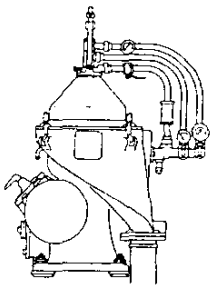
ALFA-LAVAL

102



WHPX 405
NWHPX 405

MAINTENANCE
REPAIR

MR

Mineral Oil Separator

WHPX 405 TGD-20
NWHPX 405 TGD-20

Book No.: MR SO 5292E 2/8604

ALFA-LAVAL SEPARATION AB – S-147 00 TUMBA – SWEDEN

FOREWORD

This manual is intended primarily for the maintenance personnel. It deals with the preventive maintenance as well as the disassembly and assembly of the machine.

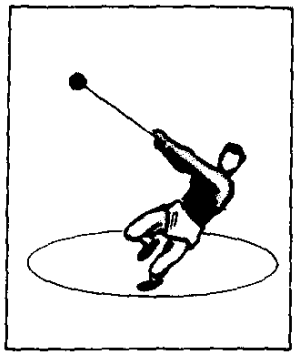
The purpose of the manual is to enable the reader to overhaul the machine and make necessary repairs, with the exception of jobs requiring machining, heat treatment and balancing.

Knowledge of the safety precautions is important.

ALFA-LAVAL SEPARATION AB
Department SDI

CONTENTS

⚠ SAFETY PRECAUTIONS ⚠
FOR HIGH SPEED SEPARATORS



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

To ensure the safety of personnel and equipment:

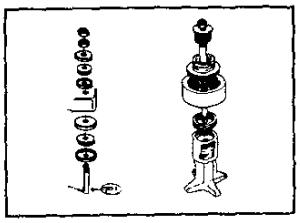
- Always carefully follow the safety instructions and precautions.
- Always carefully follow the instructions in the instruction manuals concerning installation, assembly of the components, operation and regular maintenance.
- Always use genuine Alfa-Laval spare parts and tools.
- Ensure that all operators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

NONCOMPLIANCE MAY CAUSE A SERIOUS ACCIDENT

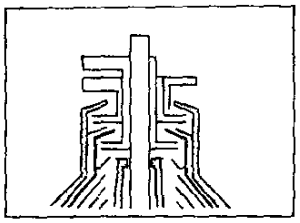
BEFORE INITIAL START-UP OF NEW/OVERHAULED MACHINES

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

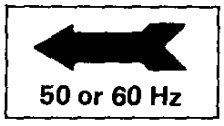
- Make sure that the gear housing has been filled with the correct quantity of specified oil.



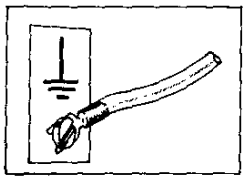
- Check that installation and tightness of rubber vibration dampers between frame and foundation is according to instructions.



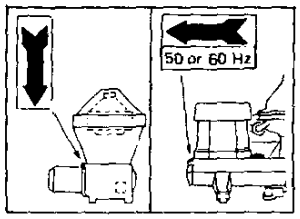
- Many separators are equipped with paring disc liquid discharge. It is important that the paring device/feed tube assembly has correct height adjustment and is securely tightened before machine is operated. See instruction manual for detailed instructions.



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



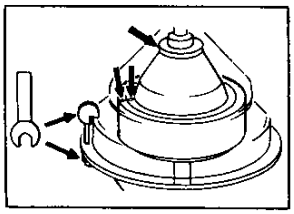
- Make sure that the separator frame, control boxes and cabinets are connected to earth (ground) in accordance with local regulations.
- Note that a separator must never be started without its bowl. This may damage its bearings.



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

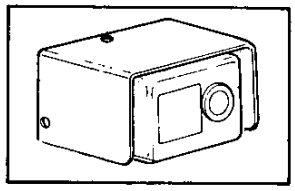
  Check the operating rpm. with an empty bowl against the value specified in the instruction book. Self--cleaning separators are to be checked before the operating water is introduced (open bowl).

OPERATION

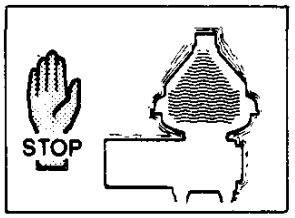


- NEVER start the machine before the lock rings of the bowl, inlet and outlet devices, frame hood, clamps, pipe couplings and other fastenings have been securely tightened. Note that the assembly mark Ò on the main lock ring must be aligned or pass the Ò mark on bowl body or bowl hood when lock ring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

- The brake should always be released before start.



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



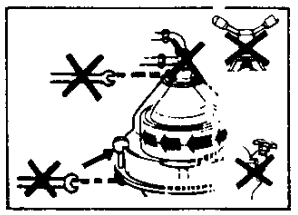
- If unusual vibration occurs:

  INSTANT ACTIONS
  - o switch off separator motor
  - o apply brake
  - o ascertain that liquid is fed to the bowl, see chapter OPERATION in Operator's Manual (OM)

  Switch off preheater. Wait until the separator has come to a complete standstill, then switch off:
  - o separate feed pump (if any)
  - o programme equipment (if any)

  Arrange manually for recirculation of unseparated oil. Dismantle, clean and check all parts carefully. Do not operate until the cause of the vibration has been located and eliminated.

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

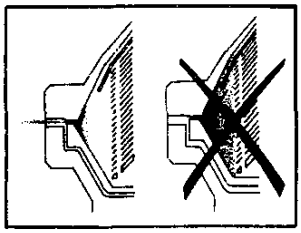


- NEVER loosen any part of the machine until the bowl has come to a COMPLETE STANDSTILL.

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

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

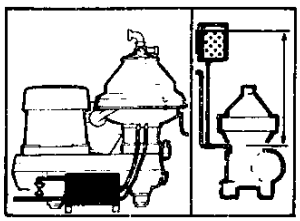
TO BE OBSERVED FOR SAFE OPERATION OF SOLIDS–EJECTING SEPARATORS OF PX–TYPE



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

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

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



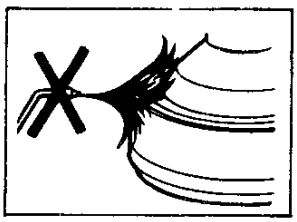
- The function of the bowl's discharge mechanism is vital for safe operation of the separator. It is therefore absolutely necessary to have an uninterrupted flow of clean, soft (dehardened) water/ /liquid at prescribed **constant** pressure. Ensure that the **entering pressure cannot fall** below the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

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

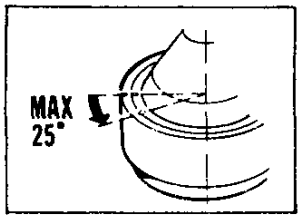
MAINTENANCE

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

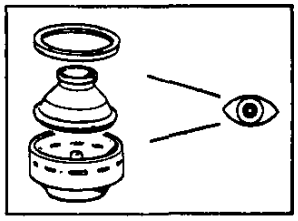
- A separator bowl is balanced as a complete unit. Do not interchange the components of a bowl with those of any other bowl. Make sure that no parts are left out during assembly. All major parts are marked with the full serial number or the last three digits for identification purposes.



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



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



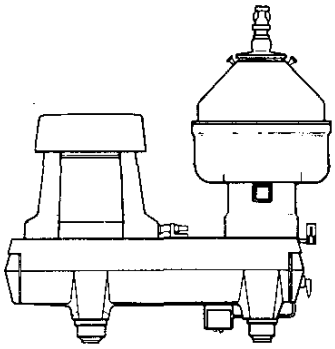
- The disc stack gradually settles and looses compression force. At each maintenance occasion check whether more discs are to be added in order to assure correct compression. NEVER remove a disc without replacing it with a new one. When reassembling, be sure to assemble slotted discs in the same order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

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

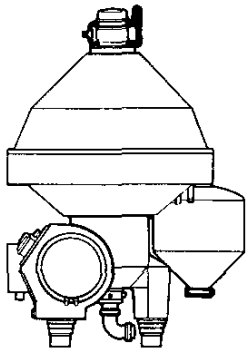
- Make sure that the brake is in good condition on machines equipped with a brake.

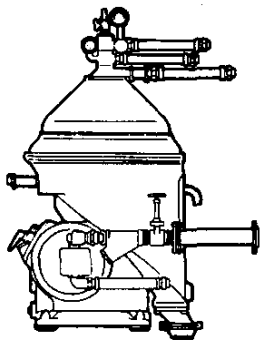
IF YOU ARE UNCERTAIN OF ANY POINTS, CONTACT YOUR ALFA-LAVAL REPRESENTATIVE.

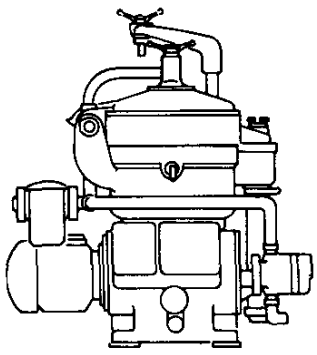
ALFA-LAVAL SERVICE



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







PUBLIKATION MANUAL DRUCKSCHRIFT PUBLICATION PUBLICACIONES

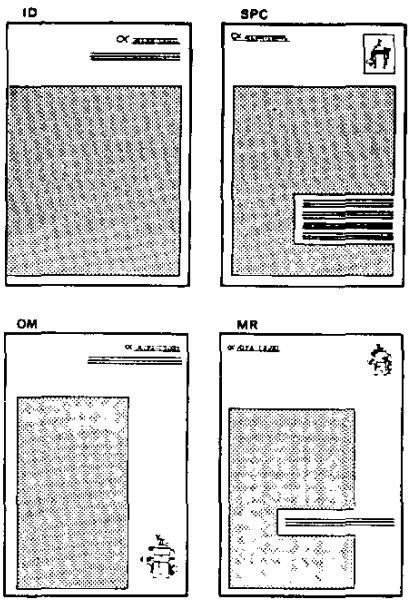
Vid beställning av publikationer ange:
publikationsbeteckning, maskintyp, tillverknings-nummer och spec. nr. eller prod. nr.

When ordering publications, please, state:
Denomination of the publication, machine type, manufacturing No., and specification- or product No.

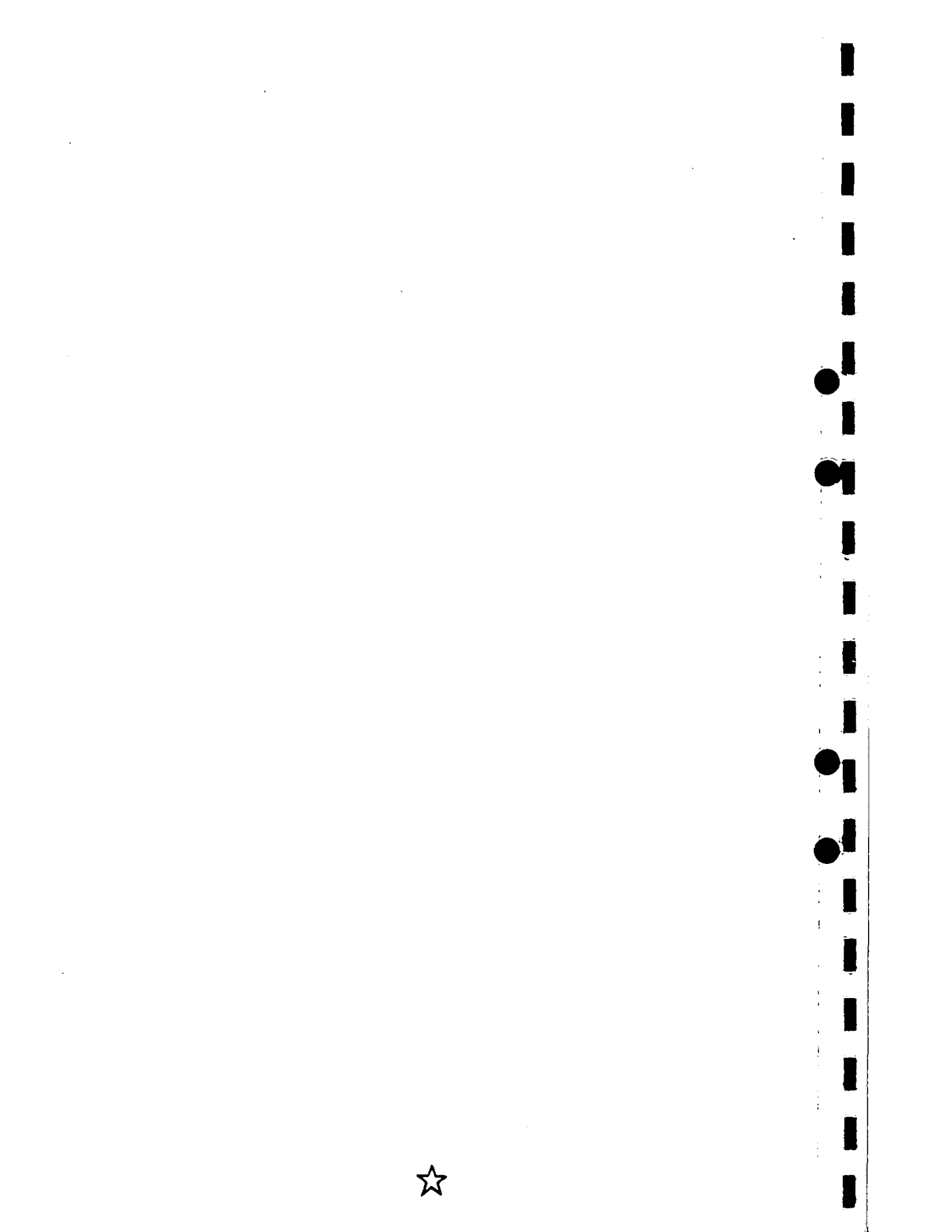
Bei Druckschriftbestellung anzugeben:
Bezeichnung der Druckschrift, Maschinentyp, Herstellungs-Nr. und Spez.-Nr. bzw. Prod.Nr.

Lors de commande des publications veuillez indiquer:
Dénomination de la publication, Type de machine, Numéro de fabrication et Numéro de la spécification ou Numéro de production.

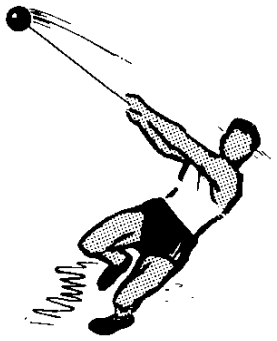
Al cursar pedidos de publicaciones sírvanse indicar:
designación de la publicación, tipo de máquina, número de fabricación y n^{o}. de especif. ó n^{o}. de prod.



Publikation		**Innehåll**	**Avsedd för**
ID	Installationsdata	Installation, måttuppgifter, tekniska data	Projektingenjörer. Konstruktörer. Installatörer. Driftsingenjörer
OM	Driftsinstruktion	Körning och daglig skötsel	Maskinskötare
SPC	Reservdelskatalog	Illustrerad reservdelsförteckning	Servicepersonal. Inköp
MR	Underhållsbok	Översynsschema, demontering, montering, inställningsmått, reparation	Servicepersonal
Manual		**Contents**	**Intended for**
ID	Installation Data	Installation, measurements, technical data	Project engineers. Design engineers. Fitters. Production engineers
OM	Operator' s Manual	Operation and daily maintenance	Machine operator
SPC	Spare Parts Catalogue	Spare parts lists	Service personnel. Purchasing dept.
MR	Maintenance	Maintenance schedule, disassembly, assembly, adjusting measurements, repair	Service personnel
Druckschrift		**Inhalt**	**Beabsichtigt für**
ID	Installationsdaten	Installation, Massangaben, technische Daten	Planungsingenieure. Konstrukteure. Installateure. Betriebsingenieure
OM	Betriebsanleitung	Betrieb, tägliche Wartung	Bedienungspersonal
SPC	Ersatzteilkatalog	Ersatzteilverzeichnis	Wartungspersonal. Einkäufer
MR	Wartung	Wartungsschema, Zerlegung, Zusammenbau, Einstellungsmasse, Instandsetzung	Wartungspersonal
Publication		**Contenu**	**Destiné aux**
ID	Particularités de l'installation	Installation, mesures, particularités techniques	Ingénieurs projecteurs. Constructeurs. Installateurs. Ingénieurs de production
OM	Guide d'utilisation	Utilisation et entretien quotidien	Utilisateurs des machines.
SPC	Liste de pièces de rechange	Listes de pièces de rechange	Personnel d'entretien. Service d'achats
MR	Guide d'entretien.	Planning de revision, démontage, assemblage, mesures de réglage, reparation	Personnel d'entretien
Publicacion		**Contenido**	**Prevista para**
ID	Datos para instalación	Instalación, dimensiones, características técnicas	Ingenieros y proyectistas. Instaladores. Ingenieros de servicio
OM	Instrucciones de funcionamiento	Funcionamiento y mantenimiento diario	Operarios de las máquinas
SPC	Catálogo de piezas de recambio	Lista de piezas de recambio ilustrada	Personal de servicio. Sección de compras
MR	Mantenimiento	Esquema de supervisión, desmontaje, montaje, dimensiones de ajuste, reparación	Personal de servicio



WHY PREVENTIVE MAINTENANCE?



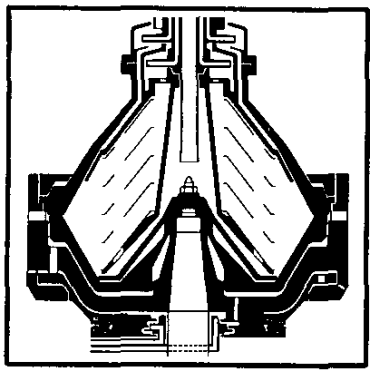
The bowl of a centrifugal separator rotates at a very high speed and great forces are generated.

The separator, like anything else, is subject to wear. Corrosion, erosion and just ordinary wear due to operation, all take their toll.

To continue safe and efficient operation, certain parts will by and by require replacement. Proper maintenance and operation will prolong parts life, and proper inspection will warn you when replacement is necessary.

- If the parts of the machine are worn, eroded, or improperly assembled, the forces generated may cause machine breakdown and injury to personnel.

MAJOR BOWL PARTS

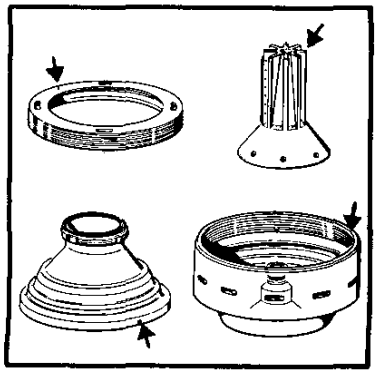


Balancing

ALFA-LAVAL separator bowls are statically and dynamically factory-balanced only as **complete** bowl assemblies.

- Therefore, major bowl parts cannot be replaced without re-balancing the **entire** bowl.

Bowl parts must never be interchanged from one machine to an other. This is just as imperative where machines of the same or a similar tvpe are concerned. The bowl parts of each machine are stamped with the machine manufacturing number or the last three digits of that number.

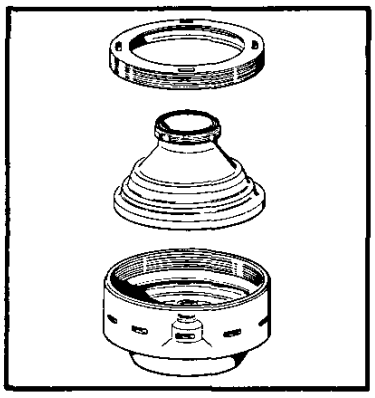


Locating means

The bowl parts are assembled in a certain relative position to each other. Alignment marks, guide pins and lugs are provided on major parts and must be undamaged and legible.

- Never operate the machine when these locating means are not in the proper relative position, or are illegible.

CORROSION



- Corrosive attacks on bowl parts and particularly bowl body, bowl hood and lock ring should be watched with the utmost care.

Parts of non-stainless steel and cast-iron

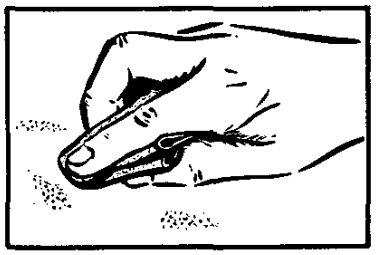
Corrosion (rusting) occurs as a rule on unprotected components of non-stainless steel and cast-iron forming part of the bowl, bowl spindle and frame and exposed to the process liquid or aggressive atmosphere.

Replace the parts when corrosion is evidently jeopardizing their strength, relative location and play, or general function.

Parts of stainless steel etc.

In certain circumstances corrosion can occur even on stainless bowl parts. The risk of attack will increase when the surface is isolated from the surroundings by a layer of solids.

Corrosion attacks on stainless steel are not easily detected. This applies for instance to attacks made by chlorides. Such attacks may begin merely as small dark spots.



- **Polish** such dark spots with a fine-grain abrasive cloth. In some cases this will prevent further attacks.

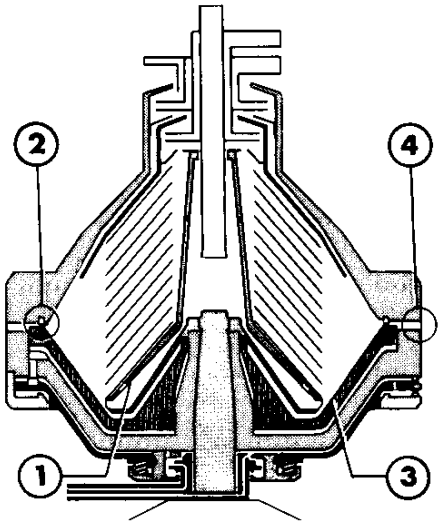
- Under special conditions corrosion on stainless steel can result in deeper attacks, so-called pits, to which special attention should be given.

Pits lying closely together or forming a regular pattern such as a straight or curved line may indicate that cracking has begun beneath the surface of the material. Such pits should be examined by an expert on materials and checked by means of crack-indicating agents — consult our representative.

- Always watch carefully any corrosion attacks found on stainless steel. Reccord the observations.

- In unfavourable circumstances even components of copper alloy and light metal etc. may become susceptible to corrosion and should, therefore, be kept under observation.

EROSION



Erosion can occur for instance when particles suspended in the process liquid slide along a surface or strike against a surface while passing through the bowl.

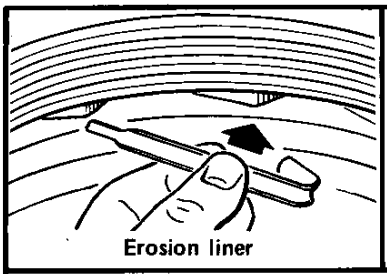
Erosion is characterized, in the former case by burnished traces in the material, and in the latter case by dents and pits with a granular and shiny surface.

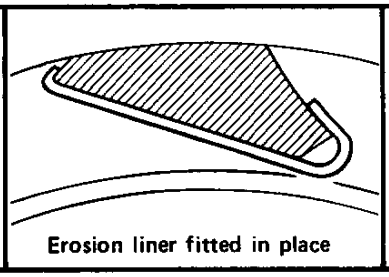
Erosion is intensified in some places by locally high flow rates.

Surfaces subjected to erosion are, by way of example,

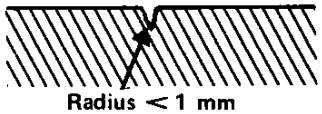
1. the underside of the distributor around the distribution holes and the wings.
2. the sealing edge of the sliding bowl bottom, and the seal ring in the bowl hood.
3. the surface of the sliding bowl bottom that faces the conical portion of the distributor.
4. the bowl wall portions ("pillars") between the sludge ports in the bowl body.

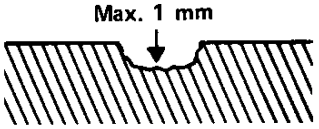
Always observe carefully any signs of erosion damage. It may deepen rapidly and weaken the bowl parts by reducing metal thickness.


Erosion liner


Erosion liner fitted in place

Pay special attention to the bowl wall portions ("pillars") between the sludge ports, especially when working conditions are such as to involve a risk of severe erosion and/or corrosion. This rule holds good even if erosion liners are used.


Radius < 1 mm

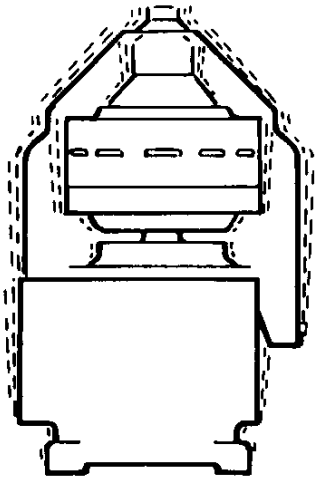


If one or more of the following observations are made, consult our representative:

1. that the bottom radius of the erosion trace is less than 1 mm in the narrowest place, or that coarse scratches are present,
2. that the largest depth of the trace exceeds 1 mm,
3. that the bowl wall portions between the sludge ports have defects presumably caused by corrosion.

Valuable information on the nature of the damage can be given by photos, plaster impressions, and hammered-in lead.

VIBRATION

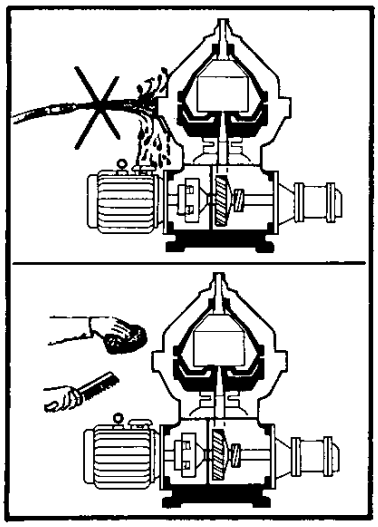


Abnormal vibration or noises are clues that something is wrong. **Stop the machine and look for the cause.**

If vibration analyzing equipment is available, use this equipment to periodically check and record the magnitude of vibration.

CLEANING

- When using chemical cleaning agents observe general rules and supplier's recommendations as to ventilation, personal protection etc.



Frame/motor

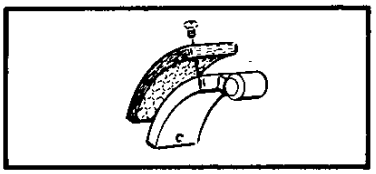
Never wash down a separator with a direct water stream. **Totally enclosed** motors can be damaged by direct hosing to the same extent as **open** motors and even more than those, because:

1. many operators believe that these motors are sealed, and normally they are not.

2. a water jet played on these motors will produce an internal vacuum, which will suck the water between the metal-to-metal contact surfaces into the windings, and this water cannot escape.

3. water directed on a hot motor may cause condensation, and subsequently produce grounding and internal corrosion.

The external cleaning of the machine should be restricted to brushing sponging or wiping while the motor is running or is still hot.



Coupling pads and brake lining

To degrease pads or lining and the corresponding friction surfaces use a suitable degreasing agent.

TABLE SHOWING SUITABLE CLEANING AGENTS FOR THE VARIOUS PARTS OF THE SEPARATOR AND FOR DIFFERENT APPLICATIONS

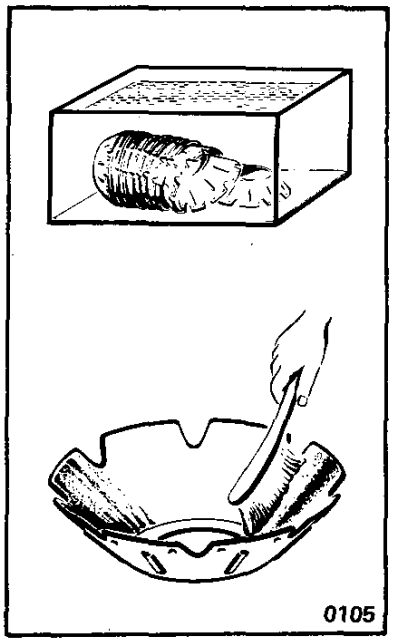
Application	Parts	Cleaning agent able to dissolve oil and grease, e.g. white spirit, diesel oil and cleaning kerosene	Cleaning agent able to dissolve deposits. Example: Shell LENSITIL Centrifuge Degreaser	See page 3:7
Separation of high-alkali lubricating oils	Parts of the driving devices	X		
	Bowl discs, other bowl parts as well as inlet and outlet parts		X	
	Paring disc device for operating water			X
Separation of other oils, such as fuel oil, cutting oil, etc.	Parts of the driving devices	X		
	Bowl discs, other bowl parts as well as inlet and outlet parts	X		
	Paring disc device for operating water			X

Bowl discs

Handle the bowl discs carefully so as to avoid damages on the surfaces during cleaning.

Separation of high-alkali lubricating oils can give a coating on the bowl discs. Mechanical removal of these deposits may prove to be a time-spending and difficult procedure. Besides, mechanical cleaning is likely to scratch the disc surfaces, causing new deposits to form quicker and adhere more firmly. An indulgent chemical cleaning is, therefore, preferred to mechanical cleaning.

The demand on a chemical cleaning agent is that it should dissolve the deposits quickly without attacking the material of the separator parts. Shell LENSITIL Centrifuge Degreaser satisfies these demands. The agent is diluted in water. Suitable concentration approx. 25 percentage by volume and temperature 80 - 90°C. Note that carbon steel parts (e.g. lock rings) may be affected by the agent if in touch with the latter during a long time.

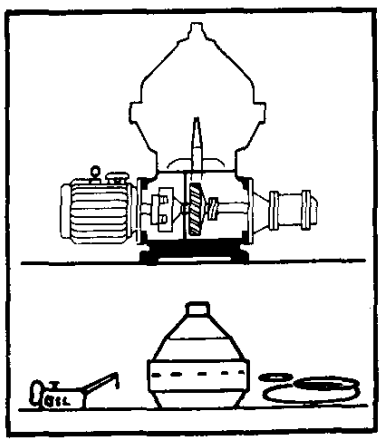


CLEANING PROCEDURE. Remove the bowl discs from the distributor and put them down, ONE BY ONE, in the cleaning agent. Let the discs remain in the cleaning agent until the deposits have been dissolved. This will normally take between two and four hours. Finally clean the discs with a SOFT brush.

OILING

Protect cleaned carbon steel parts against corrosion by oiling. Separator parts that are not mounted after cleaning should be wiped and protected against dust and dirt.

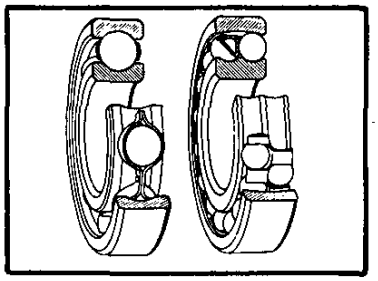
SHUT-DOWNS



If the machine is shut down for some time, the parts in contact with liquid should be oiled. The O-rings should be removed.

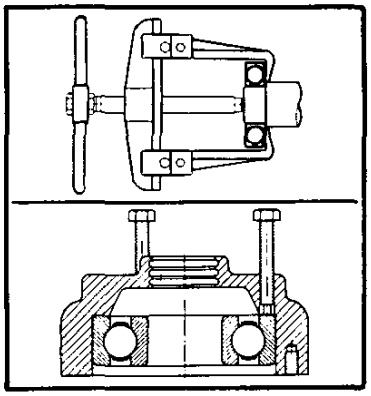
The bowl must not be left on the spindle. Vibrations in the foundation could be transmitted to the bowl and produce one-sided loading of the top bearing. The resultant indentations in the ball bearing races could cause bearing failure.

BALL BEARINGS. ROLLER BEARINGS



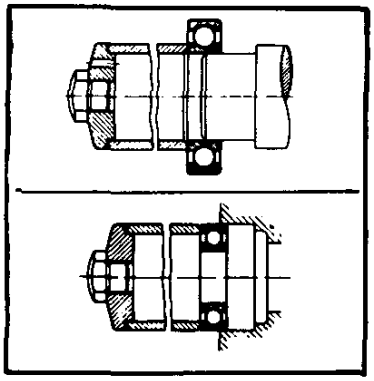
Use the greatest cleanliness when handling roller bearings.

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



Dismounting

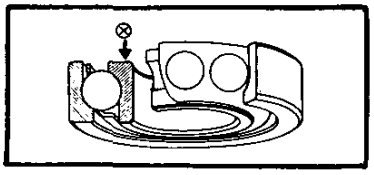
Detach the bearing from its seat by pressing against the race having the tightest fit. Use a puller or special tool. Thus, apply the pressure to the inner race when the bearing sits tightly on the shaft, and to the outer race when the bearing is tightly fitted in the housing respectively.
Arrange dismounted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

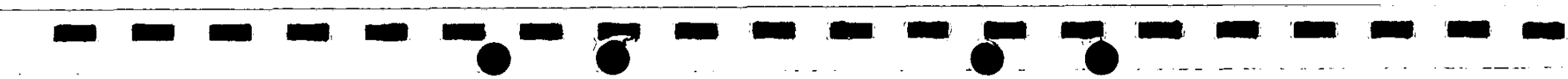
Leave new bearings in original wrapping until ready to fit. The anti-rust agent protecting a new bearing need not be removed.

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.

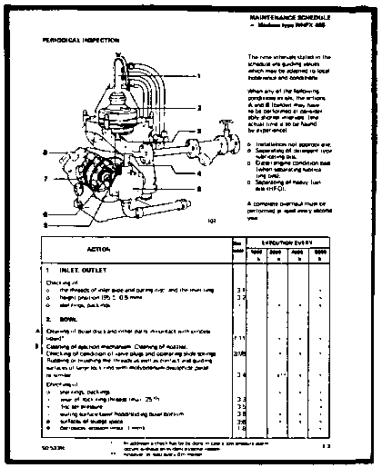


Angular contact ball bearings

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

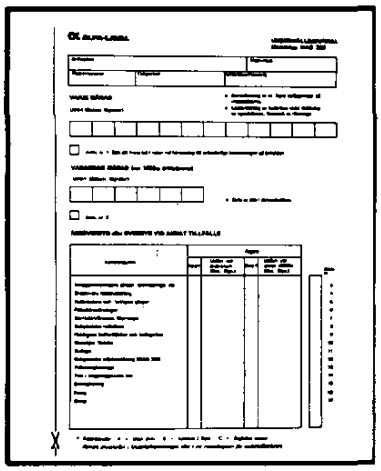


MAINTENANCE SCHEDULE



To facilitate systematic service, we have made up a maintenance schedule. The schedule specifies the various condition checks to be performed after certain periods of operation – see page 2:2.

MAINTENANCE LOG

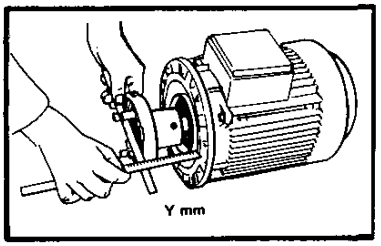


Keep a log of inspection and maintenance performed. Parts continually replaced should be given special consideration. The cause of repeated failures should be determined and corrected. Discuss your problems with our representative and, when necessary, request a visit.

Rate of corrosion and erosion should also be a part of this log. Note the extent of wear and date the log entries so that the rate of deterioration can be observed.

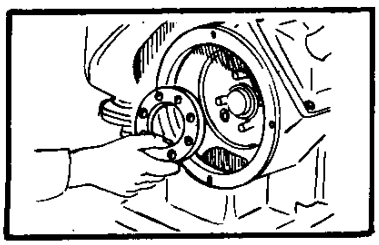
An example of a Maintenance Log with entries is found on page 2:4. Copies of the log are annexed at the end of this manual and can thus be used in your maintenance routine, if found compliant with local requirements.

CHECKPOINTS



How to perform the various condition checks is explained under »Checkpoints» – see page 3:1.

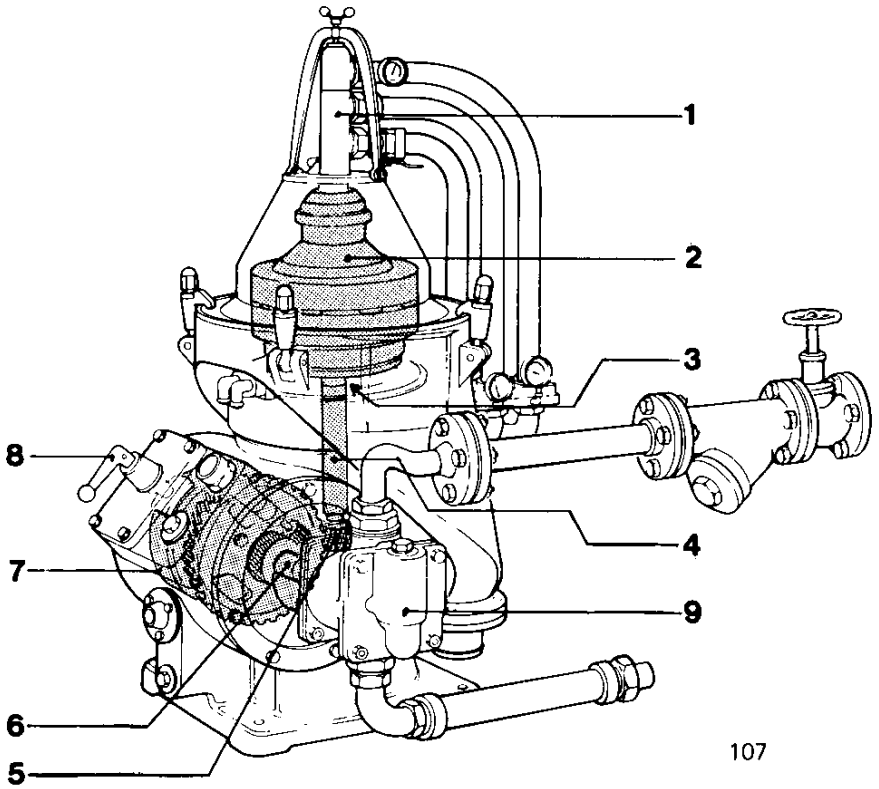
DISASSEMBLY ASSEMBLY



The identically named chapter beginning on page 4:1 describes how to disassemble and assemble the machine in the correct order by means of the proper tools.

- The chapter also indicates, at which stages of disassembly and assembly the various checks should be performed.

PERIODICAL INSPECTION



107

MAINTENANCE SCHEDULE

— Machine types WHPX 405, NWHPX 405

The time intervals stated in the schedule are guiding values, which may be adapted to local experience and conditions.

When any of the following conditions exists, the actions **A** and **B** (below) may have to be performed at considerably shorter intervals (the actual time has to be found by experience):

- o Installation inappropriate
- o For fuel oil separators
  - — Separation of bad quality HFO
- o For lubricating oil separators:
  - — Diesel engine condition bad
  - — Trunk type diesel engine burning heavy fuel oil
  - — In the case of crosshead diesel engines: Separation of piston rod stuffing box oil Inadequately cleaned piston rod stuffing box oil recycled to system oil.

A complete overhaul must be performed at least every second year.

	ACTION	See page	EXECUTION EVERY 1000 h	2000 h	4000 h	8000 h
	1. INLET. OUTLET					
	Checking of:					
	o the threads of inlet pipe and paring disc, and the level ring	3:1				x
	o height position (95 ± 0.5 mm)	3:2				x
	o seal rings, packings	—		x	x	x
	2. BOWL					
A	Cleaning of bowl discs and other parts in contact with process liquid*.	1:11		x	x	x
B	Cleaning of ejection mechanism. Cleaning of nozzles. Checking of condition of valve plugs and operating slide springs.	3:7/8		x	x	x
	Rubbing or brushing the threads as well as contact and guiding surfaces of large lock ring with molybdenum disulphide paste or similar	3:4		x**	x	x
	Checking of:					
	o seal rings, packings	—		x	x	x
	o wear of lock ring threads (max. 25 °)	3:3				x
	o disc set pressure	3:5				x
	o sealing surface bowl hood/sliding bowl bottom	3:6		x	x	x
	o surfaces of sludge space	3:6		x	x	x
	o corrosion, erosion (max. 1 mm)	1:8				x

* In addition a check has to be done in case a low pressure alarm occurs without an evident external reason (incorrect flow, temperature etc.).

** however, at least every 6th month.

ACTION	See page	EXECUTION EVERY 1000 h	2000 h	4000 h	8000 h
3. CONTROL PARING DISC					
Checking of height position (108.5 ± 0.5 mm)	3:9				x
Exchange of operating slide springs	3:8				x
4. BOWL SPINDLE					
Rubbing of cone with molybdenum disulphide paste or similar	3:10		x*	x	x
Checking of:					
o radial wobble (max.0.04 mm)	3:11				x
o ball bearing housing (indentations max. 0.5 mm)	3:12				x
o ball bearings	1:12				x
o seal rings, packings	–				x
Exchange of top bearing springs	3:12				x
5. WORM GEAR					
Oil change in worm gear housing – see Lubrication Schedule in *Operator's Manual*	–	x	x	x	x
Note: In a new installation, or after replacement of gear, change the oil after 300 operating hours.					
Checking of:					
o worm and worm wheel (in connection with oil change)	3:13	x	x	x	x
6. WORM WHEEL SHAFT					
Checking of coupling drum and shaft	3:15				x
7. COUPLING					
Checking of:					
o axial play of elastic plate (ca. 2 mm)	3:16				x
o friction pads	3:17				x
o ball bearings in nave	3:17				x
Replacement of grease in nave	3:17				x
8. BRAKE					
Checking of:					
o lining	3:17				x
o spring and brake shoe	3:17				x
9. PUMP					
Cleaning of pump strainer			x	x	x
Exchange of lipseal rings	See special instruction book				x
Checking of: relief valve, bushings, impeller shaft, wearing seals					x

*however, at least every 6th month

ALFA-LAVAL

Example

MAINTENANCE LOG
WHPX 405, NWHPX 405

Place of operation	Machine type
M/S XXZ	WHPX 405 TGD-20

Manufac. No.	Process liquid	Time for job: at a total of	Job actually done after
2222223	Lubricating oil (HD)	12.000 operating hours	12.150 operating hours

Reason for job

Preventive ☐ 1000 h ☐ 2000 h ☒ 4000 h ☐ 8000 h

Other reason .....

Job ordered by:	Date	Job done by:	Date
A. Nn	Nov. 20 1984	B. Fm	Dec. 10 1984

ACTION	EXECUTION EVERY 1000 h	2000 h	4000 h	8000 h
1. INLET. OUTLET				
Checking of:				
o the threads of inlet pipe and paring disc, and the level ring				x
o height position (95 ± 0.5 mm)			✓	x
o seal rings, packings		x	x	x
2. BOWL				
Cleaning of bowl discs and other parts in contact with process liquid.*		x	x✓	x
Cleaning of ejection mechanism. Cleaning of nozzles. Checking of condition of valve plugs and operating slide springs.		x	x✓	x
Rubbing or brushing the threads as well as contact and guiding surfaces of large lock ring with molybdenum disulphide paste or similar		x	x✓	x
Checking of:				
o seal rings, packings		x	x(1)	x
o wear of lock ring threads (max. 25 °)				x
o disc set pressure				x
o sealing surface bowl hood/sliding bowl bottom		x	x(2)	x
o surfaces of sludge space		x	x	x
o corrosion, erosion (max. 1 mm)				x
3. CONTROL PARING DISC				
Checking of height position (108.5 ± 0.5 mm)				x
Exchange of operating slide springs				x
4. BOWL SPINDLE				
Rubbing of cone with molybdenum disulphide paste or similar		x	x✓	x
Checking of:				
o radial wobble (max.0.04 mm)				x
o ball bearing housing (indentations max. 0.5 mm)				x
o ball bearings				x
o seal rings, packings				x
Exchange of top bearing springs				x

✓ = Approved ○ = See note

* In addition a check has to be done in case a low pressure alarm occurs without an evident external reason.

Keep the log in the Maintenance and Repair Manual or in a central maintenance register.

Example

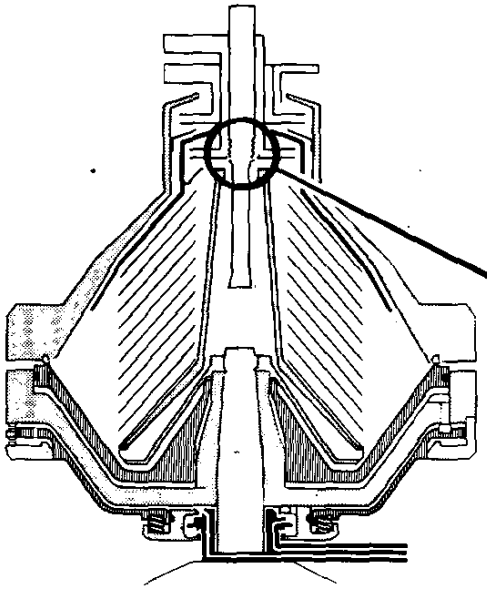
ACTION	EXECUTION EVERY 1000 h	2000 h	4000 h	8000 h
5. WORM GEAR				
Oil change in worm gear housing – see Lubrication Schedule in Operator's Manual *Note: In a new installation, or after replacement of gear, change the oil after 300 operating hours.*	x	x	✓ x	x
Checking of: o worm and worm wheel (in connection with oil change)	x	x	✓ x	x
6. WORM WHEEL SHAFT				
Checking of coupling drum and shaft				x
7. COUPLING				
Checking of: o axial play of elastic plate (ca. 2 mm) o friction pads o ball bearings in nave				x x x
Replacement of grease in nave				x
8. BRAKE				
Checking of: o lining o spring and brake shoe				x x
9. PUMP				
Cleaning of pump strainer			✓	
Exchange of lipseal rings } See special instruction book		x	x	x x
Checking of: relief valve, bushings, impeller shaft, wearing seals } See special instruction book				x

Notes:

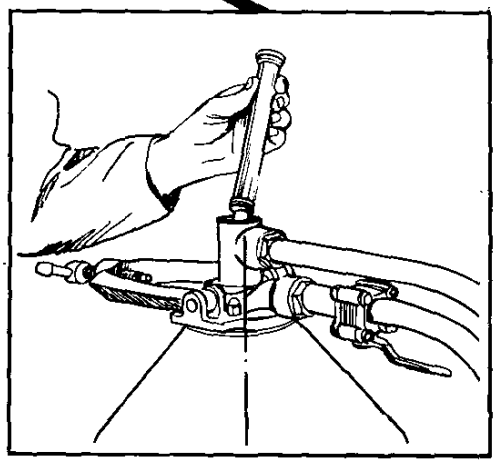
① Sliding bowl bottom seal ring replaced

② Bowl hood nylon ring replaced

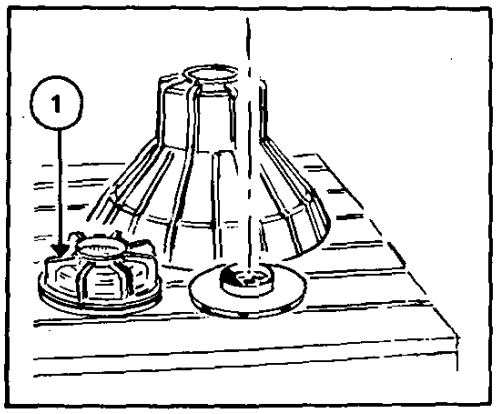
THREADS OF INLET PIPE AND PARING DISC



- Damage to the threads and to the top surface of the level ring may cause the paring disc to scrape against the paring chamber housing even **though** the height adjustment has been made correctly – see »Height position of paring disc».

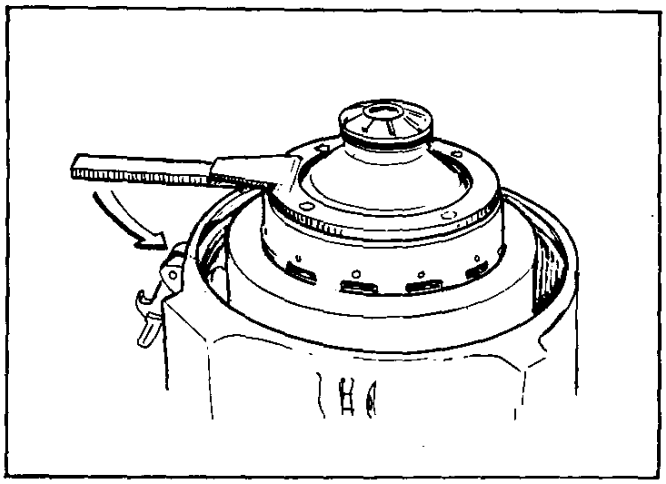


Screw the inlet pipe **counterclockwise** (left-hand thread) in the paring disc, checking that the pipe turns easily in the disc. If required, rectify the threads.



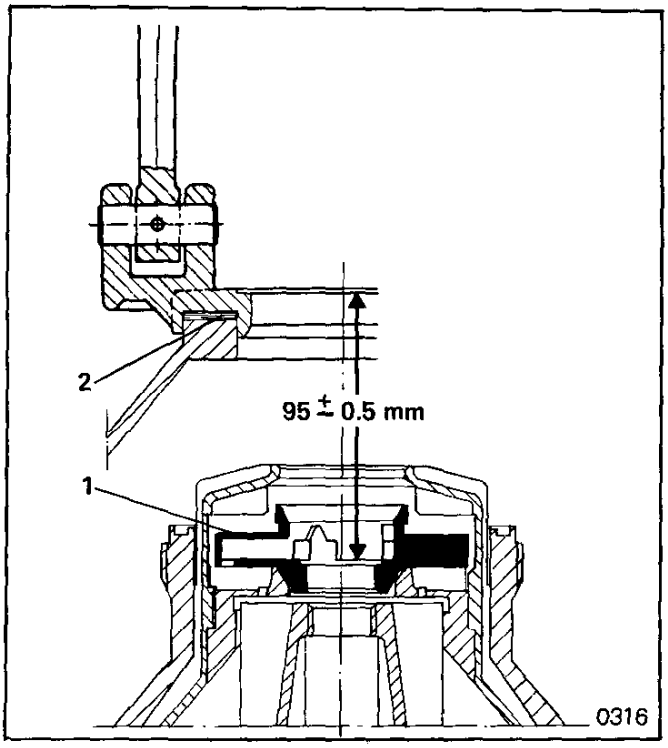
Remove any protrutions on the top surface (1) of the level ring with a file as the paring disc supports on that surface during the check.

HEIGHT POSITION OF PARING DISC



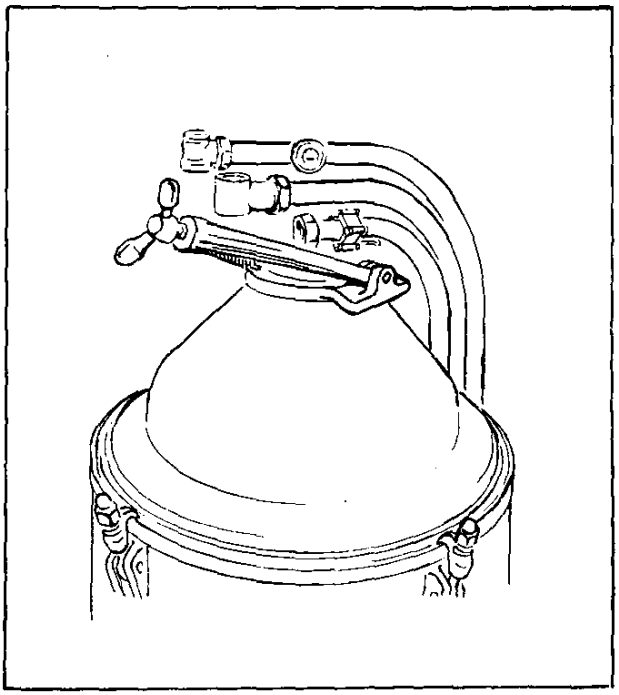
- Assemble the bowl without small lock ring, gravity disc, and upper paring disc (water paring disc).

  Tighten the large lock ring until the bowl hood is in close contact with the bowl body.



- Incorrect height position can cause the paring disc 1 – see lowermost figure – to scrape against paring chamber housing.

The height position should be checked if the bowl spindle has been disassembled or the bowl has been replaced.



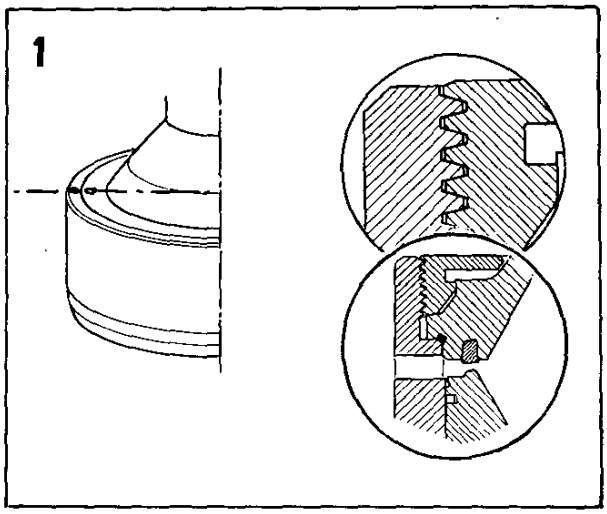
- Put frame hood in place and clamp with the hinged bolts.

- Measure the distance according to the figure. Adjust the distance by adding or removing height adjusting rings 2.

With inlet and outlet parts mounted:

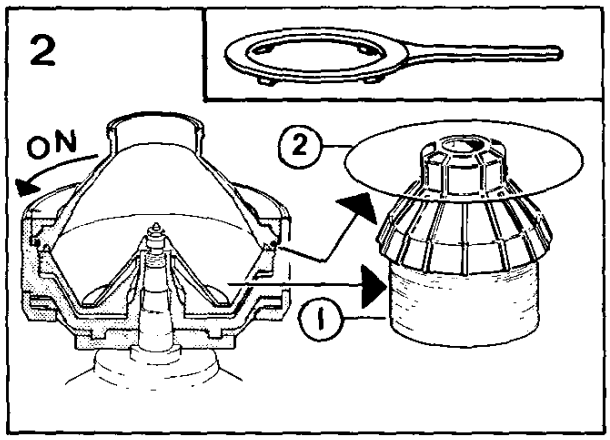
Revolve the worm wheel shaft by hand. If it turns heavily or if a scraping noise is heard, wrong height adjustment or wrong fitting of the inlet pipe may be the cause.

THREADS OF LARGE LOCK RING AND BOWL BODY

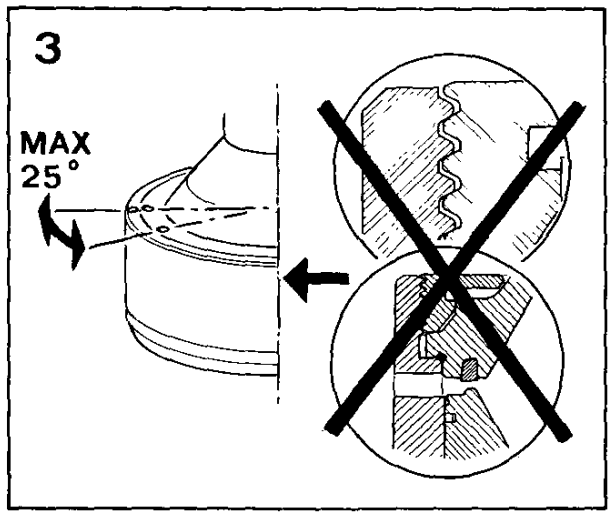


- Excessive wear of these threads can render the machine hazardous to personnel and plant.

1. In a new bowl, the alignment marks (ϕ) on bowl body and lock ring should be right in front of each other. However, in time these marks will pass each other due to thread wear.



2. Check the thread conditon by tightening the lock ring after removing the disc set (1) and bowl hood O-ring (2) from the bowl.



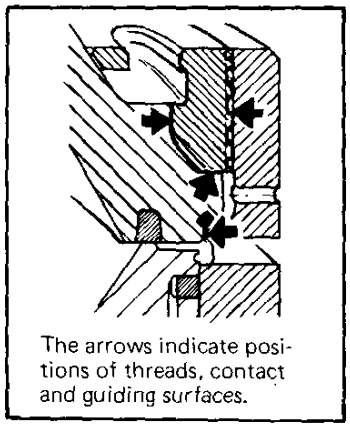
3. When mark ϕ on lock ring passes the corresponding mark on bowl body by more than 25 °: contact our representative immediately.

Note

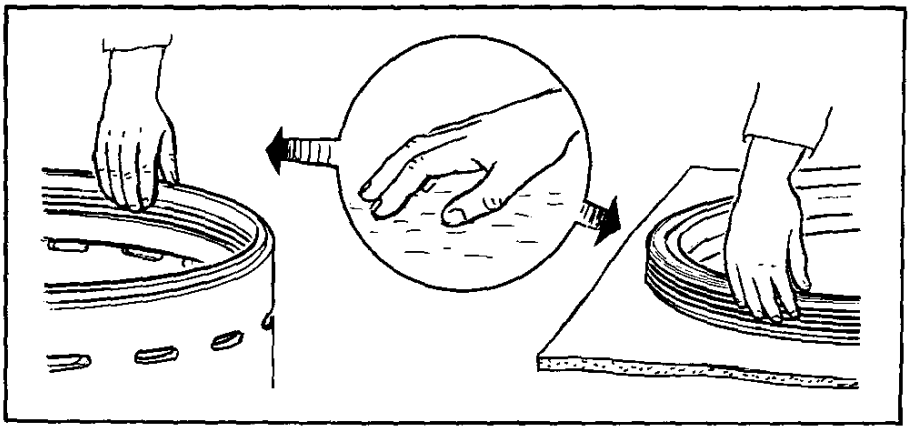
- If thread wear has been observed, mark bowl body at the new position of alignment mark on lock ring, e.g. by punching.
- If marks ϕ are not legible, corrosion or erosion will be the cause. Contact our representative immediately for determination of the extent of thread wear and punching of new alignment marks.

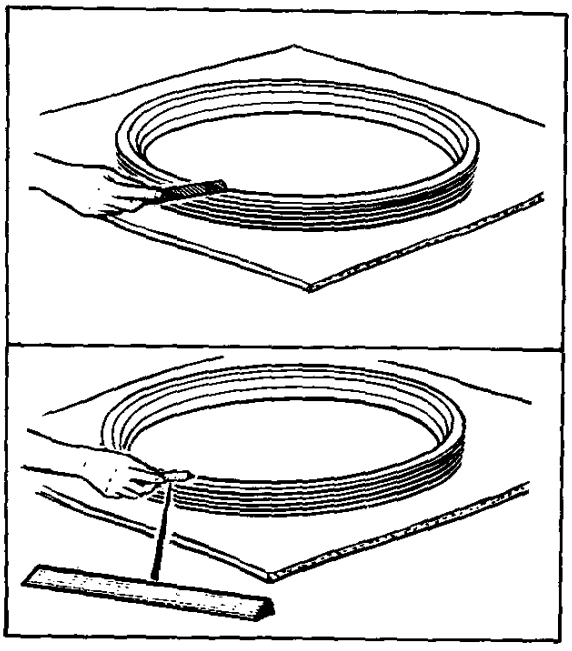
LOCK RING JOINT

- Impact marks and the like on lock ring, bowl hood, and bowl body may cause seizure damage.



The arrows indicate positions of threads, contact and guiding surfaces.





Clean the threads as well as contact and guiding surfaces with a suitable degreasing agent. Then check for burrs and protrutions caused by impact.

If damage is established, rectify according to following recommendations:

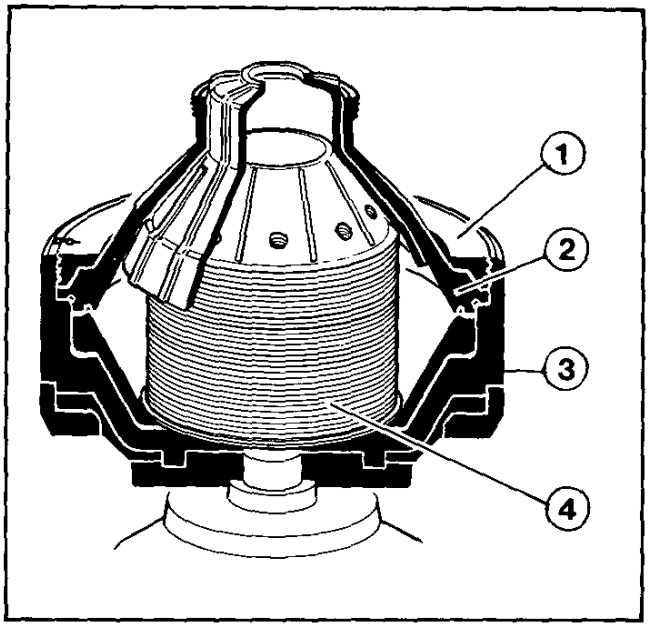
If the seizure damage is considerable, use first a **fine and single-cut** file, but moderately so as not to aggravate the damage.

If possible, avoid using the file!

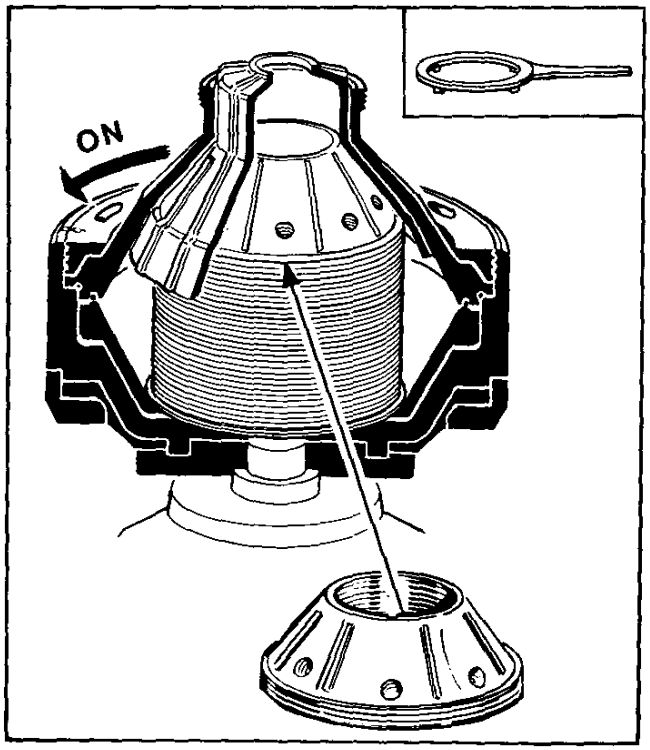
Then use a whetstone (by way of suggestion grain size 240). Use **fine emery cloth** if whetstones are not available.

DISC SET PRESSURE

- Insufficient pressure in the disc set may affect the bowl balance, which in turn will cause abnormal machine vibration.



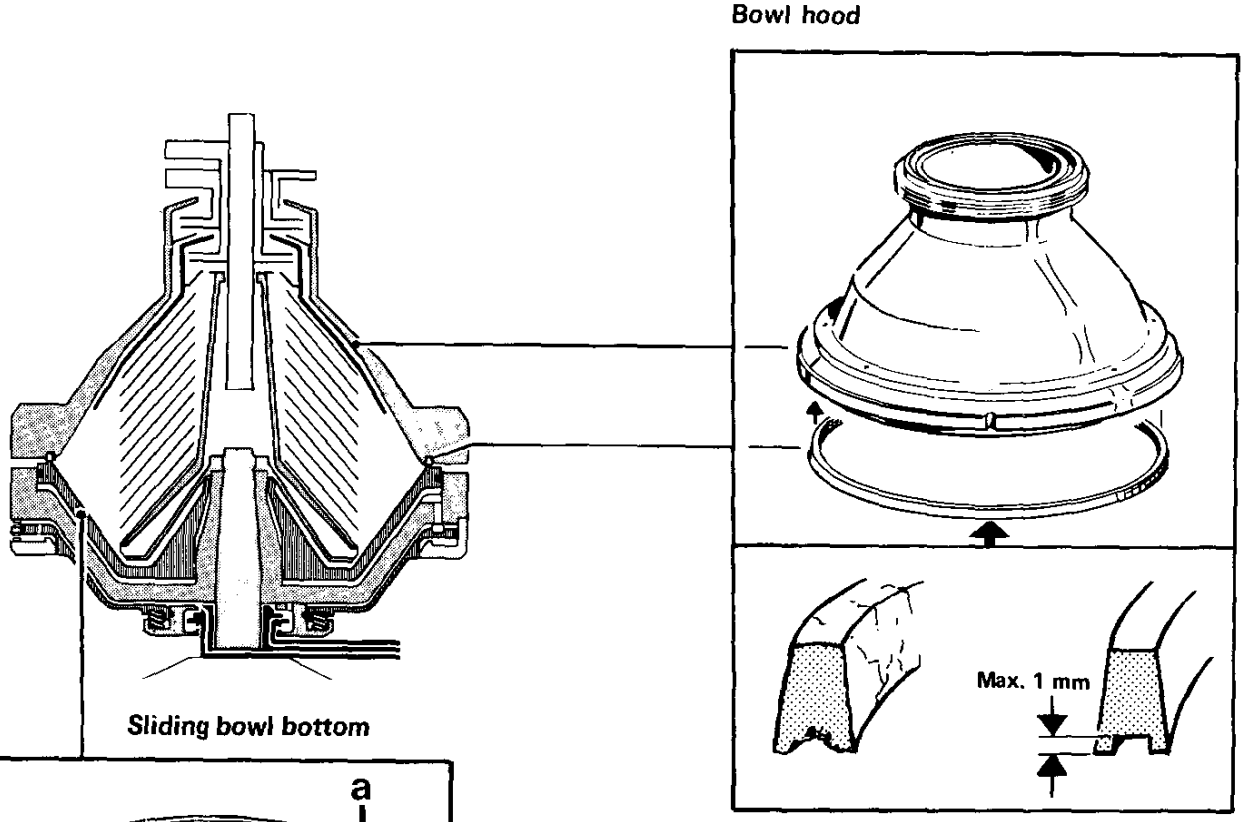
The lock ring (1) should press the bowl hood (2) firmly against the bowl body (3), the hood in turn should excert a pressure on the disc set (4) clamping the latter in place.



If the lock ring can be tightened without resistance until the bowl hood lies tightly against the bowl body, the disc set pressure must be increased. Correct pressure is obtained when it is possible to tighten the lock ring so far **by hand** that mark ◊ on lock ring is positioned 60° - 90° before mark ◊ on bowl body. To attain this end: add the smallest number possible of discs to the top of bowl disc set beneath the top disc.

BOWL HOOD/ SLIDING BOWL BOTTOM

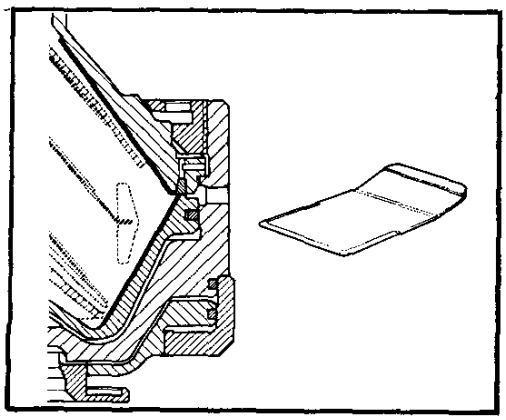
- Poor sealing between the bowl hood seal ring and the sealing edge of the sliding bowl bottom will cause a leakage of process liquid from the bowl.



Replace the bowl hood seal ring if it has fissures or pores, deep scratches or indentations made by course solid particles.

The ring should be replaced also when its sealing surface is depressed by more than 1 mm even though acceptable in other respects, as the ejected volume would otherwise be reduced too much.

Also check the sealing edge (a) of the sliding bowl bottom. If damaged through corrosion or erosion or in other ways it can be rectified by turning in a lathe, provided that suitable equipment is available. Maximum permissible reduction of the original profile height: 0.5 mm.



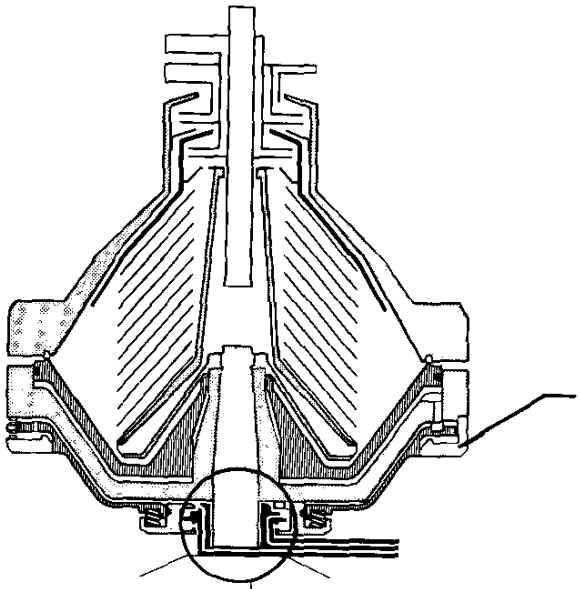
- Damaged surfaces in the sludge space may render sludge discharge difficult.

The surfaces of the sludge space (shown with a thick line in the figure) must not be damaged. Be cautious when cleaning. Do not use a steel tool but the sludge scraper of brass included in the set of tools.
Contact an ALFA-LAVAL representative if there are scratches or other damages on the surfaces of the sludge space.

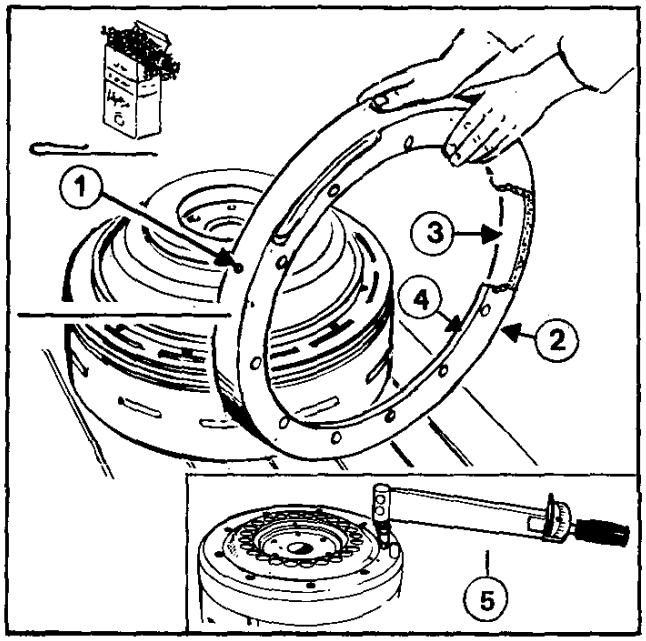
SO 5341E
(0316, 0318)

EJECTION MECHANISM

- Dirt and lime deposits in the ejection mechanism may cause bad ejecting function or non at all.



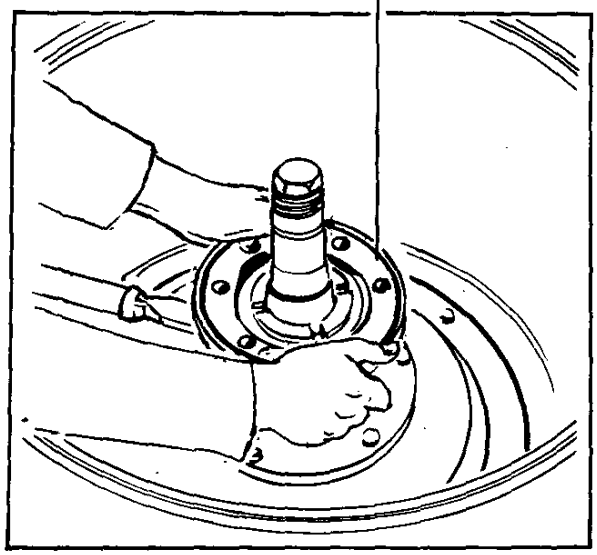
Dosing ring

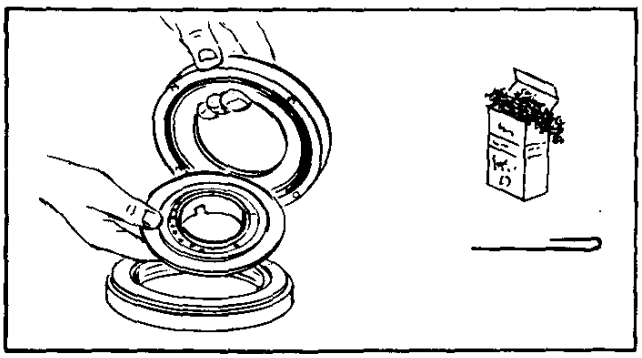


Clean the nozzles (1) and (2) of the dosing ring with a soft iron wire or the like. Polish the surface (3) with steel wool. Inspect the surface (4) in contact with the operating slide. Remove any marks with whetstone (grain size 240).

Note! The dosing ring screws must be tightened with a torque of 0.7 kpm (7 Nm). Firmer tightening may jam the operating slide. Use a dynamometric wrench (5).

Paring disc device

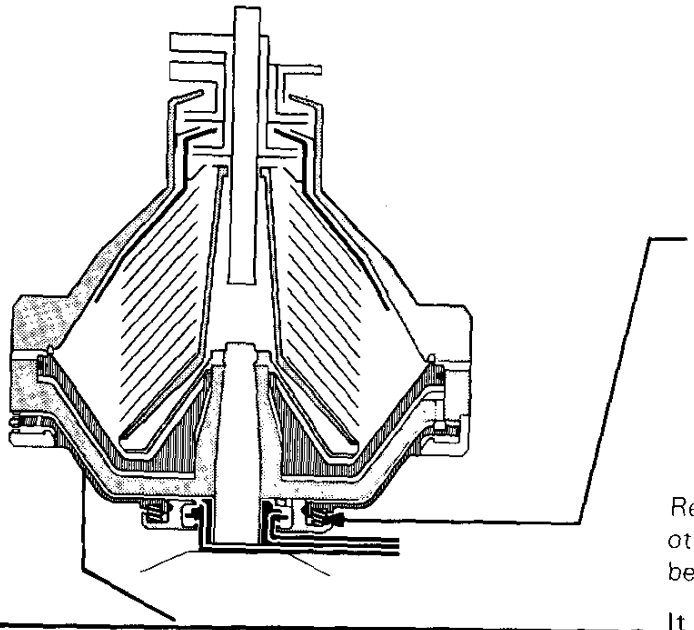


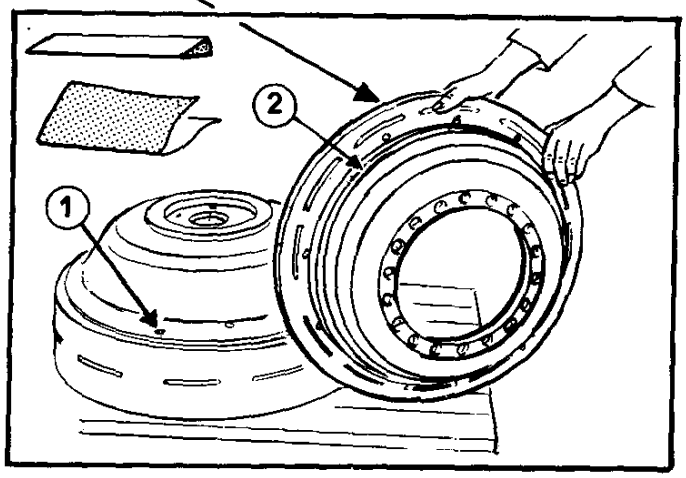


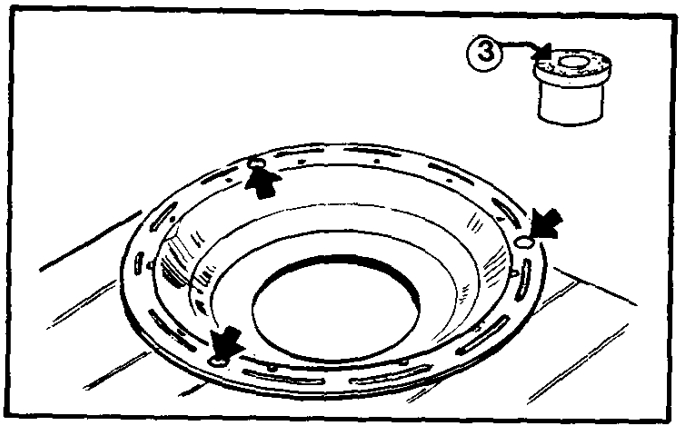
Clean the channels of the paring disc device. Remove any lime deposits with steel wool.

Note! Lime deposits can to advantage be dissolved in a 10 % acetic acid solution which should first be heated to 80 ° C.

(Ejection mechanism . . .)

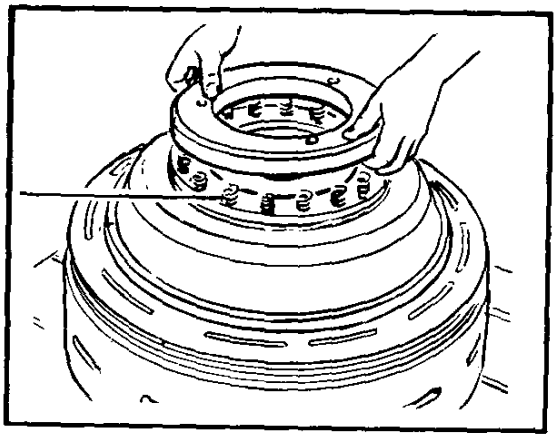






- Defective or broken springs as well as poor sealing between the valve plugs of operating slide and the bowl body may prevent complete closing of the bowl.

Operating slide springs



Replace springs which differ appreciably from the other ones in regard to length or which seem to be defective in other respects.

It is recommended to replace all the springs at the annual overhaul.

Operating slide

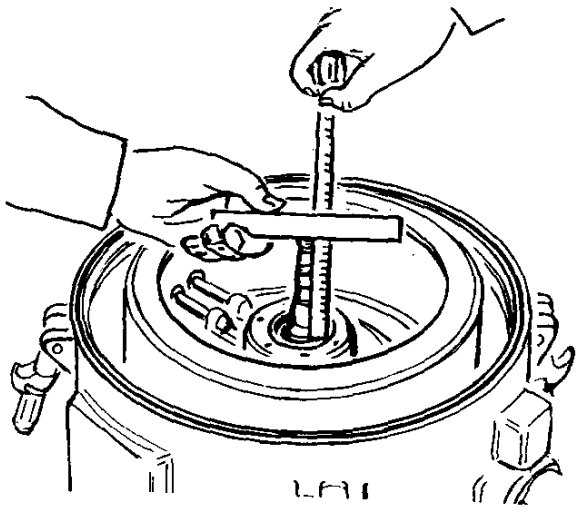
Examine the three sealing surfaces (1) of the bowl body in contact with the valve plugs. Remove any marks and lime deposits with a **very fine-grain** emery cloth.

Inspect the guiding surface (2) in contact with the dosing ring. Remove any marks with whetstone (grain size 240).

Valve plugs

Check the sealing surface (3) of the three valve plugs. Preferably replace all plugs even if only one of them is defective (scratches, pores).

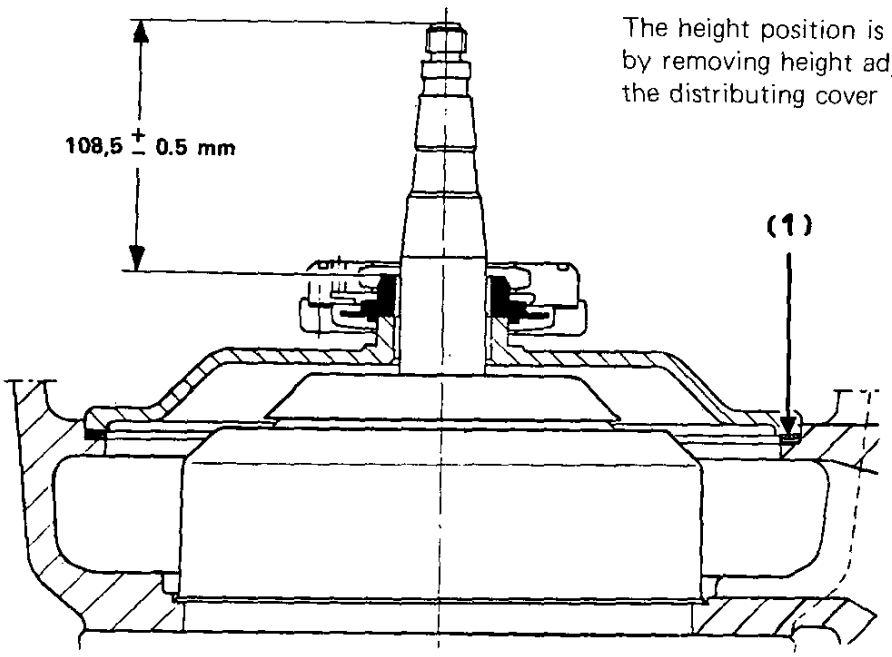
CONTROL PARING DISC HEIGHT POSITION



- Incorrect height position may cause the paring disc to scrape against the paring chamber housing.

A check should be made when the bowl spindle has been dismounted.

Measure the distance from the paring disc to the spindle top. The measure should be as stated in figure below.



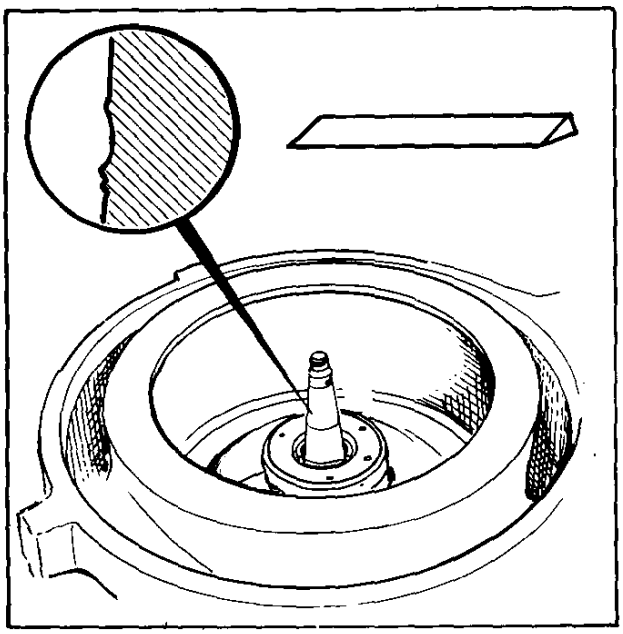
The height position is adjusted by adding or by removing height adjusting rings (1) under the distributing cover

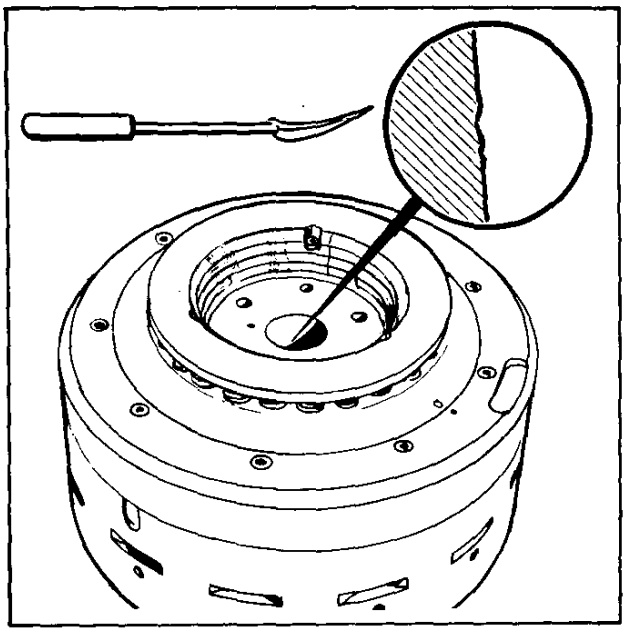
After adjustment rotate the spindle. If a scraping noise is heard, re-adjust.

BOWL SPINDLE CONE/BOWL BODY NAVE

- Impact marks and similar on the spindle cone and/or in the nave may cause bad bowl run.

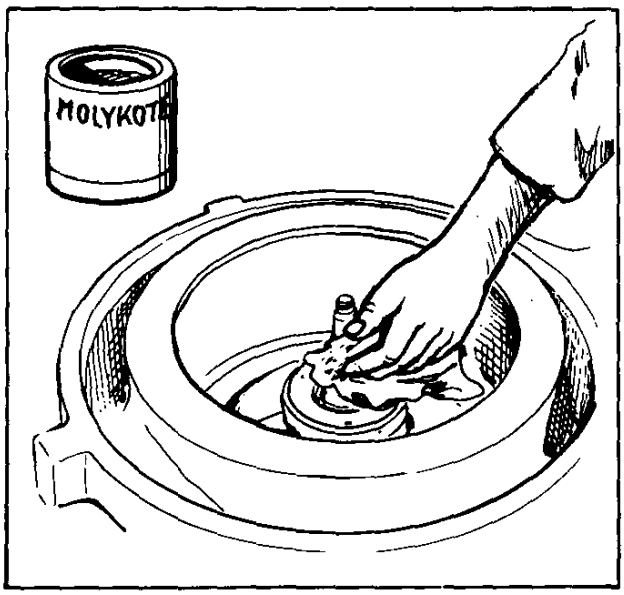
  Heavy rusting may cause the bowl body to stick firmly to the spindle cone and can thus obstruct disassembly.





Clean spindle cone and bowl body nave with a suitable degreasing agent. Remove any impact marks on nave and cone with a scraper, and an oil-stone respectively. Remove any rust with a fine-grain emery cloth (e.g. No. 320). Finish with polishing paper (e.g. No. 600).

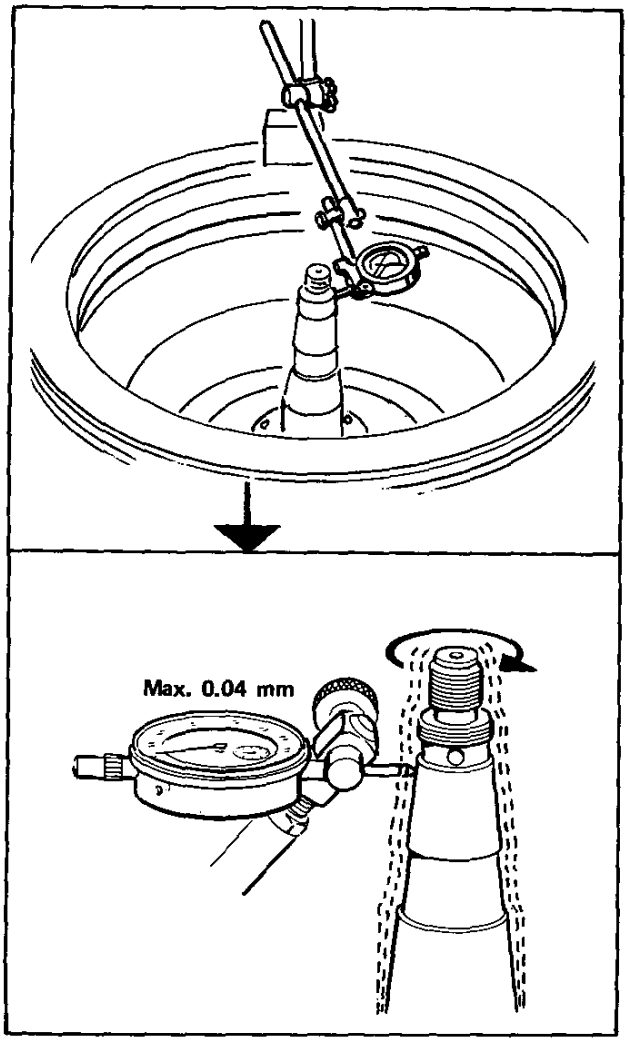
N.B. Always use the scraper with great care. The conicity must not be marred.



Prevent the bowl body from jamming on the cone by applying a thin layer of molybdenum disulphide paste to the cone (for instance Molykote 1000 Universal Paste).

Rub in the paste under pressure with a clean cotton cloth.

RADIAL WOBBLE OF BOWL SPINDLE



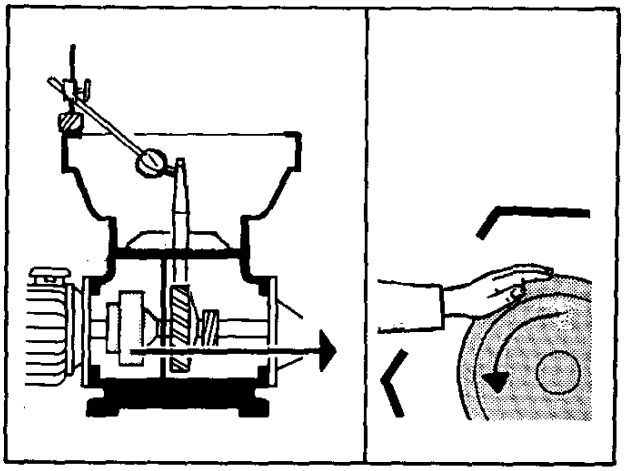
- Excessive spindle wobble is indicated by rough bowl run (vibration).

Clamp a dial indicator e.g. in a support, and fasten the latter to the bowl casing of frame.

Measure the wobble at the top of the spindle tapered end. Maximum permissible radial wobble: 0.04 mm.

First check the wobble before dismounting the spindle. If wobble is too large: replace ball bearings in top and bottom bearings.

Remeasure wobble after assembly. If it is still excessive, the spindle is probably damaged and must be replaced.



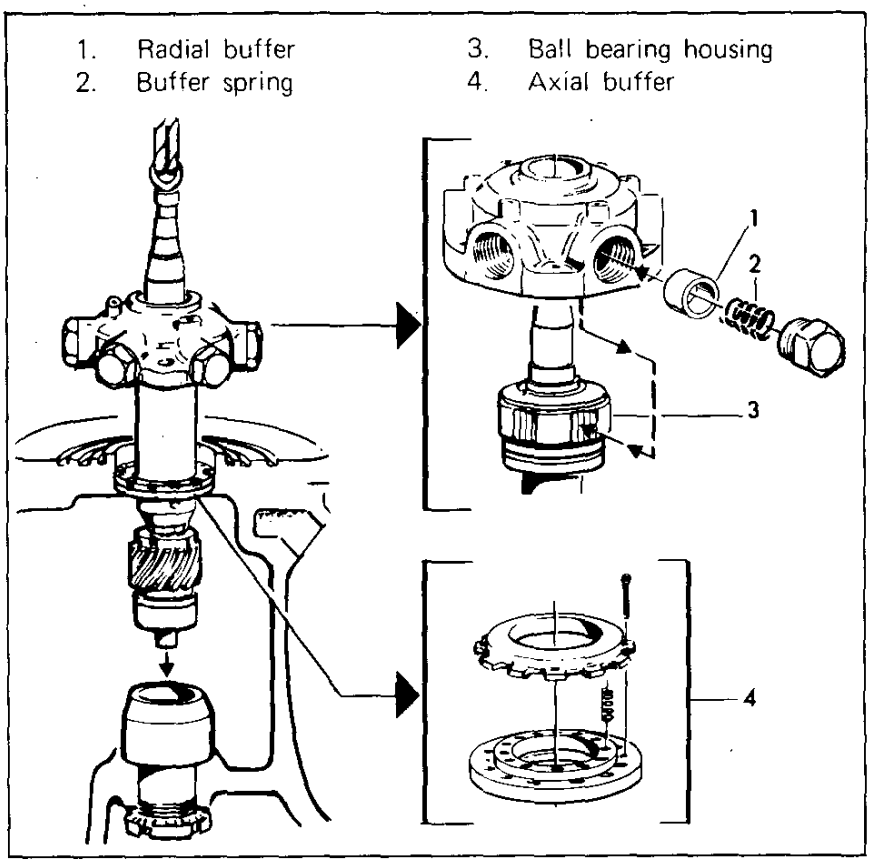
IMPORTANT!

During indication the spindle must be revolved by hand using the worm wheel shaft.

Before measuring make sure the buffer plugs are properly tightened – see »Top bearing springs - - ».

TOP BEARING SPRINGS and BALL BEARING HOUSING

- Weakened or broken buffer springs as well as defective contact surfaces for the buffers on the ball bearing housing may give rise to machine vibration (rough bowl running).



Springs

The condition (stiffness) of a spring can hardly be determined without using special testing equipment. So, an estimation of the spring condition must be based on the knowledge of the machine run before the overhaul.

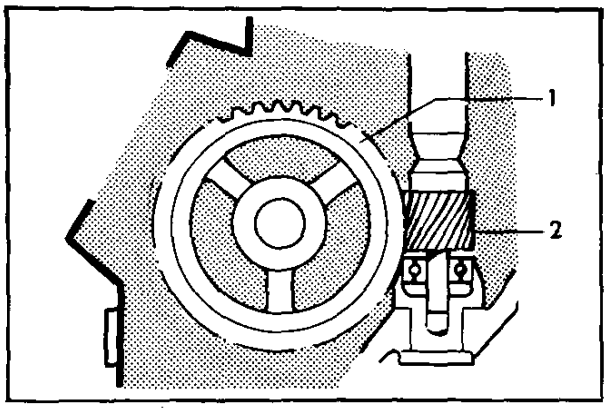
It is recommended, however, to replace all the springs at the annual overhaul!

In case of a sudden spring fracture, the complete set should be replaced even when only one spring has broken.

Ball bearing housing

Examine the contact surface for the buffers (1) on the ball bearing housing (3). In case of defects (indentations deeper than 0.5 mm) replace the housing as well as buffers and springs.

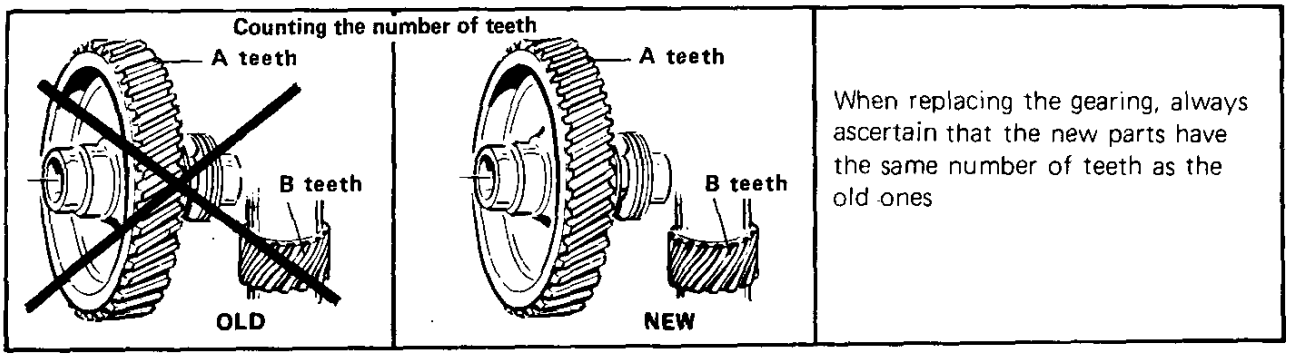
WORM AND WORM WHEEL (WORM GEARING)



1. Worm wheel 2. Worm

Check the teeth of worm wheel and worm for wear. Examine the contact surfaces and compare the tooth profiles. The gearing may work satisfactorily even when worn to some degree.

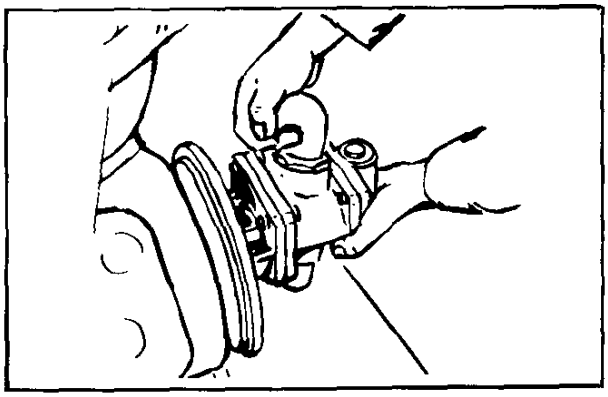
- Replace worm wheel and worm at the same time, even if only one of the parts is considerably worn.
- To avoid damaging the teeth when lifting the bowl spindle, **first** push the worm wheel aside. For the same reason put the spindle in place **before** mounting the worm wheel.



When replacing the gearing, always ascertain that the new parts have the same number of teeth as the old ones

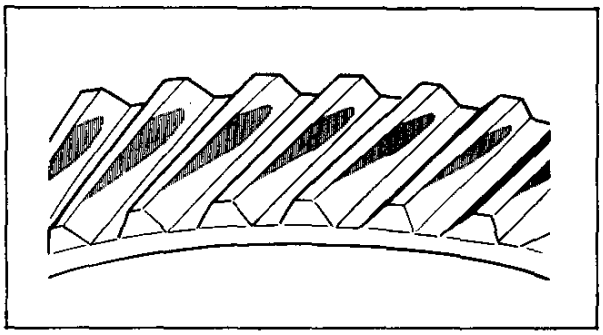
Presence of metal chips in the oil bath is an indication that the worm wheel is wearing abnormally.

Action to allow inspection



Remove the pump to uncover the worm gear.

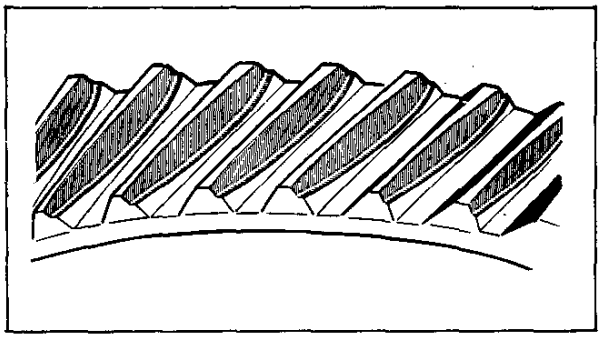
Examples of various tooth appearances after operation



Satisfactory teeth

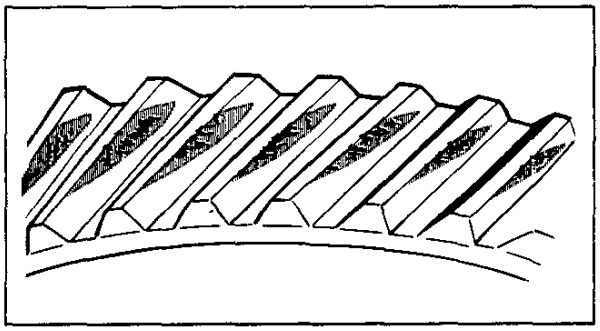
Uniform wear of contact surfaces. Surfaces smooth.

Good contact surfaces will form on the teeth when the gear is subjected only to a moderate load during a running-in period.



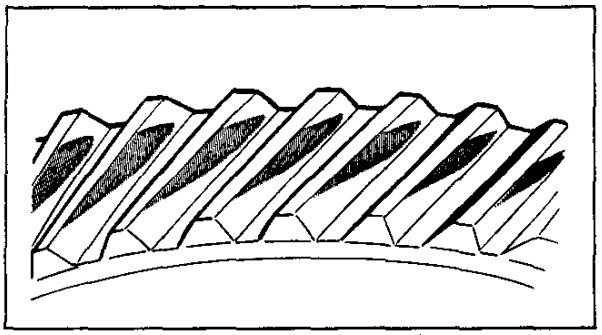
Worn teeth

Teeth wear, sometimes occurring only on some of the teeth. If the wear has gone as far as shown in the illustration, replace the part.



Spalling

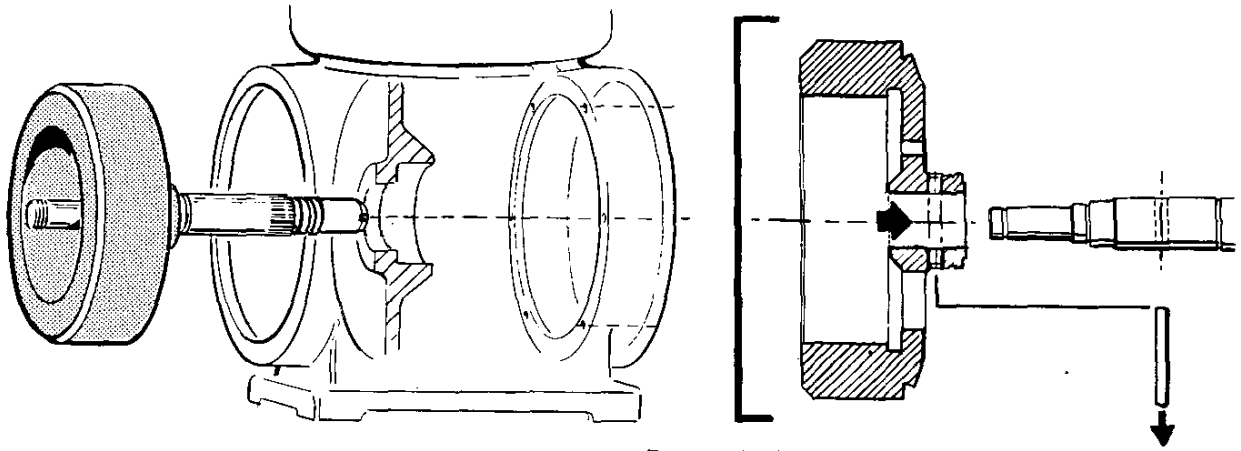
Small bits of the teeth have split off, so-called spalling. Generally due to excessive load or improper lubrication. Damage of this type need not necessitate an immediate replacement of the part, but keen checking at short intervals is imperative.



Pitting

Small cavities in the tooth, so-called pitting. Can occur through excessive load or improper lubrication. Damage of this type need not necessitate an immediate replacement of the part, but keen checking at short intervals is imperative.

- If the worm wheel shaft has been damaged, a new shaft can be fitted in the coupling drum. It is a condition, however, that suitable equipment is available, so that the measures and tolerances indicated below can be maintained. Otherwise, a shaft assembly including the drum must be ordered.



Removal of shaft

Drill one riveted end of the cylindrical pin. Ease out the pin.

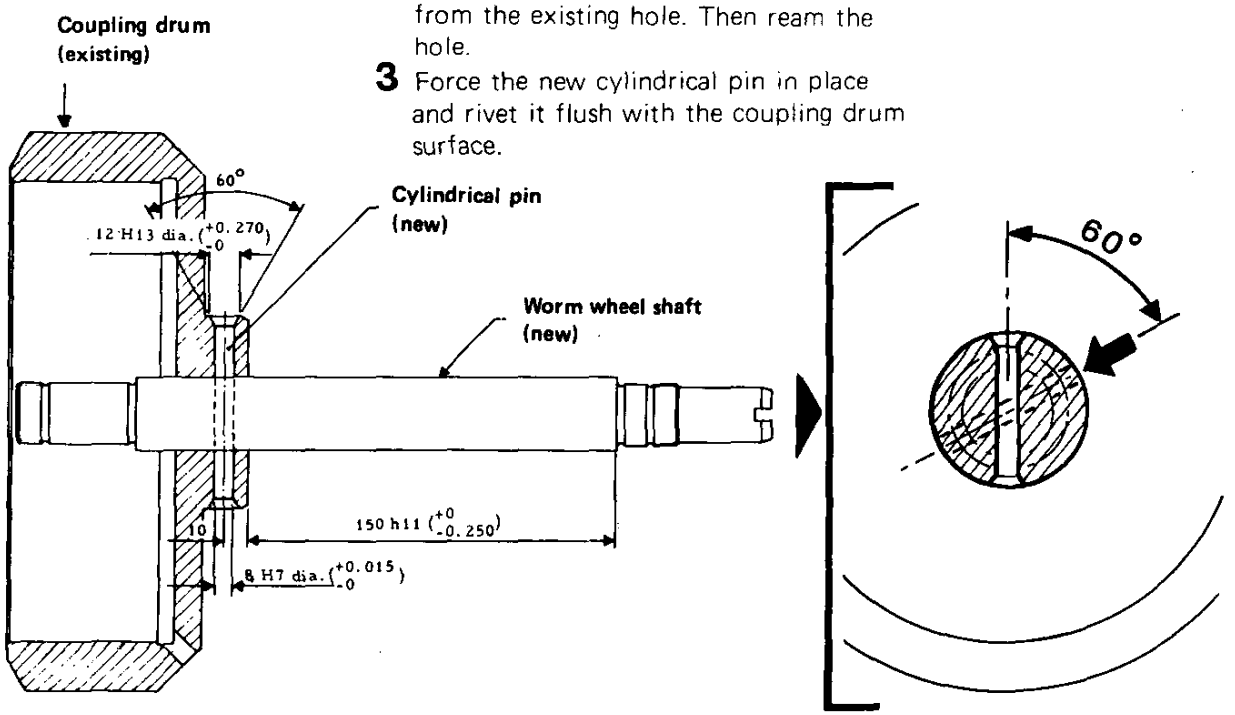
Press or knock the shaft out of the drum.

Fastening the new shaft

1 Fix the new shaft in the correct position according to drawing.

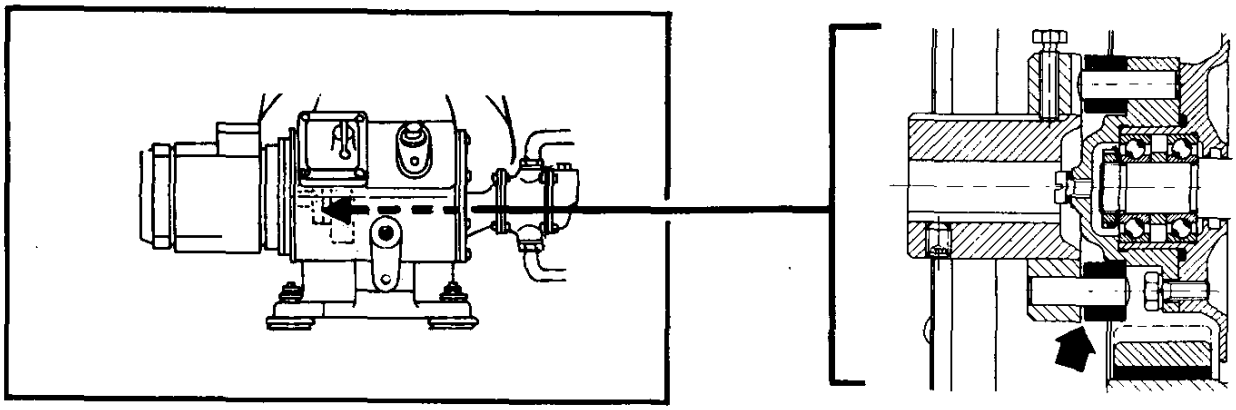
2 Drill a new hole through the coupling drum and the worm wheel shaft 60 ° from the existing hole. Then ream the hole.

3 Force the new cylindrical pin in place and rivet it flush with the coupling drum surface.



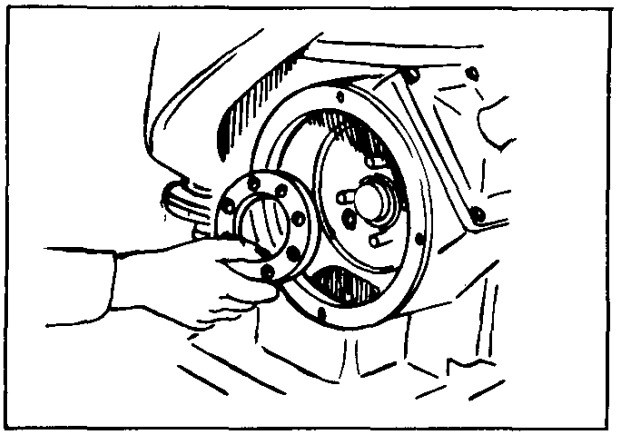
AXIAL PLAY OF ELASTIC PLATE

- The axial play of the elastic plate should be 2 mm (approx.).

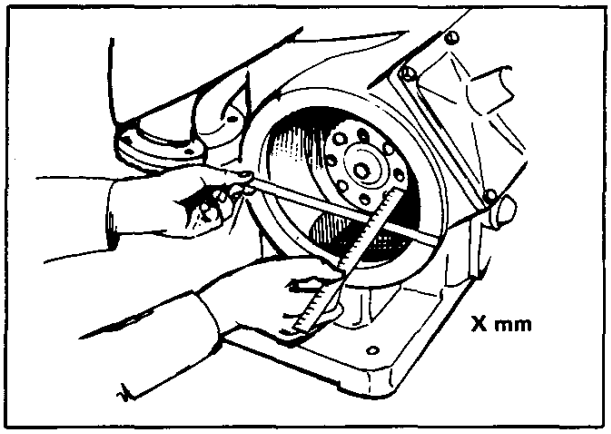


Play: 2 mm (approx.)

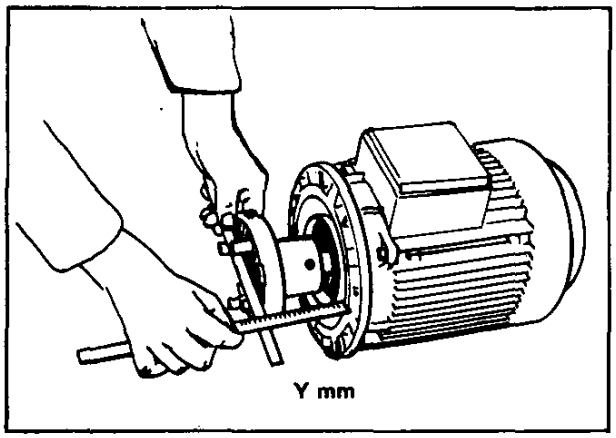
Check the play as follows:



1. Fit the elastic plate in its place in the coupling disc of the machine. Make sure good contact is obtained.



2. Measure the distance from frame ring (or motor adapter) to elastic plate.



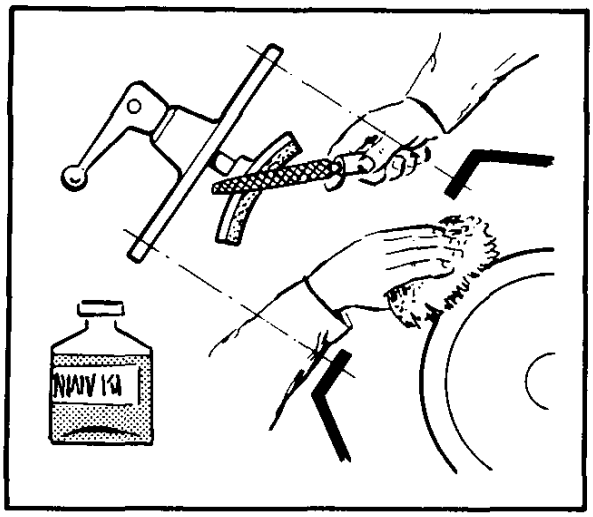
3. Measure the distance from motor coupling disc to motor flange (or motor adapter).

   X – Y = 2 mm (approx.)

   If required, adjust the position of the motor coupling disc.

BRAKE

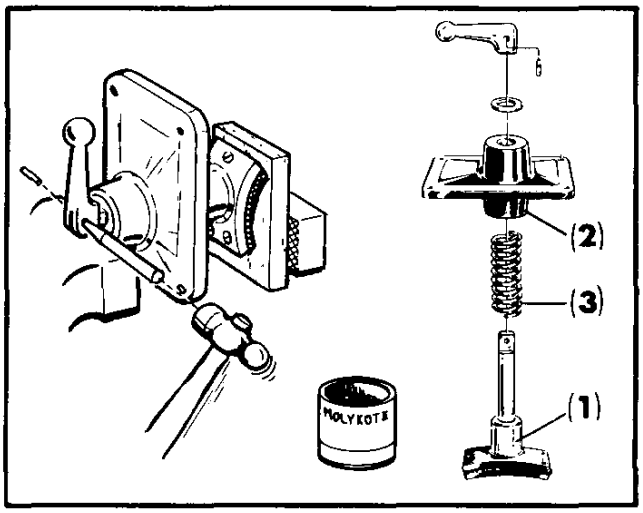
- A worn or oily lining will lengthen the braking period.



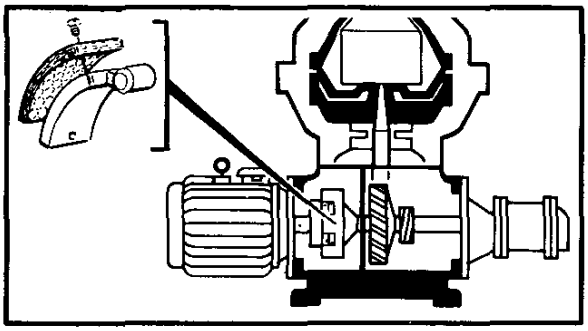
If oiliness is the fault: clean the lining and the coupling drum with a suitable degreasing agent.

Roughen the friction surface of the lining with a coarse file.

- Formation of rust on the brake parts may cause the brake to jam.



Remove any rust from the surface (1) of the brake shoe and the corresponding guiding surface in the cap (2). Rub the surfaces for instance with Molykote 1000 Universale Paste. Replace the spring (3) if it has lost its stiffness. Oil the spring when mounting.

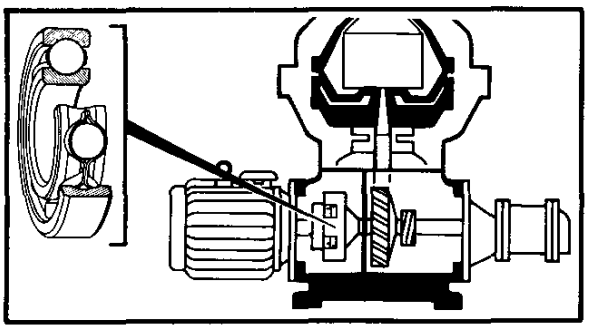


FRICTION PADS

- Worn or oily pads will cause a long acceleration period.

Replace all pads even if only one is worn.

If pads are only oily: clean the pads and the inside of the coupling drum with a suitable degreasing agent. Roughen friction surfaces of pads with a coarse file.

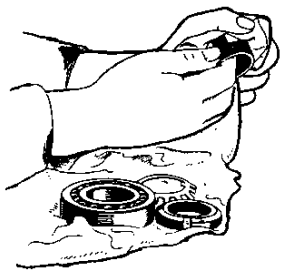


NAVE OF COUPLING DISC

When renewing the grease or when fitting new bearings, grease must be applied only to the respective bearing in the nave. Thus the nave proper must not be packed with grease, as superfluous grease might ooze out of the nave and adhere to the friction blocks.

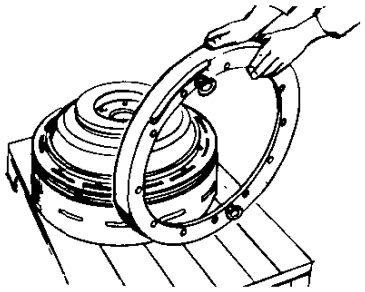
This chapter describes how to disassemble and assemble the machine in the correct order by means of the proper tools. **The relative positions of the parts appear from the machine drawings inserted at the end of the manual. Each part is illustrated and its part number is stated in the Spare Parts Catalogue.**

The symbol  appear here and there in text and illustrations. It refers to the page where description of the checking method/ recommendation is found.

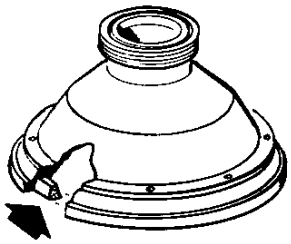


REMINDER

- *Handle the parts with care. Protect them against damage, dust,* and dirt. Make sure the parts are clean and free of burrs when mounting.



- Don't place parts directly on the floor. Use a clean rubber mat, fibreboard or a suitable pallet as base.



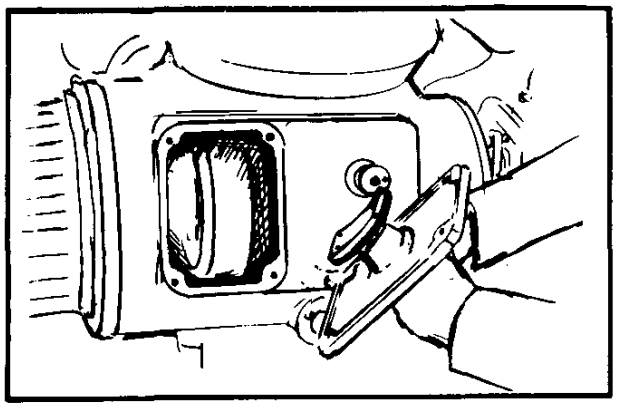
- Be specially careful of the bowl hood seal ring. It may easily get scratched if the hood is put down carelessly and on a dirty base.

- *Position the hoisting device very exactly when assembling and* disassembling. **Never** use a hoisting device that works jerkily.

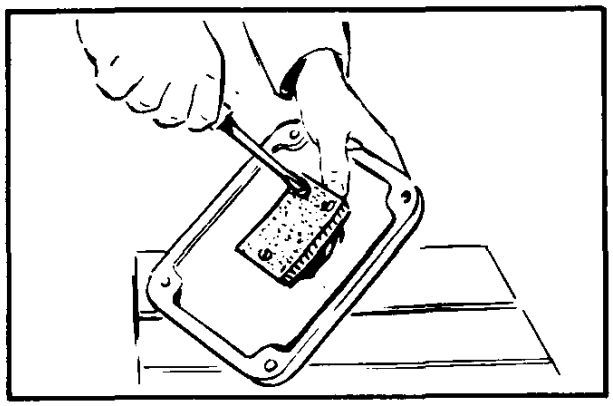
  An electrically operated hoist should have two speeds; 1.5 metre/minute and 6 meters/minute approx. **The lower speed is used when lifting the parts out of the machine, and into it respectively.**

EXCHANGE OF BRAKE LINING

page 3:17



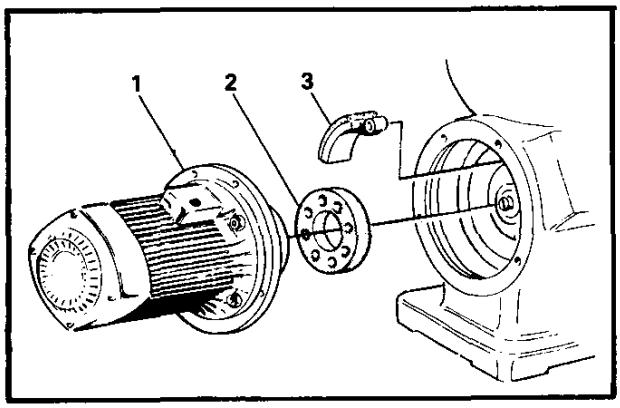
1. Remove the brake cap.



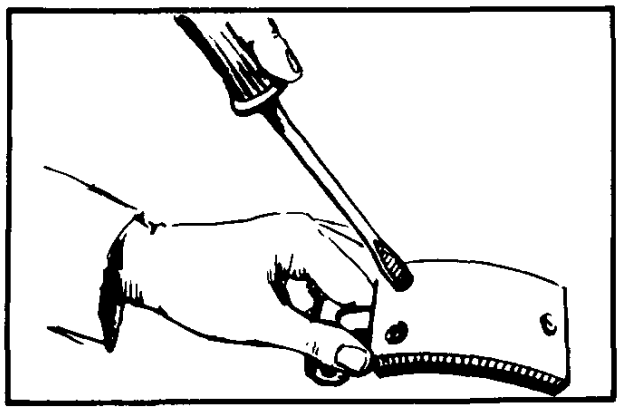
2. Remove the screws and exchange the lining.
Note. The screws are slotted in both ends

EXCHANGE OF FRICTION PADS

page 3:17

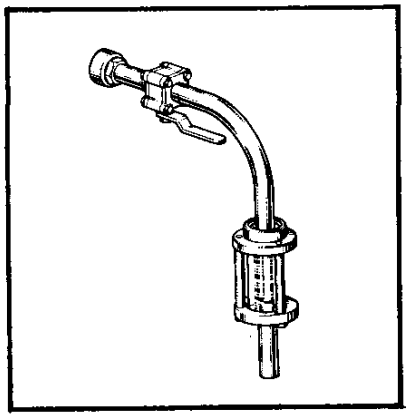


1. Remove the motor
2. Remove the elastic plate
3. Remove the friction blocks

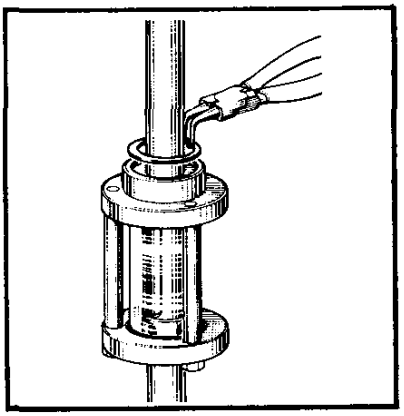


4 Exchange the friction pads.
Note. The screws are slotted in both ends.

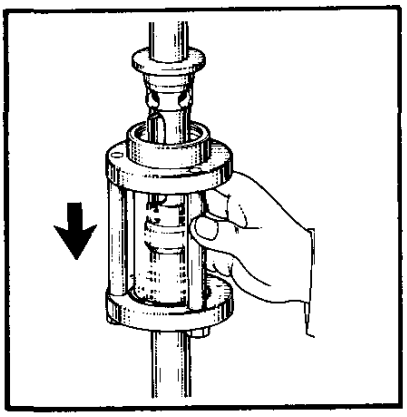
REPLACING THE SCRAPER OF THE SIGHT GLASS



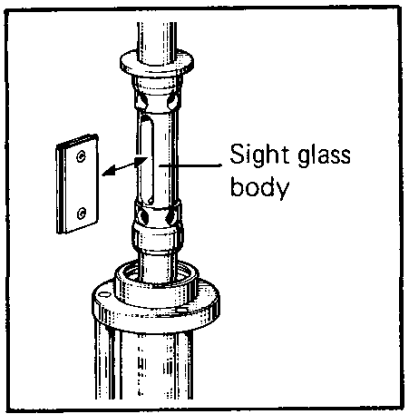
1 Lift off the heavy phase pipe.



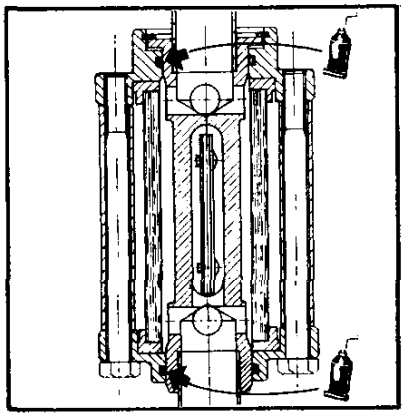
2 Remove the snap ring.



3 Pull down the sight glass. (The flange of the sight glass has a smaller internal diameter than that of the glass and it is therefore necessary to use more force when the flange is pulled along the scraper.)

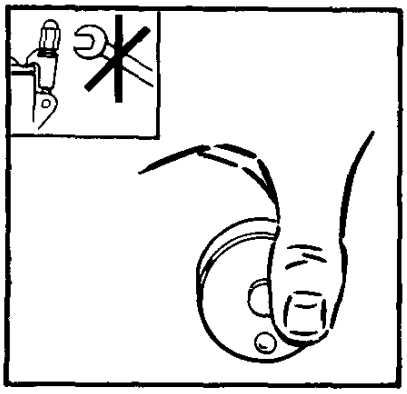


4 Remove the worn scraper. Clean the sight glass body. Insert the new scraper.

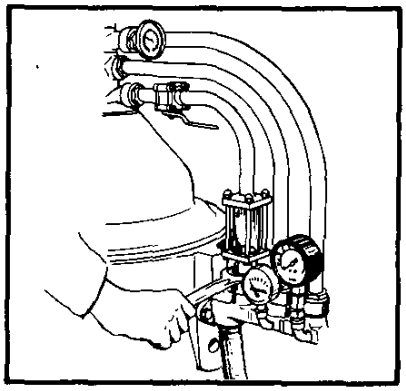


5 Lubricate the O-rings in the flanges with silicone grease. Push up the sight glass and lock it with the snap ring. Check that it is possible to turn the sight glass around the scraper.

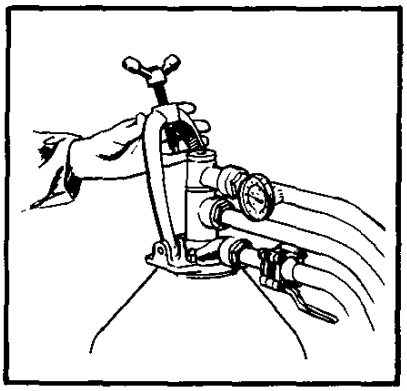
COMPLETE DISASSEMBLY



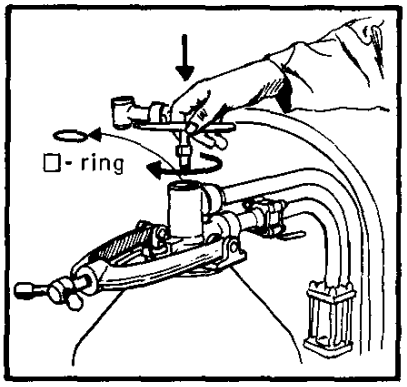
1 *Important!* Never start disassembly until bowl is stationary.



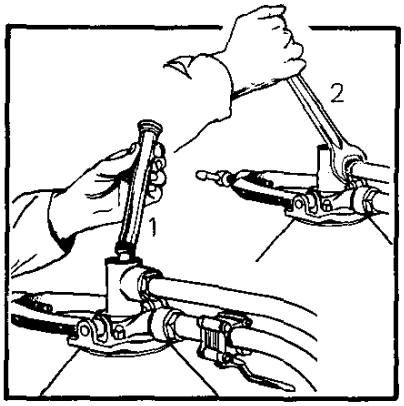
2 Undo the coupling nuts of inlet and outlet piping at the pipe support.



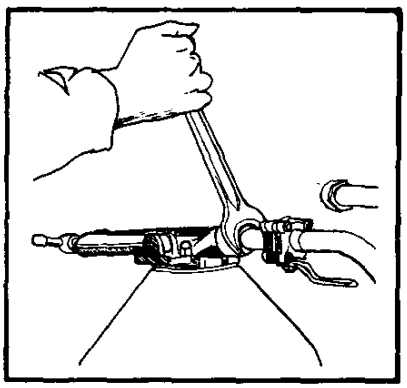
3 Loosen clamp screw and lower clamping stirrup.



4 Unscrew inlet pipe **clockwise** (left-hand thread) with pin spanner.

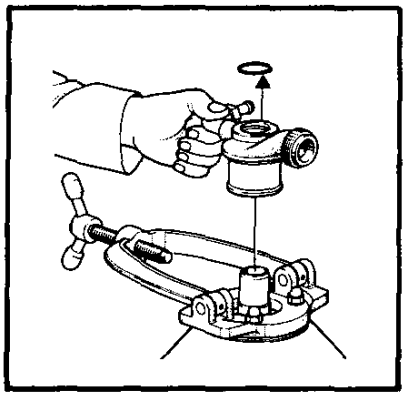


5 Remove inlet pipe (1). Disconnect the outlet pipe for light phase (oil) (2). Swing aside the pipe and remove support with O-ring.

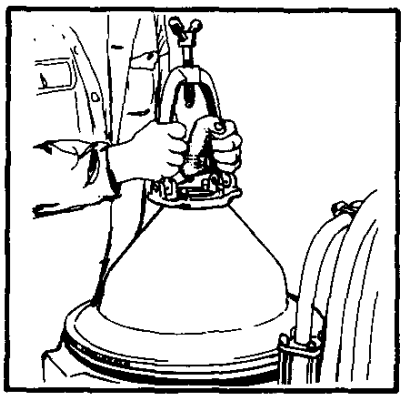


6 Undo coupling nut of connection housing and swing aside the outlet pipe for heavy phase (water).

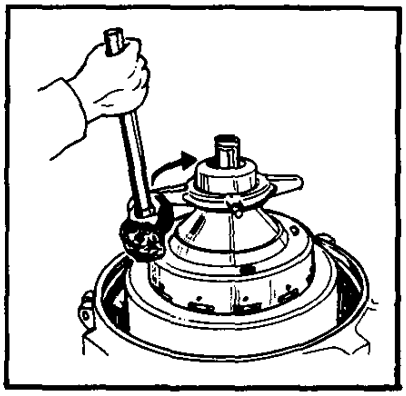
Scraper of the sight glass - p.4:3.



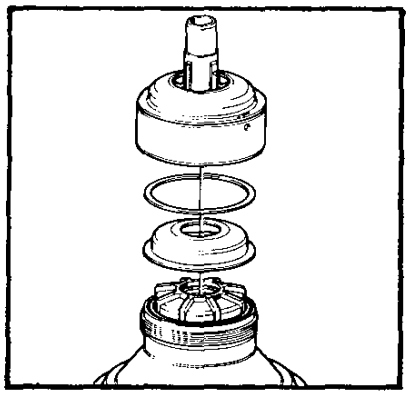
7 Remove connection housing.



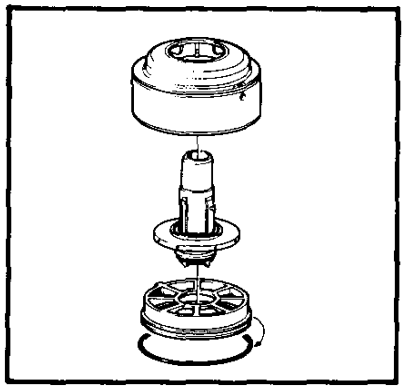
8 Remove frame hood. **If necessary, use a hoist.**



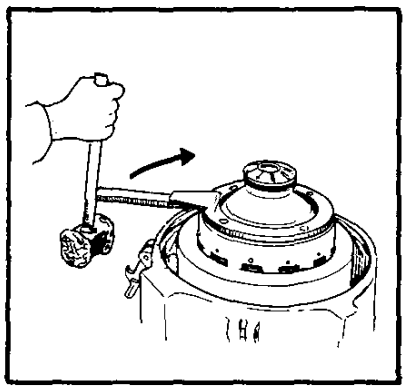
9 Unscrew small lock ring **clockwise** (left-hand thread).



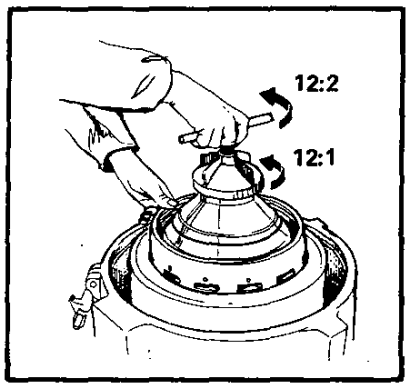
10a Remove small lock ring, packing and gravity disc.



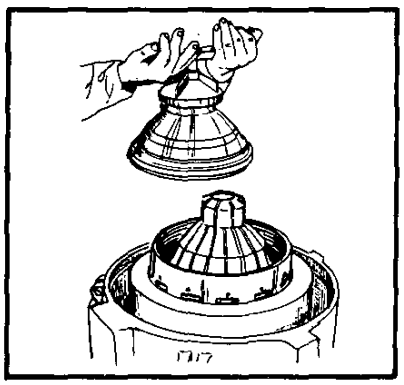
10b Force out sleeve with wings and paring disc from small lock ring.



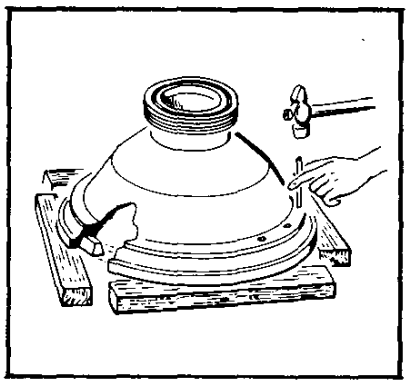
11 Unscrew large lock ring **clockwise** (left-hand thread).



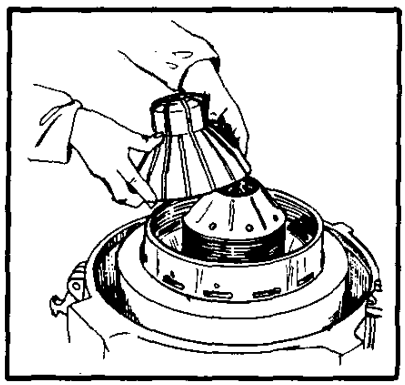
12 Ease off bowl hood with tool screw.



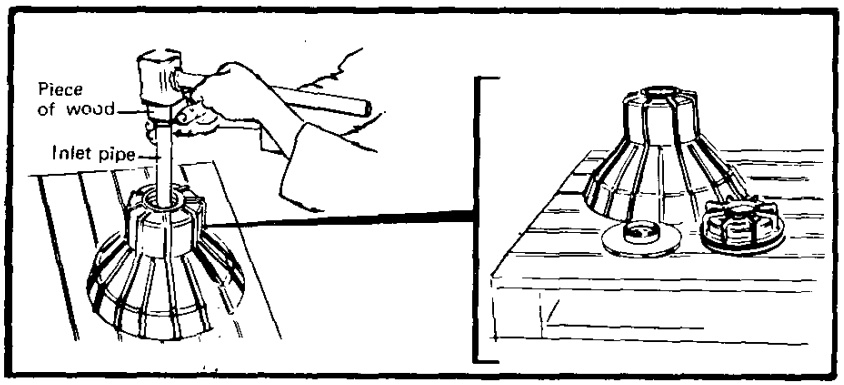
13 Remove the bowl hood.



13a If the seal ring in lower edge of bowl hood needs replacement, force out a part of the ring by means of the pin, inserting it alternately in the holes intended for this purpose. Then pull off the ring by hand.

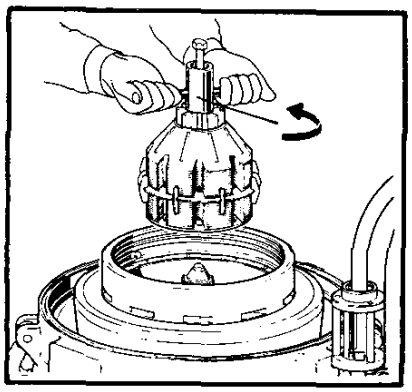


14 Remove top disc.



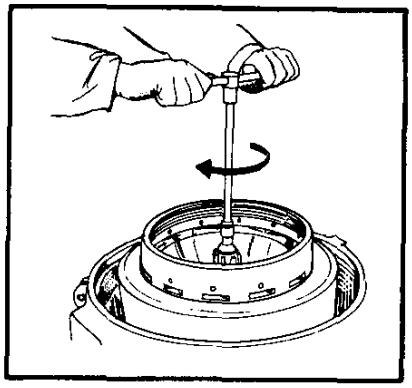
14a Screw inlet pipe in paring disc (counter-clockwise). Force out level ring and paring disc from top disc.

Paring disc thread – page 3:1.

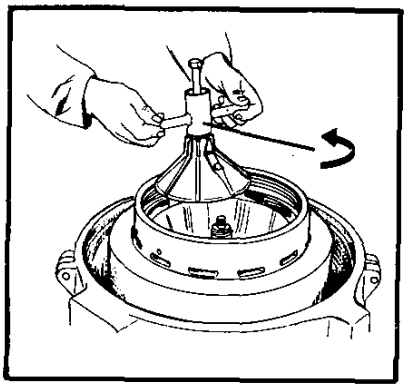


15 Lift out the distributor with disc set in place.

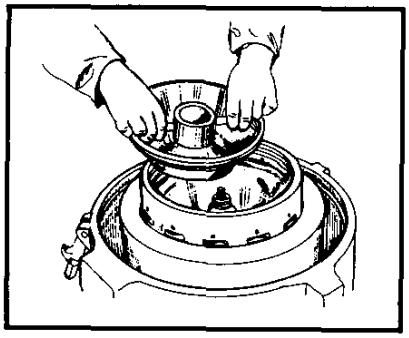
Lock ring threads – page 3:3
Bowl disc cleaning – page 1:11



16 Unscrew cap nut **clockwise** (left-hand thread).

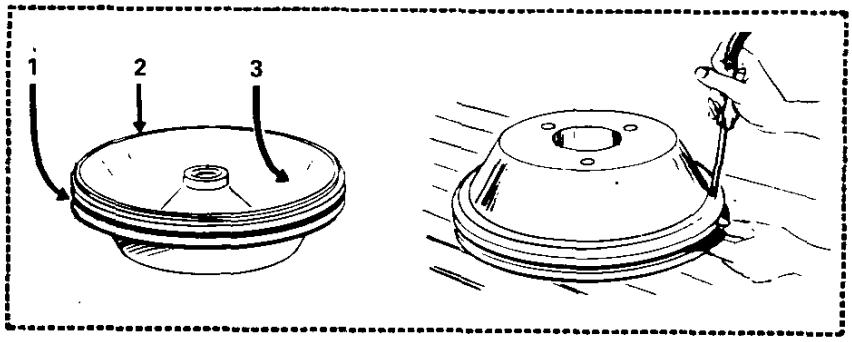


17 Lift out the distributing cone.

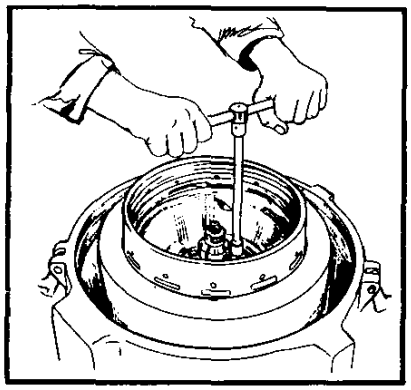


18 Lift out sliding bowl bottom.

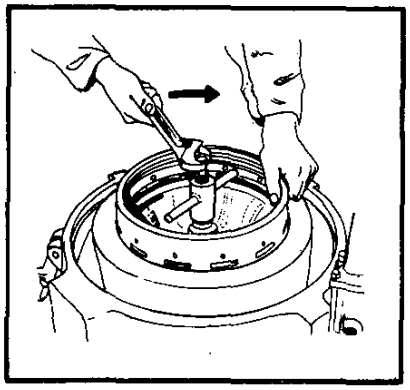
Corrosion. Erosion page 1:8
Sealing edge of sliding bowl bottom – page 3:6



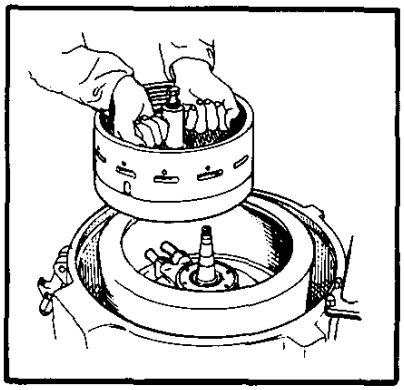
18a If seal ring (1) of sliding bowl bottom should be replaced and compressed air is available, turn bottom upside down and inject compressed air through hole on underside. This will press the ring outwards far enough to be easily gripped. **Take care not to *scratch sealing edge (2) and sludge space surface (3).***



19 Unscrew the three screws from bowl body.

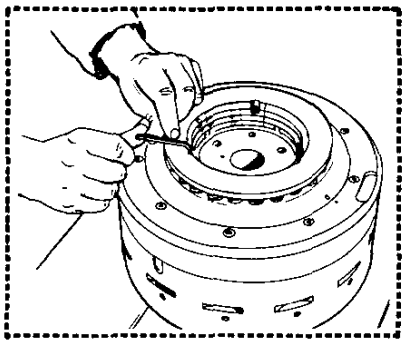


20 Ease off bowl body with central screw of lifting tool. When necessary, knock on spanner handle.

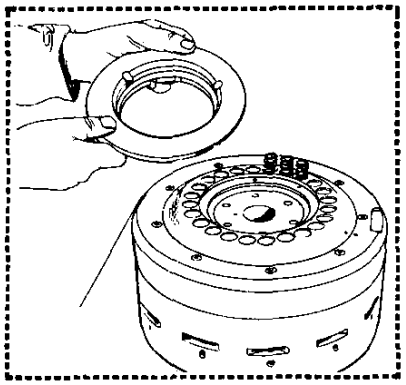


21 Remove bowl body. **If necessary, use a hoist.**

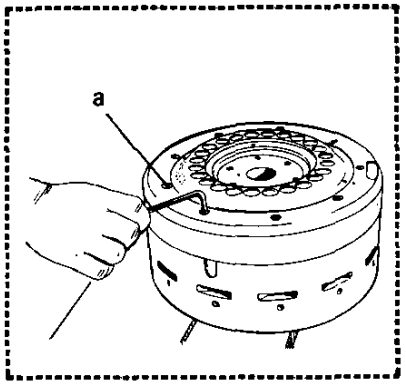
Bowl body nave/ bowl spindle cone – page 3:10.



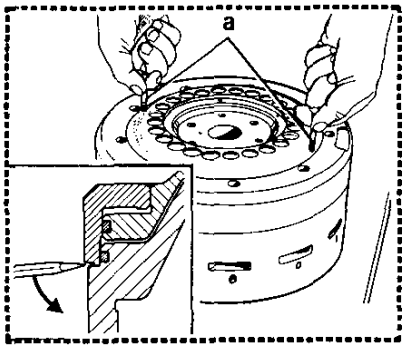
21a To take apart the ejection mechanism, turn bowl body upside down. Loosen the screws of spring support successively a little at a time. Remove the screws.



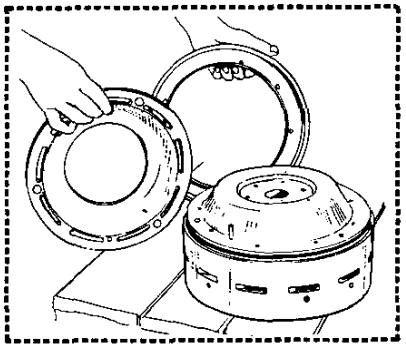
21b Remove spring support and springs.



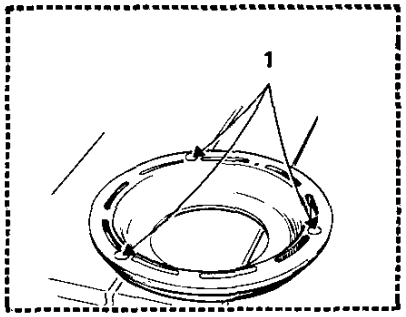
21c Unscrew the screws of dosing ring.



21d Lift operating slide and dosing ring with two of the dosing ring screws. If necessary, prize loose the dosing ring as shown in figure.

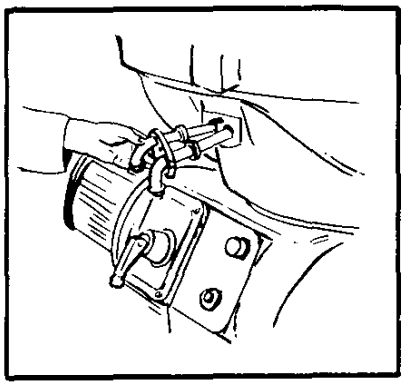


21e Take apart operating slide and dosing ring.

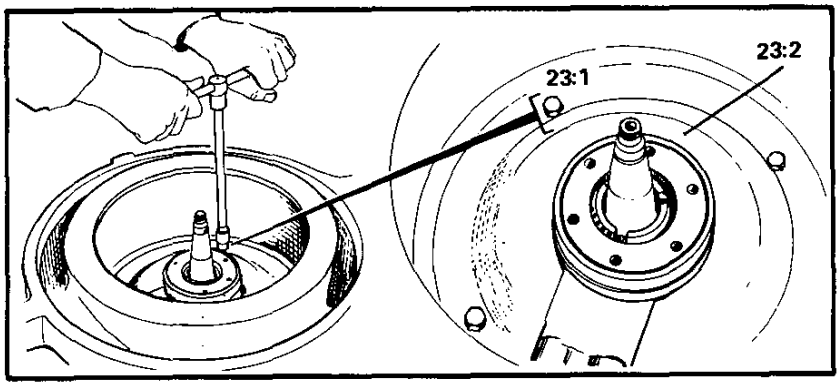


21f Place the slide with valve plugs (1) facing upwards.

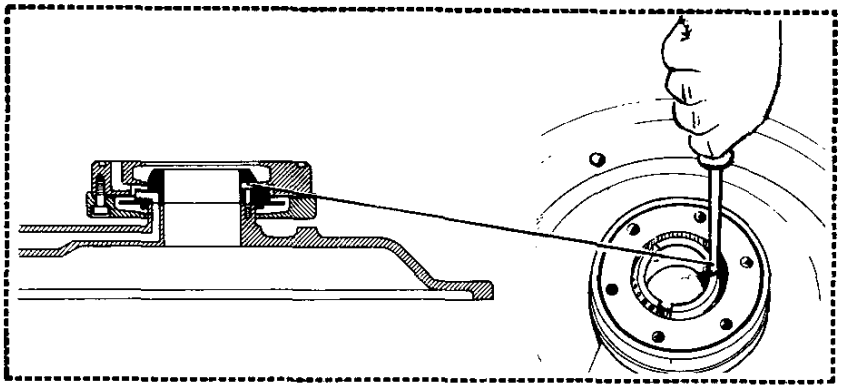
Cleaning of nozzles – page 3:7
Springs, valve plugs – page 3:8



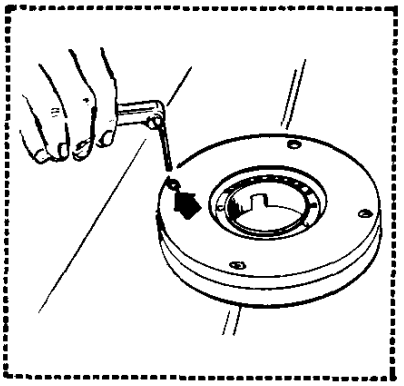
22 Remove operating water inlet tubes.



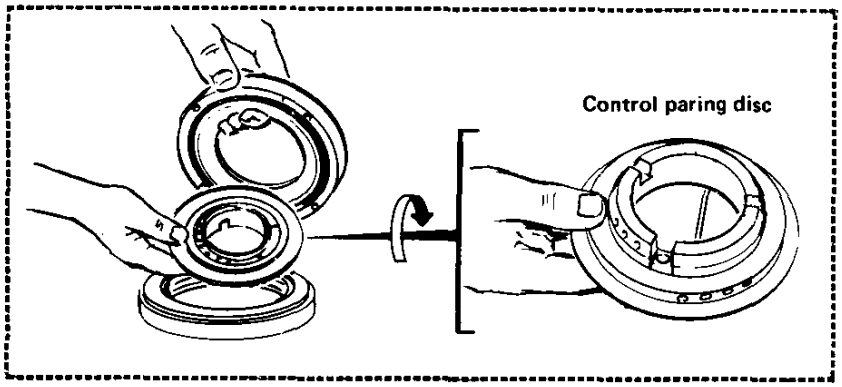
23 Screw out screws (23:1). Remove distributing cover (23:2) together with paring disc device.



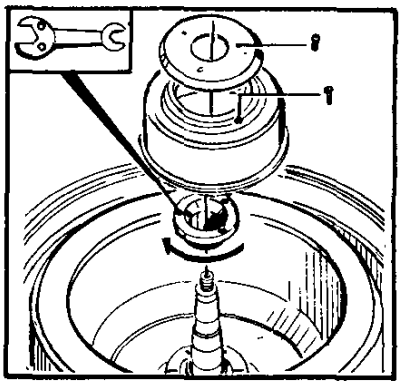
23a To take apart the paring disc device, remove it first from distributing cover by screwing out the screws.



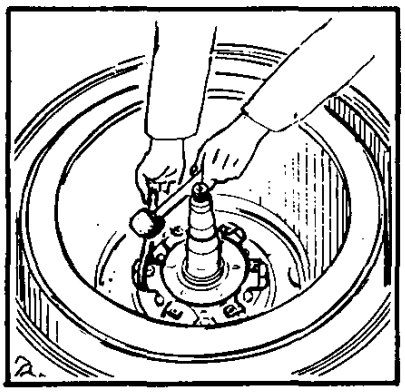
23b Then turn it upside down and remove the screws.



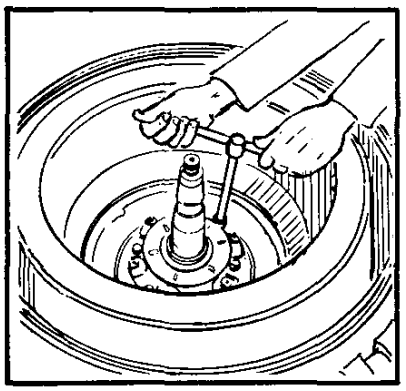
23c Cleaning of paring disc – page 3:7



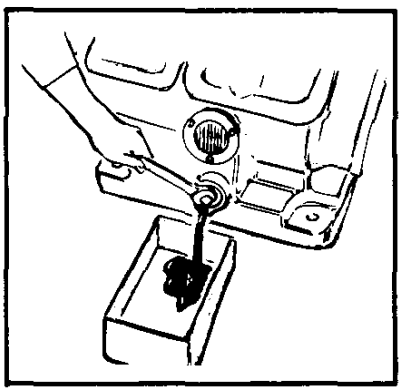
24 Remove protecting plate and cap. Unscrew throw-off collar **clockwise** *(left-hand thread)*.



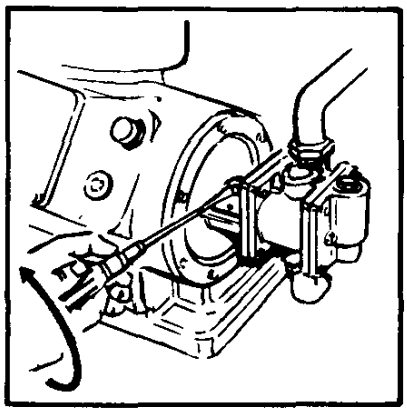
25 Do not unscrew buffer plugs completely, only undo them a little.



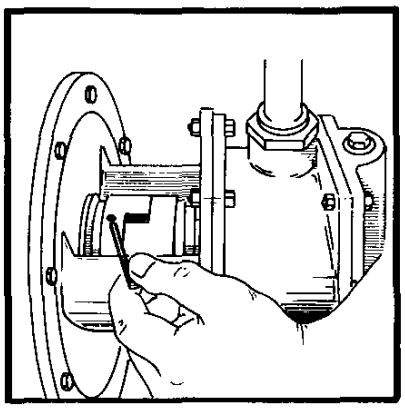
26 Unscrew the screws of spring casing



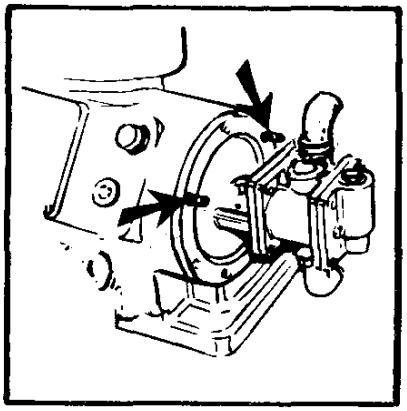
27 Drain oil from worm gear housing.



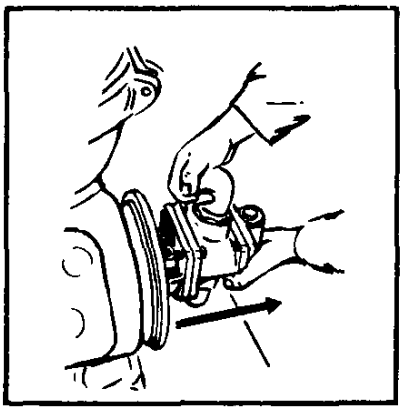
28 Remove pump pipe connections and half-sleeves over the coupling.



29 Loosen the coupling stop screw with a hexagon wrench. Do not remove the screw.

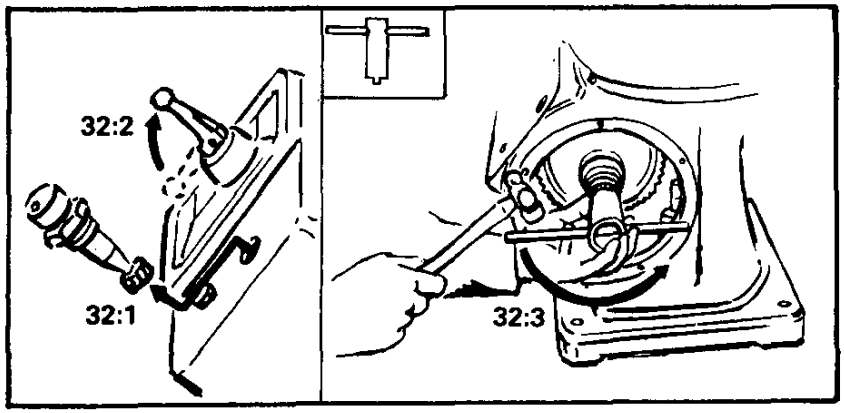


30 Remove two of the pump adapter screws and replace by studs, 3/8" – 16 UNC.

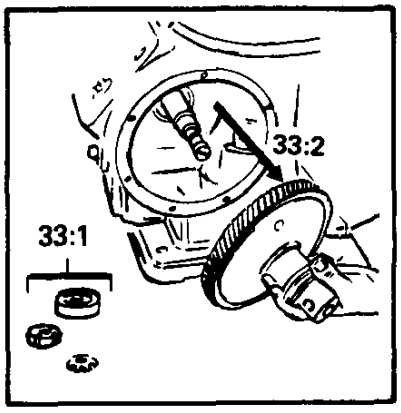


31 Remove remaining pump adapter screws and withdraw the pump carefully. The studs must act as guides.

Pump – see special instruction book

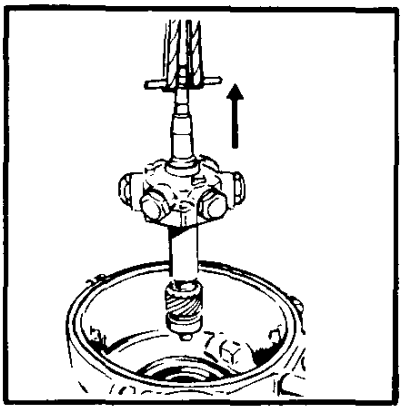


32 Remove the tachometer (32:1). Apply the brake (32:2) and remove round nut (32:3) and its lock washer.

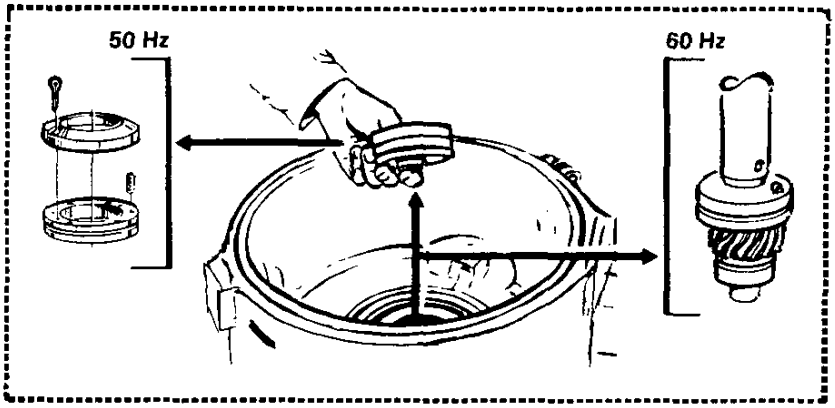


33 Remove worm wheel and ball bearing.

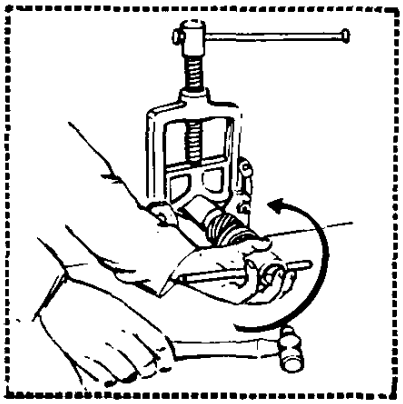
Worm wheel – page 3:13.



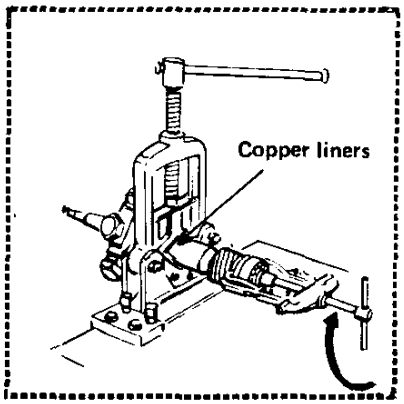
34 Worm
– page 3:13



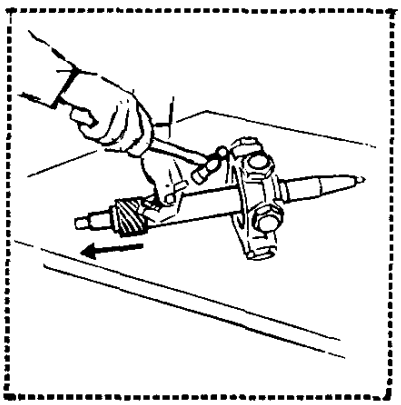
35a Buffer springs – page 3:12.



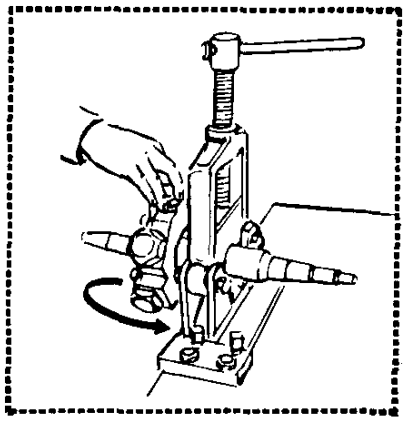
35b Remove round nut and lock washer.



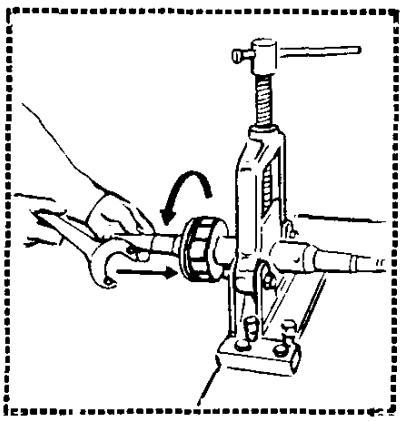
35c Pull off bearing together with spacing washer.



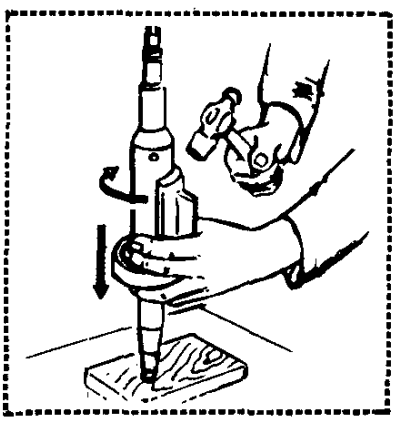
35d Knock off the worm, using a hammer and **soft** drift.



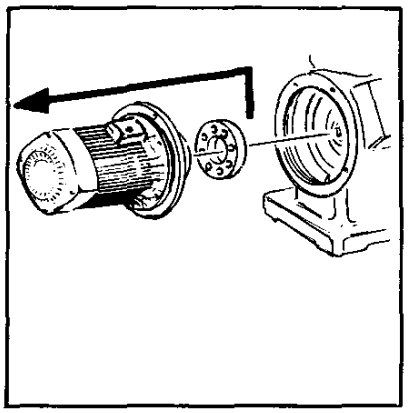
35e Buffer springs
– page 3:12.



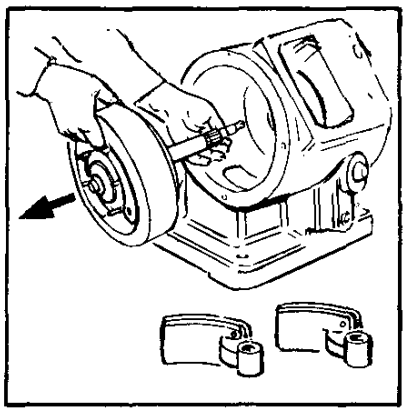
35f Unscrew oil deflector **clockwise** (left-hand thread).



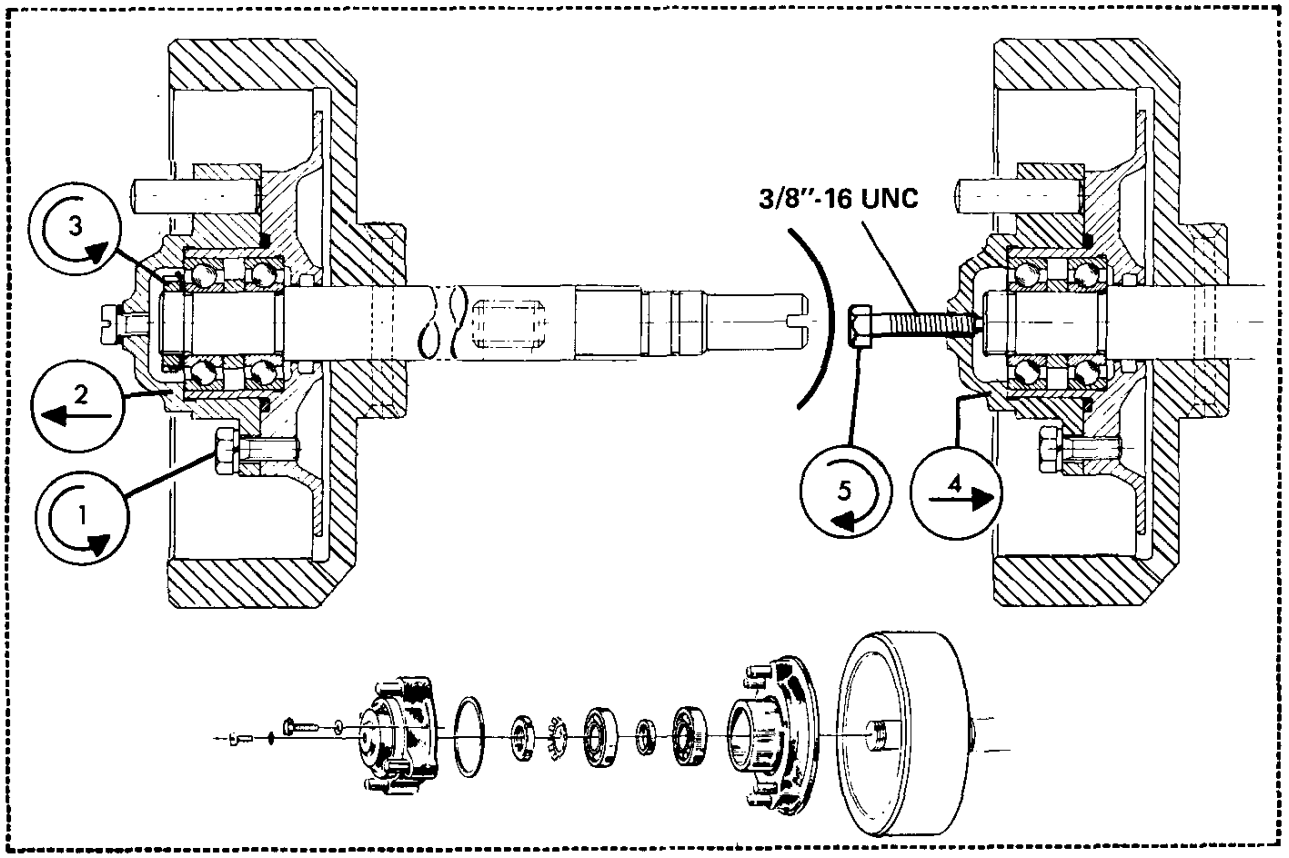
35g Knock off the ball bearing.



36 Remove the motor.

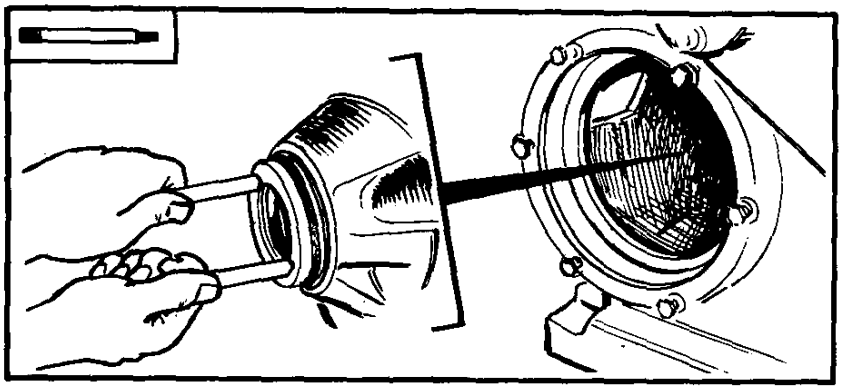


37 Remove frictions blocks.
Lift out worm wheel shaft.
Friction pads page 3:17.

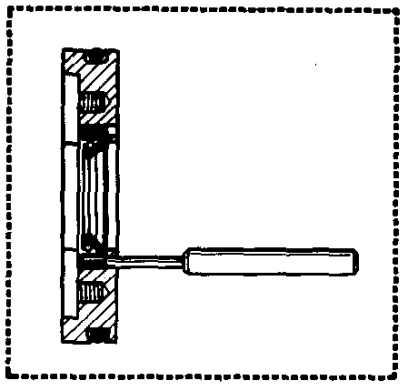


37a Disassembly of nave: remove screws (1) and coupling pulley (2). Unscrew round nut (3). Put coupling pulley again in place (4) and pull off nave with a 3/8"-16 UNC-screw (5).

Grease in nave – page 3:17.

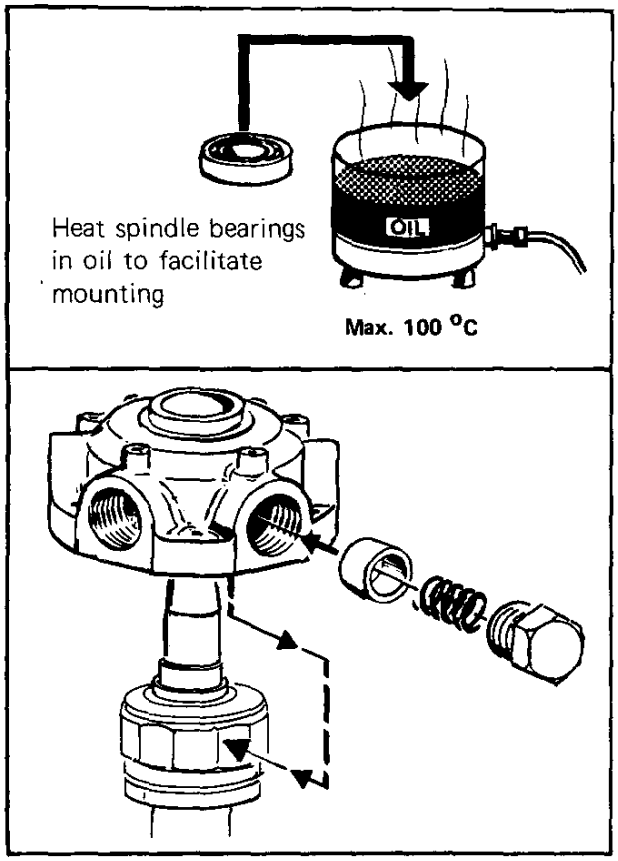


38 Remove sealing washer using two screws with threads 1/4"-20 UNC.

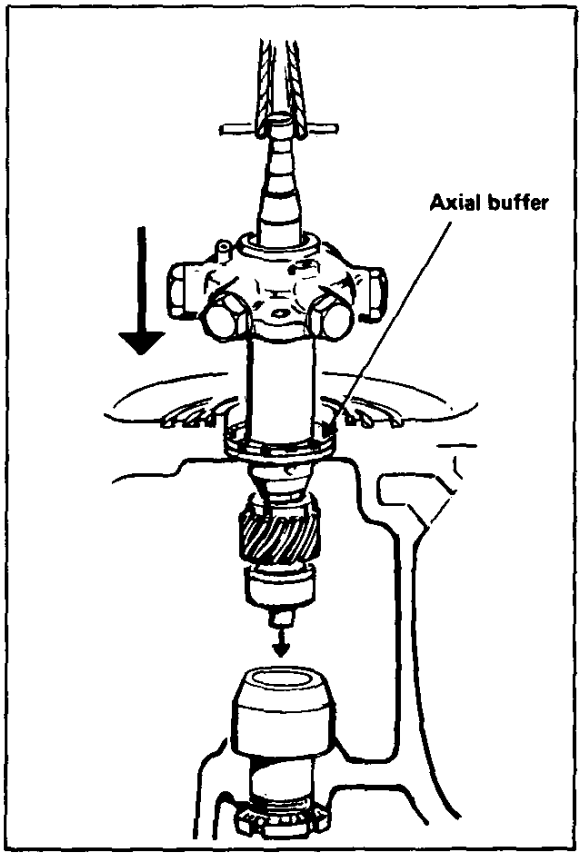


38a Removal of lipseal ring.

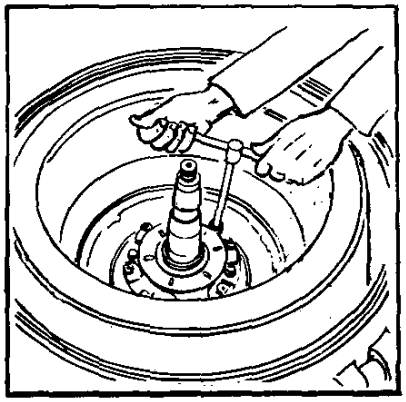
ASSEMBLY (after complete disassembly)



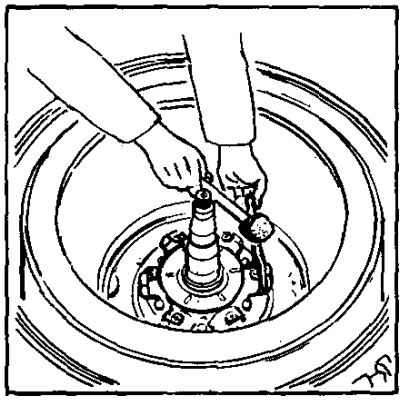
1. Take care to bring the flats of ball bearing housing right in front of the buffer holes.



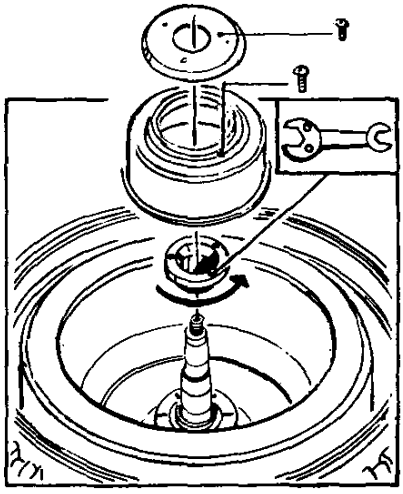
2. Guide the bearing into bottom bushing. If it does not completely enter its seat, tap the spindle top with a tin hammer.



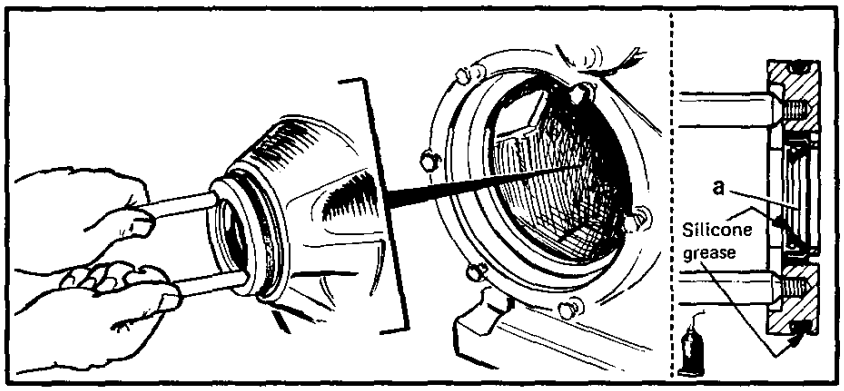
3. Tighten screws of spring *casing.*



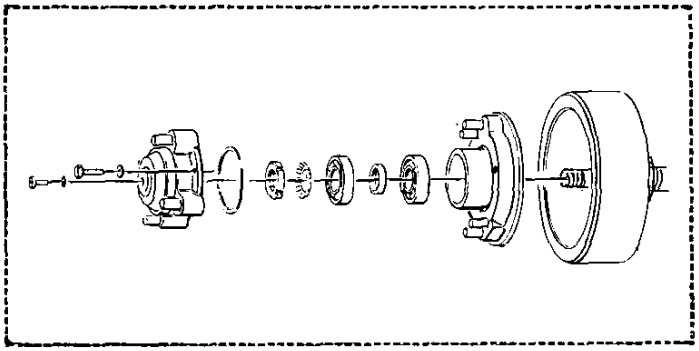
4. Tighten buffer plugs.



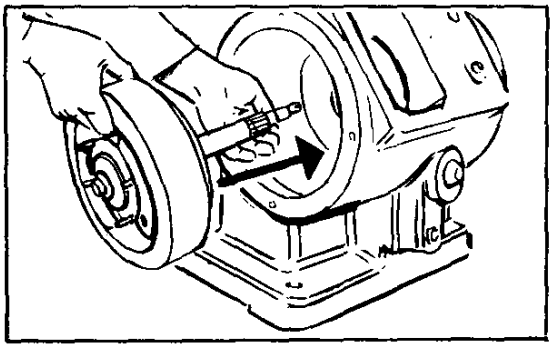
5. Screw *throw-off collar* **counter-clockwise** on spindle (left-hand thread).



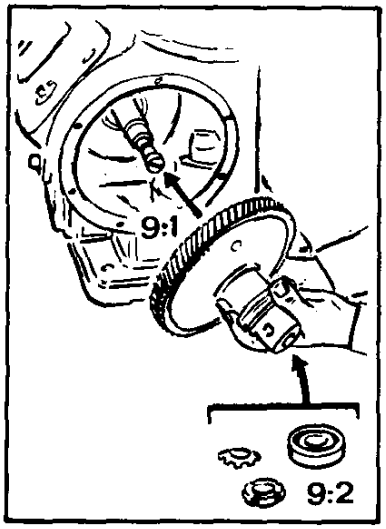
6 Fit sealing washer in frame Check that lipseal ring (a) is correctly fitted.



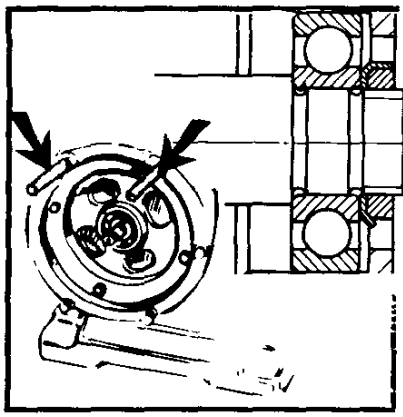
7 Grease in nave – page 3:17



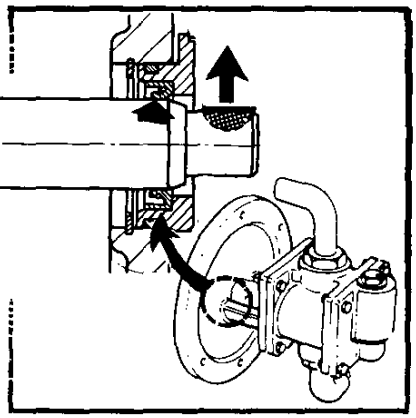
8 Fit worm wheel shaft. Put friction blocks in place inside the coupling drum.



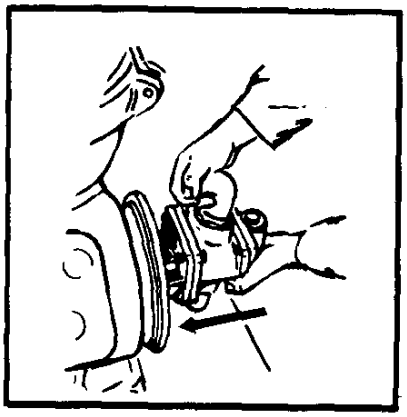
9 Fit worm wheel (9:1), ball bearing, lock washer and round nut (9:2).



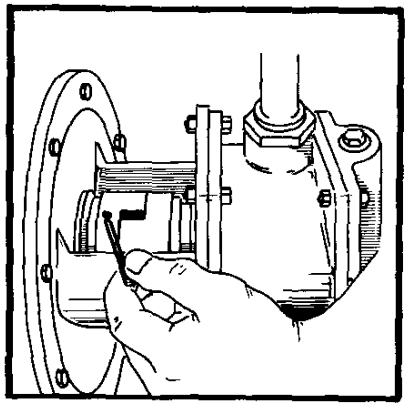
10 Fit two studs 3/8" – 16 UNC in the frame flange to guide the pump adapter. Rotate the worm wheel shaft until the Woodruff key faces upwards.



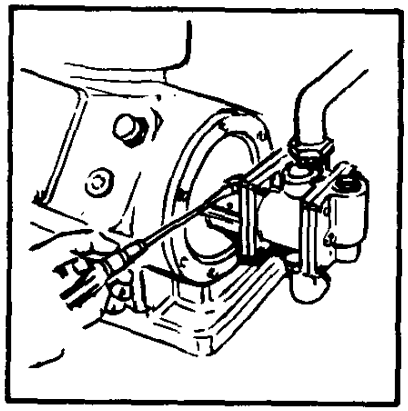
11 Inspect the lip sealing ring in pump adapter. Change if defective in any way. Make sure to fit correctly. Smear silicone grease on the sealing lip.



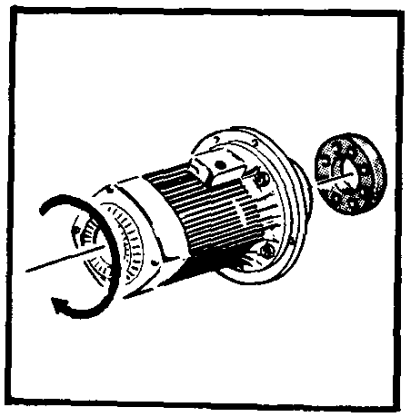
12 Fit the pump. Be very careful that the sealing ring is not damaged by the key.



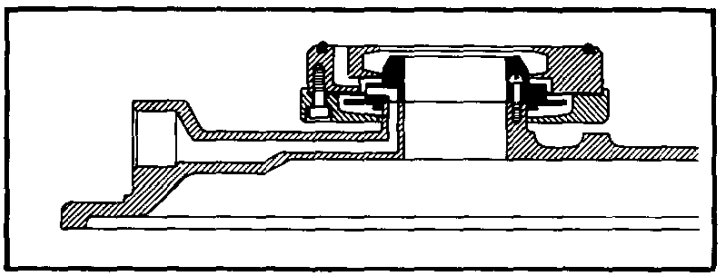
13 Tighten the coupling stop screw with a hexagon wrench.



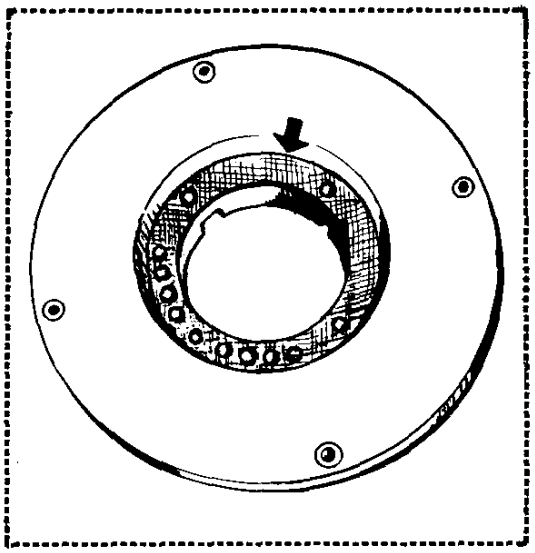
14 Fit the half-sleeves over the coupling. Refit the pipe connection.



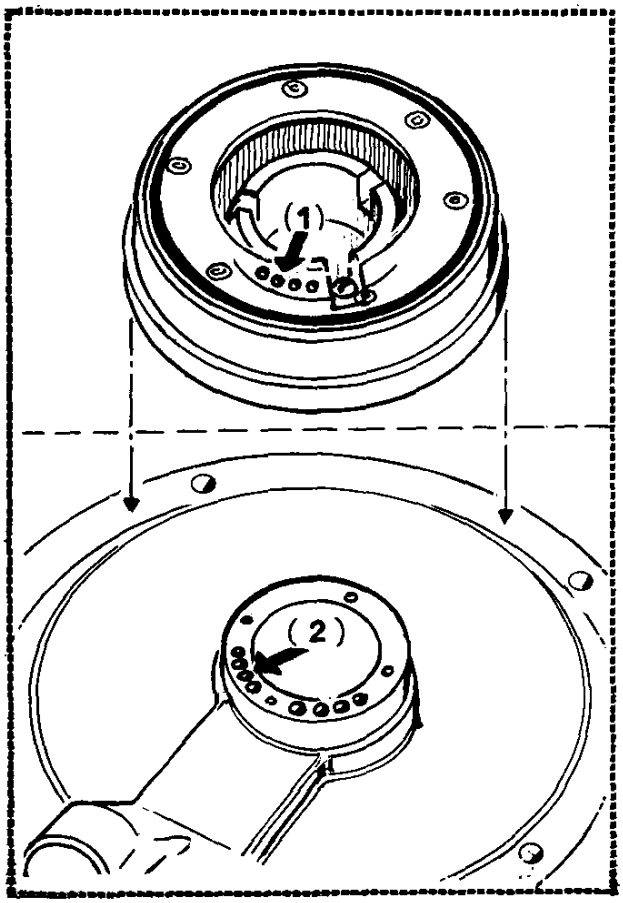
15 Axial play of elastic plate – page 3:16



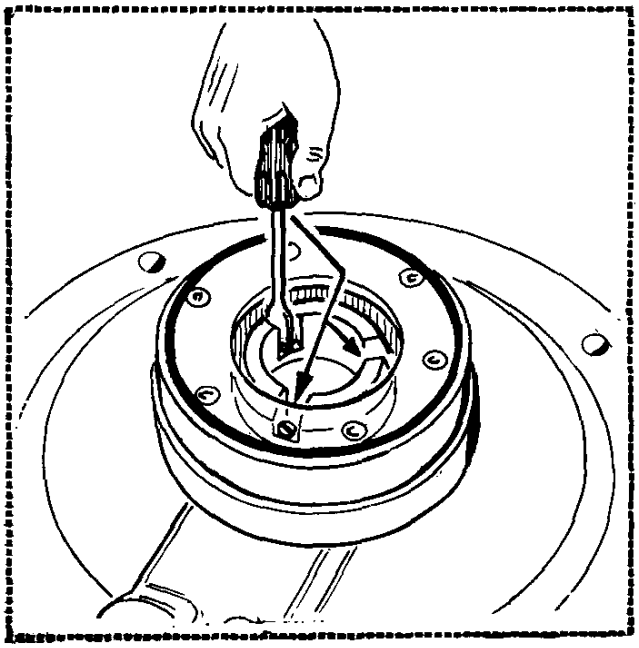
16 If the paring disc device has been dismounted from distributing cover fasten it as follows:



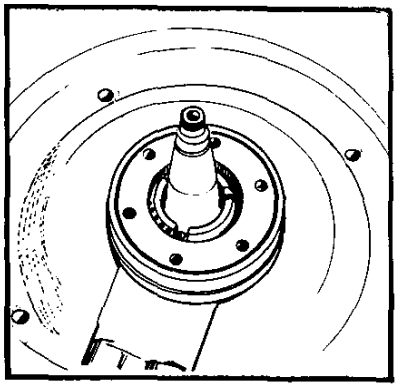
16a First fasten the packing to the underside of the paring disc device.



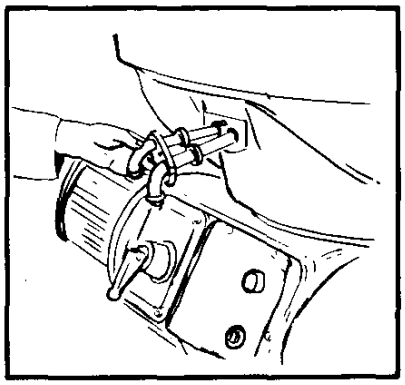
16b Align the four holes (1) in paring disc with the four holes (2) in distributing cover.



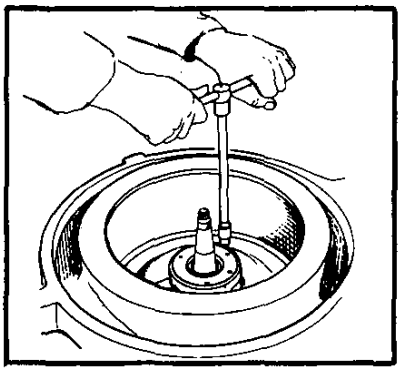
16c Tighten screws of paring disc.
NOTE: Do not tighten too hard, as the threads may then be damaged.



17 Put the distributing cover in place. Do not tighten the screws (this will make it easier to fit the operating water inlet tubes).

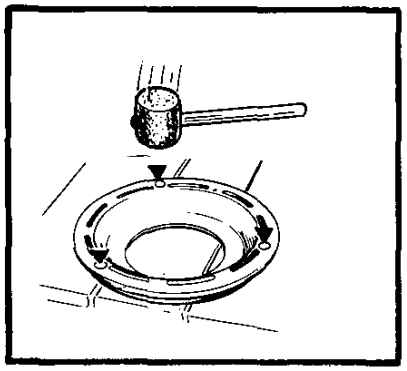


18 Fit the operating water inlet tubes.

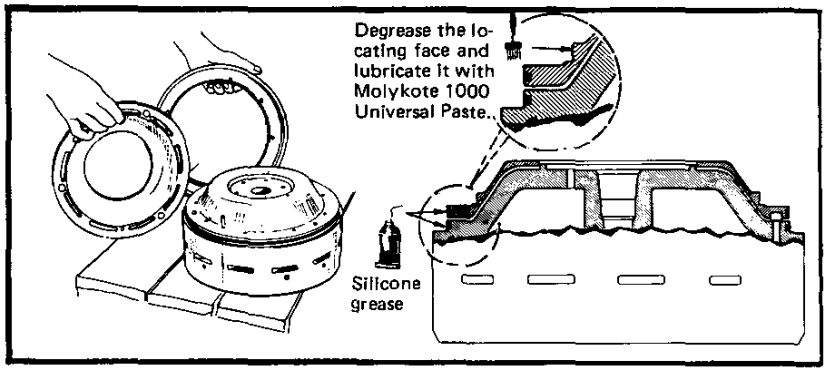


19 Fasten the distributing cover.

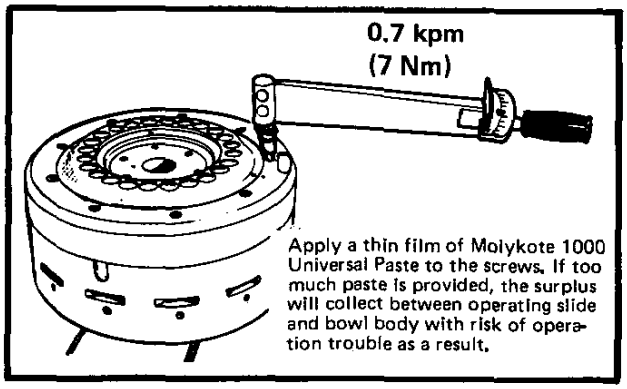
Height position of paring disc – page 3:9



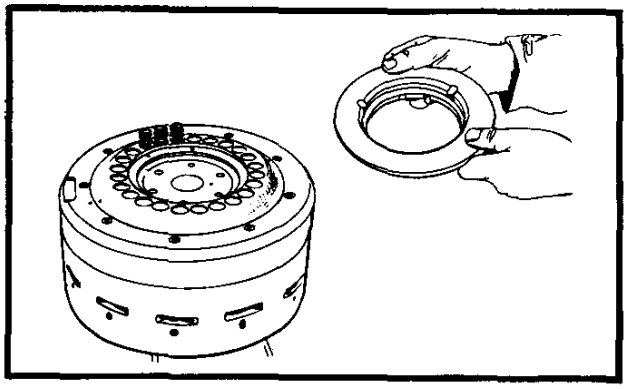
20 Any new valve plugs should be knocked in with a rubber mallet to avoid damaging the sealing surface.



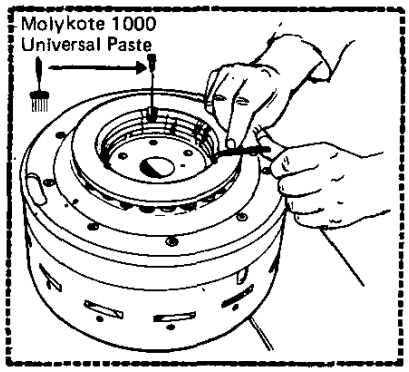
20a Fit the operating slide and dosing ring.



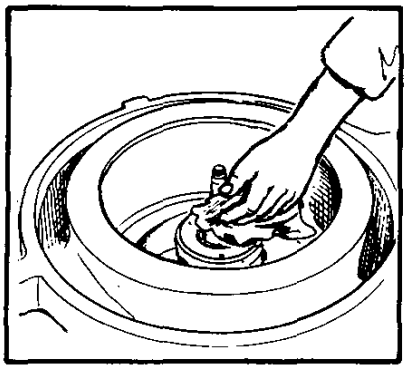
20b It is absolutely necessary to use a dynamometric wrench when tightening the dosing ring screws. First tighten diametrically, then all round.



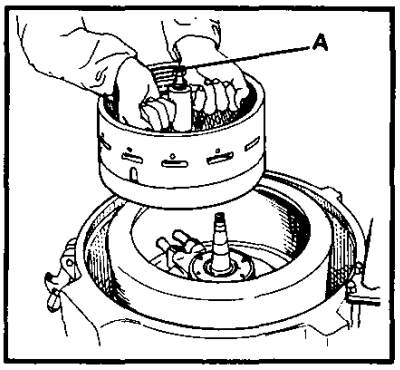
20c Fit springs and spring support.



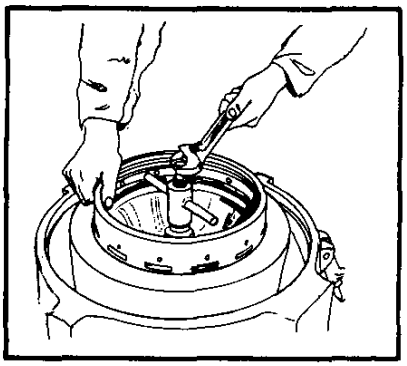
20d Tighten screws successively a little at a time. Finally tighten them firmly (by hand).



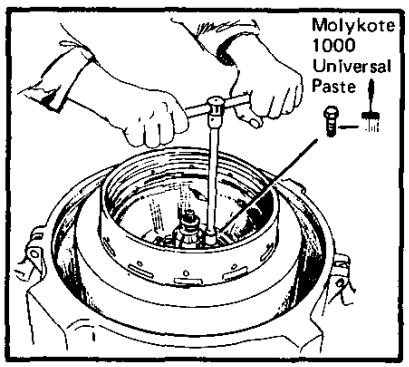
21 Wipe off spindle top and nave bore in bowl body. **Rub spindle cone with a thin layer of Molykote 1000 Universal Paste.**



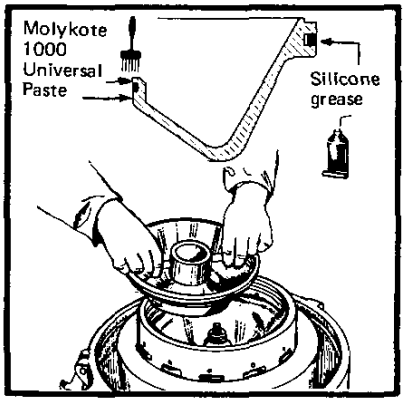
22 Lower bowl body until central screw (A) supports on spindle top. If necessary, use a hoist.



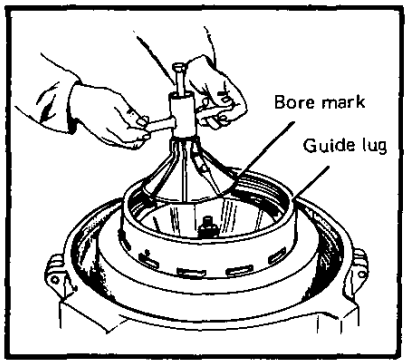
23 Now screw up the screw so that the bowl body sinks down on the spindle cone.



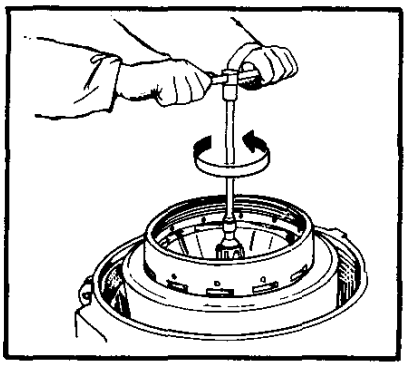
24 Tighten bowl body screws firmly.



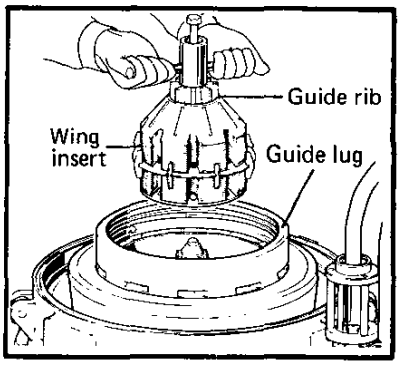
25 Fit the sliding bowl bottom.



26 The guide pins on underside of distributing cone must enter recesses in bowl body nave.

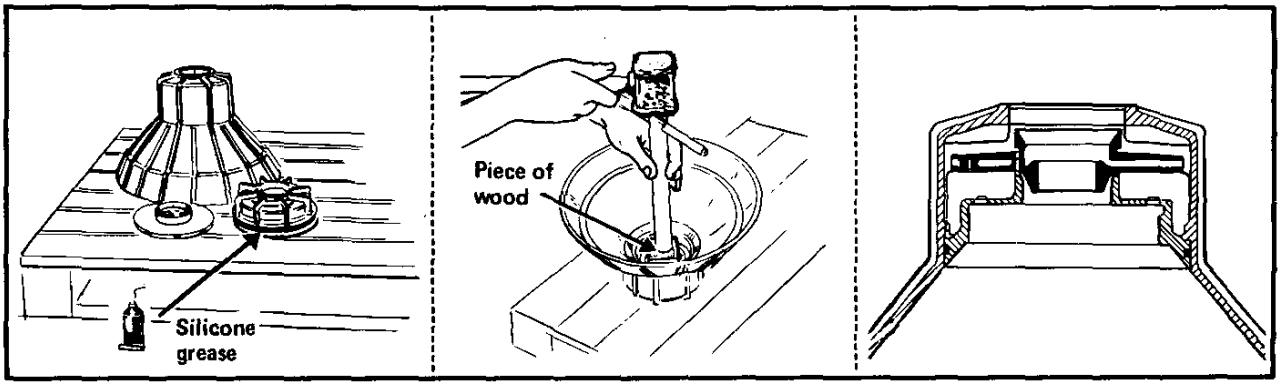


27 Lubricate the cap nut threads with Molykote 1000 Universal Paste. Screw cap nut counter-clockwise on spindle (left-hand thread). Tighten firmly.

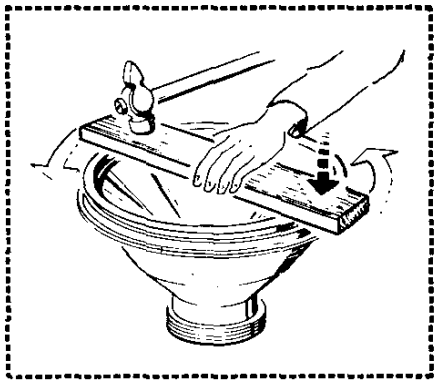


28 Recesses in underside of distributor must fit over guide pins of distributing cone.

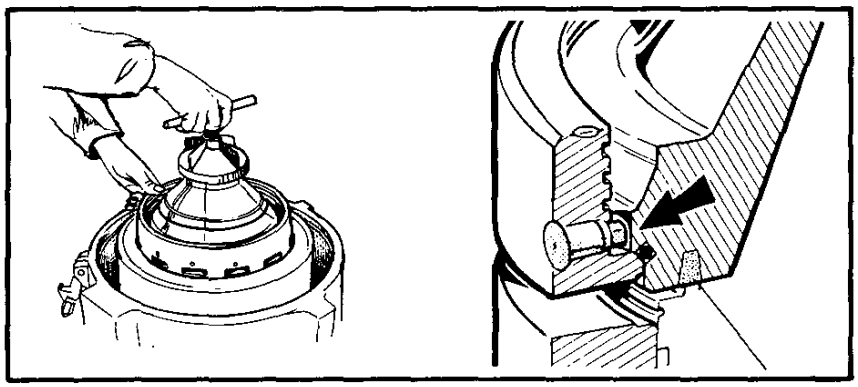
Number of bowl discs **under** the wing insert: 40.



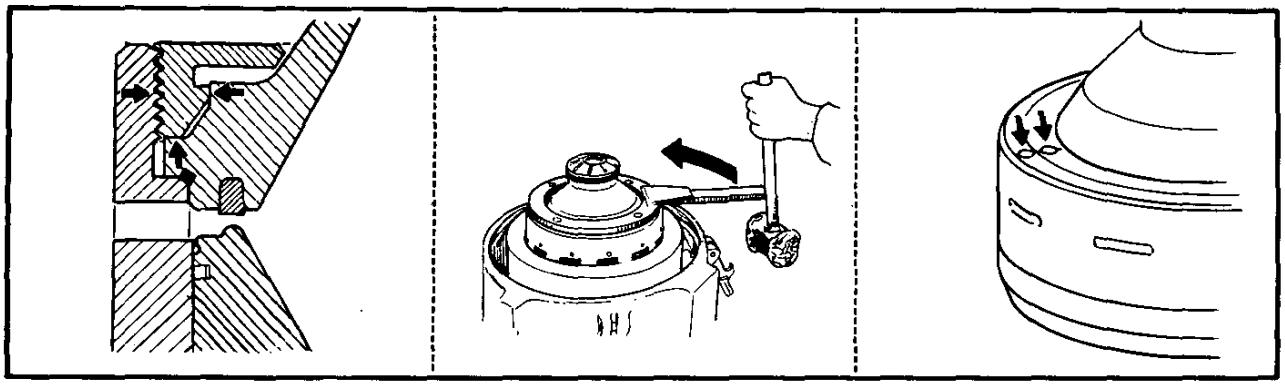
29 Fit paring disc and level ring in top disc. Be sure to turn the paring disc the right way round. Fit top disc on distributor (bore mark on disc must face the guide lug of bowl body).



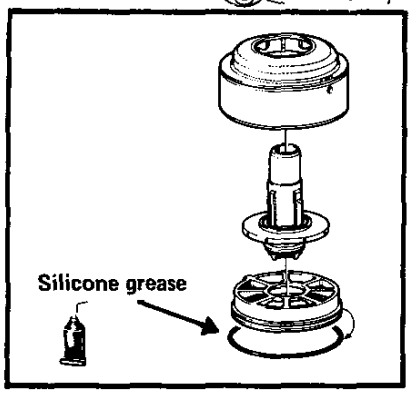
30 If the seal ring in bowl hood needs replacement, fit the new ring as follows:
Press the ring into groove in lower edge of bowl hood with a straight board (1" x 5"), which is placed across the ring. Hammer carefully the board right above the ring, first on one side and then on the other. Turn board around successively and drive ring into groove as evenly as possible.
Note. If a new seal ring of nylon (polyamide) is 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 80 ^{o} - 90 ^{o} C (175 ^{o} - 195 ^{o} F).
If the ring is too narrow, put it in hot water, 70 ^{o} - 80 ^{o} C (160 ^{o} - 175 ^{o} F) for 5 minutes (approx.)



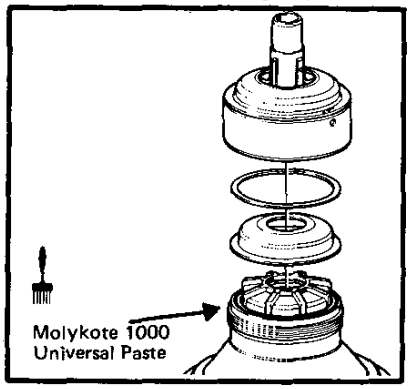
31 Put bowl hood in place. The guide lug on bowl body must enter the recess in hood.



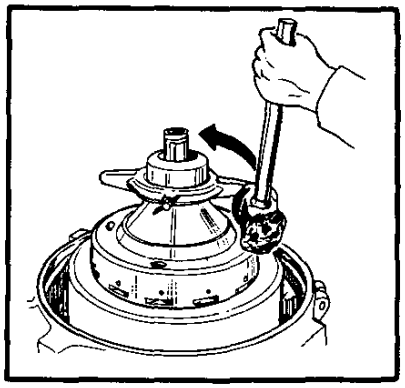
32 Degrease large lock ring threads, contact and locating faces (see arrows above). Apply Molykote 1000 Universal Paste to the threads and faces stated. Brush on the paste according to the manufacturer's directions. Tighten ring **counter-clockwise** (left-hand thread) until bowl hood lies tightly against bowl body (in a new bowl marks ◊ will now be in line with each other – see arrows above).
Disc set pressure – page 3:5 Height position of paring disc – page 3:2



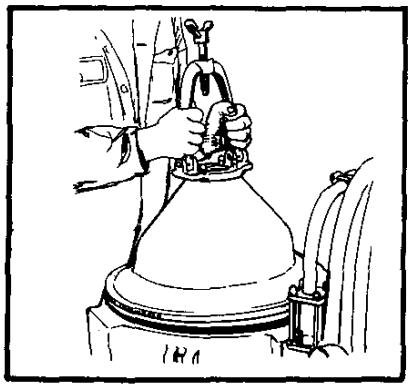
33a Fit paring disc and sleeve with wings in small lock ring.



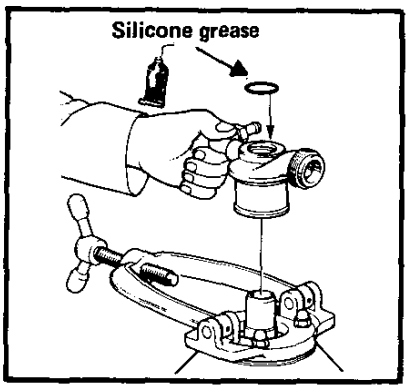
33b Fit gravity disc, packing and small lock ring.



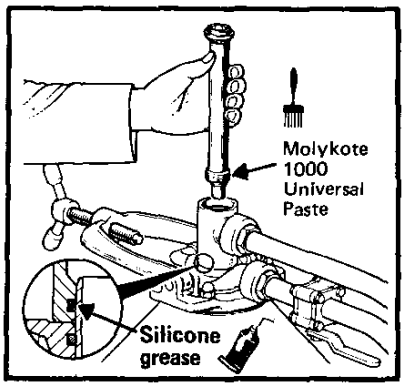
34 Tighten small lock ring **counter-clockwise** (left-hand thread).



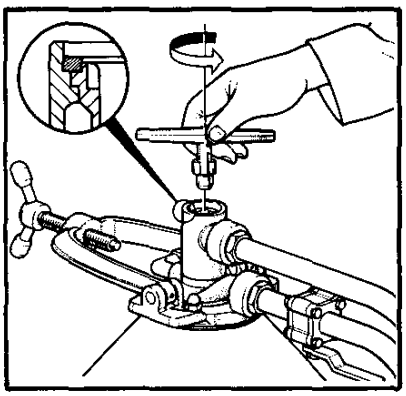
35 Put frame hood in place and clamp it with the hinged bolts.



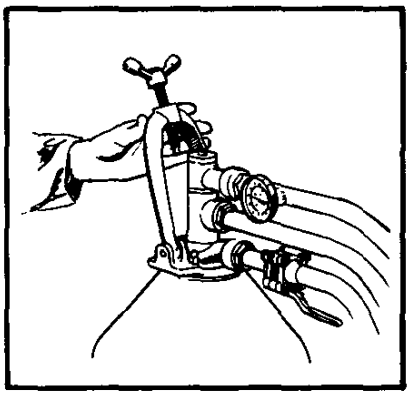
36 Fit the connection housing and the outlet pipe for heavy phase (water).



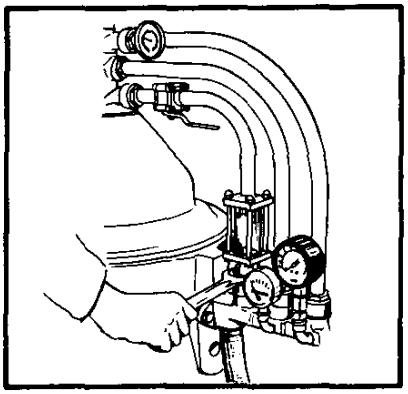
37 Fit support. Connect the outlet pipe for light phase (oil). Fit inlet pipe.



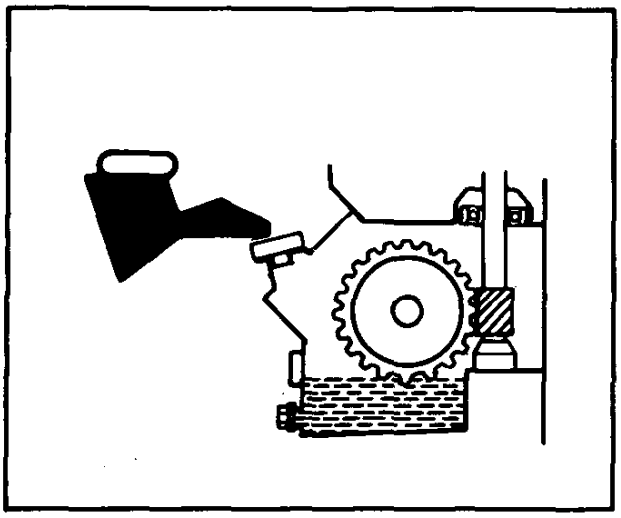
38 Screw in the pipe **counter-clockwise** (left-hand thread).



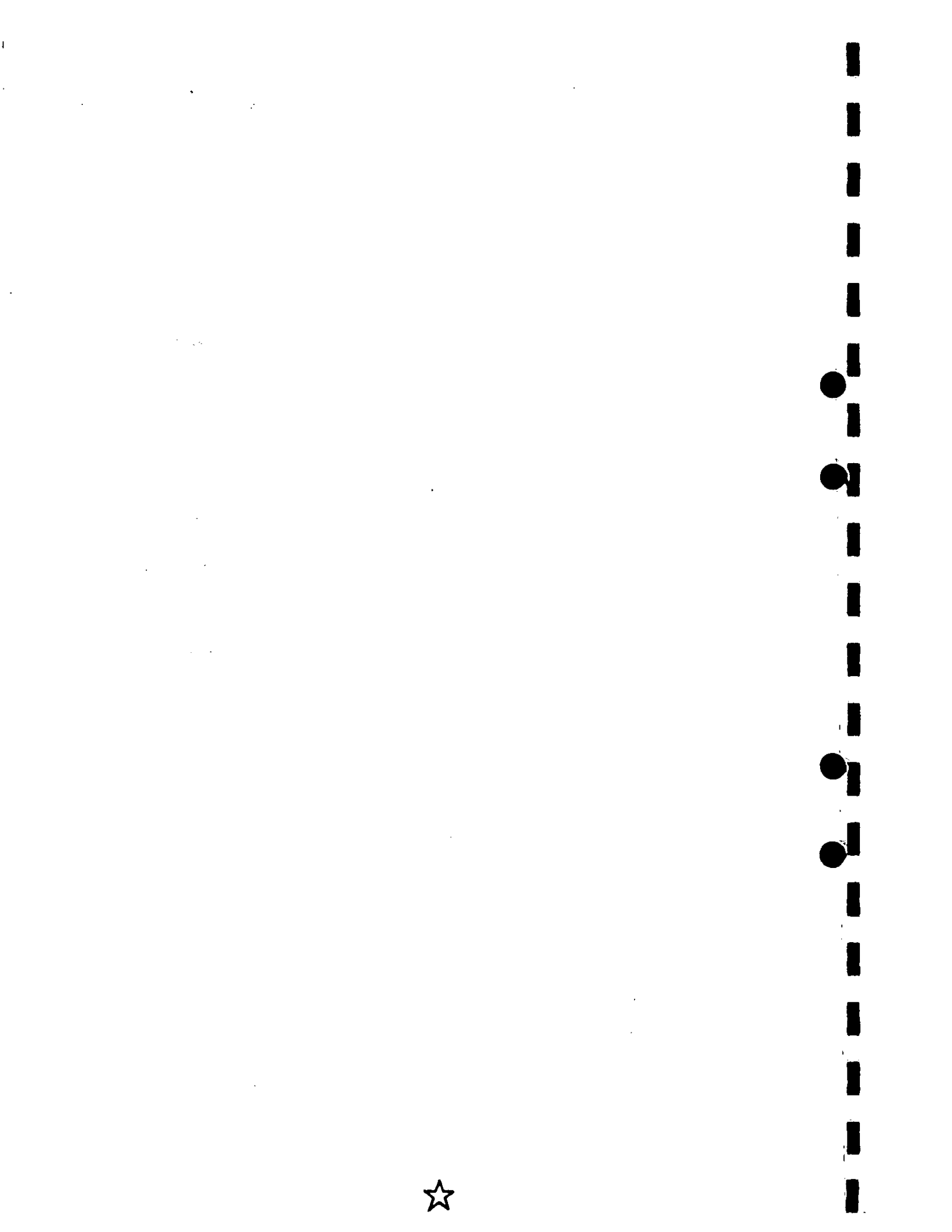
39 Tighten clamp screw firmly.



40 Tighten the pipes at the support.



41 Pour oil into worm gear housing.
See also **Lubricating Schedule in Operator's Manual.**



SPEC. NO. 881071-01

THROUGHPUT CAPACITIES 1/h

Rated capacity 4,700

Recommended max. throughput*

Fuel oils - diesel engine

Distillate - viscosity 1.5-5.5 cSt/40°C		3,700
Marine diesel oil - viscosity 13 cSt/40°C		3,100
Heavy fuel oil** - viscosity in cSt/50°C	30	2,900
	40	2,900
	60	2,200
	100	2,100
	180	1,500
	380	1,200

Lubricating oils, by-pass treatment, optimum

R & O type - Crosshead diesel	1,400 - 1,600
Detergent - Crosshead diesel	1,200 - 1,400
- Trunk piston diesel	800 - 1,000
Steam turbine	3,100

* Maximum density of oil 991 kg/m^3 at 15°C. Density preferably measured at 50°C and according to ASTM method D 1298-80, corrected to 15°C according to ASTM tables D 1250-80.

** For HFO-cleaning plants dimensioned specifically for operation in series, these figures are to be increased by 35% (purifier-clarifier plus stand-by)

SLUDGE AND WATER SPACE 1.2 litres.

BUILT-ON FEED PUMP

Capacity in 1/h at	50 Hz	60 Hz
- 538718-84	2,420	2,900
- 538718-85	3,630	4,350
- 538718-83	4,350	5,220

Suction lift: Max. 4 m wg (manometric).
Delivery head: Max. 15 m wg (manometric).

BUILT-IN OIL OUTLET PARING DISC PUMP

Delivery head: See back pressure diagram over-leaf.

ELECTRIC MOTOR

With separate feed pump: Size 4 kW.
With built-on feed pump: Size 5.5 kW.

SPEED

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

Table of rpm at	50 Hz	60 Hz
- Drive motor	1420 - 1500	1700 - 1800
- Bowl spindle	max. 7605	
- Revolution counter	118- 125	142 - 150

RUNNING-UP/STOPPING TIME

Approx. 2 min. / Minimum 4 min.
(Running-out with brake applied).

MATERIALS

Frame, lower and upper parts
- cast iron ("Centriblue" finish*).

Frame hood
- cast iron (grey finish*).

Bowl body and hood, sliding bowl bottom, disc stack, gravity discs, operating slide, dosing ring, spring holder
- stainless steel.

Other bowl parts
- Ni-alloy, tinned steel, bronze, brass.

Paring disc pumps
- brass

Other inlet and outlet parts
- tinned steel, bronze, brass.

* An epoxy enamel.

OPERATING WATER

Volume of tank for closing, make-up, opening, sealing, and displacement water min. 40 litres.
(One tank for max. 3 separators).

Height from operating water connection of the separator to the max. water level in the tank 3 m ± 0.2 m.

Total hardness: Max 180 ppm $CaCO_3$(10°dH).

pH-value: > 6.

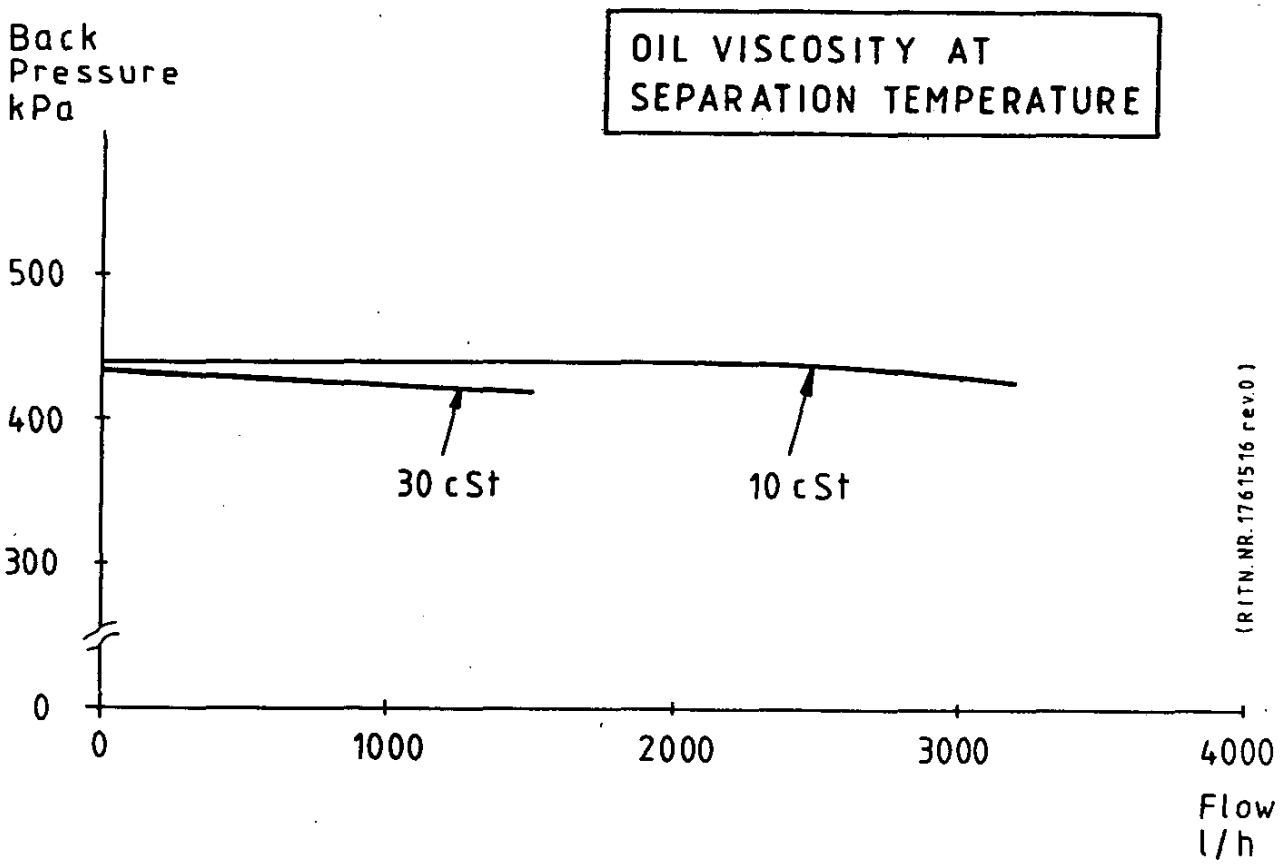
Salinity: Max cloride content of 60 ppm Cl. (Equivalent to 100 ppm NaCl).

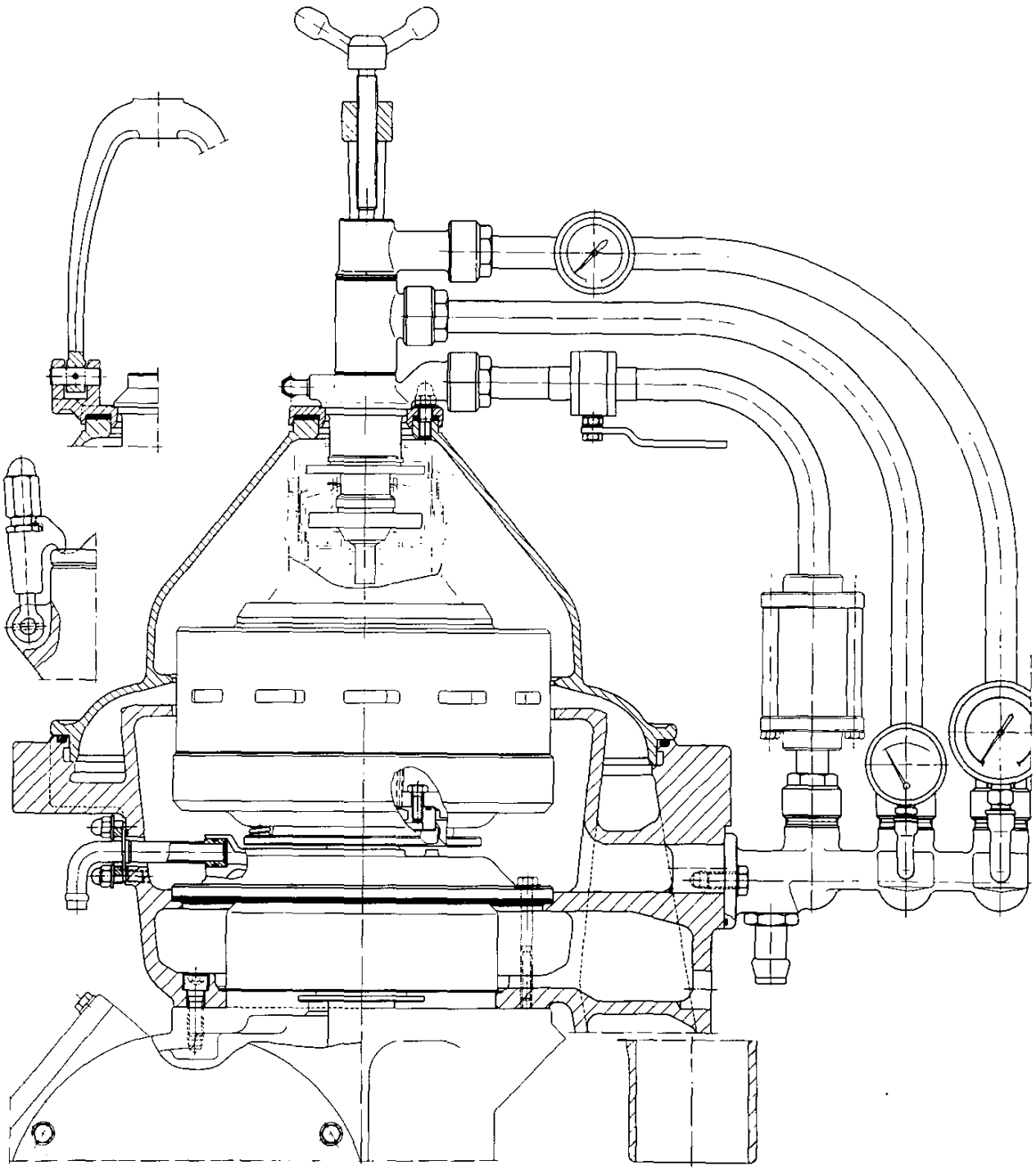
SHIPPING DATA

Separator, complete with set of tools, excluding motor

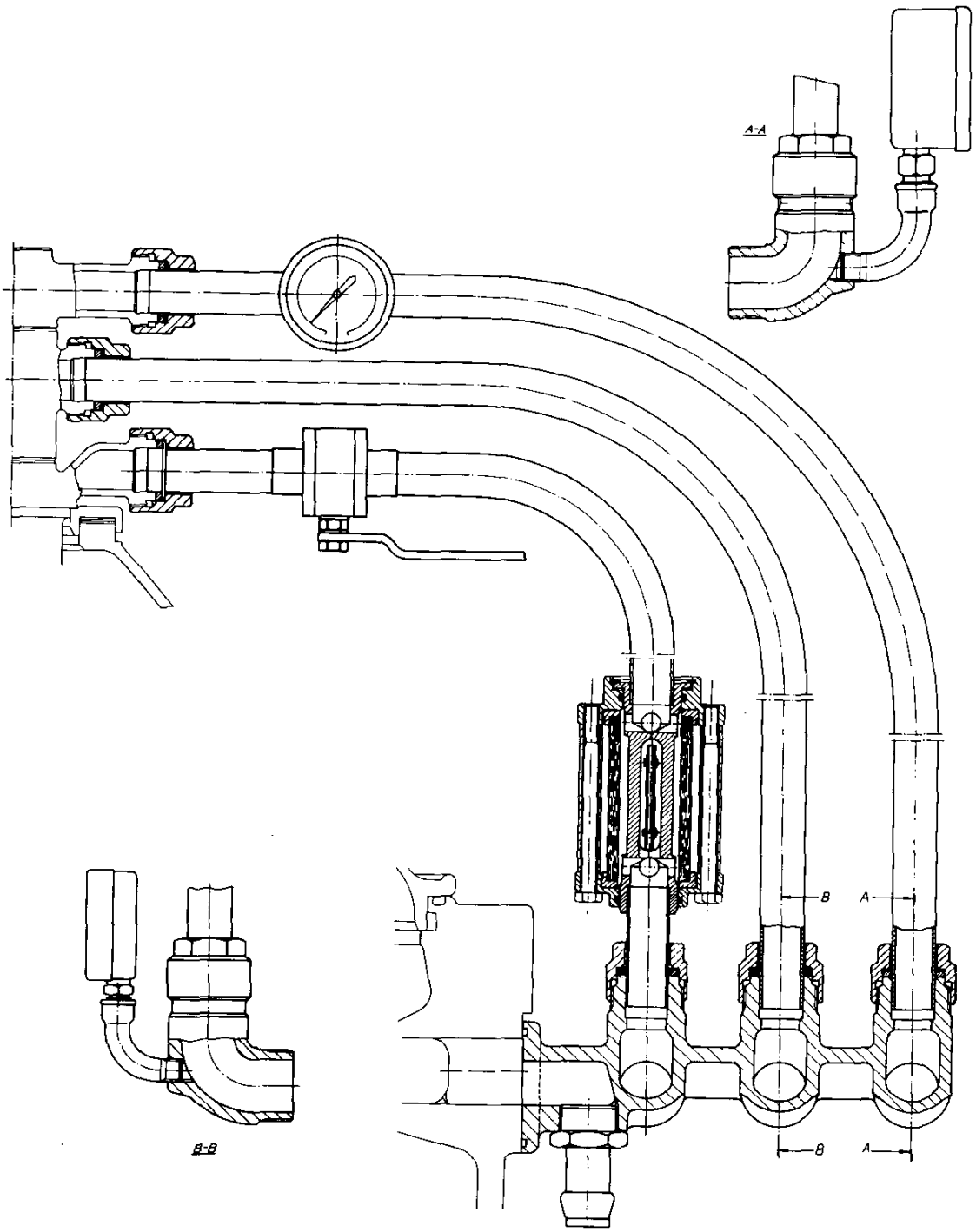
Weights: Net 400 kg, gross 530 kg.

Volume: 1.55 m^3.

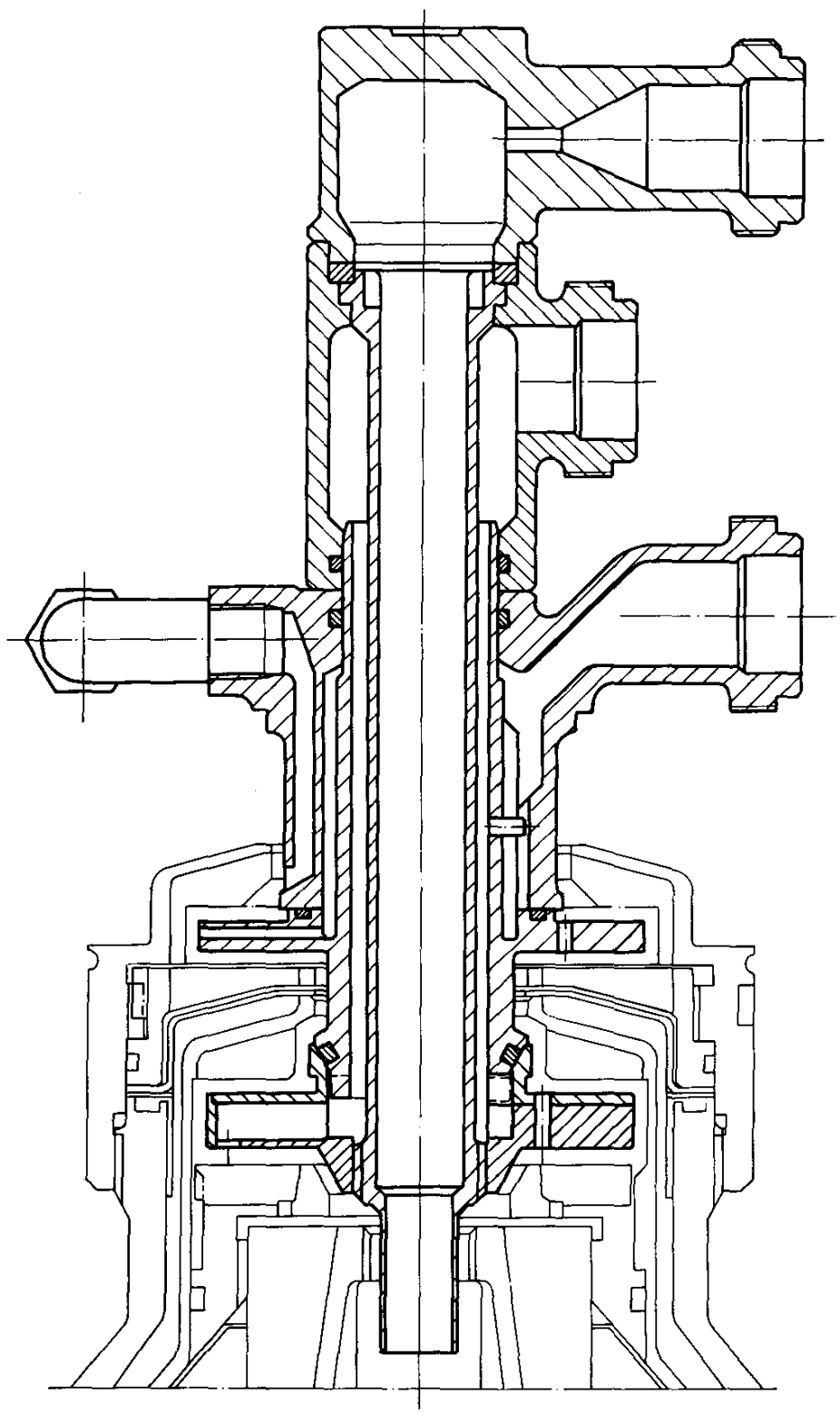

OIL VISCOSITY AT
SEPARATION TEMPERATURE
Back
Pressure
kPa
500
400
300
0
30 cSt
10 cSt
0
1000
2000
3000
4000
Flow
l/h
(RITN.NR.1761516 rev.0)



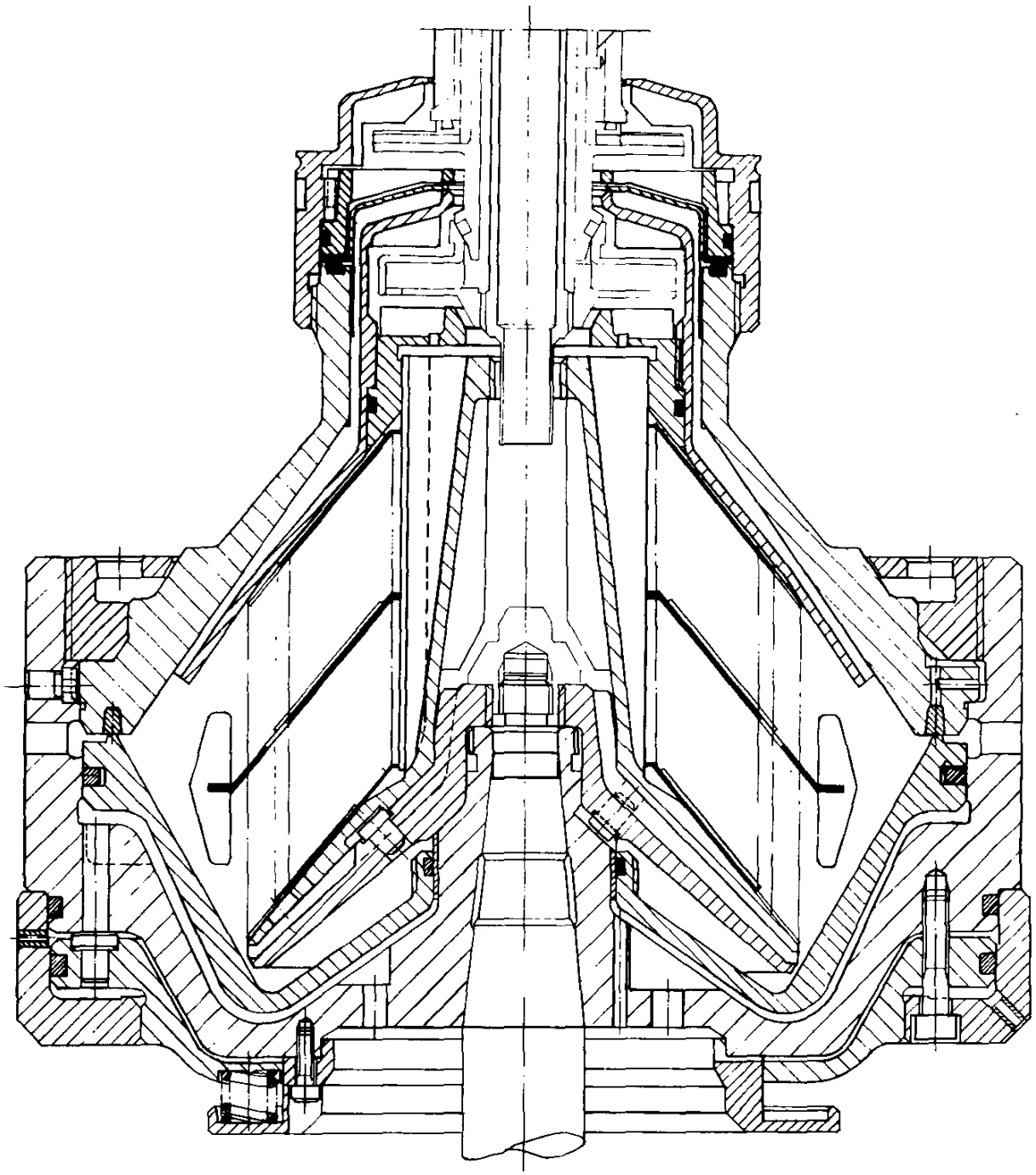
544229-Z



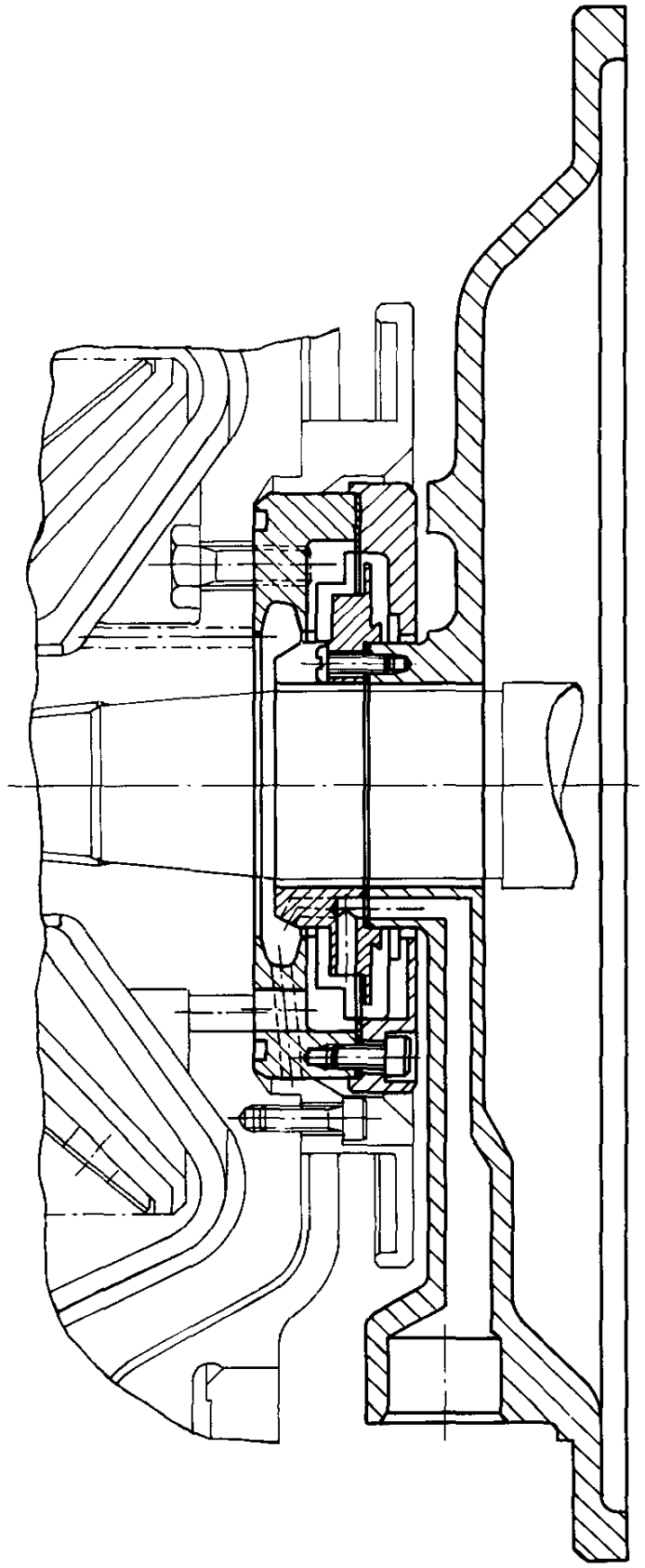
544228-Z



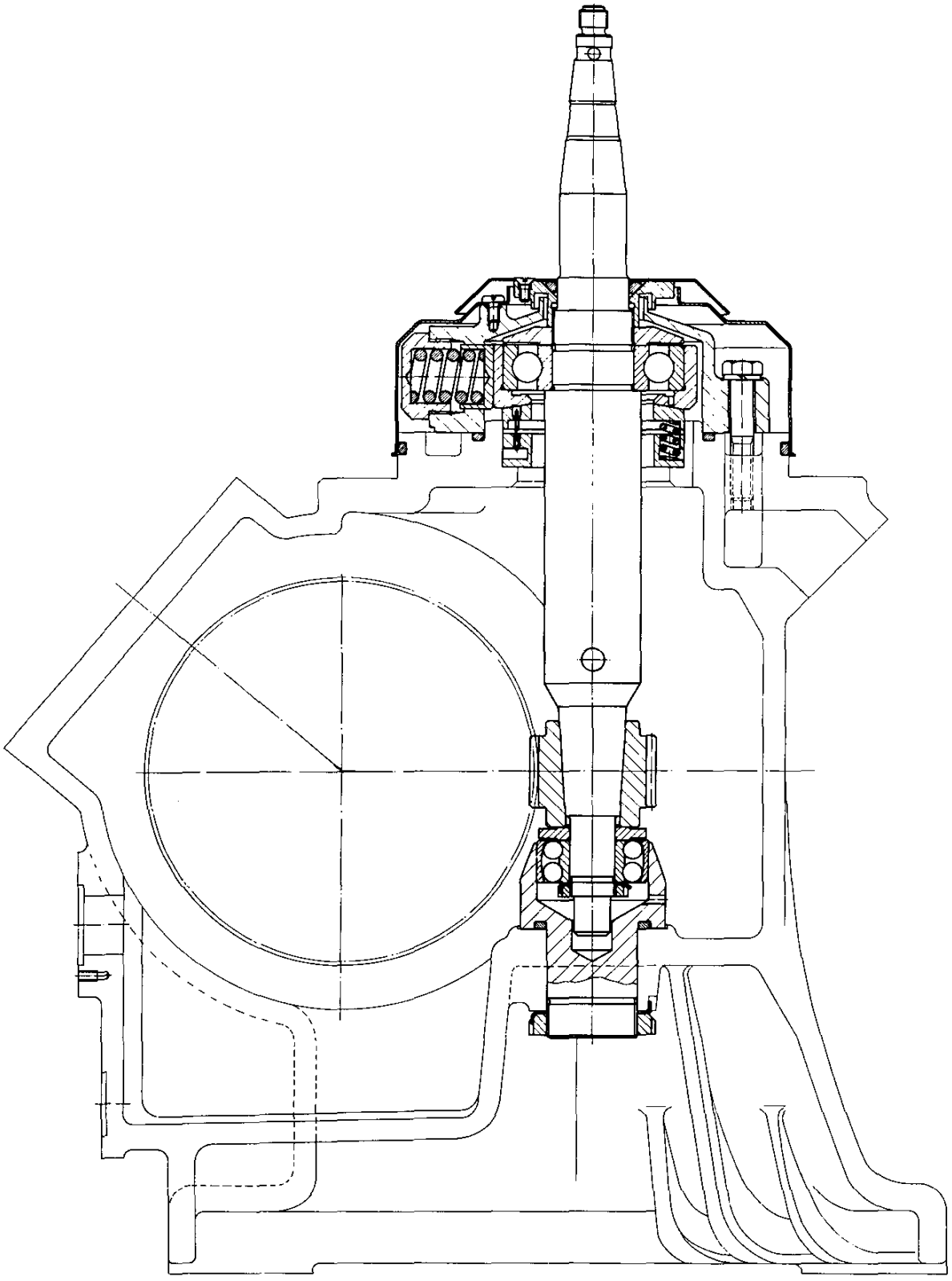
544224-Z



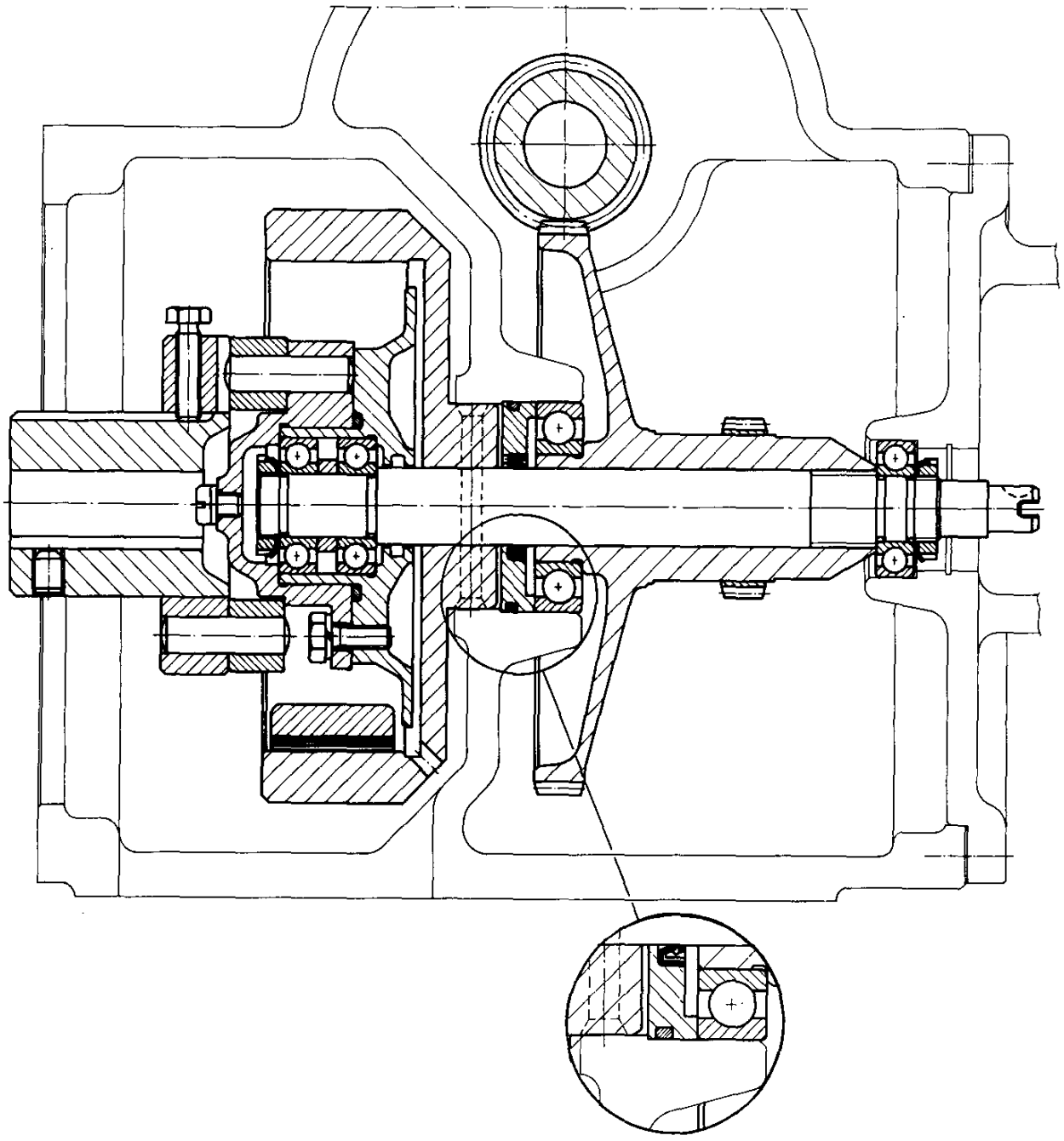
544225-Z



537137-Z



537211-Zver



537211-Zhor

ALFA-LAVAL

MAINTENANCE LOG
WHPX 405, NWHPX 405

Place of operation		Machine type	
Manufac. No.	*Process liquid*	*Time for job: at a total of . . . . . operating hours*	Job actually done after . . . . . operating hours

Reason for job	Other reason
Preventive ☐ 1000 h ☐ 2000 h ☐ 4000 h ☐ 8000 h	. . . . .

Job ordered by:	Date	Job done by:	Date

ACTION	EXECUTION EVERY			
	1000 h	2000 h	4000 h	8000 h
1. INLET. OUTLET				
Checking of:				
o the threads of inlet pipe and paring disc, and the level ring				x
o height position (95 ± 0.5 mm)				x
o seal rings, packings		x	x	x
2. BOWL				
Cleaning of bowl discs and other parts in contact with process liquid.*		x	x	x
Cleaning of ejection mechanism. Cleaning of nozzles.				
Checking of condition of valve plugs and operating slide springs.		x	x	x
Rubbing or brushing the threads as well as contact and guiding surfaces of large lock ring with molybdenum disulphide paste or similar		x	x	x
Checking of:				
o seal rings, packings		x	x	x
o wear of lock ring threads (max. 25 °)				x
o disc set pressure				x
o sealing surface bowl hood/sliding bowl bottom		x	x	x
o surfaces of sludge space		x	x	x
o corrosion, erosion (max. 1 mm)				x
3. CONTROL PARING DISC				
Checking of height position (108.5 ± 0.5 mm)				x
Exchange of operating slide springs				x
4. BOWL SPINDLE				
Rubbing of cone with molybdenum disulphide paste or similar		x	x	x
Checking of:				
o *radial wobble (max.0.04 mm)*				x
o ball bearing housing (indentations max. 0.5 mm)				x
o ball bearings				x
o seal rings, packings				x
Exchange of top bearing springs				x

SO 5340E-2

✓ = Approved ○ = See note

* In addition a check has to be done in case a low pressure alarm occurs without an evident external reason.

Keep the log in the Maintenance and Repair Manual or in a central maintenance register.

ACTION	EXECUTION EVERY			
	1000 h	2000 h	4000 h	8000 h
5. WORM GEAR				
Oil change in worm gear housing – see Lubrication Schedule in Operator's Manual	x	x	x	x
Note: In a new installation, or after replacement of gear, change the oil after 300 operating hours.				
Checking of:				
o worm and worm wheel (in connection with oil change)	x	x	x	x
6. WORM WHEEL SHAFT				
Checking of coupling drum and shaft				x
7. COUPLING				
Checking of:				
o axial play of elastic plate (ca. 2 mm)				x
o friction pads				x
o ball bearings in nave				x
Replacement of grease in nave				x
8. BRAKE				
Checking of:				
o lining				x
o spring and brake shoe				x
9. PUMP				
Cleaning of pump strainer		x	x	x
Exchange of lipseal rings } See special instruction book				x
Checking of: relief valve, bushings, impeller shaft, wearing seals } See special instruction book				x

Notes:

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

ALFA-LAVAL

MAINTENANCE LOG
WHPX 405, NWHPX 405

Place of operation		Machine type
Manufac. No.	Process liquid	Time for job: at a total of ..... operating hours / Job actually done after ..... operating hours

Reason for job

Preventive ☐ 1000 h ☐ 2000 h ☐ 4000 h ☐ 8000 h

Other reason .....

Job ordered by:	Date	Job done by:	Date

ACTION	EXECUTION EVERY 1000 h	2000 h	4000 h	8000 h
1. INLET. OUTLET				
Checking of:				
o the threads of inlet pipe and paring disc, and the level ring				x
o height position (95 ± 0.5 mm)				x
o seal rings, packings		x	x	x
2. BOWL				
Cleaning of bowl discs and other parts in contact with process liquid.*		x	x	x
Cleaning of ejection mechanism. Cleaning of nozzles.				
Checking of condition of valve plugs and operating slide springs.		x	x	x
Rubbing or brushing the threads as well as contact and guiding surfaces of large lock ring with molybdenum disulphide paste or similar		x	x	x
Checking of:				
o seal rings, packings		x	x	x
o wear of lock ring threads (max. 25 °)				x
o disc set pressure				x
o sealing surface bowl hood/sliding bowl bottom		x	x	x
o surfaces of sludge space		x	x	x
o corrosion, erosion (max. 1 mm)				x
3. CONTROL PARING DISC				
Checking of height position (108.5 ± 0.5 mm)				x
Exchange of operating slide springs				x
4. BOWL SPINDLE				
Rubbing of cone with molybdenum disulphide paste or similar		x	x	x
Checking of:				
o radial wobble (max.0.04 mm)				x
o ball bearing housing (indentations max. 0.5 mm)				x
o ball bearings				x
o seal rings, packings				x
Exchange of top bearing springs				x

SO 5340E-2

✓ = Approved O = See note

* In addition a check has to be done in case a low pressure alarm occurs without an evident external reason.

Keep the log in the Maintenance and Repair Manual or in a central maintenance register.

ACTION	EXECUTION EVERY			
	1000 h	2000 h	4000 h	8000 h
5. WORM GEAR				
Oil change in worm gear housing – see Lubrication Schedule in Operator's Manual	x	x	x	x
Note: In a new installation, or after replacement of gear, change the oil after 300 operating hours.				
Checking of:				
o worm and worm wheel (in connection with oil change)	x	x	x	x
6. WORM WHEEL SHAFT				
Checking of coupling drum and shaft				x
7. COUPLING				
Checking of:				
o axial play of elastic plate (ca. 2 mm)				x
o friction pads				x
o ball bearings in nave				x
Replacement of grease in nave				x
8. BRAKE				
Checking of:				
o lining				x
o spring and brake shoe				x
9. PUMP				
Cleaning of pump strainer		x	x	x
Exchange of lipseal rings				x
Checking of: relief valve, bushings, impeller shaft, wearing seals } See special instruction book				x

Notes:

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

ALFA-LAVAL

MAINTENANCE LOG
WHPX 405, NWHPX 405

Place of operation		Machine type	
Manufac. No.	Process liquid	Time for job: at a total of ..... operating hours	*Job actually done* after ..... operating hours

Reason for job

Preventive ☐ 1000 h ☐ 2000 h ☐ 4000 h ☐ 8000 h

Other reason .....

Job ordered by:	Date	Job done by:	Date

ACTION	EXECUTION EVERY			
	1000 h	2000 h	4000 h	8000 h
1. INLET. OUTLET				
Checking of:				
o the threads of inlet pipe and paring disc, and the level ring				x
o height position (95 ± 0.5 mm)				x
o seal rings, packings		x	x	x
2. BOWL				
Cleaning of bowl discs and other parts in contact with process liquid.*		x	x	x
Cleaning of ejection mechanism. Cleaning of nozzles.				
Checking of condition of valve plugs and operating slide springs.		x	x	x
Rubbing or brushing the threads as well as contact and guiding surfaces of large lock ring with molybdenum disulphide paste or similar		x	x	x
Checking of:				
o seal rings, packings		x	x	x
o wear of lock ring threads (max. 25 °)				x
o disc set pressure				x
o sealing surface bowl hood/sliding bowl bottom		x	x	x
o surfaces of sludge space		x	x	x
o corrosion, erosion (max. 1 mm)				x
3. CONTROL PARING DISC				
Checking of height position (108.5 ± 0.5 mm)				x
Exchange of operating slide springs				x
4. BOWL SPINDLE				
Rubbing of cone with molybdenum disulphide paste or similar		x	x	x
Checking of:				
o radial wobble (max.0.04 mm)				x
o ball bearing housing (indentations max. 0.5 mm)				x
o ball bearings				x
o seal rings, packings				x
Exchange of top bearing springs				x

SO 5340E-2

✓ = Approved ○ = See note

* In addition a check has to be done in case a low pressure alarm occurs without an evident external reason.

Keep the log in the Maintenance and Repair Manual or in a central maintenance register.

ACTION	EXECUTION EVERY			
	1000 h	2000 h	4000 h	8000 h
5. WORM GEAR				
Oil change in worm gear housing – see Lubrication Schedule in Operator's Manual	x	x	x	x
Note: In a new installation, or after replacement of gear, change the oil after 300 operating hours.				
Checking of:				
o worm and worm wheel (in connection with oil change)	x	x	x	x
6. WORM WHEEL SHAFT				
Checking of coupling drum and shaft				x
7. COUPLING				
Checking of:				
o axial play of elastic plate (ca. 2 mm)				x
o friction pads				x
o ball bearings in nave				x
Replacement of grease in nave				x
8. BRAKE				
Checking of:				
o lining				x
o spring and brake shoe				x
9. PUMP				
Cleaning of pump strainer		x	x	x
Exchange of lipseal rings } See special instruction book				x
Checking of: relief valve, bushings, impeller shaft, wearing seals } See special instruction book				x

Notes:

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

ALFA-LAVAL

MAINTENANCE LOG
WHPX 405, NWHPX 405

Place of operation		Machine type	
Manufac. No.	Process liquid	Time for job: at a total of ..... operating hours	*Job actually done* after ..... operating hours

Reason for job

Preventive ☐ 1000 h ☐ 2000 h ☐ 4000 h ☐ 8000 h

Other reason .....

Job ordered by:	Date	Job done by:	Date

ACTION	EXECUTION EVERY			
	1000 h	*2000 h*	*4000 h*	*8000 h*
1. *INLET. OUTLET*				
Checking of:				
o the threads of inlet pipe and paring disc, and the level ring				x
o height position (95 ± 0.5 mm)				x
o seal rings, packings		x	x	x
2. BOWL				
Cleaning of bowl discs and other parts in contact with process liquid.*		x	x	x
Cleaning of ejection mechanism. Cleaning of nozzles.				
Checking of condition of valve plugs and operating slide springs.		x	x	x
Rubbing or brushing the threads as well as contact and guiding surfaces of large lock ring with molybdenum disulphide paste or similar		x	x	x
Checking of:				
o *seal rings, packings*		x	x	x
o wear of lock ring threads (max. 25 °)				x
o disc set pressure				x
o *sealing surface* bowl hood/sliding bowl bottom		x	x	x
o surfaces of sludge space		x	x	x
o corrosion, erosion (max. 1 mm)				x
3. CONTROL PARING DISC				
Checking of height position (108.5 ± 0.5 mm)				x
Exchange of *operating slide springs*				x
4. BOWL SPINDLE				
Rubbing of cone with molybdenum disulphide paste or similar		x	x	x
Checking of:				
o radial wobble (max.0.04 mm)				x
o *ball bearing housing* (indentations max. 0.5 mm)				x
o ball bearings				x
o seal rings, packings				x
Exchange of top bearing springs				x

SO 5340E-2

✓ = Approved ○ = See note

* In addition a check has to be done in case a low pressure alarm occurs without an evident external reason.

Keep the log in the Maintenance and Repair Manual or in a central maintenance register.

ACTION	EXECUTION EVERY			
	1000 h	2000 h	4000 h	8000 h
5. WORM GEAR				
Oil change in worm gear housing – see Lubrication Schedule in Operator's Manual	x	x	x	x
Note: In a new installation, or after replacement of gear, change the oil after 300 operating hours.				
Checking of:				
o worm and worm wheel (in connection with oil change)	x	x	x	x
6. WORM WHEEL SHAFT				
Checking of coupling drum and shaft				x
7. COUPLING				
Checking of:				
o axial play of elastic plate (ca. 2 mm)				x
o friction pads				x
o ball bearings in nave				x
Replacement of grease in nave				x
8. BRAKE				
Checking of:				
o lining				x
o spring and brake shoe				x
9. PUMP				
Cleaning of pump strainer		x	x	x
Exchange of lipseal rings } See special instruction book				x
Checking of: relief valve, bushings, impeller shaft, wearing seals } See special instruction book				x

Notes:

SO 1274E-2

ALFA-LAVAL