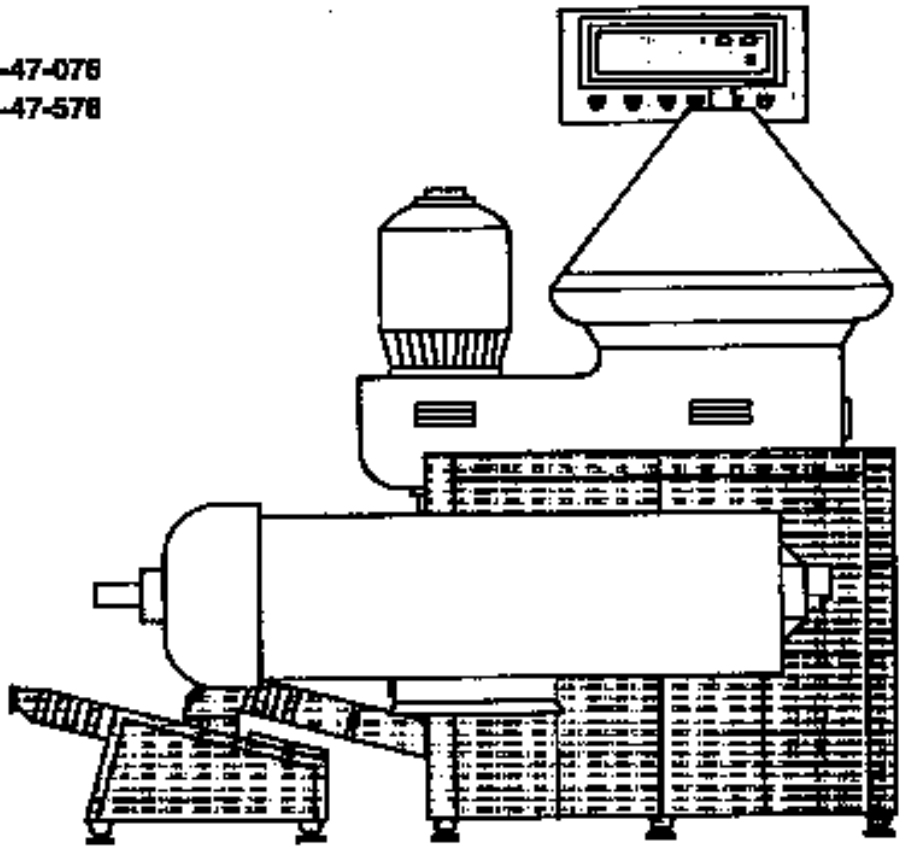
Instruction Manual and Parts List

No. 3177-9001-030

Edition 0285

Hermetic Clarifier with self-cleaning bowl

Model SA 14-47-076
Model SA 14-47-576



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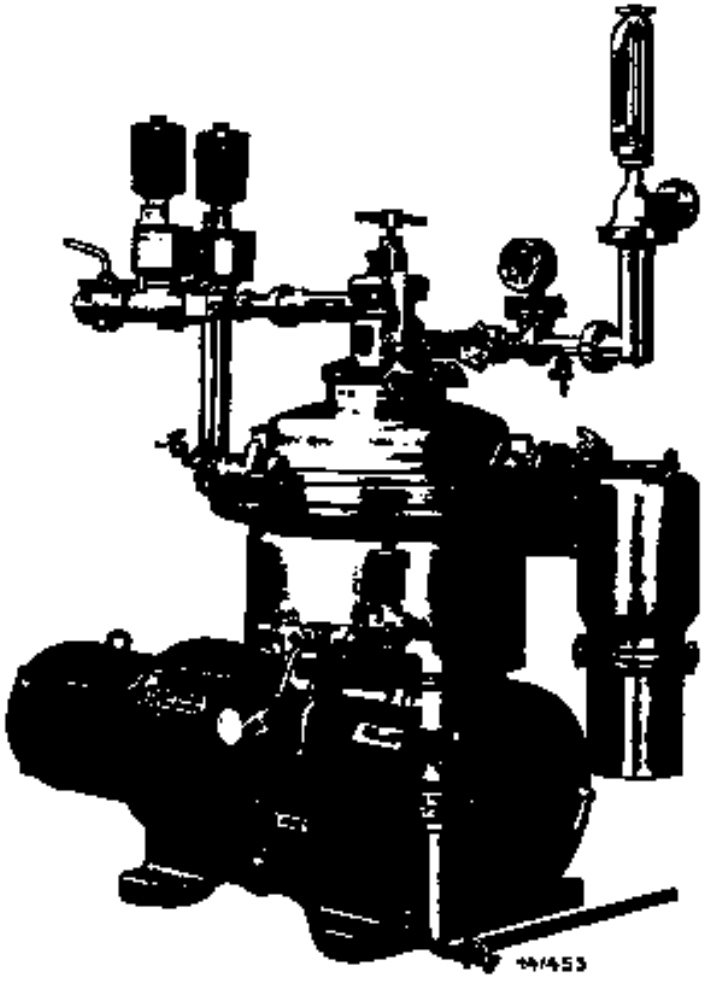
WESTFALIA SEPARATOR



Westfalia Separator AG
D-59302 Oelde (F.R.Germany)

Type		No	
built in		Inner ø of bowl mm	
Rpm. of bowl:			
Permissible density of product to be treated			
heavy liquid kg/dm³		solids kg/dm³	

CONTENTS

Working Instructions

List of Parts

[redacted]

1.1 Correct usage

The separator is designed

- in accordance with the chemical and physical properties of the product specified by the customer and
- the method of application of the separator agreed with Westfalia Separator.

In particular, products not conforming to the specifications on the maker's nameplate may not be used.

Any mode of operation deviating herefrom is not proper and correct.

Prior to any intended deviation from the agreed operating mode, it is therefore imperative to obtain the consent of Westfalia Separator.

1.2 Safety stickers on the machine

The following warnings must be attached to the machine as self-adhesive stickers.

The stickers must always be in perfect condition.

- Clean dirty stickers.
- Replace damaged stickers.

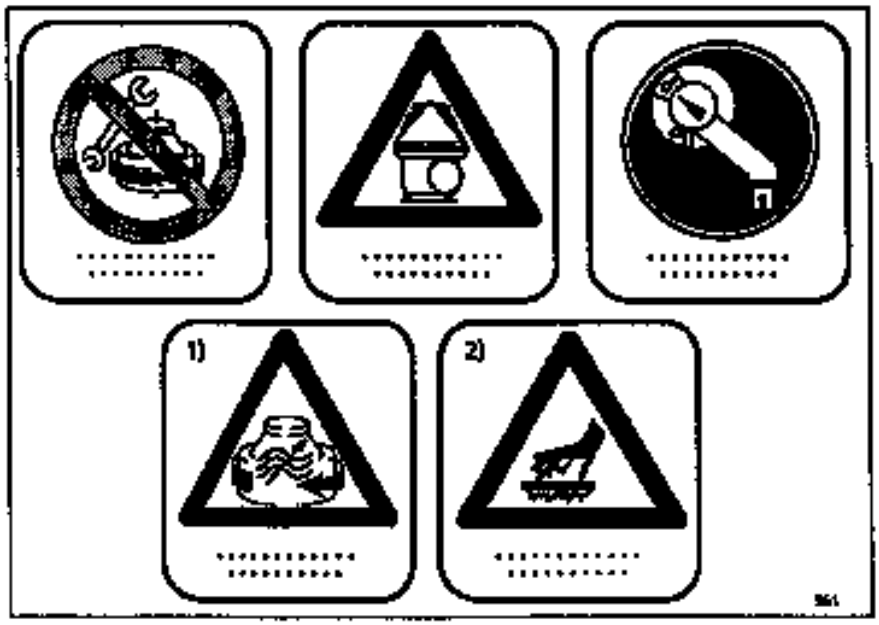


Fig. 1 *1) Only in case of operation with frequency converter*
2) Only in case of hot operation

1.3 Basic operating principles

Separators are used for the separation of liquid mixtures or for the separation of solids out of liquids or liquid mixtures.

High centrifugal forces are produced in the rotating bowl.

Fig. 2

Under the influence of the centrifugal forces, separation of the liquid mixture and/or ejection of the solids particles takes place most rapidly.

The specifically heavier components are displaced to the bowl periphery, whereas the specifically lighter components are displaced towards the centre of the bowl.

The high centrifugal force is produced by very high bowl speeds. On the one hand, high bowl speeds signify high efficiency, while on the other hand, they signify high material stressing of the separator.

1.4 Bowl speed and product

The bowl speed is an important parameter when rating the separator. It depends on the chemical and physical properties of the product such as

- temperature (if higher than 100°C or lower than 0°C),
- density of the fluid and solid components
- aggressiveness of the product as regards corrosion and erosion (has influence on the selection of the bowl material)

The bowl speed is determined on the basis of these parameters allowing for an adequate safety margin.

If one of these parameters should change during operation, it is imperative to contact Westfalia Separator AG.

1.5 Operations on the separator

The separator works reliably, provided that it is operated and looked after in accordance with our operating instructions.

Special attention must be given to:

- assembly
- starting
- shutting-down
- maintenance and servicing

1.6.1 Assembly

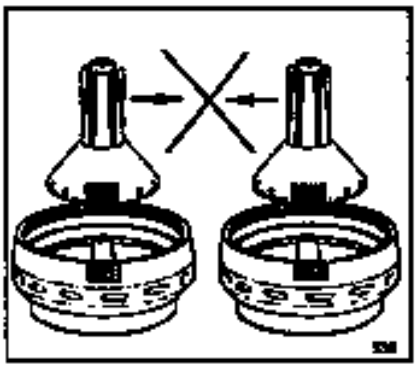


Fig. 3

- If the plant has several centrifuges, be careful not to interchange parts of different bowls since each bowl has been balanced individually.

  The bowl parts are marked with the serial-number of the machine or with the last three digits of the serial-number.

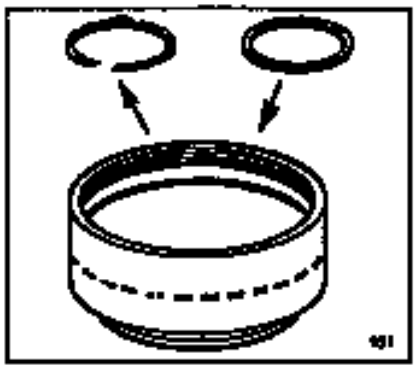


Fig. 4

- Damaged parts must be replaced immediately by practically new ones.

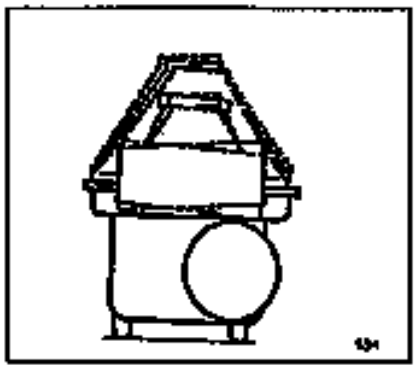


Fig. 5

- After installing spare bowl parts, the bowl must be re-balanced.

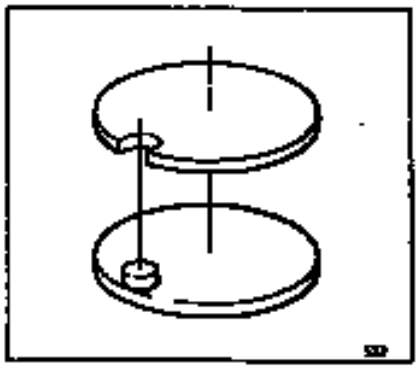


Fig. 6

- The bowl parts are arranged in fixed positions relative to one another.
- Locking devices and alignment marks must be in perfect condition.

  The bowl must not be operated if these locking devices and alignment marks are not in perfect condition.

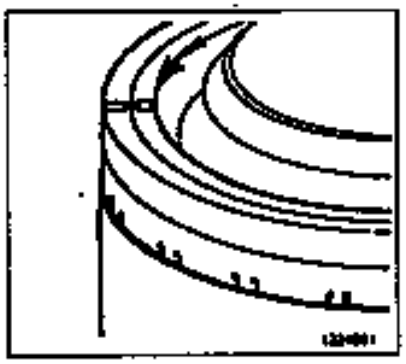


Fig. 7

- When assembling the bowl, be sure to strictly adhere to the instructions given in chapter 5, in order to avoid undue unbalance.
- Before starting the bowl, be sure to fit all parts.
- Tighten the bowl lock ring securely: the O marks on the bowl bottom or bowl top and on the lock ring must be in line with each other.

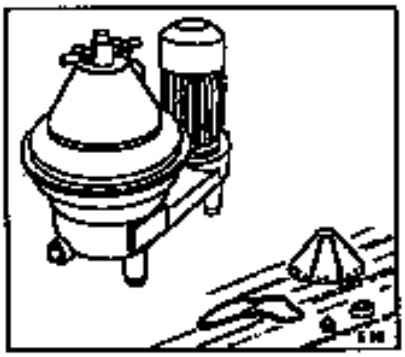


Fig. 8

- Check if the machine is completely assembled and properly installed.

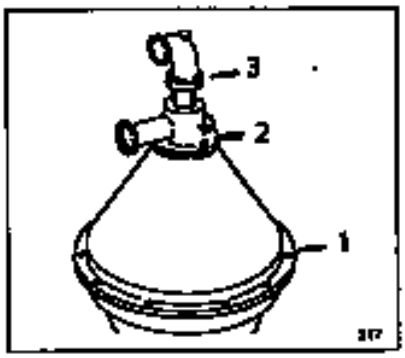


Fig. 9

- Carefully fasten hood 1, feed and discharge housing 2 and centripetal pump 3.

1.5.2 Electrical appliances

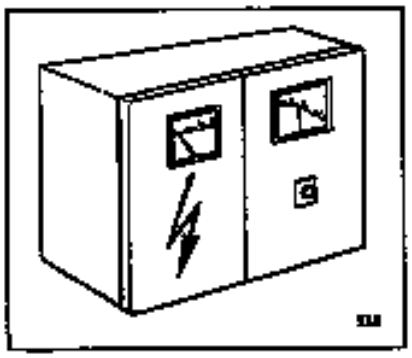


Fig. 10

- The governing accident prevention regulations apply for the electrical appliances and installations.
- The frequency and voltage of the power supply must correspond to the machine specifications.
- Carry out potential equalization.
- Observe legal regulations; e.g. in the EU:
  - Low voltage guideline 73/23/EWG,
  - Electro-magnetic compatibility 89/336/EWG.

1.6.3 Before start-up

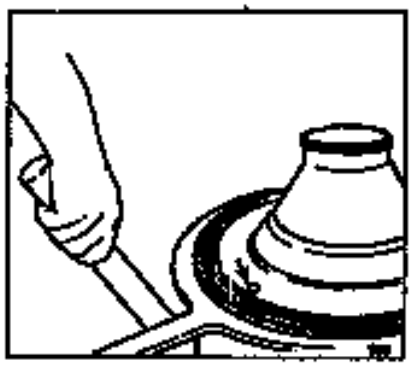


Fig. 11

- Check that the bowl lock ring has been firmly tightened.
- The "O" marks on bowl bottom or bowl top and on the lock ring must be aligned.

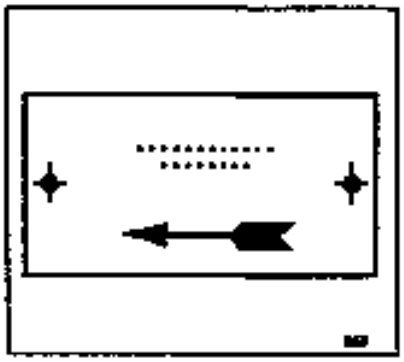


Fig. 12

- The bowl must rotate in clockwise direction (see arrow on frame or solids collector).

Fig. 13

- The separator may only be equipped with protection devices conforming to EN 294.
  - Equip solid and liquid discharges accordingly.

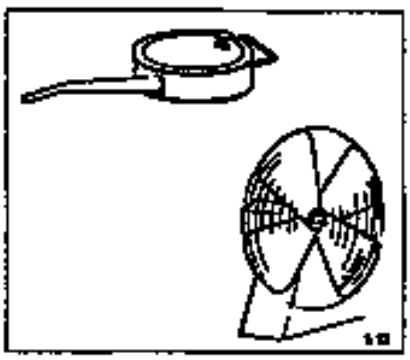


Fig. 14

- Check that the lubrication and cooling systems are serviceable.

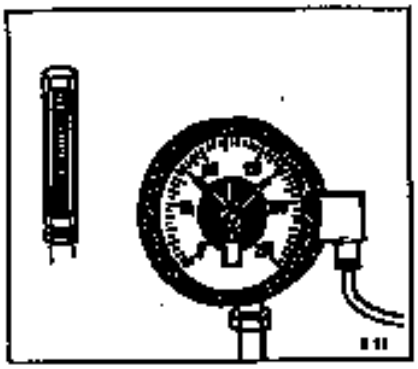


Fig. 15

- Check whether the supervisory equipment is operational and the correct limit values are adjusted.
- When hoods, concentrate collectors and vessels are pressurized, e.g. by
  - inert gas,
  - cooling,
  - steam sterilization etc.

  the pressures stated on the nameplate must not be exceeded.

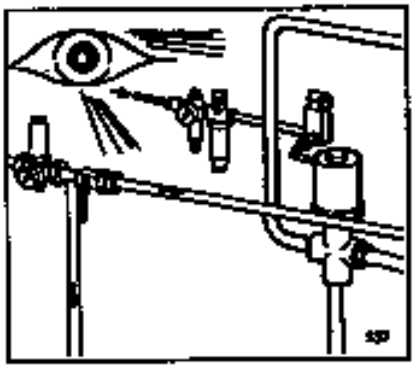


Fig. 16

- Check that the paths are set to product.
- Regularly check hoses for signs of ageing.
- Check sight glasses for mechanical damage.
- Replace damaged parts by parts which are as good as new.

1.5.4 Putting into operation

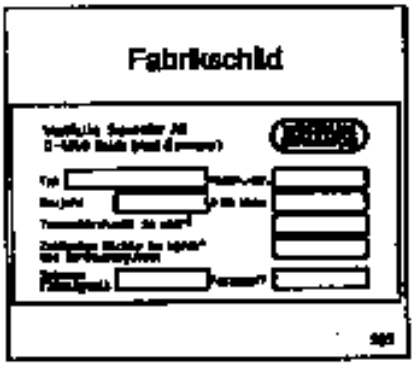


Fig. 17

- Refer to chapter "operation".
- Refer to the maker's nameplate. The values for
  - bowl speed,
  - density of the heavy liquid,
  - density of the solids (centrifugally dry)

  are maximum values and must not be exceeded.

Fig. 18

- Wear ear protection.

Fig. 19

In case of frequency converter operation:

- Do not under any circumstances manipulate the frequency converter to exceed the permissible bowl speed (see maker's nameplate).
- The separator may only be operated with an independent device for speed limiting.

Fig. 20

- Do not feed product which is subjected to explosion protection regulations.
- The separator must not be used in areas where explosion protection is required.

Fig. 21

- In case of operation with products harmful to persons, the corresponding safety regulations must be observed.
- Refer to the safety data sheet of the product.
- Wear protective clothing.

Fig. 22

- Stop the separator immediately if unusual noises or vibrations occur.

Fig. 23

Only in case of hot operation:

- Product-contacting parts such as
  - pipes and hoses,
  - hood,
  - solids collector reach temperatures over 60 °C.

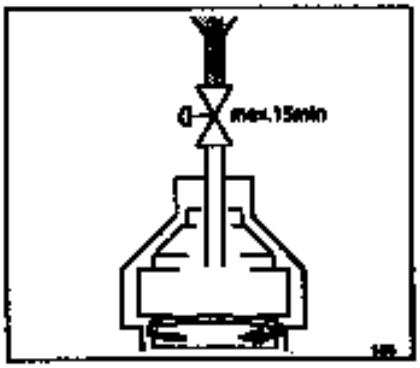


Fig. 24

- The bowl must not run for longer than 15 minutes without liquid supply as otherwise overheating of the bowl material may occur.

1.5.6 Shut-down and "Emergency-Off"

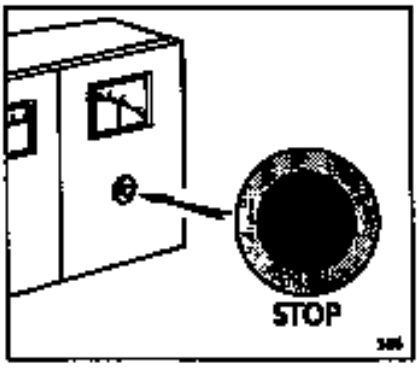


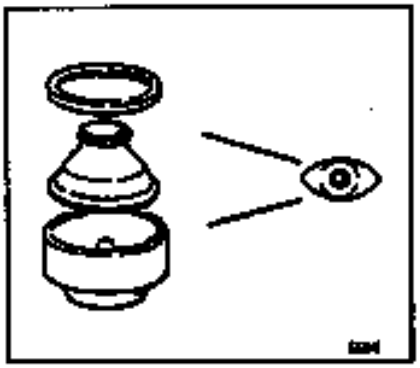
Fig. 25

- For shut-down refer to the chapter "operation".

1.5.6 Maintenance and repair

Unfavourable operating conditions may require shorter maintenance intervals. The factors listed below are unfavourable because they either attack the material of the separator directly or have a negative effect on lubrication/cooling.

- aggressive product (chemical or physical)
- high product temperature
- product with grease decaying properties
- environment: temperature, dust and vapours



Particularly stressed parts such as bowl lock ring, bowl bottom, bowl top and other bowl parts with a large diameter must be checked on a regular basis to ensure safe and efficient operation.

Fig. 26

Timely maintenance and replacement of worn or damaged machine parts is essential for safe operation of the machine.

Maintenance and repair work may only be carried out by the customer to the extent as described in this instruction manual.

Maintenance and repair work not described in this manual may only be carried out by the manufacturer or by "repair shops" authorized by the manufacturer.

We, therefore, recommend in your own interest to have your separator inspected by our service engineers at regular intervals. Such inspections will keep your separator working reliably and prevent undesirable shut-downs.

Before maintenance and servicing:

- switch off all electrical appliances via the main switch,
- secure installation against unintended re-starting with locking devices.

Fig. 27

Fig. 28

Do not loosen any part before the bowl has come to a standstill.

For checking standstill refer to chapter 5.

Fig. 29

- Do not climb onto or stand on the machine or parts of the machine.
- Use a sturdy working platform.

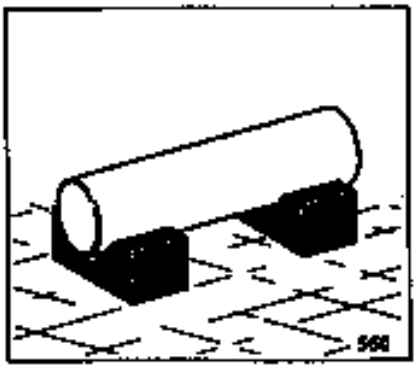


Fig. 30

- Place dismantled machine parts on a suitable base, e.g. rubber mat.
- Take steps to prevent machine parts from overturning.

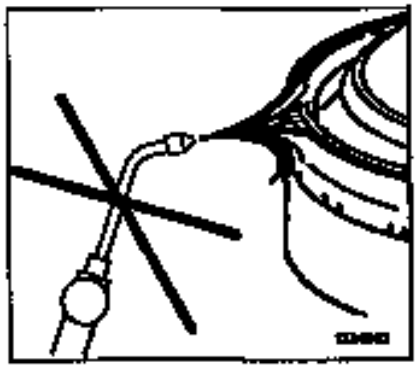


Fig. 31

Do not heat bowl parts with the naked flame.

Bowl parts must never be welded. This also applies for hood and solids collector parts of steam-sterilizable separators.

Even during cleaning the bowl parts the temperature must not exceed 100 °C.

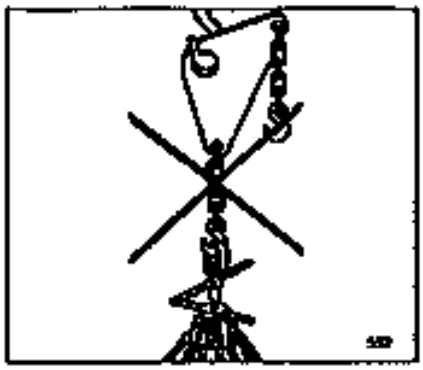


Fig. 32

- Load carrying equipment such as
  - lifting devices for bowl or distributor,
  - chains etc.

  may only be used for work routines as described in this instruction manual.
- Do not use damaged or incomplete load carrying equipment.

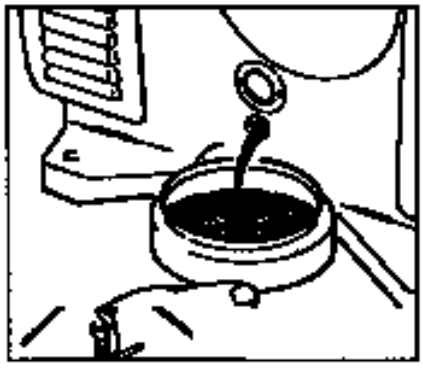


Fig. 33

Collect dripping oil to prevent danger of slipping or product infection.

When handling waste oils note:

- They can be injurious to health, depending on their chemical composition.
- Waste oil must be disposed of in accordance with local regulations.

1.6 Corrosion

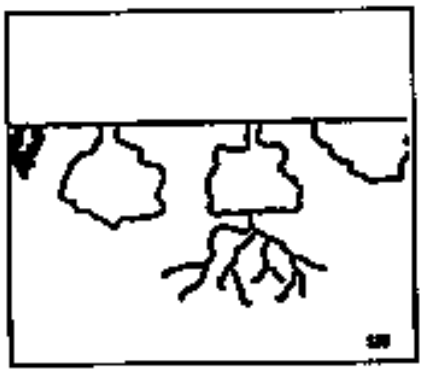
Corrosion can also affect bowl parts made of stainless steel. This corrosion can be flat-spread or pit- or crack-shaped and merits special attention.

Corrosion on stainless steel bowl material should be examined thoroughly and documented.

Flat-spread corrosion can usually be measured (reduction of wall thickness)

Pit- or crack-shaped corrosion cannot be measured without the risk of damage. At the initial stage pit-shaped corrosion is generally caused by chlorine ions.

Depending on the stressing of the part, pit-shaped corrosion can result in crack-shaped corrosion.



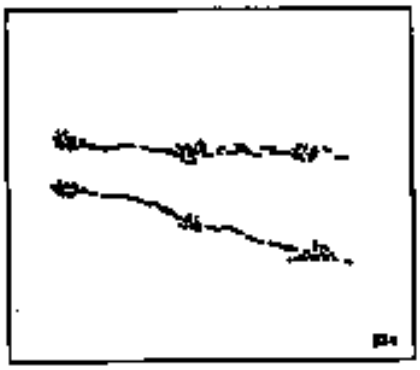
Possible formation of pit-shaped corrosion

Fig. 34

Such pittings can only be investigated by a materials expert.

In case of crack-shaped corrosion attack with or without superposed flat-spread and pit-shaped corrosion on main bowl components, the machine must be shut down immediately.

Contact your nearest Westfalia Separator representative for a thorough examination.



Pittings

Pittings which are close together or form a linear pattern can signify crack formation beneath the surface.

Such pittings should be investigated by a materials expert.

Fig. 35

1.7 Erosion

Erosion is caused by solid particles in the process liquid.

These solid particles grind marks into the surfaces with which they come into contact.

The following factors favour the occurence of erosion:

- hard solids particles
- high throughput capacities

The first signs of erosion should be carefully observed and documented. Erosion can deepen rapidly, thereby weakening the bowl material.

Contact your nearest Westfalia Separator representative for a thorough examination. Information on the nature of the damage can be provided by photos, plaster casts or lead molds.

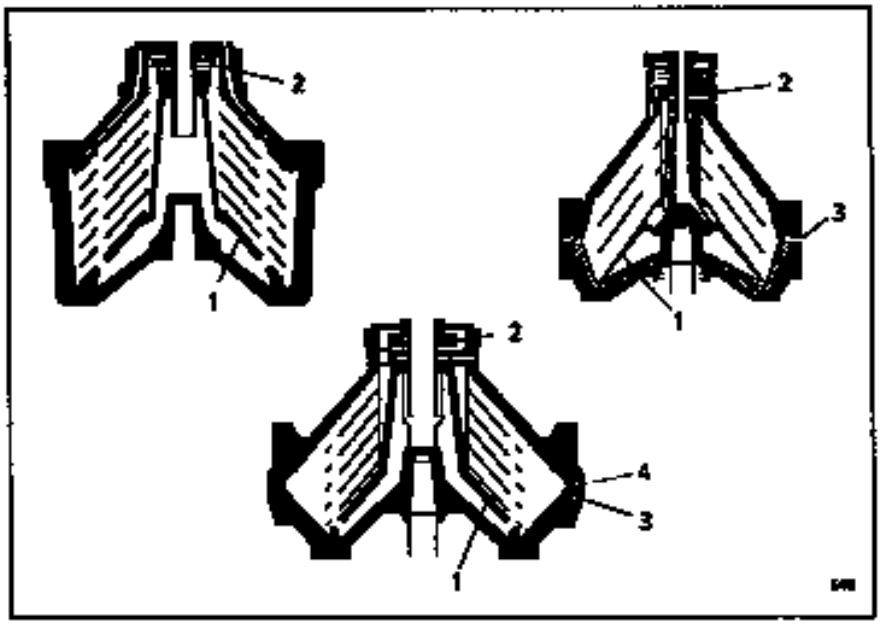


Fig. 39

The surfaces most susceptible to erosion are:

1) the bottom of the distributor, the rising channels and the ribs.

2) the centripetal pump (Cavitation)

3) all surfaces in the area of the solids discharge ports

4) the nozzles

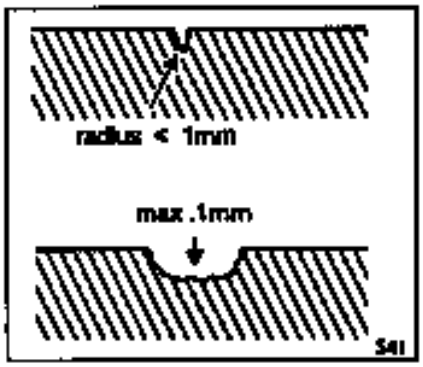
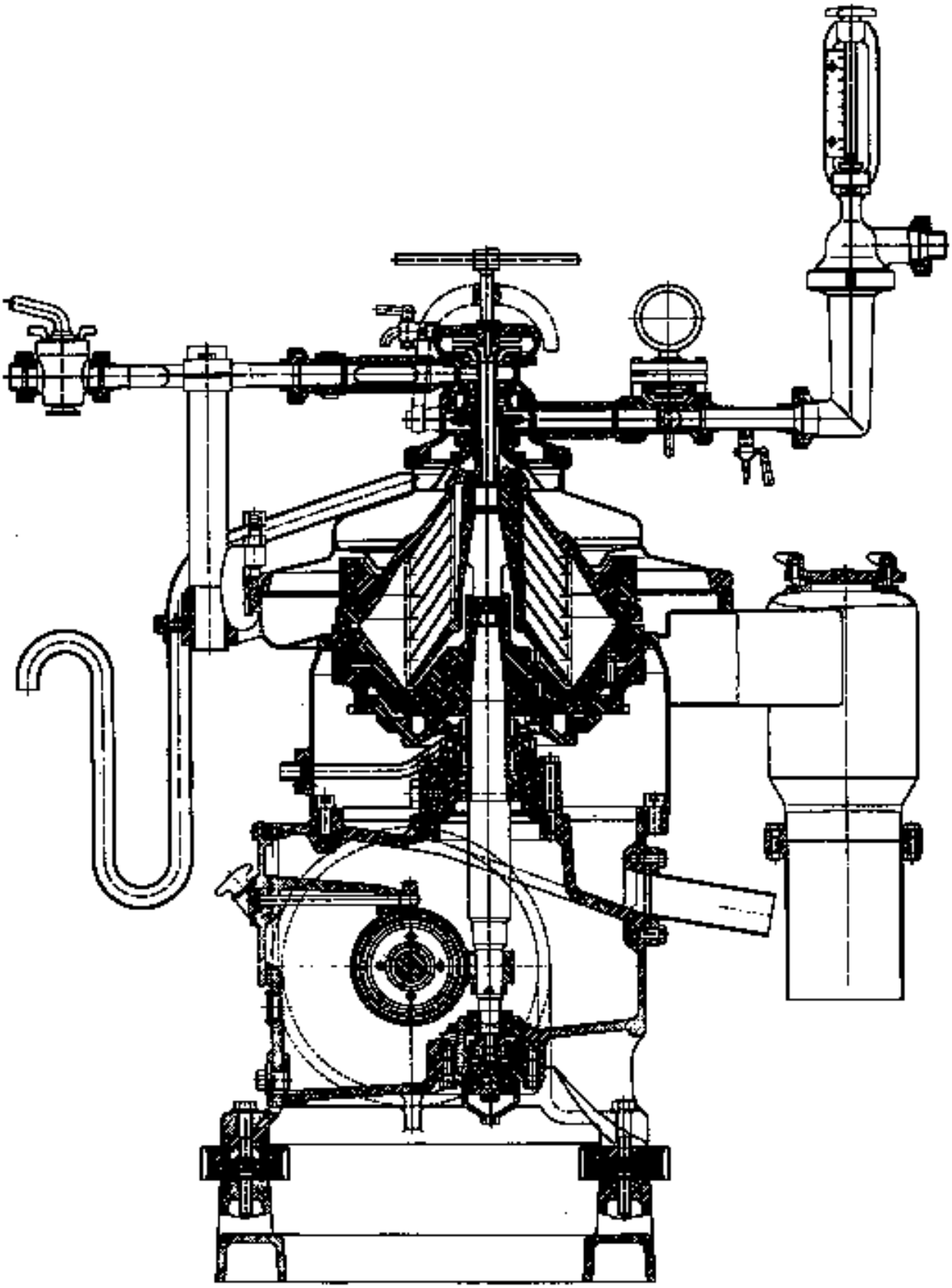


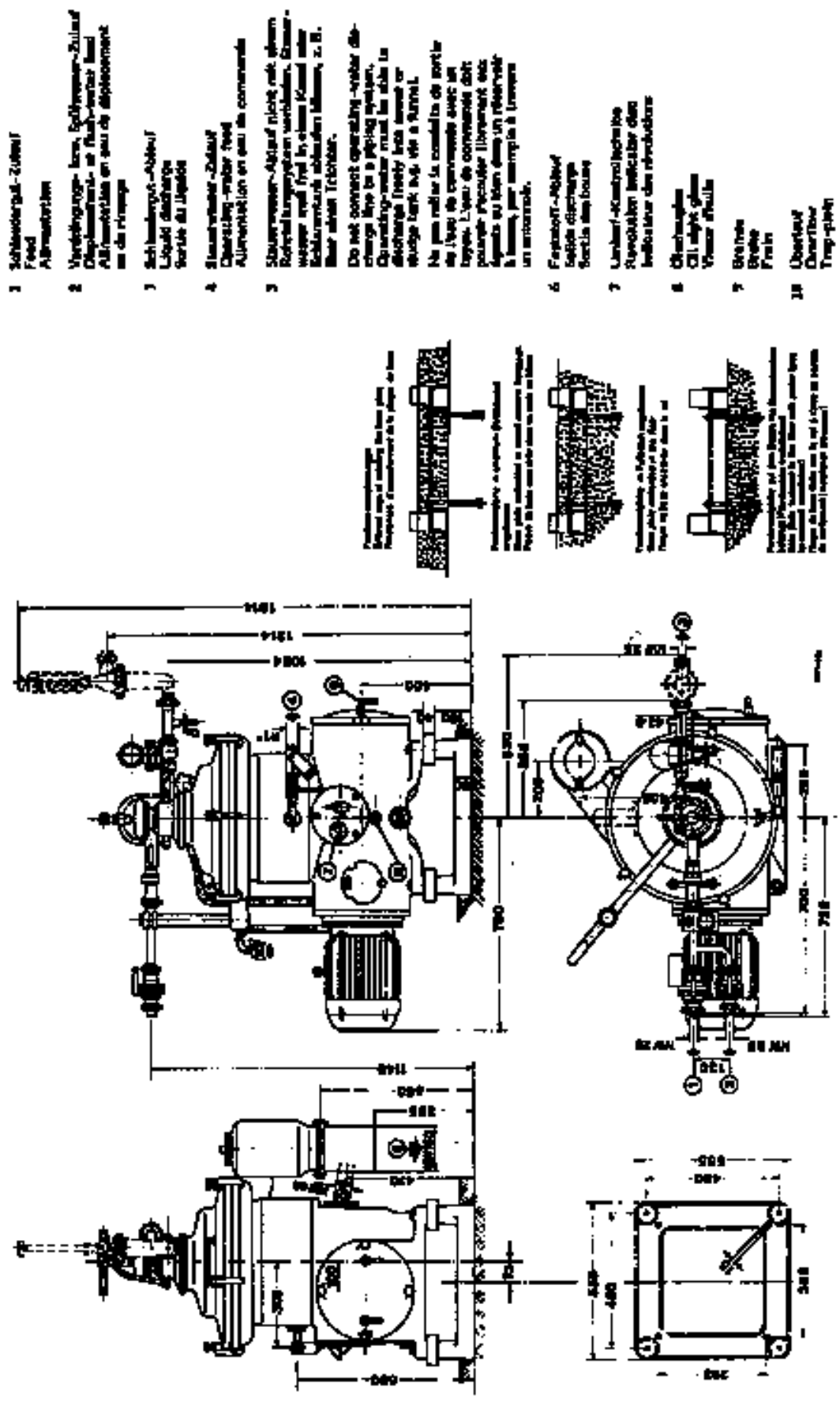
Fig. 37

Signs of erosion which you should immediately report to your nearest Westfalia Separator representative:

- The bottom of the erosion mark has a radius smaller than 1 mm (large notch effect).
- The depth of erosion mark exceeds 1 mm at the deepest point.

Sectional View of the Separator





1 Installation

When installing the separator, make sure that sufficient room is available (at least 300 mm) to mount and to remove the motor and to remove the horizontal drive shaft which is to be pulled out towards the brake side of the frame.

Take care that the foundation of the separator cannot receive vibrations from other machines, because they can cause damage to the ball bearings.

For installing or removing the bowl a 500 kg hoist will be necessary.

Do not install a shut-off valve in the frame drain and do not connect this frame drain to a piping system. The operating water must be able to discharge freely into a sewer or sludge tank, e. g. via a funnel. Otherwise it will rise into the upper section of the frame, resulting in slowing down of the bowl. It can also seep down through the neck bearing into the gear chamber and damage the gear.

The inner diameter of the operating-water line should be 1/2" when the line is not longer than 3 m; when longer than 3 m, the inner diameter should be 3/4". Required operating-water pressure: 2 bar min., 3 bar max. (see sect. 5.4).

It is recommended that a second shut-off valve be installed in the operating-water supply line. This is to protect the machine during standstill against inrush of water caused by unintended opening of the shut-off valve.

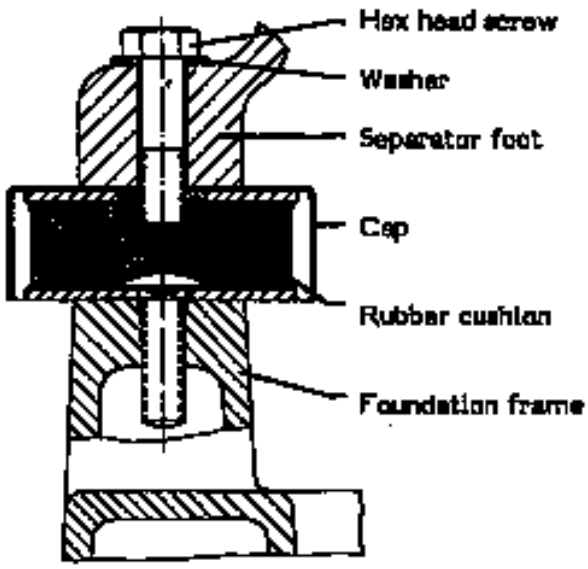


Fig. 1/1

Fastening the separator to the foundation frame

Embed the foundation frame in the floor so that the mounting blocks of the frame protrude from the floor. Make sure that the mounting blocks are **absolutely level**. The foundation frame must be firmly anchored with anchor bolts and with poured concrete.

After the concrete has set, the separator has to be fastened to the foundation frame as shown in Fig. 1/1. To absorb vibrations, a rubber cushion has to be put between each separator foot and mounting block.

2.1 Lubrication of bearings and gear parts

All bearings and gear parts are splash lubricated from a central oil bath.

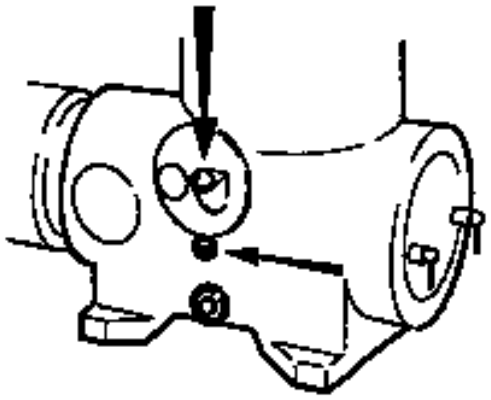


Fig. 2/1

Oil level

Before the initial start-up of the separator fill gear chamber with oil until oil level is slightly above middle of sight glass. About 4 litres of oil are required for one filling.
During operation oil level must never be allowed to sink below middle of sight glass; refill oil when necessary.

Oil check

Check oil level once a week.
Check from time to time if oil contains water. To do this, loosen oil drain screw and allow a small amount of oil to drain. If the oil shows a milky colouring (emulsification) an immediate oil change is necessary.

Oil change

Make first oil change after about 250 operating hours; then change oil every 750 operating hours. However be sure not to wait longer than 6 months to change the oil.

Each time when carrying out oil change, thoroughly clean gear chamber and flush with thin-bodied oil, prior to filling in new oil. Remove all metal particles from inner walls and corners of the gear chamber. Do not use fluffy cleaning rags or cotton waste. The sight glass should also be cleaned, as a layer of oil will probably have deposited on the inner side of the glass and this is easily mistaken for the oil level.

Lubricating oil

As lubricating oil use only a gear oil designated

CLP 220 (according to DIN 51502)

or designated CC 220 (according to ISO/DIS 3498).

The lubricating oil shall meet the following requirements:

1) Viscosity: 220 $\pm$ 22 mm^2/s (cSt) at 40 °C
2) Additives:
   a) additives giving increased protection against corrosion and increased resistance to aging, - with properties preventing corrosion on steel according to DIN 51355/B, degree of corrosion 0. Corrosive effect on copper according to DIN 51759/100 A3, degree of corrosion 1.
   b) additives for decreasing wear and increasing the load-carrying capacity. The "FZG" gear rig test according to DIN 51354 as well as the test according to A 16.6/90, load grade > 12, must have been passed.
3) Demulsifying behaviour according to DIN 51599: < 60 minutes.

The gear oil designated "Separator lubricating oil CLP 220" which has been extensively investigated by us meets the above requirements and should preferably be used. For the order number refer to page 20/1 of the parts list.

2.2 Lubrication of threads and contact surfaces on bowl parts

Before assembling the bowl apply a thin film of one of the lubricants specified below to threads and contact surfaces of bowl bottom, bowl top, lock rings, etc.

For separators operating in the food processing industry we recommend you to use the following lubricants:

Molykote D (white paste; apply sparingly),

Molykote DX (white paste; may be used in excess),

Klüber Grease KSB 8 (may be used in excess).

For separators operating in the chemical industry we suggest the use of molybdenum disulfide pastes, e. g.

Molykote G or Molykote G Rapid.

Besides the above mentioned lubricants, other pastes or greases with the same properties may also be used.

The greased surfaces must be free from sand and fillings. Otherwise the surfaces can become scored.

ATTENTION: Marks caused by knocks to threads, bearing and guide surfaces of the bowl parts can lead to seizing. Therefore, the threads, contact and guide surfaces must always be checked after cleaning.

2.3 Lubrication of the motor bearings

For lubrication of the motor bearings, refer to the instructions of the motor manufacturer (see motor plate).

3.1 General

The separator is powered by a 7.5 kW three-phase AC flange-type motor, type B5. The motor power is rated to cover the high acceleration current.

3.2 How to fit the motor

The motor is to be fastened to the seperator by means of a flange. Appropriate flanges and clutch drivers are available for all standard flange-type motors, type B5.

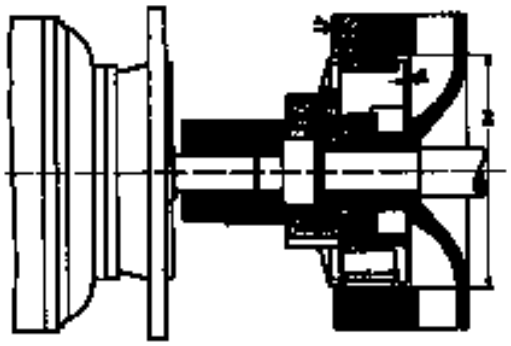


Fig. 3/1a

Position of the clutch driver in ring of clutch drum

Dimensions in mm					
Fig. 3/1a				Fig. 3/1b	
A	B	C	D	E	d
0	59.5	3±0.5	180	M10	7

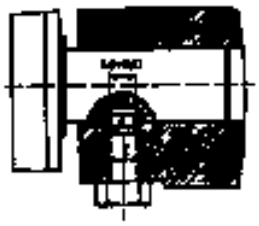


Fig. 3/1b

Fastening the clutch driver on the motor shaft

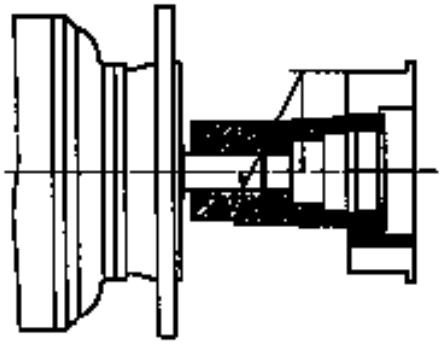


Fig. 3/1c

Tolerance between axis of clutch driver and axis of motor shaft

The motor power is transmitted to the worm wheel shaft of the separator via a centrifugal clutch. For proper functioning of the centrifugal clutch fit the clutch driver onto the motor shaft end as shown in Fig. 3/1a and 3/1b in such a manner that, after mounting the motor, the clutch shoes rest with their entire widths against the ring of the clutch drum (see fig. 3/1a).

For fitting the clutch shoes refer to sect. 8.A.3.

Fasten clutch driver to motor shaft by screwing the hex head screw all the way in (see fig. 3/1b). Make sure that the screwhead rests tightly against recessed surface.

After fastening the clutch driver, check tolerance between axis of clutch driver and axis of motor shaft. The deviation of tolerance must not exceed 0.05 mm (see fig. 3/1c).

3.3 Motor connection

3.3.1 Three-phase AC motor

The motor is started via a motor control either across-the-line or in star-delta connection. In case of star-delta starting, change-over from star to delta connection has to take place after 4 to 6 seconds.

Motor protection is ensured by PTC resistor type temperature feelers incorporated in the winding of the motor. These temperature feelers have to be connected to an appropriate tripping device.

External voltage higher than 2.5 volts must not be applied to the terminals of the temperature feelers. When testing for continuity, do not use a test lamp but only an ohmmeter.

The measuring circuit line (between tripping device and motor) has to be laid separate from other lines.

Dimensioning of switches, wiring and fuses must not be based on the rated current, but on the starting current which reaches approx. 1.5 - 1.8 the value of the rated current.

If the separator is controlled by an automatic timing unit, the timing unit must be electrically interlocked with the motor control in such a manner that failure of the drive motor inevitably leads to closing of the automatic product feed valve. (Refer also to Instruction Manual for the Timing Unit.)

3.3.2 Explosion-proof three-phase AC motor

For operation in explosion-hazarded plants, the separator is equipped with a three-phase AC motor of explosion-proof design, type BS, type of enclosure (Ex)d3n, flame-proof, ignition category G4 according to specifications 0171 of the VDE (Institute of German Electrical Engineers).
Power is transmitted via a centrifugal clutch which allows across-the-line starting of the motor. The clutch is housed in a pressure-tight section of the separator frame.

To meet the requirements of the Federal German Physical and Technical Institute, Braunschweig, the motor has to be protected against undue overheating by temperature monitoring equipment (see 3.3.2.1).

3.3.2.1 Temperature monitoring equipment

Temperature monitoring equipment approved by the Federal German Physical and Technical Institute, Braunschweig, is used for motor protection. This device consists of

three temperature feelers which are incorporated in the winding of the motor, and
one tripping device, type Calomat CK 122, which is to be installed in the motor control.

CAUTION: Before starting the motor be sure to loosen both friction brakes (to do this turn handles clockwise).

3.4 Direction of rotation of the bowl

The bowl must turn in clockwise direction when looked at from above. The direction of rotation of the bowl is correct when the revolution indicator disc (Fig. 3/3) turns in clockwise direction. If it turns in anti-clockwise direction (incorrect), reverse direction of rotation by interchanging two lead-in wires.

3.5 Speed and starting time of the bowl

The bowl speed has been rated so as to ensure the operating safety of the separator. It depends on the densities of the centrifugally dry solids and of the heavy liquid.

The bowl speed and the maximum permissible densities are shown on the name-plate of the separator.

If densities exceed those shown on the name-plate, the gear must be changed to reduce the bowl speed. In such cases, be sure to check with the factory.

The part-numbers of the gear parts marked with *** in the List of Parts depend on the motor speed as well as on the bowl speed as seen on the name-plate of the separator. For the part-numbers of the gear parts which correspond to the motor speed and bowl speed of your separator refer to the list on page 18/1.

If the bowl speed has been changed in the site by exchanging the gear parts and consequently differs from that shown on the name-plate of the separator, orders for new gear parts should state the number stamped on the part to be replaced as well as model and serial-no. of the separator concerned. Correct delivery cannot be ensured unless the order quotes these data.

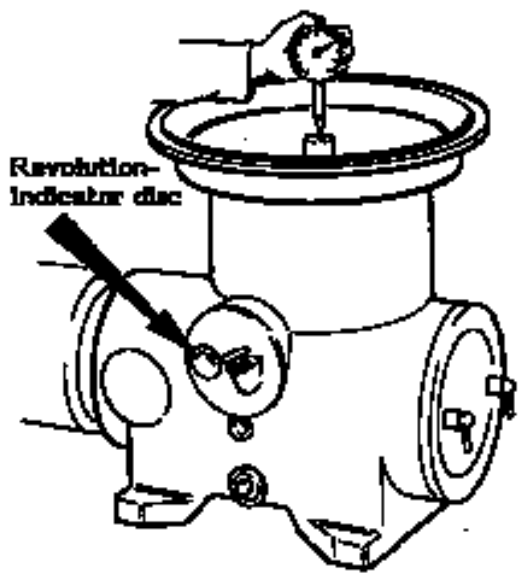


Fig. 3/3

Checking the spindle speed with a hand tachometer

Prior to the first start of the separator and after exchanging the gear parts, check the number of revolutions of the spindle (= rpm of the bowl) with a hand tachometer, before installing the bowl (fig. 3/3).

The revolution indicator disc serves to indicate whether the bowl is rotating and in which direction (see 3.4). It also allows to check the operating speed of the bowl.

The bowl is up to full speed when the revolution indicator disc makes the following revolutions:

65 rpm at a motor speed of 1,455 rpm,

78 rpm at a motor speed of 1,745 rpm.

Speed variations up to 3 % are permissible.

The starting time of the bowl is approx. 4 to 6 minutes.

Make sure that the bowl reaches its rated speed (as per name-plate of separator) within the starting time and that this speed is maintained during operation (see 10.1.1 - 10.1.3).

Important Hints

The forces resulting from the high speed rotation of the bowl are likely to endanger the operating safety of the separator if the bowl has been improperly assembled or cleaned. When assembling the bowl, strictly adhere to the instructions given in this manual.
In addition, the following should be considered:

- Prior to assembling the bowl parts, carefully clean all contact surfaces and grease them according to the instructions given under 2.2. Also, lubricate threaded areas of bowl bottom and bowl lock ring as specified under 2.2.
- When installing the bowl parts, watch for alignment of "O" marks on all parts, to make sure that parts are properly positioned and locked in place by arresting pins and guide ribs. Also, watch for proper position of the hoist, to prevent damage to guide surfaces and arresting pins when installing or removing bowl parts. The hoist shall be operated at the low lifting speed.
  Never use force when installing or removing bowl parts.
- Before inserting gaskets, check them for wear. Make sure that grooves for gaskets and gaskets are clean and that gaskets are in perfect condition. Be careful not to twist the gaskets while inserting them and check to be sure that they fit properly in their grooves.
- If the plant has several separators, be careful not to interchange parts of different bowls since each bowl has been balanced with its component parts. The parts of a bowl are marked with the serial-number of the separator or with the last three digits of the serial-number.

4.1 Assembly of the bowl

4.1.1 Assembling the lower bowl parts

The lower bowl parts are assembled in the order shown in fig. 4/1, i. e. in a position inverted with regard to service position.

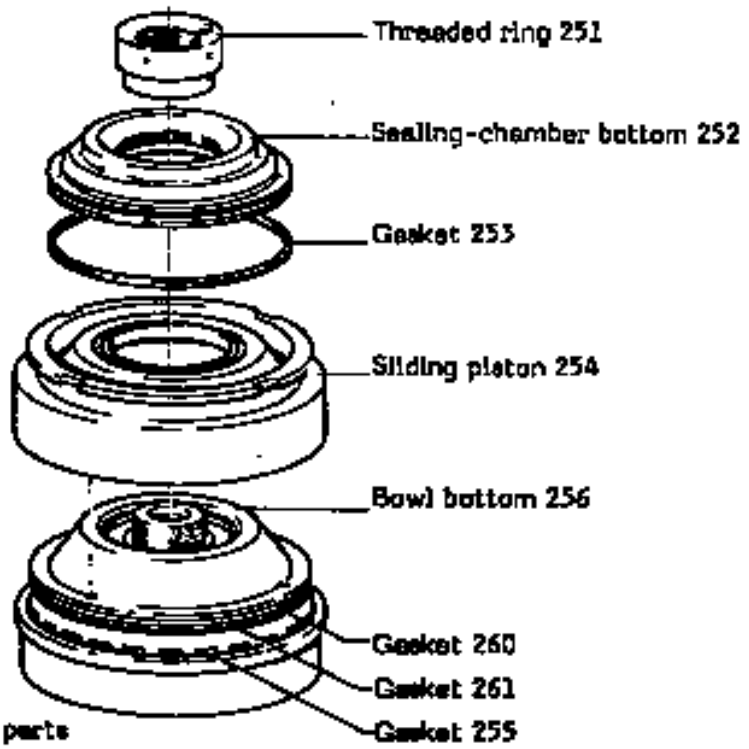


Fig. 4/1
Exploded view of lower bowl parts

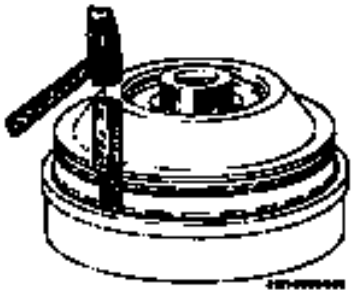


Fig. 4/2a

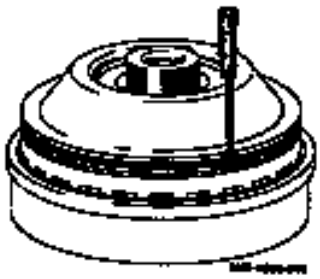


Fig. 4/2b

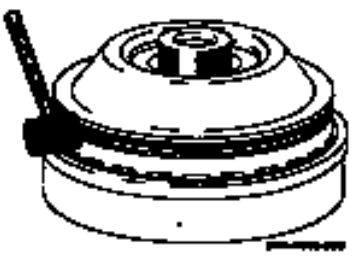


Fig. 4/2c

1) Thoroughly clean groove in bowl bottom for gasket 255.
Wipe gasket dry and insert it into groove of bowl bottom. Then place a piece of wood on gasket and hammer gasket into the groove so that it fits in evenly all around. See fig. 4/2a.

In order to make certain that the gasket is properly placed in the groove, proceed as follows after the separator has been assembled (without pump set and seals):

a) Block off all air circulation by closing solids run-off and feed and discharge pipes. The operating-water outlet on the frame must not be closed.

b) Turn on separator and let run for about 3 hours without feeding operating water. Bowl will warm up to about 90 °C through air friction.

c) Close bowl by briefly opening the valve in the operating-water supply line several times in succession. The gasket, which has become pliable through the heat of the bowl, will become firmly pressed into the anchor grooves.

d) Let bowl run closed an additional 15 minutes while feeding cold water at a low flow rate. Important: Before first solids ejection, be sure solids-run off has been re-opened.

2) Thoroughly clean grooves in bowl bottom for gaskets 260 and 261 and rub in a thin layer of neutral grease (one with no harmful effect on the process liquid).

In case the gaskets are new and a bit too small, stretch them out equally all the way around until their perimeters are approximately equal to the perimeters of the grooves.

Place gaskets into their grooves.
Then put a screwdriver under the gaskets and run it around the bowl bottom two or three times (fig. 4/2b). (This equalizes the gasket fitting all the way around and makes for best sealing during operation).
Then tap the gaskets back into their grooves with a rubber hammer (fig. 4/2c).

If the machine has been dismantled (e. g. when cleaning the bowl) and the gaskets have not been removed or exchanged, then they should be pried up carefully at one point with a small screwdriver to allow water which has collected behind them to escape. The gaskets should then be tapped back into the grooves with a rubber hammer. This will make the job of re-installing the sliding piston much easier.
The same procedure should be followed with gasket 253 in the sealing-chamber bottom.

3) Grease contact surfaces of sliding piston 254 (see 2.2).

Before installing the sliding piston, heat its outer surface with hot water or steam for about 5 minutes. Never use any other sources of heat, e. g. blow torch or welding torch.
Then place the sliding piston onto bowl bottom, by hand. The "O" marks of both parts must be in line with each other. The sliding piston is properly mounted when its sealing edge rests on gasket 255.

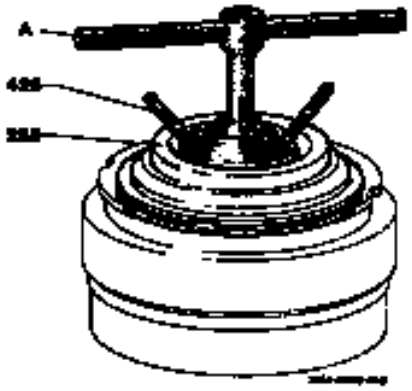


Fig. 4/3a

4) Put gasket 253 into groove of sealing-chamber bottom 252. Proceed by the same method as for gasket 261 (see para. 2).

5) Grease guide surfaces of sealing-chamber bottom (see 2.2). By means of jack 428 install sealing-chamber bottom in sliding piston (fig. 4/3a).
By turning jackscrew "A" in counter-clockwise direction, the sealing-chamber bottom will gradually sink into the sliding piston. Be sure arresting pin of sealing-chamber bottom catches into hole of bowl bottom. The "O" marks of both parts must be in line with each other.

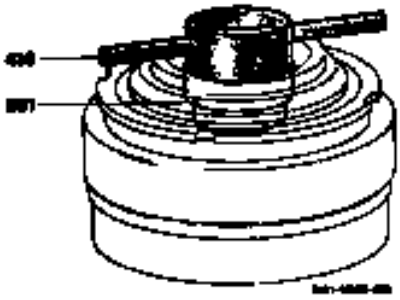


Fig. 4/3b

6) Grease threaded areas and contact surfaces on bowl bottom, threaded ring 251, and sliding piston (see 2.2). Then screw threaded ring, by hand, on to bowl bottom (right-hand thread) and tighten it with annular wrench 416 (fig. 4/3b) until "O" marks on sealing-chamber bottom and threaded ring are aligned.

Exploded view of the bowl

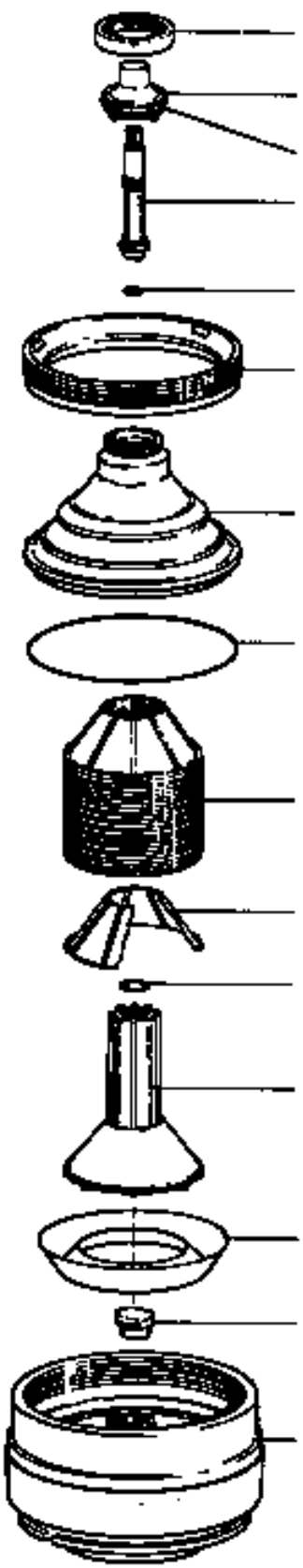


Fig. 4/4

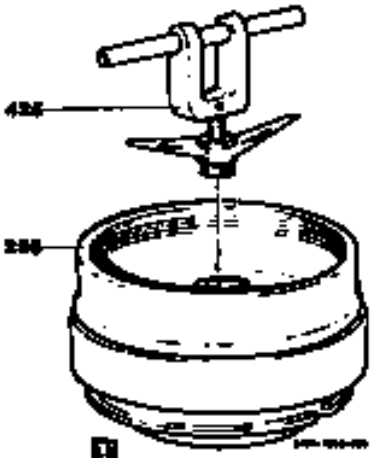


Fig. 4/5a

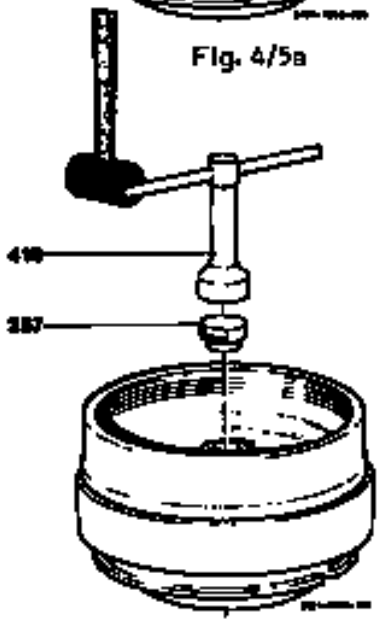


Fig. 4/5b

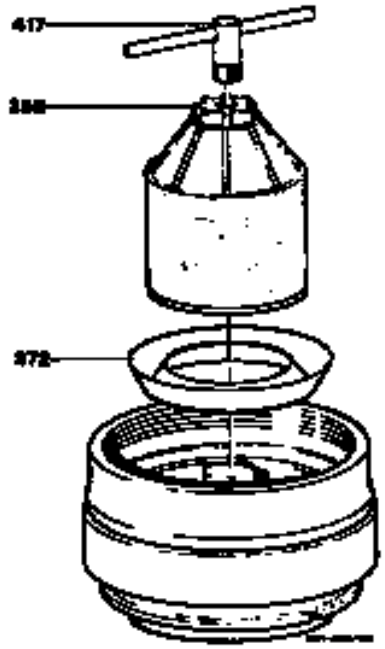


Fig. 4/5c

4.1.2 Assembling the upper bowl parts

- Oil the upper part of the spindle (thread, cone and cylindrical guide surface for spindle cap). It must be possible to move the spindle cap easily up and down on the spindle. Then clean and wipe dry the conical part of the spindle with a smooth rag. Carefully clean the inside of the bowl hub as well to assure proper fitting.

- Use jack 425 to place assembly of bowl bottom 256, sliding piston, sealing-chamber bottom and threaded ring onto the spindle (fig. 4/5a).

- Screw on spindle nut 257 (left-hand thread) and tighten it firmly with wrench 418 (fig. 4/5b).

- Insert wear liner 272 in bowl bottom (fig. 4/5c).

  Stack discs onto neck of distributor in the following order:

  a) Bottom disc (with spacers on both sides),

  b) Discs 259b in numerical order,

  c) Compensating disc (without spacers).
  This disc is only used when a disc with an overall thickness less than that of the normal disc 259b (with spacers) is required to obtain the necessary pressure in the disc set.
  It is included in the set of spare parts, unless it is already fitted in the bowl. When mounting the compensating disc, make sure to place it on top of the disc stack, directly below the bowl top.

- Use device 417 to place distributor 258 with disc set into bowl bottom. Make sure arresting pin of distributor fits into groove of bowl bottom.
  The "O" marks of both parts must be in line with each other.

- Insert gasket 265 into groove of distributor neck.

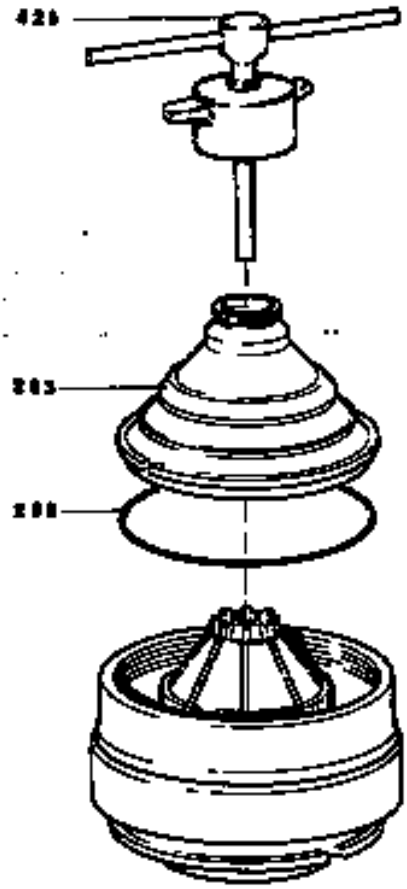


Fig. 4/6a

- Insert gasket 262 into groove of bowl top 263.

- Apply a thin film of grease to guide surfaces of bowl top and bowl bottom (see 2.2).

  With the aid of jack 426 place bowl top so into bowl bottom that the arresting pin of bowl bottom fits into groove of bowl top. Insertion can be facilitated by shaking bowl top lightly.

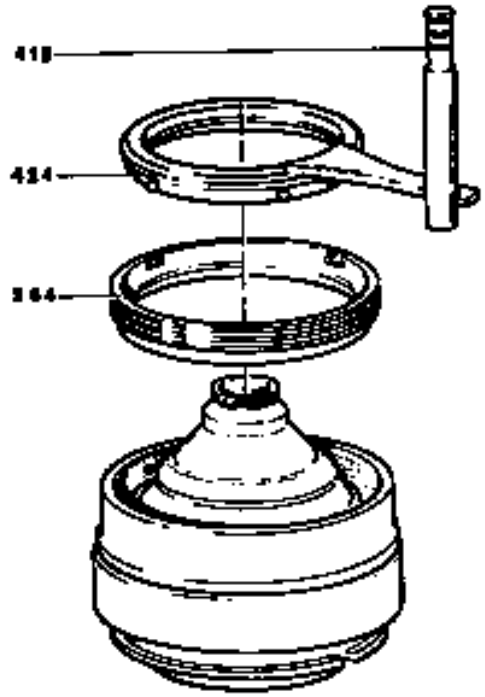


Fig. 4/6b

- Carefully clean, wipe dry and grease (see sect. 2.2) threads and guide surfaces of bowl bottom and bowl lock ring 269 as well as the contact surfaces on bowl top and bowl lock ring to prevent seizing of the threads.

  Screw bowl lock ring into bowl bottom, by hand (left-hand thread).

  Tighten the lightly screwed-on bowl lock ring by rapping with mallet 415 against handle of annular wrench 424, until the "O" marks on ring and bowl bottom are in line with each other.

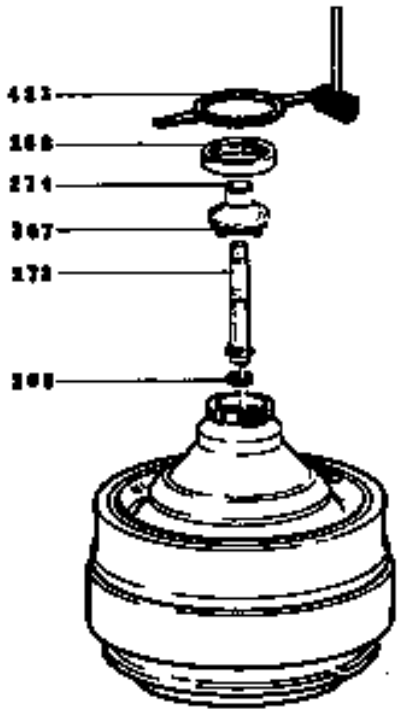


Fig. 4/7

- Fit gasket 266 onto feed tube 273.
- Place feed tube into bowl top.
- Insert gasket 267 into groove of sealing cone 271.
- Place sealing cone so onto bowl top that the arresting pin of the sealing cone fits into the corresponding hole of bowl top.
- Clean, wipe dry and grease (see sect. 2.2) threads on bowl top and in lock ring 268.

  Then screw on lock ring, by hand (left-hand thread), and tighten it firmly by rapping against handle of annular wrench 423.
- Check if bowl can be turned by hand.

4.2 Assembling the feed and discharge system (fig. 4/9) (see also sect. 4.2.1)

1) Install the hood and fasten with clamps. Align adjusting ring as described in sect. 4.2.1.

2) Check if threaded ring 71 in discharge 75 is tightened firmly (left-hand thread), see fig. 4/8.

3) Place on discharge and fasten to hood with clamp ring 41.

*4) Slip lower part of pump 274a, and upper part of pump 274b on feed tube. Thread upper part of pump on feed tube (left-hand thread), using wrench 431 (width 32).

5) Insert gasket 90 into ring 89. Fit ring into discharge.

6) Moisten the two seals 91 with water and slip them onto ring 92. Then fit ring 92 onto feed tube. The lower seal must rest on ring 89. Make sure that the sealing lip of the lower seal is not bent inwards.

7) Place pump casing 93 onto discharge.

8) Insert gasket 94 into groove of pump casing.

9) By means of wrench 430 screw impeller 274c onto feed tube. Note that the impeller has left-hand thread.

10) Place pump cover 95 onto pump casing.

11) Hinge up bow 75b and tighten threaded spindle 75d, by hand. By doing so, you will tighten all the parts of the feed and discharge system. Do not slip a pipe over handle of threaded spindle to obtain leverage.

12) Connect feed and discharge lines of separator to permanent pipe lines. Tighten threaded connections securely.

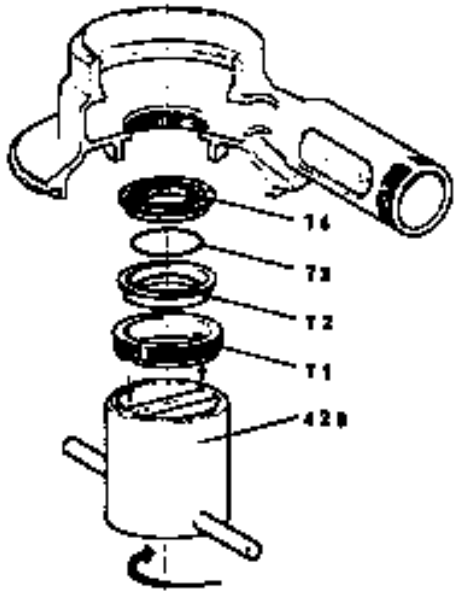


Fig. 4/8

Installing seal 74

When installing a new seal 74, proceed as follows:

1) Insert supporting ring 72, then ring 73 and seal 74 (with its sealing lip pointing upwards) into threaded ring 71.

2) Screw threaded ring with the inserted parts into discharge (left-hand thread). Tighten firmly by hitting handle of wrench 429.

* Not used when discharge pump can be dispensed with.

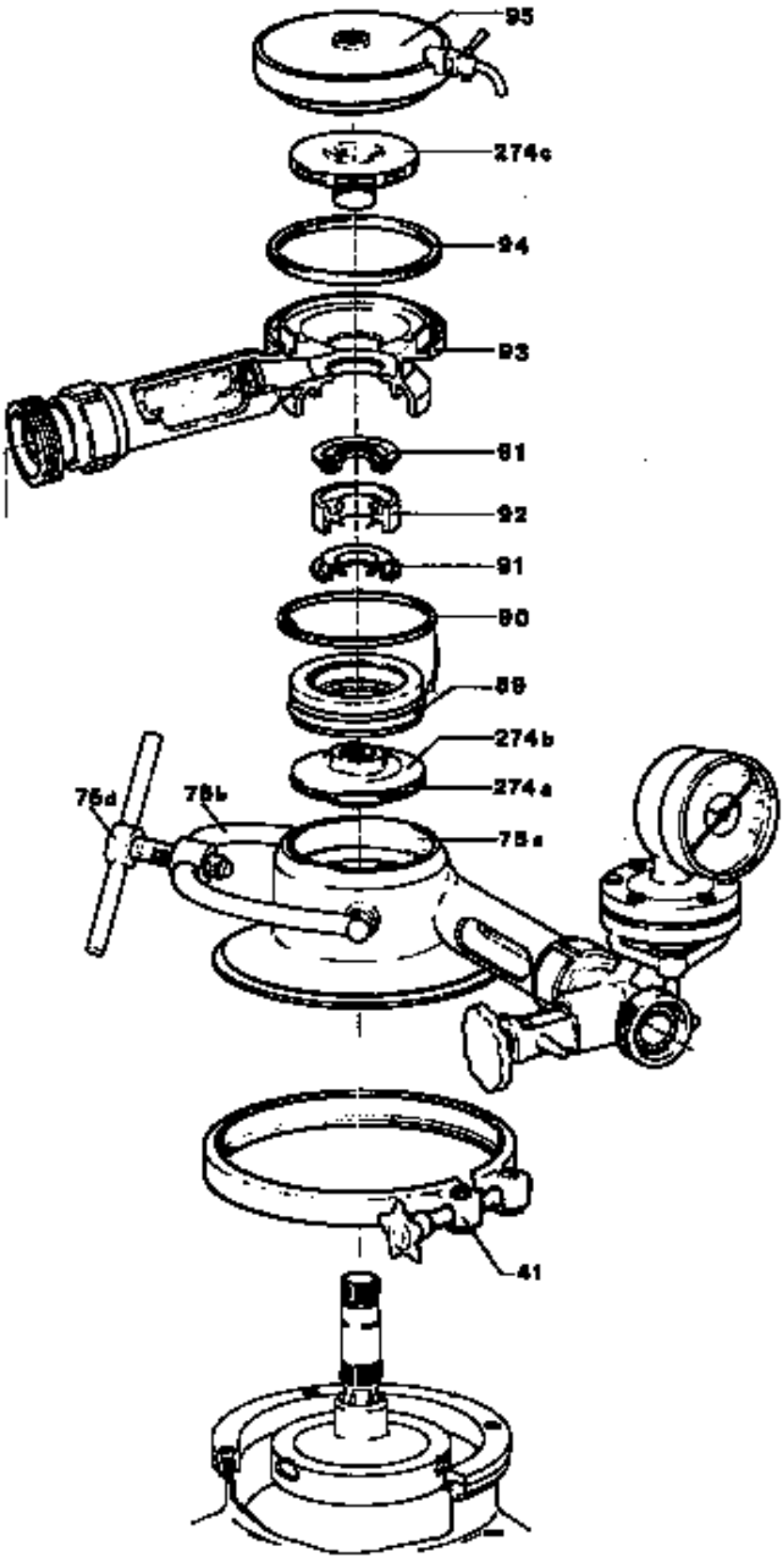


Fig. 4/9

4.2.1 Centering the feed and discharge system with reference to the bowl

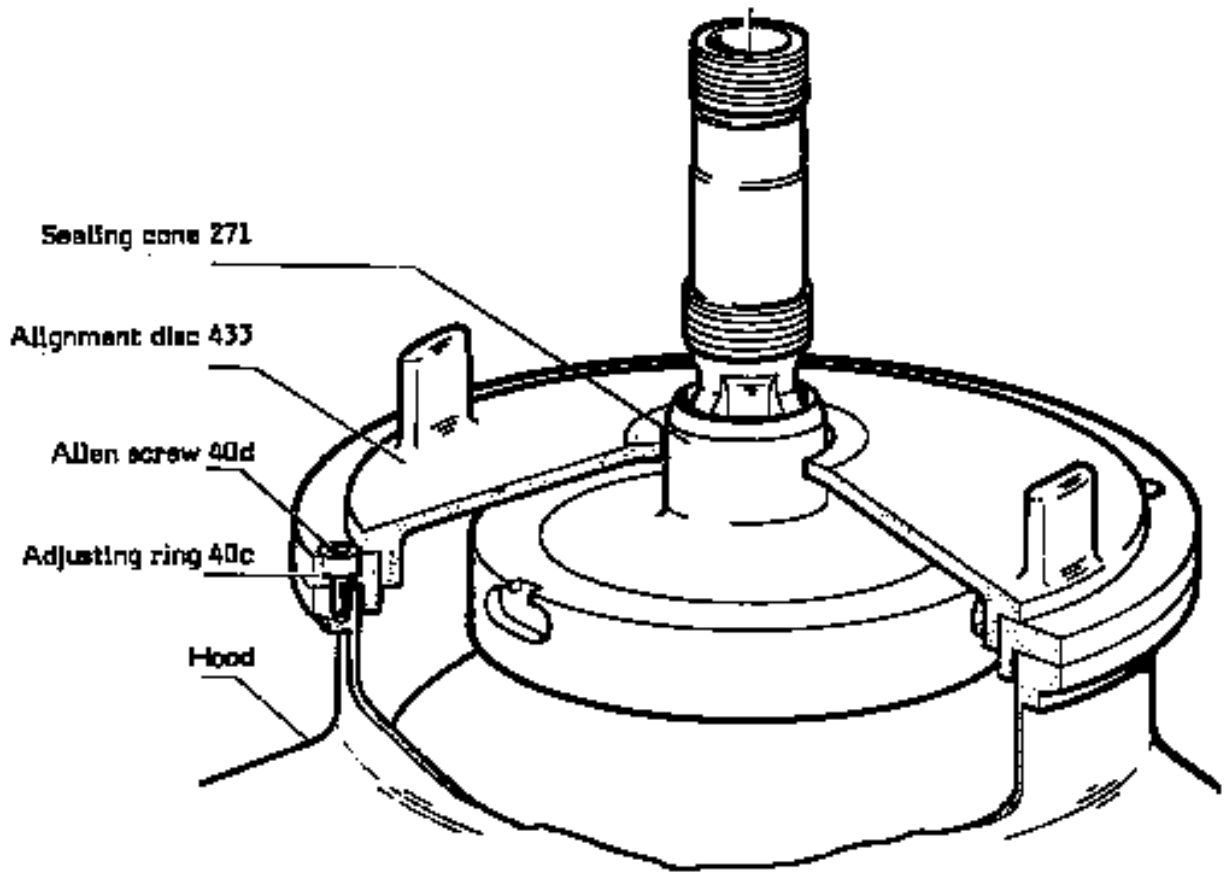


Fig. 4/10

Centering of the feed and discharge system by means of the alignment disc

Each time when having removed the hood and before re-assembling the feed and discharge system, be sure to check the centricity of the feed and discharge system with reference to the bowl for possible re-adjustment. To do this, proceed as follows:

Place hood on frame and fasten it with the clamps.

Place alignment disc 433 onto hood. Switch on the motor. When the bowl has reached its full speed, feed water through feed tube until overflow occurs at sealing cone 271. Then check if the sealing cone is exactly in the center of the hole of the alignment disc (fig. 4/10). If this is not the case, loosen Allen screws 40d and align adjusting ring 40c to obtain equal clearance between sealing cone and hole of alignment disc. Then re-tighten Allen screws firmly and switch off the motor.
IMPORTANT: Be sure not to remove the alignment disc and not to assemble the feed and discharge system before the bowl has ceased rotating (see 4.2).

Aligning of the adjusting ring with the aid of the alignment disc ensures centric running of sealing cone and feed tube in the respective seals and consequently minimizes seal wear.

4.3 Removing the feed and discharge connections Dismantling the bowl

IMPORTANT: Do NOT loosen any part of the machine or of the feed and discharge connections before the bowl has stopped completely.

For removal and dismantling proceed in reverse order of assembly (see 4.1 and 4.2). The following should be kept in mind:

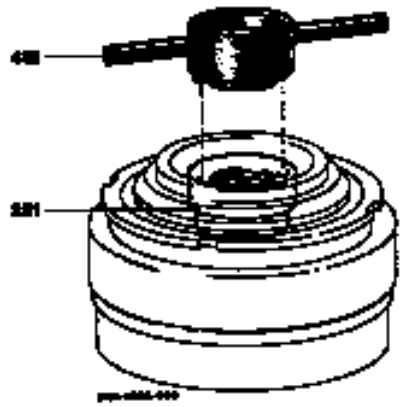


Fig. 4/11a

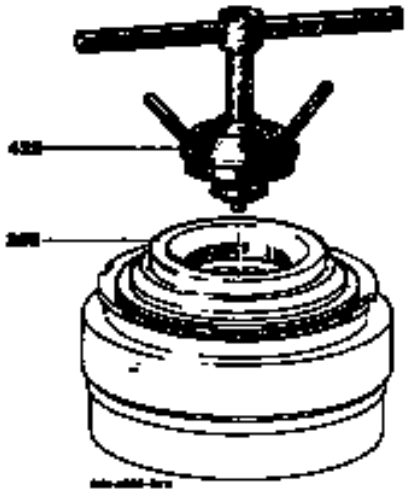


Fig. 4/11b

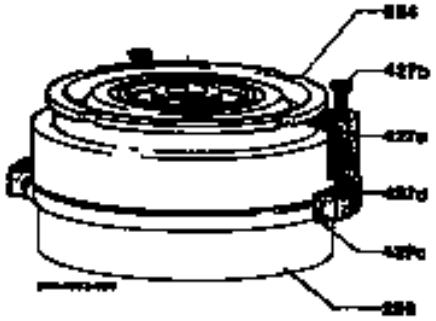


Fig. 4/11c

Handle bowl parts with care.

Be sure to replace worn gaskets and seals.

Before opening the bowl be sure to release brakes by turning the handles clockwise.

In case the bowl lock ring is stuck in the bowl bottom (e. g. after too long an operating time) heat up bowl bottom in the area of the bowl lock ring with hot water or steam.
Do NOT use any other sources of heat.

Normally the lower bowl parts such as bowl bottom, sliding piston, sealing chamber bottom and threaded ring, see fig. 4/1, need only be dismantled when new gaskets have to be inserted. Removal of sliding piston is facilitated by heating the sliding piston with hot water or steam for about 5 minutes.
Do NOT use any other sources of heat.

Then place the assembly of the lower bowl parts upside down on a stand and dismantle as follows.

Fig. 4/11a: Use annular wrench 416 to unscrew threaded ring 251 from the bowl bottom.

Fig. 4/11b: Use jack 428 to remove sealing-chamber bottom 252 from the bowl bottom.

Fig. 4/11c: Use device 427a-d to remove sliding piston 254 from the bowl bottom in the following manner: Place clamp ring 427c onto rim of bowl bottom. Place ring 427d onto clamp ring. Fit claws 427a - equally distributed - under the rim of sliding piston and tighten hex head screws alternately and evenly. By doing this, the sliding piston will gradually come off so that it is possible to lift it off by hand.

4.4 Replacing the sleeves of sealing cone and feed tube

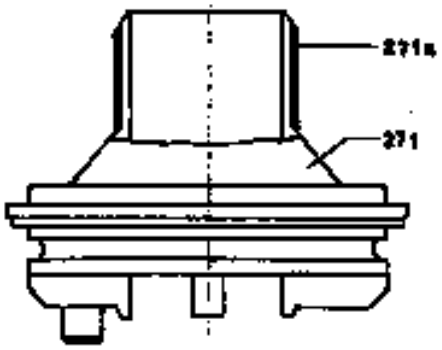


Fig. 4/12a
Sealing cone with sleeve

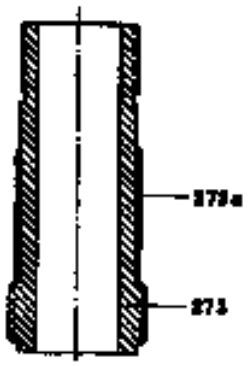


Fig. 4/12b
Feed tube with sleeve

The sleeves glued to the sealing cone and to the feed tube constitute the running surfaces for seals 74 and 91. As soon as the sleeves show pronounced grooves, they should be replaced to avoid premature wear of the seals.

Grind the damaged sleeve lengthwise; be sure not to damage the contact surface of the respective bowl part. As soon as the sleeve is almost ground through, it will split along the grinding line. After having removed the sleeve, clean the contact surface of the respective bowl part with fine emergy paper.

Take equal portions of UHU-plus adhesive from both tubes supplied with the separator. Thoroughly mix the two components on a clean and dry surface. Apply a thin film of the adhesive compound to the cleaned contact surfaces of the bowl part. Slip on the new sleeve. Be sure to remove excessive adhesive immediately. Then allow the adhesive to dry. Hardening will take 10 hours at room temperature, 3 hours at 40 °C (also refer to the instructions enclosed in the UHU-plus package).

4.5 Removing Polyamid gasket from bowl bottom

1) Heat up gasket with hot water or steam (70 - 100 °C) for about 10 minutes.

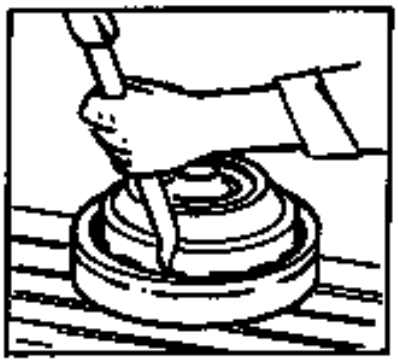


Fig. 4/13a

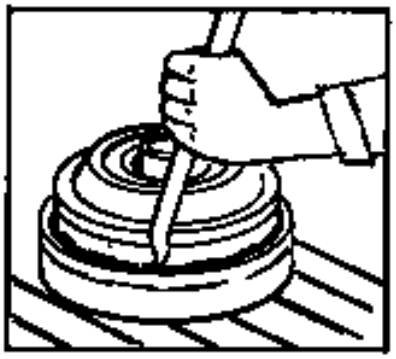


Fig. 4/13b

2) Use chisel 425 to cut a small triangular place out of the gasket.

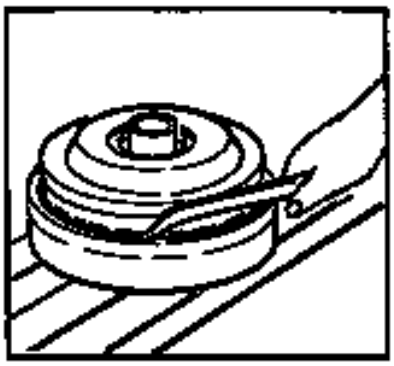


Fig. 4/13c

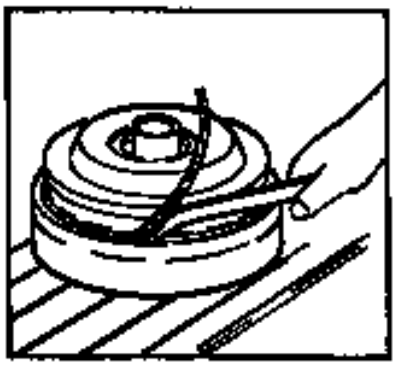


Fig. 4/13d

3) Press gasket out of its groove.

5.1 Operating principles of the bowl

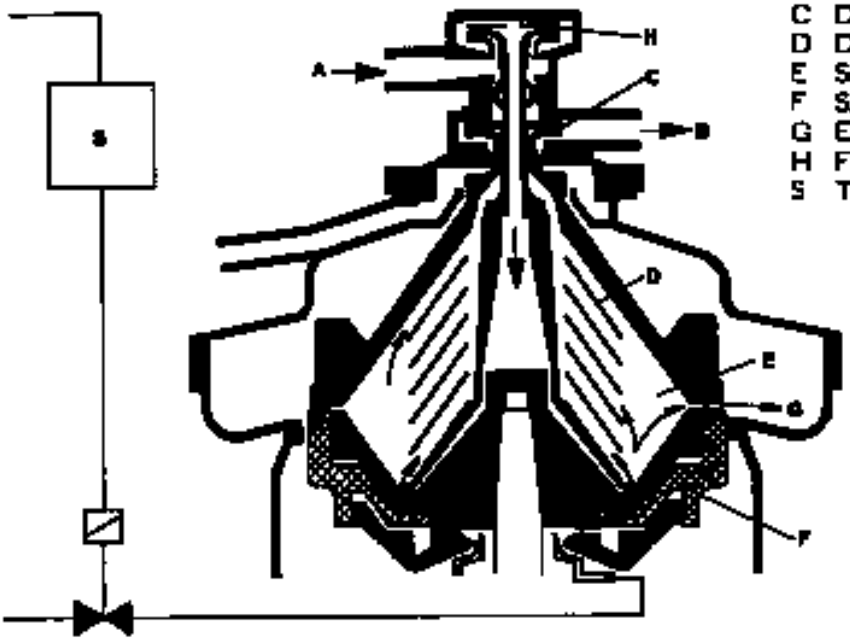
The bowl is designed for the clarification of liquids. Clarification means the centrifugal removal of solids from a liquid which has a lower density than the solids.

The process liquid enters the bowl through inlet A and flows via feed pump H towards the bowl center into the distributor space, from where it flows through channels in the distributor base into disc set D where the separation takes place. The disc set consists of a large number of conical discs placed one above the other. The liquid is distributed in the spaces between the discs where it is divided into thin layers. Since the layers of the liquid are very thin, the radial separation distance is extremely small. The solids collect on the top wall of each space and slide down into the sludge space E.

The clarified liquid flows towards the bowl center and is discharged foamfree and under pressure through line B by means of pump C.

The separated solids are ejected through ports G in bowl bottom (see sect. 5.3). Solids ejection is initiated by a timing unit S.

The enclosed piping system is sealed off towards the bowl by means of seals preventing product-air contact.



A Feed
B Discharge
C Discharge pump
D Discs (Separation room)
E Sediment holding space
F Sliding piston
G Ejection ports
H Feed pump
S Timing unit

Fig. 5/1

5.2 De-sludging of the bowl (solids ejection)

When to de-sludge the bowl?

The intervals at which solids ejections have to take place, depend on the solids content and on the nature of the process liquid. Complete filling of the sludge space (sediment space) should be avoided. As soon as the separating efficiency begins to decrease, be sure to accomplish either a "complete de-sludging" or a "partial de-sludging". Complete de-sludging means ejection of the whole bowl contents, whereas partial de-sludging means ejection of only part of the solids.
The specific application of partial ejection, total ejection or combined partial and total ejection depends on the behaviour of the solids during ejection.

Before each complete ejection be sure to stop the supply of process liquid to the separator.

Displacement

The loss of valuable process liquid - unavoidable during complete de-sludging - can in many cases be reduced to a minimum by displacing the residual process liquid left in the bowl, e. g. with water or another suitable liquid, before de-sludging takes place (important with particularly valuable process liquid).

The displacement water should be fed at the same hourly capacity as the process liquid.

The length of time during which displacement liquid must be fed into the separator has to be determined by trial and error. If the time is too long, then heavy phase will discharge from the light phase outlet. If the time is not long enough, then some of the valuable light phase will remain in the bowl and will be lost during the de-sludging process.

The light phase can also be displaced by throttling the valve in the discharge line for the heavy phase.

Flush de-sludging

It may happen that part of the solids stick to the walls of the sludge space due to particular properties or as a result of having been retained too long in the bowl. To overcome this condition, the time of separation should be reduced, or "total de-sludging" should be followed by a flush de-sludging by filling the bowl with water and emptying it by way of de-sludging.

Programme control

Total, partial, and flush de-sludgings as well as displacement of process liquid at pre-determined intervals are controlled in the most dependable way by employing an automatic timing unit. For details refer to the instruction manual "Timing Unit".

5.3 Functioning of the hydraulic system of the bowl

The operating liquid (normally water) fed into the bowl and rotating with it, develops high centrifugal pressure. This pressure is used to operate sliding piston F which opens and closes the bowl. The sliding piston F rotates at the same angular velocity as the other bowl parts, but unlike the other bowl parts it can be moved axially.

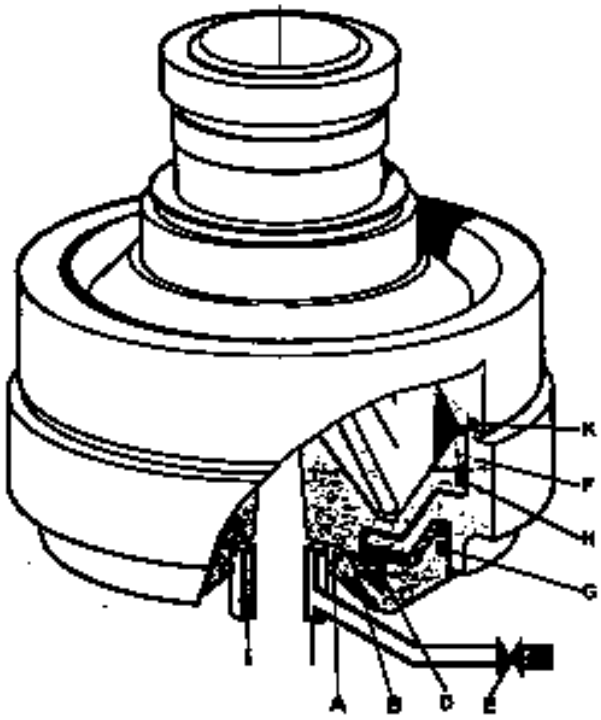


Fig. 5/2
Bowl, closed

Sealing of the bowl: After the bowl has reached its rated speed, the operating-liquid valve E is briefly opened several times in succession. The operating-liquid flows into injection chamber A and from there, through four holes B, into the sealing chamber D beneath the sliding piston.

The liquid pressure prevailing in the sealing chamber raises the sliding piston and presses it against bowl gasket K, thus sealing the bowl. Through centrifugal force, gasket G in the sealing chamber bottom seals off the sealing chamber and gasket H in the bowl bottom seals off opening chamber M and the centrifugation room.
Separation can now begin.

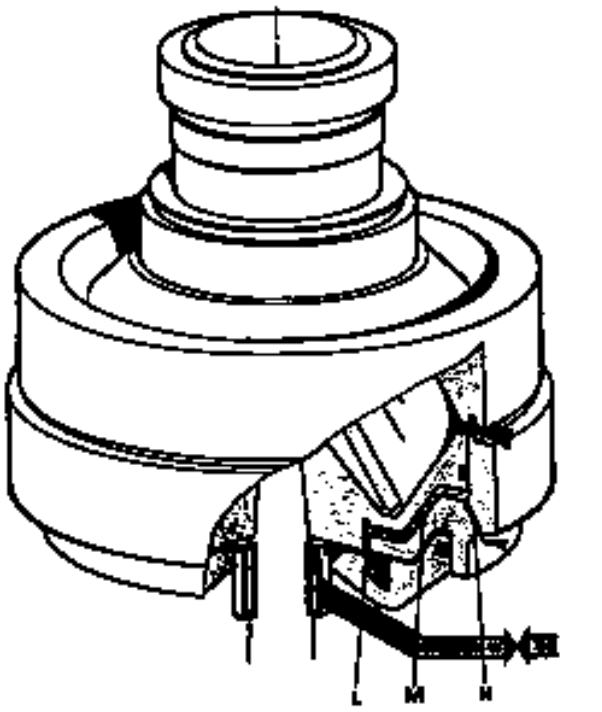


Fig. 5/3
Bowl, open

Opening of the bowl (solids ejection): When the sludge space of the bowl is filled with solids, operating-liquid valve E is opened. The operating-liquid is injected into chamber A, from where it flows into sealing chamber D. When the sealing chamber is filled, the liquid flows on into opening chamber M.

A small portion of the operating-liquid leaves the opening chamber through discharge nozzle N whose diameter has been selected so as to ensure that the amount of discharging liquid is less than the amount of liquid entering the chamber. Since the effective area of the sliding piston in the opening chamber is larger than that in the sealing chamber, the opening pressure resulting from the effective area and the liquid pressure, exceeds the sealing pressure and pushes the piston down. This opens the discharge ports in the bowl bottom for solids ejection.

Re-sealing of the bowl: After solids ejection, the operating-liquid supply is shut off again. The liquid contained in the opening chamber is ejected through discharge nozzle N. As the liquid level recedes, the opening pressure acting on the upper side of the sliding piston quickly declines. When the opening pressure has become smaller than the sealing pressure acting on the underside of the piston, the latter is pushed upwards, thus re-sealing the centrifugation room. The separation process can now recommence.

5.4 Operating-water connection (fig. 14/2)

The inner diameter of the operating-water supply line shall be 1/2" if the line is up to 3 m long; if it is longer than 3 m, the inner diameter shall be 3/4". The pressure in this line should be at least 2 bar and not more than 3 bar.
During partial de-sludging pressure fluctuations must not exceed 0.2 bar. Consumption of operating water is approx. 3 - 4 litres for each total de-sludging and 1 - 2 litres for each partial de-sludging procedure.
The operating-water connection is provided with a water-pressure reducer by means of which the line pressure is to be throttled to approx. 2.5 bar. Pressure adjustment should be made while solenoid valve is open.
The operating water must be clean and should meet the following specifications:

Hardness:	$\leq 22^{\circ}$ English hardness at separating temperatures of up to 40 °C
	$\leq 7^{\circ}$ English hardness at separating temperatures exceeding 40 °C
Chlorine ions:	$\leq$ 100 mg/litre
pH value:	6.5 to 7.5

It is recommended to clean the strainer of the water pressure reducer from time to time by putting it for a short while into diluted vinegar or hydrochloric acid. Before re-installing the strainer, flush it thoroughly with water.

5.4.1 Solenoid valves for operating water and for * flush water for hood

The solenoid valves incorporated in the operating-water system are 2/2-way straight-flow diaphragm valves with internal piloting. The solenoid valve for operating water is equipped with a manual operator (override) for test purposes. The solenoid coil is entirely embedded in Epoxy resin which ensures protection against moisture, good dissipation of heat, and perfect electrical insulation. The valves are fully tropicalized.

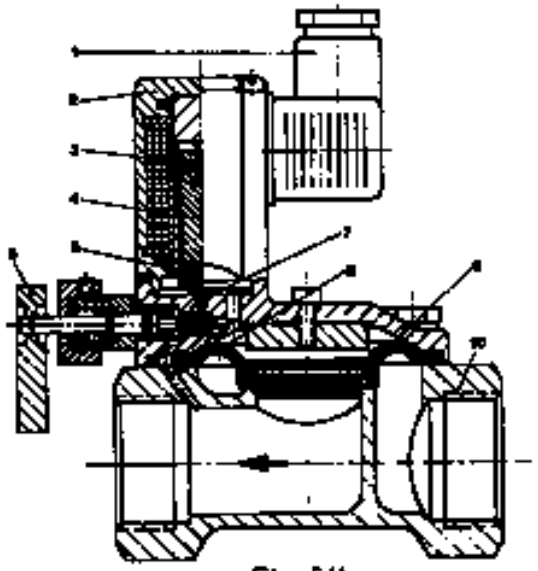


Fig. 5/4

1 Coupler socket
2 Solenoid head
3 Cylindrical pressure spring
4 Solenoid core
5 Plug (pilot valve)
6 Manual operator (override)
7 Outlet hole
8 Inlet hole
9 Diaphragm
10 Valve housing

* on special order only.

Operating principles

When the valve is closed (de-energized), the upper side and the underside of the diaphragm are exposed to the water line pressure, because water can flow from the valve inlet side through a small hole in the diaphragm into the chamber above the diaphragm. As the area exposed to the water line pressure on the upper side of the diaphragm is larger than the area exposed to the same pressure on the underside, the diaphram is kept pressed against the valve seating.

Upon energization of the solenoid coil, the plug which is integrally vulcanized in the solenoid core is lifted from the seating of the pilot valve thus opening a duct between the space above the diaphragm and the discharge side of the diaphragm valve. As this duct is larger in diameter than the small hole on the inlet side, the water can flow faster out of the space above the diaphragm than it flows into it. Thus the water pressure above the diaphragm drops so that the diaphragm is lifted by the pressure acting on its underside; the valve is opened.

If the energizing current is disconnected, the spring will drive the solenoid core downwards and the pilot valve will close. Consequently, the water pressure above the diaphragm builds up again so that the diaphragm is pressed against the valve seating; the valve is closed.

Maintenance

The solenoid valves do not require special maintenance. However, care should be taken that the coupler socket is always screwed tightly to the solenoid head to ensure perfect sealing action of the gasket.

Locating electric troubles

If it has been found that the control cabinet functions properly and that voltage is present at the valve terminals of the terminal strip while the corresponding time function element is operating, the trouble will have to be ascribed either to a defective solenoid coil, or to open circuit between terminal strip and valve, or to poor connection.

In the event of a defective solenoid coil, the solenoid head can be removed from the valve. To do this, remove first the coupler socket (loosen screw and pull out the socket), then loosen the fillister head screws. Note: Before doing so, shut off the main valve for operating water.

Since the solenoid coil is entirely embedded in the solenoid head, the complete solenoid head (No. 0018-3710-600, see page 14/4) has to be replaced.

Technical data

Solenoid valve		Type	40 A / 2451 for operating water	40 A / 122 for flush water
Part - Number			0018-3712-600	0018-3710-600
Pipe connection		R	1"	1/2"
Voltage		V	220 AC	220 AC
Frequency		Hz	50/60	50/60
Optional voltages		V	24 AC 115 AC 24 DC	24 AC 115 AC 24 DC
Power consumption:	pull-in	VA	approx. 20	approx. 20
(AC operation)	operation	VA	approx. 16	approx. 16
(DC operation)		W	approx. 12	approx. 12
Duty cycle		%	100	100
Frequency of operations		/h	1,000	1,000
Type of enclosure		IP	65	65
Pressure range		bar	0.5 - 10	0.5 - 10
Temperature:	medium	°C	+90	+90
	ambient	°C	+35	+35
Cable entry		Pg	9	9

5.5 Feed connection with automatic valve

The automatic valves incorporated in the feed connection are pneumatically or hydraulically operated, angle type piston valves. Control medium is supplied via hose connections by means of electromagnatically operated control valves.

5.5.1 Angle valve

Type of valve:

a) 2/2-way valve

b) 2/2 way valve with basic flow adjustment

Valve operation:

The valve closes by spring pressure and opens when control medium is supplied

Installation:

Inlet and outlet form a right angle. The valve can be fitted in any position; usually the lateral connection (A) is used as inlet and the lower connection (B) as outlet.

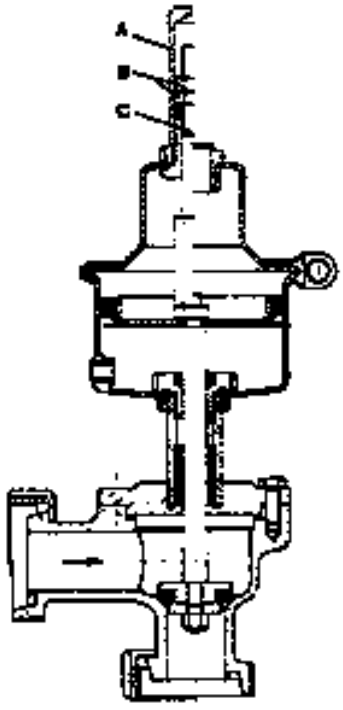


Fig. 5/6

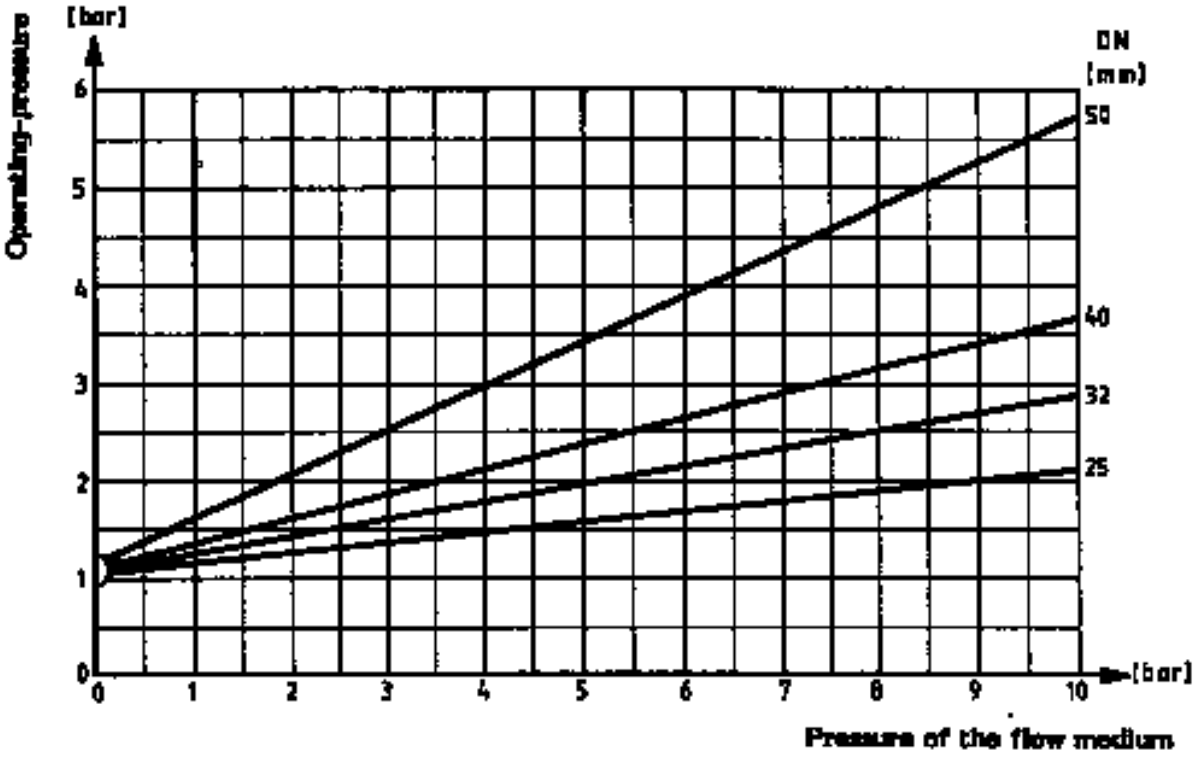
Operating principles:

When the solenoid valve has opened the control-air inlet, the piston is pushed upwards against the force of the spring, thus lifting the valve disk from its seat.
When the air pressure acting on the piston is interrupted, the spring can force the piston back into closing position.
The valve disk is equipped with a Teflon sealing ring.
Instead of compressed air water can be used as control medium.

When using valves with basic flow adjustment the stroke of the valve spindle can be limited by removing cap A and loosening check nuts B and then screwing threaded piece C upwards.
The position of the threaded piece then determines to what extent the valve outlet is left open.

Operating-pressure diagrams

Angle-valve design: a) spring-closing: flow direction A → B
b) spring-opening: flow direction B → A

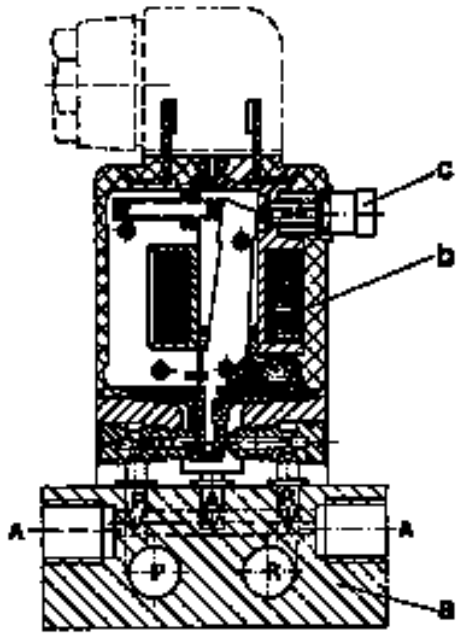


Critical pressure conditions on the 2/2-way angle-type valve

DN	Δ p
25	3.5 bar
32	2.4 bar
40	1.3 bar
50	0.6 bar

a) The **spring-closing** valve opens automatically as soon as the pressure of the flow medium under the valve disk (connection B) is by Δ p higher than that above the valve disk (connection A).

b) The **spring-opening** valve does not open any more, when the pressure of the flow medium above the valve disk (connection A) is by Δ p higher than that under the valve disk (connection B).



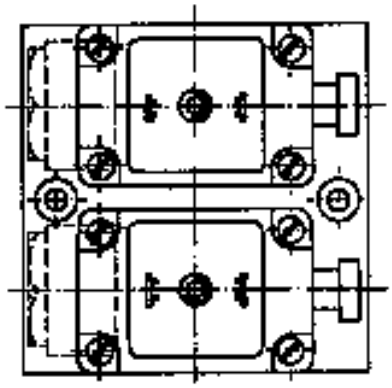


Fig. 5/8 Two-valve connection block

a Connection block
b Solenoid valve
c Manual operator

Important: When fitting the valves on the connection block be sure that the designations R and P on the valve and on the connection block correspond with each other.

5.5.2 Solenoid valve for control medium

Design and operating principle

These valves are direct acting 3-port/2-position solenoid valves, where outlet A is relieved when the solenoid is de-energized. The valves are equipped with a manual operator C (or override) for checking; it also serves for switching over the valves when the solenoid coils are de-energized. The manual operator can be arrested by pressing and turning it by 90°.
The solenoid head is completely moulded in Epoxy resin, thus ensuring perfect protection against entry of moisture, good dissipation of heat and perfect electrical insulation. These valves are fully tropicalized.

The armature of the solenoid head is incorporated in an oil-filled chamber which is completely isolated from the flow medium by a diaphragm.

The brass valve body is fastened to the solenoid head by means of two screws. These screws and the precisely adjusted valve seats must not be removed or re-adjusted.

The control valve of an one-valve connection block (feed connection with one automatic angle valve) is designed as sleeve valve whereas the control valves of a two-valve connection block (feed connection with two automatic angle valves) are designed as flange valves. The valves are mounted on the connection block (single or double connection block) with two screws each. On the two-valve connection block the pressure and relief connections are combined to a common connection each. The ports of the connection block and valves are marked as follows (Fig. 5/8):

P = Pressure connection
A = Valve outlet
R = Relief connection

When the solenoid is de-energized, valve port P is closed while port R is open and in communication with outlet A. When energized, the solenoid attracts the armature, causing the diaphragm to be shifted from the left-hand valve seat to the right-hand one. Passage P – A is thus opened and passage R – A is closed.

Maintenance

The solenoid valves do not require any maintenance.

Malfunctions

If it has been found that the timing unit functions properly and that voltage is present at the valve terminals, malfunction has to be ascribed to a defective solenoid coil. In such a case, the complete solenoid valve, Part-No. 0018-4485-800 (double connection) or Part-No. 0018-3715-630 (single connection) must be replaced. The same applies to mechanical failures.

Technical data (solenoid valve for control medium)

Solenoid valve, Part-No. 0018-4485-800, for two-valve connection block	Type	331 / C
Solenoid valve, Part-No. 0018-3715-630, for one-valve connection block	Type	330 / C
Pipe connection	R	1/8"
Voltage	V	220 AC
Frequency	Hz	50/60
Optional voltages	V	24 AC 115 AC 24 DC
Power consumption pull-in	VA	approx. 30
(AC operation) operation	VA	approx. 15
(DC operation)	W	approx. 8
Duty cycle (ED)	%	100
Frequency of operations	/min	approx. 1,000
Type of enclosure	IP	65
Pressure range	bar	0 - 10
Temperature: medium	°C	up to 90
ambient	°C	up to 45
Cable entry	Pg	9
Screw coupling for air hoses	mm	8 x 1
Mounting position		at random

5.5.3 Connection of control medium line

The control medium is conveyed from the control valves to the angle valve via hose pipes 8 x 1. For connecting the hose pipes, quick-action hose fittings are used.

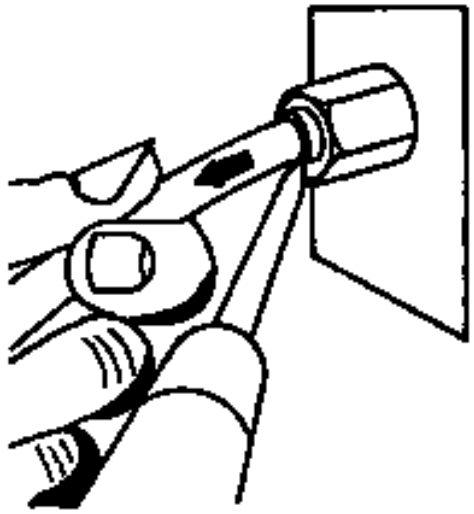


Fig. 5/9

Connection of a hose pipe

Insert hose pipe into the quick-action hose fitting as far as it will go, thus ensuring absolute tightness of the connection up to a pressure of 18 bar.

Loosening the hose pipe

Loosening of the hose pipe is effected by exerting a slight pressure onto the bush surrounding the hose pipe and simultaneously drawing back the hose pipe.

The operating instructions given in this chapter are merely general directions. The operation of each individual separator depends on the timing unit and valves employed and on the application of the machine (see instruction manual for the timing unit used in connection with the separator).

6.1 Before starting the separator

Check to be sure that

- oil level is slightly above middle of sight glass,
- brakes are released (to do this, turn handles clockwise),
- separator is correctly assembled, especially that clamps on hood, clamp ring on discharge and threaded spindle of clamp on discharge are tightened securely,
- manual shut-off valves for process liquid and water are closed and rapid-closing valve for operating water is open,
- throttle valve in discharge line is closed,
- hose cock of discharge line is connected to water supply line.

6.2 Starting the separator

- Feed water for cooling the seals in the discharge. To do this, proceed as follows:
  Slightly open hose cock in discharge line and valve in water supply line (feed rate: approx. 400 litres/h at each connection).

  IMPORTANT: The bowl must never be allowed to idle dry, since dry operation involves development of excessive heat, resulting in hardening and premature wear of the seals. The bowl must, therefore, be supplied with cooling water when no process liquid is fed.

- Switch on the timing unit.

- Switch on the motor. If strong vibrations occur, stop the separator and check to see if the bowl is clean and properly assembled.

  Bear in mind that perfect sealing action of the seals will only be attained after start-up of the separator and after the discharge pressure has been adjusted by means of throttle valve.

- As soon as the bowl has reached its rated speed which is after about 4 - 6 minutes:
  Close the bowl hydraulically by repeatedly actuating push button "De-sludging" on the timing unit.

- Check bowl for leakage:
  Fill bowl with water by opening manual shut-off valve in the water supply line. If the water supply line is also equipped with a solenoid valve then that valve has to be opened via the timing unit.
  Open inspection cover on the solids outlet. If water discharges from the solids outlet while the bowl is being filled, the bowl is leaky (also recognizable by increased power consumption of the motor: see ammeter of motor control). In this case open and close the bowl by actuating push button "de-sludging" on the timing unit. Repeat this procedure until the bowl closes properly. After each de-sludging keep a waiting time of 15 - 20 seconds before feeding water again.

- Feed process liquid by opening manual shut-off valve in process liquid supply line. If this line is also equipped with a solenoid valve then that valve has to be opened via the timing unit. Adjust to hourly capacity.

  Stop cooling-water supply in feed and discharge lines. The seals will now be cooled by the process liquid.

  Open throttle valve in discharge line.

  At the beginning it may become necessary to vent the bowl for a short time. This is done by opening cock 95a in the pump cover.

- Adjust desired throughput capacity (watch flowmeter).
  Adjust discharge pressure by means of throttle valve so that the clarified liquid discharges foamfree.

  The hourly capacity of the separator depends on the desired degree of purity of the clarified liquid. The degree of purity depends on the viscosity and, hence, on the temperature of the process liquid. It further depends on the difference in densities of the carrier liquid and of the solids as well as on the size and nature of the solids to be removed. If the particle size of the solids is very small and if the density of the solids is almost equal to that of the carrier liquid, then the hourly capacity has to be reduced to extend the retention time of the process liquid in the bowl.

  Maximum permissible throughput capacity: 8,000 litres/h

  Maximum permissible discharge pressure: 8 bar

  To protect the seals, be sure not to operate with a higher discharge pressure than actually necessary for the conveyance of the clarified liquid. If no discharge pump is used, item 4 in sect. 4.2 does not apply.

Reference values for discharge pressures

(with 4 m feed height; 85 dia. feed pump;

90 dia. discharge pump; 7,500 rpm of pump)

Capacity l/h	Feed pressure kp/cm^2	Discharge pressure kp/cm^2
2,000	0.4	7.4
3,000	0.4	6.9
4,000	0.4	6.4
5,000	0.4	5.9
6,000	0.4	5.3
7,000	0.4	4.0

6.3 De-sludging of the bowl (solids ejection)

The separation programme including solids ejection is automatically performed by the timing unit. By pressing the corresponding push buttons (depending on the design of the timing unit, and number of valves used), the programme in action can be interrupted at any time and an automatic partial or total solids ejection can be initiated immediately.

6.3.1 Total de-sludging

Upon actuation of the push button "total de-sludging" the following programme is performed:

Closing of the process liquid supply valve.

* Displacement of the liquid bowl contents (see 5.2 "Displacement").

Total de-sludging of the bowl.
Operating water is supplied for 10 seconds. Although the solids ejection procedure takes only a few seconds, the shut-off valve in the operating-water line should remain open for 10 seconds in order to be sure that even the difficult to dislodge solids will be ejected from the bowl. Solids which remain in the bowl can harden and thus lead to trouble.

* Flush de-sludging (see 5.2 "Flush de-sludging").

After such total de-sludging a waiting time of 15 - 20 seconds should be kept before feeding process liquid or flush liquid.

* depending on the timing unit, the valves employed, and the pre-set programme.

6.3.2 Partial de-sludging

Partial de-sludging means partial emptying of the sediment space of the bowl. It is not feasible with all types of liquid, but only with products whose centrifugally removed solids are soft and pasty in character, and free of fibres. It can be accomplished, for example, when separating pulp from juices, when clarifying citrus and pine apple juices, when separating yeast from beer and wine, when processing fermentation broths, etc.
During partial de-sludging, the process liquid valve normally remains open.

After actuating the push button "partial de-sludging" operating water is supplied for the time of 1 - 2.5 seconds. The time of operating-water supply (= partial de-sludging time) depends on the amount of ejected solids and on the operating-water pressure. To ensure that always equal amounts of sludge are ejected, the operating-water pressure must be kept constant.
The exact time of partial de-sludging is to be found out by checking the solids ejections and by evaluating the ejected solids, while the machine is running.

6.4 Stopping the separator

- Close the product feed valve.
- Feed cooling water to seals by opening the valve in the water-supply line.
- Displace bowl filling: see 5.2, "Displacement".
- De-sludge the bowl.
- Flush bowl several times with water and de-sludge to ensure that no solids will be left in the bowl. To do this, proceed as follows
  Fill bowl with water. When the bowl is filled, that is, when water appears in the sight glass of the discharge line, de-sludge the bowl. Repeat this procedure several times.
- When cleaning in place with heated detergent solutions, finish up by flushing with cold water. Which detergent is to be selected for cleaning depends on the residues in the bowl. Alkaline and (or) acid cleansing solutions may be used. To avoid corrosion be sure to use only approved detergents.
- Fill the bowl with water. If the bowl is leaky, leave the water supply valve open.
- Stop the motor.
- Apply the brakes by turning the handles in anti-clockwise direction.
  IMPORTANT: Do not loosen any part of the separator before the bowl has stopped completely.
  Note that the bowl has not stopped before the revolution indicator disc (fig. 3/3) has ceased rotating.
- Stop cooling-water supply for seals.
- Close main shut-off valve in operating-water line.
- If dismantling of the bowl is intended, it should be done immediately after stopping of the bowl when the contact surfaces of the bowl parts are still wet.

7.1 Cleaning the bowl

Self-cleaning bowls need not be taken apart for cleaning at the end of a run, unless the nature of the separated solids makes bowl dismantling for thorough cleaning necessary. Experience will show how often the bowl has to be dismantled.

During the first few months of operation, the lock rings should be removed every two weeks for greasing the threads, to prevent seizing. Later on, the greasing intervals may be extended. However the bowl should be dismantled at least every two months for thorough cleaning of the inner bowl parts.

Never use metal scrapers or metal brushes for cleaning the discs and bowl parts.

Remove gaskets from the bowl parts and clean grooves and gaskets to prevent corrosion. Replace damaged gaskets. Swollen gaskets should be left to dry at a warm place so that they can regain their original dimensions and can be re-used.

The gaskets in bowl bottom and sealing-chamber bottom whose edges have been frayed through abrasion, can be re-used after grinding off the edges with an emery wheel. When grinding, be careful not to damage the sealing surfaces.

Special care should be taken in cleaning the small orifices in threaded ring, sealing-chamber bottom and sliding piston for feed and discharge of operating water (fig. 10/1) to ensure trouble-free performance of the de-sludging process.

Clean and wipe dry guide surfaces and threads of bowl parts and grease them (see 2.2). Spindle cone and inside of bowl hub should be oiled and then wiped clean and dry with a smooth rag.

Re-assemble bowl immediately after cleaning.

7.2 Cleaning the operating-water feeding system

The strainer in the water pressure reducer and the small holes in the operating-water feeding device should be cleaned every 3 - 6 months.

7.3 Cleaning the gear chamber

When changing oil, clean gear chamber thoroughly with kerosene. Be sure to remove all metal particles from walls and corners. Do not use fluffy cleaning rags or cotton waste.

7.4 Cleaning prior to a long-term shut-down of the separator

Prior to a long-term shut-down, clean the separator thoroughly (see 7.1). The clean bowl parts and all unvarnished machine parts should be wiped dry and greased to avoid corrosion. The clean grease-coated bowl should be kept in a dry place.

To prevent gaskets from getting brittle, keep them in a cool and dry room, protected from dust and light.

Drain the lubricating oil and fill gear chamber with corrosion-preventing oil, e. g. SHELL Ensis Oil 30. Oil level must be up to middle of sight glass. Let separator run without bowl for approx. 10 minutes to make sure that all gear parts are coated with the corrosion-preventing oil. Then drain the oil. Oil upper end of spindle by hand and protect it with splash cover 411.

Check water shut-off devices for leakage. If necessary, remove connecting piping between faulty shut-off device and separator to avoid damage which may be caused by drip water.

Stop operating-water supply at the branch point of the water mains to prevent inrush of water into the separator, caused by unintended opening of the shut-off valve.

Before re-starting the separator, fill gear chamber with the lubricating oil specified on page 2/1. Oil level must be slightly above middle of sight glass. Then let the separator run without bowl for 10 minutes.

8.1 Removing the vertical gear parts

After dismantling the upper bowl parts unscrew spindle nut (left-hand thread). Use jack 425 to remove bowl bottom from the spindle cone and to lift the whole assembly out of the frame.

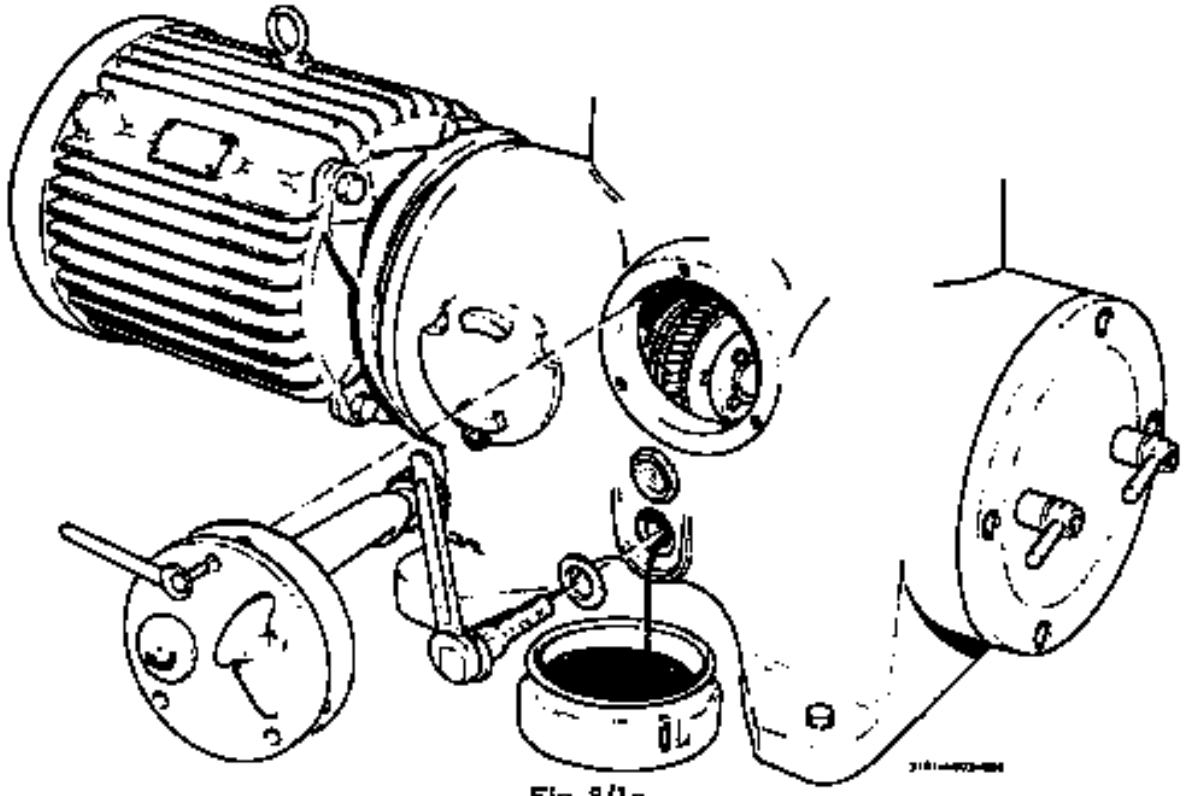


Fig. 8/1a

Undo oil drain screw and let oil drain into oil pan.

Unscrew hex head screws of revolution indicator housing.

Remove the housing.

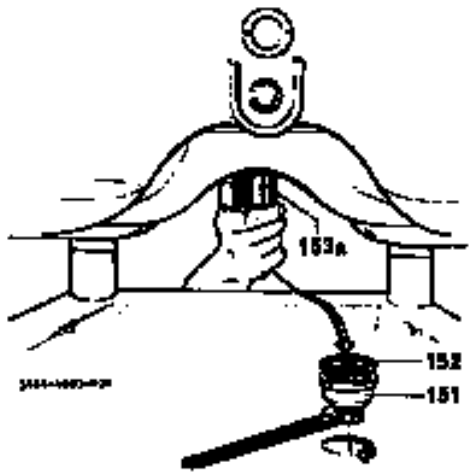


Fig. 8/1b

Unscrew bottom bearing cap 151 and remove gasket 152.

Unscrew bottom bearing threaded piece 153a and remove it together with the other parts of bottom bearing.

If bottom bearing housing 156 (fig. 16/1) has to be replaced, straighten tab washers 155 and unscrew hex head screws 154. Then take two hex head screws and screw them into two opposite tapholes of the housing. By doing this, the housing will come out of the lower section of the frame.

Undo hex head screws 160 and remove operating-liquid feed 161 and spindle cap 158m.

Unscrew hex head screws 159r of neck bearing (be sure not to lose gaskets 159n and washers 159p).

Remove neck bearing protection cap 159m and spindle spring 158k.

Screw spindle nut 257 on worm spindle, by hand.
Then pull out worm spindle together with neck bearing bridge.
IMPORTANT: Be sure not to damage gaskets 159a and 159k; if necessary, install new gaskets.

Separate neck bearing bridge from worm spindle by turning spindle upside down and tapping it on a wooden surface. See fig. 8/2b.

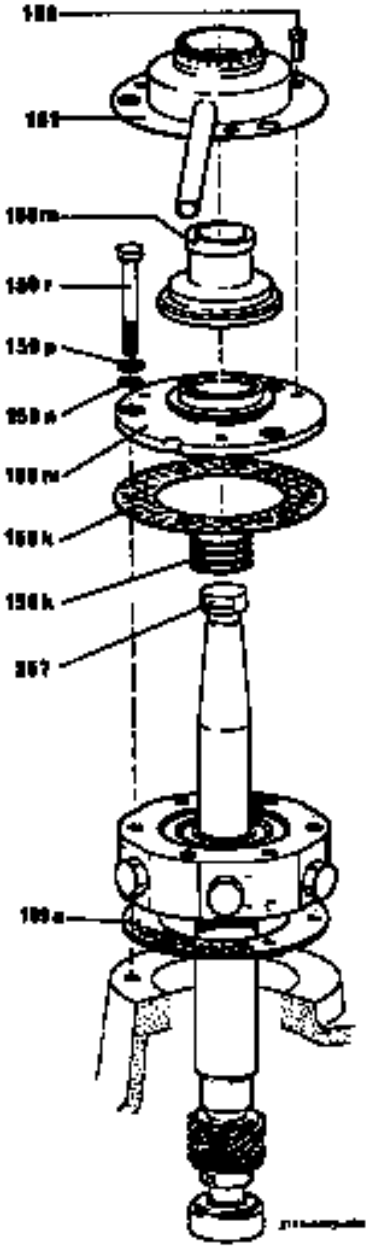


Fig. 8/2a

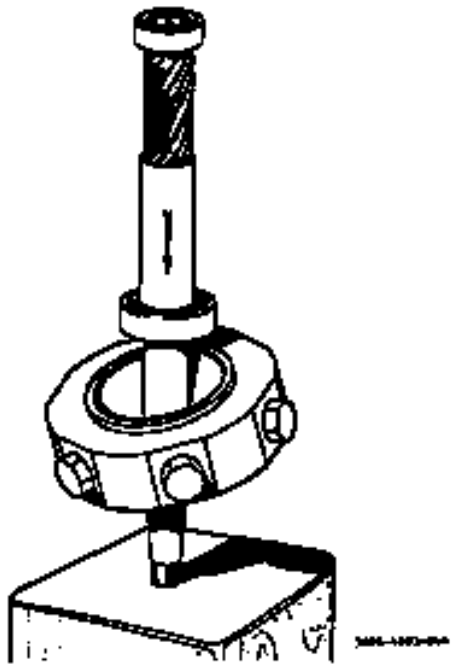


Fig. 8/2b

8.2 Assembling the vertical gear parts

When assembling the vertical gear parts proceed in reverse order of removal (see 8.1) and according to the instructions given below (see 8.2.1 - 8.2.3).

8.2.1 Important hints

- Before assembling clean gear chamber thoroughly (see 7.3).
- For reasons of safety, replace ball bearings on worm wheel shaft and on worm spindle every 5,000 operating hours.
- Check ball bearings of worm spindle before re-fitting.
  IMPORTANT: Only the high precision ball bearings listed in this manual may be used.
- Heat ball bearings as well as ball bearing protection rings in approx. 80 °C oil, before fitting them on the spindle.
- It must be possible to install the worm spindle, with ball bearings attached, without having to hit on the upper spindle end, and to move the built-in spindle axially by hand. If this is not the case, smooth the inside of the bottom bearing housing with a very fine emery cloth.
- When replacing the worm spindle 158c, the worm wheel assembly with clamp plates, 208, should be replaced at the same time, since this part, also worn down to some extent, would cause premature wear to the new worm.
- When installing the neck bearing bridge assembly 159b-g, check to be sure that gaskets 159a and 159k are in good condition.
- IMPORTANT: After re-assembly of the vertical gear parts, check bowl height for possible re-adjustment (see 8.3).

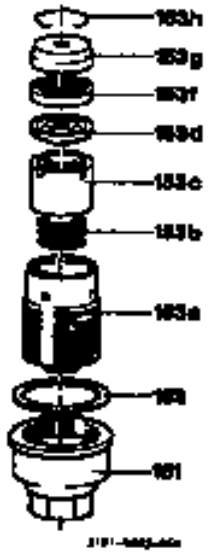


Fig. 8/3

8.2.2 Assembling the bottom bearing

Thoroughly clean all constituent parts of bottom bearing 153a-h.

Fit pressure spring 153b into bottom bearing pressure piece 153c.

Put bottom bearing pressure piece with inserted pressure spring into bottom bearing threaded piece 153a.

Put set of bottom bearing running parts into bottom bearing threaded piece:

Bottom bearing pressure disc 153d,
Ball cage 153f,
Bottom bearing running disc 153g.

Insert snap ring 153h in bottom bearing threaded piece.

8.2.3 Assembling the neck bearing bridge

The upper ball bearing of the worm spindle is contained in pressure ring 159g which is held by six radially arranged, evenly distributed springs 159d.

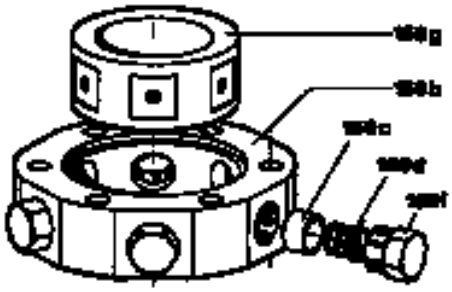


Fig. 8/4a

Insert pressure ring in neck bearing bridge 159b in such a manner that the six recesses of the pressure ring face the six tapholes of the neck bearing bridge.

Grease spring pistons 159c thoroughly, put neck bearing springs 159d into spring pistons and slip threaded plugs 159f on spring pistons.

Screw threaded plugs with spring pistons and neck bearing springs into tapholes of neck bearing bridge and tighten them.

8.2.4 Assembling the neck bearing bridge (gas-tight design)

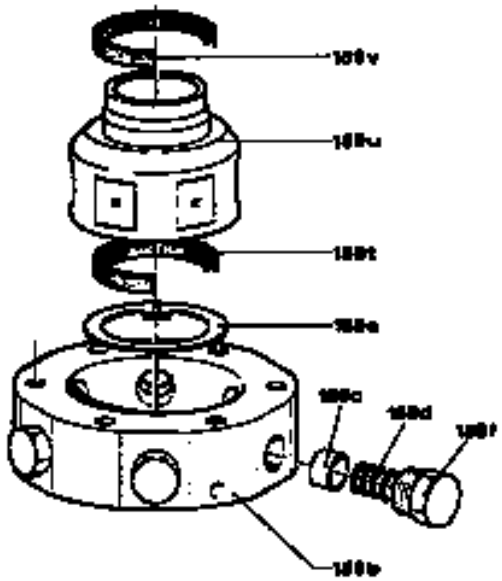


Fig. 8/4b

The neck bearing bridge of gas-tight design is to be assembled in the same manner as described before (see 8.2.3.), except that before assembly, sealing ring 159t has to be fitted into and sealing ring 159v onto pressure ring 159u. The sealing lips of the sealing rings must point downwards. Secure the lower sealing ring with ring 159a.

8.3 Bowl height

8.3.1 Checking the bowl height

The bowl height has been adjusted at the factory prior to shipment of the separator. It must be checked for possible re-adjustment before the first start of the separator, after re-assembling the vertical gear parts as well as after exchanging the bowl or the sealing cone.

Prerequisite to correct bowl height adjustment is that

- the bowl is properly closed (the "O" marks on bowl lock ring and on bowl bottom must be in line with each other),
- the hood is properly seated on the sediment collector and the clamps are tightened securely,
- discharge 75a is placed on, but not yet fastened,
- discharge pump 274a-b has been screwed on firmly with the aid of wrench 431.

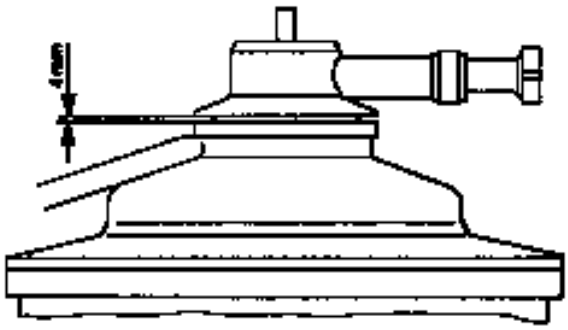


Fig. 8/5

The bowl height is correct when the discharge can be raised so far that there is a distance of about 4 mm between upper rim of hood and contact surface of discharge (see fig. 8/5). In that case fasten discharge with clamp ring.

If the distance does not conform to this measurement, the bowl has to be re-adjusted to proper height (see 8.3.2).

8.3.2 Re-adjusting the bowl height

For re-adjustment of the bowl height proceed as follows:

Unscrew bottom bearing cap 151 (fig. 16/1). Adjust bowl height by turning bottom bearing threaded piece 153. A full turn of the bottom bearing threaded piece to the Right or to the Left raises or lowers the bowl by 2 mm.

If the clearance shown in fig. 8/5 is greater than 4 mm, the bowl is too high. Lower the bowl by turning the bottom bearing threaded piece in counter-clockwise direction.

If the clearance shown in fig. 8/5 is less than 4 mm, the bowl is too low. Raise the bowl by turning the bottom bearing threaded piece in clockwise direction.

ATTENTION: Under no circumstances should the bowl be placed so high that the upper ball bearing is exposed to axial stress since this would result in uneven running of the separator and in premature wear of the ball bearing. It is, therefore, recommended that, upon adjustment, the bottom bearing threaded piece be turned counter-clockwise by half a turn to lower the bowl by 1 mm. By this means, axial stress on the upper ball bearing will be eliminated.

After adjusting to proper bowl height, replace bottom bearing cap with gasket and tighten it firmly.

8.4 The Centrifugal Clutch

8.4.1 General

The centrifugal clutch **gradually** brings the bowl up to its rated speed, eliminating premature wear on gear parts and motor. The acceleration time can be controlled by the number of clutch shoes used.

When fewer clutch shoes are used, the friction moment will be lower, the starting time longer, and wear on gear parts and motor less. 2 or 3 or 4 or 6 clutch shoes must be used, depending on the motor power to be transmitted.
The clutch shoes are to be fitted - **evenly distributed** - into the clutch driver (see 8.4.3).
Note that the driving effect of new clutch shoes will improve after several starts.

Smoking of the clutch during the first few starts is quite normal and will disappear after a short time of operation.

If the bowl comes up to rated speed as per name-plate of separator in less than 4 minutes, the motor will pull too high a starting current. This condition can be easily overcome by reducing the number of clutch shoes to 4 or 3 or 2. Be sure to keep the shoes evenly distributed (fig. 8/7a).

Check condition of clutch shoes from time to time. Make sure to replace the clutch shoes before their linings are worn down to the rivet heads, to avoid damage to the contact surface of the ring of the clutch drum. Such damage would result in premature wear of the clutch shoe linings. To avoid unbalance, all the clutch shoes have to be replaced as soon as one of their linings is worn. Never replace clutch shoes separately.

8.4.2 Removing the clutch shoes

Remove triangular screw 6 and cover 9.

Use socket wrench 401 (width 17) to loosen screw 201a.

Push clutch cover 201b towards motor side.

Pull out clutch shoes 201d towards motor side.

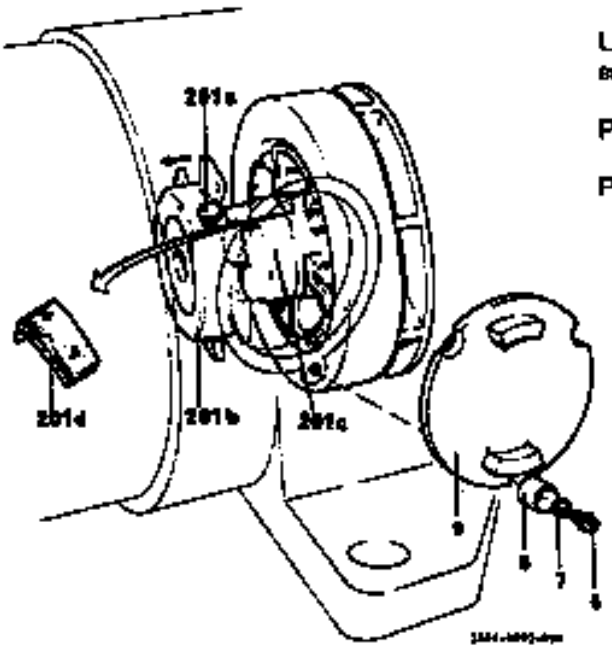


Fig. 8/6

8.A.3 Fitting the clutch shoes

Fig. 8/7a
Clutch driver with clutch shoes (seen from motor side)

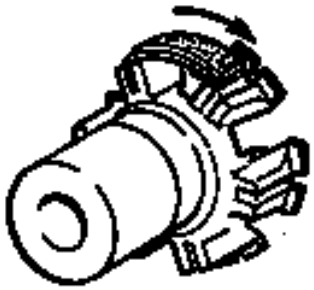


Fig. 8/7b
Clutch driver with one clutch shoe

Fig. 8/7c
Clutch shoe

Put clutch shoes 201d (two or three, four or six shoes) – evenly distributed – in slits of clutch driver 201c in such a manner that they will be pushed by the driver and not pulled. See figs. 8/7a–c. Make sure the shoes fit loosely in the slits of the clutch driver.

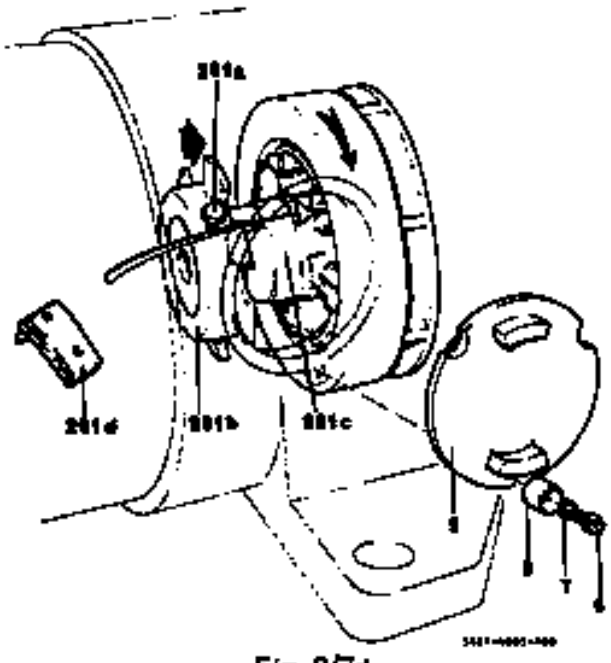


Fig. 8/7d

Push clutch cover 201b forward until it rests on the centering rim of clutch driver 201c and not before it.

Tighten hex head screw 201a in clutch cover, using socket wrench 401 (width 17).

Screw cover 9 into lower section of frame and arrest it by means of screw 6, cap 8 and lock washer 7.

In case the clutch emits disturbing noises during the acceleration period, apply a very thin coat of molybdenum disulfide paste to lips "e" of the clutch shoes (fig. 8/7c). If too much paste is applied, there is the chance that some might be thrown by centrifugal force on the friction surfaces, leading to clutch slippage.

8.5 Removing the horizontal gear parts

8.5.1 Removing the motor

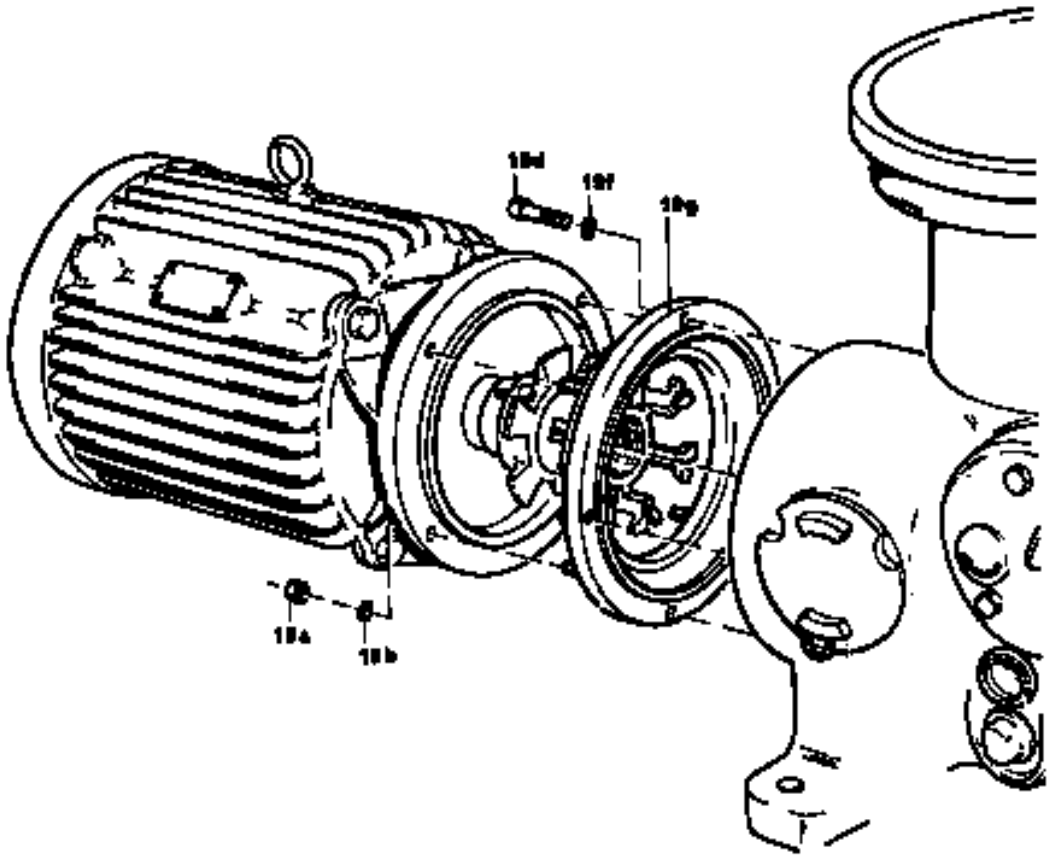


Fig. 8/8

Remove lead-in wires from motor terminals.

Take out clutch shoes (see 8.4.2).

Remove hexagon nuts 19a from motor flange and take off lock washers 19b.

Remove motor together with clutch driver 201c.

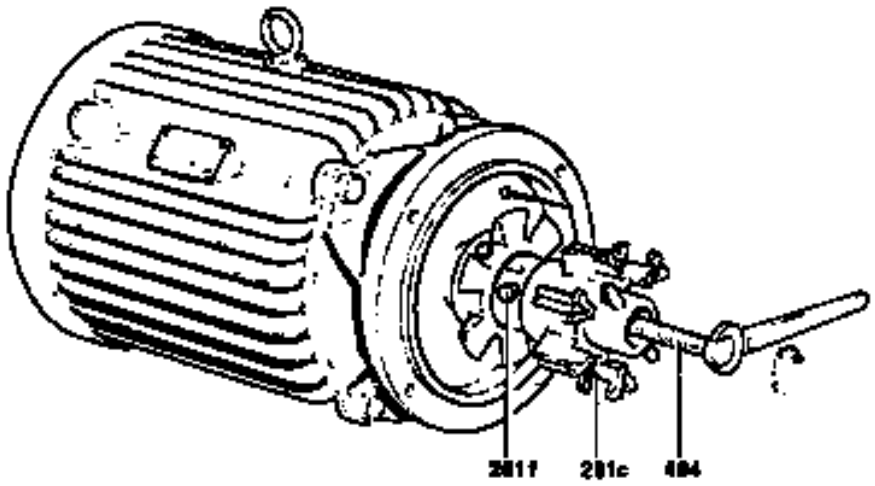


Fig. 8/9a

Use wrench 402 to loosen hex head screw 201f in clutch driver.

By means of pulling device 404 remove clutch driver from motor shaft end.

8.5.2 Removing the centrifugal clutch

Remove the motor (see 8.5.1).

Unscrew hex head screws 19d and remove flange 19g (see fig. 8/8).

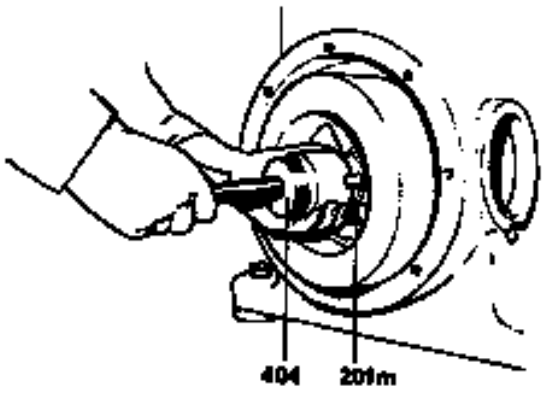


Fig. 8/9b

Loosen hex head screw 201m which is found in the hub of clutch drum 201h.

Use pulling device 404 to withdraw clutch drum from worm wheel shaft end, on motor side. Then remove clutch drum by hand.

8.5.3 Removing the worm wheel shaft and the worm wheel

Remove motor (see 8.5.1).

Remove flange (see fig. 8/8).

Loosen oil drain screw and let oil drain into oil pan (fig. 8/1a).

Remove revolution indicator housing (fig. 8/1a).

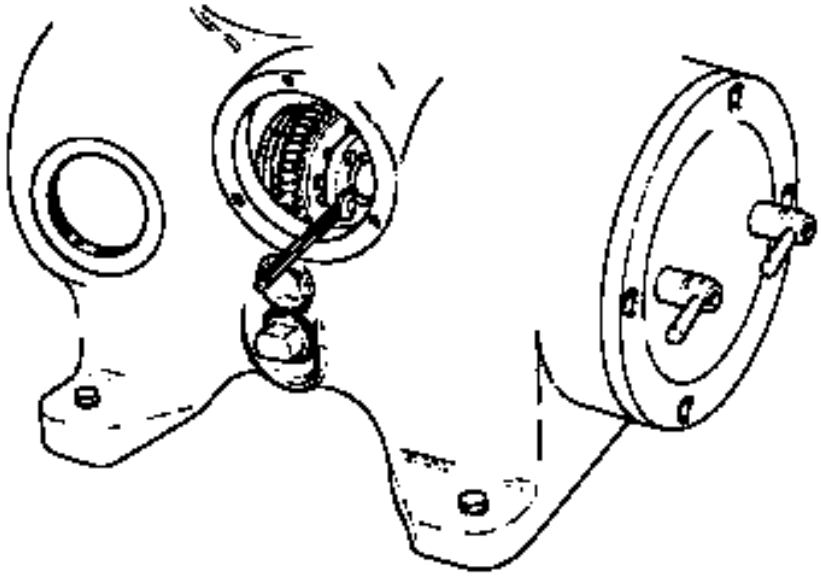


Fig. 8/10a

Loosen hex head screws 208h in clamp plates of worm wheel. While doing so, hold clutch drum to prevent worm wheel shaft from rotating.

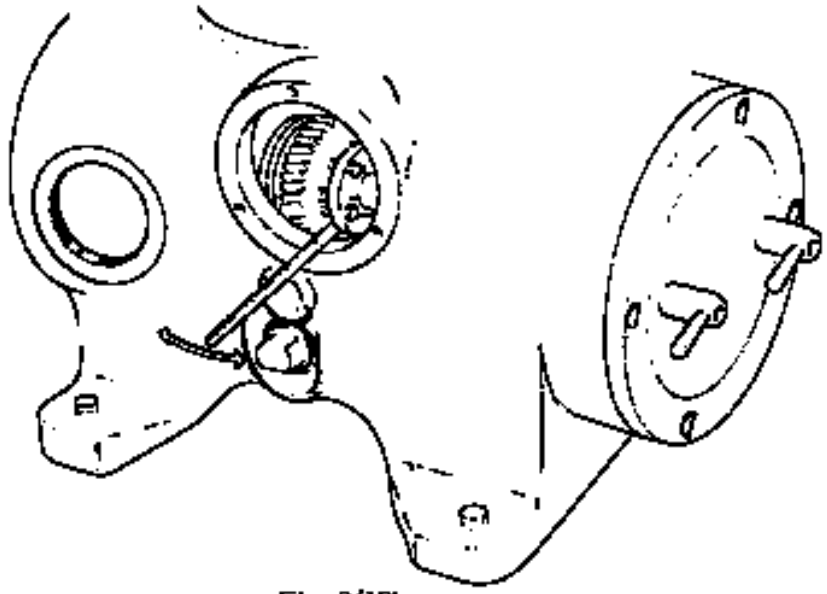


Fig. 8/10b

Loosen clamp plates 208a and 208g so that worm wheel can be moved on worm wheel shaft.

Loosen hex head screw 201m in hub of clutch drum.

Use pulling device 404 to withdraw clutch drum 201h from worm wheel shaft end, on motor side. Then remove clutch drum by hand (fig. 8/9b).

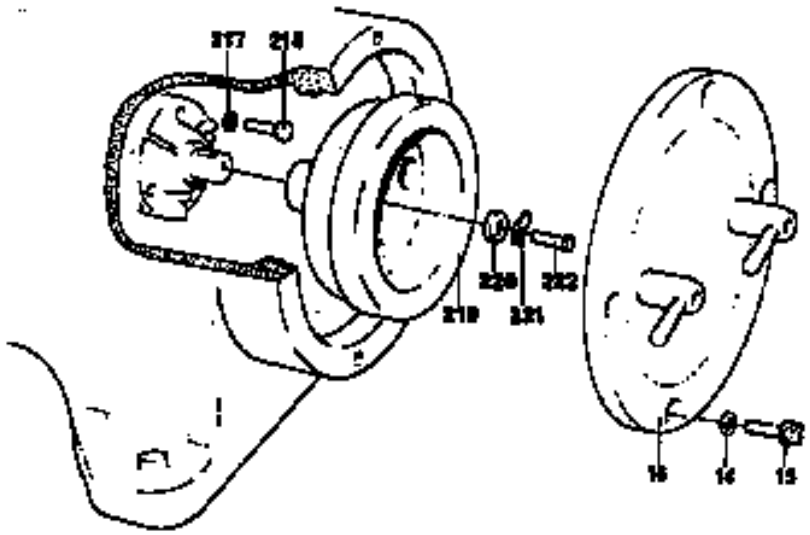


Fig. 8/11a

Undo triangular screws 15 and remove cover 16.

Undo hex head screw 222 and remove lock washer 221 and centering disc 220.

Remove brake drum 219 by hand.

Use socket wrench to unscrew hex head screws 218 holding the bearing cover.

Remove key 209 from shaft end (fig. 8/11b).

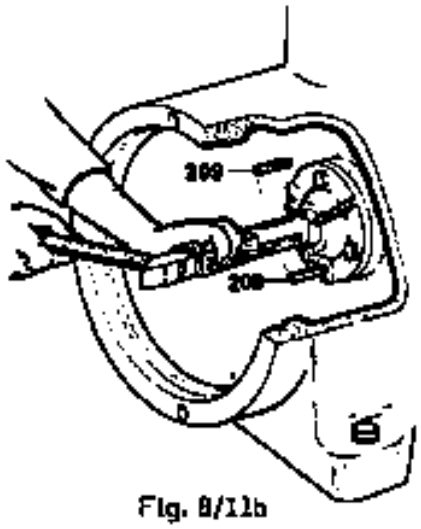


Fig. 8/11b

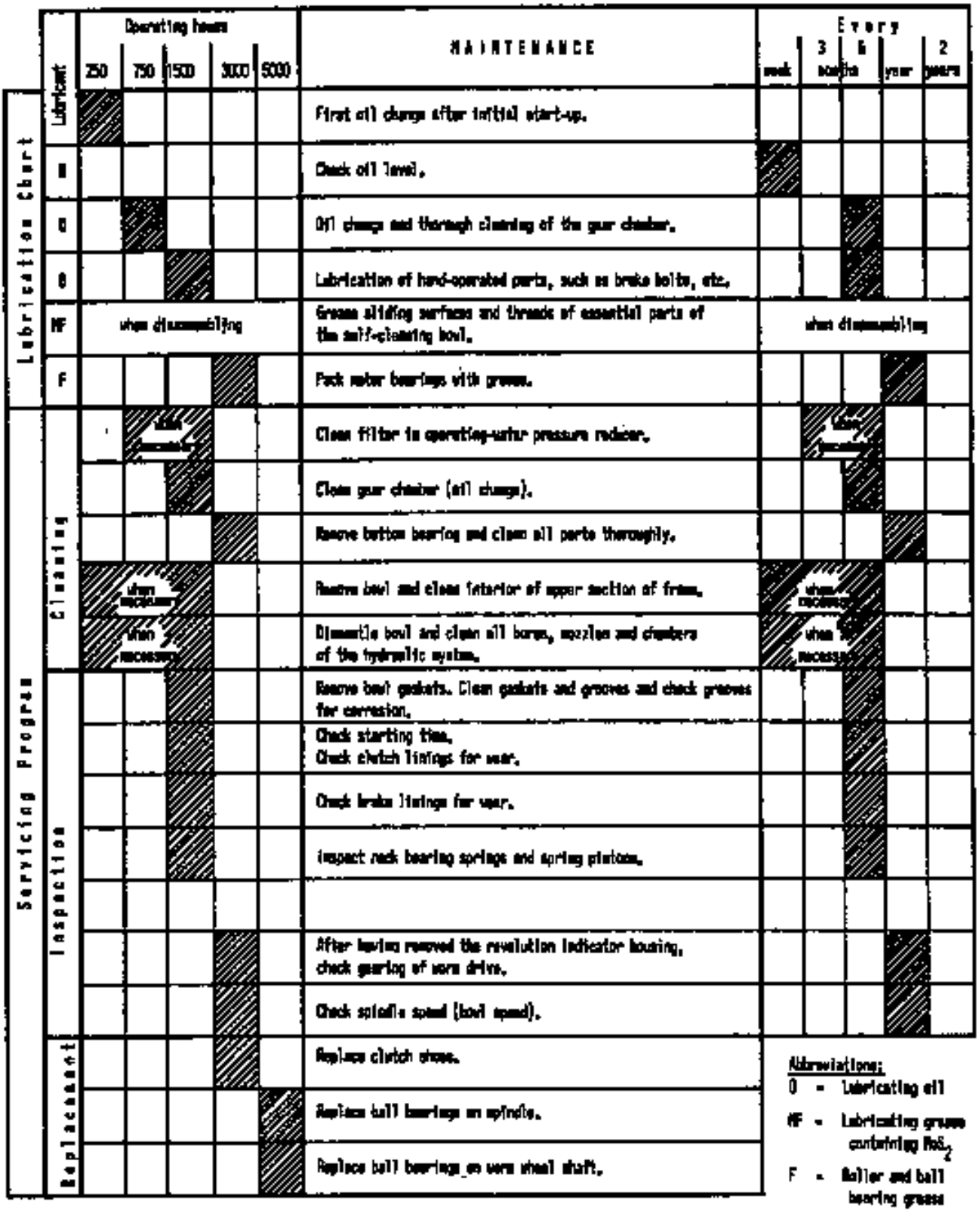
Place a piece of hard wood against worm wheel shaft end and hit it with a hammer to drive out shaft towards brake side.
When shaft has completely loosened from ball bearing on motor side, remove shaft by hand. While doing so, hold worm wheel to prevent damage to gear teeth.

Take worm wheel assembly with clamp plates out of the gear chamber.

8.6 Assembling the horizontal gear parts

For assembly proceed in reverse order of removal (see sect. 8.5). The following should be kept in mind:

- For reasons of safety, replace ball bearings of worm wheel shaft and of worm spindle every 5,000 operating hours.
- The worm wheel with clamp plates, 208, has been balanced in the factory as a complete assembly. To avoid unbalance, clamp plates 208a and 208g must, therefore, not be rotated on the wheelbody 208d, and parts 208a-d and 208g must not be replaced individually.
- When mounting the worm wheel assembly with clamp plates push the worm wheel towards brake side until it rests against shoulder of worm wheel shaft 210. This ensures correct positioning of the toothed rim with reference to the worm spindle.
- The worm wheel must be firmly clamped to the worm wheel shaft, accomplished by tightening screws 208h in both clamp plates. Tighten screws crosswise, by single turns, to make sure clamp plates are drawn together evenly.
- IMPORTANT: When toothed rim 208c is worn and needs replacement, the entire worm wheel assembly with clamp plates, 208, must be replaced. It is recommended that worm 158c be replaced at the same time, since this part, also worn down to some extent, would cause premature wear to the new toothed rim.
- After mounting new gear parts, install the bowl and adjust to correct height (see 8.3).
- Fill gear chamber with oil as specified in sect. 2. Oil level must be slightly above middle of sight glass.
- Check spindle speed with a hand tachometer (see 3.5) and check direction of rotation of the bowl (see 3.4).
- To run in new gear parts (worm wheel, worm), let separator run - without bowl - for about one hour. During this time, switch motor on and off several times.


Lubrication Chart
Servicing Program
Lubricant
Operating hours
250
750
1500
3000
5000
MAINTENANCE
Every
week
3 months
6 months
year
2 years
Cleaning
Inspection
Replacement
O
MF
F
when disassembling
First oil change after initial start-up.
Check oil level.
Oil change and thorough cleaning of the gear chamber.
Lubrication of hand-operated parts, such as brake bolts, etc.
Grease sliding surfaces and threads of essential parts of the self-cleaning bowl.
Pack motor bearings with grease.
Clean filter in operating-water pressure reducer.
Clean gear chamber (oil change).
Remove bottom bearing and clean all parts thoroughly.
Remove bowl and clean interior of upper section of frame.
Dismantle bowl and clean all bores, nozzles and chambers of the hydraulic system.
when necessary
Remove bowl gaskets. Clean gaskets and grooves and check grooves for corrosion.
Check starting time.
Check clutch linings for wear.
Check brake linings for wear.
Inspect rack bearing springs and spring pistons.
After having removed the revolution indicator housing, check gearing of worm drive.
Check spindle speed (bowl speed).
Replace clutch shoes.
Replace ball bearings on spindle.
Replace ball bearings on worm wheel shaft.
Abbreviations:
O = Lubricating oil
MF = Lubricating grease containing MoS2
F = Roller and ball bearing grease

10 Trouble Shooting

10.1 General

Troubles	Causes	Remedies
10.1.1 The bowl does not come up to rated speed or takes too long to do so (see 3.5).	Brakes are on.	Release brakes by turning handles clockwise.
	Motor is incorrectly connected.	See wiring diagram.
	Friction surfaces of clutch shoes are oily.	Wipe friction surfaces dry. Do not use benzine, nor trichlorethylene, nor any other solvent.
	Linings of clutch shoes are worn.	Replace clutch shoes (see 8.4.2 and 8.4.3).
	Insufficient number of clutch shoes.	Add one or two clutch shoes (see 8.4.1 and 8.4.3).
	Bowl is too high or too low and, therefore, rubs on feed and discharge pump.	Adjust to proper bowl height (see 8.3).
	Liquid or sludge has collected in the sediment collector, resulting in slowing-down of the bowl.	Check operating-water discharge: liquid must be able to flow out freely (see sect. 1). Clean sediment collector underneath the bowl.
	Clamp plates are not tight enough; worm wheel slips on shaft.	Tighten long hex head screws on worm wheel evenly and firmly. Tighten crosswise, by single turns, with a torque of 45 Nm.
	Product feed valve is open.	Close product feed valve.
10.1.2 The bowl speed drops during operation.	Friction surfaces of clutch shoes are oily.	Wipe friction surfaces dry. Do not use benzine, nor trichlorethylene, nor any other solvent.
	Motor speed drops during operation.	Inspect motor and line voltage.
10.1.3 The bowl comes up to rated speed too quickly (in less than 4 minutes). Motor pulls too high a starting current.	Too many clutch shoes are used.	Reduce number of clutch shoes to four or threeor two.
	Note that the driving effect of new clutch shoes will improve after several starts.	Make sure shoes are equally distributed (see 8.4.1 and 8.4.3).

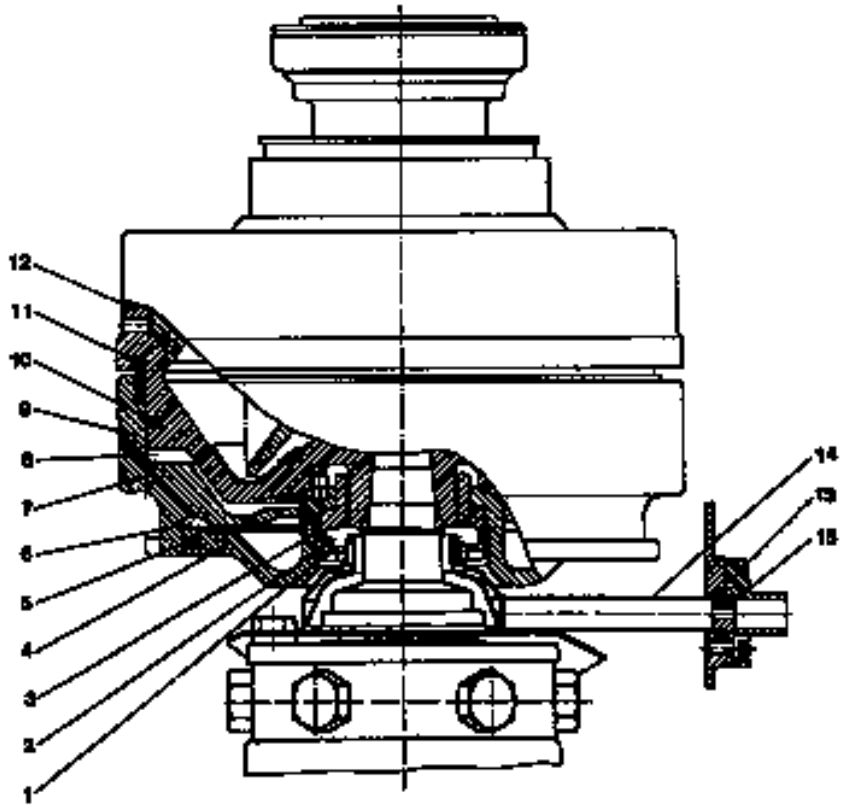
Troubles	Causes	Remedies
10.1.4 Uneven run of the separator.	Separated solids have deposited unevenly in the bowl (see also 10.2.5).	Stop separator and apply the brakes. Close product feed valve. Do not de-sludge the bowl, since de-sludging would increase vibrations occurring during slowing-down of the bowl. If the bowl leaks, open water feed valve all the way. Clean the bowl (see 7.1).
	Sediment of very solid structure has hardened as a result of too long a retention time in the bowl.	Perform total de-sludgings at shorter intervals, - if necessary with subsequent flush de-sludgings.
	Bowl is not properly assembled or, if plant has several separators, parts of different bowls may have been interchanged.	Assemble bowl properly (see 4.1).
	Tension of disc stack has slackened.	Make sure bowl lock ring is screwed on tightly (see page 4/6). Check disc count. If necessary, add spare disc or compensating disc.
	Bowl is damaged and, therefore, out of balance.	Send bowl to factory or authorized factory repair shop. Do not attempt to make your own repairs. Never weld or solder. Bowl is made of heat-treated steels.
	Neck bearing springs are weak or broken.	Replace all 6 neck bearing springs.
	Pressure spring in bottom bearing is broken. Bowl is found to be about 2 mm too low in the frame.	Install new pressure spring (see 8.2.2). Adjust to proper bowl height (see sect. 8.3).
	Ball bearings are worn.	Replace damaged bearings. IMPORTANT: When replacing, use only the high precision ball bearings as specified in the Parts List.

Troubles	Causes	Remedies
10.1.4 Uneven run of the separator (cont'd.)	Gear parts are in bad condition as a result of	Clean gear chamber thoroughly (see 7.3).
	1. normal wear,	Replace demaged gear parts (see 8.2 and 8.6).
	2. premature wear caused by:	
	a) lack of oil b) oil of too low a viscosity, (in general, recognized by blue tempering colour of gear parts)	Change oil (see chapt. 2). If necessary, change oil more often.
	c) metal abrasives present in the lubricating oil due to the following possible causes:	
	viscosity of oil is too low,	
	oil has not been changed in time,	
	gear chamber has not been cleaned,	
	d) replacement of one gear part only, instead of both parts,	
	e) inrush of water because automatic valves for operating-water had been open for a longer period after shut-down of the separator.	Regarding inrush of water, the following should be kept in mind: Make sure manual shut-off valve ahead of the operating-water connection is always closed during shut-down of the separator.
10.1.5 Liquid discharges through overflow pipe of hood.	Lower seal 74 is damaged.	Replace the seal. Check sleeve on head piece for wear. If necessary, replace the sleeve (see 4.4). Check centering of feed and discharge system (see 4.2.1).

10.2 Bowl performance

Troubles	Causes	Remedies
10.2.1 The bowl does not close.	Orifices 3 in threaded ring and sealing chamber bottom - leading from injection chamber to sealing chamber - are clogged or the injection chamber is soiled.	Remove bowl bottom (see 4.3). Clean orifices and injection chamber.
	Orifice 7 in sliding piston, through which the opening water discharges, is clogged.	Remove sliding piston (see 4.3). Clean orifice. Be sure not to enlarge diameter of orifice (1.7 mm) while cleaning.
	Sludge has deposited at the periphery of the opening chamber. This prevents the piston from rising to its highest position and sealing off the centrifugation room.	Dismantle the bowl (see 4.3). Clean the opening chamber. If necessary, replace gasket 10. Check operating-water for impurities.
	Gasket 5 in sealing-chamber bottom is damaged or its edges have been frayed through the up- and down movement of the sliding piston.	Replace damaged gasket. If, however, only the edges of the gasket are frayed and the gasket is not damaged otherwise, it can be re-used after grinding off the edges with an emery wheel.
10.2.2 The bowl does not close properly.	Gasket 5 in sealing-chamber bottom or gasket 10 in bowl bottom does not seal properly.	Make sure gasket is stretched out enough. Before fitting in gaskets, lightly lubricate the groove in sealing-chamber bottom or, respectively, in bowl bottom (see 4.1.1, No. 2).
	Gasket 11 in bowl bottom is damaged.	Replace gasket.
	Sealing edge of sliding piston is damaged.	Re-turn sealing edge very lightly as soon as traces of erosion are to be seen. Be sure not to remove more than 2.5 mm of the material.
	Shut-off valve for operating water does not close properly.	Install a new shut-off valve.

Bowl and operating-water feed assembly
shown with regard to possible operating troubles
(refer to sect. 10.2)



1 Threaded ring
2 Injection chamber
3 Feed channel
4 Sealing-chamber bottom
5 Gasket in sealing-chamber bottom
6 Sealing chamber
7 Discharge nozzle
8 Opening chamber
9 Sliding piston
10 Gasket in bowl bottom
11 Polyamid gasket in bowl bottom
12 Bowl bottom
13 Gasket in operating-water line
14 Operating-water supply line
15 Orifice plate

Fig. 10/1

The operating-water pressure should be at least 2 bar and should not exceed 3 bar.

By means of pressure reducing valve adjust operating-water pressure to 2.5 bar (the solenoid valve being open).

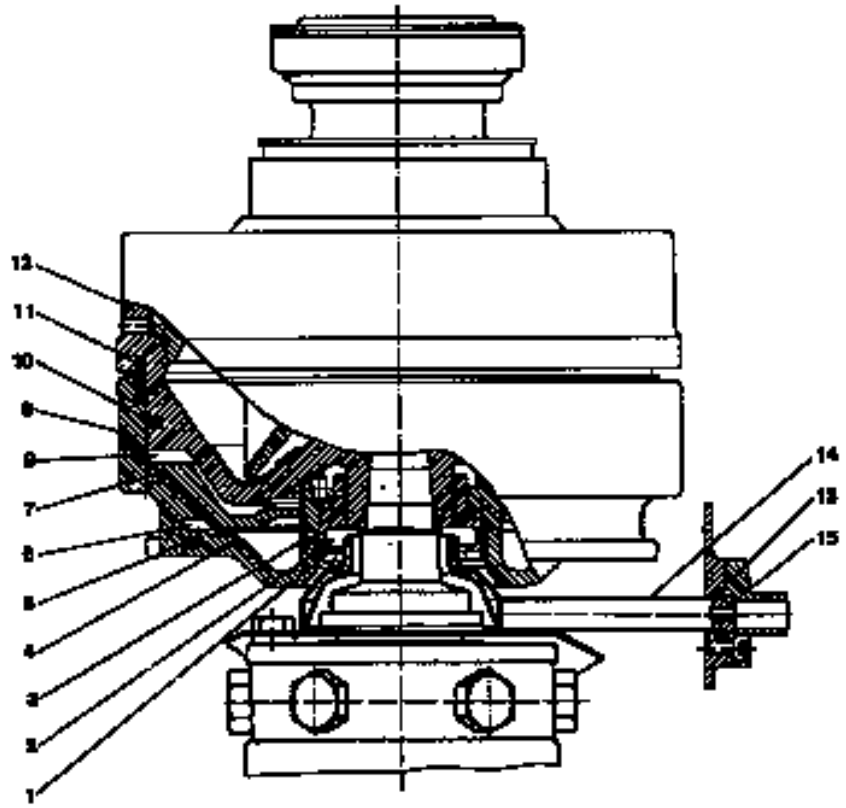
For partial de-sludgings be sure to maintain equal operating-water pressure.

Pressure fluctuations up to 0.2 bar are permissible.

I.D. of operating-water line:	1/2" when up to 3 m long 3/4" when longer than 3 m.
Required amount of operating-water	3.2 l/10 s at a pressure of 2.5 bar. In case of a pressure other than 2.5 bar the amount of operating-water can be controlled by using an orifice plate 15 with an adequate I.D.

Troubles	Causes	Remedies
10.2.3 The bowl does not open at all or not completely.	The operating-water pressure is too low or fluctuates too much due to tapping water for other purposes.	Check line pressure; if necessary, assemble operating-water line separately to avoid fluctuations of pressure.
	Strainer in water-pressure reducer of operating-water line is clogged.	Clean strainer.
	Gasket 13 in operating-water line is damaged. Part of the operating water seeps away.	Replace gasket.
	The inner diameter of the operating-water line has become too small due to dirt accumulation or damage.	Clean or replace operating-water line.
	Dry dirt or rubber particles have settled between bowl bottom and sliding piston or between sliding piston and sealing-chamber bottom.	Clean bowl parts. See 7.1. Round off edges on gaskets. Replace damaged gaskets. Grease contact surfaces.
	The sealing chamber is soiled.	Dismantle bowl (see 4.3) and clean sealing chamber.
10.2.4 Partial de-sludgings are irregular.	Operating-water pressure fluctuates.	Pressure fluctuations should not exceed 0.2 bar If necessary, install a separate operating-water line or install a tank (approx. 50 - 100 litres) with pressure-controlled pump. The operating-water pressure should range between 2 and 3 bar.
	Orifice plate 15 has not been installed.	Install orifice plate.
	The inner diameter of orifice plate 15 is too large for the existing operating-water pressure. Opening and closing of the bowl takes place so quickly that any small change in water pressure causes an irregularity in partial de-sludging.	Solder up hole of orifice plate and drill in a new hole. I.D. of orifice plate should be dimensioned so as to ensure perfect partial de-sludgings and to allow, in addition, quick and efficient complete de-sludgings. A partial de-sludging will then take 1 - 2 seconds.

Bowl and operating-water feed assembly shown with regard to possible operating troubles (refer to sect. 10.2)



1 Threaded ring
2 Injection chamber
3 Feed channel
4 Sealing-chamber bottom
5 Gasket in sealing-chamber bottom
6 Sealing chamber
7 Discharge nozzle
8 Opening chamber
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15 Orifice plate

Fig. 10/1

The operating-water pressure should be at least 2 bar and should not exceed 3 bar.

By means of pressure reducing valve adjust operating-water pressure to 2.5 bar (the solenoid valve being open).

For partial de-sludgings be sure to maintain equal operating-water pressure.

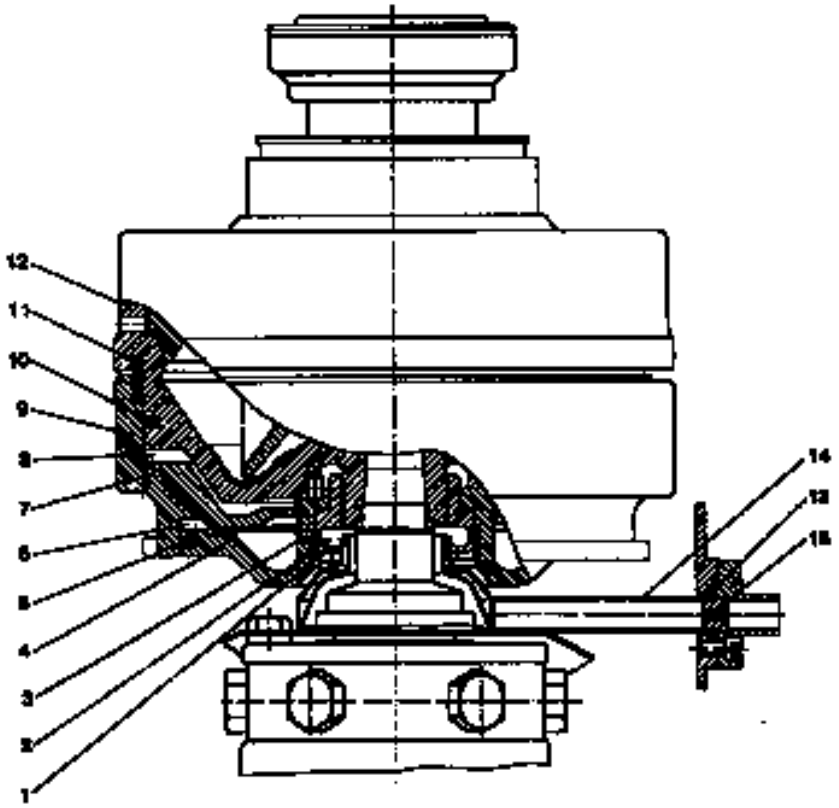
Pressure fluctuations up to 0.2 bar are permissible.

I.D. of operating-water line: 1/2" when up to 3 m long
3/4" when longer than 3 m.

Required amount of operating-water: 3.2 l/10 s at a pressure of 2.5 bar.
In case of a pressure other than 2.5 bar the amount of operating-water can be controlled by using an orifice plate 15 with an adequate I.D.

Troubles	Causes	Remedies
10.2.5 The bowl does not de-sludge completely.	The bowl has been closed too early. Solid particles which could not be ejected, have gradually accumulated and hardened through the long time of centrifugation.	Clean bowl thoroughly (see 7.1). Leave operating-water valve open for about 10 seconds. If necessary, finish up by flush-water de-sludging procedures (see 5.2).
	Discharge nozzle 7 in sliding piston, through which the water leaves the opening chamber, has become too large due to cleaning or erosion. The sliding piston moves down too slowly; part of the sludge remains in the bowl.	Reduce diameter of nozzle bore to 1.7 mm. This is done by drilling up the nozzle bore to 4 mm, then closing it by driving in a pin and boring it to proper diameter; or re-tap nozzle bore to size.
10.2.6 Gasket 11 in bowl bottom wears off too fast.	Bowl has been closed too early. Solids have become lodged between top of piston and gasket in bowl bottom.	Extend opening time of operating-water valve.
	The product contains abrasive solids.	Be sure to pre-strain product before feeding it to separator.
10.2.7 The bowl does not close or open properly after a long-term shut-down of the separator.	The bowl has not been cleaned thoroughly before the long-term shut-down of the separator. Scale has deposited between sealing-chamber bottom and sliding piston or between sliding piston and bowl bottom.	Before dismantling the bowl, dissolve the scale with citric acid. Then take bowl apart and clean the parts thoroughly. See 7.1.

Bowl and operating-water feed assembly
shown with regard to possible operating troubles
(refer to sect. 10.2)



1 Threaded ring
2 Injection chamber
3 Feed channel
4 Sealing-chamber bottom
5 Gasket in sealing-chamber bottom
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Fig. 10/1

The operating-water pressure should be at least 2 bar and should not exceed 3 bar.

By means of pressure reducing valve adjust operating-water pressure to 2.5 bar (the solenoid valve being open).

For partial de-sludgings be sure to maintain equal operating-water pressure.

Pressure fluctuations up to 0.2 bar are permissible.

I.D. of operating-water line: 1/2" when up to 3 m long
3/4" when longer than 3 m.

Required amount of operating-water: 3.2 l/10 s at a pressure of 2.5 bar.
In case of a pressure other than 2.5 bar the amount of operating-water can be controlled by using an orifice plate 15 with an adequate I.D.

IMPORTANT!

When ordering parts, please state the following:

1) Model 2) Serial-No.	of the Separator:
	Both designations are shown on the name-plate of the separator. The Serial-No. also appears on the rim of the sediment collector.
3) Description 4) Part-No.	of the part to be replaced:
	For details refer to List of Parts. The Part-No. is also shown on all major parts.
5) Bowl Serial-No.	(only required when ordering bowl parts):
	The Bowl Serial-No. appears, in large figures, on bowl lock ring and on bowl bottom.

Part-Numbers ending with letter "L" (e. g. 3158-1021-L) designate parts which are available in different designs for the separator concerned. To ensure correct delivery of these parts, Model and Serial-No. of the Separator MUST be stated.

No.in Fig.	Part - No.	Qty.		Part Description
-	3117-3495-000	1		Revolution indicator assembly (1a-h)
1a	3117-3497-010	1		Revolution indicator disc
1b	0026-1049-030	2		Cylindrical pin
1c	3117-3488-010	1		Shaft
1d	0007-2502-750	1		Gasket 12/3
1f	3117-3493-000	1		Housing
1g	0019-1741-800	1		Oil fill screw
1h	3117-3487-010	1		Worm wheel
2	0019-6935-400	3		Hex head screw DIN 933 - M 10x25
3	0004-5358-700	1		Gasket 165/202x1
4	0019-0840-030	1		Oil drain screw
5	0004-5037-710	1		Gasket 38/50x1.5
6	0019-8594-100	1		Triangular screw DIN 22424 - AM 10x15
7	0026-1337-190	1		Lock washer DIN 127 - A 10
8	0826-2280-300	1		Cap DIN 22423 - B26
9	3037-1079-000	1		Cover
10	0001-0006-640	1		Sight glass
11	0004-5034-760	1		Gasket 35/44x1.5
-	3036-1020-060	1		Foundation frame assembly (13a-f)
13a	3036-1003-020	1		Foundation frame
13b	0021-3150-750	4		Rubber cushion
13c	0026-2126-400	4		Cap
13d	0026-1353-400	4		Washer
13f	0019-6608-400	4		Hex head screw DIN 931 - M 16x60
14	0026-1328-190	4		Lock washer DIN 127 - A 12
15	0019-8621-100	4		Triangular screw DIN 22424 - AM 12x40 - 5.6
16	3163-1066-010	1		Cover
17	0019-5050-060	2		Threaded pin DIN 553 - M 8x10 - 5.8
-	1073-1043-020	2		Brake assembly (18a-g)
18a	0021-3515-690	2		Handle
18b	0004-1872-720	2		Gasket 13/25x2
18c	0021-3544-640	2		Brake housing
18d	0006-4337-160	2		Cylindrical pressure spring
18f	1073-1031-020	2		Brake bolt, complete
18g	0021-4100-680	2	*	Brake lining
-	0026-1263-550	4	*	Countersunk rivet DIN 661 - 4x15
-	3036-1021-L	1		Flange assembly (19a-g)
19a	0013-0280-400	4		Hexagon nut DIN 934 - M 12
19b	0026-1328-190	4		Lock washer DIN 127 - A12
19c	0019-7669-090	4		Stud DIN 939 - M 12x40
19d	0019-6972-400	4		Hex head screw DIN 933 - M 12x40
19f	0026-1328-190	4		Lock washer DIN 127 - A12
19g	3036-1028-L	1		Flange
20	3163-1001-020	1		Lower section of frame
21	0019-6968-300	2		Hex head screw DIN 933 - M 12x25
22	3036-1045-000	1		Frame drain
23	0004-5457-740	1		Gasket 52/60x122x1

* This part is included in brake bolt, complete, 18f, but it is also available as seperate item.

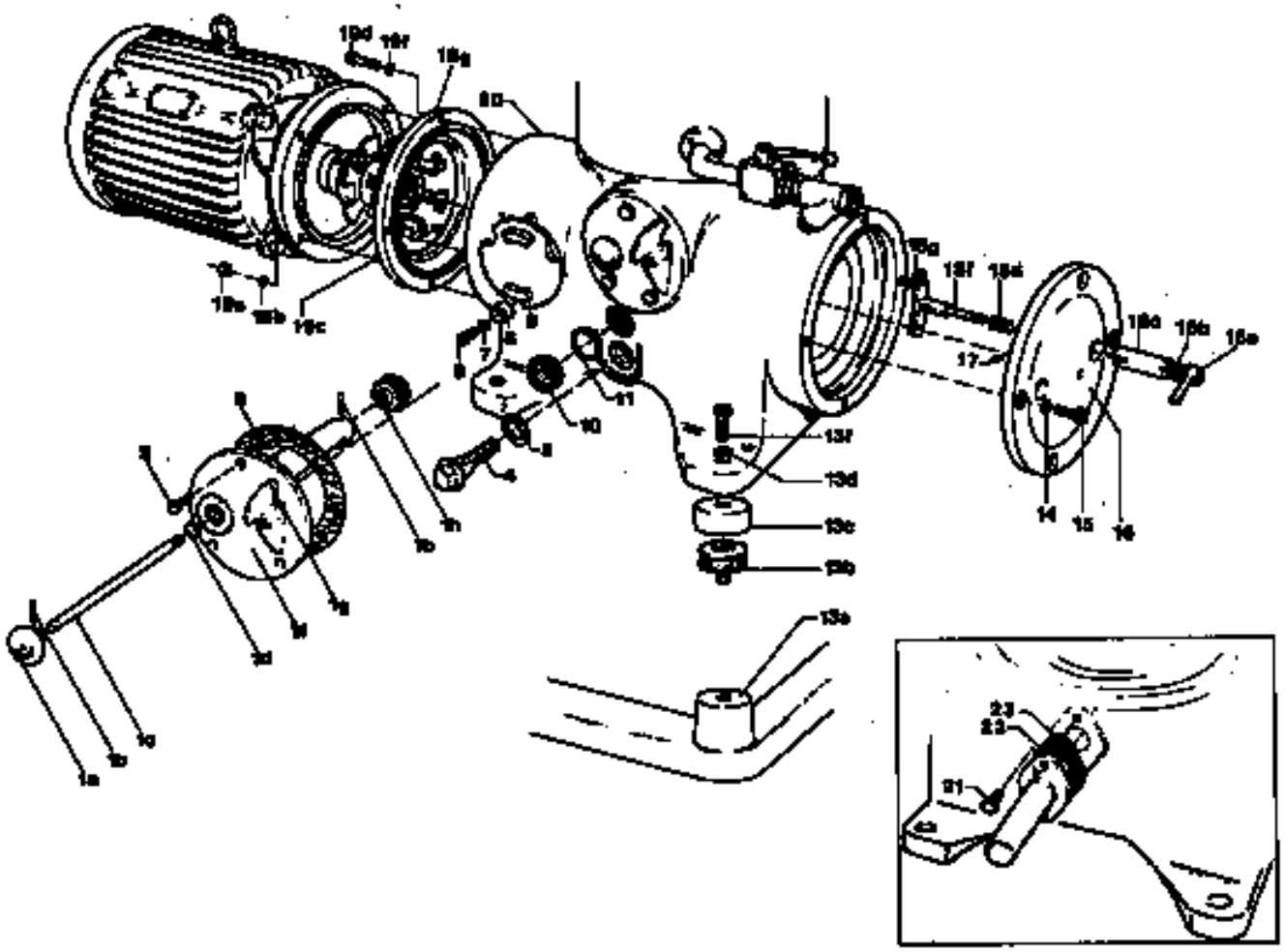
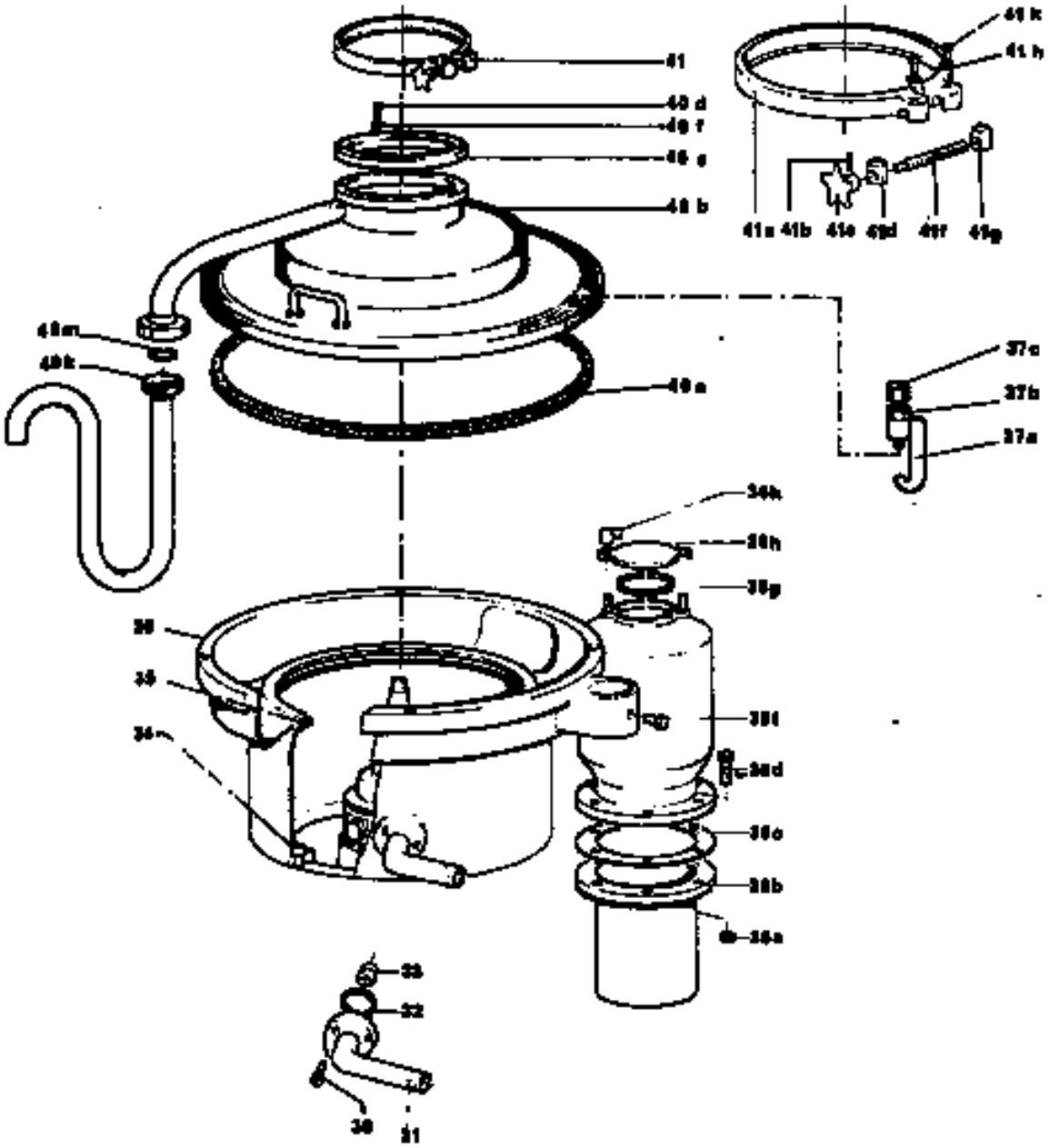


Fig. 13

No.in Fig.	Part - No.	Qty.		Part Description
30	0019-6120-400	3		Allen screw DIN 912 - M 8x15
31	3181-2184-000	1		Band
32	0007-2507-750	1		Gasket 16/3.5
33	3181-2021-000	1		Orifice plate
34	0019-6200-150	4		Allen screw DIN 912 - M 16x35 - 8.8
35	0007-2325-840	1		Gasket 397/416x9.8
36	3181-1018-010	1		Sediment collector
36a	0013-0279-400	6		Hexagon nut DIN 934 - M 10
36b	3145-2208-000	1		Pipe
36c	0004-5193-750	1		Gasket 159/210x2
36d	0019-6513-300	6		Hex head screw DIN 931 - M 10x45
36f	0019-6901-400	1		Hex head screw DIN 933 - M 8x16
36g	0007-2150-750	1		Gasket 94/110x8
36h	3145-1061-030	1		Inspection cover
36k	0013-2852-640	2		Cap nut M10
-	3159-1150-010	5		Clamp assembly (37a-c)
37a	3159-1153-010	5		Clamp
37b	0013-0282-400	5		Hexagon nut 934 - M16 DIN
37c	0019-0165-400	5		Hex head screw M 16x65
-	3177-7759-000	1		Hood assembly (40a-41k)
40a	0004-2361-750	1		Packing cord 6x6x1850
40b	3177-7765-000	1		Hood
40c	3048-7758-000	1		Adjusting ring
40d	0019-6105-400	6		Allen screw DIN 912 - M 6x12
40f	0026-1343-300	6		Washer
40k	3169-2775-000	1		Siphon
40m	0007-2208-750	1	*	Gasket DIN 11851 - G25
-	1033-7719-020	1		Clamp ring assembly (41a-k)
41a	1033-7718-010	1		Clamp ring
41b	0026-1075-400	1		Cylindrical pin
41c	1033-9833-000	1		Handle
41d	1033-7717-000	1		Threaded piece (left-hand thread)
41f	1033-1129-000	1		Threaded bolt
41g	1033-7717-010	1		Threaded piece (right-hand thread)
41h	0026-1343-300	2		Washer DIN 443 - 13
41k	0019-2507-400	2		Fillister head screw DIN 85 - M 6x10

* This part is included in the preceding "complete" part, but it is also available as separate item.


41
40 d
40 f
40 e
40 b
40 a
40 m
40 k
41 k
41 h
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41 b
41 c
41 d
41 f
41 g
37 c
37 b
37 a
34 k
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Fig. 14/1

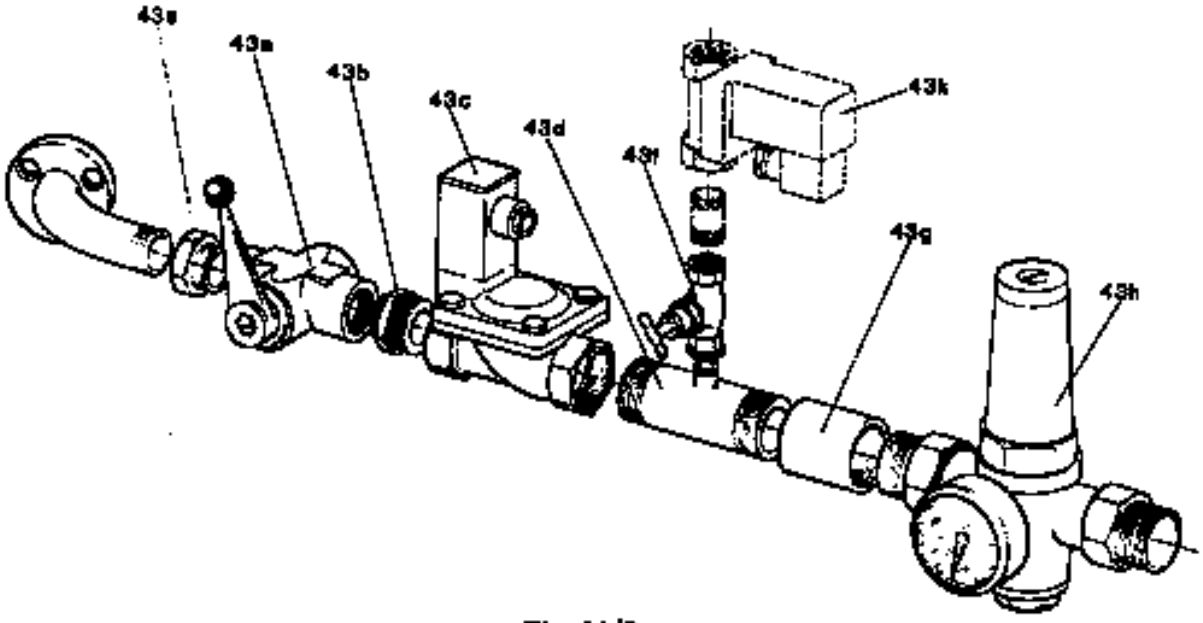

Fig. 14/2

No. in Fig.	Part - No.	Qty.		Part Description
-	8134-2120-020	1		Operating-water connection, complete (43a-h)
43a	0018-1763-630	1		Ball-type valve 3/4"
43b	0018-1778-300	1		Reducing nipple 1" - 3/4"
43c	0018-3712-600	1		Solenoid valve 1" (see also page 14/4)
43d	8134-2165-030	1		Connecting piece
43e	0018-0867-300	1		Reducing piece DIN 2990 - 3/4" x 1/2"
43f	0018-1310-640	1		Straight-way valve DIN 3512 - 1/4"
43f	0018-1312-640	1	**	Straight-way valve DIN 3512 - 1/2"
43g	0018-0762-410	1		Socket DIN 2986 - 1"
43h	0018-1741-000	1		Water pressure reducer, complete, 1" (see also page 14/5)
43k	0018-3710-600	1	**	Solenoid valve 1/2" (see also page 14/4)

** For automatic hood flushing only (on special order).

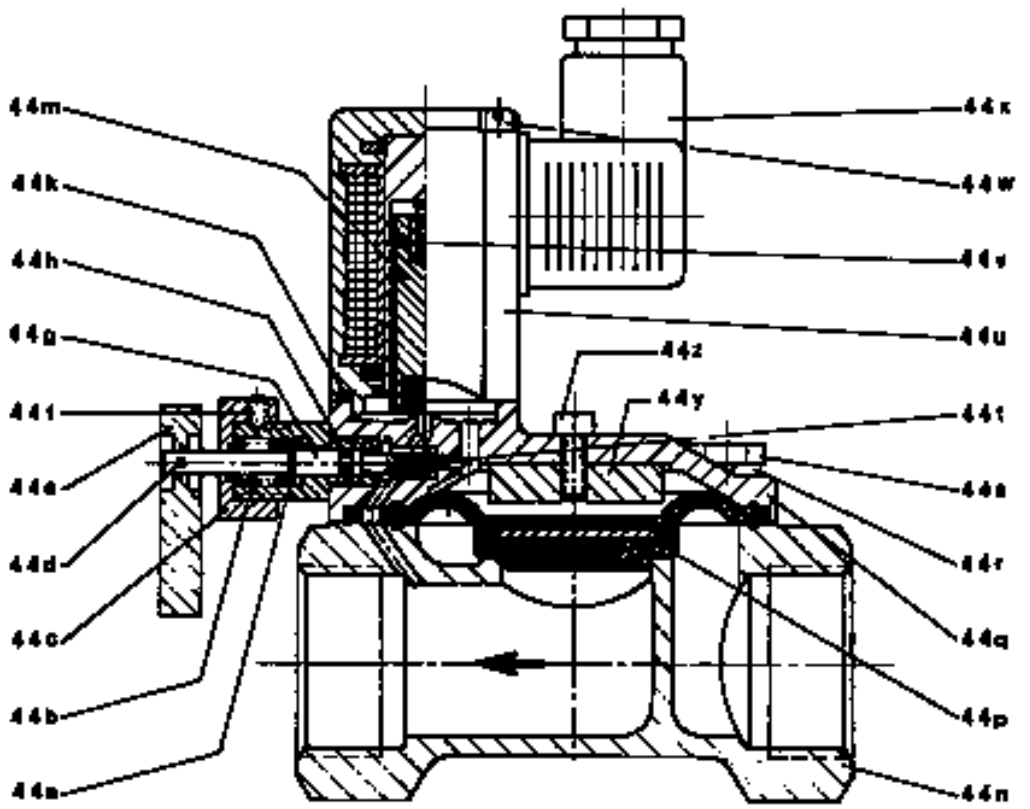

Fig. 14/3

No.in Fig.	Part - No. R 1" valve for operating water	Part - No. R 1/2" valve for hood flushing water	Qty.	Part Description
-	0018-3712-600	0018-3710-600	1	Solenoid valve assembly (44a-z)
44a	0018-3710-000	-	1	Ring 4W 2271
44b	0006-4084-170	-	1	Pressure spring
44c	0018-3710-010	-	1	Screw part 4W 2273
44d	0026-1557-300	-	1	Cylindrical notched pin 2x14
44e	0018-3710-020	-	1	Lever 4W 2274
44f	0019-3950-400	-	1	Threaded pin M4x4
44g	0018-3710-030	-	1	Valve spindle 4S 1316
44h	0007-1910-750	-	1	Gasket R4x1
44k	0007-1946-750	0007-1946-750	1	Gasket 25 x 1.5
44m	0018-3710-040	0018-3710-040	1	Solenoid core 4M 719
44n	0018-3712-080	0018-3710-080	1	Valve housing
44p	0018-3712-750	0018-3711-750	1	Diaphragm
44q	0018-3712-070	0018-3710-070	1	Valve housing cover
44r	0026-1389-620	-	6	Washer DIN 433 - 8.4
44r	-	0026-1322-170	6	Lock washer DIN 127 - A5
44s	0019-6903-400	-	6	Hex head screw DIN 933 - M8x20
44s	-	0019-6077-400	6	Fillister head screw DIN 84 - M4x55
44t	0018-3710-060	-	1	Plug 4D 612
44u	0018-3710-800	0018-3710-800	1	Solenoid head 220 Volts, 50/60 Hz
44v	0006-4079-160	0006-4079-160	1	Cylindrical pressure spring
44w	0019-2387-030	0019-2387-030	4	Fillister head screw DIN 84 - M4x55
44x	0018-3710-050	0018-3710-050	1	Coupler socket
44y	0018-3712-090	-	1	Limiting disc 30x6.5
44z	0019-6077-400	-	1	Allen screw DIN 912 - M4x10

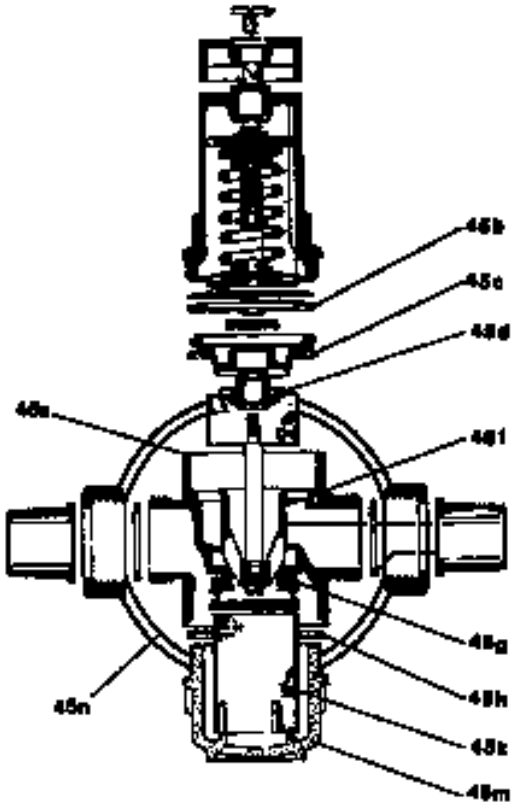

Fig. 14/4

No.in Fig.	Part - No.	Qty.	Part Description
	1"		
-	0018-1741-000	1	Water pressure reducer, complete 1.5 - 6 bar (45a-n)
45a	0018-1741-690	1	Water pressure reducer assembly (45a-m)
45b	0018-1741-750	1	Diaphragm
45c	0007-1907-750	1	Gasket 49/3.5
45d	0018-1741-020	1	Sealing disc
45f	0018-1741-010	1	Nozzle
45g	0004-5738-840	1	Grooved ring 30/40x7
-	0018-1741-620	1	Grooved ring holder
45h	0007-2929-750	1	Gasket 55.2/3
45k	0018-1741-030	1	Strainer
45m	0018-1741-610	1	Plug
45n	0001-0279-600	1	Pressure gauge 0 - 6 bar AR 6316 DIN 6063

Strainer 45k should be cleaned from time to time, the cleaning intervals being dependent on the degree of impurities contained in the water. To remove the strainer, unscrew plug 45m.

No.in Fig.	Part - No.	Qty.		Part Description
-	3177-2296-L	1		Feed and discharge connections, complete (71-102)
71	0019-1624-400	1		Threaded ring
72	3177-2257-000	1		Ring
73	0026-0539-400	1		Wire ring 39/2
74	0004-5843-920	1		Seal 36.8/56x12
75a	3048-2285-080	1		Discharge
75b	3048-2126-050	1		Bow
-	0019-1335-400	2		Screw M 16x32
75d	0019-1014-300	1		Threaded spindle M 16x74
76	0007-2299-750	4		Gasket 25.5/33.5x4
77	0001-0090-820	2		Cylindrical sight glass
78	0013-0370-400	2		Grooved nut M 45x1.5
79	3015-2287-000	1		Valve connection
-	1072-2273-020	1		Stuffing box, complete (80a-f)
80a	0021-3096-300	1		Handle
80b	0026-1062-400	1		Cylindrical pin
80c	1072-2284-000	1		Stuffing box housing
80d	0019-1590-610	1		Threaded bolt
80f	1072-2279-020	1		Round slide valve
81	0007-2285-750	2		Gasket 22/32x5
82	0026-5508-300	1		Washer 22/31.5x2
83	0026-1462-300	1		Snap ring 46
84	0007-2208-750	5		Gasket DIN 11851 - G 25
-	3177-2166-000	1		Connection piece, complete
85a	0018-1525-400	1	*	Hose cock 1/4"
85b	0007-2073-850	1	*	Gasket 11.5/18x3
86	0007-2210-750	2		Gasket DIN 11851 - G 40
87	8918-2000-300	1		Pressure gauge, complete
88	0018-4113-400	1	**	Threaded connection
88	0018-1831-400	1	**	Hose connection
89	3048-2217-030	1		Ring
90	0007-2363-750	1		Gasket 86/98x6
91	0004-5704-920	2		Lip seal 22/50x9
92	3049-2257-010	1		Ring
93	3048-2223-060	1		Pump housing
94	0007-2750-750	1		Gasket 100/112x6
95	3048-2235-030	1		Pump cover, complete
95a	0018-1545-400	1	*	Cock 3/8"
95b	0007-2529-750	1	*	Gasket 6.5/13x6
96	3015-2178-000	1		Threaded piece
97	0007-2209-750	1		Gasket DIN 11851 - G 32
98	3177-2166-010	1		Connection piece, complete
98a	0019-6938-400	1	*	Hex head screw DIN 933 - M 10x35
98b	0019-6515-400	1	*	Hex head screw DIN 931 - M 10x55
99	0018-4010-300	1		Support 48x400
100	0018-3980-400	2		Ball-type valve 25
101	0018-3939-400	2		Cone connection
102	0013-2842-300	2		Grooved coupling nut
274a-c	see page 19/1	1		Pump assembly

* This part is included in the preceding "complete" part, but it is also available as separate item.

** Depending on local conditions.

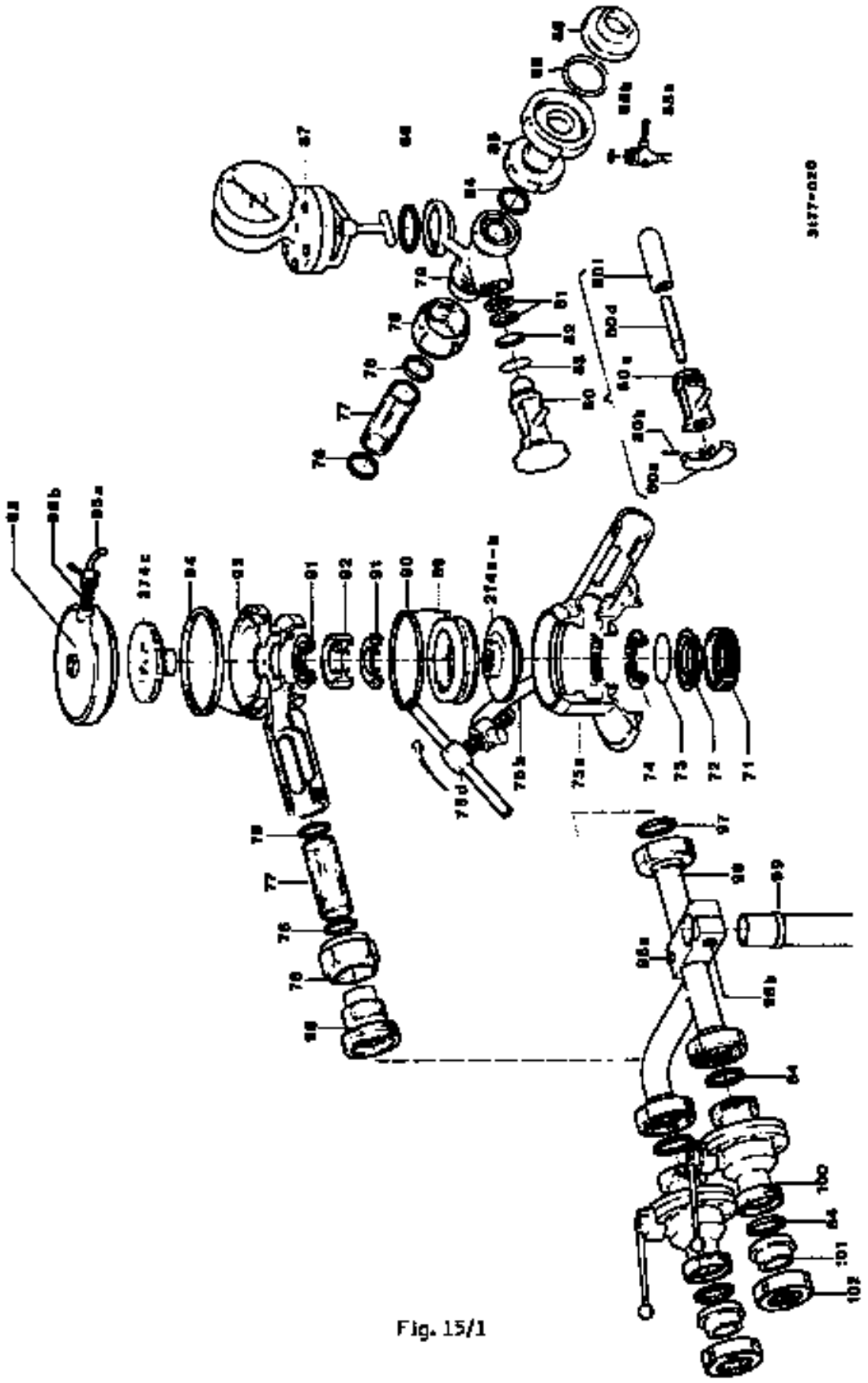

Fig. 15/1

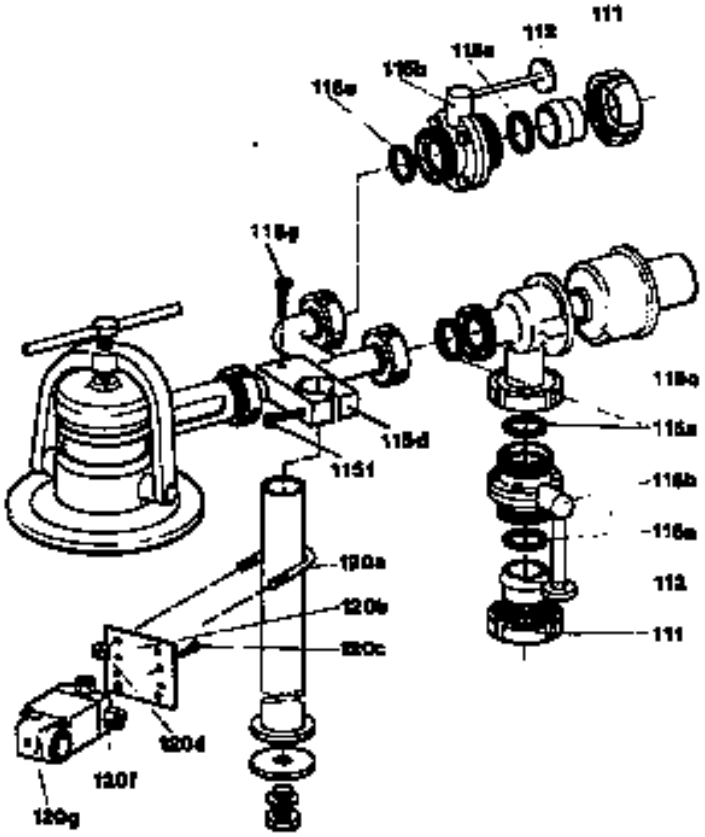

Fig. 15/2

No.in Fig.	Part - No.	Qty.	Part Description
111	0013-2842-400	2	Grooved coupling nut DIN 11851 - F25
112	0018-3942-400	2	Cone connection DIN 11851 - D25
-	8134-2111-120	1	Feed connection, complete (115a-g)
115a	0007-2208-750	5	Gasket DIN 11851 - G25
115b	0018-2823-400	2	Butterfly valve 25
115c	0018-4830-400	1	Angle valve 2/2 - 25
115d	3177-2166-010	1	Connection piece
115f	0019-6515-400	1	Hex head screw DIN 931 - M 10x55
115g	0019-6938-400	1	Hex head screw DIN 933 - M 10x35
-	8134-2010-010	1	Solenoid valve block, compl. (120a-g)
120a	0019-1863-400	1	U-bolt M 5/50
120b	8134-2208-050	1	Lamina
120c	0019-2218-400	3	Cheese head screw DIN 84 - AM 4x10
120d	0013-0275-630	2	Hexagon nut DIN 934 - M5
120f	0018-4236-600	3	Screw connection 8 / R 1/4"
120g	0018-3715-630	1	3-way solenoid valve 330C
			Accessories for the solenoid valve blocks
-	0018-4235-600	1	Screw connection 8 / R 1/8"
-	0018-4236-600	1	Screw connection 8 / R 1/4"
-	0018-0380-848	5	Pipe 8x1x5000

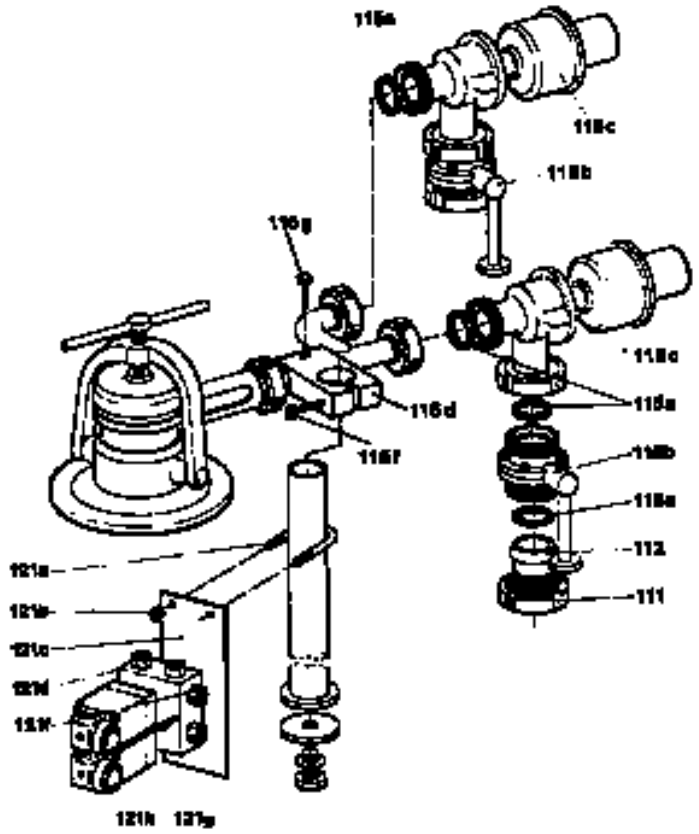

Fig. 15/3

No.in Fig.	Part - No.	Qty.	Part Description
111	0013-2842-400	2	Grooved coupling nut DIN 11851 - F25
112	0018-3942-400	2	Cone connection DIN 11851 - D25
-	8134-2112-130	1	Feed connection, complete (115a-g)
115a	0007-2208-750	6	Gasket DIN 11851 - G25
115b	0018-2823-400	2	Butterfly valve 25
115c	0018-4830-400	2	Angle valve 2/2 - 25
115d	3177-2166-010	1	Connection piece
115f	0019-6515-400	1	Hex head screw DIN 931 - M 10x55
115g	0019-6938-400	1	Hex head screw DIN 933 - M 10x35
-	8134-2010-000	1	Solenoid valve block, complete (121a-h)
121a	0019-1863-400	1	U-bolt M 5/50
121b	0013-0275-630	2	Hexagon nut DIN 934 - M5
121c	8134-2208-040	1	Lemina
121d	0019-1492-000	4	Threaded plug R 1/4"
121f	0018-4236-600	4	Screw connection 8 / R 1/4"
121g	0019-2395-030	2	Cheese head screw DIN 84 - CM 5x30
121h	0018-4485-600	1	Solenoid valve block, complete
-	0018-4485-800	2	Solenoid valve
-	0018-4485-280	1	Connection block
			Accessories for the solenoid valve block:
-	0018-4236-600	1	Screw connection 8 / R 1/4"
-	0018-4235-600	2	Screw connection 8 / R 1/8"
-	0018-0380-848	1	Pipe 8x1x5000

Angle valve

Design: spring-closing

No.in Fig.	Part - Number DN 25	Part - Number DN 32	Qty.	Part Description
-	0018-4830-400	0018-4831-400	1	Angle valve 2/2 (130.1 - 130.30)
130.1	0018-4830-000	0018-4831-000	1	Valve housing
130.2	0018-4820-070	0018-4831-070	1	Gasket
130.3	0013-0251-300	0013-0251-300	1	Cap nut
130.4	0018-4820-050	0018-4831-050	1	Washer
130.5	0018-4820-040	0018-4831-040	1	Gasket
130.6	0018-4820-030	0018-4831-030	1	Valve disk
130.7	0018-4820-010	0018-4831-010	1	Valve housing cover
130.8	0019-6841-400	0019-6841-400	6	Hex head screw DIN 933 - M 6x16
130.9	0018-4827-080	0018-4827-080	1	Gasket
130.10	0018-4827-100	0018-4827-100	2	Washer
130.11	0018-4827-090	0018-4827-090	1	Packing compl.
130.12	0018-4827-060	0018-4827-060	1	Sleeve
130.13	0018-4827-120	0018-4827-120	1	Nut
130.14	0018-4820-020	0018-4831-020	1	Valve spindle
130.15	0018-4827-110	0018-4827-110	1	Pressure spring
130.16	0018-4827-140	0018-4827-140	1	Housing for control medium
130.17	0007-1946-750	0007-1946-750	1	Gasket 25/1.5
130.18	0018-4827-130	0018-4827-130	1	Threaded piece
130.19	0004-5743-830	0004-5743-830	1	Grooved ring 10/16x4.5
130.20	0018-4827-160	0018-4827-160	1	Washer
130.21	0004-5866-840	0004-5866-840	1	Grooved ring 68/80x8.5
130.22	0018-4827-150	0018-4827-150	1	Washer
130.23	0013-0278-400	0013-0278-400	1	Hexagon nut M8
130.24	0018-4827-170	0108-4827-170	1	Pressure spring
130.25	0018-4827-180	0018-4827-180	1	Cover
130.26	0005-0303-700	0005-0303-700	1	Nipple Pg 16
130.27	0018-4827-190	0018-4827-190	1	Clamp ring
130.28	0019-6847-400	0019-6847-400	1	Hex head screw M 6x30
130.29	0026-1382-400	0026-1382-400	1	Disk DIN 125 - 6.4
130.30	0013-0276-400	0013-0276-400	1	Hexagon nut M6

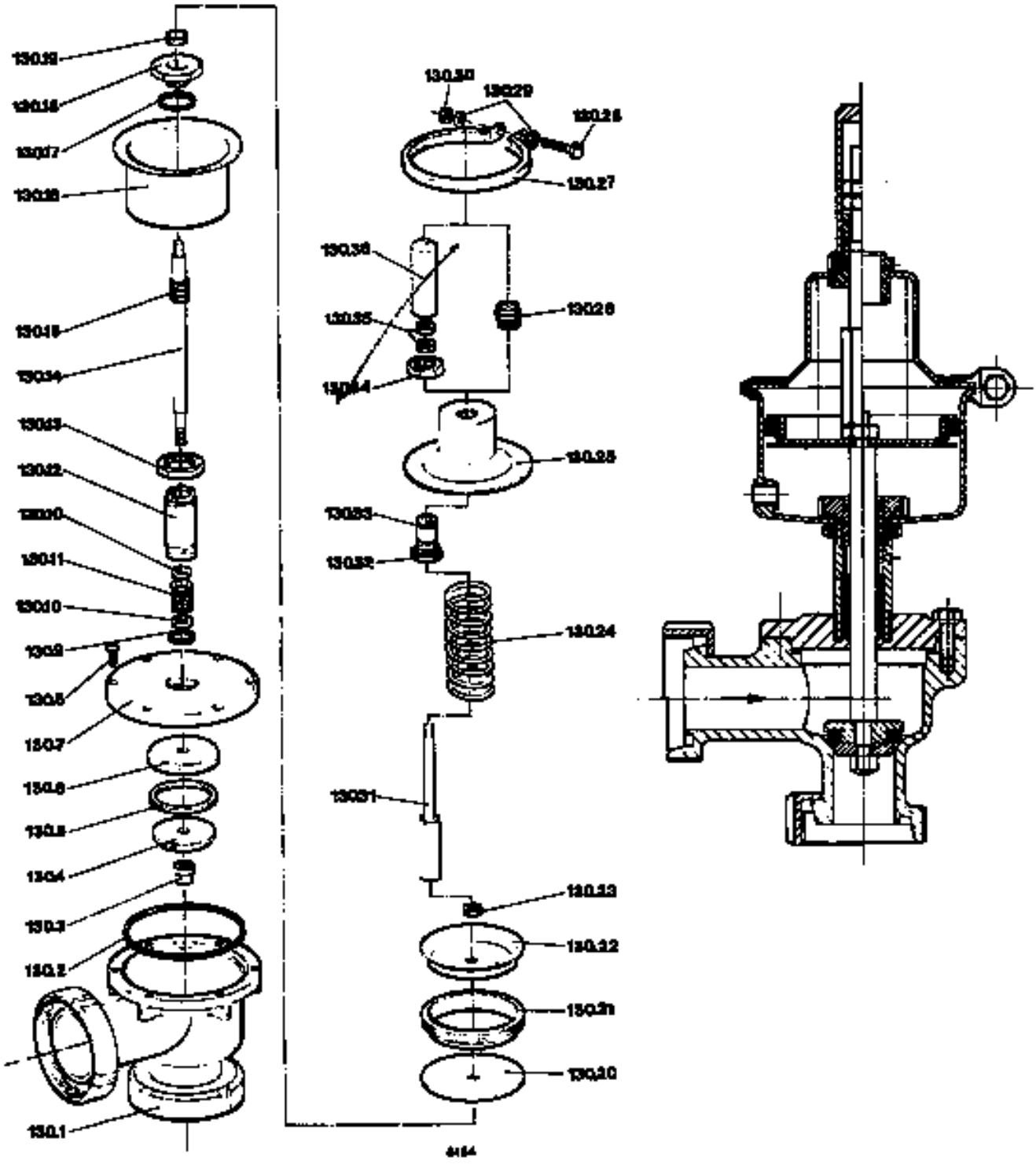
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Fig. 15/4

Measuring range: 700 - 4,000 litres/h

No.in Fig.	Part - No.	Qty.		Part Description
-	8021-2000-090	1		Flowmeter assembly (131a-u)
131a	0007-2210-750	2		Gasket 42/52x5
131b	0013-2846-300	1		Grooved coupling nut DIN 11851 - F65
131c	8021-2001-150	1		Inlet cup
131d	8021-2012-000	1		Float cone
131e	0007-2279-750	1		Gasket 56/68x6
131f	8021-2003-120	1		Outlet pipe
131g	0007-2298-750	2		Gasket 13.5/22x10
131h	0026-1375-300	1		Washer
131k	0013-3010-300	1		Nut M 35x1.5
131m	0019-1380-300	1		Threaded sleeve
131n	8020-2002-000	1		Intermediate piece
131p	0001-0083-820	1		Cylindrical sight glass
131r	0019-1732-400	1		Handle screw
131s	0019-2478-300	2		Cheese head screw DIN 85 - M 4x8
131t	0004-5261-720	2		Gasket 4.8/9x1
131u	8021-2017-000	1		Scale 700 - 4,000 litres/h
131v	0018-3949-400	2	*	Cone connection
131w	0013-2844-300	2	*	Grooved coupling nut
-	3015-9033-010	1	*	Bracket (to support flowmeter)

* On special order only.

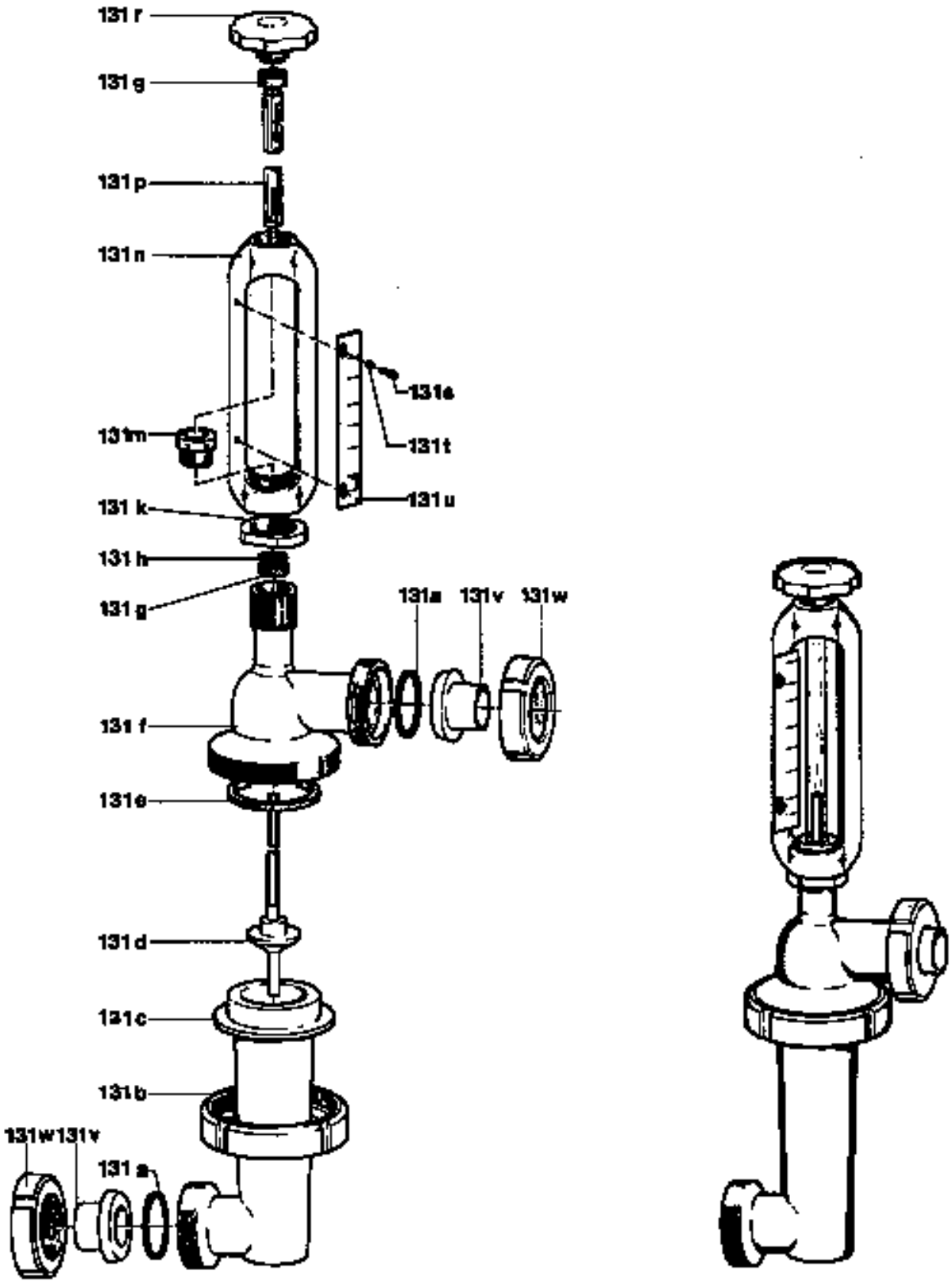
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Fig. 15/5

No.in Fig.	Part - No.	Qty.		Part Description
151	0010-4203-200	1		Bottom bearing cap
152	0004-5048-740	1		Gasket 55/70x2
153	0010-4200-010	1		Bottom bearing assembly (153a-h)
153a	0010-4202-000	1		Bottom bearing threaded piece
153b	0006-4272-160	1		Cylindrical pressure spring
153c	0010-4201-200	1		Bottom bearing pressure piece
-	0010-4210-000	1		Set of Bottom bearing running parts (153b-g)
153d	-	1	*	Bottom bearing pressure disc
153f	-	1	*	Ball cage
153g	-	1	*	Bottom bearing running disc
153h	0026-1482-170	1		Snap ring
154	0019-6970-150	4		Hex head screw DIN 933 - M 12x30 - 8.8
155	0026-5892-600	4		Tab washer DIN 93 - 13
156	3036-1112-010	1		Bottom bearing housing
157	0004-5252-770	1		Gasket 85/135x0.3
158	see page 18/1	1	***	Worm spindle assembly (158a-m)
158a	0011-2305-120	1		Pendulum ball bearing DIN 630 - 2305 M/P6
158b	0008-2508-000	1		Ball bearing protection ring
158c	see page 18/1	1	***	Worm
158d	0026-1567-120	1		Notched pin
158f	3272-3410-000	1		Spindle
158g	0011-6209-110	1		Grooved ball bearing DIN 625 - 6209/P6
158h	0008-4508-000	1		Ball bearing protection ring
158k	0006-4231-160	1		Spindle spring
158m	0008-4501-660	1		Spindle cap
-	0008-4500-190	1		Neck bearing bridge assembly with covering (159a-r)
159a	0004-5017-770	1		Gasket 129/182 x 0.3
-	0008-4510-200	1		Neck bearing bridge assembly (159b-g)
159b	0008-4506-000	1		Neck bearing bridge
159c	0026-1289-110	6		Spring piston
159d	0006-4306-060	1		Set of 6 neck bearing springs
159f	0019-1423-030	6		Threaded plugs
159g	0008-4507-090	1		Neck bearing pressure ring
159h	0008-4509-010	1		Distance ring
159k	0004-5016-770	1		Gasket 115/182x0.3
159m	0008-4502-030	1		Neck bearing protection cap
159n	0004-5923-800	3		Gasket M 12
159p	0026-1371-030	3		Washer DIN 125 - 13
159r	0019-6544-150	3		Hex head screw DIN 931 - M 12x90 - 8.8
160	0019-6901-400	3		Hex head screw DIN 933 - M 8x15
161	3163-1219-010	1		Operating-water feeding device

* This part is not available as apperate item, but only assembled with the parts 153d-g.

*** The design and, hence, the number of this part depends on the motor speed as well as on the bowl speed given on the name-plate of the separator (see table on page 18/1). In case of reduced bowl speed be sure to refer to sect. 3.5.
IMPORTANT: When replacing this part, the worm wheel 208 should be replaced at the same time.

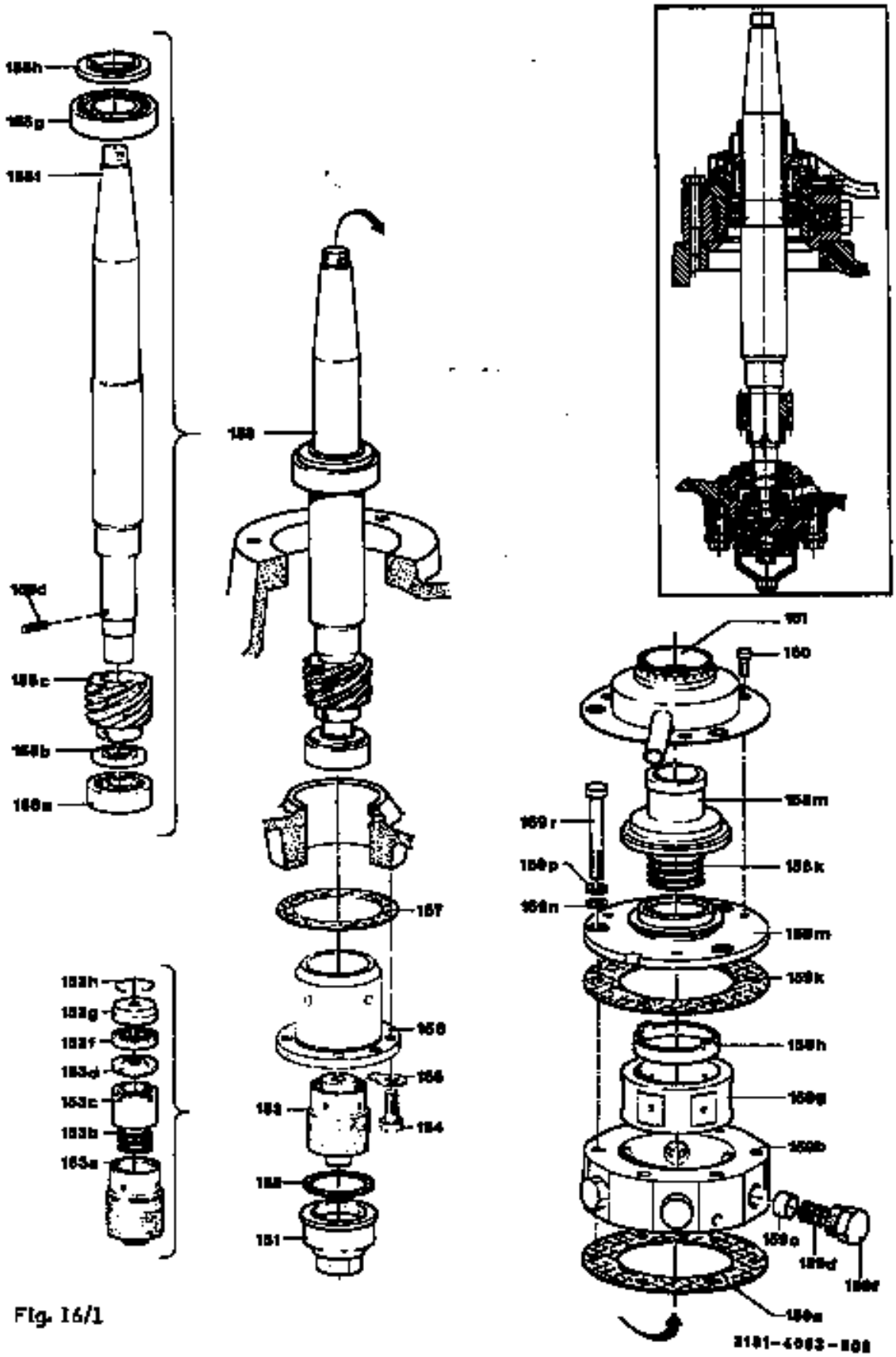
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Fig. 16/1

No.in Fig.	Part - No.	Qty.		Part Description
151	0010-4203-200	1		Bottom bearing cap
152	0006-5048-740	1		Gasket 55/70x2
153	0010-4200-010	1		Bottom bearing assembly (153a-h)
153a	0010-4202-000	1		Bottom bearing threaded piece
153b	0006-4272-160	1		Cylindrical pressure spring
153c	0010-4201-200	1		Bottom bearing pressure piece
-	0010-4210-000	1		Set of bottom bearing running parts (153d-g)
153d	-	1	*	Bottom bearing pressure disc
153f	-	1	*	Ball cage
153g	-	1	*	Bottom bearing running disc
153h	0026-1482-170	1		Snap ring
154	0019-6970-150	4		Hex head screw DIN 933 - M 12x30 - 8.8
155	0026-5892-600	4		Tab washer DIN 93 - 13
156	3036-1112-010	1		Bottom bearing housing
157	0004-5252-770	1		Gasket 85/135x0.3
158	see page 18/1	1	***	Worm spindle assembly (158a-p)
158a	0011-2305-120	1		Pendulum ball bearing DIN 630 - 2305 M/P6
158b	0008-2508-000	1		Ball bearing protection ring
158c	see page 18/1	1	***	Worm
158d	0026-1567-120	1		Notched pin
158f	3272-3410-000	1		Spindle
158g	0011-6209-110	1		Grooved ball bearing 6209/P6
158n	0019-6307-150	1		Threaded pin DIN 913 - AM 6x8 - 10.9
158p	0008-4551-000	1		Spindle cap
-	0008-4520-260	1		Neck bearing bridge assembly with covering (159a-w)
159a	0004-5017-770	1		Gasket 129/182x0.3
-	0008-4510-000	1		Neck bearing bridge assembly (159b-f, u)
159b	0008-4506-000	1		Neck bearing bridge
159c	0026-1289-110	6		Spring piston
159d	0006-4306-060	1		Set of 6 neck bearing springs
159f	0019-1423-030	6		Threaded plug
159k	0004-5016-770	1		Gasket 115/182x0.3
159n	0004-5923-800	3		Gasket M 12
159p	0026-1371-030	3		Washer DIN 125 - 13
159r	0019-6544-150	3		Hex head screw DIN 931 - M 12x90 - 8.8
159s	0026-5850-170	1		Securing ring DIN 472 - 85x3
159t	0004-5554-750	1		Sealing ring A 55x80x10
159u	0008-4507-030	1		Neck bearing pressure ring
159v	0004-5557-750	1		Sealing ring DIN 3760 - A 65x85x10
159w	0008-4502-020	1		Neck bearing protection cap
160	0019-6901-400	3		Hex head screw DIN 933 - M 8x15
161	3163-1219-010	1		Operating-water feeding device

* This part is not available as separate item, but only assembled with the parts 153d-g.

*** The design and, hence, the number of this part depends on the motor speed as well as on the bowl speed stated on the name-plate of the seperator (see table on page 18/1). In case of reduced bowl speed be sure to refer to sect. 3.5.
IMPORTANT: When replacing this part, the worm wheel 208 should be replaced the same time.

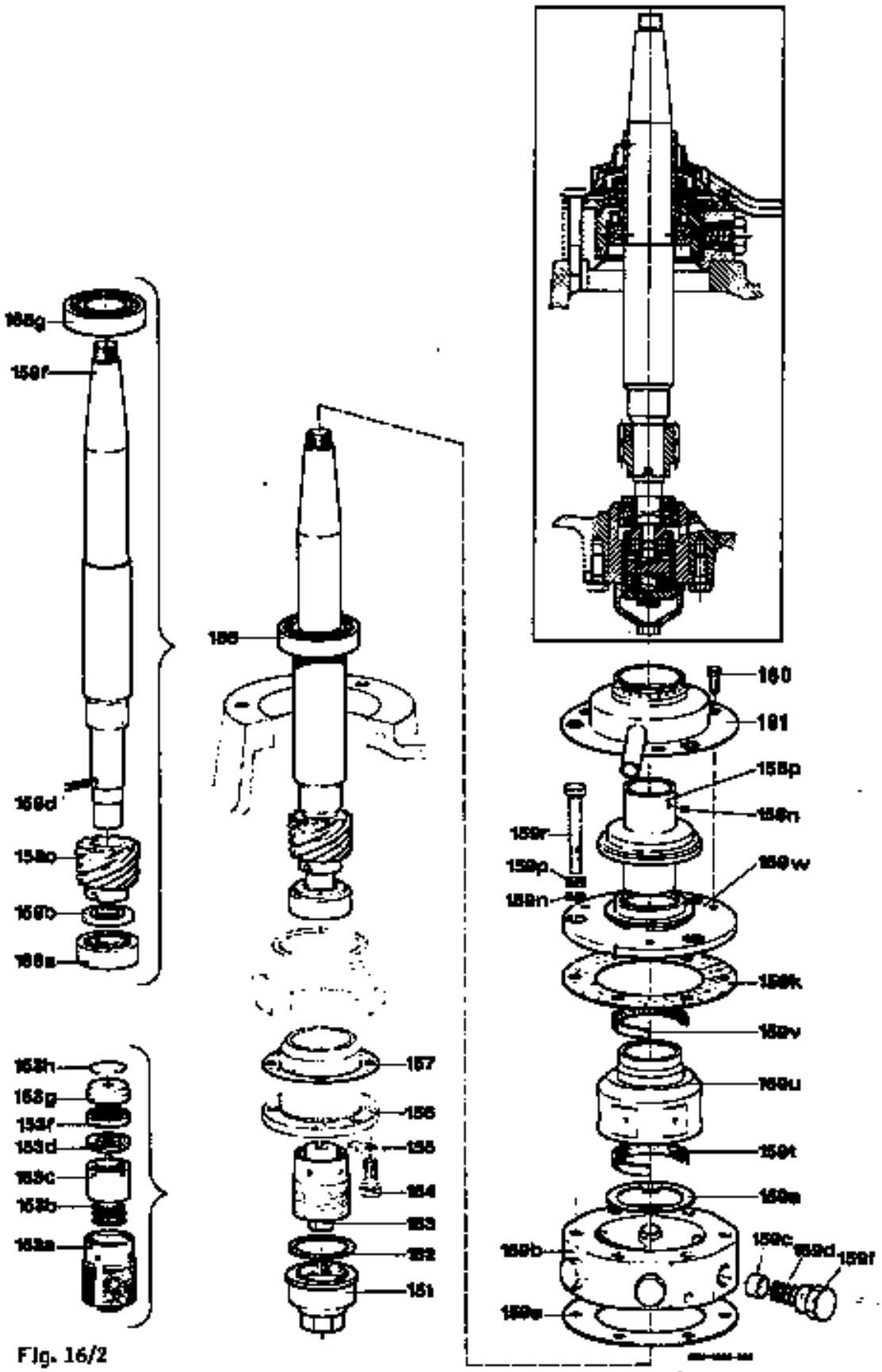
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Fig. 16/2

No.in Fig.	Part - No.	Qty.		Part Description
-	3037-3385-020	1		Centrifugal clutch assembly (201a-m)
201a	0019-5195-150	1		Hex head screw DIN 561 - AM 10x25 - 8.8
201b	3037-3479-010	1		Clutch cover
201c	3037-3468-L	1	*	Clutch driver (depending on motor)
201d	3313-3397-000		+)	Clutch shoe
201f	0019-0167-030	1		Hex head screw M 10x15 - 4.6
-	3037-3370-000	1		Clutch drum assembly (201g-m)
201g	3037-3366-000	1		Ring
201h	3037-3365-000	1		Clutch drum
201k	0019-6519-150	4		Hex head screw DIN 931 - M 10x75 - 8.8
201m	0019-5195-150	1		Hex head screw DIN 933 - AM 10x25 - 8.8
202	0019-6935-150	3		Hex head screw DIN 933 - M 10x25 - 8.8
203	0026-1337-190	3		Lock washer DIN 127 - A 10
204	3163-3375-010	1		Bearing cover
205	0004-5548-750	1		Sealing ring A 40x60x10
206	0004-2500-770	1		Gasket 80/130x0.2
207	0011-6208-000	1		Grooved ball bearing DIN 625 - 6208
208	see page 18/1	1	***	Worm wheel assembly with clamp plates (208a-h)
208a		1	**	Clamp plate with toothing
208b	not available	1	**	Pressure ring
208c	as separate item	1	**	Toothed rim
208d		1	**	Wheel body
208f	0019-6513-150	4		Hex head screw DIN 931 - M 10x45 - 8.8
208g	not available as separate item	1	**	Clamp plate
208h	0019-6524-150	4		Hex head screw DIN 931 - M 10x100 - 8.8
209	0026-1765-160	2		Key A5 10x8x70
210	3037-3400-020	1		Worm wheel shaft
211	0026-1744-160	1		Key M 40x1.5
212	0011-6208-000	1		Grooved ball bearing DIN 625 - 6208
213	0013-0444-090	1		Grooved nut SKF-KM8
213a	0026-0914-170	1		Tab washer DIN 5406 - MB 8
214	0004-5546-750	1		Sealing ring A 35x56x10
215	0004-2500-770	1		Gasket 80/130x0.2
216	3163-3375-020	1		Bearing cover
217	0026-1337-190	3		Lock washer DIN 127 - A 10
218	0019-6935-150	3		Hex head screw DIN 933 - M 10x25 - 8.8
219	3163-3371-000	1		Brake drum
220	0026-1658-030	1		Centering disc
221	0026-5890-600	1		Tab washer DIN 93 - 8.4
222	0019-6907-150	1		Hex head screw DIN 933 - M 8x30 - 8.8

+) The number of clutch shoes to be used (2 or 3 or 4 or 6 shoes) depends on the motor size and on the motor speed.

* When ordering this part, please state diameter of motor shaft end and width of key.

** This part is not available as separate item, but only assembled with the parts 208a-h.

*** The design and, hence, the number of this part depends on the motor speed as well as on the bowl speed as stated on the name-plate of the separator (see table on page 18/1). In case of reduced bowl speed be sure to refer to sect. 3.5.
IMPORTANT: When replacing this part, the worm 158c should also be replaced.

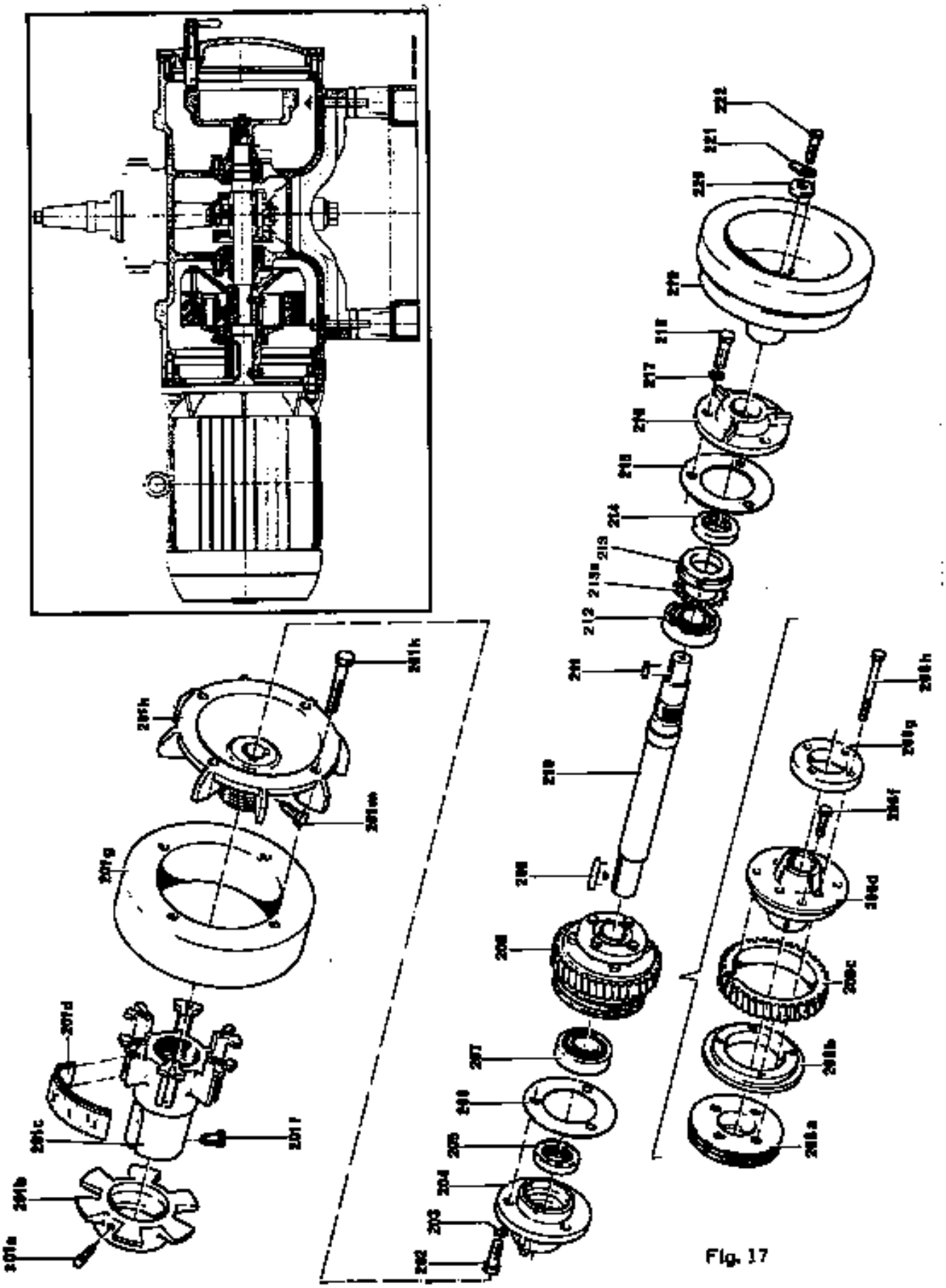


Fig. 17

No.in Fig.	Fig.	Part Description	Motor speed n = 1,455 rpm (50 Hz) Part - No. Bowl speed n = 7,570 rpm	Motor speed n = 1,745 rpm (60 Hz) Part - No. Bowl speed n = 7,560 rpm
-	16/1	*** Worm spindle assembly	3272-3429-000	3272-3429-010
-	16/2	*** Worm spindle assembly (with gas-tight neck bearing)	3272-3429-070	3272-3429-080
158c	16/1 16/2	*** Worm	3036-3423-110	3106-3423-000
208	17	*** Worm wheel assembly	3106-3449-000	3106-3449-010

*** The design and, hence, the number of this part depends on the motor speed as well as on the bowl speed as stated on the name-plate of the separator. In case of reduced bowl speed be sure to refer to sect. 3.5.
IMPORTANT: Worm spindle 158c and worm wheel assembly 208 should always be replaced at the same time.

No.in Fig.	Part - No.	Qty.		Part Description
-	3177-6600-060	1		Bowl, complete (251-273a)
251	3181-6627-000	1		Threaded ring
252	3181-6425-020	1	*	Sealing-chamber bottom, complete
252a	0026-1537-300	1	+)	Arresting pin
253	0007-2416-750	1		Gasket 282/302x8
254	3181-6500-070	1	*	Sliding piston, complete
254a	0026-5703-400	3	+)	Arresting pin
254b	0007-2624-750	1	+)	Gasket 330/4
254c	3181-6469-010	1	+) *	Ring
255	0007-2858-840	1		Gasket
256	3181-6604-070	1	*	Bowl bottom, complete
256a	3181-6647-000	1	+)	Arresting pin
257	0013-2956-400	1		Spindle nut
258	3177-6620-000	1	*	Distributor
-	3181-6660-010	1		Set of discs, complete (259a-b)
259a	3181-6662-010	1		Bottom disc
259b	3181-6663-L		**	Disc
-	2243-6666-030	1		Compensating disc
260	0007-2418-750	1		Gasket 322/342x8
261	0007-2417-760	1		Gasket 328/342x5
262	0007-2092-750	1		Gasket 308/8
263	3177-6611-010	1	*	Bowl top
264	3181-6631-010	1	*	Bowl lock ring
265	0007-2229-750	1		Gasket 40/48x5
266	0007-2218-750	1		Gasket 23/31x4
267	0007-2052-750	1		Gasket 60/3.5
268	0338-6631-050	1		Lock ring
271	3177-6642-000	1		Head piece, complete
271a	0002-3144-400	1	+)	Sleeve
272	3181-6485-000	1		Wear liner
273	3177-2245-000	1		Feed tube, complete
273a	0002-3030-400	1	+)	Sleeve
-	3177-2230-000	1		Pump assembly (274a-c)
274a	3049-2243-010	1		Lower part of pump } Discharge pump
274b	3049-2242-010	1		Upper part of pump } Discharge pump
274c	3048-2256-060	1		Impeller (feed pump)

* This part can only be replaced by one of our service engineers or by a special repair shop authorized by us, because of special re-fitting to machine and possible re-balancing of bowl.

** The number of discs depends on the intended use of the separator and on the thickness of the spacers.

+) This part is included in the preceding "complete" part, but it is also available as separate item.

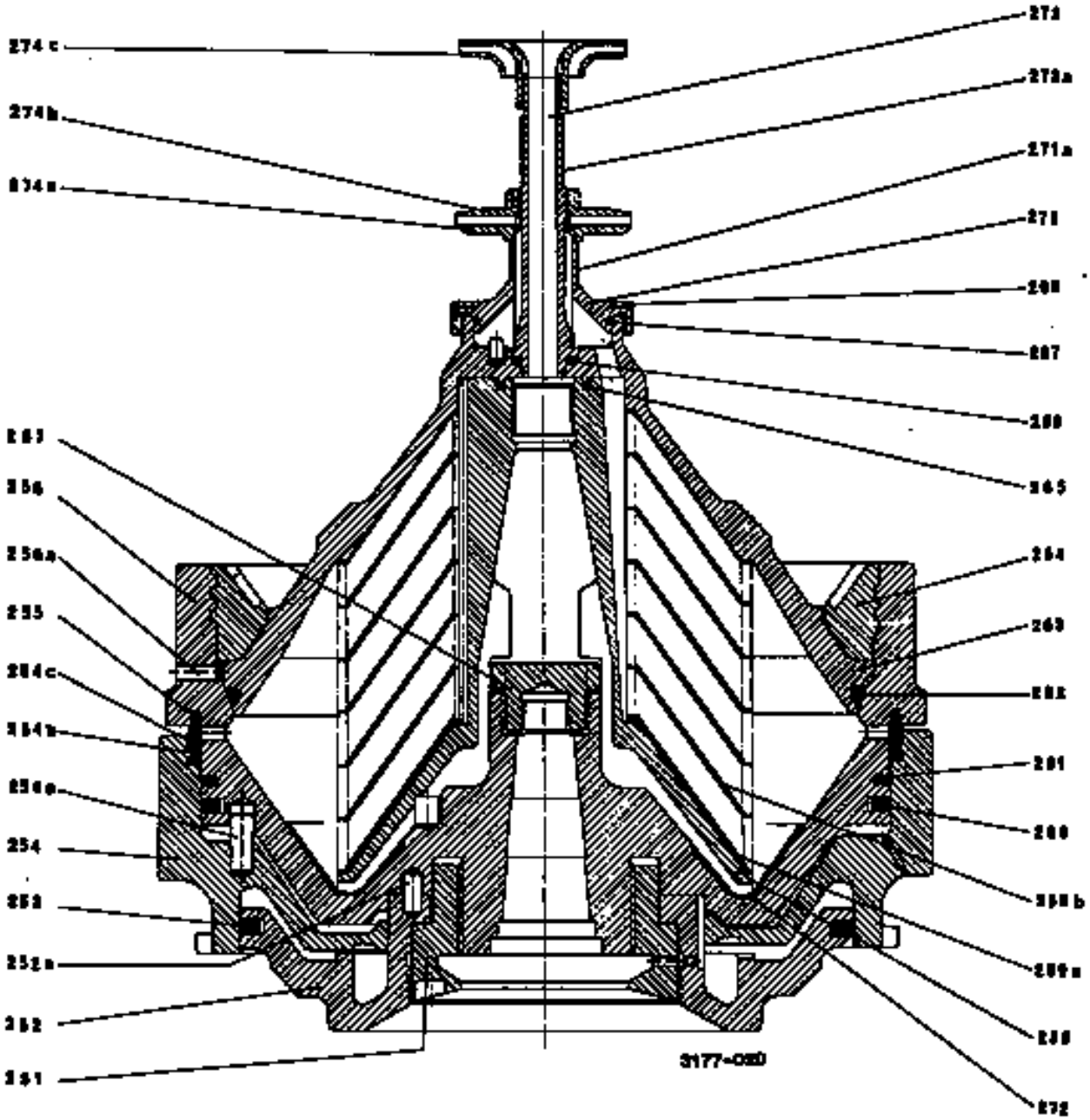
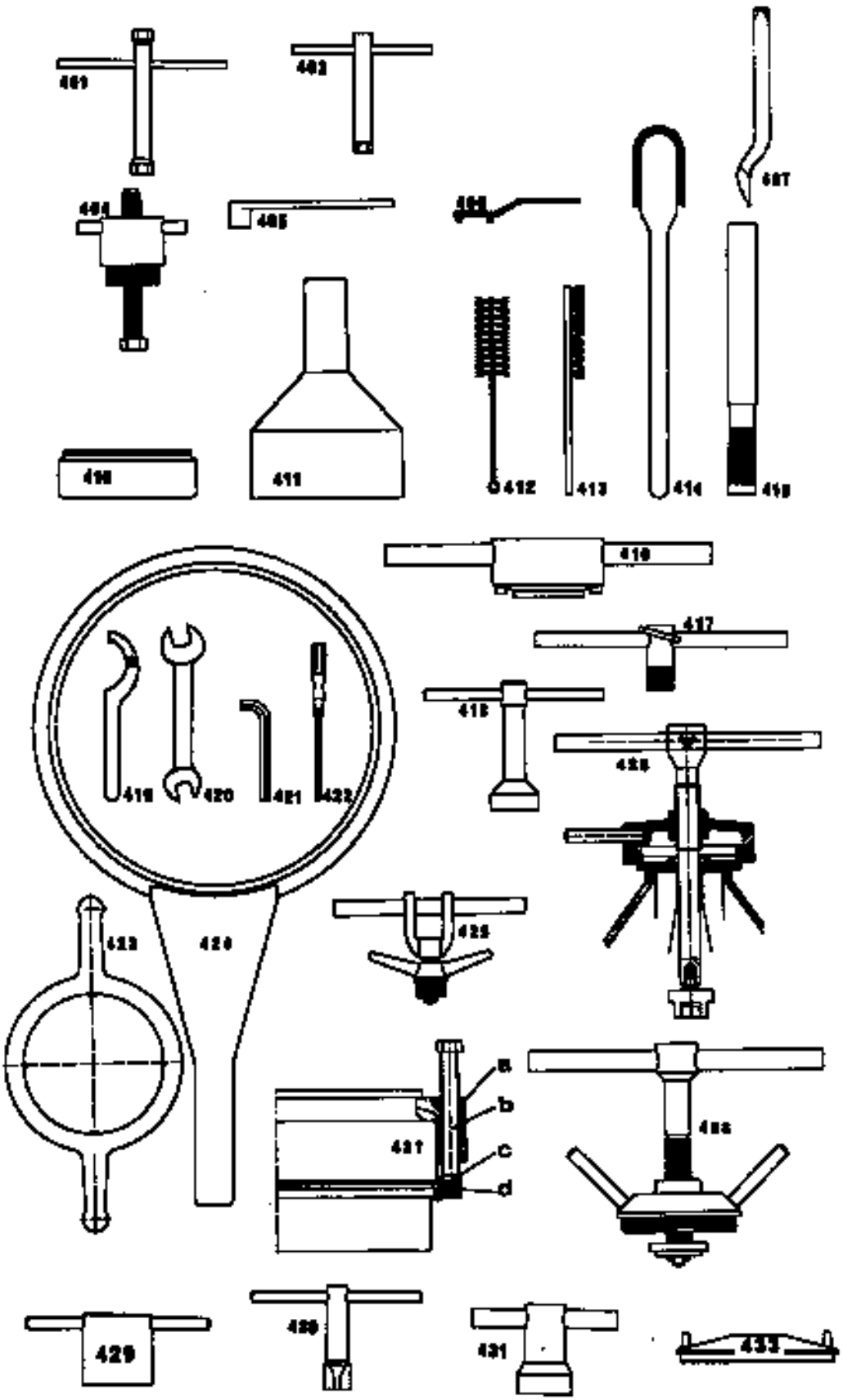


Fig. 19

All the parts mentioned in the packing list furnished with the separator should be found in the packing case.

No.in Fig.	Part - No.	Qty.	Part Description
401	0003-4253-150	1	Hexagon socket wrench DIN 896 - B 17x19
402	0003-4227-030	1	Hexagon socket wrench DIN 659 - 13
404	3313-9910-000	1	Pulling device (for clutch)
405	0003-0450-030	1	Triangular socket wrench M12
406	0003-4585-000	1	Wrench (for sight glass)
407	0003-0215-000	1	Chisel
410	0003-0277-800	1	Oil cup
411	0003-0296-000	1	Splash cover
412	0003-4540-960	4	Cylindrical brush 10x40x160
-	0003-4544-960	4	Cylindrical brush 15x85x285
-	0003-4552-960	1	Cylindrical brush 45x110x270
413	0003-4690-960	1	Brush 35x125x285
414	0003-4695-960	1	Brush 70x100x500
415	0003-0200-000	1	Mallet
416	3181-9940-010	1	Annular wrench (for threaded ring)
417	3181-9970-000	1	Lifting device (for distributor)
418	0003-4150-030	1	Socket wrench 41 (for spindle nut)
419	0003-3845-000	1	Pivoted hook wrench 60x90
420	0003-4202-320	1	Double-ended wrench DIN 3110 - 10x13
-	0003-4205-320	1	Double-ended wrench DIN 3110 - 17x19
-	0003-4208-320	1	Double-ended wrench DIN 3110 - 22x27
-	0003-4209-320	1	Double-ended wrench DIN 3110 - 24x30
421	0003-3773-320	1	Allen wrench DIN 911 - 3
-	0003-3775-320	1	Allen wrench DIN 911 - 5
-	0003-3776-320	1	Allen wrench DIN 911 - 6
-	0003-3777-320	1	Allen wrench DIN 911 - 8
-	0003-3789-320	1	Allen wrench DIN 6911 - 4
422	0003-4636-050	1	Screwdriver 5x125
-	0003-4637-050	1	Screwdriver 10x160
423	0003-3980-000	1	Annular wrench (for small lock ring)
424	0003-0358-000	1	Annular wrench (for large lock ring)
425	3037-9930-010	1	Jack (for bowl bottom)
426	3177-9930-000	1	Jack (for bowl top)
427	3181-9800-020	1	Puller assembly (427a-d) (for sliding piston)
427a	3181-9837-000	3	Claw
427b	0019-5230-150	3	Hex head screw DIN 561 - BM 20x160 - 8.8
427c	3181-9882-020	1	Clamp ring
427d	3181-9823-010	1	Ring
428	3181-9800-000	1	Jack (for sealing-chamber bottom)
429	0003-3957-000	1	Wrench (for threaded ring 71)
430	0003-0110-000	1	Pump wrench (for feed pump)
431	0003-3716-200	1	Wrench 32 (for discharge pump)
433	3048-9810-020	1	Alignment disc
-	3182-9920-000	1	Tool board
-	0015-0014-060	2	2.5-litre can of separator lubricating oil CLP 220
-	0015-0103-000	1	Tube of Molykote paste DX (for lock rings)
-	0015-1005-000	1	Package of "UHU-plus"



3177-020

Fig. 20

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