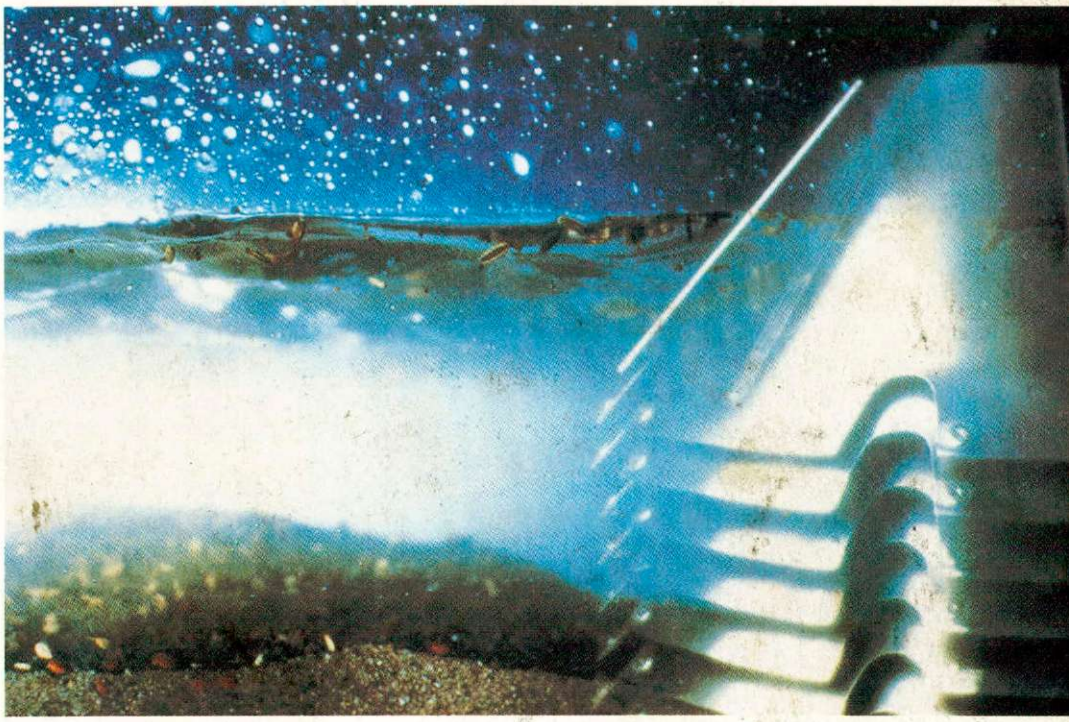
Operator´s Manual



Tetra Centri®

Self-cleaning Hermetic Separators

A 610HGD-14C

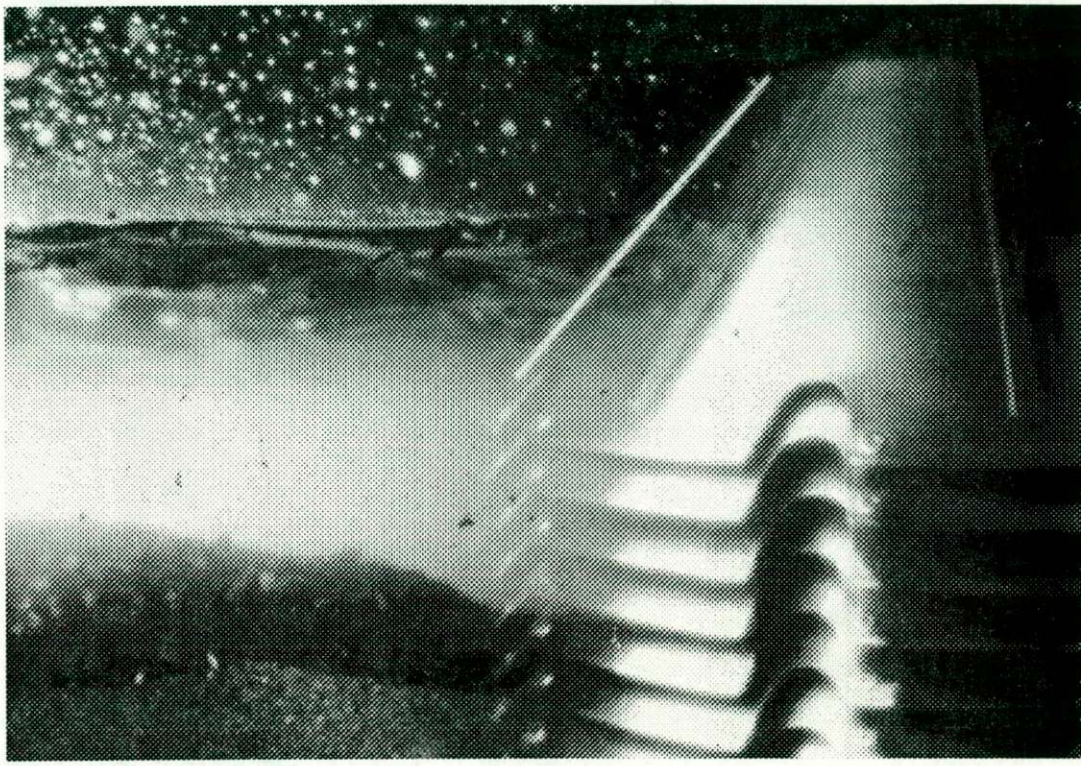
H 610HGD-74C

Product No. 881154-03-01 & 881154-01-03
Book No. 1271703-02 Rev. 2

Tetra Pak

Tetra Pak Processing Components

Operator´s Manual



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Product No. 881154-03-01/2 & 881154-01-03/2
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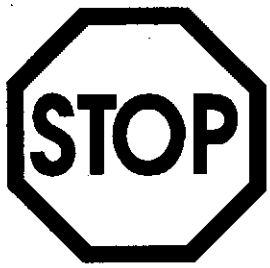
Contents

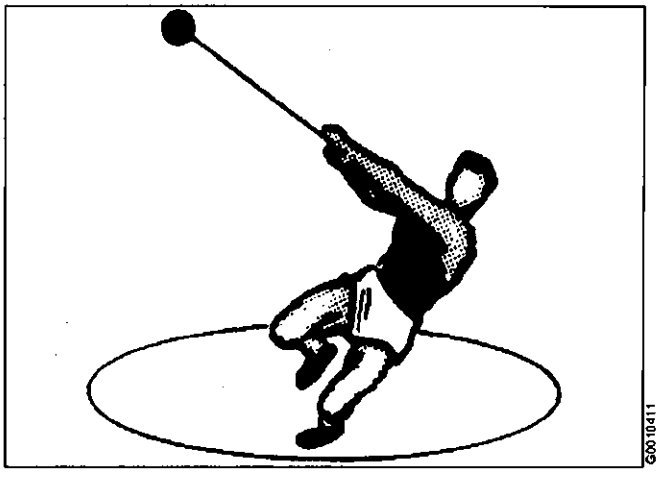


Study instruction manuals and observe the warnings before installation, operation, service and maintenance.

Not following the instructions can result in serious accidents.

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

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.

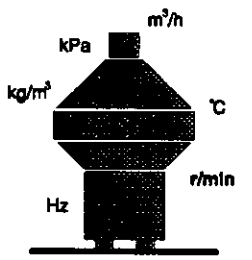
The following basic safety instructions therefore apply:

- **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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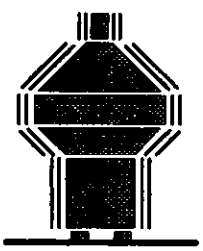


S0055611

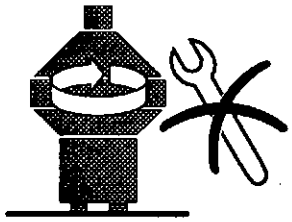
DANGER

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

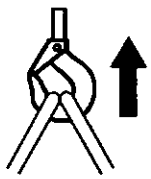
- Follow local regulations for electrical installation and earthing (grounding).



WARNING

Crush hazards

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



Noise hazards

- Use ear protection in noisy environments.

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.

S0055411

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 General information

Contents

2.1 Foreword

This manual is intended primarily for the Machine Operating Personnel. It is essential that these persons have read and understood the contents of this book. It describes the mechanical and separating-technical functions of the machine as well as the principles of operation and daily maintenance.

The purpose of the manual is to enable the operator to operate the machine and to achieve satisfactory separating results with regard to existing safety precautions and with supplementary operating routine.

A manual should always be available near the place of operation.

Keep Operating routine, Lubrication Schedule, etc., easily visible.

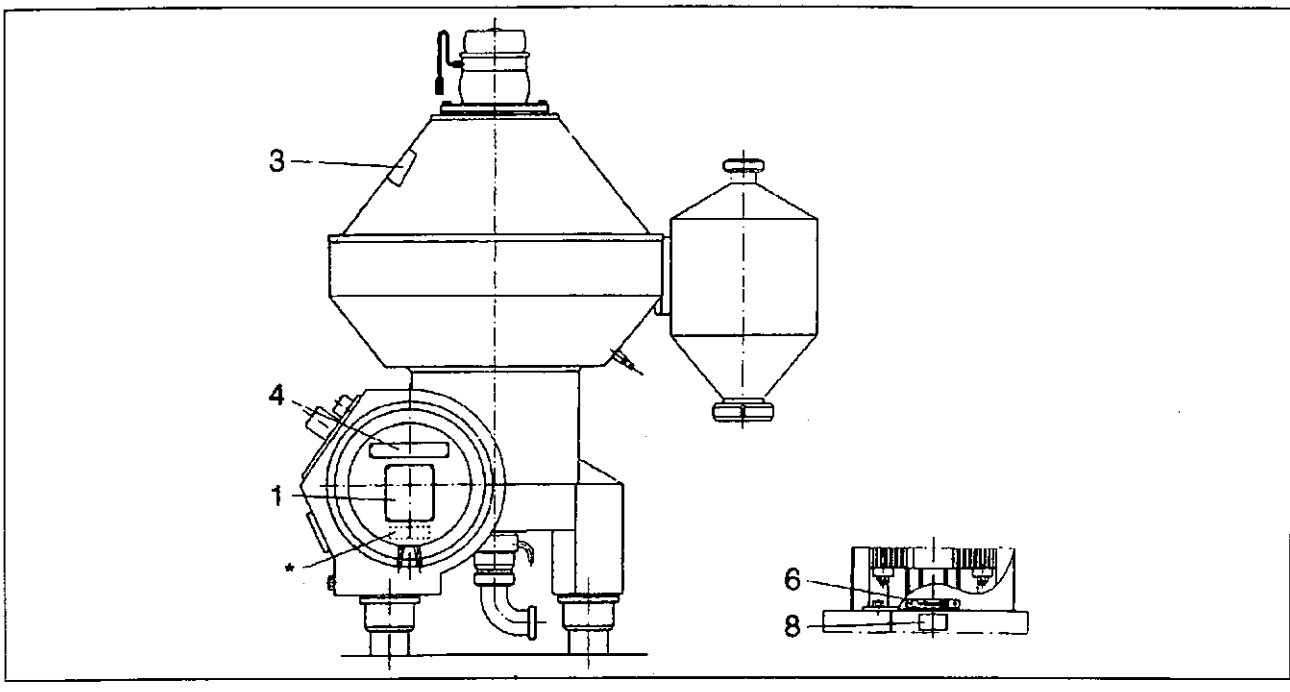
Let all operating personnel read the manual.

It is important to be familiar with the Safety Precautions.

The manufacturing company reserves the right to make changes in design or add any improvements on its products without any obligations to provide notice thereof or to install same on units previously delivered by it.

2.2 Identification and safety signs, machine A 610HGD-14C

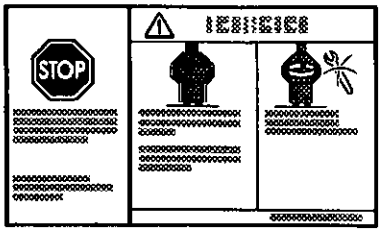
Alfa Laval ref. 556162, rev. 0



1. Machine plate Text on plate:

Separator	A 610HGD-14C
Manufacturing serial No / Year	XXXX
Product No	881154-03-01
Machine top part	548940-01
Outlet	548931-03
Bowl	561182-01
Machine bottom part	549501-05 / -06 (50 Hz / 60 Hz)
Max. speed (bowl)	6240 / 6235 r/min (50 Hz / 60 Hz)
Direction of rotation (bowl)	←
Speed motor shaft	1500 / 1800 r/min (50 Hz / 60 Hz)
El. current frequency	50 Hz / 60 Hz
Recommended motor power	18,5 kW
Max. density of feed	1030 kg/m^3
Max. density of sediment	1046 kg/m^3
Max. density of operating liquid	1000 kg/m^3
Process temperature min./max.	0 / 100 °C

3. Safety label



S0081521

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.

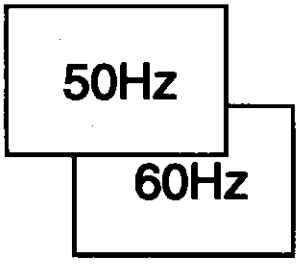
Separator must **stop rotating** before **any** dismantling work is started.

4. Name plate "Tetra Pak"

S0063221

6. Arrow indicating direction of rotation

8. Frequency label 50 Hz / 60 Hz

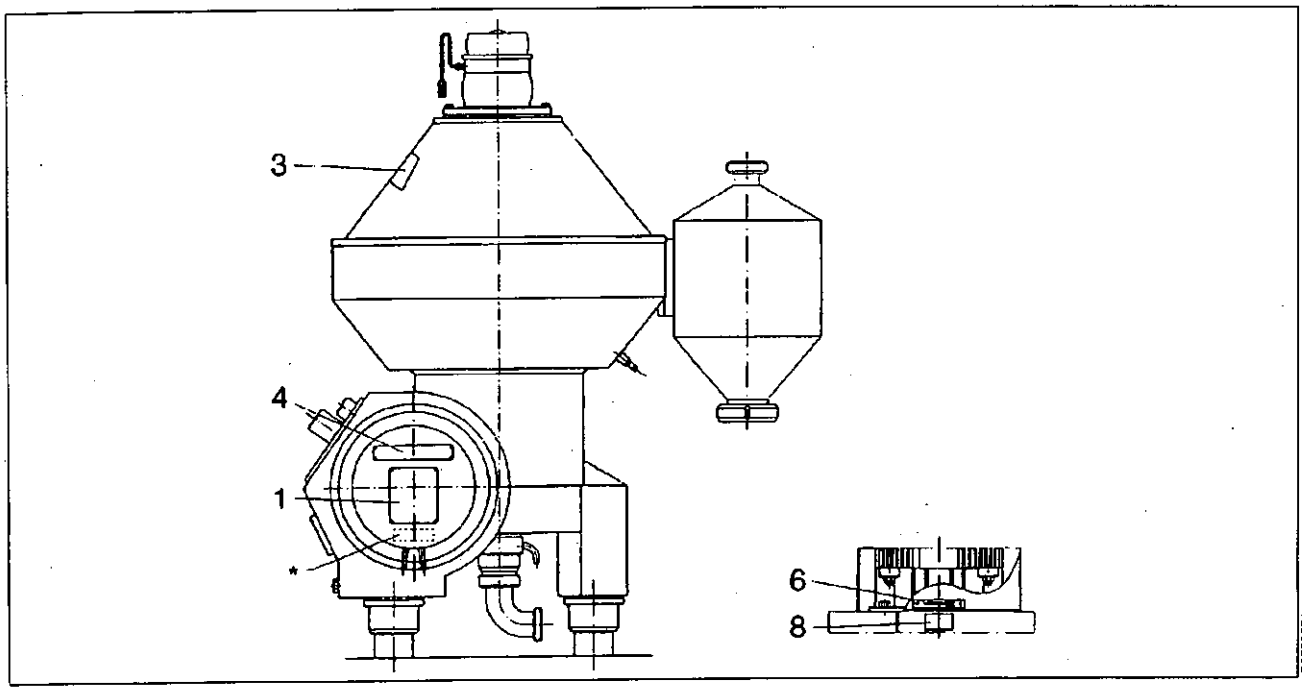


S0083111

* Space reserved for plate indicating representative

2.3 Identification and safety signs, machine H 610HGD-74C

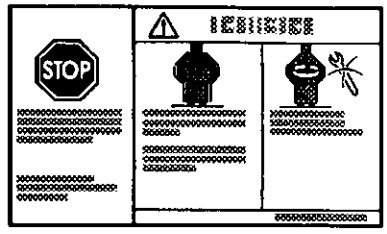
Alfa Laval ref. 556162, rev.0



1. Machine plate Text on plate:

Separator	H 610HGD-74C
Manufacturing serial No / Year	XXXX
Product No	881154-01-03
Machine top part	548940-01
Outlet	558820-01
Bowl	549514-01 / -02
Machine bottom part	549501-01 / -02 (50 Hz / 60 Hz)
Max. speed (bowl)	6240 / 6235 r/min (50 Hz / 60 Hz)
Direction of rotation (bowl)	←
Speed motor shaft	1500 / 1800 r/min (50 Hz / 60 Hz)
El. current frequency	50 Hz / 60 Hz
Recommended motor power	18,5 kW
Max. density of feed	1030 kg/m^3
Max. density of sediment	1046 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.

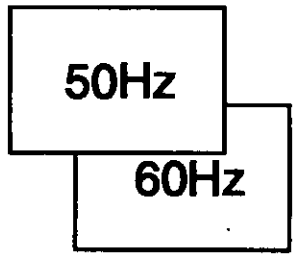
Separator must **stop rotating** before **any** dismantling work is started.

4. Name plate "Tetra Pak"

S0063221

6. Arrow indicating direction of rotation

8. Frequency label 50 Hz / 60 Hz



S0063111

* Space reserved for plate indicating representative

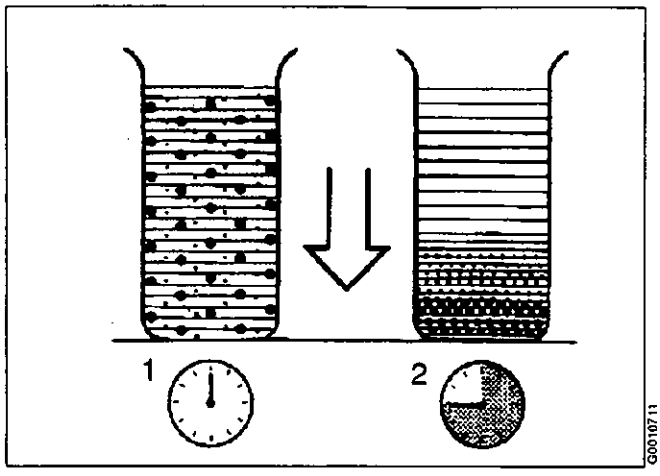
3 Separation process

Contents

3.1 Basic principles

The purpose of separation can be:

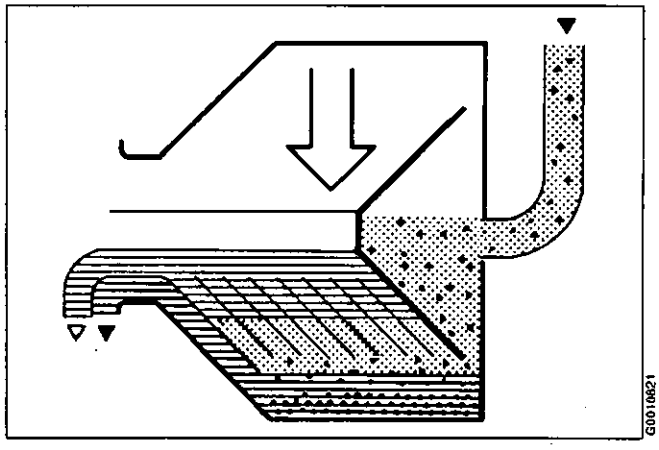
- to free a liquid of solid particles.
- to separate two mutually insoluble liquids with different densities, removing any solids at the same time.
- to separate and concentrate solid particles from a liquid.



3.1.1 Separation by gravity

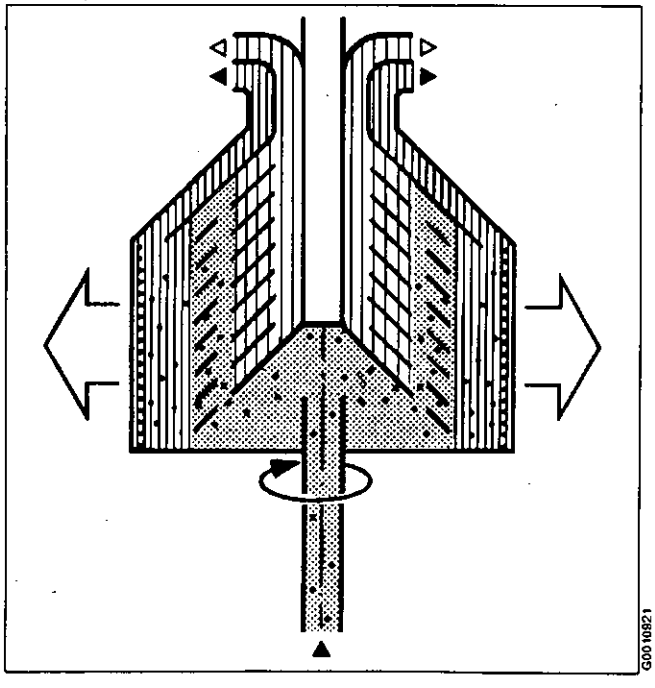
A turbid liquid in a stationary vessel will clear slowly as the heavy particles in the liquid mixture are sinking to the bottom under the influence of gravity. The lighter liquid phase will rise while the heavier sinks.

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.



3.1.2 Centrifugal separation

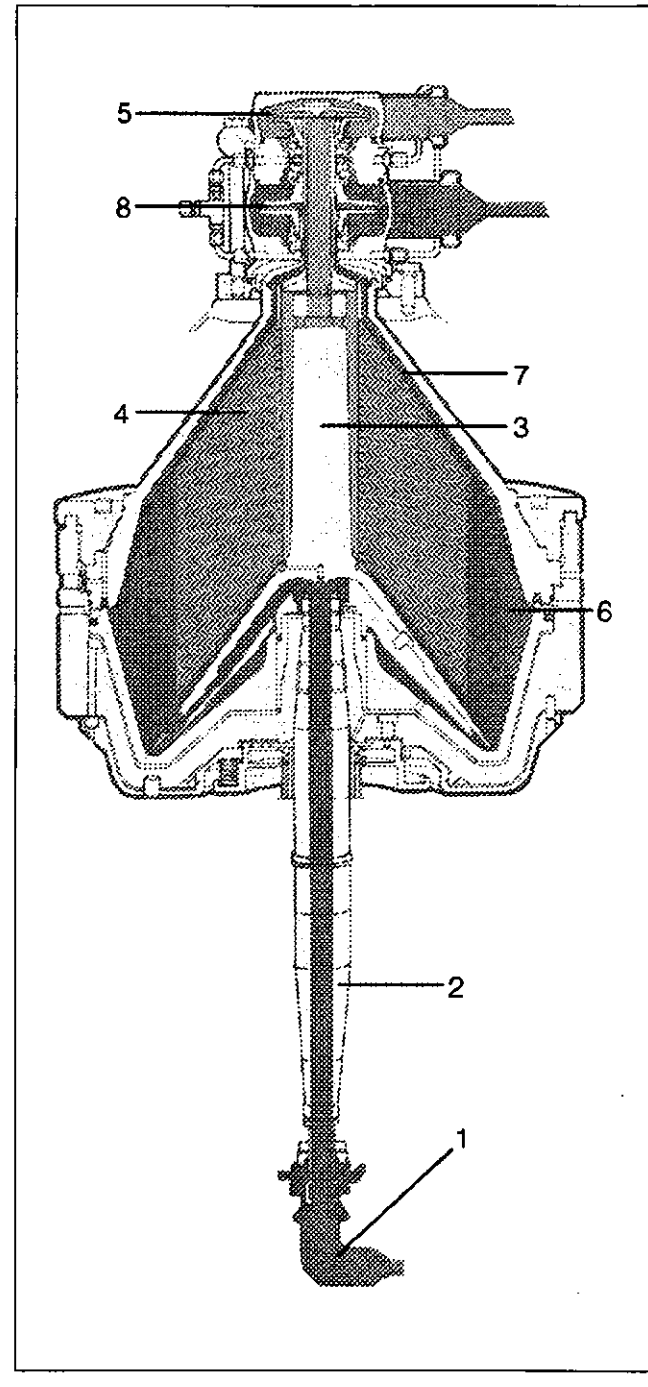
In a rapidly rotating vessel the gravity is replaced by the centrifugal force, which can be thousands of times greater. Separation and sedimentation are continuous and very fast. When liquid and solid particles in a liquid mixture are subjected to the centrifugal force in a separator bowl, it takes only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



3.2 General

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*

3.3 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.

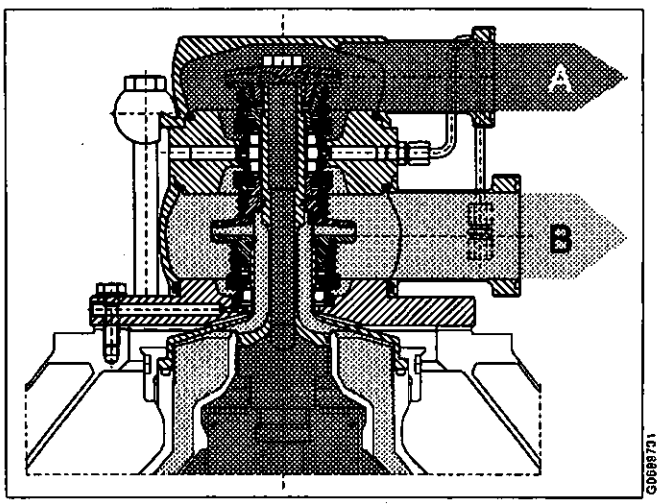
The throughput is regulated by adjusting the inlet pressure.

3.3.1 Light phase

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 counter pressure in the light phase outlet pipe the light phase concentration will be higher.



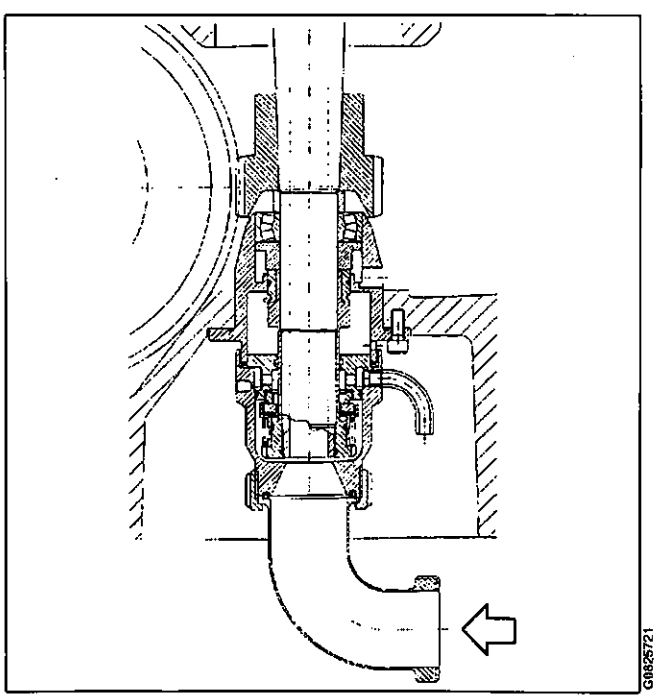
A. Light phase
B. Heavy phase

3.3.2 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.

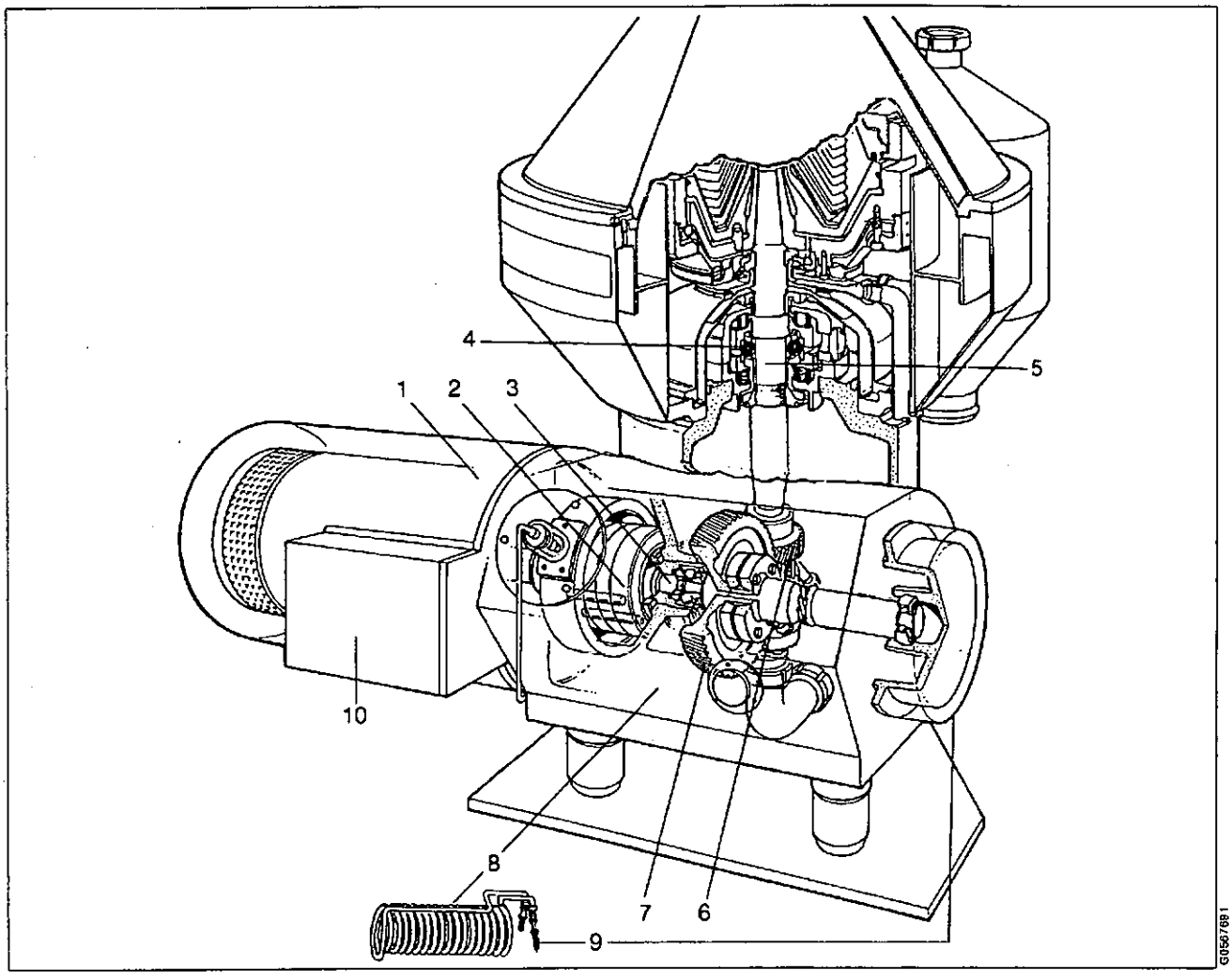
Make sure, therefore, that the inlet pressure is kept at the recommended value and that the balance vessel is always full. In the vessel, the liquid should flow gently without bubbling.



4 Mechanical function

Contents

4.1 Power transmission



1. *Electromotor*
2. *Rigid 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 "12.5 Connection list" on page 81.

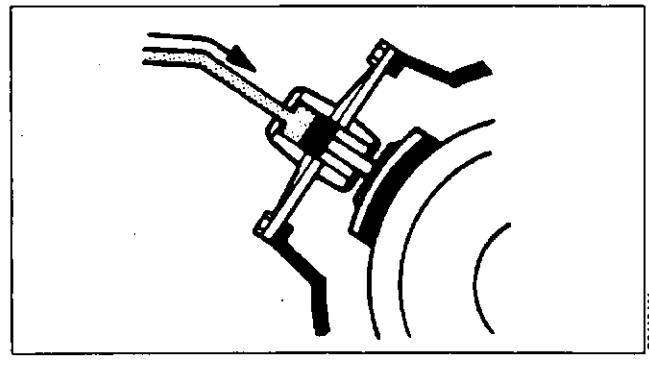
Oil – see chapter *"Lubrication"* in the *Maintenance and Repair* manual.

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 a motor of frequency drive type which is similar to a standard three phase motor. The long running up time is, however, controlled by a frequency converter. To require further information on frequency drive, see,"12.8 Guidelines for frequency converter drives" on page 88.

4.2 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.



4.3 Sensors and indicators

Cover interlocking switch (1), option

The cover of the separator can be equipped with an interlocking switch. When cover is closed the interlocking circuit in the control system is closed which makes it possible to start the separator.

Speed sensor (2)

The proximity speed sensor (2a) is of inductive type, giving a number of pulses per revolution of the motor shaft. The number of pulses is stated in chapter "12.5 Connection list" on page 81. The bowl speed is calculated from the gear ratio and the
r/min of the motor shaft.

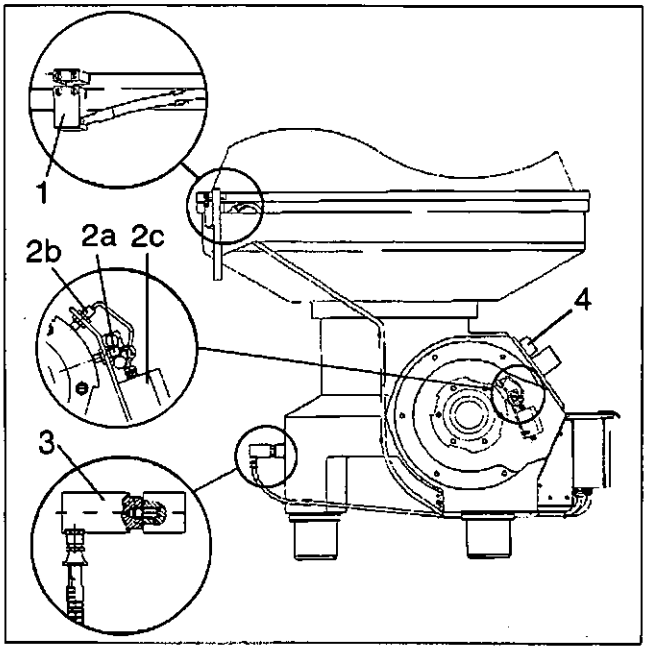
During normal operation the speed is allowed to vary within speed limits described in chapter "11.3 Component description and signal processing" on page 67.

The bracket for the speed sensor (2a) and the junction box (2c) are prepared for an optional speed sensor (2b), if needed.

Vibration sensor (3), option

The vibration sensor is of velocity type. The signal must be converted to a signal usable in the control system.

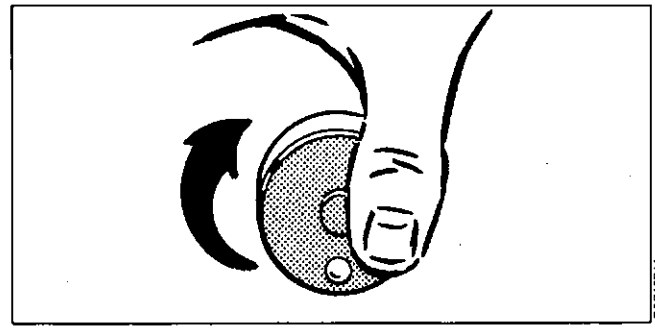
When any of the two limit values is exceeded appropriate countermeasures should be undertaken. The two levels are warning for unacceptable vibrations and safety stop respectively in case of extreme unbalance. The vibration levels are further described in chapter "11.3 Component description and signal processing" on page 67.



1. Cover interlocking switch (option)
2a. Speed sensor
2b. Speed sensor (option)
2c. Junction box
3. Vibration sensor (option)
4. Revolution counter

Revolution counter (4)

A revolution counter, which should turn clockwise during operation, indicates the speed of the separator and is driven from the worm wheel shaft. The correct speed is needed to achieve the best separating results and for reasons of safety. The number of revolutions on the revolution counter for correct speed is shown in chapter "12.1 Technical data" on page 74.

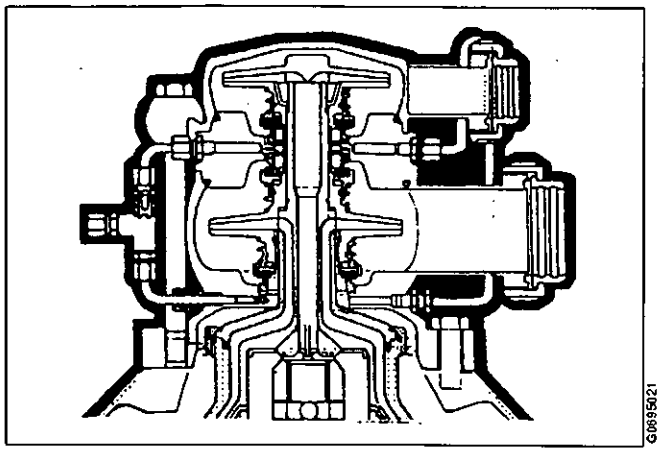


The revolution counter should turn clockwise

4.4 Outlet / inlet

4.4.1 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.



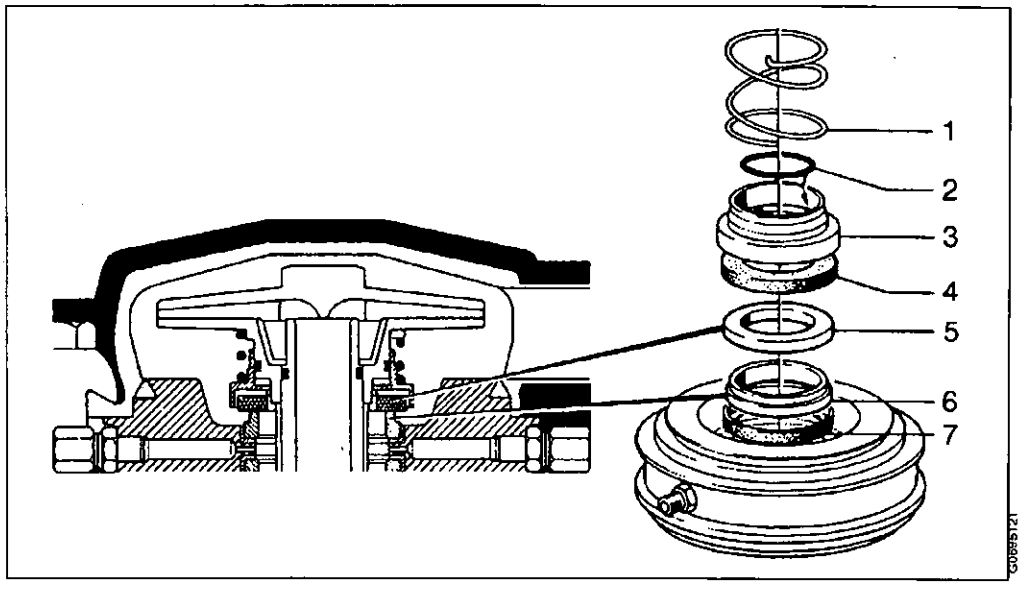
4.4.2 Inlet device

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.

4.4.3 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.

4.5 Axial seals – cooling system

During starting / separation / stopping periods

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

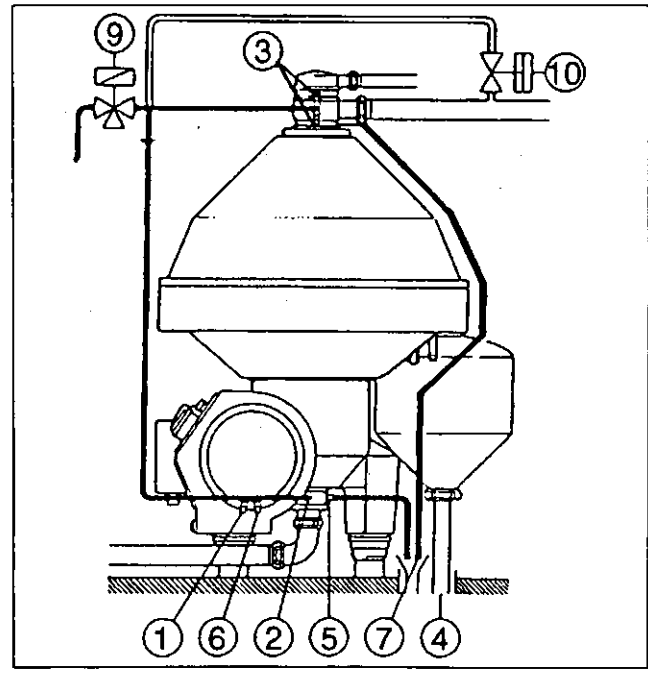
The cooling water from the outlet seals discharges through the sediment outlet (4) and pipe (7). From the inlet seals the water flows out through outlet (5).

Water pressure and flow – see "12.5 Connection list" on page 81.

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

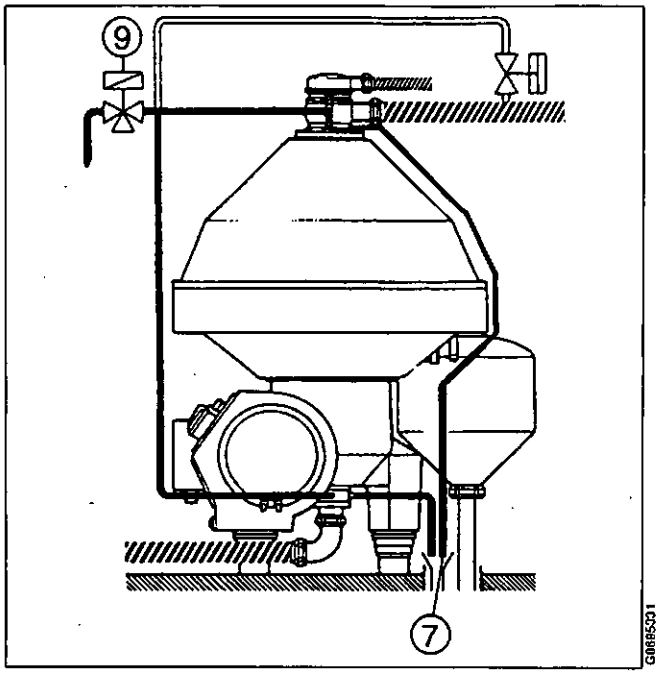
**) Normally included in the control unit cabinet.*

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

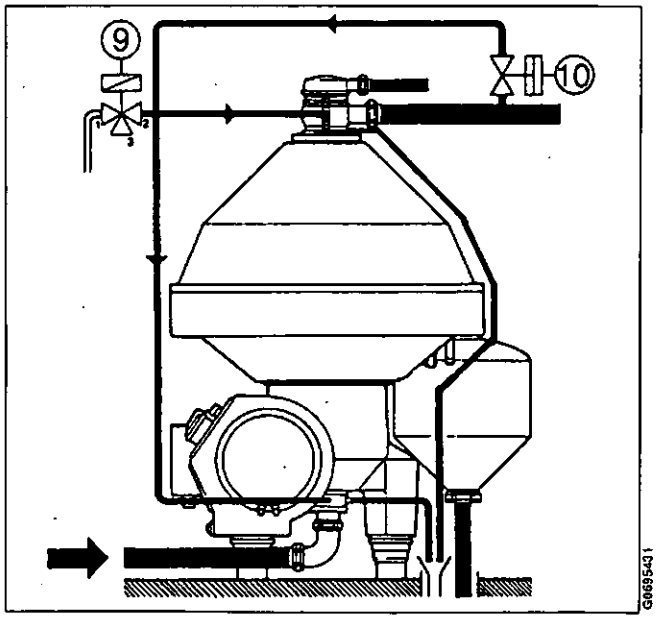
If the flushing water is discoloured, this may be due to leaking axial seals.

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

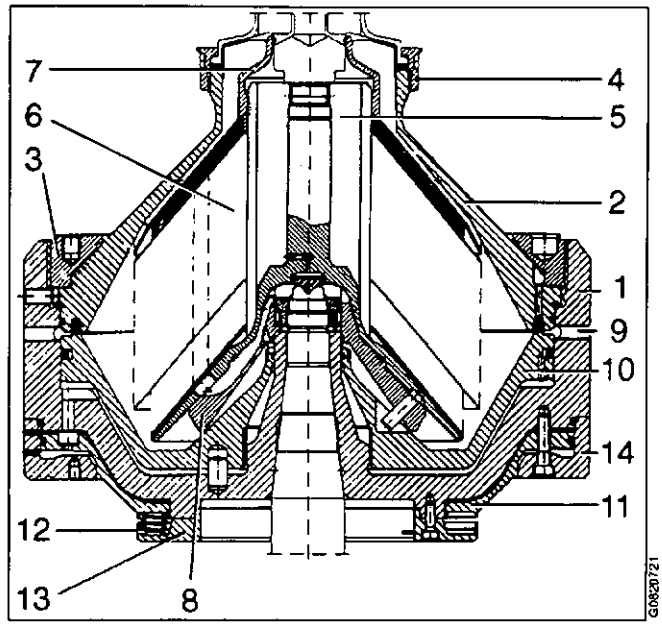
During cleaning (CIP)

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.



4.6 Bowl

1. *Bowl body*
2. *Bowl hood*
3. *Lock ring, large*
4. *Lock ring, small*
5. *Distributor*
6. *Disc stack*
7. *Top disc*
8. *Distributing cone*
9. *Sediment outlet*
10. *Sliding bowl bottom*
11. *Operating slide*
12. *Spring*
13. *Spring support*
14. *Dosing ring*



The parts by which the sediment ejections are effected are those numbered 10 - 14 in the list above.

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 (5), the distributing cone (8) and the disc stack (6), where the separation takes place. Uppermost in the disc stack is the top disc (7).

NOTE

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

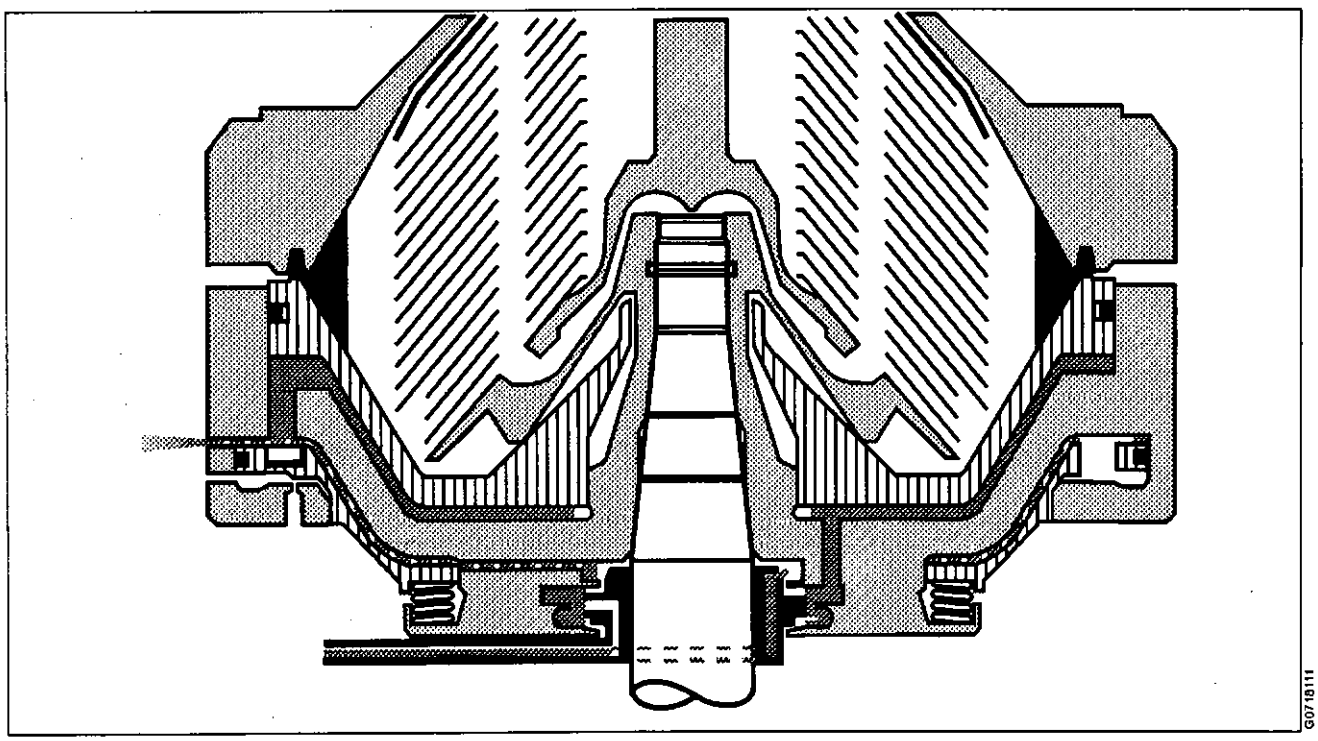
5 Sediment discharge function

Contents

5.1 Function description

1. The operating water supply pressure is increased for about 3 seconds. The dosing ring chamber is filled above the operating slide.

   When the inflow of operating water exceeds the outflow through the nozzle, an increase in liquid force will occur.

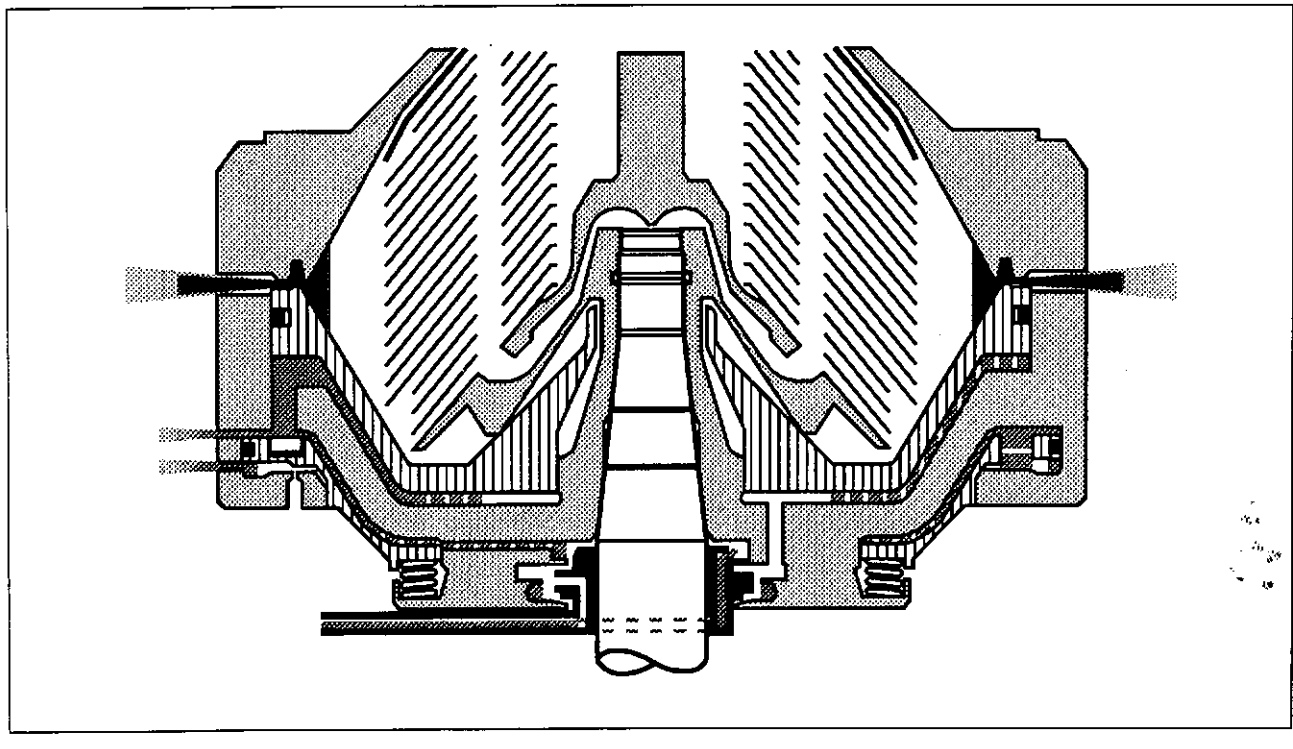


2. When the liquid force becomes greater than the spring force, the operating slide will move downwards and the discharge openings will be uncovered.

   The space underneath the sliding bowl bottom is emptied and the force directed upwards becomes less than that directed downwards.

   The sliding bowl bottom moves downwards and sediment ejection will take place through the discharge openings in the bowl wall.

   As soon as the level in the dosing ring chamber above the operating slide reaches the ducts, operating water begins to flow into the space underneath the operating slide.

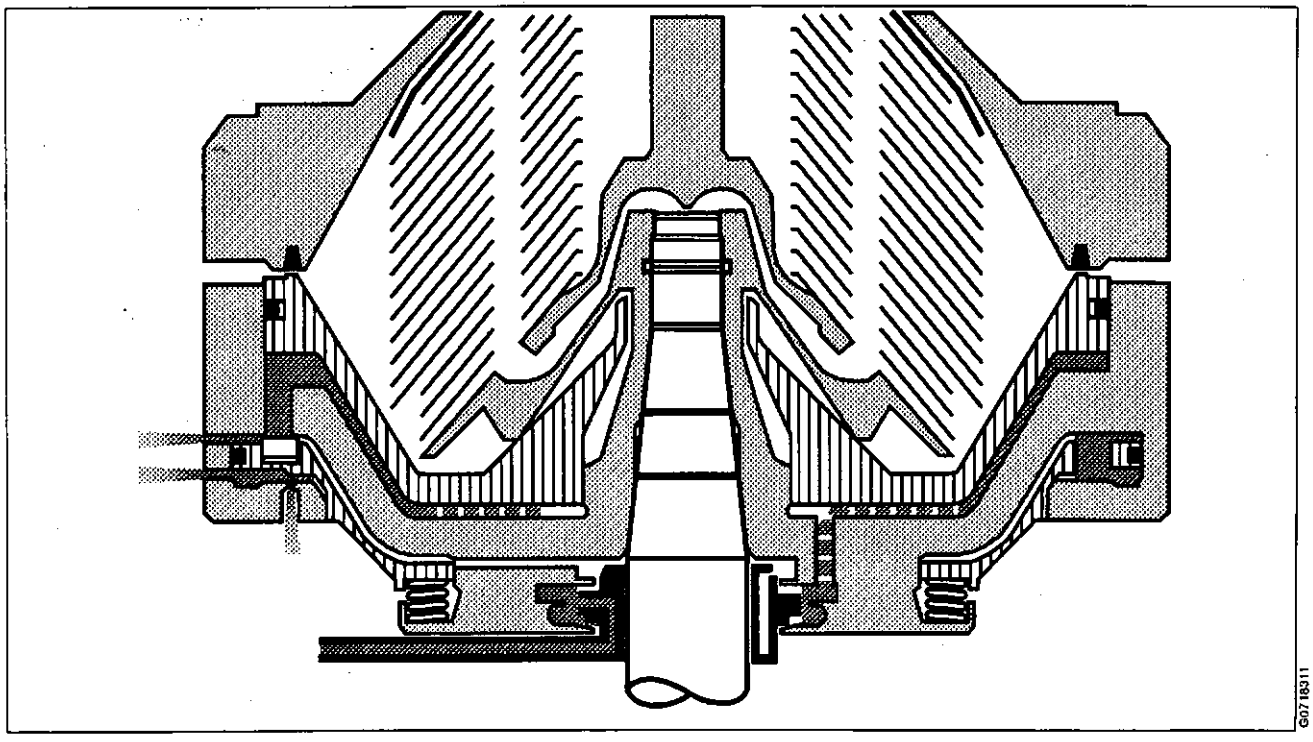


3. When the dosing chamber underneath the operating slide is filled with liquid, the force directed upwards plus the spring force become greater than the force directed downwards. By this means the operating slide is forced upwards and the discharge openings are closed.

   When the flow of operating water from the underside of the sliding bowl bottom has ceased, the sliding bowl bottom will begin to close.

   The outflow from the dosing ring chamber takes place through the nozzles.

   The space underneath the sliding bowl bottom, also the separating space above it, become filled, thus restoring the original equilibrium of forces. This keeps the sliding bowl bottom stationary in the closed position.



6 Installation and first start

Contents

6.1 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.

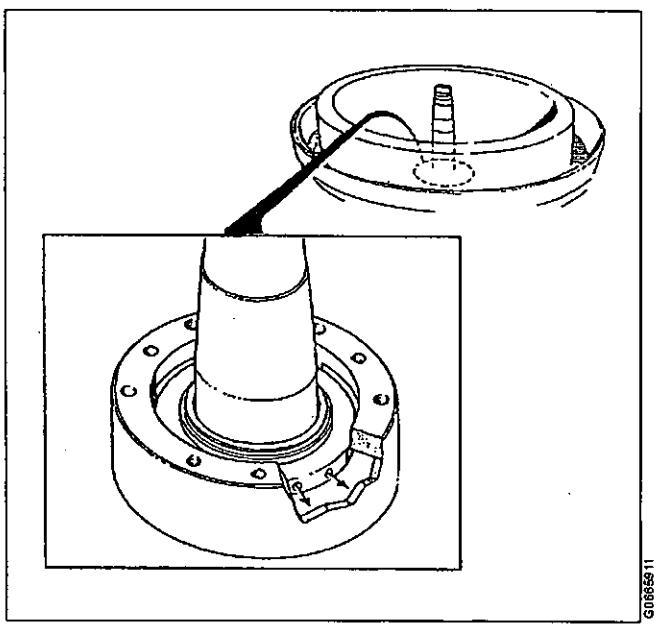
Checking the operating water flow.

When make-up water is fed (**376***) 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 "12.5 Connection list" on page 81:
   - Water for lubrication oil cooler **409***.
   - Water for discharge **372***.
   - 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

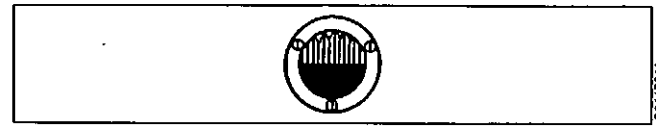
Outlet **406*** and **464*** must be open. No restrictions allowed.

*) Numbers refer to "12.5 Connection list" on page 81.

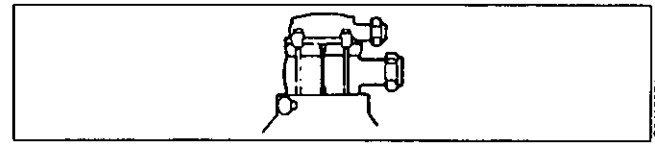
6.2 Before first start

Pour about 13 litres lubricating oil of correct grade into the worm gear housing – see chapter *"Lubrication"* in the *Maintenance and Repair* 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 *Maintenance and Repair* manual.
- Make sure that the frame hood bolts have been tightened.



- Make sure that the bolts for centering ring and outlets have been tightened to the correct torque. See *Maintenance and Repair* 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.

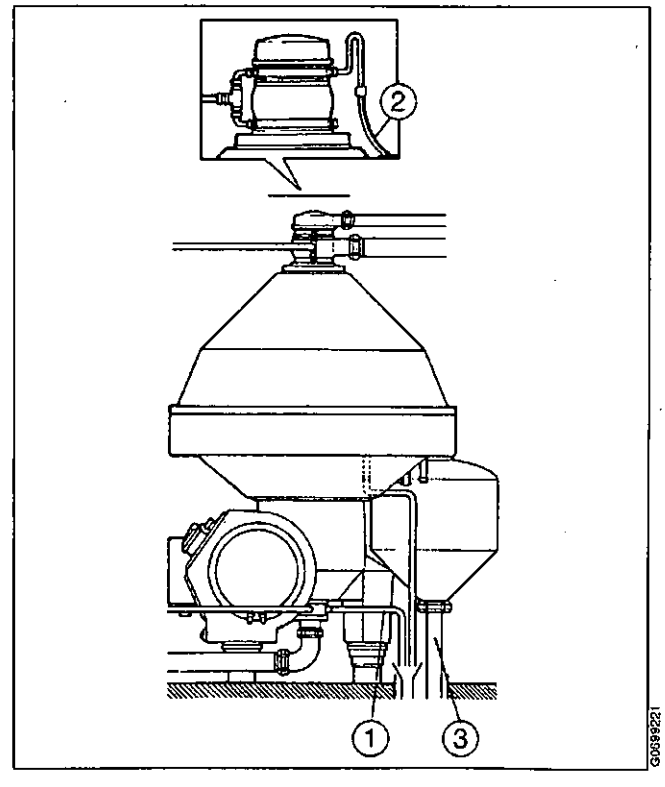
Make sure that cooling water is being supplied to the separator.

Check at

(1) – from inlet device seal

(2) – from outlet upper seals

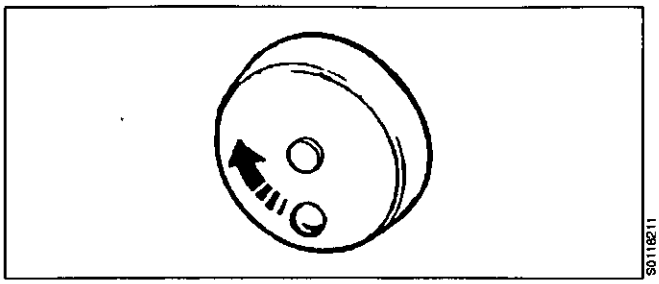
(3) – from outlet bottom seal (at operation).



6.3 First start

- Start the machine
- Check the direction of rotation (see revolution counter).
- When the bowl has reached running speed, check the revolution counter reading. For speed particulars, see "12.1 Technical data" on page 74.

  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.



Revolution counter

6.4 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.
- 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.

6.4.1 Cleaning

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

6.4.2 Separation

- Supply process liquid.
- Check the inlet pressure.
- Adjust the outlet pressures.

6.4.3 Operation

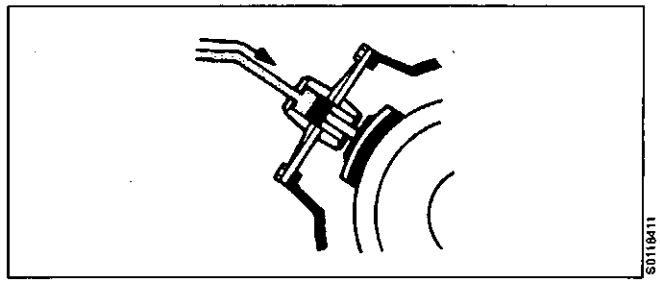
- Check the throughput. Make a final adjustment of inlet and outlet pressures.
- Make sure that no air is being sucked into the feed pipe via e.g.a balance vessel, if fitted. This should always be kept filled. The process liquid should flow evenly in the vessel without bubbling.

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.

6.5 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.

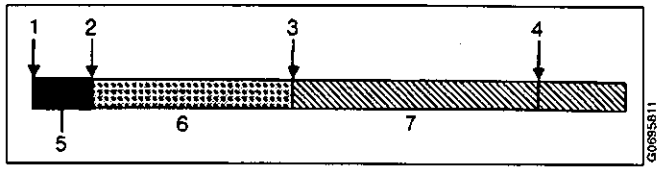
7 Cleaning

Contents

7.1 Check of cleaning / disc pressure

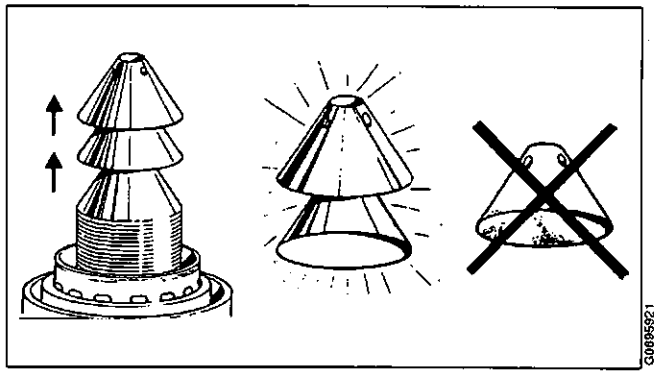
7.1.1 Cleaning

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*

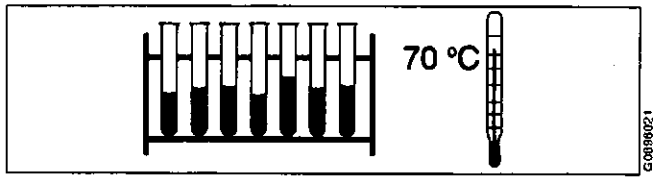
Inspect **all** discs. The upperside as well as the underside of **every** disc must be bright. Fatty discs and sediment residue on the discs indicate bad cleaning.



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.



7.1.2 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 opposite 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 the *Maintenance and Repair* manual.

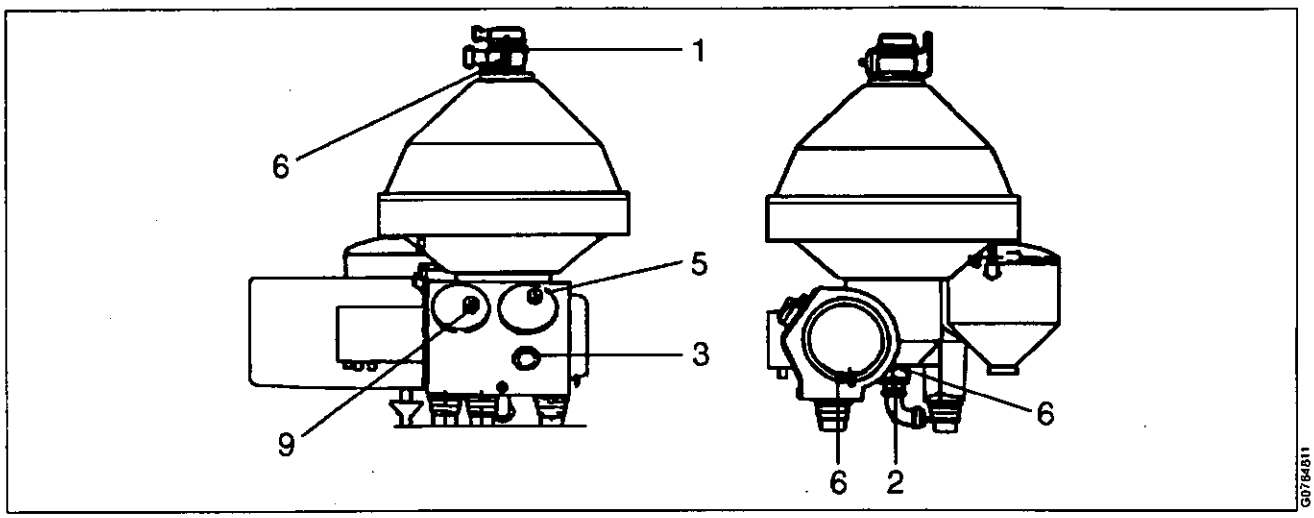
NOTE

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

8 Operating routine

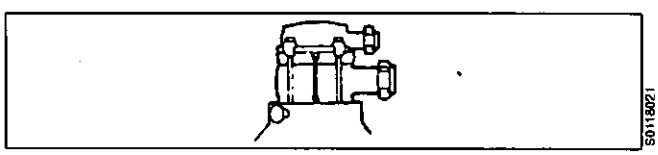
Contents

8.1 Check points

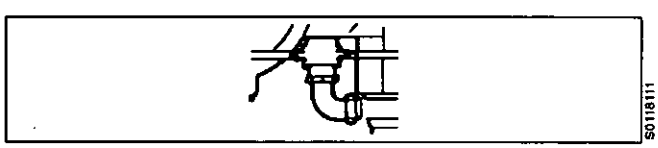


8.1.1 Before start

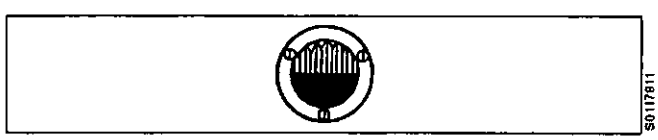
1. Check that the hook bolts of the outlet, the screws of the frame hood and the centering ring are all tightened.



2. Check that inlet device is tightened.

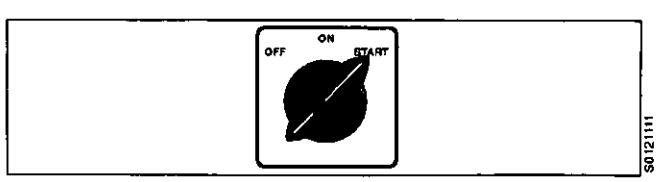


3. Check the oil level.

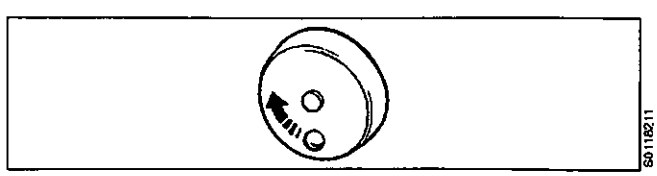


8.1.2 Start and run-up

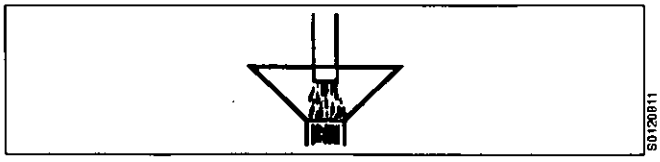
4. Start the separator.

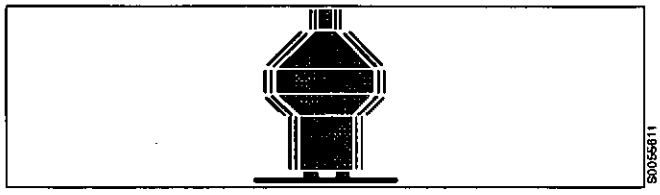


5. Check the direction of rotation of the bowl (see revolution counter).



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



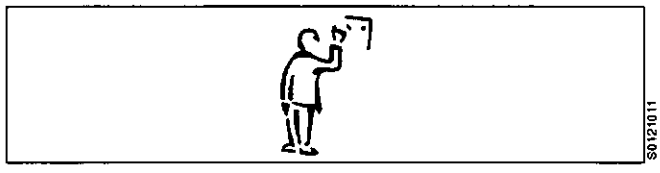


DANGER

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.



8.1.3 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.

8.1.4 Cleaning

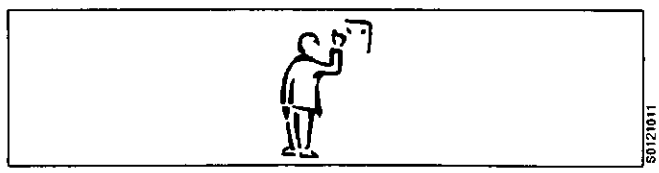
Cleaning of machine after separation is imperative.

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).



8.1.5 Stop

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

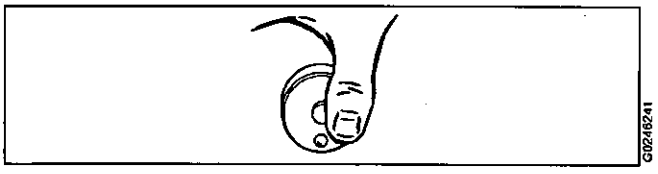
The bowl must be closed and filled with liquid during the run down period. Water is fed to the axial seals automatically until the bowl has stopped.

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.

9 Trouble tracing

Contents

9.1 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	Possible 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. For correct times, see Data sheet
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. For correct time, see Data sheet
	Overvoltage of power supply	Check. Remedy
	Motor defect	Check. Remedy

Indication	Possible 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 control 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 *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

Indication	Possible 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 "9.2 Sediment discharge" on page 55
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 "9.2 Sediment discharge" on page 55
	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	

9.2 Sediment discharge

Indication	Cause	Remedy
Bowl does not close	No make-up water	Find out cause. Rectify
	Closed or throttled valves	Slacken connections at machine and check flow of water
	Electrical or mechanical defect on solenoid valves or programme timer	See instructions for discharge programme equipment
	Opening time incorrect (at large ejection)	Adjust opening time, see Programme instructions
	Bowl not at full speed at total ejection - poor drainage of space between operating slide and bowl body	Bowl must be allowed to reach full speed between ejections
	Make-up water pressure too low	Check pressure and remedy
	Ejection too large (more than half bowl volume)	Change discharge volume (another dosing ring)
	Control paring disc device clogged or incorrectly fitted	Dismantle the bowl. Check that operating water is being ejected through the holes in the paring disc
	Leakage at distributing cover for operating water	Tighten the screws. Change defective seals
	Leakage between valve plugs in operating slide and sealing faces of bowl body *	Change valve plugs and/or dress sealing faces
	Operating slide for bowl seizes	Dress, clean and lubricate
	Operating slide springs are defective	Change
	Sliding bowl bottom seizes	Check guides. Lubricate
	Clogged drain nozzle in operating slide (poor drainage)	Clean
	Ducts to space under the sliding bowl bottom are clogged	Clean

Indication	Cause	Remedy
Bowl does not close (continued)	Seal ring of sliding bowl bottom is defective **	Change seal ring
	Seal ring of bowl hood against sliding bowl bottom is defective *	Change seal ring
Bowl opens badly or not at all	No operating water	Find out cause. Rectify
	Closed or throttled valves	Slacken connections at machine and check flow of water
	Electrical or mechanical defect on solenoid valves or programme timer	See instructions for discharge programme equipment
	Opening time too short	Extend the time
	Control paring disc device clogged or incorrectly fitted	Dismantle the bowl. Check that operating water is being ejected through the holes in the paring disc
	Leakage at distributing cover for operating water	Tighten the screws. Change defective seals
	Operating slide for bowl seizes	Dress, clean and lubricate
	Sliding bowl bottom seizes	Check guides. Lubricate
	Drain nozzle in operating slide is lacking	Check
	Leakage at seal ring of operating slide against bowl body	Change seal ring
	Seal ring of sliding bowl bottom is defective **	Change seal ring

* Trouble usually caused by exceptionally long intervals between servicing.

** Always after service. Carry out several ejections.

Indication	Cause	Remedy
Bowl leaks	Leakage between valve plugs in operating slide and sealing faces of bowl body *	Change valve plugs and/or dress sealing faces
	Operating slide for bowl seizes	Dress, clean and lubricate
	Operating slide springs are defective	Change
	Sliding bowl bottom seizes	Check guides. Lubricate
	Seal ring of sliding bowl bottom is defective **	Change seal ring
	Seal ring of bowl hood against sliding bowl bottom is defective *	Change seal ring
Bowl opens unintentionally during operation or uncontrolled ejection	Pressure in pipe for make-up water too high	Reduce the pressure
	Leakage at distributing cover for operating water	Tighten the screws. Change defective seals
	Leakage between valve plugs in operating slide and sealing faces of bowl body *	Change valve plugs and/or dress sealing faces
	Operating slide springs are defective	Change
	Ducts to space under the sliding bowl bottom are clogged	Clean
	Seal ring of sliding bowl bottom is defective **	Change seal ring

* Trouble usually caused by exceptionally long intervals between servicing.

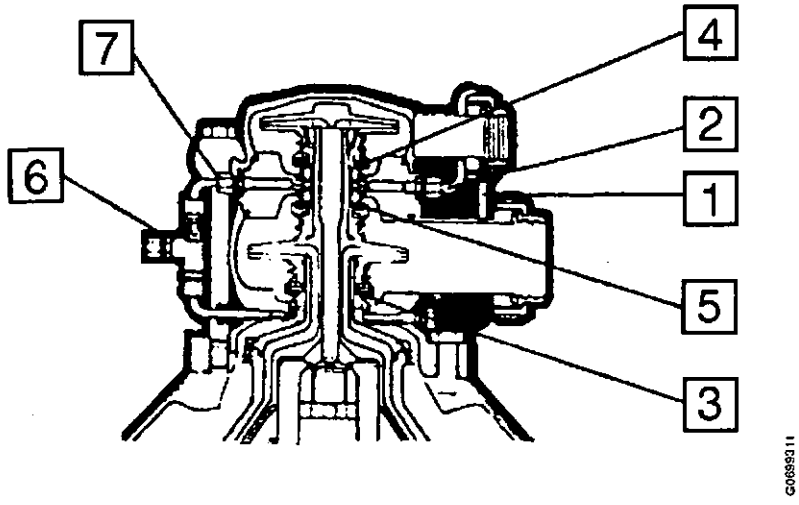
** Always after service. Carry out several ejections.

Indication	Cause	Remedy
Ejected quantity too large / small	Pressure in pipe is too high / low	Reduce / increase the pressure
	Solenoid valve is open too long	Reduce opening time, see Programme instructions
	Operating slide for bowl seizes	Dress, clean and lubricate
	Operating slide springs are defective	Change
	Sliding bowl bottom seizes	Check guides. Lubricate
	Clogged drain nozzle in operating slide (poor drainage)	Clean
	Leakage at seal ring of operating slide against bowl body	Change seal ring
	Seal ring of sliding bowl bottom is defective **	Change seal ring

* Trouble usually caused by exceptionally long intervals between servicing.

** Always after service. Carry out several ejections.

9.3 Axial seals

Indication	Cause	Remedy
Product discharging through cyclone outlet during operation	Bowl is open or untight	See "9.2 Sediment discharge" on page 55
	Outlet seals are leaky	• Remove pipes (1) and (6). • Check for leakage at (2) and (7). • Cream leakage – seal (4) leaky. • Skimmilk leakage – seal (5) leaky. • Skimmilk leakage in cyclone outlet – axial seal (3) leaky. Exchange the defective seal. See also below.
		
Product flows from cooling water outlet of inlet	Inlet seal is leaky	Exchange the seal. See also below
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 53
	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

10 Demand specification

Contents

10.1 Service water

Alfa Laval ref. 553406 rev. 5

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

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

The following requirements are of fundamental importance

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

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

1.2 Max particle size 50 µm.

2. Total hardness 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 the harder the water is.

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

Chloride ions contribute to corrosion on the separator surfaces in contact with the operating water, including the spindle. Corrosion is a process that is accelerated by increased separating temperature, low pH, and high chloride ion concentration.

A chloride concentration above 60 mg/l is not recommended.

4. pH>6

Increased acidity (lower pH) increases the risk for corrosion; this is accelerated by increased temperature and high chloride ion content.

NOTE

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

10.2 Compressed air

Alfa Laval ref. 553407, rev. 2

The supply of compressed air to separator discharge system, valve actuators, positioners, instruments etc. must be of such a quality that satisfactory function is ensured for a reasonable time.

To this end three conditions must be fulfilled:

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

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

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

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

NOTE

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

11 Interface description

Contents

11.1 General

Alfa Laval ref. 556961, rev. 3

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 to be found.

11.2 Definitions

Stand still (Ready for start) means

- The machine is assembled correctly.
- All connections are installed according to Connection list, Motor drive data, Interconnection diagram and Interface description.

Start means

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

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

Normal stop means

- Stopping of the machine at any time with brake applied.
- The bowl must be kept filled.
- Sludge ejection must not be made

Safety stop means

The machine must be stopped in the quickest and safest way because the vibration level is too high. Comply to following conditions:

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

11.3 Component description and signal processing

Hydraulic connections

Discharge valve 375

Signal processing

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

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

A discharge can be indicated by the sudden increase in current or the decrease in speed when the solids is leaving the bowl.

Electrical connections

Separator motor 701

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

Motor temperature sensor 730

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

Speed sensor 741a

Proximity sensor of inductive type PNP or NAMOUR standard giving number of pulses per revolution of the motor shaft. See "12.5 Connection list" on page 81. The bowl speed is gear ratio (see "12.1 Technical data" on page 74) multiplied by the speed of the motor shaft.

Speed sensor (option) 741b

The bracket for the speed sensor and the junction box is prepared for an extra speed sensor, if needed.

Signal processing in "Start mode":

When the speed of 93% of the synchronous speed is reached, the Y-D starting equipment should switch over to D.

- The separator shall be stopped automatically according to "Normal stop" procedure, and a low speed alarm shall be given when the accumulated time for acceleration is longer than the maximum time specified in "12.1 Technical data" on page 74. An abnormal start time indicates some malfunction of the separator equipment and should be investigated.
- If the speed exceeds the synchronous speed with more than 5%, the separator shall be stopped automatically according to "Normal stop" procedure, and a high speed alarm shall be given. Excessive bowl speeds generate stress levels to the material that can be damaging.

In case of sudden lack of pulses from the speed sensor, the separator shall be stopped automatically according to "Safety stop" procedure with a timer controlled stop sequence, and an alarm for speed sensor failure shall be given.

Vibration sensor 750 (optional)

As an option the separator can be equipped with a vibration sensor.

The vibration sensor is of velocity type. The signal has to be converted in a special transducer, in which the signal is compared with preset limit values. When the preset limit values are exceeded, appropriate countermeasures have to be performed. The two levels are warning for acceptable vibrations and emergency stop respectively in case of extreme unbalance.

Vibration signal

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

During start (bowl speed range of 0–95% of synchronous speed). In case of a vibration signal exceeding set point for immediate safety stop during 3 seconds, the machine must be stopped and an alarm should be given.
The set point value is given in Technical data.

During normal operation

Two levels of vibration are considered for this machine:

1. In case of a signal exceeding set point for warning stop during 3 seconds.
   Following action must be taken:

- A warning alarm shall be given. Initiate a small discharge or stop the machine manually with a normal stop sequence and the reason of the vibration investigated.

2. In case of a signal exceeding set point for immediate safety stop during 3 seconds.

   Following actions must be taken:

- Immediate safety stop of the machine including alarm for too high vibrations.

Cover interlocking switch 760 (optional)

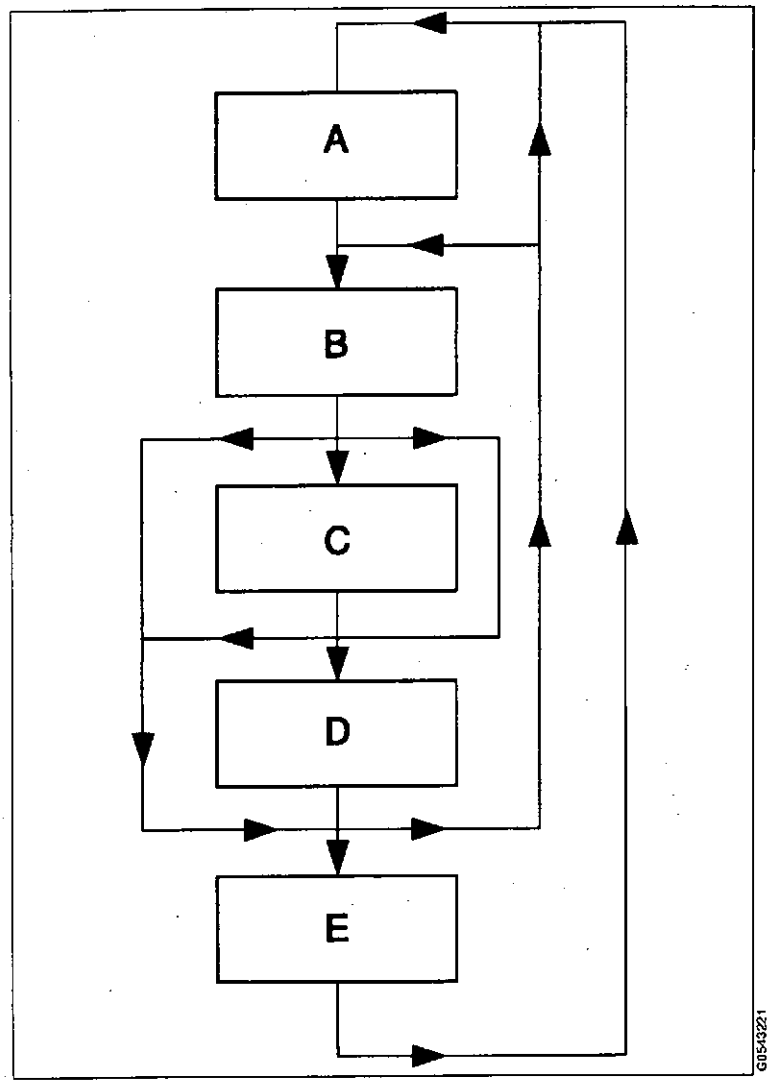
As an option the separator can be equipped with an interlocking switch. When the cover is closed, the interlocking circuit in the control system is closed and the separator could be started.

Signal processing

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

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

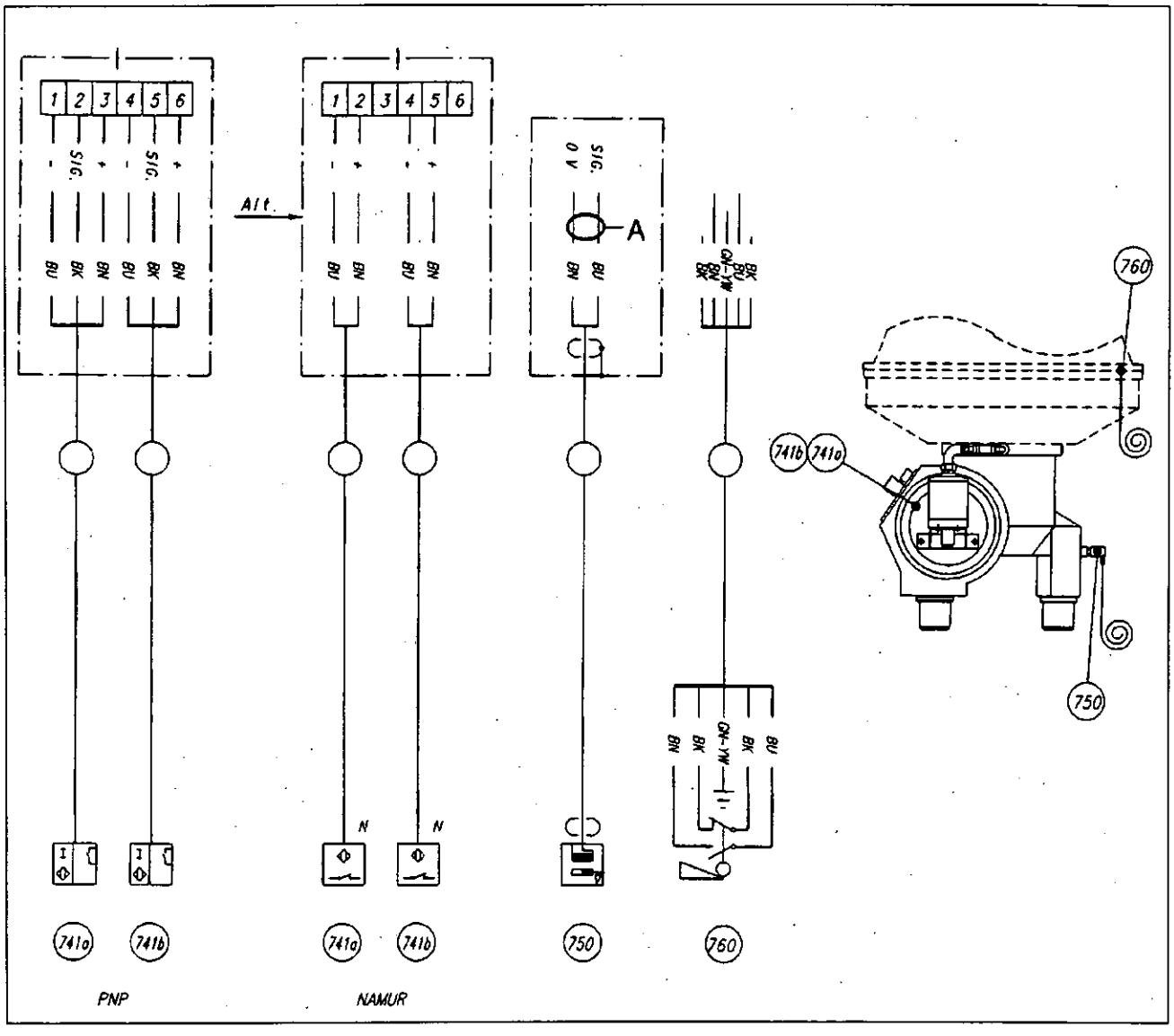
11.3.1 Function graph and running limitations



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

11.4 Interconnection diagram for monitoring kit

Alfa Laval ref. 562208, rev. 0



Wire colour codes:

BK = Black
BN = Brown
BU = Blue
GN-YW = Green-yellow

SIG = Signal

741a.Speed sensor (motor shaft speed), NAMOUR or PNP type

741b.Speed sensor (motor shaft speed), NAMOUR or PNP type

750. Vibration sensor (velocity transducer)

760. Interlocking switch (frame top part).
Normally open when cover not fitted.

12 Technical reference

Contents

12.1 Technical data

Alfa Laval ref. 560070, rev. 1(H 610HGD-74C), 557434, rev. 0 (A 610HGD-74C)

NOTE

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

Product number	881154-03-01
Separator type	A 610HGD-14C H 610HGD-74C
Application **-A 610HGD-14C** **-H 610HGD-74C**	 Butter oil. Hot milk.
Restrictions	Feed temperature: 0 °C to +100 °C. Ambient temperature: +5 °C to +45 °C. Discharge intervals: 1 - 60 minutes. Maximum allowed density of operating liquid: 1000 kg/m^3 Basic demands for PX-sealing not fulfilled. Only land based installations are permitted. Separator bowl must be kept filled during stopping sequence. Use of the machine in applications subject to hygienic demands requires an well-adapted cleaning program. Risk for corrosion and erosion have to be investigated in each case by the application centre. Further restrictions and instructions are found in other chapters in this manual.
Designed in accordance with directives and standards	89/392 EEC 91/368 EEC 93/44 EEC — The Council Directive of the European Communities. (CE-marking is possible if manuals are included in the delivery). EN 292-2 — Safety of machines. 89/336 EEC — EMC and amendments related to said directive.

Bowl speed max.	6240 / 6235	r/min 50 Hz / 60 Hz
Speed motor shaft max.	1500 / 1800	r/min 50 Hz / 60 Hz
Revolution counter	118-125 / 142-150	r/min 50 Hz r/min 60 Hz
Gear ratio	104:25 97:28	50 Hz 60 Hz
Hydraulic capacity **- A 610HGD-14C** **- H 610HGD-74C**	 25 000 15 000	 kg/h kg/h
Min./max. discharge volume	5	litres fixed discharge volume
Max. density of sediment / feed	1046 / 1030	kg/m^3
Motor power	18,5	kW
Power consumption **- A 610HGD-14C** **- H 610HGD-74C**	 9,5 / 20 9,5 / 15	 kW (idling / at max. capacity) kW (idling / at max. capacity)
Lubricating oil volume	12	litres
Max. running time without flow A 610HGD-14C **- empty bowl** **- filled bowl**	 210 480	 minutes minutes
Max. running time without flow H 610HGD-74C **- empty bowl** **- filled bowl**	 180 180	 minutes minutes
Starting time	6 / 6,5	minutes (min. / max.)
Stopping time with brake	6,5 / 7	minutes (min. / max.)
Stopping time without brake	18	minutes (avarage)
Sound power / sound pressure level	9,1 / 74	Bel (A) / dB(A)
Vibration level max.	7,1 / 9	mm/s (new sep. / sep. in use)
Alarm levels for vibration monitor: connection 750	9 / 14	mm/s (1st / 2nd)
Volume of bowl	10	litres
Bowl max. inner diameter	405	mm
Weight of bowl	274	kg
Weight of separator	1021	kg (without motor)
Bowl body material	AL 111 2377-02	

There are no other materials than stainless steel in contact with process fluid except for sealings and gaskets.

12.2 In and outlet pressures

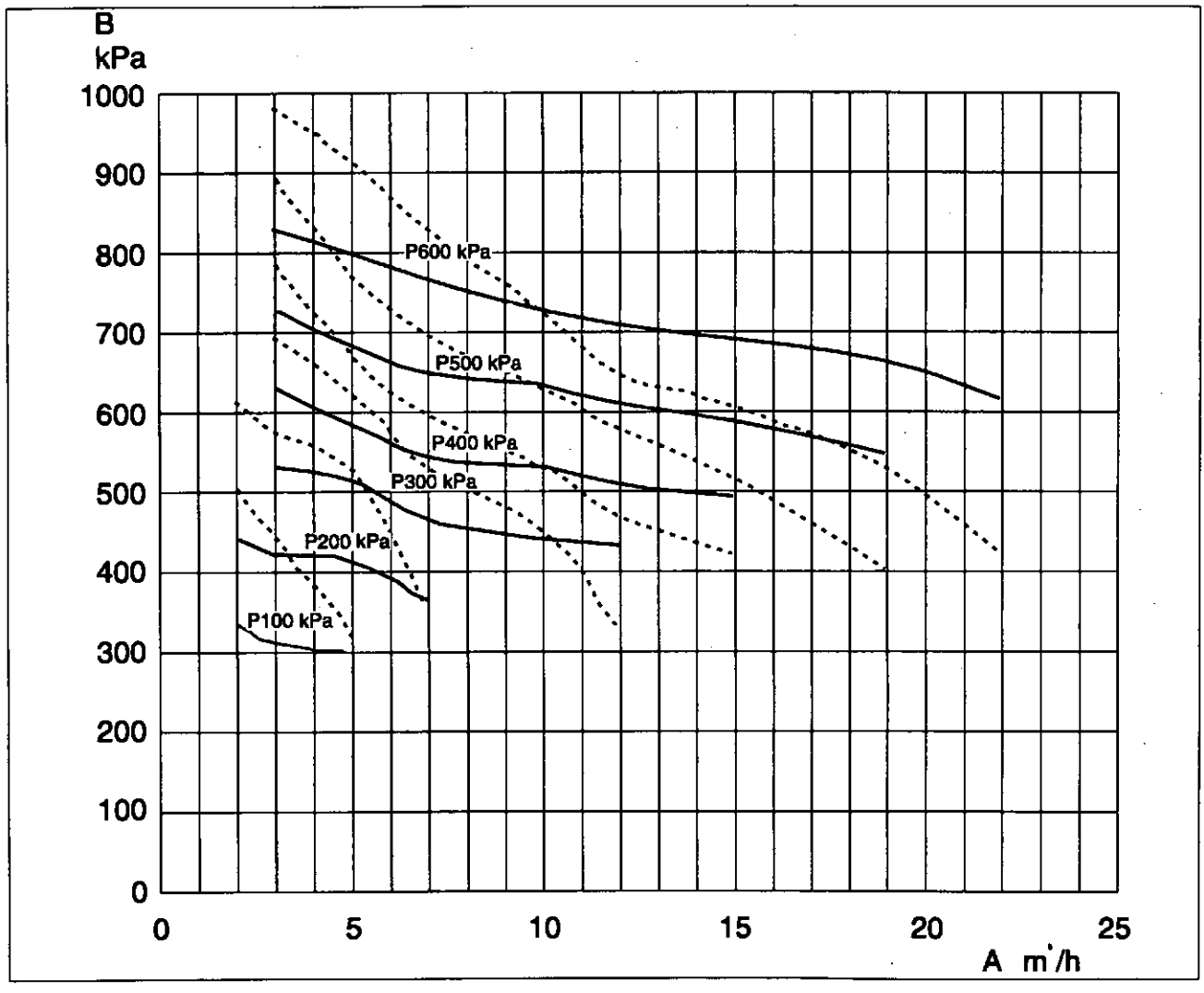
Permissible inlet and outlet pressures

Inlet Recommended inlet pressure is 400 - 600 kPa

Min. 300 kPa, Max. 600 kPa

Outlet Recommended outlet pressure: 400 - 700 kPa

Diagram for H 610HGD-74C



——— *Light phase*

– – – – – *Heavy phase*

The constant inlet pressure directly before the separator as shown in the illustration.

A. Inlet flow

B. Outlet pressure for light and heavy phase

The curves have been obtained when operating with water and when 10% of the total flow was taken out as light phase.

12.3 Bowl sealing diagram

Alfa Laval ref. 560342, rev. 0

The diagram illustrates the operational conditions required under which satisfactory sealing can be expected in solids-ejecting PX-type centrifugal separators.

No aspects of separation capabilities are included in the diagram.

The Y-axis shows the density of the sediment, i.e. the density of the solids/liquid mixture that accumulates at the bowl periphery during operation. Accordingly, this is a lower value than that of the density of the solid particles only.

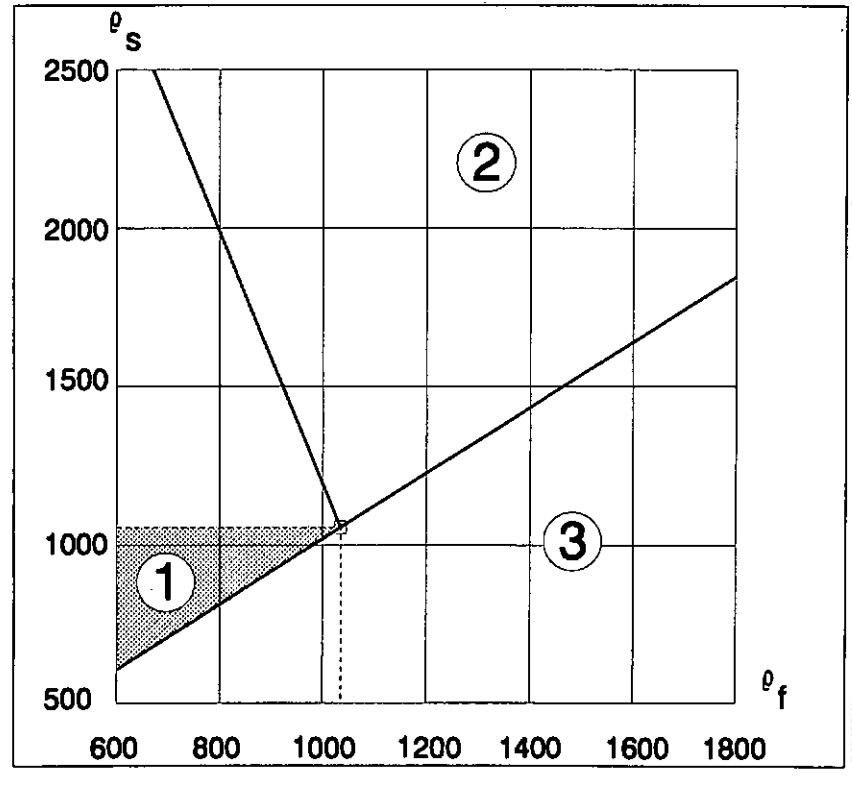
The X-axis shows the density of the feed. The triangular area called the "Operational envelope" illustrates the permissible combinations of densities where no leakage should occur.

ρ_s =*Sediment density (kg/m^3)*
ρ_f = *Feed density (kg/m^3)*

1 = Admitted operational area
2 = Sealing not possible within this area
3 = Non physical area (feed density higher than sediment density)

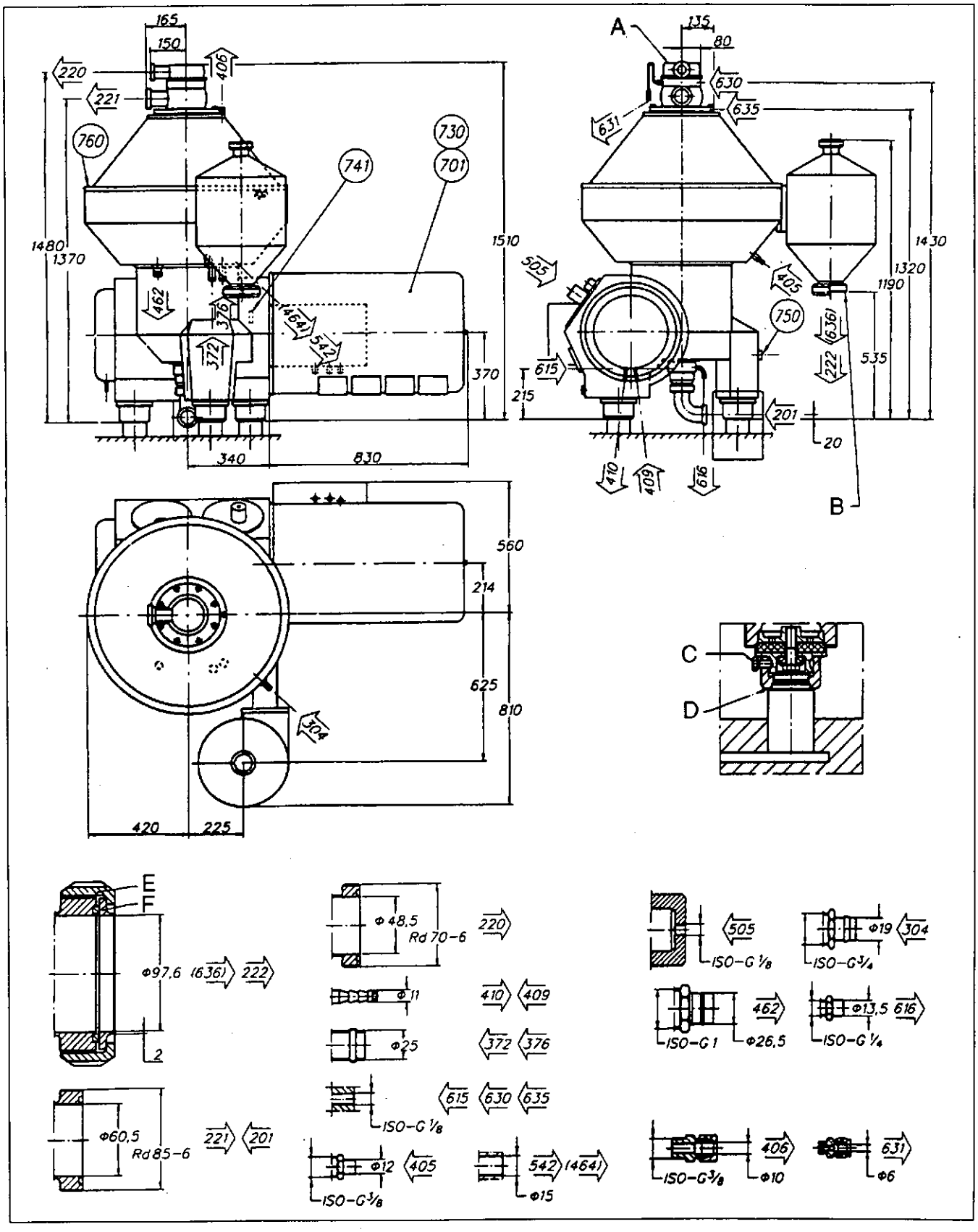
A = Max. admitted density of sediment (1046 kg/m^3)
B = Max. admitted density of feed (1030 kg/m^3)

***Note!** The max. admitted values of densities refer to the properties of the bowl. See the System* manual *(if any) for the max. values admitted for the system, which normally are lower.*



12.4 Basic size drawing

Alfa Laval ref. 549929, rev. 3



A. Maximum horizontal displacement at the inlet and outlet connections during operation ±20 mm
B. Maximum vertical displacement at the cyclone connection during operation ±10 mm
C. Tightening torque 100 Nm
D. Adjusting washers, max. 4 pcs/foot
E. Nut, DN 101,6, SMS 1148
F. Stainless steel

Connections 201, 220 and 221 turnable 360°.

All connections to be installed non-loaded and flexible

Data for connections, see "12.5 Connection list" on page 81.

12.5 Connection list

Alfa Laval ref. 557431, rev. 1

Connection No.	Description	Requirements / limits
201	Inlet for product	
	• Allowed temperature	Min. 0 °C, max. 100 °C
220	Outlet for light phase	
	• Back pressure	0 - 700 kPa
221	Outlet for heavy phase	
	• Back pressure	0 - 600 kPa
222	Outlet for sludge (sediment)	To be installed in such a way that the cyclone can not be filled with sludge
	• Discharge volume	Approx. 5 litres
	• Discharge interval	Min. 1 minute, max. 4 hours
304	Flushing in sediment outlet	
	• Consumption	Approx. 10 litres/discharge
372	Inlet for discharge liquid	See "10.1 Service water" on page 62
	• Consumption	Approx. 0,4 litres/discharge
	• Pressure	200 kPa
	• Time	Min. 0,7 sec., max. 4,8 sec
376	Inlet for make-up liquid	See "10.1 Service water" on page 62
	• Consumption	Max. 10 litres/discharge
	• Pressure	Min. 30 kPa, max. 50 kPa
405	Inlet for cooling liquid, frame top	Fresh water
	• Consumption	Min. 100 litres/h
	• Pressure	Max. 50 kPa
406	Outlet for cooling liquid, frame top	

DANGER

Disintegration hazard

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

NOTE

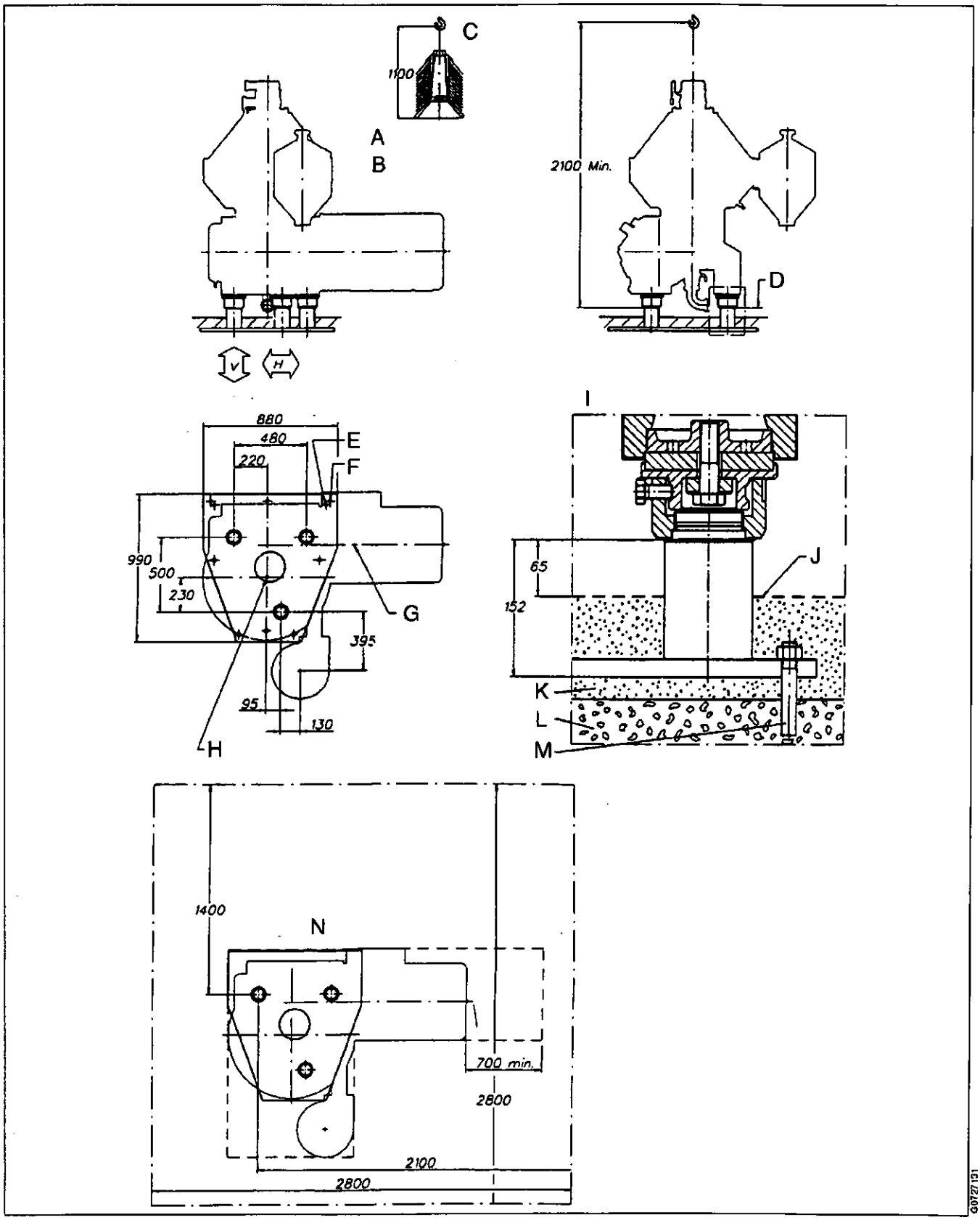
Outlet **406**, **464** and **542** must be open. No restrictions are allowed.

Connection No.	Description	Requirements / limits
409	Inlet for water to lubrication oil cooler • Consumption • Pressure	Fresh water Min. 80 - 100 litres/h Max. 50 kPa
410	Outlet from lubrication oil cooler	
462	Drain of frame top part, lower • Draining of discharge liquid and splash in connection with discharge	
464	Drain of the space between frame top part and bearing housing	
505	Inlet for compressed air to brake • Pressure	See "10.2 Compressed air" on page 63 400 ± 50 kPa
542	Ventilation of frame bottom part	Do not block the hole. No restrictions allowed
615	Inlet for sealing liquid between media and ambient area at hollow spindle • Consumption	See "10.1 Service water" on page 62 60 – 80 litres/h
616	Outlet for sealing liquid between media and ambient area at hollow spindle	Free outlet, without water trap
630	Inlet for sealing liquid between media at hermetic top • Consumption	See "10.1 Service water" on page 62 60 - 80 litres/h
631	Outlet for sealing liquid between media at hermetic top	
635	Inlet for sealing liquid between media and the frame top • Consumption	See "10.1 Service water" on page 62 60 - 80 litres/h
636	Outlet for sealing liquid, water	
701	Motor for separator Technical data: See Interface description and "12.7 Electric motor" on page 86 • Allowed frequency variation (momentarily during max. 5 seconds:	 ± 5% ± 10%)
730	Temperature sensor, motor winding Type	 PTC-thermistor 190 °C

Connection No.	Description	Requirements / limits
741	Speed sensor for motor shaft (option) Type For technical data see "11 Interface description" on page 65	Inductive proximity switch
750	Unbalance sensors, vibration (option) Type For technical data see "11 Interface description" on page 65	Velocity transducer
760	Cover interlocking switch (option) Type For technical data see "11 Interface description" on page 65	Mechanical switch

12.6 Foundation drawing

Alfa Laval ref. 549928, rev. 2



A. *Max. height of largest component incl. lifting tool*
B. *Recommended speed for lifting:*
   - *Low speed 0,5 – 1,5 m/min*
   - *High speed 2 – 6 m/min*
C. *Min. lifting capacity required when doing service: 800 kg*
D. *Horizontal max. deviation 0,4°*
E. *3 holes M20 for horizontal adjustment*
F. *7 holes Ø 20 for anchorage*
G. *Center of motor*
H. *Center for lifting device*
I. *Installation acc. to stated foundation forces*
J. *Floor level*
K. *Expanding concrete*
L. *Structural concrete*
M. *Anchor bolt*
N. *Service side*

—·—·— *Recommended free floor space for unloading when doing service*

- - - - - *No fixed installations within this area*

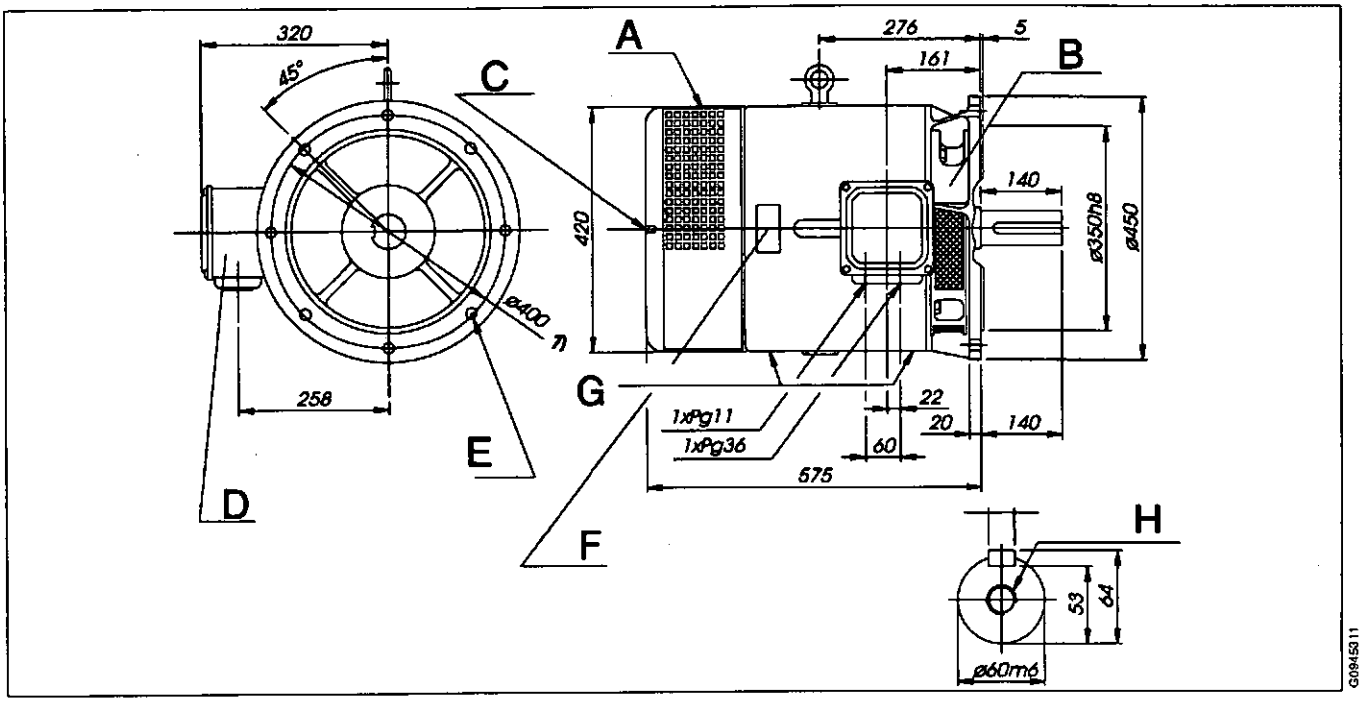
Vertical force not exceeding 20 kN/foot

Horizontal force not exceeding 20 kN/foot

Total static load max. 16 kN

12.7 Electric motor

Alfa Laval ref. 562211, rev. 1



A. Air outlet on upper side
B. Turned 180°
C. Hole M10 x15 deep
D. Terminal box located on left hand side when looking at the driving end
E. 8 holes, Ø19 equally spaced
F. Plate with relubrication information on motor frame. The motor shall be delivered with one extra lubrication plate for mounting on the motor protecting hood.
G. Drain holes Ø8. For horizontal mounting IM 3001, the motor has to be mounted with the drain holes facing downwards.
H. M20 x 42 deep

Relubrication instructions

Mounting	Motor speed synchronous (r/min)	Relubrication intervals in hours when ambient temperature is max: 40 °C		Grease quantity, grams per bearing		Type of grease
		D-end	ND-end	D-end	ND-end	
IM 3001	1500	18000	21000	20	9	Esso Unirex N3 [1]
	1800	15000	18000			

[1] Any compatible grease would be suitable

Manufacturer	Brook Hansen
Manufacturers drawing	MDR/SB/C/4/94
Standards	IEC 34-series, 72-1
Size	IEC 200 M
Type	CF 200 M
Weight	249 kg
Poles	4
Bearings	DE 6313/C3 NDE 6210LB/C3
Method of cooling	IC 01 (IEC 34-6)
Noise level	Mean sound pressure level 70 dB(A) at 50 Hz and 74 dB(A) at 60 Hz. Tolerance +3 dB(A).
Vibration level	Balanced with half key, quality grade N acc. to ISO 2373 (max. 2,8 mm/s rms).
Lubrication	The motor is equipped with grease nipples. Relubrication information to be found on separate plate on the motor frame and in the table "Relubrication instructions".
Thermistor tripping temperature	155°C
Specification	Drip proof 3-phase induction motor for frequency converter drive.
Note!	The motor wound 22 KW. Winding overhang to be epoxy treated.

Type of mounting (IEC 34-7)		Degree of protection (IEC 34-5)
	IM 3001	IP 23

12.8 Guidelines for frequency converter drives

Alfa Laval ref. 563692, rev. 0

12.8.1 Frequency converter

Introduction

The conventional method of driving an Alfa Laval separator is to use a Control Torque motor (CT motor) with star/delta start.

An alternative is to use a frequency converter for the separator motor, whereby the following advantages can be achieved:

1. The starting current will be lower than with CT motor drive. This leads to smaller dimensions for fuses and cables and therefore reduces costs for the electrical installation.
2. A standard motor can be used - this too reduce costs.
3. No torque surges during start - which leads to reduced load on the mechanical transmission.
4. No current transients during start - which leads to reduced load on the power supply system.

This document presents guidelines primarily for the choice and installation of frequency converters. Some basic requirements for the electric motor are also presented.

DANGER

Disintegration hazard

A frequency converter drive makes it possible to operate the separator at different speeds. It is therefore of utmost importance that the drive system is so designed and safeguarded that the maximum allowable bowl speed is never exceeded.

Power supply voltage

Standard frequency converters, designed for use with normally existing power supply voltage and frequencies shall be chosen.

Rated power and current

When choosing the rated power for the converter or the rated motor current, regard must be paid to the motor current peaks which occur, for example, during the automatic discharges of separators. These current peaks must be of lower level than the maximum monitored output current of the converter - in order that it will be possible for the motor to accelerate up to full speed before the next discharge takes place (i.e. within the period between consecutive discharges).

Output frequency

The converter shall be set to the output frequency, 50 or 60 Hz, which applies for the corresponding separator.

DANGER

Disintegration hazard

It is of utmost importance that this setting has to be double-checked. A faulty frequency setting can lead to overspeed with risk of a major breakdown.

It shall not be possible to alter the motor frequency by subsequent adjustment of the converter - this shall be prevented by locking the parameters or by disconnecting the control terminals.

Start function

The start of the separator shall be carried out using a suitably adjusted acceleration ramp. The acceleration period is to be chosen with regard to the separator's moment of inertia, the braking torque during start and the motor's rated torque.

Note that the current level from the power supply is lower than the level of motor current up to the time when full speed is reached - after this the values of supply current and motor current are practically the same.

Adjustment of current limit for converter

The current limit is so adjusted that an acceptable acceleration time (time for recovery) up to full speed is obtained after a discharge. The appropriate value of current limit is determined during practical tests, which should include the largest discharges likely to occur in operation.

Stop function

1. The frequency converter shall be programmed for free slow-down (parameter name "coast" or "freewheel") unless it is required that the separator shall be stopped within a given time. The separator's own mechanical brake can be used to stop the separator.
2. If controlled stopping is required, then the separator is braked using a braking chopper - which is a part of the frequency converter - and an external braking resistor.

Braking is carried out according to an adjusted braking ramp - the braking chopper and braking resistor shall therefore be dimensioned for a braking power which corresponds to the motor's rated output.

Start of rotating motor (flying start)

The frequency converter should be able to function in such a way that it can "catch" a rotating load. This function is normally chosen in the converter by means of a parameter adjustment.

During a stop with free slow-down, the converter can then after re-start - and while the motor is still rotating - "catch" the motor at existing speed and accelerate in accordance with the preset acceleration ramp.

Safeguard against reversed direction of rotation

The frequency converter is to be set for one direction of rotation only and the motor is connected for correct direction of rotation with the use of this setting.

The possibility of changing the motor's direction of rotation through adjustment of the converter shall be prevented either through locking of parameters or by disconnecting control terminals.

Monitoring of output frequency

It must be possible to program the frequency converter so that it can monitor the chosen maximum output frequency. If the frequency should exceed the maximum allowable frequency, then the converter shall stop the separator.

Communication with the separator's control system

The separator's control system shall be connected to the frequency converter so that start and stop of the separator can be initiated from the control panel. Furthermore, the control system shall monitor the separator speed via a speed sensor mounted in the separator. The control system shall stop the separator if the speed should exceed or fall below the speed limits which are stated in "11 Interface description" on page 65 for the corresponding separator.

Safeguard against overspeed, separate monitoring

If the risk analysis shows that such an improvement of the safety level is justified, then the separator can be equipped with an extra speed-monitoring unit.

The separate monitoring unit shall stop the separator - by switching off the electrical power supply to the frequency converter - if the speed should exceed a limiting value which has been defined by safety considerations.

If only one speed sensor is used for communication with the control system and with the separate monitoring unit, then the sensor shall be monitored for failure.

Electrical installation, EMC

The installation of the frequency converter shall be in accordance with existing rules and regulations. Instructions shall always be supplied together with a frequency converter.

1. **Emission:**

   In order to suppress the emitted electromagnetic radiation, the power cable from the converter to the motor shall be shielded - the shield shall be connected to motor as well as to converter with special cable glands. It is also necessary that the enclosure of the converter and the motor's terminal box are made of metal, so that required shielding can be obtained.

   To reduce circuit-bound electrical disturbances to the power supply, the converter shall be supplied with a power supply filter.

2. **Immunity:**

   The signal outputs and the control connections of the converter shall conform to the requirements for immunity to electromagnetic disturbances as stated in the EMC directive or corresponding regulations.

3. **Length of motor cable:**

   Attention shall be paid to the motor cable's length, so that tripping-out of converter because of excessive currents as well as impaired properties of power supply filter can be avoided. In doubtful cases, the converter's manufacturer should be consulted regarding maximum allowable cable length.

Enclosure class

When installing in the process area, the converter's enclosure shall be at least of class IP54. When installed in a special room for switch gear, the enclosure can be of class IP23.

12.8.2 Electric motor

Motor type, rated power

If the separator is supplied with a CT motor, then no alterations are required for frequency converter drive. If the motor is changed, then a standard asynchronous motor with squirrel cage rotor - suitable for frequency converter drive - shall be chosen. The rated power of the motor shall be not less than that of the CT motor.

Motor insulation

If the power supply voltage is 415 V or less no insulation strengthening is required for standard motors. When the power supply voltage is between 440 and 575 V the insulation level of the motor winding shall be checked with regard paid to the cable length between motor and converter.

At supply voltage 660 to 690 V a motor with reinforced winding insulation shall be chosen.

Thermal protection in motor

CT motors used by Alfa Laval are provided with thermistors in the stator windings - these shall therefore be connected to the motor's monitoring equipment when frequency converter drive is used. If, however, a standard motor is used, then it is recommended that the motor is first equipped with thermistors in the stator windings. The tripping temperature for the thermistors shall be the maximum allowable operating temperature for the corresponding insulation class.

Electrical installation, EMC

The motor cable shall be shielded so that approved suppression of electromagnetic radiation can be obtained - as required by the EMC directive or corresponding regulations. The shielding shall be connected to both motor and frequency converter with special cable glands.

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