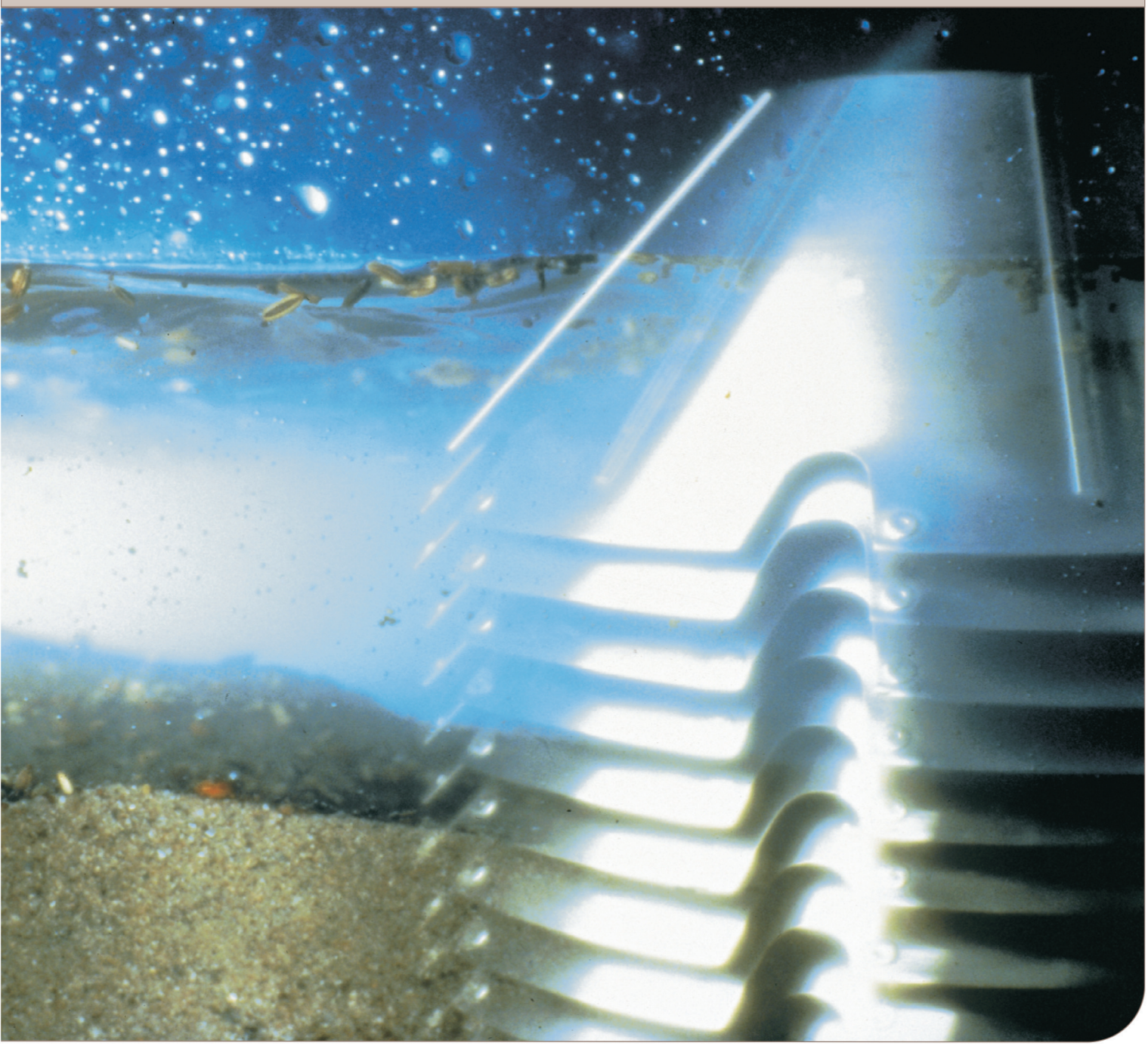
Separator manual

High speed separator

MMB 305S-11



Product No. 881152-01-05/2
Book No. 9018134-02 Rev. 5

Published By:

Alfa Laval Technologies AB
Box 74
SE-221 00 Lund, Sweden
+46 46 366500

The original instructions are in English

Contents

1 Read this first 9

2 Safety instructions 11

2.1 Warning signs in text 16

2.2 Recycling Information 17

2.3 Requirements of personnel 18

2.4 Remote start 18

3 Separator basics 19

3.1 Basic principles of separation 20

3.2 Design and function 22

3.2.1 Application 23

3.2.2 Design 24

3.2.3 Outline of function 24

3.2.4 Separating function 25

3.2.5 Water seal in the purification mode 26

3.2.6 Displacement of oil 26

3.2.7 Gravity disc 26

3.2.8 Clarifier disc 26

3.2.9 Power transmission 27

3.2.10 Sensors and indicators 28

3.3 Definitions 29

4 Operating instructions 31

4.1 Operating routine 32

4.1.1 Before first start 32

4.1.2 Selection of gravity disc 33

4.1.3 Start after a service 33

4.1.4 Before normal start 34

4.1.5 Starting and running-up procedure 36

4.1.6 Separation 37

4.1.7 Stopping procedure 37

4.1.8 Safety stop 39

4.1.9 Removal of separated sludge 40

5 Service instructions 41

5.1 Periodic maintenance 42

5.1.1 Introduction 42

5.1.2 Maintenance intervals 42

5.1.3 Maintenance procedure 44

5.1.4 Service kits 44

5.2 Maintenance logs 45

5.2.1 Daily checks 45

5.2.2 Oil change - monthly 46

5.2.3 IS - Intermediate Service 47

5.2.4 MS - Major Service 48

5.3 Check points at Intermediate Service 50

5.3.1 Corrosion 50

5.3.2 Erosion 52

5.3.3 Cracks 53

5.3.4 Threads of inlet pipe, paring disc 54

5.3.5 Spindle top cone and bowl body nave 55

5.3.6 Threads on bowl hood and bowl body 56

5.3.7 Disc stack pressure 58

5.4 Check points at Major Service 59

5.4.1 Paring disc height adjustment 59

5.4.2 Radial wobble of bowl spindle 60

5.5 3-year service 61

5.6 Lifting instructions 61

5.7 Cleaning 63

5.7.1 Cleaning agents 64

5.7.2 Cleaning of bowl discs 65

5.8 Oil change 66

5.8.1 Oil change procedure 66

5.9 Vibration 68

5.9.1 Vibration analysis 68

5.10 General directions 69

5.10.1 Ball and roller bearings 69

5.10.2 Before shutdown 72

5.10.3 Before start-up 72

6 Dismantling/Assembly 73

6.1 Inlet/outlet and bowl 75

6.1.1 Inlet/outlet and bowl – dismantling 77

6.1.2 Inlet/outlet and bowl – assembly 82

6.2 Bowl spindle and frame 90

6.2.1 Bowl spindle and frame – dismantling 90

6.2.2 Bowl spindle and frame – assembly 95

6.3 Friction coupling 101

6.3.1 Friction coupling – dismantling 102

6.3.2 Friction coupling – assembly 104

6.4 Flat belt and tightener 107

6.4.1 Change of belt 107

6.5 Oil filling device 112

6.5.1 Dismantling/assembly 112

6.6 Brake 113

6.6.1 Checking of friction element 114

6.7 Frame feet 115

6.7.1 Mounting of new frame feet 115

7 Trouble-tracing 117

7.1 Trouble-tracing procedure 118

7.2 MMB mechanical function 119

7.2.1 The separator does not start 119

7.2.2 Start-up time too long 119

7.2.3 Starting power too low 119

7.2.4 Starting power too high 119

7.2.5 Separator vibrates during starting sequence 120

7.2.6 Separator vibrates during normal running 121

7.2.7 Smell 121

7.2.8 Noise 121

7.2.9 Speed too high 122

7.2.10 Speed too low 122

7.2.11 Stopping time too long 122

7.2.12 Water in oil sump 122

7.2.13 Liquid flows through bowl casing drain 123

7.3 Purification faults 124
7.3.1 Unsatisfactory separation result 124
7.3.2 Outgoing water contains oil 124
7.3.3 Oil discharge through water outlet = broken water seal 125
7.4 Clarification faults 126
7.4.1 Unsatisfactory separation result 126
7.4.2 Oil discharge through water outlet 126
8 Technical reference 127
8.1 Product description 128
8.1.1 Declaration - EU 129
8.1.2 Declaration - UK 131
8.2 Technical data 133
8.3 Basic size drawing 134
8.3.1 Dimensions of connections 135
8.4 Connection list 136
8.5 Interface description 137
8.5.1 General 137
8.5.2 Definitions 137
8.5.3 Component description and signal processing 138
8.5.4 Function graph and running limitations 139
8.6 Quality specification, operating water 140
8.7 Lubricants 141
8.7.1 Lubrication chart 141
8.7.2 Recommended lubricants 142
8.7.3 Recommended lubricating oils 146
8.8 Drawings 148
8.8.1 Foundation plan 148
8.8.2 Electric motor 149
8.8.3 Nomogram gravity disc 150
8.8.4 Machine plates and safety labels 151
8.9 Storage and installation 153
8.9.1 Storage and transport of goods 153
8.9.2 Planning of installation 156
8.9.3 Foundations 158

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

Not following the instructions can result in serious accidents.

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

1 Read this first

This manual is designed for operators and service engineers working with the Alfa Laval separator MMB 305S-11.

For information concerning the function of the separator, see Chapter “3 Separator basics” on page 19, and Chapter “8 Technical reference” on page 127.

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

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

S0068011

Separator Manual and Spare Parts Catalogue

This Separator manual consists of:

Safety instructions

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

Separator basics

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

Operating instructions

This chapter contains operating instructions for the separator only.

Service instructions

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

Dismantling / Assembly

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

Trouble-tracing

Refer to this chapter if the separator functions abnormally.

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

Technical reference

This chapter contains technical data and drawings concerning the separator.

2 Safety instructions

G0010421

The centrifuge 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.

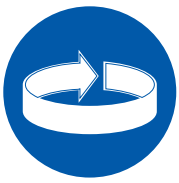
The following basic safety instructions therefore apply:

- **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.**

S0151211

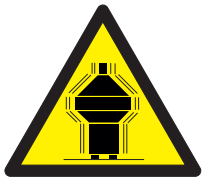
Disintegration hazards

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



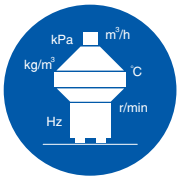
S01512F1

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



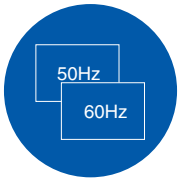
S01512N1

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



S01512P1

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



S01512L1

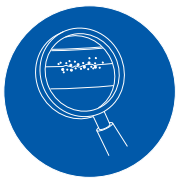
- Welding or heating of parts that rotate can seriously affect material strength.

S01512J1

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

S01512G1

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



S01512H1

Entrapment hazards

- Do NOT stand on the separator or parts of.

Entrapment hazards

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

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

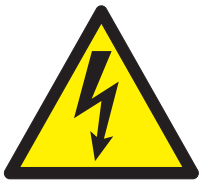
- To avoid accidental start, switch off and lock power supply before starting **any** dismantling work.

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

S0151261

Electrical hazard

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



S0151271

Crush hazards

- Use correct lifting tools and follow lifting instructions.

S01512M1

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

S01512Y1

Noise hazards

- Use ear protection in noisy environments.

S0151291

Burn hazards

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

S01512A1

Skin irritation hazards

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

S01512D1

Cut hazards

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

S01512B1

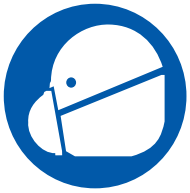
Flying objects

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

S01512C1

Health hazard

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



S01512V1

2.1 Warning signs in text

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

DANGER

Type of hazard

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

WARNING

Type of hazard

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

CAUTION

Type of hazard

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

NOTE

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

2.2 Recycling Information

Unpacking

Packing material consists of wood, plastics, cardboard boxes and in some cases metal straps.

- Wood and cardboard boxes can be reused, recycled or used for energy recovery.
- Plastics should be recycled or burnt at a licensed waste incineration plant.
- Metal straps should be sent for material recycling.

Maintenance

During maintenance oil and wear parts in the machine are replaced.

- Oil must be taken care of in agreement with local regulations.
- Rubber and plastics should be burnt at a licensed waste incineration plant. If not available they should be disposed to a suitable licensed land fill site.
- Bearings and other metal parts should be sent to a licensed handler for material recycling.
- Seal rings and friction linings should be disposed to a licensed land fill site. Check your local regulations.
- Worn out or defected electronic parts should be sent to a licensed handler for material recycling.

Scrapping

At the end of use, the equipment must be recycled according to relevant local regulations.

Besides the equipment itself, any hazardous residues from the process liquid must be taken into consideration and dealt with in a proper manner. When in doubt, or in the absence of local regulations, please contact your local Alfa Laval sales company.

2.3 Requirements of personnel

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

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

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

2.4 Remote start

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

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

3 Separator basics

Contents

3.1 Basic principles of separation 20

3.2 Design and function 22

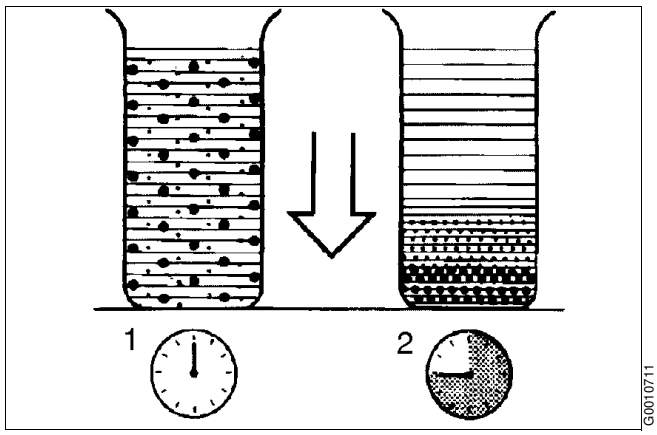
3.2.1 Application 23
3.2.2 Design 24
3.2.3 Outline of function 24
3.2.4 Separating function 25
3.2.5 Water seal in the purification mode 26
3.2.6 Displacement of oil 26
3.2.7 Gravity disc 26
3.2.8 Clarifier disc 26
3.2.9 Power transmission 27
3.2.10 Sensors and indicators 28

3.3 Definitions 29

3.1 Basic principles of separation

The purpose of separation can be:

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



Sedimentation by gravity

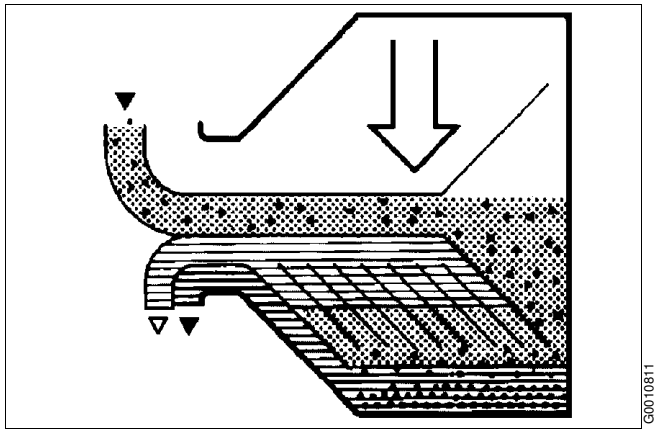
Separation by gravity

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

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

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

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



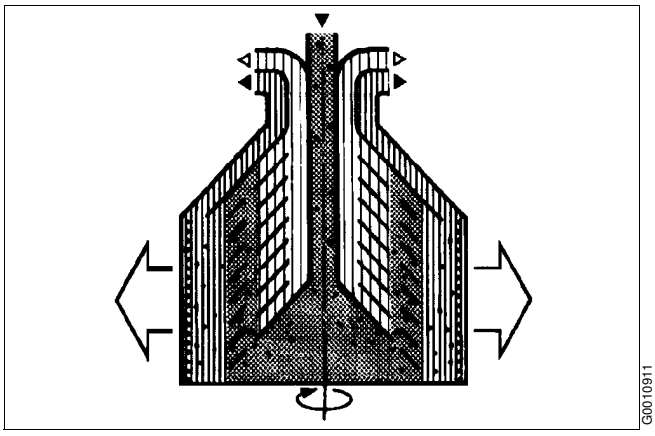
Sedimentation in a settling tank, with outlets making it possible to separate the lighter liquid parts from the heavier

Centrifugal separation

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

Separation and sedimentation is continuous and happens very quickly.

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



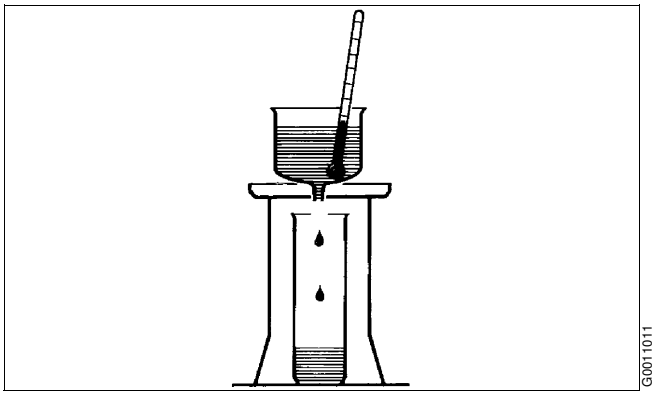
The centrifugal solution

Separating temperatures

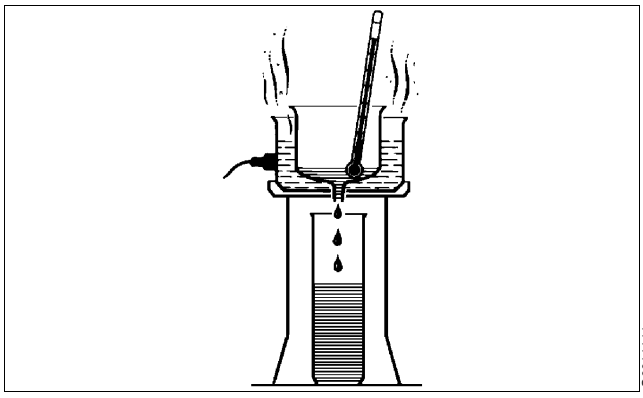
For some types of process liquids (e.g. mineral oils) a high separating temperature will normally increase the separation capacity. The temperature influences oil viscosity and density and should be kept constant throughout the separation.

Viscosity

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



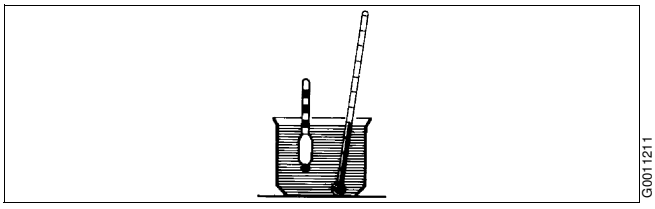
High viscosity (with low temperature)



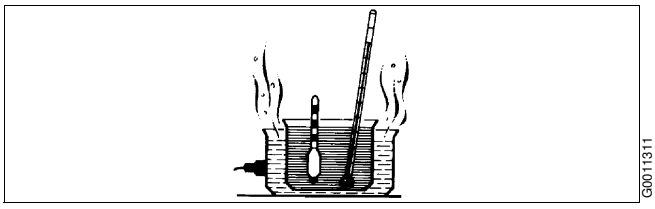
Low viscosity (with high temperature)

Density difference

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

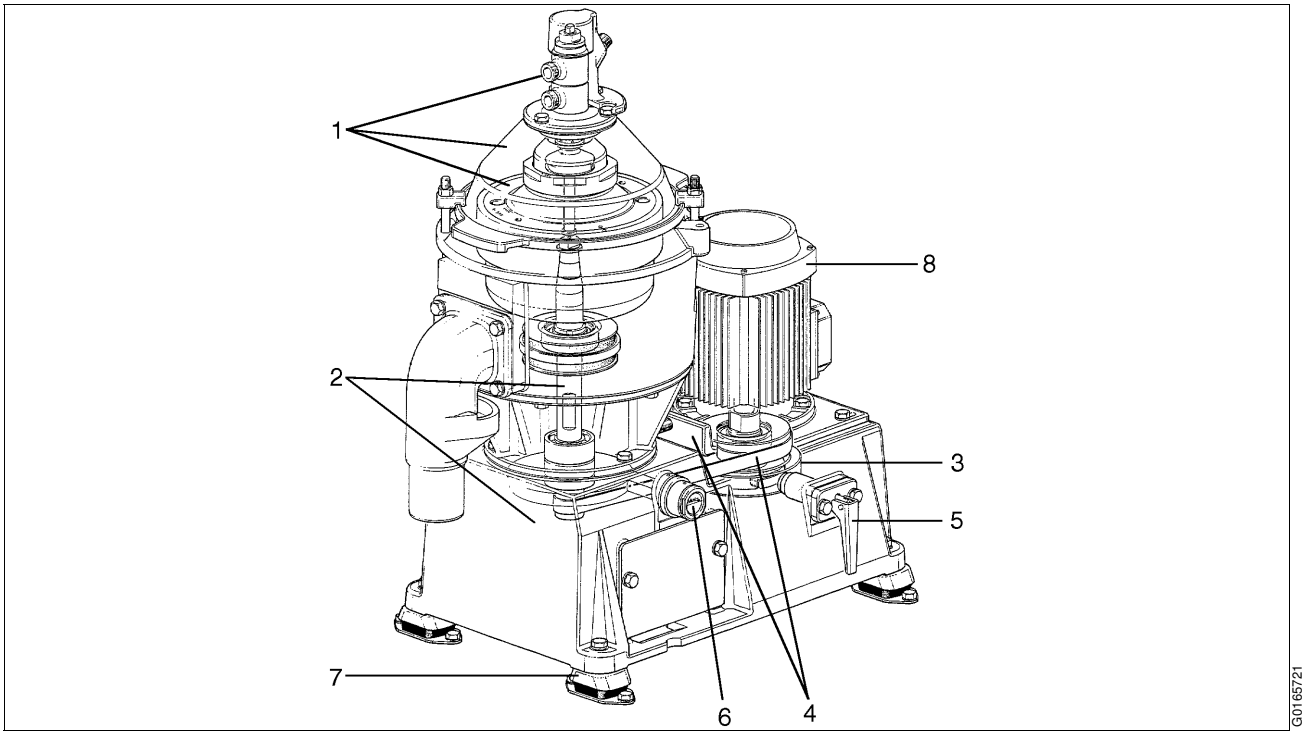


High density (with low temperature)



Low density (with high temperature)

3.2 Design and function



Periodic maintenance is essential
Periodic maintenance in accordance with the instructions in this manual is essential for upholding correct running conditions and achieving an optimal separation process. The following parts are subject to maintenance at regular intervals:

1 Separator inlet, outlet, frame hood and bowl
2 Bowl spindle and frame
3 Friction coupling
4 Flat belt and tightener
5 Brake
6 Oil filling device and sight glass
7 Frame feet
8 Electric motor

3.2.1 Application

The MMB 305S-11 is a high-speed centrifugal separator intended for marine and land applications. It is specifically designed for cleaning of mineral oils from water and solid particles (sludge).

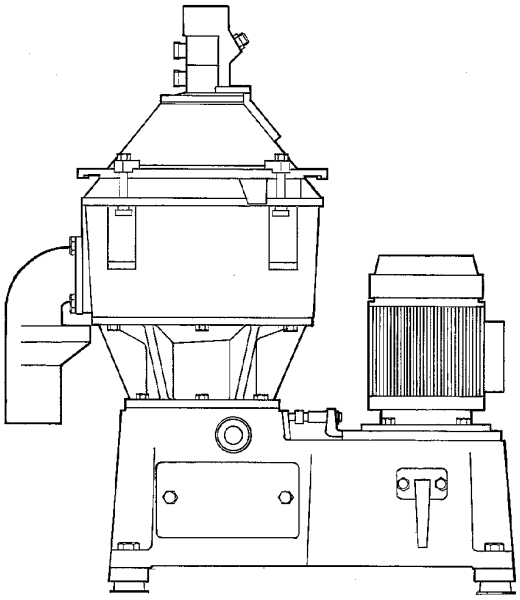
It handles the following types of lubricating oils and low viscosity fuel oils:

- Distillate, viscosity 1,5 - 5,5 cSt/40 °C.
- Marine diesel oil, viscosity 13 cSt/40 °C.
- Lubricating oil
  - R & O type
  - Detergent
  - Steam turbine

The cleaned oil is discharged continuously, while the solid particles are collected in the separator and have to be removed manually.

The separator can be operated either as a purifier or as a clarifier. When operated as a purifier the separator discharges the separated water. When the oil contains only small amounts of water the separator is operated as a clarifier, collecting the water together with the solid particles.

The separator has to be installed together with devices for control of start, stop, feed, back pressure and seal water.



G0165211

The MMB 305S-11 separator

WARNING

Disintegration hazards

Use the separator only for the purpose and parameters (type of liquid, rotational speed, temperature, density etc.) specified in chapter "8 Technical reference" on page 127 and in the Purchase Order documents.

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

3.2.2 Design

The separator comprises a frame consisting of the frame lower part (H), the intermediate part (E) and the frame top part (D) with a frame hood (B).

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

3.2.3 Outline of function

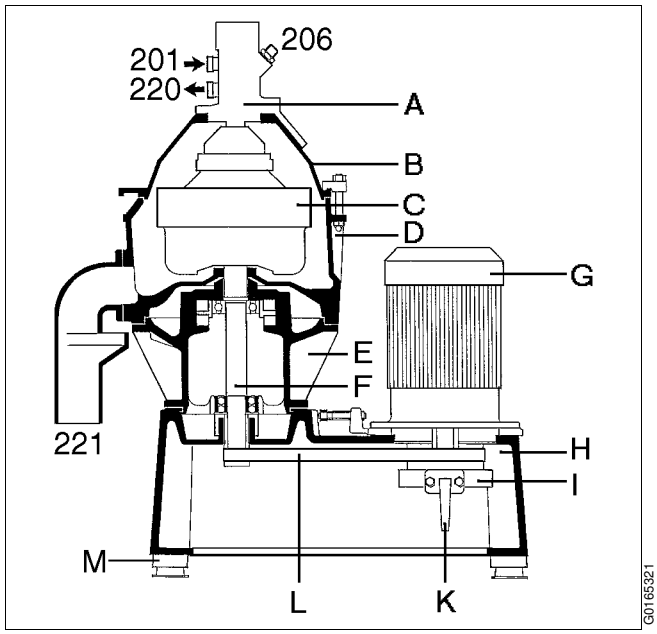
The separation process takes place in the rotating bowl. Unseparated oil is fed into the bowl through the inlet (201). The oil is cleaned in the bowl and leaves the separator through the outlet (220) via a paring chamber.

Impurities heavier than the oil are collected in the sludge space at the bowl periphery. The sludge has to be removed manually at regular intervals.

Permissible pressures and operating conditions are specified in chapter “8 Technical reference” on page 127.

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

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



Sectional view
Main parts, inlets and outlets

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

201 Oil inlet
206 Inlet for liquid seal and displacement water
220 Oil outlet
221 Water outlet

3.2.4 Separating function

The separator can operate in one of two modes:

- **The purification mode** in which three-phase separation takes place. The separated oil and water are continuously discharged from two separate outlets (220 and 221). The separated solid particles - the sludge - must be removed manually at appropriate intervals.

  This is the most common mode of operation for this separator.

- **The clarification mode** in which two-phase separation takes place. The oil is continuously separated from the heavy phase, consisting of water and sludge.

  This is an optional mode of operation and is only suitable for oils containing very small amounts of water.

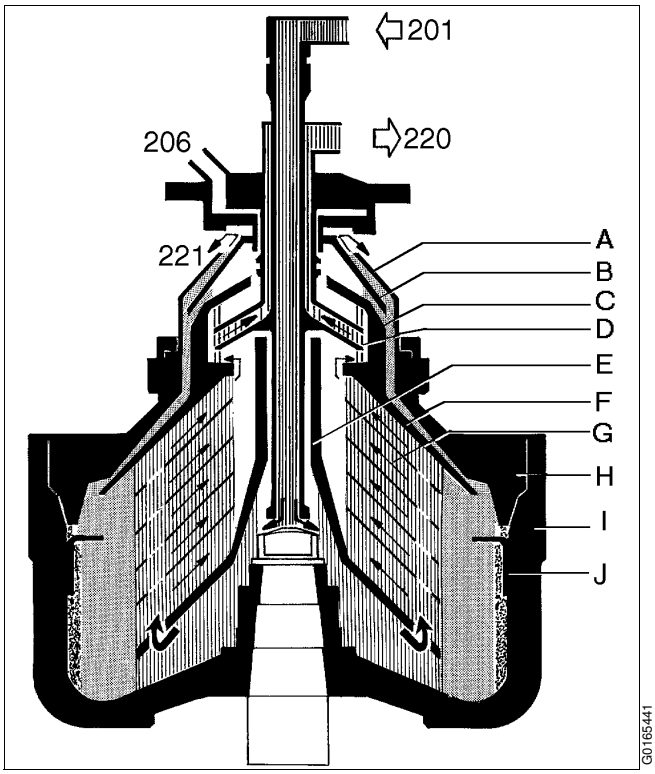
Separation takes place in the separator bowl to which uncleaned oil is fed through the oil inlet (201). The oil is distributed by the distributor (E) towards the periphery of the bowl.

When the unseparated oil reaches the slots in the distributor, it rises through the channels formed by the disc stack (G) where it is evenly distributed between the discs.

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

Separated sludge (solid particles) and water – which are heavier – move towards the bowl periphery. In the purification mode, separated water rises along the outside of the disc stack, passes above the top disc up to the gravity disc (A) and leaves the bowl through the water outlet (221) of the separator.

The sludge collects in a sludge basket (J), which is emptied manually.

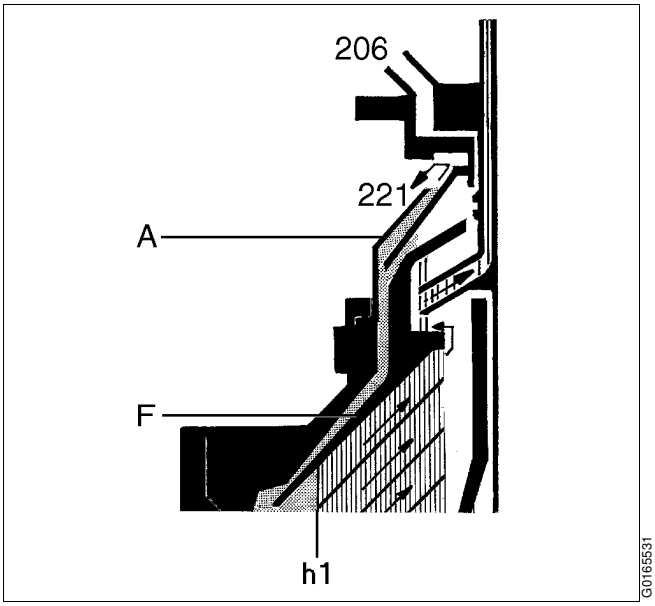


The bowl and the separating principle

201 Oil inlet
206 Sealing and displacement water
220 Oil outlet
221 Water outlet
A Gravity disc
B Guiding cone
C Paring chamber cover
D Paring disc
E Distributor
F Top disc
G Disc stack
H Bowl hood
I Bowl body
J Sludge basket

3.2.5 Water seal in the purification mode

To prevent oil from escaping past the outer edge of the top disc (F) and through the water outlet (221), the bowl must be provided with a water seal. This is done by filling the bowl with water through the water inlet (206) before the uncleaned oil is fed to the separator. When the oil feed is turned on, the water is forced towards the bowl periphery and an interface (h1) is formed between the water and the oil. The position of this interface is determined by the inner diameter of a gravity disc (A).



Principle of liquid seal and displacement water in purification
h1 Oil/water interface
A Gravity disc
F Top disc
206 Water inlet
221 Water outlet

3.2.6 Displacement of oil

To avoid oil losses when opening the bowl for cleaning, displacement water can be fed to the bowl. Before the separator is stopped, the oil feed is shut off and displacement water added through the water inlet (206). This water changes the liquid balance in the bowl, and the interface (h1) moves inwards to a new position, increasing the water volume in the sludge space. When the bowl is stopped, mainly water and sludge remains inside the bowl body.

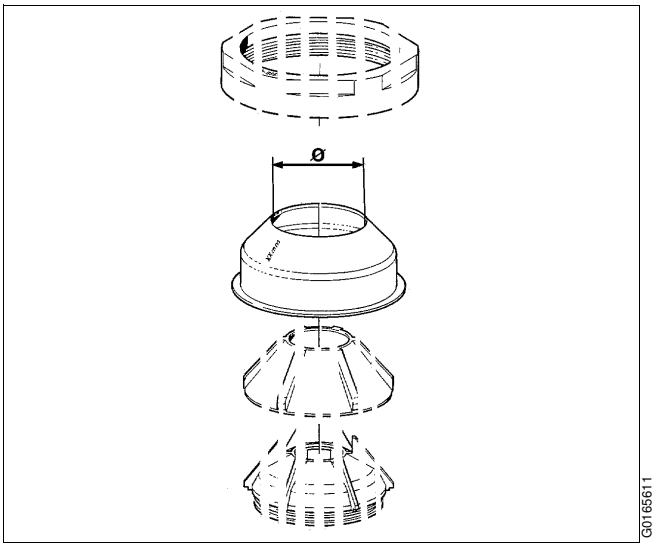
3.2.7 Gravity disc

In the purification mode, the position of the interface (h1) can be adjusted by replacing the gravity disc (A) for one with larger or smaller diameter.

The correct gravity disc is selected from a nomogram, see “8.9 Storage and installation” on page 153.

3.2.8 Clarifier disc

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



Location of gravity disc and clarifier disc

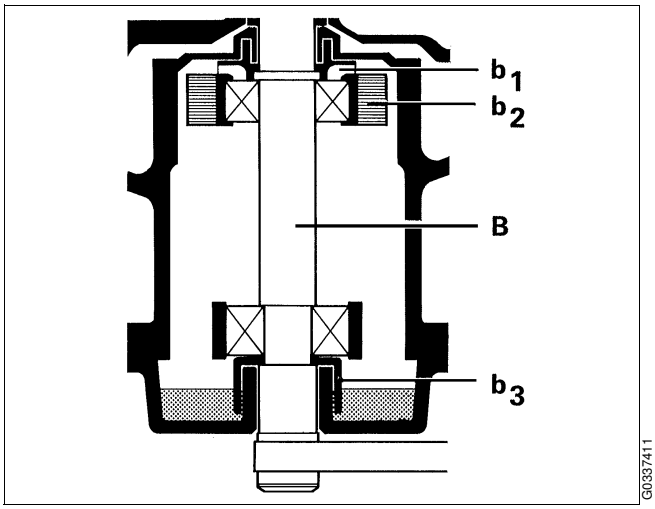
3.2.9 Power transmission

Bowl spindle

In addition to its primary role in the power transmission system, the bowl spindle also serves as lubricator for spindle ball bearings.

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

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

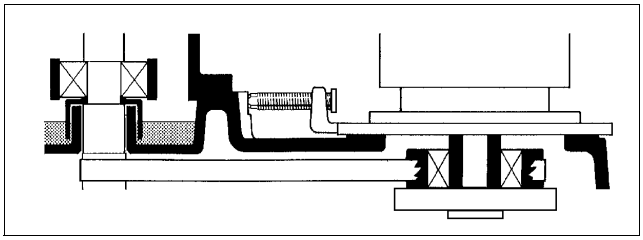


Bowl spindle assembly and oil filling device
B Bowl spindle
b1 Fan
b2 Rubber buffers
b3 Oil pump

Belt drive

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

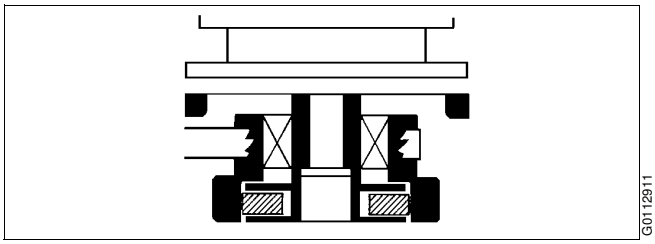
Procedure for change of belt will secure a fixed distance between spindle and motor belt pulley.



Belt drive

Friction coupling

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

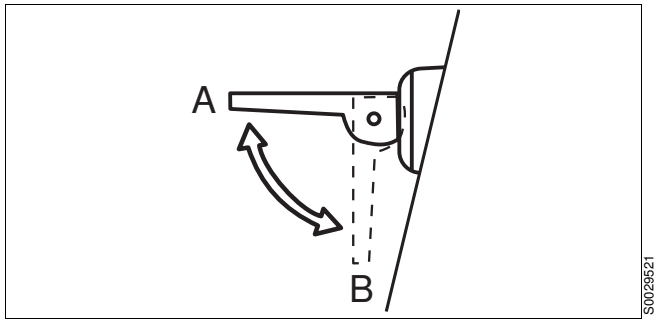


Friction coupling

Brake

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

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



Brake on (A), brake off (B)

3.2.10 Sensors and indicators

Sight glass

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

3.3 Definitions

Back pressure Pressure in the separator outlet.

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

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

Counter pressure See Back pressure.

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

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

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

Intermediate Service (IS) Overhaul of separator bowl and inlet/outlet. Renewal of seals in bowl and inlet/outlet.

Major Service (MS) Overhaul of the complete separator, including bottom part (and activities included in an Intermediate Service). Renewal of seals and bearings in bottom part.

Phase Light phase: the lighter liquid separated, e.g. oil.
Heavy phase: the heavier liquid separated, e.g. water.

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

Sediment (sludge) Solids separated from a liquid.

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

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

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

4 Operating instructions

Contents

4.1 Operating routine 32

4.1.1 Before first start 32
4.1.2 Selection of gravity disc 33
4.1.3 Start after a service 33
4.1.4 Before normal start 34
4.1.5 Starting and running-up procedure 36
4.1.6 Separation 37
4.1.7 Stopping procedure 37
4.1.8 Safety stop 39
4.1.9 Removal of separated sludge 40

4.1 Operating routine

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

If there is a System Manual, always follow the operating instructions of the System Manual. If there is no System Manual the instructions below are to be followed.

4.1.1 Before first start

Technical demands for connections and logical limitations for the separator are listed in chapter “8 Technical reference” on page 127:

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

Before first start the following shall be checked:

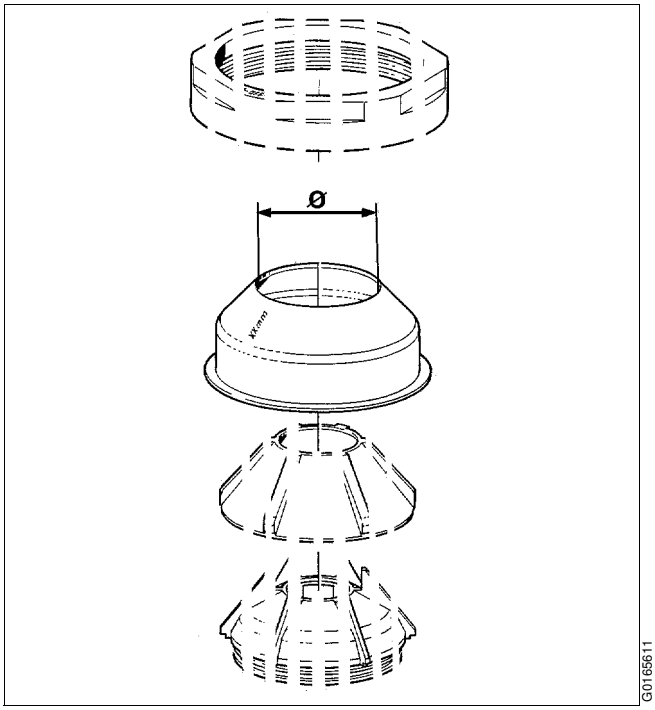
1. Ensure the machine is installed correctly and that feed-lines and drains have been flushed clean.
2. Fill oil in the oil sump. Fill up to the middle of the sight glass. For grade and quality of oil see “8.7.3 Recommended lubricating oils” on page 146.
3. Motors equipped with regreasing nipples: When starting the motor for the first time, or after long storage of the motor, apply the specified quantity of grease until new grease is forced out of the grease outlet.

4.1.2 Selection of gravity disc

The separator is delivered with a set of gravity discs with different diameters for purification operation. The hole diameter of the gravity disc sets the position of the oil/water interface in the separator, see page 26. The separation efficiency can be optimized by selection of the correct diameter for each oil quality.

As a guide the “8.9 Storage and installation” on page 153 can be used. The hole diameter of the first gravity disc to be tried can be read directly from the nomogram. The best separation results are obtained by using a gravity disc with as large a hole diameter as possible.

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



Location of gravity disc and clarifier disc

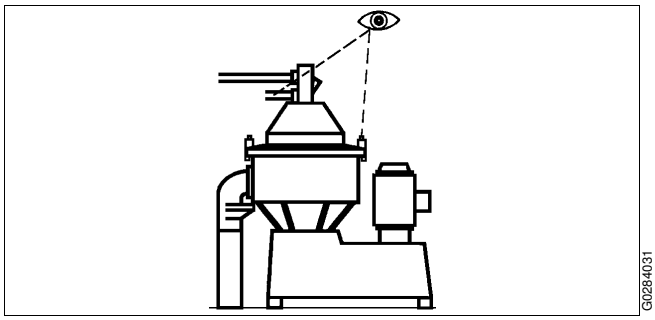
4.1.3 Start after a service

Pay special attention to unusual conditions when starting the separator after a service. Different fault symptoms are listed in chapter “7 Trouble-tracing” on page 117.

4.1.4 Before normal start

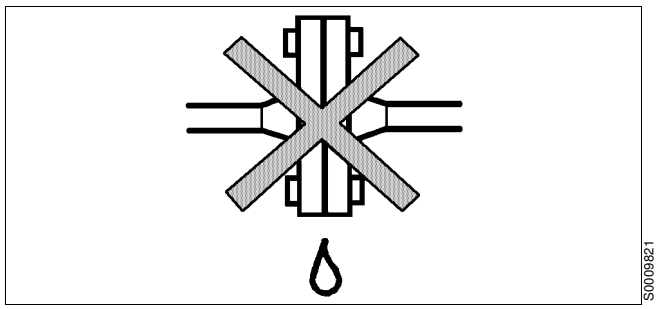
Check these points before every start.

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



Check assembly and tightenings

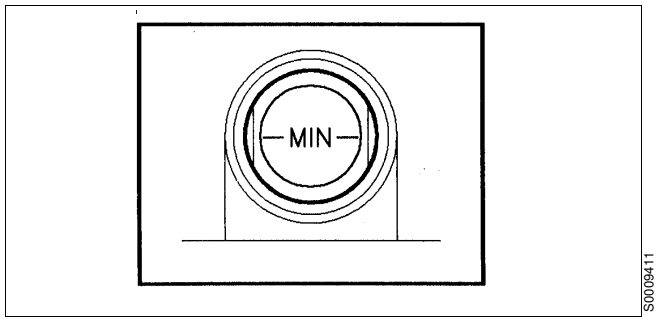
3. Make sure that all couplings and connections are securely tightened to prevent leakage.
4. Make sure that the inlet pipe is tightened.



Check for leakages (not admitted)

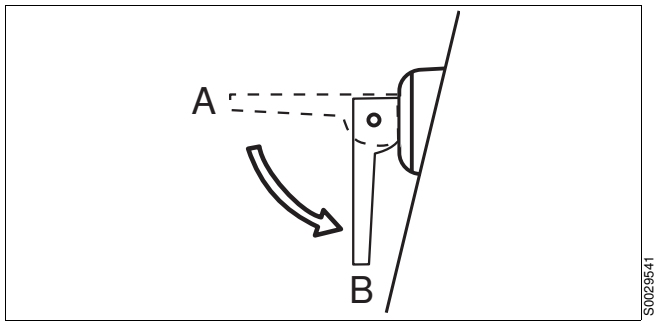
5. Read the oil level. The line in the middle of the sight glass shows the **minimum** level. Refill if necessary.

   For grade and quality of oil see “8.7.3 Recommended lubricating oils” on page 146.



Check the oil level

6. Release the brake (B).



Release the brake

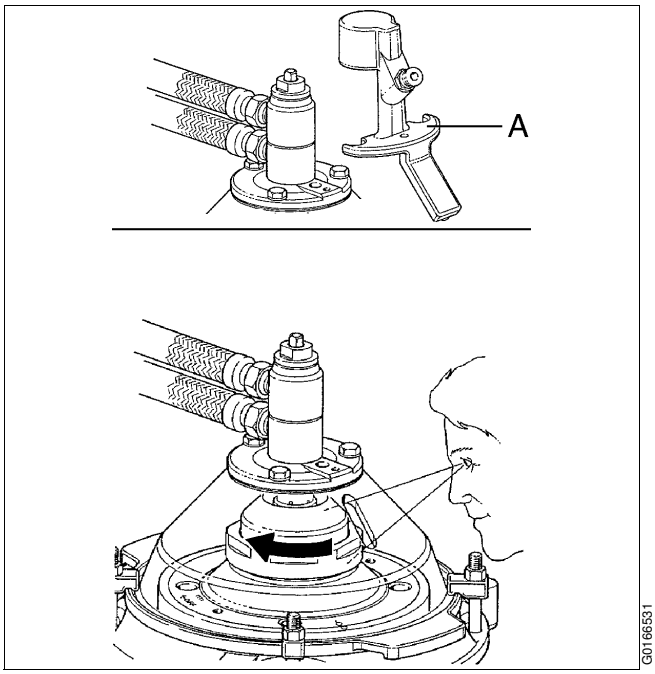
7. Make sure the direction of rotation of the motor and bowl corresponds to the sign on the frame.

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

WARNING

Disintegration hazards

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



Check that rotational direction of the bowl is clockwise

4.1.5 Starting and running-up procedure

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

WARNING

Disintegration hazards

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

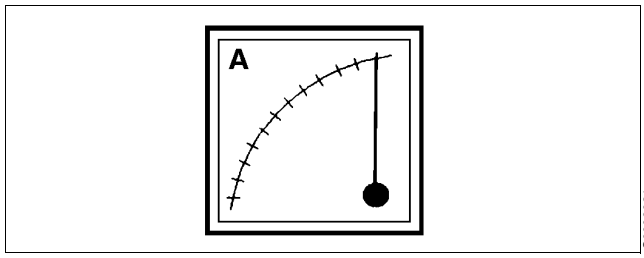
The cause of the vibration must be identified and rectified before the separator is restarted.

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

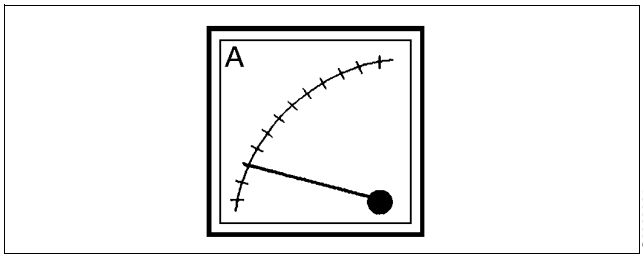
4. Check the current to the separator motor to ensure that the separator has reached full speed:

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

   For normal length of the start-up period see “8.2 Technical data” on page 133.

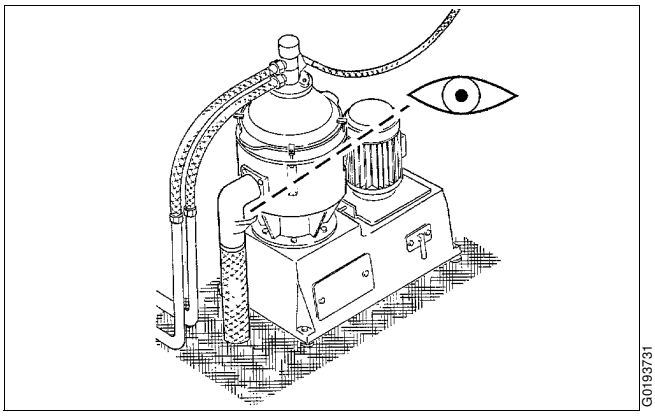


Current increases during start...



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

5. For **purification**:
   a. Supply water to form the water-seal. The water should have the same temperature as the process liquid and be supplied quickly.
   b. Close the water feed when water flows out through the water outlet.
   c. Start the oil feed slowly to avoid breaking the water seal. Then fill the bowl as quickly as possible.
6. For **clarification**:
   a. Start the oil feed with full flow. Fill the bowl as quickly as possible.
7. For both **purification** and **clarification** modes:
   Check the separator inlet and outlet pressures. See recommended values in your System Manual.
8. Adjust to desired throughput.



Water outlet

4.1.6 Separation

Do regular checks on:

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

4.1.7 Stopping procedure

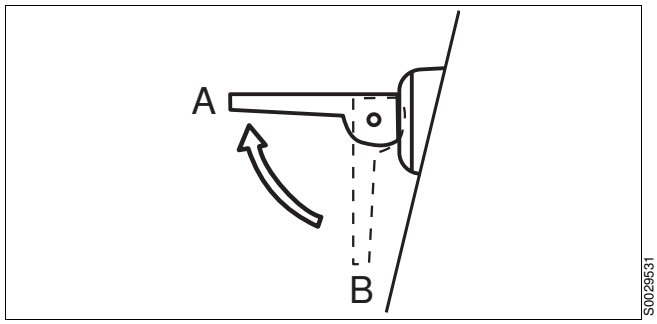
1. Feed sealing water until water flows out through the water outlet. Then close this feed.
2. Turn off the oil feed.
3. Stop the separator.

4. Pull the brake (A).

   Wait until the separator has come to a complete standstill (3-4 minutes).

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

   Release the brake when the separator is at standstill (B).

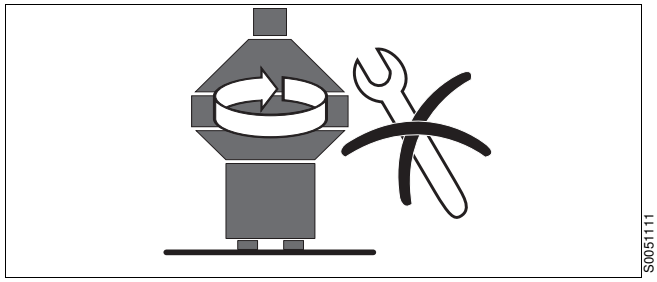


The final action, pull the brake

WARNING

Entrapment hazards

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



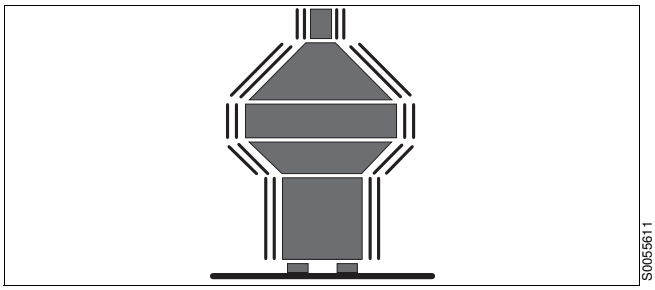
The separator must not be dismantled before standstill

NOTE

Manual cleaning must be carried out before next start up. See below, “4.1.9 Removal of separated sludge” on page 40.

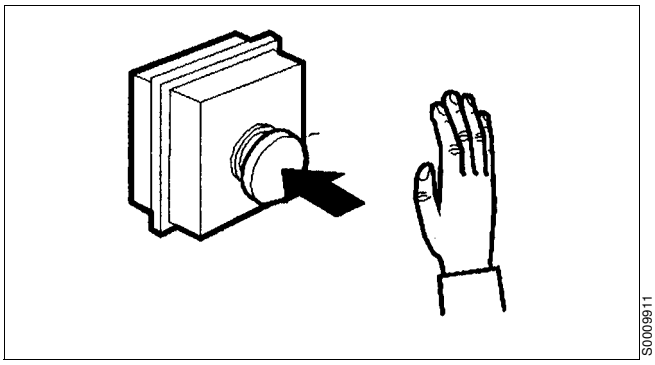
4.1.8 Safety stop

f the separator begins to **vibrate** excessively during operation, stop it immediately by pushing the **safety stop**. The separator motor is switched off.



Hazard!

- Keep the **bowl filled** during the run-down to minimize the excessive vibration.
- **Evacuate the room.** The separator may be hazardous when passing its critical speeds during the run-down



CAUTION

Disintegration hazards

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

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

4.1.9 Removal of separated sludge

Separated sludge is collected in the sludge basket inside the bowl. Remove the sludge as follows:

1. Stop the separator.
2. Open the bowl. Follow the instructions in chapter “6 Dismantling/Assembly” on page 73.
3. Lift out the sludge basket and empty it.
4. Assemble.

The length of the periods between cleaning depends on the feed rate of the oil and on the quantity of solid particles in the oil. Guidelines for emptying intervals:

Marine diesel oil - 1 week

Lubricating oil - 1 day

NOTE

Appropriate intervals for a specific case must be based on experience.

The downtime is shortened if the basket with sludge is exchanged for a cleaned one.

5 Service instructions

Contents

5.1 Periodic maintenance 42
- 5.1.1 Introduction 42
- 5.1.2 Maintenance intervals 42
- 5.1.3 Maintenance procedure 44
- 5.1.4 Service kits 44

5.2 Maintenance logs 45
- 5.2.1 Daily checks 45
- 5.2.2 Oil change - monthly 46
- 5.2.3 IS - Intermediate Service 47
- 5.2.4 MS - Major Service 48

5.3 Check points at Intermediate Service 50
- 5.3.1 Corrosion 50
- 5.3.2 Erosion 52
- 5.3.3 Cracks 53
- 5.3.4 Threads of inlet pipe, paring disc 54
- 5.3.5 Spindle top cone and bowl body nave 55
- 5.3.6 Threads on bowl hood and bowl body 56
- 5.3.7 Disc stack pressure 58

5.4 Check points at Major Service 59
- 5.4.1 Paring disc height adjustment 59
- 5.4.2 Radial wobble of bowl spindle 60

5.5 3-year service 61

5.6 Lifting instructions 61

5.7 Cleaning 63
- 5.7.1 Cleaning agents 64
- 5.7.2 Cleaning of bowl discs 65

5.8 Oil change 66
- 5.8.1 Oil change procedure 66

5.9 Vibration 68
- 5.9.1 Vibration analysis 68

5.10 General directions 69
- 5.10.1 Ball and roller bearings 69
- 5.10.2 Before shutdown 72
- 5.10.3 Before start-up 72

5.1 Periodic maintenance

5.1.1 Introduction

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

WARNING

Disintegration hazards

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

5.1.2 Maintenance intervals

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

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

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

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

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

In seasonal operation change the oil before a new period.

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

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

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

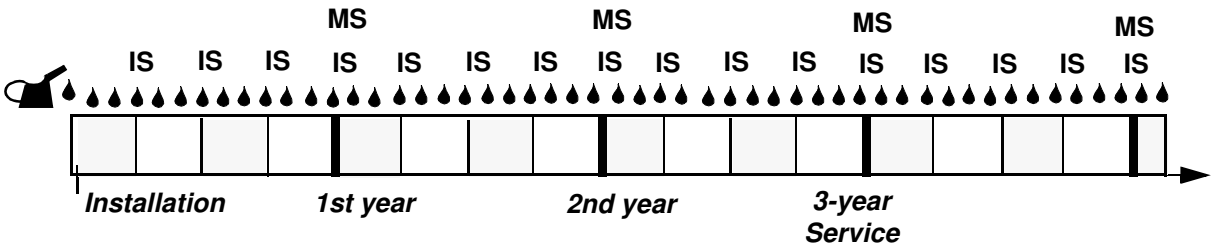
Service schedule

Oil change

I**ntermediate **S**ervice = **IS

M**ajor **S**ervice = **MS

3-year Service



Other

Check and prelubricate spindle bearings of separators which have been out of service for 6 months or longer. See also “5.10.2 Before shutdown” on page 72.

NOTE

Do not interchange bowl parts!

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

5.1.3 Maintenance procedure

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

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

1. Dismantle the parts as mentioned in the Service Log and described in Chapter “6 Dismantling/Assembly” on page 73.

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

2. Inspect and clean the dismantled separator parts according to the Service Log.

3. Fit all the parts delivered in the Service kit while assembling the separator as described in chapter “6 Dismantling/Assembly” on page 73. The assembly instructions have references to check points which should be carried out during the assembly.

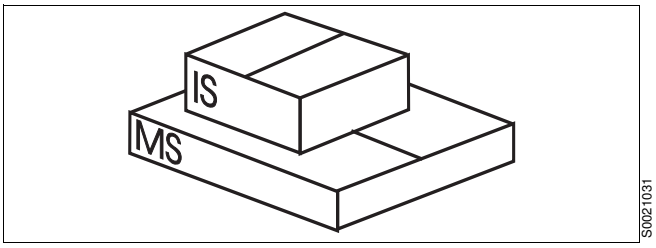
5.1.4 Service kits

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

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

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

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



Spare parts kits are available for Intermediate Service and Major Service

NOTE

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

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

5.2 Maintenance logs

5.2.1 Daily checks

The following steps should be carried out daily.

Main component and activity	Part	Page	Notes
Inlet and outlet Check for leakage	Connecting housing	34	
Separator bowl Check for vibration and noise		36	
Belt transmission Check for vibration and noise		36	
Oil sump Check	Oil level	34	
Electrical motor Check for heat, vibration and noise See manufacturer's instructions			

5.2.2 Oil change - monthly

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

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

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

See chapter “8.7 Lubricants” on page 141 for further information on oil brands etc.

Main component and activity	Part	Page	Notes
Bowl spindle and transmission			
Check	Belt tension	107	
Change	Oil in oil sump	66	

5.2.3 IS - Intermediate Service

Name of plant: Local identification:

Separator: MMB 305S-11 Manufacture No./Year:

Total running hours: Product No.: 881152-01-03 /2

Date: Signature:

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

Main component and activity	Part	Page	Notes
Inlet and outlet, frame			
Clean and inspect	Threads of inlet pipe	54	
	Paring disc	54	
	Housings and frame hood		
Separator bowl			
Clean and inspect	Bowl hood	56	
	Top disc	65	
	Bowl discs	65	
	Distributor		
	Threads on bowl hood and bowl body	56	
	Bowl spindle cone and bowl body nave	55	
Check	Disc stack pressure	58	
	Galling of guide surface	56	
	Corrosion, erosion, cracks	50 - 52	
Power transmission			
Check	Belt and belt tension	107	
Change	Oil in oil sump	66	
Electrical motor			
Lubrication (if nipples are fitted)	See sign on motor		
Signs and labels on separator			
Check attachment and legibility	Safety label on hood	151	
	Other plates and labels		

5.2.4 MS - Major Service

Name of plant: Local identification:

Separator: MMB 305S-11 Manufacture No./Year:

Total running hours: Product No.: 881152-01-03 /2

Date: Signature:

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

Main component and activity	Part	Page	Notes
Inlet and outlet, frame			
Clean and inspect	Threads of inlet pipe	54	
	Paring disc	54	
	Housings and frame hood		
Separator bowl			
Clean and inspect	Bowl hood	56	
	Top disc	65	
	Bowl discs	65	
	Distributor		
	Threads on bowl hood and bowl body	56	
	Bowl spindle cone and bowl body nave	55	
Check	Height of paring disc	59	
	Disc stack pressure	58	
	Galling of guide surface	56	
	Corrosion, erosion, cracks	50 - 52	

Main component and activity	Part	Page	Notes
Vertical driving device			
Clean and inspect	Oil mist fan	98	
	Oil pump	93	
	Bowl spindle	90	
	Ball bearing housing indentations	90	
Check	Radial wobble of bowl spindle	60	
Oil sump			
Clean	Oil sump	66	
Change	Oil	66	
Clean and inspect	Oil filling device	111	
Brake			
Clean and inspect	Brake	113	
Friction coupling			
Clean and inspect	Friction coupling	114	
Electrical motor			
Replace	Bearings[1)]		
Signs and labels on separator			
Check attachment and legibility	Safety label on hood	151	
	Other signs and labels		

[1)] See manufacturer's instructions.

5.3 Check points at Intermediate Service

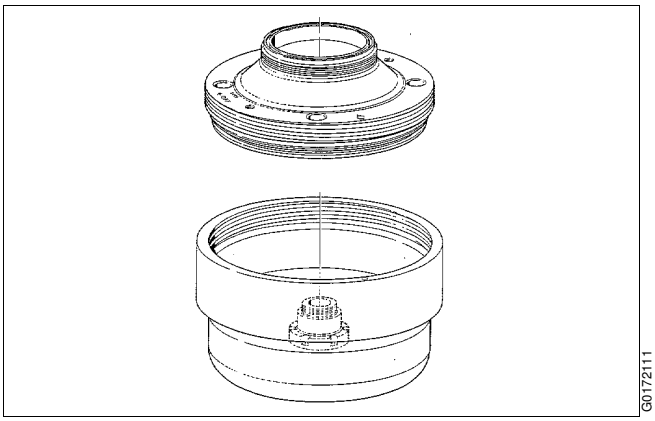
5.3.1 Corrosion

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

WARNING

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 a corrosion damage exceeds 1,0 mm or if cracks have been found. Do not continue to use the separator until it has been inspected and given clearance for operation by Alfa Laval.

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

Non-stainless steel and cast iron parts

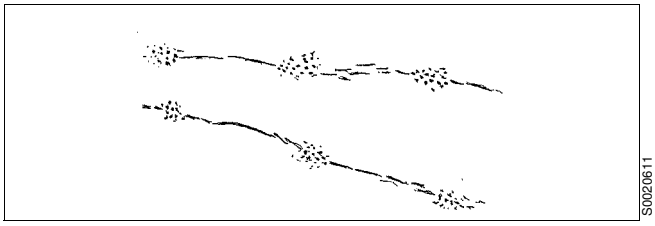
Corrosion (rusting) can occur on unprotected surfaces of non-stainless steel and cast iron. Frame parts can corrode when exposed to an aggressive environment.

Stainless steel

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

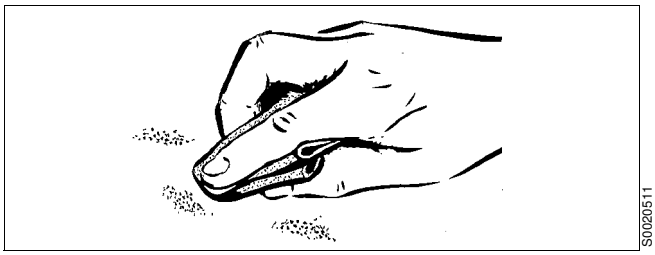
- exposed to a stationary solution,
- in a crevice,
- covered by deposits,
- exposed to a solution that has a low pH value.

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



Example of chloride corrosion in stainless steel

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



Polish corrosion marks to prevent further damage

WARNING

Disintegration hazard

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

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

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

Other metal parts

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

5.3.2 Erosion

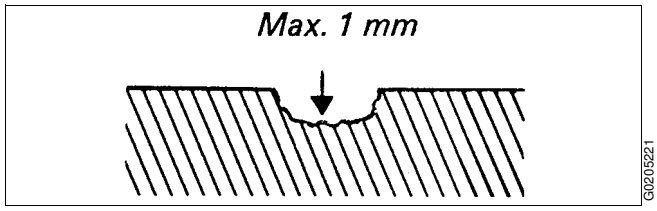
Erosion can occur when particles suspended in the process liquid slide along or strike against a surface. Erosion can become intensified locally by flows of higher velocity.

WARNING

Disintegration hazard

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

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



Maximum permitted erosion

Erosion is characterised by:

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

Parts of the bowl particularly subjected to erosion are:

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

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

5.3.3 Cracks

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

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

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

WARNING

Disintegration hazard

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

Always replace a part if cracks are present.

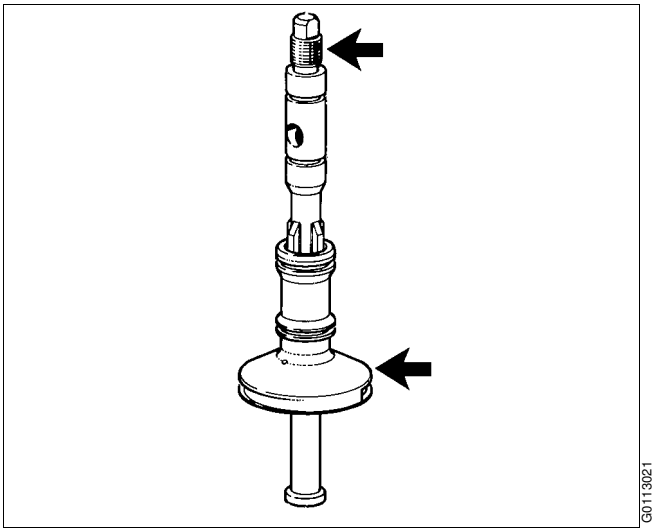
It is particularly important to inspect for cracks in rotating parts.

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

5.3.4 Threads of inlet pipe, paring disc

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

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



5.3.5 Spindle top cone and bowl body nave

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

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

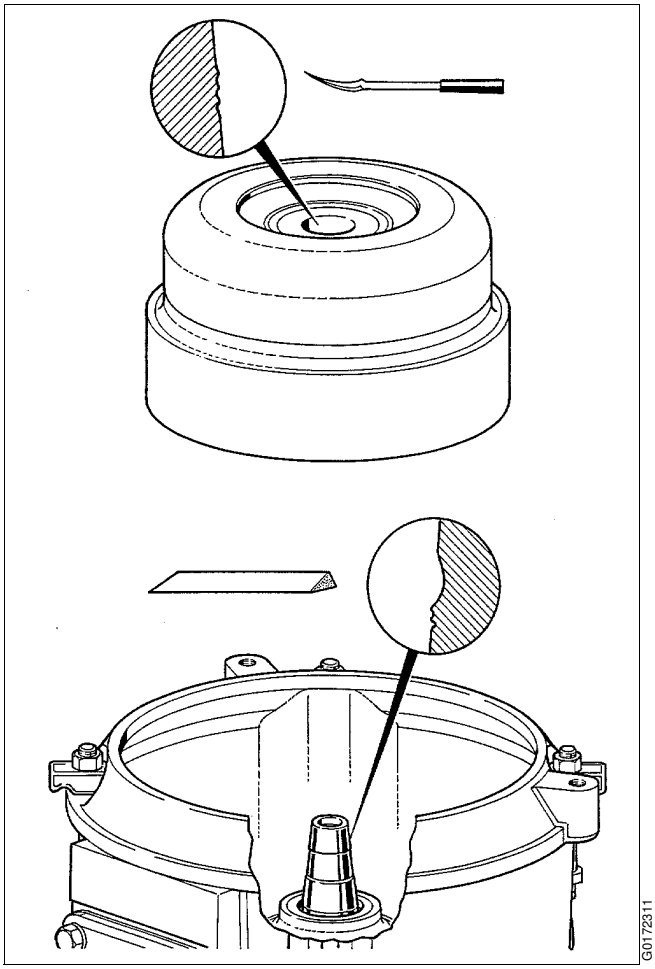
- Remove any impact marks using a scraper and/or a whetstone.

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

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

NOTE

Always use a scraper with great care. The conicity must not be marred.



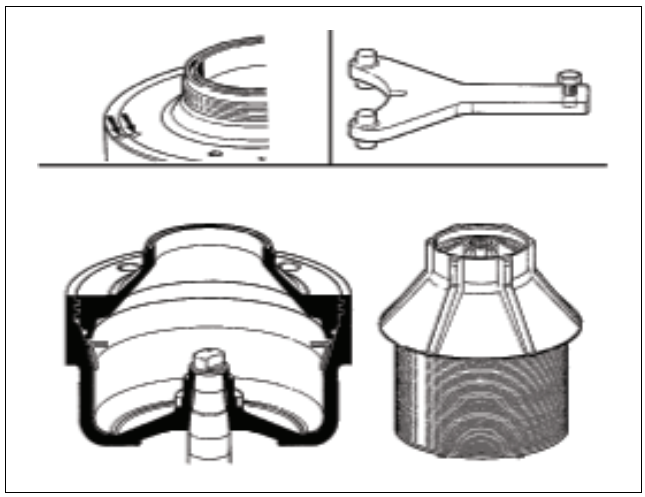
Use whetstone or scraper with great care.

5.3.6 Threads on bowl hood and bowl body

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

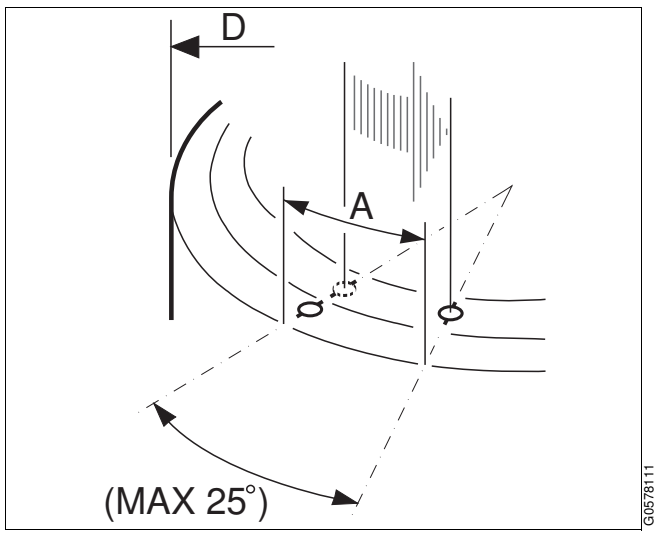
Examine the thread condition by tightening the bowl hood after removing the disc stack and top disc from the bowl

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


G01172451

Wear

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



G05781111

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

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

WARNING

Disintegration hazards

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

Damage

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

Examine for burrs and protrusions caused by impact.

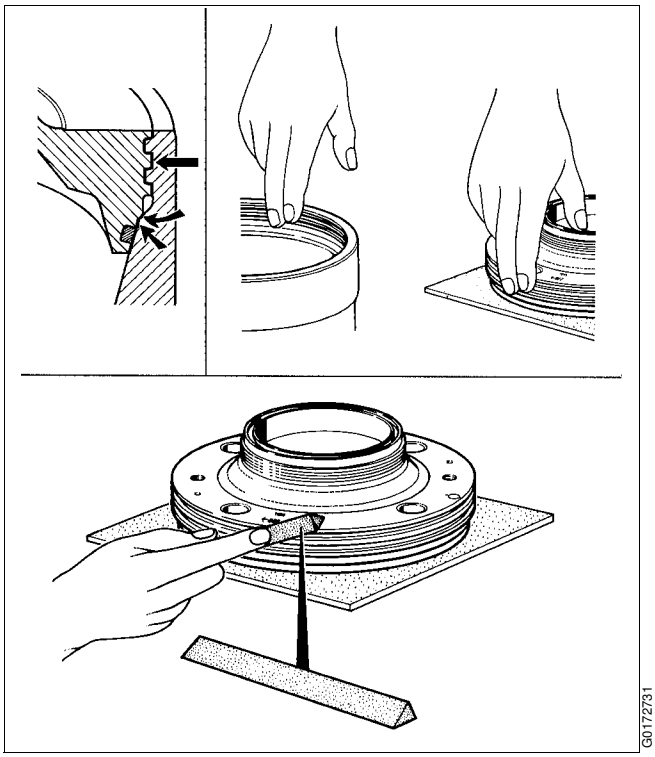
Clean the threads, contact and guide surfaces with a suitable degreasing agent.

> **CAUTION**
>
> **Cut hazard**
>
> The threads have sharp edges which can cause cuts.

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

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

After rectifying, the threading has to be primed with Molykote 1000.



Contact surfaces to inspect on the bowl

5.3.7 Disc stack pressure

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

NOTE

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

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

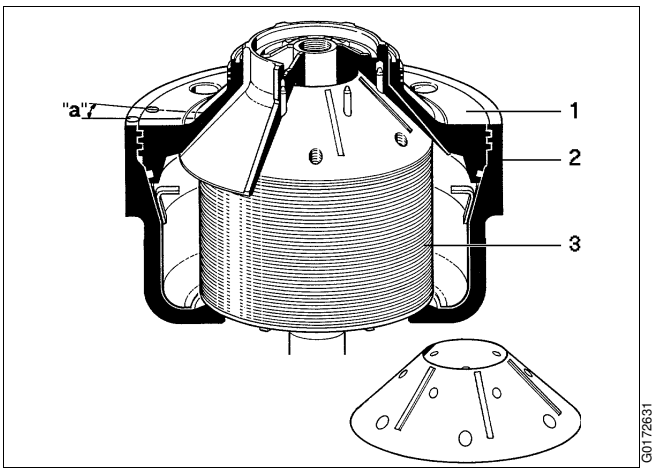
   The assembly mark on the bowl hood should now be positioned at the angle “a” (see illustration), 30° - 60° ahead of the corresponding mark on the bowl body.

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

3. Re-check the disc stack pressure if one or more discs have been added.

NOTE

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

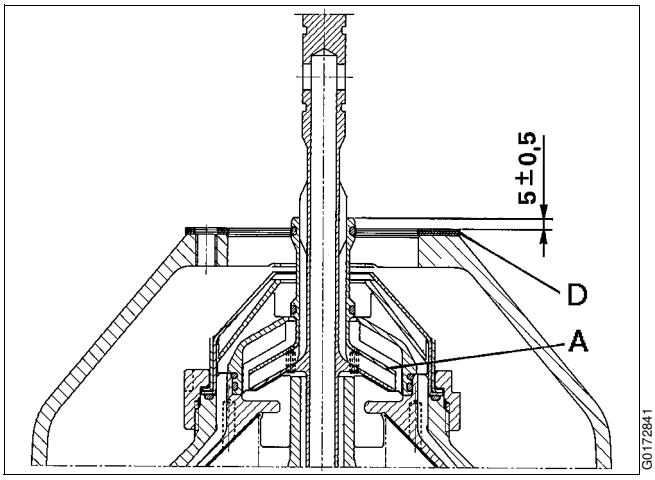


1 Bowl hood
2 Bowl body
3 Disc stack
“a” Angle between assembly marks before final tightening.

5.4 Check points at Major Service

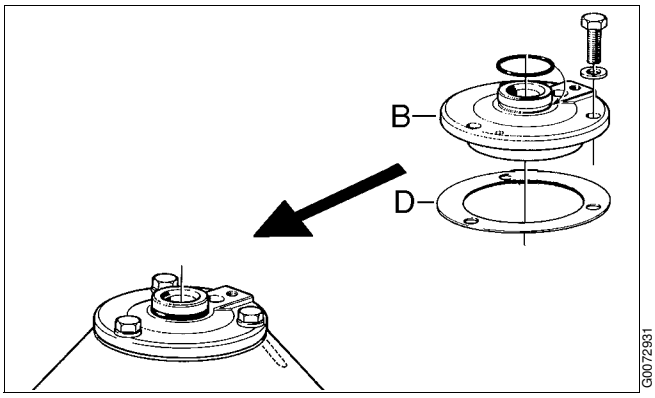
5.4.1 Paring disc height adjustment

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



NOTE

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

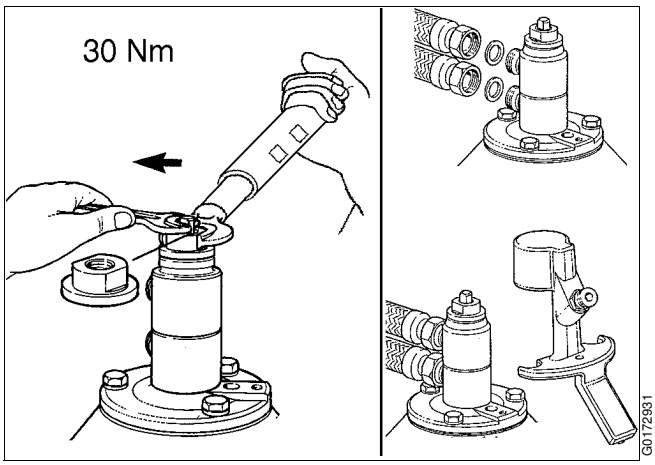


1. Assemble the bowl and frame hood as described in chapter “6.1.2 Inlet/outlet and bowl – assembly” on page 82.

   Before fitting the connecting housing:

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

   Left-hand thread!



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

5.4.2 Radial wobble of bowl spindle

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

NOTE

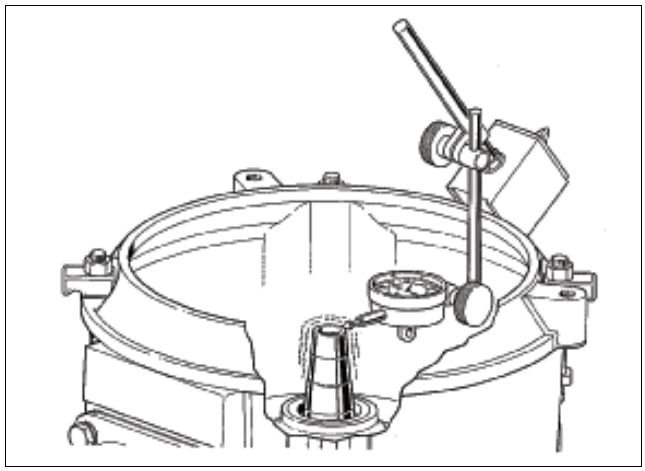
Spindle wobble will cause rough bowl run. This leads to vibration and reduces lifetime of ball bearings.

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

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

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

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



5.5 3-year service

Exchange of frame feet

See “6.7.1 Mounting of new frame feet” on page 115.

Friction coupling

Exchange of ball bearings, see “6.3 Friction coupling” on page 101.

Frame intermediate part

Replace O-ring, see “6.2 Bowl spindle and frame” on page 90.

5.6 Lifting instructions

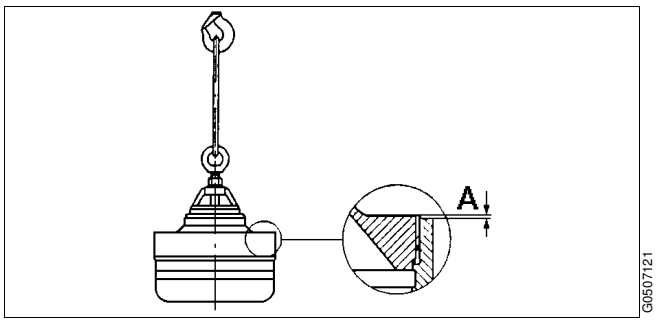
1. Remove the inlet/outlet housings, the frame hood and the bowl according to the instructions in chapter “6.1.1 Inlet/outlet and bowl – dismantling” on page 77.

NOTE

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

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

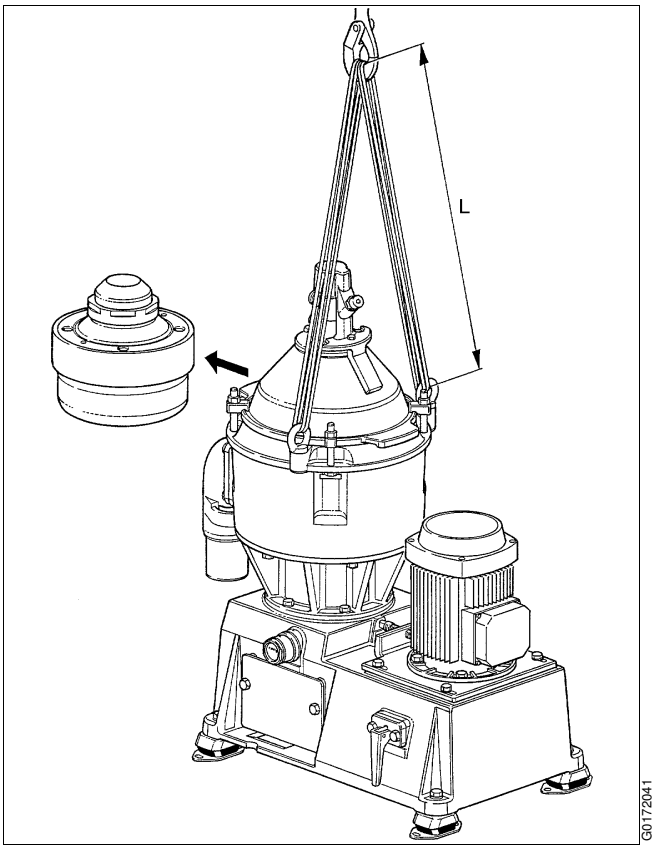
When lifting the bowl, use the compression tool fastened on the distributor.



A <2 mm

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

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



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

WARNING

Crush hazards

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

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

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

8. Remove the lifting eyes afterwards.

NOTE

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

Bowl: Use lifting slings for WLL 100 kg.

5.7 Cleaning

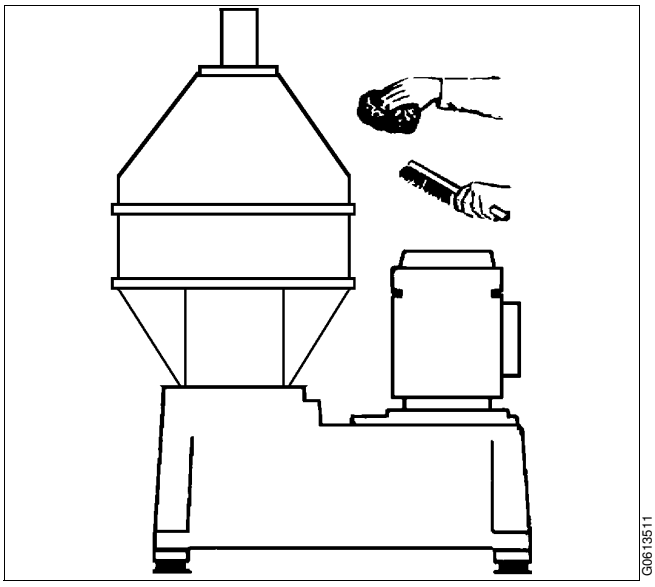
External cleaning

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

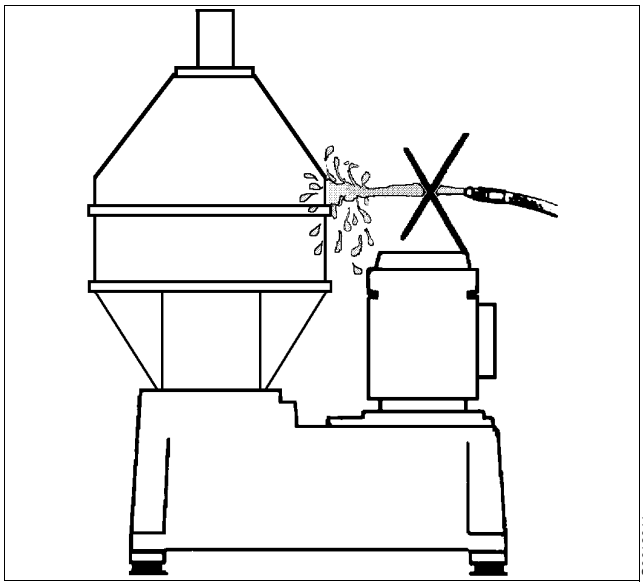
Never wash down a separator with a direct water stream. Totally enclosed motors can be damaged by direct hosing to the same extent as open motors and even more than those, because:

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

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



Use a brush and a sponge or cloth when cleaning



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

5.7.1 Cleaning agents

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

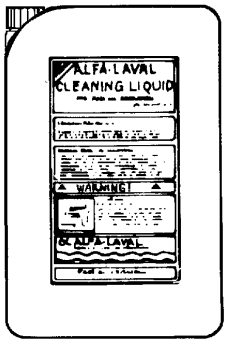
For separator bowl, inlet and outlet

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

- For cleaning of **lube oil** separators the most important function of the cleaning agent is to be a good solvent for the gypsum in the sludge. It should also act as a dispersant and emulsifier for oil. It is recommended to use **Alfa Laval cleaning liquid for lube oil separators** which has the above mentioned qualities. Note that carbon steel parts can be damaged by the cleaning agent if submerged for a long time.
- **Fuel oil** sludge mainly consists of complex organic substances such as asphaltenes. The most important property of a cleaning liquid for the removal of fuel oil sludge is the ability to dissolve these asphaltenes.

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

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



S0008511

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

*Alfa Laval cleaning liquid for **fuel oil** separators is available in 5-litre plastic containers.*

CAUTION

Skin irritation hazard

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

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

For parts of the driving devices

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

Oiling (protect surfaces against corrosion)

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

5.7.2 Cleaning of bowl discs

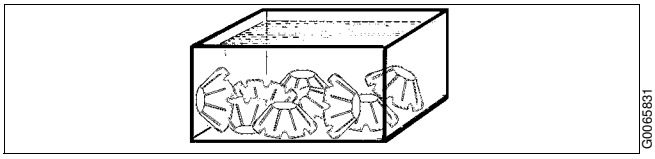
Bowl discs

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

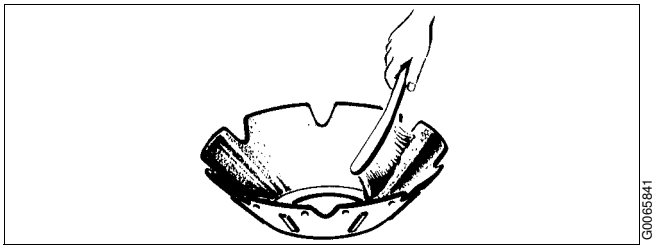
NOTE

Mechanical cleaning is likely to scratch the disc surfaces causing deposits to form quicker and adhere more firmly.
A mild chemical cleaning is therefore preferable to mechanical cleaning.

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



Put the discs one by one into the cleaning agent



Clean the discs with a soft brush

WARNING

Cut hazards

The discs have sharp edges that can cause cuts.

5.8 Oil change

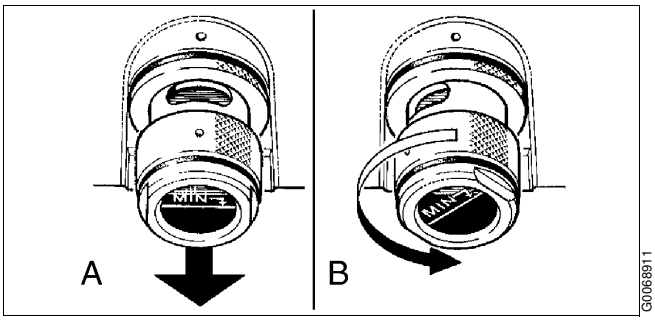
5.8.1 Oil change procedure

NOTE

Before adding or renewing lubricating oil in the oil sump, the information concerning different oil groups, handling of oils, oil change intervals etc. given in chapter "8.7 Lubricants" on page 141 must be well known.

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

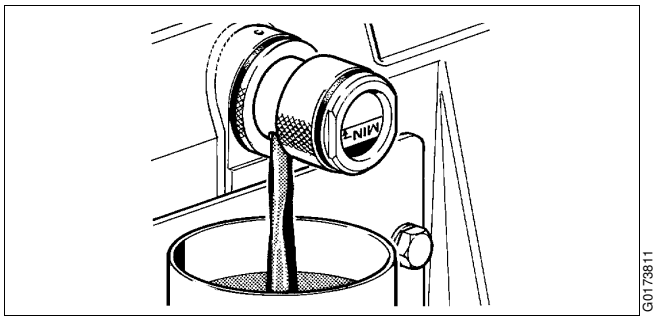
1. Place a collecting vessel under the drain hole.
2. Pull out (A) the oil filling device and turn it half a turn (B).
3. Collect the oil in the vessel.



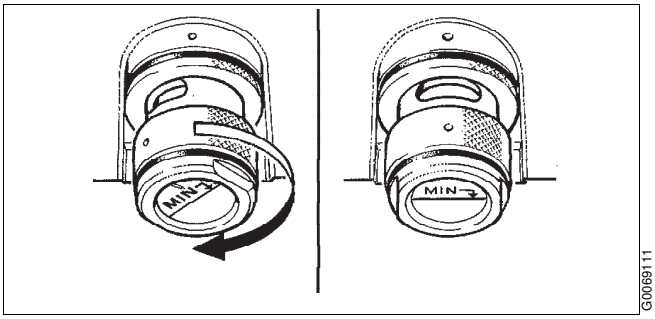
CAUTION

Burn hazards

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



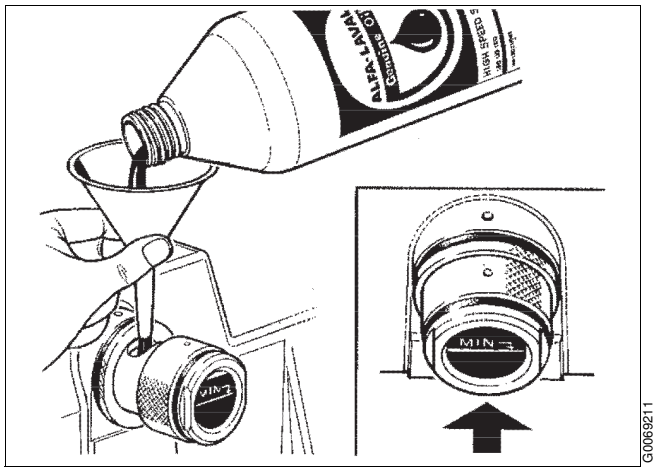
4. Turn the oil filling device back to position (A), the drain hole pointing upwards.



NOTE

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

5. Fill the oil sump in the frame housing with new oil. The oil level should be slightly above middle of the sight glass. Information on volume see “8.2 Technical data” on page 133.
6. Push in the oil filling device.



5.9 Vibration

5.9.1 Vibration analysis

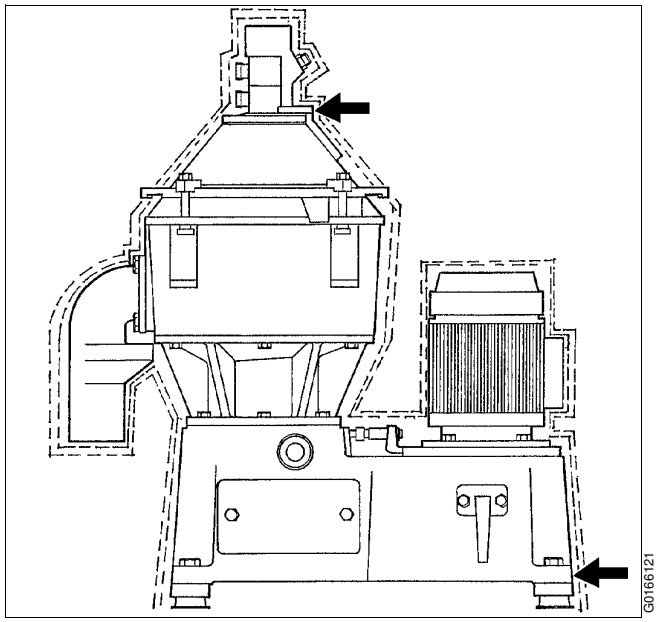
A separator normally vibrates and produces a different sound when passing through its critical speeds during run-up and run-down.

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

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

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

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



Measuring points for vibration analysis

WARNING

Disintegration hazards

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

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

5.10 General directions

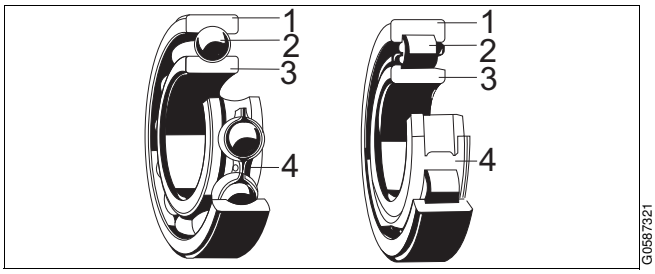
5.10.1 Ball and roller bearings

Specially designed bearings for the bowl spindle

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

Only Alfa Laval genuine spare parts should be used.

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



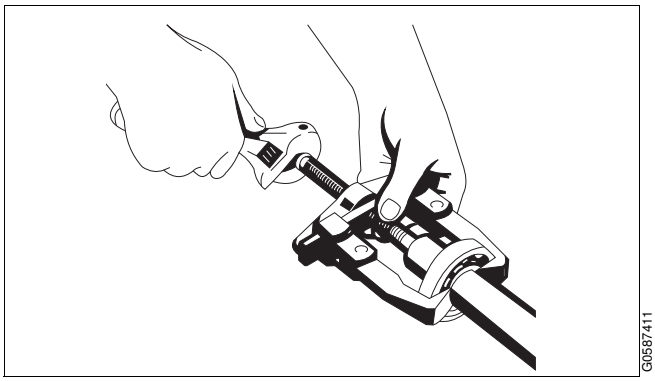
1. *Outer race*
2. *Ball/roller*
3. *Inner race*
4. *Cage*

> **NOTE**
>
> Using an incorrect bearing can cause a serious breakdown with injury to personnel and damage to equipment as a result.
>
> Do not re-fit a used bearing. Always replace it with a new one.

Dismantling

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

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



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

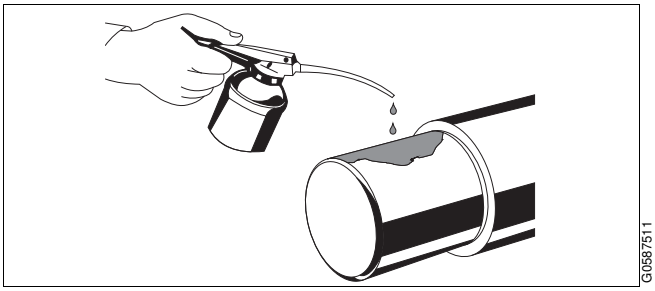
> **NOTE**
>
> Do not hit with a hammer directly on the bearing.

Cleaning and inspection

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

Assembly

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



Clean and smear the bearing seating before assembly

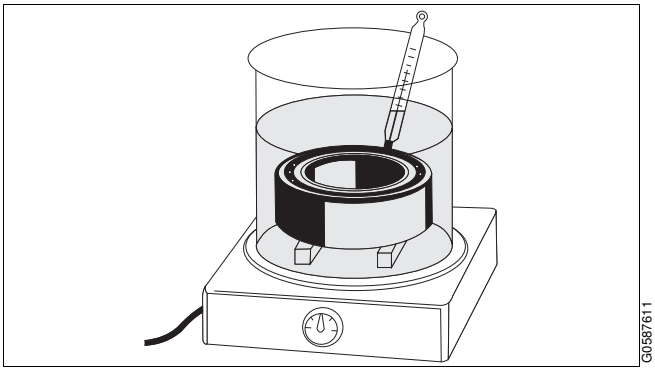
- When assembling ball bearings, the bearings must be heated in oil to maximum 125 °C.

NOTE

Heat the bearing in a clean container with a cover.

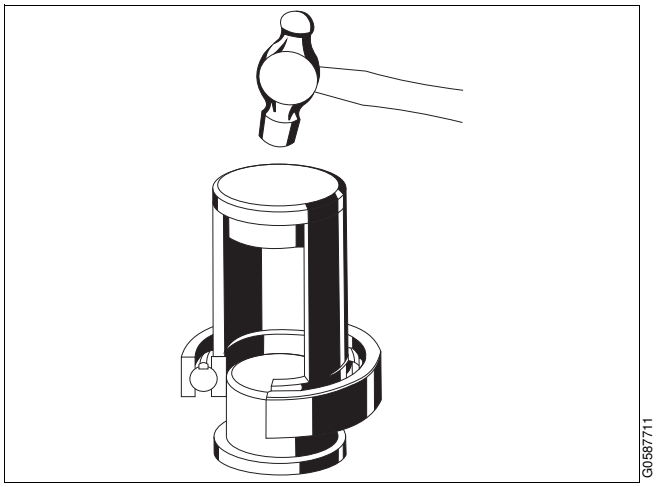
Use only clean oil with a flash point above 250 °C.

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



The bearing must not be in direct contact with the container

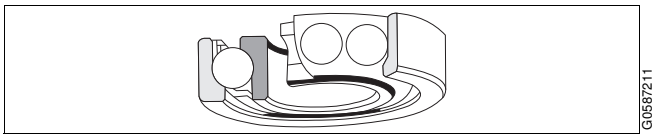
- There are several basic rules for assembling cylindrical bore bearings:
  - Never directly strike a bearing's rings, cage or rolling elements while assembling. A ring may crack or metal fragments break off.
  - Never apply pressure to one ring in order to assemble the other.
  - Use an ordinary hammer.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



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

Angular contact ball bearings

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



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

5.10.2 Before shutdown

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

- Remove the bowl, according to chapter “6 Dismantling/Assembly” on page 73.

NOTE

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

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

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

For storage see “8.9 Storage and installation” on page 153.

5.10.3 Before start-up

- If the separator has been shut-down for more than 3 months but less than 12 months, an Intermediate Service (IS) has to be made. In addition to IS-service: Lubricate the top bearing with 10 mil. of lubricating oil.
- If the electric motor is equipped with grease nipples; pre-lubricate according to the instructions in the manufacturers information. See “8.7 Lubricants” on page 141 for type of grease.

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

6 Dismantling/Assembly

Contents

6.1 Inlet/outlet and bowl 75
- 6.1.1 Inlet/outlet and bowl – dismantling 77
- 6.1.2 Inlet/outlet and bowl – assembly 82

6.2 Bowl spindle and frame 90
- 6.2.1 Bowl spindle and frame – dismantling 90
- 6.2.2 Bowl spindle and frame – assembly 95

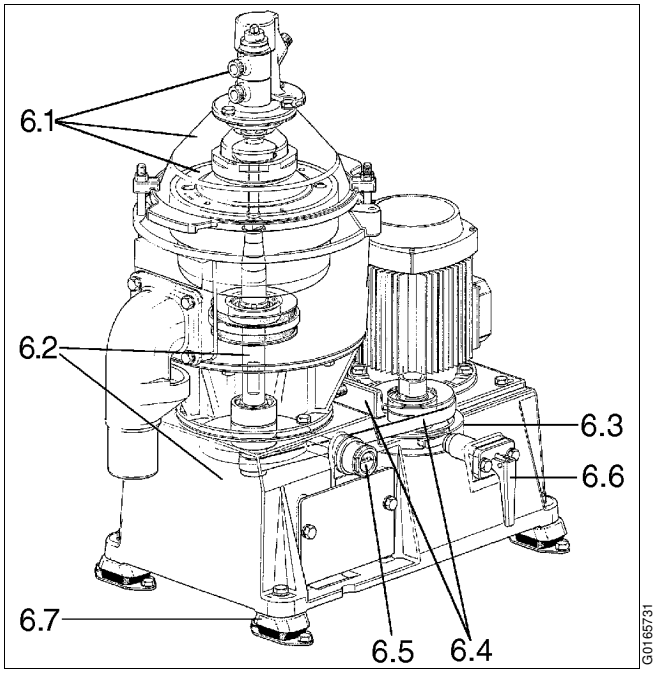
6.3 Friction coupling 101
- 6.3.1 Friction coupling – dismantling 102
- 6.3.2 Friction coupling – assembly 104

6.4 Flat belt and tightener 107
- 6.4.1 Change of belt 107

6.5 Oil filling device 112
- 6.5.1 Dismantling/assembly 112

6.6 Brake 113
- 6.6.1 Checking of friction element 114

6.7 Frame feet 115
- 6.7.1 Mounting of new frame feet 115



WARNING

Entrapment hazard

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

References to check-points

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

✔ **Check point**
"5.3.7 Disc stack pressure" on page 58.

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

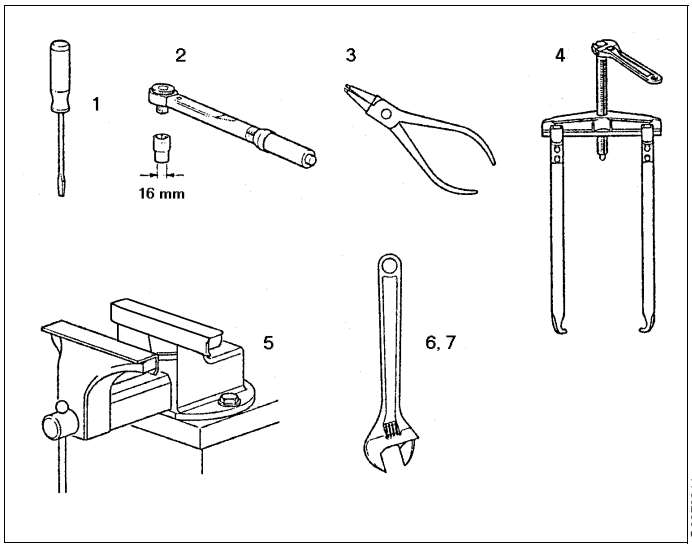
Tools

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

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

For bowl and bowl spindle

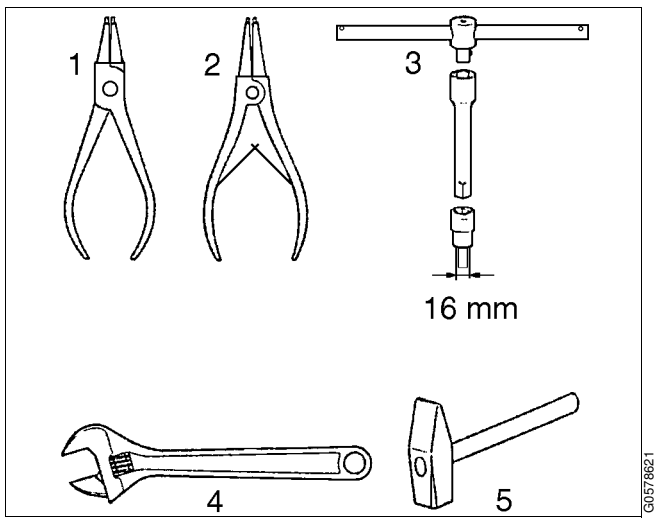
1. *Screw driver*
2. *Torque wrench (50 Nm) with socket 16 mm*
3. *Pliers for internal snap ring*
4. *Ball bearing puller*
5. *Screw vice with copper liners*
6. *Adjustable wrench, length approx. 400 mm*
7. *Adjustable wrench or spanner, width of jaws 24 mm*



Two lifting slings, working load limit (WLL): >300 kg

For friction coupling and flat belt

1. *Pliers for internal snap ring*
2. *Pliers for external snap ring*
3. *T-handle, extension rod and socket 16 mm*
4. *Adjustable wrench or spanner, width of jaws 36 mm*
5. *Hammer*



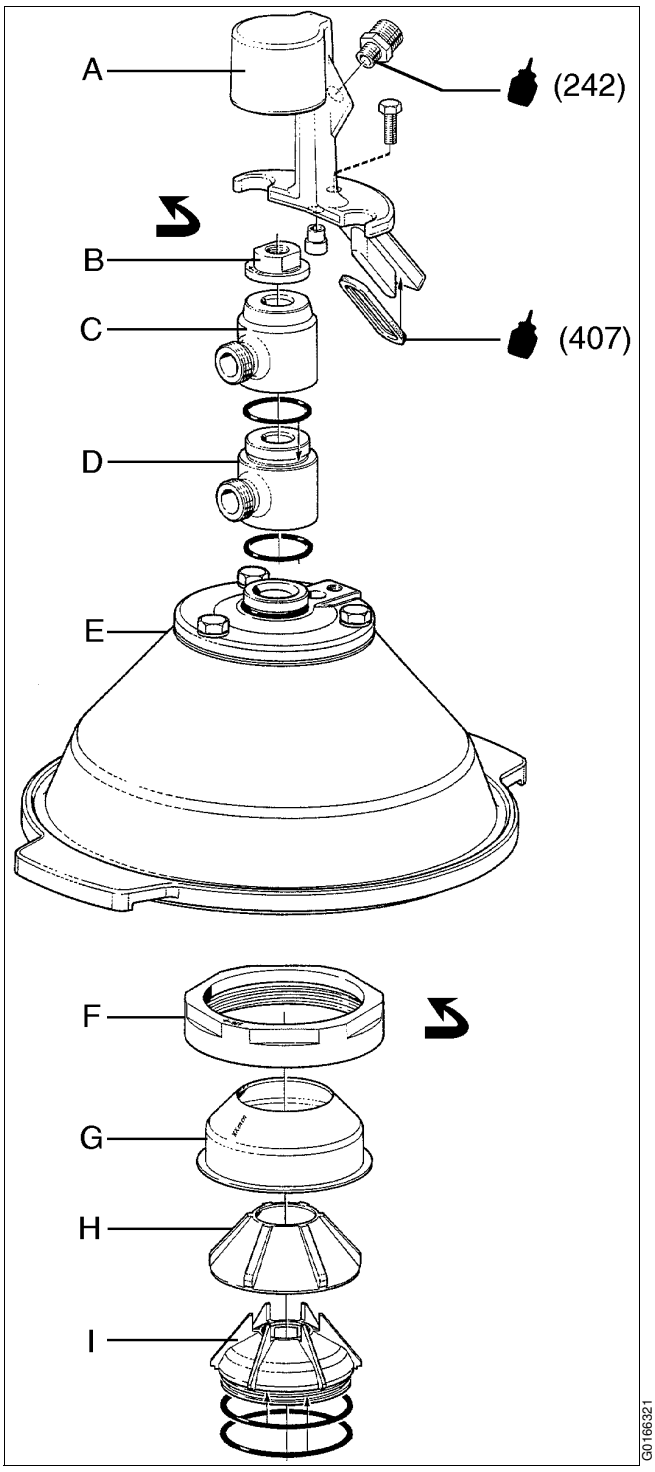
6.1 Inlet/outlet and bowl

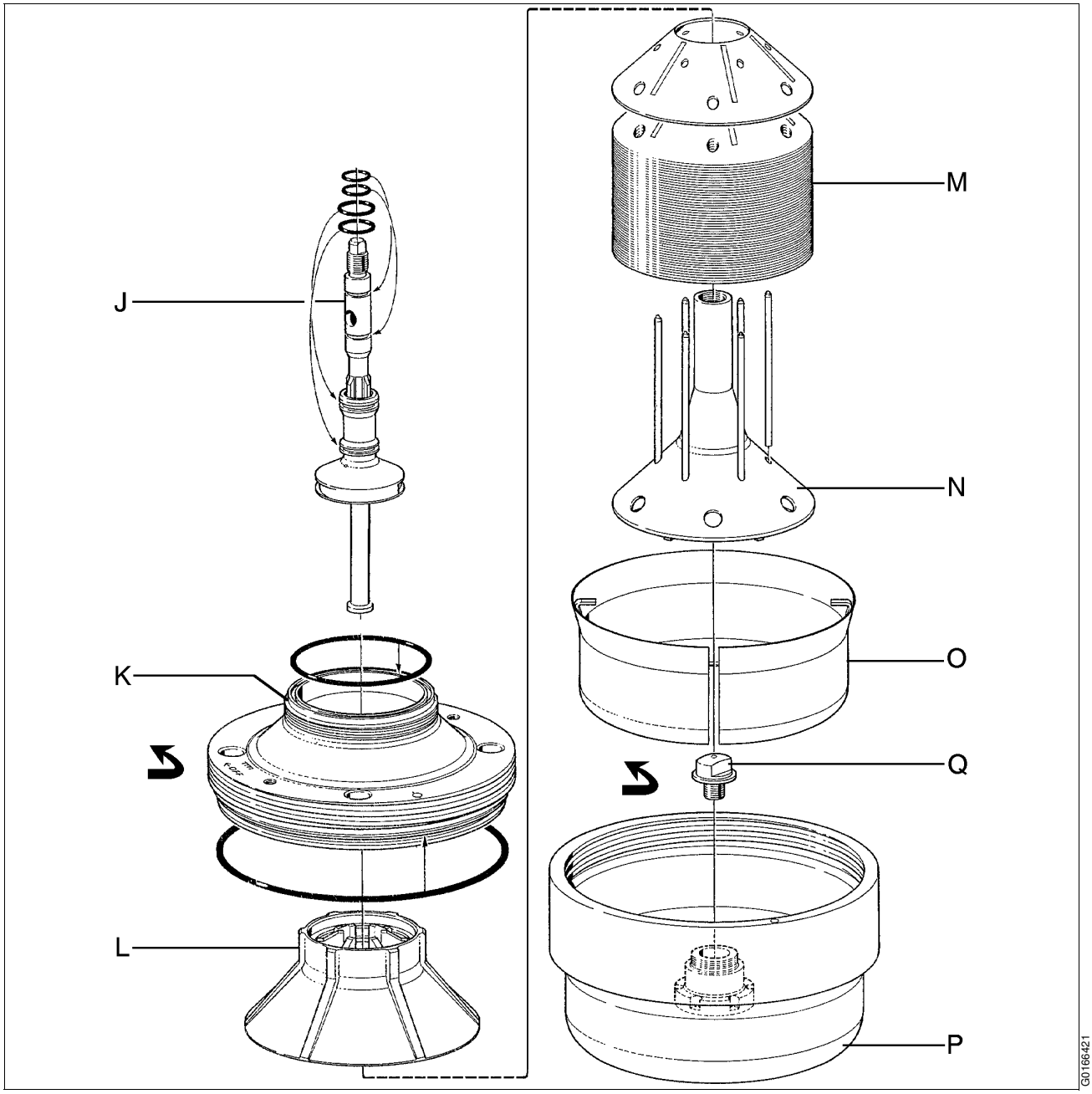
A Safety device
B Nut
C Inlet housing
D Outlet housing
*E Frame hood (incl. connecting housing)**
F Lock ring
G Gravity disc/clarifier disc
H Leader cone
I Paring chamber cover

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

Left-hand thread

Loctite 242/407





J Inlet pipe
K Bowl hood
L Top disc
M Bowl discs
N Distributor
O Sludge basket
P Bowl body
Q Cap nut

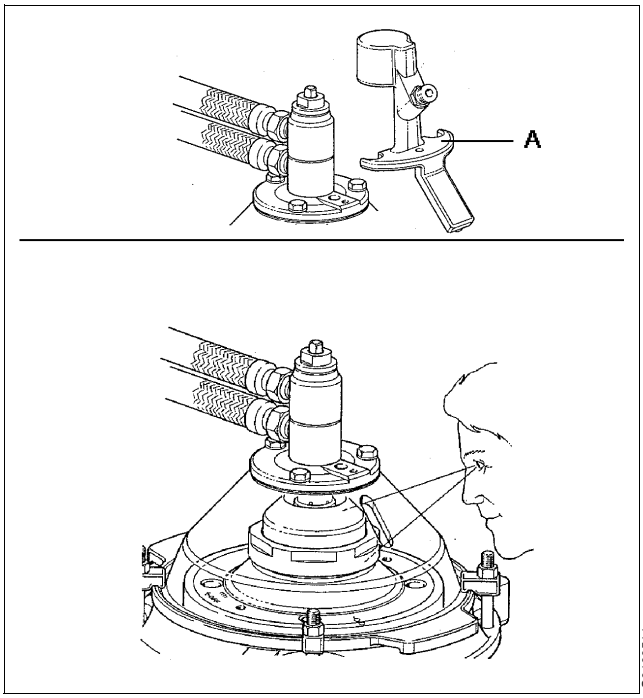
Left-hand thread

6.1.1 Inlet/outlet and bowl – dismantling

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

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

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



WARNING

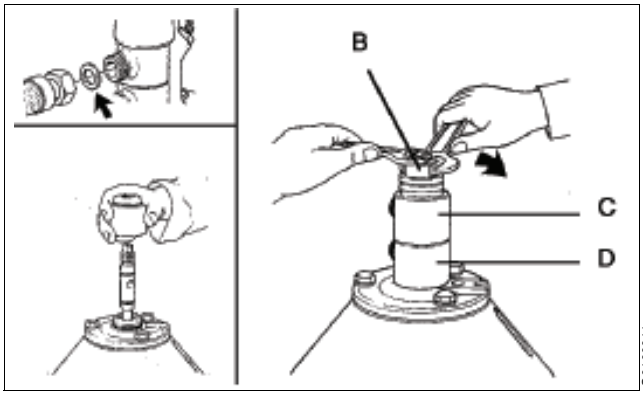
Entrapment hazards

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

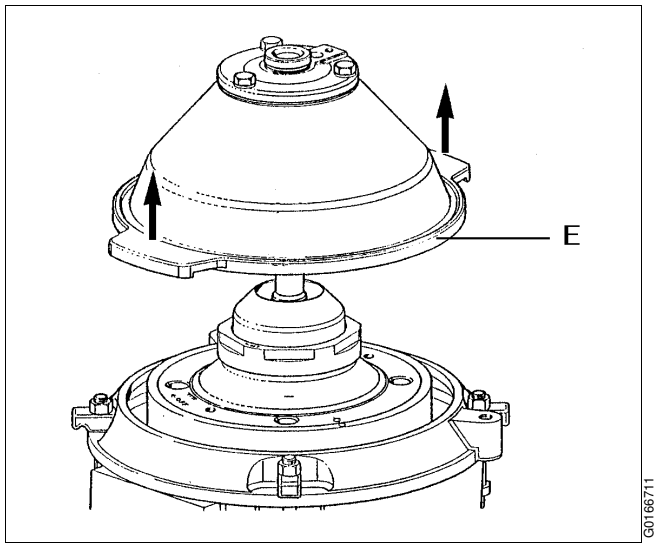
The bowl parts can remain very hot for a considerable time after the bowl has come to a standstill.

2. Unscrew nut (B) clockwise and lift off inlet and outlet housings (C, D) together with the connecting hoses.

   Left-hand thread!

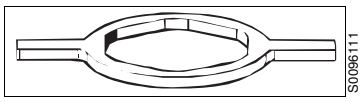


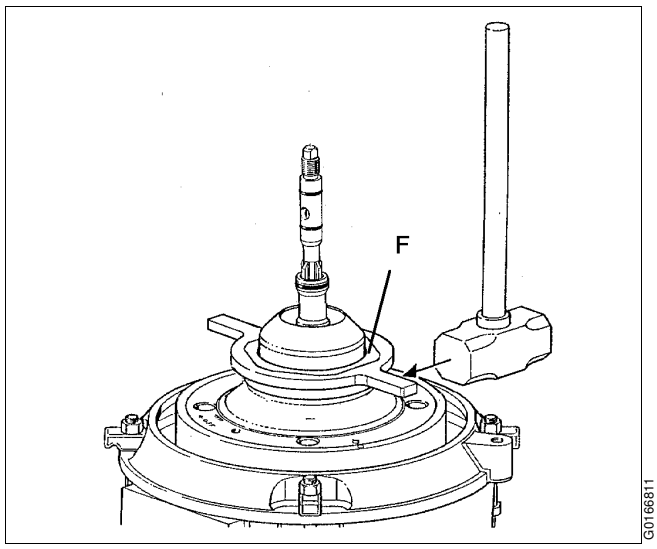
3. Remove the four hooks and lift off frame hood (E).



4. Unscrew lock ring (F) clockwise by using the special tool; “Spanner for lock ring”.

   Left-hand thread!

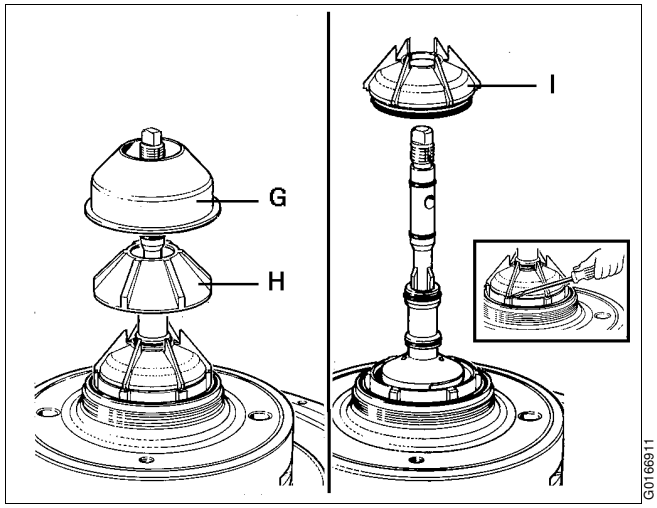




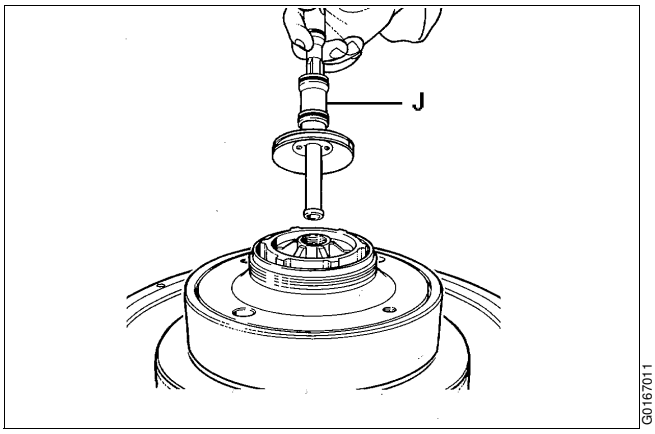
5. Lift off gravity disc/clarifier disc (G) and leader cone (H).

> **NOTE**
>
> If the gravity disc has to be replaced owing to changed operating conditions, see “8.9 Storage and installation” on page 153.

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

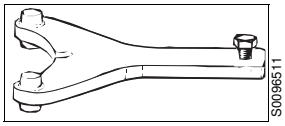


7. Lift out inlet pipe (J) with the paring disc.

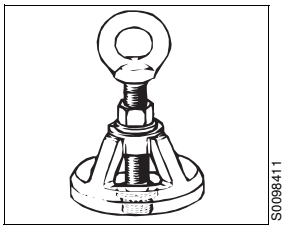


8. Preparations for unscrewing of bowl hood (K):

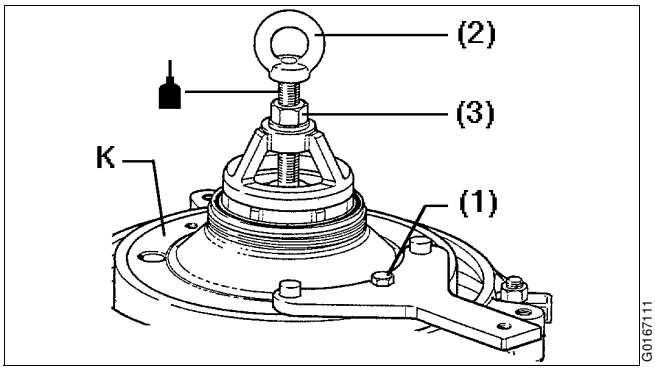
   – Fit the spanner to the bowl hood and secure it with the bolt (1).



   – Fit the compression tool and screw down the central screw until it stops (2).



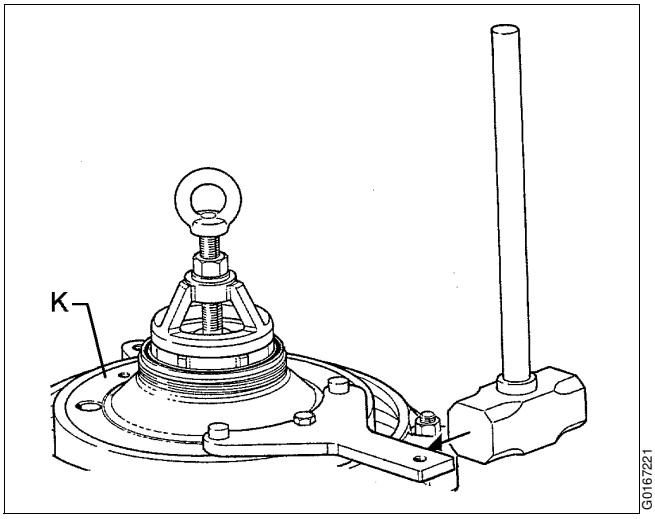
   – Compress the disc stack by tightening the nut (3) firmly.



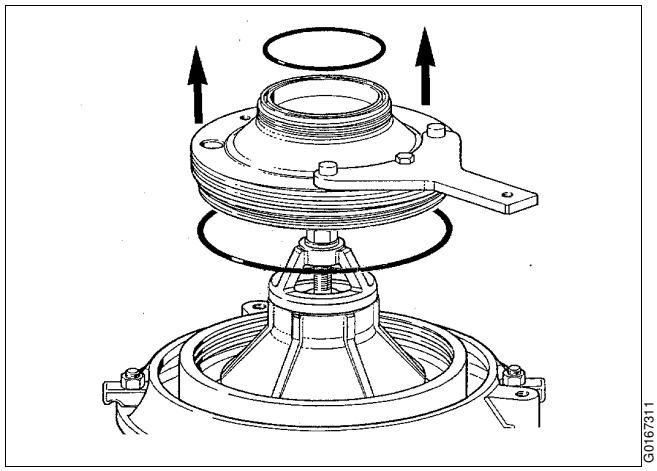
NOTE
Use the compression tool as instructed.
Use of substitute tools can damage the equipment.

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

   Left-hand thread!



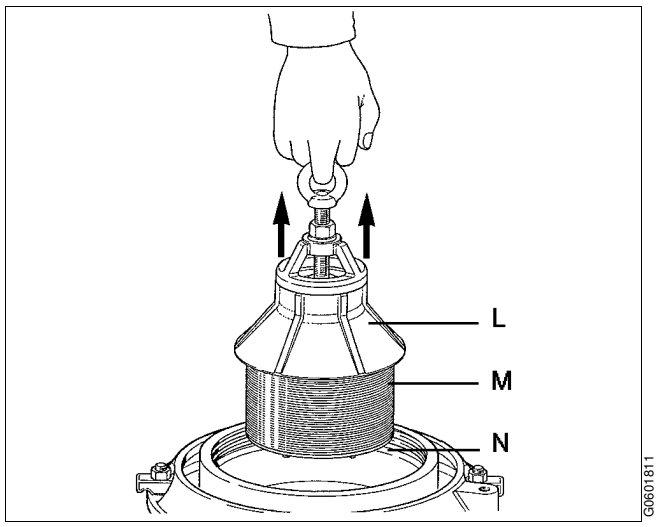
10. Lift off the bowl hood with the spanner still attached.



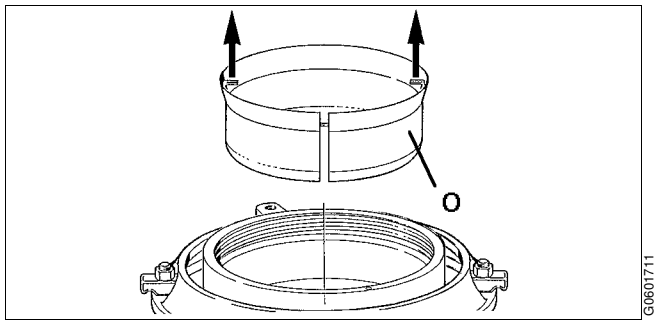
11. Lift out top disc (L), bowl discs (M) and distributor (N).

12. Remove the disc stack from the compression tool.

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

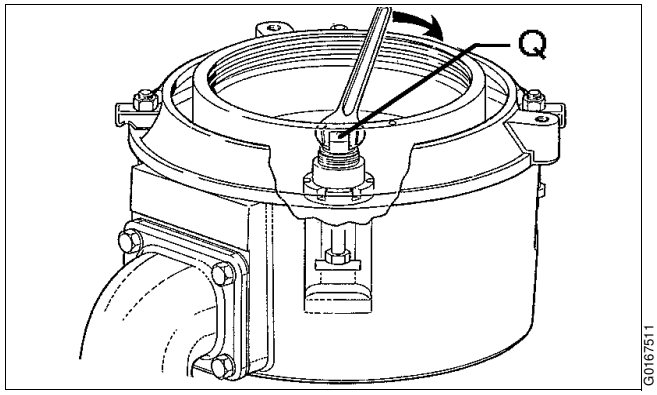


13. Lift out the sludge basket (O).

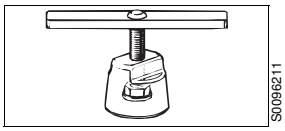


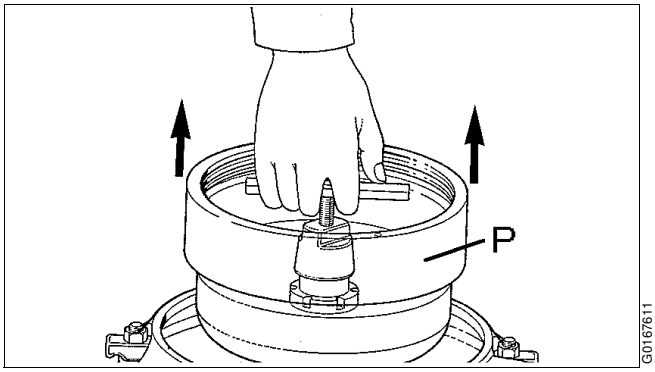
14. Unscrew cap nut (Q).

    Left-hand thread!



15. Lift out bowl body (P) using the special tool.





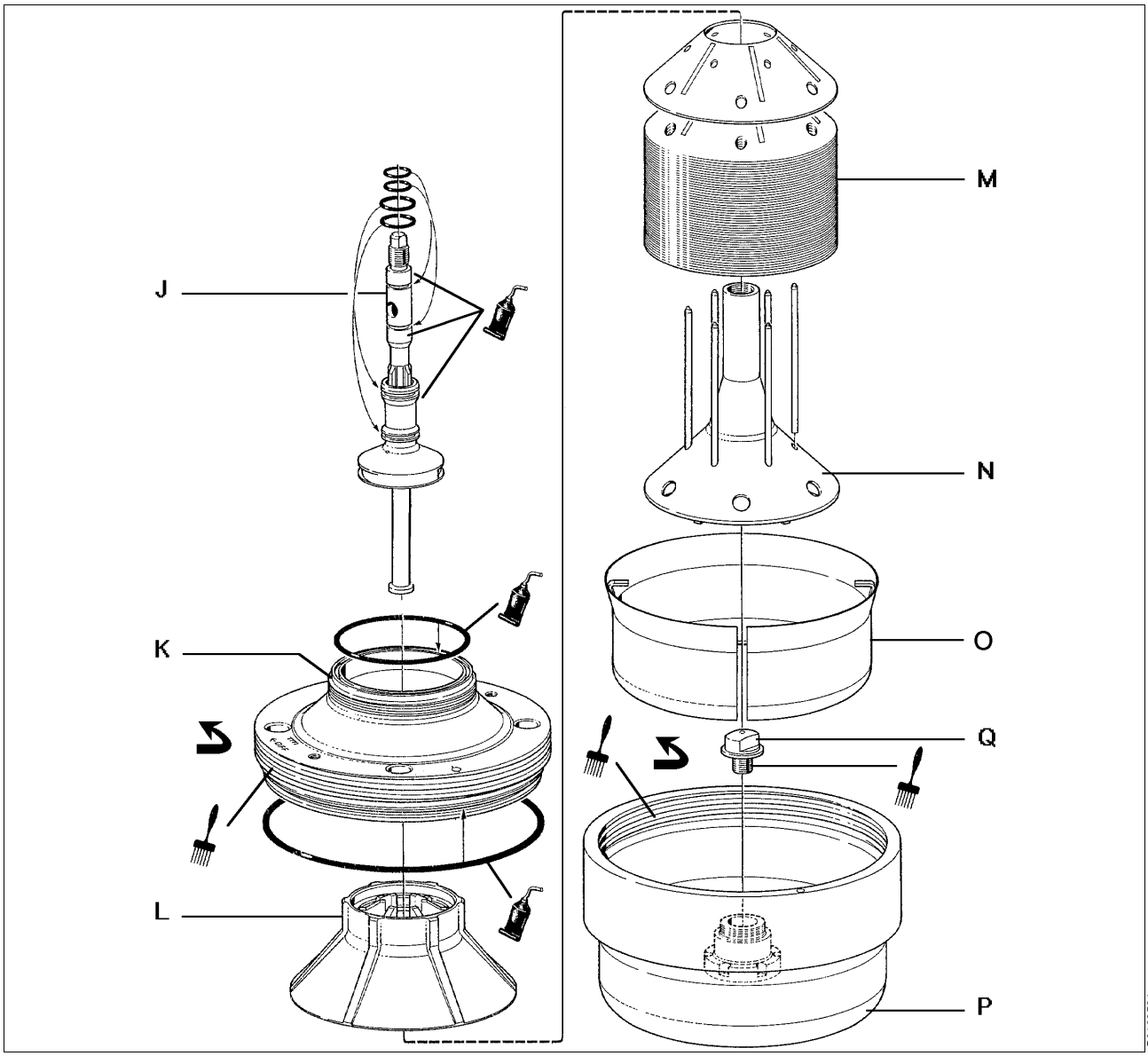
- Ease the bowl body off with the central screw of the tool. If necessary, knock on the handle.
- Soak and clean all parts thoroughly in suitable cleaning agent, see “5.7.1 Cleaning agents” on page 64.
- Remove O-rings and replace them with spares from the intermediate service kit (IS).

✔ **Check points**
“5.3.1 Corrosion” on page 50,
“5.3.2 Erosion” on page 52,
“5.3.3 Cracks” on page 53.

6.1.2 Inlet/outlet and bowl – assembly

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

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



J	*Inlet pipe*	*N*	*Distributor*
K	*Bowl hood*	*O*	*Sludge basket*
L	*Top disc*	*P*	*Bowl body*
M	*Bowl discs*	*Q*	*Cap nut*

Left-hand thread

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

Silicone grease (thin layer)

A Safety device
B Nut
C Inlet housing
D Outlet housing
E Frame hood (incl. connecting housing)
F Lock ring
G Gravity disc/clarifier disc
H Leader cone
I Paring chamber cover

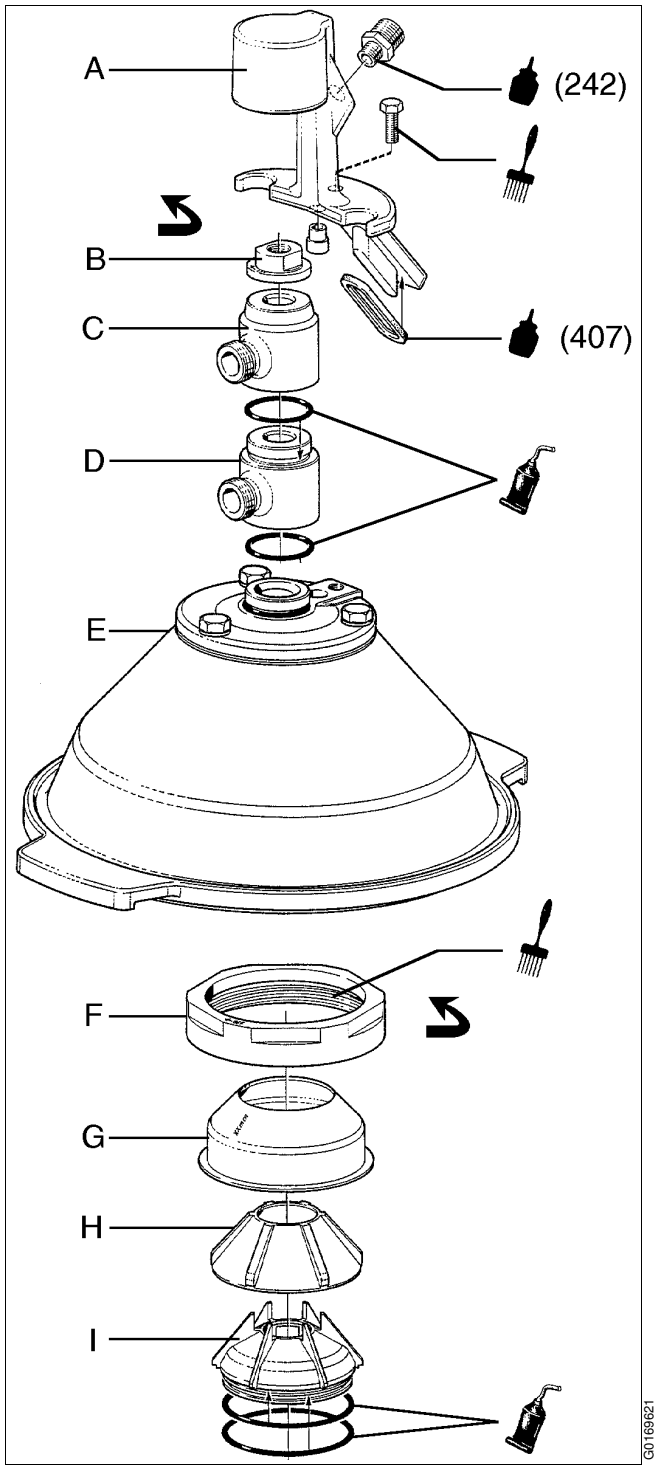
Left-hand thread

Loctite 242/407

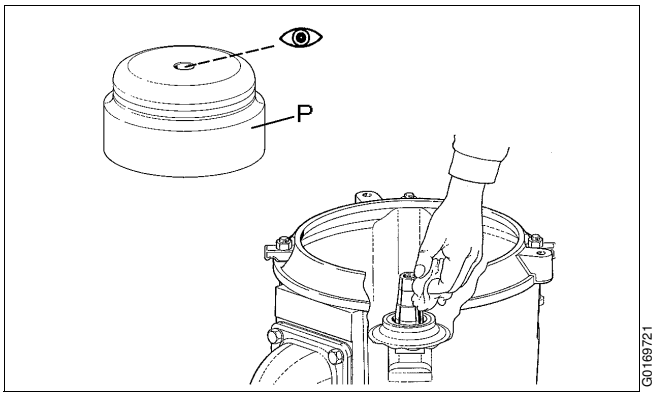
Silicone grease (thin layer)

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

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



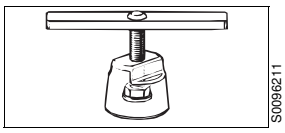
1. Wipe clean the spindle top and nave bore in bowl body (P). Apply oil to the tapered end of the spindle, smear the oil over the surface and wipe off surplus with a clean cloth.

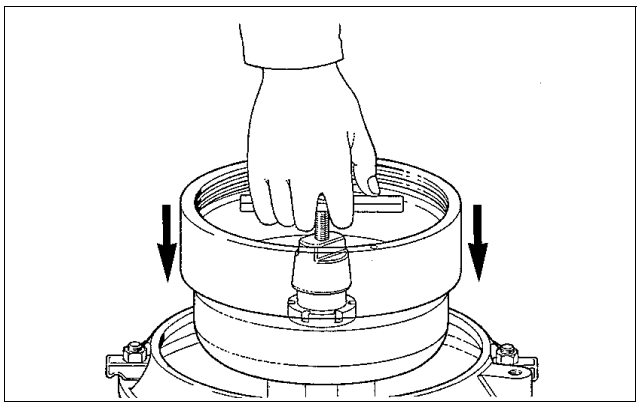


✔ **Check point**
"5.3.5 Spindle top cone and bowl body nave" on page 55.

2. Fit the bowl body on the spindle. Avoid damaging the spindle cone.

   a. Attach the special "Lifting tool" to the bowl body nave.



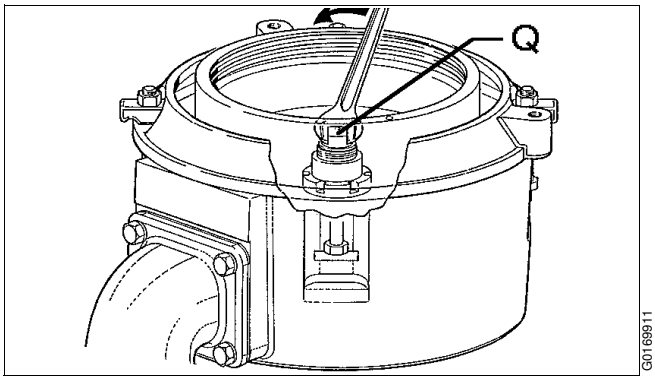


   b. Screw down the central screw of the tool, then lower the bowl body until the screw rests on the spindle top.

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

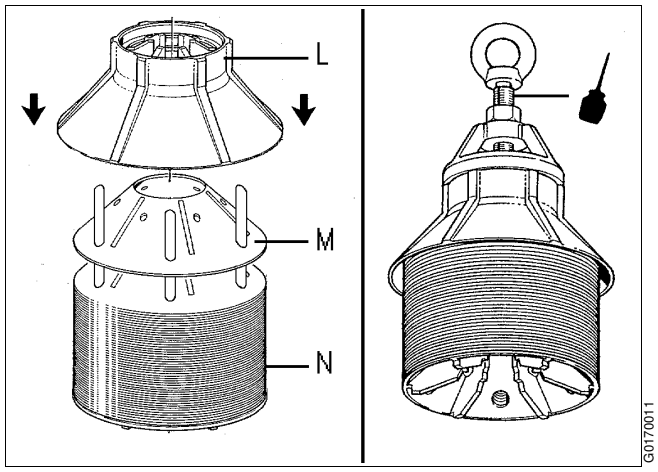
3. Screw cap nut (Q) counter-clockwise onto the spindle. Tighten firmly.

   Left-hand thread!



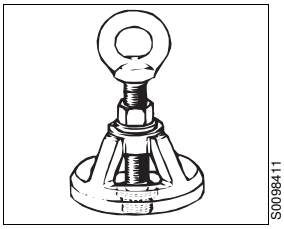
✔ **Check point**
Before assembling the bowl discs, check the threads of the bowl hood and bowl body, see "5.3.6 Threads on bowl hood and bowl body" on page 56.

4. Assemble bowl discs (M) with top disc (L) and distributor (N). Make sure that the pins in the distributor fit properly into the holes of the top disc.



5. Fit the “Compression tool” and screw down the central screw until it stops.

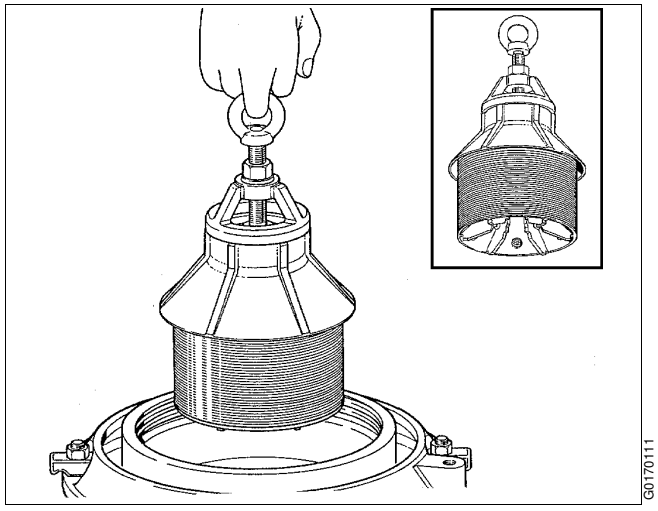
   Compress the disc stack by tightening the nut firmly.



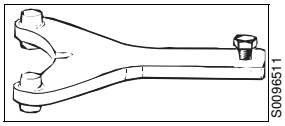
Oil

NOTE
Use the compression tool as instructed. Use of substitute tools can damage the equipment.

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



7. Fit the special “Spanner for the bowl hood” to the bowl hood (K) and tighten the securing bolt.

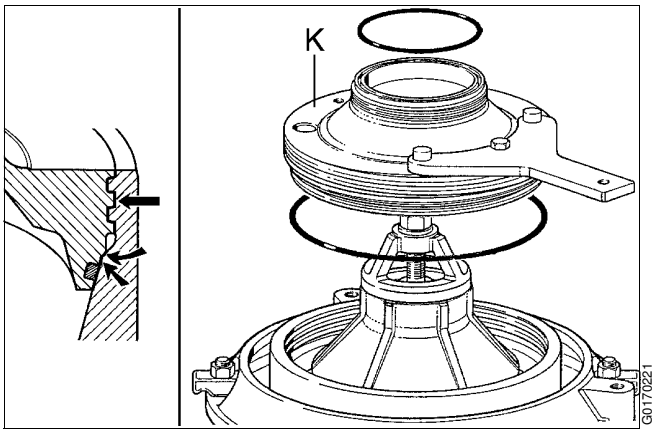


Install the bowl hood:

– Apply a thin layer of Molykote Paste 1000 to the threads and on contact and locating surfaces. Do not forget the ribs on top disc.

– Screw on the bowl hood by hand.

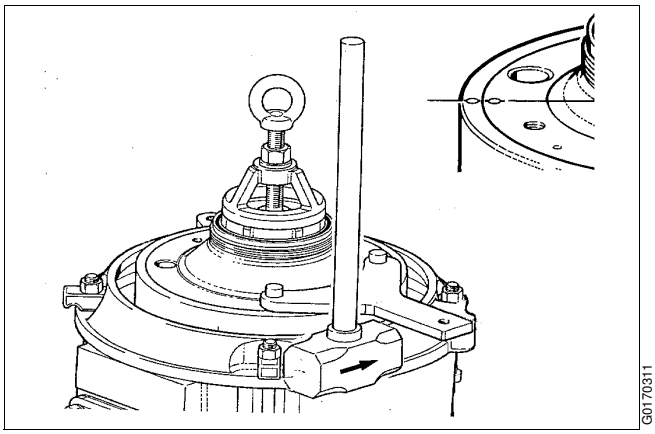
Left-hand thread!



✔ **Check point**
“5.3.7 Disc stack pressure” on page 58.

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

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



WARNING

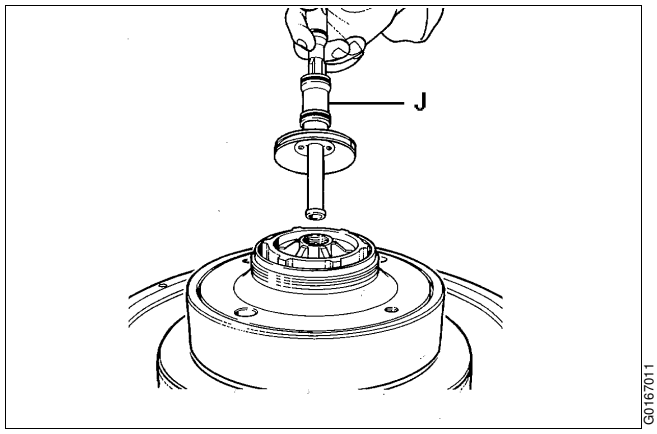
Disintegration hazard

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

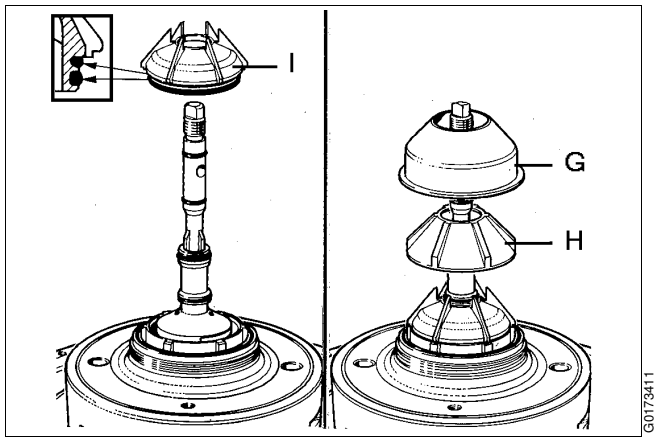
✔ **Check point**
“5.3.6 Threads on bowl hood and bowl body” on page 56.

9. Place inlet pipe (J) in the bowl.

✔ **Check point**
"5.3.4 Threads of inlet pipe, paring disc" on page 54.



10. Fit paring chamber cover (I) by pressing it down gently.
11. Assemble leader cone (H) and gravity disc/ clarifier disc (G).

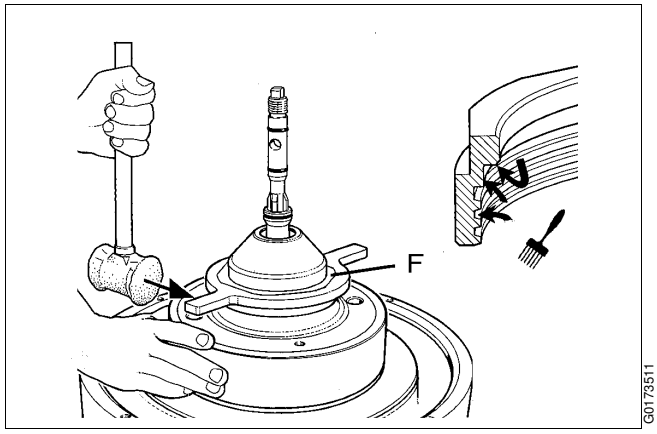


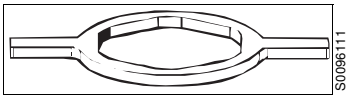
12. Fit lock ring (F).

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

    Left-hand thread!

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

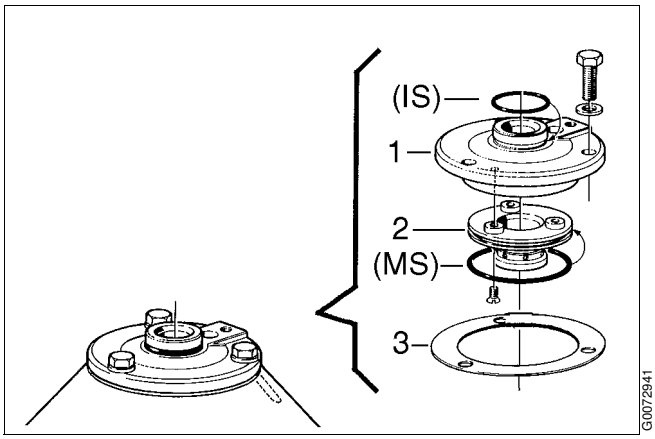




13. Fit frame hood (E).

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

✔ **Check point**
"5.4.1 Paring disc height adjustment" on page 59. To be performed at Major Service and if the bowl spindle has been dismantled.



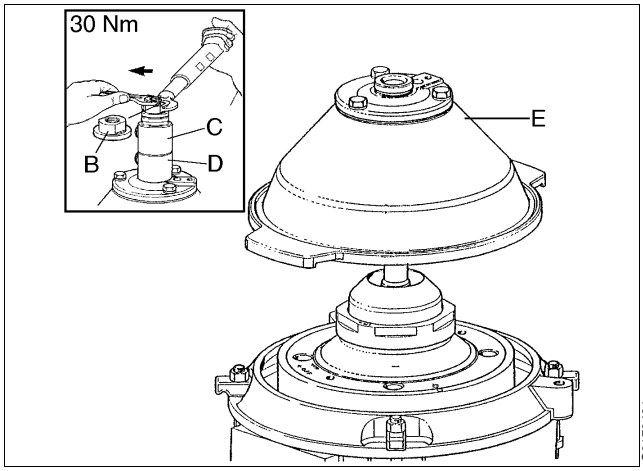
1. Connecting housing
2. Insert
3. Height adjusting ring(s)

14. Fit inlet/outlet housing (C and D).

    Tighten nut (B).

    Left-hand thread!

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



    Then rotate the bowl by means of the flat belt.

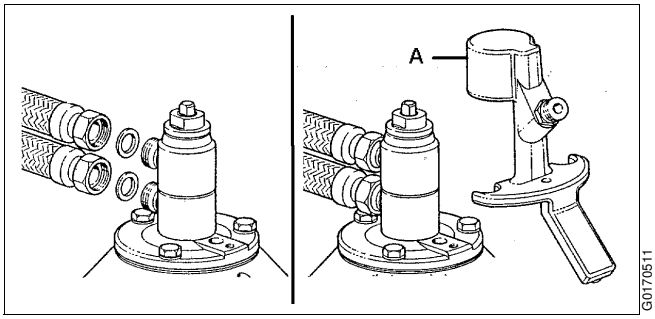
    If the bowl does not rotate freely or a scraping noise is heard, incorrect bowl assembly or incorrect height adjustment of the paring disc can be the cause.

15. Fit the cover on the frame bottom part if it has been removed.

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

    Fit and secure safety device (A).

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



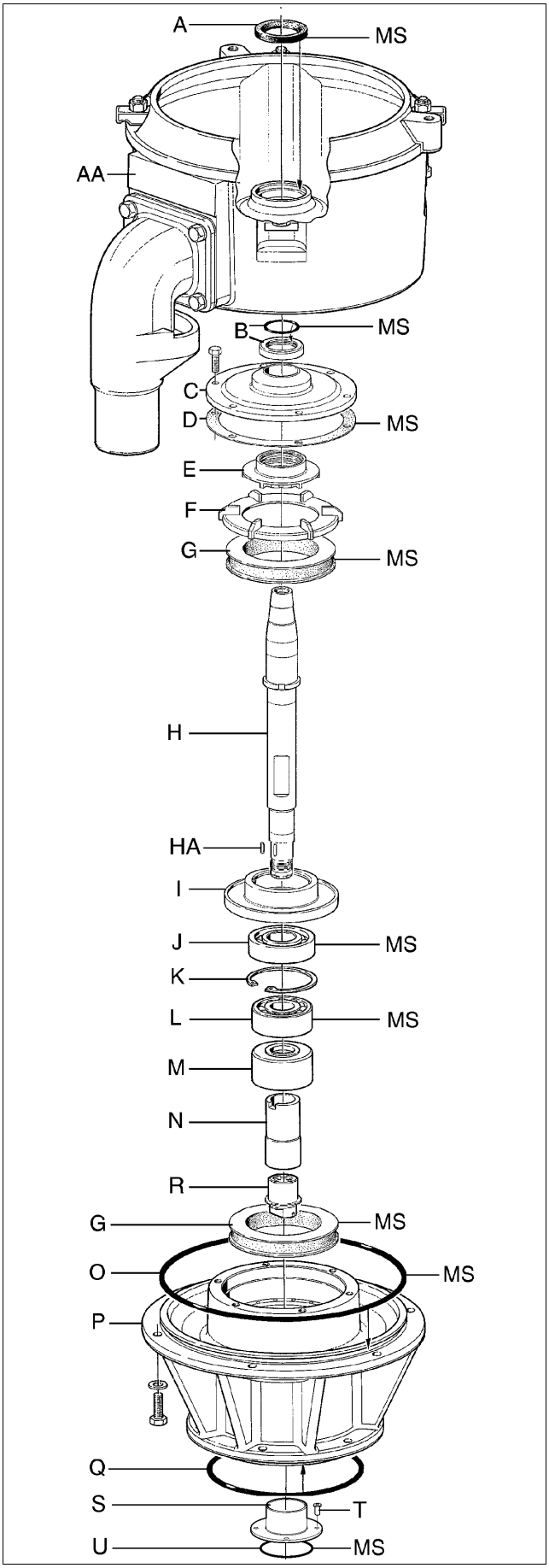
6.2 Bowl spindle and frame

6.2.1 Bowl spindle and frame – dismantling

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

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

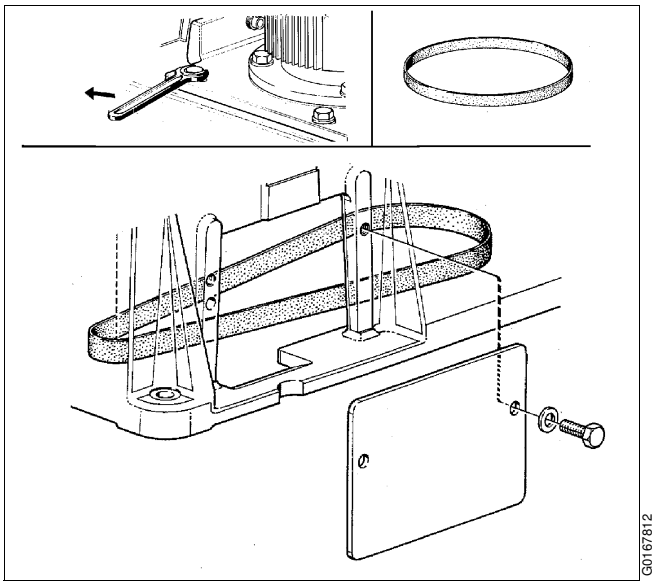
✔ **Check point**
"5.4.2 Radial wobble of bowl spindle" on page 60.



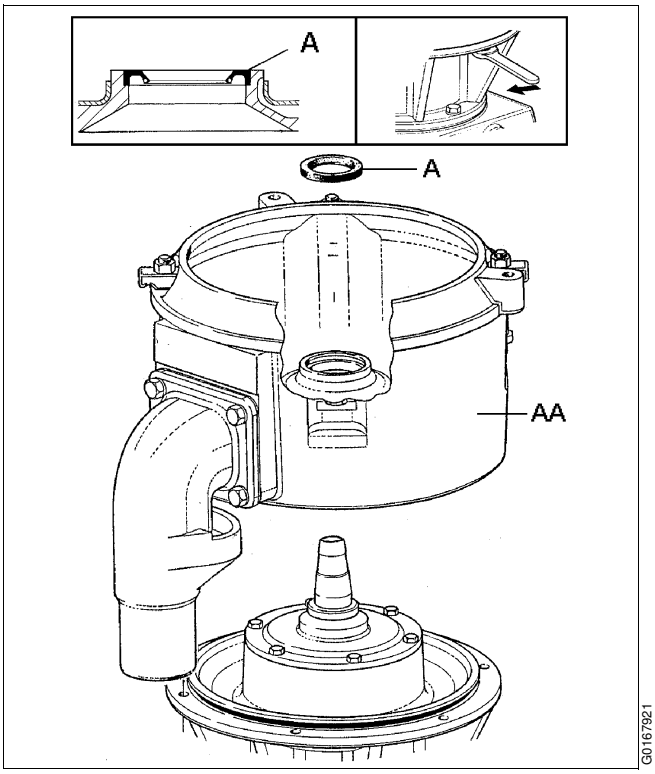
A Seal ring
AA Frame top part
B Deflector ring/O-ring
C Top bearing cover
D Gasket
E Fan
F Buffer holder
G Rubber buffers
H Bowl spindle
HA Flat key
I Ball bearing holder
J Ball bearing
K Snap ring
L Ball bearing
M Oil pump
N Belt pulley
O O-ring
P Frame, intermediate part
Q O-ring
R Nut
S Sleeve
T Screw
U O-ring

MS Parts to be renewed at Major Service

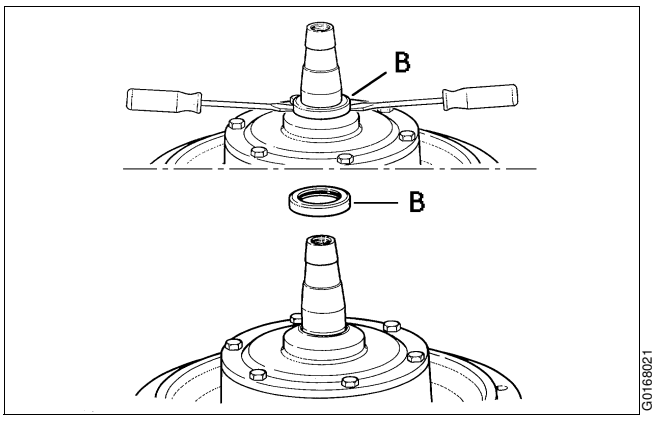
1. Loosen but do not remove the motor adapter screws. Remove the cover from the frame bottom part. Remove the flat belt.



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

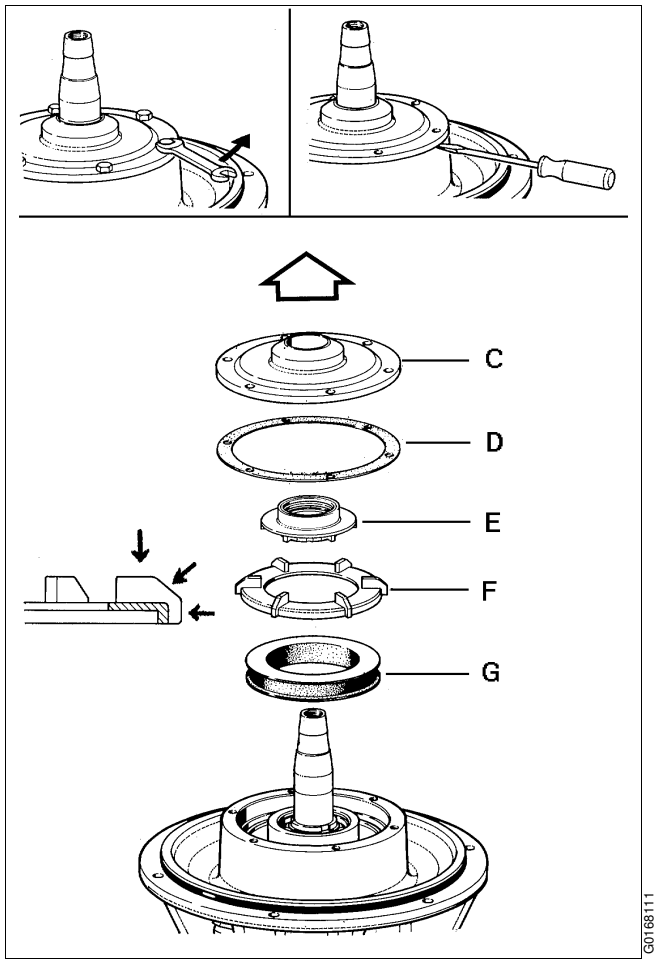


3. Clean the bowl spindle cone in place and remove deflector ring (B).



4. Remove, in the following sequence:
   - Top bearing cover (C)
   - Gasket (D)
   - Fan (E)
   - Buffer holder (F)
   - Rubber buffer (G)

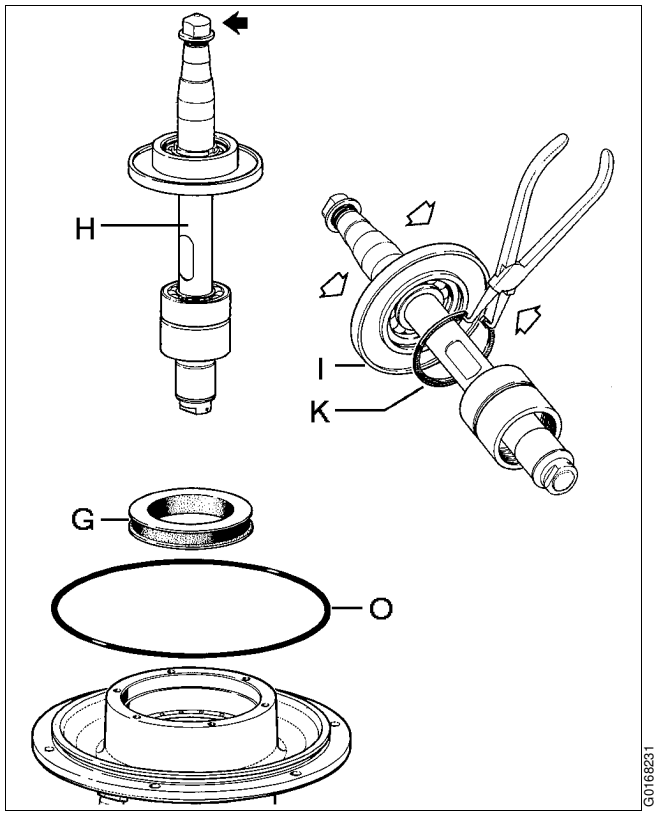
NOTE
Be very careful not to damage the wings of the buffer holder.



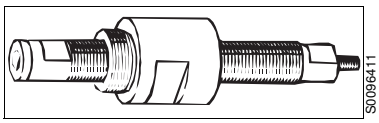
5. Screw the cap nut (left-hand thread) onto the spindle top to protect the top and bore.

   Lift out spindle assembly (H), rubber buffer (G) and O-ring (O).

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



6. Clamp the bowl spindle (H) in a screw vice. Remove the nut (R) and lift off the belt pulley (N). If the pulley has stuck, lubricate and fit the special “Mounting and dismantling tool” (1).

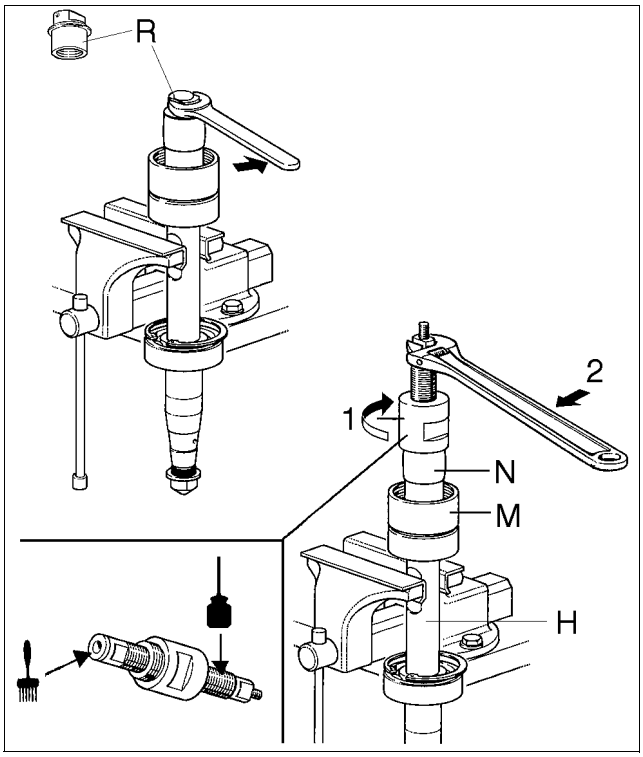


Use a long spanner (450-650 mm) to press belt pulley (N) off the spindle (H).

Remove oil pump (M) by hand, do not loos the flat key.

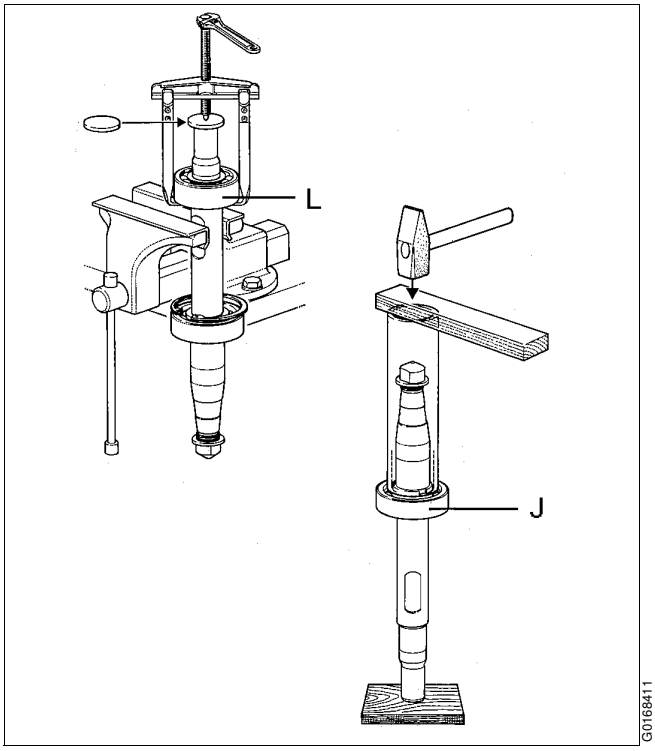
Molykote 1000 Paste
(thin layer to be rubbed into surface)

Oil



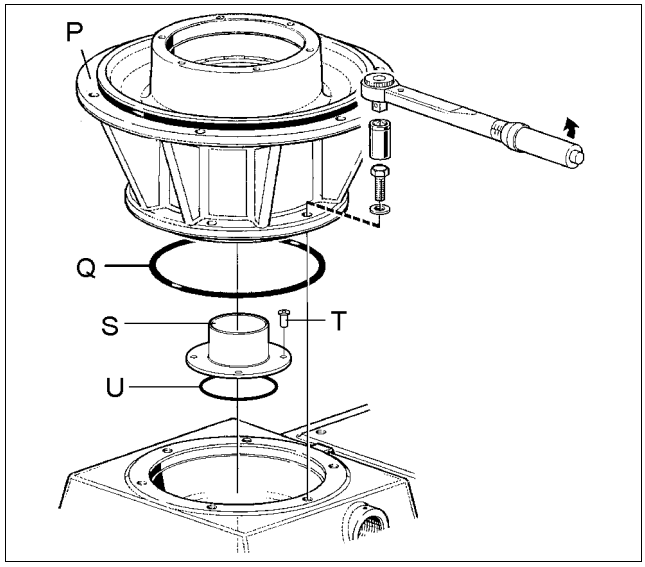
7. Pull off ball bearing (L) using a puller and thrust washer. Pull off bearing (j) using the “driving off tool” and a hammer.

NOTE
Always discard a used bearing.



8. Lift off frame intermediate part (P).
9. **In case of 3-year service**: discard the O-ring (Q). This O-ring is not included in any service kit, but must be ordered separately.
10. Unscrew the screws (T) and remove sleeve (S) and O-ring (U).
11. Clean the oil sump.
12. Clean all dismantled parts thoroughly in a degreasing agent and check for damage and corrosion.

    Replace all parts supplied in the spare parts kits.



6.2.2 Bowl spindle and frame – assembly

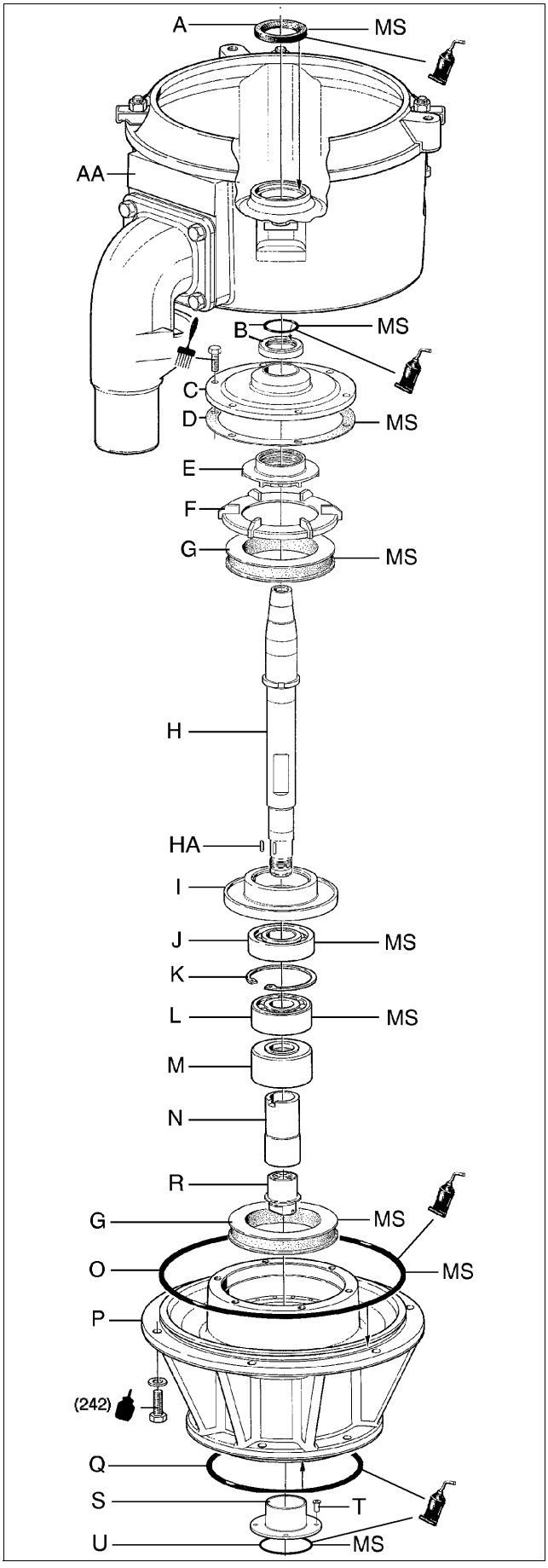
A Seal ring
AA Frame top part
B Deflector ring/O-ring
C Top bearing cover
D Gasket
E Fan
F Buffer holder
G Rubber buffers
H Bowl spindle
HA Flat key
I Ball bearing holder
J Ball bearing
K Snap ring
L Ball bearing
M Oil pump
N Belt pulley
O O-ring
P Frame, intermediate part
Q O-ring
R Nut
S Sleeve
T Screw
U O-ring

MS Parts to be renewed at Major Service

Loctite 242

Silicone grease (thin layer)

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

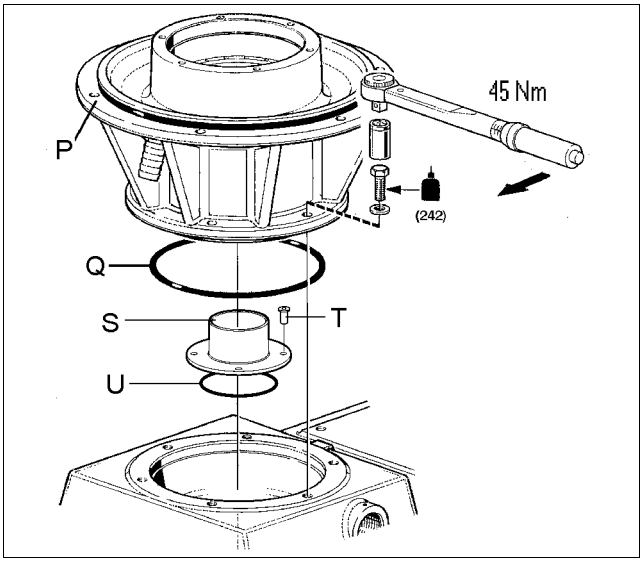


1. Fit O-ring (U) and sleeve (S) with screws (T).
2. Assemble the frame intermediate part (P). **In case of 3-year service:** Fit a new O-ring (Q).

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

   Secure the screws with Loctite 242.

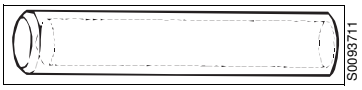
Loctite 242

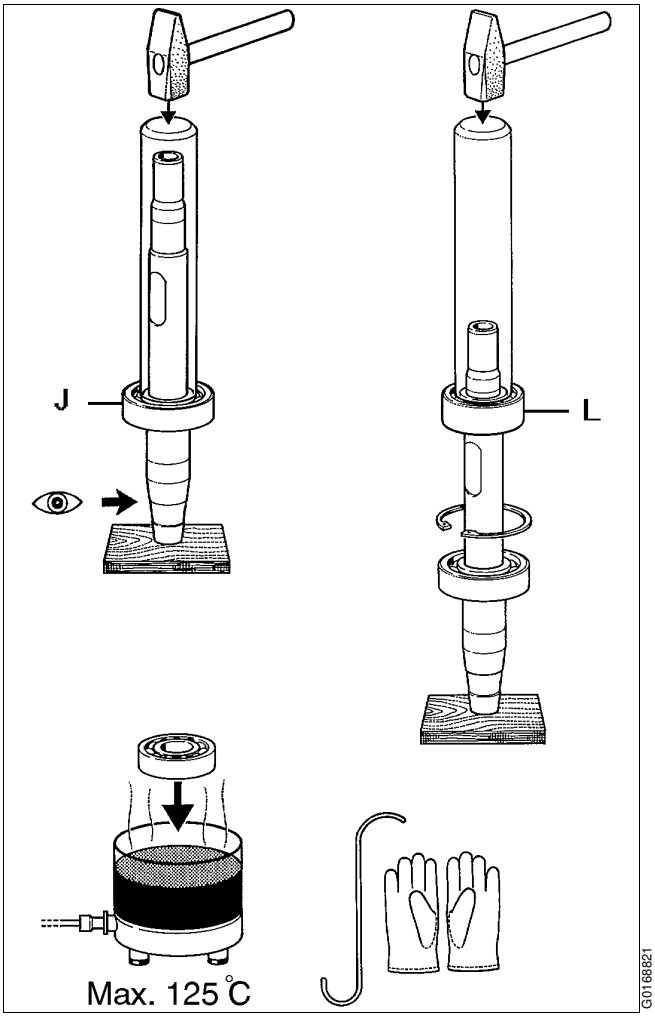


3. Inspect the tapered end of the bowl spindle.

   Assemble ball bearings (J and L).

   Heat the **new** ball bearings in oil to maximum 125 °C. Use the special “Mounting tool” from the tool kit.



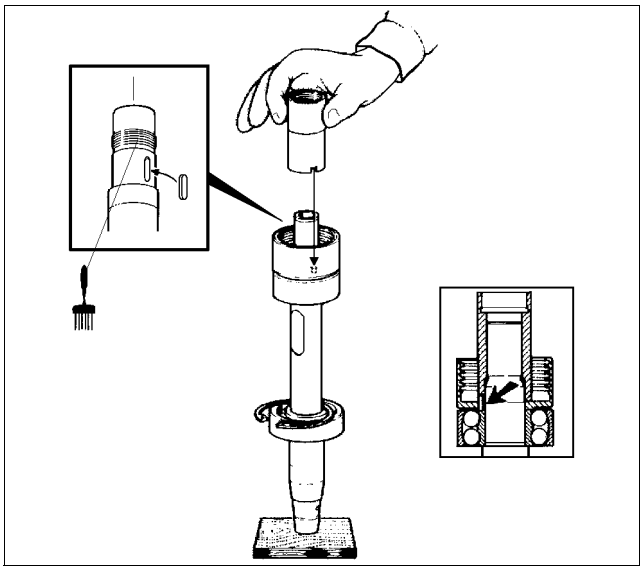


NOTE

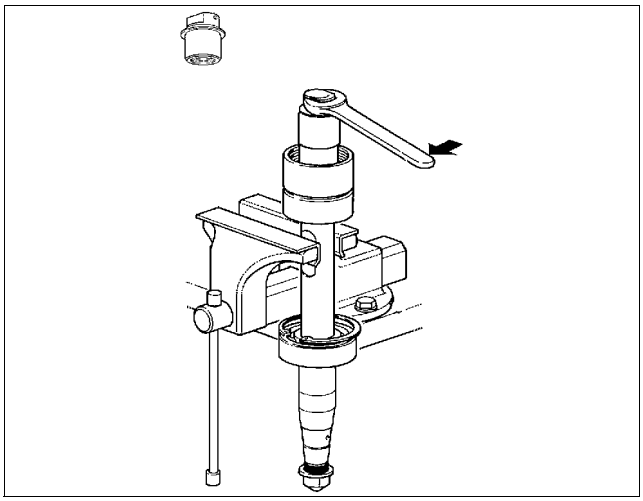
Always fit **new** bearings.

If in doubt how to install roller bearings in a correct way, please see the detailed description in “5.10.1 Ball and roller bearings” on page 69.

4. Fit oil pump (M) and belt pulley (N), do not forget the flat key. Make sure that the recess in the belt pulley fits over the guide pin in the oil pump.



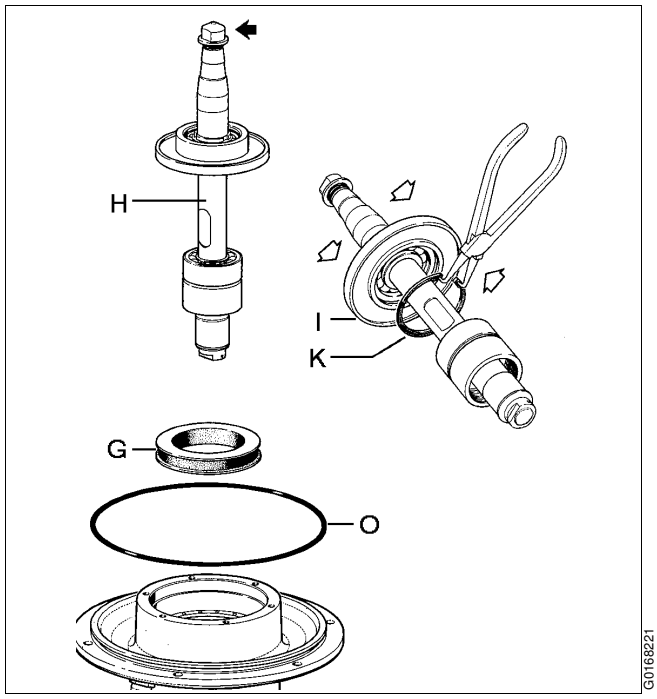
5. Fit the nut and tighten it.



6. Fit ball bearing holder (I) and secure it with snap ring (K).

   Fit O-ring (O) and rubber buffer (G).

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



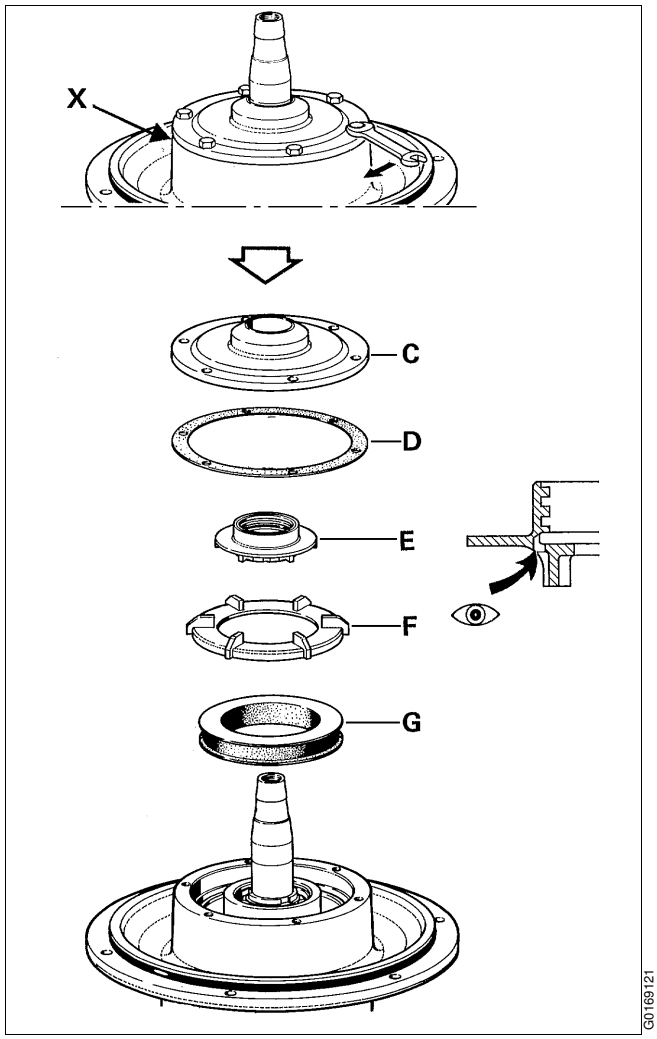
7. Assemble, in the following sequence:

   – Rubber buffer (G)
   – Buffer holder (F)
   – Fan (E)
   – Gasket (D)
   – Top bearing cover (C)

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

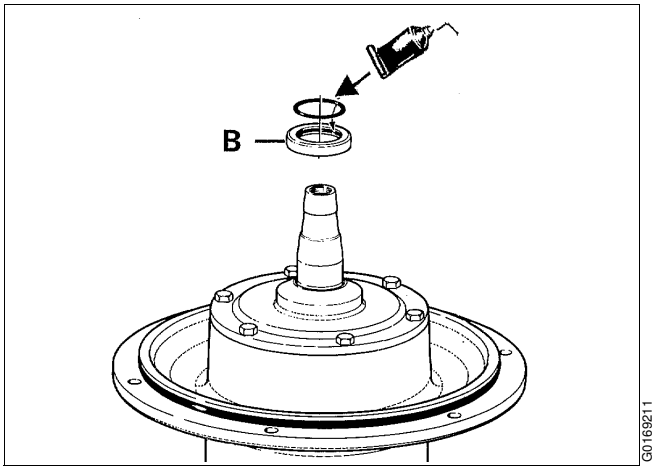
   Before tightening, make sure that there is some play (X) between top bearing cover (C) and the frame. The play will disappear when the screws are tightened.

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



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

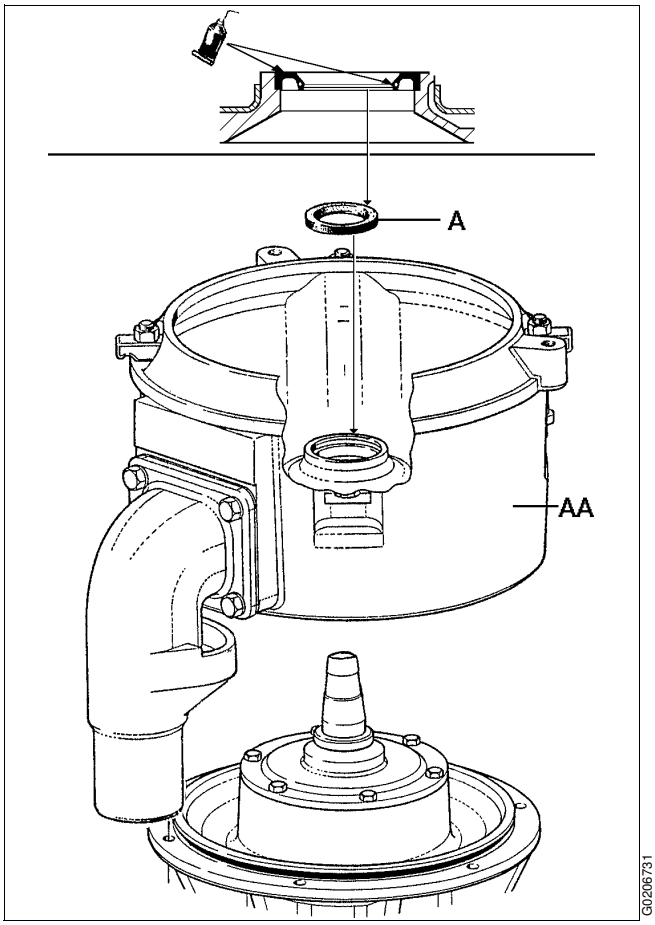
Silicone grease (thin layer)



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

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

   When frame top part (AA) is assembled there shall be a small gap between the bowl spindle and the lip seal (A).

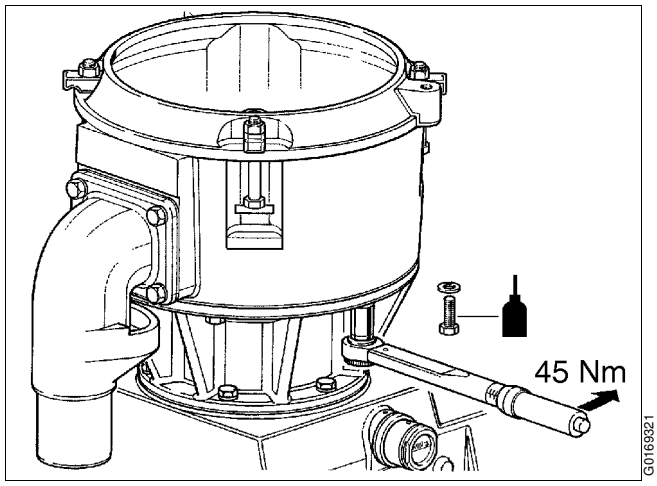


10. Tighten the screws of the top frame using a torque wrench.

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

    Secure the screws with Loctite 242.

Loctite 242



11. Fit and adjust the flat belt, see “6.4.1 Change of belt” on page 107.

✔ **Check point**
“5.4.2 Radial wobble of bowl spindle” on page 60.

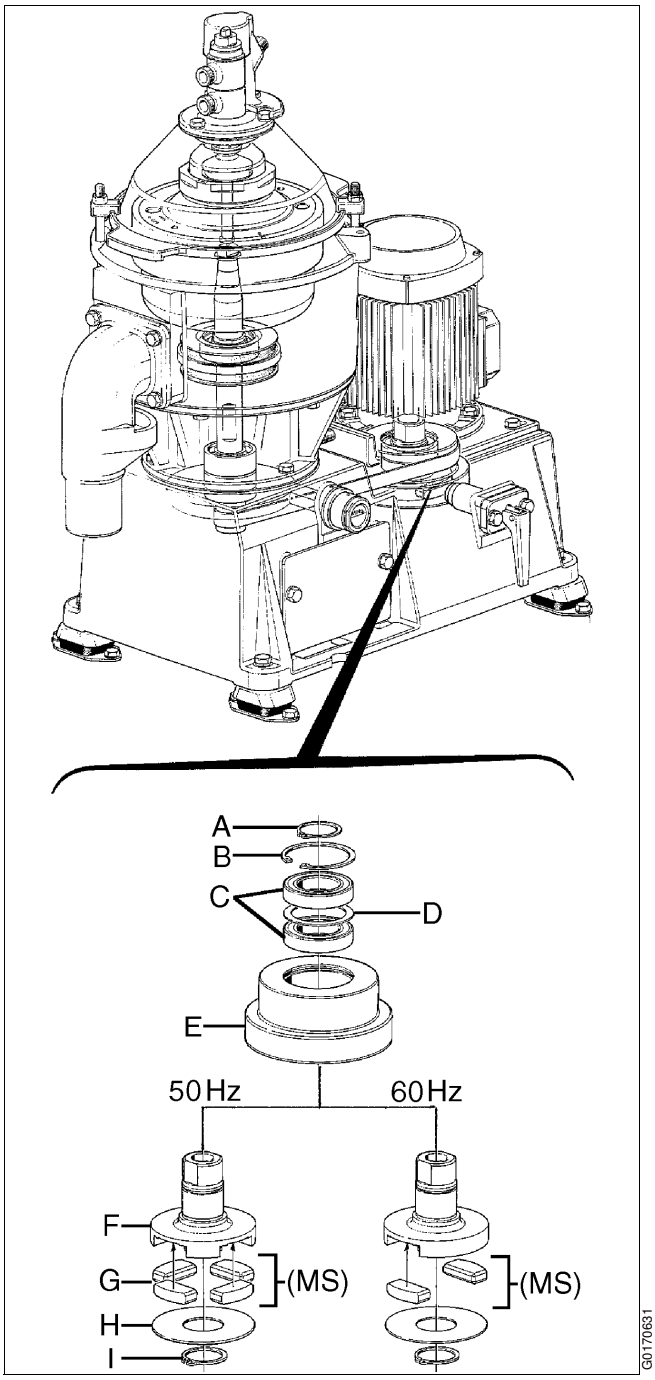
6.3 Friction coupling

If the separator does not attain full speed within about 2,5 minutes, the friction elements or the coupling may be worn or greasy. The friction elements must then be replaced with new ones or be thoroughly cleaned from grease.

WARNING

Entrapment hazards

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

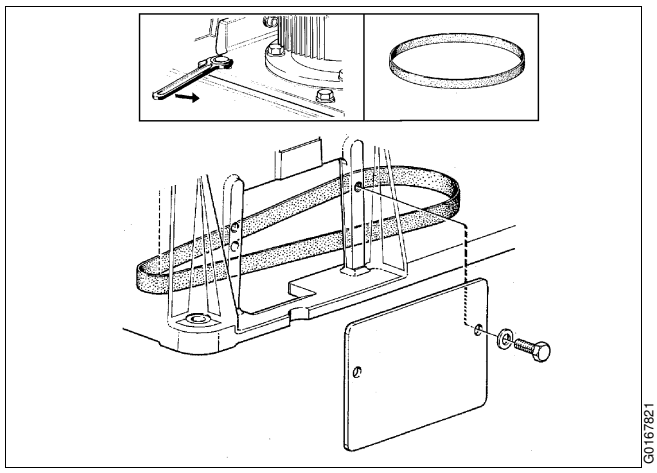


A Snap ring
B Snap ring
C Ball bearings
D Washer
E Belt pulley
F Coupling hub
G Friction element
H Cover
I Snap ring

(MS) =Set of friction elements included in the Major Service Kit

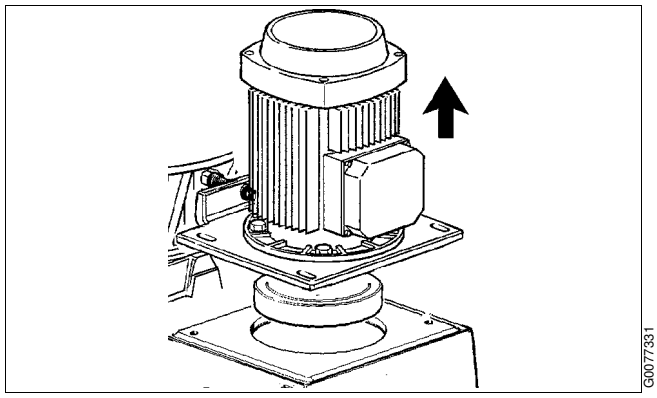
6.3.1 Friction coupling – dismantling

1. Check that the belt tightener is in backward position.
2. Remove the motor adapter screws.
3. Remove the side cover from the frame bottom part.
4. Loosen but do not remove the two screws securing the brake.
5. Remove the flat belt.



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

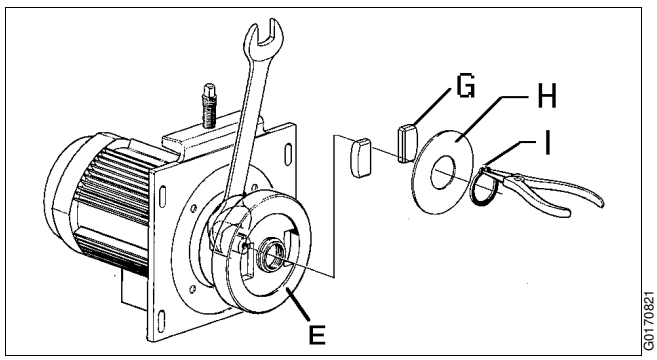
   Weight of motor including adapter and friction coupling is not more than 20 kg.



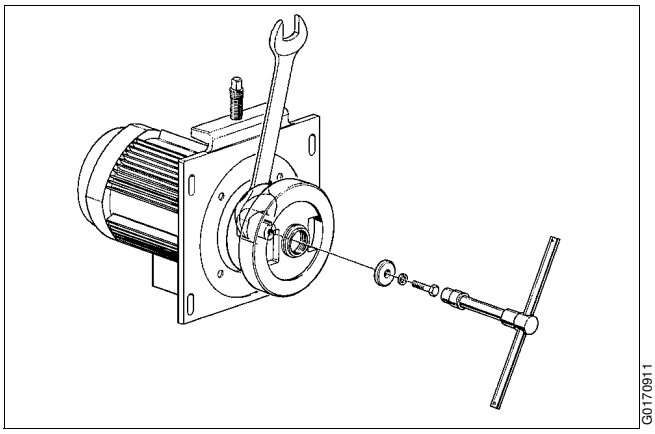
7. Remove snap ring (I), cover (H) and friction elements (G).

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

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



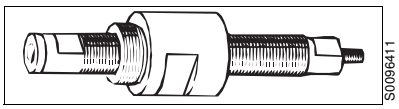
8. Remove the screw, spring washer and washer from the friction coupling.



Complete dismantling of the friction coupling

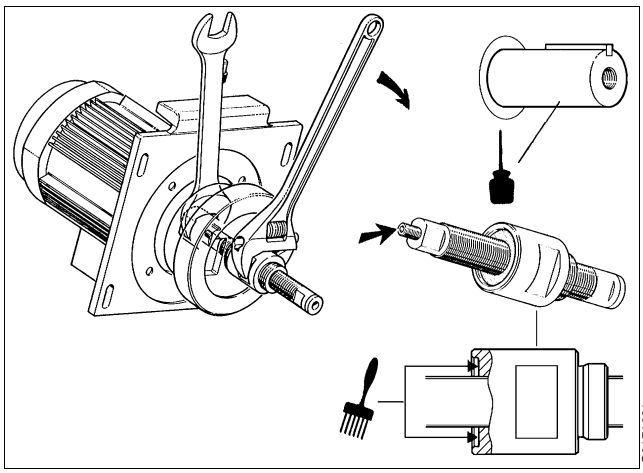
9. Lubricate and fit the special “Mounting and dismantling tool”.

   Ease off the coupling.

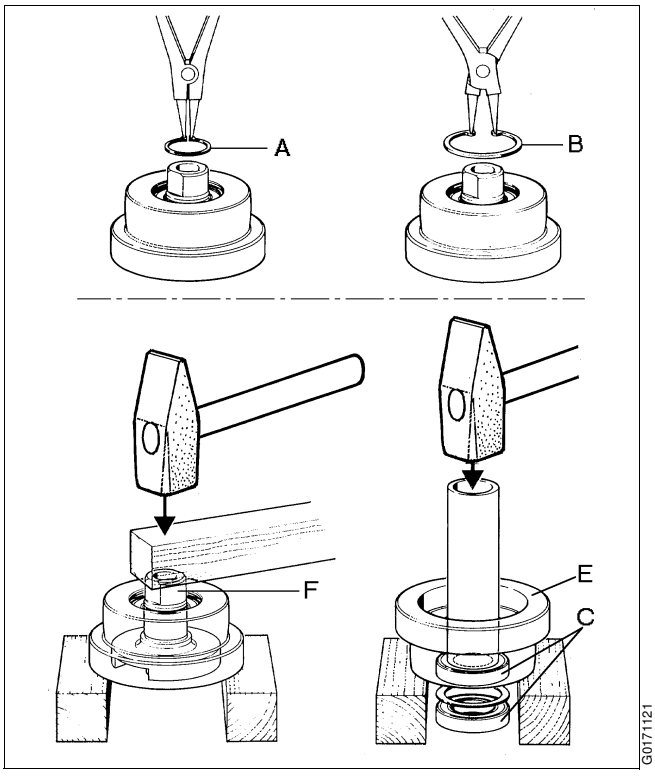


Molykote 1000 Paste
(thin layer to be rubbed into surface)

Oil



10. Remove snap rings (A and B) and drive off coupling hub (F). Turn the coupling, i.e. belt pulley (E) with bearings (C), the other way round and drive off the ball bearings and washer, using a tube.



NOTE
Always discard a used bearing.

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

6.3.2 Friction coupling – assembly

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

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

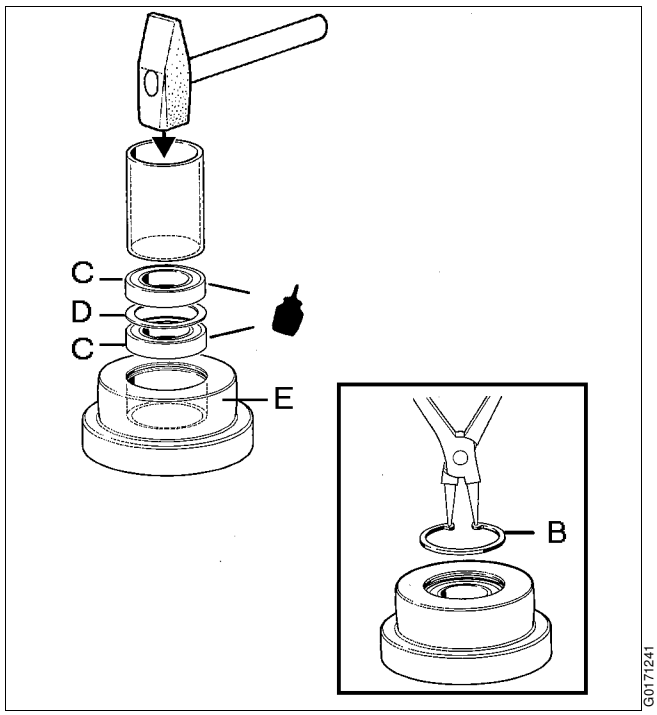
   Apply Loctite 641 on the outer surfaces of ball bearings (C).

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

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

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

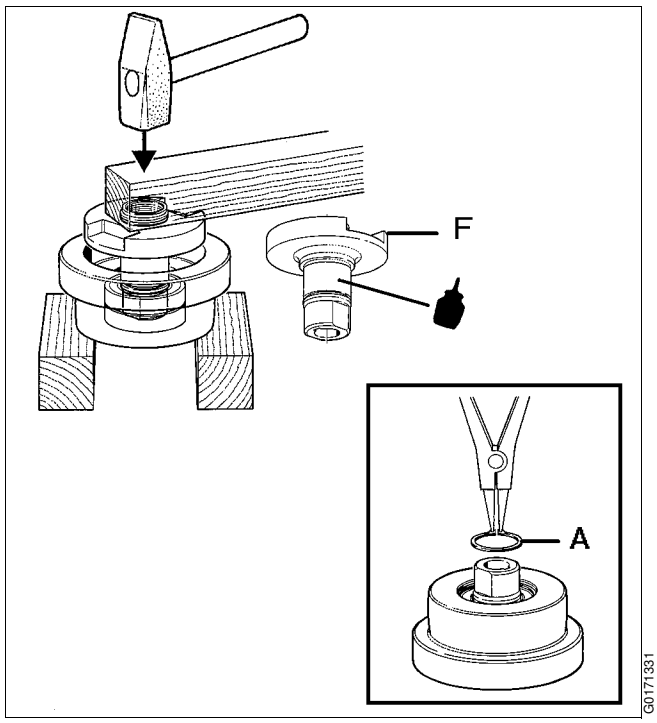
Loctite 641



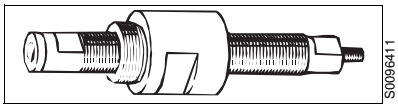
NOTE
Do not refit used bearings.

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

Loctite 641

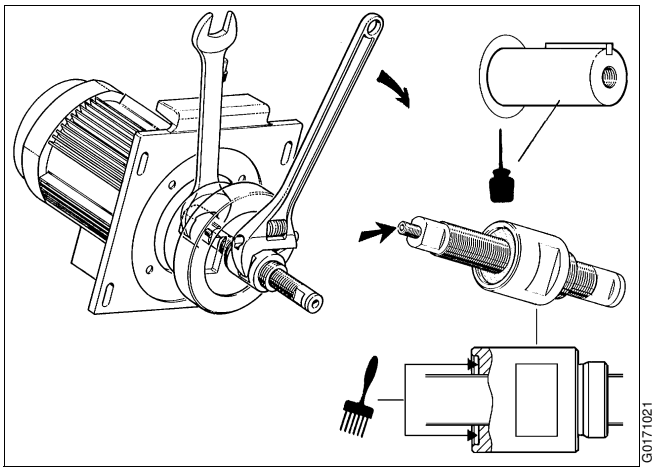


4. Wipe clean the motor shaft and apply a thin oil film on it. Fit the special “Mounting and dismantling tool” to the motor shaft (by means of the small screw on one end of the tool) and press the friction coupling onto the shaft.

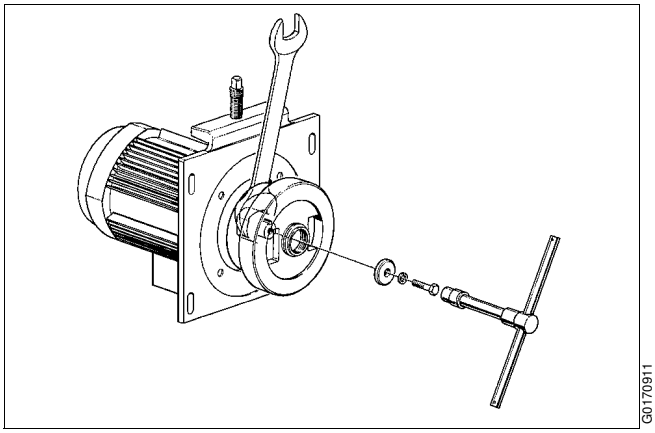


Molykote 1000 Paste
(thin layer to be rubbed into surface)

Oil

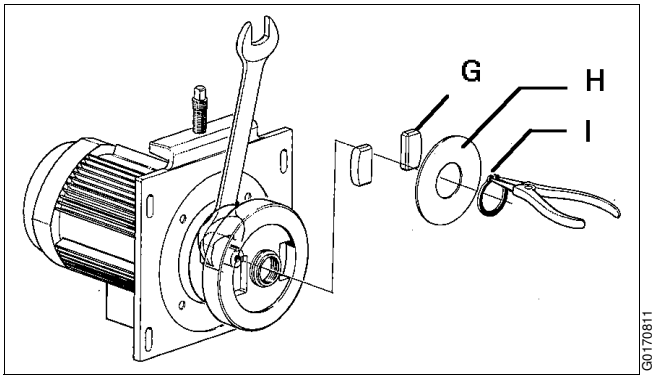


5. Fit the screw with the washer and spring washer to secure the friction coupling.



Assembly of friction elements

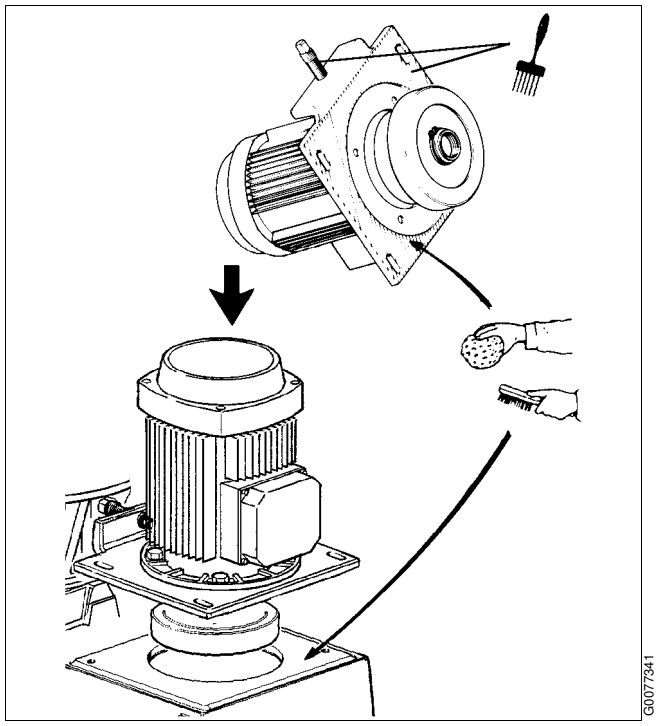
6. Fit new friction elements (G), cover (H) and snap ring (I).
   - A coupling with two friction elements (G) is used for 60 Hz installations.
   - A coupling with four friction elements (G) is used for 50 Hz installations.



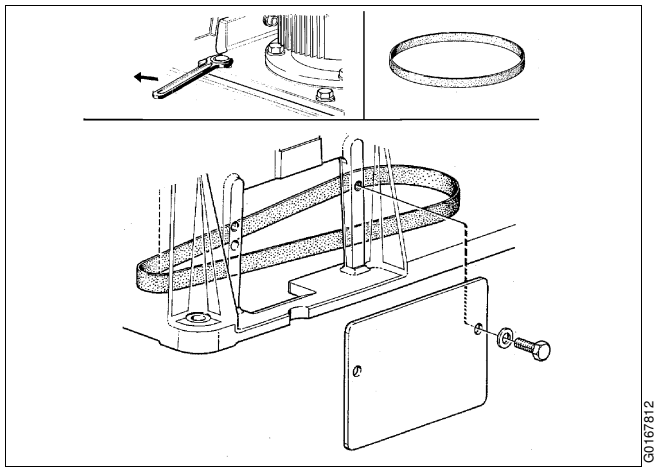
7. Degrease and clean the contact surfaces of frame and motor adapter. Lubricate the contact surfaces with Molykote 1000 paste. Then fit the electric motor with adapter and friction coupling in position.

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

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



8. Fit and tighten the flat belt, see “6.4.1 Change of belt” on page 107.
9. Tighten the brake screws and fit the side cover.



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

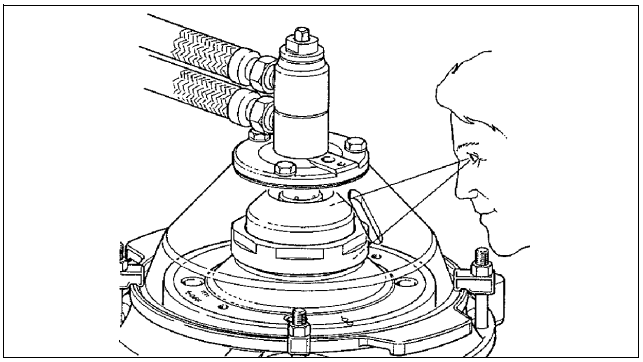
6.4 Flat belt and tightener

WARNING

Entrapment hazards

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

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



6.4.1 Change of belt

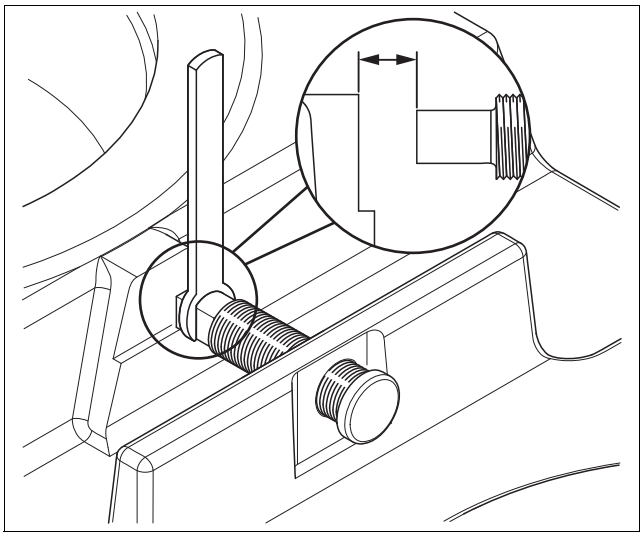
Alfa Laval ref. 9007861, rev. 2

Remove water tank and brake

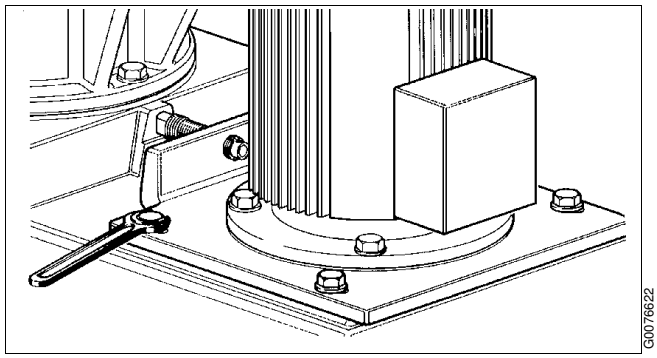
1. Remove the water tank by lowering the back end of the tank and then pulling it out of the frame.
   For separators without water tank: Remove the cover.
2. Remove the brake.

Remove belt

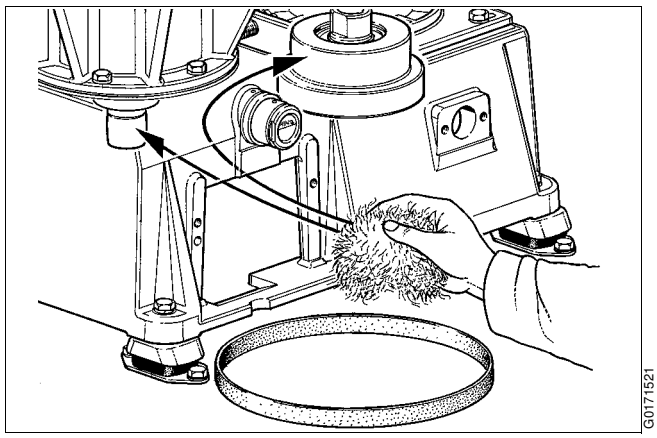
1. Adjust the belt tightener to make sure there is a gap between frame pad and belt tightener.



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



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



NOTE

Make sure there is no dirt, oil or grease on the raceways.

5. Remove the motor adapter screws.
6. Remove the friction coupling.

   Lift the motor together with adapter and friction coupling.

NOTE

The capacity of the lifting equipment should be at least 50 kg.

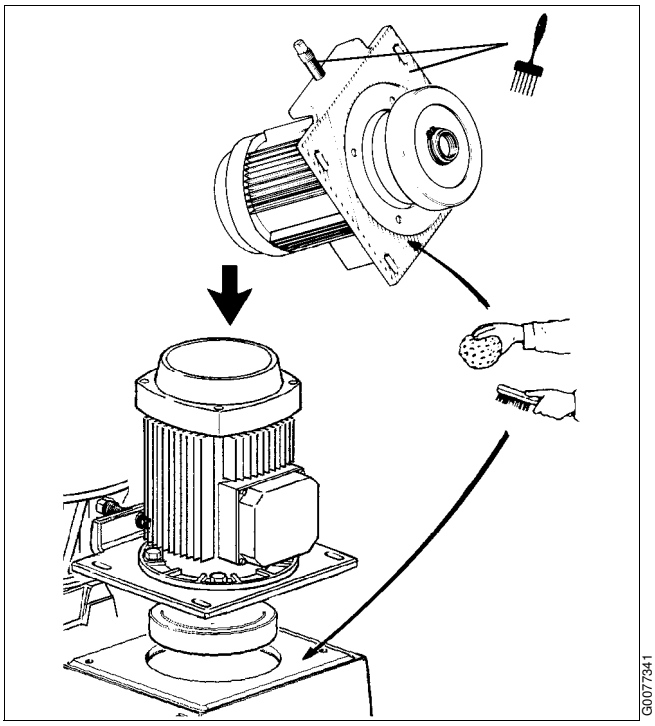
7. Lubricate the adapter and the frame surface.

   Make sure there is a sufficient film of lubricating paste between the adapter and the frame surface.

   For more information regarding lubricants refer to the lubrication instructions for the product.
8. Install motor and friction coupling.
9. Fit the motor adapter screws but do not tighten them.
10. Lubricate the threads of the belt tightener.

    Make sure there is a sufficient film of lubricating paste on the threads of the belt tightener.

    For more information regarding lubricants refer to the lubrication instructions for the product.

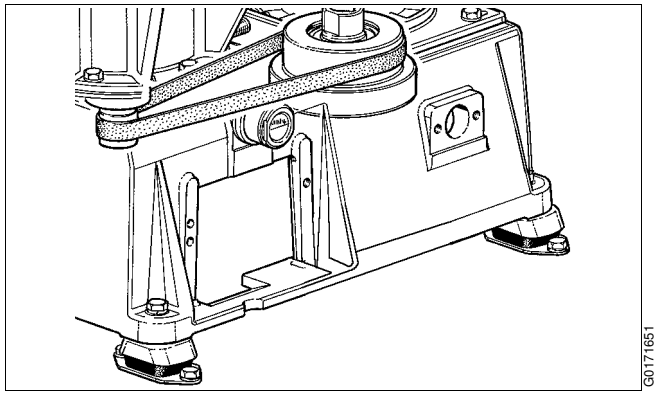


Install belt

1. Assemble the belt on the motor side first and then on to the spindle.

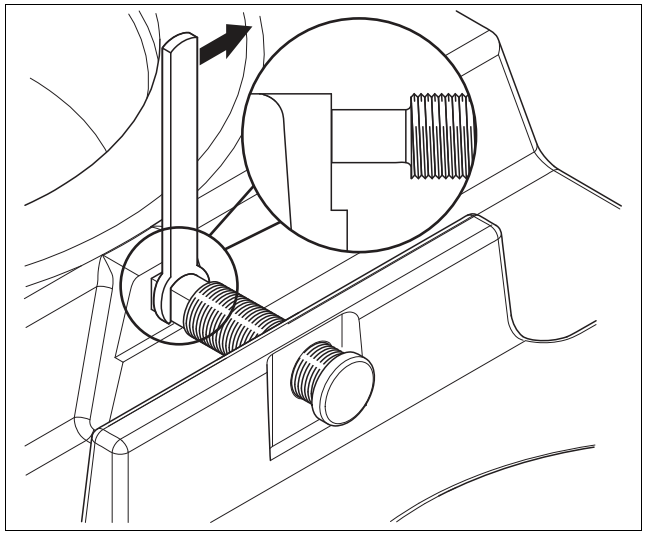
   Tighten the belt by moving the motor backwards by hand.

   Pull the belt around a few turns by hand.

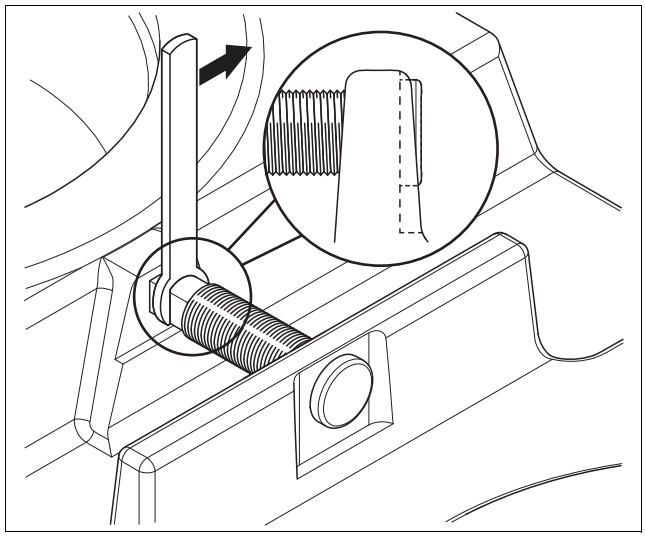


2. Tighten belt.

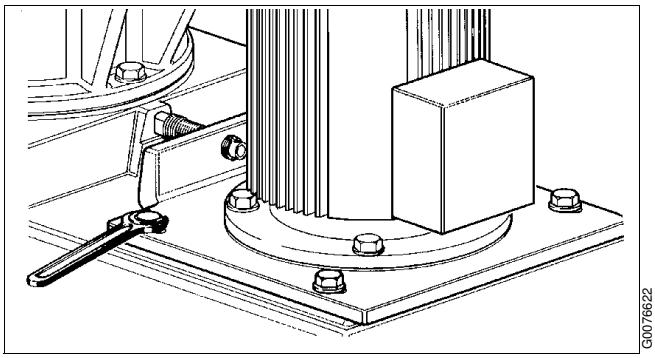
   Rotate the belt tightener until it makes contact with the frame pad.



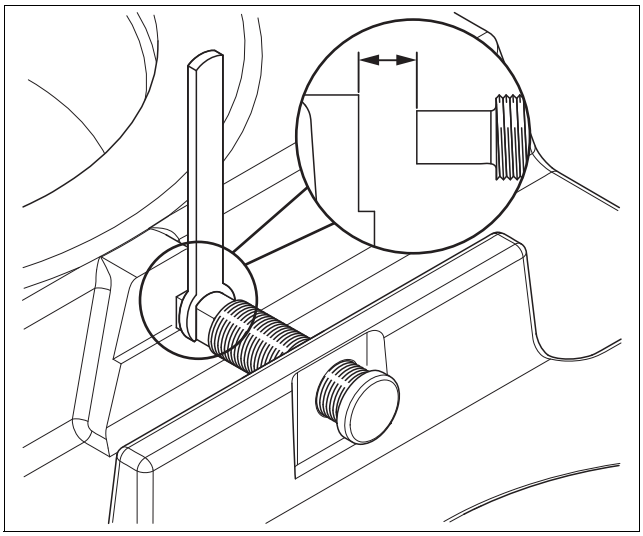
   Tighten the belt by rotating the belt tightener until the end lug of the screw is in contact with the motor adapter.



3. Tighten the motor adapter screws.



4. Loosen the belt tightener.



Install water tank, or cover, and brake

1. For separators with water tank: Install the water tank.
   For separators without water tank: Install the cover.
2. Install the brake.

Before starting the separator

3. Wait at least 30 minutes before starting the separator.

6.5 Oil filling device

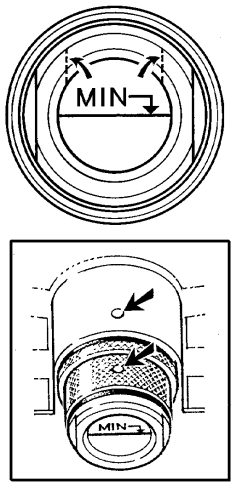
6.5.1 Dismantling/assembly

Drain off the oil, see “5.8 Oil change” on page 66.

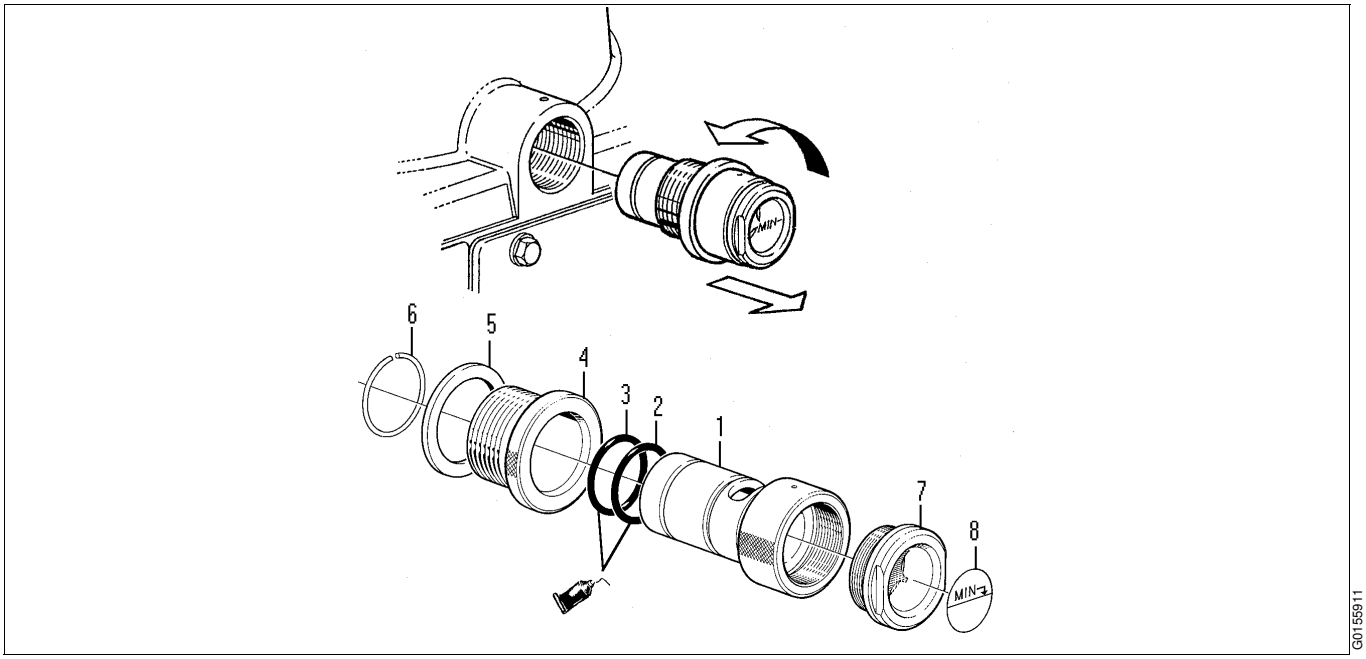
Unscrew nipple (4) and pull off the oil filling device. Then unbend the round safety wire (6) and pull off the nipple (4).

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

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



G01555811

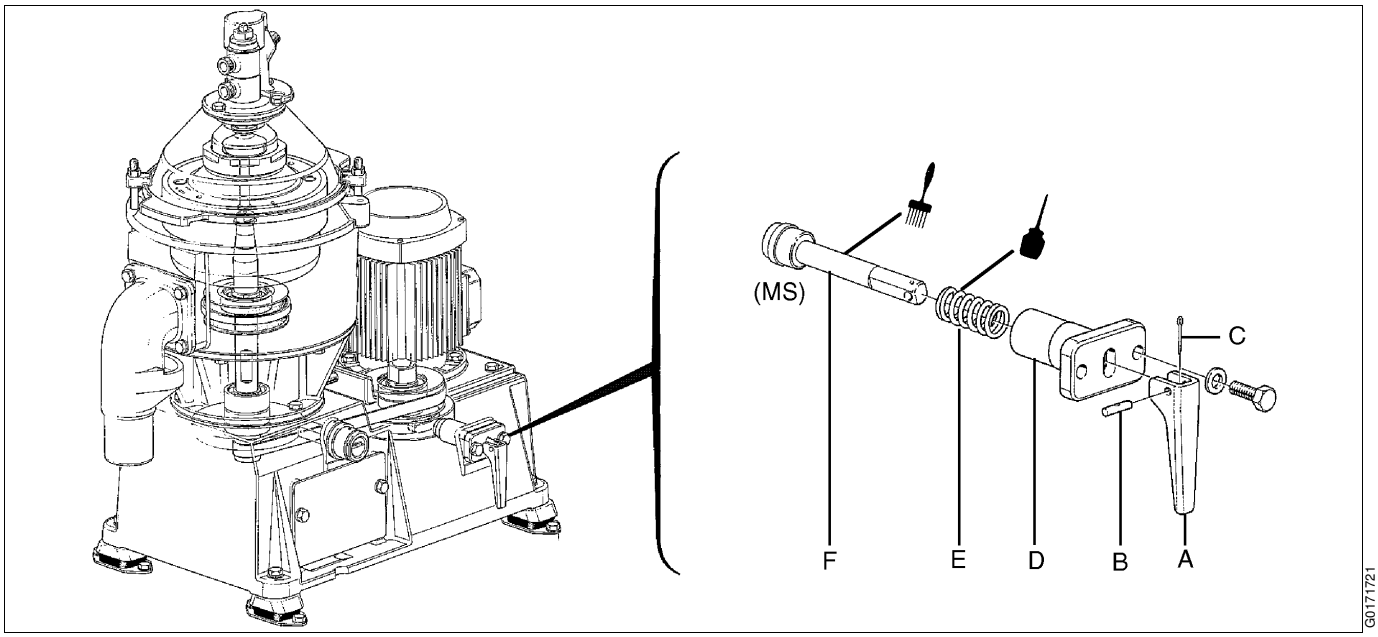


G01555911

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

Silicone grease (thin layer)

6.6 Brake



A Brake handle
B Cylindrical pin with hole
C Split pin
D Bracket
E Spring
F Spindle with friction element

Oil

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

CAUTION

Inhalation hazard

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

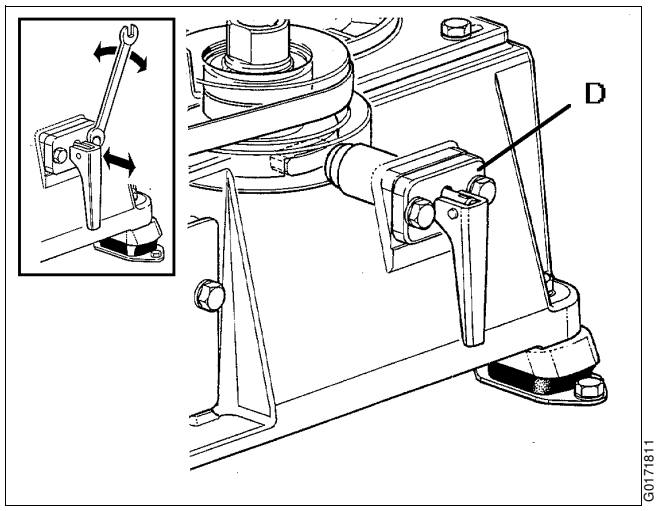
Do not use compressed air for removal of any dust. Remove dust by vacuum or wet cloth.

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

6.6.1 Checking of friction element

A worn or oily friction element will lengthen the stopping time. Remove bracket (D) with the brake. Examine the friction element.

- If the friction element is worn; Fit a new complete spindle (F) (includes friction element).
- If the friction element is oily; Clean the element and its surface in contact with the belt pulley with a suitable degreasing agent.

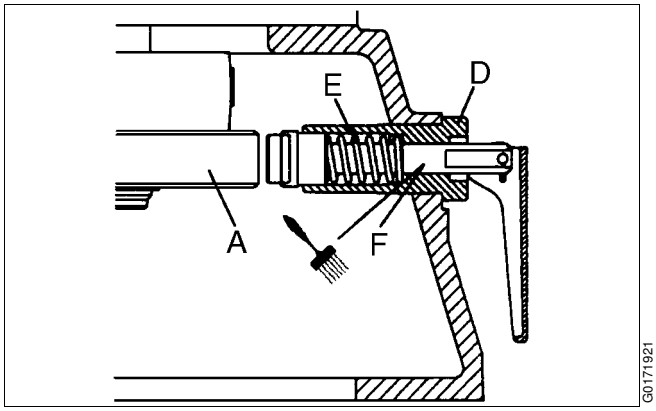


Checking of bracket (D), spindle (F) and spring (E)

Rust can form on the brake parts and cause the brake to jam.

Remove rust from the spindle and the corresponding guide surface on the bracket. Rub the surface of the spindle with lubricating paste. Replace the spring with a new one if it has lost its stiffness. Oil the spring when assembling.

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



Checking the brake

After the brake assembly has been fitted, release the brake and rotate the bowl slowly by hand. If a scraping noise is heard, the friction element is probably touching the coupling pulley surface (A). If so, it is necessary to adjust the position of the motor adapter and retighten the flat belt, see “6.4 Flat belt and tightener” on page 107.

6.7 Frame feet

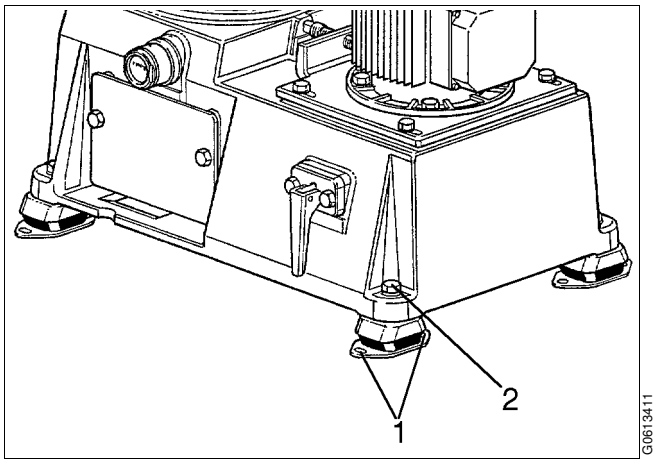
6.7.1 Mounting of new frame feet

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

Remove the bowl before lifting the separator.

Follow “5.6 Lifting instructions” on page 61.

1. Loosen the foundation bolts and lift the separator.
2. Remove the existing frame feet.
3. Mount the new feet.
4. Place the separator in its original position and fasten the foundation bolts.
5. Remove the two eye bolts.
6. Assemble the separator bowl, see “6.1.2 Inlet/outlet and bowl – assembly” on page 82.



7 Trouble-tracing

Contents

7.1 Trouble-tracing procedure 118

7.2 MMB mechanical function 119

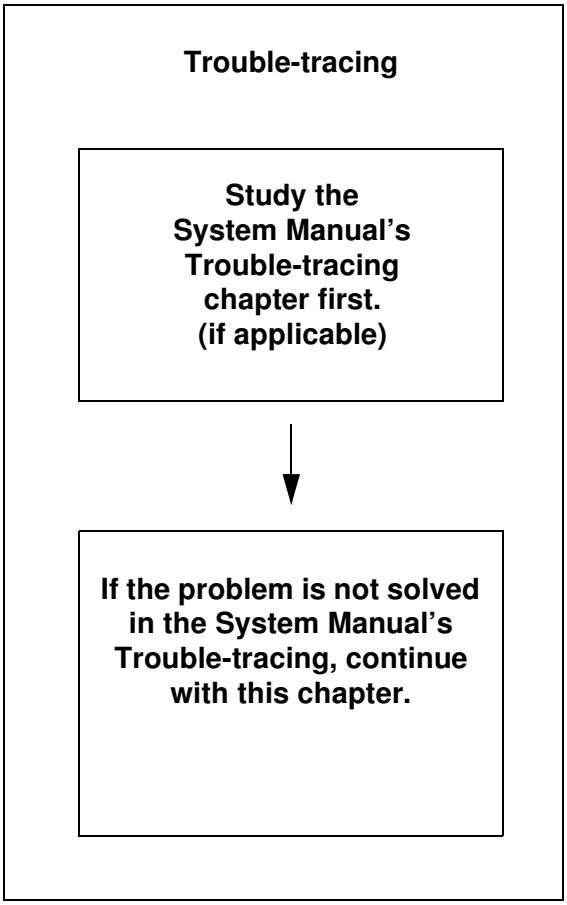
7.2.1 The separator does not start 119
7.2.2 Start-up time too long 119
7.2.3 Starting power too low 119
7.2.4 Starting power too high 119
7.2.5 Separator vibrates during starting sequence 120
7.2.6 Separator vibrates during normal running 121
7.2.7 Smell 121
7.2.8 Noise 121
7.2.9 Speed too high 122
7.2.10 Speed too low 122
7.2.11 Stopping time too long 122
7.2.12 Water in oil sump 122
7.2.13 Liquid flows through bowl casing drain 123

7.3 Purification faults 124

7.3.1 Unsatisfactory separation result 124
7.3.2 Outgoing water contains oil 124
7.3.3 Oil discharge through water outlet = broken water seal 125

7.4 Clarification faults 126

7.4.1 Unsatisfactory separation result 126
7.4.2 Oil discharge through water outlet 126



7.1 Trouble-tracing procedure

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

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

7.2 MMB mechanical function

7.2.1 The separator does not start

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

7.2.2 Start-up time too long

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

7.2.3 Starting power too low

Possible cause	Action
Motor failure.	Repair the motor.

7.2.4 Starting power too high

Possible cause	Action
Motor failure.	Repair the motor.
Brake applied	Release the brake.
50 Hz pulley running on 60 Hz power supply.	After immediate stop, install correct pulley.

7.2.5 Separator vibrates during starting sequence

NOTE

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

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

7.2.6 Separator vibrates during normal running

Possible cause	Action
Uneven sludge deposits in sludge space.	Clean the bowl.
Bearings damaged or worn.	Fit new bearings.
Vibration-dampers in frame feet worn out.	Fit new frame feet.
Spindle top bearing rubber buffer defective.	Fit new rubber buffer.

7.2.7 Smell

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

7.2.8 Noise

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

7.2.9 Speed too high

Possible cause	Action
Incorrect transmission (50 Hz pulley running on 60 Hz power supply).	After immediate stop, install correct transmission.
Frequency of power supply (50/60 Hz).	Check.

7.2.10 Speed too low

Possible cause	Action
Brake is applied.	Release the brake.
Friction elements worn or oily.	Fit new friction elements or clean the old ones if they are oily.
Belt tension too loose.	Tighten the belt.
Motor failure/motor bearings.	Repair the motor.
Top/bottom bearings damaged or worn.	Fit new bearings.
Bearing overheated/damaged.	Fit new bearings.
Incorrect transmission (60 Hz pulley running on 50 Hz current).	Make sure that the pulley is intended for 50 Hz power supply.

7.2.11 Stopping time too long

Possible cause	Action
Brake worn or oily.	Fit a new brake or clean if oily.

7.2.12 Water in oil sump

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

7.2.13 Liquid flows through bowl casing drain

Possible cause	Action
High water content in oil.	None (normal).
Broken water seal.	See 7.3.3.
The supply of displacement/sealing water is not sufficient due to clogged strainer, kinked hose or low water pressure.	Straighten the hose or clean the strainer. Check the water flow.
Seal ring on gravity disc/clarifier disc defective.	Fit a new seal ring.
Bowl hood seal ring defective.	Fit a new seal ring.
Seal rings in paring disc device defective.	Fit new seal rings.
Bowl speed too low.	Make sure current is on and brake is off. Retighten the flat belt or inspect motor and power transmission.

7.3 Purification faults

7.3.1 Unsatisfactory separation result

Possible cause	Action
Gravity disc hole too small.	Use a gravity disc with a larger hole.
Incorrect separating temperature.	Adjust temperature.
Throughput too high.	Reduce throughput.
Sludge space in bowl is filled.	Empty the sludge basket in the bowl.
Disc stack clogged.	Clean the bowl discs.
Inlet clogged.	Clean.
Bowl speed too low.	See ‘‘7.2.10 Speed too low” on page 122.

7.3.2 Outgoing water contains oil

Possible cause	Action
Gravity disc hole too large.	Use a gravity disc with a smaller hole.
Seal ring under the gravity disc defective.	Fit a new seal ring.

7.3.3 Oil discharge through water outlet = broken water seal

Possible cause	Action
Gravity disc too large.	Use a gravity disc with a smaller hole.
Separation temperature too low.	Increase temperature.
Throughput too high.	Reduce throughput.
Valve(s) in oil outlet line closed.	Open the valve(s) and adjust back pressure to normal value.
Sealing water volume too small.	Supply more water.
Seal ring under gravity disc defective.	Fit a new seal ring.
Disc stack clogged.	Clean the bowl discs.
Bowl speed too low.	See “7.2.10 Speed too low” on page 122.
Bowl incorrectly assembled.	Examine and make correct.

7.4 Clarification faults

7.4.1 Unsatisfactory separation result

Possible cause	Action
Separating temperature too low.	Adjust.
Throughput too high.	Reduce throughput.
Feed oil contains water.	Re-assemble and operate the separator as a purifier.
Disc stack clogged.	Clean the bowl discs.
Sludge space in bowl filled.	Empty the sludge basket.
Bowl speed too low.	See ‘‘7.2.10 Speed too low” on page 122.

7.4.2 Oil discharge through water outlet

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

8 Technical reference

Contents

8.1 Product description 128
- 8.1.1 Declaration - EU 129
- 8.1.2 Declaration - UK 131

8.2 Technical data 133

8.3 Basic size drawing 134
- 8.3.1 Dimensions of connections 135

8.4 Connection list 136

8.5 Interface description 137
- 8.5.1 General 137
- 8.5.2 Definitions 137
- 8.5.3 Component description and signal processing 138
- 8.5.4 Function graph and running limitations 139

8.6 Quality specification, operating water 140

8.7 Lubricants 141
- 8.7.1 Lubrication chart 141
- 8.7.2 Recommended lubricants 142
- 8.7.3 Recommended lubricating oils 146

8.8 Drawings 148
- 8.8.1 Foundation plan 148
- 8.8.2 Electric motor 149
- 8.8.3 Nomogram gravity disc 150
- 8.8.4 Machine plates and safety labels 151

8.9 Storage and installation 153
- 8.9.1 Storage and transport of goods 153
- 8.9.2 Planning of installation 156
- 8.9.3 Foundations 158

8.1 Product description

Alfa Laval ref. 9017667, rev. 2

Product number:	881152-01-05/0
Separator type:	MMB 305S-11
Application:	Mineral Oil
Technical design:	Purifier (clarifier as option) with solid-wall bowl Machine bottom part for belt drive. Intended for marine- and land applications. Sealings available in Nitrile.
Restrictions:	Ambient temperature: +5 °C to +55 °C. Feed temperature: 0 °C to +100 °C. Not to be used for liquids with flashpoint below 60 °C. Risk for corrosion and erosion has to be investigated in each case by application centre.

8.1.1 Declaration - EU

Alfa Laval ref. 591985, rev. 12

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

Manufacturer: Alfa Laval Technologies AB

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

Type:.....

Product specification:.....

Configuration number:.....

Serial number:.....

Declaration of Incorporation of Partly Completed Machinery

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

Designation	Description
2006/42/EC	Machinery Directive

The following essential requirements of 2006/42/EC are applied and fulfilled:
1.1, 1.1.2, 1.1.3, 1.1.4, 1.1.5, 1.1.6, 1.1.7, 1.2.3, 1.2.4, 1.3.1, 1.3.2, 1.3.3, 1.3.4, 1.3.7, 1.3.8, 1.3.9, 1.5.1, 1.5.2, 1.5.4, 1.5.5, 1.5.6, 1.5.8, 1.5.9, 1.5.11, 1.5.15, 1.6.1, 1.6.3, 1.6.4, 1.6.5, 1.7

To meet the requirements the following standards have been applied:

Designation	Description
EN 60204-1:2018	Electrical equipment of machines, part 1: General requirements
EN ISO 12100:2010	Safety of machinery - General principles for design - Risk assessment and risk reduction
ISO 3744:2010	Acoustics - Determination of sound power levels of noise sources using sound pressure

EU Declaration of Conformity

The machinery complies with the following Directives:

Designation	Description
2014/30/EU	Electromagnetic Compatibility
2011/65/EU	Restriction of the use of certain hazardous substances in electrical and electronic equipment

To meet the requirements the following standards have been applied:

Designation	Description
EN IEC 63000:2018	Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances

The technical construction file for the machinery is compiled and retained by the authorized person Fredrik Nytomt within the Business Unit High Speed Separators,
Alfa Laval Technologies AB, Box 74. SE-221 00 Lund, Sweden. By reasoned request all relevant technical documentation will be sent by post to national authorities.

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

Signed for and on behalf of: Alfa Laval Technologies AB

Place: .....

Date of issue: .....

Signature: .....

Name: .....

Function: .....

Entity .....

8.1.2 Declaration - UK

Alfa Laval ref. 591985, rev. 12

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

Manufacturer: Alfa Laval Technologies AB

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

Type:.....

Product specification:.....

Configuration number:.....

Serial number:.....

Declaration of Incorporation of Partly Completed Machinery

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

Supply of Machinery (Safety) Regulations 2008

The following essential requirements are applied and fulfilled:
1.1, 1.1.2, 1.1.3, 1.1.4, 1.1.5, 1.1.6, 1.1.7, 1.2.3, 1.2.4, 1.3.1, 1.3.2, 1.3.3, 1.3.4, 1.3.7, 1.3.8, 1.3.9, 1.5.1, 1.5.2, 1.5.4, 1.5.5, 1.5.6, 1.5.8, 1.5.9, 1.5.11, 1.5.15, 1.6.1, 1.6.3, 1.6.4, 1.6.5, 1.7

To meet the requirements the following standards have been applied:

Designation	Description
EN 60204-1:2018	Electrical equipment of machines, part 1: General requirements
EN ISO 12100:2010	Safety of machinery - General principles for design - Risk assessment and risk reduction
ISO 3744:2010	Acoustics - Determination of sound power levels of noise sources using sound pressure

UK Declaration of Conformity

The machinery complies with the following Regulations:

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

To meet the requirements the following standards have been applied:

Designation	Description
EN IEC 63000:2018	Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances

The technical construction file for the machinery is compiled and retained by the authorized person Fredrik Nytomt within the Business Unit High Speed Separators,
Alfa Laval Technologies AB, Box 74. SE-221 00 Lund, Sweden. By reasoned request all relevant technical documentation will be sent by post to national authorities.

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

Signed for and on behalf of: Alfa Laval Technologies AB

Place: .....

Date of issue: .....

Signature: .....

Name: .....

Function: .....

Entity .....

8.2 Technical data

Alfa Laval ref. 556411, rev. 3

Units according to ISO Standard.

The manufacturer reserves the right to change specifications without notice.

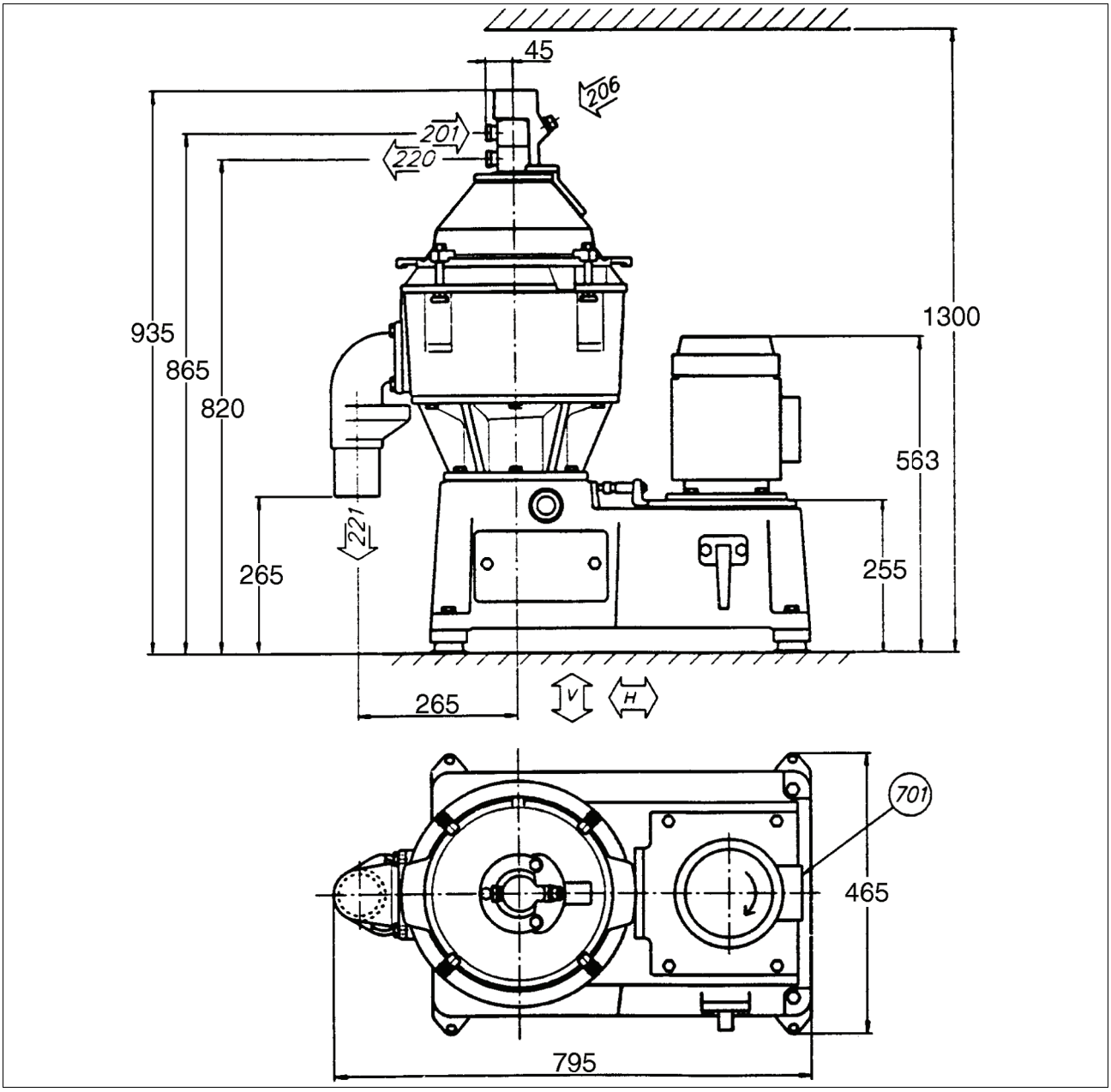
.

Bowl speed max.:	9510/ 9510	rev/min. 50Hz/60Hz
Speed motor shaft max:	3000/3600	rev/min. 50Hz/60Hz
Gear ratio:	130:41/ 106:4150	50/60Hz
Hydraulic capacity:	6	m^3/h
Max. density of sediment/feed:	1600/1100	kg/m^3
Feed temperature:	0/100	min./max. ×C
Weight of separator:	179	kg (without motor)
Motor power:	3	kW
Jp reduced to motor shaft:	10,1	kg/m^2 50Hz
Jp reduced to motor shaft:	7	kg/m^2 60Hz
Power consumption:	0,7/ 2,3	kW(idling/ at max. capacity)
Max. power consumption:	4,3	kW (at starting up)
Starting time:	2 / 2,5	minutes (min./ max.)
Stopping time with brake:	3 / 4	minutes (min./ max.)
Stopping time without brake:	18	minutes (average)
Lubricating oil volume:	0,5	liters
Max. running time,		
empty bowl:	480	minutes
filled bowl, without flow:	480	minutes
Sound power/ sound press. level.	8,9/ 74	Bel(A)/ dB(A)
Max vibration level, separator in use:	9	mm/sec (r.m.s)
Bowl max. inner diameter	217	mm
Bowl volume	3,6	liters
Bowl weight	32	kg
Bowl body material	AL 111 2377-02	

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

8.3 Basic size drawing

Alfa Laval ref. 557416, rev. 2



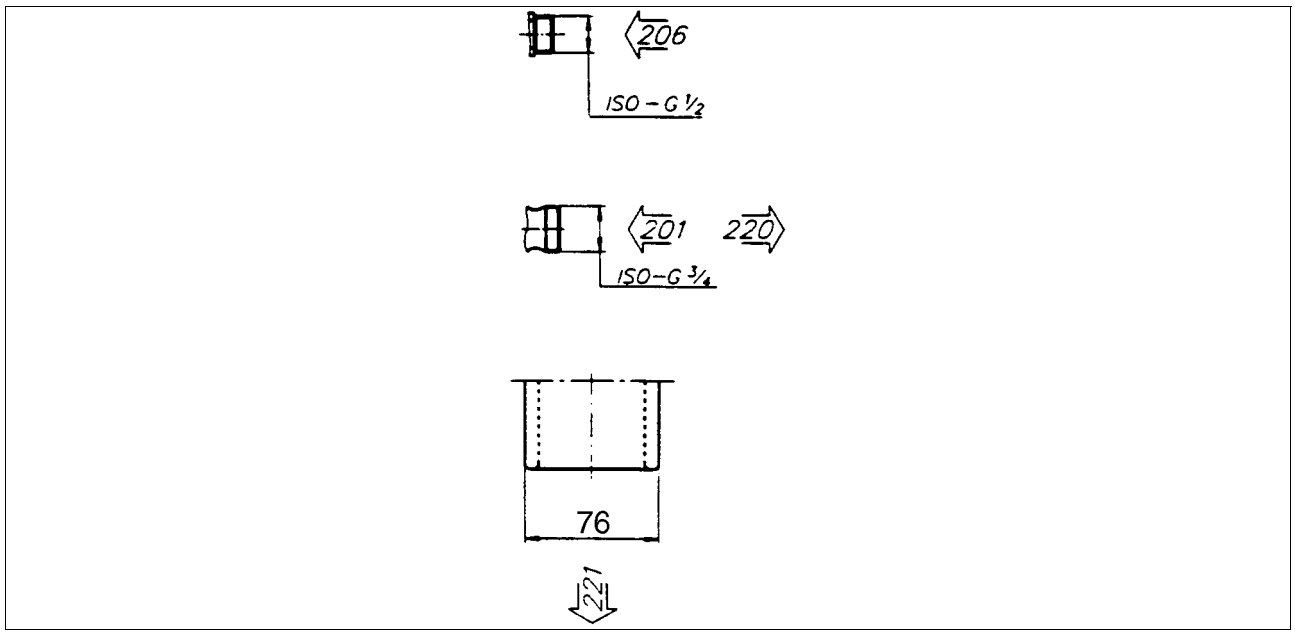
Connections 201 and 220 are turnable

V *Vertical force not exceeding 5 kN/foot*

H *Horizontal force not exceeding 7 kN/foot*

8.3.1 Dimensions of connections

Alfa Laval ref. 557416, rev. 2



Data for connections, see“8.4 Connection list” on page 136

All connections to be installed non-loaded and flexible

8.4 Connection list

Alfa Laval ref. 557433, rev. 1

Connection No.	Description	Requirements/limit
201	**Inlet for process liquid**	
	– Permitted temperatures	Min. 0 °C, Max. +100 °C
206	**Inlet for liquid seal and displacement liquid**	Fresh water
	– Liquid seal water flow	5,5 ±0,6 litres/minute
	– Liquid seal water period	30 seconds
220	**Outlet for light phase (oil)**	
	– Pressure	Max. 280 kPa
221	**Outlet for heavy phase (water)**	No counterpressure
701	**Motor for separator**	
	– Deviation from nominal frequency	Max. ±5%

“8.3 Basic size drawing” on page 134, and “8.3.1 Dimensions of connections” on page 135.

8.5 Interface description

Alfa Laval ref. 557260, rev. 2

8.5.1 General

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

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

8.5.2 Definitions

Stand still (Ready for start) means:

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

Start means:

- The power to the separator is on.
- The acceleration is supervised to ensure that a certain speed has been reached within a certain time.

Normal stop means:

- Stopping of the machine at any time with feed or safety/back up liquid and with brake applied.
- The bowl must be kept filled.

Safety stop means:

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

Comply to the following conditions:

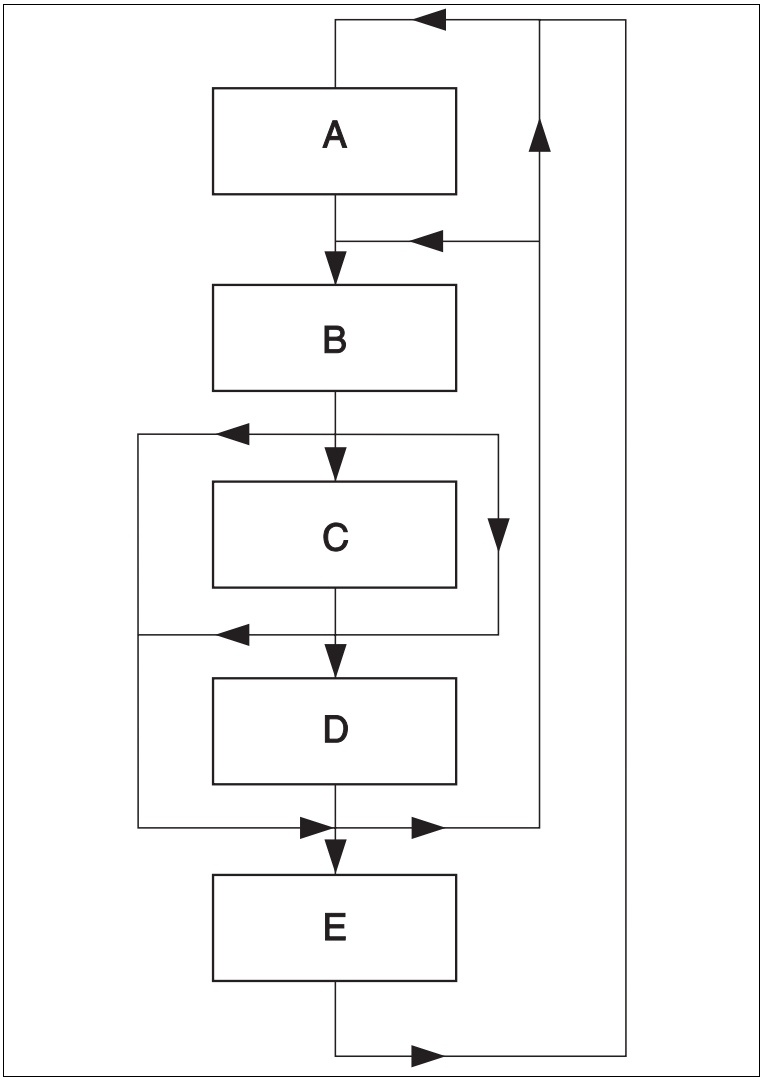
- The bowl must be kept filled.
- The machine must not be restarted before the reason for the safety stop has been investigated and action has been taken.
- In case of emergency condition in the plant, the machine must be stopped in a way that is described in EN 418.

8.5.3 Component description and signal processing

Separator motor 701

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

8.5.4 Function graph and running limitations



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

8.6 Quality specification, operating water

Alfa Laval ref. 553406 rev. 11

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

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

NOTE

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

The following conditions must be fulfilled

1. Clean water with turbidity 0,2 NTU/FNU, according to standard ISO 7027-1 “Water quality – Determination of Turbidity – Part 1: Quantitative methods”.
   Because deposits must not be allowed to form in certain areas in the separator.
2. A maximum particle size of 50 µm
3. A total hardness of less than 180 mg $CaCO_3$ per litre, which corresponds to 10°dH or 12.5°E. Hard water may with time form deposits in the operating mechanism. The precipitation rate is accelerated with increased operating temperature and low discharge frequency. These effects become more severe as the hardness of the water increase.
4. A chloride content of max 100 ppm NaCl (equivalent to 60 mg Cl/l)
   A chloride concentration above 60 mg/l is not recommended. Chloride ions contribute to corrosion on the separator surface in contact with the operating water, including the spindle. Corrosion is a process that is accelerated by increased separating temperature, low pH, and high chloride ion concentration.
5. pH>6
   Increased acidity (lower pH) increases the risk for corrosion; this is accelerated by increased temperature and high chloride ion content.

8.7 Lubricants

8.7.1 Lubrication chart

Alfa Laval ref. 553216-01, rev. 9

CAUTION

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

Lubricating points	Lubrication	Interval
The oil bath Bowl spindle bearings are lubricated by oil splash from the oil bath.	Lubricate with oil. For information on type of lubricant see Recommended lubricating oils. For information on lubricating oil volume: see Technical data	For information on oil change interval see Recommended lubricating oils.
Bowl spindle taper	Lubricate with oil. Only a few drops for rust protection.	At assembly.
Bowl Sliding contact surfaces, thread of lock nut and cap nut.	Lubricate with paste. For information on pastes see Recommended lubricants.	At assembly.
Rubber seal rings	Lubricate with grease. For information on grease see Recommended lubricants	At assembly.
Friction coupling ball bearings. ***Not valid for rigid coupling:***	The bearings are sealed and packed with grease and need no extra lubrication.	-
Electric motor	Follow manufacturer's instructions.	Follow manufacturer's instructions.
Threads	Lubricating oil, if not otherwise stated.	At assembly.

NOTE!

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

8.7.2 Recommended lubricants

Alfa Laval ref. 553217-01, rev. 14

Lubricant recommendation for hygienic and non-hygienic applications

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

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

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

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

Part No	Quantity	Designation	Manufacturer	Remark
537086-02	1000 g	Molykote 1000 Paste	Dow Corning	-
537086-03 537086-06	100 g 50 g	Molykote G-n plus Paste	Dow Corning	-
537086-04	50 g	Molykote G-rapid plus Paste	Dow Corning	-
-	-	Gleitmo 705	Fuchs Lubritech	-
-	-	Wolfracoat C Paste	Klüber	-
-	-	Dry Moly Paste	Rocol	-
-	-	MTLM	Rocol	-

Bonded coating for assembly of metallic parts, non-hygienic applications:

Part No	Quantity	Designation	Manufacturer	Remark
535586-01	375 g	Molykote D321R Spray	Dow Corning	-
-	-	Gleitmo 900	Fuchs Lubritech	Varnish or spray

Paste for assembly of metallic parts, hygienic applications (NSF registered H1 is preferred):

Part No	Quantity	Designation	Manufacturer	Remark
-	-	Molykote D Paste	Dow Corning	-
537086-07	50 g	Molykote P-1900	Dow Corning	NSF Registered H1 (7 Jan 2004)
-	-	Molykote TP 42	Dow Corning	-
561764-01	50 g	Geralyn 2	Fuchs Lubritech	NSF Registered H1 (3 sep 2004)
-	-	Geralyn F.L.A	Fuchs Lubritech	NSF Registered H1 (2 Apr 2007) German §5 Absatz 1 LMBG approved
554336-01	55 g	Gleitmo 1809	Fuchs Lubritech	-
-	-	Gleitmo 805	Fuchs Lubritech	DVGW (KTW) approval for drinking water (TZW prüfzeugnis)
-	-	Klüberpaste 46 MR 401	Klüber	White; contains no lead, cadmium, nickel, sulphur nor halogens.
-	-	Klüberpaste UH1 84-201	Klüber	NSF Registered H1 (26 Aug 2005)
-	-	Klüberpaste UH1 96-402	Klüber	NSF Registered H1 (25 Feb 2004)
-	-	252	OKS	NSF Registered H1 (23 July 2004)
-	-	Foodlube Multi Paste	Rocol	NSF Registered H1 (13 Apr 2001)

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

Part No	Quantity	Designation	Manufacturer	Remark
-	-	No-Tox Food Grade Silicone grease	Bel-Ray	NSF Registered H1 (16 December 2011)
-	-	Dow Corning 360 Medical Fluid	Dow Corning	Tested according to and complies with all National Formulary (NF) requirements for Dimethicone and European Pharmacopeia (EP) requirements for Dimeticone or Silicone Oil Used as a Lubricant, depending on viscosity.
569415-01	50 g	Molykote G 5032	Dow Corning	NSF Registered H1 (3 June 2005)
-	-	Geralyn SG MD 2	Fuchs Lubritech	NSF Registered H1 (30 March 2007)
-	-	Chemplex 750	Fuchs Lubritech	DVGW approved according to the German KTW-recommendations for drinking water.
-	-	Paraliq GTE 703	Klüber	NSF Registered H1 (25 Feb 2004). Approved according to WRAS.
-	-	Unisilkon L 250 L	Klüber	Complies with German Environmental Agency on hygiene requirements for tap water. Certified by DVGW-KTW, WRAS, AS4020, ACS.
-	-	ALCO 220	MMCC	NSF Registered H1 (25 March 2002)
-	-	Foodlube Hi-Temp	Rocol	NSF Registered H1 (18 April 2001)

Always follow the lubrication recommendations of the bearing manufacturer.

Grease for ball and roller bearings in electric motors

Part No	Quantity	Designation	Manufacturer	Remark
-	-	Energrease LS2	BP	-
-	-	Energrease LS-EP2	BP	-
-	-	Energrease MP-MG2	BP	-
-	-	APS 2	Castrol	-
-	-	Spheerol EPL 2	Castrol	-
-	-	Multifak EP2	Chevron	-
-	-	Multifak AFB 2	Chevron	-
-	-	Molykote G-0101	Dow Corning	-
-	-	Molykote Multilub	Dow Corning	-
-	-	Unirex N2	ExxonMobil	-
-	-	Mobilith SHC 460	ExxonMobil	-
-	-	Mobilux EP2	ExxonMobil	-
-	-	Lagermeister EP2	Fuchs Lubritech	-
-	-	Rembrandt EP2	Q8/Kuwait Petroleum	-
-	-	Alvania EP 2	Shell	-
-	-	LGEP 2	SKF	-
-	-	LGMT 2	SKF	-
-	-	LGFP 2	SKF	NSF Registered H1 (17 Aug 2007)
-	-	Multis EP2	Total	-

8.7.3 Recommended lubricating oils

Alfa Laval ref. 553219-09, rev. 4

Selection of lubricating oil for belt drive HSS

Select lubricating oil type with regards to ambient temperature.

Ambient temperature (°C)	Frame temp and cooling	Oil type	Oil change interval (operating hours)
+5 to +45	N/A	Mineral lubricating oil AL 116 3157 ISO-L-HM 150 Viscosity grade: VG150 Viscosity index: VI > 90 Alfa Laval oil types: Art no 546098-81 4 litre Art no 546098-83 1 litre	1500
+2 to +65	N/A	Synthetic lubricating oil AL 116 3146 ISO-L-CTPR 220 Viscosity grade: VG220 Viscosity index: VI > 140 Alfa Laval oil types: Art no 542690-80 20 litre Art no 542690-81 4 litre	2000
+2 to +65	N/A	Hygienic synthetic lubricating oil AL 116 3158: ISO-L-CTPR 220 Viscosity grade: VG220 Viscosity index: VI > 140 Registered as NSF H1 for use in the food processing industry Conform to FDA CFR 21 178.3570, 178.3620 and/or generally regarded as safe (US 21 CFR 182)	2000

General requirements for HSS lubricating oils

- Compatible with non-ferrous metals.
- Compatible with most paints and conventional sealing materials

Oil change interval

Oil change interval is dependent on operating conditions.

Operating conditions	Oil change interval
In a new installation. After change of gear transmission.	200 hours
Continuous operation.	See selection of lubricating oil
When the separator is operated for short periods.	12 months
Seasonal operation	Before every operating period

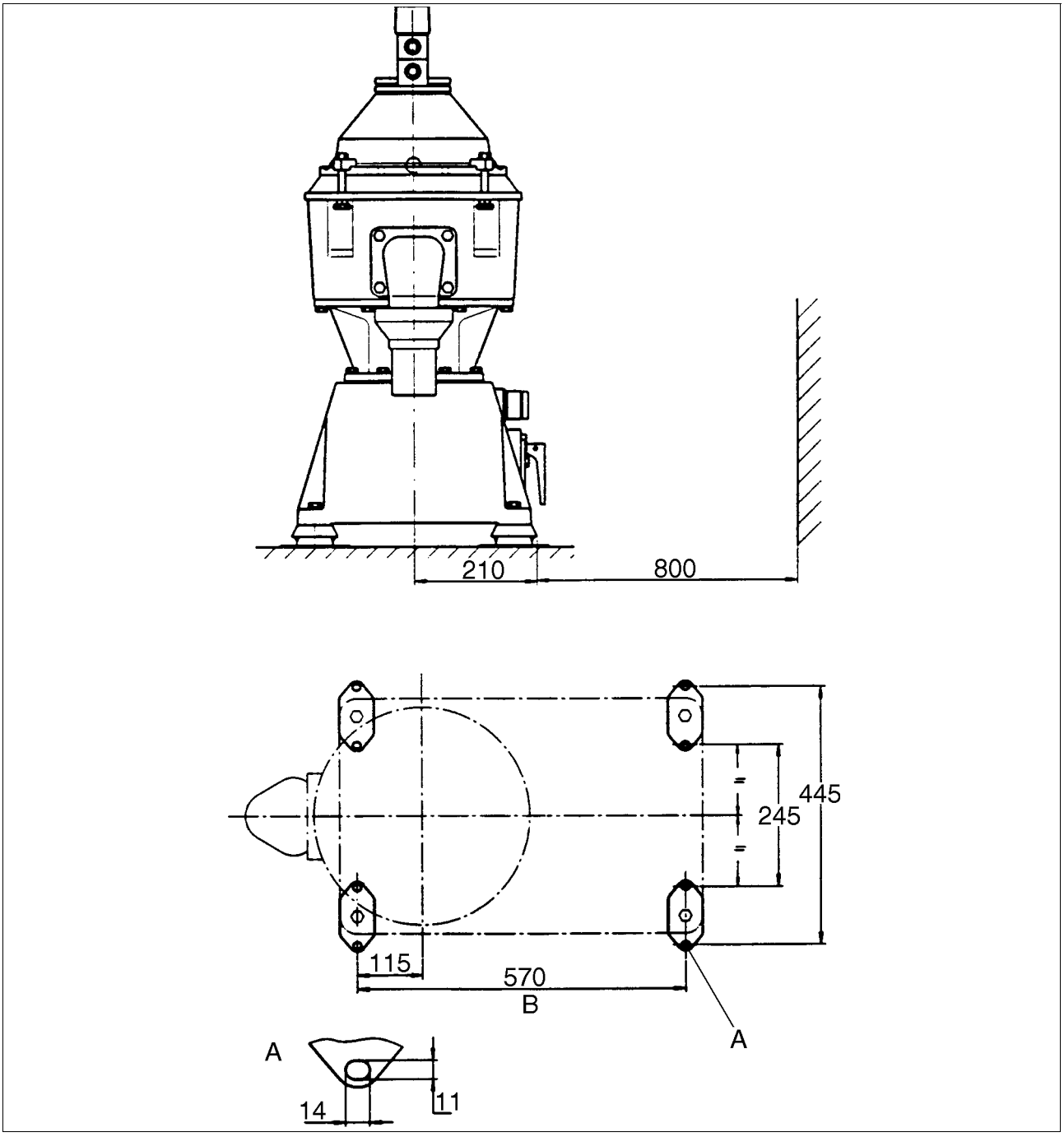
Other information

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

8.8 Drawings

8.8.1 Foundation plan

Alfa Laval ref. 557416, rev. 1



A 8 holes for foundation bolts
B Service side

8.8.2 Electric motor

For information regarding motor specifications, see motor plate.

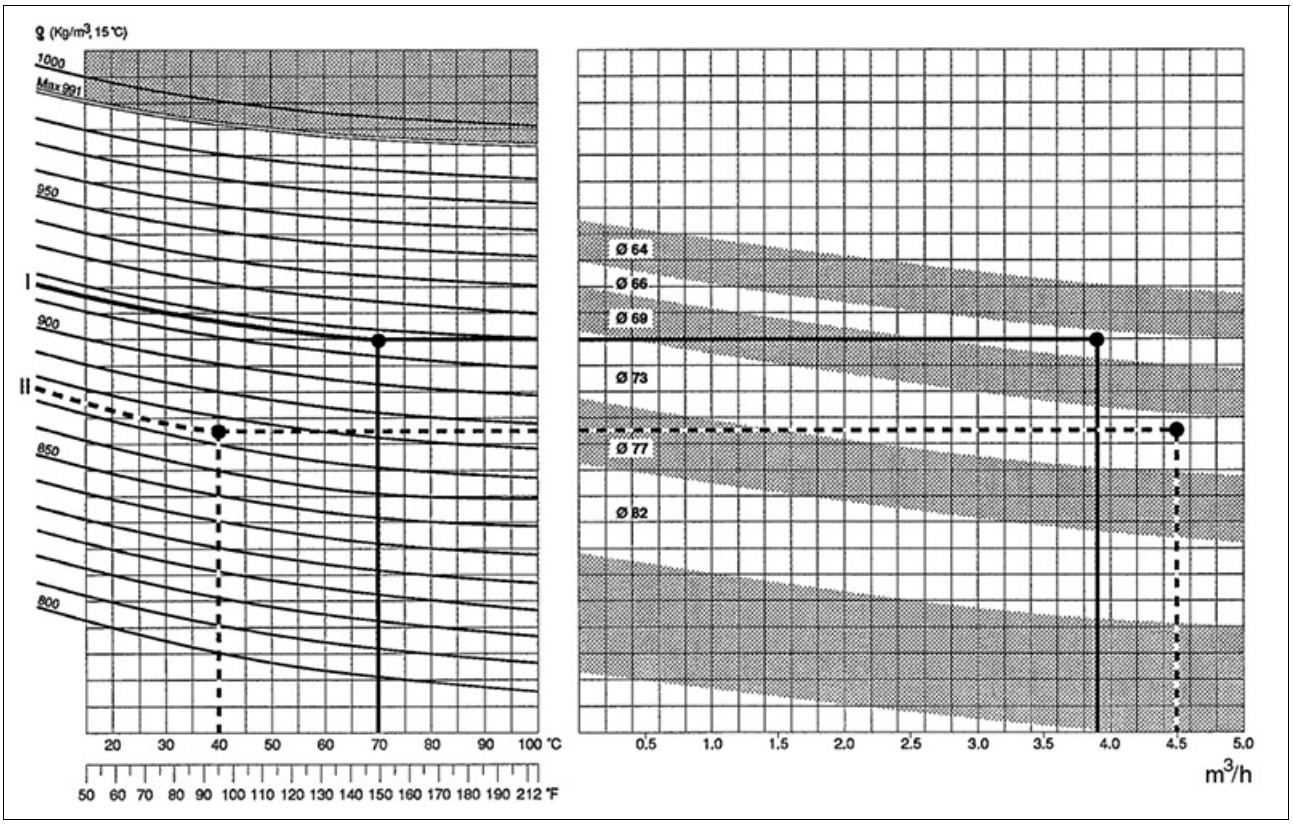
For further information see motor manufacturer's documentation.

NOTE

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

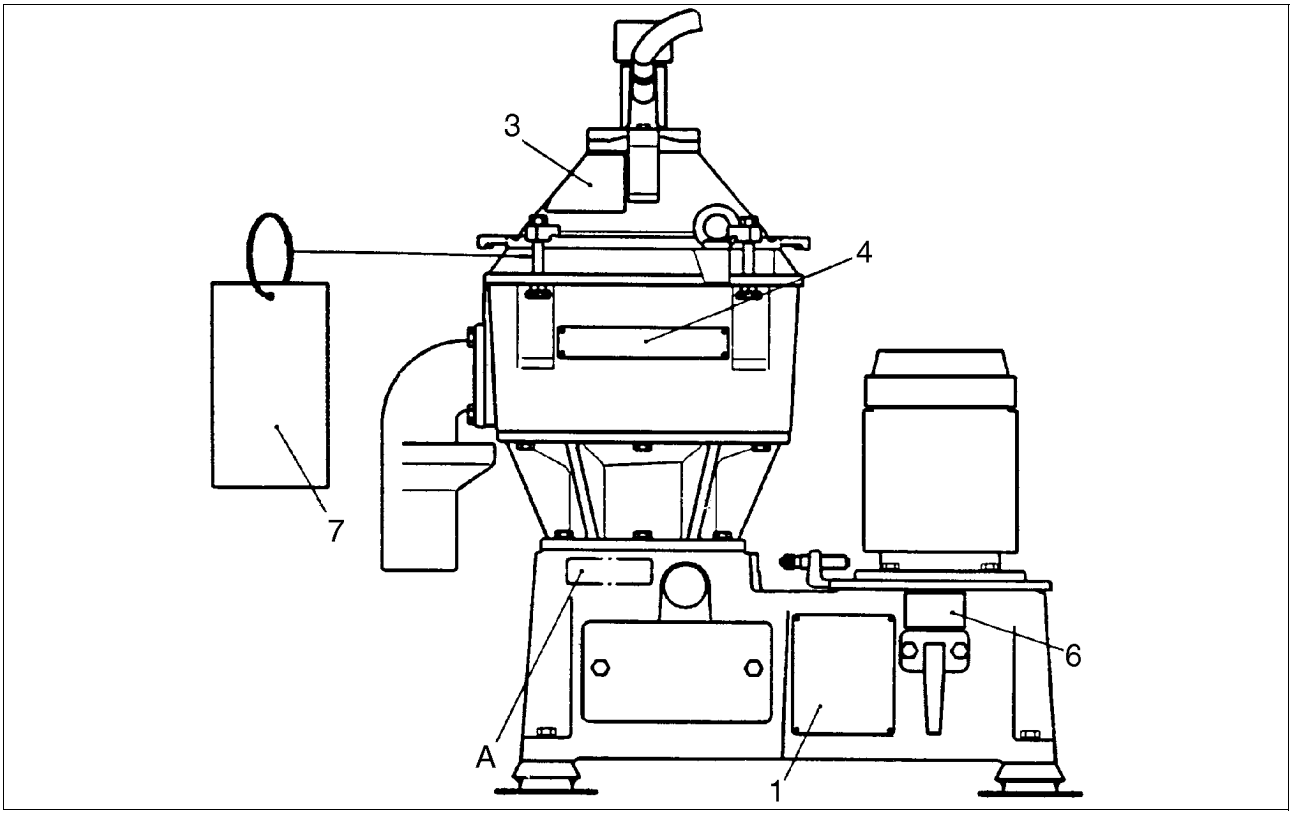
8.8.3 Nomogram gravity disc

Alfa Laval ref. 9043898, rev. 0



8.8.4 Machine plates and safety labels

Alfa Laval ref. 559214, rev. 2



1. Machine plate

Separator
Manufacturing serial No / Year
Product No
Inlet and outlet
Bowl
Machine bottom part
Max. speed (bowl)
Direction of rotation (bowl)
Speed motor shaft
El. current frequency
Recommended motor power
Max. density of feed
Max. density of sediment
Process temperature min./max.

3. Safety label

S00690N1

Text on label:

WARNING

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

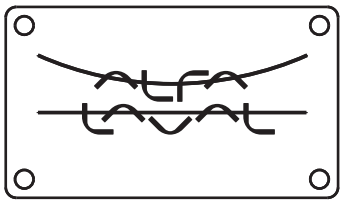
Failure to strictly follow instructions can lead to fatal injury.

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

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

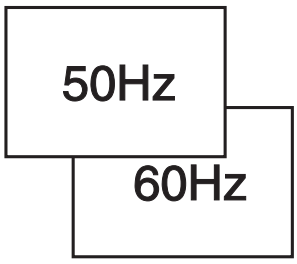
Separator must **stop rotating** before **any** dismantling work is started.

4. Name plate



S0063211

6. Power supply frequency

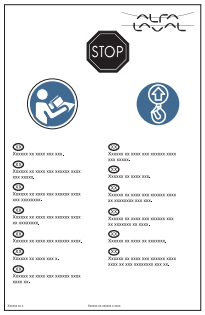


S0063111

7. Label

Text on label:

Read the instruction manual before lifting.



S0069111

A. Space for label indicating representative

8.9 Storage and installation

8.9.1 Storage and transport of goods

Storage

Before storing a separator that has been in operation, make sure to drain any parts containing water, such as Operating water module (if any), Operating water system and Cooling jackets.

Specification

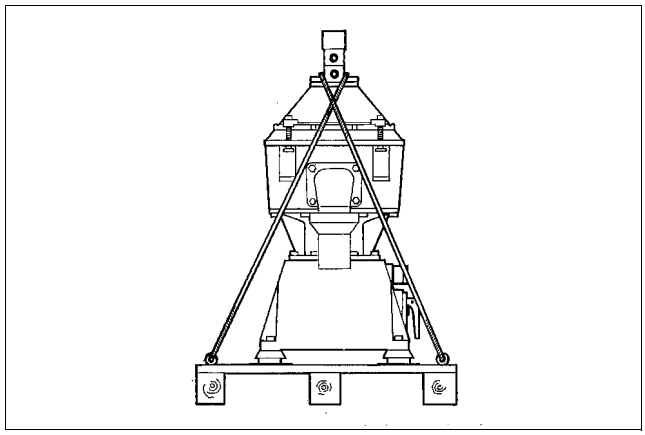
Upon arrival to the store, **check all components and keep them:**

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

A separator can be delivered with different types of protection:

- Fixed on a pallet.

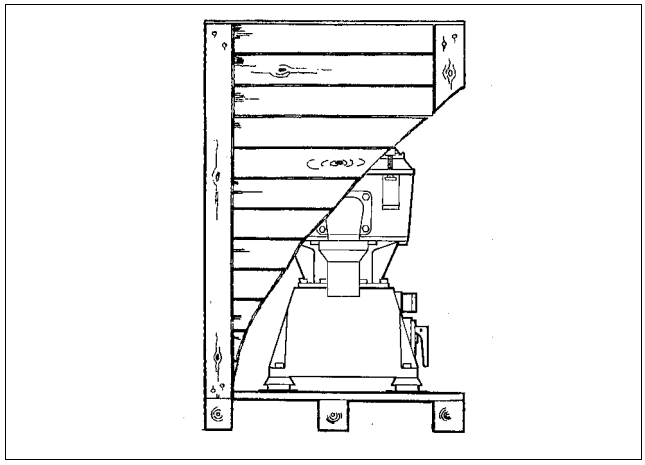
  The separator must be stored in a dry storage room, protected from rain and humidity. It must be well protected from mechanical damage and theft.



Fixed on a pallet

- In a wooden box which is not water tight.

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

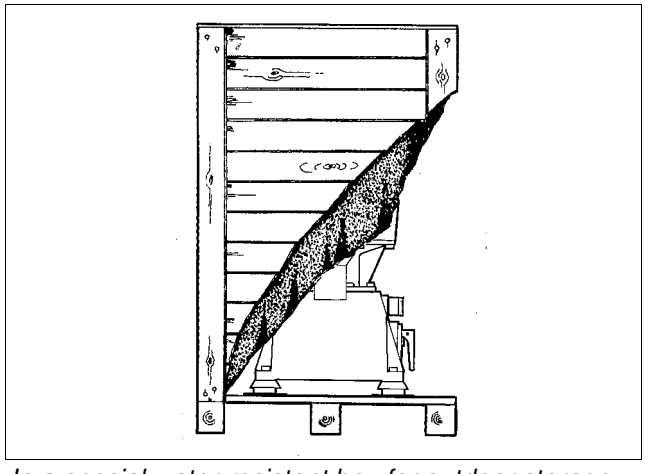


In a wooden box which is not water tight

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

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

  The packaging for outdoor storage is only to special order.



In a special water-resistant box for outdoor storage

Transport

Specification

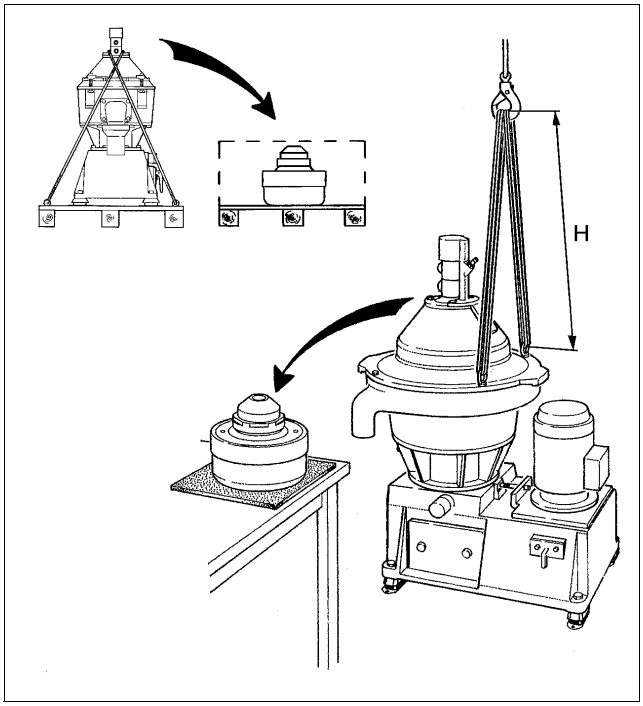
- During transport of the separator, the bowl **must always be removed from the machine and transported separately.**
- When lifting a separator it must always be **hung securely**. See details in chapter “5.6 Lifting instructions” on page 61.

WARNING

Crush hazards

Use correct lifting tools and follow lifting instructions.

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

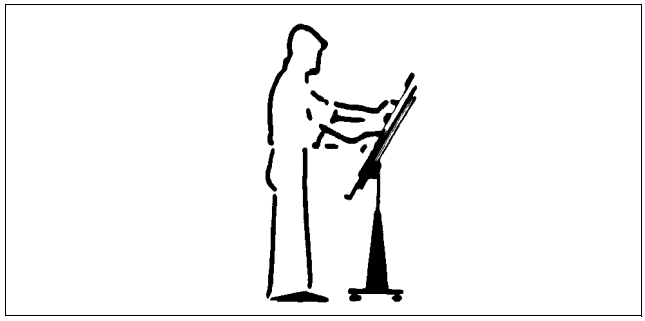


H = minimum 750 mm

8.9.2 Planning of installation

Introduction

The space required for one or more separators can be calculated by consulting “8.3 Basic size drawing” on page 134, and instructions for ancillary equipment, electrical and electronic equipment and cables.

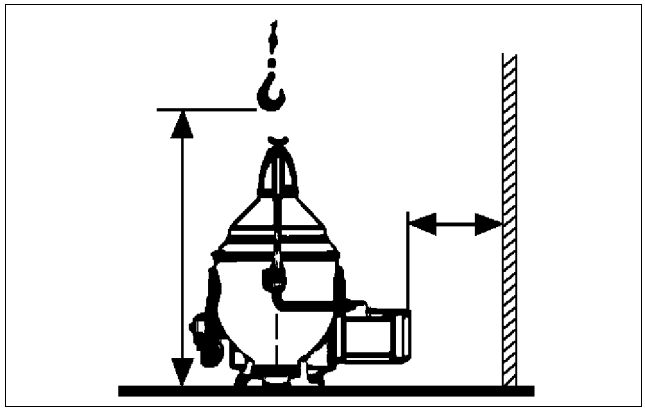


Check the drawings when planning the installation

Important measurements

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

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



Suitable space must be obtained for the maintenance work

Space for separator

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

Specification

See the “8.8.1 Foundation plan” on page 148 for the service space required with the separator installed.

Recommendation

The spanner for the bowl hood should have sufficient space to make a complete turn without touching any of the ancillary equipment surrounding the separator.

Lifting height for transport of bowl

Specification

A minimum height is required to lift the bowl, bowl parts and the bowl spindle, see the drawing “8.8.1 Foundation plan” on page 148.

Recommendation

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

Space for oil changing

Specification

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

Recommendation

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

8.9.3 Foundations

NOTE

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

Specification

- The separator should be installed at floor level, see “8.8.1 Foundation plan” on page 148.
- The separator must be installed on a strong and rigid foundation to reduce the influence of vibrations from adjacent machinery.
- The foundation should be provided with a cofferdam.
- Fit the separator frame on the foundation as follows:
  - Check that the bolts do not press against the edges of the holes, otherwise the elasticity of the mounting of the separator frame will be impeded.
  - Fit height adjusting washers required.
  - Check that the separator frame is horizontal and that all feet rest on the foundation.
  - Tighten the screws.