ALFA-LAVAL

Instruction book

01 - 5601221

MACHINERY WORLD

Separator

MRPX 207SGV-34

In letters, telegrams, telex messages and calls state type and manufacturing No. of the machine.

Unless the manufacturing No. has been filled in on this page, the book serves purposes of general information only and neither part Nos. nor operating instructions are unreservedly applicable.

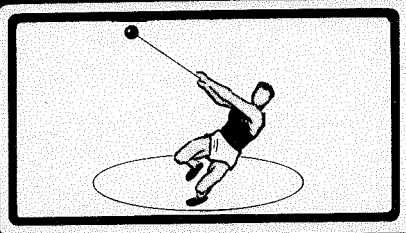
Manufacturing number:

(SG4183-0610DE)
Spr 4183-20 :41
Reg 33435
Utg 1/6810
2/7102, 7310, 7705,
7901, 7902, 7905
3 &106

Printed in Sweden

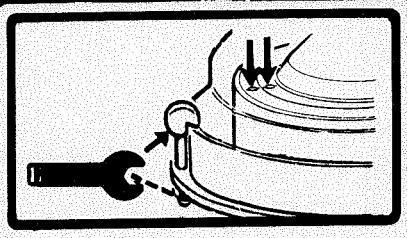
Book No.: SV4183-20:03E

△ SAFETY PRECAUTIONS FOR CENTRIFUGAL SEPARATORS △

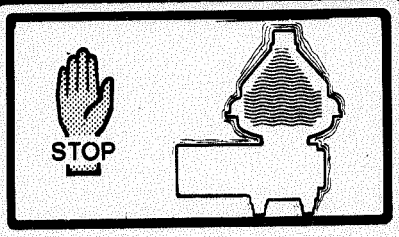


The bowl of a centrifugal separator rotates at a very high speed and great forces are generated.
To ensure your own safety, always carefully follow the instruction book(s) concerning installation, assembly of the components, operation and regular maintenance.
Always use Alfa-Laval spare parts and tools supplied with the machine.

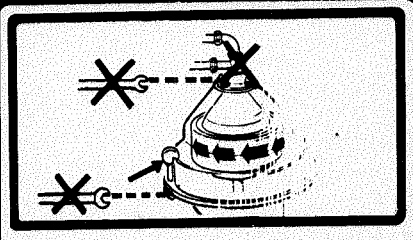
OPERATION



Never start the machine before the lock rings of the bowl inlet, outlet and other fastenings have been securely tightened. Note that the assembly marks Ø (arrowed) must be aligned or pass each other (due to thread wear) when the lock ring is fully tightened.

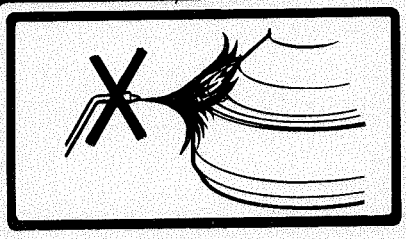


If excessive vibration occurs, IMMEDIATELY fill and keep the bowl full of liquid whilst stopping. Switch off and apply brakes, if fitted. After the bowl has stopped; dismantle, clean and check all parts carefully.



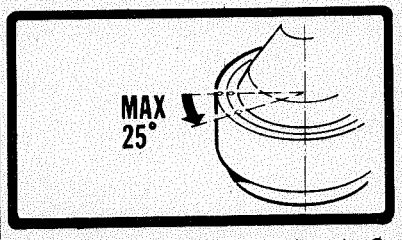
Never loosen any part of the machine until the bowl has completely stopped.

MAINTENANCE

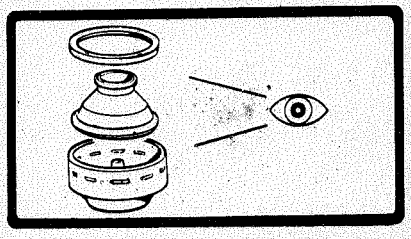


Never heat the bowl body, bowl hood or lock ring with a naked flame.

Never carry out any welding work on the components that rotate.



Never operate the machine when the Ø assembly mark on the lock ring can pass the corresponding mark on bowl body/bowl hood by more than 25 degrees. Consult your AL representative.



Check at regular intervals for damage due to corrosion and/or erosion. If in doubt, consult your AL representative.

- Switch off and disconnect the power supply to the machine before starting any dismantling work.
- Never use the machine for separating a liquid that is more corrosive or has a higher density, temperature, different characteristics of the solids, etc. than that for which the machine has been purchased.
  In case of doubt, consult your AL representative.
- A separator bowl is balanced as a complete unit. Do not interchange the components of a bowl with those of any other machine, even if it is the same type. Make sure that no parts are left out at assembly.
- Follow the safety instructions concerning inflammable, toxic or corrosive process media and cleaning agents. Affix information and warning notices in prominent places.

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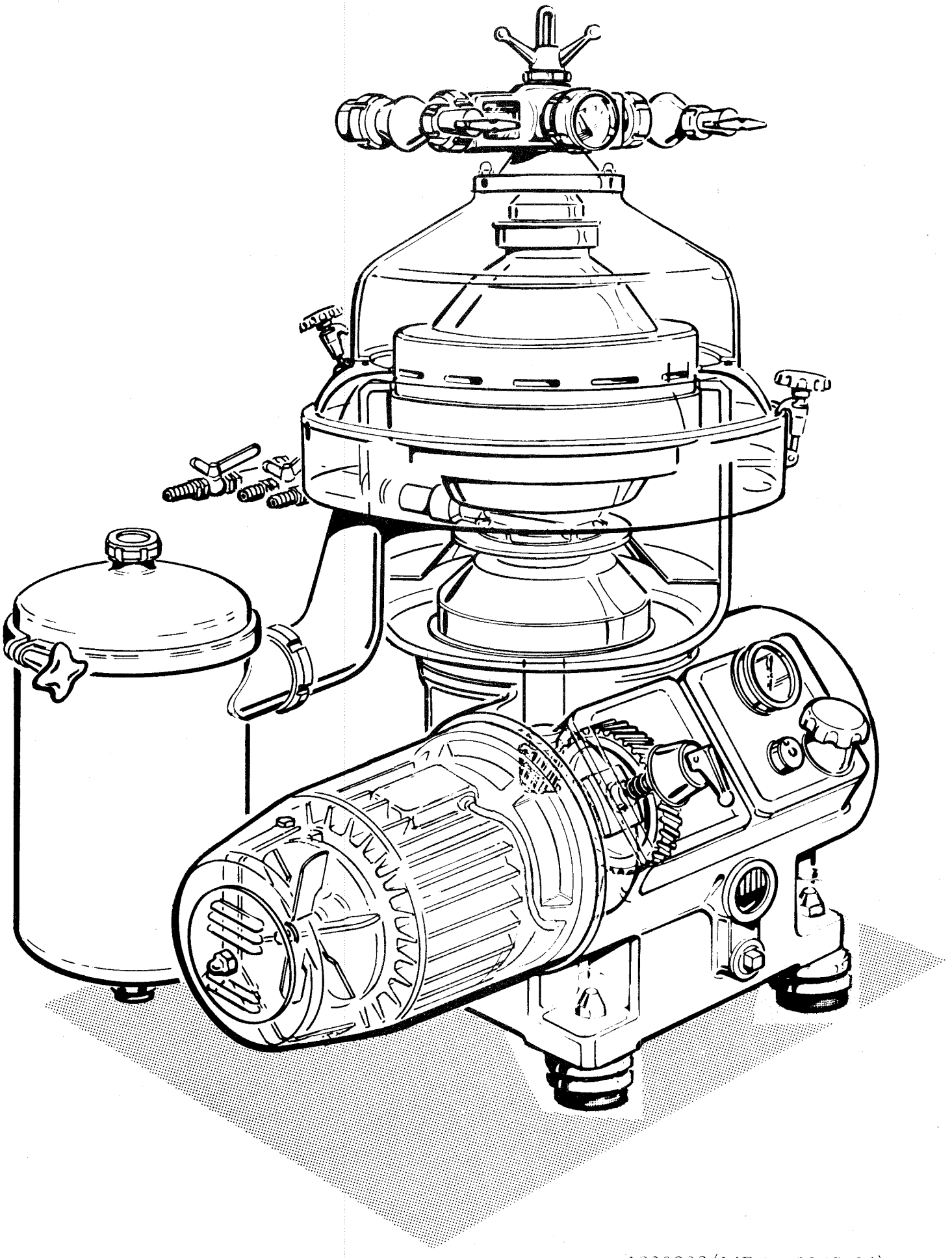

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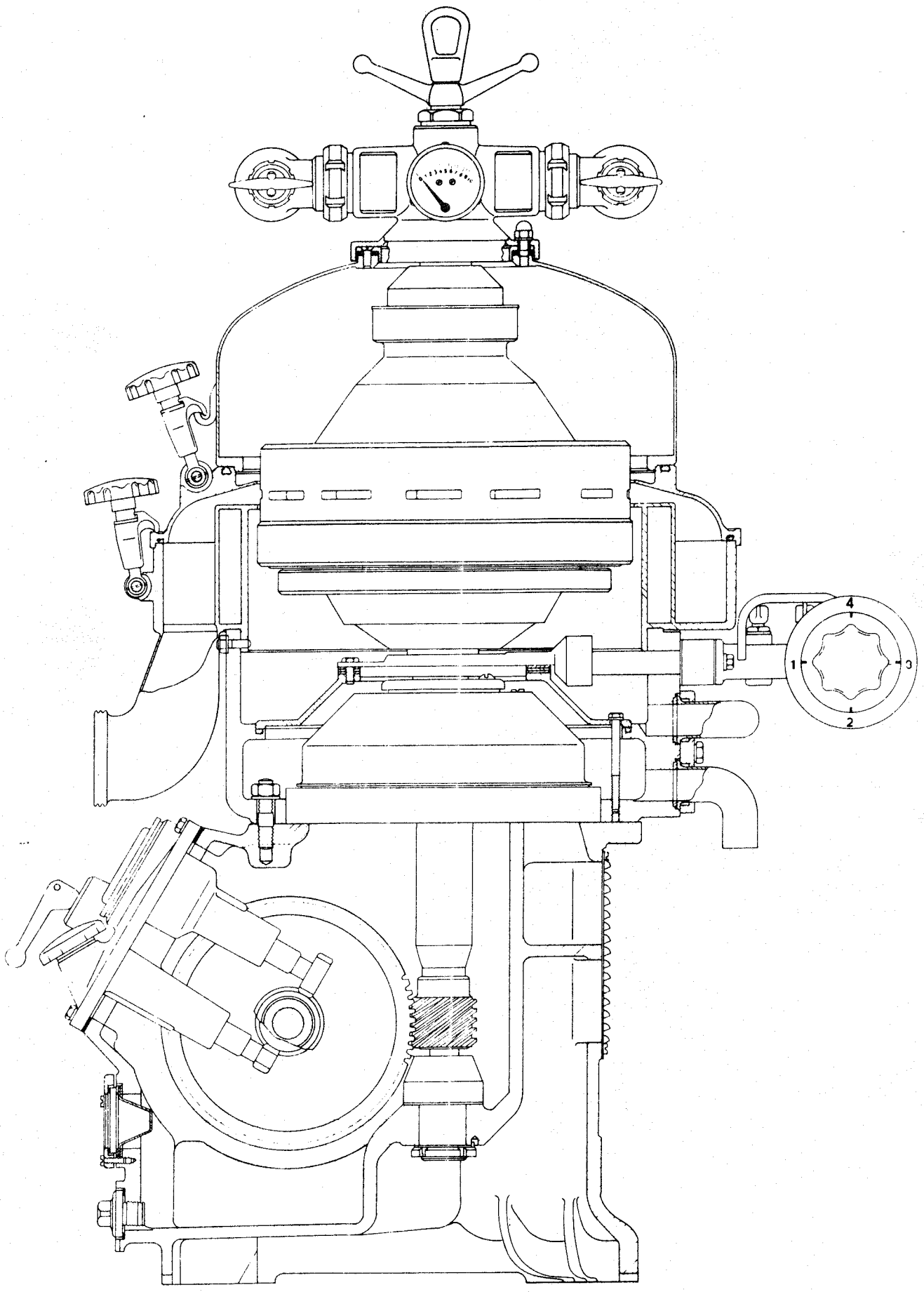
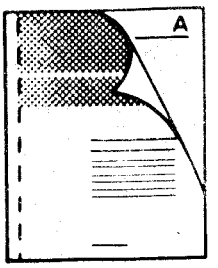

4
1
3
2



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

As appears from the table of contents, the Instruction Book contains instructions concerning installation and operation, dismantling and assembly as well as cleaning and overhaul. Since practically all machine parts have been identified by a part number, the Instruction Book serves also as a PART NUMBER LIST (SPARE PARTS LIST).

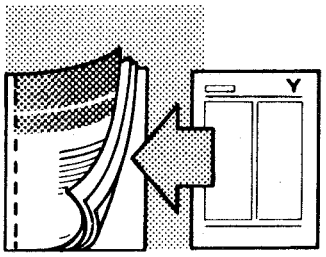
The Instruction Book deals not only with parts and devices included in the standard design, but also with special and alternative equipment. Parts incorporated in the deal are specified in the packing list accompanying the shipment.

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 Book is intended for a machine made to special order, supplementary instructions are often given in chapter Y - please check this before placing the machine in service. Supplementary data (on treatment of liquid, weights etc.) are often found also in the technical information submitted in connection with the purchase.
The ALFA-LAVAL/DE LAVAL representative is always glad to provide advice and information beyond the contents of this Instruction Book.

TYPE DENOMINATION
MANUFACTURING No.

It may occur that the type denomination on the type plate of the machine and on the title page of the Instruction Book are not exactly identical. In such cases the manufacturing No. of the machine is determining; the correct Instruction Book is always marked with the manufacturing number appearing on the type plate. Always state the type denomination indicated on the type plate when ordering spares.

SAFETY REGULATIONS

Chapter K contains a survey of the safety regulations which must ABSOLUTELY be observed when the machine is to be used.
The electric installation must be done by an experienced electrician with knowledge of the local safety stipulations.
It should be noted that, as a rule, the instruction book contains no safety regulations necessitated by any special properties of the process liquid, such as inflammability, toxicity or corrosiveness.

LUBRICATION
CLEANING

As a rule, the mounting instructions are mentioning only what part or parts should be lubricated or cleaned. All information on lubricants and cleaning agents to be used is given in chapters H and L.

SPECIAL TOOLS

The design of the special tools appear from chapter F.

ORDERING ROUTINE

When ordering spare parts always state the PART NUMBER and NAME as well as the TYPE DENOMINATION and MANUFACTURING NUMBER of the machine as indicated on the type plate.
Always base the spare parts order on an Instruction Book having the manufacturing number of the actual machine stamped on its title page.

Model order form

Name of part	Part number	Quantity	Remarks
mnmnmnmnmnmn	mnmn	m	
mnmnmnmn	mnmnm	m	
mnmnmnmnmn	mnmn	mn	
mnmnmnmn	mnmnm	mn	

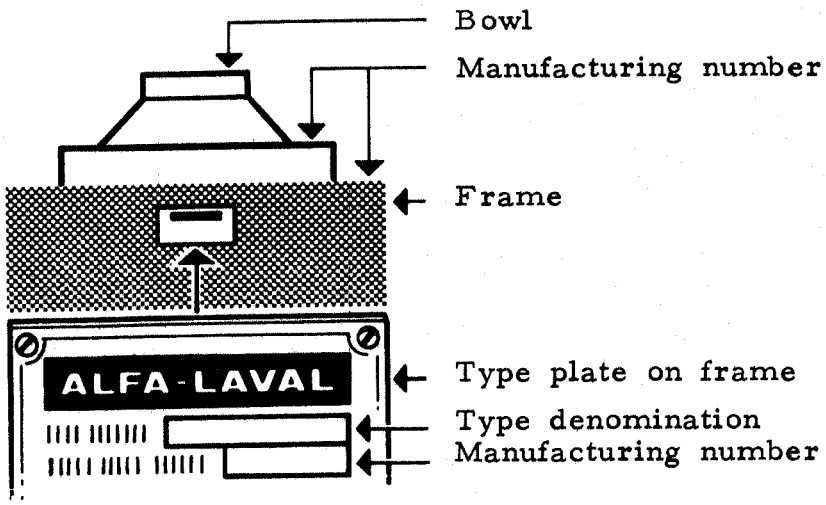
Correct ordering = Correct delivery in shortest time.

Delivery

It may occur that the part number of a delivered part differs from that stated in the Instruction Book. In such cases, the new part is at least equivalent to and fully interchangeable with the old one.

P.t.o.

(Ordering Routine, page 2)

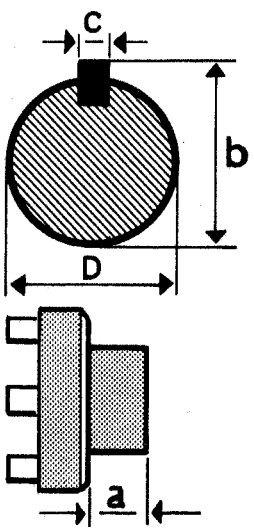


If the machine has been rebuilt after delivery, if the part number is not inserted in the Instruction Book, or when in doubt about the correct part number for other reasons, mention this in the order. In such cases correct statement of the TYPE DENOMINATION and the MANUFACTURING NUMBER indicated on the TYPE PLATE is particularly valuable.

Several manufacturing numbers

If the manufacturing numbers indicated on the bowl and on the type plate (frame) differ from each other, state both of them.

Coupling pulley. Belt pulley



Besides part number and name (see chapter R) also state the dimensions b, c and D of the motor shaft. When ordering a coupling pulley also state the suitable nave length a.

ABBREVIATIONS

h = hour

r.p.m. = revolutions per minute

c/s = Hz = cycles per second

ϕ = diameter

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

SSU = Saybolt Seconds Universal: indication of oil viscosity

^{o}E = degree Engler: indication of oil viscosity

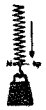
EP = Extreme Pressure: lubricants made capable of resisting high contact pressures through admixture of additives.

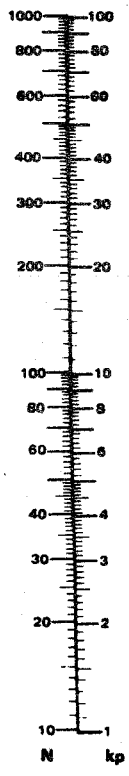
ASTM = American Society for Testing Materials.

NLGI-classes = classification of lubricating grease by means of penetration after processing according to National Lubricating Grease Institute, USA.

ISO = standards of processing according to International Organization for Standardizing.

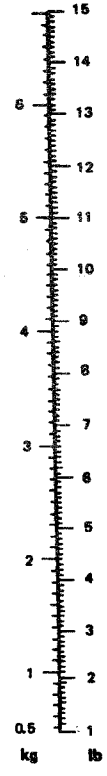
Force





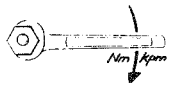
1 N = 0.102 kp

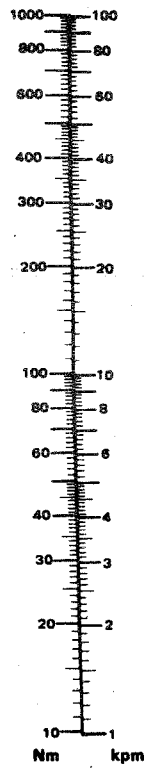
Mass



1 kg = 2.205 lb

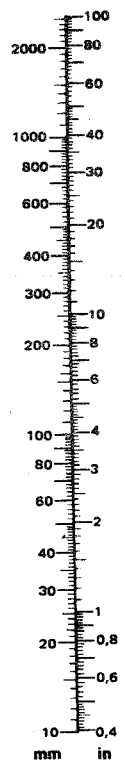
Moment of Force





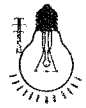
1 Nm = 0.102 kpm

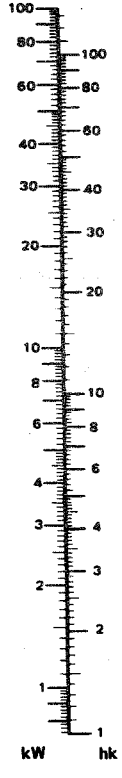
Length



1 mm = 0.03937 in

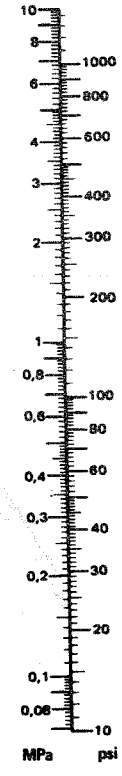
Power





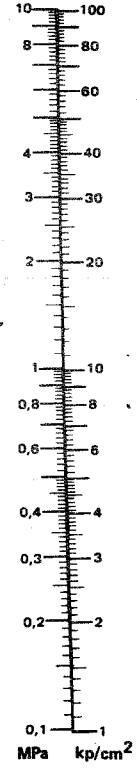
1 kW = 1.36 hk

Pressure



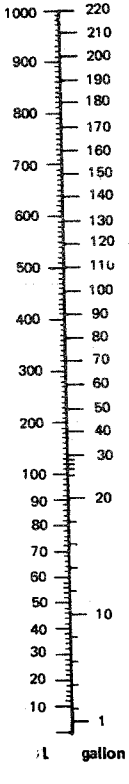
1 MPa = 145 psi

Pressure



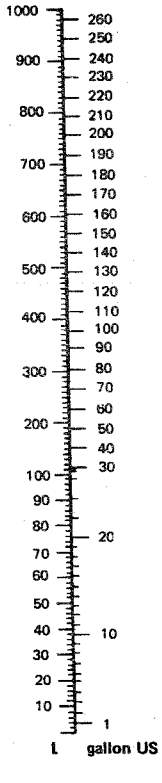
1 MPa = 10.20 kp/cm^2

Volume



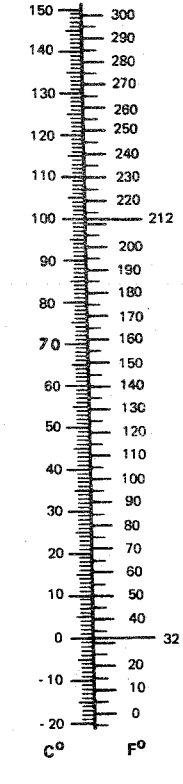
1 l = 0.220 gallon UK

Volume



1 l = 0.264 gallon US

Temperature



$^{o}C = 5/9 (^{o}F - 32)$

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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

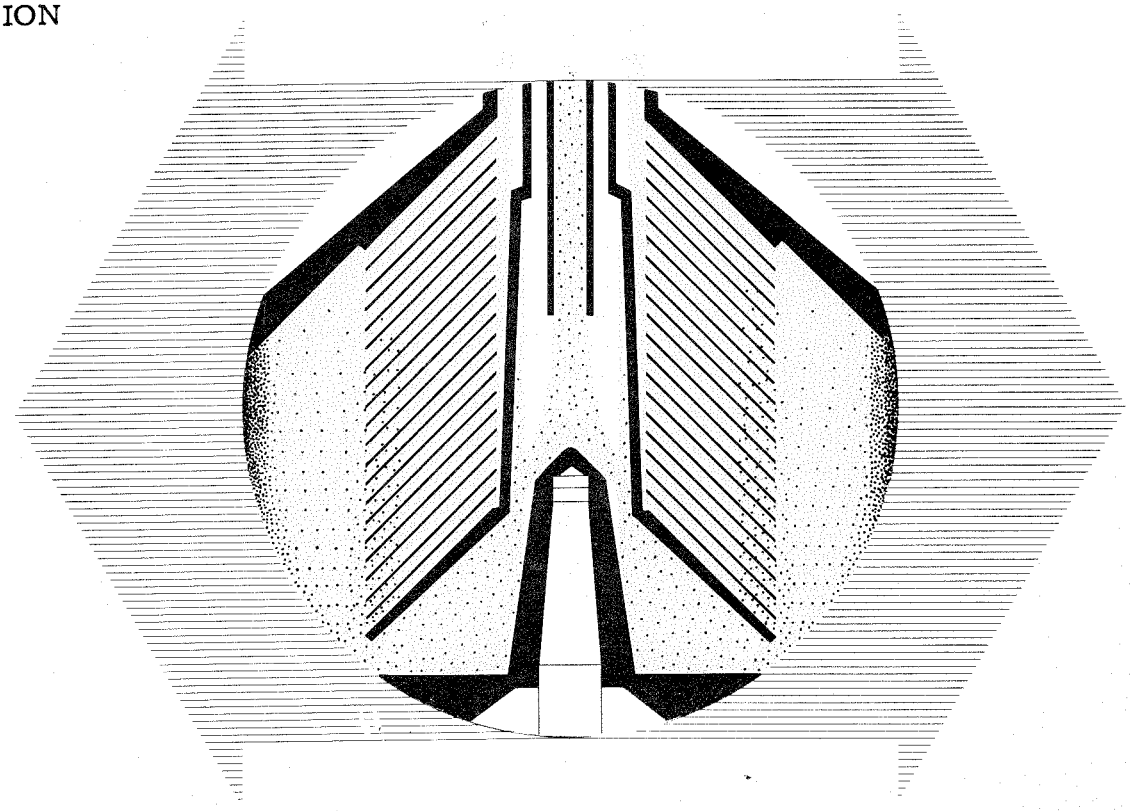
A liquid - liquid separation in which the machine is used for separating two intermixed liquids, which are insoluble in each other and have different specific gravities, the heavier liquid constituting the major part of the mixture. Solids with specific gravities higher than those of the liquids can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

Solids ejection	Emptying of the bowl during operation by uncovering and closing slots in the bowl wall.
Total ejection	Total emptying of the bowl with the feed (as a rule) turned off.
Partial ejection	Total or partial emptying of the solids space in the bowl but without emptying the rest of the bowl. The feed need not be interrupted.
Combined programme	A combination of total and partial ejections in succession.

FACTORS INFLUENCING THE SEPARATION

Difference in specific gravity	The centrifugal force acts on all particles proportionally to their specific gravity. This applies to solid particles as well as to fluid particles. The greater the difference in specific gravity, the easier the separation.
Size and shape of particles	The larger the particle, the quicker the sedimentation. The particles to be separated off must not be so small that the mixture is close to colloidal state. The smooth and round particle is easier separated off than the irregular one. Rough treatment, e.g. in pumps, can split the particles, with reduced size and separating speed as a result.
Viscosity	The more fluid a liquid is, the quicker is the separating process and the better the separation – in other words, low viscosity improves the separation result. The viscosity can in many cases be reduced by heating.
Time in centrifugal field	If the separation is not satisfactory, the throughput must be reduced. Lower throughput gives, normally, a better separation result.

CLARIFICATION



Centrifugal force

Bowl parts

Liquid

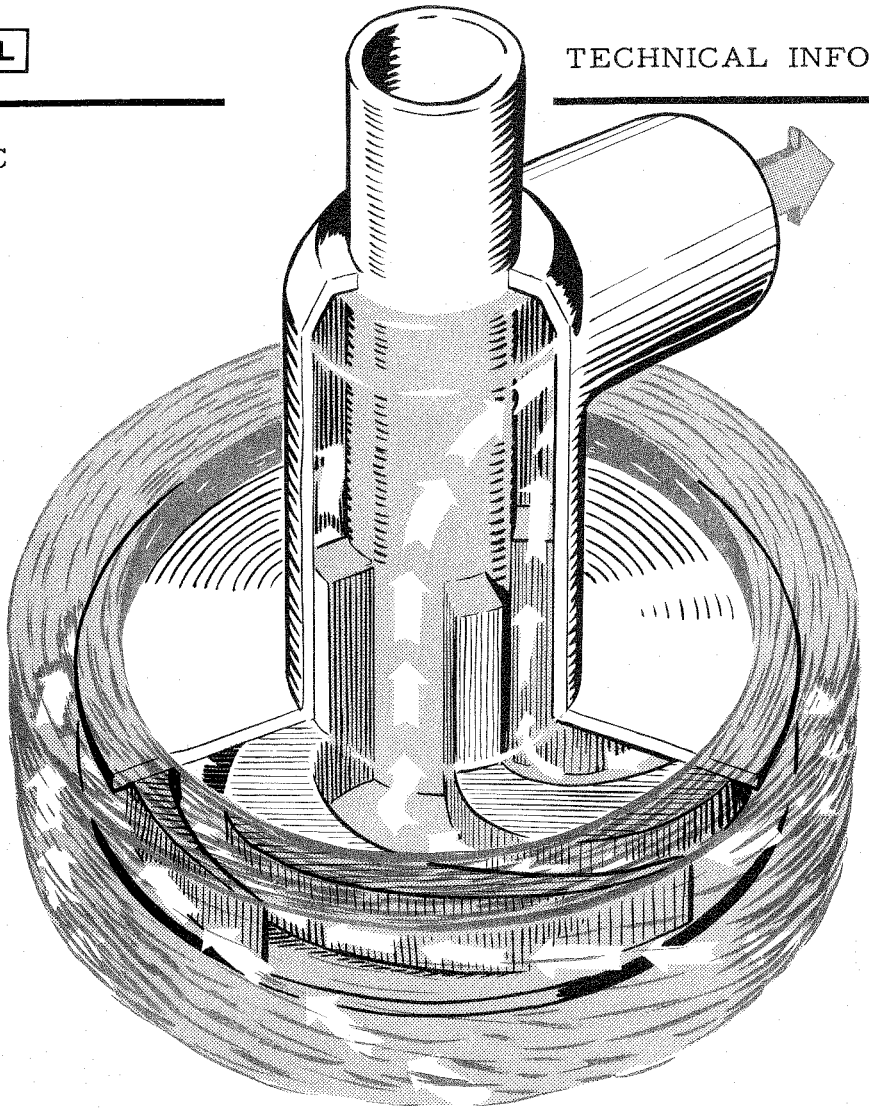
Solids

Clarifier bowl

This bowl has one outlet. The process liquid flows through the distributor to the interspaces between the bowl discs. Through the action of the centrifugal force the heavy particles move along the underside of the discs towards the bowl periphery, where they settle on the bowl wall. The liquid proceeds towards the bowl centre and discharges through the bowl hood.

The course of separation can be influenced e.g. by changes in the viscosity (rise in separating temperature) or in the throughput.

PARING DISC

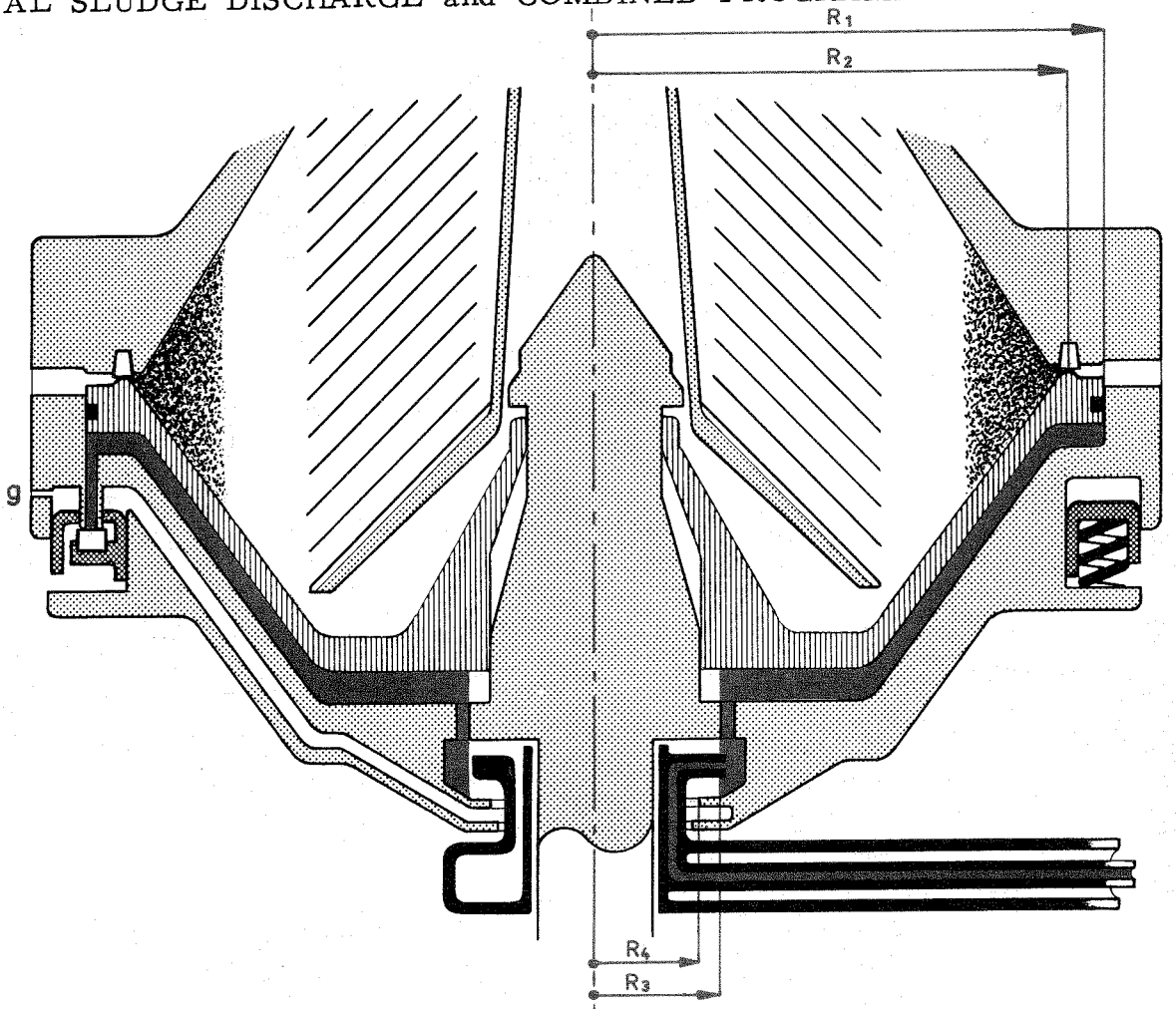


The paring disc has for its object to discharge the liquid under pressure.

The liquid rotates, driven by the rotating paring chamber, in the form of a ring around the stationary 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 (nothwithstanding the back pressure) up to the highest pressure the paring disc can produce at this liquid quantity.

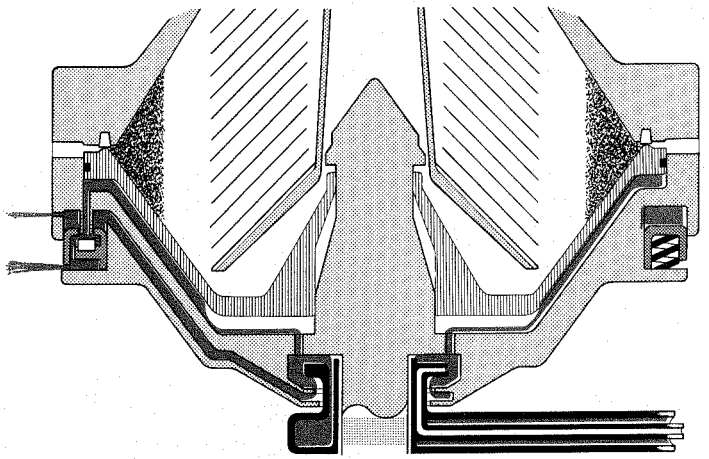
TOTAL SLUDGE DISCHARGE and COMBINED PROGRAMME



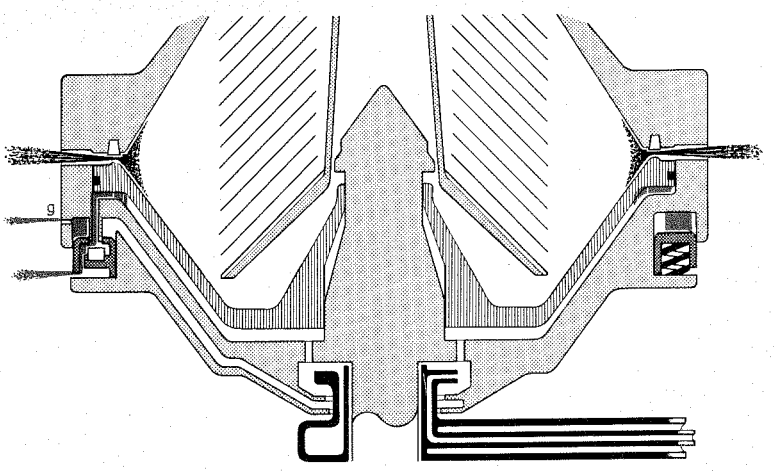
The sludge discharge takes place through a number of slots in the bowl wall. Between discharges these slots are closed by a large valve slide, the sliding bowl bottom, which constitutes an inner, sliding bottom in the separating space. The sliding bowl bottom is forced upwards against a seal ring by the liquid pressure acting on its underside. This pressure builds up during the rotation because of the centrifugal force and increases with the distance from the axis of rotation. The operating liquid exerts an upwards 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). Operating liquid is supplied on the underside of the bowl and evaporation or leakage of operating liquid is continuously made up for. This is done through a paring disc device under the bowl which maintains a constant horizontal operating liquid level (radius R_3) under the bowl, as its pumping effect neutralizes the static pressure from the supply.

(cont.)

(Sludge Discharge ... page 2)



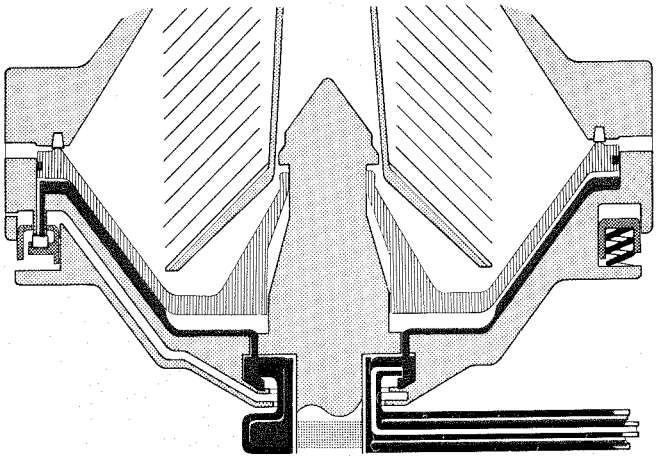
Operating liquid is now supplied through the outer wider tube so that it flows over the lower edge of the paring chamber (radius R_4) and continues through a channel out to the upper side of a sliding ring, the operating slide. Between discharges the operating slide is pressed upwards by coil springs. It is now forced downwards by the liquid pressure, thereby opening discharge valves from the space below the sliding bowl bottom so that the operating liquid in this space flows out.



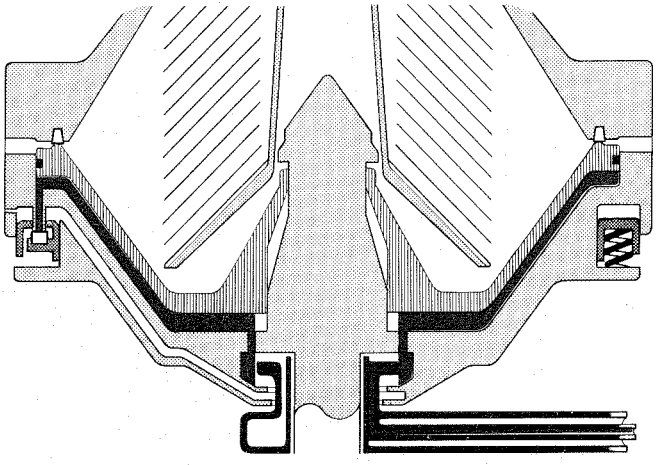
When the pressure exerted by the operating liquid against the underside of the sliding bowl bottom diminishes, the latter is forced downwards and opens so that the sludge is ejected from the bowl through the slots in the bowl wall. The operating liquid on the upper side of the operating slide flows out through a **nozzle (g)**. This nozzle is always open but so small that the outflow is negligible in view of the rapid inflow according to the upper illustration.

(cont.)

(Sludge Discharge --- page 3)



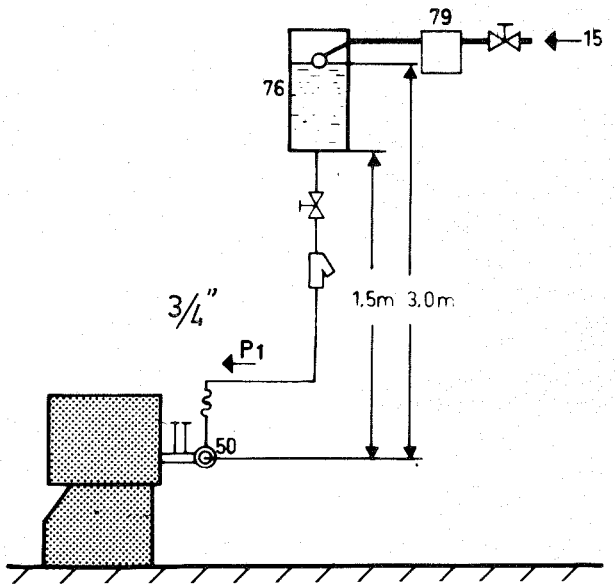
The coil springs again force the operating slide upwards, thus shutting off the discharge valves from the space below the sliding bowl bottom. Operating liquid is supplied through the outer, wide tube, but only enough to flow to the space below the sliding bowl bottom and force the latter upwards so that the bowl is closed. (If too much liquid is supplied, it will flow into the channel to the operating slide and the bowl will open again.)



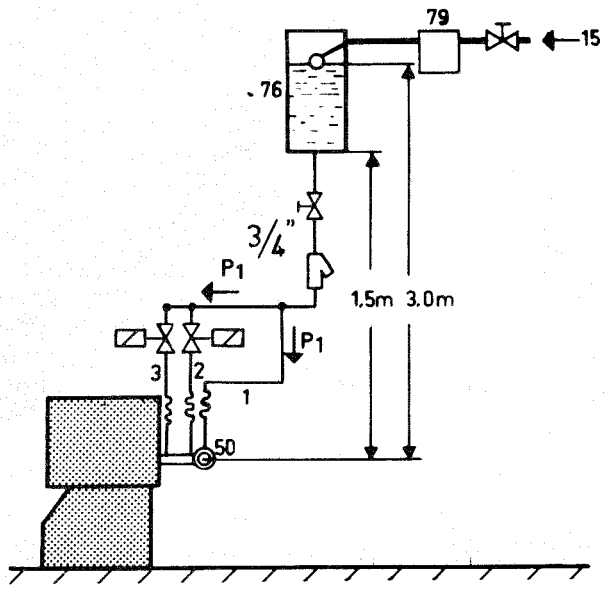
The outer, wider inlet is now closed while the inner, narrower one is open. The paring disc device counter-balances the static pressure from the operating liquid supply.

The situation is identical with that shown in the first illustration of the series but for the difference that the sludge discharge cycle is now accomplished.

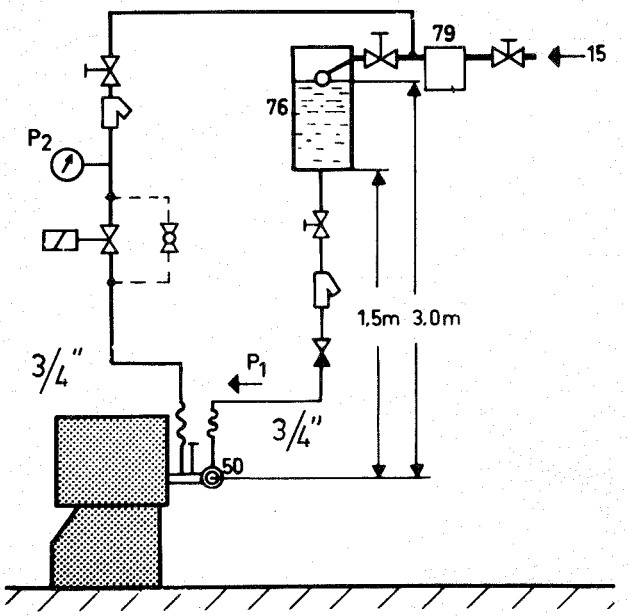
A



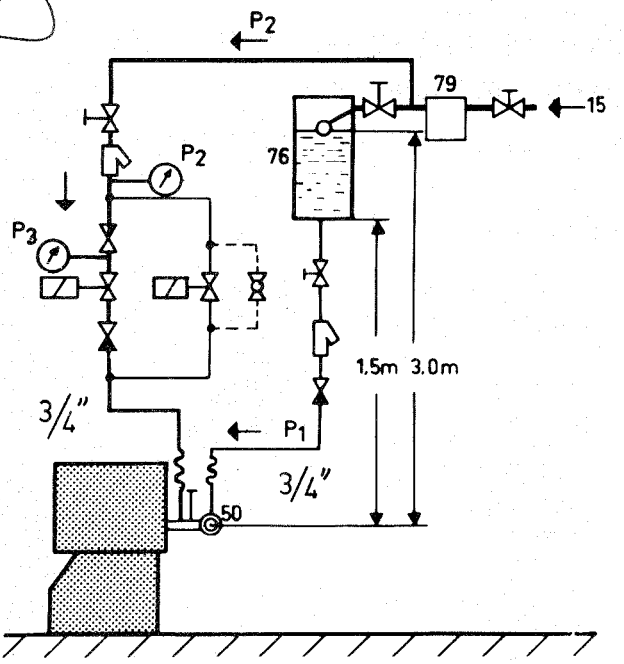
B



C



D



Valve

Check valve

Pressure regulating valve

Solenoid valve

By-pass with cock

Compensator, e.g. rubber hose

Strainer

Pressure gauge

15 Operating liquid
50 Control valve
76 Operating liquid tank
79 Dehardening filter

p1=0.15-0.30 kg/sq.cm (2.2-4.2 psi)
p2=1.5-3.0 kg/sq.cm (22.0-42.0 psi)
p3=0.3-0.7 kg/sq.cm (4.3-10.0 psi)

OPERATING LIQUID SYSTEM

The figure shows four examples of operating liquid supply.

A = machine with bowl for total discharge; manual control.

B = machine with bowl for total discharge; automatic or manual control.

C = machine with bowl for partial discharge (with level ring) or rapid total discharge; automatic control.

D = machine with bowl for combined programme (combined partial and total discharge); automatic control.

The actual type of bowl discharge appears from the perspective drawing in chapter I, "Bowl", and indicates which one of the above examples that is applicable in the present case.

Operating liquid

Pure, soft water can be used as operating liquid. Hard water involves the risk of lime deposits, which may cause obstruction of the narrow channels in the operating liquid system and thus interruption of the service. The demands on the softness of the water increase with higher operating temperature, since lime precipitation is more liable to occur at higher temperatures. Addition of a dehardening agent or provision of a dehardening filter in the operating liquid line will prevent lime precipitation.

Operating liquid tank

The operating liquid tank, which should be made of copper or stainless steel and hold 50-100 lit. (11-22 Imp.galls), must be placed so that the liquid level will be lying within the height measurement limits above the control valve stated in the figure. In case the head room is too small, the tank may be replaced by a reducing valve or the like. This may, however, be less reliable than the tank. Besides, the tank system saves liquid during operation, since the back pressure of the control paring disc is balanced in an open system.

Bowl for total discharge

When the machine is equipped with bowl for total discharge and the discharge should be controlled manually (by means of control valve), the operating liquid system must be arranged as shown in Fig. A.
pl – see figure.
Liquid at pressure pl initiates all functions according to the setting of the control valve.
For automatic control, two solenoid valves are added to the system. These solenoid valves are provided in the conduits to the two inner connections on the control valve as shown in Fig. B.
As regards further equipment see directions for automatic control.
If it is wanted to change from automatic control to manual control, simply disconnect the automatic control device, whereupon the sludge discharge can be controlled in the usual manner by means of the control valve.
pl – see figure.
Liquid supplied through conduit 1 closes the bowl when starting – this pipe must be shut off during operation.
Liquid supplied through conduit 2 keeps the bowl closed during operation – the solenoid valve must close when the solenoid valve in conduit 3 opens.
Liquid supplied through conduit 3 opens and closes the bowl during operation – when the solenoid valve closes, the solenoid valve in conduit 2 must open.

Bowl (with level ring) for partial discharge

The discharge mechanism of these bowls is designed for automatic control – see directions for automatic control. The system is arranged as shown in Fig. C.

Bowl for rapid total discharge

In an emergency, for instance if the automatic system fails, manual control is possible – see below.
pl – see figure.
p2 – see figure.
Liquid at pressure pl closes the bowl when starting and keeps the bowl closed during operation all according to the setting of the control valve.
Liquid at pressure p2 opens and closes the bowl at sludge discharge.

Bowl for combined programme

The discharge mechanism of this bowl is designed for automatic control with possibility of setting to various programmes of total and partial discharges — see directions for automatic control. The system is arranged as shown in Fig. D.
In an emergency, for instance if the automatic control device fails, manual control is possible but will give total discharges only.

p1 — see figure.
p2 — see figure.
p3 — see figure.
Liquid at pressure p1 closes the bowl when starting and keeps the bowl closed during operation, all according to the setting of the control valve.
Liquid at pressure p2 opens the bowl for total discharge.
Liquid at pressure p3 opens the bowl for partial discharge and closes the bowl after partial and total discharge. By means of the pressure-regulating valve the liquid flow quantity and thus the degree of partial discharge can be regulated.

MANUAL CONTROL OF AUTOMATICALLY OPERATED LIQUID SYSTEM

To allow manual control of the systems shown in Figs. C and D the solenoid valve in the conduit for high-pressure liquid must be by-passed.
Preferably, a manually controlled sludge discharge is carried out as follows: shut off the feed of process liquid and set the control valve to position 2 — open the valve in the by-pass and close it again immediately after accomplished discharge — set the control valve to position 3 and wait till the indication shows that the bowl is closed — set the control valve to position 4 and open for feed of process liquid.

Note

Manual control may necessitate a shortening of the interval between discharges.

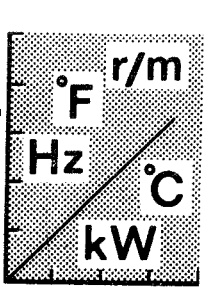
FULLY AUTOMATED SYSTEM

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.



DATA

Supplementary particulars (such as weight data) are contained in the technical information sent to you in connection with the purchase of the machine.

POWER REQUIRED

Suitable motor output for throughflow up to 8 m^3/h (1 760UK gal/h): 7.5 kW (10 hp).
Suitable motor output for throughflow above 8 m^3/h (1 760 UK gal/h): 11 kW (15 hp).
Starting power: 10 kW (14 hp).
Working power at max. back pressure (depending on throughflow)i. e.: 5 m^3/h - 6.3 kW, 10 m^3/h - 7.8 kW.

SPEED

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

Worm Wheel Shaft	1420 - 1500	1700 - 1800
Drive (motor)	1420 - 1500 *	1700 - 1800 **
Tachometer	1420 - 1500	1700 - 1800
Revolution counter	118 - 125	142 - 150

* with direct coupling:4-polar, 50 c/s A.C. motor or D.C. motor.

** with direct coupling:4-polar, 60 c/s A.C. motor.

LUBRICATING OIL for Worm Gear Housing

Oil type: Depending on motor size and working temperature according to specifikation in chapter H.
Oil charge for filling to operating level: 8 l (1.76 UK gal).

RUNNING-UP TIME

From stand-still to full bowl speed: approx. 2 min.

DISCHARGE PRESSURE

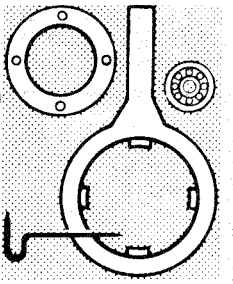
Max. permissible back pressure: 5 kg/cm^2 (71.12 psi).
Min. back pressure to prevent air penetration: 3.8 kg/cm^2 (54.10 psi).

FEED PRESSURE

0.1 - 0.3 kg/cm^2 (1.42 - 4.27 psi).

OPERATING LIQUID

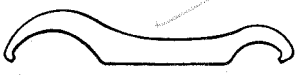
Operating liquid system and pressure -- depending on bowl type — see Technical Information, chapter B.



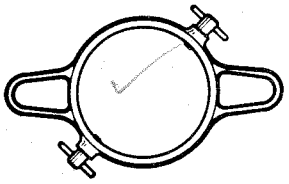
SET OF TOOLS

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 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.

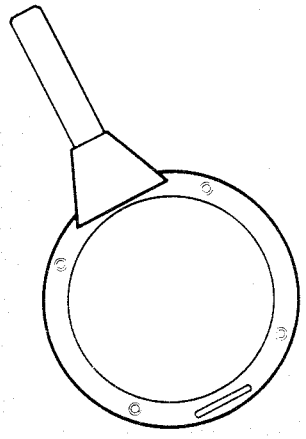
TOOLS for BOWL, INLET and OUTLET



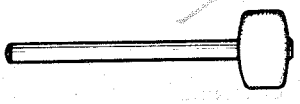
Hook spanner for coupling nuts
-- 69696



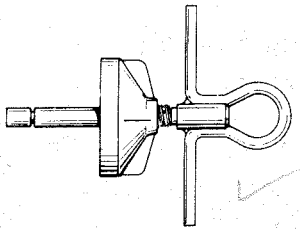
Spanner for small lock ring
-- 72625



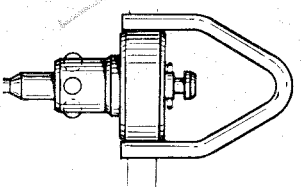
Spanner for large lock ring
-- 72236



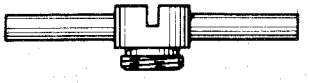
Tin mallet
-- 64324



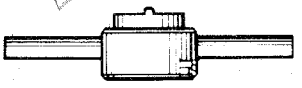
Lifting tool for bowl hood
-- 72621



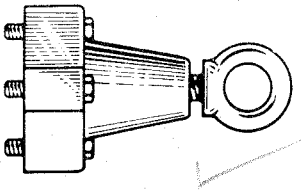
Lifting tool for distributor
-- 74387



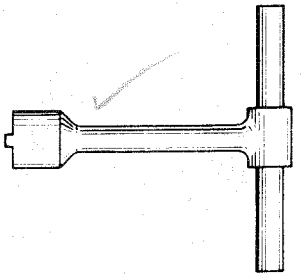
Lifting tool for distributing cone. Spanner for cap nut -- 516773-80



Lifting tool for sliding bowl bottom
-- 72623

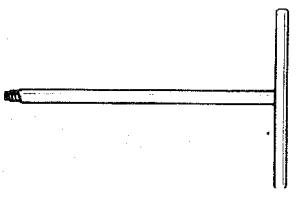


Lifting tool for bowl body
-- 72712



Only for bowl for combined programme:

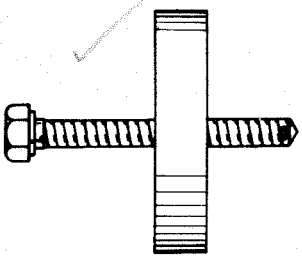
Pin spanner for valve seat and seat for valve plug
-- 519370-80



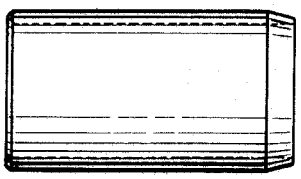
Only for bowl for partial discharge:

Lifting tool (2) for level ring
-- 516866-80

TOOLS for POWER TRANSMISSION



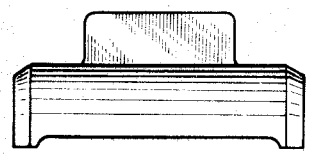
Only for machine with clutch coupling
Driving-off tool for nave
-- 523249-80



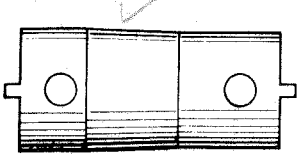
Only for machine with clutch coupling
Driving-on sleeve for ball bearings
-- 65374

Extractor bolt (2) for seal washer.
Guide bolt for motor
-- 70300

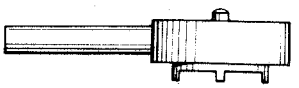
TOOLS for BOWL SPINDLE



Driving-off tool for ball bearing of top bearing
-- 70293

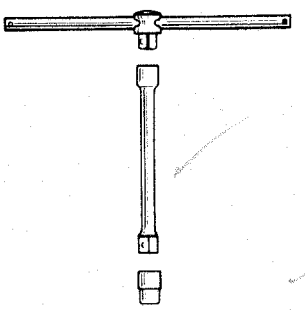


Pin spanner for round nuts
-- 72719



Pin spanner for deflector
-- 73101

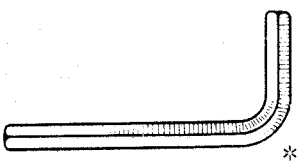
GENERAL TOOLS



T-handle
-- 72243

Extension rod
-- 72244

Socket (2)
15 mm -- 72245
21 mm -- 72246
9/16" -- 73376**



Hexagonal hole wrench
10 mm -- 66769
14 mm -- 66884**
NV 1/2"--42351

** only for UNC.

The set of spares listed below includes only parts belonging to the standard equipment of the machine. Make it a rule always to keep consuming articles in stock. Avoid incorrect ordering— observe the ordering routine described in chapter A.

INLET. OUTLET (comp. chapter I)

223402-25	Seal ring for frame ring
71402	Seal ring for frame hood
71068	Packing (2) for regulating valve

BOWL (comp. chapter I)

71181	Spring (5)
-	Bowl disc - see Bowl
-	Nozzle - see Bowl
-	Valve plug (3) - see Bowl
520243-1	Valve seat *
517774-10	Packing for cap nut
517774-11	Packing for lock ring
	Seal rings:
71301	for bowl hood
71351	for bowl hood (2)
67587	for operating slide (2)
14238	for sliding bowl bottom (2)
71350	for sliding bowl bottom (2)
223406-11	for valve seat (3)*

CLUTCH COUPLING. WORM WHEEL SHAFT (comp. chapter P)

71627	Friction pad (2) incl. 6 screws No. 8341
223412-21	Seal ring for seal washer
73547	Lip-seal ring

BOWL SPINDLE (comp. chapter P)

	Springs:
9699	for axial buffer (12)
70219	for top bearing (6)
	Seal rings:
65594	for spring casing
64706	for throw-off collar
223402-11	for protecting cap

FRAME PARTS (comp. chapter S)

	Seal rings:
73632	for distributing ring (2) (paring disc)
38259	for distributing ring (2) (paring disc)
64708	for control valve
71401	for hood (paring disc device)
60739	for control valve
38710	for tachometer shaft
190611	for cyclone
	Packings:
68937	for control valve (3)
71360	for paring disc device
71362	for paring disc device
65227	Brake lining incl. 3 screws No. 8341
518859-82	Touch-up paint (tin 1/8 Litre)
515482-36	Strainer inset
537086-02	Molybdenum disulfide paste

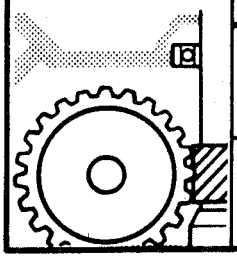
* Only for bowl for combined programme.

SPECIAL SPARE PART NUMBERS

Listed below are some spare part numbers which for practical reasons have not been inserted in the chapter where they properly belong.

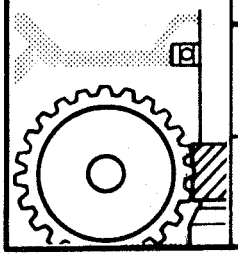
Power transmission (comp. chapter P)

Machine with 7.3 kW (10 hp) motor:



	Speed of worm wheel shaft in r/m	1420 - 1500	1700 - 1800
	Worm wheel	528100-89	528100-88
	Friction block (2) with pad and screws	43705	74315

Machine with 11 kW (15 hp) motor:



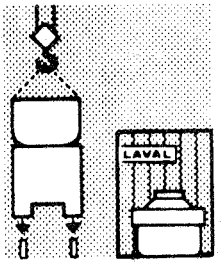
	Speed of worm wheel shaft in r/m.	1420 - 1500	1700 - 1800
	Worm wheel	528100-89	528100-88
	Friction block (3) with pad and screws	74313	71623

The speed of the worm wheel shaft is indicated on the type plate.

Always check that the old worm gear part and the new one have the same number of teeth.

With D.C. or A.C. 50 c/s operate the machine at a speed of 1420 - 1500 r/m.

With A.C. 60 c/s operate the machine at a speed of 1700 - 1800 r/m.



INSTALLATION

This chapter deals with the mounting of the machine and with the actions to be taken before the first start. The ALFA-LAVAL representative is always glad to provide further advice and information.

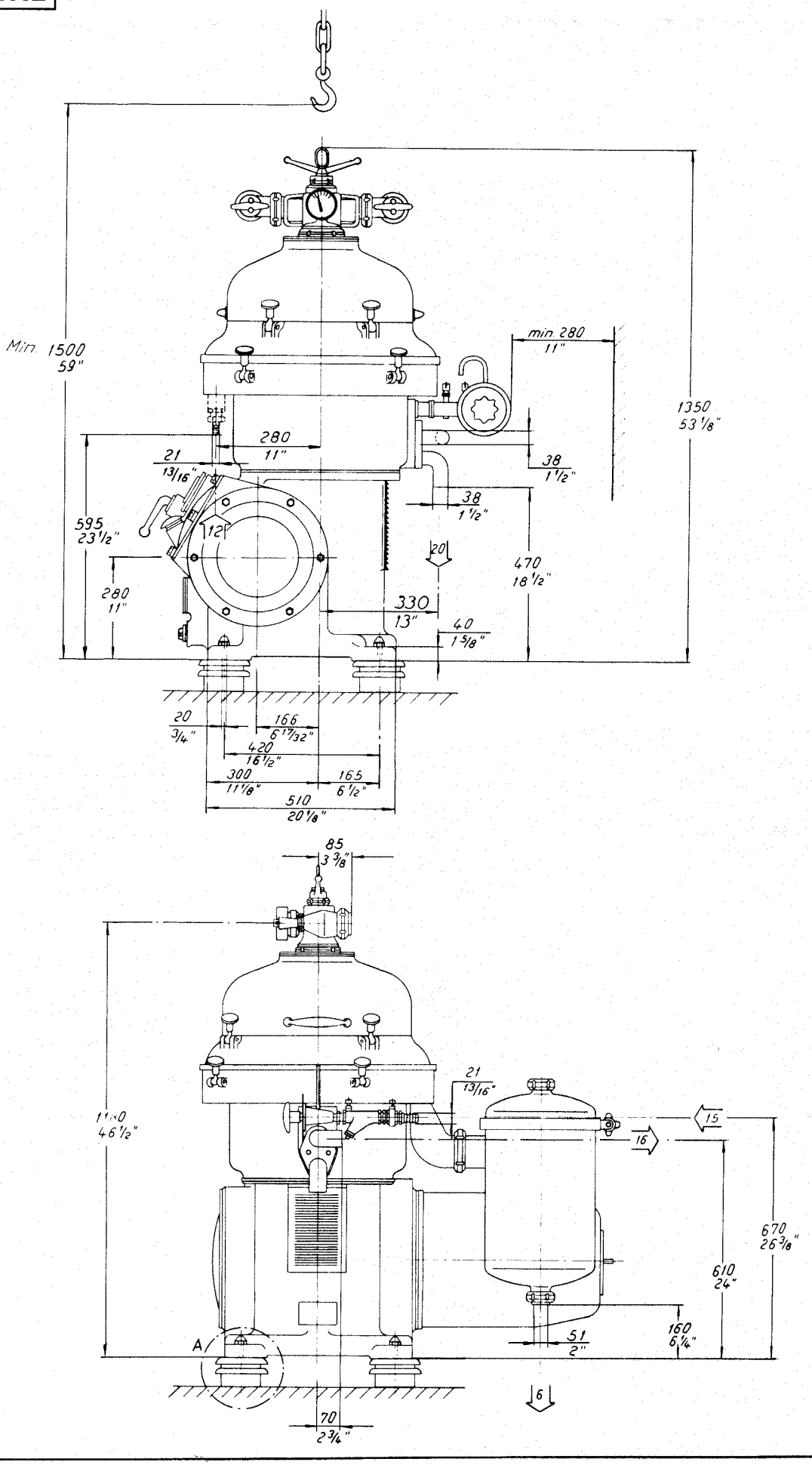
DIMENSIONED DRAWING

All measurements needed for the installation are given in the dimensioned drawing, the reference numbers of which are explained below. (The table applies to several types of separator and thus comprises more reference numbers than are found in the drawing.)

1 Feed
2 From heater
3 To heater
4 Light effluent
5 Heavy effluent
6 Solid effluent
7 Overflow liquid
8 Drain
9 Auxiliary liquid for liquid seal
10 Auxiliary liquid for liquid seal
11 Auxiliary liquid
12 Flushing liquid
13 Self-emptying
14 Air or other gas (except steam)
15 Operating liquid
16 Operating liquid
17 Cooling air
18 Cooling air
19 Ventilation
20 Ventilation
21 Return flow
22 Electric connection
23 Effluent
24 Raw material
25 Treated raw material
26 Steam
27 Waste liquid
28 Flushing liquid
29 Reagent
30 Flushing liquid
31 Barrier liquid
32 Barrier liquid
33 Barrier liquid
34 Barrier liquid
35 Waste liquid
36 Ventilation
37 Air or other gas (except steam)
38 Water feed
39 Outlet for bowl emptying
40 Inlet
41 Outlet
42 Concentrate
43 Operating liquid
44 Ventilation
45 Air or other gas (except steam)
46 Waste liquid
47 Constant pressure valve
48 Flow meter
49 Shut-off valve
50 Control valve
51 Flow indicator
52 Sight glass
53 Electric connection
54 Brake handle
55 Revolution counter
56 Oil filling screw
57 Oil gauge glass
58 Oil drain screw
59 Waste liquid
60 Shut-off valve
61 Feed pump
62 Strainer
63 Light liquid feed
64 Heavy liquid feed
65 Light effluent
66 Heavy effluent
67 Barrier liquid
68 Air or other gas (except steam)
69 Protective gas
70 Protective gas
71 Electric connection
72 Cream
73 Thermometer
74 Strainer
75 Steam preheater
76 Operating water tank
77 Sludge tank
78 Sludge pump
79 Softening filter
80 Condensation water
81 Interface control
82 Pump for feed and discharge
83 Discharge pump
84 Three-way valve
85 Plate heat exchanger
86 Skimmilk
87 Whey
88 Bowl emptying
89 Draw-off
90 Nozzle flow
91 Flow-control valve
92 Flushing liquid
93 Barrier liquid
94 Check valve
95 Pressure regulator
96 Pressure gauge
97 Fixed throttling
98 Pilot liquid
99 Indicator gas
100 Cooling liquid
101 Compressed air
102 Vibration switch
103 Oil level switch
104 Protective gas
105 Protective gas

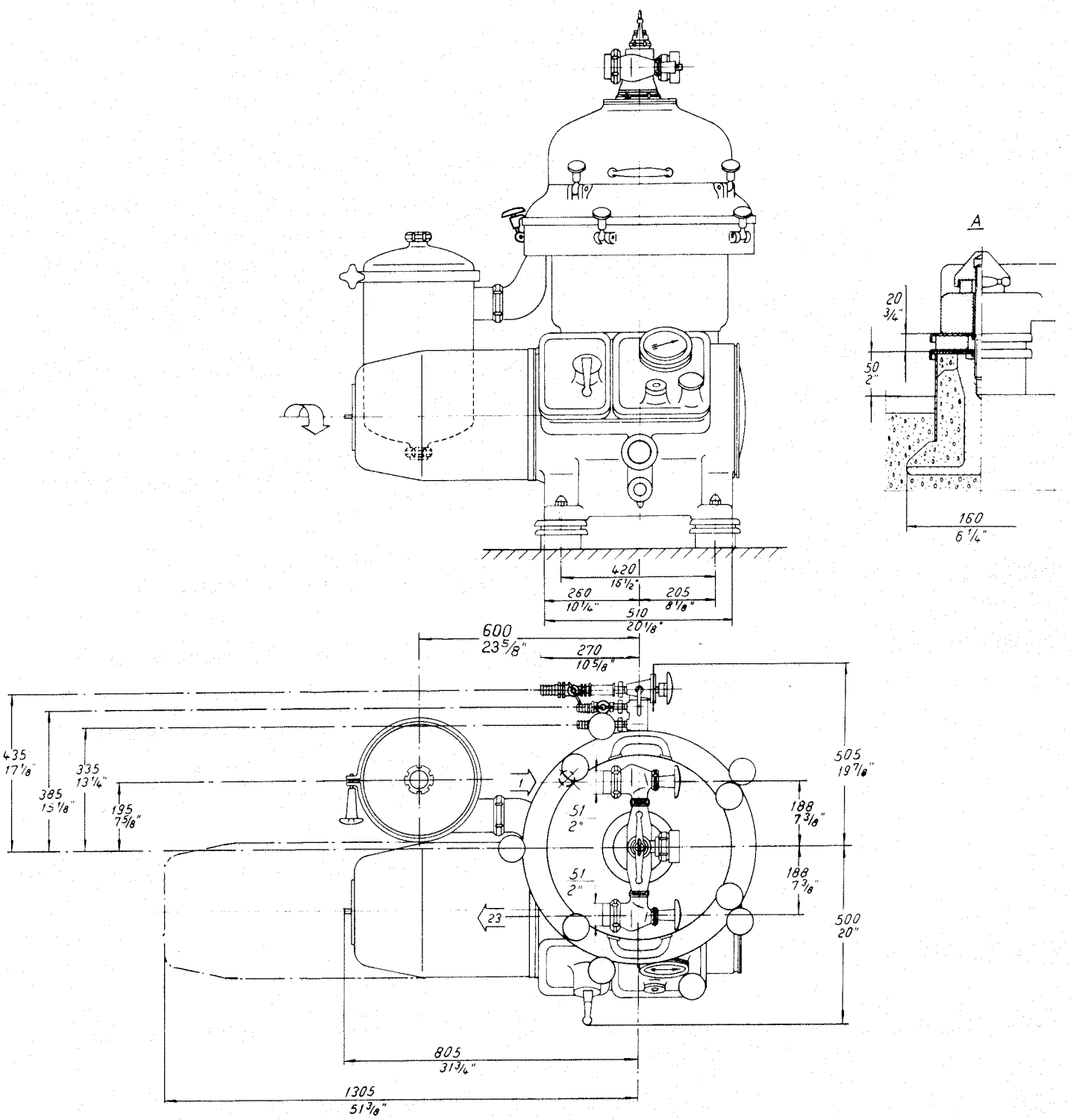
ALFA-LAVAL

G


Min. 1500
59"
min. 280
11"
1350
53 1/8"
280
11"
21
13/16"
38
1 1/2"
38
1 1/2"
595
23 1/2"
112°
20
470
18 1/2"
280
11"
330
13"
40
1 5/8"
20
3/4"
166
6 17/32"
420
16 1/2"
300
11 1/8"
165
6 1/2"
510
20 1/8"
85
3 3/8"
21
13/16"
1170
46 1/2"
15
16
670
26 3/8"
610
24"
160
6 1/4"
51
2"
A
6
70
2 3/4"

ALFA-LAVAL

G


A
20
3/4"
50
2"
160
6 1/4"
420
16 1/2"
260
10 1/4"
205
8 1/8"
510
20 1/8"
600
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270
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435
17 1/8"
385
15 1/8"
335
13 1/4"
195
7 5/8"
505
19 7/8"
188
7 3/8"
51
2"
188
7 3/8"
51
2"
500
20"
805
31 3/4"
1305
51 3/8"

UNPACKING	When unpacking take care not to scratch metallic or painted surfaces. Place the bowl parts on a soft base (such as wood or rubber). Check by means of the packing list that all parts have been unpacked.
FOUNDATION	This must be plane, solid and vibrationless. The measurement to the nearest wall must not be smaller than the minimum stated in the dimensioned drawing. Make sure that pipes, pumps and other apparatuses are installed so as to be easily accessible for inspection.
FRAME ERECTION	See chapter S. Necessary measurements are found in the dimensioned drawing.
LUBRICATION	Never start the machine unless the worm gear housing contains oil. See chapter H.
HEIGHT ADJUSTMENT	Check this according to directions in chapter L.
BOWL.INLET.OUTLET	Dismantle and (if necessary) clean the parts in contact with liquid – see chapter I . Make sure that the seal rings are mounted (in some cases they are packed separately in the packing case). If the cap nut sits on the bowl spindle, unscrew it (clockwise) before mounting the bowl body. Before running, the bowl must be assembled as directed in chapter I.
MOUNTING the MOTOR	See chapter R.
CONNECTION to MAINS	Connect the motor to the mains so that the bowl will rotate CLOCKWISE.
Note.	The machine must never be started unless the bowl is placed on the spindle and the worm gear housing contains the prescribed quantity and quality of lubricating oil. If the machine is to be run up to full speed, the bowl must be fitted on the bowl spindle and the hood be clamped.

PIPINGS

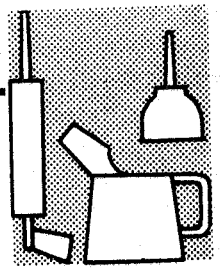
Fit the pipes and hoses so that the inlet and outlet connections of the machine are not subjected to strain. Tightweld (hard-solder) internal pipe ends in connection sleeves so as to avoid dirtcollecting pockets. This is particularly important in plants on which high hygienic demands are made, such as in food industry.
Grind and polish all welding seams (hard-solderings) carefully.
All attachements should be made so as to allow variations in length and to prevent transmission of strains and vibrations.
Blow or flush out each section of the piping after mounting. Also flush out the whole pipe system after installation so that metallic ashes and other impurities are removed entirely and cannot get into the machine, pumps or other apparatuses.

CHECKING

Examine the installation before putting the machine into service. Check particularly:
o That the worm wheel shaft rotates at prescribed speed and that the bowl rotates clockwise
o That the directions given under the heading BEFORE STARTING in chapter K have been observed.

CLEANING PLACE

A table, a stand or the like affording sufficient place for the bowl and the special tools for the latter should be provided, preferably in the immediate proximity of the machine.



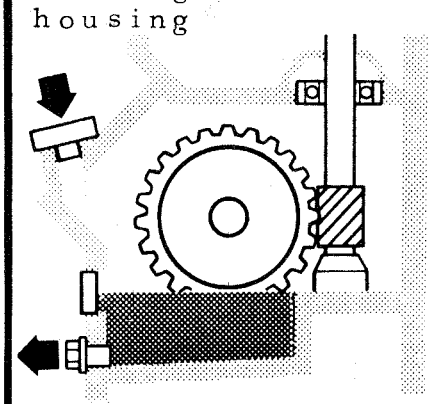
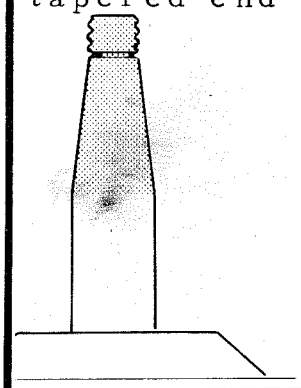
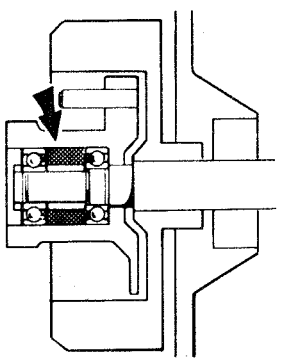
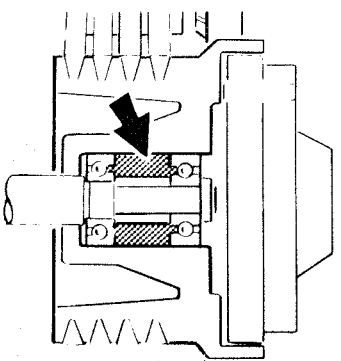
LUBRICATION

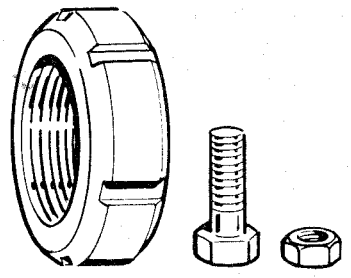
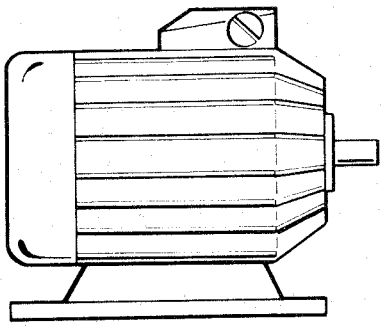
It should be understood that the mentioning of certain brands as examples of a suitable lubricant does not involve an exclusion of other brands with equivalent properties.

ABREVIATIONS – see chapter A.

The machine is delivered without oil in the worm gear housing. It must NOT be started unless oil in the quantity and of the quality prescribed has been supplied. A change of the separating temperature can make it necessary to replace the oil by oil of a different type.

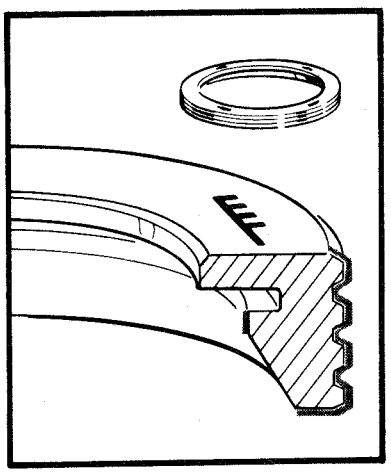
Lubricants, oil as well as grease, must be kept in clean, closed cans to prevent penetration of dust and moisture and to reduce the oxidizing effect to the air as far as possible. The storing room should be dry and cool.

LUBRICATION POINT	LUBRICANT	WHEN
Worm gear housing 	At ambient temp. 0-10°C and separating temp. 0-15°C = SAE 30. At ambient temp. lowest 10°C and separating temp.: 0-15°C = SAE 40 15-95°C = SAE 50 Oil quantity: 8 lit. (1.75 UK gal)	Filling before first starting. First oil exchange after 300 hours' operation, then after every period of 1500 hours' operation. In seasonal operation before every operating period. Cleaning before exchange. Oil level in upper half of the gauge glass.
Bowl spindle tapered end 	Molybdenum disulfide paste. Oil Grease Rust preventive	Always before putting the bowl body on the spindle, however at least once a month. Apply sparsely to avoid slipping but sufficiently to avoid seizing. At service interruptions with bowl removed.
Clutch coupling nave 	Anyone of the recommended ball bearing greases.	Renewal of grease once a year, as well as cleaning of bearings and bearing seats. Grease the bearings and fill the space in the bearing seat to approx. one third.
Nave of V belt and flat belt gearing 	Anyone of the recommended ball bearing greases.	Renewal of grease once a year, as well as cleaning of bearings and bearing seats. Grease the bearings and fill the space in the bearing seat to approx. one third.

LUBRICATION POINT	LUBRICANT	WHEN
Other machine parts 	Parts of stainless steel: Molybdenum disulfide grease or equivalent. Parts of steel: Oil as recommended for the worm gear housing.	Before every mounting. Observe, however, that the conveyor pulley must NEVER be lubricated.
Motor 	Follow motor supplier´s recommendations.	Follow motor supplier´s recommendations.

Bowl

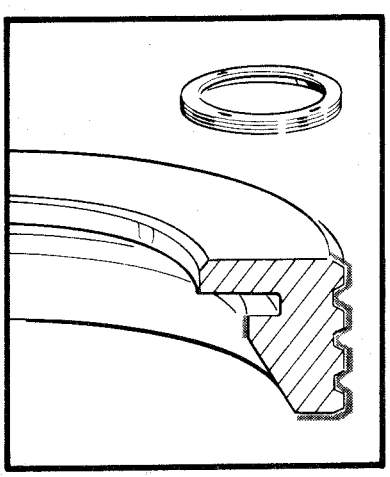
Before every assembly wipe clean the threads of lock rings, bowl body and bowl hood as well as the contact surfaces between these parts. If necessary, they should be cleaned with a clean cloth moistened with cleaning agent (see chapter L). After wiping, lubricate them according to one of the alternatives below.



Alternative 1

When the bowl lock ring is made of stainless steel or monel metal and the bowl body and/or the bowl hood are of stainless steel, the lock ring carries the symbol shown in the adjoining drawing. The following lubrication procedure is recommended:

1. PRIMING with molybdenum disulfide paste. Rub or brush in the paste sparsely all over the surface – follow the directions printed on the wrapping, if any. Always prime new parts as well as parts which have lost their previously applied primer due to e.g. thorough cleaning or machining.
2. LUBRICATION with molybdenum disulfide grease after priming, and before assembly after routine dismantling as well. Polyethylene-castor oil paste, polytetrafluoroethylene-castor oil paste or some other equivalent lubricant can be used for machines emploied in the food industry or where dark-coloured lubricants are unsuitable.



Alternative 2

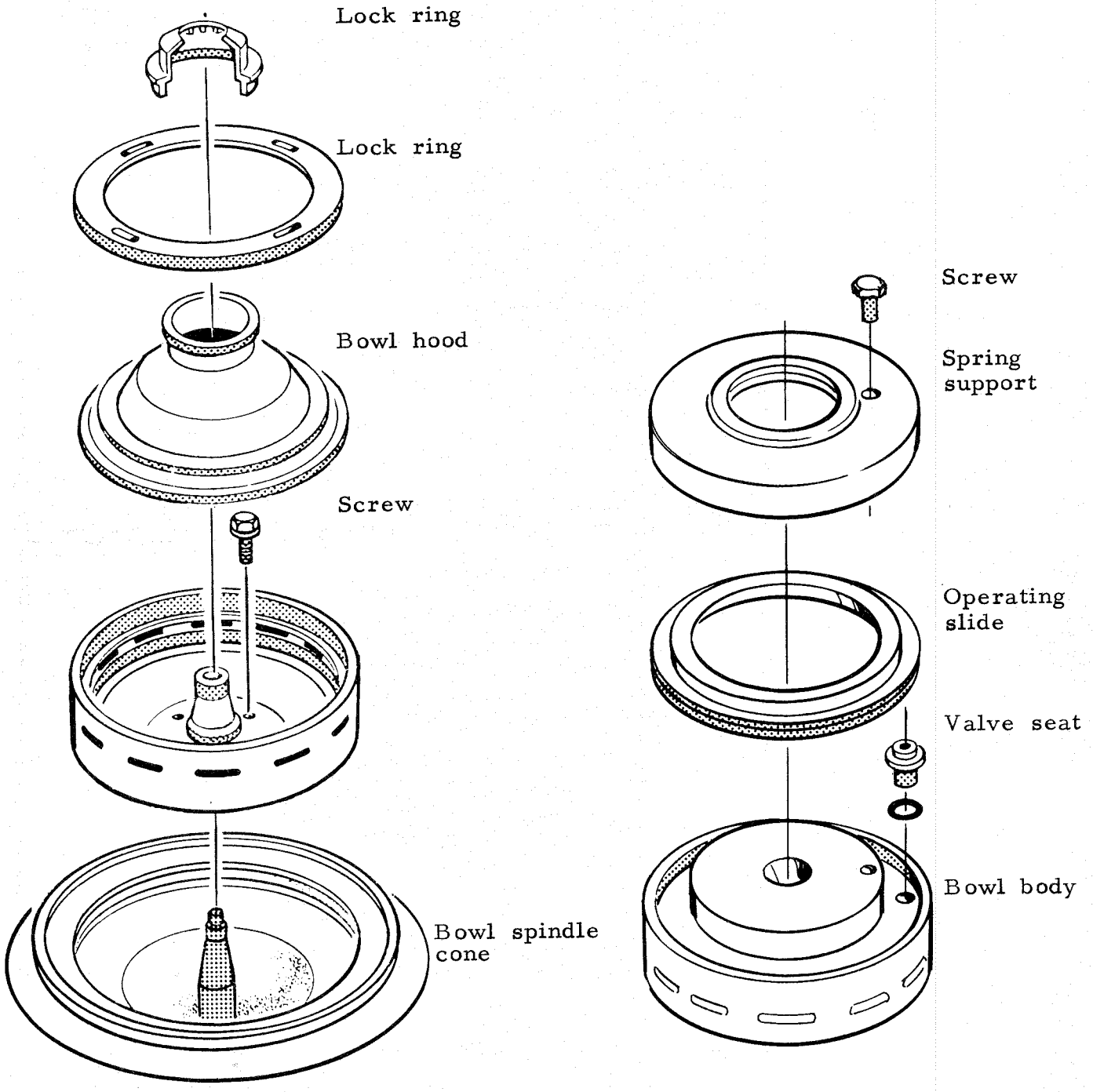
When the lock ring is made of carbon steel priming is normally unnecessary, lubrication alone will do – for lubricant see above.

If practical experience shows that no inconveniences occur, consistent grease, oil as prescribed for the worm gear housing, castor oil, tallow or liquid paraffin may be used as lubricant.

However, if a tendency to seizing is observed, alternative 1 must be applied.

(Lubrication Directions, page 3)

Bowl (cont.)



All surfaces spotted on the drawing must be cleaned and lubricated before the parts are mounted.
Notify the special lubricating directions on foregoing page.

LUBRICANTS

Lubricating oil for worm gear housing

For choise of lubricating oil type follow the recommendations given in the lubrication schedule.
The oil types mentioned in the table must meet the demands on quality stated below. When in doubt consult an authorized ALFA-LAVAL representative.
Always use a high grade lubricating oil.

SAE-oils

Oil type	Max. viscosity		Min. viscosity index	Pour point
	SSU at 210°F	°E at 100°C		°C (°F)
SAE 10W	210 at 100°F	1,5-2 at 50°C	-	-20 -4
SAE 20	45-58	1,4-1,8	80	-10 +14
SAE 30	58-70	1,8-2,1	80	-10 +14
SAE 40	70-85	2,1-2,5	80	-10 +14
SAE 50	85-110	2,5-3,2	80	-10 +14

EP-oils

	Examples
EP - 1	BP Energol Gear 300 EP Caltex Meropa Lubricant 3 Gulf EP Lubricant 75 Mobil Compound DD Shell Macoma 72
EP - 2	BP Energol Gear 425 Caltex Meropa Lubricant 3 Gulf EP Lubricant 115 Mobil Compound EE Shell Macoma 75
EP - 3	Mobil Mobilube HD 80 - 90 Gulf Transgear EP 80 - 90

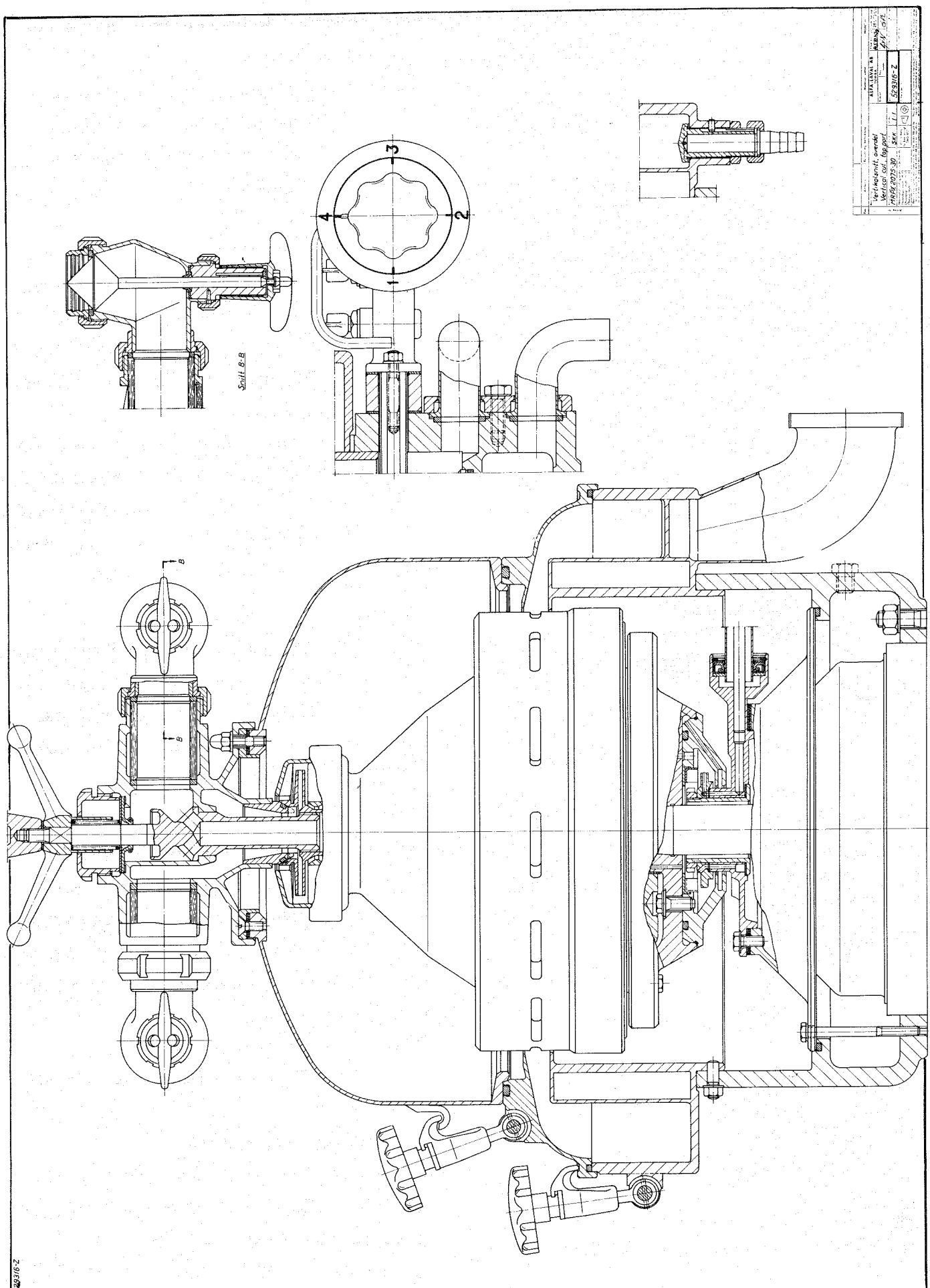
Observe

- Special Diesel cylinder lubricating oils containing amine type additives (generally intended for heavy-oil-burning marine diesel engines) and "multigrade" motor-car lubricating oils should not be used.
- Never intermix oils of different makes, as they may contain different components.

(Lubricants, page 2)

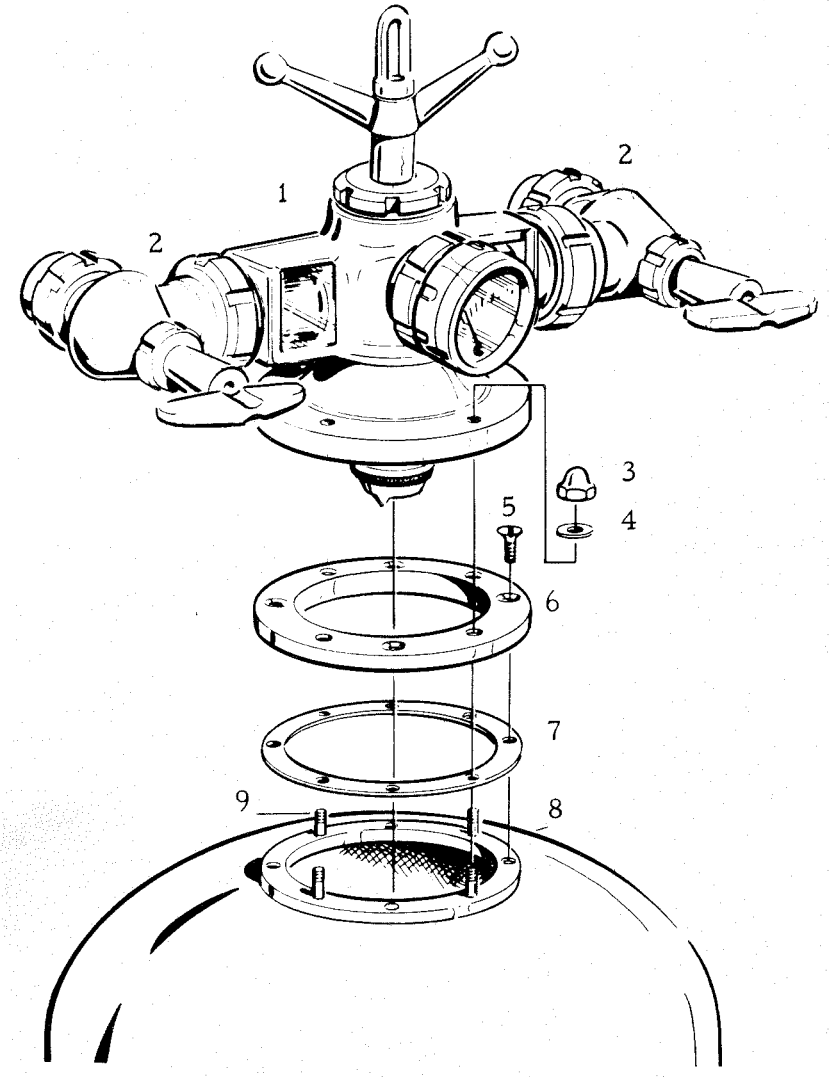
Molybdenum disulfide paste	Examples: Molykote Paste G Rocol Anti-Scuffing Paste
Molybdenum disulfide grease	Examples: Molykote BR-2 Molykote BR-3 Polyethylene-castor oil paste or polytetrafluoro ethylene-castor oil paste is recommended for machines used in the food industry or where dark-coloured lubricants are unsuitable.
Ball bearing grease	Always use a high grade lithium soap type ball bearing grease according to NLGI-class 2 or 3 and usable at temperatures above 100°C (212°F). Drop point about 180°C (356°F) according to ASTM D 566-44. Examples: BP Energrease 2 or 3, Caltex Starfak premium Grease 2 or 3, Castrol Spheerol AP Grease 2 or 3, Esso Beacon Grease 2 or 3, Gulfcrown Grease 2 or 3, Mobilux Grease 2 or 3, Shell Alvania Grease 2 or 3.
Lubricating grease. Consistent grease.	Always use one of the recommended ball bearing greases.
Oil	Use the oil recommended for the worm gear housing

ALFA-LAVAL



529316-Z
(4183-6)

FRAME HOOD and PARTS MOUNTED ON IT



Parts list

1 Connection housing
-- see chapter X
2 Regulating valve (2)
-- see chapter X
3 Cap nut (4)
-- 72947
4 Washer (4)
-- 223101-34
5 Screw (4)
-- 2212608-3
6 Guide ring
--- 527971-1
7 Height adjusting ring (1-7)
-- 528096-1
8 Frame hood
-- 74566, 74549*
9 Stud bolt (4)
-- 67912

* for purification or concentration

Dismantling

Note that the bowl must come to rest before dismantling is commenced. To render the bowl accessible e.g. for cleaning dismantle as follows:

- Loosen the valve couplings at the connection housing.
- Turn the handle CLOCKWISE till it recoils by spring action — the paring disc in the bowl is unscrewed.
- Undo the hinged bolts and lift off the frame hood.

The guide ring should be removed only when the height position of the paring disc has to be adjusted. Do not dismantle the connection housing unless it is necessary. For bowl dismantling see Bowl.

Height adjustment

Check the height position of the paring disc before the first starting as well as after exchange of parts that can affect the height position — see chapter L, Height Adjustment.

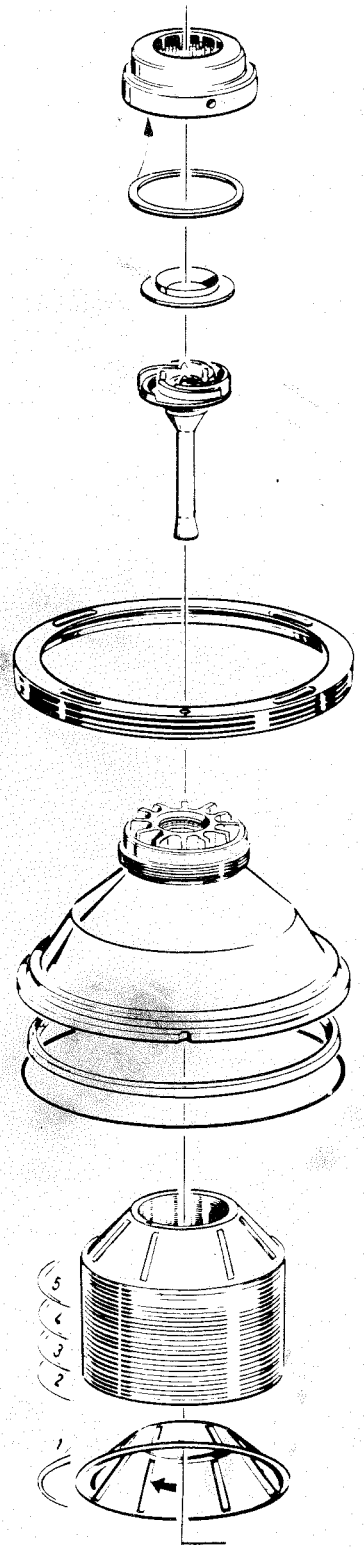
Assembly

Clean all parts. Carefully lubricate threads and contact surfaces. Ascertain particularly that the thread of the inlet pipe is well lubricated and that the seal ring is inserted and free from defects.

Before using the machine:

- Clamp the frame hood with the hinged bolts.
- Connect the valves.
- Press down the handle and screw it ANTI-CLOCKWISE till the pipe thread engages the paring disc thread. Let up the handle and tighten it firmly.

CLARIFIER BOWL for COMBINED PROGRAMME -- 524246-81



Lock ring
-- 524230-2
(left-hand thread)

Packing
-- 517774-11

Paring disc,
top part**
-- 74650

Paring disc,
bottom part**
-- 524231-1

Lock ring *
-- 524229-03
(left-hand thread)

Bowl hood *
-- 524227-1

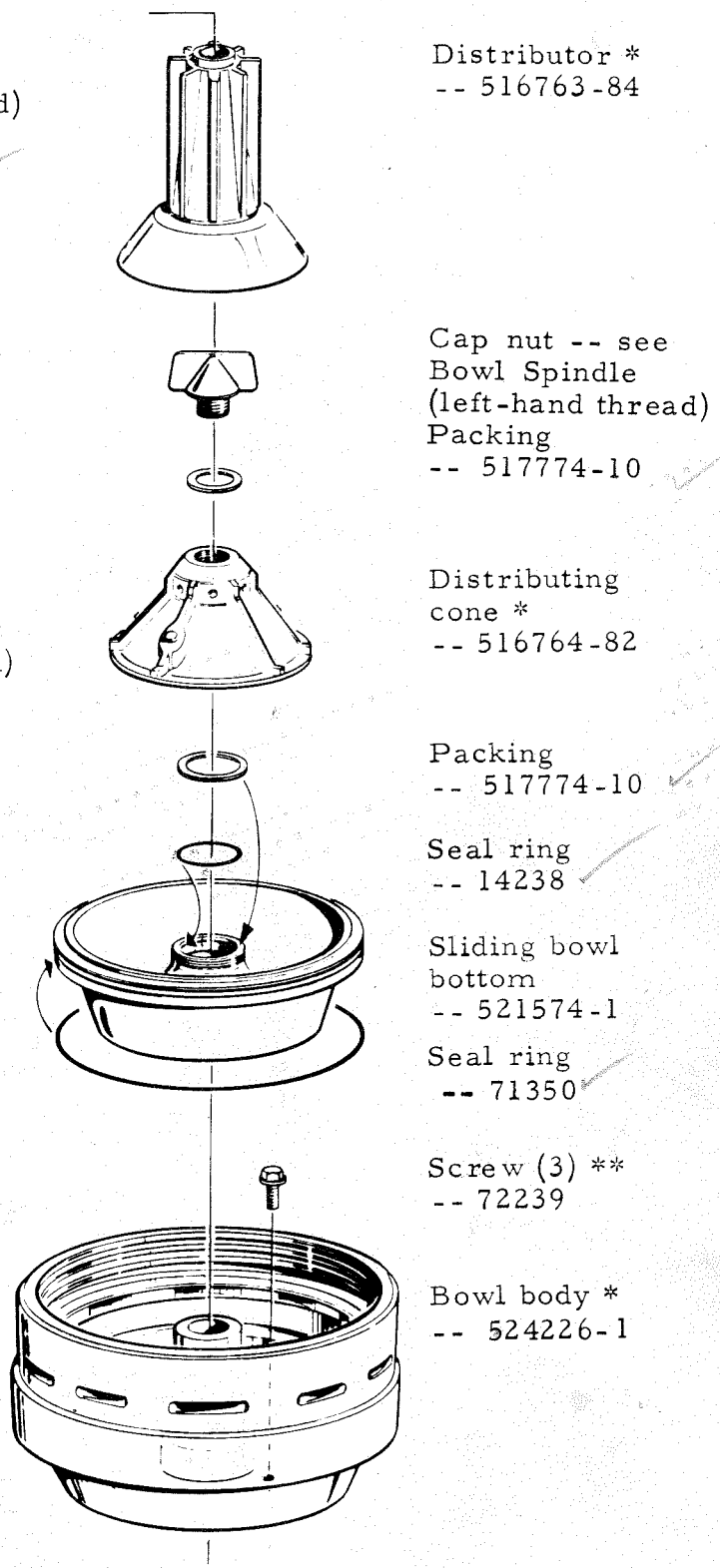
Seal ring
-- 71301

Seal ring
-- 71351

Disc set

Disc
-- 516888-83

Bottom disc
-- 516888-82



Distributor *
-- 516763-84

Cap nut -- see
Bowl Spindle
(left-hand thread)

Packing
-- 517774-10

Distributing
cone *
-- 516764-82

Packing
-- 517774-10

Seal ring
-- 14238

Sliding bowl
bottom
-- 521574-1

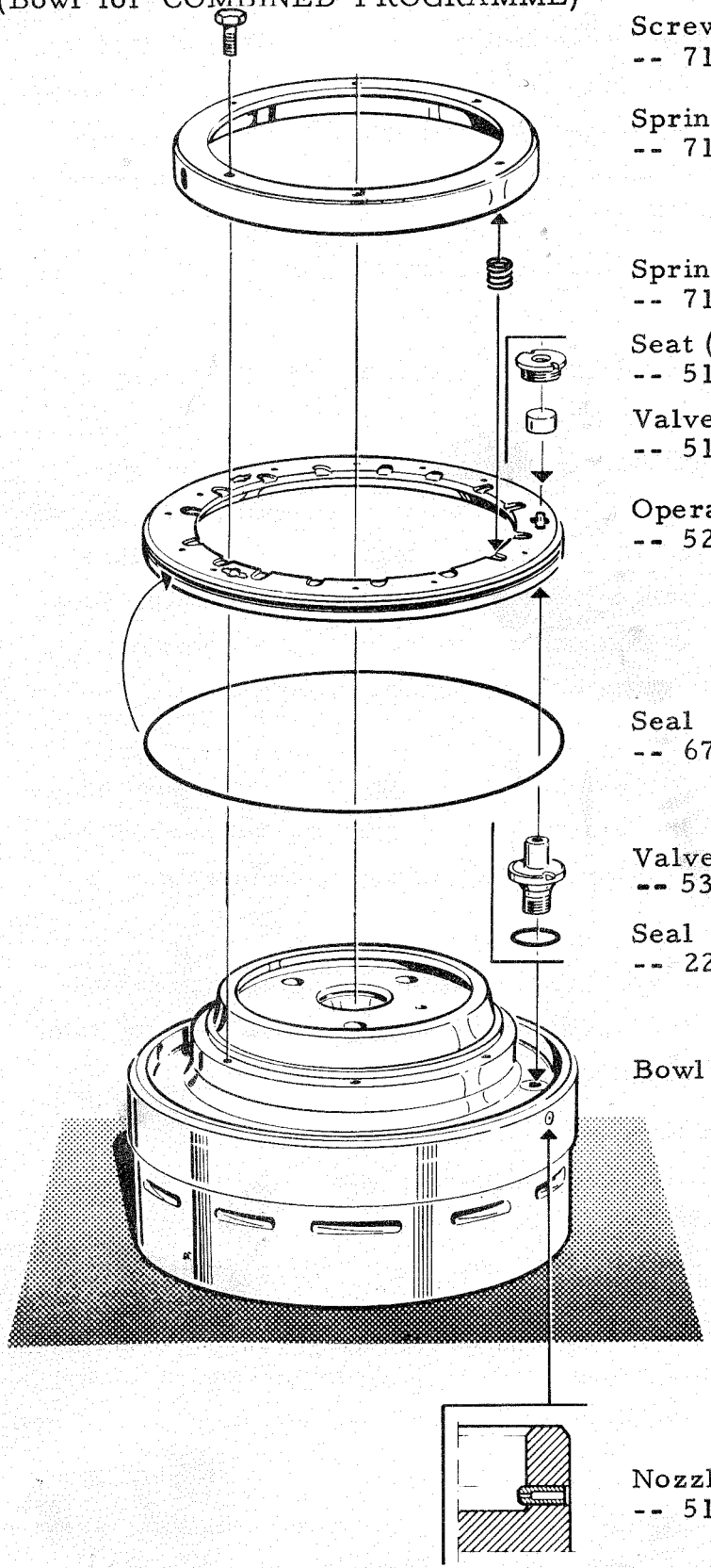
Seal ring
-- 71350

Screw (3) **
-- 72239

Bowl body *
-- 524226-1

(cont. S88716)

(Bowl for COMBINED PROGRAMME)



Screw (6)
-- 71348

Spring support*
-- 71182

Spring (15)
-- 71181

Seat (3)
-- 519369-1

Valve plug (3)
-- 518549-2

Operating slide
-- 520399-1

Seal ring
-- 67587

Valve seat (3)
-- 536562-01

Seal ring
-- 223406-11

Bowl body*

Nozzle
-- 515133-1

* Exchange necessitates rebalancing -- send the COMPLETE bowl to an ALFA-LAVAL/DE LAVAL representative.

** Not included in the complete-unit number.

CLEANING. OVERHAUL. LUBRICATION

Satisfactory functioning cannot be ensured unless the parts in contact with liquid are carefully cleaned before assembly. This applies particularly to seal rings, sliding surfaces, guiding and contact surfaces, and threads. Also take care that no burrs are knocked up on the metal parts when handling them.
Follow the directions given in chapter L and H.

EXCHANGE of PARTS

Each bowl constitutes a balanced unit which will get out of balance if any parts having an "*" added to their part number in the general drawing are exchanged without the bowl being rebalanced. To prevent confusion of parts, for instance when a plant consists of several machines of the same type, these main 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 position 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.

After mounting check:
... that the ring lies properly (not twisted) in the groove.
... that it fills the groove evenly all around.

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

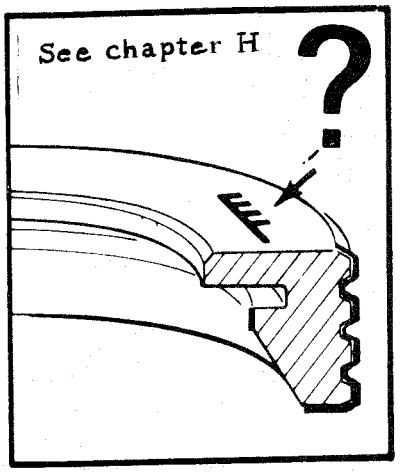
Aggressive liquids as well as liquids containing very hard particles may cause corrosion and erosion damage. If rapidly growing or advanced damage is noticed, consult an ALFA-LAVAL/DE LAVAL representative.

DISMANTLING. ASSEMBLY

Dismantle and assemble the bowl with the help of the special tools in the order indicated by the exploded drawing. Place the parts on a clean, soft surface.

The bowl should rotate clockwise. The principal components therefore have left-hand threads where indicated in the text.

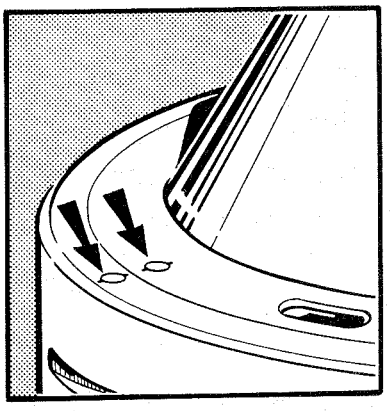
Lock rings



The lock rings have left-hand threads and are unscrewed CLOCKWISE. The large lock ring is loosened by blows of a lead mallet or similar on the handle of the spanner.

Clean and lubricate the threads of the lock rings and their contact surfaces with bowl hood and bowl body before every assembly. Seizing may be the result, especially in new machines, if this lubrication is neglected or an unsuitable lubricant is used. Careful lubrication of these surfaces will prevent unnecessary wear on threads and contact surfaces.

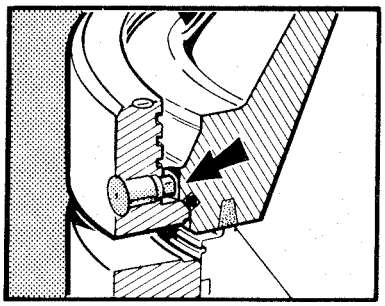
Tighten the lock rings ANTI-CLOCKWISE – the small lock ring until a tight seal is obtained and the large lock ring until the bowl hood lies TIGHTLY against the bowl body.



In a new bowl the marks ◊ will now be in line with each other. The best way to use the spanner is to move the handle clockwise and check the movement with a heavy jerk. The lock ring should press the bowl hood against the bowl body so that perfect sealing is obtained at the seal ring and should also keep the distributor pressed against the bottom of the bowl body, firmly clamping the disc set. For final tightening it may thus be necessary to hit the spanner handle with a lead mallet or similar (NEVER extend the spanner handle).

Note: See chapter L for checking pressure in disc set and inspecting threads.

Bowl hood



The lifting tool is screwed ANTI-CLOCKWISE (left-hand thread) onto the bowl hood.
If the hood does not sink correctly into its seat when being mounted, some guide is displaced – check this.
The seal ring in the lower edge of the hood should be removed only for exchange – see chapter L, Bowl Overhaul.
Lubricate the threads and the surfaces in contact with the large lock ring before mounting.

Distributor. Disc set

Lift the distributor into the bowl body and out of it with the disc set mounted on it. If the discs have been removed, make sure to refit them in numerical sequence with disc No. 1 undermost.

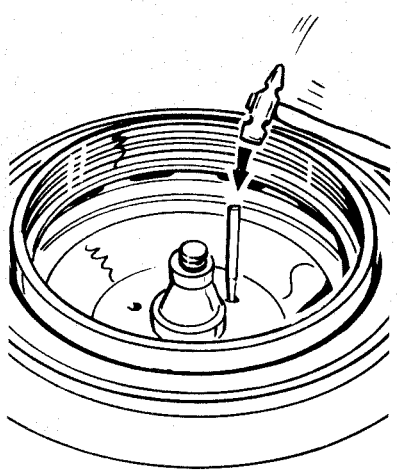
Cap nut

The cap nut has a left-hand thread and is unscrewed CLOCKWISE. Lubricate the thread before putting on. Tighten the cap nut firmly.

Sliding bowl bottom

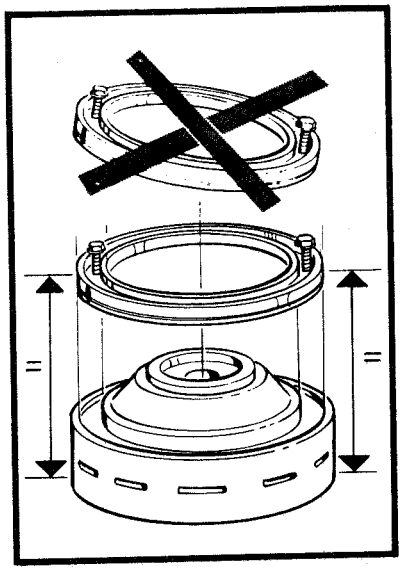
When mounting make sure that the sliding bowl bottom drops into the proper position, i.e. with its upper rim approximately flush with the lower edge of the discharge openings in the bowl body.
Before assembly lubricate the sliding surfaces of the sliding bowl bottom – nave bore and peripheral surface.

Bowl body



The screws in the bottom of the bowl must be unscrewed and removed before the lifting tool is positioned. It is also advisable to knock off the distributing ring with a drift. The bowl body is eased off the spindle cone with the central screw of the lifting tool.
Lubricate the nave opening, the nave and the top of the spindle sparingly before mounting the bowl body – excessive lubrication may cause the bowl to slip.

Discharge mechanism

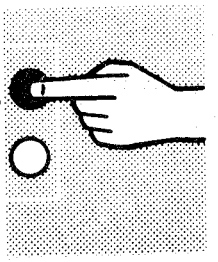


The operating slide must be handled with great care. Skew and uneven insertion or removal and the use of force lead in most cases to deformation and consequently to breakdowns. When placed in position the slide should be lowered perfectly level, and it should then be possible to lift it slightly by hand all the way round.

Valve plugs, fastenings and valve seats should not be removed except to be exchanged. The nozzle in the bowl body and the passages should be cleaned with a soft iron wire.

Lubricate the outer edge surface of the operating slide as well as the surface in the bowl body over which the slide moves.

Tighten the spring support screws evenly and firmly.



OPERATION

DATA see chapter C.
SPECIAL EQUIPMENT see chapter X.

SAFETY REGULATIONS

In all centrifugal separators the bowl rotates at a very high speed, normally between 100 and 150 revolutions per SECOND. Thus, very great forces are released and it is essential, therefore, to follow strictly the directions given in the Instruction Book concerning assembly of parts, starting, stopping and overhaul.

In this connection remember particularly:

... to tighten the bowl lock ring (lock rings),

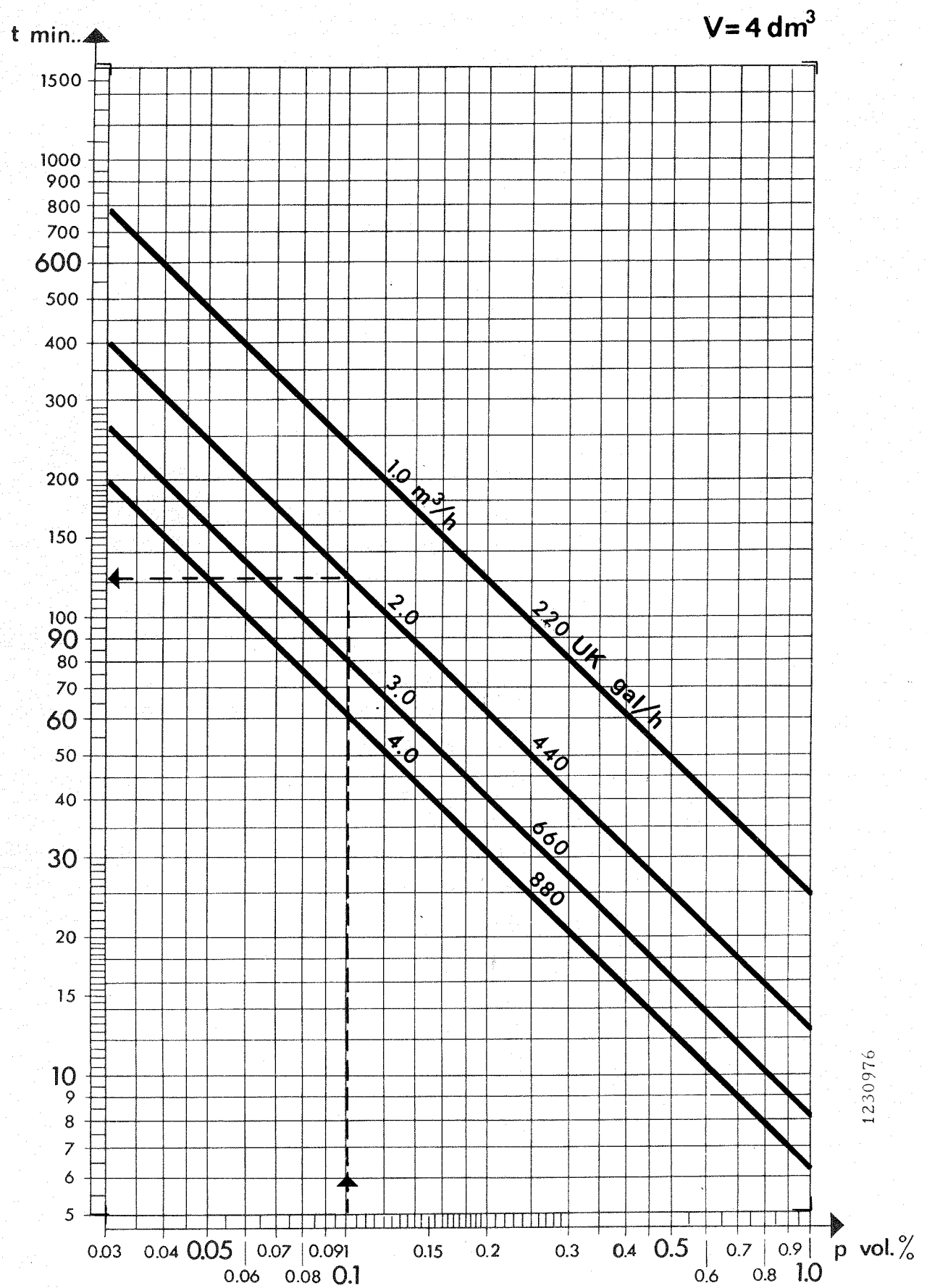
... to fasten carefully the frame hood as well as the inlet and outlet parts,

... to check the speed,

... that no machine part must be loosened until the bowl has topped rotating,

... that bowl body, bowl hood and lock ring must never be heated by means of a flame,

... that the machine must never be used for processing liquids with a higher density (temperature, sludge nature etc.) than that for which it was originally intended. Thus, always consult an ALFA-LAVAL representative before using the machine beyond its proper range of separation.


V= 4 dm³
t min.
1500
1000
900
800
700
600
500
400
300
200
150
100
90
80
70
60
50
40
30
20
15
10
9
8
7
6
5
1.0 m³/h
2.0
3.0
4.0
220 UK gal/h
440
660
880
0.03
0.04
0.05
0.06
0.07
0.08
0.091
0.1
0.15
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
p vol.%
1230976

INTERVAL between SOLIDS EJECTIONS (not for self-triggering machine)

When the solids content of the process liquid is known in percent by volume of moist solids or it can be established (e.g. in a test glass centrifuge), suitable intervals between solids ejections can be chosen with the guidance of the adjoining nomogram. The nomogram, which refers to homogeneous distribution of the solids in the process liquid and total emptying of the bowl solids space is based on the adjoining formula, in which

$$t = V \cdot \frac{100 \cdot 60}{p \cdot Q}$$

t = theoretical maximum time in minutes between two solids ejections

p = percent by volume of moist solids in process liquid

Q = throughput, in l/h

V = bowl space available for solids deposit, in dm^3

After test separation and check of the solids concentration correct the time so as to obtain the discharge consistency that is best suited for the process and the type of solids. If the solids are liquid, the interval between ejections can normally be extended. However, the solids space must not be overfilled, as otherwise a part of the process liquid could remain untreated.

With total ejection the whole bowl is emptied, whereas with partial ejection only the solids space "V" is emptied, entirely or partly.

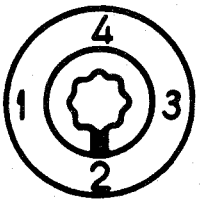
In partial ejection the discharge quantity is usually adjusted so that only a part of the available solids space "V" is emptied. To calculate the interval between ejections when those should take place at a filling degree of for instance 50%, 25% or 20% divide the stated solids space volume "V" by 2, 4 and 5 respectively. The time "t" thus obtained is used as a guiding value for setting the solids ejection interval on the timer of the timing unit (control unit).

Note. With bowl arranged exclusively for partial ejection the discharge quantity is regulated by turning off the level ring, which is located under the sliding bowl bottom — see Sludge (Solids) Blockage in chapter B. Only total ejections will take place if the level ring is removed. In bowls arranged for combined programme the partial discharge quantity is regulated by adjusting the operating liquid pressure for this function — see Operating Liquid System in chapter B.

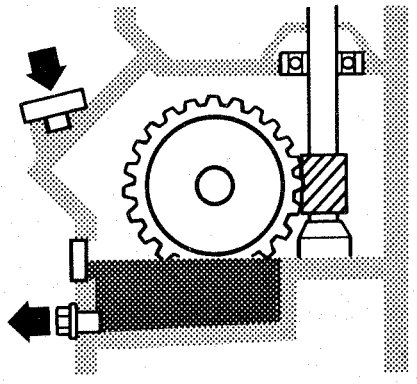
BEFORE STARTING

For machine equipped for programmed sludge discharge — see special instructions.

The bowl should be well cleaned and assembled as directed in chapter I.



Check particularly: that brake is released — that collecting covers (frame hood respectively) are clamped with the hinged bolts — that oil level in worm gear housing is somewhat above the middle of the gauge glass* — that operating liquid tank is full — that control valve is in position 2 (operating liquid feed turned off; bowl open).



* Note. The oil level must never be allowed to sink below the lower edge of the gauge glass. If the glass is provided with corrugations they should be vertical. Keep the gauge glass clean, otherwise a line, which could be mistaken for the oil level, will in time build up on the inside of the glass.

If the machine has been idle (for instance during a night), screw out the drain screw some turns and drain off any water.

START and RE-CIRCULATION

Start the motor. If the process liquid is to be preheated or cooled, circulate it through the preheater, or the cooler respectively, until suitable temperature is reached.

ACCELERATION PERIOD

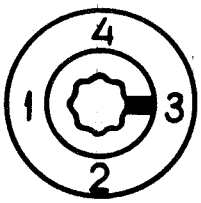
Shortly after starting it may occur that the bowl begins to vibrate more than normal. The cause is generally lack of balance due to bad cleaning of the bowl. Stop the machine and clean the bowl if the vibrations are very heavy.

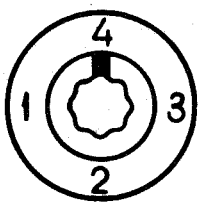
Heat is always generated in the clutch coupling during the running-up period. This will be noticeable, especially when the pads on the friction blocks are new, through smoke and a smell of burning. Like the sliding sound, this is quite normal and has no importance.

During acceleration the power consumption is higher than in normal operation.

The acceleration time stated in chapter C may vary somewhat depending for instance on the condition of the friction pads in the clutch coupling.

CLOSING THE BOWL





The bowl is to be closed when it has attained the prescribed speed. Before initiating the closing operation, compare the speed indication with the speed table in chapter C.

o Close the bowl by setting the control valve to position 3. Now wait until liquid flows out through the indicator pipe, indicating that the bowl has closed.

o Set to operative position by turning the control valve to 4. In this position any losses of liquid in the discharge mechanism are made up for.

FILLING

o Open fully the outlet valve. The back pressure will consist partly of the flow resistance in pipes and pipe fittings, partly of any delivery head to the collecting tank.

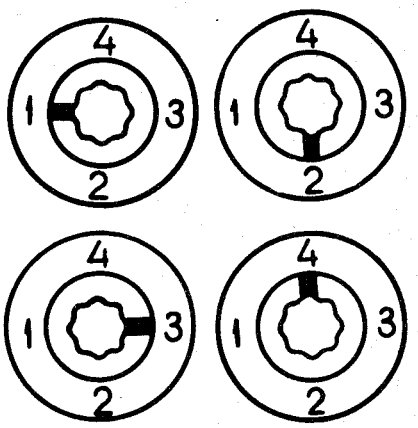
o With automatically controlled machine connect the automatic control device.

o Open the process liquid feed valve, check the feed pressure and adjust to suitable throughput. This must not exceed the permissible value and must be suited to the separability of the process liquid.

If a high back pressure is wanted, e.g. to avoid penetration of air or formation of vapour, increase the back pressure gradually by throttling the outlet valve till no air or vapour bubbles are visible through the sight glass in the outlet.

SLUDGE DISCHARGE

Bowl designed for total discharge (Fig. A)



Shut off the feed; open the bowl by turning the control valve to position 1. Hold this position until the "shot" is heard, i.e. the noise made when the sludge is thrown out of the bowl.

Empty the bowl discharge mechanism by turning the control valve to position 2. Hold this position for 5-6 seconds.

Close the bowl by turning the control valve to position 3. Hold this position until operating liquid escapes through the indicator pipe, showing that the bowl has closed.

Set to operating condition by turning the control valve to position 4 to compensate for any liquid losses during operation.

Refill the bowl – see Filling.

Occasionally, especially if the sludge is corrosive, the discharge operation should be repeated. This also applies if the sludge space has become over-full. Between discharges it is advisable to flush the bowl, e.g. by admitting flushing water.

Bowl designed for total discharge -- automatic control (Fig. B)

The steps described above are performed automatically. If no provision is made for automatic interruption of the feed, this must be shut off manually.

Bowl designed for rapid totaland partial discharge -- automatic control (Fig. C)

Sludge discharge takes place automatically but the feed is not interrupted. This is generally accompanied by flushing of the sludge cover.

Bowl designed for combined programme -- automatic control (Fig. D)

Sludge discharge takes place automatically and is either total or partial (optional). In partial discharge the feed is not interrupted, but the sludge cover is usually flushed. If no provision is made for automatic interruption of the feed, this must be done manually for total discharge.

Note: For manual operation of automated machines, see Chapter B.

CLEANING BY RINSING

The bowl need not be dismantled after every run if it can be adequately cleaned by rinsing before being stopped.

In some cases it is sufficient to shut off the process liquid feed and supply a rinsing liquid, e.g. water, instead and work the sludge discharge mechanism a few times. In other cases, a suitable detergent must be added to the rinsing liquid and a longer series of discharges performed. It is particularly important to rinse the bowl thoroughly if the process liquid contains active substances that may cause corrosion or sludge of an adhesive type. Residues of corrosive liquids can often be neutralized by the addition of suitable agents before the last rinse. A suitable procedure can be worked out by practical trials and its effectiveness checked when the bowl is dismantled.

The check should be concentrated in the first instance on the discs near the bottom of the disc set, as it has been found by experience that these are the most difficult to get clean. If detergents are used, the last discharge or the last few discharges should always be performed with pure rinsing liquid without any additives. Where there is a long standstill between runs, the bowl should be cleaned manually – see Chapter L.

Note: If the machine begins to vibrate abnormally, this means that the bowl has not been properly cleaned. The machine must then be stopped for manual cleaning and a different rinsing programme worked out.

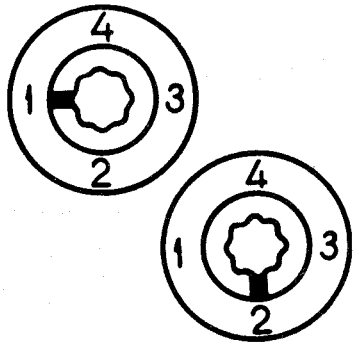
Flushing the frame hood (or set of covers respectively)

When the bowl is provided with discharge pump so-called paring disc), the inside of the frame hood (or set of covers respectively) and the outside of the bowl can be flushed either by raising the back pressure above the highest permissible value or by entirely shutting off discharge pipe. The flushing liquid will now be thrown out at the bowl top and discharge through the draining device of the bowl casing. Check the drainage.

STOPPING

The brake must always be applied to stop the bowl. Bowl designed for total discharge should be kept closed and filled with liquid during the run-down period if heavy vibration occurs; bowls for partial discharge and combined programme must ALWAYS be kept closed and filled during the run-down.

Bowl designed for total discharge — manual control (Fig. A)



Shut off the feed and open the bowl — control valve to position 1. Hold this position until the discharge is effected.
Shut off the operating liquid feed — control valve to position 2. Then shut off the supply of operating liquid to the control valve.
Switch off the motor and apply the brake.
Do not release the brake until the bowl has stopped. The collecting cover hinged bolts must not be undone or any other parts dismantled until the bowl has come to a complete standstill.

Bowl designed for total discharge — automatic control (Fig. B)

Shut off the feed. Empty the bowl by operating the control unit. Shut off the feed of operating liquid. Switch off the control unit. Turn control valve to position 2. Switch off the motor, etc. — see above.

Bowl designed for rapid total and partial discharge or combined programme — automatic control (Fig. C and D)

Empty the bowl by operating the control unit. Wait until the bowl has closed and refilled, then shut off the feed. Switch off the control unit.
Switch of the motor, etc. — see above. Turn the control valve to position 2 when the bowl speed has decreased to about half the full speed.

FORCING OUT REMAINING LIQUID

A small quantity of liquid will collect in the bottom of the bowl after the machine has stopped. To expel this liquid, proceed as follows: release the brake when the bowl has stopped after the last rinse; switch on the motor and without feeding in any liquid, let the bowl run up to about 10% of full speed; then switch off the motor and apply the brake (see Stopping).

MANUAL CLEANING

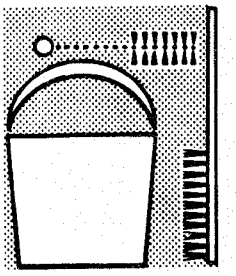
See Chapter L.

Indication	Cause	Remedy
Machine vibrates	1. Moderate vibrations normally occur at the critical number of revolutions during the running-up and retardation periods.	None.
	2. Bowl out of balance due to: bad cleaning – wrong assembling – badly tightened lock ring – bowl assembled with parts from different machines.	Stop immediately and establish cause. Badly tightened lock ring involves fatal danger.
	3. Vibration damping rubber washers have lost elasticity.	Renew rubber washers.
	4. Top bearing spring broken.	Exchange all springs.
	5. Foundation too weak.	Reinforce foundation.
Speed too high	1. Tachometer reading wrong.	Check by means of revolution counter.
	2. Wrong transmission.	Stop immediately. Check that proper transmission or belt pulley is used in view of motor speed.
	3. The motor speed is not appropriate.	Stop immediately and provide a motor with correct speed.
Speed is too low. Running-up time too long.	1. Brake applied.	Release the brake.
	2. Pads of clutch are worn or oily.	Exchange or clean all pads.
	3. Voltage drop in mains.	Check mains voltage (D.C.)
	4. Ball bearing damage.	Locate and exchange defective bearing.
	5. Other machine defects.	Stop immediately. Check that bowl can be rotated by hand.
	6. Motor defect.	Exchange or repair motor.
Starting power too low.	1. Ammeter reading wrong.	
	2. Clutch pads worn or oily.	See -- Speed is too low.
Starting power too high.	1. Ammeter reading wrong.	
	2. Motor defect.	Exchange or repair motor.
	3. Ball bearing damaged.	Locate and exchange defective bearing.
	4. Other machine defects.	See -- Speed is too low.
Retardation time too long.	Brake lining worn or oily.	Exchange or clean lining.
Water in worm gear housing.	1. Condensation.	Drain water.
	2. Axial seals not tight or turned wrongly.	Exchange rings and turn correctly.
	3. Leakage via top bearing.	Exchange seal rings and adjust axial seal.
Noise from worm gear housing.	1. Oil quantity wrong.	Check quantity and quality.
	2. Worm wheel or worm worn.	Exchange worn parts. Exchange of complete gear is generally advisable.
	3. Ball bearing worn or damaged.	Exchange bearing.
Noise from clutch coupling.	1. Normal when starting and stopping due to sliding of friction blocks.	None.
	2. Wrong play between coupling pulley and elastic plate.	Adjust.
	3. Speed too low.	See -- Speed too low.
Smell	1. Normal at start and stop when friction blocks are sliding, thus causing burnt smell.	None.
	2. V belts or flat belts are sliding.	Clean belts. Adjust belt tension.
	3. Bearing running hot.	Feel over machine and locate spot. Exchange bearing.
	4. Motor overheated.	Trace cause. Adjust overcurrent relay, if any provided.
"Scraping" sounds	Wrong height position	Stop and adjust -- see Chapter L.

Indication	Cause	Remedy
Purification and concentration: Outgoing heavy phase contains light phase.	1. Liquid seal has broken or is close to breaking due to: o filling too fast at start o too little seal liquid 2. Closed valve in light phase outlet. 3. Gravity disc too large. 4. Throughput too high. 5. Seal ring under gravity disc missing or damaged. 6. Changed separation temperature resulting in changed density ratio. 7. For bowl with paring disc: Back pressure too high.	No separate filling of seal liquid is needed for concentration (see chapter B) or if the heavy phase constitutes at least 25 % of the process liquid. Open valve. Change to smaller disc. Reduce rate of feed. Check and rectify. Change to smaller disc. Reduce the back pressure in light phase outlet.
Purification and concentration: Outgoing light phase contains heavy phase.	1. Gravity disc too small. 2. Closed valve in heavy phase outlet. 3. Throughput too high. 4. Sludge space overfull.	Change to larger disc. Open valve. Reduce rate of feed. Empty bowl more often.
Purification and concentration: Light and heavy phases fail to separate.	1. Purifier bowl assembled with clarifier bowl parts. 2. Sludge space overfull. 3. Closed valves.	Check. Exchange parts. Empty bowl. Check. Open valves.
Clarification: Poor clarification	1. Unsuitable separation temperature. 2. Sludge space overfull. 3. Throughput too high. 4. Water present in feed. 5. Clarifier bowl assembled with purifier bowl parts.	Empty bowl more often. Reduce rate of feed. Run the machine as a purifier. Check. Exchange parts.
Bowl clogs with sludge.	1. Water washing unsuitable or incorrectly applied. 2. Sludge too viscous. 3. Frame filled with sludge. 4. Sludge tank overfull. 5. Defective strainer.	Empty bowl more often. Clean frame and shorten interval between discharges. Flush sludge cover during discharge cycle. Empty sludge tank and clean bowl casing in frame. Check whether solid particles are stuck between the bowl discs.
Too much process liquid in sludge.	1. Feed not shut off during total discharge. 2. Leakage between bowl hood and sliding bowl bottom. 3. Bowl not fully closed.	Check. Exchange seal ring. If necessary, turn the sliding bowl bottom smooth. Check the operating liquid system and automatic controls if any.
Gas is liberated (only for bowl with paring disc).	Back pressure is too low.	Increase the back pressure.

Indication	Cause	Remedy
Bowl fails to close	1. Control valve wrongly operated.	Carefully follow the operating instructions. (When programme system is on, control valve must be in operating position.)
	2. The pipes are wrongly connected to the control valve.	Observe directions in chapter B and G.
	3. Control valve obstructed or wrongly mounted.	Check throughflow as directed in chapter L, Bowl Discharge Mechanism.
	4. None or insufficient operating liquid feed due to empty tank, obstructed strainers, closed or throttled valves, insufficient pipe dimension.	Check. Clean strainers. Check float valve in operating liquid tank.
	5. Programmed operation: Interruptions of operating liquid feed due to electrical or mechanical defects in solenoid valves, relais or programming components. Insufficient feed of operating liquid.	If bowl can be closed manually, seek fault in programme equipment.
	6. The pressure is insufficient because tank is placed too low or flow resistance in pipes is too high.	Elevate tank. Check pressures at control valve with pressure gauge. Pressures must not drop below recommended values when valve is opened.
	7. Control paring disc device obstructed or wrongly mounted. Wrong height position.	Clean out holes on upper side of paring disc. Check bowl discharge mechanism and height position as advised in chapter L.
	8. Leakage: control valve – distributing cover, distributing ring – bowl body, operating slide – bowl body, valve plug – sealing surface.	Check. Clean seals and sealing surfaces.
	9. Operating slide of bowl jams due to imperfect lubrication, defective seal, burrs or slant.	Check. Clean and lubricate carefully.
	10. Operating slide springs are defective.	Check and renew.
	11. Sliding bowl bottom jams.	See paragraph 9.
	12. Channels to space under sliding bowl bottom obstructed.	Clean out the channels.
	13. Pressure in main line varies.	
	14. Pressure of operating liquid is too high.	Adjust the reducing valve.
	15. Nozzle in bowl body for draining the space between bowl body and operating slide is obstructed.	Clean – compare Bowl.

Indication	Cause	Remedy
Bowl fails to open	1. See paragraphs 1-11 under "Bowl fails to close".	See corresponding paragraphs 1-11.
	2. Nozzle in bowl body not inserted. Compare paragraph 15 under "Bowl fails to close".	Check. With manual operation an incomplete discharge may take place. In programme-controlled machines the discharge fails to come off.
	3. Channels to space between bowl body and upper side of operating slide are obstructed.	Clean out – compare Bowl.
The bowl fails to remain closed, but opens again.	1. Feed of closing operating liquid is too ample.	Shorter closing time is necessary. With programme-controlled machine reduce the cam time for the cam governing the closing solenoid valve.
	Wrong operating liquid pressures.	Check pressures.
The bowl opens unintentionally during operation.	1. Liquid losses are not compensated.	See paragraphs 4 and 8 under "Bowl fails to close".
	2. Holes at periphery of control paring disc are obstructed.	Clean out. Check throughflow as advised in chapter L, Bowl Discharge Mechanism.



CLEANING. OVERHAUL

It has proved very difficult in practice to prescribe how often cleaning should be carried out and how thorough the overhaul should be. However, aided by the directions given in this chapter it should not be difficult to make up a suitable working routine with regard paid to special local conditions. The ALFA-LAVAL/DE LAVAL representative will always be glad to provide further advice and information.

GENERAL HINTS

When cleaning and overhauling always follow strictly the directions given in this book concerning the dismantling, lubrication and assembling.

Set of spares

Make it a habit to inspect and replenish the set of spare parts (and tools) once a year. It pays to keep the consuming parts in stock.

Service interruptions

If the machine is to be put out of service for some time, the parts in contact with liquid should be oiled. Preferably, the bowl should be removed from the spindle. The seal rings should be taken out and kept flat, not hanging.

The time intervals stated below relate to continuous operation. If the mentioned number of operating hours is not obtained during the period, the latter can be extended, but a thorough overhaul at least once every third year is imperative.

OPERATING HOURS	Operation check	
Every 24th (every day*)	Machine run (speed). Power consumption. Oil level in worm gear housing. Observation of discharged liquids. Temperature.	Throughput. Sludge tank. Pressure. Level in operating liquid tank. Automatic control device, if any (signal lamps).
Every 200th (every week*)	Worm gear housing Check and if necessary replenish oil.	Further actions Speed check. Leakage tracing.
Every 750th (every month*)	Bowl Dismantling of bowl and thorough cleaning of bowl inset parts. Thorough cleaning and lubrication of lock rings and oiling of bowl body nave bore. Check on seals.	Power transmission Cleaning and oiling of bowl spindle cone. Control system Check flow of operating liquid. Check sludge discharge interval of automatic control device. Strainers and filters Cleaning and checking.
Every 1500th (every second month*)	Worm gear housing Cleaning and oil change. (In case of new installation, however, after 300 operating hours and in seasonal operation before every working period).	Bowl Dismantle and clean sludge discharge mechanism of bowl. Check springs, seals and sludge ports. Check erosion. Power transmission Exchange friction pads Frame Renew brake lining
Every 9000th (every year*)	Thorough overhaul, cleaning and lubrication. Bowl check Pressure in set of discs. Lock ring joint. Corrosion and other material attacks. Power transmission. Dismantle bowl spindle, clutch coupling and worm wheel shaft. Check particularly ball bearings and gear as well as top bearing springs and buffers. Renew grease in nave.	Control system Clean operating liquid tank and check pipes and valves. Height positions Check and adjust. Frame Touch up the paint. Check elasticity of vibration dampers and mounting of machine. Motor - see special manual for motor.

* In continuous operation.

CLEANING AGENTS

Metallic machine parts

Use Cleaning kerosene, White spirit, Mineral spirits or another solvent with equivalent properties.
If the cleaning agent is unsuitable in view of the product of the process, the bowl, inlet and outlet parts in contact with liquid can normally be cleaned with a soda or trisodiumphosphate solution, or with current technical defatting agent on an alkaline basis.
A certain care should be exercised when cleaning light metal parts, as these may be attacked by strong alkaline solutions.
Benzine or benzol may also be used for the metal parts, but if so, the cleaning should be done in the open air due to the risk of explosion, and because benzol vapours are dangerous to inhale.

Seal rings

Wipe seal rings with a cloth moistened with some of the above cleaning agents.

Coupling pads and brake lining

Trichlorethylene should be used for cleaning these parts and the corresponding friction surfaces. Note that it should be done under safe control (ventilation), and preferably in the open air.

Discharge mechanism

Any deposits on the parts of the control device are to advantage dissolved in an approx. 10 percent solution of acetic acid heated to about 80°C (175°F).

WASHING AGENTS for DAIRY MACHINES

Lye solution

1% alkaline solution, for instance of the following composition: 90% caustic soda (NaOH), 9% sodium tripolyphosphate ($Na_5P_3O_{10}$), 1% wetting agent (non-ionic ethylenediaminoacetate)

Acid solution

0,5-0,8% nitric acid solution.

MANUAL CLEANING of BOWL

During the first time the bowl should be dismantled and, when necessary, cleaned after every automatic washing until a suitable washing programme has been established. Thereafter the intervals between dismantlings can be extended successively. Observe that defective or wrongly fitted strainers letting through particles that are too large to pass between the bowl discs can cause sludge blockage. If this occurs, the bowl discs must be cleaned one by one.

Any tendency of the lock ring to stick to the bowl body must also be considered when determining the intervals between dismantlings. It is difficult to prescribe how often the lock ring threads must be lubricated, as this depends both on the lubricant used and on the care with which the lubrication is performed.

Discharge mechanism

The hardness of the water decides how often cleaning must be done. However, as a rule the parts should be cleaned every time the bowl body is removed from the spindle.
Clean all channels and nozzles in bowl body, operating slide and paring disc device.

Check on liquid flow

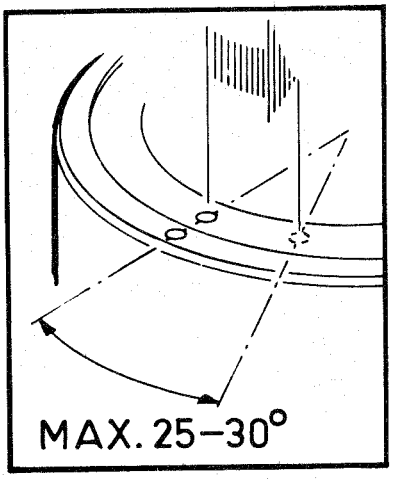
:: Open the feed of operating liquid.
:: Set the control valve to 1. Liquid should flow out through all holes in the upper side of the paring disc.
:: Set the valve to 3. Liquid should flow out in the same way but in smaller quantities.
:: Set the valve to 4. Liquid should flow out at the periphery of the paring disc.

BOWL OVERHAUL

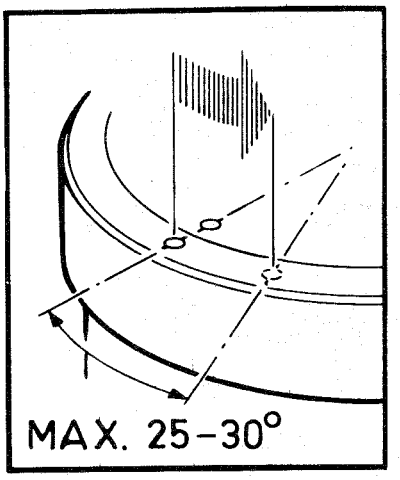
Exchange of parts

Bowl parts marked "*" on the perspective drawing in chapter I can be exchanged only in an authorized ALFA-LAVAL/DE LAVAL workshop, as the exchange necessitates rebalancing – thus the COMPLETE bowl must be sent in. Other **parts** can be exchanged on the spot.

Thread checking



Lock ring with external thread



Lock ring with internal thread

In a new bowl, the guide marks (ϕ) should be right in front of each other. In time, these marks can be drawn past each other due to wear of the threads. When the ϕ-mark of the lock ring can be drawn past the other ϕ-mark by more than 25-30°, an authorized ALFA-LAVAL/DE LAVAL representative should be consulted.

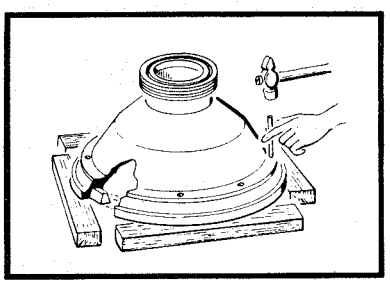
Thread checking should be done at least once a year. The checking is carried out as follows:
Unscrew the large lock ring, remove the distributor with disc set. Remove the outer seal ring of the bowl hood, put on the hood and screw on the lock ring.

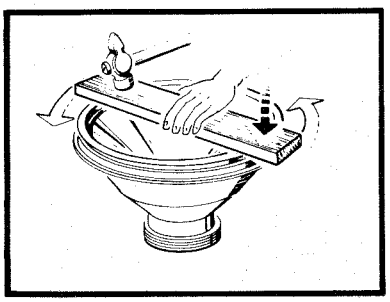
Tighten the large lock ring anti-clockwise till tight contact is obtained between the contact surfaces of bowl body and bowl hood.

Pressure in disc set

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

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.

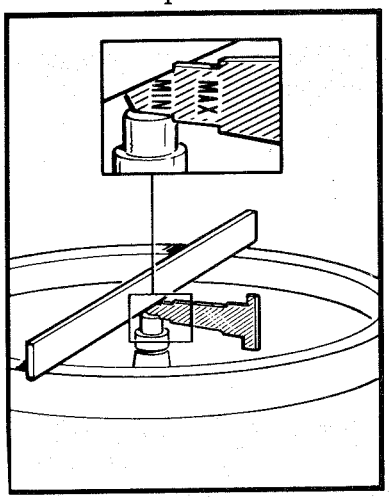
If a new seal ring of nylon (polyamide) turns out to be too wide when mounted, this is due to absorption of moisture – it will recover correct dimensions after drying for about 24 hours at a temperature of 175°-195°F (80°-90°C) in heating chamber.

If the ring is too narrow, put it in hot water, 160°-175°F (70°-80°C), for about 8 hours.

HEIGHT ADJUSTMENT

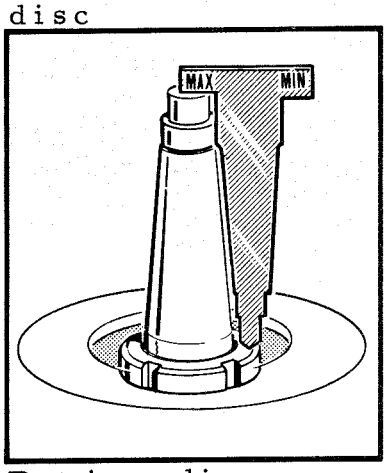
The height positions should be checked both in connection with the annual inspection and after exchange of parts which can affect the height position.
The tolerances are narrow and it is essential, therefore, that all parts are well cleaned and free from burrs.

Bowl spindle



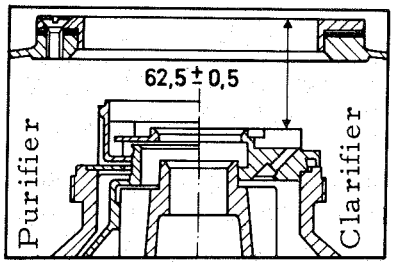
Remove the seal ring from the frame ring. Place a ruler across the frame ring. Push the narrow tonque of the templet, marked MIN (16, 5 mm), between the ruler and the spindle top. There should be a small play between the templet and the ruler, however not so large that the wide templet tongue marked MAX (18, 5 mm) can be inserted. The height position is adjusted by means of height adjusting rings – see chapter P.

Control paring disc



Put the templet on the spindle top with the measurement indication 148, 5 facing the spindle. There should now be a small play between the lower end of the templet and the top face of the ring nut, otherwise the paring disc is positioned too high. Turn the templet so that the measurement indication 149, 5 faces the spindle. Now there should be a small play between the templet tongue and the spindle top, otherwise the paring disc is positioned too low. The height position of the control paring disc is adjusted by means of height adjusting rings under the distributing cover – see control paring disc in chapter S.

Paring disc (outlet)

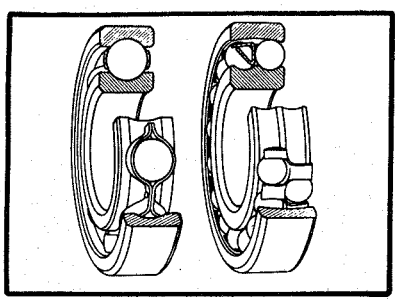


Tighten the large lock ring till the bowl hood lies tightly against the bowl body according to chapter I. Put on the paring chamber bottom part with seal ring removed. Put on the frame hood and clamp it with the hinged bolts. Remove the connection housing. Place a steel ruler across the opening and measure with a slide gauge. The distance between the paring chamber bottom part and the guide ring should correspond to the indication in the illustration. Adjustment is made by means of the height adjustment rings – see chapter I, Inlet. Outlet.

Check

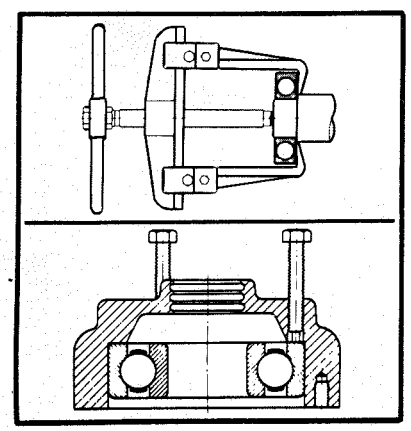
After every height adjustment loosen the brake cap and turn the worm wheel shaft by hand. If it turns heavily or a scraping noise is heard, wrong adjustment may be the cause – recheck.

BALL BEARINGS. ROLLER BEARINGS



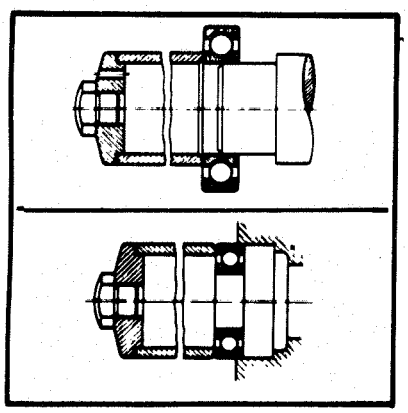
Use the greatest cleanliness when handling roller bearings.

Avoid unnecessary dismounting of bearings. They may suffer damage, or impurities may get into them during the handling.



Dismounting

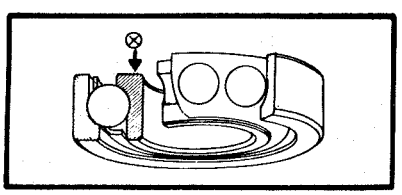
Detach the bearing from its seat by pressing against the race having the tightest fit. Use a puller or special tool. Thus, apply the pressure to the inner race when the bearing sits tightly on the shaft, and to the outer race when the bearing is tightly fitted in the housing respectively.
Arrange dismounted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

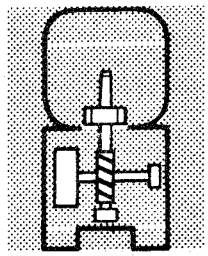
Leave new bearings in original wrapping until ready to fit. The anti-rust agent protecting a new bearing need not be removed.

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 ^{O}C. Never leave the bearing in the oil bath longer than required for throrough 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.

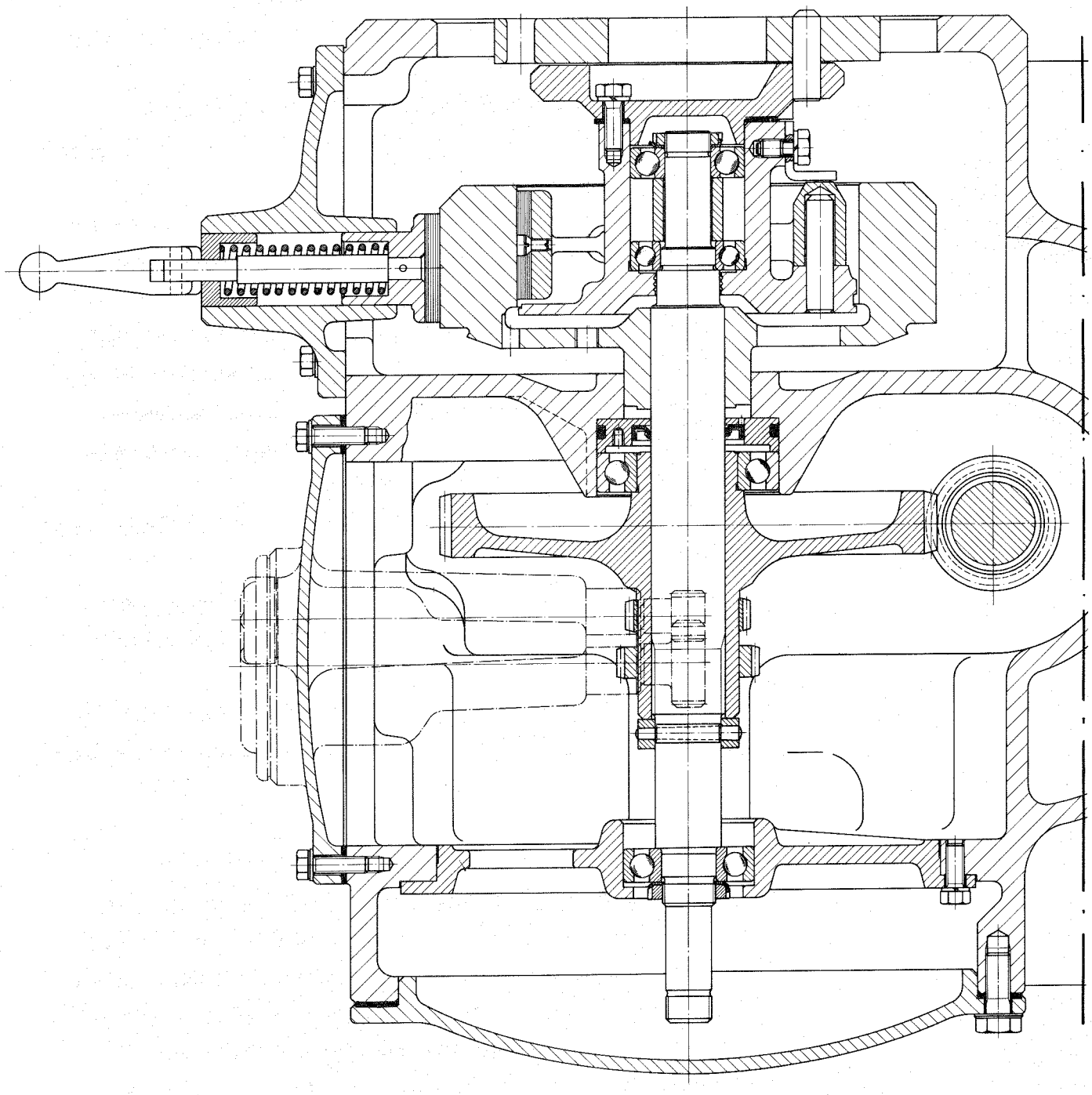


POWER TRANSMISSION

Clutch Coupling -- Worm Wheel Shaft -- Bowl Spindle -- General Drawings -- Perspective Drawings with Part Numbers -- Dismantling -- Assembling.

SPECIAL TOOLS see chapter F -- LUBRICATION see chapter H -- CLEANING see chapter L.

CLUTCH COUPLING. WORM WHEEL SHAFT



For pump equipment, if any - see chapter X.

POWER TRANSMISSION

Dismantle and assemble the parts in sequence shown in the illustrations on the following pages, using the special tools supplied.

In addition to the specific instructions, remember the following points at all times...

... cleanliness and neatness are essential

... make sure that all seal rings and gaskets are intact

... exchange spring washers whenever necessary

... exchange all clutch pads, even if only one of them is worn

... oily clutch pads should be degreased according to the directions in chapter L, Cleaning Agents, and roughened with a coarse file

... take care to avoid getting oil or grease on the clutch and the friction surface of the conveyor pulley

... avoid unnecessary dismantling of ball bearings

... follow the directions given in chapter L for assembly of ball and roller bearings

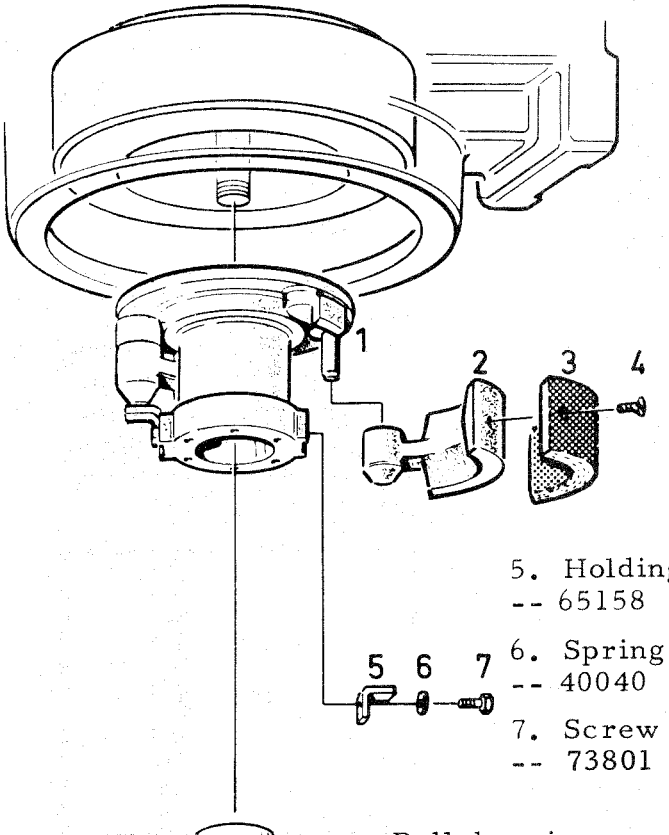
... round nuts should be tightened with a spanner and locked with lock washers

... the worm-gear housing should be cleaned and filled with clean oil after any work that may have introduced dirt

... follow the directions for cleaning and overhaul in chapter L and the directions for lubrication in chapter H.

Machine without clutch coupling

If the machine is delivered with fixed coupling and special motor, the clutch coupling parts, except the elastic plate, are omitted. The conveyor pulley of the worm wheel shaft is provided with threaded holes in the flange for fastening the special coupling pulley. The other parts in the power transmission are not concerned.



1. Nave
for 2 blocks -- 69826
for 3 blocks -- 65152

2. Friction block (2-3)
-- see chapter F

3. Pad (2-3)
-- 71628

4. Screw (6-9)
-- 8341

5. Holding bracket (2-3)
-- 65158

6. Spring washer (2-3)
-- 40040

7. Screw (2-3)
-- 73801

Ball bearing
-- 8726 (SKF 6206*)

Spacing sleeve
-- 38160

Ball bearing
-- 7026 (SKF 6305*)

Lock washer
-- 38159 (SKF MB 5)

Round nut
-- 67472 (SKF KM 5)

Packing
-- 38164

Coupling pulley
-- 65155

Spring washer (6)
-- 40040

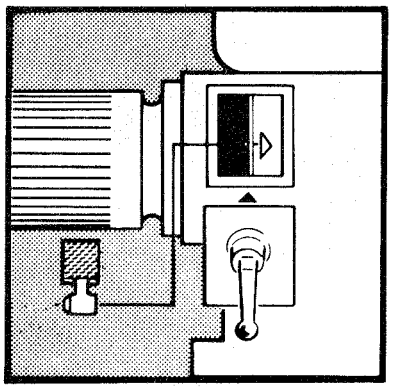
Screw (6)
-- 34963

Elastic plate
-- 60571

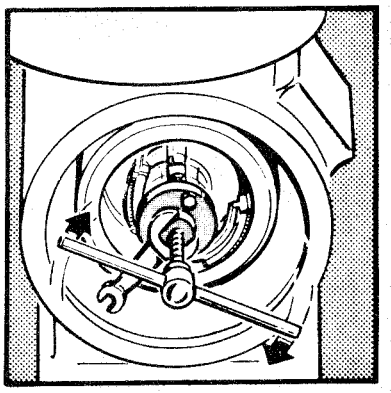
* or equivalent bearing of other make

First dismantle drive mechanism

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

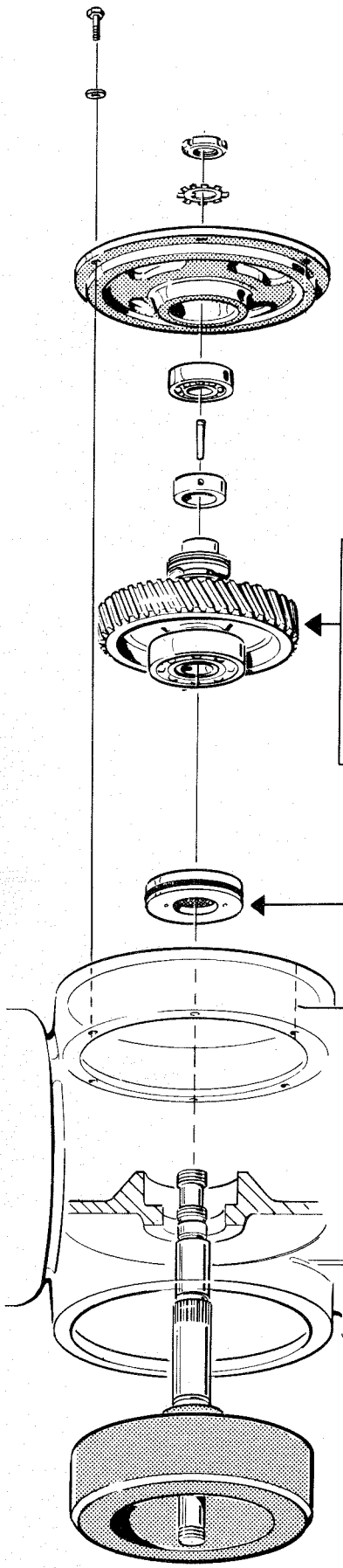


When the blocks are assembled they should move freely, and the holding brackets should be mounted so that they engage the groove in the nave and prevent the blocks from slipping off their pivots.



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.

First dismantle motor, clutch and frame shield (pump)



Screw (6)
-- 72933
Spring washer (6)
-- 40040
Round nut
-- 67473 (SKF KM 6)
Lock washer
-- 37992 (SKF MB6)

Bearing shield
-- 528097-1

Ball bearing
-- 6525 (SKF 6306)*

Pin
-- 64729
Stop ring
-- 65170

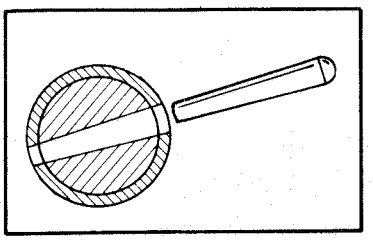
Worm wheel
-- see Ch. F

Ball bearing
-- 68827
(SKF 6211)*

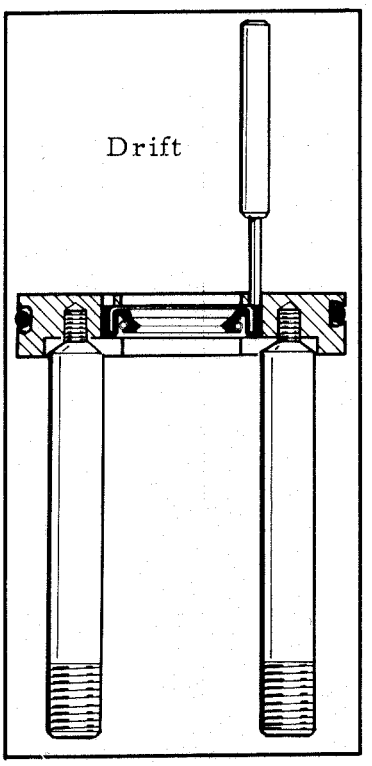
Lipseal ring
-- 73547

Seal washer
-- 528098-1
Seal ring
-- 223412-21

Worm wheel shaft with conveyor pulley, lock washers (2) and round nuts (2)
-- 65165



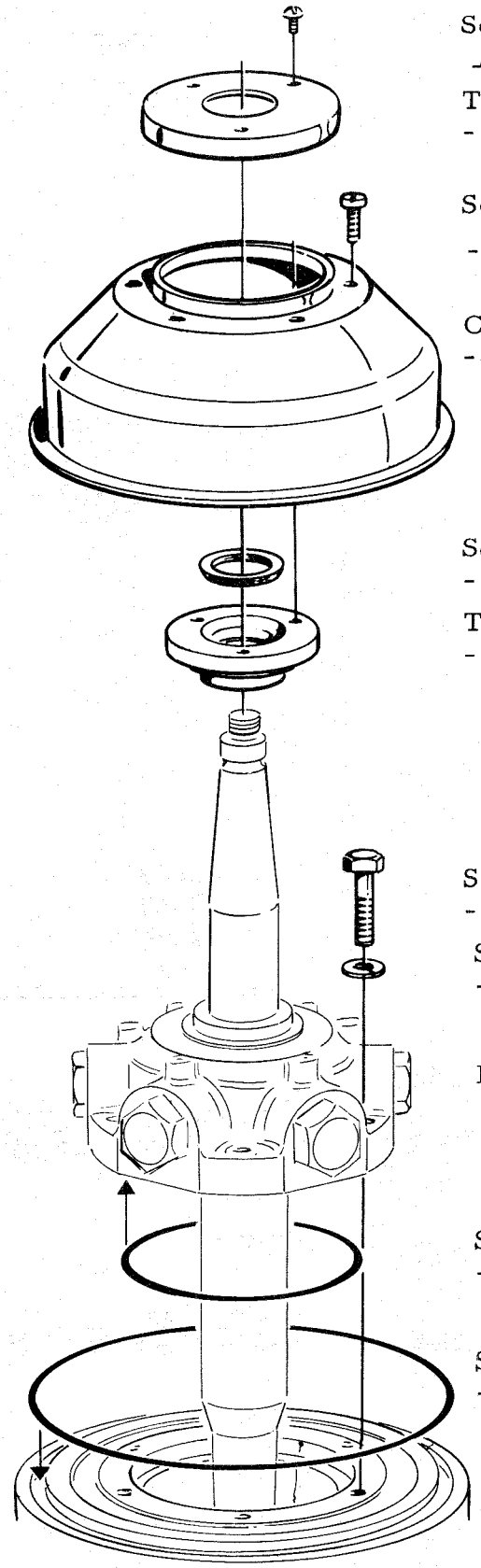
Align the stop ring correctly when fitting -- both the hole and the pin are tapered (taper 0.02). If there is any play, the hole must be reamed.



Use the motor guide 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.

* or equivalent bearing of other make

ASSEMBLY and DISMANTLING of COMPLETE BOWL SPINDLE



Screw (3)
-- 2211725-06

Top shield
-- 71386

Screw (6)
-- 2211723-08

Cap
-- 70888

Seal ring
-- 64706

Throw-off collar
-- 70222

Screw (6)
-- 63656

Spring washer (6)
-- 62094

Bowl spindle

Seal ring
-- 65594

Seal ring
-- 223402-11

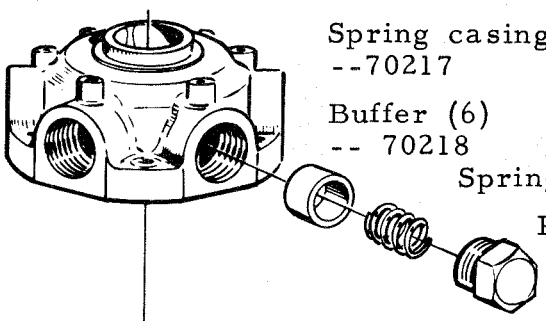
The bowl body, control valve and paring-disc device for operating liquid must be removed to make the parts accessible for dismantling.

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).

BOWL SPINDLE (assembly No.) for: 1420-1500r/m --528110-80
: 1700-1800 r/m --528110-81

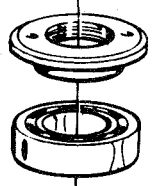


Spring casing
--70217

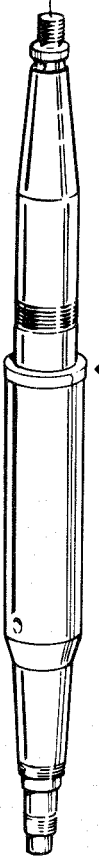
Buffer (6)
-- 70218

Spring (6) -- 70219

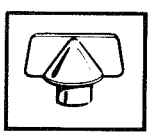
Plug (6)
-- 70220



Deflector
-- 70216
(left-handthread)
Ball bearing
-- 9876 (SKF 6310MA/P6)*

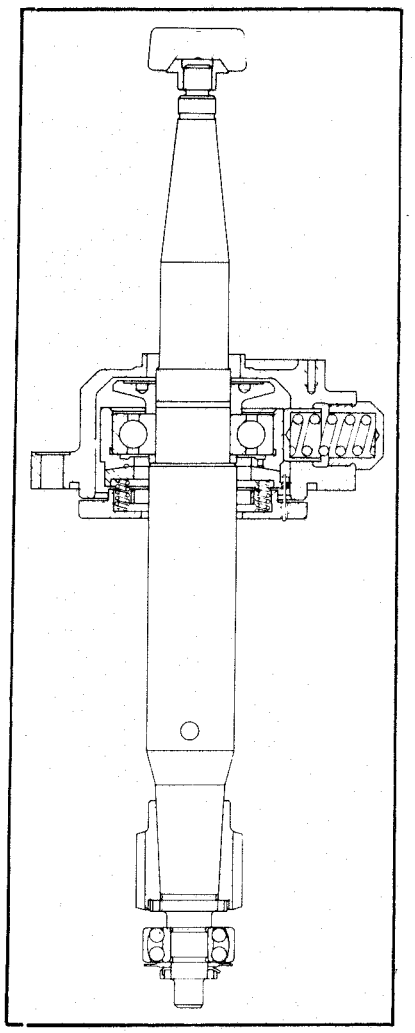


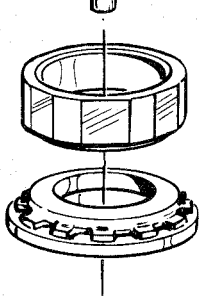
Spindle
-- 71383



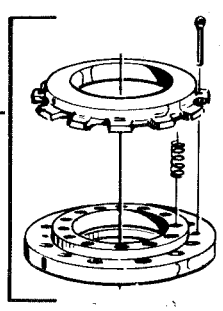
Cap nut
-- 516949-04
(see Bowl)

Height adjusting ring (0-3)
2 mm -- 70213
4 mm -- 70214
6 mm -- 70215



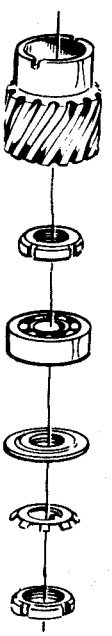


Ball bearing housing
-- 70212



Split pin (2)
-- 64227
Wear ring
-- 70211
Spring (12)
-- 9699

Spring support
-- 70210



Worm
1420-1500 r/m--71921
1700-1800 r/m--71917

Round nut
-- 11522

Ball bearing
-- 60695 (SKF 2305M)*

Washer
-- 8511

Lock washer
-- 38159 (SKF MB5)

Round nut
-- 67472 (SKF KM5)

* or equivalent bearing of another make.

DISMANTLING, ASSEMBLY

Spring casing

After unscrewing the plugs, move the upper end of the spindle round, pressing it outwards. This releases the buffers, which can then be removed. When assembling, make sure that the buffers butt against the planed surfaces of the ball bearing housing. The final tightening of the plugs is best done when the bowl spindle is in place in the machine.

Deflector

The deflector has a left-hand thread and is unscrewed CLOCKWISE.

Lower ball bearing

Both the bearing and the washer should be warmed before being fitted on the spindle.

Worm

The worm is located on a tapered section of the spindle and can be knocked off with a tin mallet or a hammer and soft drift. If the worm is exchanged, it is important that the worm wheel should be inspected at the same time and also exchanged if necessary.

When assembling, remember to tighten the round nut securely.

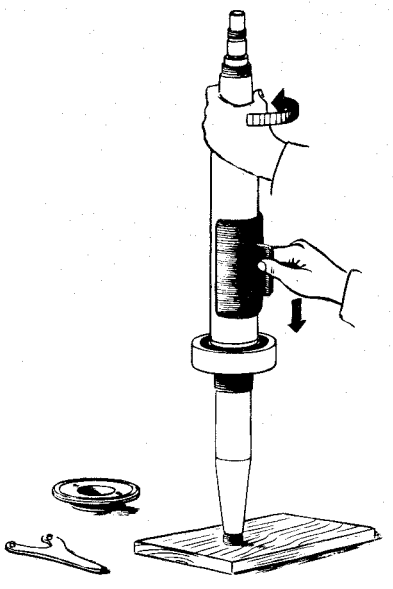
Axial buffer

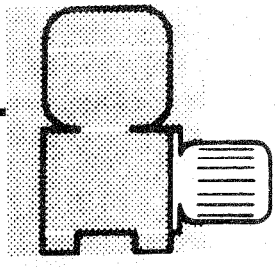
The axial buffer is mounted as a unit held together by the split pins. The springs must not be compressed when the buffer is fitted.

Upper ball bearing

If the bearing is to be removed, first dismantle the other parts of the spindle. Stand the bowl spindle top end downwards on a soft surface (wooden board or similar) and drive off the bearing by blows on the inner ring with the drive-off tool.

Warm the ball bearing before fitting it.





MOUNTING the MOTOR

General Drawing – Perspective Drawing with Part Numbers – Mounting.

SPECIAL TOOLS see chapter G – LUBRICATION see chapter H – CLEANING see chapter L – MOTOR see special manual.

GENERAL HINTS

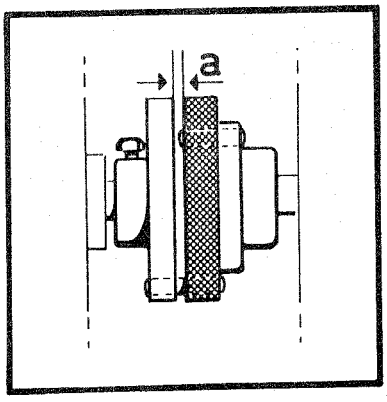
Motor

The speed prescribed for the ingoing shaft of the machine (the worm wheel shaft) and which must on no conditions be exceeded, is stamped on the type plate of the machine. The worm gear ratio and the friction blocks of the clutch are suited to this speed.

Check the number of revolutions by means of the revolution counter after installation and after exchange of motor.

For particulars concerning power requirement and speed see chapter C.

Coupling pulley or belt pulley



When the machine is delivered with motor, the pulley has been fastened in its correct position on the motor shaft. Score the position of the pulley before loosening it from the motor shaft. The axial play for the elastic plate - measurement "a" in illustration - should be about 2 mm (5/64").

When finishing a predrilled coupling pulley or belt pulley, the tolerance H7-J6 according to ISO should be applied.

Electric cable

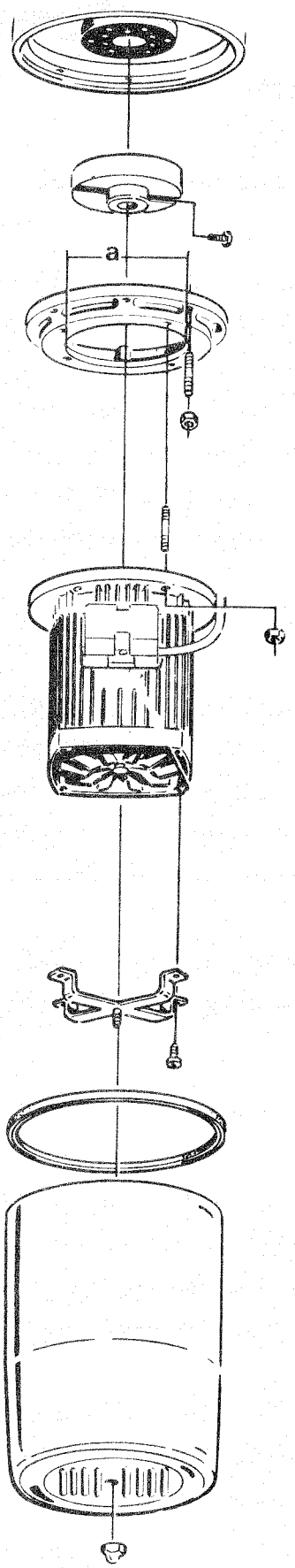
The electric cable to the motor should preferably have a free length allowing the removal of the motor without disconnecting the cable from the terminals.

Connection to mains

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

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

FLANGE MOTOR ("4"-drive)



Frame

Coupling pulley*
-- 533487-80

Set screw -- 2210941-18

Measure "a"	230 mm	250 mm
Motor adapter	526426-2	70622
Stud bolt (4)	2216301-14	66690
Nut (4)	221809-5	70493

Stud bolt (4)
-- 2216261-3

Nut (4)
-- 72946

Motor --539443-00

Holder for protecting hood
-- 786145-81

Screw (4)
-- belong to motor

Seal strip
-- 11591

Protecting hood
-- 786131-80

Cap nut
-- 72947

* When ordering - follow the instructions given in chapter A.

Mounting the motor

Push the elastic plate on to the pins in the coupling pulley of the machine.

Push the motor (with the adapter fixed) carefully on to the stud bolts, at the same time fitting the pins of the coupling pulley into the holes of the elastic plate, so far that the adapter enters the guide in the frame but there is still room left for screwing on the nuts. Now push home the motor and tighten the nuts alternately.

Screw out the lifting eye and fit the protecting hood.

Dismounting the motor

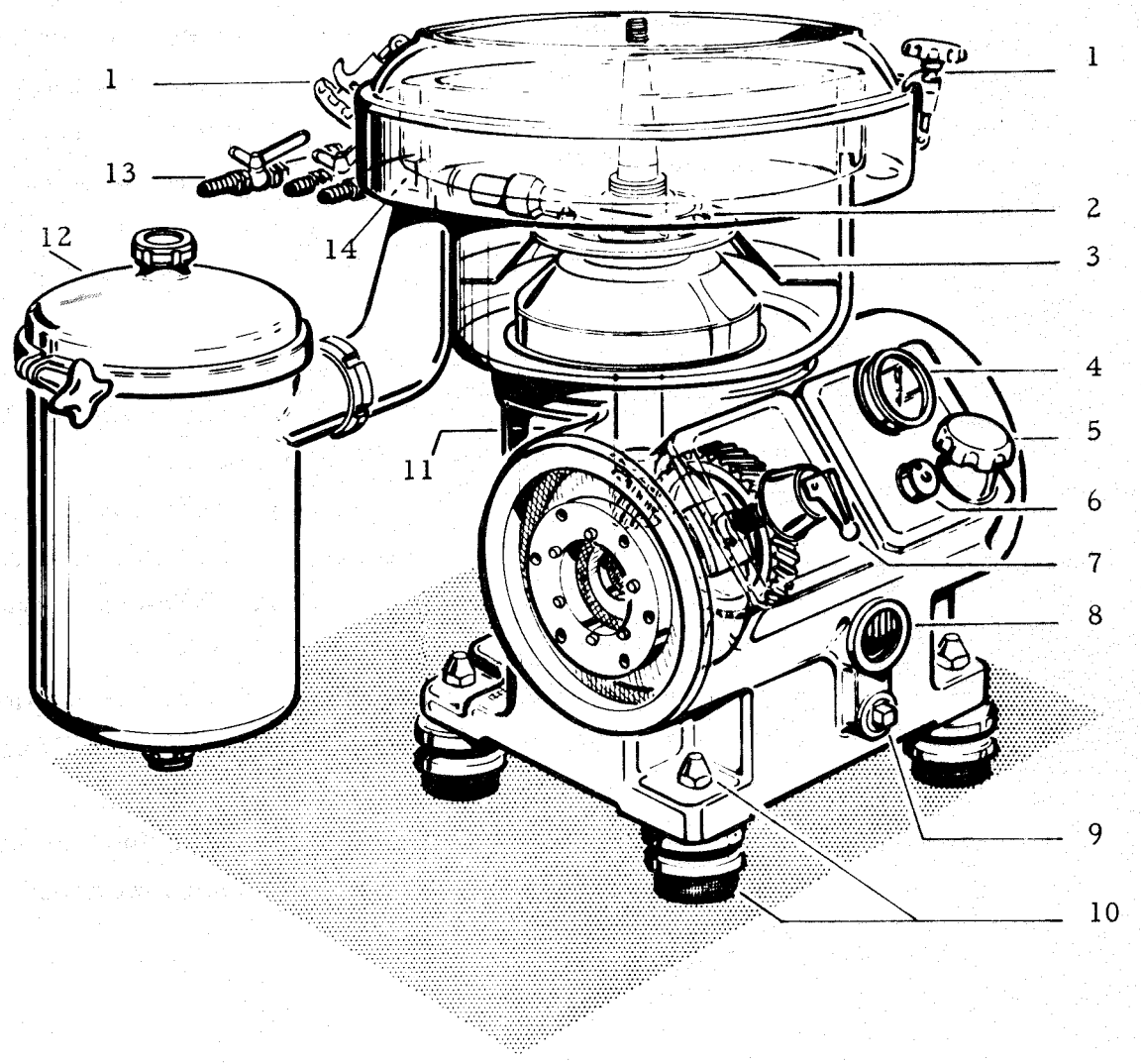
Remove the protecting hood.

If necessary, remove the connection box from motor and loosen cable. Screw in lifting eye.

Unscrew the nuts stepwise as far as possible while alternatingly withdrawing the motor adapter with motor on the bolts.

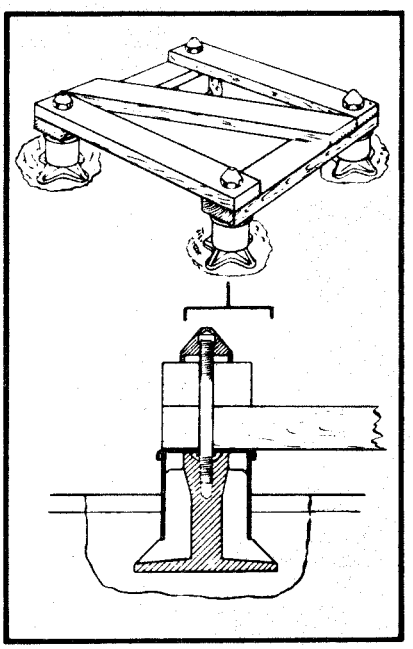
Lift off the motor adapter and motor.

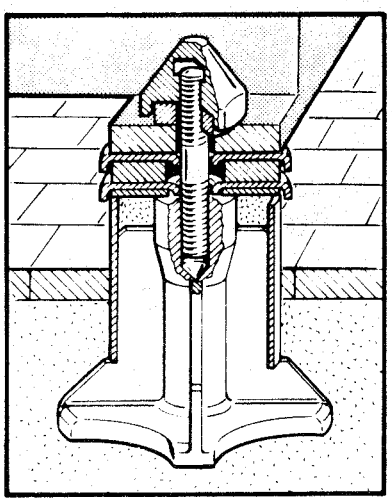
FRAME PARTS. FRAME ERECTION



1 Hinged bolt
2 Paring disc device
3 Hood for paring disc device
4 Tachometer
5 Oil filling screw
6 Revolution counter
7 Brake
8 Oil gauge glass
9 Oil drain
10 Vibration damper
11 Connection for ventilation and drain
12 Cyclone
13 Control valve
14 Flushing device for sludge cover

ERECTION





For necessary measures for embedment of the anchoring feet – see dimensioned drawing in chapter G. Exact levelling is necessary before embedment is carried out.

A wooden templet according to the sketch is preferably used to facilitate the levelling of the anchoring feet. It is essential to provide for exactly correct centre distances between the anchor bolts, so that the bolts will not press against the edges of the holes in the frame. Otherwise the resilient mounting of the frame will be impeded.

After the concrete has hardened:

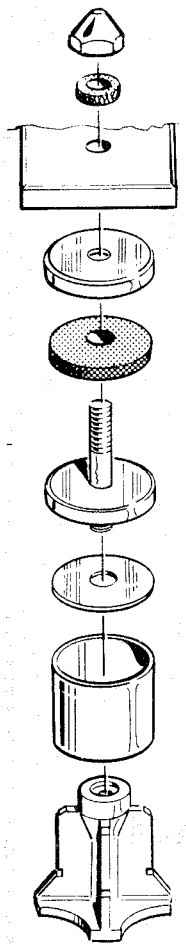
o Also fill up the space between the spacing sleeves and the anchoring feet with concrete.

o Put the frame in its place and check by means of a spirit level and at least in two directions that the levelling has been correctly done. When necessary adjust by means of adjusting washers.

o Fit the vibration dampers in the order appearing from the dimensioned drawing and the adjoining illustration of the frame parts.

o Screw on and tighten the cap nuts, but not so firmly that the elasticity of the rubber washers is eliminated.

VIBRATION DAMPER (4)



Cap nut
-- 71078
Rubber washer
-- 65235

Frame

Cup cover
-- 65233

Rubber washer
-- 65232

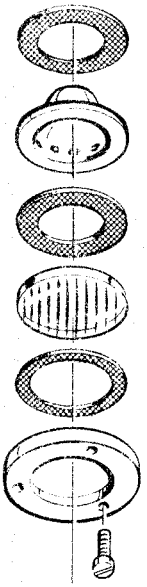
Anchor screw
-- 71079

Height adjusting
washer (6)
-- 71077

Spacing tube
-- 71074

Anchoring foot
-- 71073

OIL GAUGE GLASS



Packing --
38967

Oil level stabilizer
-- 61899

Packing --
38967

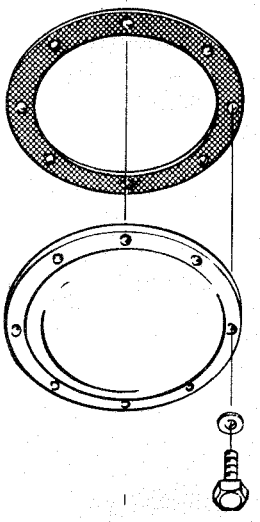
Glass disc
-- 38685

Packing
-- 37167

Fixing ring
-- 65457

Screw (3)
-- 65458

FRAME SHIELD

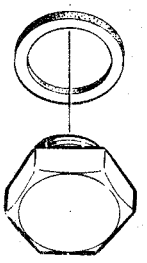


Packing
-- 37490

Shield
-- 528045-2

Washer (6)
-- 66381
Screw (6)
-- 62627

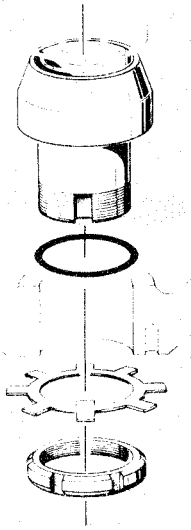
OIL DRAIN



Packing
-- 35607

Screw
-- 62467

BOTTOM BUSHING



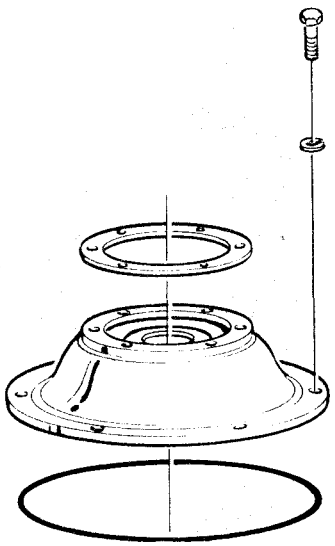
Bushing
-- 70202

Seal ring
-- 66554

Lock washer
-- 38723
(SKF MB 10)

Round nut
-- 67477
(SKF KM 10)

HOOD for PARING DISC DEVICE



Screw (6)
--2210941-09

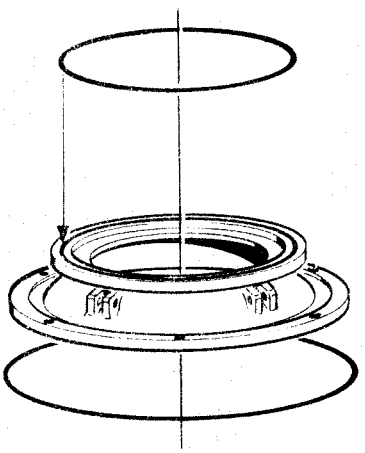
Washer (6)
-- 22405

Height adjusting ring (1-5)
-- 67642

Hood
-- 71384

Seal ring
-- 71401

FRAME RING

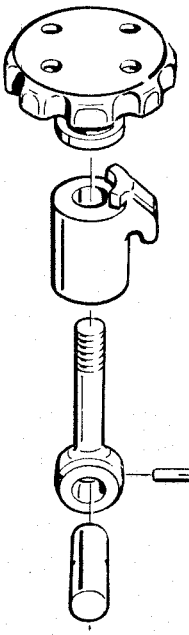


Seal ring
-- 71402

Frame ring
-- 515609-80

Seal ring
-- 223402-25

HINGED BOLT (9) for FRAME HOOD and FRAME RING



Hand wheel
-- 67885

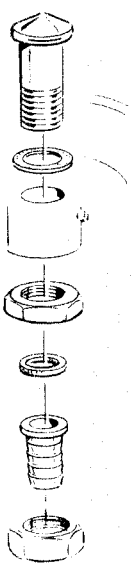
Clamping shoe
-- 70279

Hinged bolt
-- 68121

Pin
-- 67783

Hinge pin
-- 71456

FLUSHING DEVICE for SLUDGE COVER



Nozzle
-- 785868-1

Packing
-- 516281-10

Sludge cover

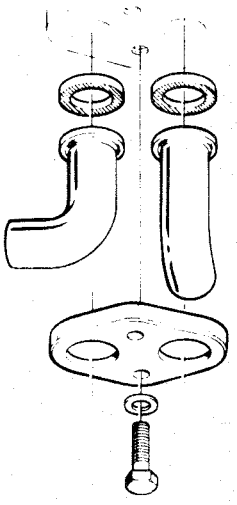
Nut
-- 785877-1

Packing
-- 68937

Hose nipple
-- 252613-12

Coupling nut
-- 521136-1

CONNECTION for VENTILATION and DRAIN on FRAME TOP PART



Packing (2)
-- 71066

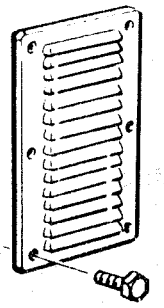
Pipe (2)
-- 532047-80

Flange
-- 531774-2

Washer(2)
-- 66381

Screw (2)
-- 2210948-34

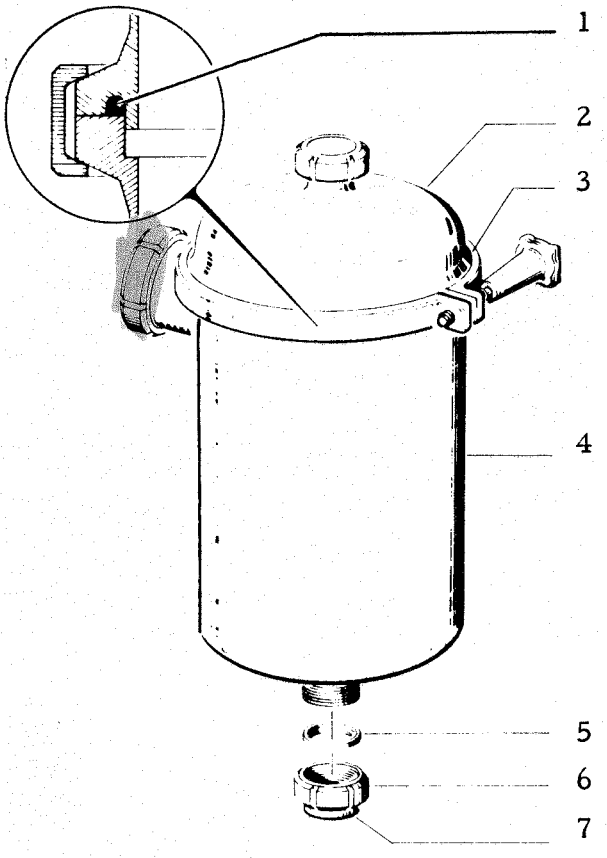
VENTILATION on FRAME BOTTOM PART



Grating
-- 65445

Screw (6)
-- 11677

CYCLONE



1 Packing -- 223412-50

2 Cover
-- 32224-0072-1

3 Clamping ring
-- 32041-0062-1

4 Container
-- 32302-0005-2

5 Packing
-- 190604

6 Nut
-- 190616

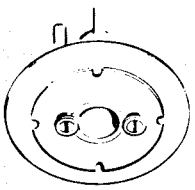
7 Sleeve
-- 190630

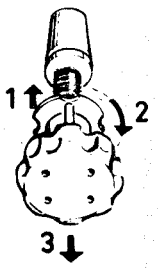
- Packing (against frame)
-- 190611

(32302-0004-4)

CONTROL VALVE -- 71812

Plug cock

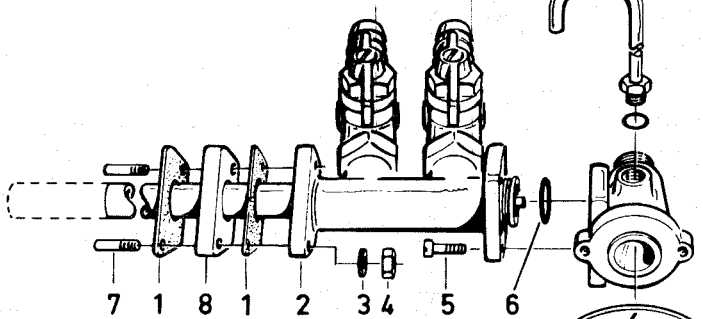




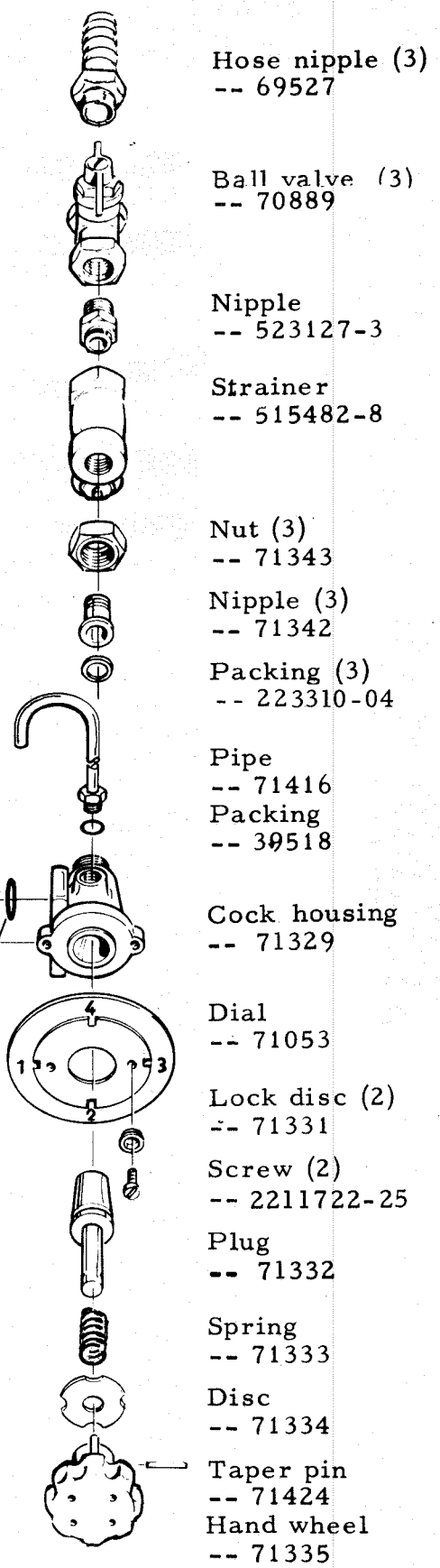
For dismantling depress the disc and turn it a quarter revolution so that the recesses face the lock discs. Pull the hand wheel outwards. For cleaning see chapter L.

Grease the plug before mounting. Check the liquid flow -- see chapter L.

NOTE. The plug can be removed from the housing during operation. The feed of operating liquid from the tank must, however, be shut off. The plug must be reinserted within 3 minutes, as otherwise the bowl may open.



1 Packing (2)
-- 71923
2 Connection piece
-- 71813
3 Washer (2)*
-- 65451
4 Nut (2)*
-- 2218043-16
5 Screw (4)
-- 2211722-25
6 Seal ring
-- 64708
7 Stud bolt (2)*
-- 2216241-4 **), 64367
8 Spacing piece *)**)
-- 516939-2



Hose nipple (3)
-- 69527

Ball valve (3)
-- 70889

Nipple
-- 523127-3

Strainer
-- 515482-8

Nut (3)
-- 71343

Nipple (3)
-- 71342

Packing (3)
-- 223310-04

Pipe
-- 71416

Packing
-- 30518

Cock housing
-- 71329

Dial
-- 71053

Lock disc (2)
-- 71331

Screw (2)
-- 2211722-25

Plug
-- 71332

Spring
-- 71333

Disc
-- 71334

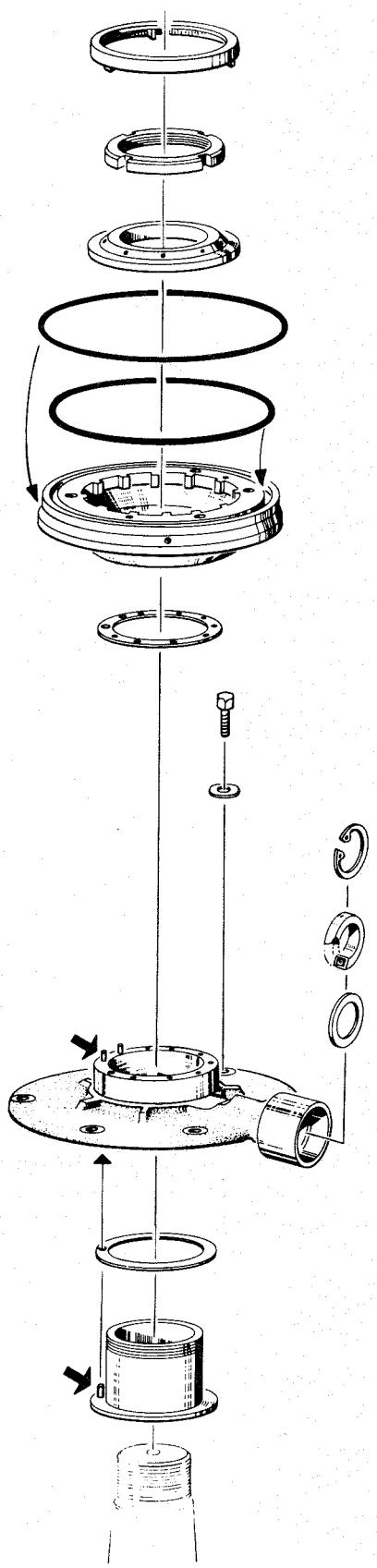
Taper pin
-- 71424

Hand wheel
-- 71335

* Not included in the complete-unit number.

** Only with certain frame types.

PARING DISC DEVICE for OPERATING LIQUID -- 515184-81 (*-marked parts are not included in the complete unit number)



Collar
-- 515183-80

Round nut
-- 71364

Paring disc
-- 71363

Seal ring
-- 73632

Seal ring
-- 38259

Distributing ring
-- 516390-1

Packing
-- 71362

Screw (6)
-- 2210942-36*
Washer (6)
-- 22405*

Snap ring
-- 223642-1

Lipseal ring
-- 60739

Washer
-- 68917

Distributing cover
-- 524435-80

Packing
-- 71360

Sleeve
-- 71358

Bowl spindle cone

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

Dismantling

For dismantling the bowl see chapter I. 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 appearing from the illustration. Use the special tools.

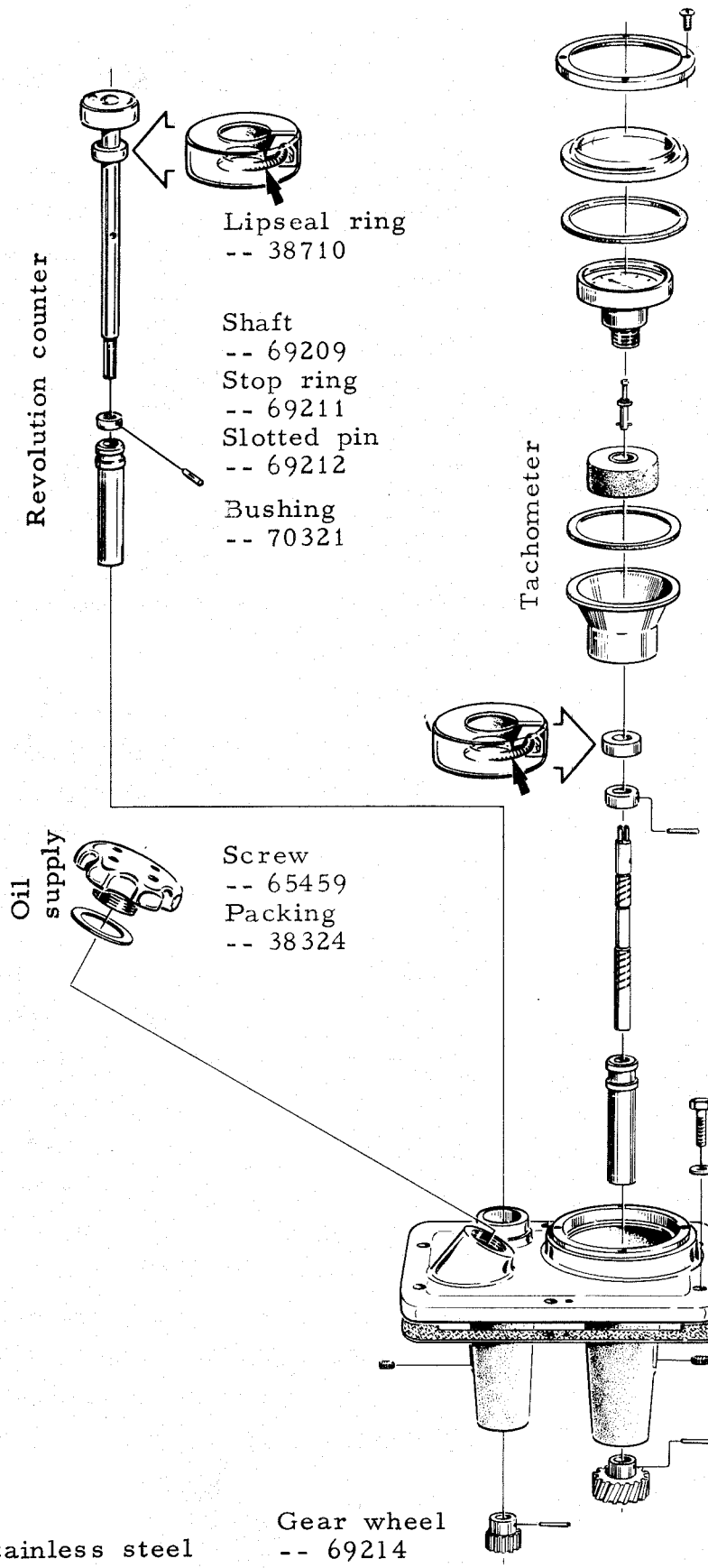
Cleaning

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

Assembling

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

REVOLUTION COUNTER and TACHOMETER -- 519678-80 (*-marked parts are not included in the complete-unit number)



Screw (4)
-- 11565
Ring
-- 43105
Protecting glass
-- 43094
Seal ring
-- 43695
Tachometer
--537470-02
Intermediate shaft
--537469-80
Holder
-- 70325
Packing
-- 70323
Guide sleeve
-- 70324
Lipseal ring
-- 38710
Stop ring
-- 69211
Slotted pin
-- 69212
Shaft
-- 70322
Bushing
-- 70321
Screw (6)
-- 72933*, 2210942-38*)**)
Washer (6)
-- 20758*, 65451*)**)
Cap
-- 70320
Packing*
-- 65220
Set screw (2)
-- 221585-13
Taper pin (2)
-- 69226
Gear wheel
-- 69225

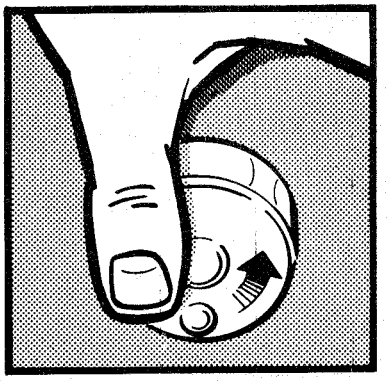
**) stainless steel

(cont.)

(Revolution Counter and Tachometer, page 2)

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 1:50).
Make sure the lipseal ring is directed according to the illustration.

TACHOMETER

Speed particulars - see chapter C.

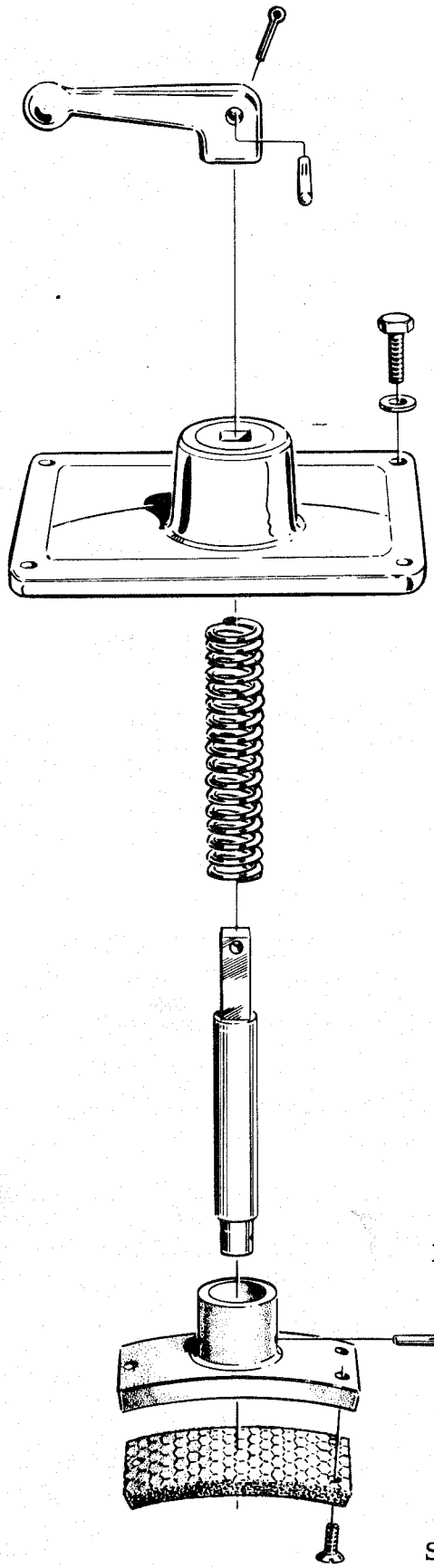
Dismantling

Remove the ring and the protecting glass with packing. Lift out the tachometer and unscrew it from the holder. Take out the intermediate shaft in the same direction as the tachometer. Remove the gear wheel and knock out the shaft towards the tachometer side.

Assembling

Lubricate shaft and gear wheel with oil of the same type as used in the gear housing. Direct the gear wheel correctly - pin and hole are tapered. In case of play ream the hole (conicity 1:50).
Direct the lipseal ring according to the illustration, slip it onto the shaft and knock it carefully into its seat. Push home the shaft and secure the gear wheel with the taper pin.

BRAKE -- 67799 (*-marked parts are not included in the complete-unit No.)



Split pin
-- 8199

Handle
-- 533513-1

Pivot
-- 39098

Screw (4)*
-- 2210942-38

Washer (4)*
-- 65451

Cap
--67786

Spring
-- 39096

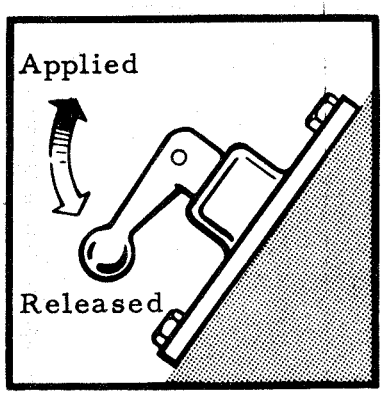
Spindle
-- 65461

Brake shoe, compl.
- 537602-80

Slotted pin
-- 67960

Lining
-- 65227

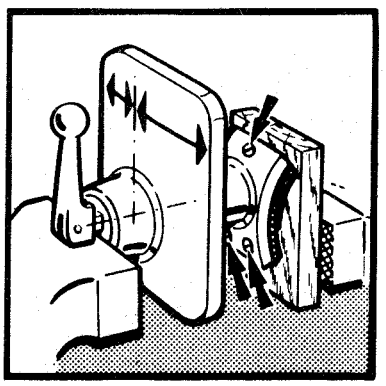
Screw (3)
-- 8341



Exchange of lining

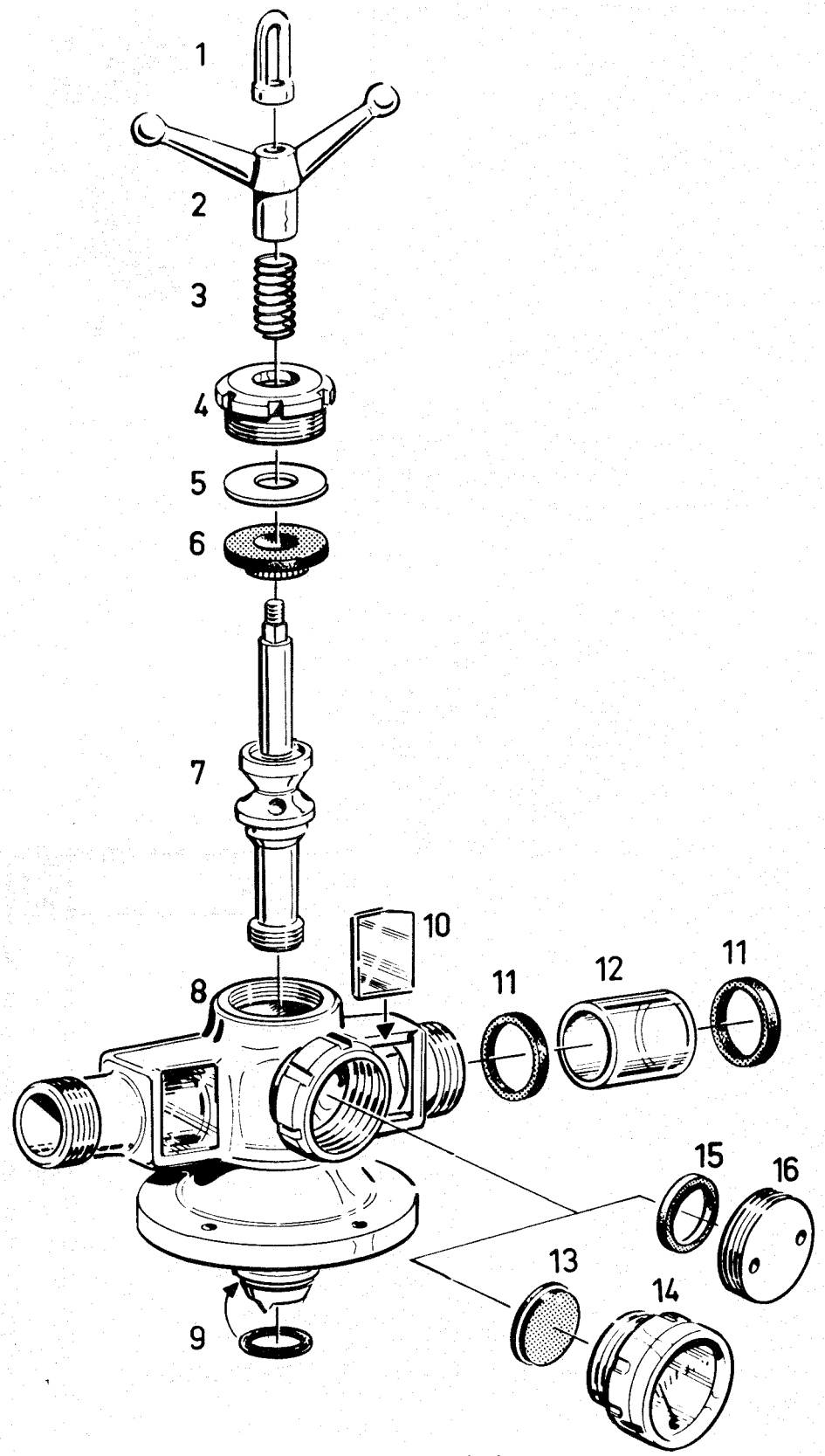
Release the brake and remove the cap. Exchange the lining. Note that the screws are slotted at both ends (use an angle driver). Fasten the cap to the machine with the handle pointing downward.

Dismantling. Assembling



Clamp the cap in a screw vice, apply the brake, and remove the handle. See that cap, handle, and brake shoe are turned as shown by the arrows in the figure. Fasten the cap to the machine with the handle pointing downward.

CONNECTION HOUSING (with pressure gauge) -- 528088-81, (without pressure gauge) -- 528088-83



1 Lifting eye nut
-- 527976-2
2 Handle
-- 71404
3 Spring
-- 70634
4 Cap nut
-- 70635
5 Washer
-- 70633
6 Packing collar
-- 75020
7 Inlet pipe
-- 527975-1
8 Housing
-- 528003-81
9 Seal ring
-- 71866
10 Protecting glass(2)
-- 523339-1
11 Packing(4)
-- 71068
12 Sight glass (2)
-- 74565
13 Membrane*
-- 74384
14 Pressure gauge*
-- 74386
15 Packing**
-- 71066
16 Cover**
-- 74656

Set of Spares

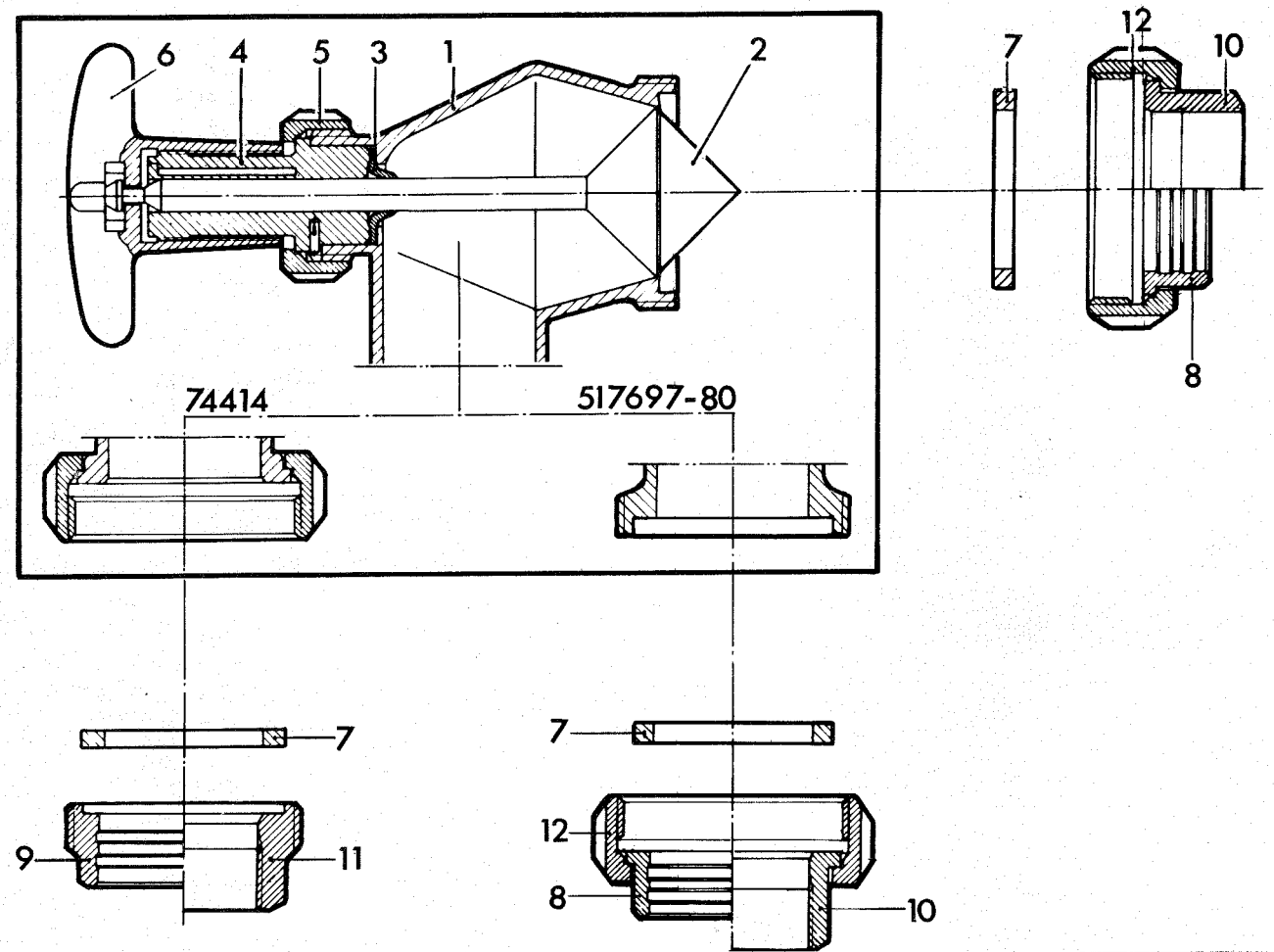
6 Packing collar
-- 75020
9 Seal ring (2)
-- 71866
11 Packing (4)
-- 71068
12 Sight glass (2)
-- 74565
13 Membrane*
-- 74384

* Only for connection housing with pressure gauge.

** Only for connection housing without pressure gauge.

REGULATING VALVE without connecting parts 74414

REGLERINGSVENTIL utan kopplingsdelar 517697-80



Pos.	Part No. Detalj nr.	Description	Benämning	Qty. Ant.
1.		Valve housing	Ventilhus	
2.	74421	Valve cone	Ventilkägla	
3.	74494	Packing collar	Tätningsmanschett	
4.	74425	Valve bushing	Ventilbussning	
5.	190613	Coupling nut	Kopplingsmutter	
6.	518469-03	Hand wheel	Vred	
		Connecting parts	Anslutningsdelar	
7.	71068	Packing	Packning	2
8.	190630	Sleeve (even pipes) 51 mm, 2"	Hylsa (släta rör) 51 mm, 2"	
9.	190644	Nipple (even pipes) 51 mm, 2"	Nippel (släta rör) 51 mm, 2"	
10.	72234	Sleeve (threaded pipes) R 1 1/2"	Hylsa (gängade rör) R 1 1/2"	
11.	72226	Nipple (threaded pipes) R 1 1/2"	Nippel (gängade rör) R 1 1/2"	
12.	190616	Coupling nut	Kopplingsmutter	
		Spare part	Reservdel	
3.	74494	Packing collar	Tätningsmanschett	