Self-cleaning Separator

H MRPX 510 TGD-74

Book No.: OM SO 8121E 1/8807

ALFA-LAVAL SEPARATION AB - S-14700 TUMBA - SWEDEN

Self-Cleaning Separator

TABLE FOR PROCESSING AND OPERATING DATA
To be noted in connection with the first start and after service

Machine type:	Spec. No.:	Manufacturing No.:	Date:	Sign.:
	Separation	Standardization	Clarification	
Throughput				
Inlet pressure				
Heavy phase pressure				
Light phase pressure				
Discharge volume 1 small discharge				
Discharge volume 2 large discharge				
Discharge interval 1				
Discharge interval 2				
Process liquid				
Ampere meter at throughput above				
Amp. Discharge 1				
Amp. Discharge 2				

Notes:

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.

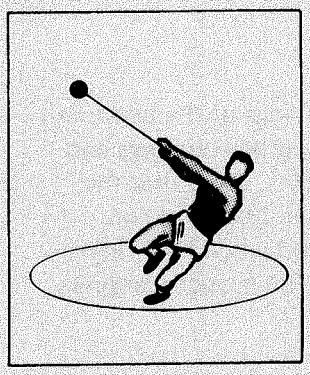
Keep Operating Routine, Lubrication Schedule, etc., easily visible.

Let all operating personnel read the manual.

It is important to be familiar with the safety precautions.

ALFA-LAVAL SEPARATION AB
Department Instruction Manuals

⚠ SAFETY PRECAUTIONS ⚠
FOR HIGH SPEED SEPARATORS



The bowl of a centrifugal separator rotates at a very high speed and great forces are generated.

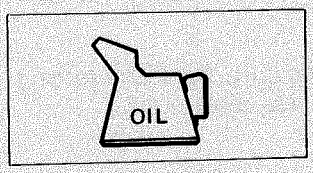
To ensure the safety of personnel and equipment:

- Always carefully follow the safety instructions and precautions.
- Always carefully follow the instructions in the instruction manuals concerning installation, assembly of the components, operation and regular maintenance.
- Always use genuine Alfa-Laval spare parts and tools.
- Ensure that all operators who run and service a separator are well trained and knowledgeable about the machine and its mode of operation.

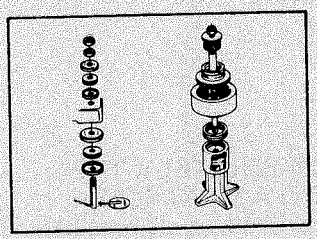
NONCOMPLIANCE MAY CAUSE A SERIOUS ACCIDENT

BEFORE INITIAL START OF NEW/OVERHAULED MACHINES

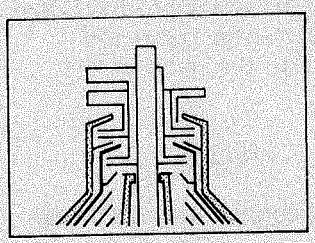
- Never transport or lift a separator with its bowl installed. This may cause bearing and bowl spindle damage.



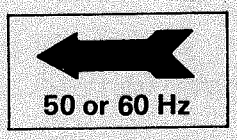
- Make sure that the gear housing has been filled with the correct quantity of specified oil.



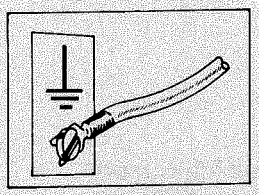
- Check that installation and tightness of rubber vibration dampers between frame and foundation is according to instructions.



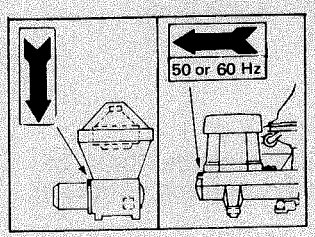
- Many separators are equipped with paring disc liquid discharge. It is important that the paring device/feed tube assembly has correct height adjustment and is securely tightened before machine is operated. See instruction manual for detailed instructions.



- Be sure to check that the frequency and voltage of the current to be connected agrees with machine specifications, see figure on the arrow sign on the frame.



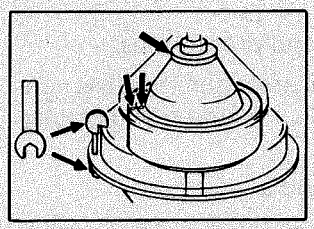
- Make sure that the separator frame, control boxes and cabinets are connected to earth (ground) in accordance with local regulations.
- Note that a separator must never be started without its bowl. This may damage its bearings.



- Be sure that the motor rotates in the same direction as the arrow on the separator frame. The lock ring(s) of the bowl may unscrew if it rotates in the wrong direction.

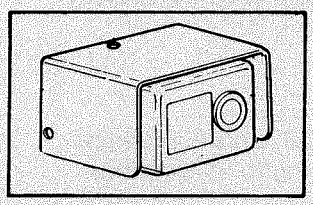
  Check the operating rpm with an empty bowl against the value specified in the instruction book. Self--cleaning separators are to be checked before the operating water is introduced (open bowl).

OPERATION

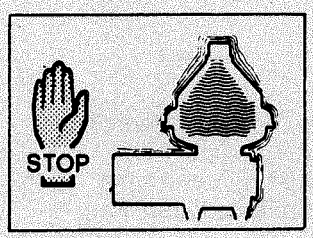


- NEVER start the machine before the lock rings of the bowl, inlet and outlet devices, frame hood, clamps, pipe couplings and other fastenings have been securely tightened. Note that the assembly mark ○ on the main lock ring must be aligned or pass the ○ mark on bowl body or bowl hood when lock ring is fully tightened. In this position there must be proper compression of disc stack.

- The brake should always be released before start.

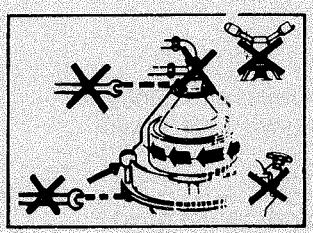


- If machine is equipped with vibration alarm unit check the setting and adjust it if necessary to individual process conditions.



- If unusual vibration occurs INCREASE IMMEDIATELY THE LIQUID FEED, PRODUCT OR WATER TO A MAXIMUM. Switch off motor, but leave the program controls on. If possible, turn the discharge frequency to OFF position and apply the brake. After the bowl has stopped completely, dismantle, clean and check all parts carefully. Do not operate until the cause of the vibration has been located and eliminated.

- Check that there is no leakage from piping connections on the separator and to/from the separator.

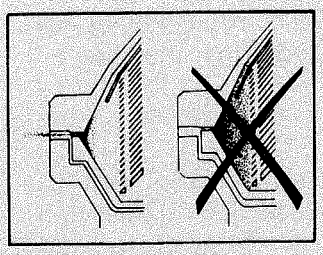


- NEVER loosen any part of the machine until the bowl has come to a COMPLETE STANDSTILL.

- NEVER use the machine for separating liquid which is more corrosive or has higher density, higher temperature, different characteristics of the solids, etc. than originally specified. Consult your ALFA-LAVAL representative.

- Follow local safety regulations concerning inflammable, toxic, or corrosive process media. Affix information and warning notices in prominent places.

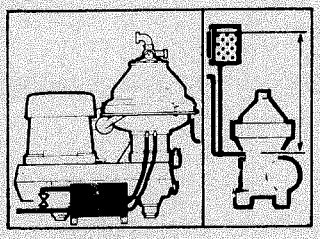
TO BE OBSERVED FOR SAFE OPERATION OF SOLIDS–EJECTING SEPARATORS OF PX–TYPE



- The bowl has to discharge solids at intervals which depend on feed rate, feed solids content of the entering product and characteristics of the solids. To avoid excessive vibration and risk of damage the solids must be discharged before the solids space is overfilled or hard packed.

  Always consult your ALFA-LAVAL representative, if possible before increasing feed rate or solids content of feed.

- NEVER program a machine with a variable discharge program for total discharge before consulting your ALFA-LAVAL representative.



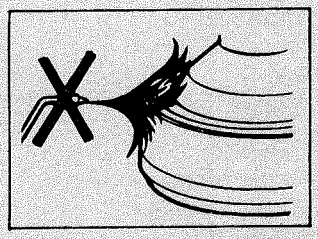
- The function of the bowl's discharge mechanism is vital for safe operation of the separator. It is therefore absolutely necessary to have an uninterrupted flow of clean, soft (dehardened) water/ /liquid at a prescribed **constant** pressure. Ensure that the **entering pressure cannot fall** below the minimum level required and does not exceed the maximum level allowed.

- At manual operation always stop the machine with a liquid filled bowl and run it down filled until the bowl opens by itself.
  If your separator has been equipped with an automatic safety liquid system to ensure that the bowl is filled at feed power failure, run-down or heavy unbalance – make sure that the liquid supply is always available whenever the machine is operated. This is very important to avoid heavy vibrations/damages.

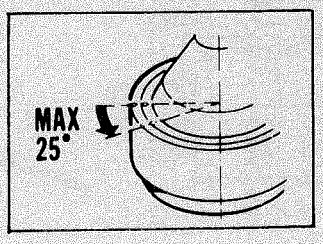
MAINTENANCE

- Switch off and, if possible, lock out the power to the machine and allow it to stop completely before starting any dismantling work. Hang up a warning sign against turning on power.

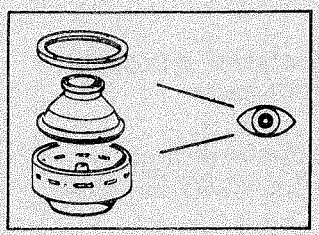
- A separator bowl is balanced as a complete unit. Do not interchange the components of a bowl with those of any other bowl. Make sure that no parts are left out during assembly.
  All major parts are marked with the full serial number or the last three digits for identification purposes.



- NEVER heat rotating bowl parts, such as bowl body, bowl hood, lock rings, etc. with a naked flame or attempt repairs by welding. This could destroy the mechanical and structural strength of the material.



- NEVER operate the machine when the ○ assembly mark on the main lock ring can pass the corresponding mark on bowl body/ bowl hood by more than 25 degrees.
  Consult your ALFA-LAVAL representative.



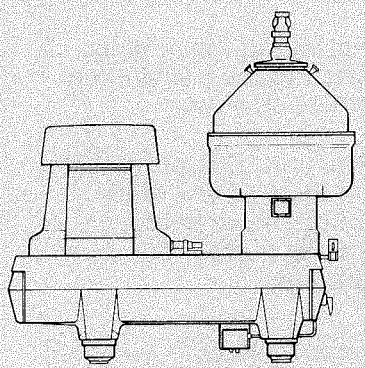
- The disc stack gradually settles and loses compression force. At each maintenance occasion check whether more disks are to be added in order to assure correct compression. NEVER remove a disc without replacing it with a new one. When reassembling, be sure to assemble slotted discs in the same order that they previously had.

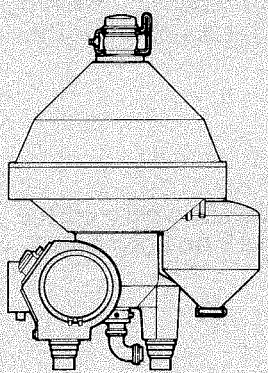
- At each service occasion, yet at least every third month the most important parts should be checked for damage. Special attention should be given to bowl pillars at sediment discharge ports, threads of bowl body/main lock ring as well as the frame and the upper frame part which is permanently hit by ejected solids and/or operating water. If the process liquids are corrosive or erosive the frequency must be increased.

- Make sure that the brake is in good condition on machines equipped with a brake.

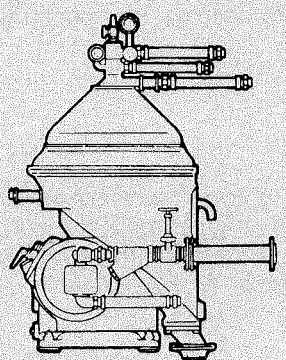
IF YOU ARE UNCERTAIN OF ANY POINTS, CONTACT YOUR ALFA-LAVAL REPRESENTATIVE.

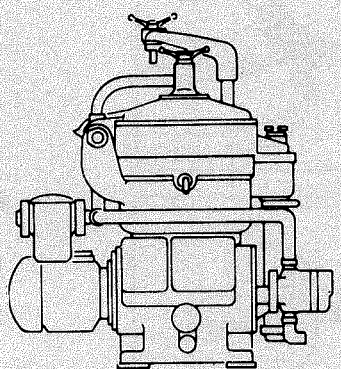
ALFA-LAVAL SERVICE





For reliability and safe operation we recommend that your separator is inspected at regular intervals by ALFA-LAVAL service engineers. These inspections will also ensure that your separator is working efficiently and economically.





GENERAL DEFINITIONS

1) Industrial applications
2) Dairy applications

Density (specific gravity)

The mass per unit of volume.

Sediment (Sludge)

Solids separated from a liquid.

Throughput

The feed of process liquid to the separator per unit time. Expressed in m^3/h or lit/h (UKGPH) (USGPH).

Clarification

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

1) Purification
2) Concentration

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

1) Concentration
2) Separation

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

Abbreviations

h = hour
r/min = revolutions per minute
Hz (Herz) = c/s = cycles per second
ø = diameter
SAE-grade = indication of oil viscosity according to Society of Automotive Engineers, USA.
SSU = Saybolt Seconds Universal, indication of oil viscosity.
^oE = degree Engler, indication of oil viscosity
cS_t = centistoke, indication of oil viscosity
Sec. R1/100^oF = Redwood seconds, indication of oil viscosity at 100^oF (38^oC).
EP = Extreme Pressure, lubricants made capable of resisting high contact pressures through a mixture of additives.
ASTM = American Society for Testing Materials.
NLGI-classes = classification of lubricating grease by means of penetration after processing according to National Lubricating Grease Institute, USA.
ISO = standards of machining according to International Organization for Standardizing.
1 bar = 0.1 MPa = 100 kPa $\approx$ 1 kg/cm^2

BASIC PRINCIPLES

The purpose of separation can be

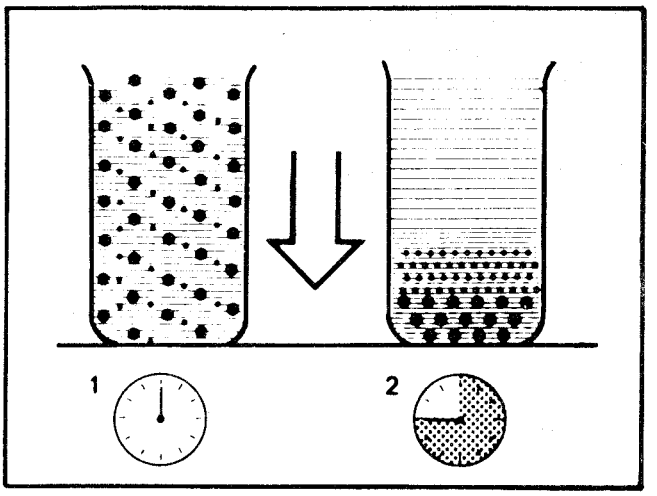
to free a liquid of solid particles

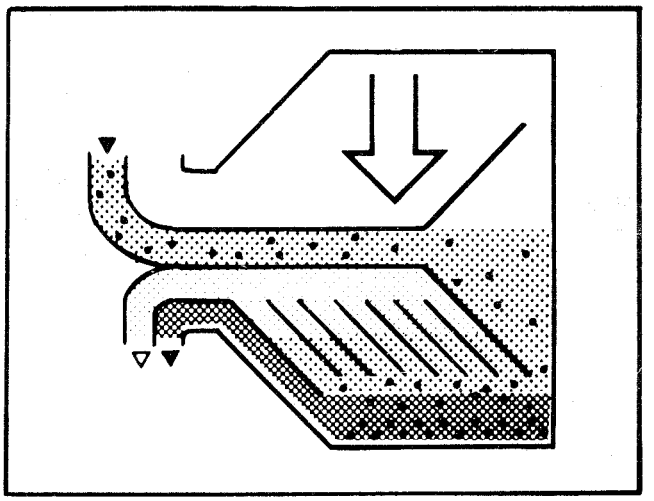
to separate two mutually insoluble liquids with different densities, removing any solids at the same time

to separate and concentrate solid particles from a liquid.

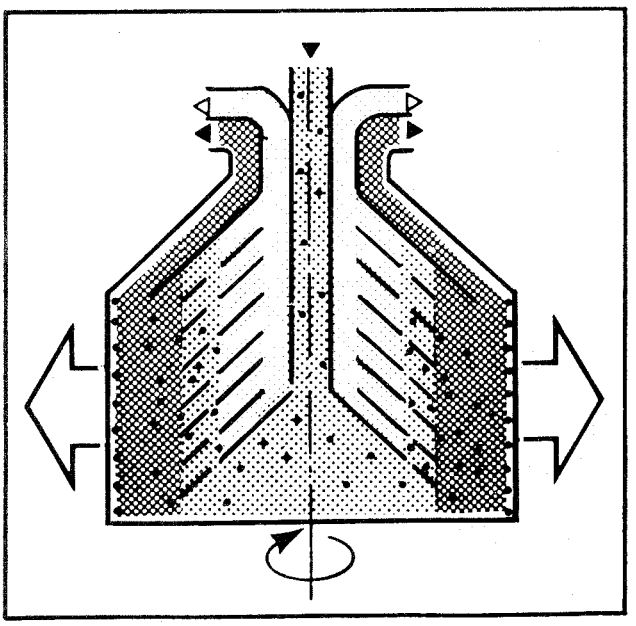
Separation by Gravity

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 ration of the two liquid phases. Any solid and heavier particles in the liquid mixture will settle and form a sediment layer on the tank bottom.



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 the influence of gravity.

BOWL

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

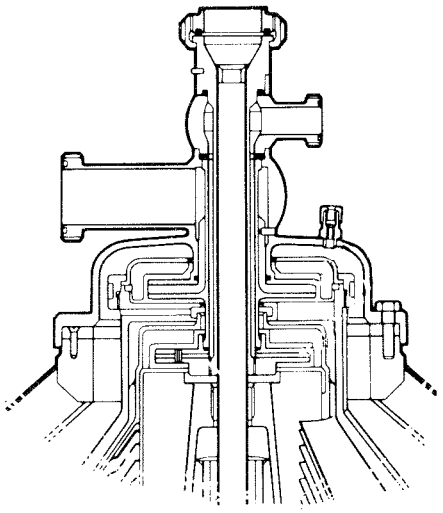
The bowl body (1) and the bowl hood (2) which make up the casing of the bowl are held together by the large lock ring (3).

Housed in the bowl are the distributor (4), the distributing cone (7) and the disc set (5), where the separation takes place. Uppermost in the disc set is the top disc (6).

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

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

INLET/OUTLET



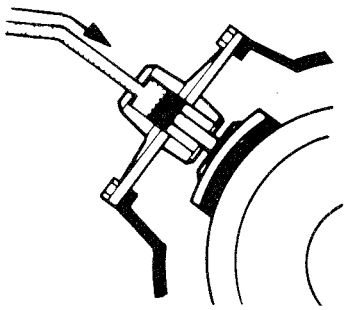
The separator is equipped with paring discs:

A paring disc is a stationary pump wheel mounted in a chamber in the rotating bowl neck. The paring disc reaches into the rotating liquid ring and pares out liquid.

To prevent aeration of the product it is important that the paring disc is covered to a certain extent.
Recomended back pressure - see Data.

Safety precautions

The Maintenance and Repair Manual (MR) contains information on height adjustment measures as well as checking and adjusting procedure. It is essential that the paring discs should be correctly positioned relative to the rotary parts of the bowl.




DATA
r/min
0235

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 air is supplied.

SPEED 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.

The speed has to be checked at start - up of the plant and after exchange of worm gear and /or motor.

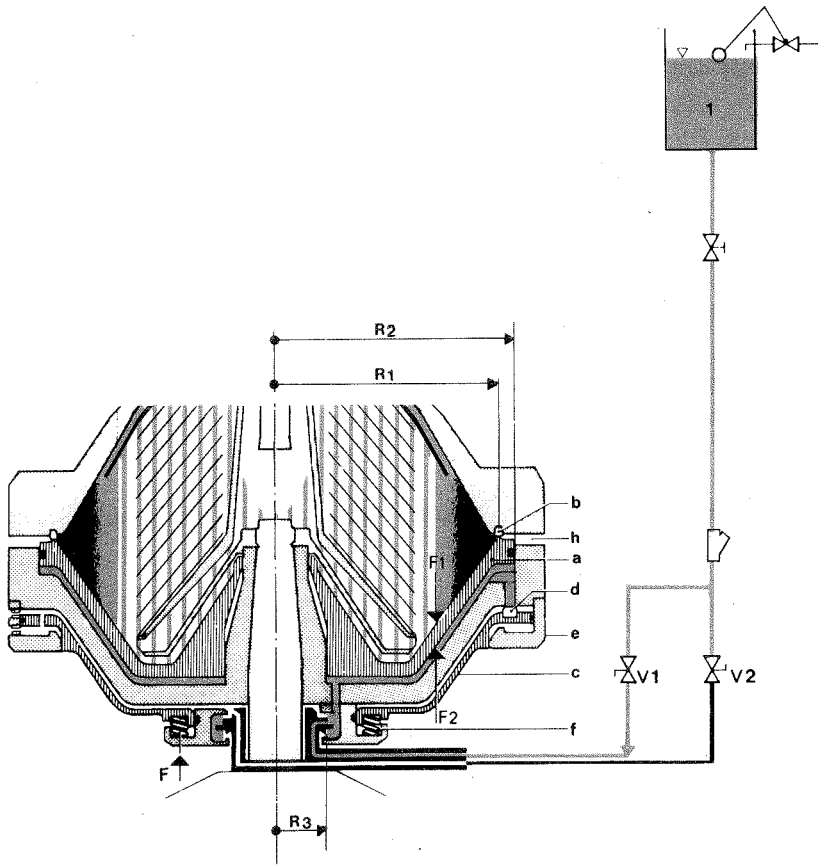
After connection to the mains check that the bowl rotates clockwise .

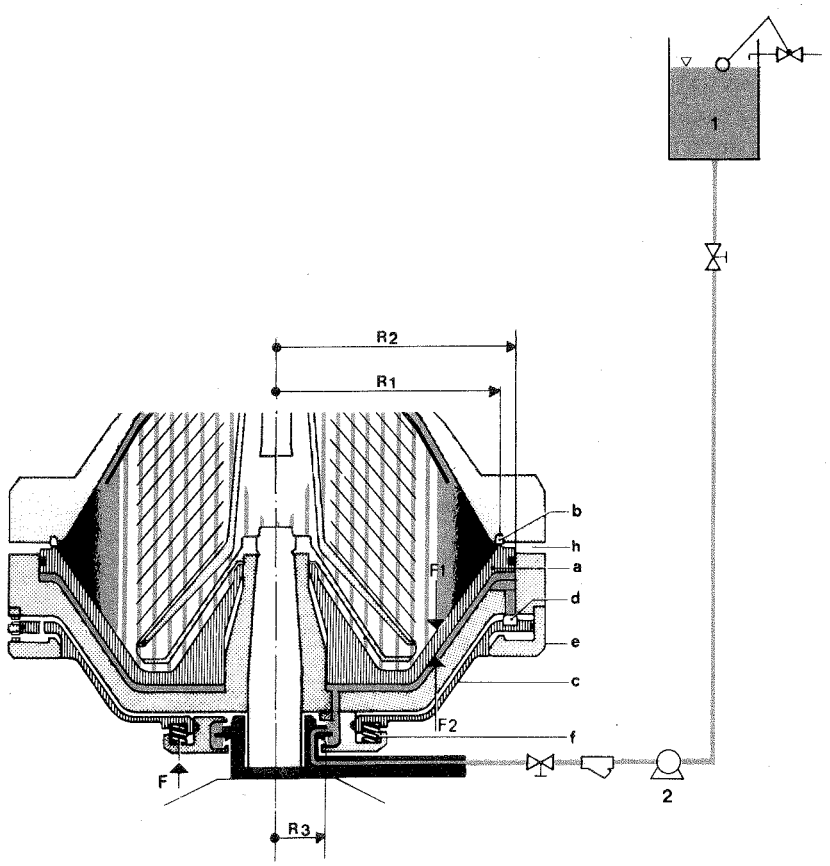
The separator must never be started unless the bowl is placed on the spindle and the worm gear housing contains lubricating oil in the prescribed quantity and of the proper quality.

Remote indication of speed

In addition to the revolution counter, the separator is provided with a sensor for remote indication of speed. This instrument shows the number of revolutions for the bowl.

It is essential to operate the machine at the correct speed both in order to achieve the best separating results and for reasons of safetey.


1
R2
R1
b
h
a
d
e
c
F1
F2
f
V1
V2
F
R3


1
R2
R1
b
h
a
d
e
c
F1
F2
f
F
2
R3

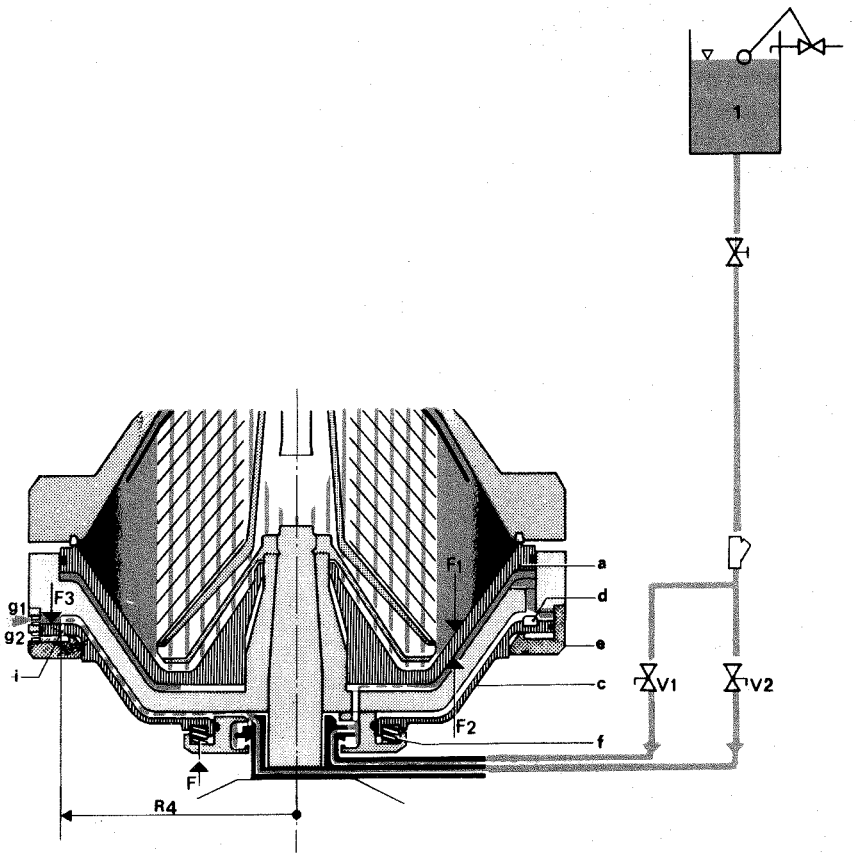
GENERAL

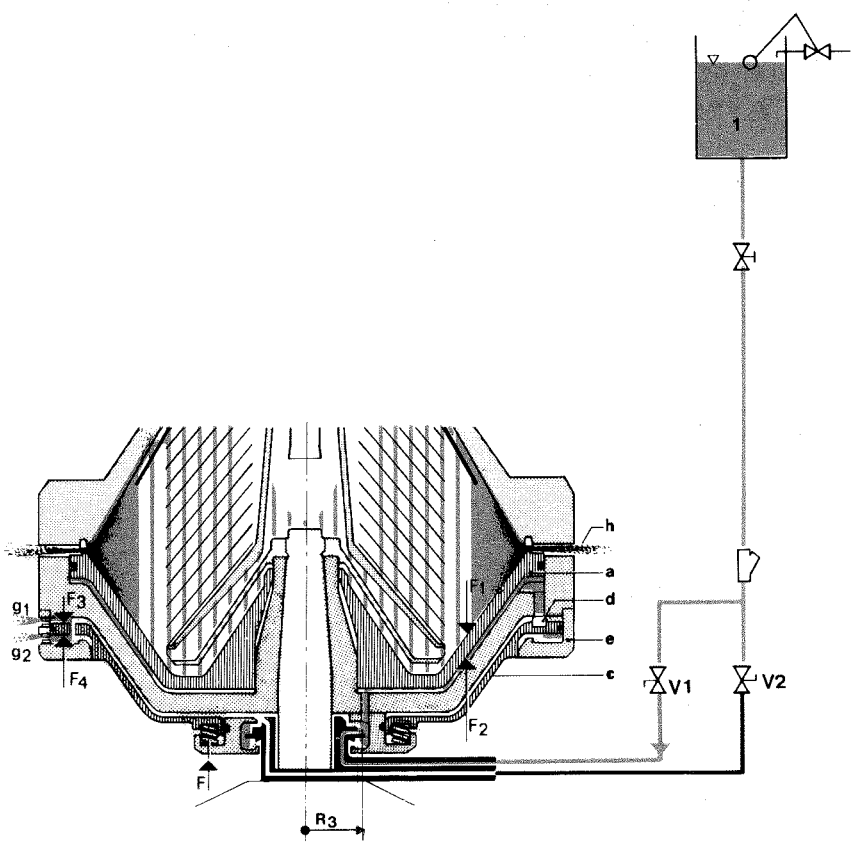
The sediment (sludge) ejection takes place through a number of ports (h) in the bowl wall. Between ejections these ports are covered by a slide valve, the so-called sliding bowl bottom (a), which forms an internal bottom in the separating space of the bowl. The sliding bowl bottom is pressed upwards against a seal ring (b) by the liquid force acting on its underside. Ejection is effected by reducing this liquid force. Consequently, the sliding bowl bottom will be pressed downwards by the liquid force acting on its upper side, thereby uncovering the ports through which the sediment is ejected from the bowl.

Positioning of the sliding bowl bottom takes place hydraulically by means of operating water supplied through a paring disc device on the underside of the bowl. The operating water has a closing function (closing water) as well as an opening function (opening water).

SEPARATING PHASE

During rotation the liquid pressure will increase with the distance from the axis of rotation due to the centrifugal force. The operating water (closing water) exerts an upward force (F_2) exceeding the counteracting downward force (F_1) produced by the process liquid, because the underside of the sliding bowl bottom has a larger pressure surface (radius R2) than its upper side (radius R1). Leakage or evaporation is automatically made up for from the operating water tank through the paring disc, which keeps the operating water at a constant level (raduis R3) because its pumping effect balances the static pressure from the tank. This water feed is going on also during the ejection cycle. Operating slide (c) keeps drain valves (d) closed through the force (F) produced by the coil springs (f). Separation goes on and solids are moving towards the bowl periphery.


1
g1
F3
g2
i
F1
a
d
e
c
V1
V2
F2
f
F
R4


1
h
a
g1
F3
d
F1
e
g2
F4
c
V1
V2
F2
F
R3

Initiation of ejection

Valve V2 is opened.

The chamber in dosing ring (e) fills up above the operating slide (c).

Since the ingoing flow is larger than the drainage through nozzle g_1, a liquid force F_3 will build up.

When the force F_3 exceeds the spring force F, the operating slide (c) will move downwards uncovering the drain valves (d).

The compartment below the sliding bowl bottom (a) is drained, force F_2 decreasing and force F_3 increasing.

When the level in the chamber in dosing ring (e) above the operating slide (c) reaches radius R4, an overflow to the chamber beneath the operating slide begins through the channels (i).

Ejection and closing

The compartment below sliding bowl bottom (a) is drained and force F_2 becomes smaller than force F_1.

Sliding bowl bottom (a) moves downwards and sediment ejection takes place through ports (h) in the bowl wall.

Valve V2 is closed.

When the chamber in dosing ring (e) below operating slide (c) becomes filled, the force F_4 together with spring force F becomes larger than force F_3. Consequently the operating slide is pressed upwards and closes drain valves (d).

The sliding bowl bottom (a) begins closing when the drainage on the underside ceases.

The chambers in dosing ring (e) are drained through nozzles g_1 and g_2.

The compartment below sliding bowl bottom (a) is refilled to level R_3 from operating water tank (1), whereby the initial force F_2 is reestablished.

The separating space above sliding bowl bottom (a) is filled. Force F_1 increases.

Force F_2 now exceeds F_1 and thus locks the sliding bowl bottom (a) in the closing position.

The compartment below and the separating space above the sliding bowl bottom are filled.

The closing is finished.

A new separating phase begins.

FAT IN THE MILK

The number of fat globules in the milk is 15 milliards per ml. The majority of the globules, say 80%, have a diameter of less than 1 μm. Despite their great number, these small globules constitute only a minor percentage of the total fat content of the milk. The greater part of the fat appears in the milk as 1 - 10 μm fat globules. Globules larger than 10 μm are also present, but their number is small.

The fat globules are enclosed in a membrane with an approximate thickness of 5.10^{-6} mm and consisting mainly of lipoproteins. It is due to these membranes that milk and cream are fairly stable fat emulsions.

FACTORS INFLUENCING FAT CONTENT OF SKIMMILK

In normal circumstances the main part of the pure fat in skimmilk consists of fat from the so-called inseparable globules, i.e. globules smaller than 0.8 - 1.0 μm.

Since the number of inseparable fat globules in the whole milk **at the moment of separation** is decisive for the number of such globules in the skimmilk – the more small globules, the more will remain in the skimmilk at separation – the number of inseparable globules in the **whole milk** is also decisive for the fat content of the skimmilk. Thus all factors influencing the number of such fat globules in the separated milk will also influence the separation result, i.e. the degree of skimming.

The most important of such factors are:

Number of inseparable fat globules in the milk at the moment of milking.

The decisive element here is the stage in the lactation period – towards the dry period of the cow the milk contains a larger number of inseparable fat globules. During the time of year when the number of dry cows is greatest, the fat content of the skimmilk is highest. The health and breed of the cows, as well as the fodder state can also influence the numerical proportions of small and large fat globules in the milk.

Splitting of fat globules during transportation of milk from cow to separator.

Modern milk processing, with all the effects of factors such as stirring and pumping in the various stages of production, storing and transport, may considerably increase the number of inseparable fat globules in the milk. The mechanical treatment of the milk during stirring and pumping will accelerate splitting of the globules still more if it takes place in combination with **intermixing of air.**

The number of inseparable fat globules in the skimmilk, and thus the skimming degree, depends also on the following factors:

Separation temperature

Optimal skimming is obtained at 50 - 60°C, at higher temperatures protein will start precipitating. Lowering the temperature means impairing the skimming degree.

Throughput

Increasing the throughput above the nominal value will raise the fat content of the skimmilk.

A very high fat content in the cream (>60%) will impair the skimming.

Intermingling of air with the milk immediately before separation results in poorer skimming.

A clogged bowl cannot give normal separation (see Separation temperature).

Condition of the disc stack. A neglected disc stack – deformed discs or discs coated with milkstone or otherwise badly cleaned – will give poor skimming.

Age of milk

Milk is less separable after storing than immediately after milking. The separability suffers most during the first 24 hours after milking.

Besides fat from the inseparable fat globules, the skimmilk can contain fat from fat globules; so-called cream splashes, which have got into the skimmilk after having been already separated from it. Because, for instance, skimmilk pipes and pipes for whole milk or cream are connected to leaky cocks. Furthermore, the sampling vessels for skimmilk can have been "infected" by whole milk or cream.

DETERMINATION OF FAT CONTENT OF SKIMMILK

Gravimetric methods

a. The Röse-Gottlieb method with Mojonnier and Semi-Micro modifications.

b. Stoldt and Weibull-Stoldt.

Butyrometric methods

a. The Gerber-method

b. The Babcock-method

Only the gravimetric methods give reliable information on the skimmilk fat content.

Reliable results depend, however, on the test being carried out exactly according to directions and in laboratories with first-class equipment and trained personnel.

The butyrometric methods can be used only for quick tests when any occasional seriously unsatisfactory operations are to be investigated.

There are no reliable comparative figures for results from butyrometric and gravimetric methods.

SAMPLING OF SKIMMILK

The most reliable information on the skimming efficiency of a separator can be obtained by means of an average sample, i.e. a sample consisting of a number of equally sized samples, taken at equally long intervals.

Even random samples will give reliable information if the plant is run under **constant** operating conditions – in this connection it is not least important to eliminate the variations in the composition of the milk which can arise if milk from a large storage tank is processed.

On no condition whatsoever must sour milk, return milk, cream, whey or water be mixed with the whole milk during sampling.

The samples must be drawn off immediately after the separator – preferably from a small pet cock on the skimmilk pipe immediately after the skimmilk outlet. Before collecting a sample in the sample bottle draw off a sufficient quantity of skimmilk to ensure that the cock is thoroughly flushed out.

If there is no pet cock and no other possibility, one can unscrew a pipe joint and draw a sample that way. In this case it is still more important to put off the sampling proper until enough skimmilk has run out to ensure that any fat adhering to the joint has been flushed off.

The milk samples, which should be sent to a laboratory for examination of the fat content, must contain at least 30 ml milk and be treated with potassiumdichromate preservative till they are a light lemon yellow colour. The bottles should be well filled so that the smallest possible space is left for splashing, provided with a tight-fitting cork, and distinctly marked.

FLUCTUATIONS IN CREAM FAT CONTENT

The fat content of the cream obtained depends on the pressures in the two outlets. If the back pressure on the skimmilk or cream outlet side is changed during separation, for instance due to changed back pressure in succeeding apparatuses, the cream fat content will also change and readjustment will become necessary.

Special difficulties arise when the cream is passed directly through a closed cooler, and particularly so when it comes to low-temperature refrigeration of thick cream, in which case great resistance variations can occur. If the resistance in the cooler increases, the cream pressure will rise, and thus the cream from the separator will become thicker with greater resistance in the cooler, and so on. In this way the separator bowl and the cooler can be completely obstructed by thick cream.

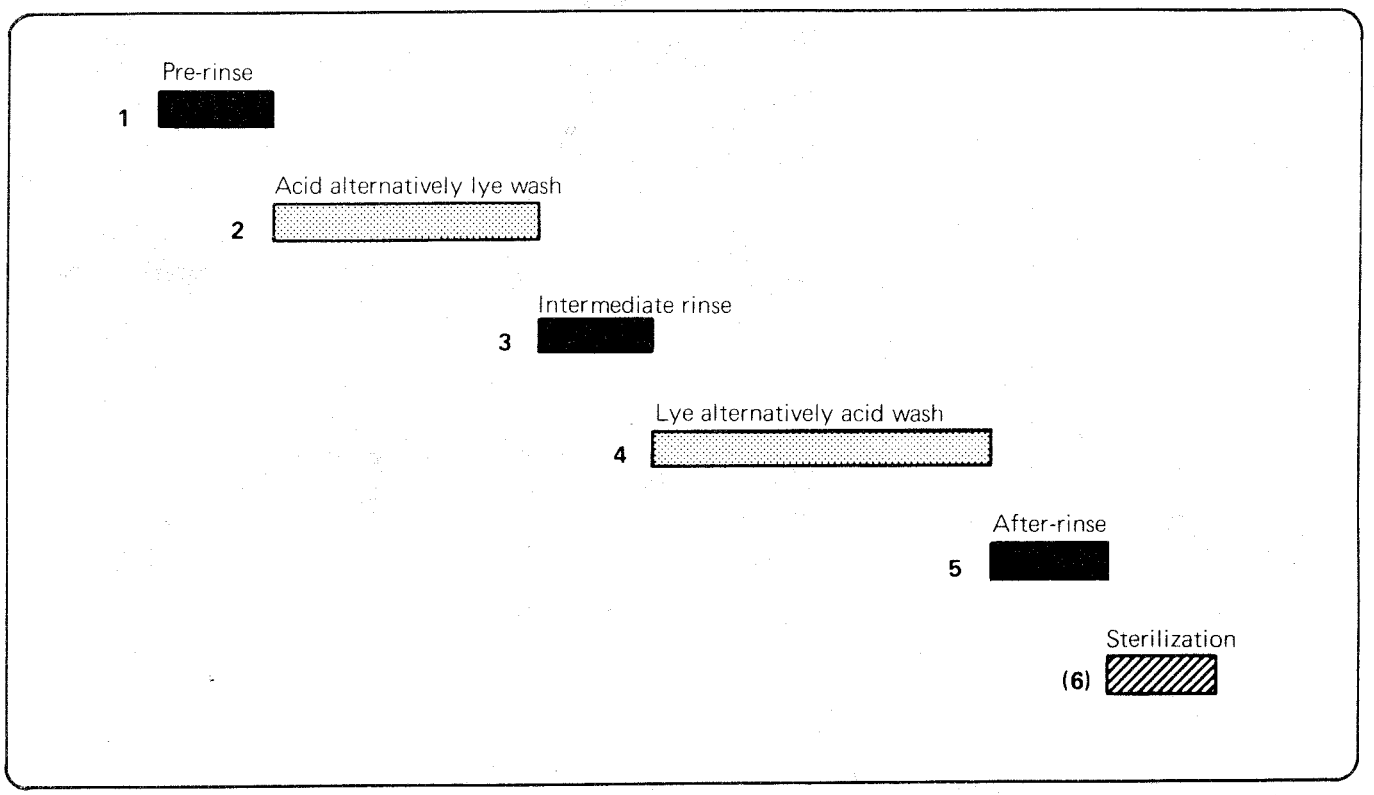
If a cream stoppage occurs, change over to circulation until the fault has been remedied.

CLEANING

GENERAL PROCEDURE FOR CLEANING OF MRPX SEPARATORS

One prerequisite for satisfactory skimming efficiency is that the separator parts in contact with the milk have been perfectly cleaned before the milk feed is turned on.
Normally the separator is incorporated in a combined unit together with heat exchangers and further peripheral equipment, and due regard must be paid to this fact in determining the cleaning times and the volumes of detergent solution – even though the cleaning cycle is in principle the same for separator and heat exchanger.
Two kinds of detergents should be used – acid solution and alkaline solution (lye).
The bowl must be emptied repeatedly during the various cleaning stages.

Cleaning cycle



1 Immediately after completion of the milk separation, pre-rinse with water.

It is important to pre-rinse as thoroughly as possible to prevent milk residues from mixing with subsequent detergent solution. (1)

2 Circulate acid solution. The duration of circulation depends on the degree of contamination of the separator. (2)

Note. In certain cases it may be better to start with lye solution; depending on milk quality, separating time, separating temperature and water hardness.

Guiding values

	Rinsing/ washing time Minutes	Number of ejections	Liquid temperature °C
(1)	15 - 20	4 - 5	
(2)	20 - 30	2 - 3	70±3

(Cleaning cycle)

3 Intermediate rinse

4 Circulation of alkaline solution, the main ingredient of which is NaOH. Circulation time depends on degree of contamination, as for lye washing.

5 After-rinse with water

(6) **Hot** water disinfection shall be effected immediately **prior** to cream separation.

In disinfection with chlorous agents the temperature must in no circumstances exceed 25°C, as chlorine is highly corrosive at higher temperatures.

	Rinsing/ washing time Minutes	Number of ejections	Liquid temperature °C
(3)	10 - 15	3 - 4	
(4)	35 - 45	3 - 4	75 ± 3
(5)	10 - 15	3 - 4	
(6)	6 - 10		90

Composition of detergents

For the acid solution use nitric acid (HNO_3).

Note. Find out the exact concentration of the acid purchased (normally 53%).

As for the alkaline solution a so-called detergent compound should be used comprising NaOH plus a complexing agent (for instance sodium polyphosphates $Na_5P_3O_{10}$) or EDTA (ethylenediaminetetraacetic acid) or NTA (nitrilotriacetic acid) with a non-ionic wetting agent.

Solution concentrations

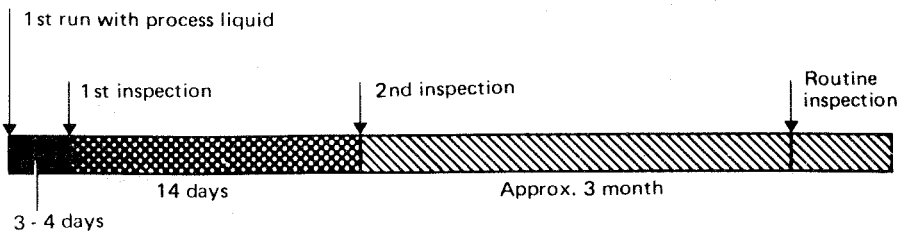
Acid solution: 0.8 - 1% nitric acid solution.

Alkaline solution: the concentration should amount to 1 - 1.5% so that a detergent solution with a pH-value of 12 to 13 is obtained.

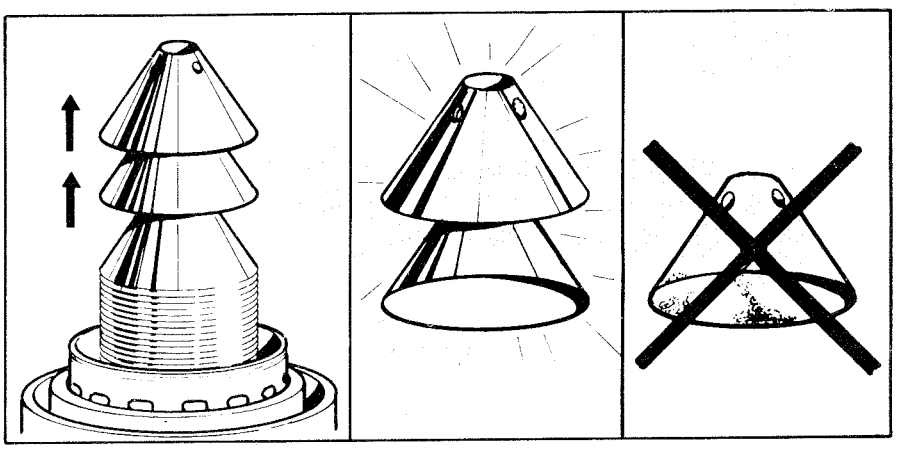
Disinfectant solution: for disinfection with chlorous agents such as sodium hypochlorite (NaOCl) use maximum 1 dl per 100 lit. of water.

As regards non-chlorous disinfectants follow strictly the instructions issued for such agents.

CHECK ON CLEANING

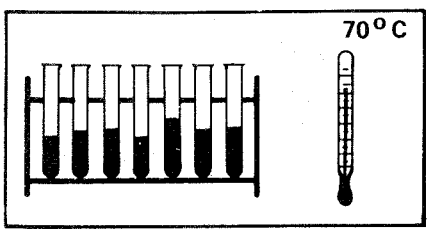


The bowl should be dismantled and the cleaning checked approx. 3 - 4 days after the first operation with process liquid. Repeat the check after a further 14 days. If the results are favourable, the bowl can be left untouched until a minor overhaul is due. This should normally be made after about 3 months.



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 milk 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.

Hot milk, cold milk

Indication: High fat content in skimmilk	Indication: Cream stoppage	Indication: Cream is too thin	Indication: Cream is too thick	Cause	Remedy
■				Wrong analysis values.	–
■				Wrong sampling.	–
■				Natural properties of milk.	Remember to readjust the cream outlet pressure when shifting to whole milk with a different fat content.
■				Splitting of fat globules before the separator due to penetration of air into the milk when pumped (in production stage as well as during storing and transport stages).	Always regulate a pump on its pressure side, as otherwise a vacuum may occur in the pump and air be sucked into it. This would have a splitting effect on the fat globules.
■				Separating temperature too low.	See »Separating result»
■				Rate of throughput too high.	Reduce throughput.
■				Whole milk or cream has leaked in after the machine.	Check that valves are correctly set and tight.
■				Separation with clogged disc stack.	Change cleaning programme or empty bowl more frequently.
■				Deformed discs.	Replace discs.
■	■			Cream with an excessively high fat content is extracted. The cream is cooled too much in the plate heat exchanger – the resistance in the pipe conduit increases (does **not** apply when an intermediate vessel is used).	Turn off the milk feed and shift to water. Re-adjust the cream outlet pressure.
		■		–	Throttle cream discharge pipe or open skimmilk pipe wider.
			■	–	Open cream discharge pipe wider or throttle skimmilk pipe.

INDICATION	CAUSE	REMEDY
SEDIMENT EJECTION		
Bowl fails to close	1. Operating water lines wrongly run.	Observe directions
	2. None or insufficient operating liquid feed due to:	
	a. Obstructed strainers, closed or throttled valves, insufficient pipe dimensions, insufficient pressure.	Observe directions
	b. Electrical or mechanical defects in solenoid valves or control unit.	
	3. Leakage: valve plug (in operating slide) - sealing surface (in bowl body).	Check. Clean sealing surfaces. Reverse or replace valve plugs.
	4. Operating slide of bowl jams due to imperfect lubrication, defective seal ring, burrs or deformation.	Check. Clean and lubricate carefully.
	5. Operating slide springs are defective.	Check and renew.
	6. Sliding bowl bottom jams - the seal ring is defective.	Renew seal ring. Lubricate carefully.
	7. Obstructed channels to space under sliding bowl bottom.	Clean
Bowl fails to open	1. See paragraphs under "Bowl fails to close".	See corresponding paragraphs.
	2. Operating water tank placed too low (refers to operating water pipe not provided with pump).	Minimum height - see recommendation.
	3. Seal rings in operating water paring disk device are damaged.	Replace.
	4. Dosing ring tightened too firmly.	Check the tightening torque.
	5. Nozzles in dosing ring are obstructed.	Clean by blowing.
	If operating water pipe is provided with pump:	
	:: Pump is defective.	
	:: Time relay of pump is wrongly set.	Adjust setting.
	:: Electrical defect.	
The bowl opens unintentionally during operation	Any liquid losses are not compensated for. See paragraphs 2, 3, 5 and 7 under "Bowl fails to close".	See corresponding paragraphs.
Ejected quantity too small	1. Dosing ring dirty.	Clean the ring.
	2. Valve plugs in operating slide are worn.	Reverse or replace valve plugs.
	3. Seal ring of bowl hood is worn.	Replace the seal ring.
Continuous water leakage in bowl casing drain	1. Operating water tank placed at too high a level.	Maximum height - see recommendation.
	2. Operating water paring disk is dirty.	Clean.
	3. Worn seal rings in the operating water paring disk device.	Replace.

TROUBLE TRACING
MECHANICAL FUNCTION (except Sludge Ejection and Axial Seals)

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

PHASE	INDICATION	CAUSE	REMEDY	REMARKS
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 pressure air	
		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 hrs – if no extra fan cooling)	
	Unusually long running-up period	Time relay in starter has not switched over from star to delta	Check setting of time 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	Time relay in starter switches over from star to delta too soon	Check time relay setting. For correct times, see Data Sheet	
		Overvoltage of power supply	Check. Remedy	
		Motor defect	Check. Remedy	
	Noise and possibly vibration	Damaged ball bearing	Check and change bearing	**Stop the separator with water or product and find out the cause**
		Worm gear badly worn	Change worm and worm wheel	
		Height settings are incorrect	Correct settings, see Maintenance Manual	
		Incorrect assembly	See Maintenance Manual	
	Vibration	Bowl out of balance due to: bad cleaning – incorrect assembly – badly tightened lock ring – disc set not clamped suffiently – 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

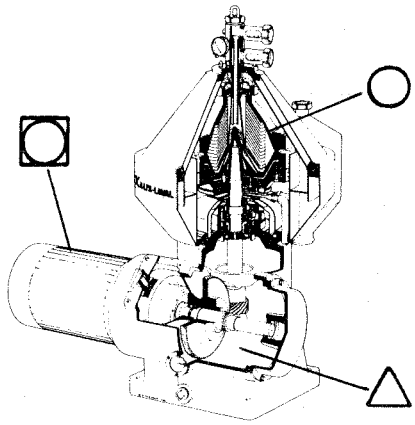
MECHANICAL FUNCTION (except Sediment Ejection and Axial Seals)

PHASE	INDICATION	CAUSE	REMEDY	REMARKS
Operation CIP	**Noise and possibly vibration**	Damaged ball bearing	Check and change bearing	**Stop the separator with water or product and find out the cause**
		Worm gear badly worn	Change worm and worm wheel	
		Height settings are incorrect	Correct settings, see Maintenance Manual	
		Incorrect assembly	See Maintenance Manual	
	Vibration	Bowl out of balance due to: bad cleaning – incorrect assembly – badly tightened lock ring – disc set 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)	
	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 Sludge Ejection	
	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	Moderate vibration at the critical speeds during starting and stopping is normal
		Bowl is leaking	See Sludge Ejection	
		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	

BEFORE ASSEMBLY

SEE RECOMMENDATION

ACC. TO INSTRUCTIONS OF SUPPLIER



OIL QUANTITY-WORM GEAR HOUSING: approx. 8 litres

OIL CHANGE INTERVAL: *first change after 300 hours of operation* and thereafter as per recommendation depending on which oil quality is used.

In seasonal operation before every operating period.

Top up when necessary (oil level to upper half of oil gauge glass when the machine stands still).

Clean sump before refilling.

TYPE OF WORM GEAR HOUSING OIL

Alfa -Laval supply lubricating oil of highest quality to minimize wear and permit operation at higher temperatures and for prolonged periods.

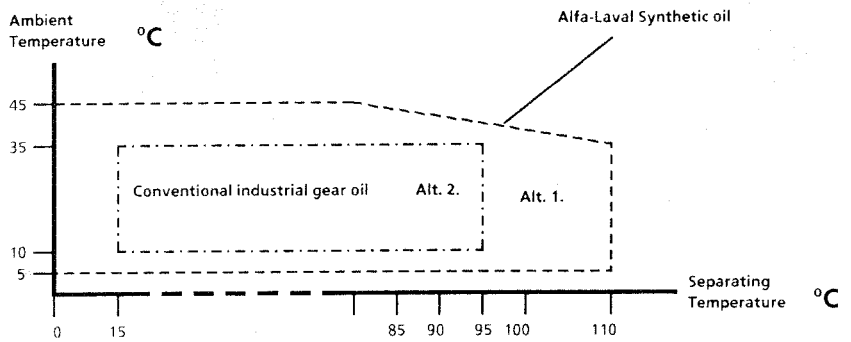
It is however possible to use a conventional industrial gear oil with EP (extreme pressure) properties and suitable for lubrication of worm gears steel/bronze and splash lubrication of roller bearings.

Note! Synthetic oils of polyglycol type must not be used.

RECOMMENDED OILS

At *ambient* temperature **+ 10 °C to + 35 °C** and *separating* temperature **+ 15 °C to 95 °C** use alternative **1 or 2**.

Use alternative **1** for other temperature ranges



PROPERTIES	ALTERNATIVE **1** ALFA-LAVAL OIL	ALTERNATIVE **2** CONVENTIONAL INDUSTRIAL GEAR OILS WITH EP-PROPERTIES
Viscosity at 100 °C cSt Viscosity index (VI) Viscocity class	26 150 ISO VG 220	16,5 - 22 90 - 105 ISO VG 220
Heat resistance	The ALFA-LAVAL OIL *is usable* at an oil bath temperature of 150 °C during 1000 hours.	The oil *must be usable* at an oil bath temperature of 100 °C during 1000 hours. Examples that fullfill the demands: BP : Energol GR-XP220 CASTROL : Alpha SP220 ESSO : Spartan EP 220 GULF : EP Lubricant HD 220 MOBIL : Mobilgear 630 SHELL : Omala oil 220 TEXACO : Meropa 220
Oil change interval	2000 hours	1000 hours
Alfa-Laval article No	542690-81 (4 lit. container)	-

LUBRICANTS

Lubricants for screw joints and sliding surfaces in food production.

Light, non-toxic greases and pastes.

Molykote paste D (white) "Lubr. engineers" LE 4025	Polyethylene - castor oil paste Castor oil

Other lubricants.

Lubricants for lock ring joints

Special lubricants that prevent seizure.

Priming	Lubricating
Molykote paste G rapid Rocol Anti-Scuffing Paste Molykote spray 321 R	Molykote paste 1000 Molykote grease BR-2 and BR-3 Molykote spray 321 R

Lubricant for screw joints

Lubricants giving equal tightening torque.

Molykote paste 1000
or
a corresponding paste **which does not influence the tightening** torque. In view thereof, e.g. Molykote paste G is unsuitable for screw joints.

Lubricant for rubber rings

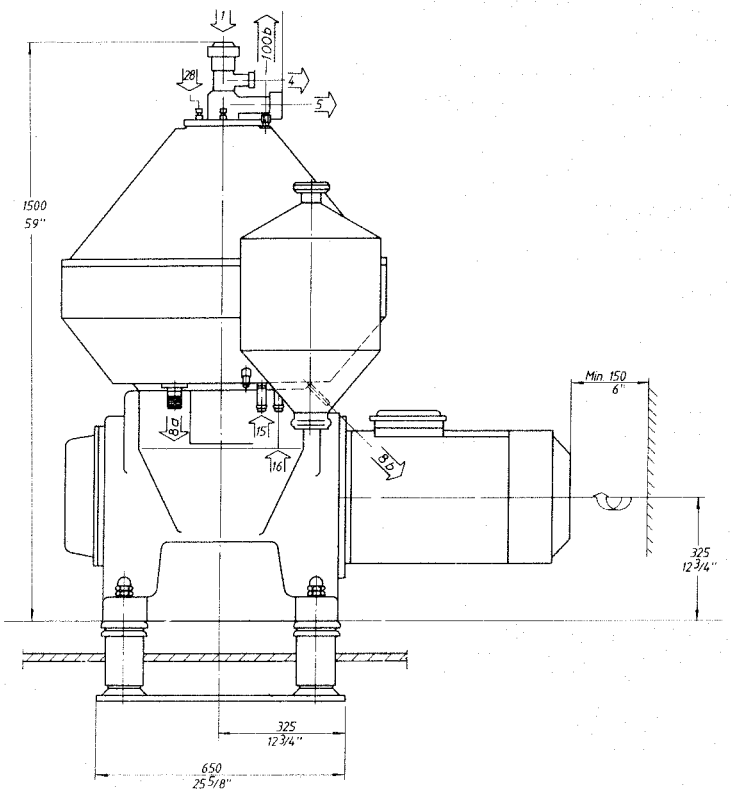
Lubricating grease of silicone type, suitable for contact with rubber rings and for limited contact with food. Consistency according to NLGI-class 2-4. The grease must have good resistance against hot water.

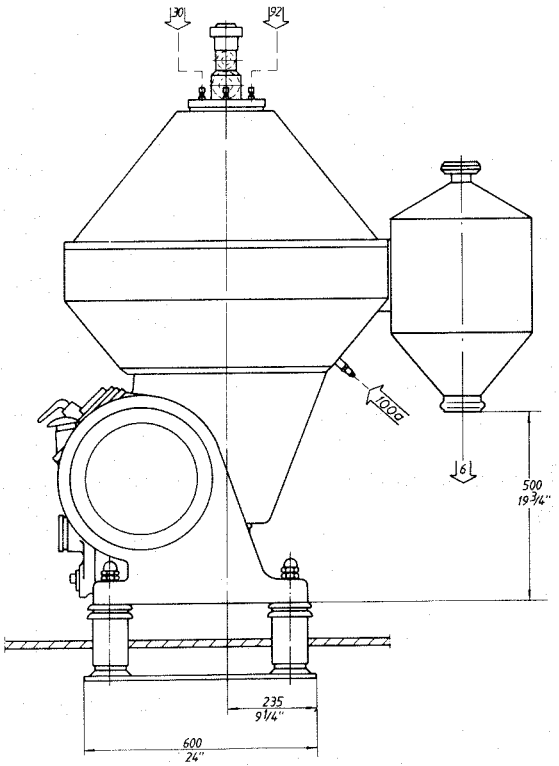
Examples of suitable lubricants:

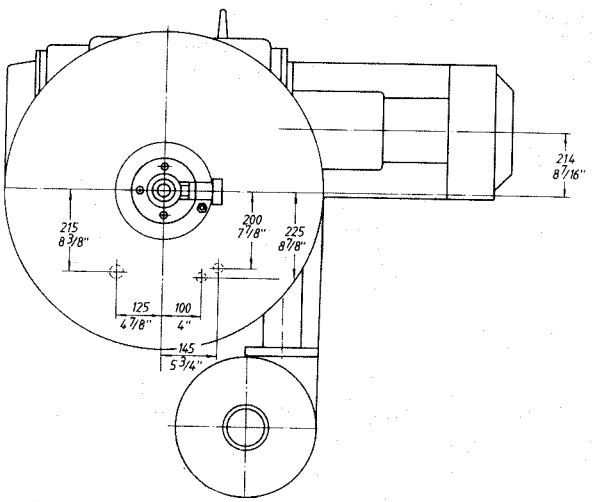
Dow Corning	Molykote 111 Compound
Klüber	Unisilikon L 250 L
Wacker	Silicon Paste P

Application

Apply the lubricant in a thin layer on the rubber ring and on the surfaces against which the ring is to slide. Avoid surplus.


1
100
28
4
5
1500
59"
Min. 150
6"
15
16
325
12 3/4"
325
12 3/4"
650
25 5/8"

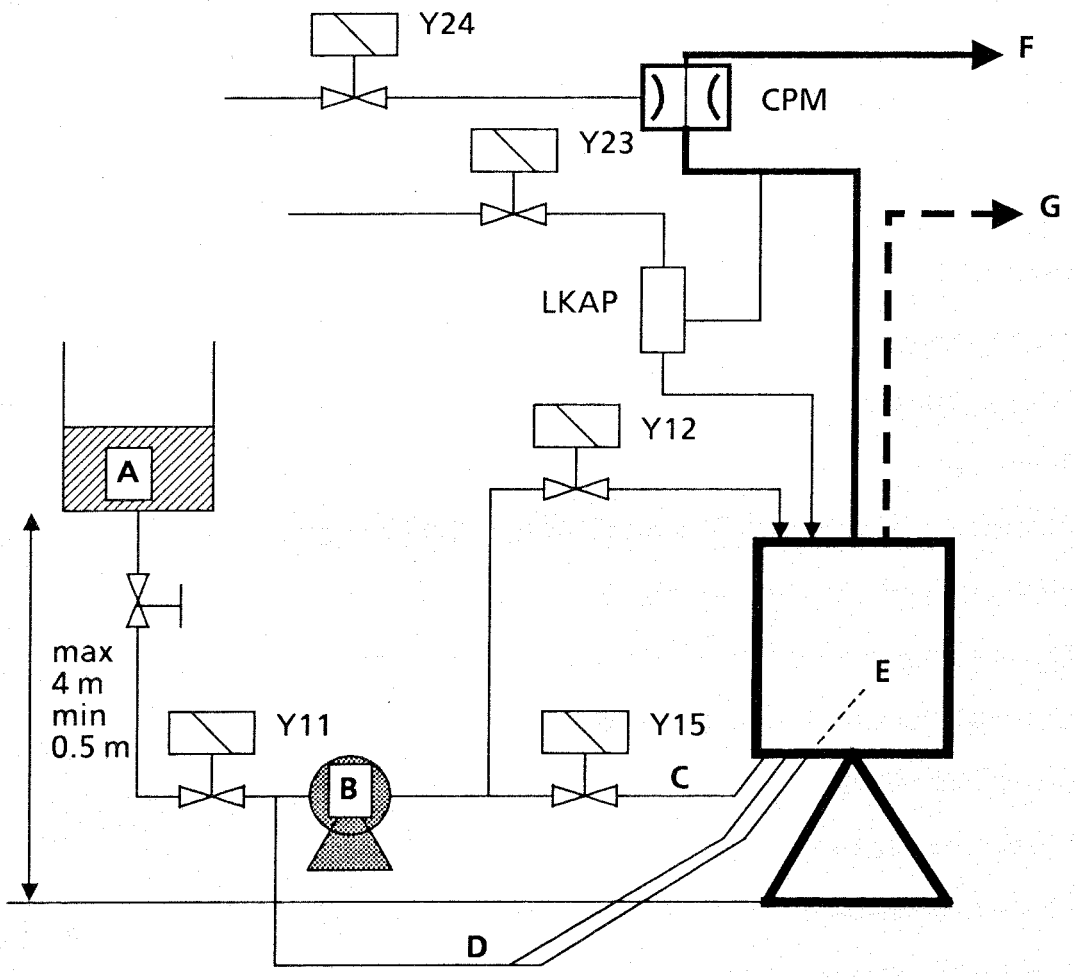

30
92
100a
6
500
19 3/4"
235
9 1/4"
600
24"


214
8 7/16"
215
8 3/8"
200
7 7/8"
225
8 7/8"
125
4 7/8"
100
4"
145
5 3/4"

The separators are used for separation, standardization and purification of hot milk. They are constructed for continuous, automatic operation and CIP cleaning.

1	Product
4	Light phase
5	Heavy phase
6	Sediment
8a	Draining of operating water after discharge
8b	Draining of operating water
15	Operating water for discharge
16	Operating water for closing
28	Flushing water
30	Flushing water
92	Flushing water
100	Inlet, cooling water
100b	Outlet, cooling water

FLOW CHART



A	Tank for operating water
B	Pump for operating water
C	Valve for discharge
D	Closing water
E	Jacket cooling water
F	Outlet, heavy phase
G	Outlet, light phase
CPM	Constant pressure valve
LKAP	Two-way closing valve

Y11	Operating water
Y12	Valve for flushing after ejection of sediment
Y23	Air for CIP valve
Y24	Air for CPM in heavy phase outlet

POWER

Motor power: 15 kW
Starting power: 27 kW

Power at nominal throughput:

7 m^3/h - hot milk separation: 12 kW
10 m^3/h - standardization: 13 kW

Running with bowl empty and closed: 8 kW

SPEED

The prescribed speed of the worm wheel shaft which must not be exceeded is stamped on the name plate of the machine.

The table shows rpm.

WORM WHEEL SHAFT	1420 - 1500	1700 - 1800
Motor	1420 - 1500	1700 - 1800
Revolution counter	118 - 125	142 - 150

RUNNING -UP TIME

4 minutes

STOPPING TIME

8 minutes

BACK -PRESSURE

Maximal skim-milk pressure (overflow pressure):

550 kPa (5.5 bar) at 7 m^3/h.
460 kPa (4.6 bar) at 10 m^3/h.

Suitable skim-milk pressure: 50 - 100 kPa (0.5 - 1 bar) below maximal pressure.

INLET PRESSURE

Recommended inlet pressure: 30 - 50 kPa (0.3 - 0.5 bar).

INTERVAL BETWEEN DISCHARGES

Dependent upon sediment content but at hot milk separation normally 20 - 30 minutes. Maximum 1 hour.

OPERATING WATER

Quality
Content of suspended substances less than 0.001 volume %. Total hardness less than 10° dH (180 mg $CaCO_3$/liter). Content of chlorides less than 100 ppm (60 mg Cl/liter). pH value larger than 6.

Consumtion
Approx. 0.8 lit./ejection.

Water for flushing of bowl outside and frame hood inside: approx. 15 lit/ejection at 400 kPa (4 bar).