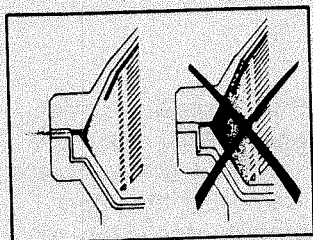


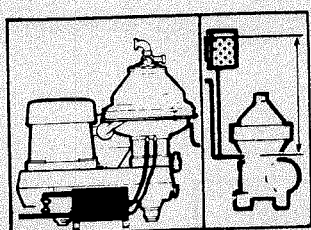


TO BE OBSERVED FOR SAFE OPERATION OF SOLIDS— EJECTING SEPARATORS OF PX-TYPE



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

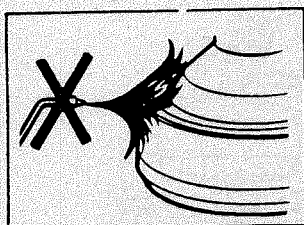
Always consult your ALFA-LAVAL representative, if possible before increasing feed rate or the solids content of feed.



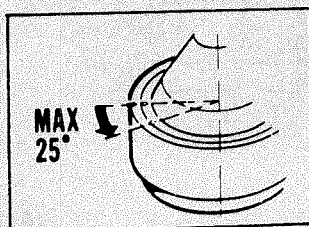
- NEVER program a machine with a variable discharge program for total discharge before consulting your ALFA-LAVAL representative.
- The function of the bowl's discharge mechanism is vital for safe operation of the separator. It is therefore absolutely necessary to have an uninterrupted flow of clean, soft (dehardened) water/liquid at 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 machine is operated. This is very important to avoid heavy vibrations/damages.
- Regarding operating water/liquid refer to separate section below.

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 sign warning 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.



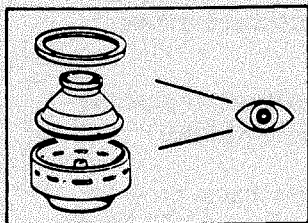
- NEVER heat rotating bowl parts, such as bowl body, bowl hood, lock rings, etc. with a naked flame or attempt repairs by welding. This could destroy the mechanical and structural strength of the material.



- NEVER operate the machine when the ϕ 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.

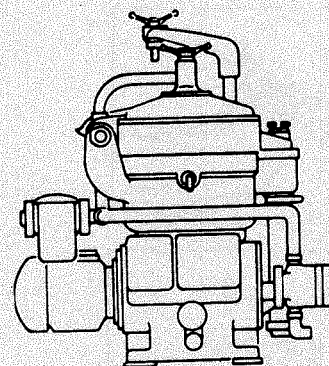
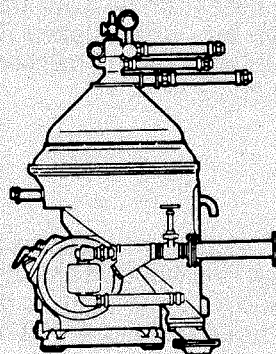
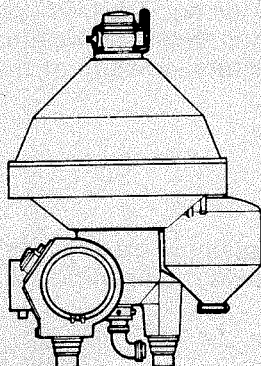
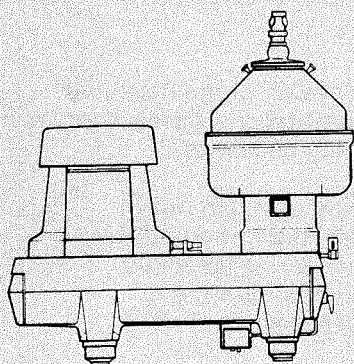


- At each service occasion, yet at least every third month the most important parts should be checked for damage. Special attention should be given to bowl pillars at sediment discharge ports, threads of bowl body/main lock ring as well as the frame and the upper frame part which is permanently hit by 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.

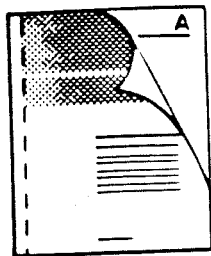
IF YOU ARE UNCERTAIN OF ANY POINTS,
CONTACT YOUR ALFA-LAVAL
REPRESENTATIVE.

ALFA-LAVAL SERVICE

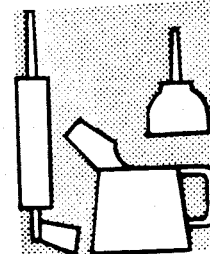


For reliability and safe operation we recommend that your separator is inspected at regular intervals by ALFA-LAVAL service engineers. These inspections will also ensure that your separator is working efficiently and economically.

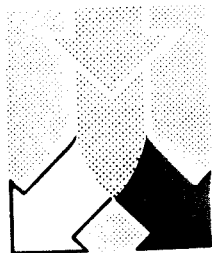
CHAPTER **A**
Useful information



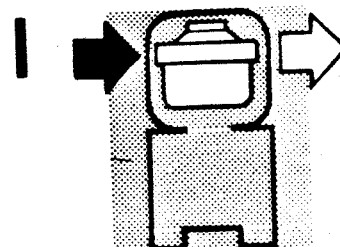
CHAPTER **H**
Lubrication



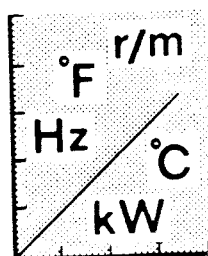
CHAPTER **B**
Technical information



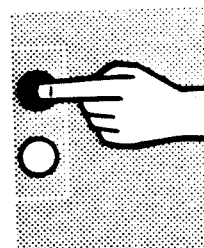
CHAPTER **I**
Inlet
Bowl
Outlet



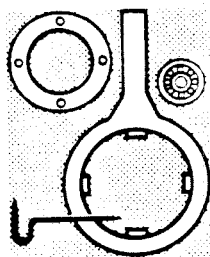
CHAPTER **C**
Data



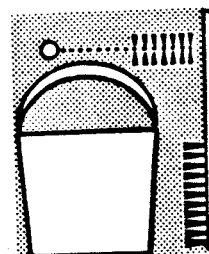
CHAPTER **K**
Operation
Trouble tracing



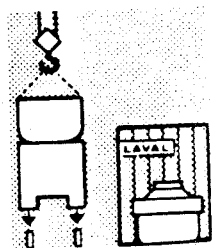
CHAPTER **F**
Set of tools



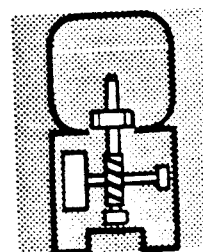
CHAPTER **L**
Cleaning
Maintenance



CHAPTER **G**
Installation

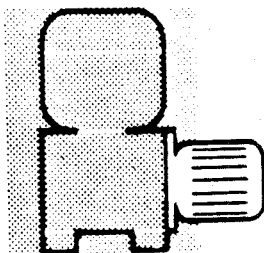


CHAPTER **P**
Power transmission



CHAPTER

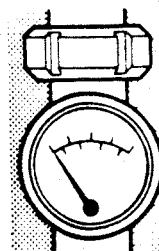
R

Mounting
the motor

CHAPTER

X

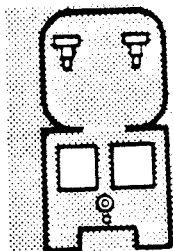
Accessories



CHAPTER

S

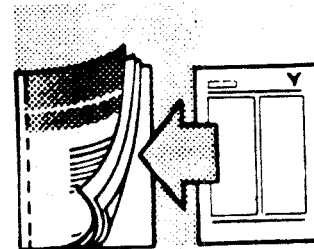
Frame parts



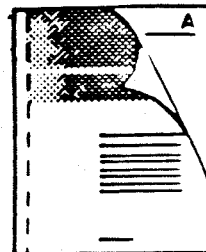
CHAPTER

Y

Supplement



ALPHABETIC REGISTER



GENERAL INFORMATION

Contents - Disposition - Supplement - Type Denomination.
Manufacturing Number - Safety Regulations - Lubrication.
Cleaning - Special Tools - Abbreviations - Ordering Routine.

Correct installation, suitable treatment of the liquid before and after the passage through the machine, correct operation and handling of the machine according to the directions given in this book, cleanliness, carefulness and methodical overhaul are factors of the greatest importance for ensuring the best machine function and intended results.

CONTENTS

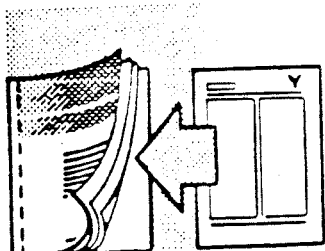
The Instruction Book contains instructions concerning installation and operation, dismantling and assembly as well as cleaning and overhaul.

The constructional particulars given in the Instruction Book are not binding. We reserve the right to make alterations without previous notice. Reconstructions made after delivery are not followed by new Instruction Books.

DISPOSITION

Every chapter of this book has its own reference letter which is placed in the right-hand top corner of each page. The chapters are arranged in alphabetical order. Whenever reference is made to a page of the Instruction Book in any form of communication with us, please state the reference letter and the heading of the chapter in question as well as the reference number appearing, preceded by the letter "S", at the bottom of the page. Illustrated pages also carry the drawing number at their bottom.

SUPPLEMENT



If the Instruction Manual is to be used for a machine made to special order, supplementary instructions are often given in chapter Y. Please check this before putting the machine into service. Supplementary data (for treatment of the liquid, specific weights, etc.) are often included in the technical information provided at the time of purchase. The ALFA-LAVAL representative is always ready to provide advice and information additional to that contained in this Instruction Manual.

TYPE DENOMINATION
MANUFACTURING
NUMBER

It may happen that the type denominations on the machine's type-plate and on the cover of the Instruction Manual do not correspond. In such cases, the machine's serial number is applicable. The correct Instruction Manual always carries the serial number appearing on the type-plate.

SAFETY REGULATIONS

Chapter K lists the safety procedures which must be regarded as absolutely IMPERATIVE. The electrical installation must be carried out by a qualified electrician familiar with local safety regulations. It should be noted that the Instruction Manual does not normally include any safety precautions required by special characteristics of the process liquid, such as inflammability, toxicity or corrosive properties.

LUBRICATION
CLEANING

The assembly instructions deal only with parts that should be cleaned and lubricated. All the information on the lubricants or cleaning agents to be used is set out in chapters H and L.

SPECIAL TOOLS

The use of special tools is shown in chapter F.

ABBREVIATIONS

h = hour

r.p.m. = revolutions per minute

c/s = cycles per second

∅ = diameter

SAE-class = indication of oil viscosity according to Society of Automotive Engineers.

SSU = Saybolt Second Universal: indication of oil viscosity.

EP = Extreme Pressure: lubricants with emulsions and additives enabling them to resist high contact pressures.

ASTM = American Society for Testing Materials.

NLGI-classes = classification of lubricating greases acting through penetration after processing as per National Lubricating Institute, U.S.A.

ISO = consolidated processing standards prescribed by International Organization for Standardizing.

kW = power

Hz = frequency

V = voltage



Function - Definitions - Factors influencing the Process - Processing Methods - Sludge - Discharge - Automatic Control - Choice between various Possibilities of Adjustment - Special Recommendations.

Information on for instance the treatment of the process liquid is contained also in the technical information sent to you in connection with the purchase of the machine.

FUNCTION

The purpose of the operation is either to liberate a liquid from strange particles, or to separate two intermixed liquids.

DEFINITIONS

Throughput

This means the quantity of liquid supplied per unit time. The throughput is given in cu.m/h or l/h (Imp. galls/h).

Reception ability

This means the largest liquid quantity that the bowl can treat per unit time, expressed in cu.m/h or l/h (Imp. galls/h).

Purification

A liquid - liquid separation in which the machine is used for separating two intermixed liquids, which are insoluble in each other and have different specific gravities. Solids with specific gravities higher than those of the liquids can be separated off at the same time.

Clarification

A liquid - sludge separation in which the machine is used to separate particles, normally solid ones, from a liquid having a lower specific gravity than that of the particles.

Concentration

A liquid - liquid separation in which the machine is used for separating two intermixed liquids, which are insoluble in each other and have different specific gravities, the heavier liquid constituting the major part of the mixture. Solids with specific gravities higher than those of the liquids can be separated off at the same time.

Emptying of the bowl

Emptying of the bowl takes place during running; the contents of the bowl being ejected through slots located in the actual wall of the bowl.

Total discharge

Total emptying of the bowl. Intake of the product to be separated must be suspended while the machine is in operation.

Partial discharge

Partial emptying of the bowl. During this process, it is not essential to suspend the intake of the product to be separated.

FACTORS INFLUENCING THE SEPARATION PROCESS

Different specific gravities

The centrifugal force acts on all particles in proportion to their specific gravity. This applies both to solid and fluid particles. The greater the difference in specific gravity, the easier the separation process.

Shape and size of particles

The larger the particle, the quicker the sedimentation. The particles to be separated must not be so small that the mixture approaches a colloidal state. Smooth and round particles are more easily separated than those which are irregular or long in shape. Rough treatment, as in the pumps, can break up the particles and thus reduce their size and the speed of separation.

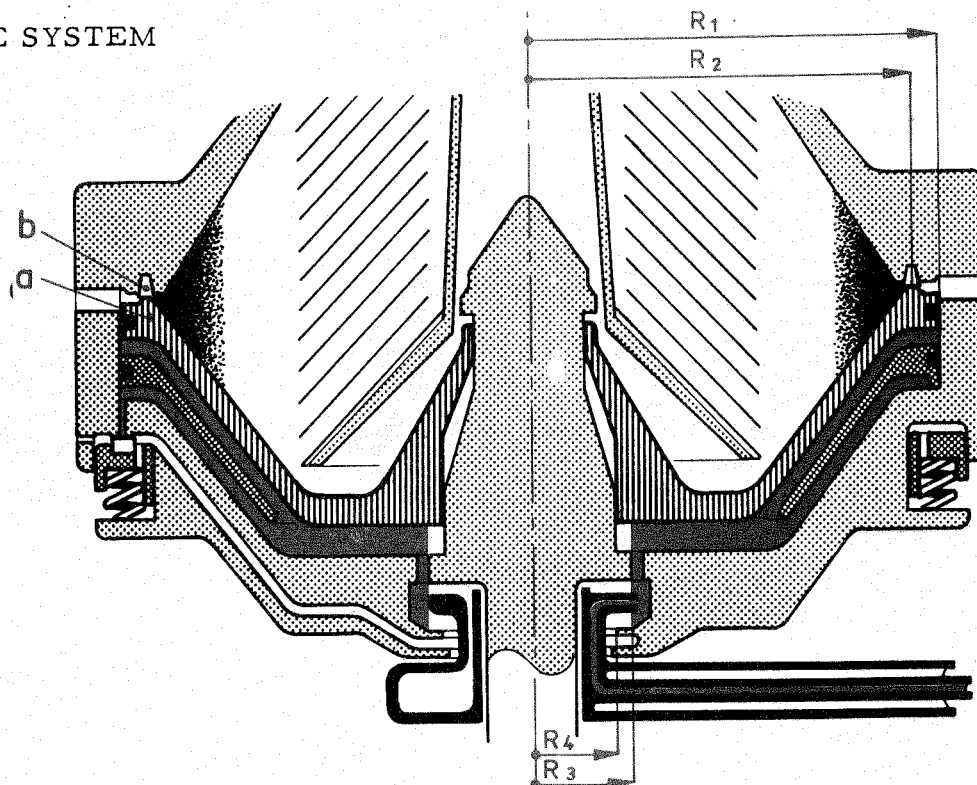
Viscosity

The more fluid a liquid is, the quicker the separation process and the better the separation. In other words, low viscosity improves the separation results. The viscosity can in many cases be reduced by heating. High viscosity reduces the throughput.

Separation time

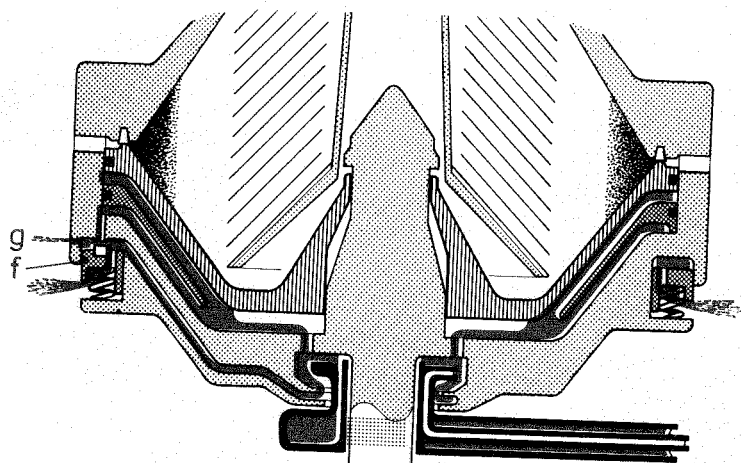
If the separation is unsatisfactory, the level of intake must be reduced. A lower level of intake normally gives better separation results.

SLUDGE DISCHARGE SYSTEM

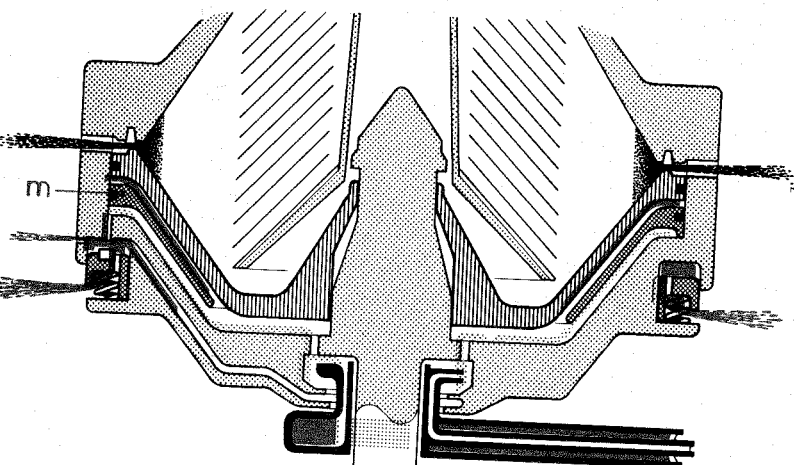
Partial discharge
with level ring

The sludge discharge takes place through a number of sludge ports in the bowl wall. Between discharges these ports are closed by the sliding bowl bottom, which constitutes a bottom within the separating space. The sliding bowl bottom is forced upwards against a seal ring by the liquid pressure acting on its underside. During rotation, this pressure builds up as a result of the centrifugal force. The operating liquid exerts an upward pressure exceeding the counter-acting downward pressure from the process liquid, because the underside of the sliding bowl bottom has a larger pressure surface (radius R_1) than its upper side (radius R_2).

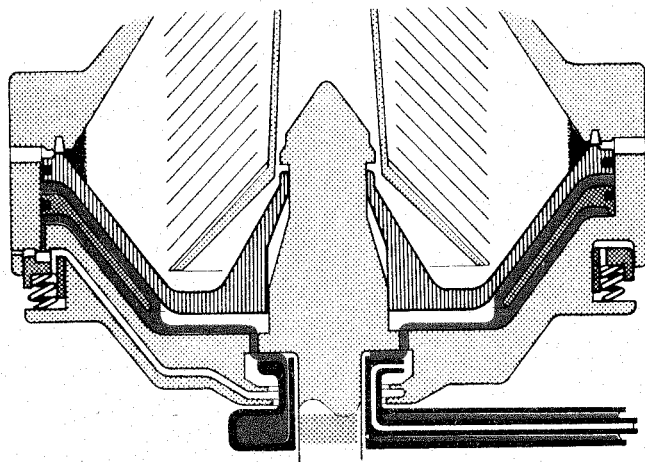
The operating liquid is introduced on the underside of the bowl, through a paring disc device which maintains the operating liquid at a constant level (radius R_3) beneath the bowl.



The operating liquid enters through the larger pipe. It flows along to the lower rim of the discharge chamber (Radius R_4), and continues through the channel towards the top part of the operating slide (f). Between discharges, the operating slide is pressed upwards by the springs. It is then forced downwards by the pressure of the liquid, thus opening the discharge valves beneath the sliding bottom of the bowl so that the operating liquid in that space is discharged through the nozzle (g).

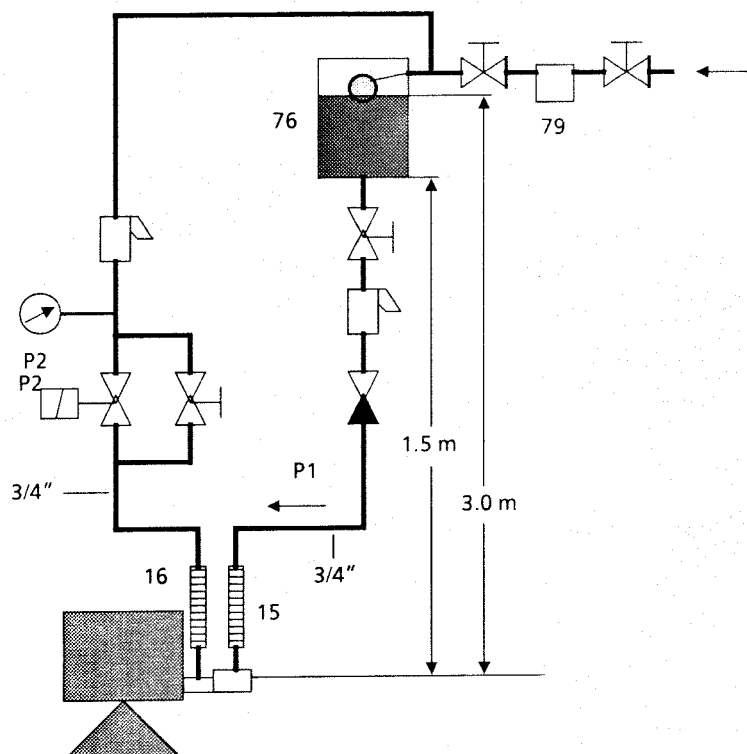


As the pressure exercised beneath the sliding bottom diminishes, the latter is forced downwards by the bowl contents. The operating liquid present above the level ring immediately shuts off the discharge of the sludge again, since the pressure in the bowl has fallen below that exercised above the level ring. The discharge of the contents will be interrupted, and only partial emptying of the bowl will thus take place.



Operating liquid is again supplied through the wider tube which fills the space below the sliding bowl bottom which is filled entirely, both above and below the level ring. In consequence, the bowl is completely closed and can be entirely filled with process liquid without the sliding bowl bottom yielding to the pressure exerted by this liquid. (Any surplus operating liquid flows through the channel to the operating slide, opening the bowl again).

OPERATING LIQUID SYSTEM



Valve

Check valve

Solenoid valve

Flexible rubber hose

Strainer

Pressure gauge

15 Operating liquid

50 Control valve

76 Operating liquid tank

79 Dehardening filter

$$p_1 = 0.15 - 0.30 \text{ kg/cm}^2$$

$$p_2 = 1.5 - 3.0 \text{ kg/cm}^2$$

Operating liquid

Pure, soft water can be used as operating liquid. Hard water involves the risk of chalky deposits, which may cause obstruction of the narrow channels in the operating liquid system and thus interruption of the service.

Soft water becomes increasingly essential when operating at a high temperature, since chalky precipitation is then more liable to occur. Addition of a dehardening agent or provision of a dehardening filter in the operating liquid line will prevent the troubles caused by chalky precipitation.

Operating liquid
tank

The operating liquid tank has a capacity of 30 to 50 litres. It must be placed so that the liquid level will be lying within the height measurement limits, above the control valve (see illustration). In case the head room is too small, the tank may be replaced by a reducing valve. The tank system saves liquid during operation, since the back pressure of the controlling disc is balanced in an open and constant system.

FULLY AUTOMATED SYSTEM

In connexion with the automatization of the operating liquid system it is preferable and in some cases even necessary to automatize also the other actions connected with the sludge discharge (such as interruption of the feed to the bowl before total discharge, flushing of the sludge cover).

If the automatic system is included in the delivery, the installation and operation is carried out according to the accompanying directions for the automatic control device, otherwise consult an ALFA-LAVAL/DE LAVAL representative on the choice of suitable equipment.

ALARM DEVICE

Pressure drops in pipes from the machine during operation may indicate a liquid loss. Such pressure drops will occur if the bowl does not close, or if it closes only partly. Whether the machine is automated or not, it is suitable, with closed system, to provide a guard such as a pressostat with alarm device in the pipe for treated liquid. The device should have means for blocking the alarm impulse from the pressostat when normal pressure drops occur, for instance in connexion with normal sludge discharge.

SLUDGE BLOCKAGE

If the nature of the sludge is such that it forms deposits in the upper frame or the sludge discharge bend, flushing should be provided to avoid sludge blockage. The flushing liquid should preferably be at the same temperature as the process liquid and is supplied through the connections provided for the purpose.

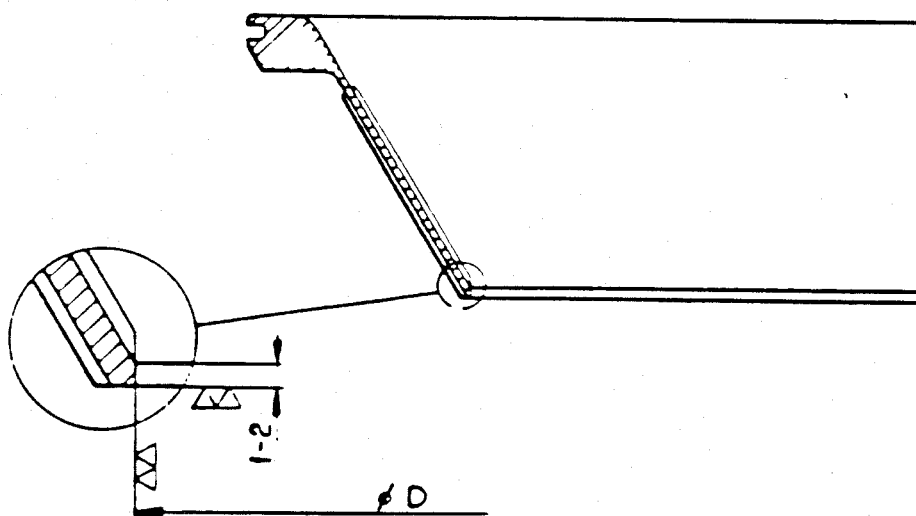
If the sludge may not be diluted with any liquid other than the process liquid or if it is of such a nature that it forms deposits in the bowl, the interval between discharges should be reduced.

Flushing of the sludge cover in the frame should begin immediately before and continue throughout the discharge cycle. With timer-controlled machines, the flushing operation is generally included in the programme - see separate instructions for automatic control. With manually operated machines a simple valve is sufficient.

Bowl with level ring

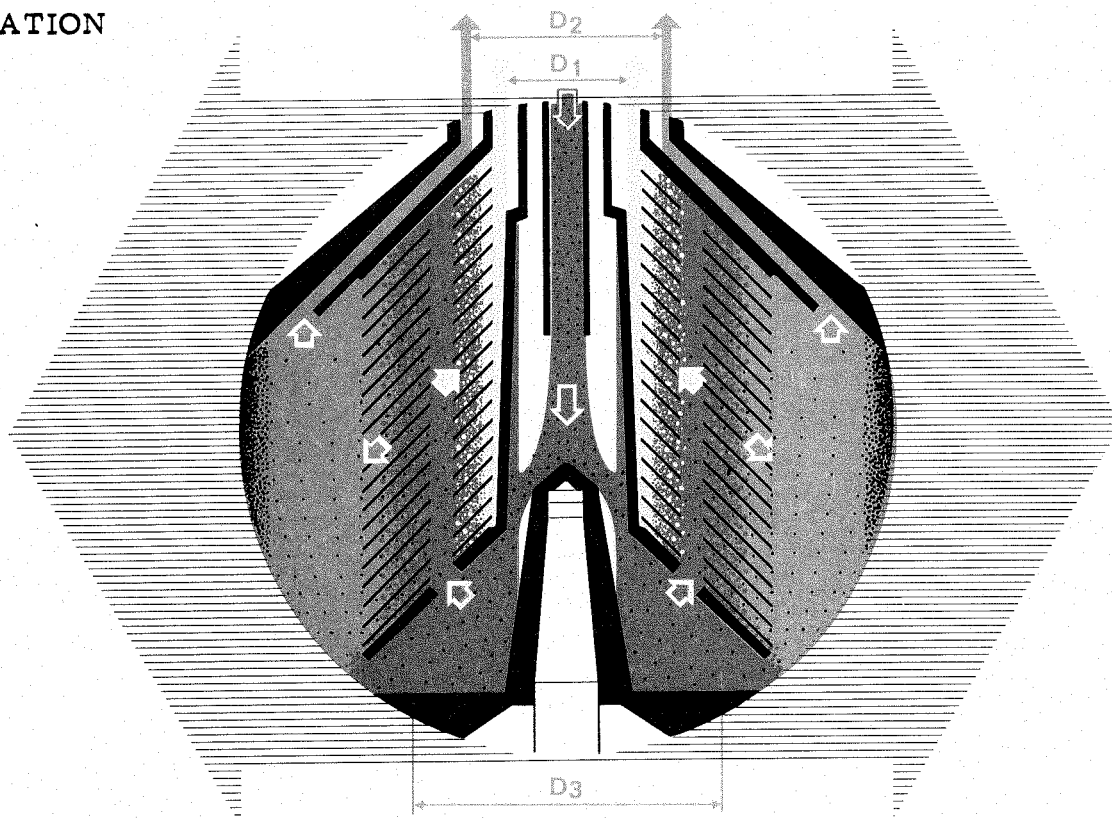
With partial discharge, the amount of sludge ejected on shooting can also be increased so that some of the process liquid will escape with the sludge and act as a flushing liquid.

To increase the quantity of sludge/liquid, the level ring is turned off to widen its inner diameter D .



It is best to do the turning by stages, e.g. 5-10mm at a time until the desired discharge quantity is obtained. The edges must be smoothed after turning (see Fig.).

CONCENTRATION



Centrifugal force



Bowl parts



Process liquid



Heavy liquid phase



Light liquid phase



Solids



Diameter of inner outlet



Diameter of outer outlet



Diameter of interface

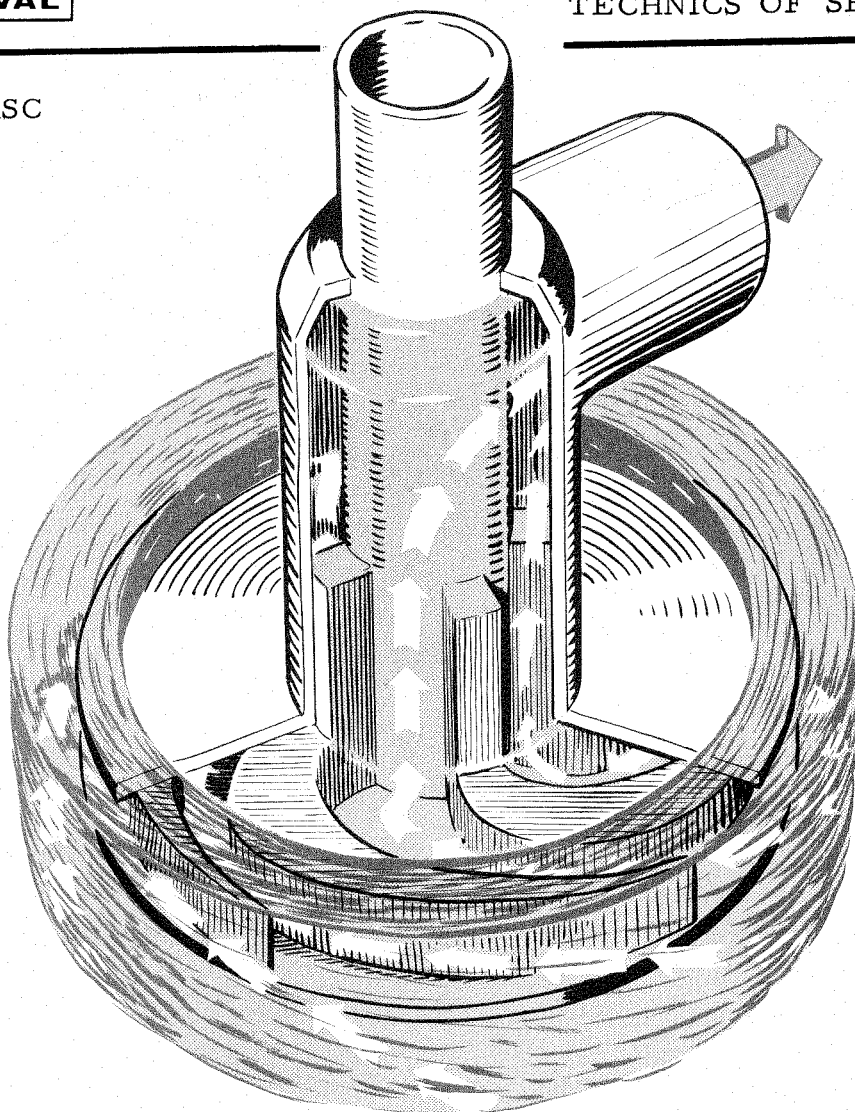
Concentrator bowl

This bowl has two outlets. The process liquid flows through the distributor to the interspace between the bowl discs, where the liquid phases are separated from each other by action of the centrifugal force. The heavy phase and any solids move along the underside of the bowl discs towards the periphery of the bowl, where the solids settle on the bowl wall.

The heavy phase proceeds along the upper side of the top disc towards the neck of the bowl hood and discharges over the gravity disc — the outer way (blue in the illustration).

The light phase moves along the upper side of the bowl discs towards the bowl centre and discharges via the top disc neck — the inner inner way (yellow in the illustration).

PARING DISC



The paring disc has for its object to discharge the liquid under pressure.

The liquid rotates, driven by the rotating paring chamber, in the form of a ring around the paring disc. This dips radially, to a greater or smaller depth, into the rotating liquid ring, which exerts a pressure rising rapidly with increasing diameter. The pressure produced by the paring disc is composed partly of the "centrifugal pressure" prevailing at the periphery, partly of the kinetic energy of the rotating liquid ring which is converted more or less completely into pressure energy.

When the throughput is small and there is no back pressure in the discharge line, the inner diameter of the liquid ring will practically equal the outer diameter of the paring disc. If the liquid must overcome a back pressure, such as a high delivery head or pressure-absorbing apparatuses, the diameter of the liquid ring in the paring chamber will diminish until the back pressure is neutralized. Thus the paring disc will pump out all liquid fed to the paring chamber (notwithstanding the back pressure) up to the highest pressure the paring disc can produce at this liquid quantity.

(cont.)

SELF-CLEANING MILK SEPARATOR HMRPX 407 TGP-74

Application

Separation , standardization and clarification of hot milk. Designed for continuous operation and CIP.

Throughput Capacity

Maximum hydraulic capacity 7000 l/h .

Motor

11 kW standard motor for 380/660 V , 50 or 60 Hz 3-phases AC.(Other voltages on request)

Working Power

Depending on throughflow and outlet pressures. Starting power 15 kW

:: 4 000 lit/h approx. 8,5 kW .

:: 7 000 lit/h approx. 9,5 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 below indicates max. rpm.

Drive motor	1500(50 Hz)	1800(60 Hz)
Bowl	7310	7310
Revolution counter	125	150

Running-up Time

4 - 5 minutes.

Time relay setting.

Only for machine with CT-motor.

4 - 5 min.

Stopping Time

Approx. 4 min. (Running out with brake applied).

Inlet Pressure

Depending on throughflow. See enclosed curves.

Outlet Pressure

Depending on throughflow. See enclosed curves

Sediment Space Volume.

approx. 3,0 lit.

Suitable Ejection Volume

Approx. 3 - 6 lit. (depending on throughflow)

Ejection Interval

Depending on process.

Material

All parts in contact with the product, as well as sediment cyclone, are of stainless steel.

Water Consumption

Operating water:

approx. 1.3-1.5 lit. / ejection

Water Quality

Operating water:

Content of suspended substances Less than 0.001 vol.%. Total hardness: Less than 10°dH (180 mg CaCO₃/lit). Content of chlorides: Less than 100 ppm (60 mg Cl/lit). pH value: Larger than 6.

Weights

Complete separator without motor:

Net weight 560 kg

Motor only:

Net weight, approx. 108 kg

Other parts:

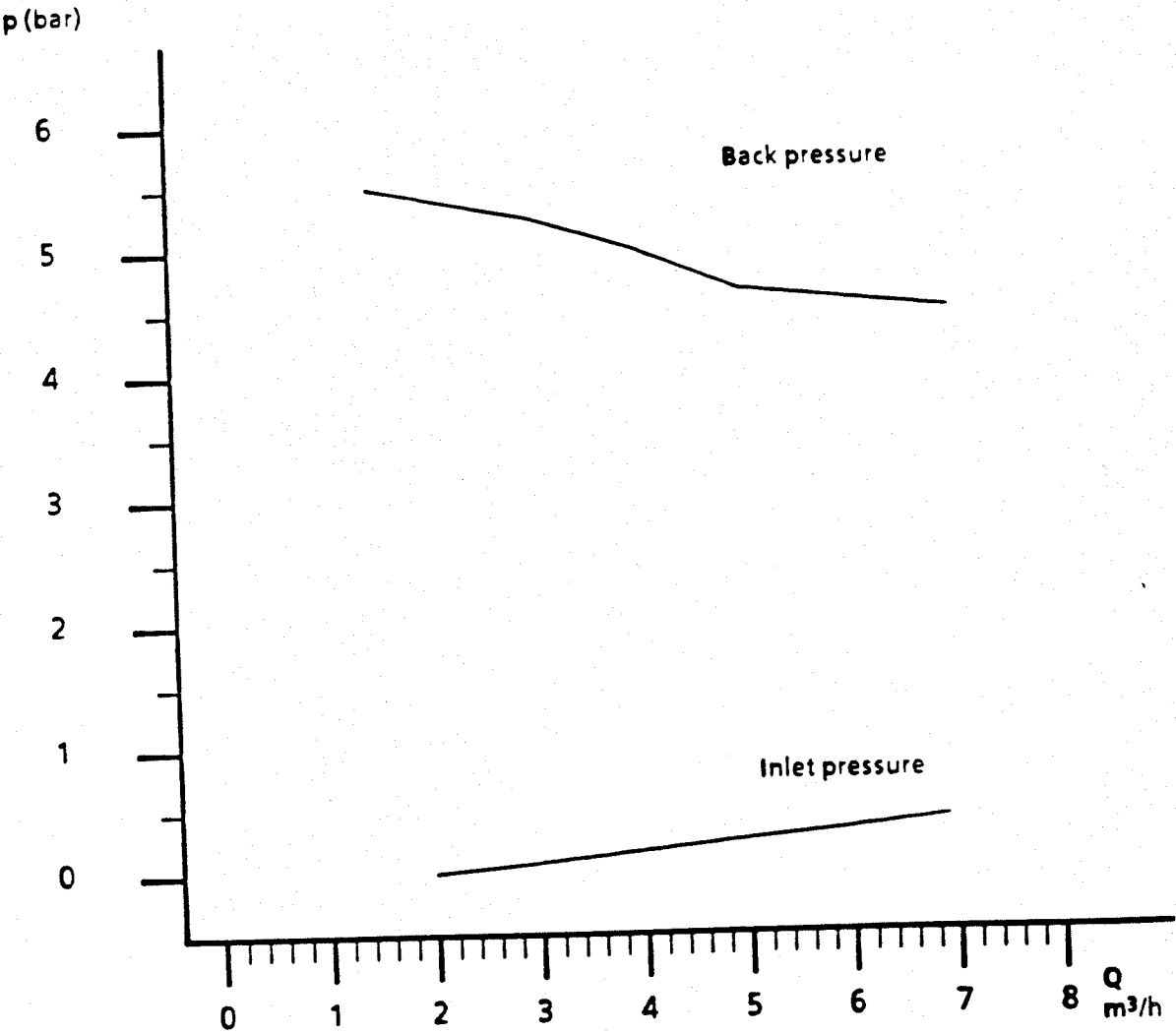
Complete bowl: Approx. 120 kg.

The manufacturer reserves the rights to change specifications without notice.

TECHNICAL DATA

HMRPX 407TGP -74

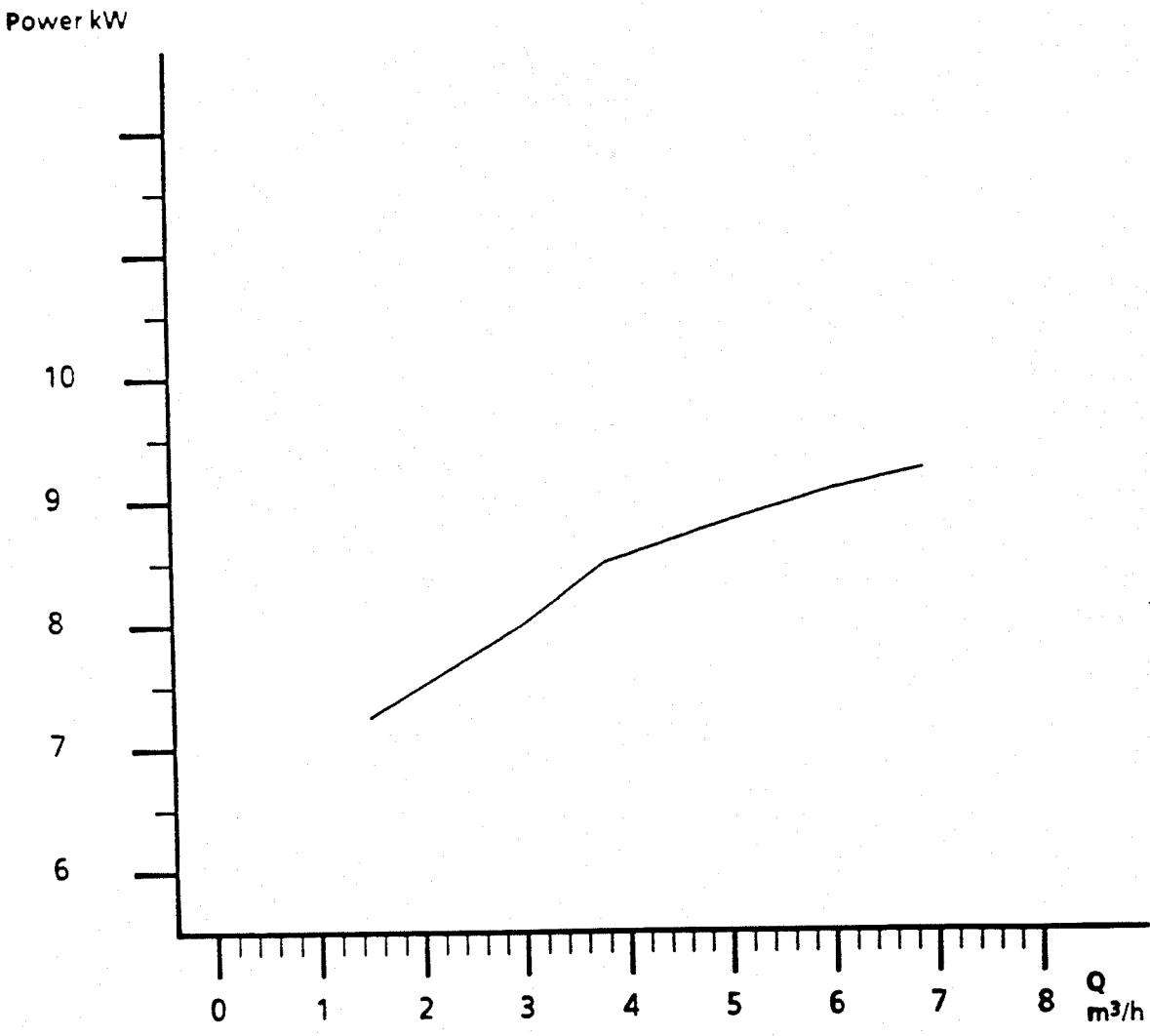
Pressure - flow (with 10% of flow as light phase)



TECHNICAL DATA

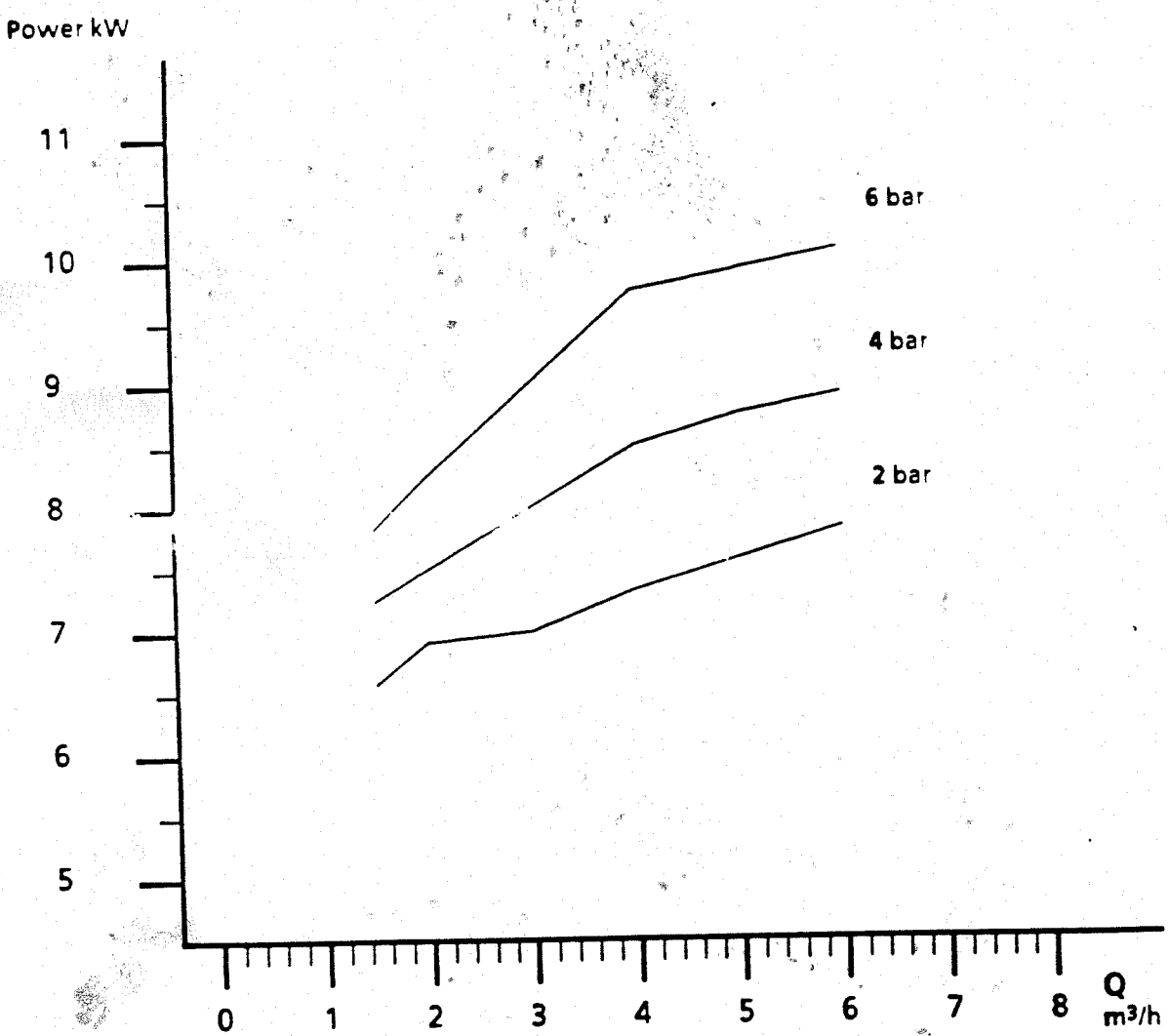
HMRPX 407TGP -74

Power - flow (with 10% of flow as light phase)



HMRPX 407TGP -74

Paring disc characteristic





PACKING LIST

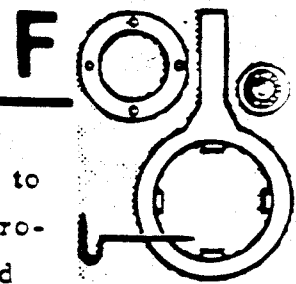
SRP/Ab
1998-05-06

KIT FOR INTERMEDIATE SERVICE 548382-15

TYPE: MRPX 407TGP-74

Prod. No.: 881104-01

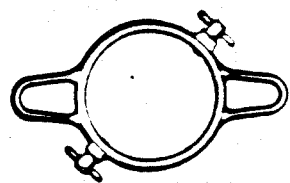
Description	Article No	Qty
O-ring	14238	1
Gasket	35607	1
O-ring	38259	1
Gasket	38324	1
Valve plug	68899	3
Rectangular ring	71068	1
Seal ring	71301	1
Gasket	71350	1
O-ring	71351	1
O-ring	73632	1
Gasket	190603	1
Gasket	190608	1
O-ring	223406-20	1
O-ring	223406-31	2
Frict pad	310637-85	1
Gasket	517774-11	1
Molycote paste	537086-03	1
Silicone grease	539474-03	1
Rectangular ring	7 007529-01	1
Rectangular ring	7 007654-01	1



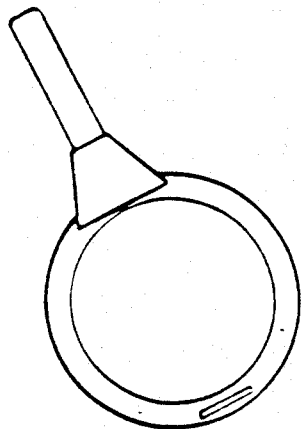
SET OF TOOLS

The special tools for the bowl are preferably hung up as close to the machine (or the cleaning place) as possible. If a tool is provided with left-hand thread or intended for a left-hand screwed joint, this has been specially pointed out in the dismantling and assembling instructions. Notification in this respect is not made where right-hand thread is concerned.

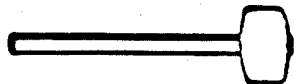
TOOLS for BOWL



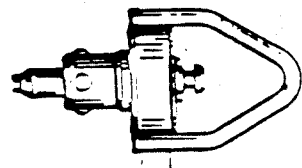
Spanner for small lock ring



Spanner for large lock ring



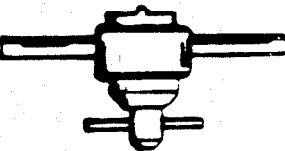
Tin mallet



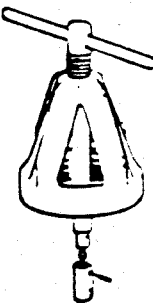
Lifting tool for distributor



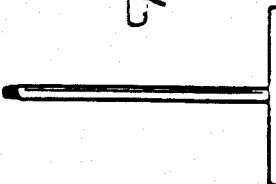
Lifting tool for distributing cone and spanner for cap nut



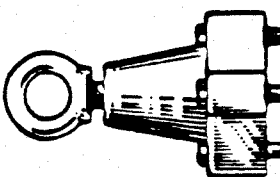
Lifting tool for sliding bowl bottom
Pin spanner for operating paring disc.



Lifting tool for bowl hood



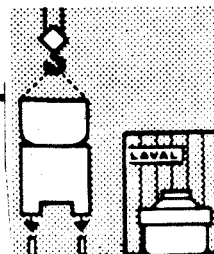
Lifting tool (2) for level ring



Lifting tool for bowl body



Pin for seal ring in bowl hood.



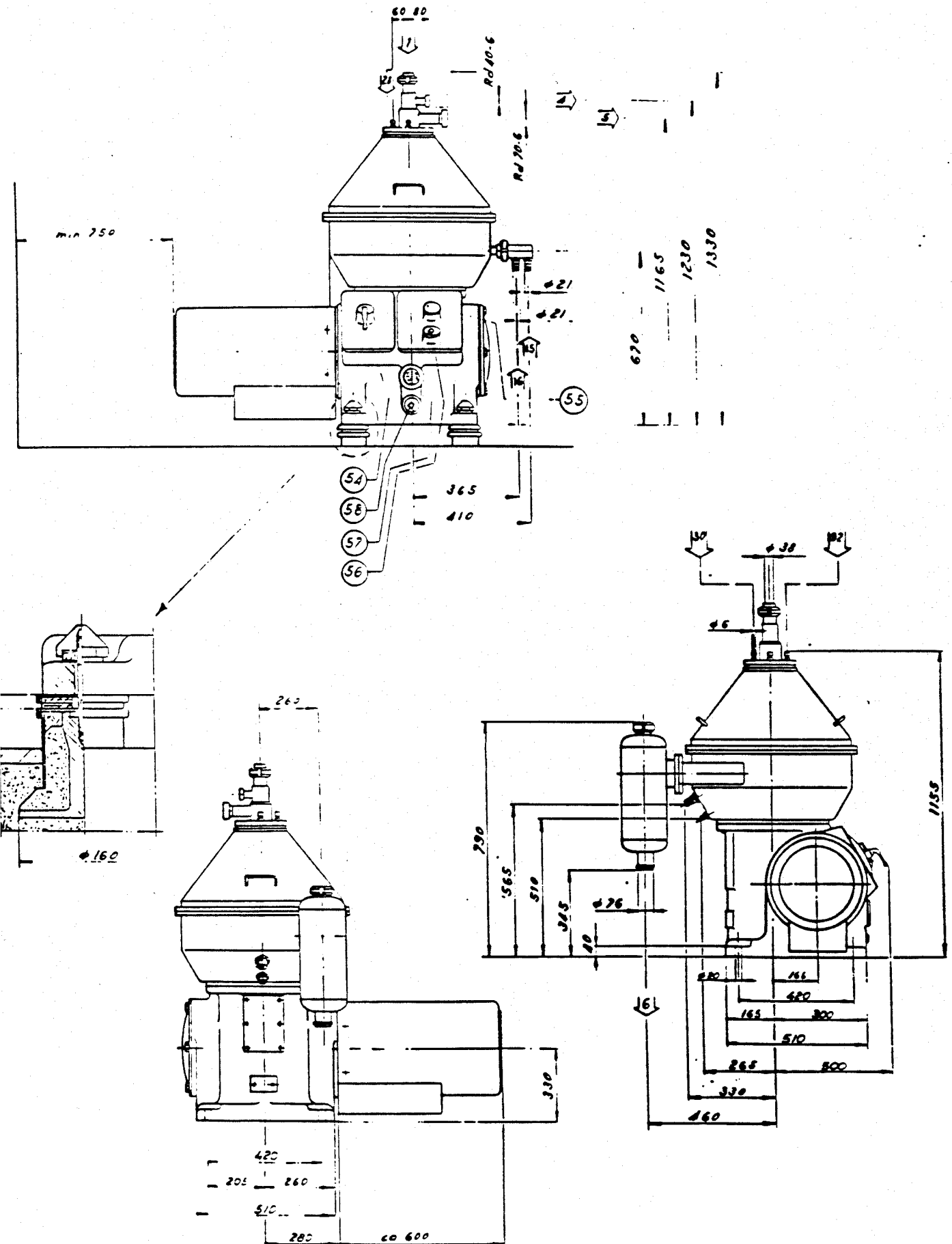
INSTALLATION

This chapter deals with installation of the machine and the action to be taken before it is operated for the first time. The ALFA-LAVAL representative will always be glad to give further advice and information.

DIMENSIONED DRAWING

All measurements needed for the installation are given in the dimensioned drawing. The relevant reference numbers are shown below. (The list relates to several types of separator, and thus includes more reference numbers than are found in the drawing.)

1 Feed	40 Inlet	80 Condensation water
2 From heater	41 Outlet	81 Interface control
3 To heater	42 Concentrate	82 Feed and discharge pump
4 Light effluent	43 Operating liquid	83 Discharge pump
5 Heavy effluent	44 Ventilation	84 Three-way valve
6 Solid effluent	45 Air or other gas (not steam)	85 Plate heat exchanger
7 Overflow liquid	46 Waste liquid	86 Skim milk
8 Drainage	47 Constant pressure valve	87 Whey
9 Auxiliary liquid for liquid seal	48 Flow meter	88 Bowl emptying
	49 Shut-off valve	89 Draw-off
10 Auxiliary liquid for liquid seal	50 Control valve	90 Flow nozzle
11 Auxiliary liquid	51 Flow indicator	91 Flow-control valve
12 Flushing liquid	52 Sight glass	92 Flushing liquid
13 Self-emptying	53 Electrical connections	93 Hydraulic sealing liquid
14 Air or other gas (not steam)	54 Brake handle	94 Check-valve
15 Operating liquid	55 Revolution counter	95 Pressure regulator
16 Operating liquid	56 Oil filling plug	96 Pressure gauge
17 Cooling air	57 Oil gauge glass	97 Fixed throttling
18 Cooling air	58 Oil drain plug	98 Pilot liquid
19 Ventilation	59 Waste liquid	99 Indicator gas
20 Ventilation	60 Shut-off valve	100 Cooling liquid
21 Return flow	61 Feed pump	101 Compressed air
22 Electrical connections	62 Filter	102 Vibration switch
23 Effluent	63 Light liquid feed	103 Oil level switch
24 Raw material	64 Heavy liquid feed	104 Protective gas
25 Treated raw material	65 Light effluent	105 Protective gas
26 Steam	66 Heavy effluent	
27 Waste liquid	67 Hydraulic sealing liquid	
28 Flushing liquid	68 Air or other gas (not steam)	
29 Reagent	69 Protective gas	
30 Flushing liquid	70 Protective gas	
31 Hydraulic sealing liquid	71 Electrical connections	
32 Hydraulic sealing liquid	72 Cream	
33 Hydraulic sealing liquid	73 Thermometer	
34 Hydraulic sealing liquid	74 Filter	
35 Waste liquid	75 Steam preheater	
36 Ventilation	76 Operating water tank	
37 Air or other gas (not steam)	77 Sludge tank	
38 Water feed	78 Sludge tank	
39 Bowl emptying outlet	79 Softening filter	



UNPACKING

When unpacking the machine, take care not to scratch metallic or painted surfaces.

Check with the packing list to see that all the parts have been duly unpacked.

FOUNDATION

The foundation must be solid and flat. It may consist of girders or a concrete slab. The sizes of the bolts, distances between them, etc. are indicated in the dimensioned drawing. The distance from the nearest wall must not be less than that specified in the dimensioned drawing. The pipes, pumps and other items of equipment should be located so that they are easily accessible for inspection.

**FRAME PARTS AND
ERECTION**

See chapter S. The required measurements can be found in the dimensioned drawing.

LUBRICATION

Never start up the machine without oil in the worm gear housing. See chapter H

HEIGHT ADJUSTMENT

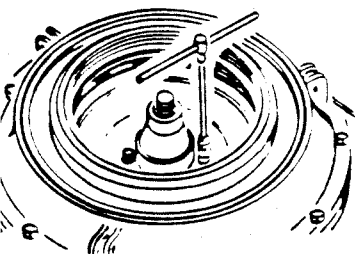
Check as specified in chapter L.

BOWL

Dismantle and clean all parts in contact with liquid (see chapter L). Make sure that the seal rings are fitted into their seatings. (In some cases these are packed separately in the case.)

The seal ring on the lower edge of the bowl hood must be protected against possible damage. The bowl hood should therefore be placed on a soft base such as wood or rubber.

(Bowl)



Screw the three screws to the distributing ring
- tighten only moderately.

Before running, the bowl should be assembled as directed in chapter I.

MOTOR ASSEMBLY

See chapter R.

CONNECTION TO MAINS

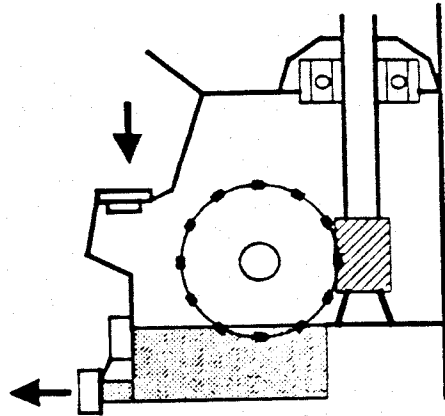
Connect the motor to the mains so that the bowl rotates
IN A CLOCKWISE DIRECTION.

Note: The machine must never be started up until the bowl has been placed on the spindle and the worm gear housing contains the prescribed quantity of lubricating oil of suitable quality. Before starting the machine, make sure that the covers are well secured.

CHECKS

Examine the installation before putting the machine into service. Check with particular care:

- that the worm wheel shaft rotates at the prescribed speed and that the bowl turns in the correct direction (clockwise),
- that the nuts of the anchoring screws are tightened as directed in chapter S.
- that the directions in chapter K entitled 'BEFORE STARTING UP' have been complied with.

LUBRICATION

The separator is delivered without oil in the worm gear housing. Therefore, it is necessary to supply oil to the worm gear housing before the first start of the separator.
For *PX 407*

8 liters

is the correct quantity. Please refer to **ALFA-LAVAL LUBRICATION Schedule** for choice of a suitable grade of oil. If no Alfa-Laval oil is available you must choose a grade of oil with the following properties:

Viscosity index: *min 150*.

Viscosity at 100° C (212° F):

26 cSt at a process liquid temperature of <100° C (<212° F) and an ambient temperature of <55° C (<131° F).

The oil must stand an oil bath temperature of 100° C (212° F) for at least 1000 h.

Always check before starting the separator that the worm gear housing contains enough oil. The oil level should be in the upper half of the sight glass.

LUBRICATION SCHEDULE

Surface to be lubricated must be degreased, clean and dry.

This schedule is a field with a rapid development which means that the information in this manual may be obsolete. If it is at variance with this schedule, the information here is valid.

LUBRICATING OILS

	Grade of oil			
	Red	Blue	Light green	Dark green
Container	Article No.	Article No.	Article No.	Article No.
1 liter	546097-83	542690-83	546098-83	546099-83
4 liters	546097-81	542690-81	546098-81	546099-81
10 liters	546097-80	542690-80	546098-80	546099-80
18 liters	546097-82	542690-82	546098-82	546099-82

Container sizes in stock in *italics*.

OIL CHANGE INTERVALS

First change after 300 hours. Then:
Red after 1000 hours
Greens after 1000 hours
Blue after 2000 hours

If seasonal operation before start of season.

OR → Due 9/11/90
If sooner

WHICH GRADE OF OIL SHOULD BE USED?

Process liquid temperature <90° C (194° F)

Ambient temperature	5 - 15° C (41 - 59° F)			15 - 30° C (59 - 86° F)		
	<4	>4, <15	>15	<4	>4, <15	>15
Motor power in kW						
Belt drive	Light green	Red	Red	Light green	Red	Red
Gear drive	Blue	Blue	Blue	Light green	Dark green	Dark green
Ambient temperature	30 - 45° C (86 - 113° F)			45 - 55° C (113 - 131° F)		
	<4	>4, <15	>15	<4	>4, <15	>15
Motor power in kW						
Belt drive	Light green	Red	Red	*	*	*
Gear drive	Light green	Dark green	Blue	Blue	Blue	*

Process liquid temperature 90 - 100° C (194 - 212° F)

Ambient temperature	5 - 35° C (41 - 95° F)			35 - 40° C (95 - 104° F)			40 - 55° C (104 - 131° F)		
	<4	>4, <15	>15	<4	>4, <15	>15	<4	>4, <15	>15
Motor power in kW									
Belt drive	Light green	Red	Red	Light green	Red	Red	*	*	*
Gear drive	Light green	Blue	Blue	Light green	Blue	*	Blue	Blue	*

* = Please contact Alfa-Laval concerning choice of suitable oil.



GREASE AND SLIDE LACQUER

Designation	Article No.	Container	Type	Use
Silicon	539474-03 539474-02	Tube 25 g Tube 100 g	Silicone grease	O-rings and gaskets at assembly. Seals and protects rubber and plastics. Non-poisonous. FDA-approved. Resistant against chemicals. Rubbed in with the fingers.
321 R	535586-02	Bottle with brush	Slide lacquer	Stainless lock-rings and contact surfaces. Non-poisonous after curing (5 min at 20° C /68° F). Apply 321 R to the surface and let dry for 10 minutes. Polish the surface with a fibre brush, apply again and let dry for 10 minutes. Polish with a clean brush until you have a shiny surface.
G-rapid plus	537086-04	Tube 50 g	Paste for assembly	Pre-treatment of lock-rings (stainless/stainless) in a 2-step method. The second step is performed with 1000 or Ti 1200. Prevents seizure damage. Applied with brush or chamois. Surplus to be removed.
1000	537086-06 537086-03 537086-02	Tube 50 g Tube 100 g Can 1 kg	Paste for threads	Paste for lock-rings to facilitate disassembly of threaded parts. Not to be mixed with oil or grease. Universal rust-preventive thread-paste for bolted assemblies and gliding surfaces. Applied with brush or chamois.
Ti 1200	537086-05	Tube 50 g	Paste for threads	Same use as for 1000 but specially suited for food applications. Non-poisonous.
BR 2 plus	538121-01	Can 1 kg	Grease for bearings	Ball bearings, roller bearings, plain bearings. Also for lock-rings of <u>carbon steel</u> after pre-treatment with G-rapid plus.

LOCKING PASTE

Designation	Article No.	Container	Use
242	544465-02	Tube 10 cc	Thread-lock medium strong. Sealing of bolted assemblies.
270	534197-03	Tube 3 cc	Thread-lock very strong. Sealing of threads <M36.

Note!

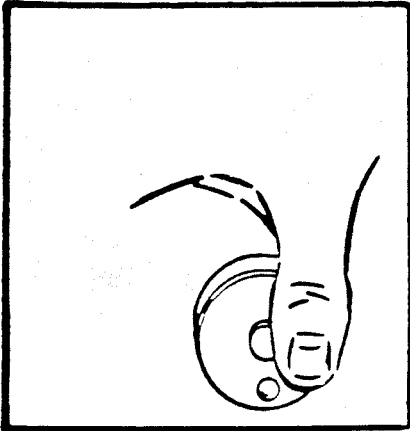
If the separator has a hollow bowl spindle (the process liquid is fed into the separator through the spindle) the recommendations are valid only for process liquids within the temperature area 15 - 80° C (59 - 176° F).

If you change from one grade of oil to another you must carefully remove any rest of the oil previously used.

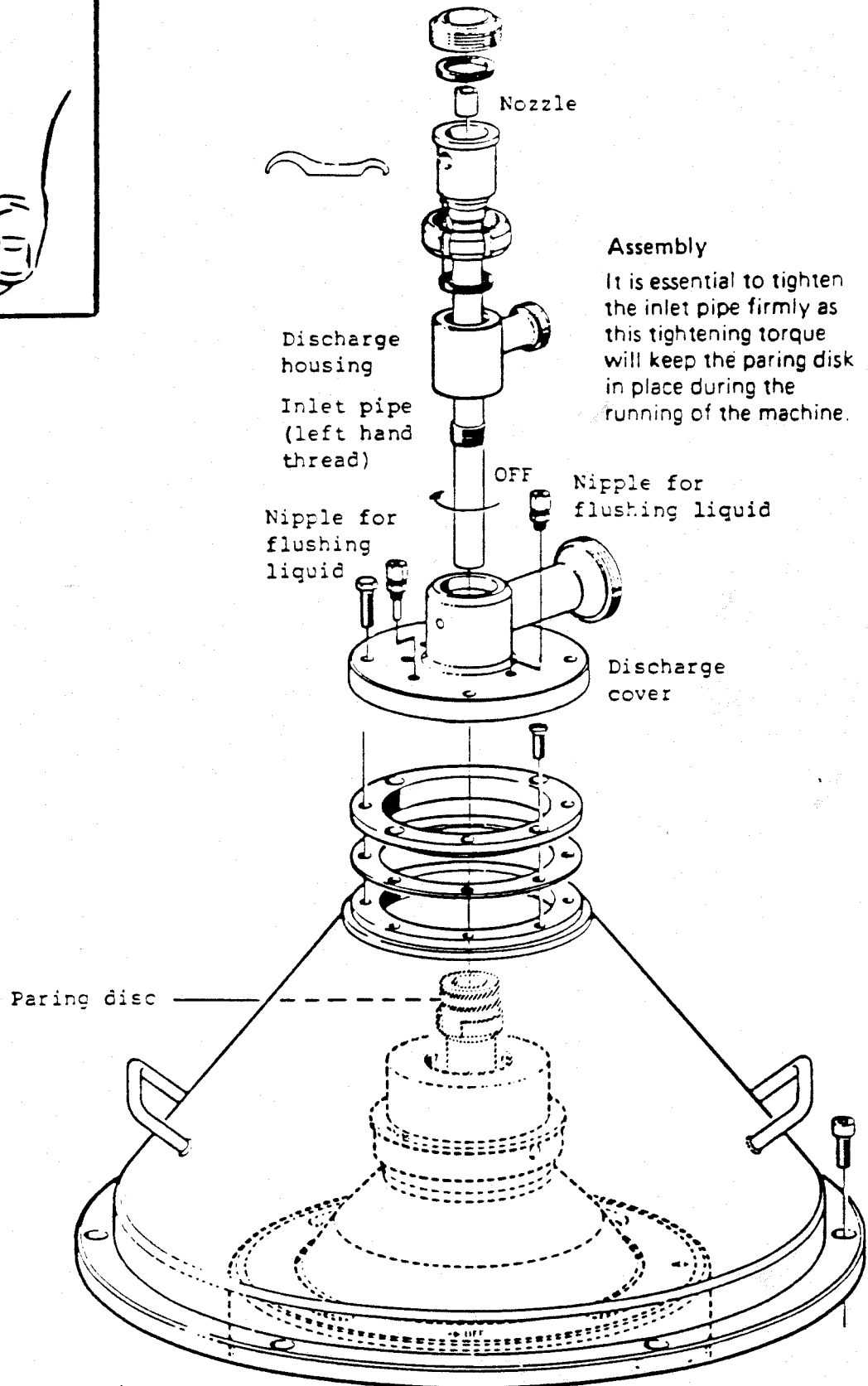
If the temperature conditions in the process are different from those stated in the tables, please contact Alfa-Laval.

Stated maximal temperatures must not be exceeded.

Oil and grease should be kept in closed containers in a cool and dry place to avoid dust, moisture and oxidising by air.

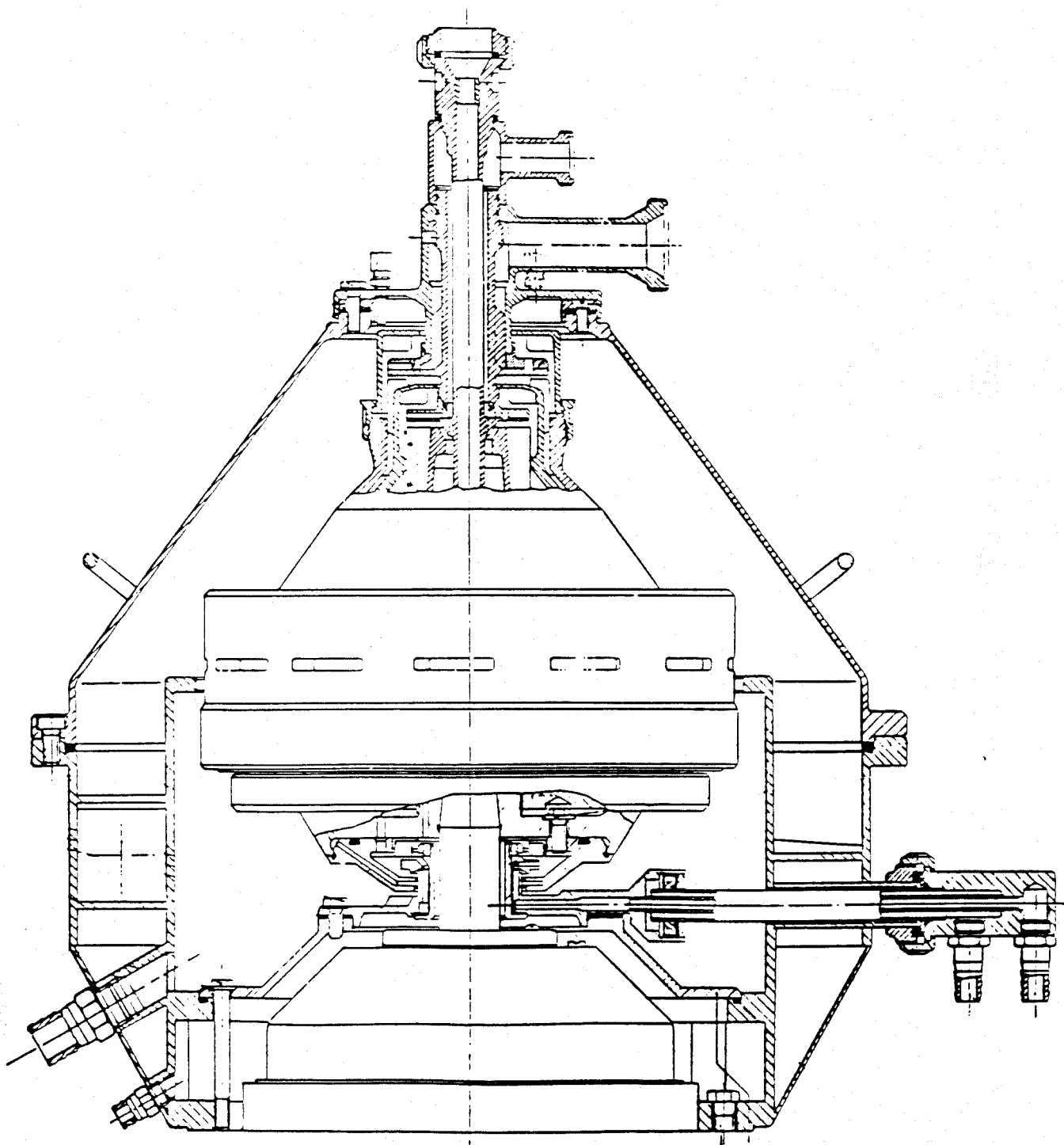


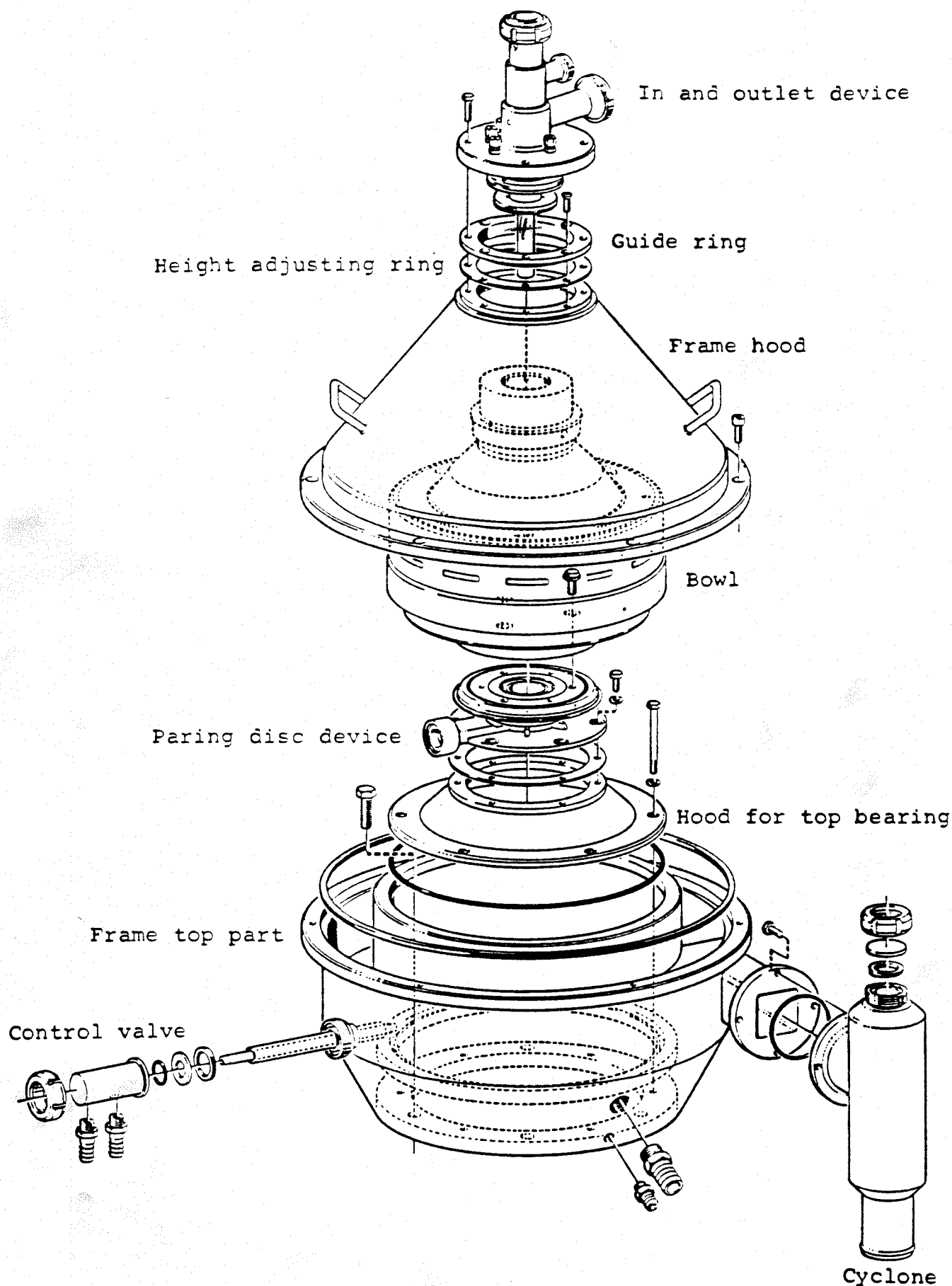
Important! Never start disassembly until bowl is stationary.

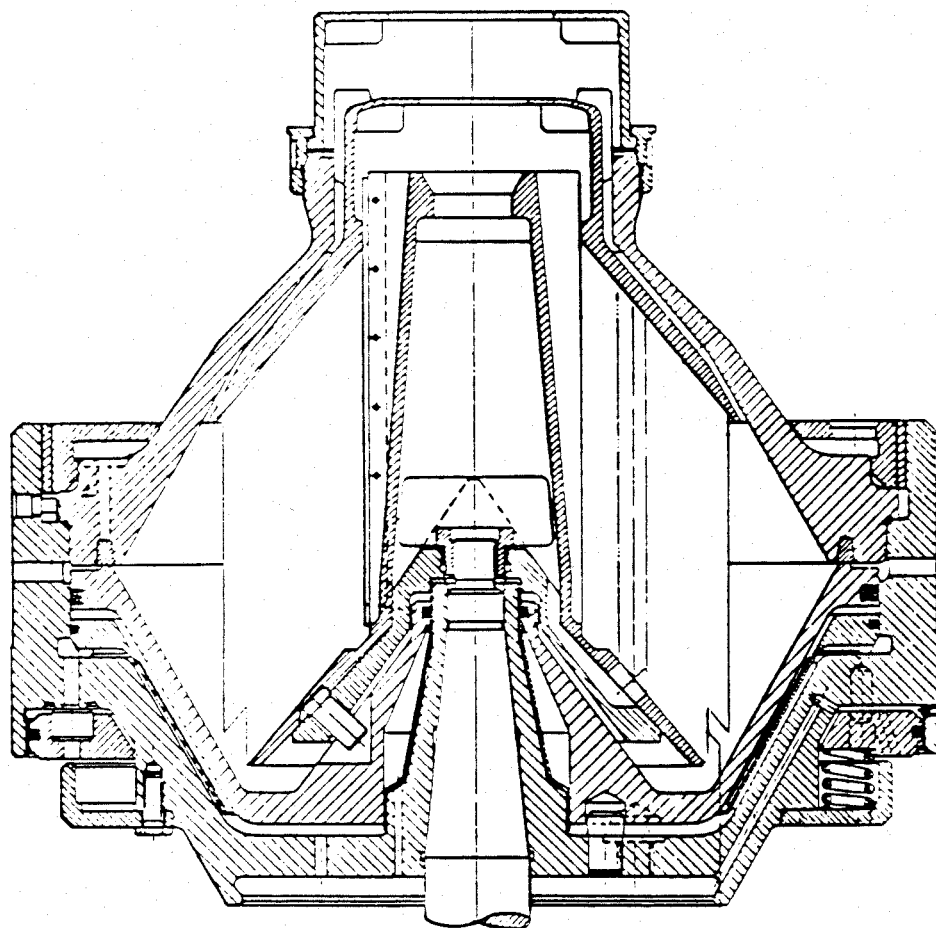


Assembly

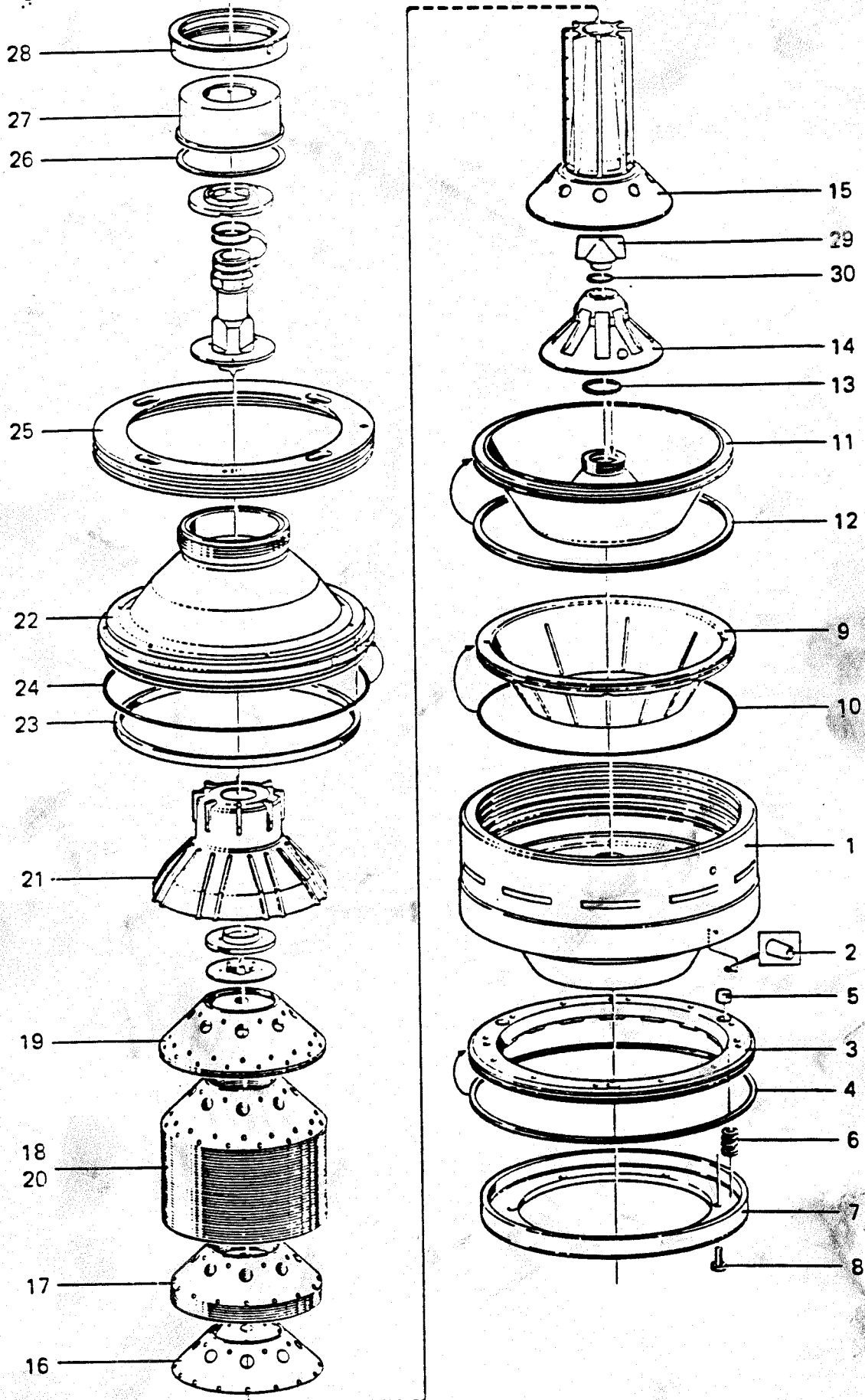
It is essential to tighten the inlet pipe firmly as this tightening torque will keep the paring disc in place during the running of the machine.







Bowl for partial discharge, with level ring



Ref	Qty	Description	Notes
1	1	Bowl body	■ Ø 3 MM
2	1	Nozzle	
3	1	Operating slide	
4	1	Rectangular ring	
5	3	Valve plug	
6	16	Spring	
7	1	Spring support	
8	6	Screw	
9	1	Level ring	
10	1	O-ring	
11	1	Sliding bowl	■ ■ ■ ■ ■ ■ ■ ■ ■ ■
12	1	Rubber ring	
13	1	O-ring	
14	1	Distributing cone	
15	1	Distributor	
16	1	Bowl disc	
17	18	Bowl disc	
18	125	Bowl disc	
19	3	Bowl disc	
20	5	Bowl disc	
21	1	Top disc	3) ■ ■ ■ ■ ■ ■ ■ ■ ■
22	1	Bowl hood	
23	1	Seal ring	
24	1	O-ring	
25	1	Lock ring	
26	1	Gasket	
27	1	Paring chamber	
28	1	Lock ring small	
29	1	Cap nut	
30	1	O-ring	
99		Molybdenum disulfide past	

- Utbyte nödvändig för ombalansering av kulan. Exchange necessitates rebalancing of bowl. Austausch erfordert Wiederauswuchtung der Trommel. L'échange nécessite le rééquilibrage du bol. El cambio hace necesario un nuevo equilibrado del rotor. La sostituzione comporta la riequilibratura del tamburo. A substituição exige o reequilíbrio do rotor. Vaihdettaessa kuula tasapainoitettava uudelleen.
3. Sänds separat. Sent separately. Wird separat gesandt. Envoyé séparément. Envío por separado. Inviato separatamente. Remessa separadamente. Lähetetään erikseen.

Bowl cap nut

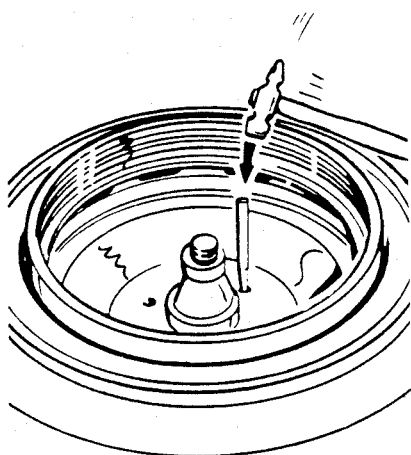
The cap nut has a lefthand thread and is therefore unscrewed **CLOCKWISE**. Lubricate the thread and contact surface before reassembling. Tighten the nut securely.

Sliding bowl bottom

The sliding bowl bottom should be lifted out and replaced with the special tool. Handle it with great care, to avoid damaging the sealing edge.

Bowl body

The bowl body need not normally be dismantled except for protective lubrication of the spindle cone - see chapter L (Bowl cleaning) - or for dismantling the discharge mechanism, and for cleaning of the nozzle.

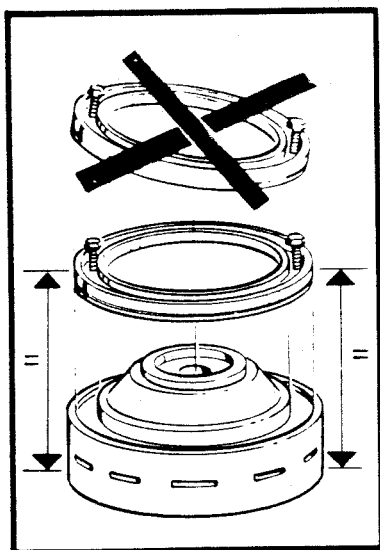


The screws in the bowl body should be unscrewed and removed before the lifting tool is placed in position. The bowl body is detached from the spindle cone with the central screw of the lifting tool.

Lubricate the nave inside, the nave and the top of the spindle before mounting the bowl body. But do this sparingly, as over-lubrication may cause the bowl to slip.

Discharge mechanism

When the bowl body is dismantled, it is advisable to dismantle the discharge mechanism in order to lubricate and clean the water passages.



The operating slide is lifted with two of the spring support screws. Inserting or removing it in a slanting or uneven position, or the use of force, generally results in deformations and consequently in serious damages. When the slide is reassembled, see that it is lowered perfectly horizontally.

The valve plugs are removed only when being changed. The nave in the bowl body and the passages should be cleaned.

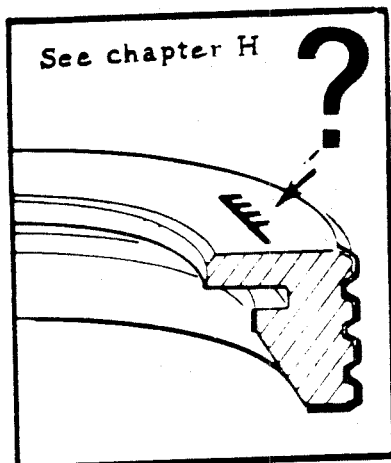
Lubricate the outer edge of the operating slide, and likewise the surface of the bowl body over which the ring moves.

Tighten the spring casing screws evenly.

DISMANTLING.
ASSEMBLY

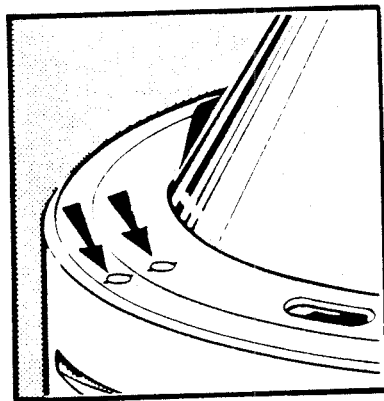
The bowl should be assembled and dismantled with the help of the special tools, in the order indicated in the drawing illustrating the dismantled parts. The parts should be placed on a soft and dry flat surface. The bowl should turn in a **CLOCKWISE** direction, and the main parts therefore have lefthand threads.

LOCK RINGS



The lock rings have lefthand threads and are thus unscrewed **CLOCKWISE**. The large lockring should be loosened by striking the handle of the appropriate spanner with a lead mallet or similar implement.

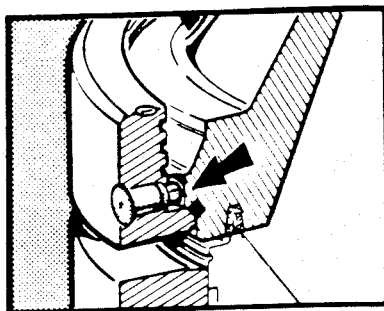
Before every assembly, clean and lubricate the threads of the lock rings and the surfaces in contact with the hood and the body of the bowl. It can happen, especially with new machines, that some seizing is found to occur if the lubrication is neglected or an unsuitable lubricant is used. Careful lubrication of these surfaces will prevent unnecessary wear on threads and contact areas.



Tighten the lock rings in an **ANTI-CLOCKWISE** direction; tightening up the small ring until a firm seal is obtained, and the large one until the hood is **COMPLETELY FAST** against the bowl body and the \emptyset markings coincide (see figure). The lock ring should exert sufficient pressure on the bowl hood to give perfect sealing, and should also keep the distributor pressed against the bowl body so that the disc set is firmly clamped.

Note: For checking the pressure in the disc set and inspecting the threads, see chapter L.

Bowl hood



Use the lifting tool to lift the bowl hood off and on. The hood is detached from the bowl body by tightening the central screw of the tool.

If the hood does not fall correctly into its seat when being mounted, one of the guides is displaced - check this. The seal ring in the lower edge of the hood should be removed only when replaced for exchange - see chapter L, Bowl Overhaul.

Distributor.
Disc set

Lift the distributor into and out of the bowl body with the disc set mounted on it.

**CLEANING. OVERHAUL.
LUBRICATION**

Before starting assembly, carefully clean parts in contact with the liquid. This applies particularly to seal rings, sliding surfaces, guiding and contact surfaces, and threads.

Follow the directions given in chapter L and H.

CHANGE of PARTS

Each bowl constitutes a balanced unit which will get out of balance if any parts marked with an "X" are changed without the bowl being rebalanced.

To prevent confusion of parts, for instance when a plant consists of several machines of the same type, these parts are stamped either with the complete manufacturing number or its three last digits.

GUIDES

When assembling, make sure that the parts are placed in the positions defined by the guides. Be careful not to damage the guides when handling the parts.

**SEAL RINGS.
PACKINGS**

Check seal rings and packings for defects and make sure that the corresponding grooves and sealing surfaces are well cleaned.

**THREADS. PRESSURE
IN DISC SET**

Check the lock ring threads and the pressure in the disc set at regular intervals - see chapter L.

CORROSION. EROSION

Aggressive liquids, as well as liquids containing very rough particles, may cause corrosion and erosion damage. If such damage is noticed, consult the ALFA-LAVAL representative.

PARING DISC DEVICE for Operating liquid

- 1 Distributing cover
- 2 Distributing ring
- 3 Sleeve
- 4 Packing
- 5 Packing
- 6 Paring disc
- 7 Round nut
- 9 O-ring
- 10 O-ring
- 11 Collar
- 12 Washer
- 13 Lipseal ring
- 14 Snap ring

The distributing ring rotates, while the other parts are non-moving.

DISMANTLING

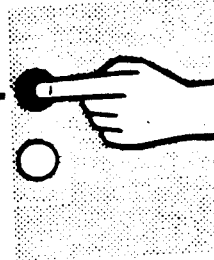
For dismantling the bowl see chapter L. The distributing ring is fastened to the bowl body by screws. These screws must be removed before the bowl body can be lifted off from the spindle. Remove the control valve. Take out the distributing cover and dismantle the parts in the sequence shown in the illustration. Use the special tools.

CLEANING

Make sure that the parts (particularly all holes and channels) are carefully cleaned - for cleaning agents see chapter L.

ASSEMBLING

Fit the parts into the distributing cover. Make sure that the height adjusting rings are in place; that the parts are correctly placed in the positions defined by the guides, and that the holes in the packing and the distributor cover face each other. Check the height position (see chapter L) and fit the control valve. Supply operating liquid and check throughflow.



OPERATION

For data, see chapter C.

SAFETY RULES

In all centrifugal separators, the bowl rotates at a very high speed which generally reaches between 100 and 150 revolutions per SECOND. This releases considerable forces which makes it essential to adhere strictly to the Instruction Manual as regards assembly of the parts, starting up and stopping the machine, and overhauls.

In this connection, take particular care to:

- screw up the lock rings completely,
- fix the frame hood and the foundation screws carefully,
- check the speed,
- never loosen any part of the machine until the bowl has COMPLETELY ceased to rotate.
- see that the bowl body, the bowl hood and the lock ring are never heated with an open flame in order to remove them,
- see that the machine is never used for process liquid with a higher density than that for which it was originally designed.

Use all the safety devices which are available and ensure that they are working properly.

Special recommendations

CREAM SEPARATION

Cream flow meter

The scale of the cream flow meter is neither graduated in percent nor in volume per hour. Such a graduation would — since the deviation is influenced by the viscosity — only apply to a certain fat content and temperature. The accurate values for the fat content or the fat contents must be determined by tests. To ensure that the fat content of the cream remains constant, the output, the fat content of the milk and temperature should of course be almost constant.

Regulating the cream fat content

The cream quantity and thus the cream fat content depend on the pressure in both outlets.

To facilitate regulation, which is effected by means of the regulating valve of the cream flow meter, the pressure in the skim milk outlet should be kept as constant as possible.

Variations in cream percentage

If the resistance in the skim milk outlet changes, e.g. the skim milk is conveyed to a tank placed at a higher level, this will involve a change of the cream percentage, i.e. the cream will get thinner with increasing resistance in the skim milk pipe and vice versa. In such cases the pressure in the skim milk outlet must be restored to the original value (by means of the skim milk valve). If required, a final adjustment can be made by means of the cream regulating valve.

If the change in cream percentage is caused by resistance variations in the cream outlet, adjust by means of the cream regulating valve.

Sampling

For checking the clean skimming, draw a skim milk sample from the pipe next to machine. It may happen that samples which are taken out simultaneously at the machine and in the skim milk tank show a different fat content. This can be due to the fact that whole milk or cream has leaked into the skim milk somewhere after the machine.

MILK CLEANING

Cleaning of kettle milk or consumption milk involves the use of a remixing device — see chapter X — which makes it possible to return all the cream to the skim milk.

STANDARDIZATION

For standardization, i.e. when milk with a prescribed fat content is wanted, a device (see chapter X) is necessary that makes it possible to remix a suitable quantity of the cream with the skim milk while the rest of the cream is discharged separately.

Always check the fat content of the standardized milk.

Keep the throughput constant.

CLEANING (CIP - Cleaning In Place)

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 an aggregate 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 are to be used - acid solution and alkaline solution (lye).

The bowl must be emptied repeatedly during the various cleaning stages by partial ejections.

Cleaning cycle, example:

Guiding values

- 1 Immediately after accomplished production pre-rinse with water.
It is important to pre-rinse as thoroughly as possible to prevent milk residues from mixing with subsequent detergent solution.

- 2 Circulation of alkaline solution, the main ingredient of which is NaOH. Circulation time depends on degree of contamination.

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

- 3 Intermediate rinse.

- 4 Circulate acid solution. The duration of circulation depends on the degree of contamination of the separator.

- 5 After-rinse with water.

- (6) Hot water sterilization when necessary.

Hot water sterilization may also be effected prior to cream separation.

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

	Rinsing/ washing time minutes	Number of partial ejections	Liquid tempera- ture °C
(1)	15 - 20	4 - 5	
(2)	35 - 45	3 - 4	80 ± 3
(3)	10 - 15	3 - 4	
(4)	20 - 30	2 - 3	70 ± 3
(5)	10 - 15	3 - 4	
(6)	6 - 10		90

(cont.)

(Cleaning, page 2)

Composition of Detergents

For the acid solution use nitric acid (HNO_3).

Note. Find out the exact concentration of the purchased acid (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 $\text{Na}_5\text{P}_3\text{O}_{10}$) or NTA (nitrilotriacetic acid) with a non-ionic wetting agent.

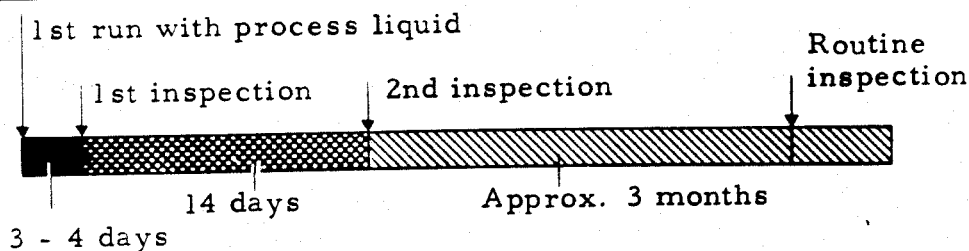
Solution Concentrations

Acid solution: 0.8 - 1% nitric acid solution.

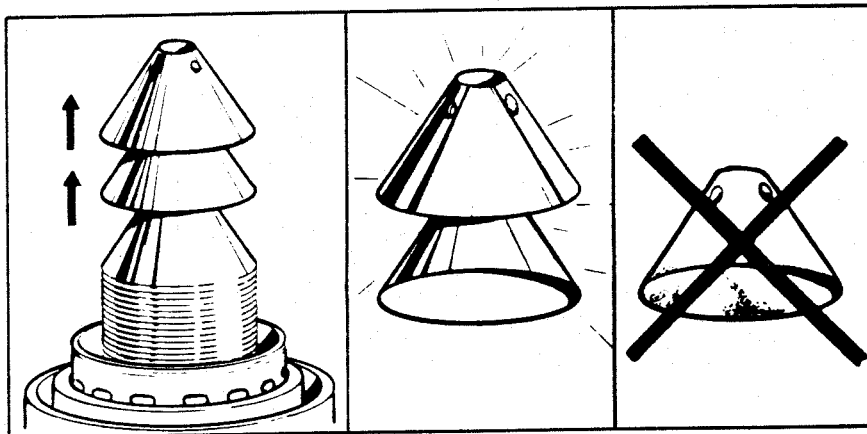
Alkaline solution: the concentration should amount to 1 - 1.5% so that a detergent solution with a pH-value of 12 to 13 is obtained.

Disinfectant solution: for sterilization with chlorous agents such as sodium hypochlorite use maximum 1 dl per 100 l 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 small overhaul is due, for instance replacement of valve plugs in the ejection mechanism. This should normally be made after approx. 3 months.

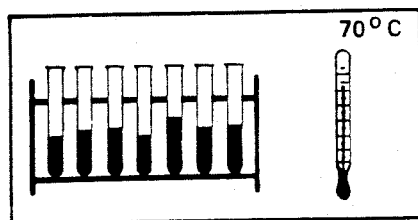


(cont.)

(Cleaning, page 3)

Inspect all the disks. The upper side as well as the under side of every disk must be bright. Fatty disks and sediment residues on the disks indicate bad cleaning.

Note: A greyish film (however not containing milk residues) may even occur on the disks if the lye has been circulated after the acid. To remove the film an extra run with acid for approx. 10 minutes is recommended.



If the bowl turns out to be badly cleaned, check the temperature and concentration of the acid, and the lye respectively. 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.

Before start

1 Make sure the cap nuts A on the frame hood as well as the inlet and outlet parts are properly tightened.

2 Release the brake B.

3 Check the oil level in sight glass C.

4 Ascertain that the operating water tank is kept filled.

5 Turn the main switch on the contactor box into position I.

Starting up

6 Start the separator by pressing the start button on the contactor box.

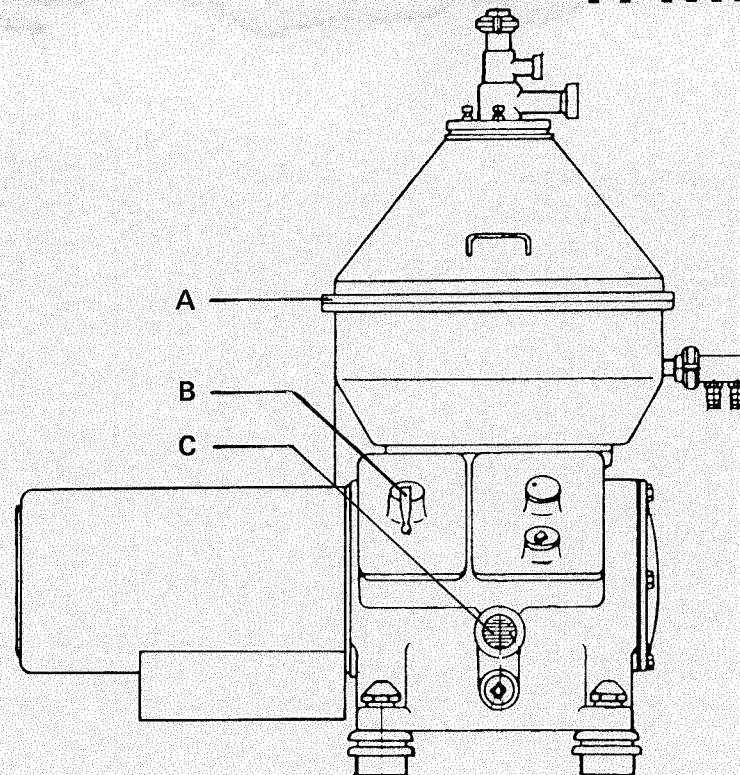
7 Abnormal vibration during run-up may be due to wrong assembly or bad cleaping of the bowl. Stop the machine **immediately** and inspect the bowl.

8 Check that the separator ammeter, placed in the contactor box, drops after about 5 mins. to the value stated below for various voltages. This indicates that the separator is up to speed.

abt. 34.5A/220V	abt. 17A/440V
abt. 20A/380V	abt. 15A/500V
abt. 18A/415V	abt. 11.5A/660V

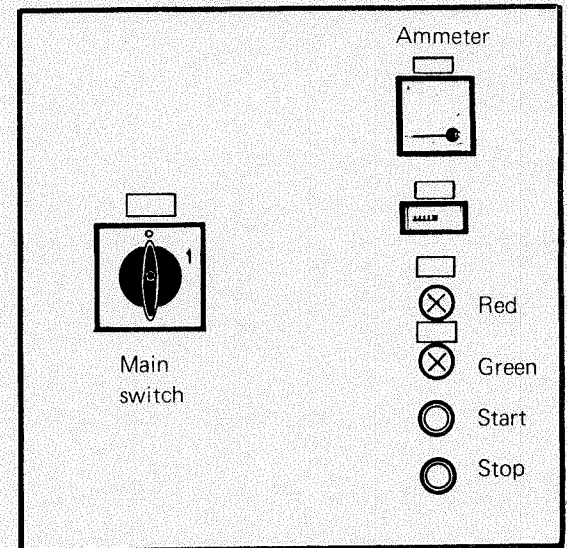
9 Ascertain that the ejection interval timer has been set to the correct time.

10 Switch on the control voltage to the programme timing unit, turning the selector switch on the front of the cabinet into position I.



H MRPX 407TGP-74

Contactor box



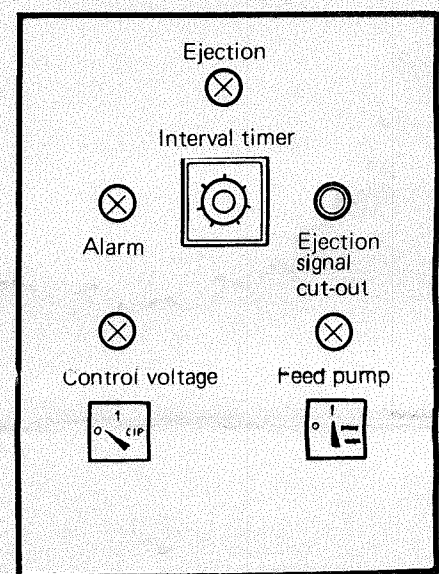
Alarm

In case of ALARM at the programme timing unit

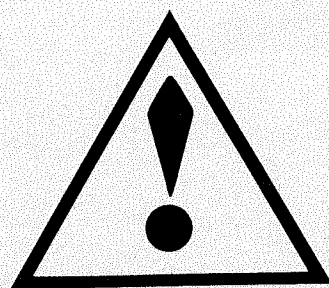
- The bowl is open:
 - Switch off the feed pump provided position AUT is not connected, in which case the pump is disconnected automatically at alarm.
 - Check if there is operating water.
 - Stop the separator.
- If the operating water pipe is provided with pump and the safety disconnection switch of the pump motor has not disengaged:

Press the resetting button on the contactor box. Switch off the current supply to the programme timing unit. Connect the unit again. If the alarm remains or goes on again: send for an electrician.

Programme timing unit



EMERGENCY STOP



If heavy vibration occurs:

- Immediately fill the bowl with liquid.
- Switch off the current supply to the motor and apply the brake B.
- Supply liquid throughout the running-down period.
- When the bowl has stopped: disassemble, clean and check the bowl parts carefully.

Cleaning

13

When Cleaning-In-Place is to be effected, reset the interval timer to such intervals that are suited for CIP, or to manual ejection respectively. After changing from process liquid to CIP-liquid, turn the selector switch in the front from position I to CIP.

Stopping

14

Having finished the CIP-operation flush out any remaining CIP-liquid. Then turn the feed pump selector switch to O. Finally turn the selector switch for automatic programme control to O.

Operating

11

Start the feed pump, turning the relevant selector switch in the unit front into position "Start". If this switch was already in position "Automat" the feed pump will start when the control voltage is switched on. See also the manual for the Programme Timing Unit.

12

Adjust to desired back pressure in the skimmilk and cream outlets. Ascertain that the correct feed pressure is obtained.

15

Switch off the separator pressing the stop button in the contactor box. NOTE: The bowl must be filled with liquid during the running-down period.

16

Apply the brake B.

17

Turn the main switch on the contactor box into position O.

18

Never loosen any part of the machine until the bowl has completely stopped.

INDICATION	CAUSE	REMEDY
CREAM SEPARATION Fat content in skimmilk is abnormally high	1. Cleaning programme is insufficient (bowl badly cleaned). 2. Extracted cream is too thick. 3. Unsuitable operating temperature. 4. Sourish milk. 5. Throughput too high. 6. Incorrect analysis. 7. Fat globules split. 8. Air bubbles in whole milk. } 9. Back pressure is too low. 10. Whole milk or cream has leaked into the skimmilk.	Draft and try out a new cleaning programme. Open further the regulating valve of cream flow meter. The temperature should be 55°C (130°F). -- Reduce throughput. -- Make sure pumps are regulated on delivery side. Check feed pressure and level in balance tanks. Suitable back pressure - see chapter C. Check any change-over connections after the machine and make sure the pressures are correct.
Cream blockage	Extracted cream is too thick.	Shut off the milk feed and shift to water. Reset the cream flow meter.
Cream is too thin	--	Throttle with regulating valve of cream flow meter.
Cream is too thick	--	Open further the regulating valve of cream flow meter. Throttle in the skimmilk pipe if the regulating valve of cream flow meter cannot be further opened.
Remixing fails in clarification and standardization	Skimmilk pressure too high at the remixing point.	Compare with cream pressure. Adjust pressure ratio.
Milk through the cyclone	1. Back pressure(s) too high. } 2. Air bubbles in whole milk. 3. Leakage between bowl hood and sliding bowl bottom.	Check the back pressure/pressure ratio(s). Check feed pressure, level in compensating vessels etc. Check seal ring of bowl hood.

FAULT SYMPTOMS	CAUSE	REMEDY
Machine is vibrating	<ol style="list-style-type: none"> 1. Moderate vibrations normally occur at critical number of revolutions during acceleration and slowing down periods. 2. Unbalanced bowl due to: ineffective cleaning - wrong assembly - lock ring not correctly tightened - bowl assembled with parts from different machines. 3. Base rubber washers have lost elasticity. 4. One or more top bearing springs broken. 5. Foundation too weak. 	<p>None.</p> <p>Stop immediately to ascertain fault. A badly tightened lock ring is a serious danger.</p> <p>Renew rubber washers. See that these are renewed every 2 years.</p> <p>Replace all collar springs.</p> <p>Reinforce foundation</p>
Speed too high	<ol style="list-style-type: none"> 1. Faulty transmission. 2. Motor speed is unsuitable. 	<p>Check with revolution counter. Stop immediately. Check that gears are correctly adjusted for motor speed.</p> <p>Stop immediately and fit motor with correct speed.</p>
Speed too low; acceleration period too long	<ol style="list-style-type: none"> 1. Brake engaged. 2. Clutch pads worn out or dirty from oil or grease. 3. Drop in mains voltage. 4. Damaged ball bearing. 5. Other machine faults. 6. Motor faults. 	<p>Disengage brake.</p> <p>Replace or clean all pads.</p> <p>Check mains voltage.</p> <p>Identify and replace.</p> <p>Check that bowl can be turned by hand.</p> <p>Replace or repair motor.</p>
Starting power of motor too low	<ol style="list-style-type: none"> 1. Ammeter reading wrong. 2. Clutch pads worn out or dirty from oil or grease. 	<p>See - Speed too low.</p>
Starting power of motor too high	<ol style="list-style-type: none"> 1. Ammeter reading wrong. 2. Motor fault. 3. Damaged ball bearing. 4. Other machine faults. 	<p>Replace or repair motor.</p> <p>Identify and replace.</p> <p>See - Speed too low.</p>
Retardation time too long	<ol style="list-style-type: none"> 1. Brake lining worn or oily. 	<p>Replace or clean brake lining.</p>
Water present in oil bath	<ol style="list-style-type: none"> 1. Condensation. 2. Axial rings not tight or badly fitted. 3. Leakage through top bearing. 	<p>Drain off water.</p> <p>Replace seal rings or fit them correctly.</p> <p>Replace seal rings</p>
Noise from worm gear housing	<ol style="list-style-type: none"> 1. Oil quantity wrong. 2. Worm wheel or worm screw worn. 3. Ball bearing worn or damaged. 	<p>Check quality and quantity.</p> <p>Replace worn parts. Replacement of complete gear is generally advisable.</p> <p>Replace ball bearing.</p>
Noise from clutch	<ol style="list-style-type: none"> 1. Normal when starting-up and slowing down, due to sliding of friction blocks. 2. Faulty play between coupling disc and rubber joint. 3. Speed too low. 	<p>None.</p> <p>Adjust.</p> <p>See - Speed too low.</p>
Smell	<ol style="list-style-type: none"> 1. Normal on starting and stopping, when sliding of friction blocks emits smell of burning. 2. Heating of ball bearing. 3. Motor over-heated. 	<p>None.</p> <p>Replace ball bearing.</p> <p>Trace cause. Adjust maximum relay current, if any.</p>
Rasping noise	<ol style="list-style-type: none"> 1. Wrong height adjustment. 	<p>Stop and adjust - See chapter L.</p>

Control system

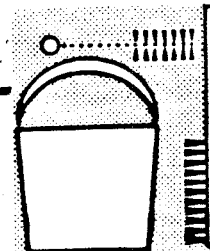
Before undertaking any further operation, a series of checks should be carried out as specified in the Instruction Manual.

If the bowl does not shut after discharge, fails to open after a discharge impulse, or opens spontaneously during running, check the input of the operating liquid. Search for the fault systematically, following the progress of the operating liquid stage by stage from the operating tank or the feed-pipe inwards.

If the operating liquid is being fed in normally, continue the examination first with the control valve, then with the paring disc device, and finally with the mobile flange of the bowl. If the machine is automatically controlled, follow the trouble tracing diagram for the automatic control device.

In most cases the trouble has been caused by faulty assembly, negligent treatment of parts leading to denting, scanty lubrication, distorted seal rings, or blocked channels or nozzles.

When chalky or saline deposits have caused the obstruction, it may in many cases be necessary to use a suitable filter for eliminating the incrustations.



CLEANING - OVERHAUL

It has in practice proved very difficult to specify how often cleaning should be carried out and how detailed the overhaul should be.

By following the directions given in this chapter, it should nevertheless not be difficult to establish a suitable working routing which takes account of special local conditions.

The ALFA-LAVAL representative will always be glad to give advice and further information.

GENERAL ADVICE

When carrying out cleaning and overhauls, always follow strictly the instructions given in this manual concerning dismantling, lubrication and reassembly.

Spare parts set

Make a habit of inspecting and replenishing the set of spare parts and tools once a year. It is advisable to keep a stock of the parts most subject to wear.

Interruptions in running

If the machine has to remain out of service for some time, the parts in contact with liquid should be lubricated. Preferably, the bowl should be removed from the spindle. The seal rings should be taken out and kept flat, not hanging. If the machine has remained at a standstill for some time, drain off the worm gear housing condensate.

The time intervals listed below refer to continuous running. If the specified number of running hours is not attained during the respective period, this can be correspondingly extended. It is imperative, however, to carry out a complete overhaul at least every three years.

RUNNING HOURS Every 24 hours (daily)*	<u>Check on running</u> Running of machine (speed). Power consumption. Oil level in worm gear housing. Inspection of discharged liquids. Temperature.	Throughput. Sludge tank. Pressure. Level in operating liquid tank. Automatic control device, if any (indicator lamps).
Every 200 hours (weekly)*	<u>Worm wheel housing</u> Check oil and top up if needed.	<u>Further action</u> Check speed. Trace leaks.
Every 750 hours (monthly)*	<u>Bowl</u> Dismantling of bowl and complete cleaning of its inside parts. Complete cleaning and lubrication of lock rings; lubrication of nave aperture in bowl bottom. Checking of seals.	<u>Control device</u> Check flow of operating liquid. Check sludge discharge interval of automatic control device. Clean and check filters.
Every 1500 hours (every 2 months)*	<u>Worm wheel housing</u> Cleaning and oil change. (For a new installation, after 300 running hours; and for seasonal working, after each working period).	<u>Bowl</u> Dismantle and clean discharge mechanism. Check springs, seals and solids ports. Check for erosion.
Every 9000 hours (annually)*	Complete overhaul, cleaning and lubrication. <u>Bowl check</u> Pressure in disc set. Corrosion of fixing ring and other damage to materials. <u>Transmission</u> Dismantle bowl spindle, clutch coupling and worm wheel shaft. Check particularly ball bearings and gear; likewise suspension springs and brake linings. Change friction pads. Renew grease in nave.	<u>Control device</u> Clean operating liquid tank; check tubes, valves and filters. <u>Height adjustment</u> Check and adjust. <u>Frame</u> Renew brake linings. Check elasticity of vibration dampers and assembly of machine.

* With continuous running

CLEANING AGENTS

Machine parts	<p>Use kerosene, white spirit, mineral spirit, or other solvents with equivalent properties.</p> <p>If the detergent is not suitable for the product to be processed, the bowl and the parts in contact with the process liquid can if required be cleaned with a soda or sodium triphosphate solution, or with any other degreasing agent with an alkaline base.</p> <p>For metal parts, benzine or benzol can also be used. But in that case the cleaning should be done in the open air to avoid the risk of explosions, and because benzol vapours are dangerous when inhaled.</p>
Seal rings	<p>Wipe these with a cloth moistened with one of the detergents mentioned above.</p>
Coupling pads and brake	<p>Trichlorethylene should be used for these parts and the corresponding friction surfaces. Note that this should be done in the open air.</p>
Discharge mechanism	<p>Any chalky deposits on the control system components can be dissolved in a 10% acetic acid solution heated to about 80°C.</p> <p>Note: All metal parts EXCEPT the friction surfaces in the clutch coupling and the brake must be oiled after cleaning - see chapter H.</p>

BOWL CLEANING

How often the bowl needs to be dismantled and cleaned must be learned from experience. Whenever the bowl is dismantled for cleaning, it is most important to inspect and lubricate the large lock rings; and likewise therefore the conical aperture in the bowl body and the cone of the bowl spindle.

During this cleaning process, it is useful to inspect the whole unit for any signs of erosion. As regards this aspect, the ALFA-LAVAL representative will always be glad to give advice and further information.

Discharge parts

Clean the control parts whenever the bowl is dismantled from the spindle.

Clean all channels and nozzles in the bowl body, the control device, and the paring disc device. The hardness of the water will determine how often cleaning must be carried out.

Every two months

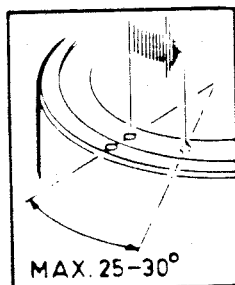
Bowl. Check signs of erosion of the discharge ports, or of corrosion in general.

BOWL OVERHAUL

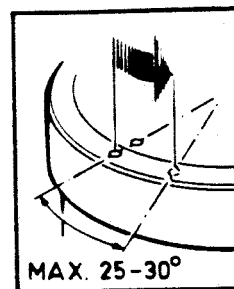
Replacement of parts

The bowl parts marked "*" in the perspective drawing in chapter I can be replaced only in an authorised ALFA-LAVAL workshop, since this requires rebalancing. The COMPLETE bowl must therefore be sent in for overhaul.

Thread checking



Lock ring with external thread



Lock ring with internal thread

In a new bowl, the guide marks (\emptyset) should be exactly in line with each other. In course of time, these marks can become out of line through the threads being worn. When the \emptyset mark on the ring is displaced by more than 25 - 30° in relation to the other \emptyset mark, an authorised ALFA-LAVAL representative should be consulted. The thread should be checked at least once a year, the procedure being as follows:

Unscrew the large lock ring, and remove the distributor together with the disc set. Remove the seal ring from the bowl hood, fit the hood and screw on the lock ring. Tighten the ring anti-clockwise until the bowl body and the hood are firmly attached to each other. Measure the angle.

Note: If the guide marks can no longer be clearly distinguished, punch them in again (re-marking the same spot).

Disc set pressure

If the lock ring can be tightened with the spanner, without resistance, until the hood lies tightly against the bowl body, the pressure should be increased by adding an extra disc (included in the set of spares) on top of the set of bowl discs. Make sure that the seal ring lies in its groove in the bowl hood.

POWER TRANSMISSION

- Bowl spindle When overhauling the bowl spindle, check with particular care the aperture in the bowl nave, the cone of the bowl spindle and the height adjustment.
- Clutch coupling. Check the belt pulley, friction blocks and brake lining.
Brake Roughen the surfaces of the pads with a file. All the pads should be changed simultaneously even if only one of them is worn out.
- Worm wheel
shaft.
Worm When changing the worm wheel, change the worm as well.
- Oil sump Clean the inside of the worm wheel sump. Change the oil.
- Foundation Check the rubber washers (shock absorbers), especially for their elasticity.

PARING DISC-BOWL

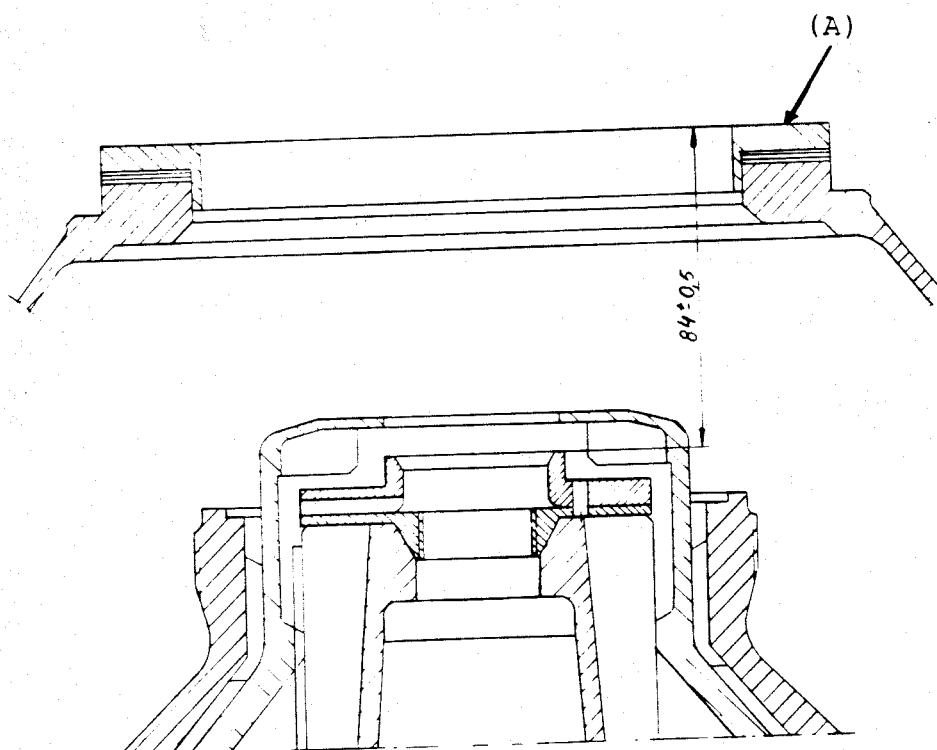
Assemble the bowl without the small lock ring. Tighten the large lock ring until the bowl hood is firmly fixed to the bowl body, as described in chapter I.

Fit the hood on to the frame and fasten it with the clamp screws.

Dismantle the feed and discharge device.

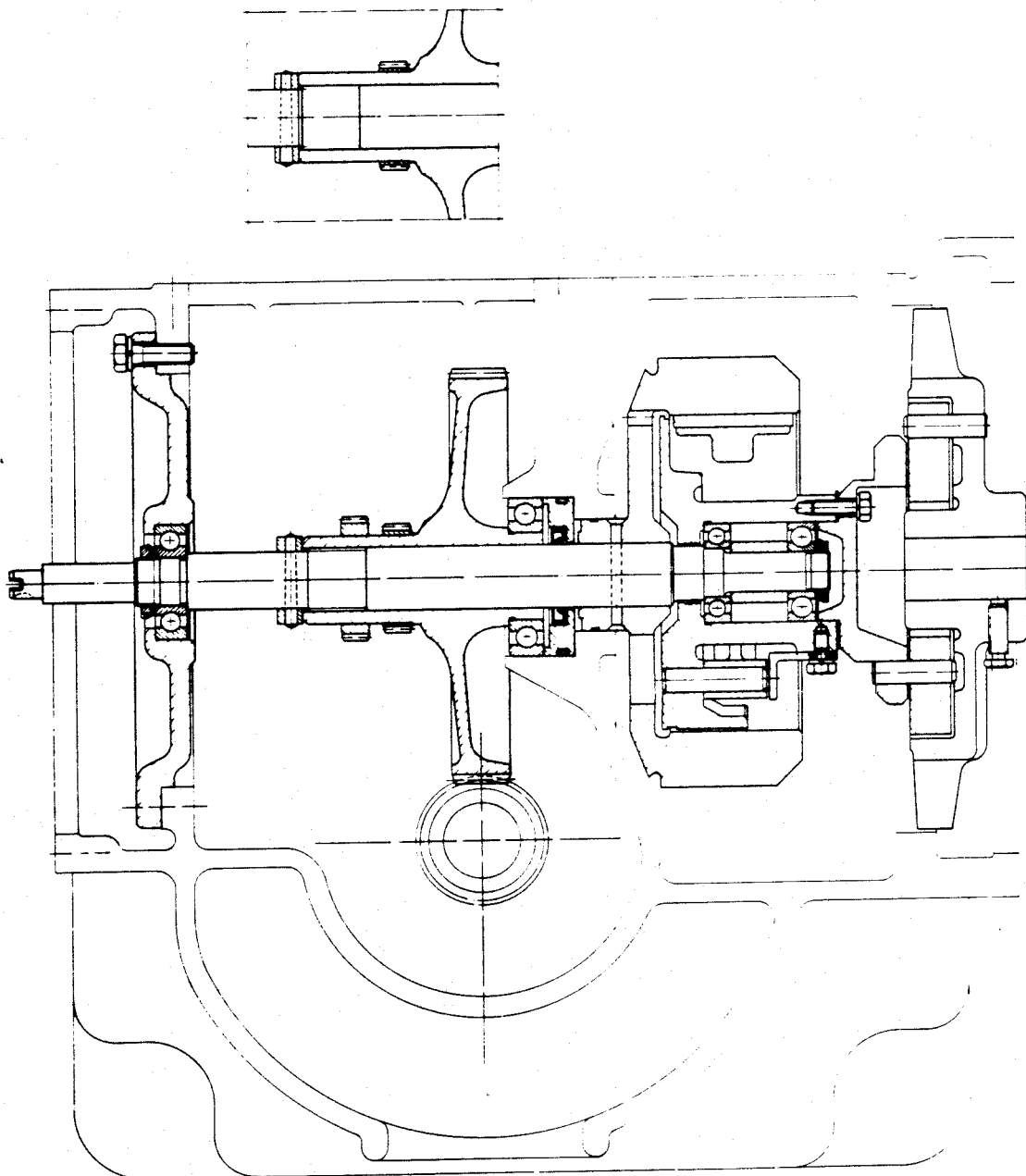
Measure with a caliper the distance between the top edge of the paring disc and the top plane of the guide ring (A). This should correspond to the measurement indicated in the illustration.

If necessary adjust.

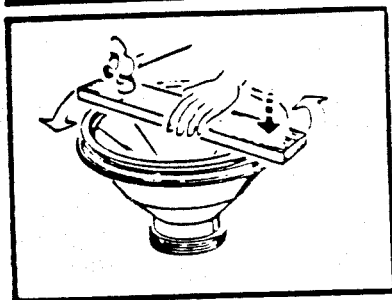
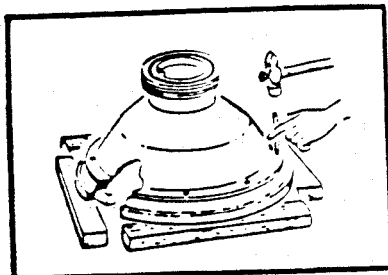


ALFA-LAVAL

FOR ART NR 53011-B, OCM-85 53011-B, 87-08-89
FOR ARTICLE NO 53011-B, AND-85 53011-B, 87-08-89



Seal ring of bowl hood



When exchanging the seal ring drive it out by means of the tool, which should be inserted alternately in the holes provided for this purpose.

The seal ring is pressed into the groove in the lower edge of the bowl hood by means of a planed board (1"x5"), which should be placed across the ring. Knock carefully on the board right above the ring, first on one side and then on the other. Turn the board around successively and drive the ring into the groove as evenly as possible.

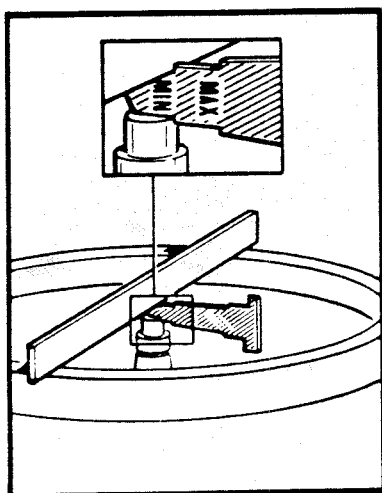
If a new seal ring of nylon (polyamide) turns out to be too wide when mounted, this is due to absorption of moisture - it will recover correct dimensions after drying for about 24 hours at a temperature of 175°-195°F (80°-90°C) in heating chamber.

If the ring is too narrow, put it in hot water, 160°-175°F (70°-80°C), for 5-10 minutes.

HEIGHT ADJUSTMENT The height levels should be checked during the annual inspection and after any replacements of parts that affect the height setting.

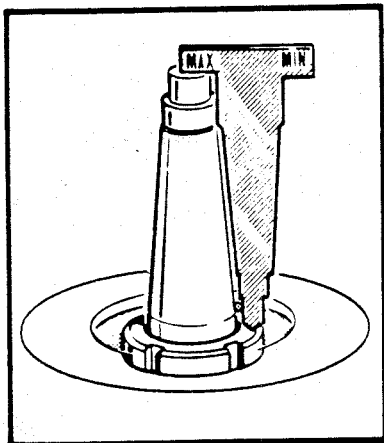
The tolerances are restricted, and it is therefore essential that all parts are thoroughly cleaned.

Bowl spindle



Remove the seal ring (gasket) from the frame ring. Lay a ruler across the ring. Pass the narrowest part of the caliper marked MIN (16.5 mm) between the ruler and the head of the spindle. There will be a little play between the caliper and the ruler, but not enough to allow the wider part marked MAX (18.5 mm) to pass through. The height setting is adjusted with spacer rings - see chapter P.

Checking of paring disc



Place the caliper on the spindle head so that the 148.5 mark is facing the spindle. There should be a little play between the lower part of the templet and the surface of the ring nut, without which the paring disc will be placed too high. Turn the templet till the 149.5 mark is facing the spindle. There should now be a little play between the templet tongue and the top of the spindle; otherwise the paring disc is being positioned too low. The height of the paring disc is regulated with spacer rings inserted below the cover - see paring disc in chapter S.

Final check

After every height adjustment, assemble the bowl and rotate the worm gear shaft by hand. If it is difficult to turn, or if a scraping noise is heard, this means that the adjustment has not been properly carried out. Check it again.

PARING DISC-BOWL

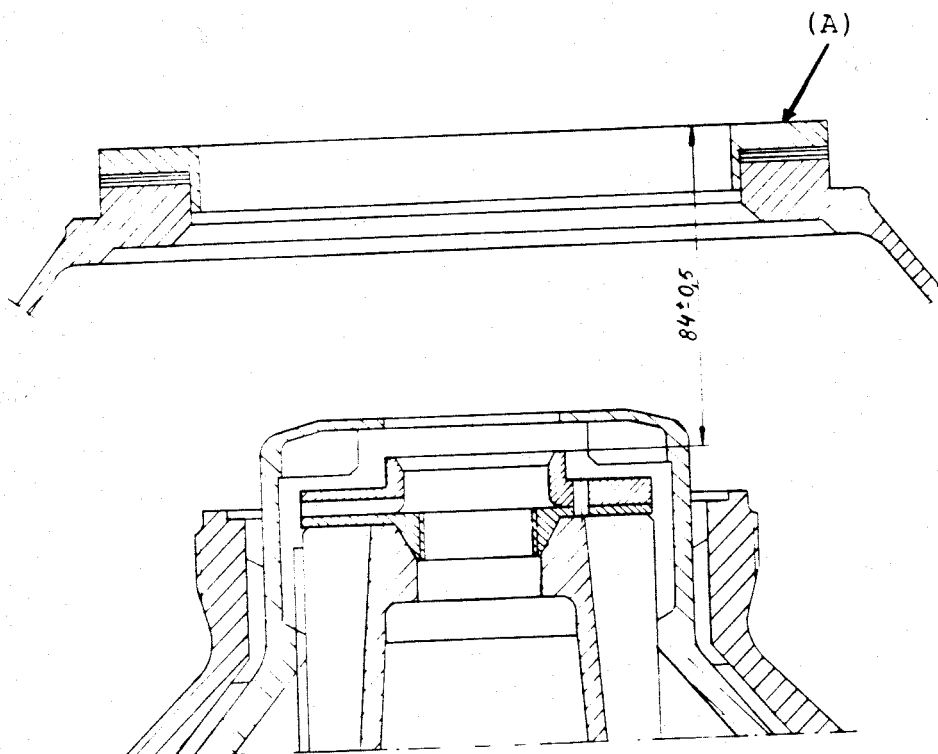
Assemble the bowl without the small lock ring. Tighten the large lock ring until the bowl hood is firmly fixed to the bowl body, as described in chapter I.

Fit the hood on to the frame and fasten it with the clamp screws.

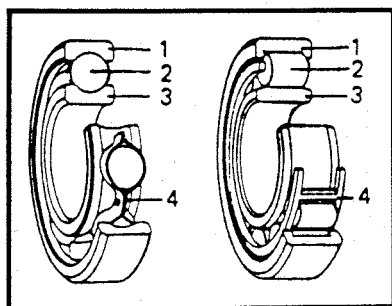
Dismantle the feed and discharge device.

Measure with a caliper the distance between the top edge of the paring disc and the top plane of the guide ring (A). This should correspond to the measurement indicated in the illustration.

If necessary adjust.



BALL AND ROLLER BEARINGS



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

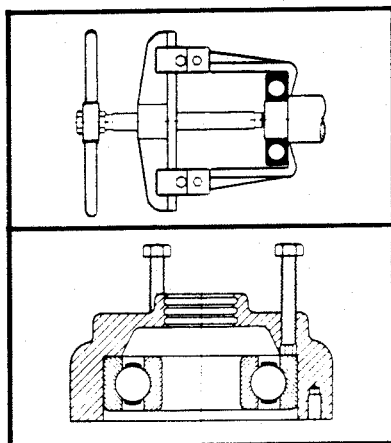
Use the greatest cleanliness when handling rolling bearings. Avoid unnecessary dismantling of bearings. **Do not re-fit a used bearing. Always replace it with a new one.**

Important: Special design bearings for the bowl spindle

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

Do not use other bearings than those stated in the Spare Parts Catalogue.

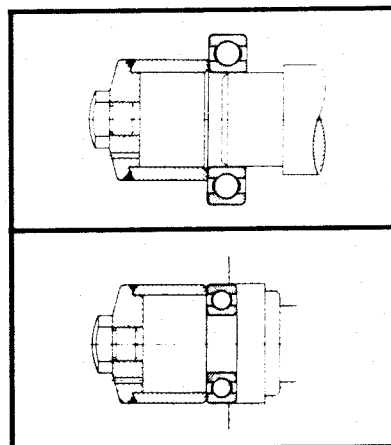
A bearing that in appearance looks equivalent to the correct bearing may be considerably different from the latter in various respects: inside clearances, design and tolerances of the cage and ball (roller) races as well as material and heat treatment. **Any deviation from the correct bearing may cause a serious breakdown.**

**Dismounting**

Detach the bearing from its seat by pressing against the race having the tightest fit. Use a puller or a special tool. Thus, apply the pressure to the inner race when the bearing sits tightly on the shaft, and to the outer race when the bearing is tightly fitted in the housing respectively.

Arrange dismounted bearings and other parts in assembling order to avoid confusion.

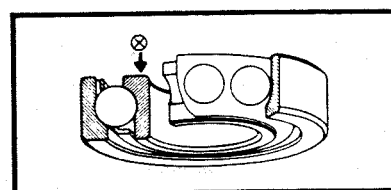
Check the shaft end and the bearing seat in the housing for damage indicating that the bearing has rotated on the shaft, and in the housing respectively. Replace the damaged part, if the faults cannot be remedied by polishing or in some other way.

**Fitting**

Leave new bearings in original wrapping until ready to fit. The anti-rust agent protecting a new bearing need not to be removed.

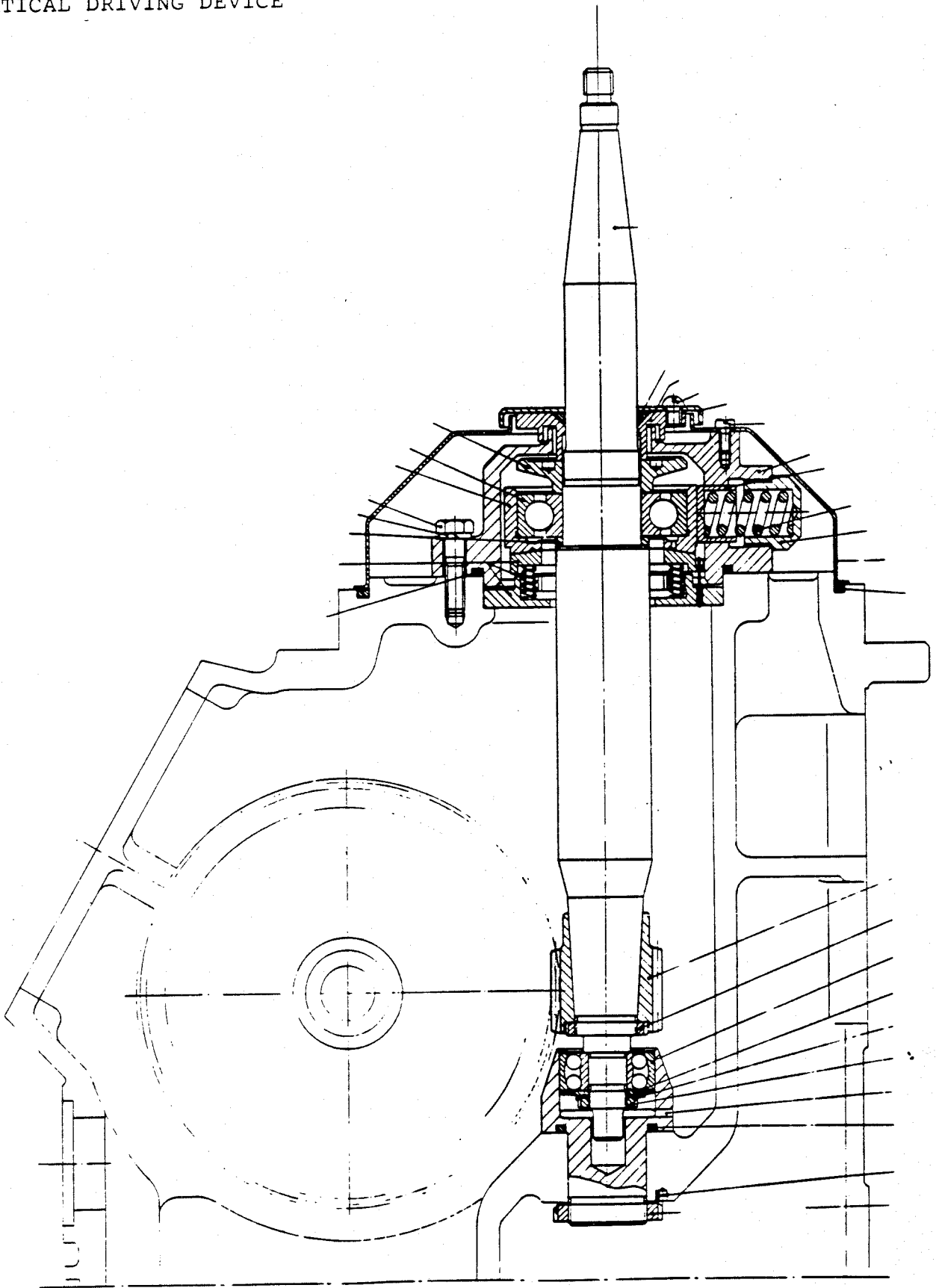
Fit a bearing on a shaft by pressure applied to the inner race and in a housing by pressure applied to the outer race. Use a suitable piece of pipe or a metal drift and a hammer. Never strike the bearing directly.

Bearings sitting with tight fit on a shaft should be heated in oil before assembly. The oil temperature should not exceed 100 °C. Never leave the bearing in the oil bath longer than required for thorough heating.

**Angular contact ball bearings**

Always fit single-row angular contact ball bearings with the stamped side of the inner race facing the axial load.

VERTICAL DRIVING DEVICE

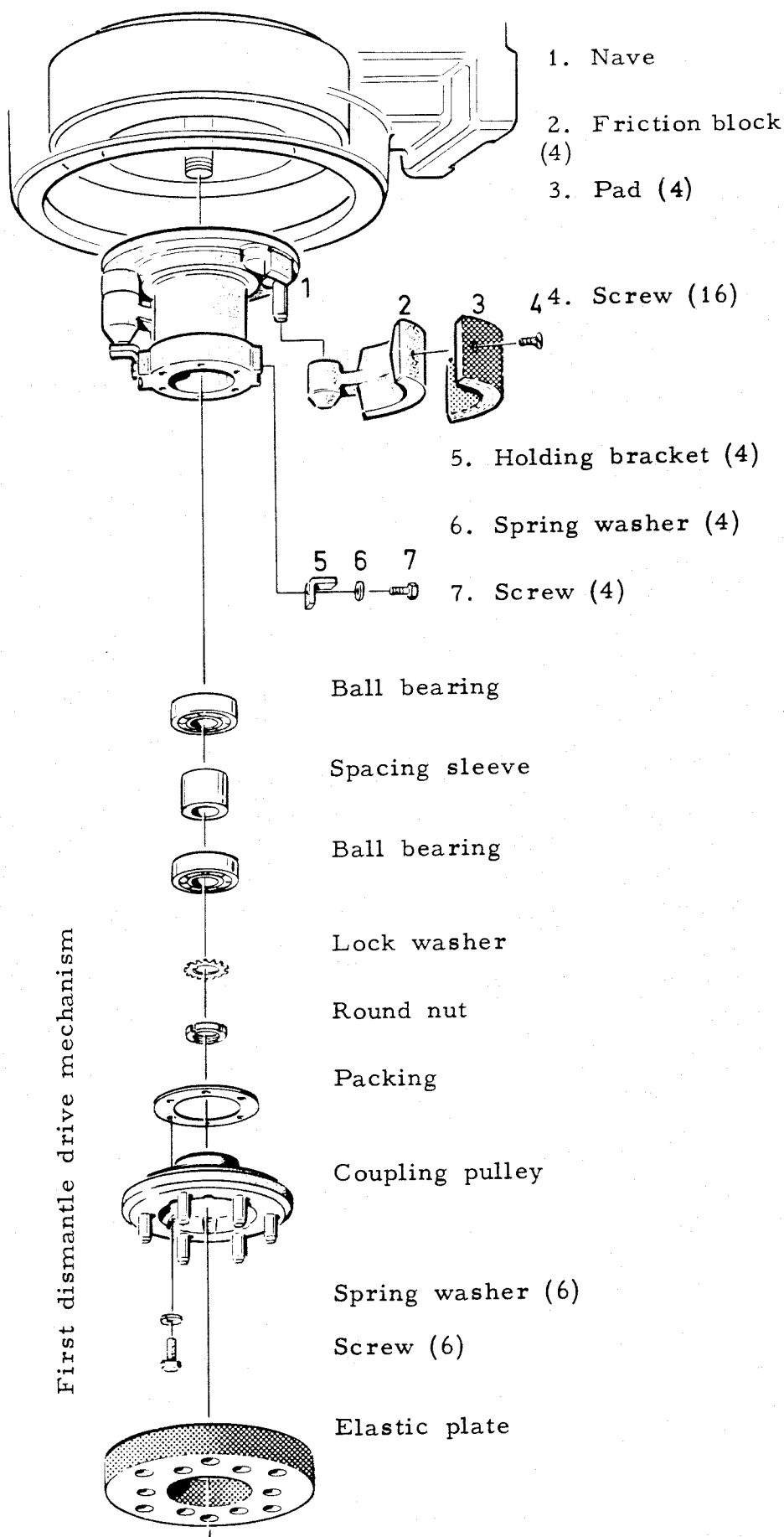


DISMANTLING.
ASSEMBLY

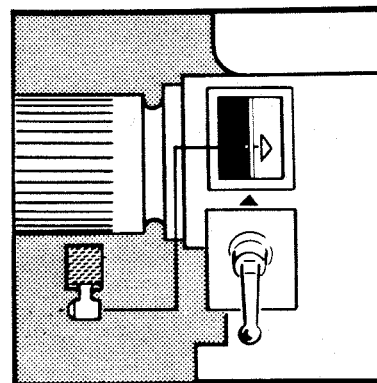
Dismantle and reassemble the parts in the sequence set out in the illustrations on the following pages.

In addition to the specific instructions given, always remember the following points:

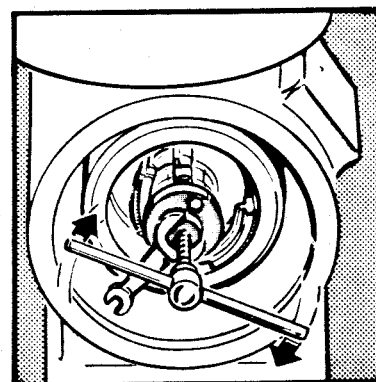
- Continual cleanliness and precision are essential.
- Make sure that all seal rings and gaskets are intact.
- Replace spring washers whenever necessary.
- Replace all clutch pads, even if only one of them is worn out.
- Oily clutch pads should be degreased as directed in chapter L, and roughened with a coarse file.
- Take care to see that no oil or grease gets on to the clutch or on to the friction surfaces.
- Avoid unnecessary dismantling of ball bearings.
- Follow the instructions given in chapter L for fitting ball bearings.
- The worm wheel housing should be cleaned out and filled with new oil after any work that may have introduced dirt.
- Follow the instructions for cleaning and overhaul in chapter L, and the instructions for lubrication in chapter H.



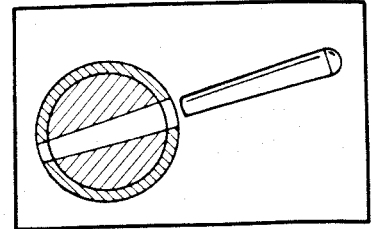
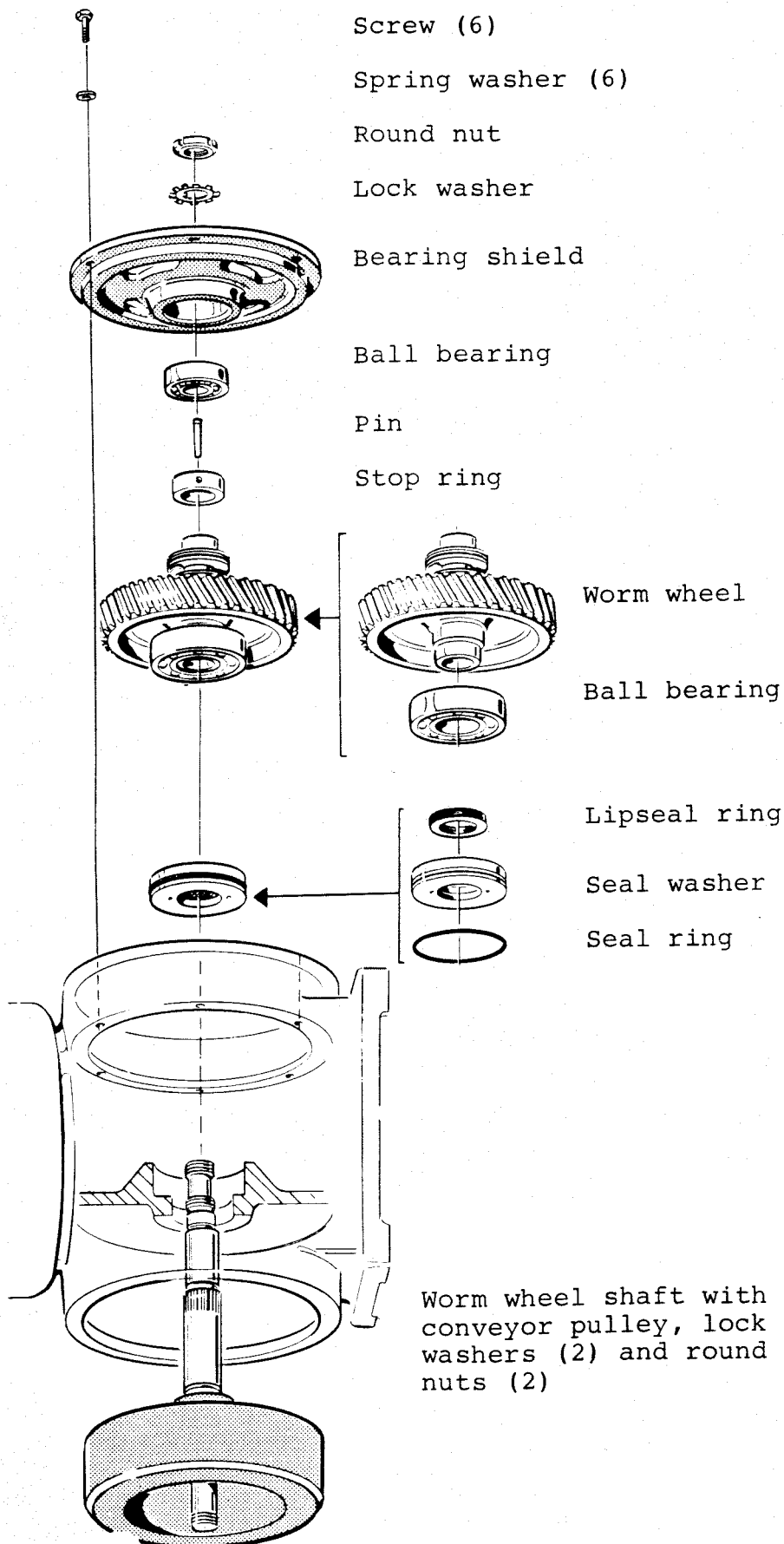
The friction blocks can be removed without the necessity of dismantling the rest of the clutch.



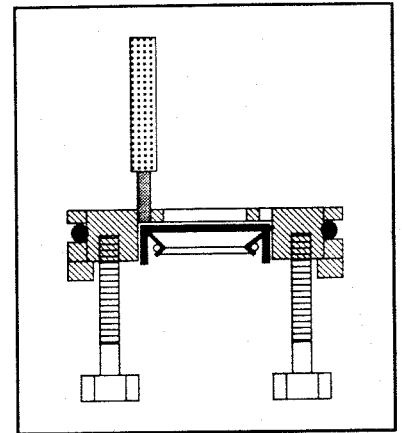
When the blocks are assembled they should move freely, and the holding brackets should be mounted so that they engage the groove in the nave and prevent the blocks from slipping off their pivots.



The illustration shows how the nave is eased off the shaft. To assemble, first fit the nave on the shaft and then the inner ball bearing. Pack one-third of the space about the spacing sleeve with ball bearing grease. Use the drive-on sleeve to drive the bearings into position.

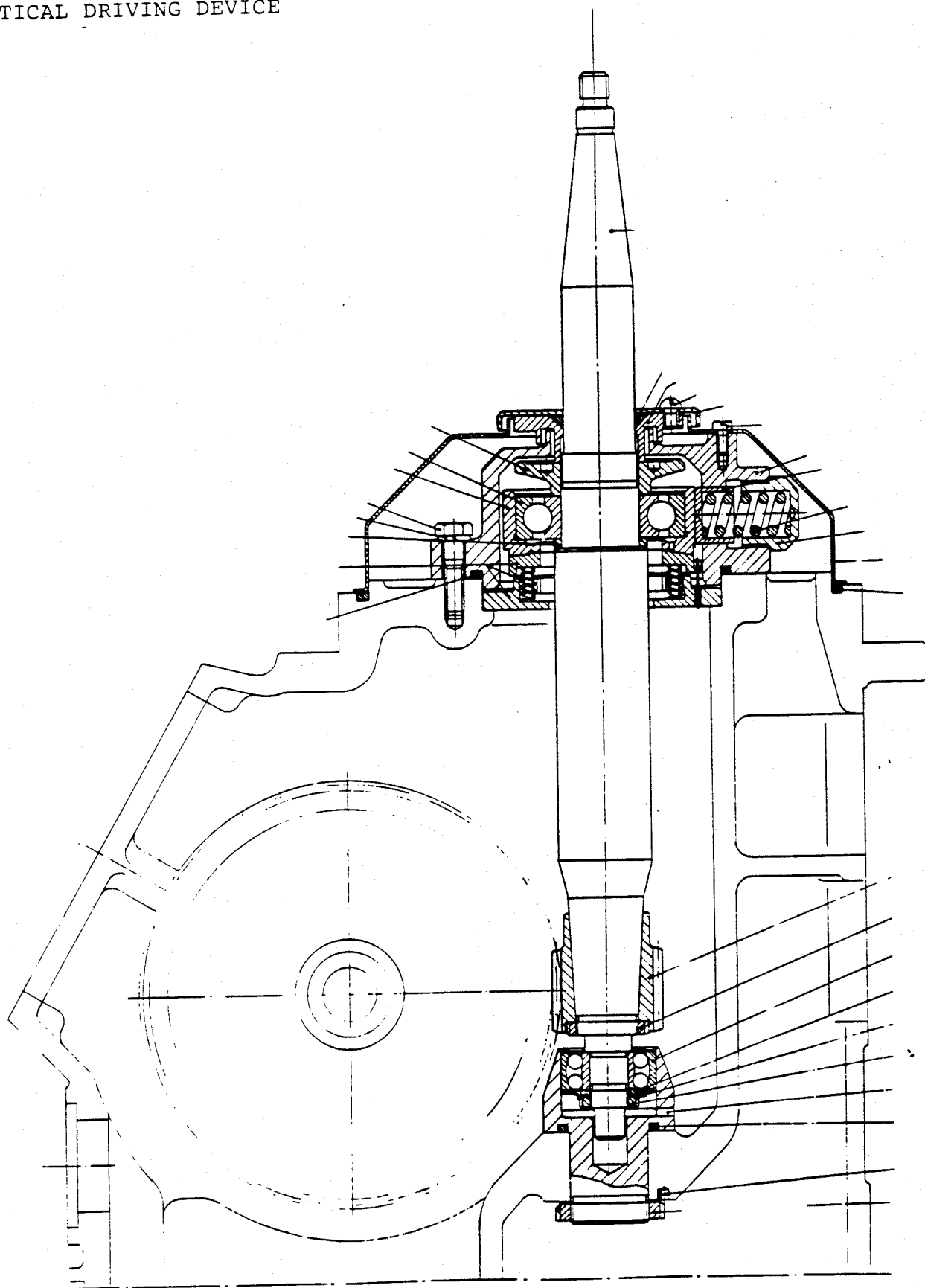


Align the stop ring correctly when fitting -- both the hole and the pin are tapered (taper 0.02). If there is any play, the hole must be reamed.

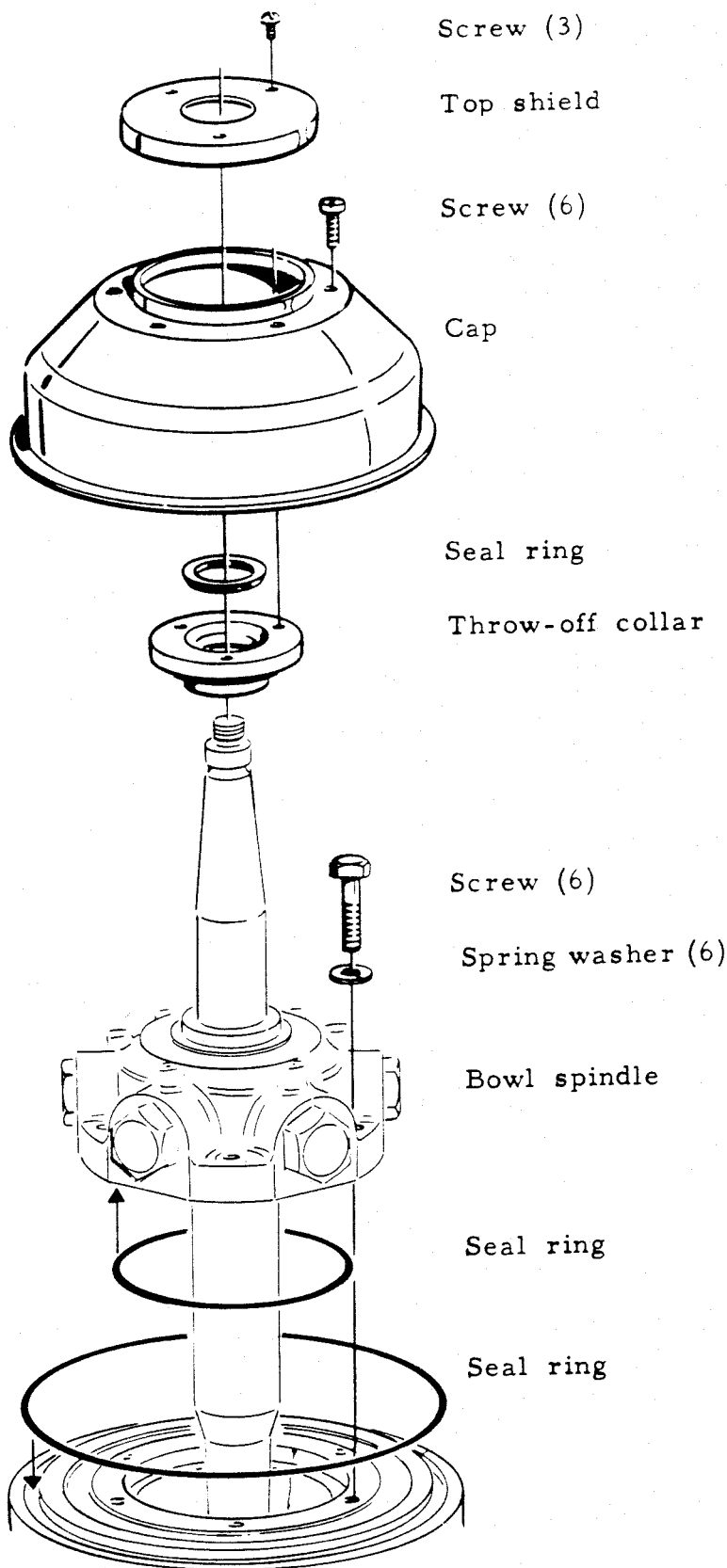


Use two 1/4" bolts to draw out the seal washer. When assembling, make sure that the lipseal ring is turned as shown in the illustration. Warm the ball bearing before fitting it on the worm wheel.

VERTICAL DRIVING DEVICE



ASSEMBLY and DISMANTLING of COMPLETE BOWL SPINDLE



Screw (3)

Top shield

Screw (6)

Cap

Seal ring

Throw-off collar

Screw (6)

Spring washer (6)

Bowl spindle

Seal ring

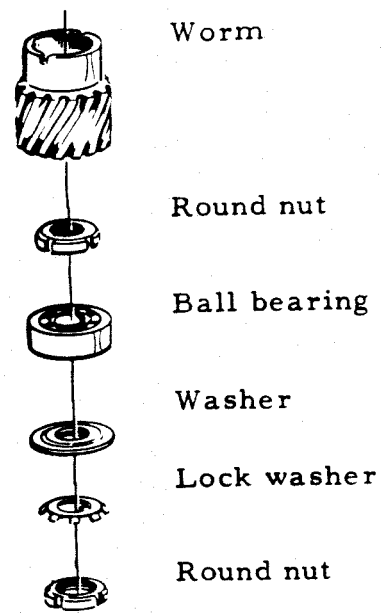
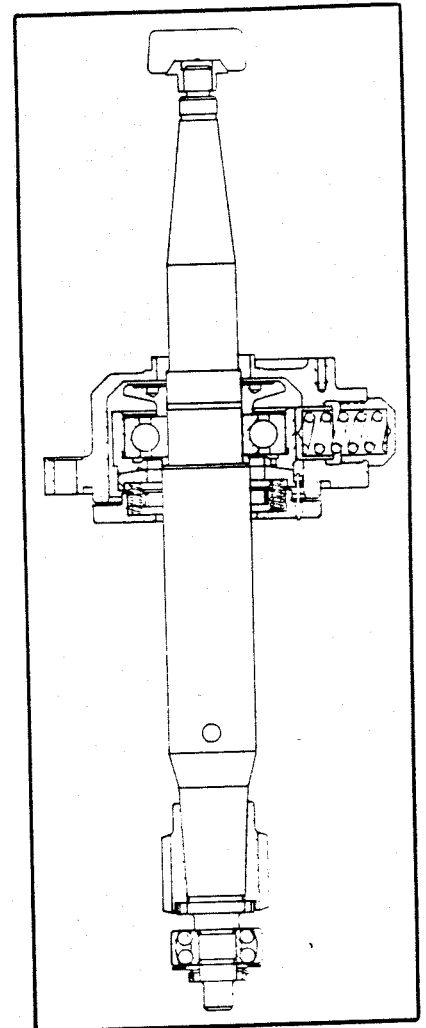
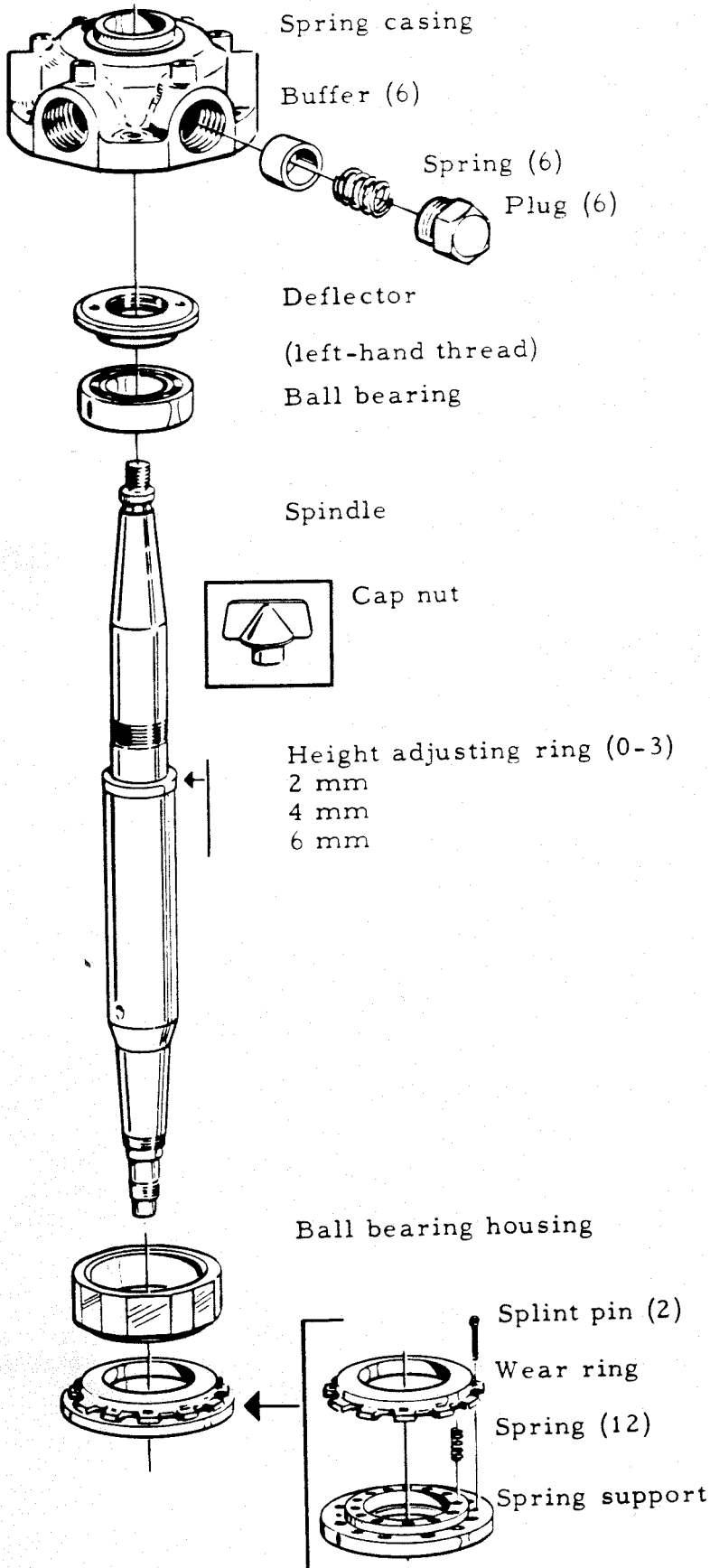
Seal ring

The bowl body, control valve and paring-disc device for operating liquid must be removed to make the parts accessible for dismantling.

The cap screws can conveniently be used to pull off the throw-off collar.

The top bearing plugs can most conveniently be unscrewed while the bowl spindle is still in place in the frame. Before the bowl spindle can be lifted out of the machine the worm wheel must be moved along the worm wheel shaft to disengage the worm. Access can conveniently be gained through the revolution counter cap opening. The spindle can be lifted out more easily if the cap nut is first screwed on.

After assembling, check that the bowl spindle turns when the worm wheel shaft is rotated. Check the height adjustment (see Chapter L).



DISMANTLING.
ASSEMBLYSpring
casing

After unscrewing the plugs, move the upper part of the spindle in a circular direction. This releases the buffers from their seating, and so enables them to be removed.

When assembling, make sure that the heads of the buffers are resting against the flat surfaces of the ball bearing housing.

Final tightening up of the plugs is best done after the bowl spindle is in place in the machine.

Deflector

The deflector has a lefthand thread, and is therefore unscrewed in a CLOCKWISE direction.

Bottom ball
bearing

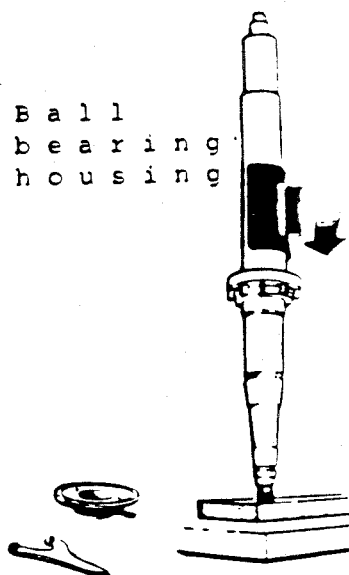
The ball bearing and washer should be heated before being fitted to the spindle.

Worm

The worm is fitted on to a tapered seat on the spindle, and can be detached by striking it with a mallet. If the worm is exchanged, it is important to inspect the worm wheel at the same time, as this is changed in conjunction with the worm.

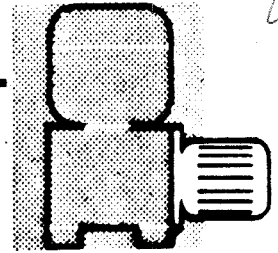
Axial buffer

The axial buffer is fitted as a single unit held together by split pins.

Ball
bearing
housing

If the ball bearing housing is to be removed, first dismantle the other parts of the spindle. Place the top end of the bowl spindle upside down on a flat surface (a wooden board), and apply light blows to the inner ring.

The ball bearing should be heated before being fitted. Remember to remove the adjusting ring.



ASSEMBLY OF MOTOR

General drawing - Perspective drawing with part numbers - Assembly.

For LUBRICATION, see chapter H - for CLEANING, see chapter L

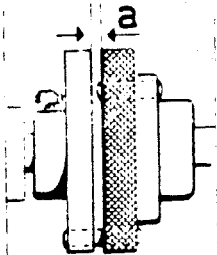
GENERAL HINTS

Motor

The specified speed for the horizontal shaft of the machine (worm wheel shaft), which must never under any circumstances be exceeded, is indicated on the plate showing the type of machine.

Check the number of revolutions with the revolution counter after installation or replacement of the motor. For details of the motor's requirements, see chapter C.

Coupling pulley



When the machine is delivered with the motor, the pulley has already been fixed in its correct position on the motor shaft. Mark the position of the pulley before detaching it from the motor shaft. The axial play - measurement 'a' in the illustration - should be about 2 mm.

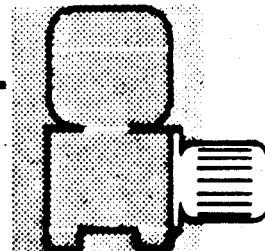
Electric cable

The motor's electric cable should preferably be longer than necessary, to allow the motor to be removed without disconnecting the cable from the terminals.

Connection to mains

Connect the motor to the mains so that the bowl will rotate CLOCKWISE.

Note: The machine must never be started up before the bowl has been fitted on to the spindle, or without having the prescribed quantity of lubricating oil of suitable quality.



ASSEMBLY OF MOTOR

General drawing - Perspective drawing with part numbers - Assembly.

For LUBRICATION, see chapter H - for CLEANING, see chapter L

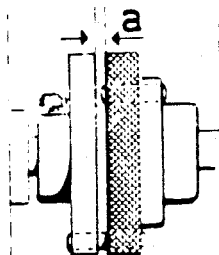
GENERAL HINTS

Motor

The specified speed for the horizontal shaft of the machine (worm wheel shaft), which must never under any circumstances be exceeded, is indicated on the plate showing the type of machine.

Check the number of revolutions with the revolution counter after installation or replacement of the motor. For details of the motor's requirements, see chapter C.

Coupling pulley



When the machine is delivered with the motor, the pulley has already been fixed in its correct position on the motor shaft. Mark the position of the pulley before detaching it from the motor shaft. The axial play - measurement 'a' in the illustration - should be about 2 mm.

Electric cable

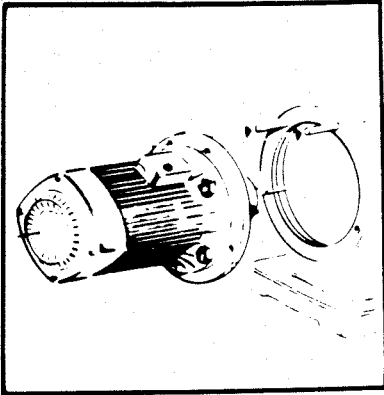
The motor's electric cable should preferably be longer than necessary, to allow the motor to be removed without disconnecting the cable from the terminals.

Connection to mains

Connect the motor to the mains so that the bowl will rotate CLOCKWISE.

Note: The machine must never be started up before the bowl has been fitted on to the spindle, or without having the prescribed quantity of lubricating oil of suitable quality.

TYPE "4" DRIVE

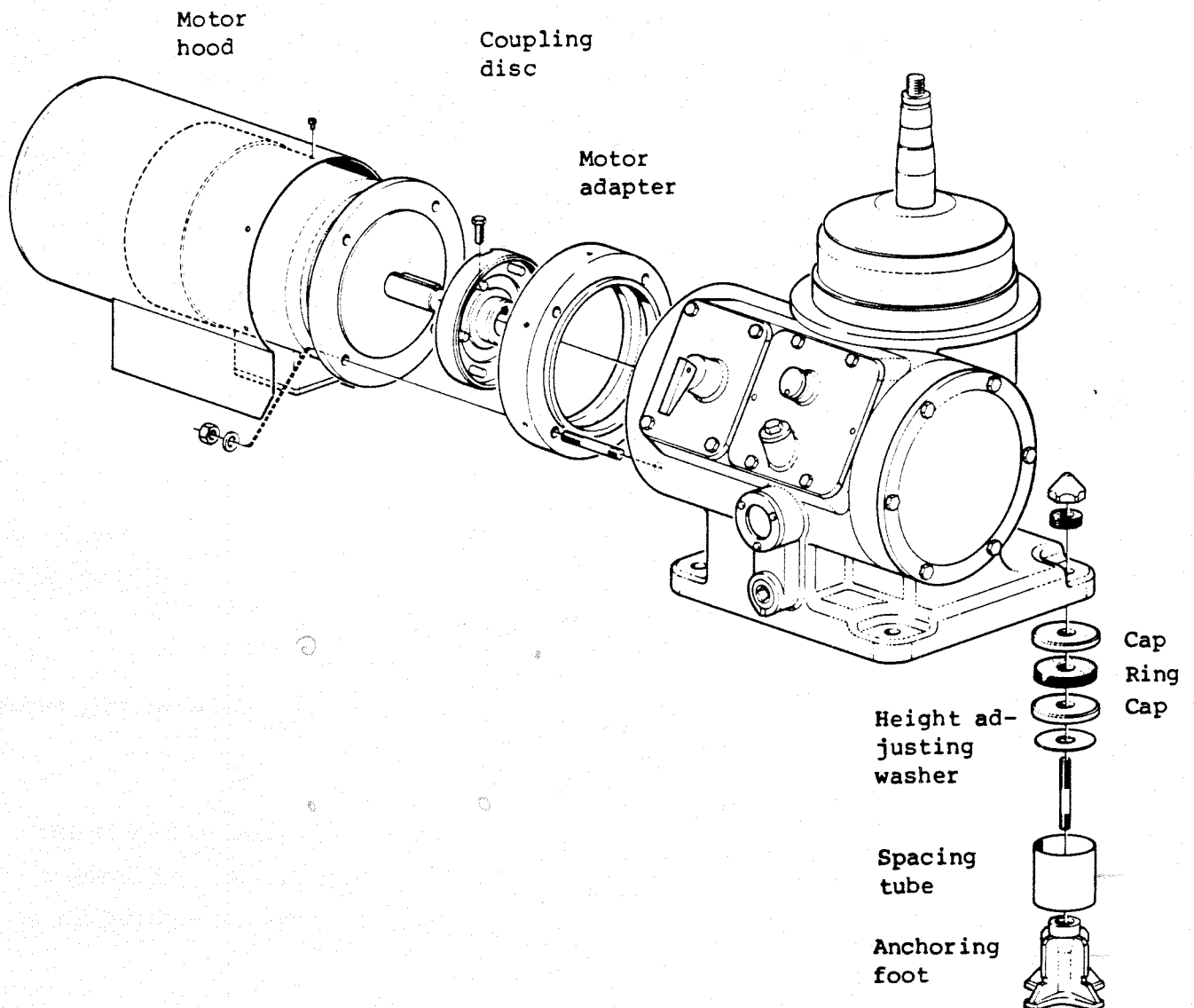


Fit the coupling disc to the motor shaft, secure it and press the elastic plate into the coupling disc.

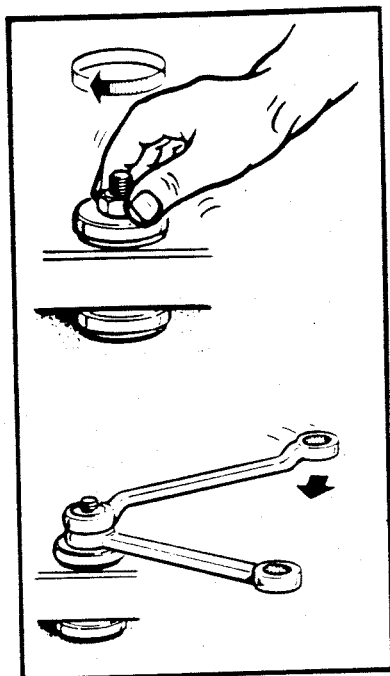
Fit the stud bolts to the frame flange. Slip the motor adapter over the stud bolts. Hang the motor on the stud bolts and fit the studs of the coupling in the holes of the elastic plate.

Tighten the nuts alternately. See that the flange of the motor fits correctly on the motor adapter.

When dismantling, take care that the electric cable is not loosened from the connection box.



ERECTION OF FRAME Place the frame on the vibration dampers, as indicated in the drawing on the preceding page, and check:



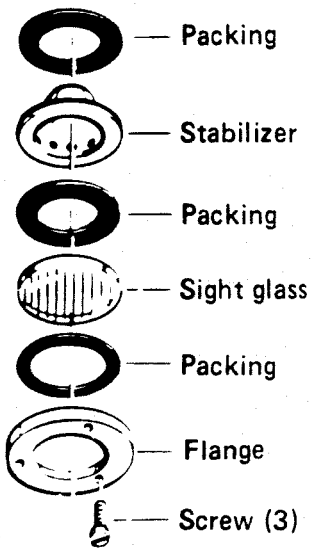
- that the bolts are not pressing against the edges of the anchoring. If one or more bolts are pressing against the edges of the holes, flexible mounting of the frame will be impeded.

- that the frame is horizontal, with its feet lying level. If adjusting washers are needed, these must have the same diameter as the base buffers.

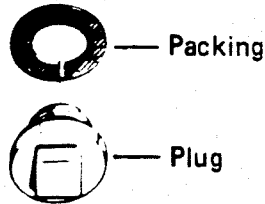
Screw down the nuts until they touch the washers, then tighten up with one further turn.

Hold the nuts firmly and secure with lock nuts.

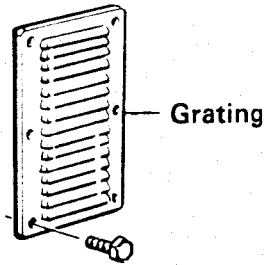
A OIL LEVEL GAUGE



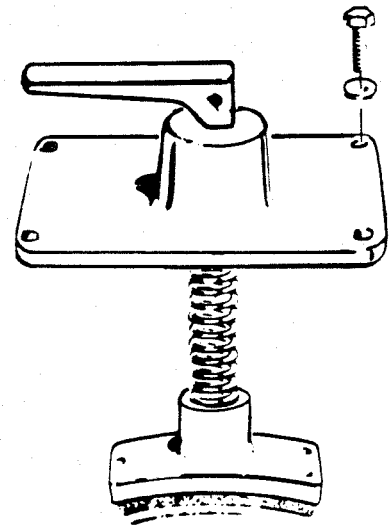
B OIL DRAINING



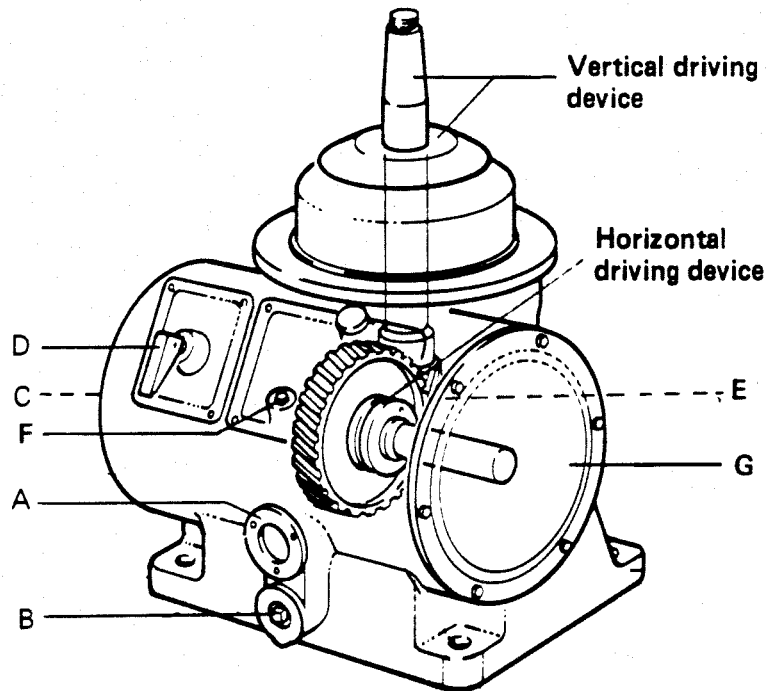
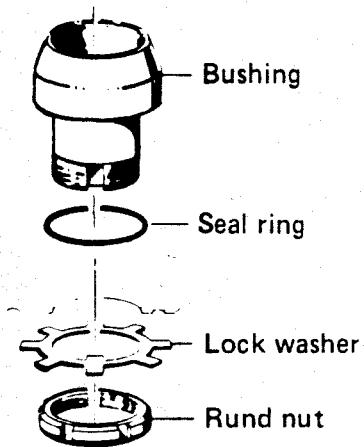
C



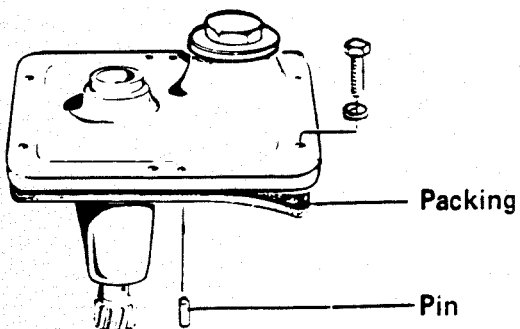
D BRAKE



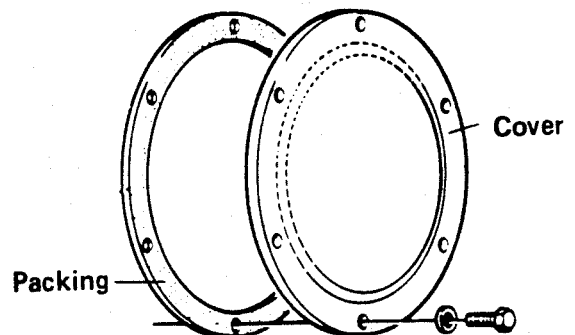
E BOTTOM BUSHING



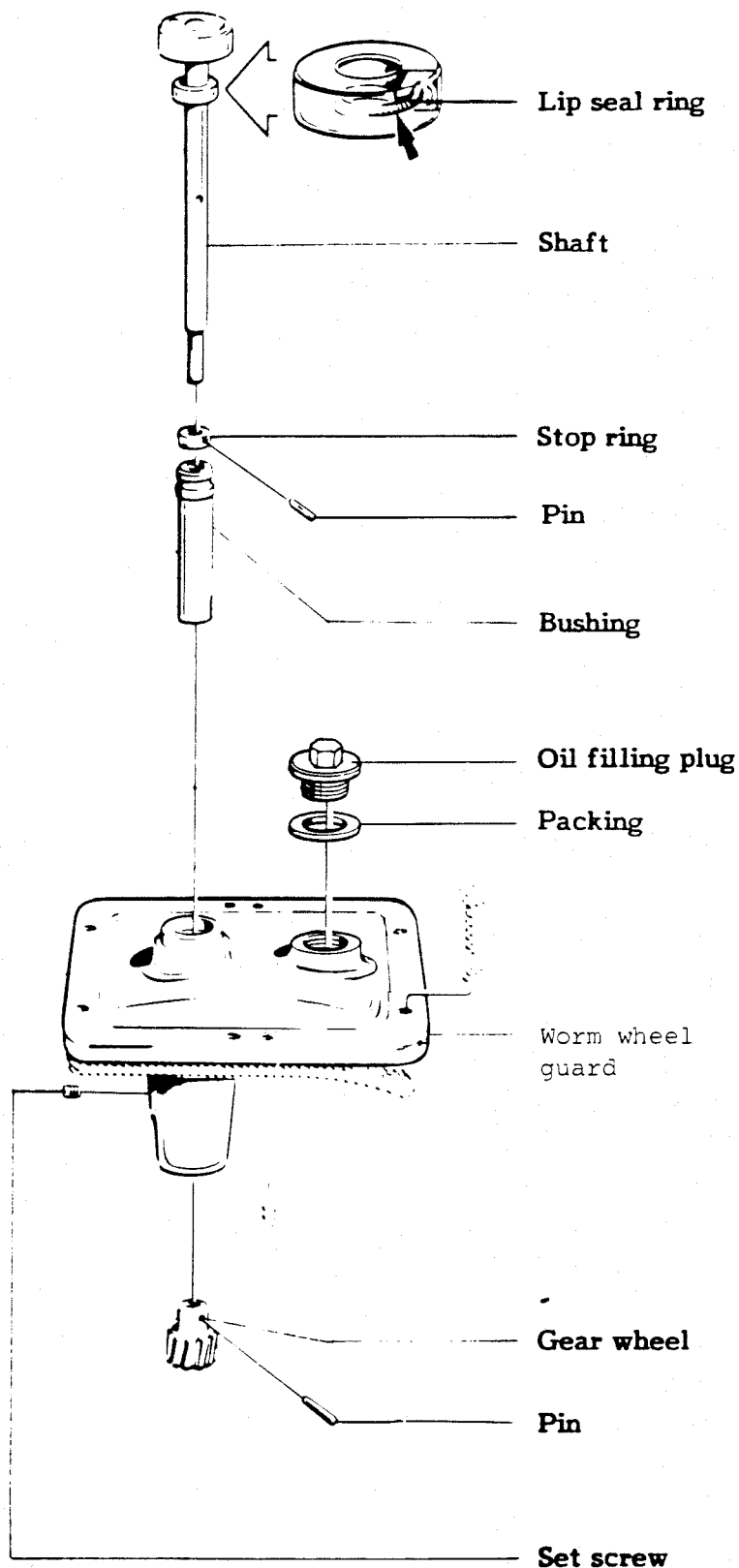
F REVOLUTION COUNTER



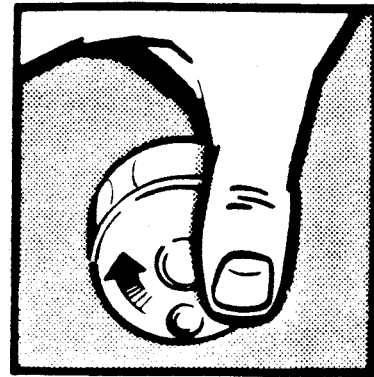
G BEARING SHIELD



PROTECTING COVER WITH REVOLUTION COUNTER



Speed checking



Speed particulars - see chapter C. Count the number of revolutions during one minute.

Assembling

When mounting lubricate shaft and gear wheel with oil of the type used in the gear housing. Direct the gear wheel correctly - pin and hole are tapered. In case of play ream the hole (conicity 0.02.) Make sure the lipseal ring is directed according to the illustration.