Operator’s Manual

Self-cleaning Hermetic Separators

	Product No.:
A MRPX 614HGV-14C	**881208-01-01**
C MRPX 614HGV-74C	**881208-01-01**
H MRPX 614HGV-74C	**881208-01-01**
W MRPX 614HGV-74C	**881208-01-01**
A MRPX 714HGV-14C	**881208-02-01**
B MRPX 714HGV-14C	**881208-02-01**
C MRPX 714HGV-74C	**881208-02-01**
H MRPX 714 HGV-74C	**881208-02-01**
W MRPX 714HGV-74C	**881208-02-01**
B BRPX 714HGV-34C	**881208-02-01**
D MRPX 714HGV-34C	**881208-02-01**
C MRPX 518HGV-74C	**881209-01-01**
H MRPX 518HGV-74C	**881209-01-01**
W MRPX 518HGV-74C	**881209-01-01**
B MRPX 618HGV-14C	**881209-02-01**
C MRPX 618HGV-74C	**881209-02-01**
F MRPX 618HGV-74C	**881209-02-01**
H MRPX 618HGV-74C	**881209-02-01**
W MRPX 618HGV-74C	**881209-02-01**
B BRPX 618HGV-34C	**881209-02-01**
D MRPX 618HGV-34C	**881209-02-01**
H MRPX 718HGV-74C	**881209-03-01**
W MRPX 718HGV-74C	**881209-03-01**
H MRPX 818HGV-74C	**881210-01-01**
B MRPX 818HGV-14C	**881210-01-02**
B BRPX 818HGV-34C	**881210-01-02**
H MRPX 818HGV-74C	**881210-01-02**
W MRPX 818HGV-74C	**881210-01-02**

Product No.:	Multiple
Book No.:	1271058-02 V3

Alfa Laval

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Printed in Sweden, 99-12

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

Not following the instructions can result in serious accidents.

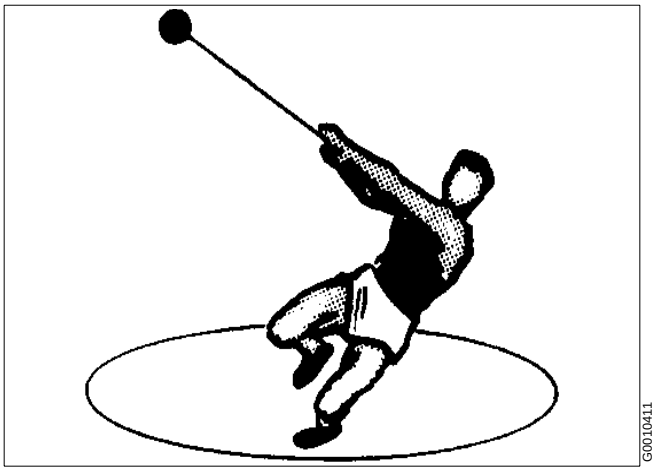
In order to make the information clear only foreseeable conditions have been considered. No warnings are given, therefore, for situations arising from the unintended usage of the machine and its tools.

Contents

1 Safety Instructions

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

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



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

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

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

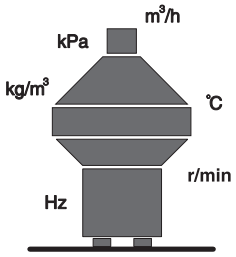
The following basic safety instructions therefore apply:

- **Use the separator only for the purpose and parameter range specified by Alfa Laval.**
- **Strictly follow the instructions for installation, operation and maintenance.**
- **Ensure that personnel are competent and have sufficient knowledge of maintenance and operation, especially concerning emergency stopping procedures.**
- **Use only Alfa Laval genuine spare parts and the special tools supplied.**

DANGER

Disintegration hazards

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



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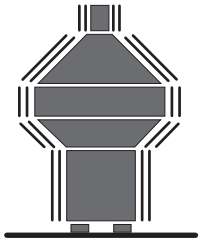

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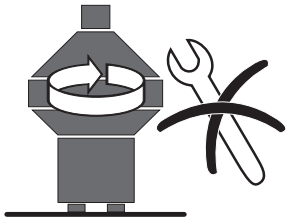
DANGER

Entrapment hazards

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

Electrical hazards

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



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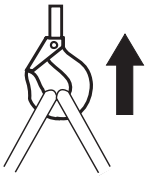
WARNING

Crush hazards

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



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Noise hazards

- Use ear protection in noisy environments.

S0051611

CAUTION

Burn hazards

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

Cut hazards

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

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S0054311

Warning signs in the text

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

DANGER

Type of hazard

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

WARNING

Type of hazard

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

CAUTION

Type of hazard

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

NOTE

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

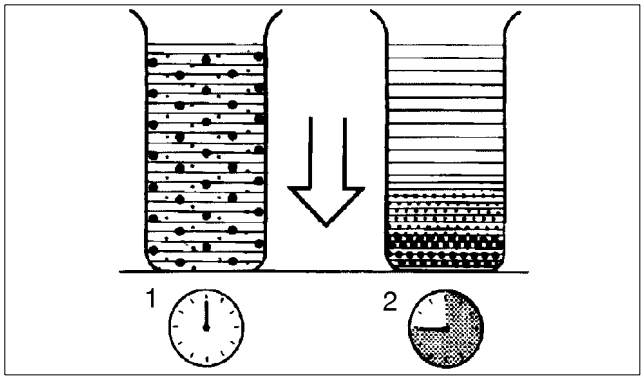
2 Separation process

Contents

2.1 Basic principles

The purpose of separation can be:

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

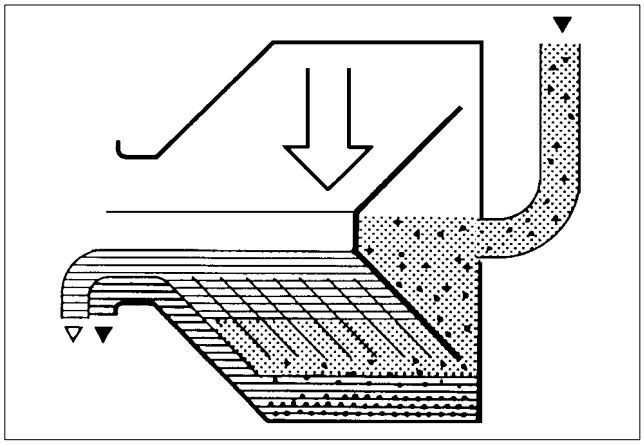


Sedimentation by gravity

2.1.1 Separation by gravity

A turbid liquid in a stationary vessel will clear slowly as the heavy particles in the liquid mixture are sinking to the bottom under the influence of gravity. The lighter liquid phase will rise while the heavier sinks.

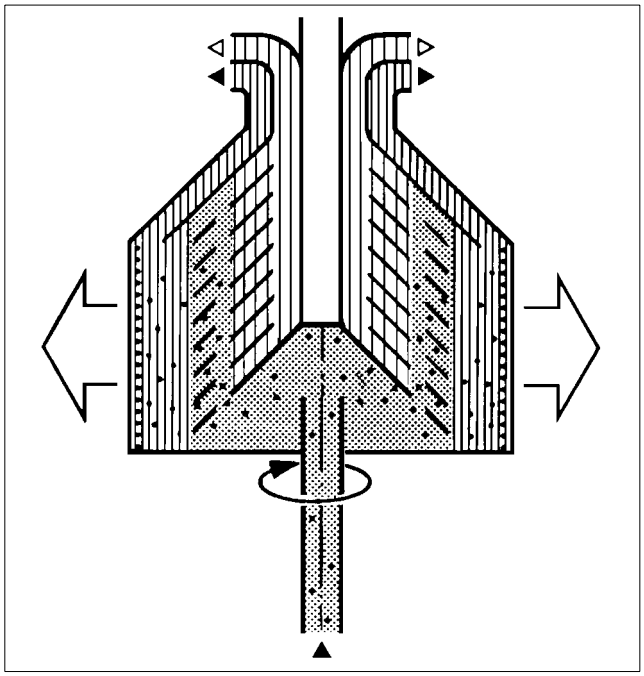
Continuous separation and sedimentation can be achieved in a settling tank having the outlets arranged at levels suited to the density ratio of the two liquid phases. Any solids and heavier particles in the liquid mixture will settle and form a sediment layer on the tank bottom.



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

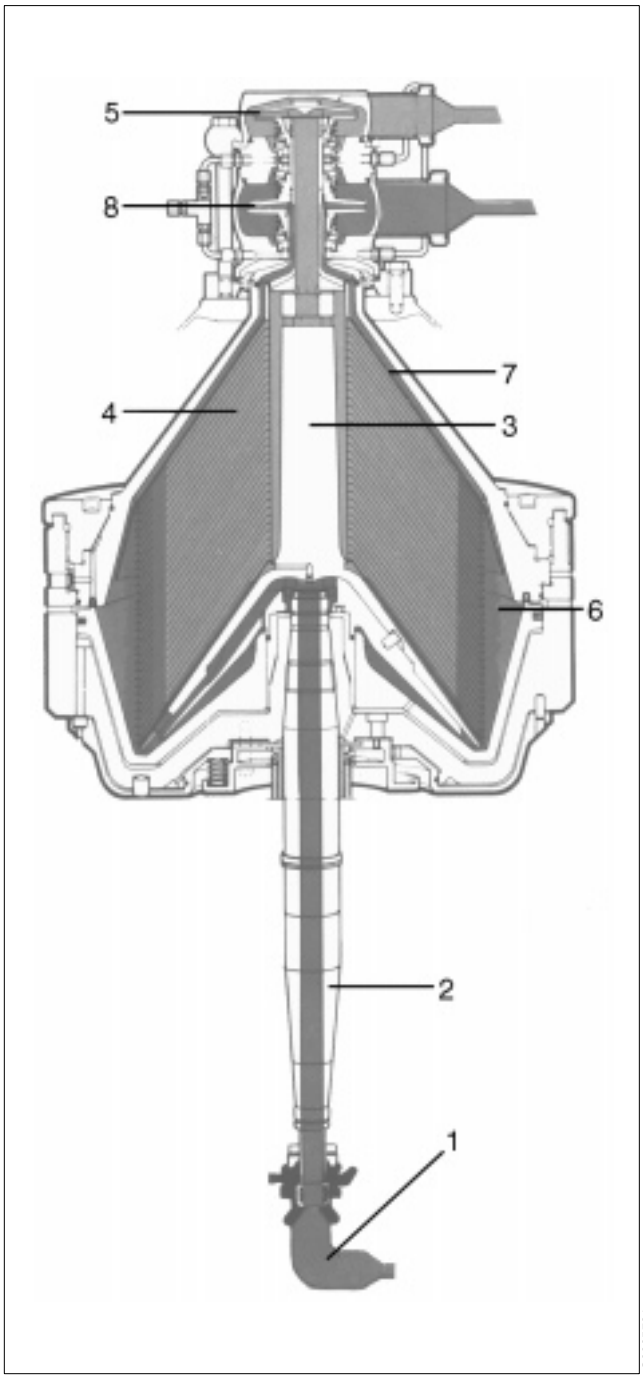
2.1.2 Centrifugal separation

In a rapidly rotating vessel the gravity is replaced by the centrifugal force, which can be thousands of times greater. Separation and sedimentation are continuous and very fast. When liquid and solid particles in a liquid mixture are subjected to the centrifugal force in a separator bowl, it takes only a few seconds to achieve what takes many hours in a tank under influence of gravity.



The centrifugal solution

2.2 General



Twin phase separators

The flow of the product through the machine is shown in the adjoining figure.

Product is fed to the inlet bend (1) for further conveyance through the hollow bowl spindle (2) to the distributor (3) and onwards through the distribution holes in the discs (4). The separation takes place in the spaces between the discs. The light phase is forced along the upper sides of the discs towards the bowl centre, leaves the bowl and is reforwarded by the impeller (5). The rest – heavy phase and sediment – moves along the undersides of the discs towards the bowl periphery where the sediment settles in the sediment space (6). The heavy phase continues along the upper side of the top disc (7) to the impeller (8), which effects the further routing.

Legend

1. *Inlet bend*
2. *Bowl spindle (hollow)*
3. *Distributor*
4. *Bowl discs*
5. *Impeller – light phase*
6. *Sediment space*
7. *Top disc*
8. *Impeller – heavy phase*

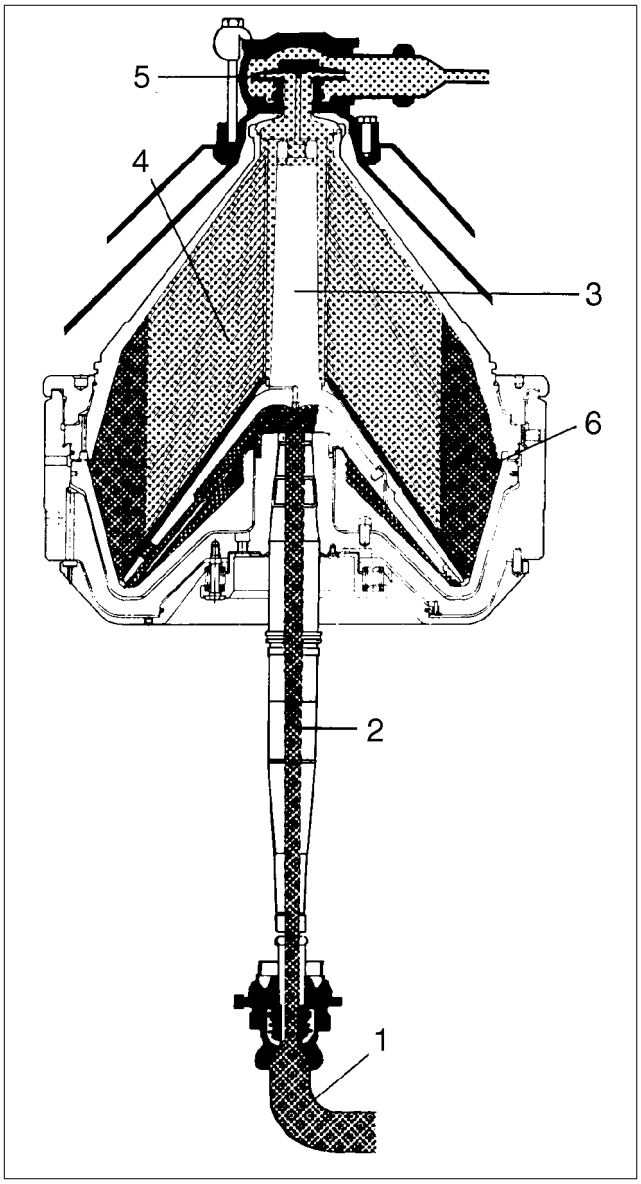
Single phase separators

The flow of the product through the machine is shown in the adjoining figure.

Product is fed to the inlet bend (1) for further conveyance through the hollow bowl spindle (2) to the distributor (3) and onwards through the distribution holes in the discs (4). The separation takes place in the spaces between the discs. The liquid is forced along the upper sides of the discs towards the bowl centre, leaves the bowl and is reforwarded by the impeller (5). The rest – sediment – moves along the undersides of the discs towards the bowl periphery where the sediment settles in the sediment space (6).

Legend

1. *Inlet bend*
2. *Bowl spindle (hollow)*
3. *Distributor*
4. *Bowl discs*
5. *Impeller – separated liquid*
6. *Sediment space*



2.2.1 Throughput

The throughput is directly dependent on the flow resistance in the separator and subsequent devices and piping as well as on the height of the collecting tanks above the outlet.

The throughput is regulated by adjusting the inlet pressure.

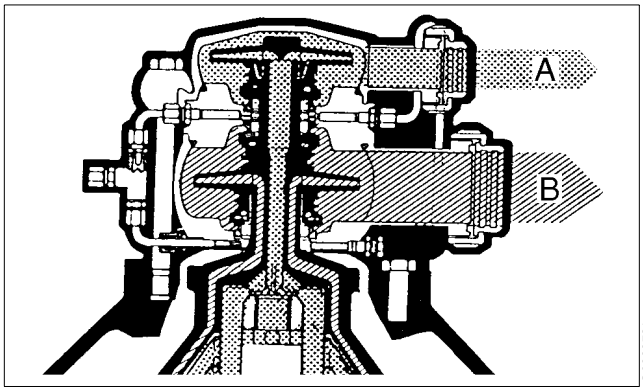
2.2.2 Light phase

Twin phase separators only

Decreased light phase counterpressure → lower concentration

Increased light phase counterpressure → higher concentration

The light phase flow and thus the concentration of the light phase are determined by the pressure difference between the two outlets. With one and the same throughput a certain pressure difference will always give the same light phase flow. With higher counterpressure in the light phase outlet pipe the light phase concentration will be higher.



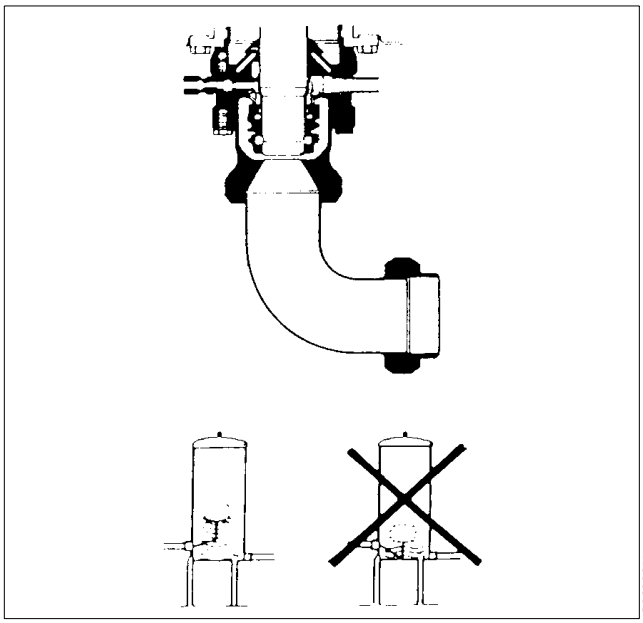
A. Light phase
B. Heavy phase

2.2.3 Air penetration / inlet pressure

A prerequisite for satisfactory separation is that air is prevented from mixing with the process liquid.

Air penetration can occur for instance if the pressure in front of the inlet device is too low or if the balance vessel suddenly becomes empty. This can be caused by a careless change-over of tanks, incorrect dimensions or by changing at the incorrect time. Even simultaneous filling and emptying of a tank can result in admixture of air.

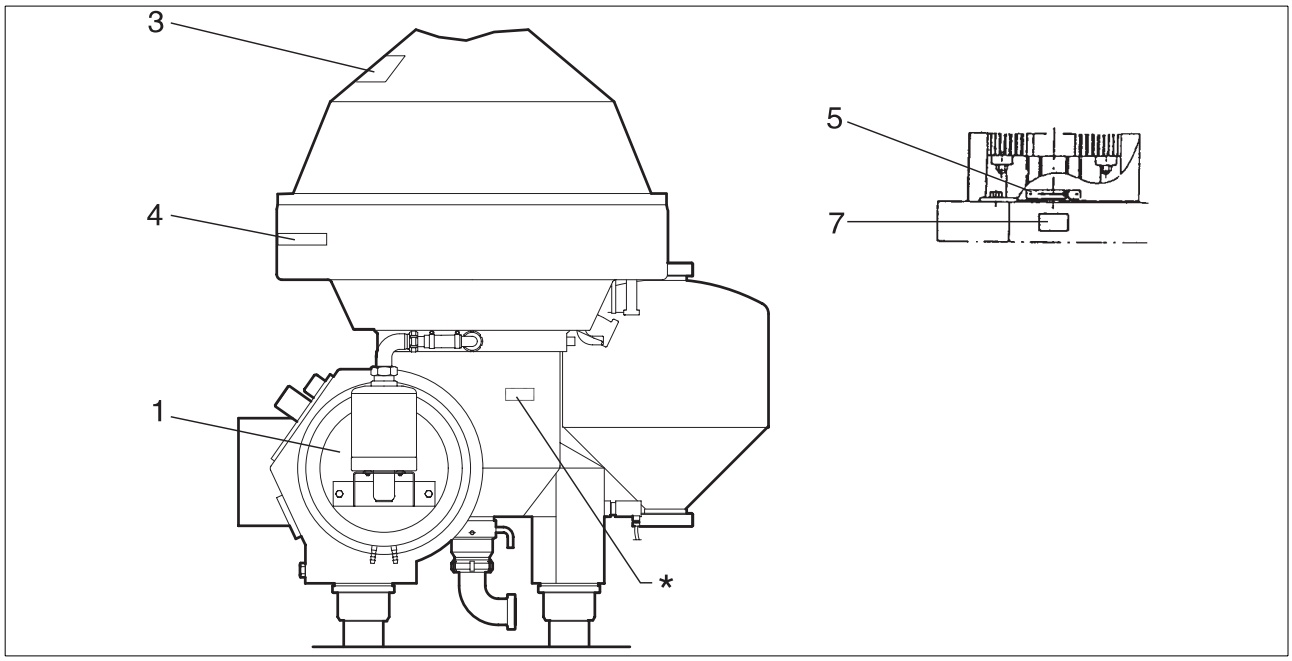
Make sure, therefore, that the inlet pressure is kept at the recommended value and that the balance vessel is always full. In the vessel, the liquid should flow gently without bubbling.



3 Mechanical function

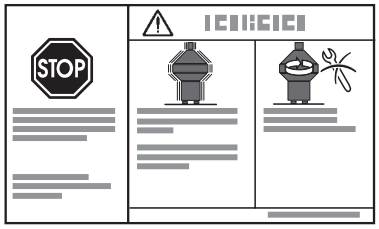
Contents

3.1 Identification and safety signs on the machine



1. Machine plate	Text on plate (**example**):
Separator	A MRPX 614HGV-14C
Manufacturing serial No / Year	XXXX
Product No	881208-01-01
Machine top part	552032-02
Outlet	562013-02
Bowl	546860-12
Machine bottom part	553136-41
Max. speed (bowl)	4265 r/min (50 Hz)
Direction of rotation (bowl)	←
Speed motor shaft	1500 r/min (50 Hz)
El. current frequency	50 Hz / 60 Hz
Recommended motor power	18,5 kW
Max. density of feed	1100 kg/m^3
Max. density of sediment	1380 kg/m^3
Max. density of operating liquid	1000 kg/m^3
Process temperature min./max.	0 - 100 °C

3. Safety label



S0061521

Text on label:

DANGER

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

Failure to strictly follow instructions can lead to fatal injury.

If excessive vibration 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

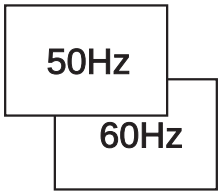
Alfa Laval

S0063211

5. Arrow

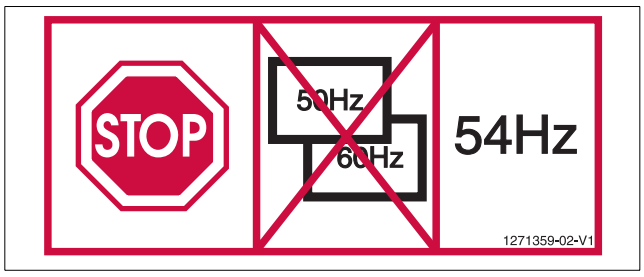
Indicating direction of rotation.

7. Power supply frequency, all separators except HM/BM/BB/WM/ RPX 818



S0063111

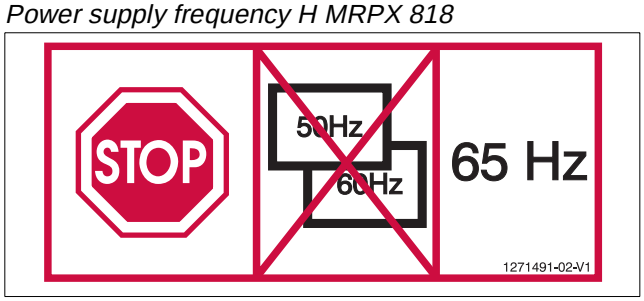
Power supply frequency, **HMRPX 818 (spec. 881210-01-01)**



S0143221

Power supply frequency H MRPX 818

Power supply frequency, **HM/BM/BB/WM/ RPX 818 (spec. 881210-01-02)**



S0145721

Power supply frequency HM/BM/BB/WM/RPX 818

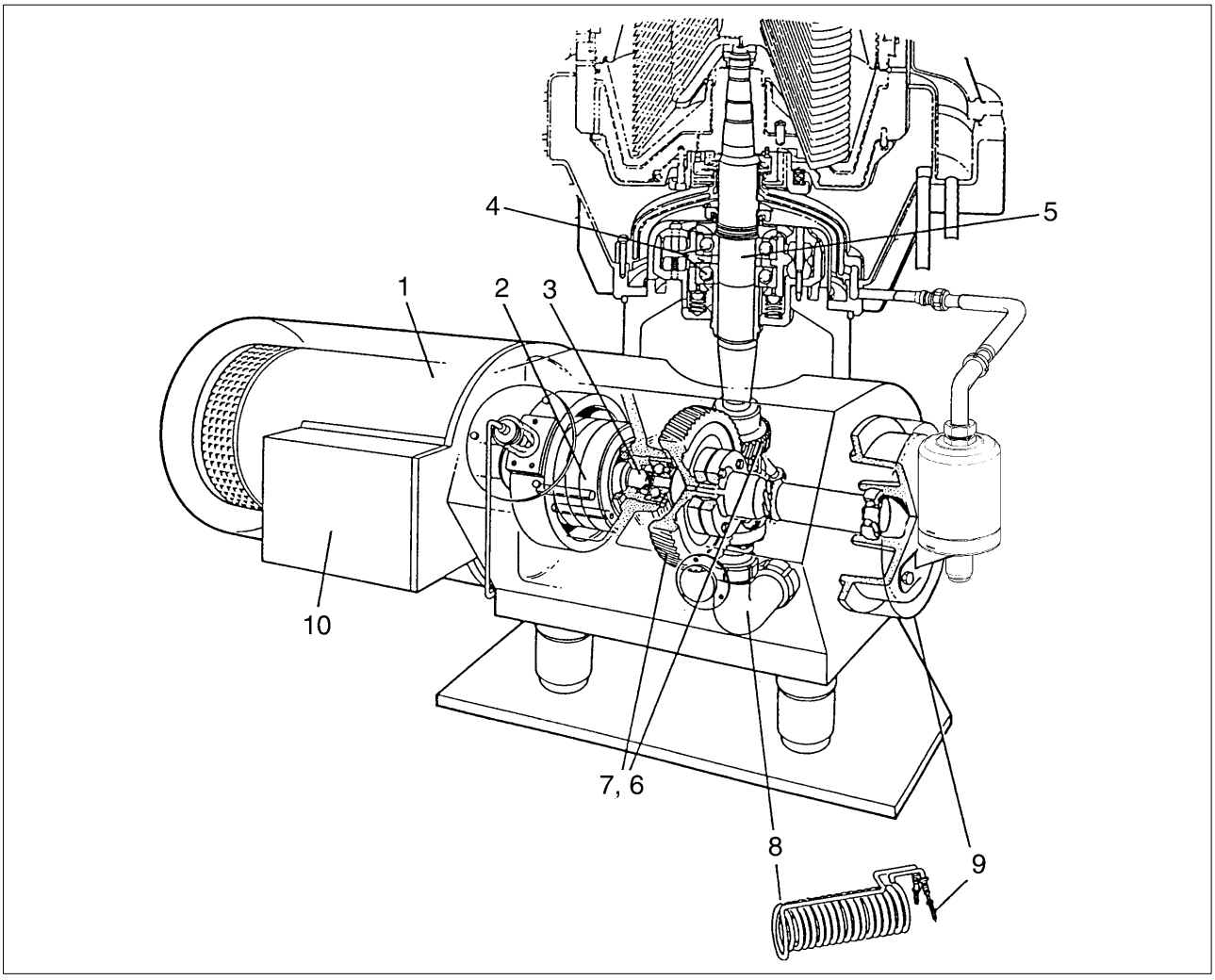
DANGER

Disintegration hazard

This machine must not be operated with higher bowl speed than 4607 r/min.

*** Space reserved for plate indicating representative**

3.2 Power transmission



1. *Electromotor (**Note**! Special motor with built-in thermistors)*
2. *Coupling*
3. *Worm wheel shaft*
4. *Top bearing*
5. *Bowl spindle*
6. *Worm*
7. *Worm wheel*
8. *Cooling coil for oil bath*
9. *Cooling water inlet/outlet for coil*
10. *Box for electric and thermistor connections. To be remedied only by authorized personnel. It is important for the sake of security during maintenance to have a disconnection switch installed visible from the separator.*

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

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

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

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

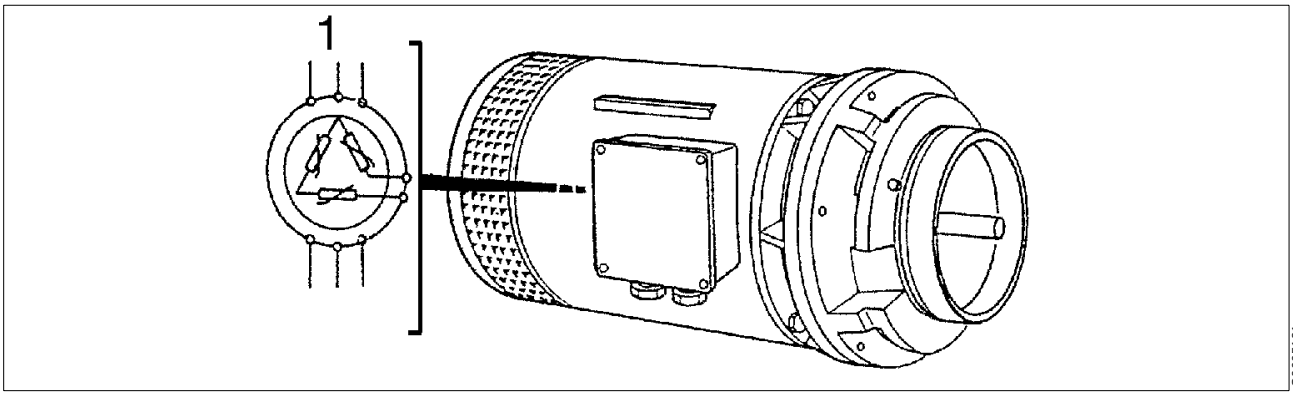
The oil is cooled by the water flowing through the coil (8).

The cooling water from the coil then passes through external pipes to the axial seals.

Sealing water – see “Connection list” in *Installation Manual*.

Oil – see “Lubricants” in *Service & Maintenance Manual*.

3.2.1 Motor and starter



View of a CT motor

1. Thermistors Run-up period: Y-connected
Operation: D-connected

The separator has a flexible coupling and for this reason the motor must be able to endure long run-up times. For this purpose the separator is equipped with one of following two motor types:

CT motor

This motor has been designed by Alfa Laval as “Control-torque motor” - abbreviated to CT motor.

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

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

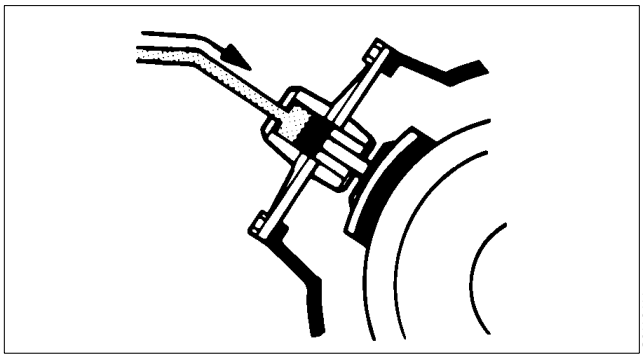
Frequency drive motor

This motor is similar to a standard three phase motor. The long running up time is, however, controlled by a frequency converter.

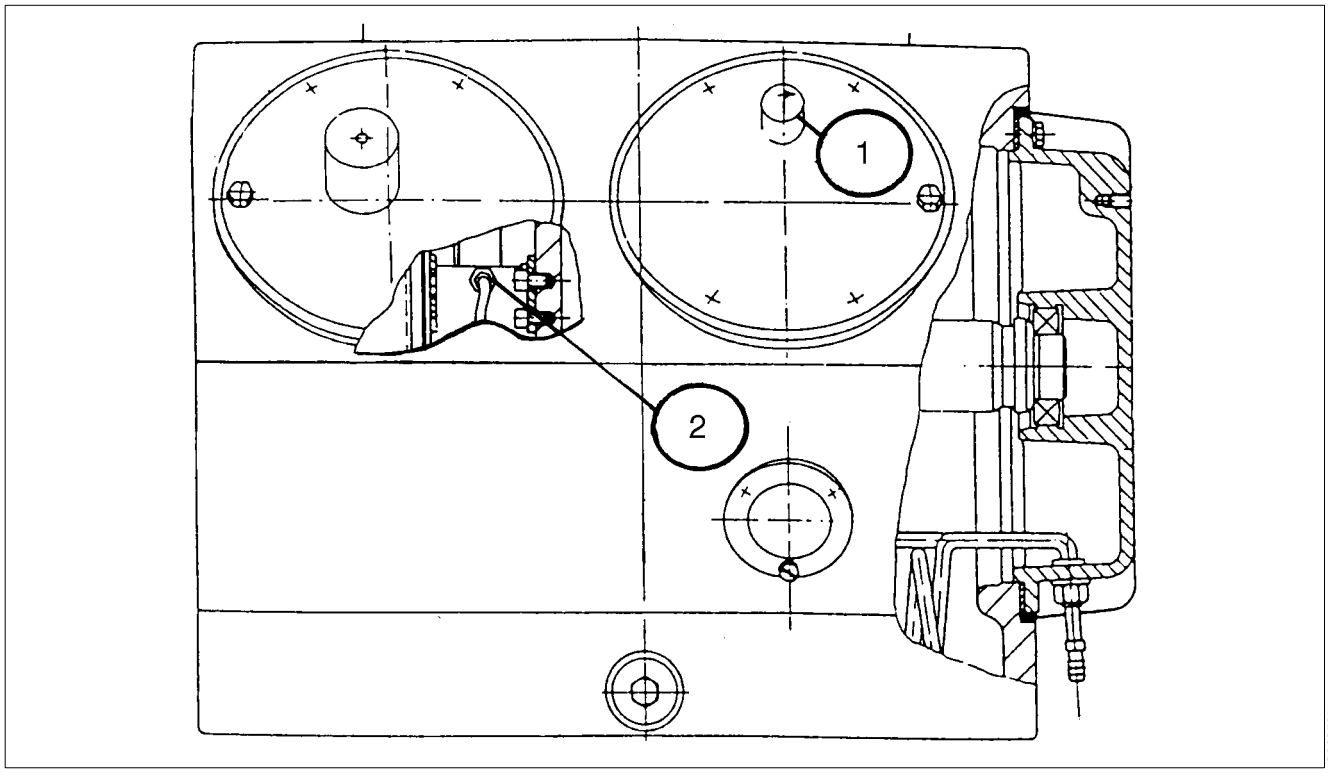
3.3 Brake

To shorten the bowl retardation time and thus quickly pass the critical speed, the brake must always be used when the machine is to be stopped.

The machine is provided with a pneumatic brake, which is actuated when compressed (max. 400 kPa) air is supplied.



3.4 Speed indication



1. *Revolution counter*
2. *Speed sensor for remote indication*

Revolution counter

For manual speed checks, the machine is provided with a revolution counter. The correct number of revolutions per minute for the machine is given on the type plate and / or on the data sheet for the type of machine in question, see “Technical data” in *Installation Manual*.

Remote indication of speed (option)

In addition to the revolution counter, the separator can be provided with a device for remote indication of speed, showing the number of revolutions made by the worm wheel shaft.

Remote indication is obtained by an electronic speed instrument.

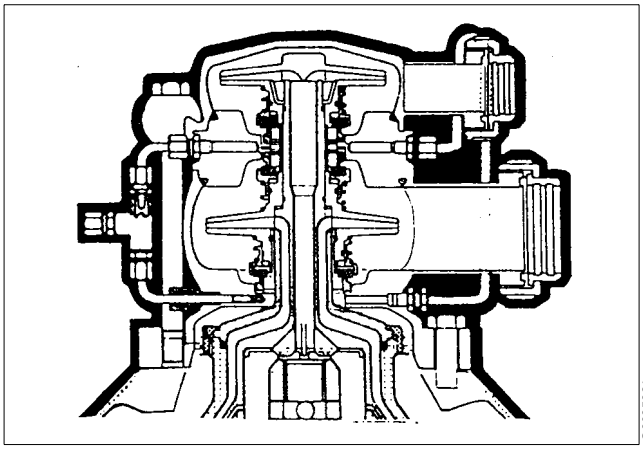
It is essential that the machine should run at the correct speed, for safety reasons as well as separation-technical.

Speed – see “Technical data” in *Installation Manual*.

3.5 Outlet / inlet (twin phase separators)

3.5.1 Outlet pumps

The pumps are fixed on to the top of the bowl and thus follow its rotation. They provide the necessary pressures for the heavy phase and the light phase. It is assumed that the separator is supplied with adequate inlet pressure.



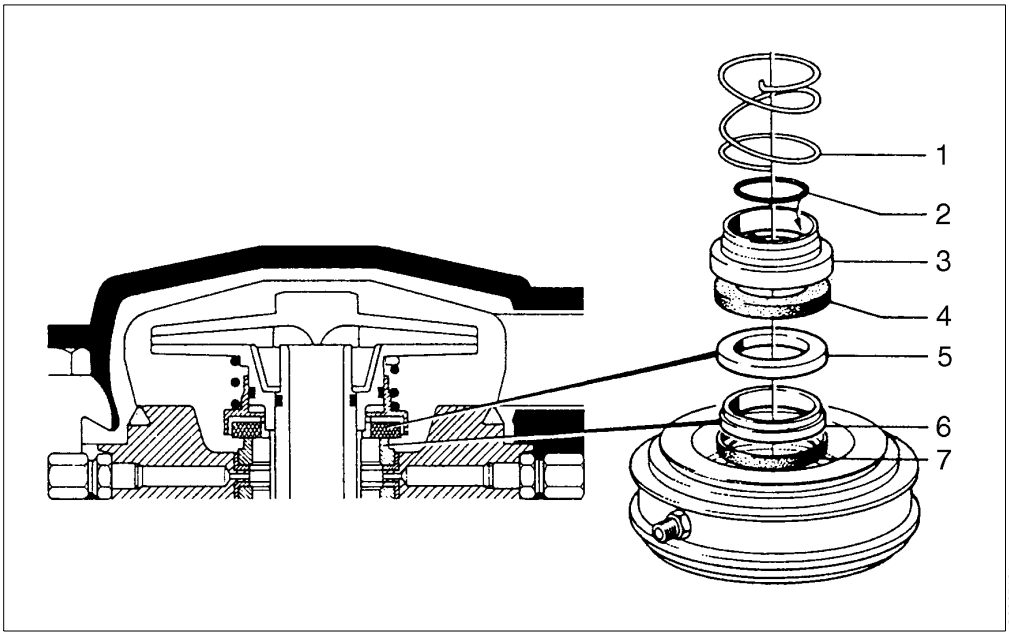
3.5.2 Inlet device

The required inlet pressure is obtained directly from the supply pipe of the separator. If necessary, an external pump can be located before the separator.

3.5.3 Axial seals

The connection of the inlet and outlets to the bowl is made airtight (hermetic) by means of axial seals. There are three seals for the outlets and one for the inlet.

1. *Coil spring*
2. *O-ring*
3. *Support for wear ring*
4. *L-shaped rubber*
5. *Wear ring*
6. *Sealing element*
7. *L-shaped rubber*



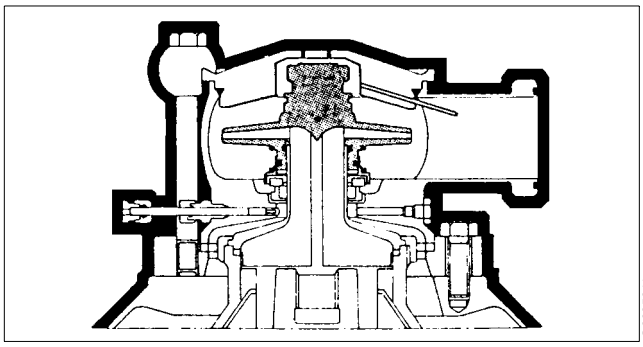
An axial seal consists of a rotary wear ring and a non-rotary sealing element.

The sealing element and wear ring must always be flushed with liquid when the bowl rotates. The seals are therefore supplied, through special channels, with flushing water, and during the CIP-period with CIP-liquid.

3.6 Outlet / inlet (single phase separators)

3.6.1 Outlet pump

The pump is fixed on to the top of the bowl and thus follows its rotation. It provides the necessary pressure for the clarified phase. It is assumed that the separator is supplied with adequate inlet pressure.



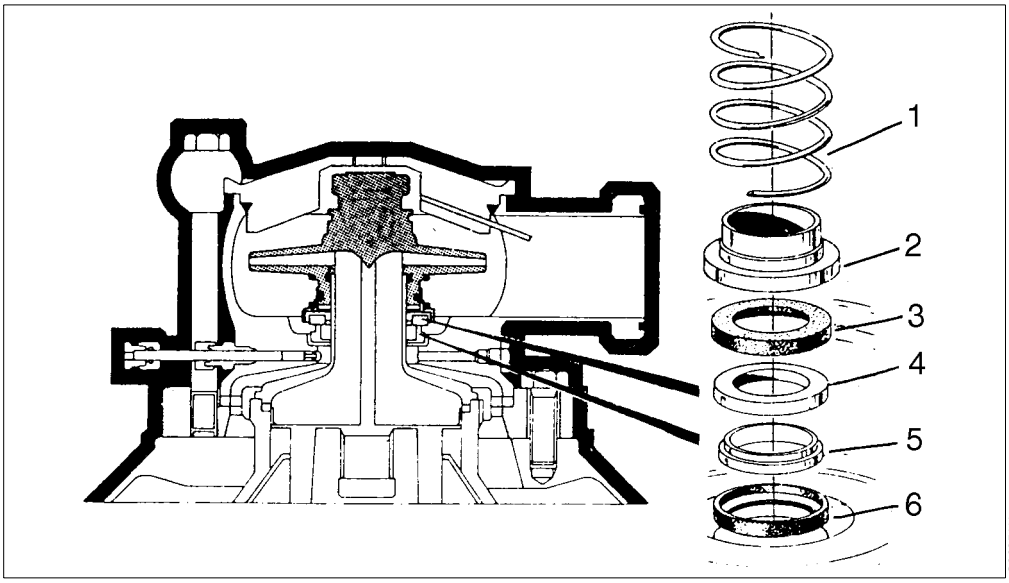
3.6.2 Inlet device

The required inlet pressure is obtained directly from the supply pipe of the separator. If necessary, an external pump can be located before the separator.

3.6.3 Axial seals

The connection of the inlet and outlet to the bowl is made airtight (hermetic) by means of axial seals. There is one seal for the outlet and one for the inlet.

1. *Coil spring*
2. *Support for wear ring*
3. *L-shaped rubber*
4. *Wear ring*
5. *Sealing element*
6. *L-shaped rubber*



An axial seal consists of a rotary wear ring and a non-rotary sealing element.

The sealing element and wear ring must always be flushed with liquid when the bowl rotates. The seals are therefore supplied, through special channels, with flushing water, and during the CIP-period with CIP-liquid.

3.7 Axial seals – cooling system

(The illustrations in this chapter show twin phase separators)

During starting / separation / stopping periods

During the starting / separation / stopping periods, cooling water is fed to the seals through connections (2 and 3).

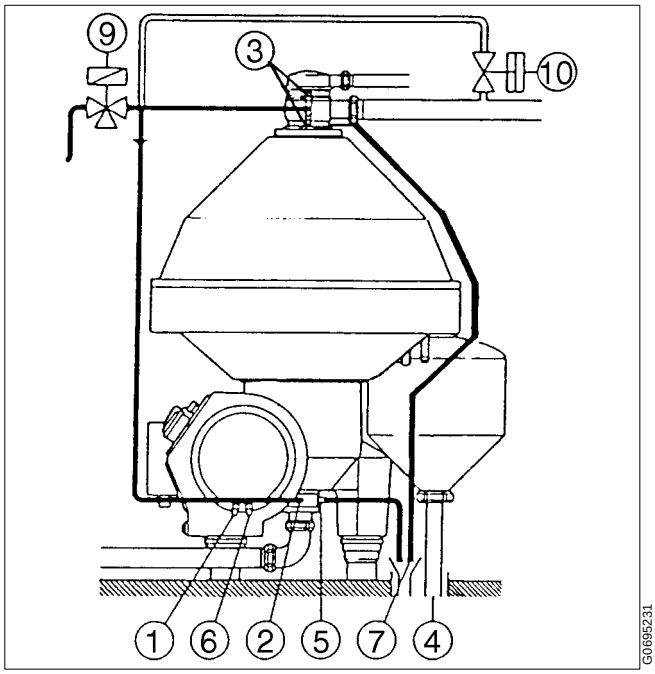
The cooling water from the outlet seals discharges through the sediment outlet (4) and pipe (7). From the inlet seals the water flows out through outlet (5).

Water pressure and flow – see “Connection list” in *Installation Manual*.

1, 6 Cooling coil for oil bath.
2, 3 Cooling water inlet
4 Sediment outlet / cooling water outlet
5, 7 Indication tube for cooling water
*9 Valve *)*
10 Valve

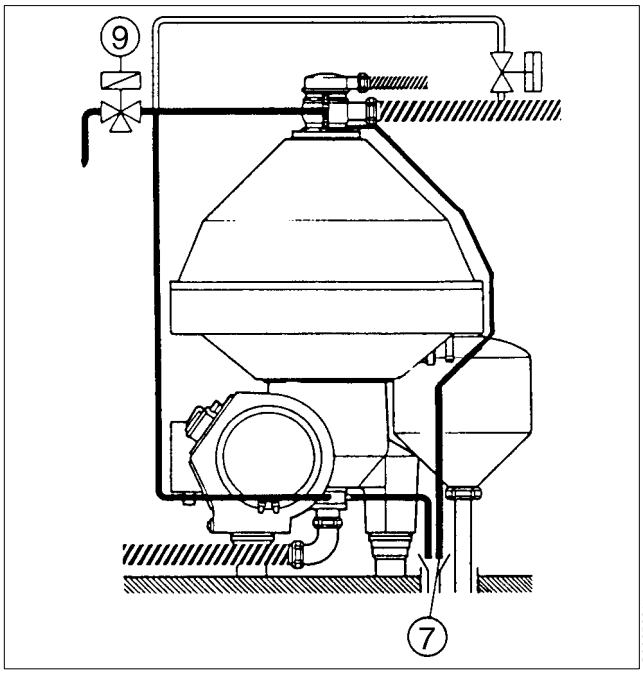
**) Normally included in the control unit cabinet.*

Note: The indication tubes (5 and 7 in the figure) provides an easy means of visual indication that water is being supplied to the seals. Note that the pipes (5 and 7) will also serve as an indication pipe for seal leakage, if any.



During separation

The cooling water flows in throughout the separating period. The flushing water should flow through the indication tube (7). The flushing water should be clear and not discoloured.



NOTE

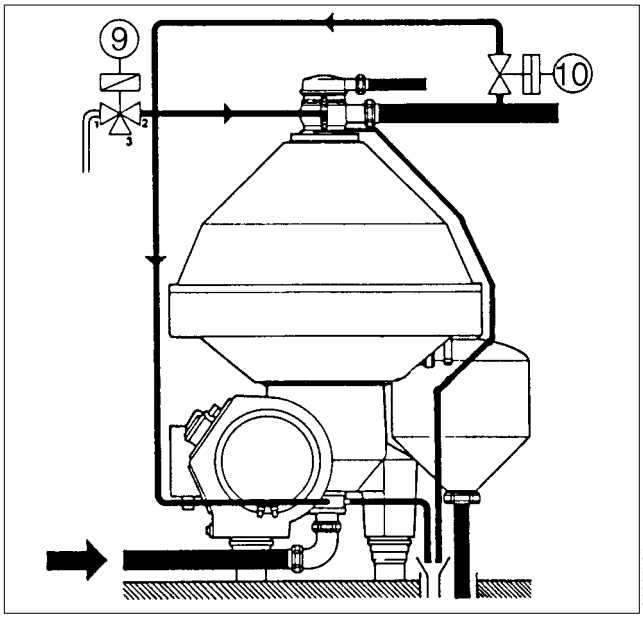
If the flushing water is discoloured, this may be due to leaking axial seals.

In cases of major leakage, the seals must, of course, be inspected and possibly replaced. (See *Service & Maintenance Manual*.)

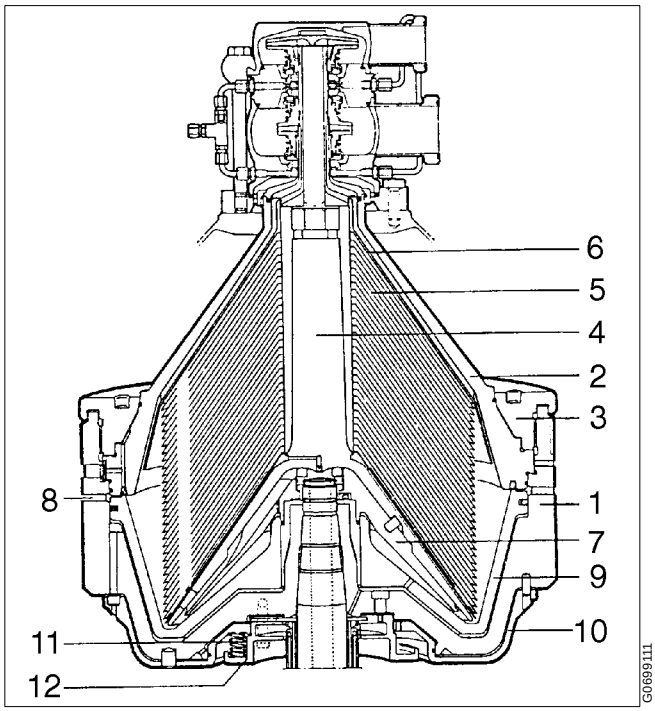
Minor discoloration from possible seal leaks may occur for a short time, especially when new seals have been installed. This does not affect the running of the machine.

During cleaning (CIP)

To clean the space around the seals it is best to draw off washing liquid from the heavy phase outlet, by a valve (10). The solenoid valve (9) is then closed.



3.8 Bowl



Twin phase separators

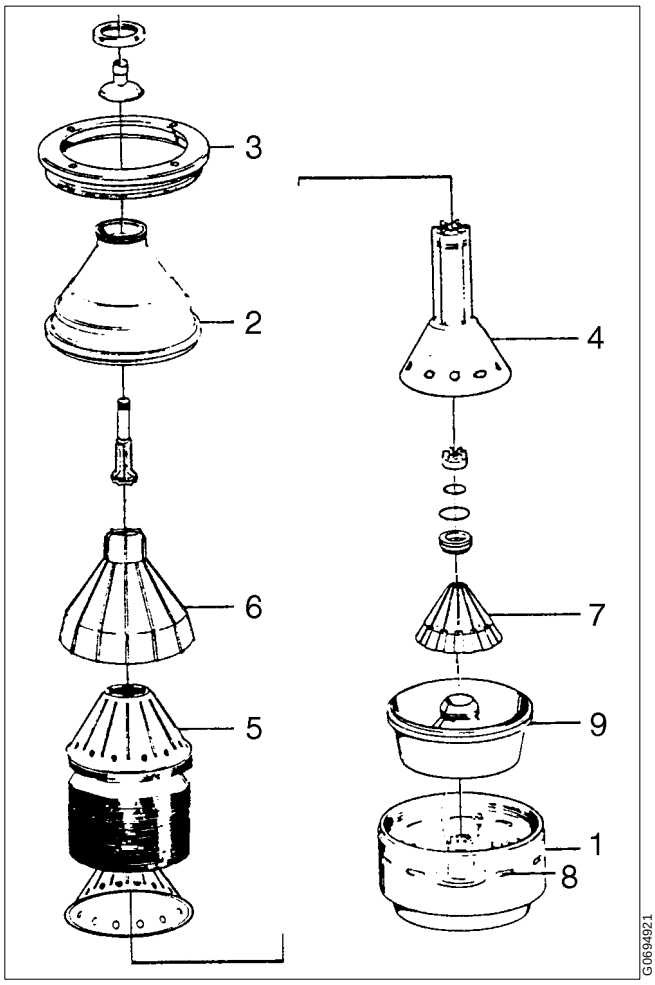
The bowl body (1) and the bowl hood (2) which make up the casing of the bowl are held together by the large lock ring (3).

Housed in the bowl are the distributor (4), distributing cone (7) and the disc stack (5), where the separation takes place. Uppermost in the disc stack is the top disc (6), on the pipe of which the discharge pumps are mounted.

The parts by which the sediment discharges are effected are marked with an asterisk (*) in the list below. The ejection process is described in section “4.1 Function description” on page 36.

NOTE

The bowl must only be disassembled / assembled by personnel with the proper training.



1. *Bowl body*
2. *Bowl hood*
3. *Lock ring (large)*
4. *Distributor*
5. *Bowl discs*
6. *Top disc*
7. *Distributing cone*
8. *Sediment port*
9. *Sliding bowl bottom*)*
10. *Operating slide*)*
11. *Spring*)*
12. *Spring support*)*

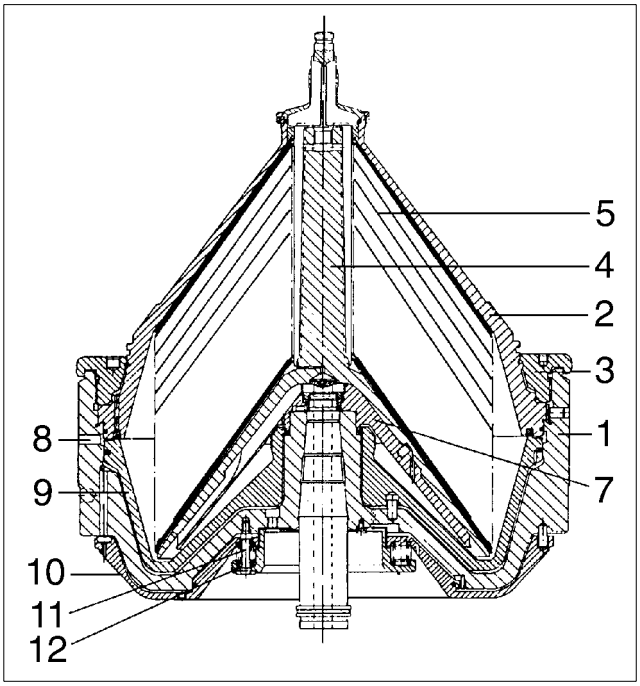
Single phase separators

The bowl body (1) and the bowl hood (2) which make up the casing of the bowl are held together by the large lock ring (3).

Housed in the bowl are the distributor (4), distributing cone (7) and the disc stack (5), where the separation takes place.

The parts by which the sediment discharges are effected are marked with an asterisk (*) in the list below. The sediment discharge function is described in another section of this book, see “4.1 Function description” on page 36.

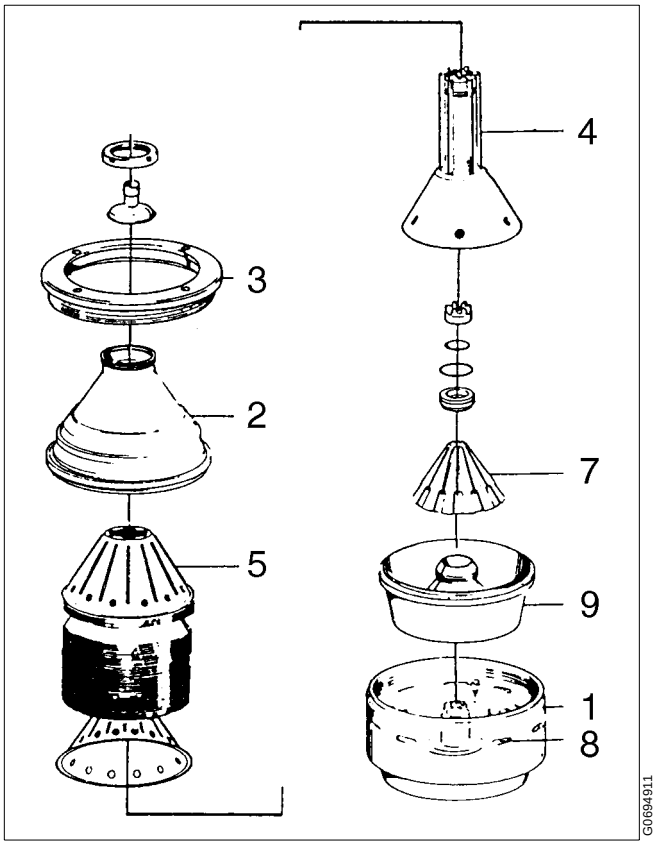
Replacement of certain parts necessitates rebalancing if the bowl. Such parts are specially indicated in the *Spare Parts Catalogue*.



NOTE

The bowl must only be disassembled / assembled by personnel with the proper training.

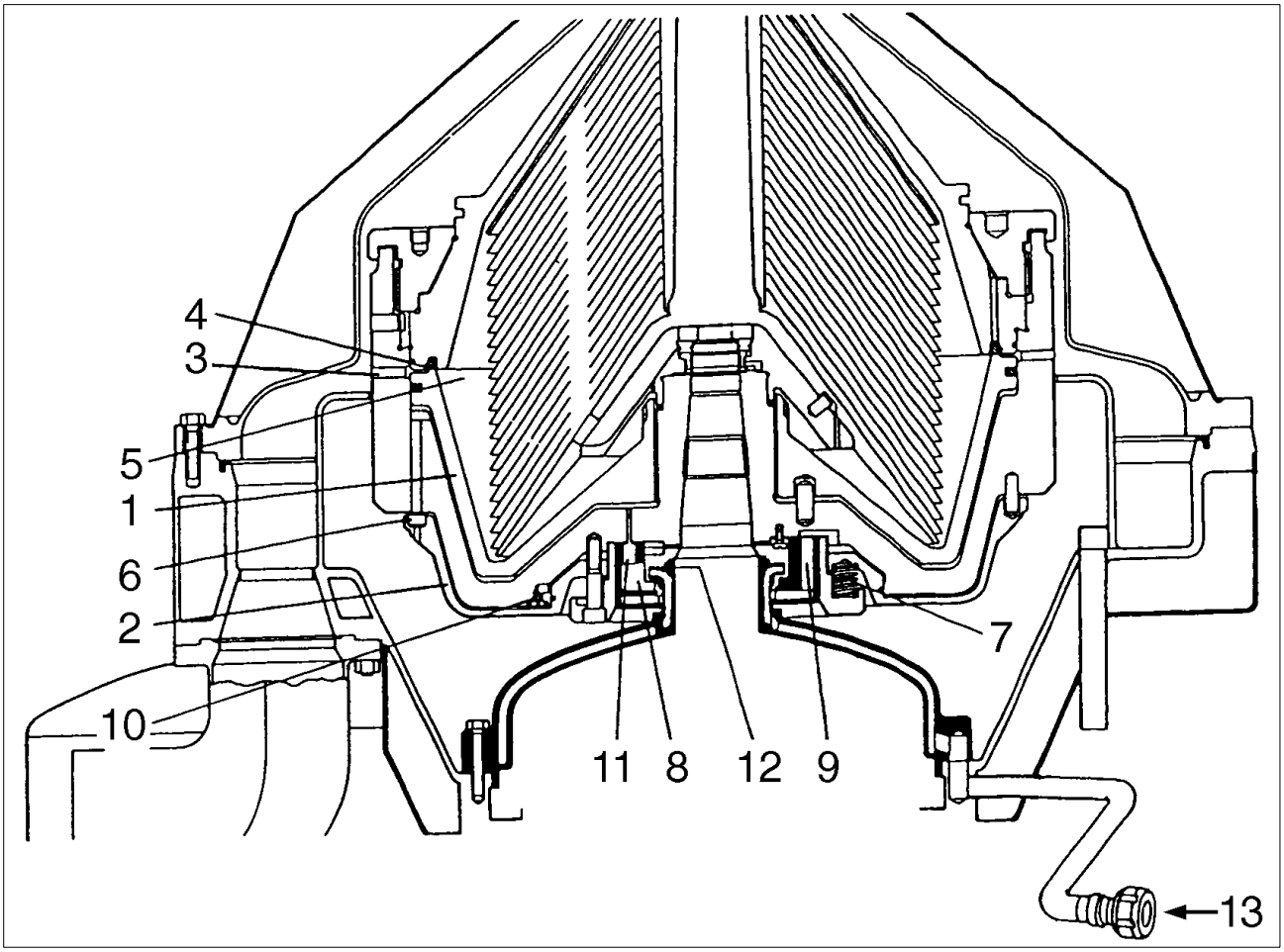
1. *Bowl body*
2. *Bowl hood*
3. *Lock ring (large)*
4. *Distributor*
5. *Bowl discs*
6. *-*
7. *Distributing cone*
8. *Sediment port*
9. *Sliding bowl bottom*)*
10. *Operating slide*)*
11. *Spring*)*
12. *Spring support*)*



4 Sediment discharge function

Contents

4.1 Function description



Bowl

1. *Sliding bowl bottom*
2. *Operating slide*
3. *Sediment ports*
4. *Seal ring*
5. *Sediment space*
6. *Valve plugs*
7. *Coil springs*
8. *Closing water chamber*
9. *Opening water channel (discharge)*
10. *Draining nozzle*
11. *Closing water channel*
12. *Control paring disc*
13. *Operating water supply from the OWMC, see* “4.2 Operating water module compact (OWMC)” on page 38

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

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

When a discharge shall be effected, compressed air forces the piston in the OWMC forwards. Water is now supplied in such quantity that water flows over the edge of operating water chamber and onwards through the channel (9) to the upper side of the operating slide.

- The slide is forced downwards by the liquid pressure created between the operating slide and the bowl body thereby opening the valve plugs enabling the closing water under the sliding bowl bottom to escape.
- The sliding bowl bottom is pressed downwards, uncovering the ports in the bowl wall so that the sediment is discharged.
- The water on the upper side of the operating slide is drained off through a nozzle (10).
- When water has been sufficiently drained through the nozzle, the coil springs again force the operating slide upwards, closing the valve plugs. The sliding bowl bottom is forced upwards by the operating water supply. Thus the bowl is closed.
- The low pressure water is supplied during the whole cycle.
- The operating water now presses the OWMC piston back into its end position by means of the operating water pressure. The discharge is completed.

Solids and / or excessive mineral content in the operating water will disturb, and eventually block the discharge function.

4.2 Operating water module compact (OWMC)

Purpose

The separator bowl can be emptied from solids by two different sediment discharge volumes determined by the duration of the increased operating liquid flow from the Operating Water Module Compact (OWMC), i.e. the time the bowl is being open. The two discharge volumes may be regarded as small and large respectively.

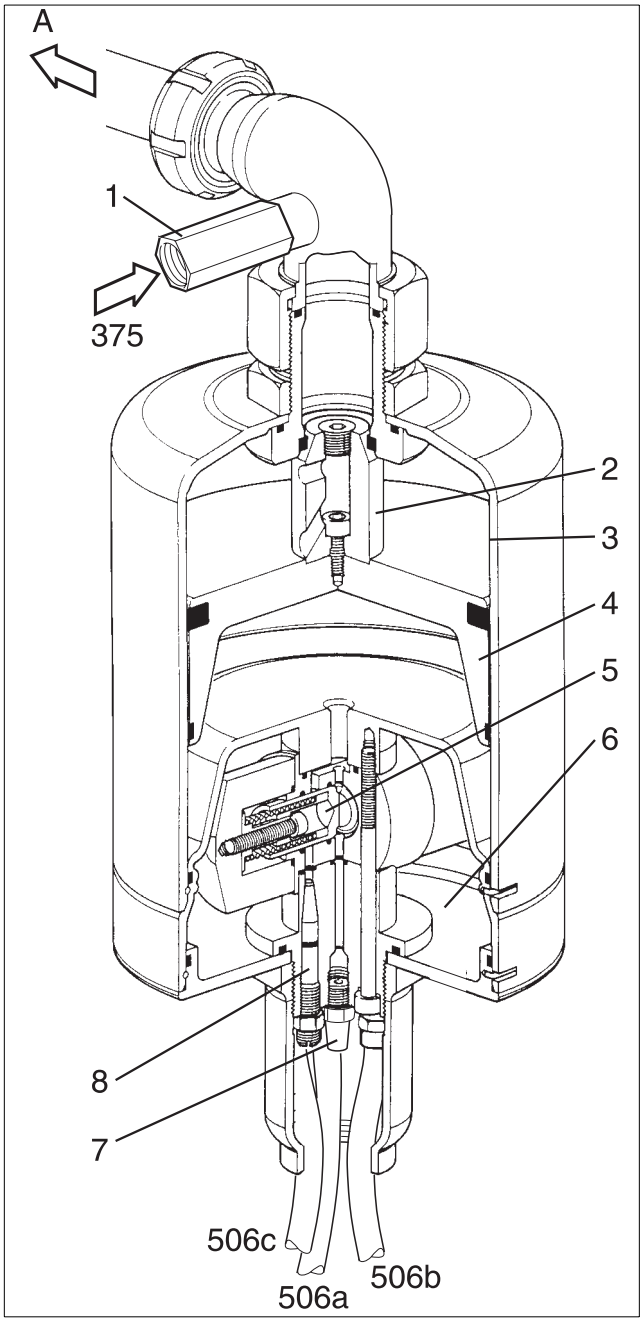
Design

1. Check valve
2. Two-step adapter
3. Water cylinder
4. Piston
5. Servo valve
6. Air reservoir
7. Silencer
8. Needle valve

375. Inlet of discharge and make-up liquid to OWMC

506a. Air supply into air reservoir
506b. Signal air, small discharge
506c. Signal air, large discharge

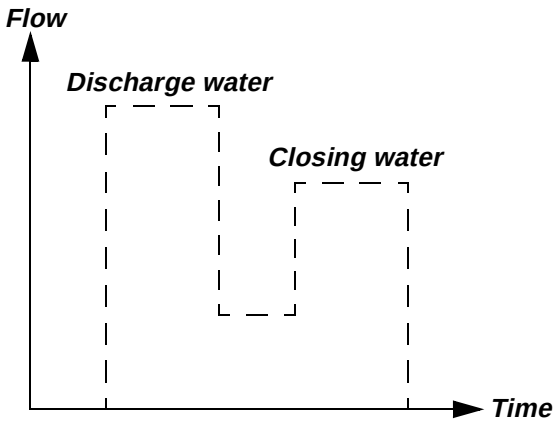
A. Outlet of discharge and make-up liquid from OWMC to bowl



The OWMC is designed as a stainless steel construction consisting of an air reservoir (6), a water cylinder (3) with piston (4) and a servo valve (5). The module is equipped with connections for air supply (506a) and signal air (506b and c).

The OWMC is also equipped with a needle valve (8) for regulating of air flow for the small discharge and a silencer (7).

The OWMC gives a two-step flow which implies that the liquid flows into a one channel system in two steps, see the illustration below. The first step creates a high liquid flow which triggers a sediment discharge, and the second step (with a lower flow) will admit the bowl to close while closing (make-up) liquid is added to the bowl. The flow between the two steps is very low.



Settings

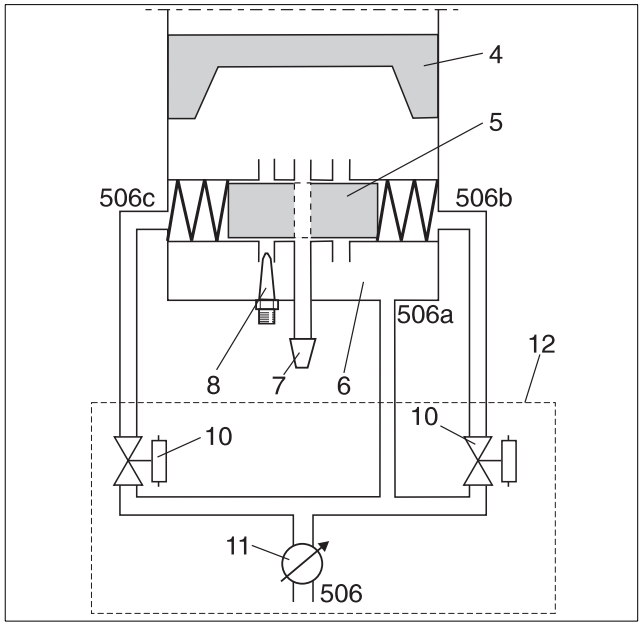
Start to set the large discharge volume.

Proceed in following way:

1. Set the air pressure regulator (11) to 400 kPa (4 bar).
2. Initiate a discharge by opening solenoid valve for air supply inlet (506c).
3. Measure the discharged volume.
4. Adjust the discharged volume by altering the pressure of the compressed air. A higher pressure gives a larger volume. The air pressure can be regulated between 400 and 600 kPa (4 - 6 bar).

Continue with the small discharge in following way:

1. Open the needle valve (8) 3 turns.
2. Initiate a discharge by opening the solenoid valve for air supply inlet (506b).
3. Measure the discharged volume.
   The recommended volume for a small discharge is the sediment space volume of the bowl given in “Technical data” in the *Installation Manual*.
4. Adjust the discharged volume by regulating the needle valve. A more open valve (anti-clockwise) gives a larger volume.



NOTE

Do not adjust the air pressure to change the volume for the small discharge. If doing so, the volumes for both large and small discharges will be changed.

The needle valve only sets the ratio between the large and small discharges.

NOTE

The separator bowl must not be discharged with a too small volume as this leads to build-up of sediment in the sediment space as well as in the disc stack resulting in an impaired separation efficiency.

5 Installation and first start

Contents

5.1 Preparations

1. Set up the machine (without the bowl) according to the installation instructions.
2. Flush the piping thoroughly to remove any residues such as chips, welding beads, etc.

NOTE

All piping must be disconnected from the separator.

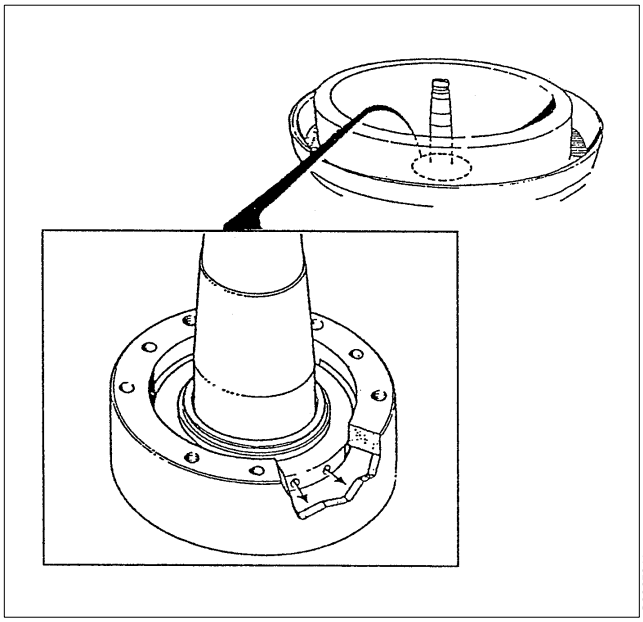
3. Check the operating water functions and operating water flow as below.

Checking the operating water flow.

When operating water is fed (**375***) water shall squirt out of the holes in weak jets.

During operation there will be no consumption of water when the pressure is lower than 50 kPa (0,5 bar).

At discharge water shall squirt out of the holes in powerful jets.



4. Check that the water flow-rates correspond to data in “Connection list” in *Installation Manual*:
   - Water for lubrication oil cooler **409***.
   - Water for discharge **375***.
   - Water for cooling frame parts **405*** and **406***.

NOTE

Pressure in connection **405*** and **406*** must not be higher than 50 kPa. Risk for deformation of frame hood and contact with rotating part.

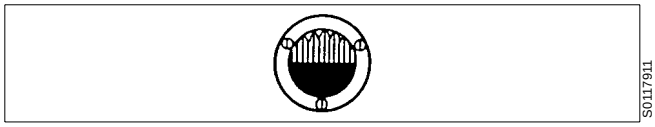
NOTE

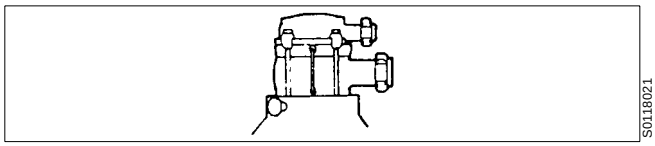
Outlet **406*** and **464*** must be open. No restrictions allowed.

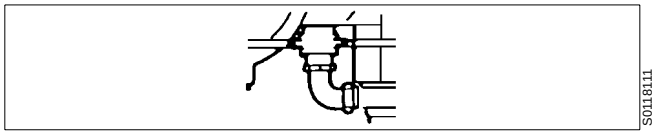
*) Numbers refer to “Connection list” in *Installation Manual*.

5.2 Before first start

- Pour about 13 litres lubricating oil of correct grade into the worm gear housing – see “Lubricants” in *Installation Manual*.
- Check the oil (approx. half way up the sight glass). Be aware of that a very small quantity of oil may remain at the bottom edge of the sight glass even when the gear housing is emptied for oil.
- Assemble the bowl and the inlet and outlet parts as described in the *Service & Maintenance Manual*.
- Make sure that the frame hood bolts have been tightened.
- Make sure that the bolts for centring ring and outlets have been tightened to the correct torque. See Service & *Maintenance Manual*.
- Make sure that the bolts for the inlet device have been tightened.
- Check that water and air are being supplied to the control panel.







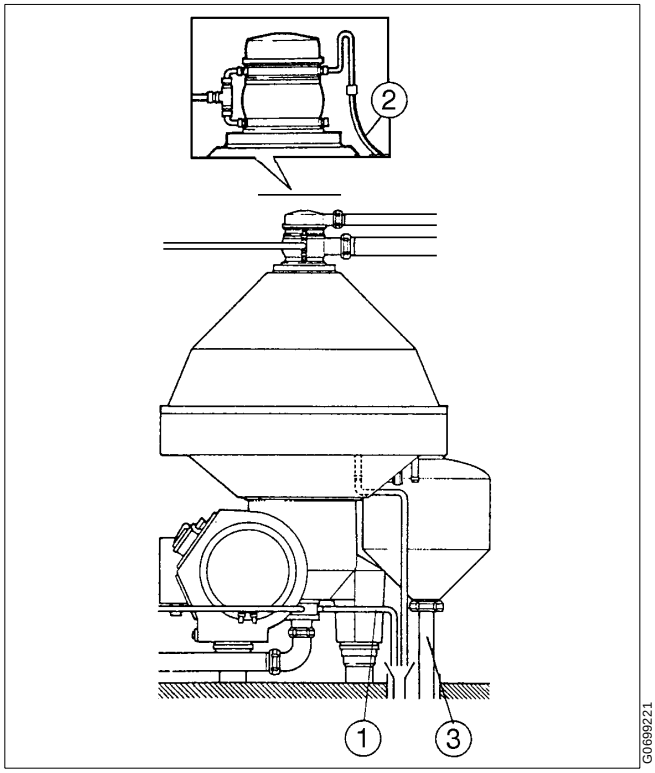
Make sure that cooling water is being supplied to the separator.

Check at

(1) – from inlet device seal

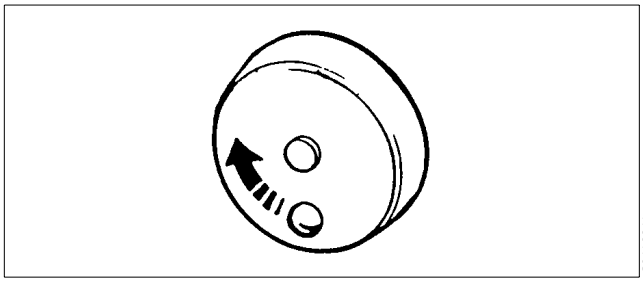
(2) – from outlet upper seals (twin phase separators only, see ill.)

(3) – from outlet bottom seal (at operation).



5.3 First start

- Start the machine
- Check the direction of rotation (see revolution counter).



Revolution counter

NOTE

At the switch-over to D the amperage will increase considerably, but will quickly drop towards the idling level provided that the motor is correctly connected. If the amperage remains at the high level, the motor has been wrongly connected. Stop the motor immediately.

- When the bowl has reached running speed, check the revolution counter reading. For speed particulars, see “Technical data” in *Installation Manual*.

  The bowl is now closed (provided that make-up water has been supplied during the run-up period).
- Make sure that the valves in the outlets are open.

5.4 Operation

- With the bowl closed, supply water to the bowl (start the feed pump).
- Make sure that the separation inlet pressure is suitable and the throughput correct. Then check outlet pressures, see “Selection of outlet impeller (twin phase separators)” in *Installation Manual*.
- Shut off the cooling water to the axial seals.

NOTE

It is important to have liquid flow through the bowl.

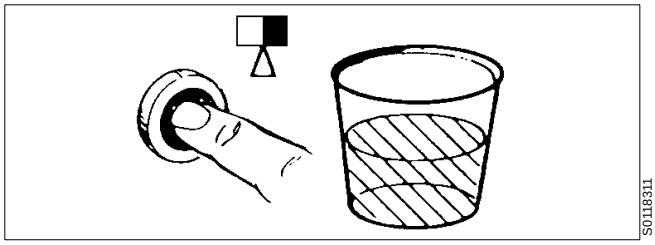
- Check that the bowl is tightly closed – no water in the cyclone outlet.
- Disconnect the pipes for cooling water to the outlet seals. Check for possible leakage from these. Major leaks must not occur. Minor leaks may temporarily be left uncorrected. Some seals need as a rule certain wear-in period.
- Connect the pipes for cooling water.
- Open the cooling water supply again.

5.4.1 Ejection process

WARNING

Liquid ejected at high velocity

Ensure that no sediment discharge takes place when opening cyclone cover. **Wear safety goggles**.



- Disconnect the pipe from the cyclone as well as the sediment cover flushing hose.
- Make the settings of the Operating Water Module to achieve the discharge volumes desired, see “Interface description, Component description and signal processing” in *Installation Manual*.
- Initiate a large discharge. If the bowl opens, closes and then opens again (so-called double discharge), adjust the air pressure until you arrive at the volume desired. Finally adjust the needle valve to achieve a suitable small discharge.
- Secure the cyclone outlet pipe and the sediment cover flushing pipe.

5.4.2 Cleaning

- Carry out the cleaning programme. Check that washing solution is running out of the axial seals.

5.4.3 Separation

- Supply process liquid.
- Check the inlet pressure, see “Selection of outlet impeller (twin phase separators)” in *Installation Manual*.
- Adjust the outlet pressures, see “Selection of outlet impeller (twin phase separators)” in *Installation Manual*.

5.4.4 Operation

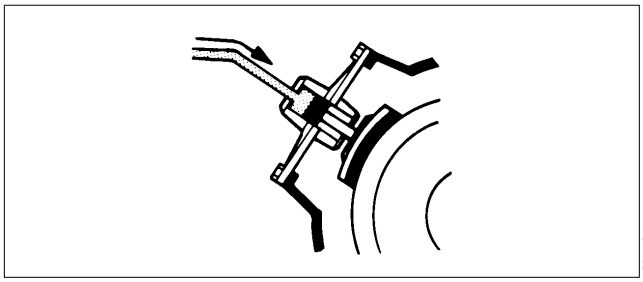
- Check the throughput. Make a final adjustment of inlet and outlet pressures.
- Make sure that no air is being sucked into the feed pipe via e.g.a balance vessel, if fitted. This should always be kept filled. The process liquid should flow evenly in the vessel without bubbling.

After separation is completed, carry out the cleaning programme. Dismantle the bowl and check the cleaning 3 – 4 days after the first operation with product.

5.5 Stopping

The control system actuates the brake when stopping the separator.

Cooling water to the axial seals and air to the brake will be turned off automatically after the bowl has stopped.



DANGER

Entrapment hazard

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

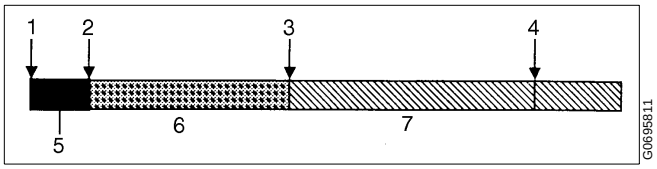
The revolution counter indicates separator rotation.

6 Cleaning

Contents

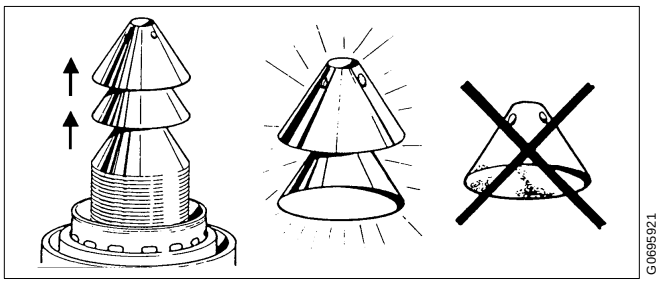
6.1 Check of cleaning

The bowl should be dismantled and the cleaning checked approx. 3 – 4 days after the first operation with process liquid. Repeat the check after a further 14 days. If the results are favourable, the bowl can be left untouched until a minor overhaul is due. This should normally be made after about 3 months.



1. *1st run with process liquid*
2. *1st inspection*
3. *2nd inspection*
4. *Routine inspection*
5. *3-4 days*
6. *14 days*
7. *Approx. 3 months*

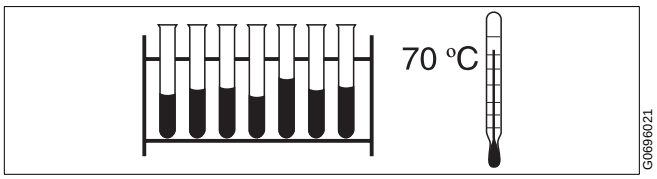
Inspect **all** discs. The upperside as well as the underside of **every** disc must be bright. Fatty discs and sediment residues on the discs indicate bad cleaning.



NOTE

A greyish film (but not containing process liquid residues) may also occur on the discs if the lye has been circulated after the acid. To remove the film an extra run with acid for about 10 minutes is recommended.

If the bowl turns out to be badly cleaned, check the temperature and concentrations of the acid and lye. Correct any deviations from the recommended values. Do not sample the concentration **once only**, but preferably 5 or 6 times at regular intervals during the entire cleaning cycle. In this way any fluctuations in the concentration can be verified.



6.1.1 Disc pressure

In a tightened bowl the disc pressure may in time decrease so that the individual discs are not stable, although the guide mark on the lock ring is directly aligned to the corresponding mark on the bowl hood. Bad bowl running (vibration) may be the result. If so, one or more extra discs must be added to the disc stack. Extra discs must be located under the thick-caulked discs. See description in the *Service & Maintenance Manual*.

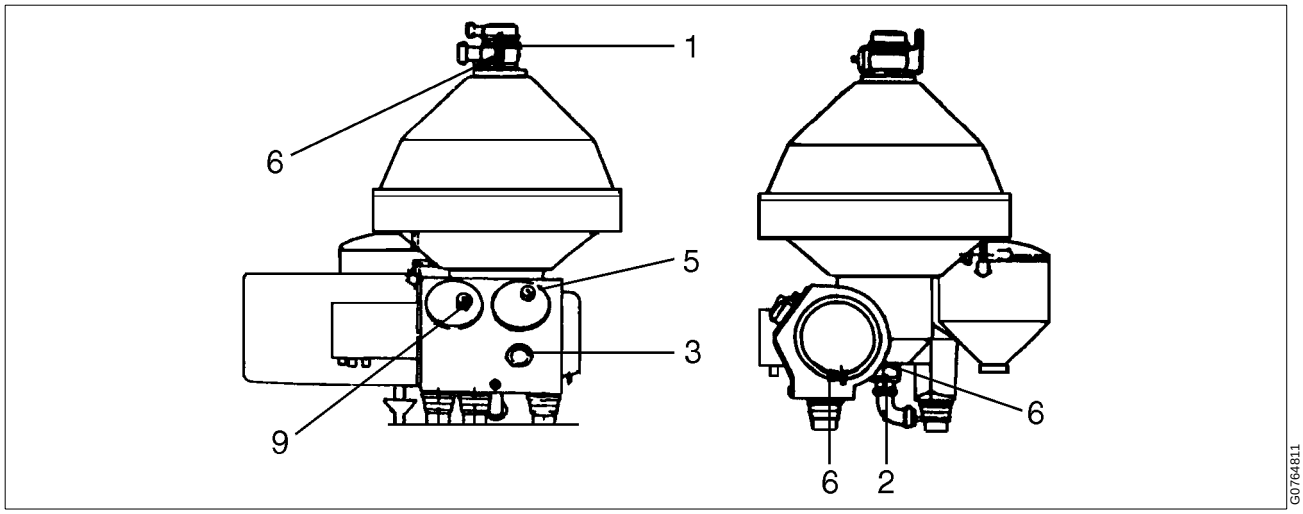
NOTE

Insufficient compression of the disc stack can affect the bowl balance, causing abnormal vibration of the machine.

7 Operating routine

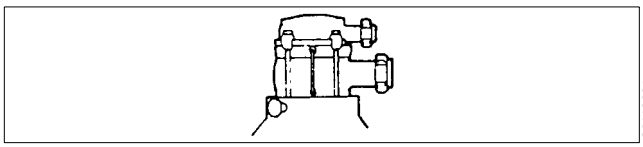
Contents

7.1 Check points

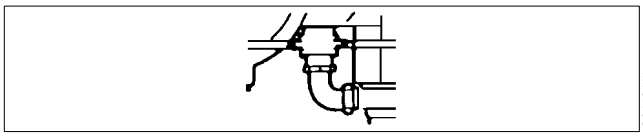


7.1.1 Before start

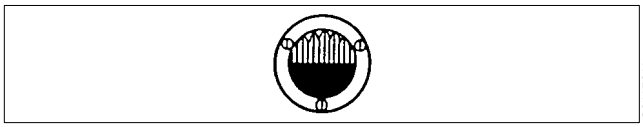
1. Check that the hook bolts of the outlet, the screws of the frame hood and the centring ring are all tightened.



2. Check that inlet device is tightened.

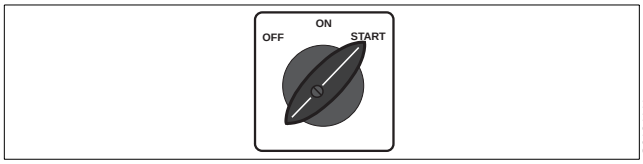


3. Check the oil level.

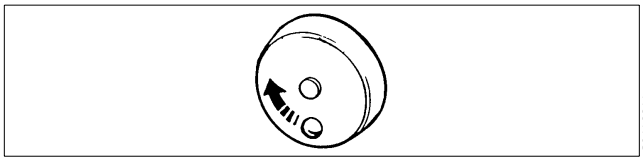


7.1.2 Start and run-up

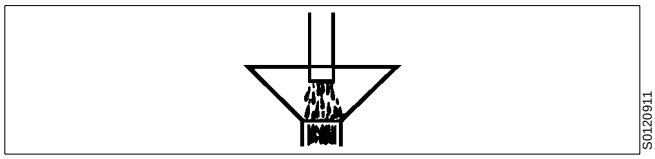
4. Start the separator.



5. Check the direction of rotation of the bowl (see revolution counter).



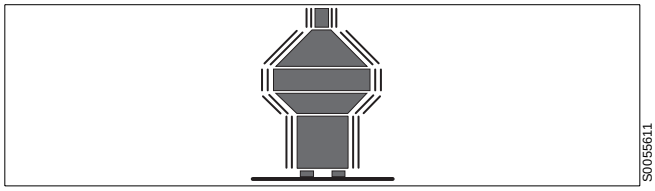
6. Check that water flows from the oil cooling coil and the axial seals.



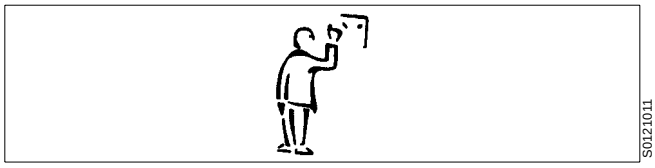
DANGER

Abnormal vibration of the machine during run-up may be due to wrong assembly or bad cleaning of the bowl.

If so, stop the machine **immediately** and inspect the bowl.



7. Choose production mode when the separator is ready for production.



7.1.3 Separation

- Check that the machine has correct inlet and outlet pressures.
- Check the throughput.
- Make sure that air is not sucked into the feed line.

7.1.4 Cleaning

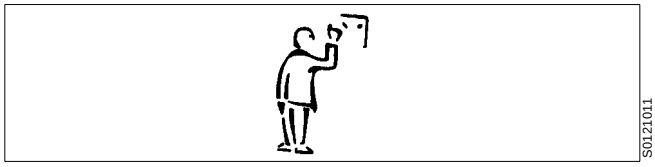
Cleaning of machine after separation is imperative.

8. When rinsing with water, set the programme selector to “CIP WATER”. Discharges will now follow at preset intervals.

   When washing with detergent, set the programme selector to “CIP LYE / ACID”. Discharges will now take place at preset intervals.

   Check that detergent is flowing from the axial seals.

   To effect a manual ejection, press the button for ejection (sediment discharge).



7.1.5 Stop

Do not stop separator uncleaned, since it will lead to that manually cleaning has to be done before start up.

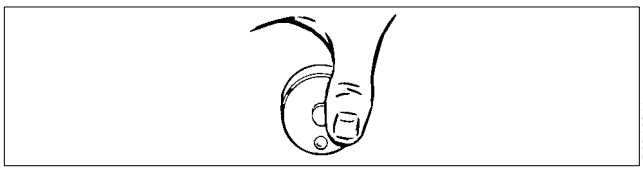
The bowl must be closed and filled with liquid during the run down period. Water is fed to the axial seals automatically until the bowl has stopped.

9. Stop the separator.

The brake is automatically energized. The cooling water is shut off and the brake is disengaged automatically when the bowl has stopped.

WARNING

Do not loosen any parts on the machine until the bowl has stopped completely
(= the revolution counter is at a stand still).



DANGER

Emergency stop

If the machine begins to vibrate during operation, stop it immediately keeping the bowl filled with liquid.

8 Trouble tracing

Contents

8.1 Mechanical function

(except sediment discharge function and axial seals)

During a start, the following functions are disconnected: Overload protection (bimetal relay) and overcurrent protection (when star connection).

Indication	Cause	Remedy
Start		
No control voltage	Power supply failure. Fuses in control panel have blown or tripped	Find the fault. Change or reset fuse
Separator motor does not start	Thermistor relay not operating	Check. Remedy
	Thermistor relay tripped before start	Motor too hot. See below
Smell of burning	Brake not released	Check the air pressure to brake
	Wrong motor or motor defect	Change or repair motor
Motor stops during start-up due to overheating	Thermistor relay trips due to repeated starts of motor	Remove motor hood. Allow motor to cool down (at least 3 hours – if no extra fan cooling)
Unusually long running-up period	Relay in starter has not switched over from star to delta	Check setting of relay
Unusually long running-up period or starting current too high	Product admitted too early	Check. Remedy
	Supply voltage too low	Check. Remedy
	Motor defect	Check. Remedy
Unusually short running-up period	Relay in starter has switched over from star to delta too soon	Check relay setting
	Overvoltage of power supply	Check. Remedy
	Motor defect	Check. Remedy

Indication	Cause	Remedy
Noise and possibly vibration	Damaged ball bearing	Check and change bearing
	Worm gear badly worn	Change worm and worm wheel
	Height settings of paring disc are incorrect	Correct settings, see *Maintenance Manual*
	Incorrect assembly	See *Maintenance Manual*
	Stop the separator with water or product and find out the cause	
Vibration	Bowl out of balance due to: Bad cleaning – incorrect assembly – badly tightened lock ring – disc stack not clamped sufficiently – bowl assembled with parts from other bowls – static unbalance	Stop immediately and find out the cause. Insufficient tightening of the lock ring can endanger life. Dismantle, clean and reassemble. (See *Service & Maintenance Manual*)
	Moderate vibration at the critical speeds during starting and stopping periods is normal	
Operation. CIP		
Machine vibrates (vibration alarm) **Low level**	Bowl out of balance due to bad cleaning – incorrect assembling – bad tightening of lock ring – bowl assembled with parts from several bowls – heavyside	Establish the cause at next stop
	Vibration dampers worn	
	Foundation too weak	
	Damaged or worn bearings. Overheating	
Machine vibrates (vibration alarm) **High level**	Bowl out of balance due to bad cleaning – incorrect assembling – bad tightening of lock ring – bowl assembled with parts from several bowls – heavyside	Stop immediately with liquid filled bowl, absolutely no discharging, and establish the cause. Badly tightened lock ring may involve fatal danger
	Vibration dampers worn	Stop immediately as above. Renew
	Foundation too weak	Stop immediately as above. Reinforce foundation
	Damaged or worn bearings. Overheating	Stop immediately as above Renew

Indication	Cause	Remedy
Speed too low **Noise** **Smell**	Damaged or worn bearings. Overheating	Stop immediately as above Renew
Overheated motor	Poor cooling	Remedy
Speed too high	Power supply frequency too high	Check. Remedy
	Motor defect	Check. Remedy
Speed too low	Voltage drop of power supply	Check and remedy the fault
	Open bowl = overloading of motor. Bowl leaking	See “8.2 Sediment discharge function” on page 59
Water in worm gear housing	Condensation	
	Leakage of oil cooling coil	Change or repair the coil
Stopping		
Braking time too short	Pressure of air to brake is too high	Check. Remedy
	Bowl is leaking	See “8.2 Sediment discharge function” on page 59
	Motor defect	Check. Remedy
	Defect in driving device	Check. Remedy
Braking time is too long	Worn or oily brake lining	Change or clean
	Pressure of air to brake is too low or air supply not turned on	Check. Remedy
	Moderate vibration at the critical speeds during starting and stopping is normal	

8.2 Sediment discharge function

Indication	Cause	Remedy
The bowl does not eject or the volume is too small	Air bubbles in piping between the OWMC and the separator	Purge the system for air
	Operating water leakage through valve plugs in operating slide or seal ring in sliding bowl bottom	Change the seals
	When intervals between discharges are long (≥ 1 h) the operating mechanism may seize	Discharge twice in order to reset the system to normal volume
	Incorrect operating pressure and time adjustment	Correct
The bowl does not close	No water in the operating water tank or the pressure from the reducing valve is insufficient	Check the water supply. Adjust the pressure to maximum value (approx. 70 kPa) but avoid leakage (max 50 l/h)
	The valve plugs in operating slide leak	Change the valve plugs
	The seal ring in the sliding bowl bottom leaks	Change the seal ring
	Impurities under the sliding bowl bottom	Clean
	Seizure on the bowl nave	Remedy according to instructions for maintenance
	The seal ring for bowl hood leaks	Change the seal ring
The discharge volume increases	This may occur if leakage of operating water increases due to readjustment of operating water pressure	Run the separator with constant operating water pressure

8.2.1 OWMC related faults

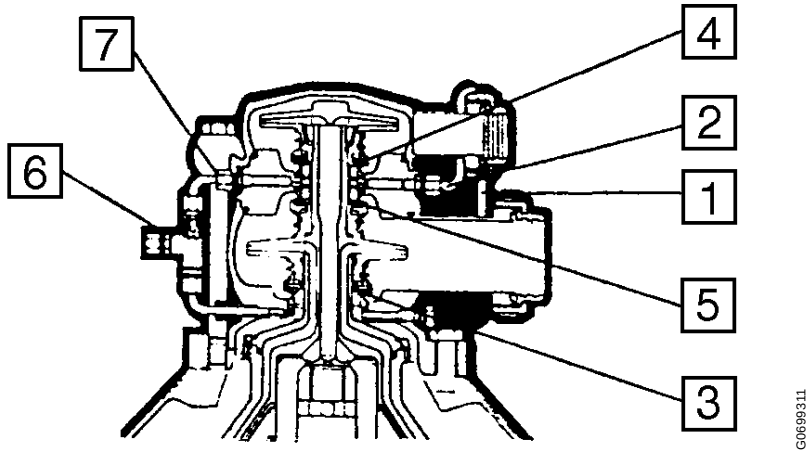
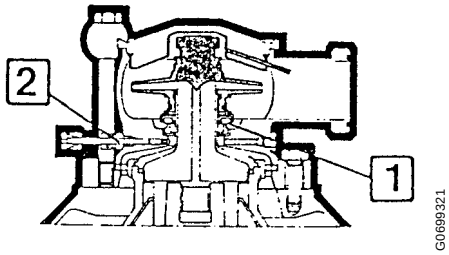
Indication	Cause	Corrective actions	Page
The bowl does not eject or the volume is too small	Needle valve for setting of small discharge is throttled too much	Adjust the throttling	40
	Air pressure for setting of large discharge is too low	Adjust the air pressure	40
	No supply or signal air to the OWMC	Check the air supply	–
	Faulty check valve in operating water feed line before the OWMC inlet	Check function of the valve	–
OWMC piston does not return to its initial position or returns too slowly	Impurities in water or air which increase friction between piston and cylinder	Follow the instructions carefully for air and water quality.	1)
		Clean and lubricate piston and cylinder with GLEITMO 1821V	2)
	Too low operating water pressure in the feed line before the OWMC	Check the operating water pressure	3)
	Silencer for air outlet in the OWMC is clogged	Renew the silencer	–
	Faulty check valve in operating water feed line before the OWMC inlet	Check function of the valve	–
The discharged volume too large	Faulty sealing for the two-pulse adapter	Renew the sealing	2) pos. 8
	Too high pressure of the air supply (506a).	Reduce the air pressure	40
Bowl fails to close after sediment discharge	Clogged nozzle fitted in the two-pulse adapter	Clean the nozzle	2)

1) See *Installation Manual*

2) See *“Operating water module (OWMC)”* in *Service & Maintenance Manual*

3) *See Installation Manual, “Connection list”*, connection 375

8.3 Axial seals

<table>
<tr><th>Indication</th><th>Cause</th><th>Remedy</th></tr>
<tr><td rowspan="2">Product discharging through cyclone outlet during operation
(twin phase separators)</td><td>Bowl is open or untight</td><td>See “8.2 Sediment discharge function” on page 59</td></tr>
<tr><td>Outlet seals are leaky</td><td rowspan="2">• Remove pipes (1) and (6).
• Check for leakage at (2) and (7).
• Light phase leakage – seal (4) leaky.
• Heavy phase leakage – seal (5) leaky.
• Heavy phase leakage in cyclone outlet – axial seal (3) leaky.
Exchange the defective seal. See also below.</td></tr>
<tr><td colspan="2"> 
</td></tr>
<tr><td rowspan="2">Product discharging through cyclone outlet during operation
(single phase separators)</td><td>Bowl is open or untight</td><td>See “8.2 Sediment discharge function” on page 59</td></tr>
<tr><td>Outlet seal is leaky</td><td rowspan="2">• Remove pipe (2).
• Product leakage in cyclone outlet – axial seal (1) leaky.
Exchange the defective seal. See also below.</td></tr>
<tr><td colspan="2"> 
</td></tr>
<tr><td>Product flows from cooling water outlet of inlet</td><td>Inlet seal is leaky</td><td>Exchange the seal. See also below</td></tr>
</table>

Indication	Cause	Remedy
Leaky seals	Normal wear	–
	Separator has been run without contact between seals and liquid	Seals must never run dry. Always check that liquid is fed to the seals
	Deposits have formed on seals because of insufficient cleaning programme	Adjust the cleaning programme
	Bowl is out of balance*	See “ Machine vibrates (vibration alarm)” on page 57
	Frame hood is not centered in relation to the outlet pipe*	Adjust the centering ring
	High product outlet pressures (e.g. because a discharge conduit has been closed unintentionally	The axial seals must not be subjected to pressures above 600 kPa (6 bar).

* Does not refer to the inlet seal