and gives full flow to the piston.

Basic settings: Open the needle valve one complete turn from closed position.

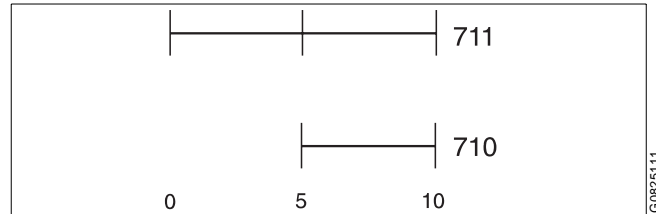
For a more comprehensive description of the OWM, see "2.4.2 Operating water system" on page 22.



1. Needle valve
2. Regulator

Large discharge

- Opening time for solenoid valves 711 and 710 are 10 and 5 seconds respectively according to the diagram beside.
- The desired discharge volume is obtained by adjusting the air pressure on the regulator (2) to about 300 - 400 kPa (3 - 4 bar).



The time sequence in seconds

Small discharge

- Opening time for solenoid valve 710 is 5 seconds, valve 711 is closed.
- The desired discharge volume is obtained by adjusting the needle valve.

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.

Motor temperature sensor (730)

The separator motor is equipped with three thermistor sensors, one in each winding. The sensors are connected in series and should be connected to a thermistor relay that trips the starting equipment when the temperature exceeds the tripping level stated in "7.3 Connection list" on page 168.

Speed sensor (741)

The separator is equipped with a proximity sensor mounted near the motor shaft pulley. The pulley is equipped with four grooves giving a correspondent number of impulses per revolution of the motor shaft. The bowl speed is calculated from the gear ratio and the r/min of the motor shaft.

The sensor is of inductive type according to DIN 19234 (NAMUR) standard. When supplied with rated voltage the sensor gives a current signal with a size depending if the position of the sensor head is near the metal surface or in front of a groove (non-metal).

Speed signal during start

- The turnover to D should occur at 93% of the synchronous speed.
- The machine must be stopped and an alarm must be given when the speed for D-turnover has not been reached within the time specified in “7.1 Technical data” on page 162.

Speed signal during normal operation

Normal operation condition is considered to have been achieved 1 minute after D-turnover.

During normal operation the speed is allowed to vary within speed limits specified below:

- When the speed exceeds the synchronous speed more than 5%, the machine must be stopped and a high speed alarm must be given.
- When the speed falls to 7% below the synchronous speed for a period longer than 1 minute, a low speed alarm signal must be given.

Vibration sensor (750)

The separator is equipped with a vibration sensor of velocity type, mounted on the frame. The sensor converts the mechanical vibration to an electric signal. The signal has to be converted in a special transducer, in which the signal is compared with preset limit values.

When the preset limit values are exceeded appropriate countermeasures have to be performed. The two levels are warning for unacceptable vibrations and safety stop respectively in case of high unbalance.

Vibration signal

The vibration signal levels given below in mV or mm/s are expressed as RMS values.

Vibration signal during normal operation

Two levels of vibration are considered for this machine (see "7.1 Technical data" on page 162):

- In case of a signal exceeding 600 mV (corresponding to a vibration velocity of 6 mm/s) following action must be taken:
A warning alarm shall be given. The machine shall be stopped manually with a normal stop sequence and the reason of the vibration investigated.
- In case of a signal exceeding 800 mV (corresponding to a vibration velocity of 8 mm/s) following actions must be taken:
 - Immediate safety stop of the machine including alarm for extreme unbalance.
 - Blocking of the discharge system (no more discharge should be performed).
 - Keeping the bowl filled.

Cover interlocking switch (760)

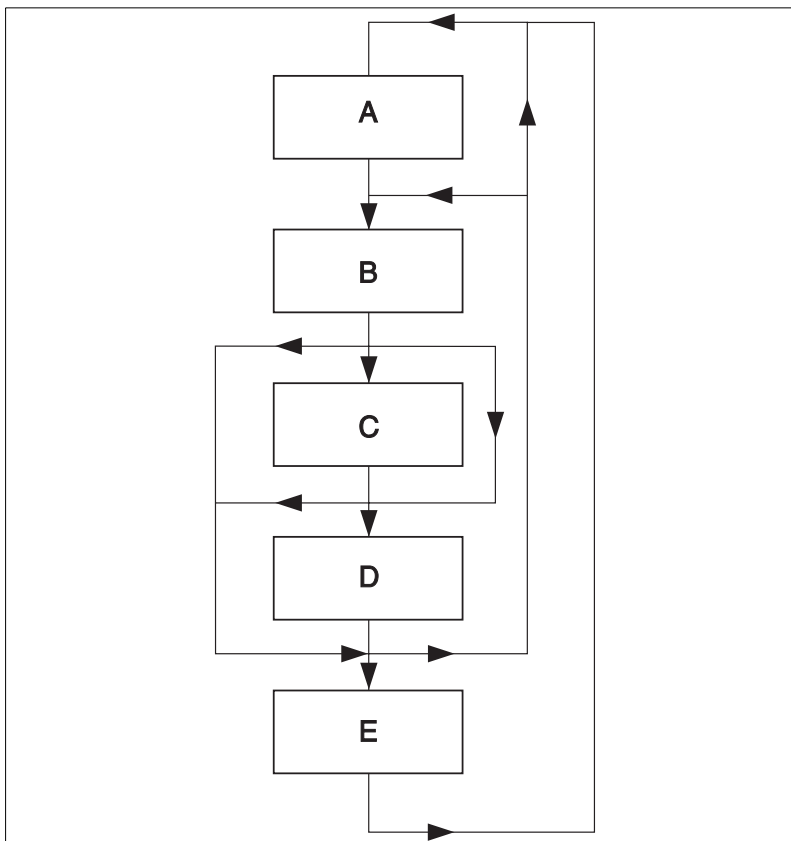
The cover of the separator is equipped with an interlocking switch. When the cover is closed the interlocking circuit in the starter control is closed and the separator could be started.

Signal Processing

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

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

7.4.4 Function graph and running limitations



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

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7.5 Quality requirements

7.5.1 Operating liquid

Alfa Laval ref. 553406, rev. 1

General

Specific requirements regarding the purity of liquid are necessary.

- Deposits must not be allowed to form inside the separator.
- Erosion and corrosion of the PX mechanism must also be prevented.

The four requirements below are of fundamental importance.

For test methods, contact an Alfa Laval representative.

If these demands cannot be met, the liquid should be pre-treated in accordance with Alfa Laval's recommendations.

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

Suspended particles Content of suspend substances: Less than 0,001 percentage of volume.

Turbidity-free liquid, solids content < 0,001 percentage of volume. Due to the centrifugal force, any suspended particles present in the liquid will separate out in the operating mechanism, causing the valves to clog and the system to breakdown. A mere 0,001 percentage of volume solids content in the operating liquid produces 10 ml of precipitate in two days when using as little as 20 lit/h of operating liquid.

Max. particle size: 50 µm.

Total hardness Less than 10° dH (180 mg CaCO₃/litre).

If the liquid is hard (i.e. 10° dH or 12,5° E), in time chalk deposits build up around the operating mechanism including the valves. The build-up of deposits accelerates with increased operating temperature and low discharge frequency.

The harder the liquid is, the more severe these effects become.

Chloride content Less than 100 ppm NaCl (60 mg Cl/litre).

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

pH value pH > 6

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

7.5.2 Compressed air

Alfa Laval ref. 553407, rev. 1

The air supply to pneumatic instruments such as transmitters, controllers, converters, relays etc. must be of such a quality that satisfactory function is ensured for a reasonable time.

To this end three conditions must be fulfilled:

1. Dirt in the form of solid particles down to a size below 10 micron (0,01 mm) must be removed from the air. This is preferably done by means of special filters or reducing valves provided with filters.
2. Oil is always transferred to the compressed air from oil-lubricated compressors and must be removed to the highest possible degree. It constitutes a serious contamination, which it is difficult to remove from the instruments. Special filters or oil separators must, therefore, be provided before the instruments. In small plants, oil-free compressors can be used as an alternative.
3. In the compressed-air system a condensation takes place at various rates, depending on the moisture content at the air inlet, the temperature before and after the compressor, partially lower temperature in any cold zones passed by the pipe (outdoor, cellar etc.) and the like.

The air must thus be dried with regard to the lowest temperature existing after the drying device, so that condensate in the instruments is avoided. Note that the air will also be cooled through expansion after passing constrictions and nozzles in the instruments, with condensation as a result. In view of the above, the following must be observed:

At the inlet to an instrument, the dew point of the compressed air should lie at least 10 °C below the lowest ambient temperature. This is usually obtained by using an absorption drier of suitable capacity. If the air contains much water, provide a primary separator before the filter.

Air filters should be placed so as to be easily surveyable and accessible in order to facilitate daily condition checks, and exchange of the filter cartridge.

NOTE

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

7.6 Lubricants

7.6.1 Lubrication chart, general

Alfa Laval ref. 553216-01, rev. 5

Lubricating points	Lubricants
Bowl spindle ball bearings and buffers are lubricated by oil mist.	Lubricating oil as specified in "7.6.2 Recommended lubricating oils" on page 182.
Bowl spindle taper.	Lubricating oil (only a few drops for rust protection).
Buffers of bowl spindle.	Lubricating oil.
Bowl: Sliding contact surfaces and pressure loaded surfaces such as lock rings, threads of lock rings, bowl hood, and cap nut.	Pastes as specified in "7.6.4 Recommended lubricants" on page 184. If not specified otherwise, follow the supplier's recommendation about method of application.
Rubber seal rings.	Grease as specified in "7.6.4 Recommended lubricants" on page 184.
Coupling ball bearings.	The bearings are packed with grease and sealed and need no extra lubrication.
Electric motor (if nipples are fitted).	Follow manufacturer's instructions.

Alfa Laval Lubricating Oil Groups:

- **Group A oil:** a high quality gear oil on paraffin base with stable AW (anti wear) additives.
- **Group B oil:** a high quality gear oil on paraffin base with stable EP (extreme pressure) additives.
- **Group D oil:** a synthetic base oil with additives stable at high operating temperatures.
- **Group E oil:** Characteristics as a group D oil but suitable at a higher operation power (≥ 55 kW).

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

Always use clean vessels when handling lubricating oil.

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

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

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

NOTE

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

NOTE

Check the oil level before start. Top up when necessary. For correct oil volume see "7.1 Technical data" on page 162.

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

Applying, handling and storing of lubricants

Always be sure to follow lubricants manufacturer's instructions.

7.6.2 Recommended lubricating oils

Alfa Laval ref. 553219-05, rev. 1

One group of lubricating oil is approved for this separator. It is designated as Alfa Laval lubricating oil group B.

The numerical value after the letter states the viscosity grade.

The corresponding commercial oil brands are found in chapter "7.6.3 Recommended oil brands" on page 183.

Ambient temperature (°C)	Alfa Laval lubricating oil group	Time in operation Oil change interval
Between +5 and +45 *	B/320	1 500 h

* 55 °C in case of water cooling of the oil in gear housing.

Note:

- In a new installation or after change of gear transmission, change oil after 200 operating hours.
- 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.

7.6.3 Recommended oil brands

Alfa Laval lubricating oil group B/320

Alfa Laval ref. 553218-05, rev. 0

Viscosity grade VG (ISO 3448/3104) 320

Viscosity index VI (ISO 2909) > 92

Manufacturer	Designation
Bel-Ray	100 Gear oil
BP	Energol GR-XP 320
Castrol	Alpha SP 320
Esso Standard Oil/ Svenska Statoil/Exxon	Spartan EP 320
Fina/Petrofina	Giran 320
Lubmarine/Beijer (ELF Brand designation according to ELF)	Epona Z 320
Mobil	Mobilgear 632 Mobilgear SHC 320 *
Nynäs	GL 320
Optimol Ölverke	Optigear BM 320
Q8/Kuwait (Gulf)	Goya 320
Shell	Lorina 320 Omala 320
Texaco	Meropa 320
Gulf	EP HD 320 (UK)
Soviet Standard	ITP-320

* This oil must be used when the frame temperature is above 80 °C. If you can't measure the temperature, about 80 °C is reached when you can touch the lower frame surface for a short time only.

7.6.4 Recommended lubricants

Alfa Laval ref. 553217-01, rev. 4

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	Molykote paste1000 - spray D321R - varnish D321R	537086-02 535586-01 535586-02	
Rocol	Antiscuffing paste (ASP)		
Klüber	Wolfracoat C paste		
Russian Standard	VNII NP 232 Gost 14068-90		

Pastes and bonded coatings for food applications

Manufacturer	Designation	Alfa Laval No.	Application
Gleitmolybdän	Gleitmo 580	561764-01	Lock rings
Dow Corning	TP 42		
Gleitmolybdän	Gleitmo 580 Gleitmo 805	561764-01	Screw joints, pins etc.
Dow Corning	Molykote D		
Lubrication Engineers	LE 4025		
Klüber	46 MR 401		

Silicone grease

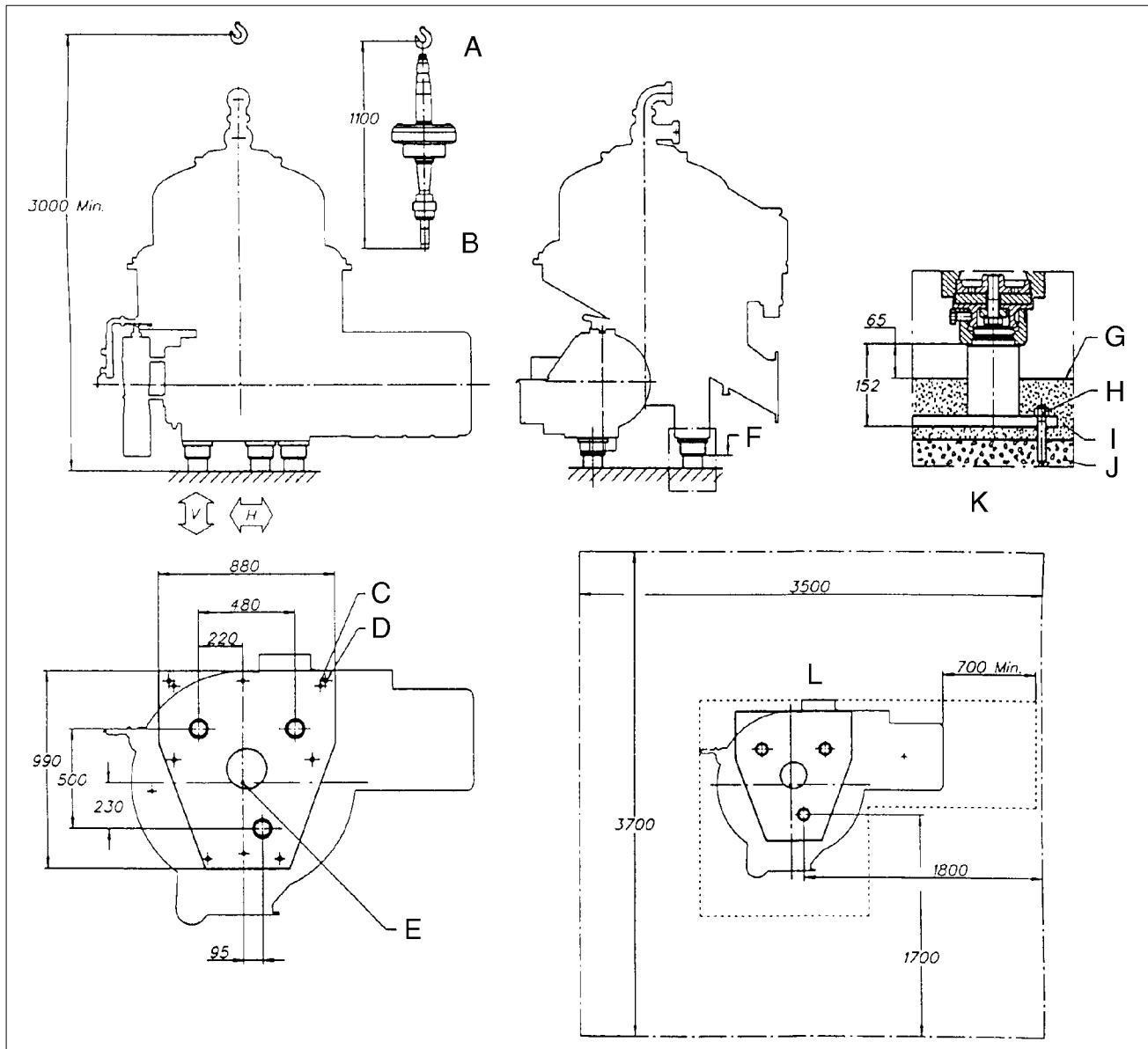
Manufacturer	Designation	Alfa Laval No.
Dow Corning	Molykote 111 compound - 100 g - 25 g	539474-02 539474-03
Gleitmolybdän	Silicone paste 750	
Wacker	Silicone Paste P (vacuum paste)	

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 - latest edition	

7.7 Foundation drawing

Alfa Laval ref. 556786, rev. 0

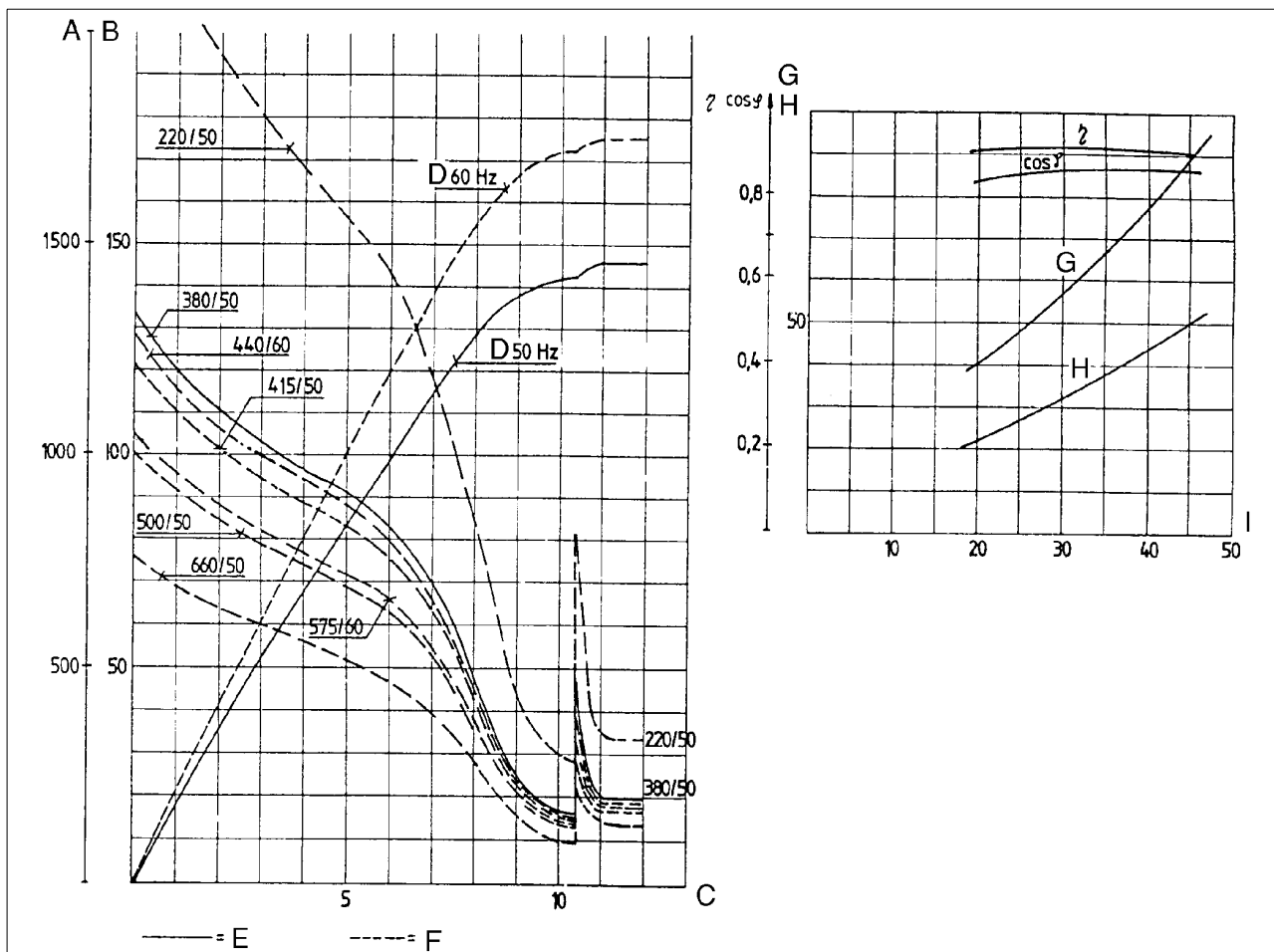


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A.	Min. lifting capacity when doing service: 900 kg		Recommended free floor space for unloading when doing service
B.	Max. height of largest component incl. lifting tool Recommended speed for lifting: Low speed, 0,5-1,5 metres/minute High speed, 2-6 metres/minute		No fixed installation within this area
C.	3 holes (M20) for horizontal adjustment		Vertical force not exceeding 69 kN/foot
D.	7 holes (Ø20) for anchoring		Horizontal force not exceeding 69 kN/foot
E.	Centre for lifting device		
F.	Max. horizontal deviation: 0,4°		
G.	Floor level		Total static load, max. 23 kN
H.	Anchor bolts		
I.	Expanding concrete		
J.	Structural concrete		
K.	Installation according to stated foundation forces		
L.	Service side		

7.8 Motor data

Alfa Laval ref. 551672, rev. 1



Current and speed curves at Y/Δ-starting

Performance curves

- A. Speed (r/min)
- B. Current (A)
- C. Time (minutes)
- D. Motor speed (r/min)
- E. Measured
- F. Calculated
- G. Current (A)
- H. Power input (kW)
- I. Power output (kW)

Article No.	Output (kW)	Manufacturer	Type	Number of poles	Speed 50 Hz (r/min)	Speed 60 Hz (r/min)	η (%)	Power factor ($\cos \varphi$)	Starting torque M_s (Nm)
544143	37	BROOK	UC 225 LH	4	1450	1750	91,5	0,87	210

η and $\cos \varphi$ are valid for 50 Hz. For 60 Hz, the values are about 0,5% higher.

Idling power, input: 10 kW

Moment of inertia: 56,18 kgm² (bowl spindle)

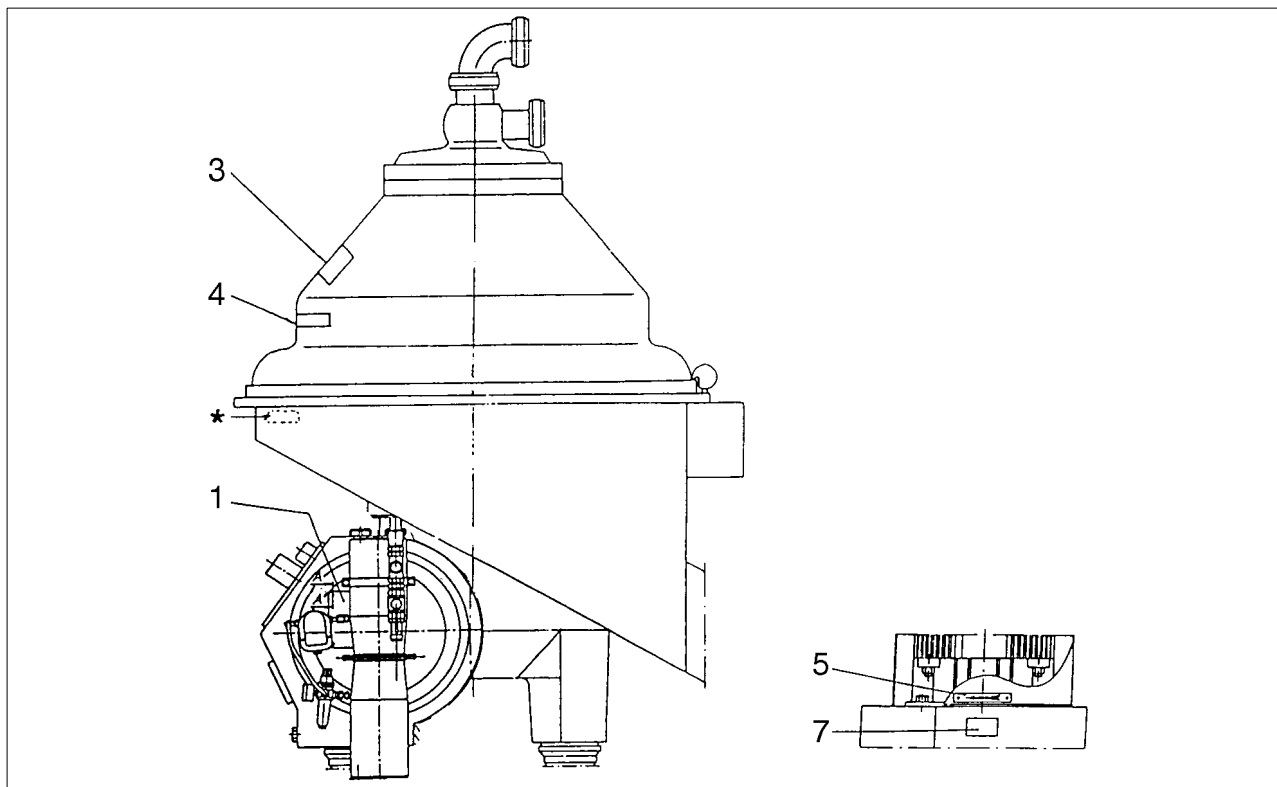
Bowl speed, max: 4135 r/min (motor 1500 or 1800 r/min)

Cables and fuses

Voltage/frequency (V/Hz)	Rated current (A)	Fuse (A)	Cable area (mm ² Cu)	Cable area (mm ² Al)
220/50	121	160	95	120
380/50	70	100	35	70
415/50	64	80	25	35
440/60	60	80	25	35
500/50	53	80	25	35
575/60	46	63	16	25
660/50	40	50	16	25

7.9 Machine plates and safety labels

Alfa Laval ref. 555564, rev. 0



1. Machine plate

Separator type	AFPX 517XGV-14CG
Manufacturing serial No / Year	XXXX / XX
Product No	881118-04-01
Machine top part	546549-01
Inlet and outlet	545896-04
Bowl	545247-03 / -05 / -08
Machine bottom part	555484-05 / -06 (50 / 60 Hz)
Max. speed (bowl)	4136 r/min (50 Hz), 4135 r/min (60 Hz)
Direction of rotation (bowl)	←
Speed motor shaft	1500 r/min (50 Hz), 1800 r/min (60 Hz)
El. current frequency	50 / 60 Hz
Recommended motor power	37 kW
Max. density of feed	1100 kg/m ³
Max. density of sediment	2071 kg/m ³
Max. density of operating liquid	1000 kg/m ³
Process temperature min./max.	0 / 100 °C



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3. Safety label

Text on label:

DANGER

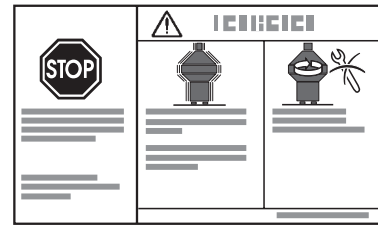
Read the instruction manuals **before** installation, operation and maintenance. Consider inspection intervals.

Failure to strictly follow instructions can lead to fatal injury.

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

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

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



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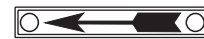
4. Name plate



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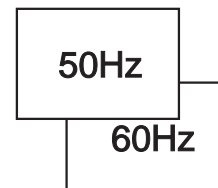
5. Arrow

Indicating direction of rotation of horizontal driving device.



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7. Power supply frequency



S0063111

* Space for label indicating representative

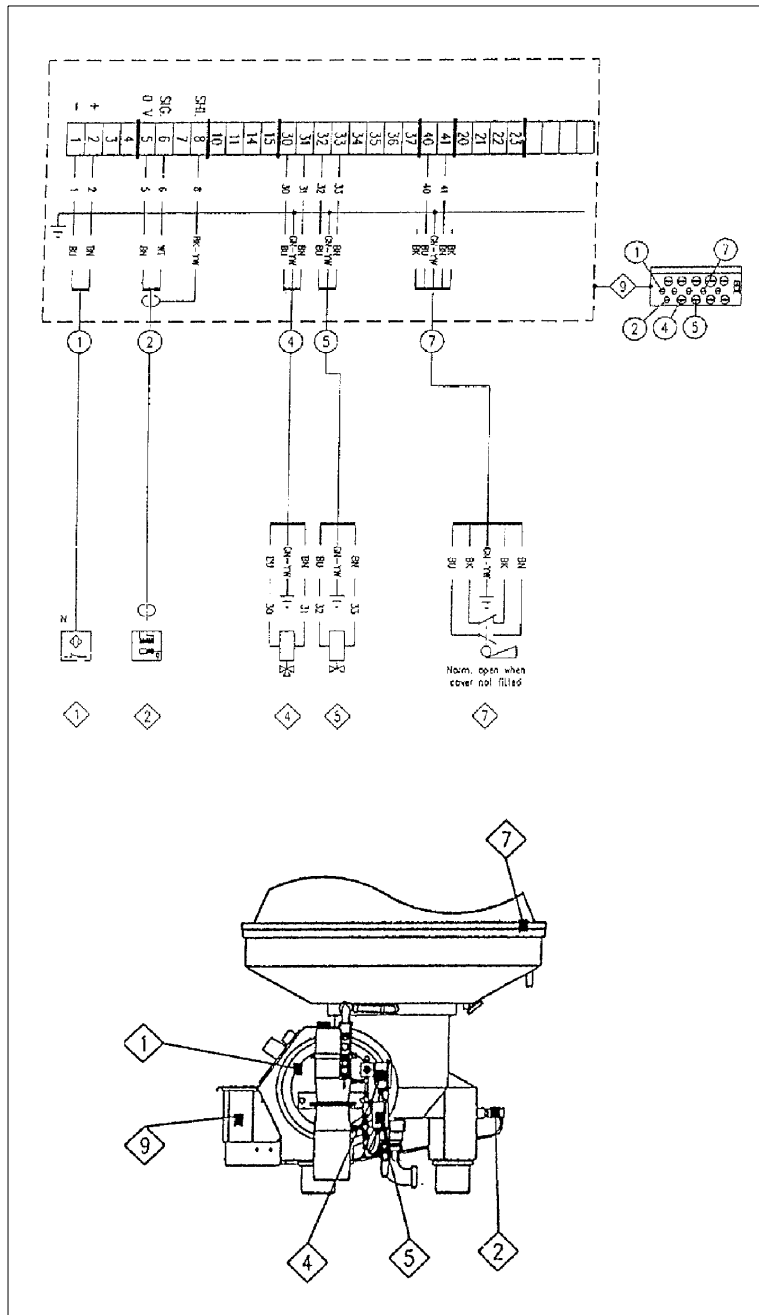
7.10 Interconnection diagram for monitoring kit

Alfa Laval ref. 555477, rev. 3

Wire colour codes:

- BK Black
- BN Brown
- BU Blue
- GN-YW Green-Yellow
- BK-YW Black-Yellow
- YW Yellow
- WT White
- RD Red
- SHI. Shield
- SIG. Signal
- TRANS Transparent

- 1. Speed sensor (motor shaft speed)
- 2. Vibration sensor (velocity transducer)
- 4. Solenoid valve (OWM 3/2-valve "Discharge")
- 5. Solenoid valve (OWM 2/2-valve "By-pass")
- 7. Cover interlocking switch (frame top part). Normally open when cover not fitted.
- 9. Junction box



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7.11 Storage and installation

7.11.1 Introduction

First of all, ensure that the separator delivered is suitable for the application. Elements that are important to consider are, e.g., process liquid density and temperature, corrosion characteristics, sludge characteristics, solids contents of the process liquid, toxicity, inflammability, degree of automation, etc.

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

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

7.11.2 Storage and transport of goods

Storage

Specification

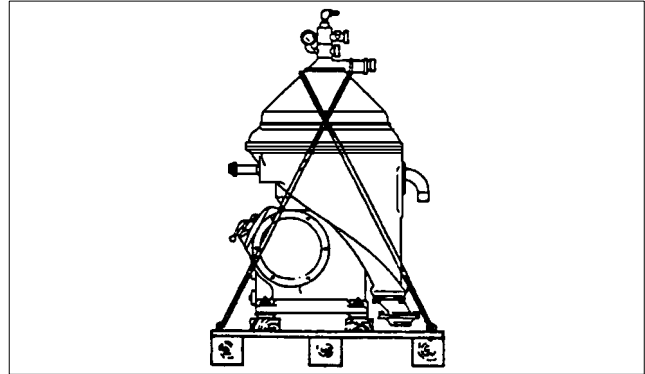
Upon arrival to the store, **check all components and keep them:**

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

A separator can be delivered with different types of protection:

- Fixed on a pallet.

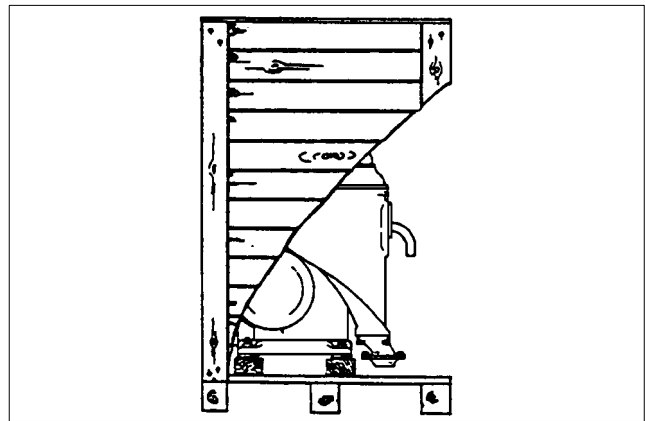
The separator must be stored in a storage room well protected from mechanical damage and also dry and protected from rain and humidity.



Fixed on a pallet

- In a wooden box which is not water tight.

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

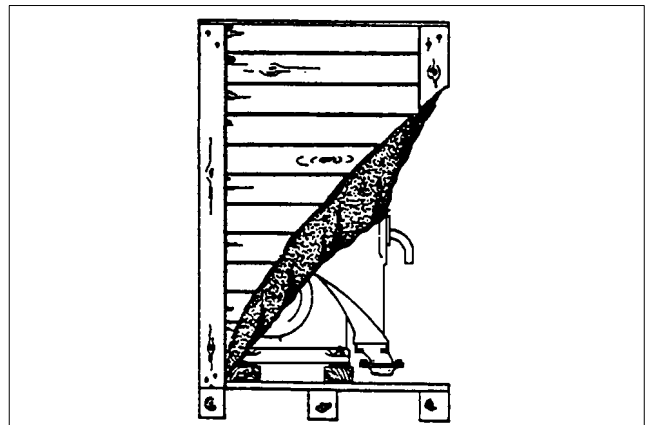


In a wooden box which is not water tight

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

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

The packaging for outdoor storage is only to special order.

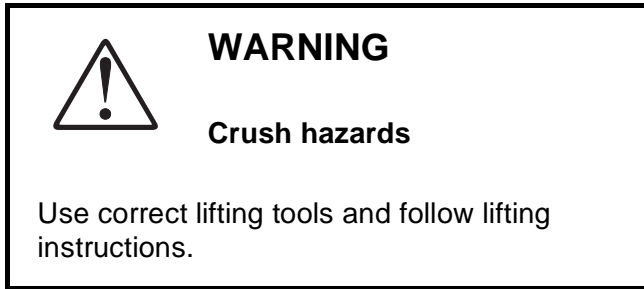


In a special water-resistant box for outdoor storage

Transport

Specification

- During transport of the separator, the frame hood and bowl **must always be removed from the machine.**
- When lifting a separator it must always be **hung securely.** See chapter “4.4 Lifting instruction” on page 68.



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

7.11.3 Planning of installation

Space for separator

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

The space required for one or more separators can be calculated by consulting the drawings in the chapters “7.2 Basic size drawing” on page 166, “7.7 Foundation drawing” on page 186 and instructions for ancillary equipment, electrical and electronic equipment and cables.

Specification

- See chapter “7.7 Foundation drawing” on page 186 for the service space required with the separator installed.



Check the drawings when planning the installation

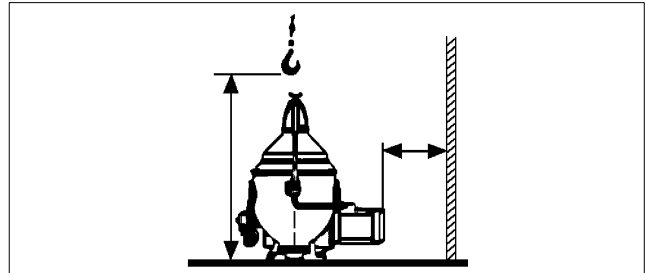
Recommendation

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

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

Lifting height for transport of bowl**Specification**

- A minimum height is required to lift the bowl, bowl parts and the bowl spindle, see chapter "7.7 Foundation drawing" on page 186.

Recommendation

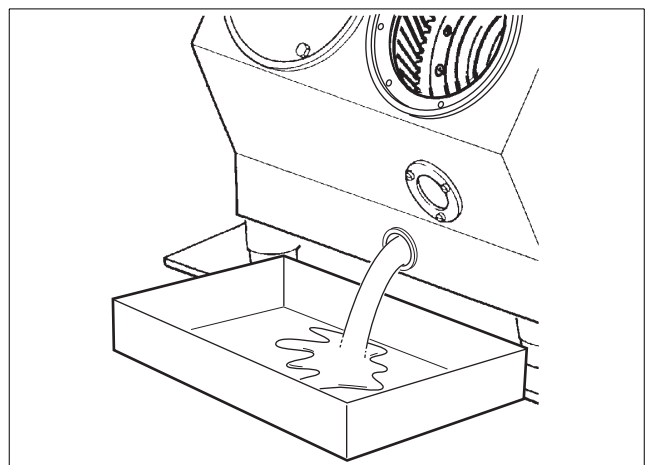
- When two or more separators are installed it is recommended to plan the installation in such a way that parts from one separator do not have to be lifted over another separator.

Space for oil changing**Specification**

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

Recommendation

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



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

7.11.4 Foundations

NOTE

When lifting a separator it must always be **hung securely**. See chapter “4.4 Lifting instruction” on page 68.

Specification

- The separator should be installed at floor level, see chapter “7.7 Foundation drawing” on page 186 for measures and how to pour the foundation plate in concrete.
- The separator must be installed on a strong and rigid foundation to reduce the influence of vibrations from adjacent machinery.

At delivery the parts 1-5 are fitted on the separator. The screw (5) is locked with Loctite 242 and tightened with **40 Nm**.

Proceed in the following way when mounting the separator onto the feet of the foundation plate (8):

1. Level against the upper face of the three holders (6). Screw the holders to compensate for inclination, if any. Any gap between a holder and a foundation foot (8) must be eliminated by adding one or more adjusting washers (7). Note that the number of washers must not exceed 4 pcs.
2. Lower the separator into the three holders.
3. Tighten the set screws (9), first by hand (or by a hand tool, if necessary) until all of them are in contact with the frame feet (2).

Then tighten the set screws with **100 Nm**.

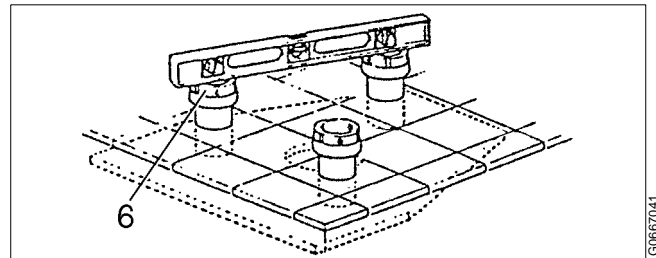
NOTE

Tighten the set screws before mounting the bowl or cyclone.

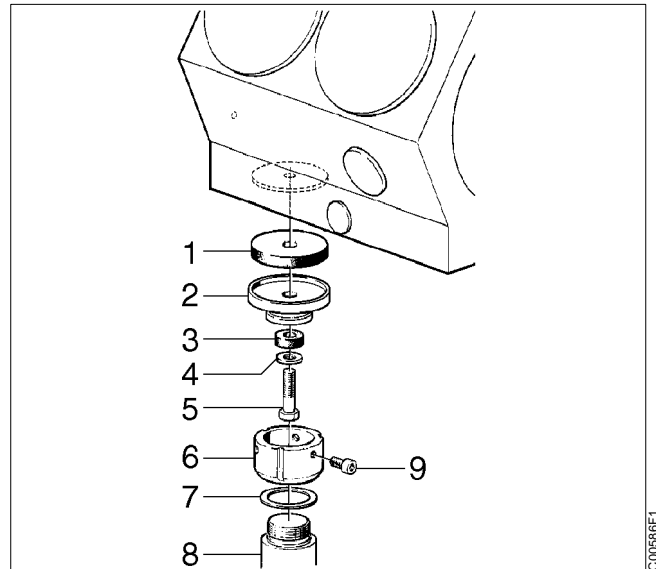
4. Mount the bowl and check that the frame is horizontal by means of a level placed on the outer frame rim.

Make a new adjustment if necessary.

Further information can be found in chapter “7.2 Basic size drawing” on page 166.



Level against the upper face of the holders (6)



1. Rubber cushion
2. Frame foot
3. Rectangular ring
4. Washer
5. Screw
6. Holder
7. Adjusting washer
8. Foot on foundation plate
9. Set screw

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