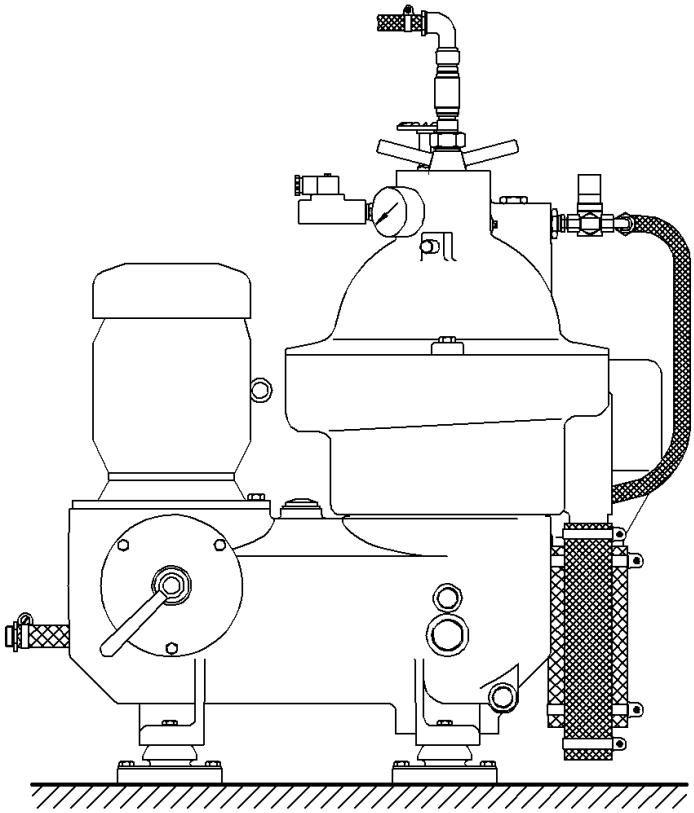
Mechanical Separation
Division

Westfalia Separator
Mineraloil Systems GmbH

Instruction Manual and Parts List

No.:	**2058-9001-101**
Edition:	**0506**
Designation:	**Mineral oil centrifuge with self-cleaning bowl**
Model:	**OSD 6-91-067**



Subject to modification!

The authors are always grateful for comments and suggestions for improving the documentation. They can be sent to

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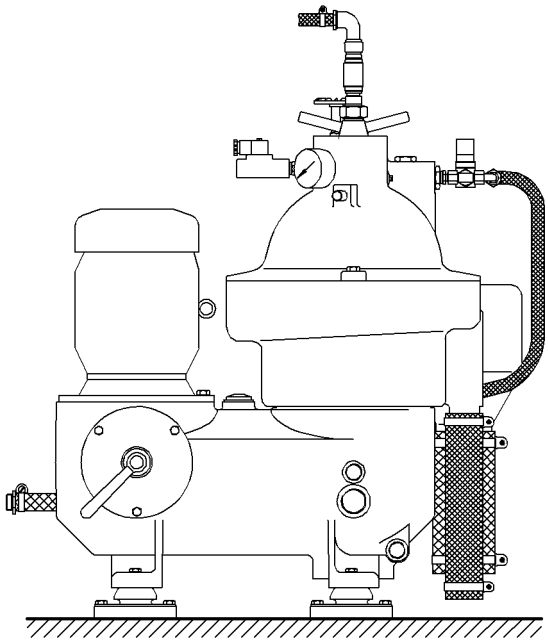

Westfalia Separator
D-59302 Oelde (F. R. Germany)

Mineraloil Systems GmbH

Model		S/N	
Built in		Ø in mm	
Max. admissible rated bowl speed in min^{-1}			
Max. admissible density in kg/dm^3 of product			
Heavy liquid kg/dm^3		Solids kg/dm^3	
min/max throughput m^3/h			
min/max temp. of product in °C			
min/max housing in bar			

This nameplate must be filled in by the operator.
Please transfer the data from the centrifuge nameplate.

For your safety

- **Strictly adhere to instructions marked with this symbol.**
  This avoids damage to the separator and other equipment.

- **Take special care when carrying out operations marked with this symbol -**
  otherwise danger to life.

Note:

- This symbol is not a safety precaution but rather a reference to information which help to better understand the separator or plant components and the processes.

- **Observe the accident prevention regulations!**

  The local safety and accident prevention regulations apply unconditionally to the operation of the separator. The plant operator must ensure compliance with these regulations.

- **Follow the instructions in the manual.**

  Follow only the instructions given in this manual.
  Repair and maintenance work that goes beyond the scope described in this manual may not be carried out.

- **Operate the separator only in accordance with agreed process and operating parameters**

- **Maintain the separator**

  as specified in this manual.

- **Carry out safety checks on the separator,**

  as described in chapter "Safety precautions" in this manual

- **Liability for the function of the machine passes to the owner.**

  Liability for the function of the machine passes unconditionally to the owner or operator irrespective of existing warranty periods in so far as the machine is improperly maintained or serviced by persons other than Westfalia Separator service personnel or if the machine is not applied in accordance with the intended use.

  Westfalia Separator shall not be liable for damage which occurs as a result of non-observance of the above. Warranty and liability conditions in the Conditions of Sale and Delivery of Westfalia Separator are not extended by the above.

6 Parts list 167

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1 Safety precautions

1.1 Correct usage

The separator is designed

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

In particular, products not conforming to the specifications on the 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 markings

The safety markings (adhesive and metal plates) are attached to all separators on the hood and frame of the respective separator in such a way that they are clearly visible.

All safety markings on the separator, control system and plant components must always be in perfect condition.

- Clean dirty safety markings.
- Replace damaged safety markings.

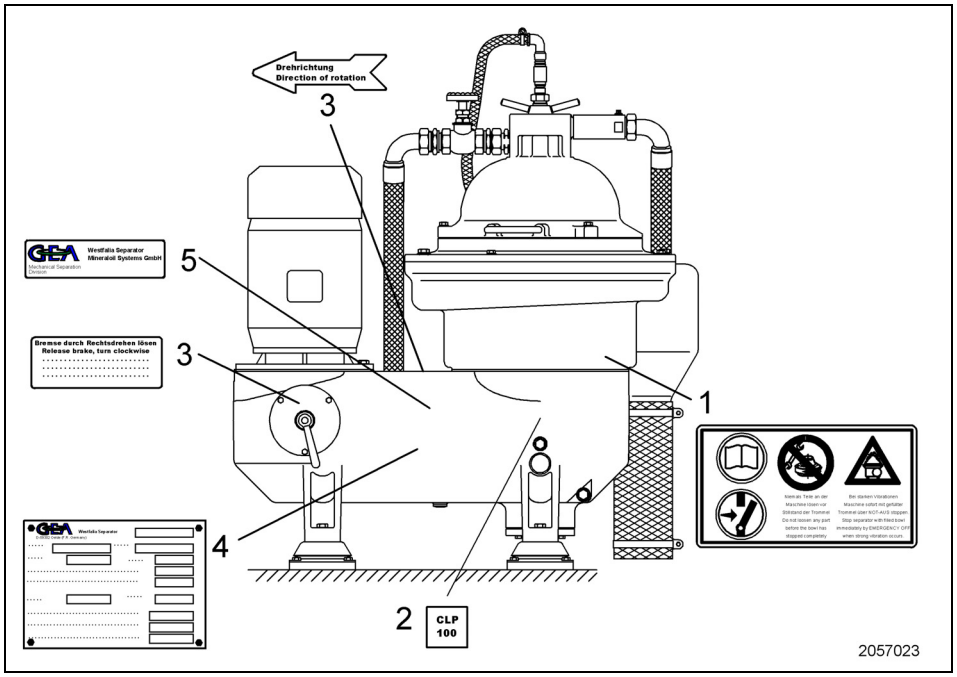


Fig. 1 Example of markings on a separator

1 Safety sticker
2 Oil quality
3 Plates
4 Nameplate
5 Maker's nameplate

The texts and part numbers of the safety markings change depending on the languages required by the customer.

1.2.1 Safety markings and their meaning

The following safety markings must be attached to the separator as adhesive labels.

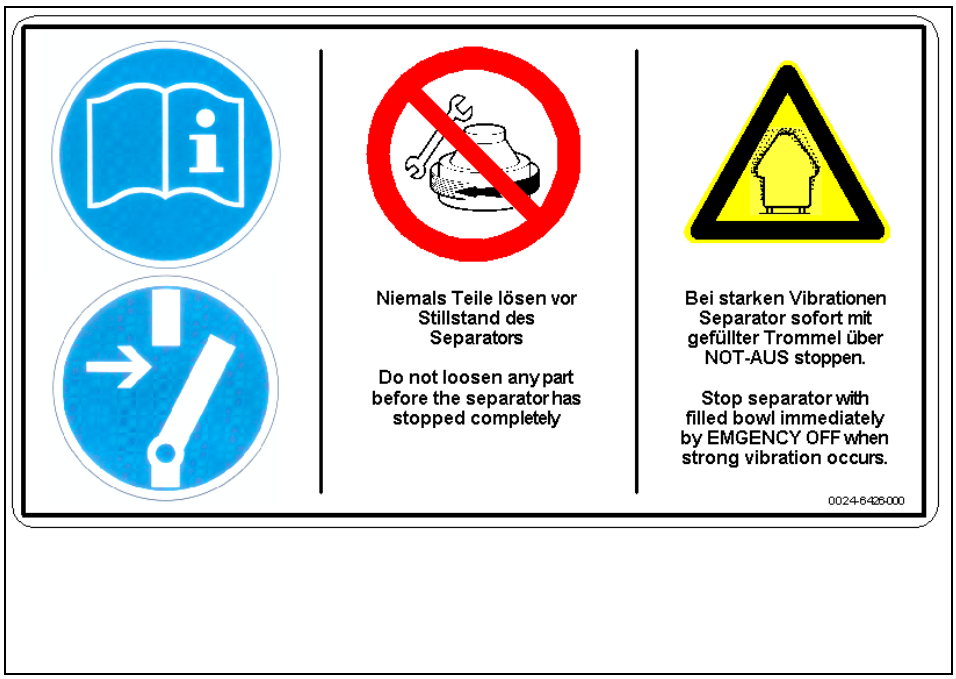


Fig. 2

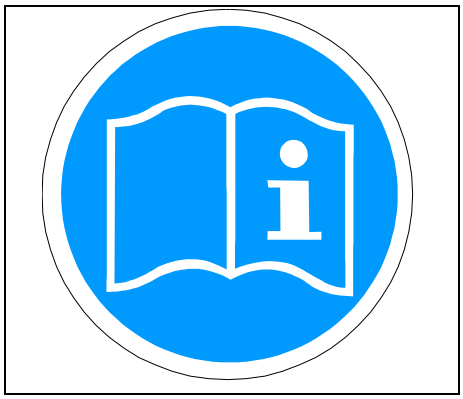


Fig. 3

Refer to the machine documentation!

- Every person who is assigned the task of installing, operating, maintaining and repairing the machine must have read and understood the documentation.
- The documentation must be complete kept near to the machine and be readily accessible to the operators. It must be available to the operators at all times!

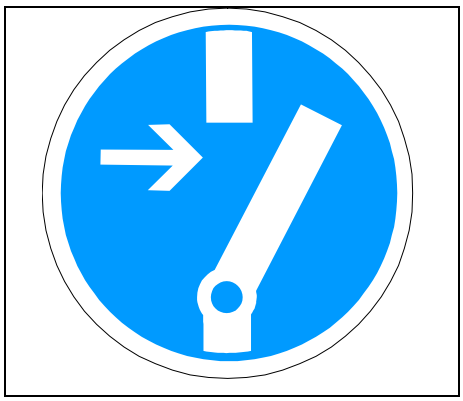


Fig. 4

Before carrying out work, disconnect power to the all components of the monitoring system!
Risk of injury due to electrical voltage and unintended start-up of the separator!

Before carrying out work on the separator and electrical plant components:

- Make sure the separator is at a standstill.
- Switch off all electrical appliances via the main switch,
- Lock the installation to prevent it from being accidentally switched on.

Fig. 5

Danger o life and limb through rotating machine parts!

- **Do not loosen any part and do not carry out maintenance or repair work on the separator before the separator is at a standstill.**
  Methods of how to check standstill are described in the machine documentation.

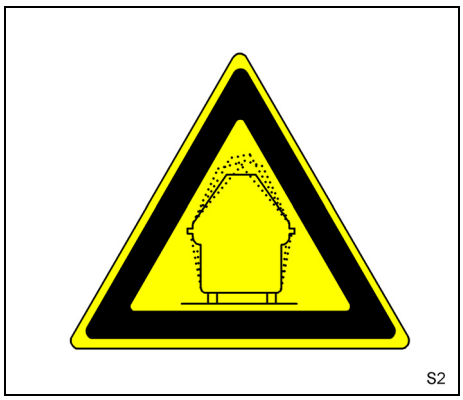


Fig. 6

Warning of unusual noises or vibrations!
When unusual noises or vibrations occur on the separator:

- Immediately shut down the separator with filled bowl via “emergency-off”.
- **Never trigger a bowl ejection!**
- Evacuate the room.
- Do not re-enter the room until the centrifuge has come to a standstill.

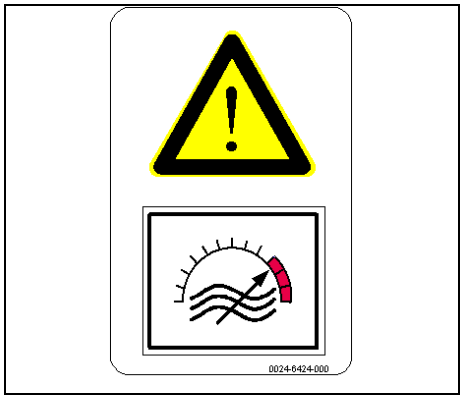


Fig. 7

Frequency converter operation!

- When setting the frequency converter, do not exceed the admissible bowl speed (see nameplate)

Note:
This adhesive plate is only used for frequency converter operation.

Fig. 8

Warning of extreme surface temperatures!

The surfaces of the separator and plant components can be hot!

Note:
This adhesive plate is only used for 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.

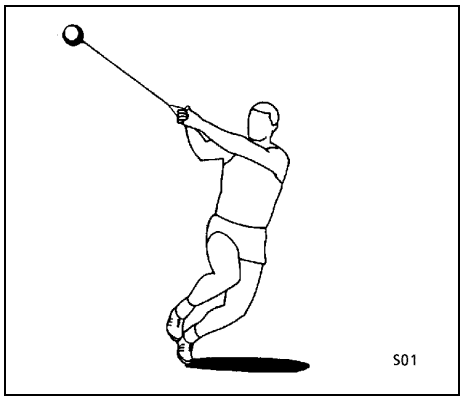


Fig. 9

High centrifugal forces are produced in the rotating bowl.

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 max. permissible 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 (212 °F) or lower than 0 °C (32 °F),
- 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.

Before using a product with properties different from those stated when placing the order, it is imperative to obtain the manufacturer's approval.

1.5 Demands relating to service personnel and spare parts

Fig. 10

- **Use only genuine spare parts from Westfalia Separator.**
  The use of non-genuine parts leads to:
  – Safety risks
  – Lower durability and availability
  – Increased maintenance requirement
  If a safety risk arises, this may have legal consequences for the responsible persons. In this case, Westfalia Separator shall assume no liability or warranty.

- Deploy only well trained personnel for maintenance work, e.g. service personnel from Westfalia Separator or personnel trained by Westfalia Separator. An incorrectly maintained/assembled machine poses a safety risk for the operators.

1.6 Operations on the separator

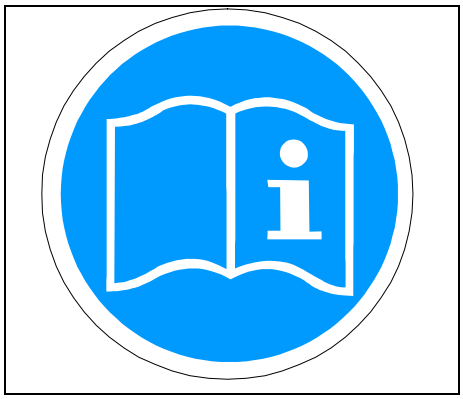


Fig. 11

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

Special attention must be given to:

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

1.6.1 Assembly

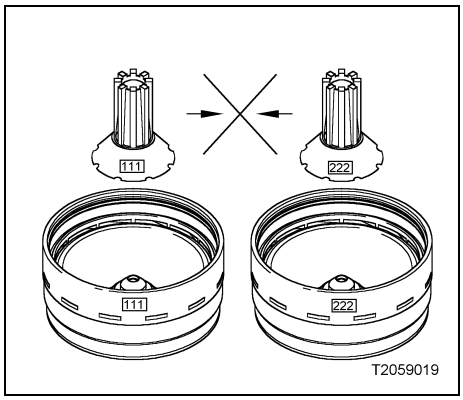


Fig. 12

- 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.

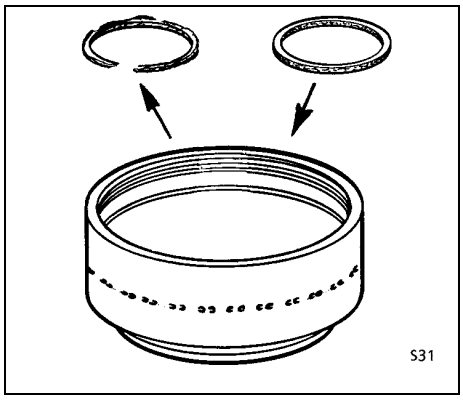


Fig. 13

- Damaged parts must be replaced immediately by new parts.

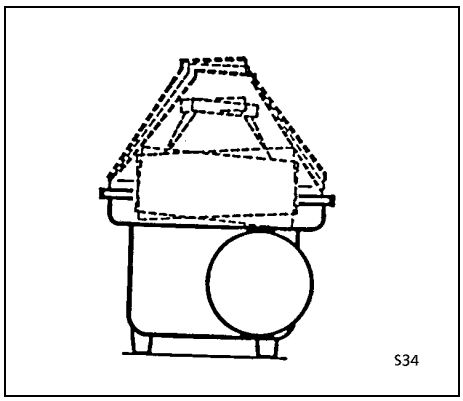


Fig. 14

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

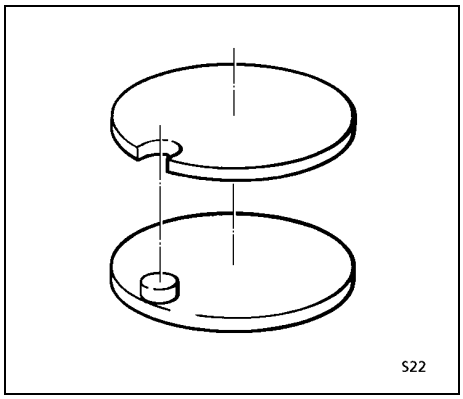


Fig. 15

- 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.

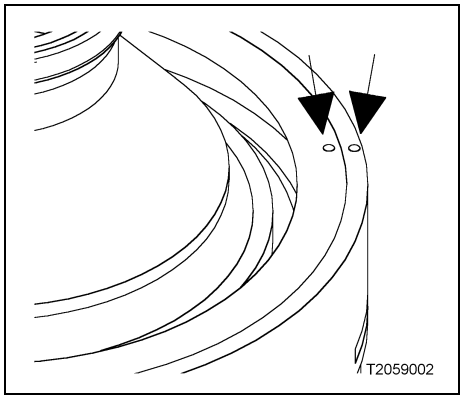


Fig. 16

- When assembling the bowl, be sure to strictly adhere to the instructions given in chapter "bowl", 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.

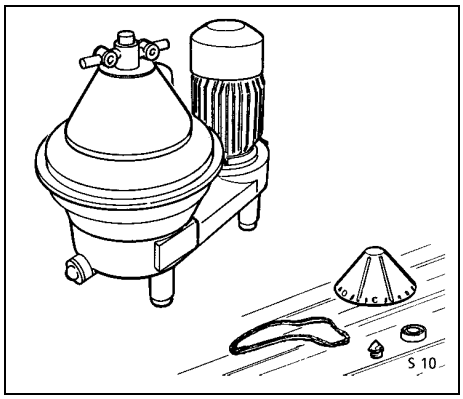


Fig. 17

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

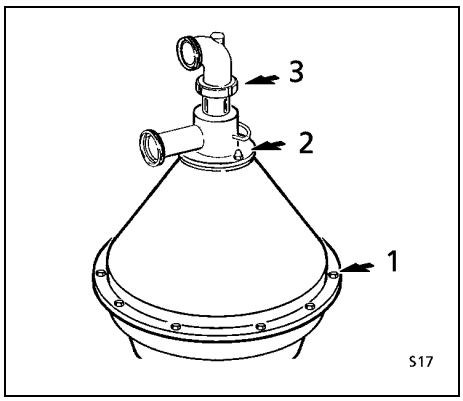


Fig. 18

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

1.6.2 Electrical appliances

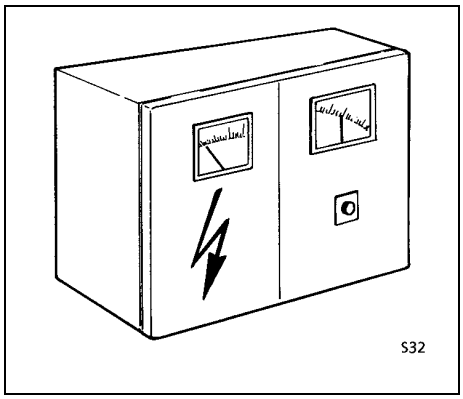


Fig. 19

- 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 voltage 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

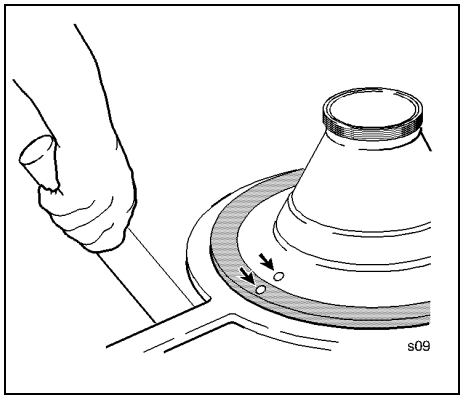


Fig. 20

- 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.

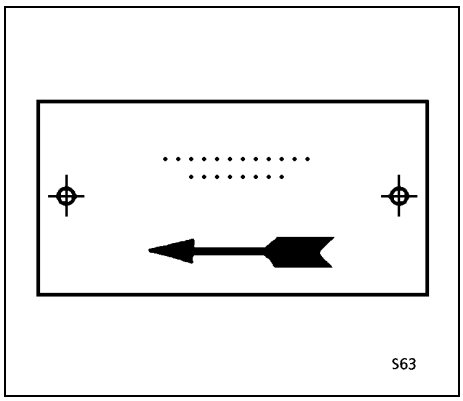


Fig. 21

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

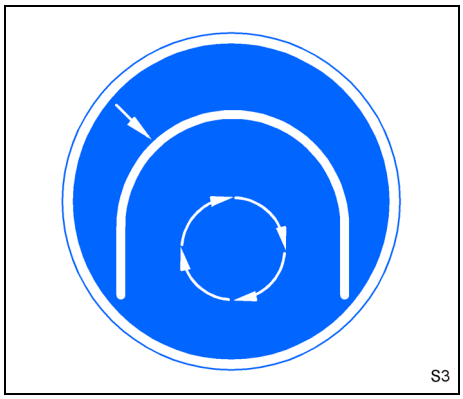


Fig. 22

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

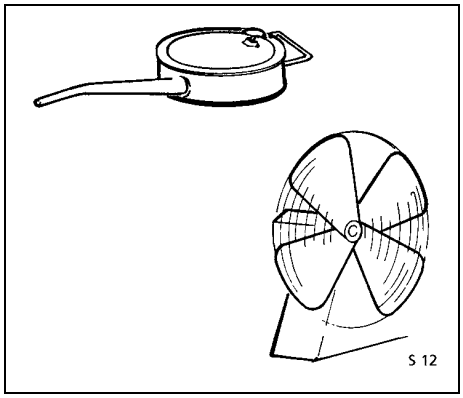


Fig. 23

- Check that the lubrication and cooling systems are serviceable.

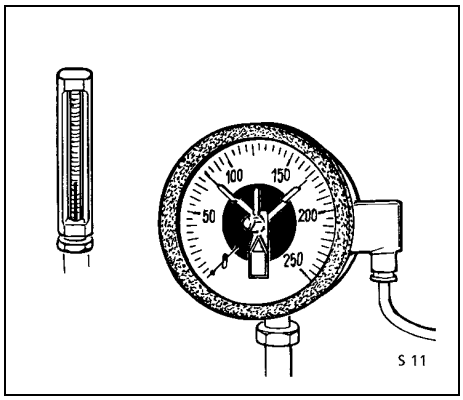


Fig. 24

- 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.

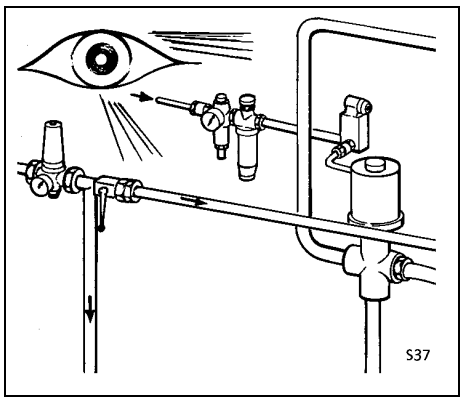


Fig. 25

- Check that the product lines are set to operation.
- Regularly check hoses for signs of ageing.
- Check sight glasses for mechanical damage.
- Replace damaged parts by reconditioned or new parts.

1.6.4 Starting

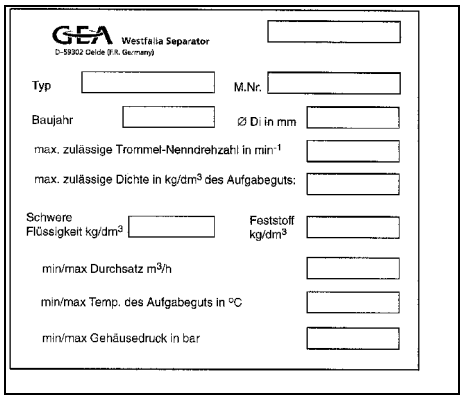


Fig. 26

- Refer to chapter “operation”.
- Note 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. 27

- Wear ear protection.

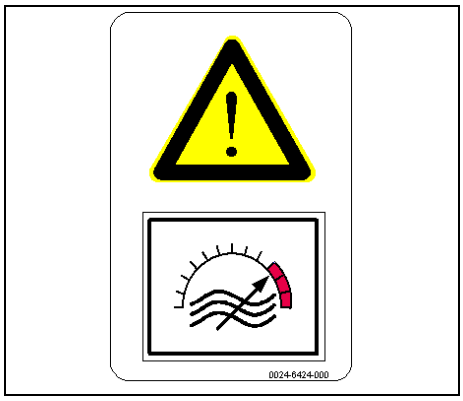


Fig. 28

In case of frequency converter operation:

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

Fig. 29

- Do not feed product which is categorised as explosive.
- The separator must not be used in areas where explosion protection is required.

Fig. 30

- When processing products harmful to persons, observe the pertinent safety regulations.
- Refer to the safety data sheet of the product.
- Wear protective clothing.

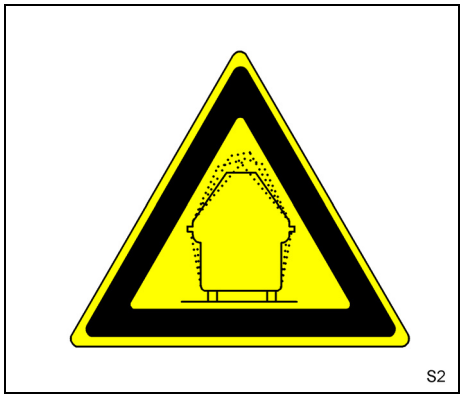


Fig. 31

When unusual noises or vibrations occur on the separator:

- Immediately shut down the separator with filled bowl via “emergency-off”.
- **Never trigger a bowl ejection!**
- Evacuate the room.
- Do not re-enter the room until the centrifuge has come to a standstill.

Fig. 32

Only in case of hot operation:

- Product-contacting parts such as
  - pipes and hoses,
  - hood,
  - solids catcher

  reach temperatures over 80 °C (176 °F).

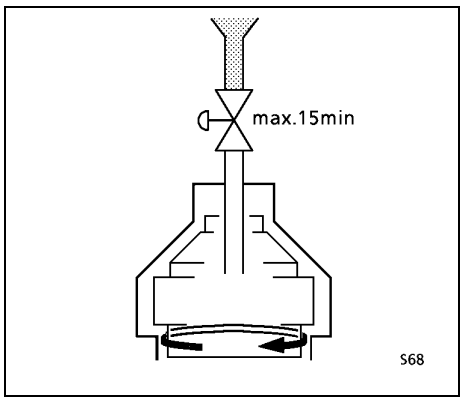


Fig. 33

- The bowl is not allowed to run without liquid supply for more than 15 minutes, as otherwise it would result in overheating of the bowl material.

1.6.5 Shut-down and »Emergency-Off«

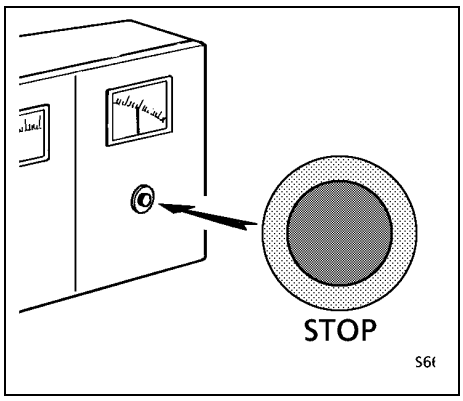


Fig. 34

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

1.6.6 Maintenance and repair

Unfavourable operating conditions may require shorter maintenance intervals. The factors listed below are unfavourable because they either attack the separator material directly or impair the lubrication/cooling system:

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

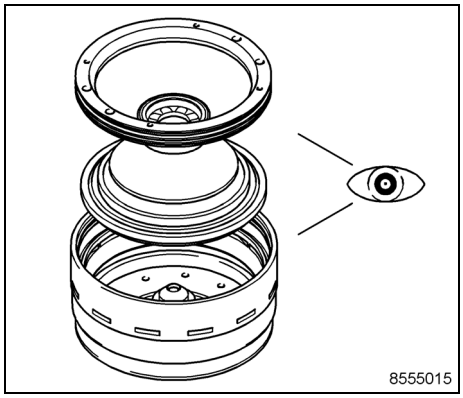


Fig. 35

Particularly highly stressed parts such as

- bowl lock ring,
- bowl bottom,
- bowl top and
- other bowl parts with a large outer diameter

must be regularly checked to ensure safe, reliable and efficient operation.

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.

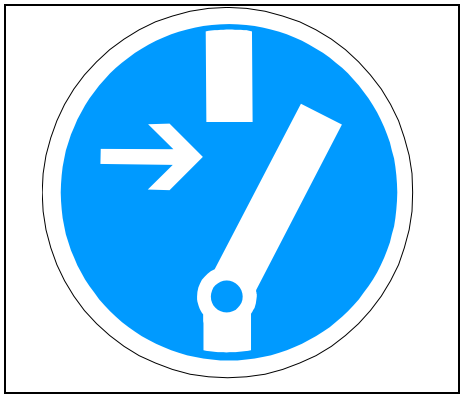


Fig. 36

Prior to carrying out any work on the separator and on electrical plant components:

- ensure that the separator is at a standstill,
- switch off all electrical appliances via the main switch,
- secure installation against unintended re-starting with locking devices.

Fig. 37

- **Do not loosen any part, nor carry out any maintenance or repair work before the bowl has come to a standstill.**
  Check for standstill as described under “Bowl”.

Fig. 38

- Do not climb onto or stand on the machine or parts of the machine.
- Make provision for and use a sturdy working platform.

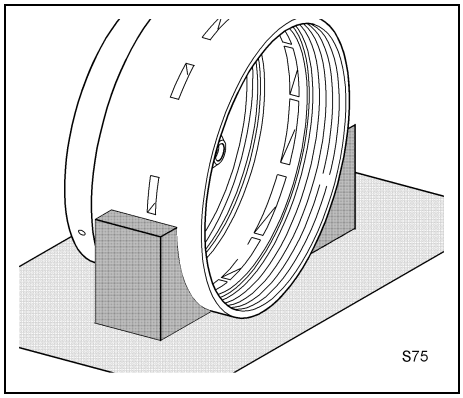


Fig. 39

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

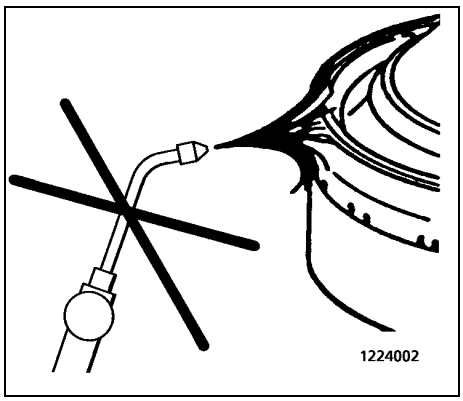


Fig. 40

- **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 (212 °F).

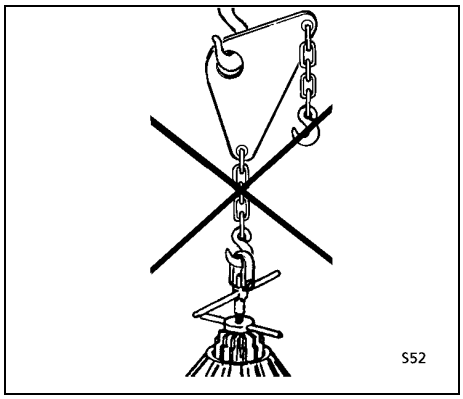


Fig. 41

- 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.

- All load suspension devices have to be checked for completeness and for possible damage at least once a year.
- In addition, when using load suspension devices and hoists, the applicable legislation and safety rules have to be strictly observed.

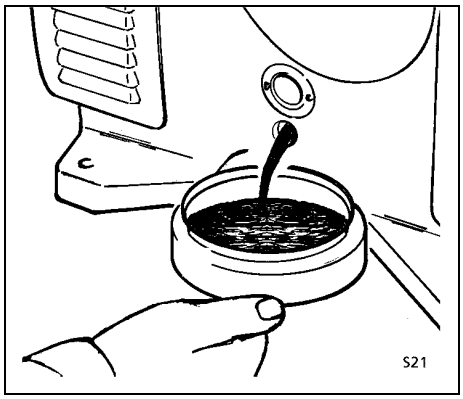


Fig. 42

- 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.

1.7 Corrosion

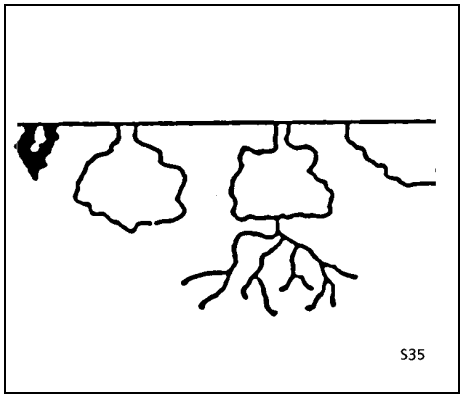
Corrosion can also affect bowl parts made of stainless steel. This corrosion can be flat-spread or pit- or crack-shaped and merits special attention.

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.



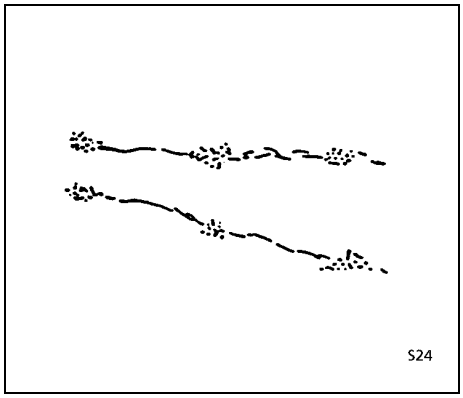
Possible formation of pit-shaped corrosion.

Fig. 43

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. 44

1.8 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 occurrence 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.

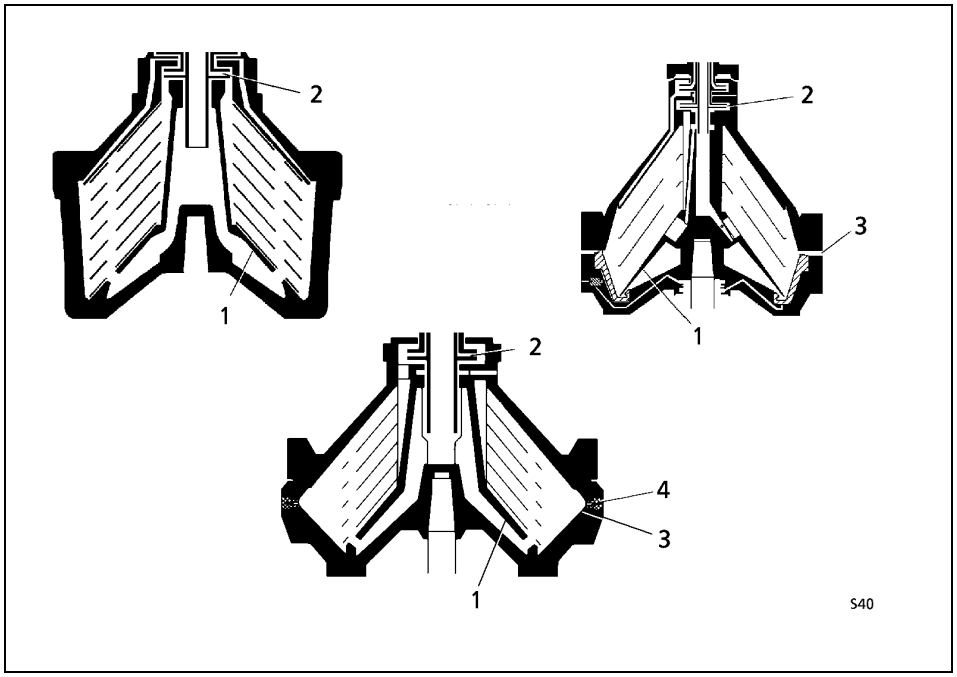


Fig. 45

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.

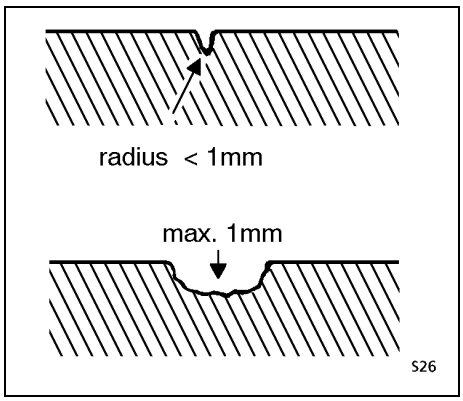


Fig. 46

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 (0.04 inch) at the deepest point.

1.9 The health hazards involved when handling heavy oils and lube oils

As a result of the deterioration in quality of fuel oils, the danger has arisen that the heavy oils used on board contain greater amounts of substances injurious to health. These include:
- polycyclic aromatic hydrocarbons,
- lead compounds,
- chemical residues.

An increased amount of polycyclic aromatic hydrocarbons is also present in used lube oils (waste oils).

The health hazards for the engine room staff depend to a large extent
- on the concentrations of the dangerous substances,
- the ambient air (inhalation of oil vapours/oil mist),
- the intensity and duration of the contact with the skin or mucous membrane.

Possible **short-term** effects:
- headaches,
- dizziness,
- nausea,
- itching or burning of the skin,

Possible **long-term** effects:
- allergic reactions, especially skin allergies,
- festering inflammation of the skin pores (oil-acne),
- damage to the central nervous system after inhalation over a long period,
- skin cancer caused by direct skin contact over a long period,
- Lung cancer or cancer of the digestive organs after inhalation over a long period
  (not certain as the causes are difficult to separate from the effects of smoking and alcohol).

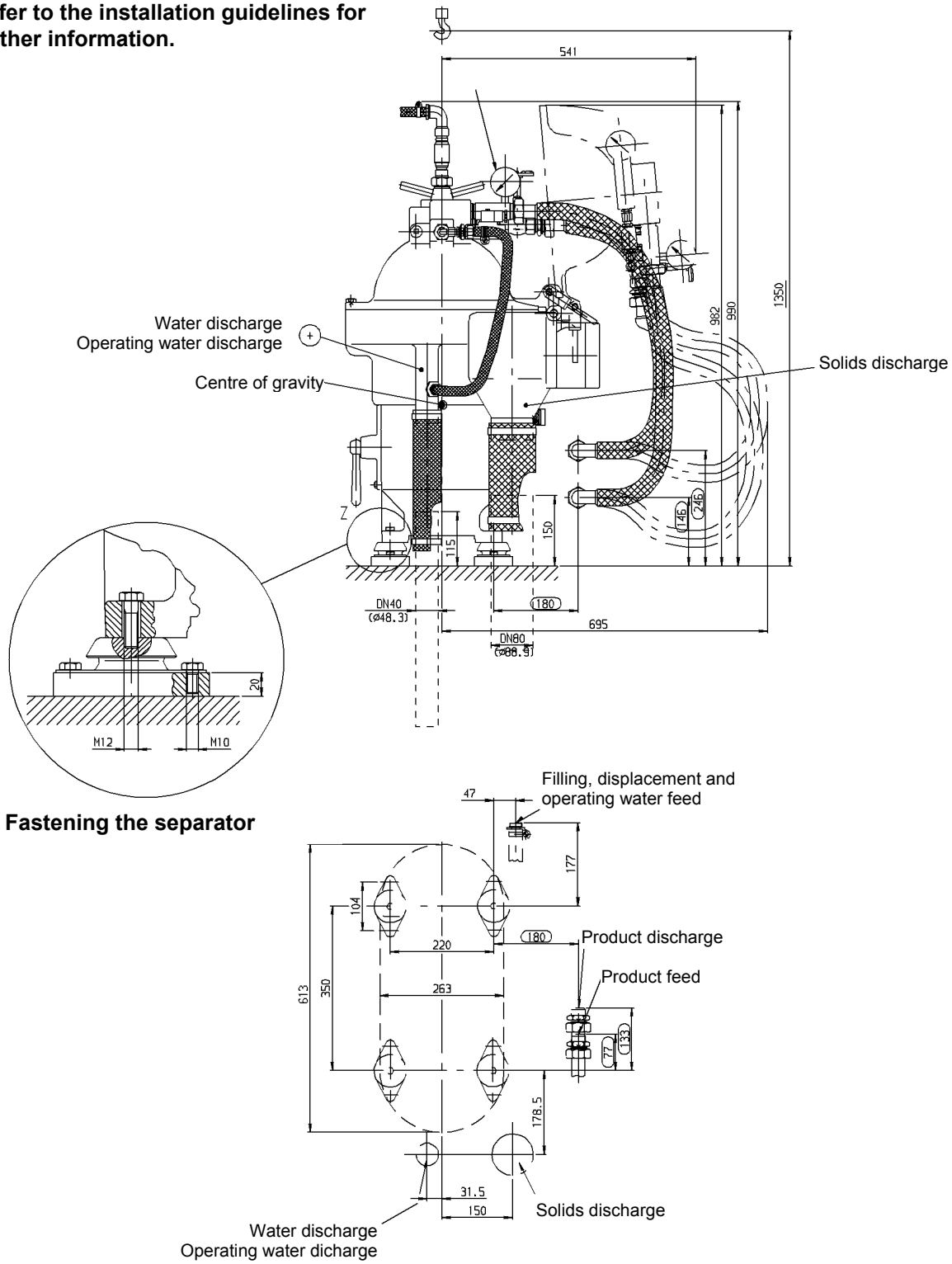
1.9.1 Code of practice and personal protective measures

- Avoid skin contact with heavy oils or lube oils if possible!
  - Wear suitable protective gloves.
  - Apply a protective ointment to the skin (e.g. ointment no. 76), especially if no protective gloves are worn!
- Avoid breathing in oil vapours if possible!
- If possible, improve the air circulation in the room!
  Fully open the air regulation flaps in the outlets of the air supply ducts in the centrifuge and filter area.
- Wash affected areas of skin frequently and thoroughly!
  Apply protective ointment to the skin!
- Personal hygiene is of the utmost importance!
- Change dirty overalls regularly!
- Exercise special care when carrying out maintenance work on and cleaning heavy oil and lube oil centrifuges and filters!

2 Machine description

2.1 Dimensioned drawing of the separator

- **Refer to the installation guidelines for further information.**

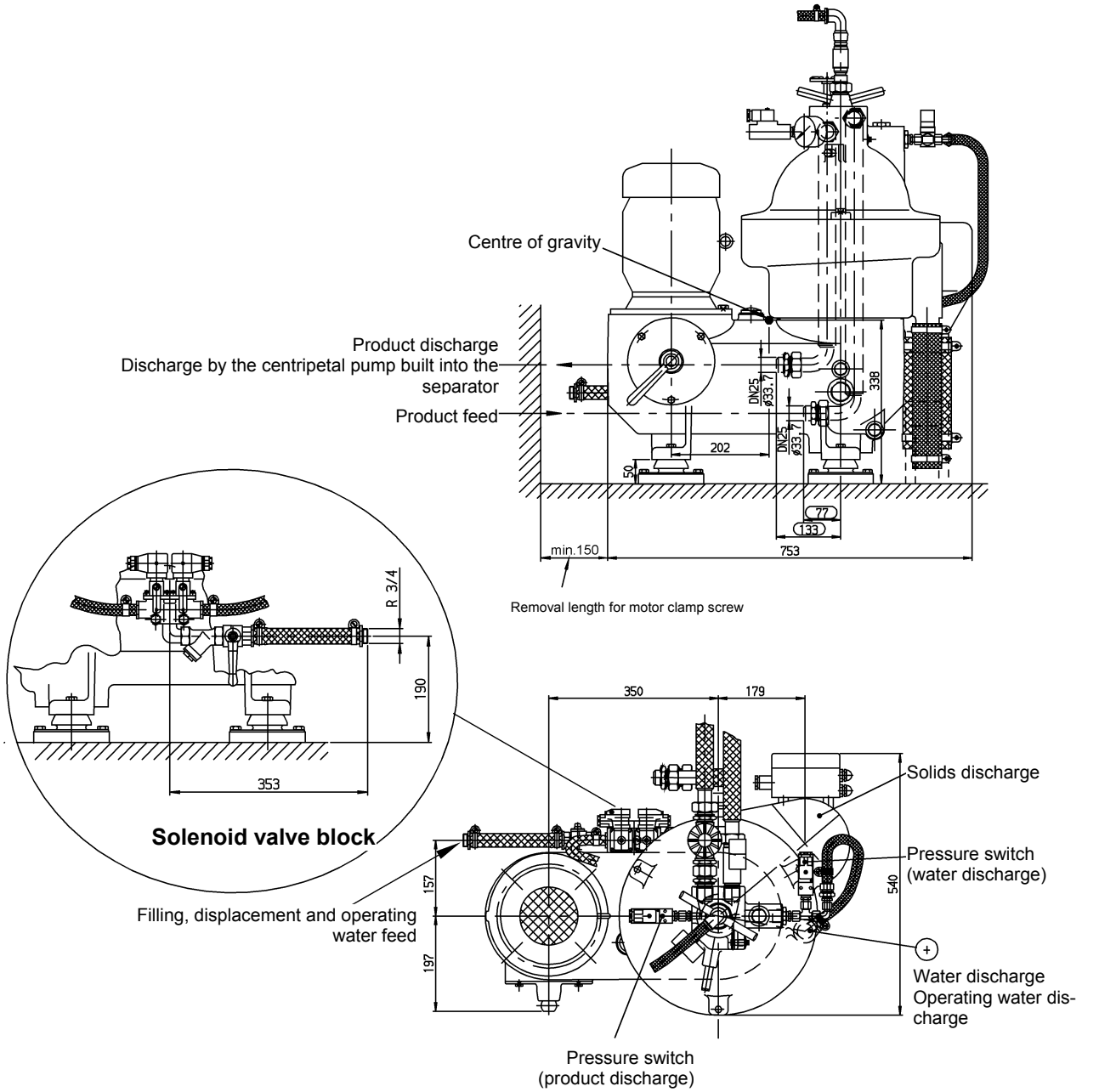


Fastening the separator

These dimensions **must** be adhered to!

Do not discharge residuals into public waters!

Fig. 47 **Subject to modification – Refer to project-specific dimensioned drawing!**



The separator foundation must not have contact with foundations of other units (e.g. auxiliary diesel engines, pumps) to avoid damage to all bearings.

These dimensions **must** be adhered to!

Do not discharge residuals into public waters!

)-020-2

Fig. 48 **Subject to modification – Refer to project-specific dimensioned drawing!**

2.2 Section through separator

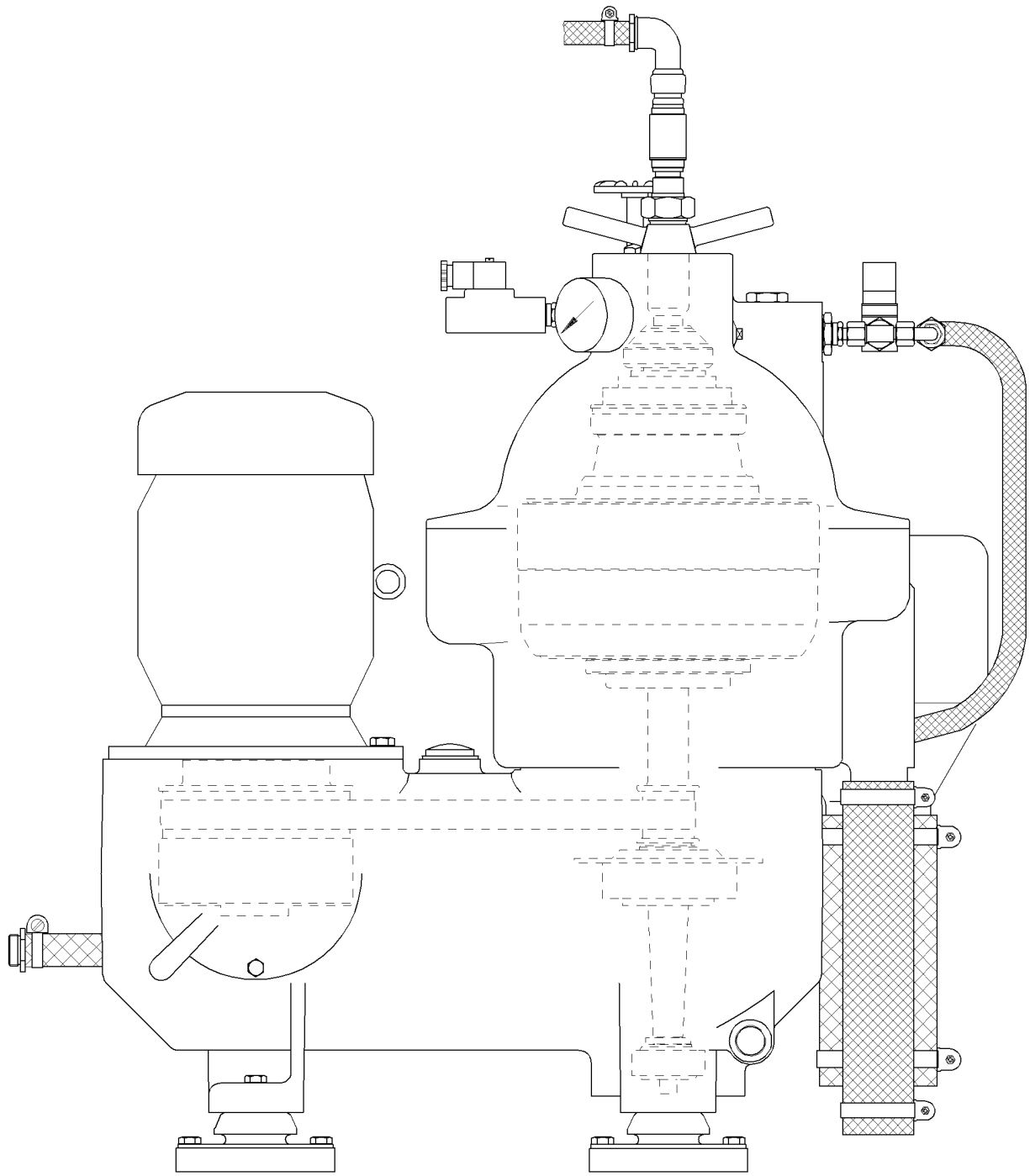


Fig. 49

2.3 General

The machine described in this manual is a high-speed centrifugal separator with self-cleaning bowl.

"Separation" means the separation of liquid mixtures which consist of two liquids, with simultaneous removal of the solids contained in the liquids.

"Clarification" is the removal of solids from a liquid.

Prerequisite for treatment technology (separation) is that the components of the product

- can be separated mechanically,
- have different densities and
- do not emulsify.

2.4 OSD ...-91-…

The separator OSD **…-91-…**

- is equipped with a self-cleaning disk bowl,
- is used for clarification and separation in fuel and lube oil treatment plants (fuel oils up to a density of 0.991 g/ml),
- operates with regulating rings (see section 2.6).

The most important part of the separator is the bowl. The bowl

- is configured as a purifier bowl at the factory,
- can – depending on the application – be converted to operate as a purifier bowl or clarifier bowl.

Converting the purifier bowl to a clarifier bowl and vice versa is possible in just a few easy steps (see diagrams).

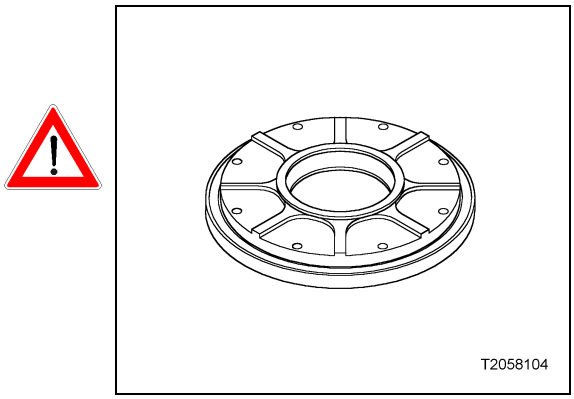


Fig. 50

In the case of the purifier bowl:

- Fit centripetal pump chamber cover with holes (see diagram).
  All holes in the centripetal pump chamber cover must be open!
- Select the correct regulating ring (see section 2.6) and fit it.

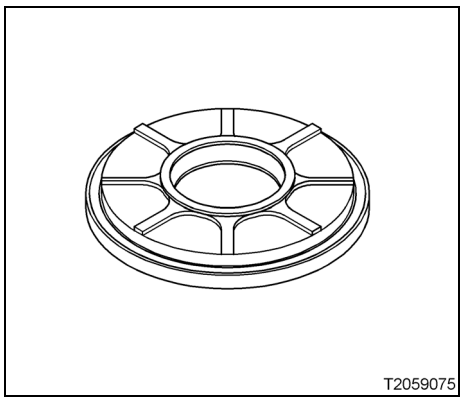


Fig. 51

In the case of the clarifier bowl:

- The centripetal pump chamber cover (without holes!) must be fitted for clarifier operation.
- Inquire the part number of the centripetal pump chamber cover at the factory.

Operating principles of the separator

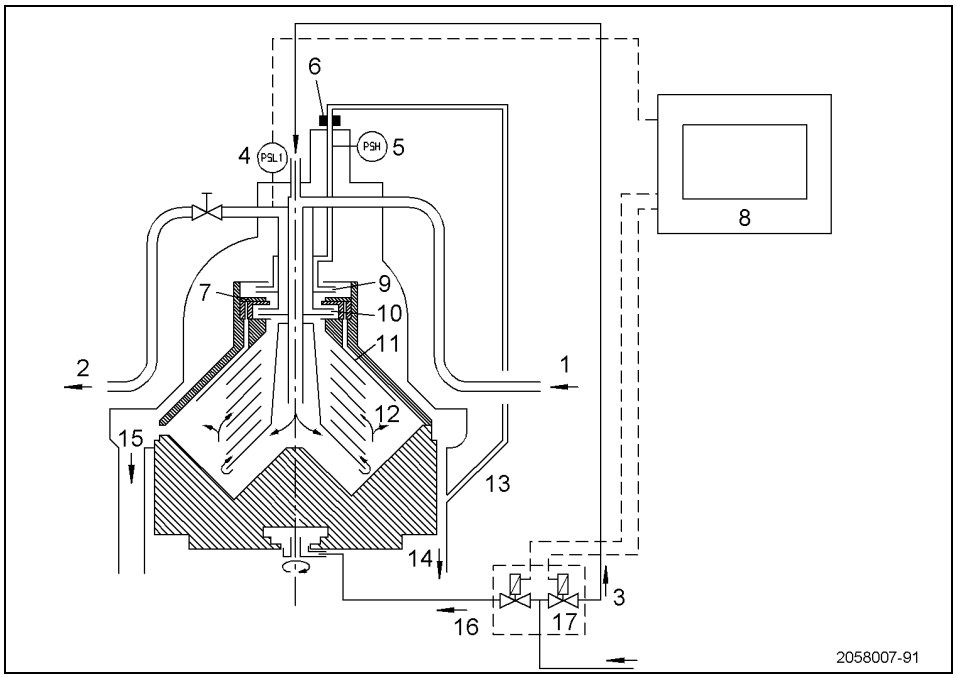


Fig. 52

1 Dirty oil feed
2 Clean oil discharge
3 Displacement water
4 Pressure switch (clean oil)
5 Pressure switch (water discharge)
6 Throttle
7 Regulating ring
8 Control unit
9 Sensing liquid pump (dirty water)
10 Centripetal pump (clean oil)
11 Separating disk
12 Solids holding space
13 Dirty water discharge
14 Operating water discharge
15 Solids discharge
16 Operating water feed
17 Solenoid valve block

The fuel or lube oil is conveyed to the separator via a separate pump.

The product is fed in through a closed line system (1).

The dirty water is discharged by sensing liquid pump (9) via a throttle (6).

The clarified clean oil is discharged (2) under pressure by centripetal pump (10).

The bowl is automatically opened and closed for desludging at full bowl speed by means of a remote controlled solenoid valve (17) in the operating water line. The opening time of the solenoid valve is up to 2 seconds.

The control and monitoring unit (8) guarantees unmanned operation.

2.5 Main components of the separator

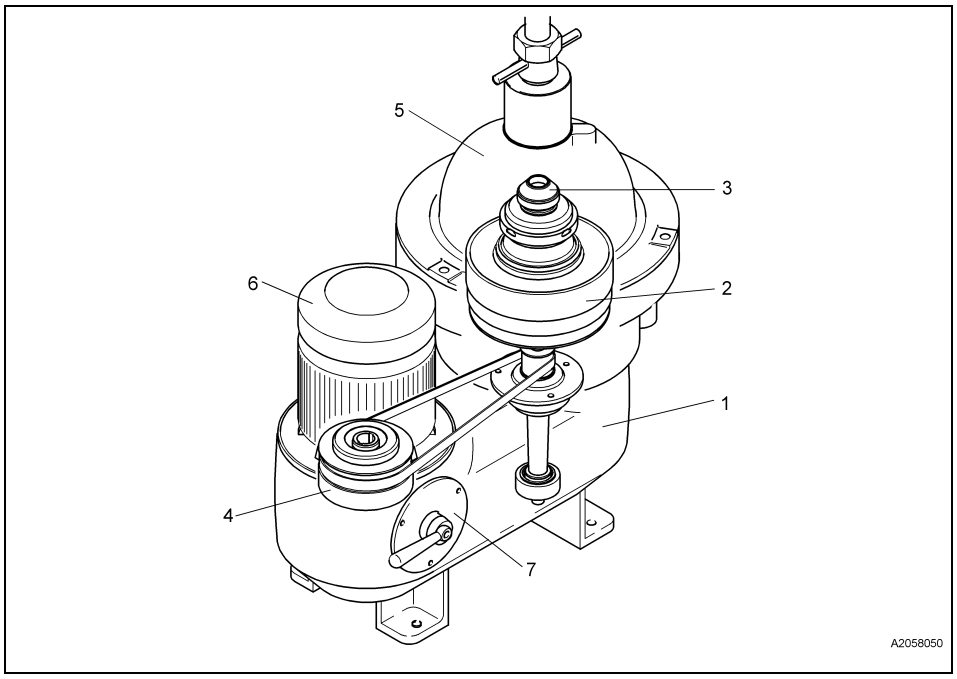


Fig. 53

Pos.	Designation	Function
1	Frame	• contains the drive parts. • supports motor, bowl and hood.
2	Bowl	See section 2.5.1
	Bowl hydraulic system	See section 2.5.2
3	Centripetal pump	See section 2.5.3
	Sensing liquid pump	See section 2.5.4
4	Drive	See section 2.5.5
5	Hood	• covers the rotating bowl. • holds the feed and discharges.
6	Motor	• accelerates the separator to the required speed. • is protected against overload during operation.
7	Brake	• The run-down time of the bowl can be shortened by applying the brake (e.g. for servicing and maintenance work). See section 2.7. **Applying the brake** • is not necessary in the case of a normal separator shut-down (section 3.7). • is ineffective if a drive belt is torn, defective or has come off! (**Be sure to observe** the run-down time of **30 minutes** until dismantling the separator! See sect. 3.7.)

2.5.1 Bowl

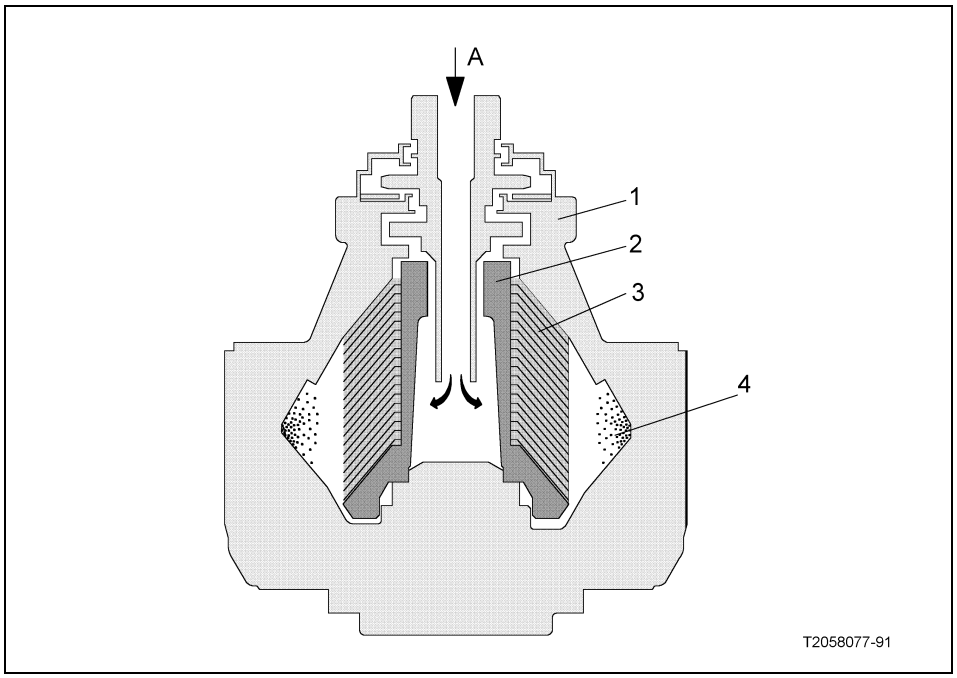


Fig. 54

Pos.	Designation	Function
1	Bowl	produces high centrifugal forces through rotation making possible separation and clarification.
2	Distributor	accelerates the product fed in through feed **A** to the rotational velocity of the bowl and then conveys it into the disk stack.
3	Disk stack	• splits the liquid mixture consisting of a light and heavy phase, e.g. oil-water, into its components. • consists of a large number of conical disks positioned on top of one another. Each disk is provided with spacers so that precisely defined interspaces are formed between the individual disks. The smooth disk surfaces facilitate sliding of the solids and hence self-cleaning of the disks.
	Separation chamber	The separation space consists of a large number of parallel chambers of low height. This produces very small radial sedimentation paths for the product.
	Solids	collect on the upper wall of each disk interspace and slide down into the solids holding space.
4	Solids holding space	collects the solids separated in the disk stack.

2.5.2 Bowl hydraulic system

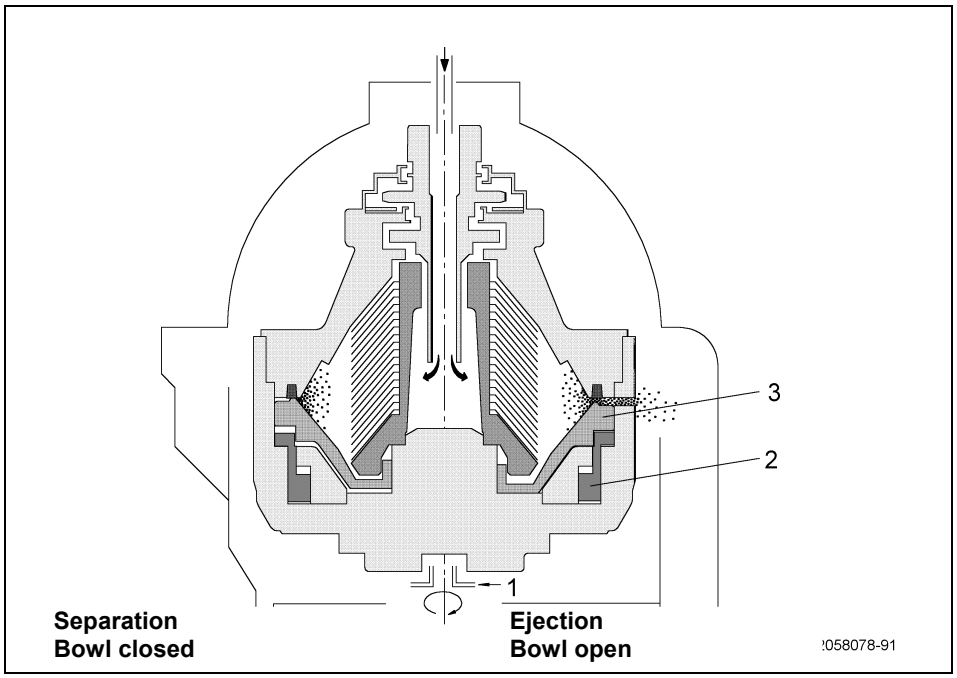


Fig. 55

Pos.	Designation	Function
1	Operating liquid (usually water)	In the rotating bowl the incoming, rotating operating liquid generates a high centrifugal pressure. This pressure is utilised for actuating the annular piston and sliding piston which closes and opens the bowl.
2	Annular piston	• is inside the bowl bottom, • rotates with the same angular velocity as the other bowl parts, • is axially movable.
3	Sliding piston	• is located inside the bowl bottom, • rotates with the same angular velocity as the other bowl parts, • is axially movable.

Closing the bowl (separation)

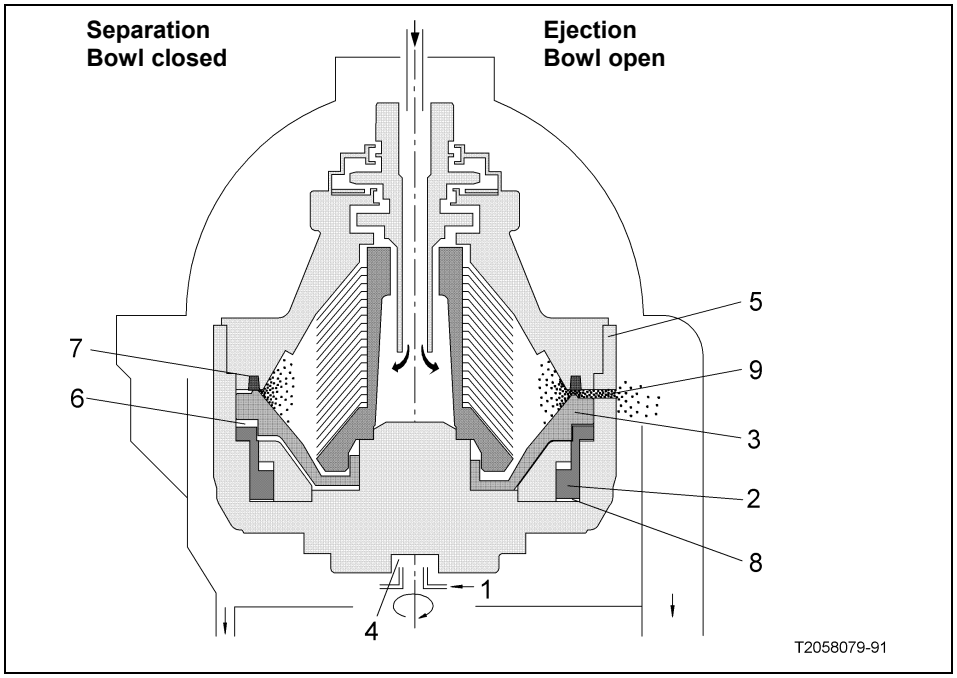


Fig. 56

After starting the separator the solenoid valve for operating liquid is actuated with the aid of the control unit, and the bowl is closed as follows:

Pos.	Designation	Function
1	Operating liquid	• flows into the injection chamber 4 of bowl bottom 5 and • from there through feed holes into closing chamber 6. This initiates closing of the bowl.
2	Annular piston	• moves into closed position.
3	Sliding piston	• is raised due to the hydrostatic pressure in closing chamber 6. • is pressed against the gasket 7 of bowl top due to the hydrostatic pressure and • closes the bowl.

Opening the bowl (ejection)

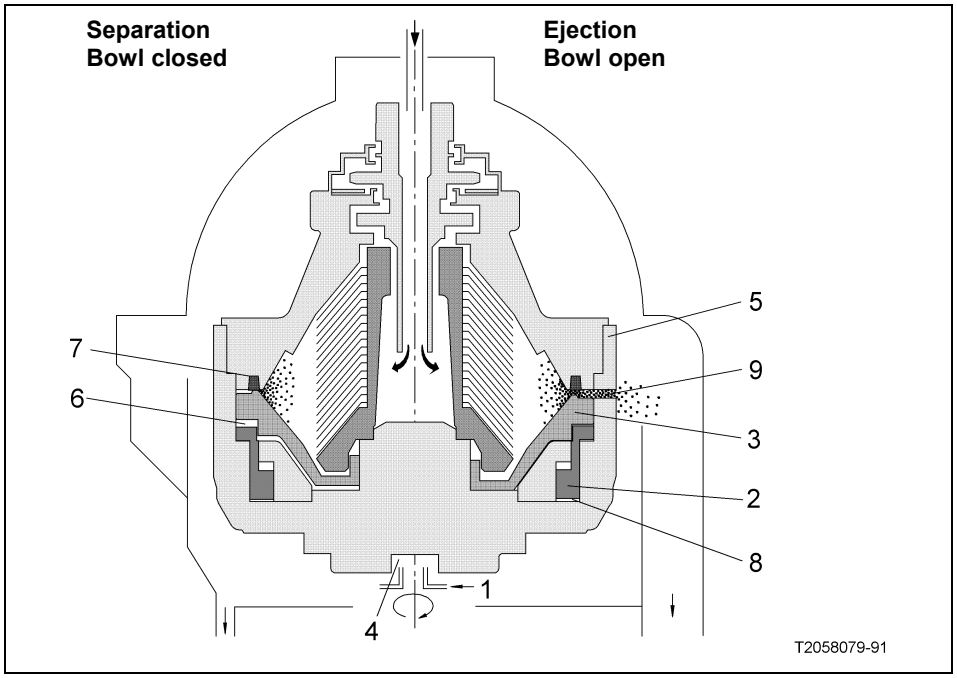


Fig. 57

The solenoid valve for operating liquid is opened with the aid of the control unit, and the ejection cycle is triggered as follows:

Pos.	Designation	Function
1	Operating liquid	• flows first into injection chamber 4 and • from there into opening chamber 8.
2	Annular piston	• rises and • empties closing chamber 6.
3	Sliding piston	• moves downwards and • opens the ejection ports in bowl bottom 5 for the separated solids 9.

2.5.3 Centripetal pump

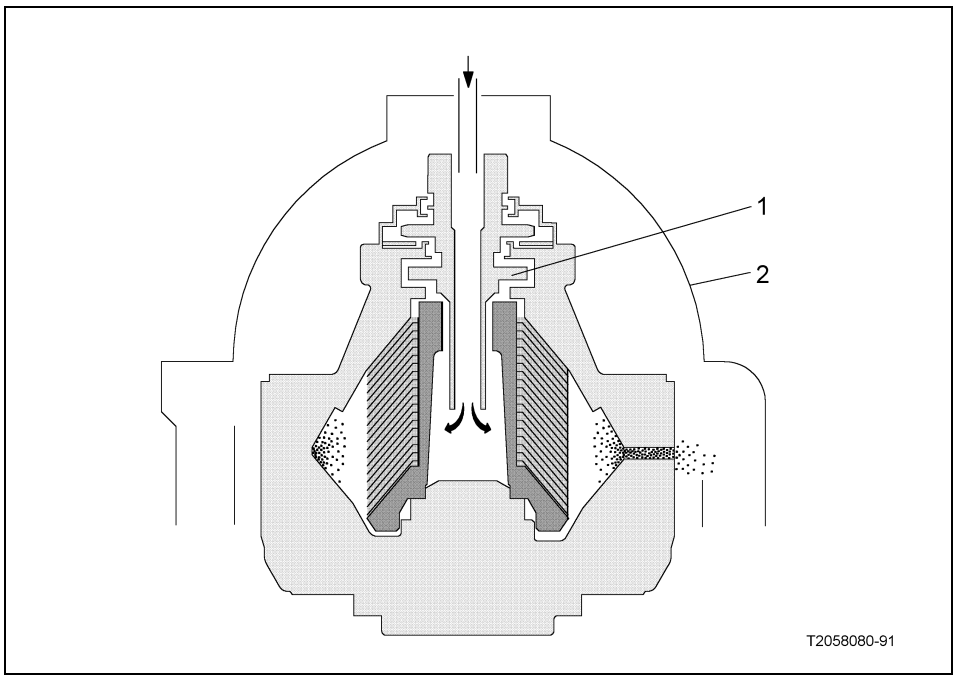


Fig. 58

Pos.	Designation	Function
1	Centripetal pump	• discharges the separated liquid under pressure. • is firmly connected to hood 2 of the separator.

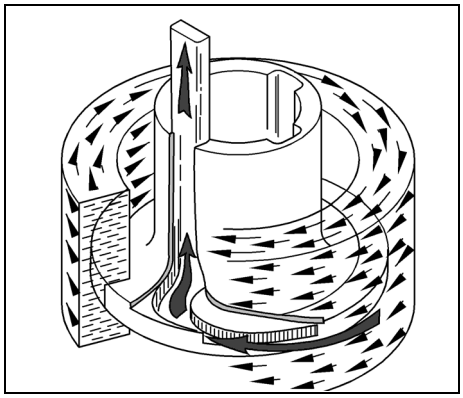


Fig. 59

- The disk provided with channels dips into the liquid rotating with the bowl.
- The liquid
  - is pared off by the centripetal pump and
  - flows through its spiral channels from the outside to the inside.

  By this means the kinetic energy is converted into pressure energy which makes possible discharging the liquid under pressure.

2.5.4 Sensing liquid pump

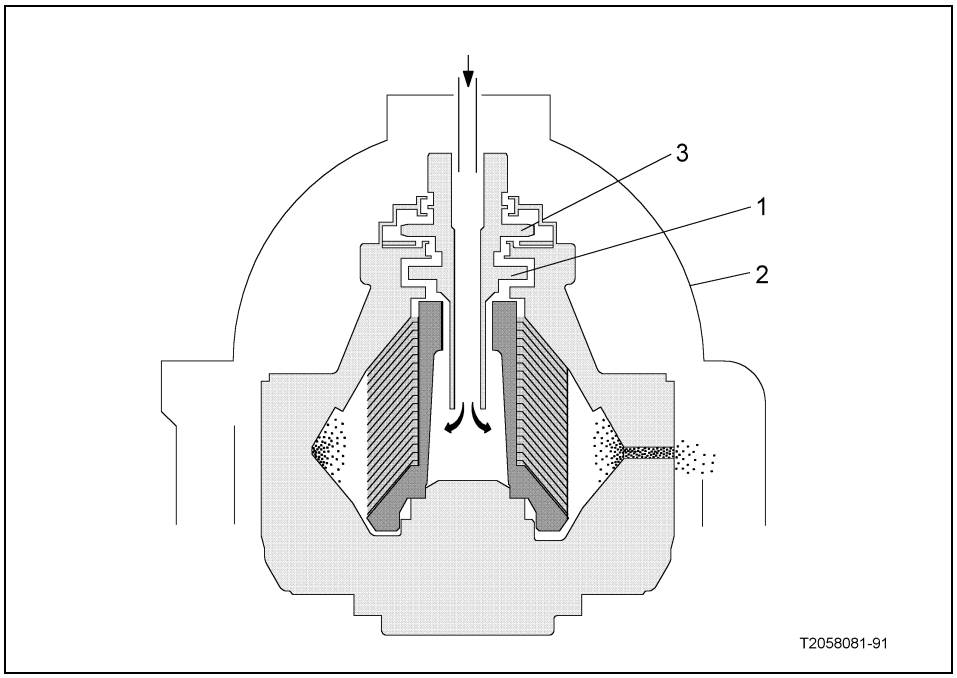


Fig. 60

Pos.	Designation	Function
3	Sensing liquid pump	• works on the same principle as the centripetal pump 1 (see section 2.5.3). • conveys the sensing liquid to the monitoring system.

2.5.5 Drive

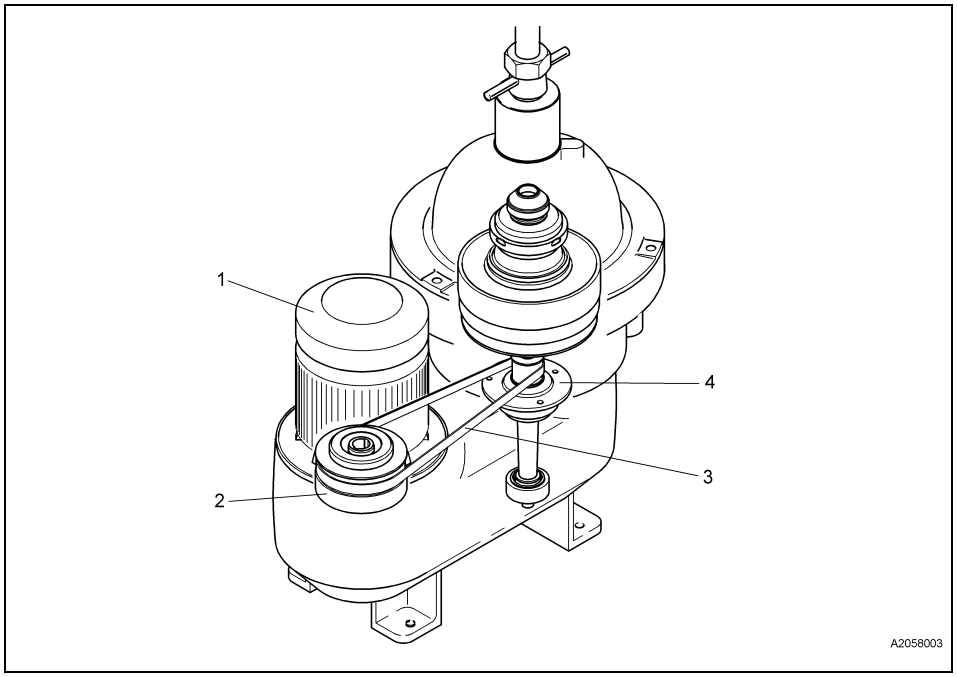


Fig. 61

Pos.	Designation	Function
1	Drive motor	drives the separator. Power transmission to the bowl spindle is via the centrifugal clutch to the motor belt pulley and via the drive belt.
2	Centrifugal clutch	• ensures power transmission between motor, drive belt and spindle. • accelerates the bowl **gradually** to rated speed; • is gentle on the drive belt and motor. For more details see section 4.5 - *centrifugal clutch.*
3	Drive belt	transfers the drive power of the drive motor 1 to the bowl spindle 4. Regularly check the seat and condition of the drive belt. The inspection and replacement intervals are given in the maintenance schedule (see 4.2.1).
4	Bowl spindle	supports the bowl.

2.6 The regulating ring
(using oil purification as an example)

Function of the regulating ring

Optimum dewatering of oils containing water is only possible if the bowl is correctly adjusted to the difference in density between the oil and the water.

The regulating ring with the correct inner diameter, i.e. with the diameter that corresponds to the density difference between the oil and water, should therefore be selected from the set of regulating rings (with different inner diameters) supplied with the separator and fitted in the bowl.

The inner diameter of the regulating ring to be selected can be determined with the aid of the diagram or by experiment. The rule of thumb is:
- **small** regulating ring for **heavy oil,**
- **large** regulating ring for **light oil.**

2.6.1 Determining the size of the regulating ring with the aid of the diagram
(using oil purification as an example)

The diagram can be used to determine
- the inner diameter of the regulating ring and,
- if desired, the density of the oil

for a given separating temperature, provided that the density of the oil is known at a temperature between 15 °C and 90 °C.

Example

Given:	
– Density of oil at 20 °C	$\rho_{oil\ 20\ °C}$ = 0.89 kg/dm^3
– Separating temperature	t = 70 °C
To be determined:	
– Inner diameter of regulating ring	d = **?**
– Density of oil at 70 °C	$\rho_{oil\ 70\ °C}$ = **?**
Determined:	
– Inner diameter of the regulating ring according to the diagram	d = 73 mm
– Density of oil at 70 °C according to the diagram	$\rho_{oil\ 70\ °C}$ = 0.858 kg/dm^3

If no regulating ring with the determined inner diameter is available, a smaller ring can be machined to the required size. Before doing that, however, check by experiment whether the regulating rings furnished with the separator are adequate for optimum dewatering.

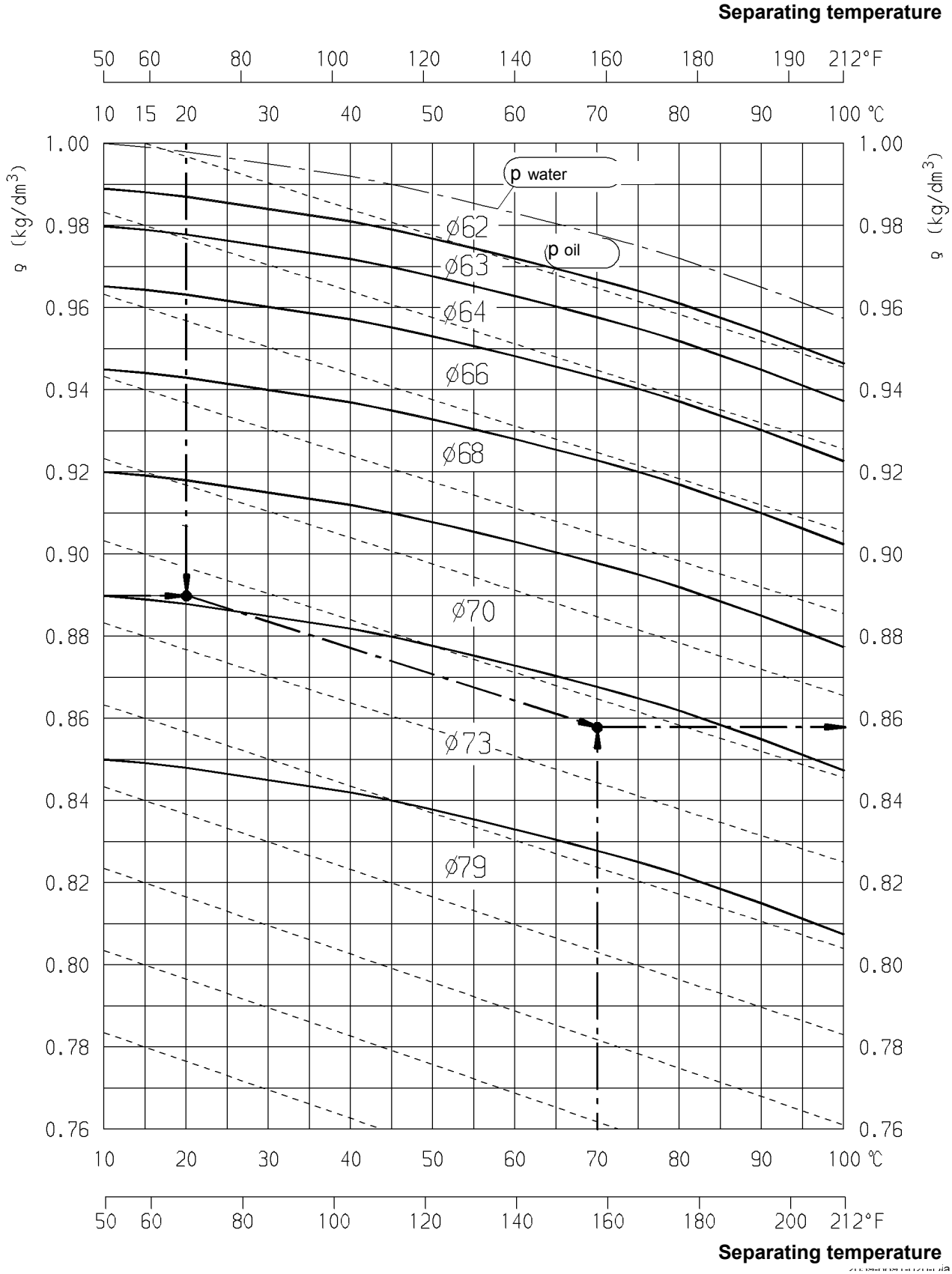


Fig. 62 Diagram for determining the regulating ring

2.6.2 Determining the regulating ring by experiment
(explained using the example of oil purification)

The next smallest regulating ring is always chosen to avoid emulsification.

When the regulating ring is too **wide**

– the water discharging through the water outlet will contain oil.

When the regulating ring is too **narrow**

– emulsification will occur or
– the oil discharging through the clean oil outlet will contain water.

The water may look milky or dirty. The coloration comes from the washing of the oil.

In the bowl a separation zone is formed between the light and heavy phases whose centre is the separating line.

After opening the bowl, the position of the separating zone can be recognised by the almost always visible separating line between water and oil on the underside of the separating disk.

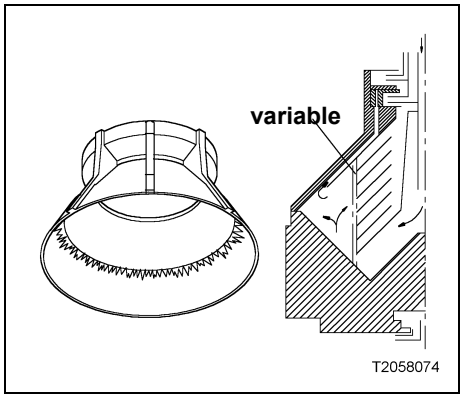


Fig. 63

Correctly selected regulating ring

- The separating line between water and oil is at the outer edge of the disks.

Effect:

– The discharging clean oil is free of water.
– The discharging water is free of oil.

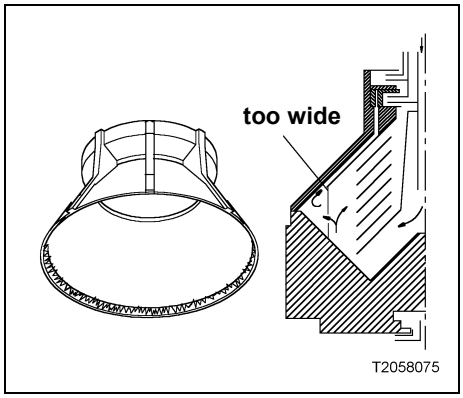


Fig. 64

Regulating ring too wide

- The separating line between water and oil runs
  – way outside the disks and
  – too close to the outer edge of the separating disk.

Effect:

– The discharging clean oil is free of water.
– The discharging water contains oil or
– oil breaks the water seal.

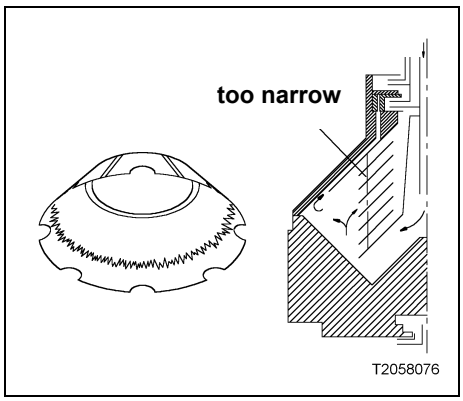


Fig. 65

Regulating ring too narrow

- The separating line between the liquid components does not pass at the outer edge of the disks but further inwards.

Effect:

– The discharging clean oil contains water.
– The discharging water is free of oil.

2.7 Technical data

Subject to modification!

The process data are in the sales documents.

Bowl	
Solids holding space (total)	0.9 dm^3
Speed - for densities of the product up to 1.05 kg/dm^3 (at 15 °C) and - for densities of the separated solids up to 1.4 kg/dm^3	12 000 min^{-1} (see nameplate)
Speed for higher densities	contact the factory
Starting time	approx. 2 - 4 min
Run-down time (without braking)	30 min
Run-down time (with braking)	6 min

Centripetal pump	
Output (depending on medium)	max. 4 000 l/h
Pressure head	1 - 1.5 bar

Operating water	
Quantity	min. 1 800 l/h
Pressure	2 - 3 bar

Standard operating water specification	
Suspended matter	max. 10 mg/l
Particle size	max. 50 µm
Hardness: – up to 55 °C separating temperature	< 12° dH
– above 55 °C separating temperature	< 6° dH
To convert the hardness values stated use the following equation: 1° dH = 1.79 ° fH = 1.25 ° eH = 17.9 ppm $CaCO_3$	
Chlorine ions	< 100 mg/l
pH	6.5 – 7.5

Normal separating temperature of the product	
DO	20 °C (68 °F)
MDO	40 °C (104 °F)
LO	90 °C (194 °F)
LO HD	95 °C (203 °F)
HFO	98 °C (208 °F)

Due to the large number of products to be treated, it is not possible to specify an exact separating temperature of the product in this manual.
The exact separating temperature of the product (in °C) is stated in the order-specific data sheet.

Motor		
Power rating	50 Hz	4 kW
	60 Hz	4.8 kW
Speed	50 Hz	3 000 RPM
	60 Hz	3 600 RPM
Design		IM V1
Enclosure		IP 55

Drive	50/60 Hz
Oil filling	approx. 2.5 l
	Oil quality, see section 4.2.3

Product pump	
Pump unit (gear or screw pump)	
Output	depending on plant rating
Suction height	max. 0.4 bar
Pressure head	2 bar

Weights	
Separator (with motor, without bowl)	160 kg
Bowl	42 kg
Motor	25 kg

Capacity (see sales documents)

The capacity of the separator depends on the
- viscosity,
- temperature,
- density,
- degree of contamination,
- water content and
- the desired degree of purity of the product.

3 Operation

3.1 Technical information

Take note of the following sections:

3.1.1 Notes on separation

The separator is used for clarification and separation in fuel and lube oil treatment plants.

The best separation effect is obtained with low viscosity of the product to be separated.

The separator operates economically with the separating temperatures and capacities specified by us.

In the case of deviating products

- see sales documents or
- inquire at the factory.

Procedure:

- Select the desired operating mode on the control unit.
- Set the separating time on the control unit.
- Start the separator (see 3.2).

3.1.2 General information on bowl ejection

The bowl is ejected automatically at full speed during the program sequence.

The ejection time is determined by the preset separating time.

For determining the separating time see 3.5.

Sequence of an ejection (example)

1.	Separating time has elapsed.
2.	Product feed valve is closed.
3.	Displacement water displaces the fuel oil to the clean oil side.
4.	Operating water opens and closes the bowl hydraulically at full bowl speed.
5.	Waiting time for speed recovery.
6.	Filling water supply
7.	Product valve is opened.
8.	Separating time resumes.

Displacement

- When separating, the loss of feed liquid unavoidable during ejection can be reduced to a minimum by displacing the feed liquid with water before sludge ejection takes place (especially important when processing valuable feed liquid).
- The duration of displacement water supply is given in the *timer overview* (see control unit manual).

- If the displacement time is **too long**, water will discharge through the light liquid outlet.
- If the displacement time is **too short,** part of the product remains in the bowl and is lost during desludging.

Flush ejection

If the solids cant be completely ejected,
  – due to an excessively long dwell time in the bowl or
  – are stuck to firmly on the wall of the solids holding space due to the solids properties,

- either the separating time must be shortened or
- a flush ejection must be carried out after the total ejection by filling the bowl with water or product and emptying it again.

Program control

- "Displacement", "ejection", "filling" and "flush ejections" at precisely defined intervals are best carried out with the automatic control unit.
- The clean oil discharge and water discharge can be monitored.
- Faults can be signalled visually or audibly.

3.2 Before start-up

- **Note:**
  - Safety precautions in chapter 1.
  - Instruction manual of the corresponding control unit.
  - Feed only product that conforms to the specifications on the nameplate.
  - Process-related deviations are possible (refer to project-specific data!).

3.2.1 Before the first start-up

- **Check that**
  - the machine is correctly assembled.
  - the hoses and hose pipes are undamaged and connected (see section 4.2.2).
  - the sight glass in the frame for observing the drive belt is clean.
  - the drive chamber is filled with oil in accordance with section 4.2.3.
  - the bowl height is correct (see section 4.7.1).
  - the brake is released by turning the handle clockwise.
  - the bowl can be rotated by hand.
  - the hex head screws on the hood are tight (see 4.4).
  - the handle connection piece is tightly bolted to the centripetal pump (see 4.4).
  - the feed and discharge lines are connected (see 4.4).

3.2.2 Before every start-up

- **Check that**
  - the machine is correctly assembled.
  - the hoses and hose pipes are undamaged and connected (see section 4.2.2).
  - the sight glass in the frame for observing the drive belt is clean.
  - the gear chamber is filled with oil as specified in section 4.2.3.
  - the brake is released by turning the handle clockwise.
  - the hex head screws on the hood are tight (see 4.4).
  - the handle connection piece is tightly bolted to the centripetal pump (see 4.4).
  - the feed and discharge lines are connected (see 4.4).

3.3 Starting the separator

- See section 3.2.2.
- Open the shut-off valve in the product feed line.
- Switch on the motor.
  Compare the current and starting time with the diagram (section 4.1.3) until the bowl reaches the speed specified on the separator nameplate.
- Start the preheater (if installed) after switching on the motor!
- Open the stop valve in the product discharge.
- Switch on the control unit.
- Check that the operating mode selected on the control unit corresponds to the valve positioning in the system.
- Start the program.
- After the feed valves have automatically opened
  – set the backpressure in the product discharge to approx. 1.5 bar;
  – adjust the desired throughput;
  – when necessary, correct the backpressure in the product discharge.
- Check the discharges for solids and dirty water; there must be no oil flow!

3.4 Monitoring of operation

The machine is monitored largely by the separator control.

Operations to be carried out regularly:

- On your daily round, especially during the first 1500 operating hours, pay attention to the following:
  – Oil level
  – Temperatures
  – Pressures
  – Leakage
  – Vibrations
  – Current consumption
  – Starting time
  – Hoses and hose pipes
- *Keep to the maintenance schedule* (see 4.2.1)!
- Inspection
  We recommend having the separator checked regularly by our specialists. These checks help to
  – maintain the operating safety of the machine and
  – avoid unplanned downtime.

3.5 Setting the separation time

When using time-dependent automatic control programs, accurate setting of the separation time (time between ejection cycles) is only possible if the throughput capacity and solids loading in the feed remain constant. If this is not the case, it may be necessary to correct the settings during operation.

The separating time depends on
- the preselected operating mode (partial or total ejection mode),
- the solids loading in the feed,
- the consistency of the solids,
- the effective solids space volume in the bowl,
- the separator throughput.

Given constant conditions, the separating time can be determined by calculation.

The following times have proven appropriate in practice (examples):

Product	Total ejection	Partial ejection
HFO	1 h to max. 2 h	0,5 h to max. 1 h
MDO	2 h	1 h
LO mild	2 h	1 h
LO HD	1 h to max. 2 h	0,5 h to max. 1 h

3.5.1 Mathematical calculation

Example for mathematical calculation of the separating time:

Given:	Solids content [1]	**p**	**= 0.05 %**
	Solids holding space volume	**V**	**= 0.9 l**
	Solids holding space given 75 % utilisation	**V'**	**= 0.6 l**
	Throughput capacity [1]	**V°**	**= 1 000 l/h**
Wanted:	Separating time	**t**	**= ? min**

The separating time to be set is calculated as follows:

$$t = \frac{V'}{V° \cdot p} \cdot 60 \cdot 100 = \frac{0.6}{1\,000 \cdot 0.05} \cdot 6\,000 = 72 \text{ min} = 1.2 \text{ h}$$

[1] Solids content and throughput capacity must be determined on site or taken from the order specification.

3.6 Ejecting the bowl

Automatic operation
• Initiate ejection program by pressing the key ”Program 1”: – The product feed is closed. – Displacement – Bowl ejection – Speed recovery • The product valve opens again.

Hand operation (in the case of unscheduled shut-down)
• Cut off the product feed to the separator: – Close the product valve using the manual override. • Eject the bowl: – Open the operating liquid valve using the manual override for **approx. 2 – 3 seconds**. • Speed recovery – Wait for approx. 20 – 30 seconds. • Separating mode – Open the product valve using the manual override.

3.7 Shutting down the separator

- Switch off the preheater (if installed).
  – Continue to feed product for a few minutes since the preheater continues to heat for a short time.

Automatic operation
• End the separation program with the key "program 0" – Two total ejections are performed automatically.

Hand operation (in the case of unscheduled shut-down)
• Close the product feed: – Close the product valve using the manual override. • Eject the bowl: See section 3.6.

- Close the discharges.
- Close the feed for operating water, filling and displacement water.
- Switch off the motor.
- Switch off the product pump (if installed).
- Close the stop valve in the suction side of the product pump (if installed).

Danger to life through high-speed rotating separator parts!

- Do not loosen any part of the separator before the bowl has come to a standstill.
  The run-down time of the bowl is **30 minutes** after switching off the motor (without braking!).
  Bowl standstill is indicated by standstill of the drive belt.

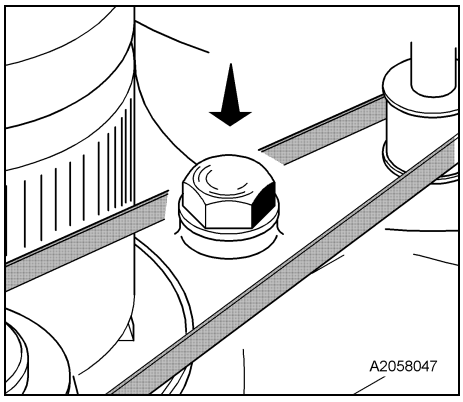


Fig. 66

Standstill of drive belt

- Shine a torch through the sight glass in the frame.
- Check that the drive belt is no longer moving.

If the sight glass in the frame is misted over:

- Unscrew the sight glass,
- shine a torch through the sight glass opening!
- Check that the drive belt is no longer moving.

Then

- Clean the sight glass and screw it back on.

In the case of torn or defective drive belts or if the belts have come off:

- Do not loosen any part of the separator before the bowl has come to a standstill.
- **Be sure to observe** the run-down time of **30 minutes** until dismantling the separator!
- Applying the brake is not effective!

- **Danger of injury through very hot separator parts!**
  When carrying out maintenance work, there is a danger of injury through hot separator parts (separating temperatures of 70 to 100 °C (158 – 212 °F).)

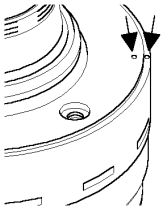
3.8 Trouble shooting

The following tables are an aid for locating and eliminating faults.

If assembly operations have to be carried out refer to the section "Maintenance and Repair".

3.8.1 Trouble shooting

Fault	Possible causes	Remedial action
The bowl does not come up to rated speed or takes too long to do so.	Brake is applied.	Release brake by turning the handle clockwise.
	Oil has run down the spindle onto the drive belt; the drive belt is slipping on the bowl spindle.	Clean belt contact surface of the spindle and flat belt pulley. Replace the drive belt.
	Motor is incorrectly connected.	Check connection.
	Insufficient number of clutch shoes.	Increase the number of clutch shoes (see section 4.5).
	Drive belt has stretched and is slipping on the bowl spindle.	Replace drive belt.
	Drive belt has not been fitted correctly.	Check position of drive belt on centrifugal clutch and bowl spindle.
	Liquid or dirt has collected in the upper section of frame and is braking the bowl.	Check the operating water discharge. Liquid must flow off freely. Clean inside of upper section of frame.
The bowl speed drops during operation.	Friction surfaces of clutch shoes are oily.	Wipe dry friction surfaces.  **Do not use benzene, trichlorethylene or any other solvent!**
	The motor speed drops during operation.	Check motor and line voltage.
The bowl reaches the rated speed too fast (in less than 1.5 minutes). The starting current of the motor is hence inadmissibly high.	Too many clutch shoes are used.	Reduce the number of clutch shoes. Make sure that the clutch shoes are evenly spaced. See section 4.5.

Fault	Possible causes	Remedial action
Uneven run of the centrifuge.	Bowl is out of balance for the following reasons:	**For pos. 1 - 4:** • Shut down separator. • Apply brake. • Close the product feed and discharge. • **Bowl must not be emptied** as otherwise the vibrations occurring during shut-down will intensify. If bowl leaks, • Completely open the water supply.
	1. The separated dirt has deposited unevenly in the bowl.	Clean bowl.
	2. Bowl has not been correctly assembled or parts of different bowls (if plant has several separators) have been interchanged.	Assemble bowl properly.
	3. The tension in the disk stack has slackened.	 Check that the bowl lock ring is screwed on **tight** enough. **CAUTION:** **A loose lock ring can endanger life!** Check number of disks.
	4. Bowl parts are damaged.	Send bowl to factory for repair. **Do not carry out your own repairs!** **Do not weld or solder** as this would weaken the bowl!
	Ball bearings are worn.	Replace damaged bearings. **ATTENTION!** Use only the ball bearings specified in the parts list.

3.8.2 Bowl faults

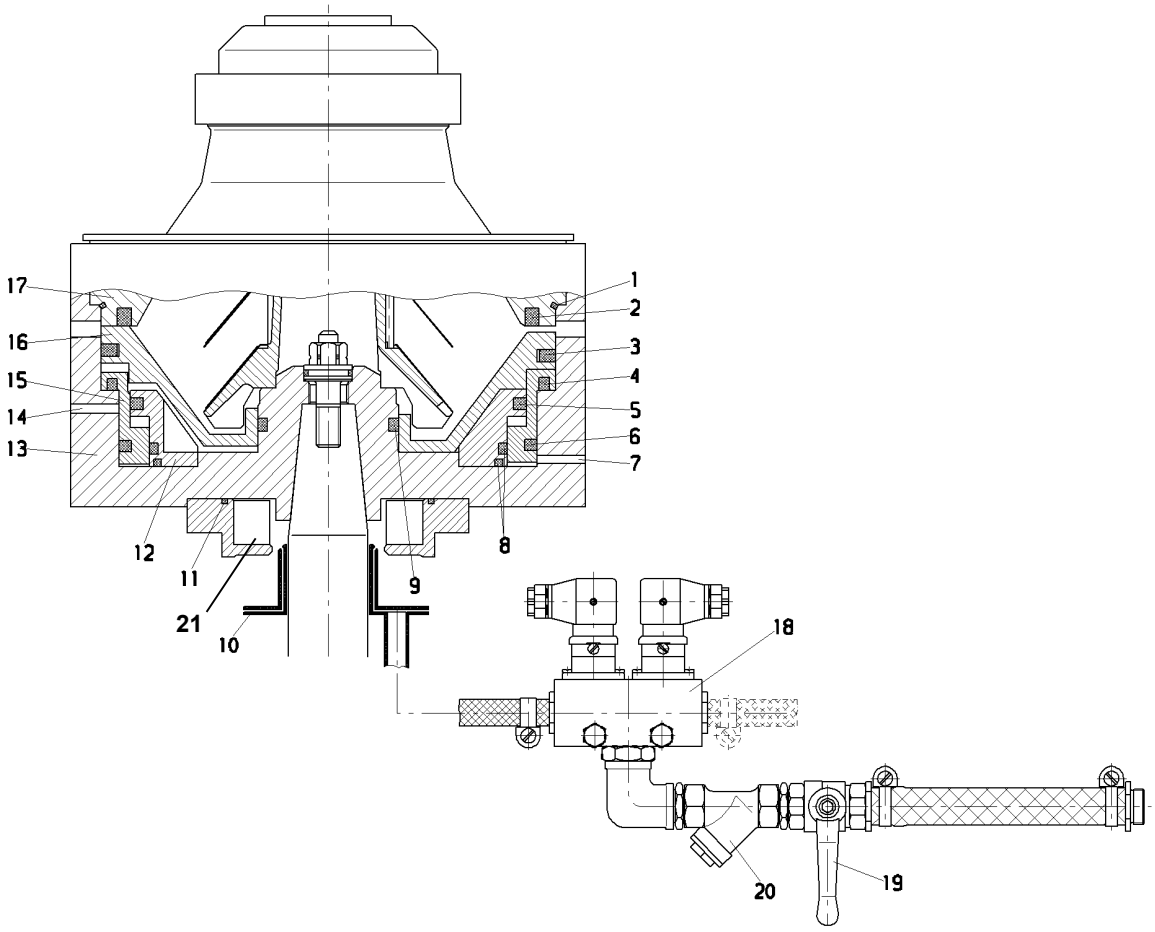


Fig. 67 Bowl and operating water feeding system

1 Gasket (bowl top)
2 Gasket (bowl top)
3 Gasket (sliding piston)
4 Gasket (annular piston)
5 Gasket (closing chamber bottom)
6 Gasket (annular piston)
7 Drain hole
8 Gaskets (closing chamber bottom)
9 Gasket (bowl bottom)
10 Operating water feeding system
11 Gasket (water chamber bottom)
12 Closing chamber bottom
13 Bowl bottom
14 Drain hole
15 Annular piston
16 Sliding piston
17 Bowl top
18 Solenoid valve block
19 Shut-off valve
20 Strainer
21 Injection chamber

Fault	Possible causes	Remedies
The bowl does not close.	Holes 7 or 14 in the bowl bottom are clogged or the injection chamber 21 is dirty.	Clean holes and injection chamber.
	A rim of dirt has deposited beneath the sliding piston.	Dismantle and clean the bowl.
	Gaskets 3, 4 or 5 are damaged or their edges are frayed.	Replace gaskets.  Replace only the **damaged** polyamide gasket 4 (see section 4.3.7)!
The bowl does not close properly or mist sprays out.	Gasket 2 in the bowl top is damaged.	Replace damaged gasket (see 4.3.8).
	The sealing edge of the sliding piston is damaged.	Remachine the sealing edge of the sliding piston very slightly (see sect. 4.3.9) or send in the sliding piston for repair.
The bowl does not open or not properly.	The operating water capacity is too low.	Check line pressure and increase if necessary. **Operating water data:** – Pressure 2 - 3 bar (with open valve) – Volume flow min. 1 800 l/h (gauge the capacity by litres) ≅ 1.0 l in 2 sec
	Strainer in operating water line is dirty.	Clean strainer.
	The operating water line has become constricted due to dirt accumulation or damage.	Clean or replace operating water line.
	The operating water shut-off device does not open properly.	Renew shut-off device.
	Opening pulse for operating water too short.	Set 2 seconds.
	Hole 7 is clogged.	Clean hole and bowl parts.
	Gaskets 6 and 8 are damaged.	Replace gaskets.

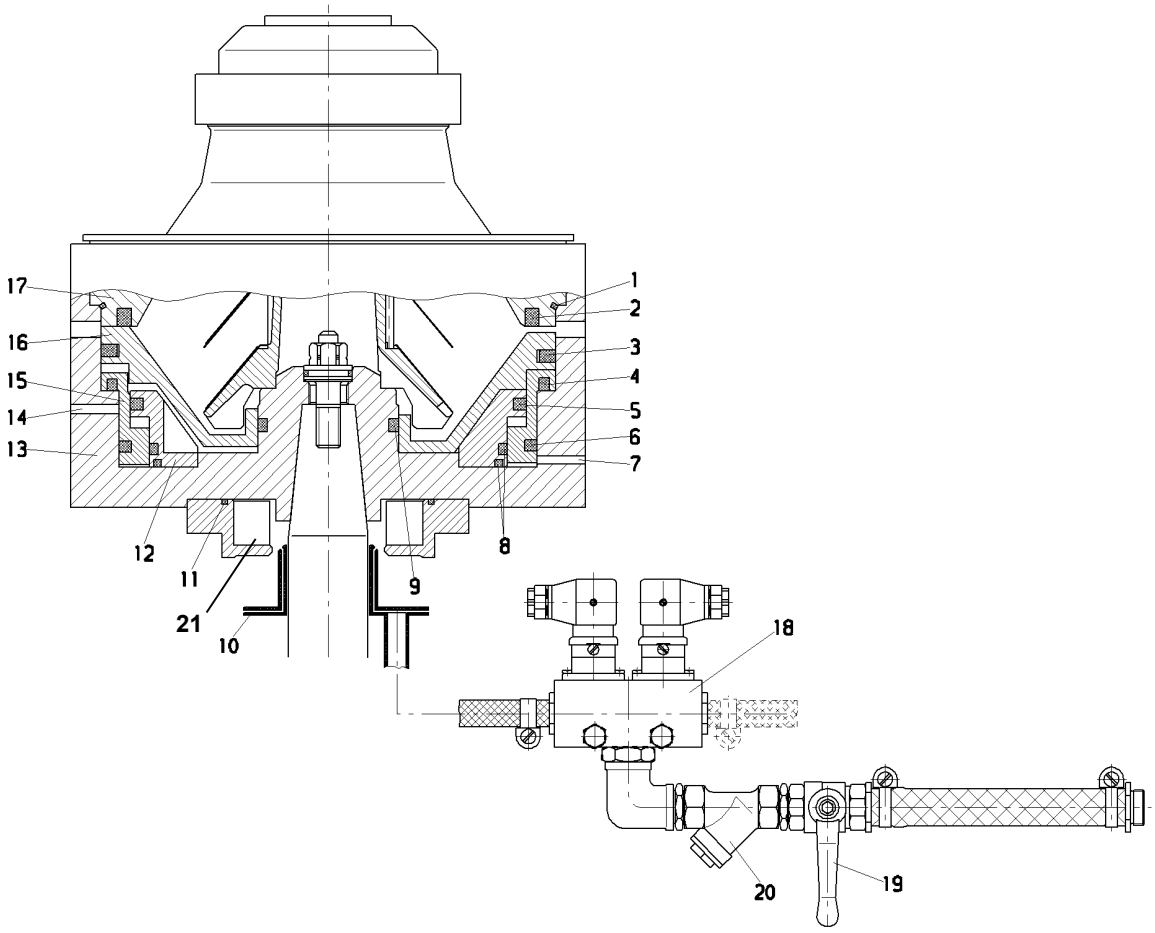


Fig. 68 Bowl and operating water feeding system

1 Gasket (bowl top)
2 Gasket (bowl top)
3 Gasket (sliding piston)
4 Gasket (annular piston)
5 Gasket (closing chamber bottom)
6 Gasket (annular piston)
7 Drain hole
8 Gaskets (closing chamber bottom)
9 Gasket (bowl bottom)
10 Operating water feeding system
11 Gasket (water chamber bottom)
12 Closing chamber bottom
13 Bowl bottom
14 Drain hole
15 Annular piston
16 Sliding piston
17 Bowl top
18 Solenoid valve block
19 Shut-off valve
20 Strainer
21 Injection chamber

Fault	Possible causes	Remedies
The bowl does not open or not properly (cont.)	Dry dirt or rubber particles have deposited: between the guides of the chamber bottom and annular piston or - between annular piston and bowl bottom or - between sliding piston and bowl bottom.	Clean bowl parts. Renew damaged gaskets. Grease guides (see 4.2.4 - lubrication schedule).
	The closing chamber is dirty.	Dismantle bowl. Clean closing chamber.
	Gasket 2 of polyamide has a loose fit in the groove of the bowl top. Product seeps into the gasket groove and presses the gasket out of the groove while the sliding piston moves downwards, so that there is no gap for solids ejection.	Replace polyamide gasket (see 4.3.8).
The bowl does not empty completely. Solids remain in the bowl.	The operating water capacity is too low.	Check line pressure and increase if necessary. **Operating water data:** – Pressure 2 - 3 bar (with open valve) – Volume flow min. 1 800 l/h (gauge the capacity by litres) ≅ 1.0 l in 2 sec
Gasket 2 in the bowl top wears too quickly.	The product contains abrasive solids.	Remove the abrasive solids by installing a strainer.
The bowl opens during separation.	The operating water in the closing chamber has diminished during a long separating time (evaporation etc.).	Set the operating water pulse and time (see manual of the control system).
	Time pulse for the operating water injection is too long.	Set the operating water pulse (see manual of the control system).

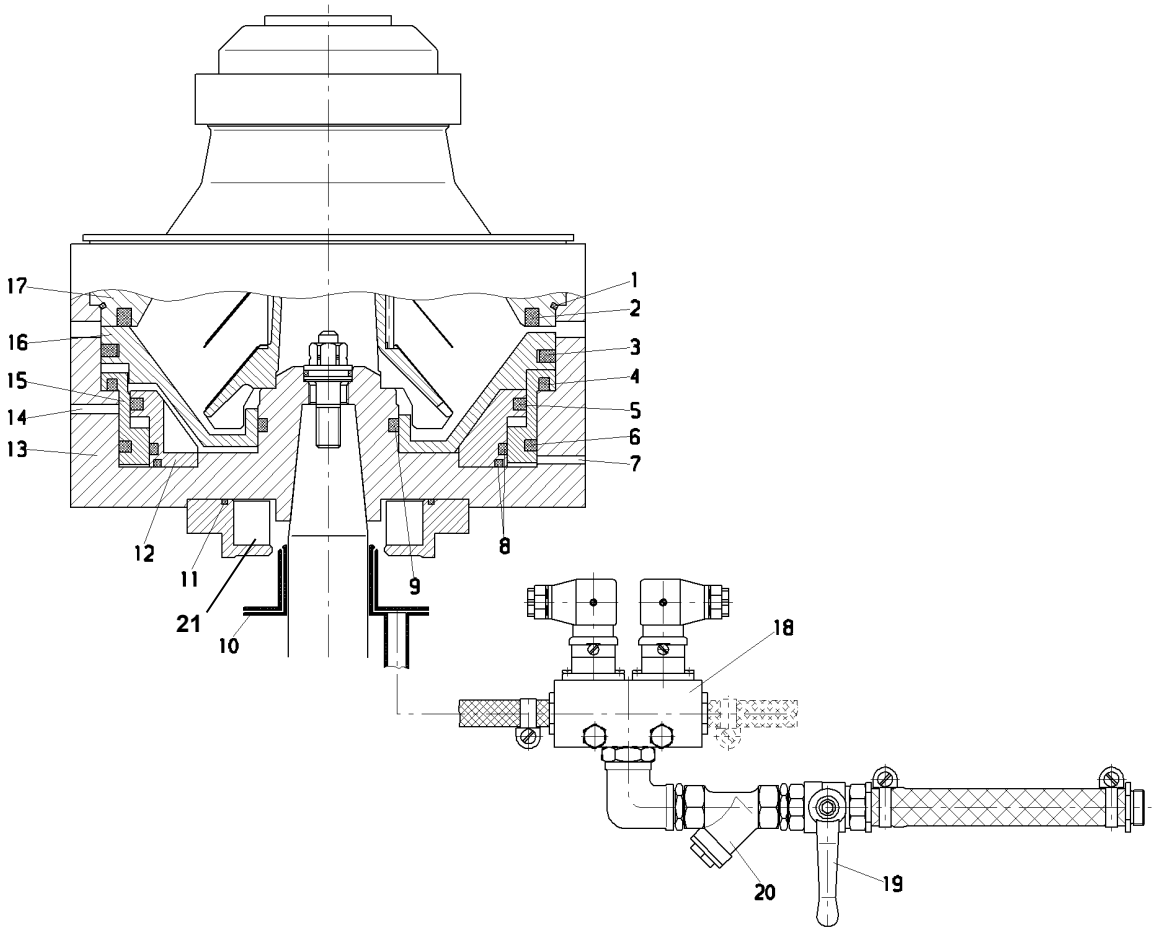


Fig. 69 *Bowl and operating water feeding system*

1 Gasket (bowl top)
2 Gasket (bowl top)
3 Gasket (sliding piston)
4 Gasket (annular piston)
5 Gasket (closing chamber bottom)
6 Gasket (annular piston)
7 Drain hole
8 Gaskets (closing chamber bottom)
9 Gasket (bowl bottom)
10 Operating water feeding system
11 Gasket (water chamber bottom)
12 Closing chamber bottom
13 Bowl bottom
14 Drain hole
15 Annular piston
16 Sliding piston
17 Bowl top
18 Solenoid valve block
19 Shut-off valve
20 Strainer
21 Injection chamber

Fault	Possible causes	Remedies
The bowl does not close or open properly after a long-term shut-down of the separator.	The bowl was not thoroughly cleaned before a long-term standstill of the separator. Scale has deposited and dried out. - between closing-chamber bottom and annular piston or - between annular piston and bowl bottom or - between sliding piston and bowl bottom.	Before removing - the closing-chamber bottom, - the sliding piston and - the annular piston dislodge the dried-up scale with citric acid in the gaps - between closing-chamber bottom, sliding piston and annular piston or - between sliding piston and bowl bottom. Dismantle and thoroughly clean the bowl.
The discharging product is not clean (bowl overflow).	Dirt of very high density has collected in the distributor neck (e.g. rust from tanks and lines). This partially blocks the feed which discharges as overflow.	Clean the distributor neck.

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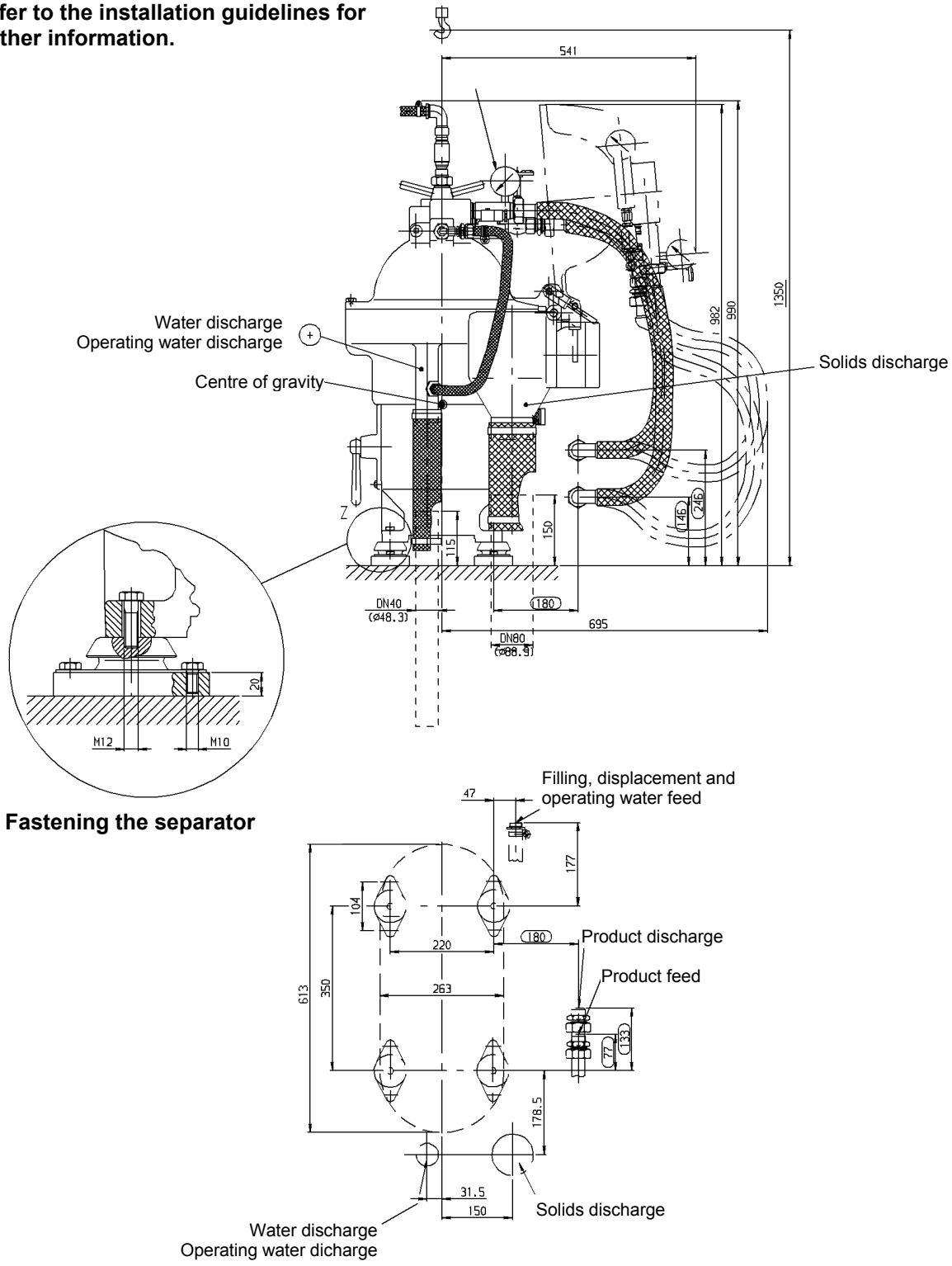
4 Installation - Maintenance - Repair

4.1 Installation of the separator

- **Refer to the installation guidelines for further information.**

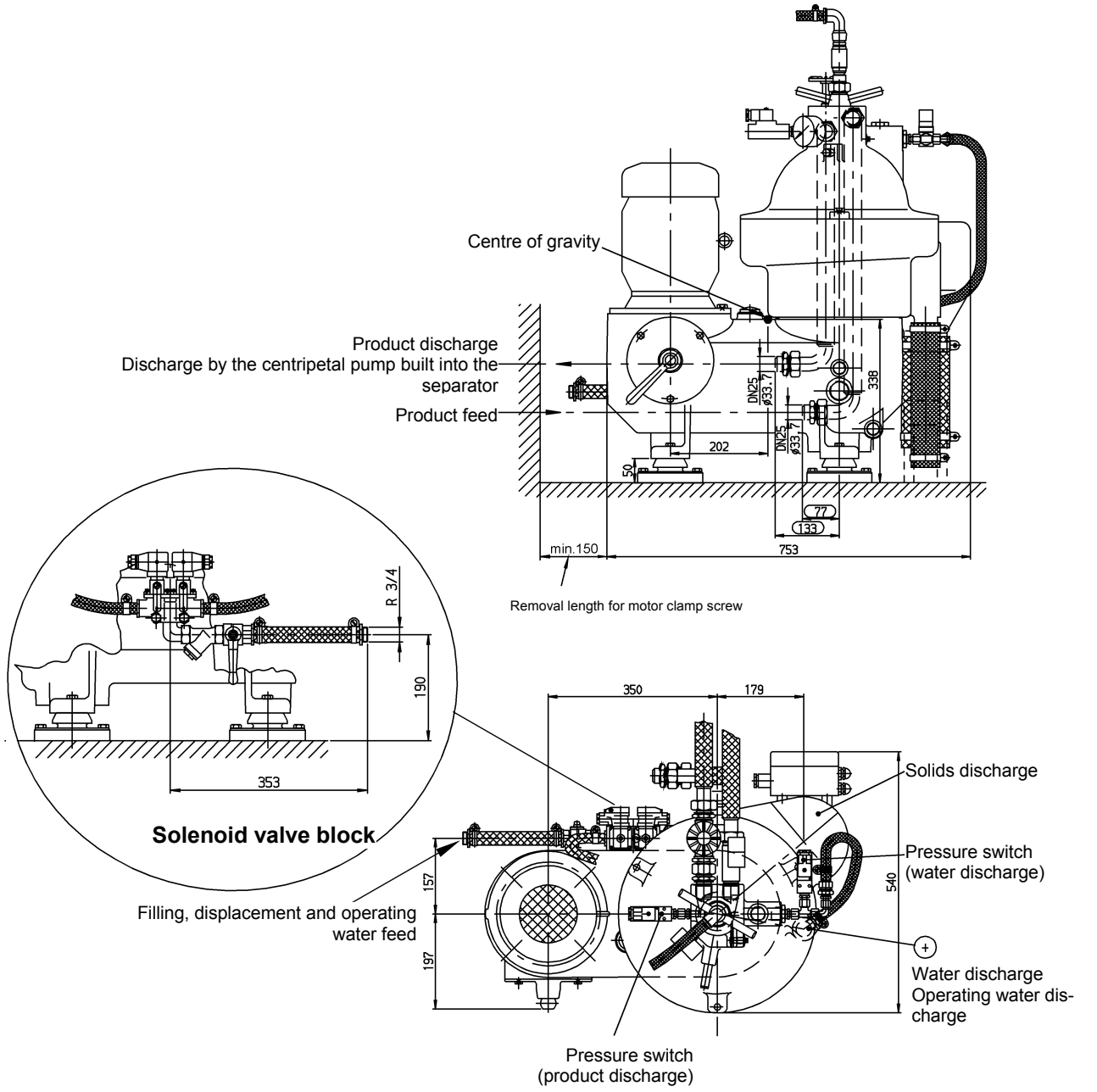


Fastening the separator

These dimensions **must** be adhered to!

Do not discharge residuals into public waters!

Fig. 70 **Subject to modification – Refer to project-specific dimensioned drawing!**



The separator foundation must not have contact with foundations of other units (e.g. auxiliary diesel engines, pumps) to avoid damage to all bearings.

⬭ These dimensions **must** be adhered to!

⊕ Do not discharge residuals into public waters!

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Fig. 71 **Subject to modification – Refer to project-specific dimensioned drawing!**

4.1.1 Transporting the separator

- **Attention!**
  Prevent accidents by using suitably rated hoists for transport and installation.

- Always transport the separator **without** installed bowl!

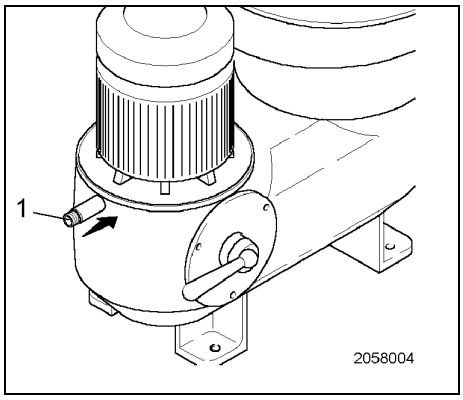

Fig. 72

- Screw double nipple 1 into the hole in the frame.
  (For special tools see section *Parts list*.)

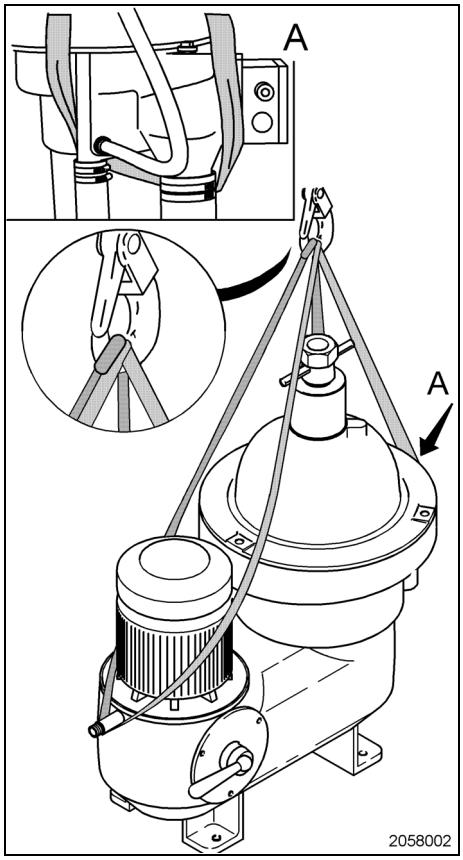

Fig. 73

- Attach the transport ropes
  - to the machine as illustrated and
  - hang them into the load hook of the hoist as illustrated.
    Wind one piece of rope twice round the hook to prevent the ropes from slipping.
- Make sure that the ropes do not damage any machine components.
- **Do not use the eye bolt of the motor to suspend the separator.**
- Make sure the machine touches down gently.

4.1.2 Installing the separator

- Before erecting the separator make sure that
  - sufficient space is available for operating and dismantling the machine.
  - the foundation is not connected to foundations of other vibrating units to avoid the transfer of vibrations.

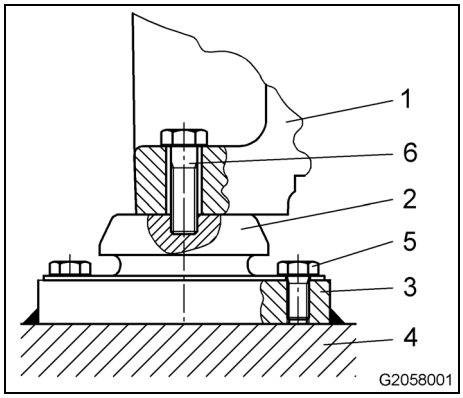

Fig. 74

- Align separator 1 with machine feet 2 and plates 3 on foundation 4.
- Tack plates 3.
- Undo screws 5.
- Lift off separator with feet (see section 4.1.1).
- Weld plates 3 to foundation 4.
- Place the separator on plates 3 and
- bolt **tight** with hex head screws 5.
- **Firmly** tighten hex head screws 6.

4.1.3 Motor

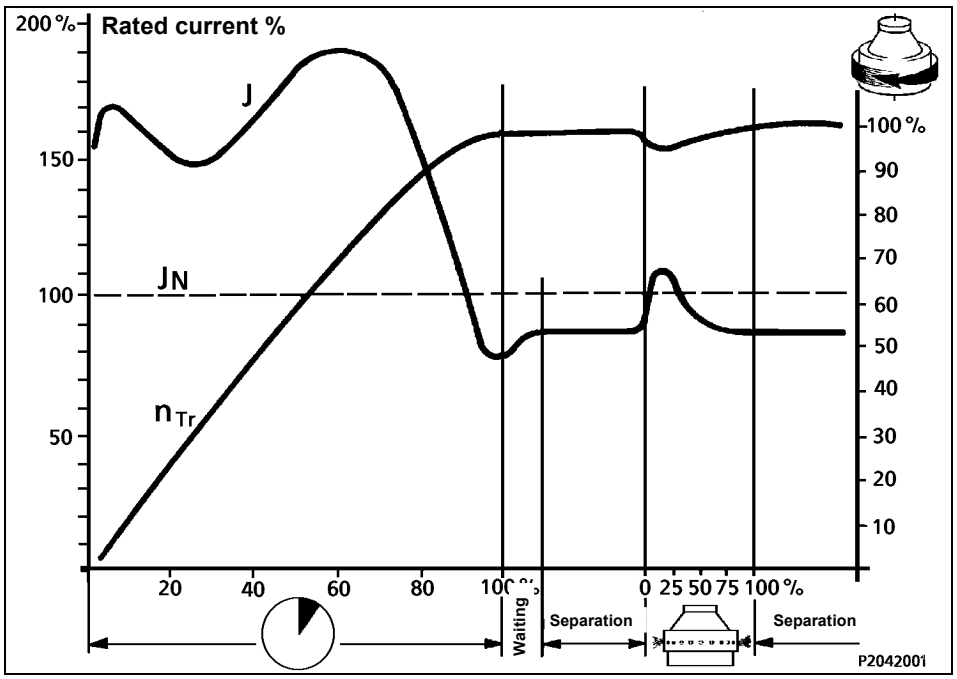

Fig. 75 Start-up diagram (current and speed characteristics)

rpm	min	s	50 Hz	60 Hz	Design	Enclosure *	at 50 Hz	at 60 Hz
			kW				rpm	rpm
see name-plate	approx. 2 - 4	2	4	4.8	IM V1	IP 55 **ISO-class** F *	3 000	3 600

***** WS standard

The separator is driven by a three-phase AC motor via a centrifugal clutch and the drive belt.

The specified motor ratings are minimum values which are based on the increased starting current. Since the current consumption of the motor drops after start-up, overloading of the motor during operation is not possible.

The starting time depends on the
- flywheel effect of the bowl,
- number of clutch shoes used,
- condition of the clutch shoes.

The starting current can peak at about 1.8–2 times the rated current (see start-up diagram). This is to be considered when selecting switches, lead-in wires and fuses.

The motor
- can be started direct on-line,

– is protected against overheating by thermal overload releases or a motor overheating protection unit.

When using thermal overload releases, the motor has to be protected as follows:
– during operation by a release set to the rated current and
– during start-up by a second release set to 1.8–2 times the rated current. The release set to the rated current must be bridged during start-up.

Overheating protection is only possible if PTC thermistors are built into the motor winding.

Note:
- The temperature feelers must be connected to a commercial tripping device.
- External voltage higher than 2.5 volts must not be applied to the connection terminals of the temperature feelers.
- When testing for continuity, use an ohmmeter and not a test lamp.

4.1.4 Direction of rotation of the bowl

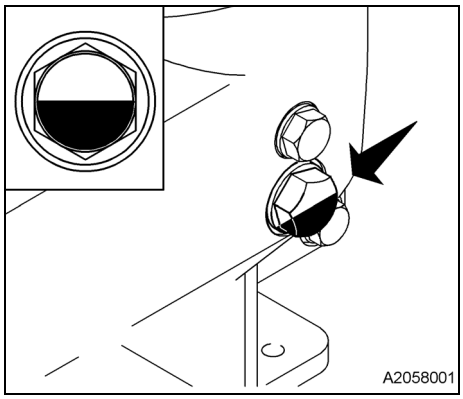

Fig. 76

- Fill the drive chamber with oil up to the half way mark on the sight glass.
- Switch on the motor.

The bowl must rotate in clockwise direction when looked at from above.

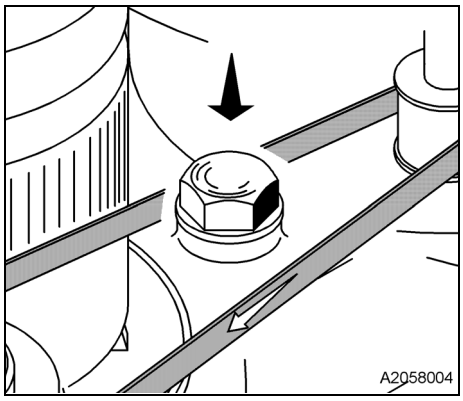

Fig. 77

The direction of rotation of the bowl is correct when the drive belt rotates clockwise (check through the sight glass in the frame).
When the direction of rotation is incorrect the motor connections must be reversed by an authorised specialist.

4.1.5 Speed and starting time of the bowl

Speed – for densities of the product up to max. 1.05 kg/dm^3 and – for densities of the separated solids up to max. 1.4 kg/dm^3	See nameplate
Starting time	approx. 2 - 4 min

The bowl speed has been rated so as to ensure the operating safety of the separator.

If the densities exceed those stated above, check with the factory.

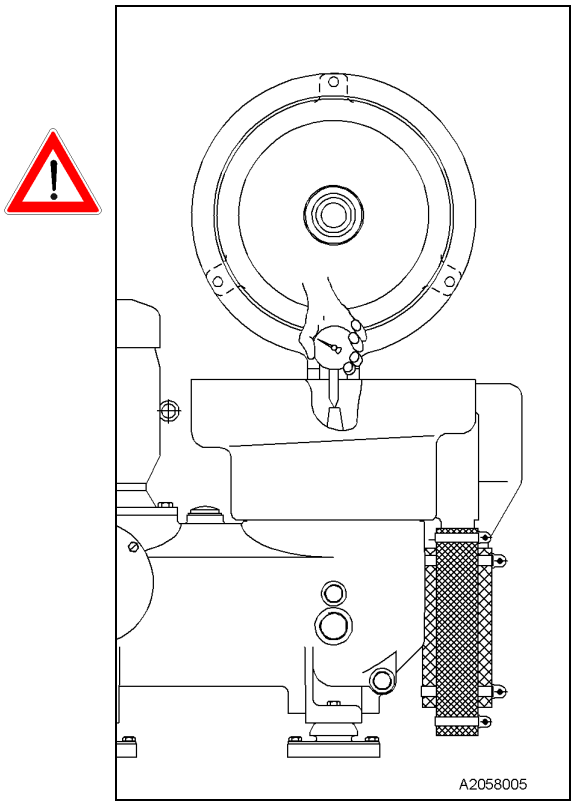

Fig. 78

- Check spindle speed (= bowl speed) with a hand tachometer:
  – Before initial start-up.
- **Do not exceed the maximum spindle running time of 1 minute!**
- **Make this check before installing the bowl.**
- Speed deviations up to 5 % are admissible.

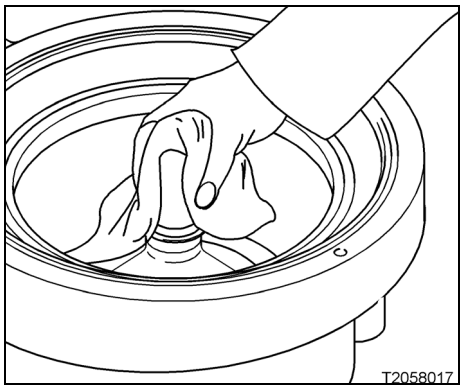

Fig. 79

Important instructions

- When the bowl has been removed, **no oil** must spill onto the drive belt via the spindle.
- After removing the bowl, place a cloth over the spindle immediately.

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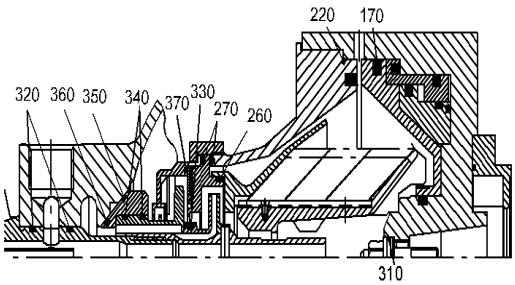
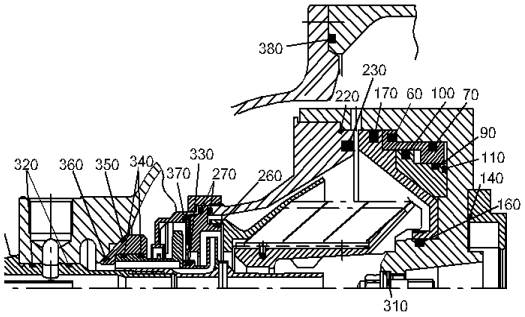
4.2 Maintenance and lubrication

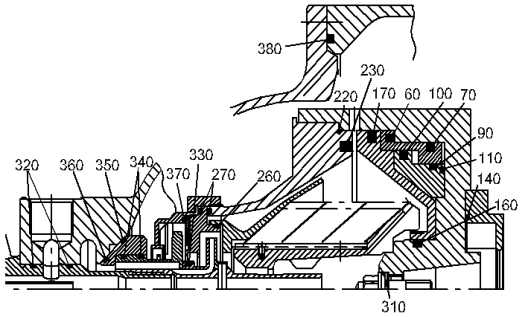
- Special care must be taken when performing maintenance and lubrication operations. Conscientiously performed maintenance and lubrication operations improve the service life of the separator.
- In the case of accessories (motor, product pump, preheater, solenoid valve block etc.) the manufacturer's maintenance and lubrication instructions must be observed.

4.2.1 Maintenance schedule

Maintenance[1]		Operations	Remark
after operating hours	at the latest after	**To assure correct functioning and operating safety,** • in case of non-routine shut-down, see section 3.7 - manual operation. • pay attention to the following points during servicing: – Oil level – Leakage – Starting time – Temperatures – Vibrations – Hoses and hose pipes – Pressures – Current consumption lines (see 4.2.2) • Before assembling, grease the guide and contact surfaces of the main bowl components.[2] • in the case of frequent starting and stopping of the separator, shaft-driven alternator operation and in power plants, the condition of the clutch shoes must be checked more often than stated in this schedule. It is not possible to state a definitive time. We recommend checking the clutch shoes after 1000 operating hours or after 2 months at the latest.	
4 000	1/2 years	Bowl inspection	• Dismantle bowl and centripetal pump. • Clean the bowl and centripetal pump parts and check for corrosion and erosion. • Clean all holes, nozzles and chambers of the hydraulic system. • The cones of bowl and spindle must be clean and dry when fitting.
12 000	1 1/2 years	Replace gaskets (bowl and hood).  	• Use set of spare parts "bowl/hood" (operation: 1 year or 8000 hours). See section *Parts list.*
20 000	2 1/2 years	Re-lubricate motor bearings (if required)	• See instructions of motor manufacturer
28 000	3 1/2 years	Oil change and thorough cleaning of the drive chamber.	When using mineral oil [3]
36 000	4 1/2 years	Clean the strainer and pipe in the operating liquid feed system on the self-cleaning separator.	• See section 4.3.4.
44 000	5 1/2 years	Clean the strainer at the water pressure reducer (if installed).	
		Clean filter in suction line of product pump (if installed).	
		Clean the sight glass in the frame for observing the drive belt.	
		Check the hoses and hose pipes and replace when necessary.	

Maintenance[1] after operating hours	Maintenance[1] at the latest after	Operations	Remark
		Bowl inspection	• Dismantle bowl and centripetal pump. • Clean the bowl and centripetal pump parts and check for corrosion and erosion. • Clean all holes, nozzles and chambers of the hydraulic system. • The cones of bowl and spindle must be clean and dry when fitting.
		Replace gaskets (bowl and hood).  	• Use set of spare parts "bowl/hood“ (operation: 1 year or 8000 hours). See section *Parts list.* • Replace only the **damaged** polyamide gasket 60 (see section 4.3.7)!
		Clean the inside of the upper section of frame.	• Remove bowl.
		Replace gaskets and retaining ring (see page 201).	• Use set of spare parts "drive" (operation: 1 year or 8000 hours). See section *Parts list.*
8 000	**1 year**	Replace the drive belt.	
24 000	**3 years**	Replace spindle ball bearings.	
40 000	**5 years**	Replace vibration absorber.	
		Check thickness of the clutch shoes[4] and replace if necessary.	 **h**: min. 18 mm New clutch shoe: h = 26 mm
		Check thickness of brake lining.	
		Re-lubricate motor bearings (if required)	• See instructions of motor manufacturer
		Oil change and thorough cleaning of the drive chamber.	When using mineral oil [3] When using synthetic oil [3]
		Check the bowl height.	• See section 4.7.1.
		In case of direct current Check the spindle speed (bowl).	• Check only after motor or drive replacement. • See section 4.1.5.
		Check the starting time.	• See section 4.1.5.
		Clean the strainer and pipe in the operating liquid feed system on the self-cleaning separator.	• See section 4.3.4
		Clean the strainer at the water pressure reducer (if installed).	
		Clean filter in suction line of product pump (if installed).	
		Clean the sight glass in the frame for observing the drive belt.	
		Check the hoses and hose pipes and replace when necessary.	

(1) The specified maintenance intervals are recommendations which apply only for normal conditions. Negative operating conditions (e.g. low-grade fuel, excessively high temperature, strong vibrations, frequent starting and stopping of the separator etc.) can necessitate shorter maintenance intervals.
(2) see section 4.2.4 - Lubrication schedule
(3) see section 4.2.3 - Oil quality and oil change
(4) In the case of frequent starting and stopping of the separator, shaft-driven alternator operation and power plants shorter maintenance intervals are required It is not possible to state a definitive time. We recommend checking the clutch shoes after 1,000 operating hours or after 2 months at the latest.

Maintenance[1] after operating hours	Maintenance[1] at the latest after	Operations	Remark
		Bowl inspection	• Dismantle bowl and centripetal pump. • Clean the bowl and centripetal pump parts and check for corrosion and erosion. • Clean all holes, nozzles and chambers of the hydraulic system. • The cones of bowl and spindle must be clean and dry when fitting.
		Replace gaskets (bowl and hood).  	• Use set of spare parts "bowl/hood“ (operation: 1 year or 8000 hours). See section *Parts list.*  • Replace only the **damaged** polyamide gasket 60 (see section 4.3.7)!
		Clean the inside of the upper section of frame.	• Remove bowl.
		Replace gaskets and retaining ring (see page 203).	• Use set of spare parts "drive" (operation: 2 years or 16000 hours). See section *Parts list.*
		Replace the drive belt.	
16 000 **32 000** **48 000**	**2 years** **4 years** **6 years**	Check thickness of the clutch shoes [4] and replace when  **h** smaller than 18 mm. New clutch shoe: **h** = 26 mm	
		Replace spindle ball bearings.	
		Replace ball bearings of centrifugal clutch.	
		Replace vibration absorber.	
		Check thickness of brake lining and replace if necessary.	
		Re-lubricate motor bearings (if required)	• See instructions of motor manufacturer
		Oil change and thorough cleaning of the drive chamber.	When using mineral oil [3] When using synthetic oil [3]
		Check the bowl height.	• See section **4.7.1**.
		In case of direct current Check the spindle speed (bowl).	• Check only after motor or drive replacement. • See section 4.1.5.
		In case of three-phase current: Check the spindle speed (bowl).	• Check only after drive replacement. • See section 4.1.5.
		Check the starting time.	• See section 4.1.5.
		Clean the strainer and pipe in the operating liquid feed system on the self-cleaning separator.	• See section 4.3.4.
		Clean the strainer at the water pressure reducer (if installed).	
		Clean filter in suction line of product pump (if installed).	
		Clean the sight glass in the frame for observing the drive belt.	
		Check the hoses and hose pipes and replace when necessary.	

Maintenance[1]		Operations	Remark
after operating hours	at the latest after		
48 000	6 years	**Equip the machines with new vibration isolators.** **We recommend having the machines checked by a WS service engineer.**	

Legend:
(1) = The specified maintenance intervals are recommendations which apply only for normal conditions. Negative operating conditions (e.g. low-grade fuel, excessively high temperature, strong vibrations, frequent starting and stopping of the separator etc.) can necessitate shorter maintenance intervals.
(2) = see section 4.2.4 - Lubrication schedule
(3) = see section 4.2.3 - Oil quality and oil change
(4) = In the case of frequent starting and stopping of the separator, shaft-driven alternator operation and power plants shorter maintenance intervals are required. It is not possible to state a definitive time. We recommend checking the clutch shoes after 1,000 operating hours or after 2 months at the latest.

4.2.2 Hoses and hose pipes

Replace hose pipes when an inspection reveals one or more of the following defects:

- Damage of the outer layer down to the fabric (e. g. chafe marks, cuts or cracks).
- Leaky spots.
- Damage to or deformation of the hose fittings.
  (Slight surface damage is not a reason for replacement.)
- The hose becomes dislodged from the fitting.
- Corrosion of the fitting diminishing function and strength.

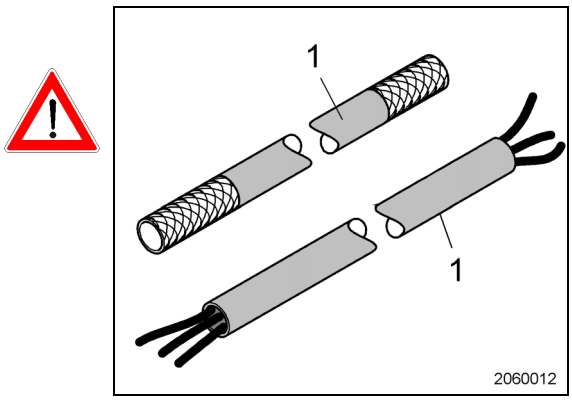


Fig. 80

Protective hose 1

- Fit the protective hoses at all contact points to the separator.
- Fit the protective tube along the entire length of the cable tree (contact points to the machine).
- Adapt the length of the protective hose.

4.2.3 Lubrication

The spindle bearings are splash-lubricated from a central oil bath.

MOTOR BEARINGS

For re-greasing the motor bearings, refer to the instructions of the motor manufacturer.

OIL QUALITY (mineral oil)

The mineral gear oil tested by Westfalia Separator with the designation "Separator lube oil CLP 100" meets the requirements and should preferably be used.

Designation according to DIN 51502	**CLP 100**
Designation as per ISO 3498	CC 100
Viscosity class	SAE 30
Viscosity (at 40 °C/104 °F)	100 ± 10 mm^2/s (cSt)
Part-No.	0015-0003-080 (2.5 litres)
Dispose of the oil as per instructions of the oil manufacturer.	

The viscosity class SAE 30 covers a larger viscosity range than specified here. However, only oils with the viscosity range specified here may be used.

Do not use mineral motor vehicle or engine oils.

OIL QUALITY (synthetic oil)

Use the synthetic lube oil tested by Westfalia Separator!

Designation according to ISO	Mobil SHC 626
Viscosity class (ISO)	VG 68
Viscosity - at 40 °C (104 °F)	65 mm^2/s
- at 100 °C (212 °F)	10.4 mm^2/s
Viscosity index (VI)	147
Density (at 15 °C/59 °F)	0.857 g/ml
based on	Polyalphaolefin
Part-No.	0015-0020-010 (1 litre)
Dispose of the oil as per instructions of the oil manufacturer.	

Do not use mineral motor vehicle or engine oils.

OIL QUANTITY

IMPORTANT: Do not forget to top up the oil in good time!

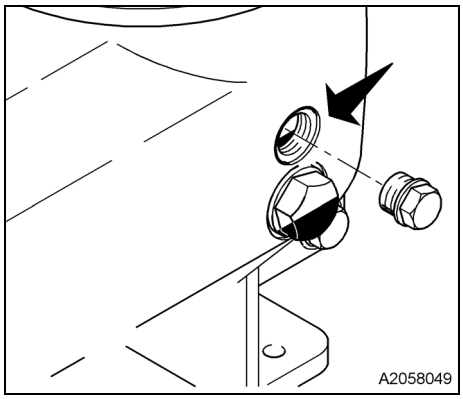


Fig. 81

Filling in oil

Fill the drive with oil before commissioning the separator.

- Unscrew the screw plug and
- fill in oil through the charge hole.

  Filling quantity approx. 2.5 litres

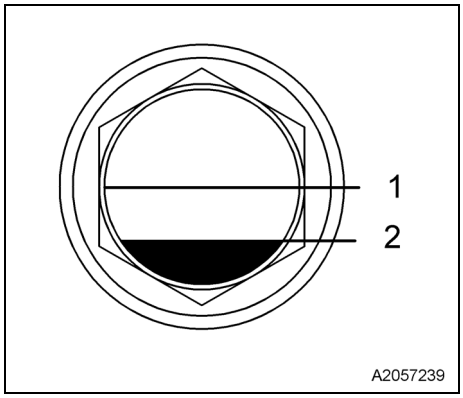


Fig. 82

Oil level

IMPORTANT:

- Check the oil level only when the separator is at standstill.
- The oil level must never drop below the lower third of the sight glass during operation.

1 Maximum oil level
2 Minimum oil level

Minimum oil level (at separator standstill)	approx. up to lower third of sight glass
Maximum oil level (at separator standstill)	up to middle of sight glass

OIL CHECK

- Check the oil level every week!
- From time to time undo the oil drain screw and check whether there is water in the oil bath. When the oil exhibits a milky colouring (emulsification), the oil must be changed immediately.

OIL CHANGE

- Change oil after about
  - 4000 operating hours or 6 months at the latest (mineral oil).
  - 8000 operating hours or 1 year at the latest (synthetic oil).
- Clean sight glass.

4.2.4 Lubrication Chart

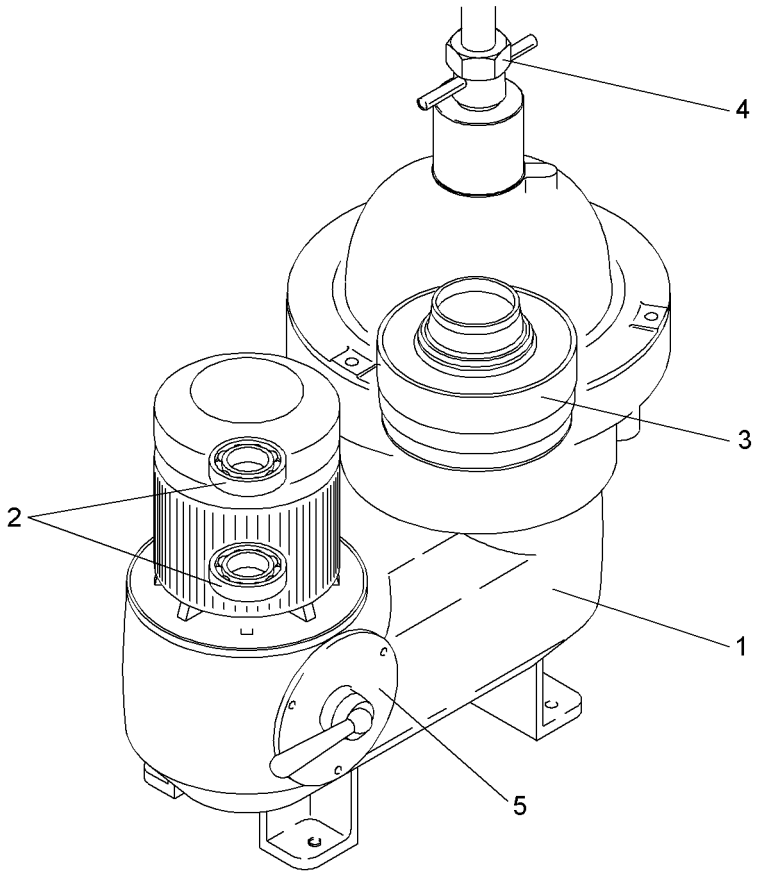


Fig. 83 Lubrication schedule

Lubricating point	Lubricant		Lubrication frequency		Amount of lubricant	Lubrication point
	Designation	Designation	after operating hours	per year		
1	Lube oil (mineral)	CLP 100 DIN 51502	4 000	2 x	2 500 cm^3	Drive chamber
		CC 100 ISO 3498				
	Lube oil (synthetic)	Mobil SHC 626 ISO VG 68	8 000	1 x	2 500 cm^3	Drive chamber
2	according to instructions of motor manufacturer					Motor bearings
3	Lubricating grease	see parts list	as required	2 x	apply sparingly	Threads and sliding surfaces of bowl
4				1 x		Threads of fittings
5				1 x		Manually-operated parts such as locking brake

- Check oil level regularly through sight glass.
- Manual lubrication
- Refer to lubricating oil table in section 4.2.5!

4.2.5 Table of lubricating oils

Westfalia Separator

Lubricating oil table for separators in onshore and shipboard operation

Separator		Lube oil		
Type	Oil filling	Symbol (Designation according to DIN 51502)	Viscosity: Kinematic viscosity at 40 °C (104 °F)	GENUINE PARTS ORIGINALTEILE from Westfalia Separator
	l		mm²/s (cSt)	
BTC 3	1,3	CLP 100	90 to 110	0015-0003-080 (2.5 l)
CTC 1				
CTC 3				
MTC 3				
OTC 2				
OTC 3				
WTC 2				
CSD 1	1,3			
OSD 2				
SD 1				
ESD 18	2,5			
GSC 15				
OSD 6				
OSD 18				
WSD 18				
GSC 25	3,7			
OSD 20				
OSD 25				
OSD 30				
OSD 35				
WSD 35				
OSD 50	5,0			
OSD 60				
SD 50				
WSD 60				

Lubricating oil sorts suggested by some firms

Manufacturer	Designation	Viscosity at 40 °C (104 °F) mm²/s (cSt)
Agip	BLASIA 100	100
	RADULA 100	
	DIESEL GAMMA 30	
ARAL	ATLANTA MARINE 30	105
	DISOLA M 3015	
	MONTANOL HK 100	100
bp	ENERGOL GR-XP 100	100
	ENERGOL DL-MP 30	114
Castrol	HYSPIN AWS 100	100
	ALPHA ZN 100	
	MARINE HEAVY	99
Chevron	GST OIL 100	100
	NL Gear Compound 100	
	Veritas Marine Oil R&O 30	108
	DELO 3000 Marine Oil 30	104
elf	ATLANTA MARINE 30	105
	DISOLA M 3015	
	TURBINE T 100	95
Esso	EXX-MAR XP	110
	NUTO H 100	100
	SPARTAN EP 100	
GULF	HARMONY 100	95
	VERITAS 30	110
INA	HIDRAOIL HD 70	95
Mobil	MOBILGARD 312	106
	GARDINIA OIL 30	104
	ROTELLA MX SAE 30	105
STATOIL	HYDRA WAY HMA 100	100
	LOAD WAY EP 100	
TEXACO	DORO AR SAE 30	119
	TARO XD SAE 30	105

4.2.6 Comments on table of lubricating oils for separators from Westfalia Separator

Faultless functioning of separators very much depends on the proper type of lubricating oil used, since a high grade oil, selected to meet all service requirements, will minimize the wear, thus extending the service life and increasing the operating safety.

For the lubrication of our separators we recommend to use the oils specified by us since continuous quality checks are performed by Westfalia Separator. Oils proposed from some firms are not subjected to these tests.
Therefore, Westfalia Separator cannot give a performance guarantee for those oils.
Be sure to select only **high grade** solvent refined products.

The specified oil types meet the requirements according to DIN. Under unfavourable operating conditions, e.g. high temperatures, the quality of the oils may be insufficient so that more efficient oils, e.g. synthetic oils, must be used. If necessary, consult Westfalia Separator.

For the different separator types and oil types the viscosity ranges are specified in the table of lubricating oils.

The operating temperature of the separator exceeds normally 80 °C (176 °F). At those temperatures some oils age quickly, so that they have to be changed prematurely.

Be sure not to use lubricating oils with viscosities lower than those specified in the table. Due to the possibility of the oil film breaking down, oil of too low a viscosity will give insufficient lubrication, resulting in increased wear. However, oils with a slightly higher viscosity than specified may be used.

Bear in mind that the viscosity groups SAE 30, 40 and 50 (SAE = **S**ociety of **A**utomotive **E**ngineers) cover larger viscosity ranges and be sure to select lubricating oils with viscosities not lower than the minimum values of the viscosity ranges restricted for the different separator types.

4.3 Bowl

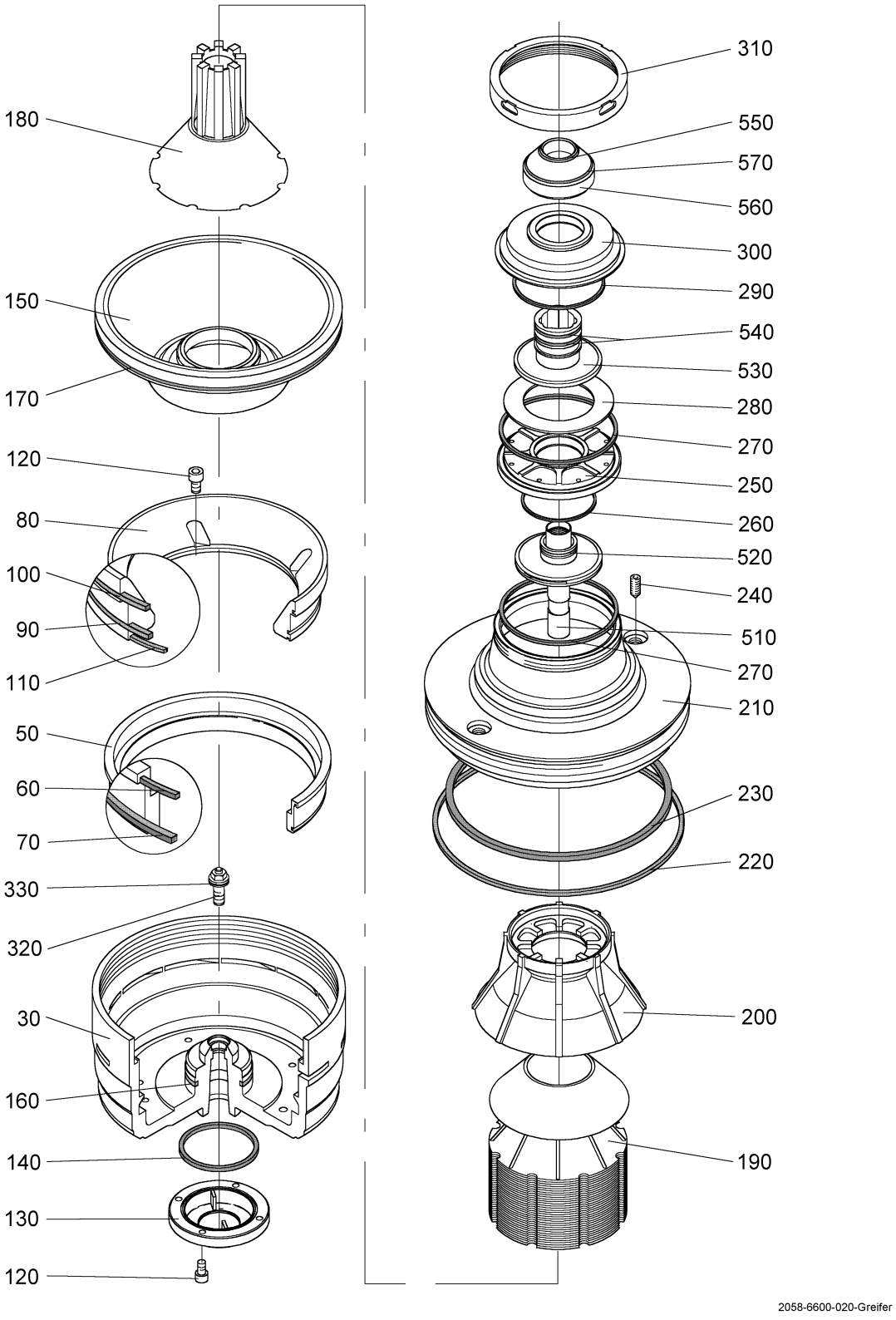


Fig. 84 *Exploded view of the bowl and centripetal pump*

Pos.		Designation	Dimensions
30	(1)	Bowl bottom, complete	
50		Annular piston	
60		Gasket	
70		Gasket	
80		Closing chamber bottom	
90		Gasket	
100		Gasket	
110		Gasket	
120		Allen screw	M 8 x 20
130	(1)	Water chamber bottom	
140		Gasket	
150		Sliding piston	
160		Gasket	
170		Gasket	
180	(1)	Distributor, complete	
190		Disk stack, complete	
200	(1)	Separating disk	
210	(1)	Bowl top	
220		Gasket	
230		Gasket	
240		Threaded pin	M 10 x 10
250		Centripetal pump chamber cover	
260		Gasket	
270		Gasket	
280		Set of regulating rings	
290		Gasket	
300		Centripetal pump chamber cover	
310		Lock ring	
320		Spindle screw	
330		Gasket	
510		Centripetal pump, compl.	
520		Gasket	
530		Sensing liquid pump	
540		Gasket	
550		Gasket	
560		Spacer ring	
570		Gasket	

(1) **ATTENTION!** After replacing this part, the complete bowl must be rebalanced.

4.3.1 Dismantling the bowl

- Switch off the main switch and lock it.

Danger to life through high-speed rotating separator parts!

- Do not loosen any part of the separator before the bowl has come to a standstill.
  The run-down time of the bowl is **30 minutes** after switching off the motor (without braking!).
  Bowl standstill is indicated by standstill of the drive belt.

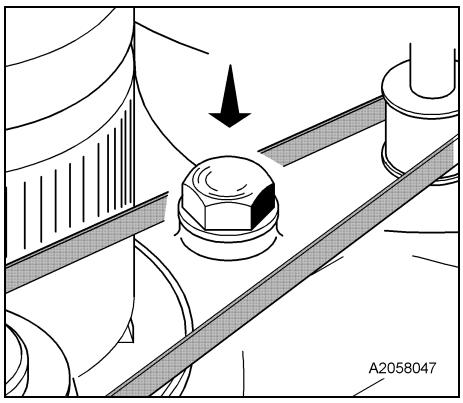


Fig. 85

Standstill of the drive belt

- Shine a torch through the sight glass in the frame,
- check that the drive belt has stopped moving.

If the sight glass in the frame is misted over:

- Unscrew the sight glass,
- shine a torch through the sight glass opening!
- Check that the drive belt is no longer moving.

Then:

- Clean the sight glass and screw it in again.

In the case of torn or defective drive belts or if the belts have come off:

- Do not loosen any part of the separator before the bowl has come to a standstill.
- **Be sure to observe** the run-down time of **30 minutes** until dismantling the separator!
- Applying the brakes is not effective!

- **Danger of injury through very hot separator parts!**
  When carrying out maintenance work, there is a danger of injury through hot separator parts (separating temperatures of 70 to 100 °C).
- Avoid damage to bowl parts when fitting and removing by
  – precise positioning,
  – no diagonal pull!
  – selecting the low lifting speed of the hoist.

- **Use only suitably rated, intact hoists.**
- Do not use force when removing or fitting parts.
- All bowl parts
  – must be gently handled,
  – always set down on a rubber mat or a wooden pallet.

If an installation is equipped with several separators:

- Do not interchange parts from different bowls **(danger of imbalance).**
  The bowl parts are marked with the serial number of the machine or the last three digits of the serial number.
- For special tools, see section *Parts list*.

- For standard tools, see section 4.11.

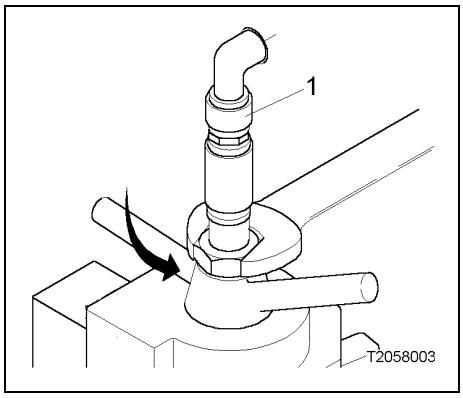


Fig. 86

- Disconnect water feed line 1.

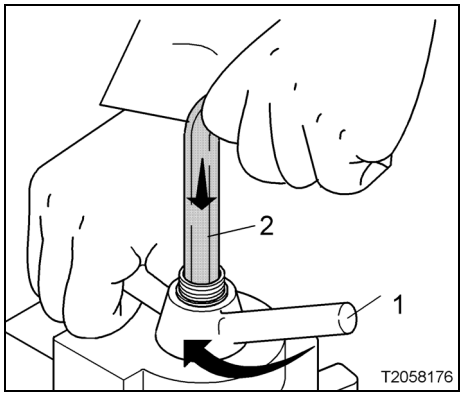


Fig. 87

- Unscrew handle connection piece 1 **(left-hand thread)** while holding
- the centripetal pump with offset wrench 2.

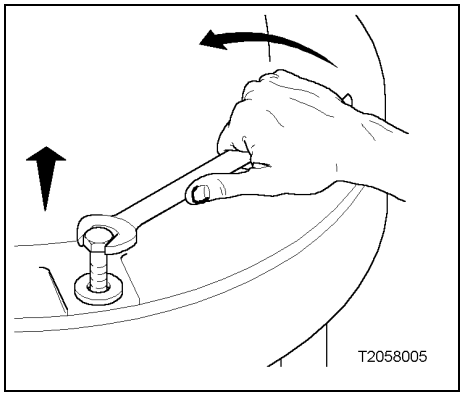


Fig. 88

- Unscrew the hex head screws with washers.

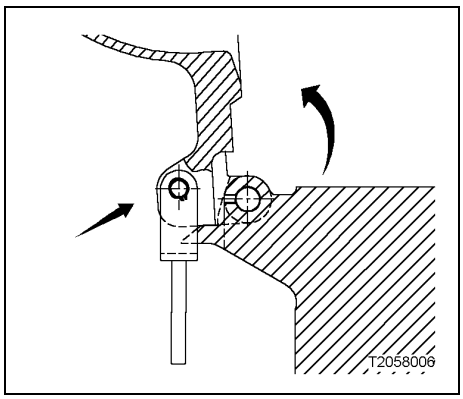


Fig. 89

- Hinge up hood.

Danger of injury by incorrect hinging up of the hood!

- The stirrup must register properly.

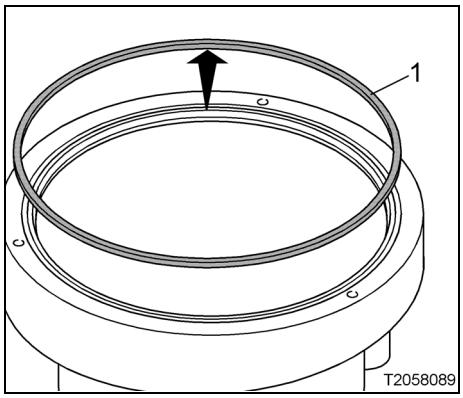


Fig. 90

If necessary (see sect. 4.2.1**):**

- Take gasket 1 out of the upper section of the frame.

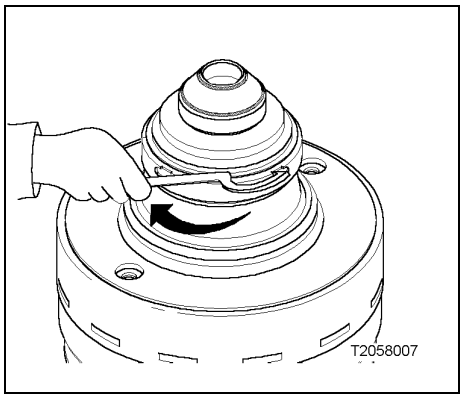


Fig. 91

- Unscrew the lock ring with the hook wrench **(left-hand thread)** and
- remove it.

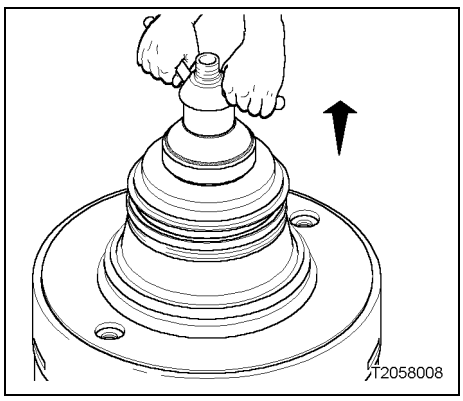


Fig. 92

- Screw handle connection piece into the centripetal pump (**left-hand thread**).
- Lift off the complete centripetal pump, centripetal pump chamber cover and spacer ring.

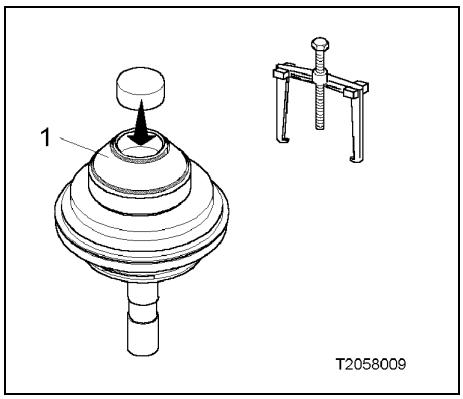


Fig. 93

- Insert the pressure piece into the spacer ring 1.
- Pull off the spacer ring with fitted gaskets with the aid of a commercial puller.

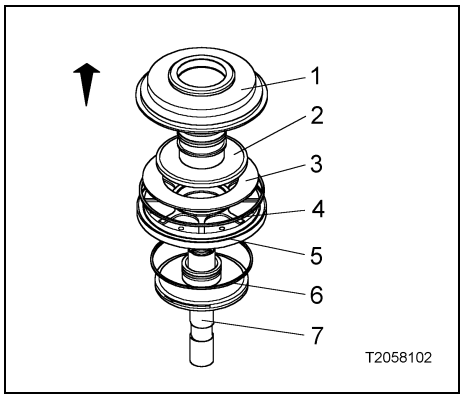


Fig. 94

- Remove the following parts:
  - centripetal pump 1 with inserted gasket.
  - sensing liquid pump 2 with inserted gaskets,
  - regulating ring 3,
  - centripetal pump chamber cover 5 with gaskets 4 and 6,
  - centripetal pump 7 with inserted gasket.

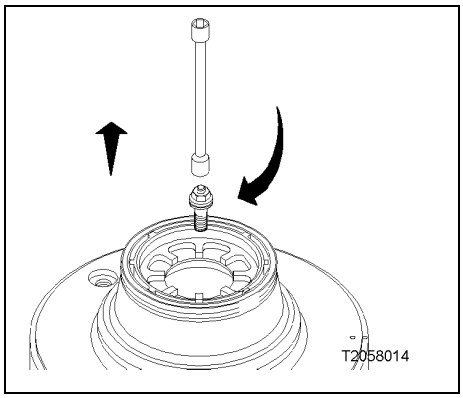


Fig. 95

- Unscrew the spindle screw
  - with a socket wrench and
  - commercially available ratchet **(left-hand thread)**.

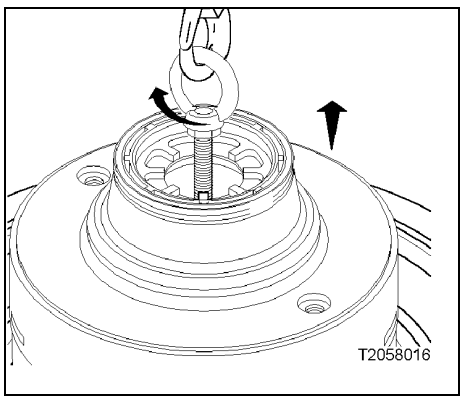


Fig. 96

- Force the bowl
  - **at least 10 mm** off the spindle cone using an eye bolt and
  - lift it out of the frame using a hoist.

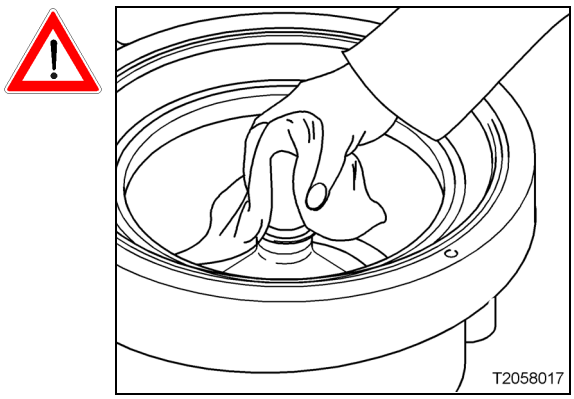


Fig. 97

- Place a cloth over the spindle.
  When the bowl has been removed, **no oil** must spill onto the drive belt via the spindle.

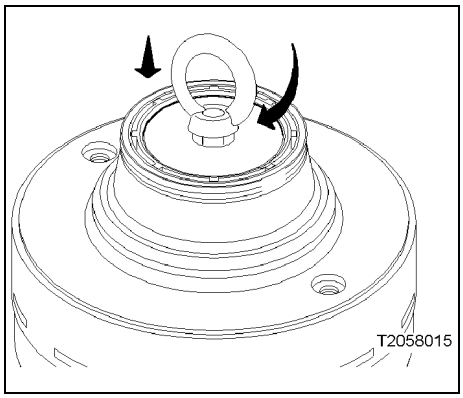


Fig. 98

- Place on plate and
- screw the complete eye bolt into the bowl bottom.

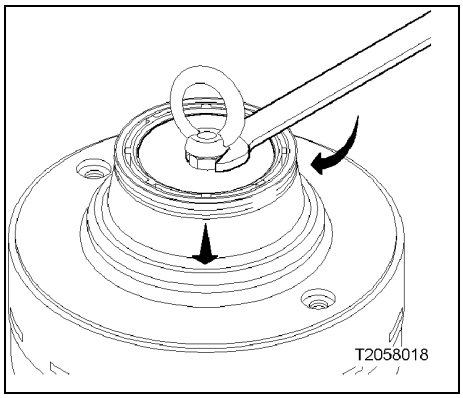


Fig. 99

- Compress the disk stack.

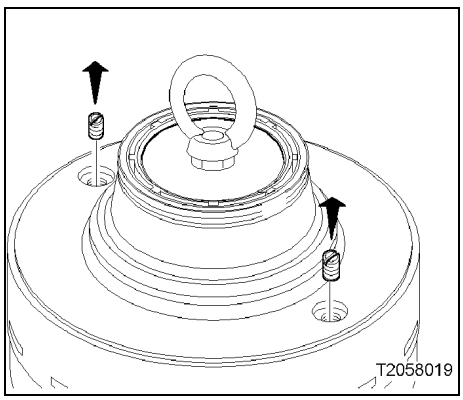


Fig. 100

- Unscrew the threaded pins out of the bowl top with a screwdriver.

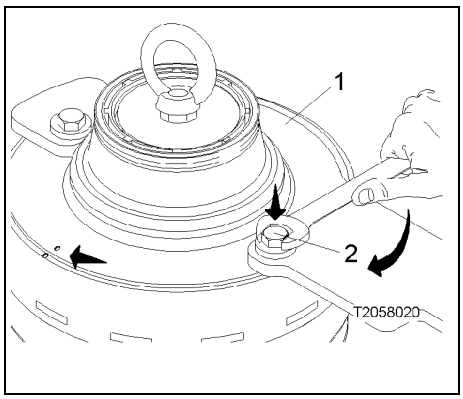


Fig. 101

- Bolt ring spanner 1 to the bowl top.
- Make sure that the "O" mark is not covered by the ring spanner.
- **Firmly** tighten the fastening screws 2 of the ring spanner.

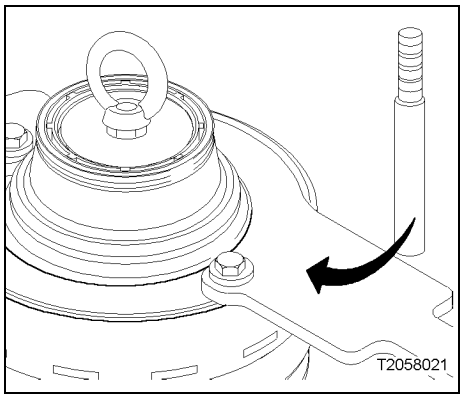


Fig. 102

- Strike open the bowl top with a mallet **(left-hand thread)**.

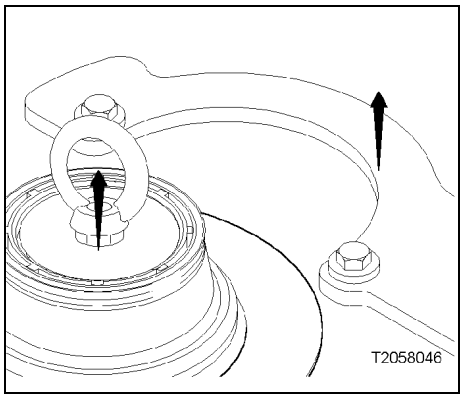


Fig. 103

- Unscrew the complete eye bolt from the bowl bottom.
- Remove the plate.
- Unscrew the ring spanner.

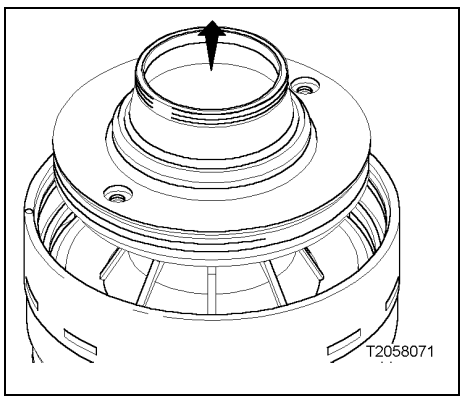


Fig. 104

- Lift off the bowl top with fitted gaskets by hand.

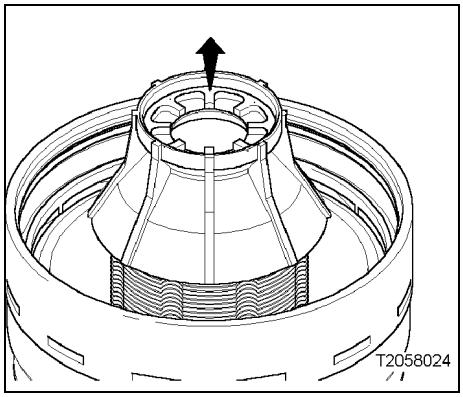


Fig. 105

- Remove separating disk.

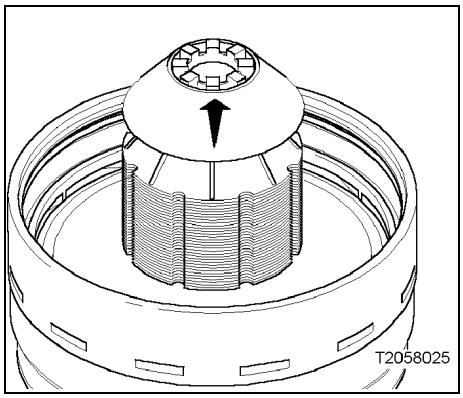


Fig. 106

- Lift out the distributor together with disk stack.

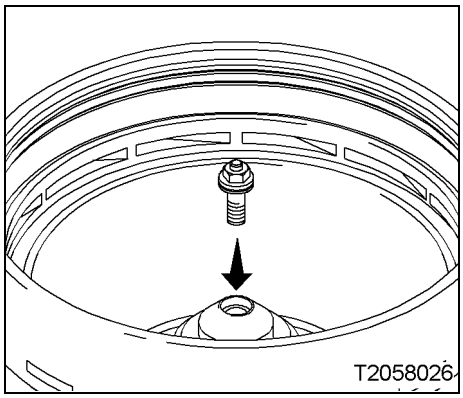


Fig. 107

- Insert the spindle screw.

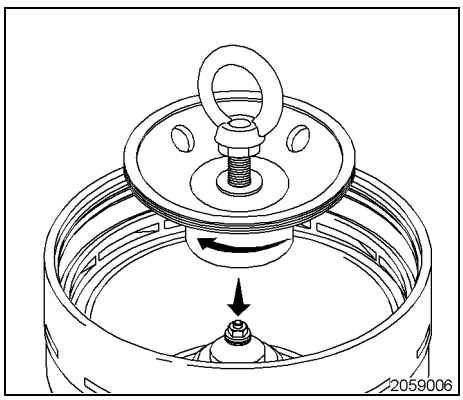


Fig. 108

- Screw the complete eye bolt into the bell-shaped piece as shown.
- Screw the bell-shaped piece with eye bolt into the thread of the sliding piston.

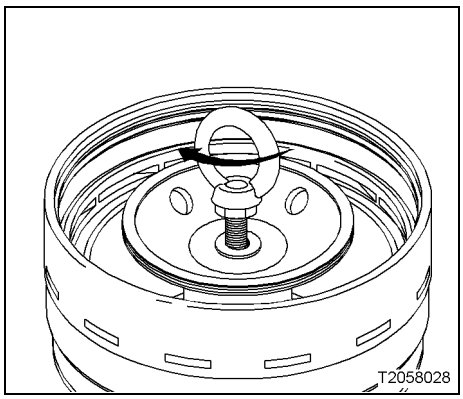


Fig. 109

- Force off the sliding piston with the aid of the eye bolt.

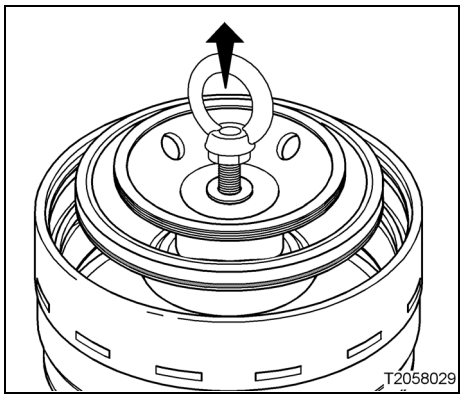


Fig. 110

- Remove the sliding piston (with fitted gasket) with bell-shaped piece and eye bolt.

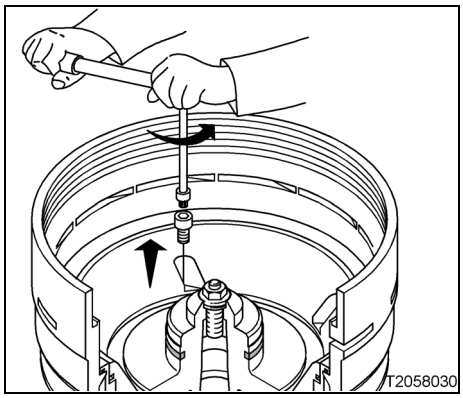


Fig. 111

- Unscrew the four Allen screws holding the closing-chamber bottom and the bowl bottom together.

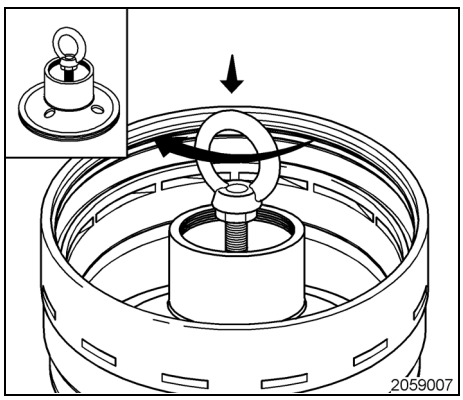


Fig. 112

- Screw the complete eye bolt into the bell-shaped piece as shown.
- Screw the bell-shaped piece into the thread of the annular piston.
- Force off annular piston and closing chamber with the aid of the eye bolt.

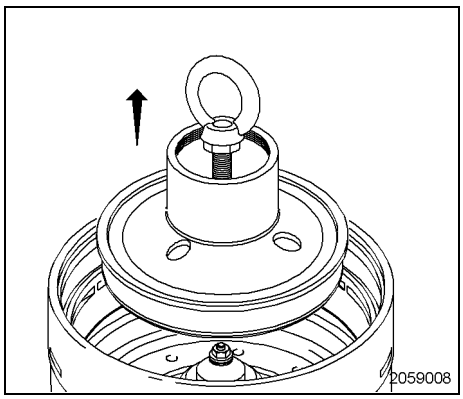


Fig. 113

- Remove the annular piston and closing chamber bottom (with fitted gaskets) with the bell-shaped piece and eye bolt.

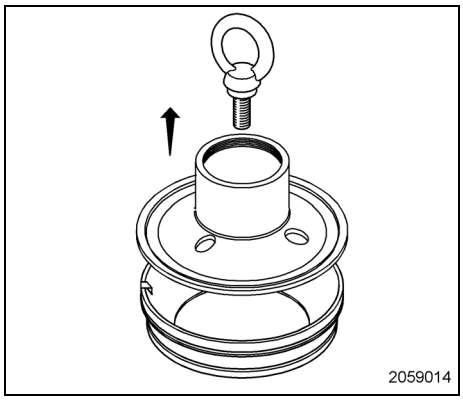


Fig. 114

- Unscrew the eye bolt and bell-shaped piece from the annular piston.

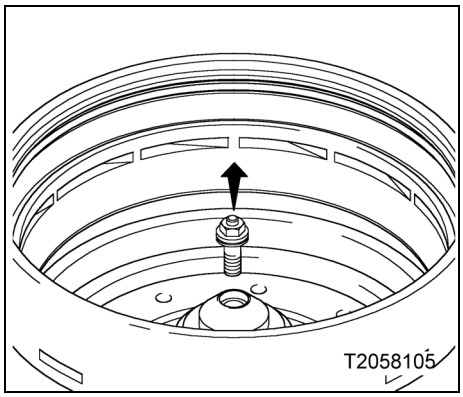


Fig. 115

- Unscrew the spindle screw.

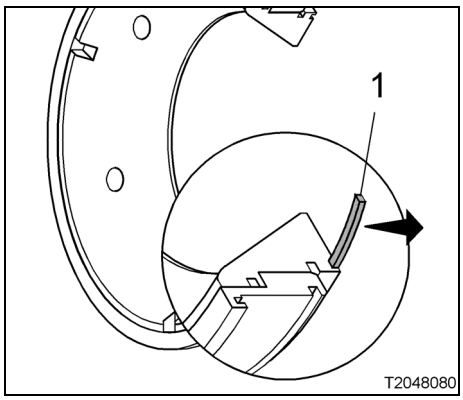


Fig. 116

- Remove gasket 1.

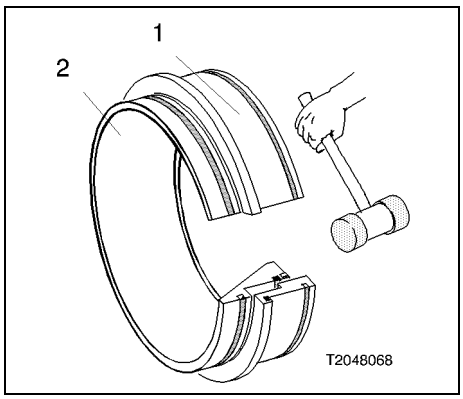


Fig. 117

- Drive annular piston 1 and closing-chamber bottom 2 apart using a mallet.

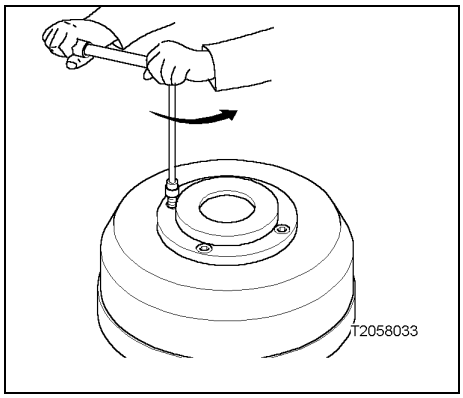


Fig. 118

When replacing the gasket in the water chamber bottom:

- Turn bowl through 180° (upside down).
- Unscrew the four Allen screws from the water chamber bottom.

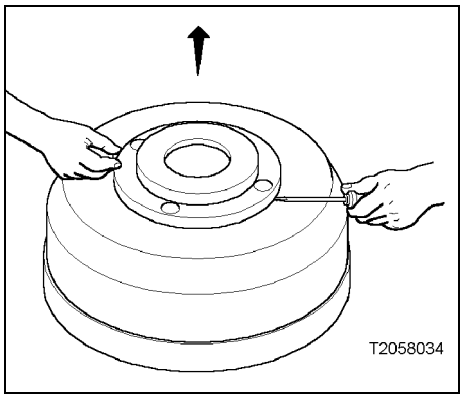


Fig. 119

- Water chamber bottom:
  – press off with a screwdriver and
  – remove it together with the gasket.

4.3.2 Cleaning the bowl

It is generally not necessary to dismantle self-cleaning bowls for cleaning after separation unless
- the nature of the product makes it necessary,
- the separator is to be shut down for a lengthy period (see section 4.9).

- Dismantle and clean the bowl for checking from time to time. See section 4.2.1 - Maintenance schedule.
- Use only a cleaning agent that is approved for the field of application!

- **Do not use acid or chloric cleaning agents.**
  Chlorine attacks stainless steel parts.

- Dissolve dried scale with citric acid.

- **For cleaning the individual disks and bowl parts**
  Do not use metal scrapers and metal brushes!

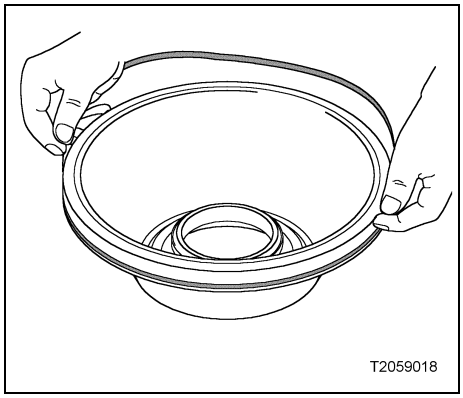


Fig. 120

- Take the gaskets out of the bowl parts.
- Clean the grooves and gaskets to avoid corrosion in the grooves.
- Replace damaged, very swollen, hardened or brittle gaskets **immediately**.

- Clean the small holes for the feed and discharge of the operating liquid **with particular care** to ensure trouble-free bowl ejections.

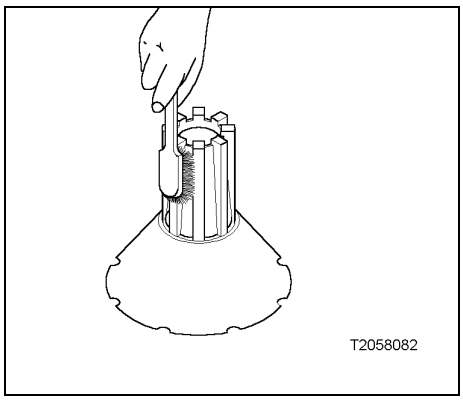


Fig. 121

- Clean the distributor between the ribs with the brush on the inside and outside.
  When the distributor neck is very dirty, the feed clogs which can cause overflow.

- Apply a **thin** coat of grease to the guide surfaces and threads of the bowl parts after drying (see 4.2.4 Lubrication schedule).
- **Reassemble the bowl immediately after cleaning.**

4.3.3 Cleaning the frame

Danger to life through electrical components!

- Never rinse off the motor with a direct water jet.
- Use only approved cleaning agents, preferably a neutral cleaning agent, benzene or diesel oil.

- **Do not use chloric cleaning agents.**
  Chlorine attacks stainless steel parts.
- Dissolve dried scale with citric acid.
- Clean the inside of the upper section of the frame from time to time:
  - Refer to the *maintenance schedule* (section 4.2.1),
  - dismantle the bowl (section 4.3.1).

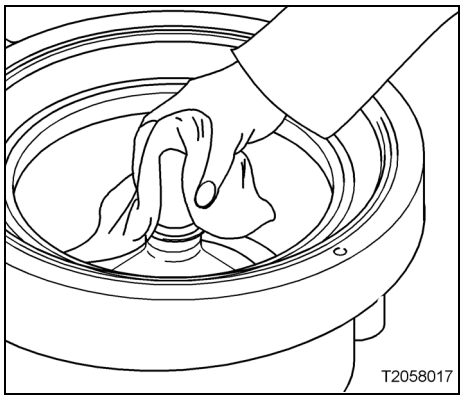


Fig. 122

- Place a cloth over the spindle.
  When the bowl has been removed, **no cleaning liquid** must spill onto the drive belt via the spindle.

4.3.4 Cleaning the strainer and the operating water feeding system

- The strainer and the operating water feeding system must be cleaned depending on the quality of the operating water and overall load. See section 4.2.1 - Maintenance schedule.
- Use citric acid in case of furring.
- Thoroughly clean the parts with water.

4.3.5 Important instructions

CAUTION: Danger of imbalance!
When the bowl has not been correctly assembled or is inadequately cleaned, forces can be produced in the high-speed rotating bowl which endanger the operating safety of the separator!

Therefore, the cleaning instructions (section 4.3.2) and assembling instructions (section 4.3.6) must be exactly followed.

Pay particular attention to the following:

- Before assembling the bowl, check to be sure that the guide and contact surfaces of the bowl are clean.
- Grease the guide surfaces as specified in the lubrication schedule (see 4.2.4).

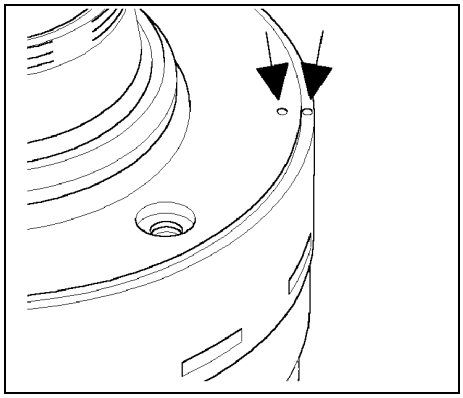


Fig. 123

- When fitting the bowl parts, make sure that the "O" marks on all parts are aligned.
  (Only then will the parts fit correctly over arresting pins and guide ribs).
- Avoid damaging bowl parts when fitting and removing by
  - precise positioning,
  - no diagonal pull!
  - Select the low lifting speed of the hoist.
- **Use only suitably rated, intact hoists.**
- Do not use force when fitting or removing parts.

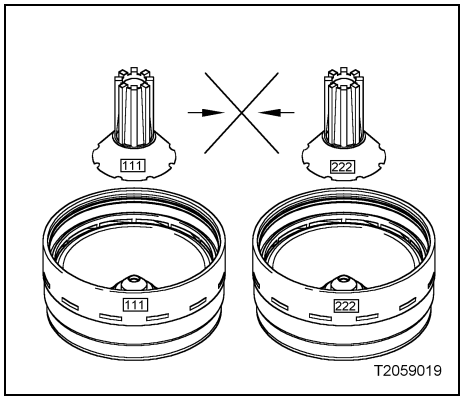


Fig. 124

- If the plant has several separators, be sure not to interchange parts of different bowls **(danger of imbalance).**
  The parts are marked
  - with the serial number or
  - the last three digits of the serial number.

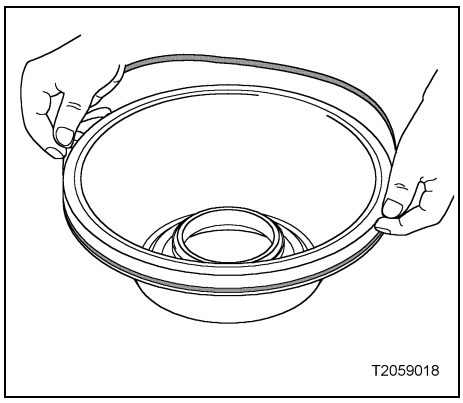


Fig. 125

- Thoroughly clean the gasket grooves of the individual bowl parts and apply a **thin** coat of grease.
- After fitting check that
  – the gaskets are not twisted,
  – the gaskets are evenly positioned in the groove.

- For special tools see section *Parts list*.
- For standard tools see section *4.11*.

4.3.6 Assembling the bowl

- **Pay special attention to sections 4.3.2 and 4.3.5**
- **For dimensions of the parts see 4.3 - exploded view**.

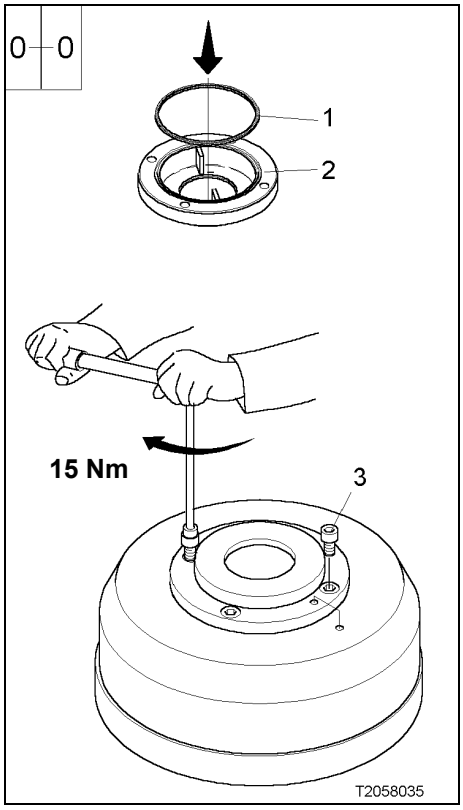


Fig. 126

When replacing the gasket in the water chamber bottom:

- Insert gasket 1 in the groove of the water chamber bottom 2.
- Turn bowl bottom through 180° (up-side down).
- Place water chamber bottom 2 on the bowl bottom.
- The "O" marks must be aligned.
- Screw in the four Allen screws 3 holding the water chamber bottom and bowl bottom together **tight**.
  Torque: 15 Nm

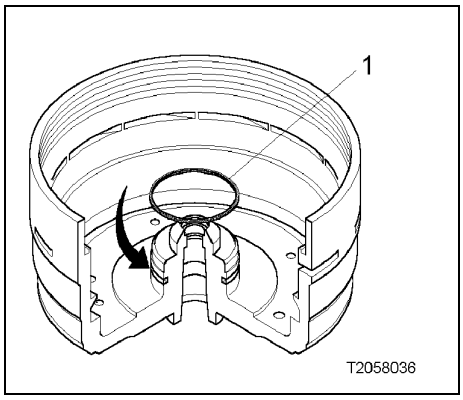


Fig. 127

- Insert gasket 1 in the groove in the bowl bottom.

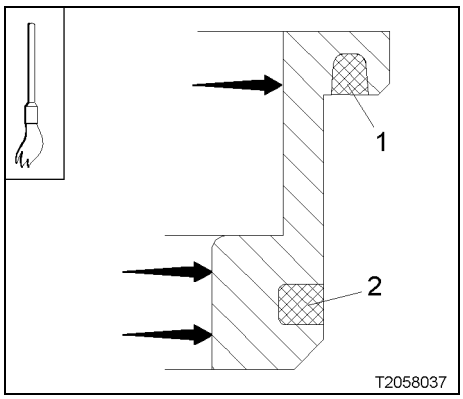


Fig. 128

- For replacing the polyamide gasket 1 see section 4.3.7.
- Insert gasket 2 in the annular piston.
- Grease guide surfaces as specified in the lubrication schedule (see 4.2.4).

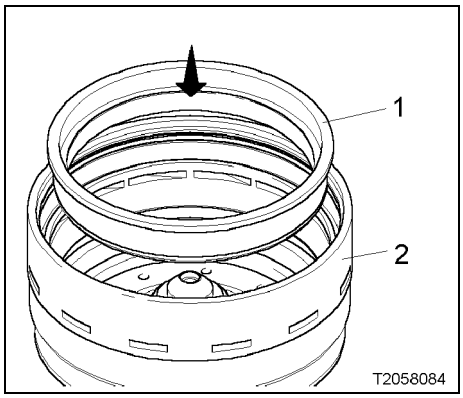


Fig. 129

- Install annular piston 1 in the bowl bottom 2.

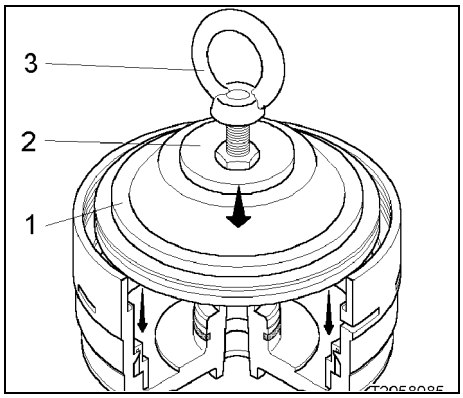


Fig. 130

- Turn the sliding piston through 180° (upside down).
- Fit sliding piston 1 together with plate 2 and complete eye bolt 3 as shown.

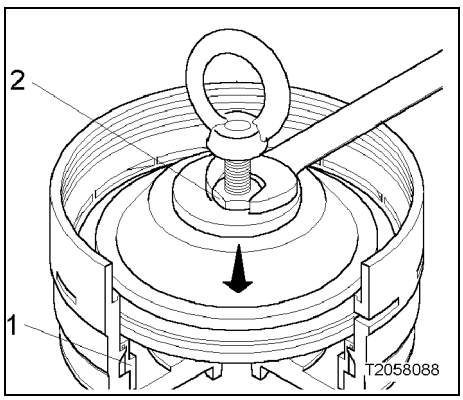


Fig. 131

- Press the annular piston 1 into the bowl bottom with the aid of nut 2.

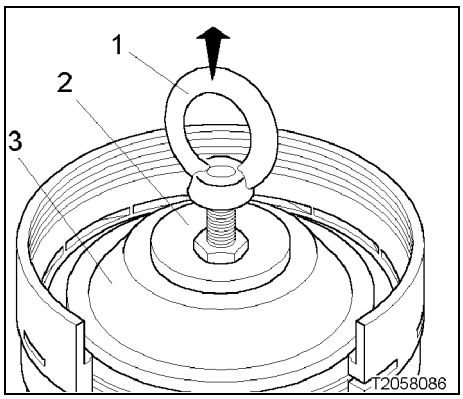


Fig. 132

- Unscrew complete eye bolt 1.
- Remove plate 2 and sliding piston 3.

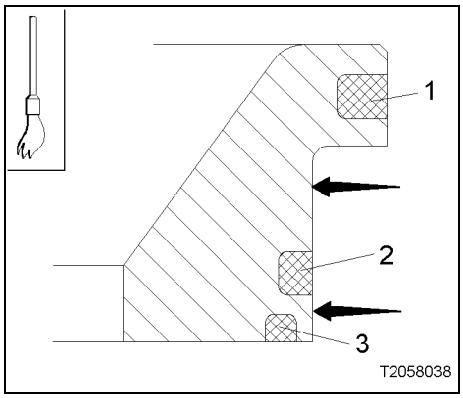


Fig. 133

- Insert gaskets 1, 2 and 3 in the closing chamber bottom.
- Grease guide surfaces as specified in the lubrication schedule (see 4.2.4).

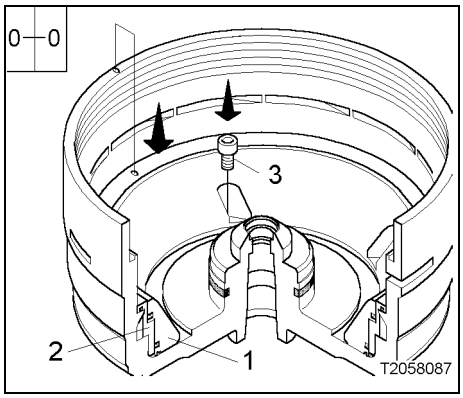


Fig. 134

- Place closing chamber bottom 1
  - in the annular piston 2 and
  - and bolt on the bowl bottom with the aid of the four Allen screws 3.
- The "O" marks must be aligned.

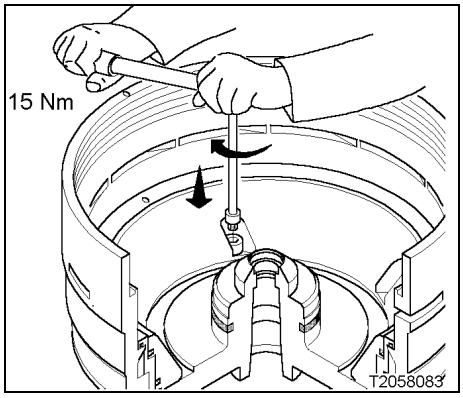


Fig. 135

- Screw **tight** the four Allen screws holding the closing chamber bottom and bowl bottom together.
  Torque: 15 Nm

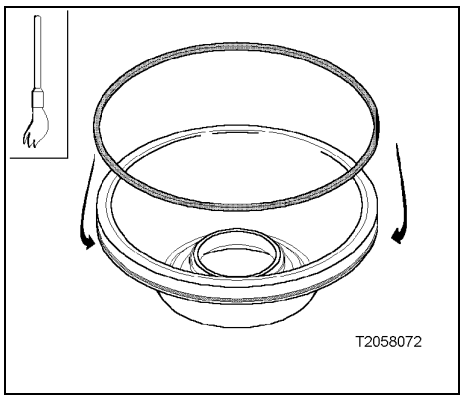


Fig. 136

- Insert the gasket in the groove of the sliding piston.
- Grease guide surfaces as specified in the lubrication schedule (see 4.2.4).

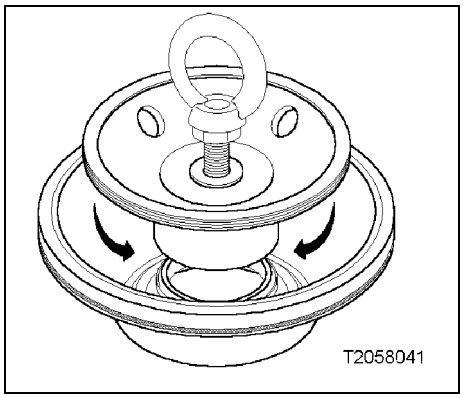


Fig. 137

- Screw the complete eye bolt into the bell-shaped piece as shown.
- Screw the bell-shaped piece with eye bolt into the thread of the sliding piston.

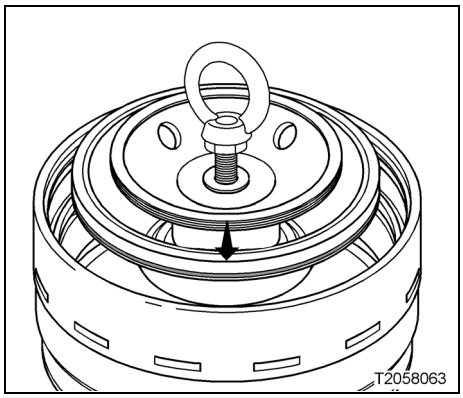


Fig. 138

- Place sliding piston with bell-shaped piece and eye bolt into the bowl bottom.

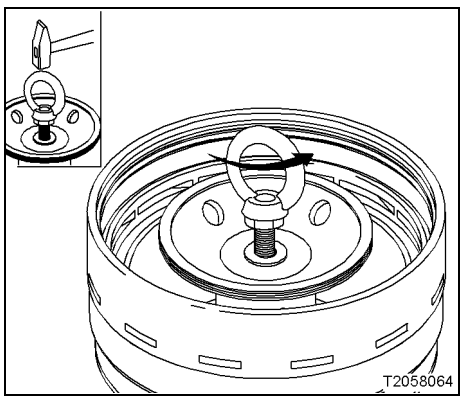


Fig. 139

- Lower the sliding piston by turning the eye bolt **counterclockwise**.
- Use light hammer blows to help as shown.

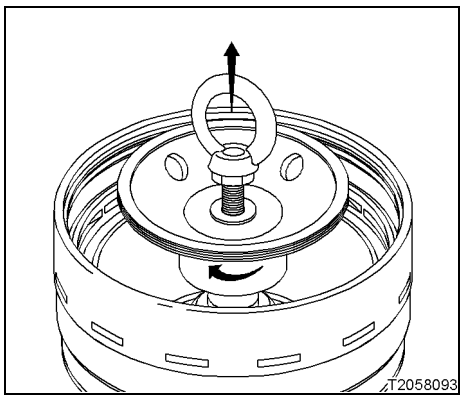


Fig. 140

- Unscrew the complete eye bolt and bell-shaped piece.

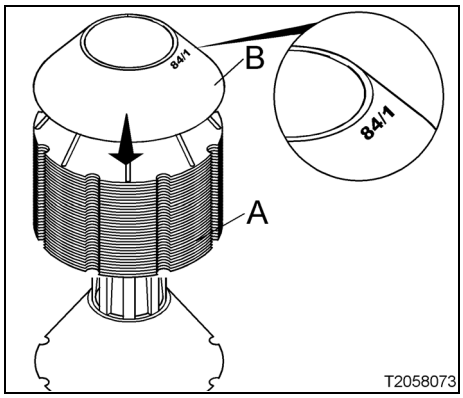


Fig. 141

- Stack the disk stack on the distributor neck.
  Be sure to fit the required total number of disks!

Note:
The required number of disks, e.g. 84/1, is stamped on the blind disk:
- Number of disks with spacers A = **84**
- Number of blind disks B = **1**

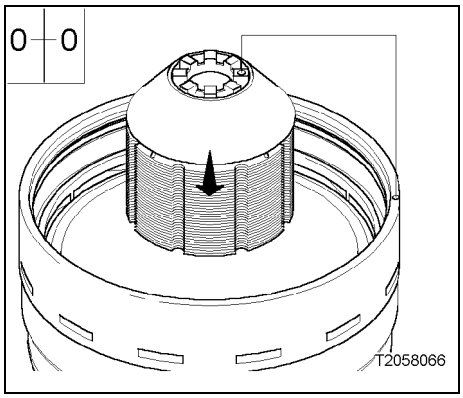


Fig. 142

- Install the distributor together with the disk stack.
  Pay attention to correct positioning!
- The "O" marks must be aligned.

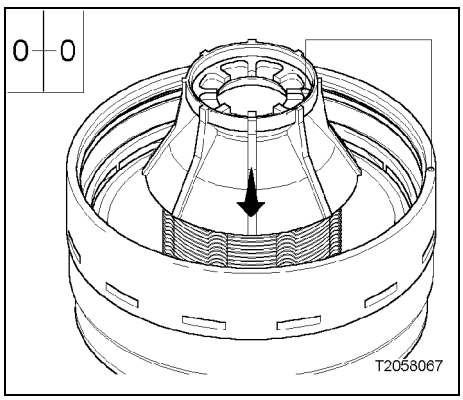


Fig. 143

- Mount the separating disk.
  Pay attention to correct positioning!
- The "O" marks must be aligned.

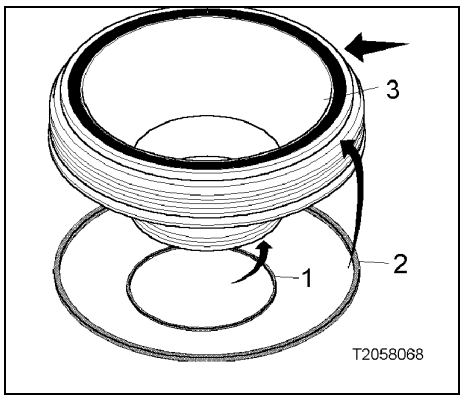


Fig. 144

- Thoroughly clean the grooves for gaskets 1 and 2 in the bowl top.
- Check gaskets
  - and
  - replace when damaged,
  - then insert.
- For replacing the polyamide gasket 3 see section 4.3.8.

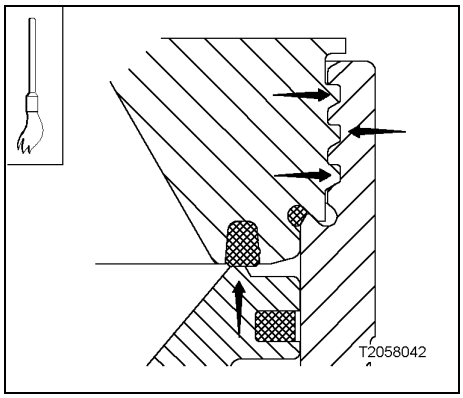


Fig. 145

- To prevent seizing of the threads,
  - the threads and guide surfaces of the bowl bottom and bowl top as well as
  - the contact surfaces on the bowl top and sliding piston

  must be carefully cleaned, wiped dry and greased in accordance with the lubrication schedule (see 4.2.4).

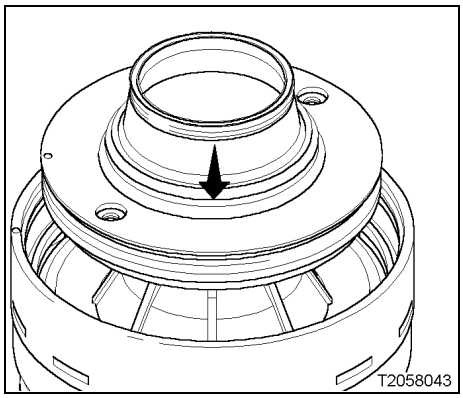


Fig. 146

- Screw the bowl top by hand into the bowl bottom (**left-hand thread**).

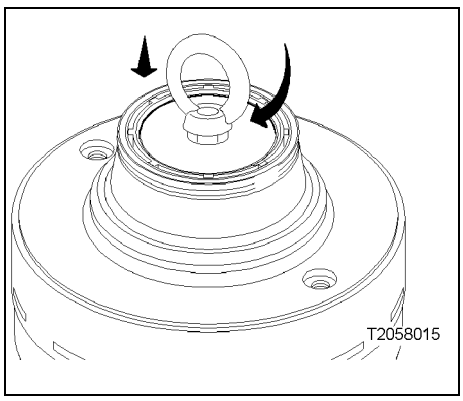


Fig. 147

- Place on plate and
- Screw the complete eye bolt into the bowl bottom.

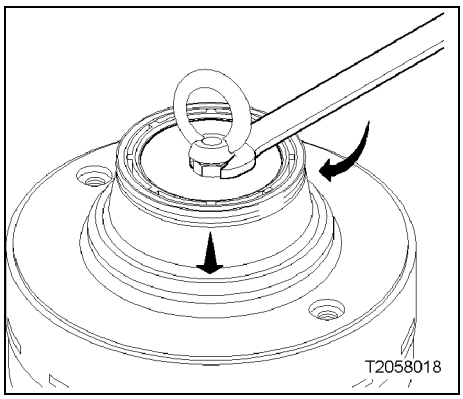


Fig. 148

- Compress the disk stack.

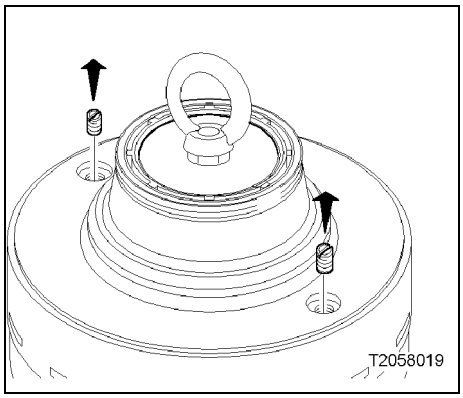


Fig. 149

- Unscrew the threaded pins out of the bowl top with a screwdriver.

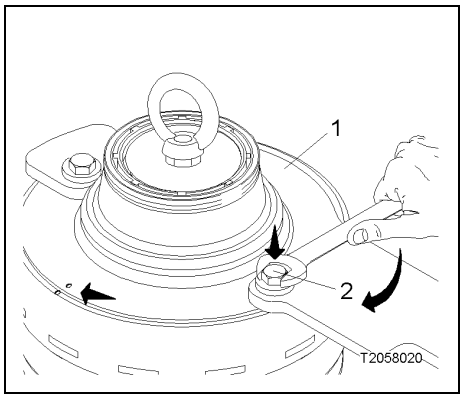


Fig. 150

- Bolt ring spanner 1 to the bowl top.
- Make sure that the "O" mark is not covered by the ring spanner.
- **Firmly** tighten the fastening screws 2 of the ring spanner.

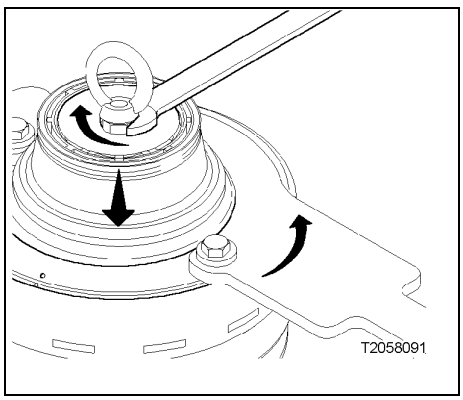


Fig. 151

- Compress the disk stack again and
- screw in the bowl top with the ring spanner.

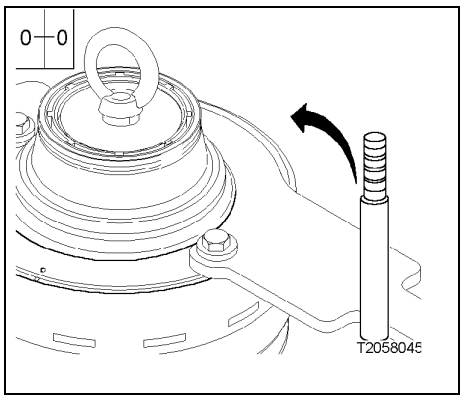


Fig. 152

- Strike the bowl top with a mallet until the "O" mark is reached.

CAUTION:
A loose bowl top can endanger life!

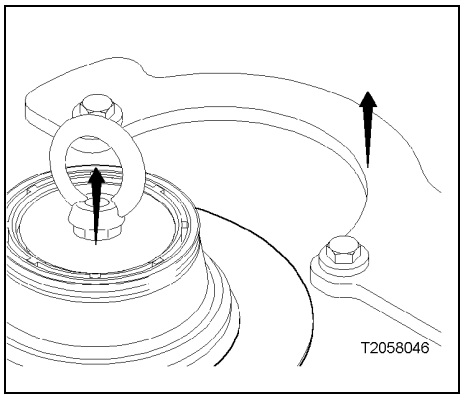


Fig. 153

- Unscrew the ring spanner.
- Unscrew the eye bolt from the bowl bottom and
- remove the plate.

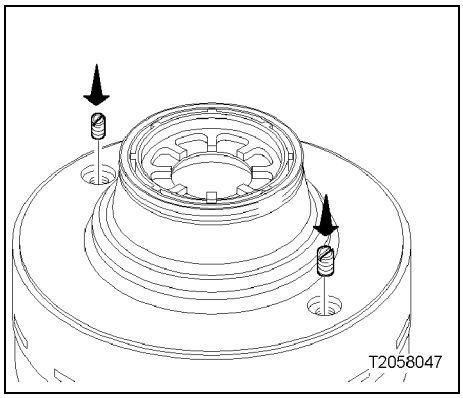


Fig. 154

- Screw in the two threaded pins using a screwdriver.

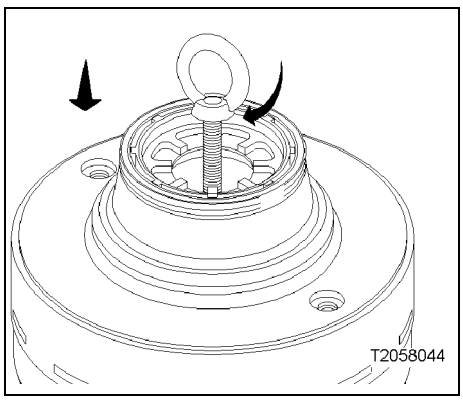


Fig. 155

- Screw the eye bolt into the bowl bottom.

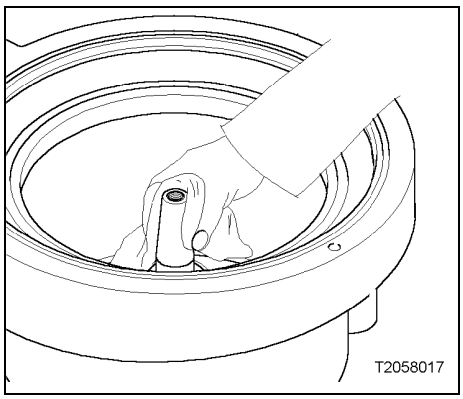


Fig. 156

- **Clean and wipe dry** the spindle cone with a suitable cloth.
  Do not grease the conical parts!

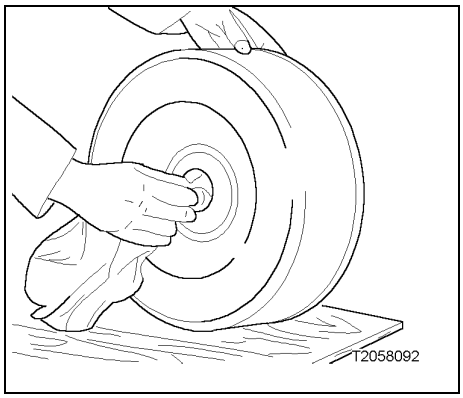


Fig. 157

- Turn bowl through 90°.
- Clean the bowl hub with a suitable cloth.
- **Do not grease the bowl hub!**

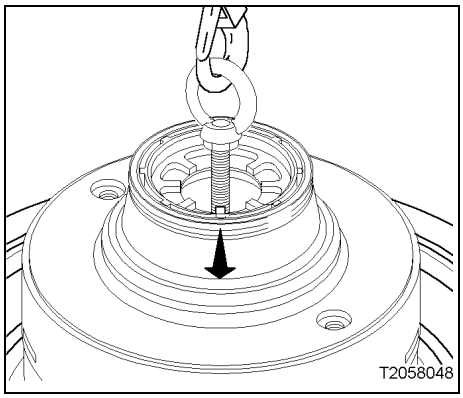


Fig. 158

- **Carefully** place the bowl using eye bolt and hoist on the spindle cone.

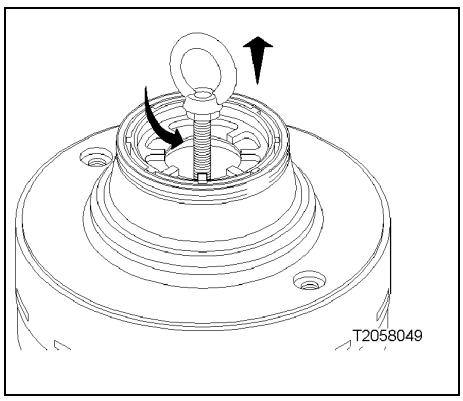


Fig. 159

- Unscrew the eye bolt from the bowl bottom.

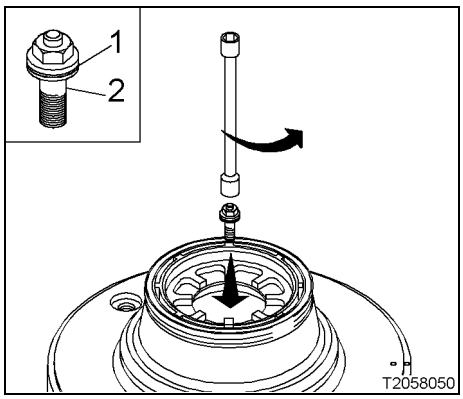


Fig. 160

- Provide spindle screw 2 with gasket 1.
- Screw in the spindle screw (**left-hand thread**).

Tools:
Socket wrench
Commercially available ratchet

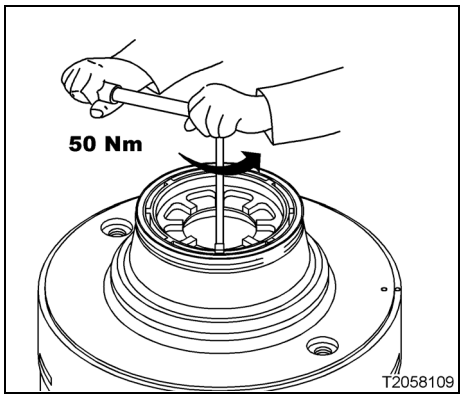


Fig. 161

- Tighten spindle screw.
  Torque: 50 Nm

CAUTION:
A loose spindle screw can endanger life!

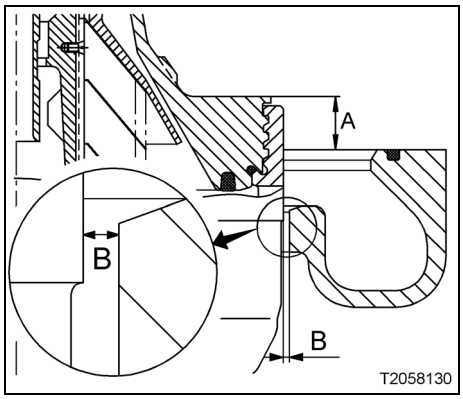


Fig. 162

- Check that the spindle and bowl are **centric**.
  The control dimension **B**
  – is **3,5** ±1,5 **mm**
  – between the bowl and the upper section of the frame.
- Pay attention to bowl height **A** (see section **4.7.1**).

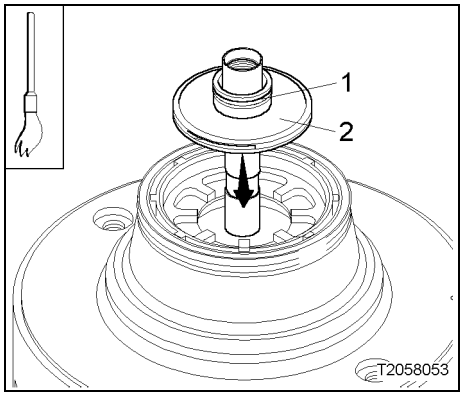


Fig. 163

- Insert gasket 1 in the centripetal pump groove.
- **Lightly** grease threads and contact surfaces of the centripetal pump.
- Install centripetal pump 2.

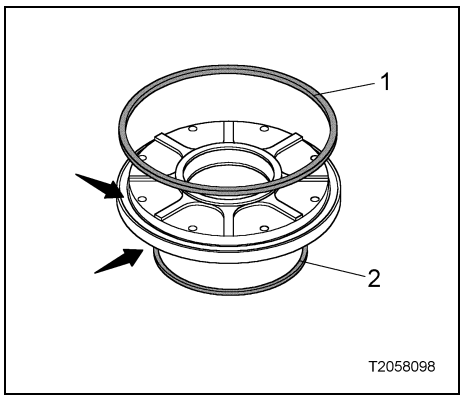


Fig. 164

- Insert gaskets 1 and 2 in the grooves of the centripetal pump chamber cover.

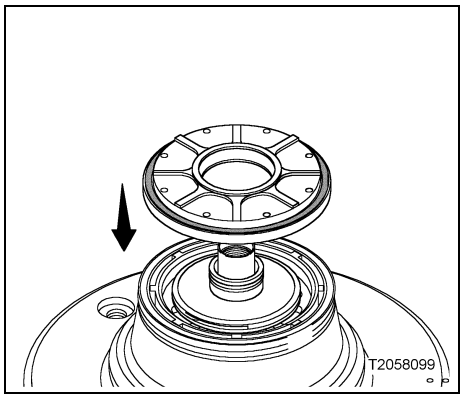


Fig. 165

- Mount the centripetal pump chamber cover with fitted gaskets.

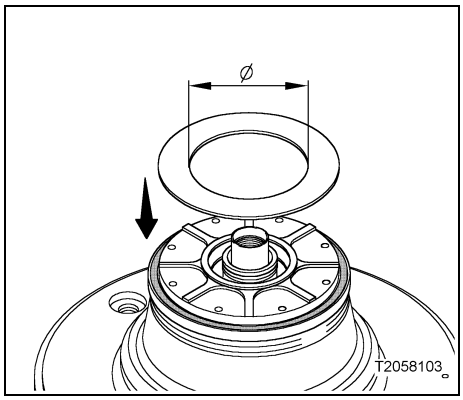


Fig. 166

- Mount the regulating ring selected from the set of regulating rings.
- See section 2.6.

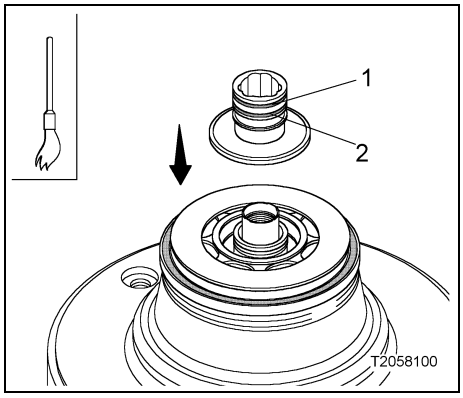


Fig. 167

- Insert gaskets 1 and 2 in the sensing liquid pump grooves.
- Grease guide surfaces.
- Install sensing liquid pump.

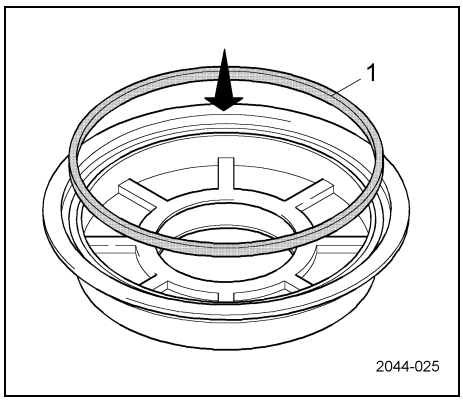


Fig. 168

- Insert gasket 1 in the groove in the centripetal pump chamber cover.

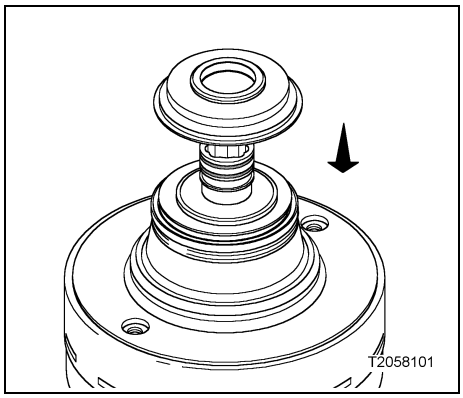


Fig. 169

- Mount the centripetal pump chamber cover.

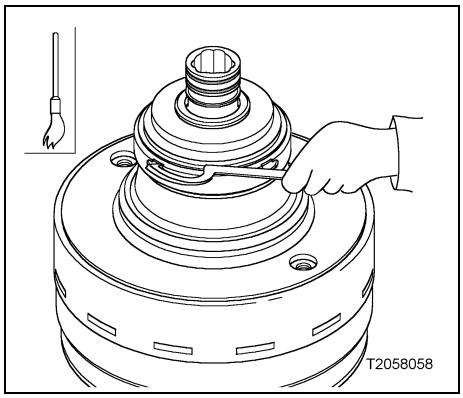


Fig. 170

- Grease the threads on the bowl top and lock ring as specified in the Lubrication schedule (see 4.2.4).
- Screw tight the lock ring using the hook wrench **(left-hand thread).**

CAUTION!
A loose lock ring can endanger life!

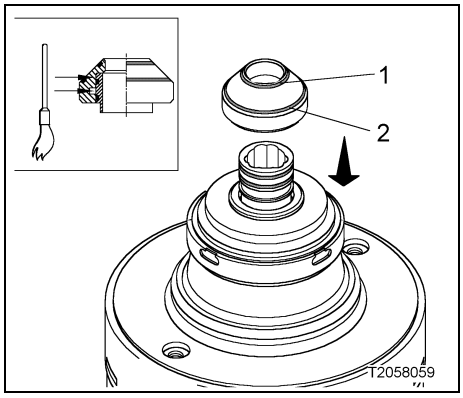


Fig. 171

- Insert gaskets 1 and 2 in spacer ring.
- Grease the guide surfaces of the centripetal pump as specified in the lubrication schedule (see 4.2.4).
- Fit spacer ring.

- **Pay attention to section 4.7.1**.

4.3.7 Replacing the polyamide gasket in the annular piston

ATTENTION:
Replace only the **damaged** polyamide gasket!

- For standard tools, see section *4.11*.

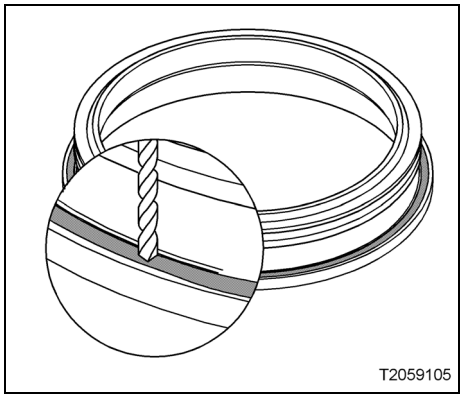


Fig. 172

REMOVAL – VARIANT I

- Drill through the damaged polyamide gasket twice centrically and vertically.
  - with a 2 mm drill bit
  - at a distance of approx. 50 to 60 mm.

ATTENTION:
The groove of the annular piston must not get damaged!

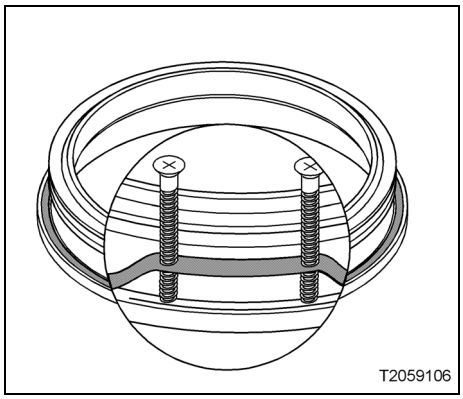


Fig. 173

- Screw two wooden screws in the holes in the polyamide gasket.
  ATTENTION:
  The groove of the annular piston must not get damaged!
- Force off the old polyamide gasket with the wooden screws.
- Lever it bit by bit out of the groove using a screwdriver.

Note:
If the polyamide gasket can't be removed, repeat this procedure.

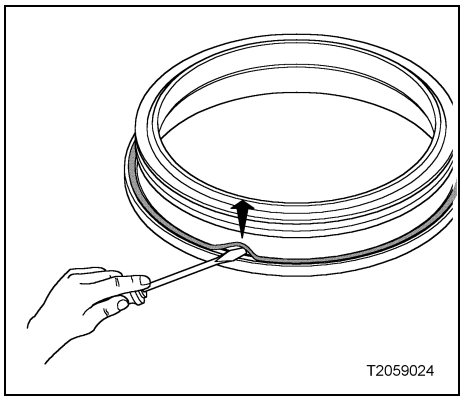


Fig. 174

REMOVAL – VARIANT II

- Heating the ring with a hot-air blower facilitates removal.
- Remove the old polyamide gasket.

ATTENTION:
The groove of the annular piston must not get damaged!

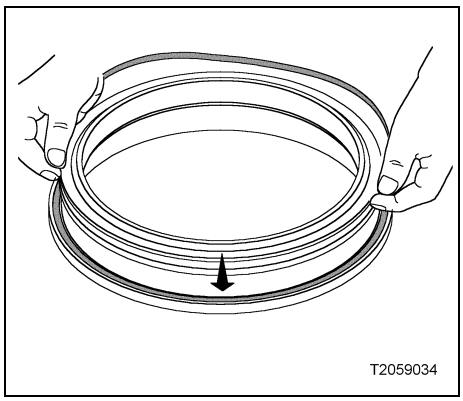


Fig. 175

FITTING

- Thoroughly clean and dry the groove.
- Heat the gasket in approx. 80 °C water for 5 minutes.
- Gasket
  - clean and wipe dry
  - lightly press into the groove.

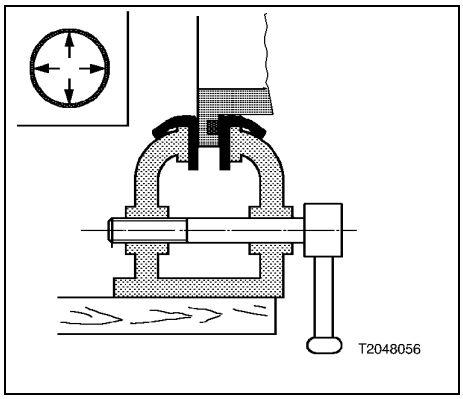


Fig. 176

- Pull the polyamide gasket into the groove applying a vice at four diametrically opposite points.

Then

- pull the gasket bit by bit into the groove with the vice.

Use smooth copper jaws.

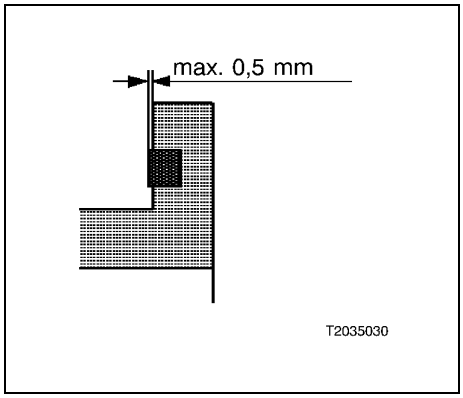


Fig. 177

If the dimension of the pressed-in gasket **is more than 0.5 mm**,

- the polyamide gasket must be further pressed in the vice.

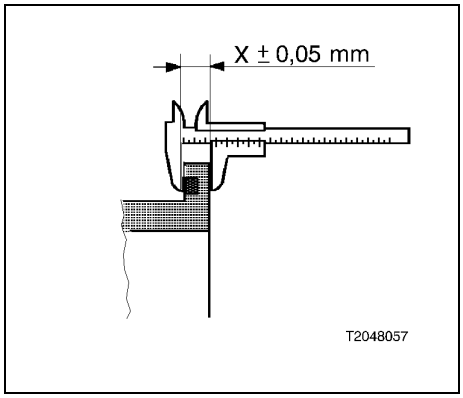


Fig. 178

- By carrying out **several measurements** around the entire circumference of the annular piston, check that the polyamide gasket is seated **parallel** in the groove.

4.3.8 Replacing the polyamide gasket (bowl top)

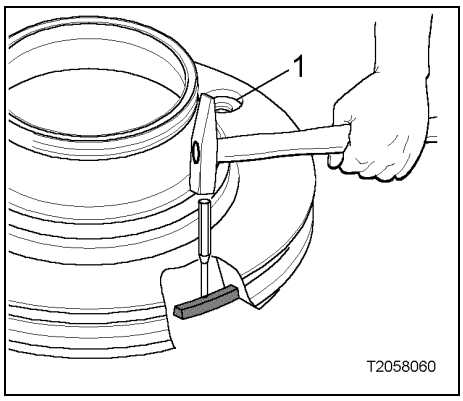


Fig. 179

REMOVAL

- Drive the gasket out of the groove with the aid of a pin punch.

To do this:

- Insert a commercial pin punch alternately in holes 1.

FITTING

- Heat the gasket in approx. 80 °C (176 °F) water for 5 minutes.
- Wipe dry the gasket.
- Fit the gasket into the clean groove of the bowl top (with the narrow side facing the bowl top).

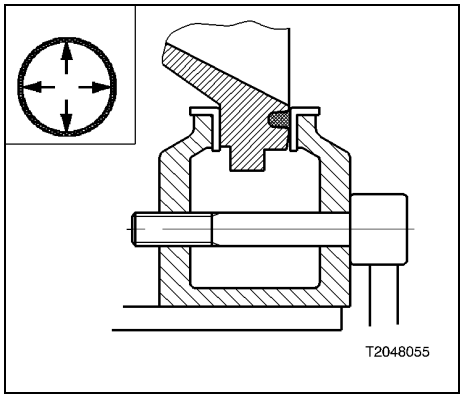


Fig. 180

Variant I

- Pull the polyamide gasket into the groove applying a vice at four diametrically opposite points.

Then

- pull the gasket bit by bit into the groove with the vice.

Use smooth copper jaws.

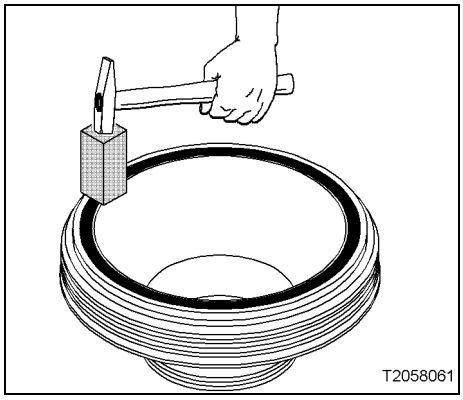


Fig. 181

Variant II

- Place on a wooden block and
- hammer the gasket evenly into the groove.

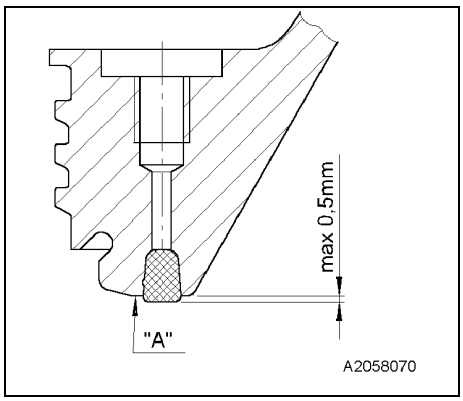


Fig. 182

- The sealing surface of the gasket must not protrude by more than **0.5 mm** from the surface "A" of the bowl top.

4.3.9 Reworking the sliding piston

The bowl seal consists of

- the sealing surface A of the sliding piston (Fig. 183) (Sealing surface A as delivered 2 mm high) and
- the polyamide gasket B of the bowl top (Fig. 185).

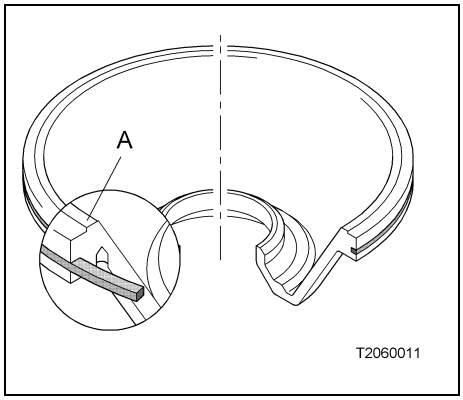


Fig. 183

When worn, the sealing surface A of the sliding piston can be remachined **up to max. 0.5 mm** several times before it has to be replaced.

When the first erosion marks (0.2 mm deep) are detected, i.e. as soon as the bowl starts to leak:

- Remachine the sealing surface of the sliding piston.

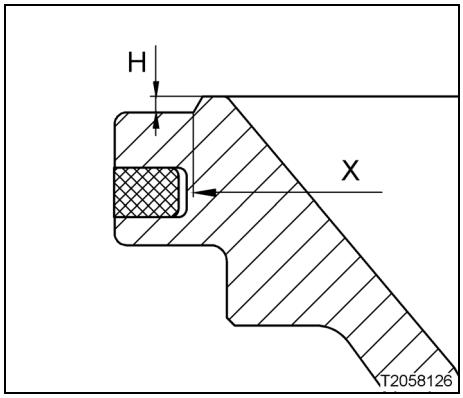


Fig. 184

- When remachining, make sure that
  - the sealing surface is machined cleanly and
  - shoulder H at diameter X is still **at least 1.5 mm high**.

Standard parameters for remachining the sealing surface	
Surface quality	Ra 2 µm (Rz 12.5 µm)
Tool	Hard metal steel of ISO quality M 30 or K 20
Speed	55 min^{-1}
Cutting depth	max. 0.15 mm
Forward feed	max. 0.1 mm/revolution

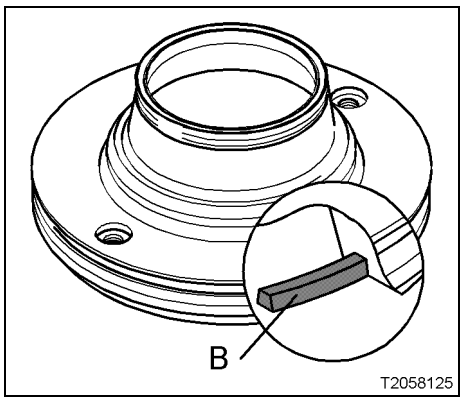


Fig. 185

After facing

- fit a new polymide gasket B into the bowl top (see section 4.3.8)!

4.4 Closing the hood

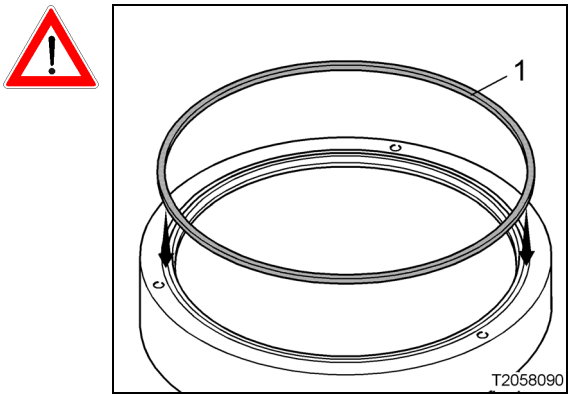


Fig. 186

If the gasket has been removed to keep to the service intervals:

- Insert a new gasket 1 in the groove of the upper part of the frame.

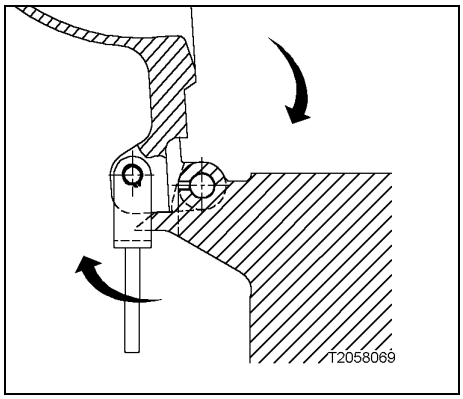


Fig. 187

CAUTION: Danger of injury!

- Unlock the shackle.
- Carefully close the hood.

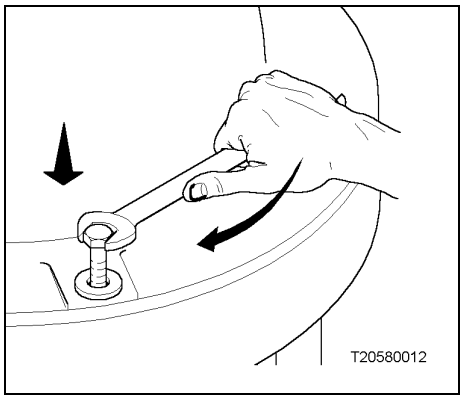


Fig. 188

- Screw in the three hex head screws (M 12 x 30) with washers.

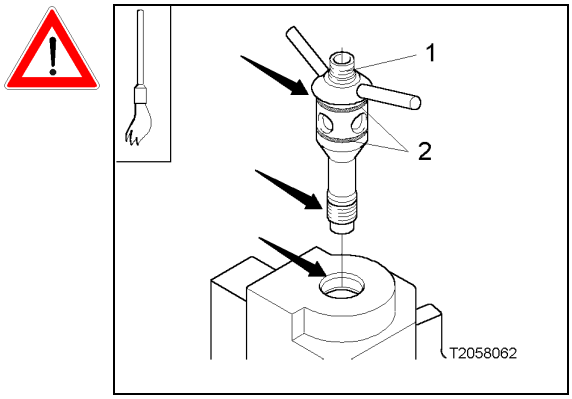


Fig. 189

If the gaskets 2 have been removed to keep to the service intervals:

- Provide handle connection piece 1 with new gaskets 2.
- Apply a **thin** coat of grease to the guide surfaces and threads of the handle connection piece as specified in the lubrication schedule (see 4.2.4).

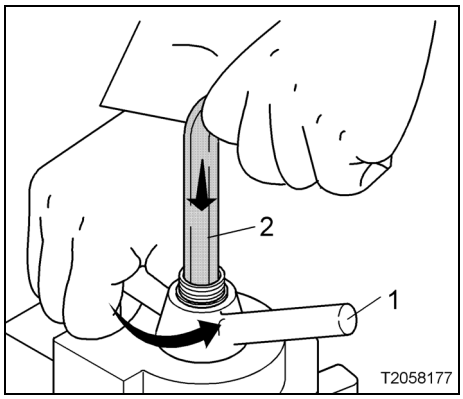


Fig. 190

- Introduce handle connection piece 1 into the hood and
- Screw it down to fasten the centripetal pump **(left-hand thread)**.
  To do this, use offset wrench 2.

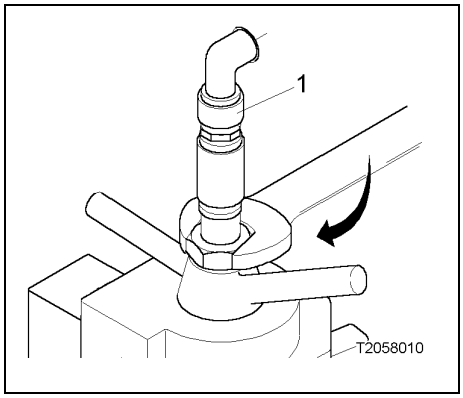


Fig. 191

- Connect water feed line 1.

4.5 Motor and centrifugal clutch

General

The centrifugal clutch
- ensures power transmission between motor, drive belt and spindle.
- brings the bowl gradually to rated speed,
- eliminates premature wear to drive belt and motor.

Note that the driving effect of new clutch shoes will improve after several starts.

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

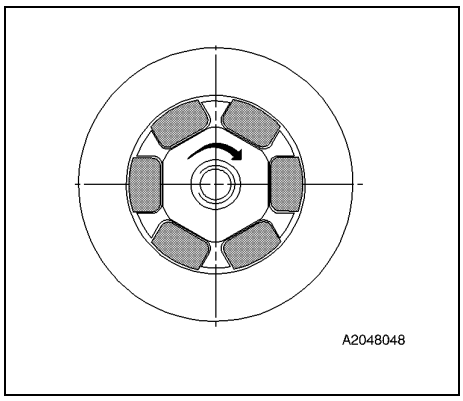


Fig. 192

If the bowl reaches its rated speed in less than 1.5 minutes (see nameplate) resulting in an inadmissibly high motor current consumption during start-up, (I_{max} >1.8 x I_N),
- reduce the number of clutch shoes,
- be sure to keep the clutch shoes evenly spaced.

- Wear to the clutch shoes depends on
  - number of start-ups,
  - ejection frequency.
- Check the condition of the clutch shoes from time to time (see 4.2.1 - Maintenance schedule).
- Always replace **all** clutch shoes at the same time to avoid imbalance. **Never replace individual clutch shoes!**

4.6 Drive

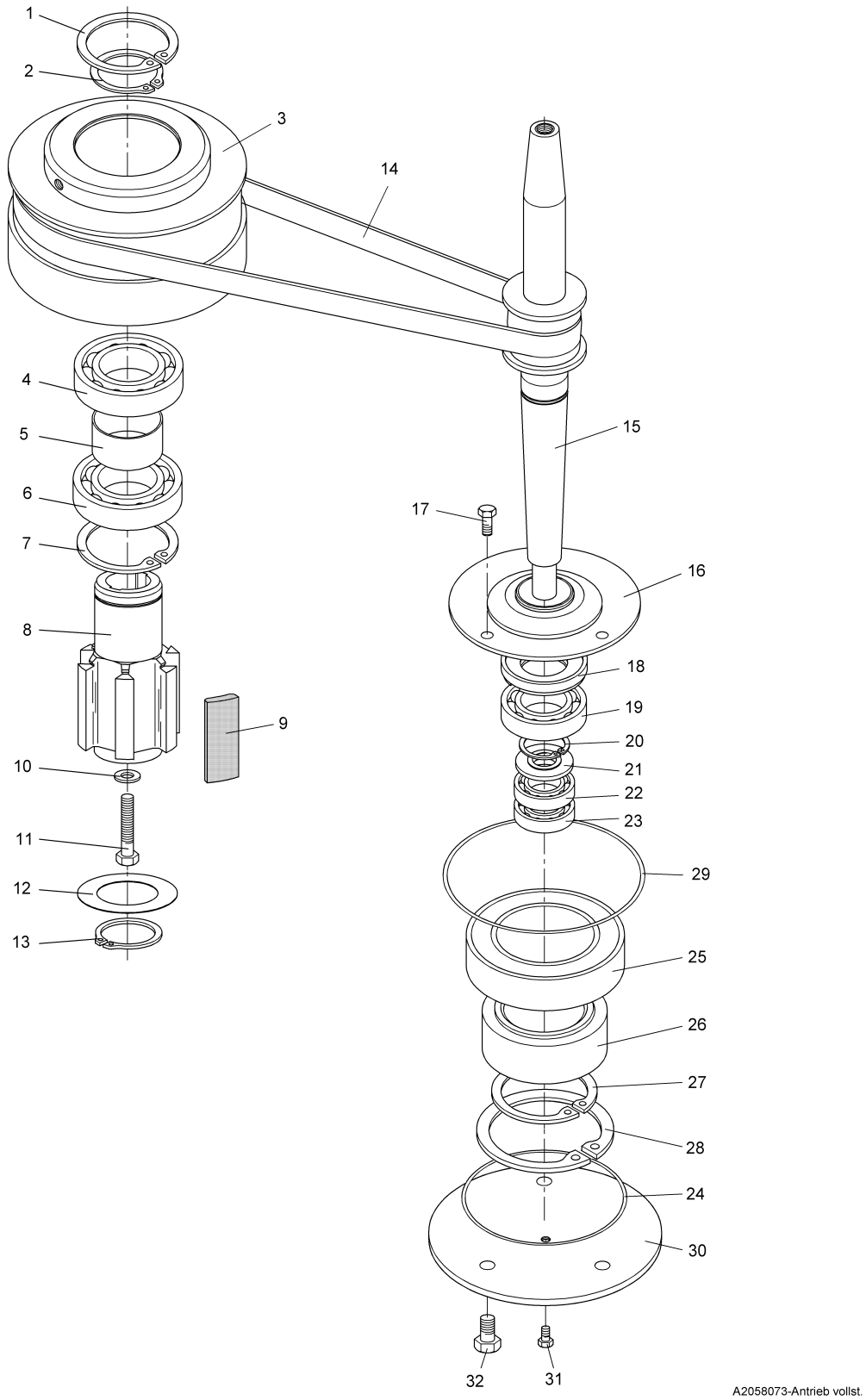


Fig. 193 Exploded view of the drive

Pos.	Designation	Dimensions
1	Retaining ring	95 x 3
2	Retaining ring	60 x 2
3	Clutch drum	
4	Grooved ball bearing	
5	Distance bush	
6	Grooved ball bearing	
7	Retaining ring	95 x 3
8	Clutch driver	
9	Clutch shoe	
10	Disk	11 x 27 x 4
11	Hex head screw	M 10 x 65
12	Disk	
13	Retaining ring	60 x 2
14	Drive belt	
15	Spindle	
16	Bearing cover	
17	Hex head screw	M 10 x 20
18	Bearing cover	
19	Grooved ball bearing	
20	Retaining ring	35 x 1,5
21	Ball bearing protection ring	
22	Angular contact ball bearing	
23	Grooved ball bearing	
24	Gasket	
25	Rubber-metal cushion	
26	Pivoting bearing, compl.	
27	Retaining ring	40 x 1,75
28	Retaining ring	62 x 2
29	Gasket	
30	Bearing cover	
31	Hex head screw (This hex head screw is glued in with Loctite 275.)	M 6 x 10
32	Hex head screw	M 10 x 20

4.6.1 Important instructions

- Switch off the main switch and lock it.

Danger to life through high-speed rotating separator parts!
- Do not loosen any part of the separator before the bowl has come to a standstill.
  The run-down time of the bowl is **30 minutes** after switching off the motor (without braking!).
  Bowl standstill is indicated by standstill of the drive belt.

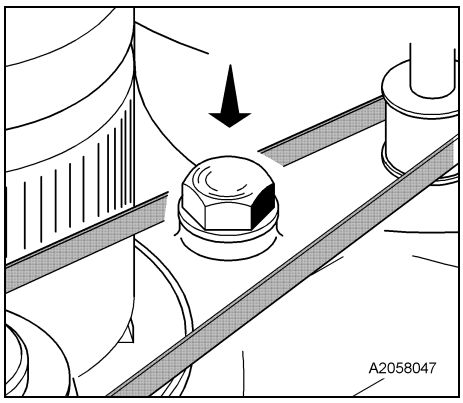


Fig. 194

Standstill of drive belt
- Shine a torch through the sight glass in the frame.
- Check that the drive belt is no longer moving.

If the sight glass in the frame is misted over:
- Unscrew the sight glass,
- shine a torch through the sight glass opening!
- Check that the drive belt is no longer moving.

Then
- Clean the sight glass and screw it back on.

In the case of torn or defective drive belts or if the belts have come off:
- Do not loosen any part of the separator before the bowl has come to a standstill.
- **Be sure to observe** the run-down time of **30 minutes** until dismantling the separator!
- Applying the brake is not effective!

- **Danger of injury through very hot separator parts!**
  When carrying out maintenance work, there is a danger of injury through hot separator parts (separating temperatures of 70 to 100 °C).

CAUTION: Danger to life and limb through electric current!
There might be residual voltage!

Prior to working on the motor:
- refer to the motor instruction manual
- take adequate preventive measures according to the rules and regulations of the VDE (Verein Deutscher Elektriker / Association of German Electrical Engineers) or EVU (Europäische Vereinigung für Unfallforschung und Unfallanalyse / European Association for Accident Research and Analysis) institutions.
- **Any work on the motor may be carried out by an authorized electrician only.**
- Avoid damage to drive parts when fitting and removing by
  – precise positioning,
  – no diagonal pull!
  – selecting the low lifting speed of the hoist.

- **Use only suitably rated, intact hoists.**

- For special tools, see section *Parts list*.

- For standard tools, see section *4.11*.
- Do not use force when removing or fitting parts.
- Treat all drive parts
  – Treat gently.
  – Always set them down on a rubber mat or a wooden pallet.

- **Before fitting the drive parts**
  – Thoroughly clean and dry the drive chamber.
    Use only a cleaning agent that is approved for the field of application!
  – Check the ball bearings of the spindle and centrifugal clutch.
    Use only the ball bearings specified in the parts list!

To avoid bearing damage,
- **always** operate the separator with installed bowl!

4.6.2 Removing the drive belt and spindle assembly

- **Pay special attention to section** 4.6.1**.**

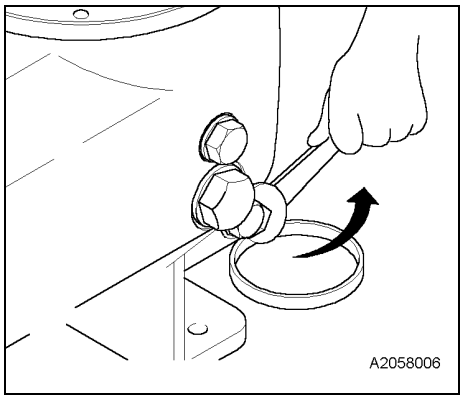


Fig. 195

- Undo the oil drain screw and
- drain the oil into an oil pan (approx. **2.5** l).

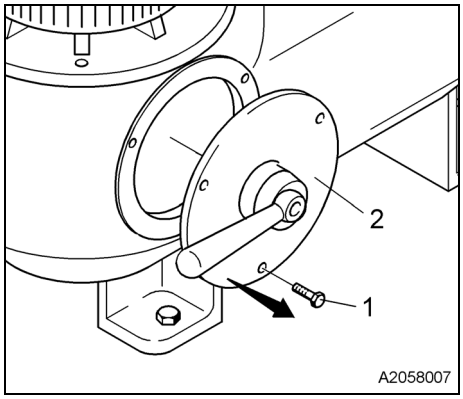


Fig. 196

- Undo three hex head screws 1.
- Remove the brake with brake housing 2.

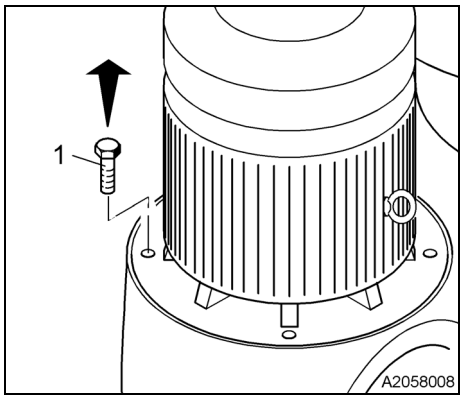


Fig. 197

- Unscrew four hex head screws 1.

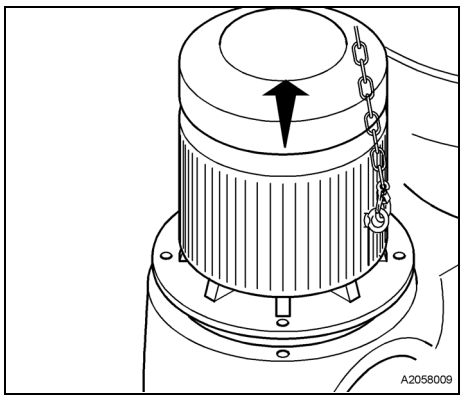


Fig. 198

- Pull the motor out of the flange guide by means of the hoist (approx. 5 mm).
  (Drive belt is slackened!)
- Pull the drive belt off the belt pulley (centrifugal clutch) downwards.

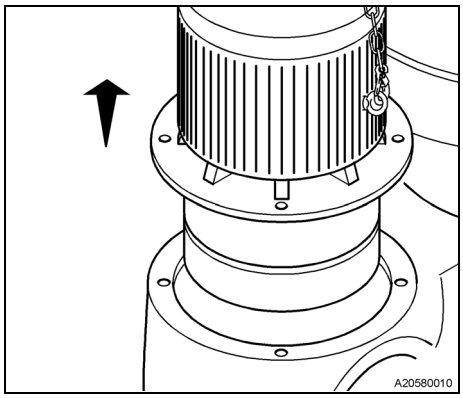


Fig. 199

- Lift the motor with centrifugal clutch out of the lower section of frame.

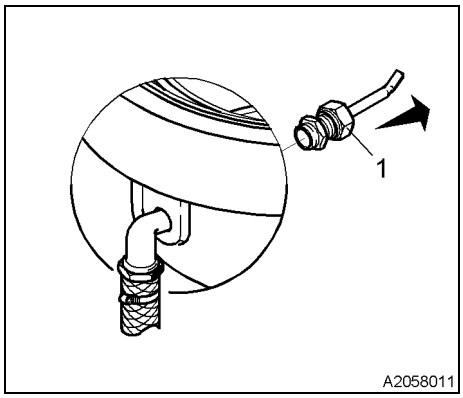


Fig. 200

- Remove the operating water connection in the upper section of frame:
  – Unscrew union 1.

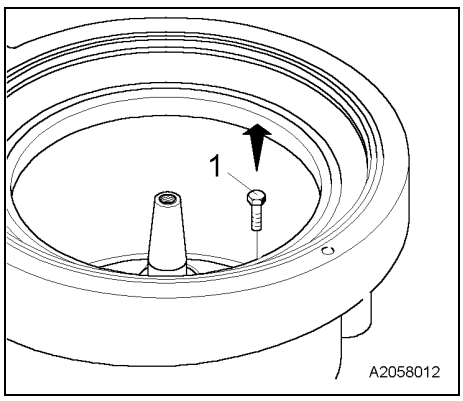


Fig. 201

- Unscrew four hex head screws 1 of the operating water feeding system.

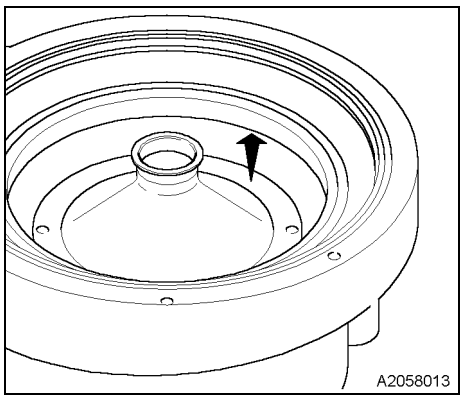


Fig. 202

- Take the operating water feeding system out of the upper section of the frame.

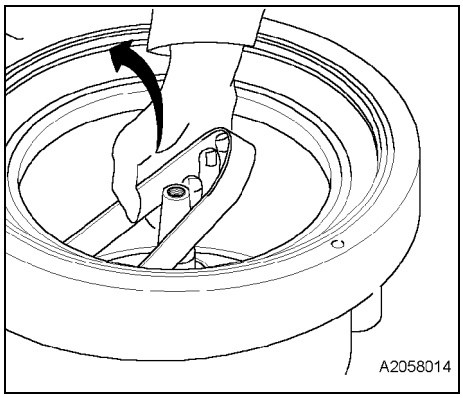


Fig. 203

- Take the drive belt out of the lower section of frame.

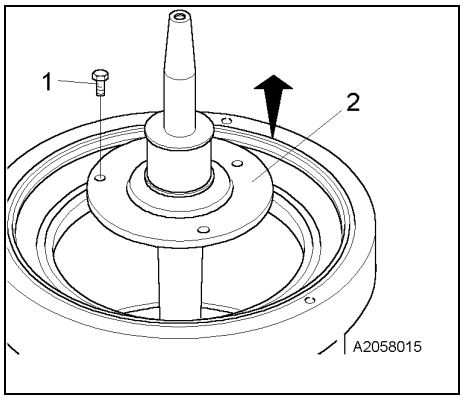


Fig. 204

- Undo three hex head screws 1.
- Unscrew spindle assembly 2 from the lower section of the frame. (For dismantling the spindle assembly, see section **4.6.3**.)

If the vibration absorber is also pulled out of the lower section of the frame:

- Loosen it from the spindle assembly by striking the spindle on a wooden base.

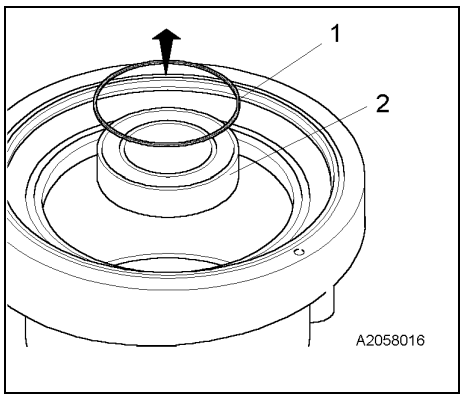


Fig. 205

- Remove from the lower section of frame:
  – Gasket 1
  – Rubber-metal cushion 2

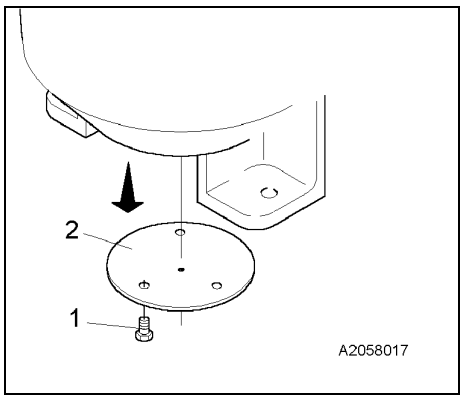


Fig. 206

If necessary:

- Unscrew three hex head screws 1 and
- take the bearing cover 2 (with glued-in hex head screw) out of the lower section of frame.

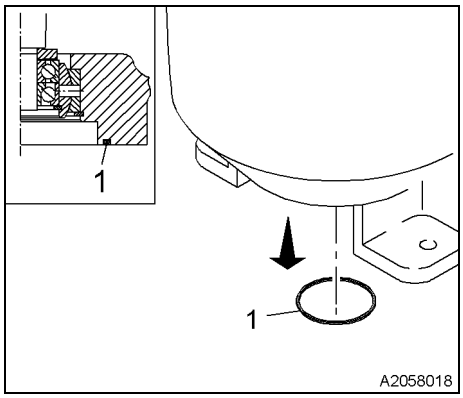


Fig. 207

If necessary:

- Take out gasket 1.

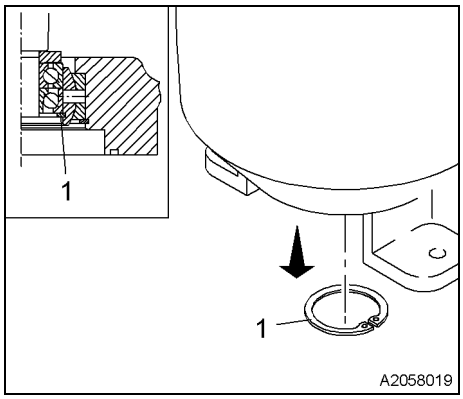


Fig. 208

If necessary:

- Take retaining ring 1 out of the pivoting bearing groove.

Tool:
commercially available inner snap pliers with offset jaws

4.6.3 Dismantling the spindle assembly

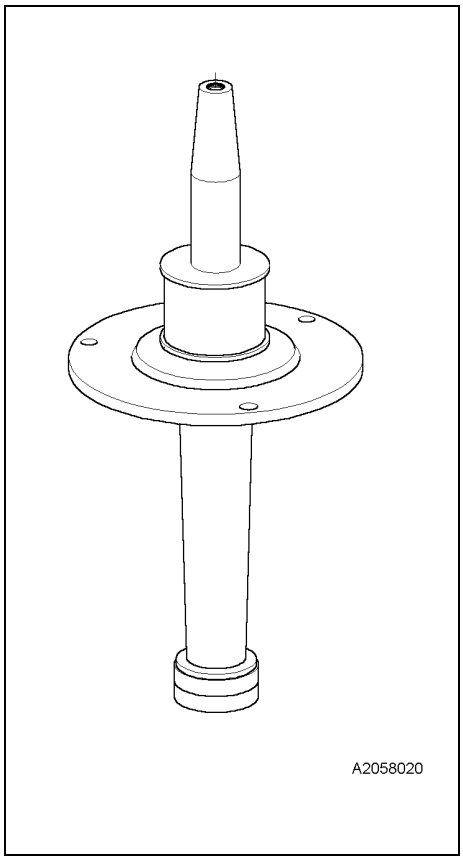


Fig. 209

Spindle assembly

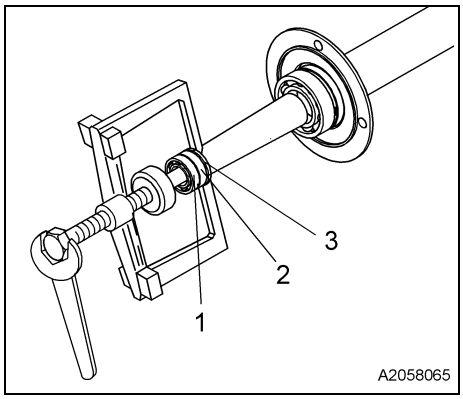


Fig. 210

- Pull off from the spindle:
  - angular contact ball bearing 1,
  - grooved ball bearing 2,
  - ball bearing protection ring 3.

Tool:
commercially available pulling device

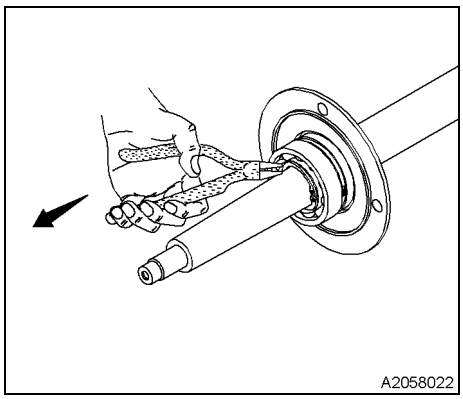


Fig. 211

- Use pliers to remove the retaining ring.

Tool:
commercially available outer snap pliers

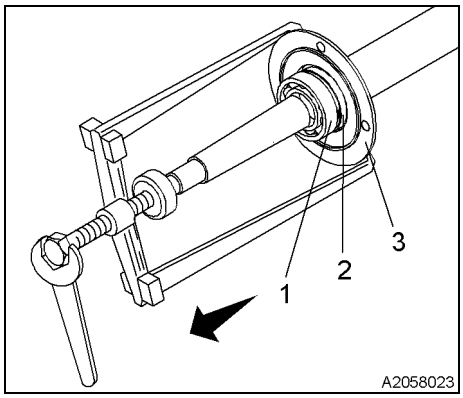


Fig. 212

- Pull off from the spindle:
  - grooved ball bearing 1,
  - Bearing cover 2,
  - bearing cover 3.

Tool:
commercially available pulling device

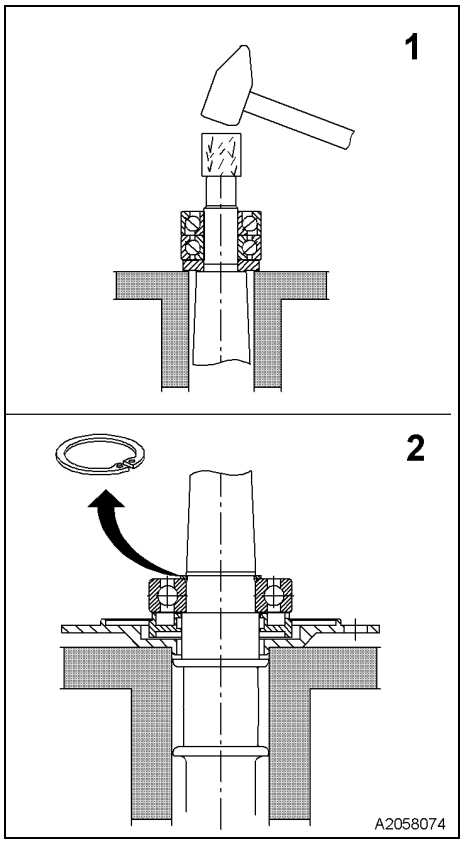


Fig. 213

If no commercial pulling device is available:

- Clamp the spindle assembly between two assembly benches (see sketches 1 and 2).
- Take the retaining ring out of the spindle groove (see sketch 2).
- Place on a block of wood and lightly hammer the spindle out of the seat of the ball bearings.
- Be careful not to damage the spindle.

Tools:
Inner snap pliers
Wooden block
Hammer

4.6.4 Removing the centrifugal clutch

- Pay special attention to section 4.6.1.

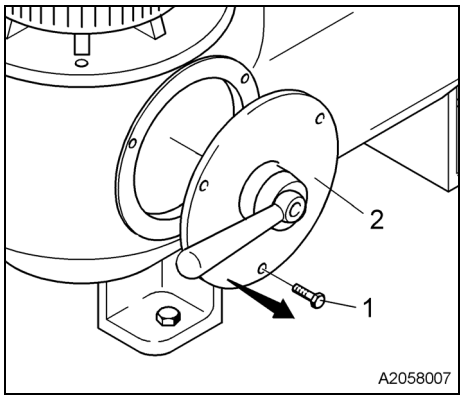


Fig. 214

- Undo hex head screws 1.
- Remove the brake with brake housing 2.

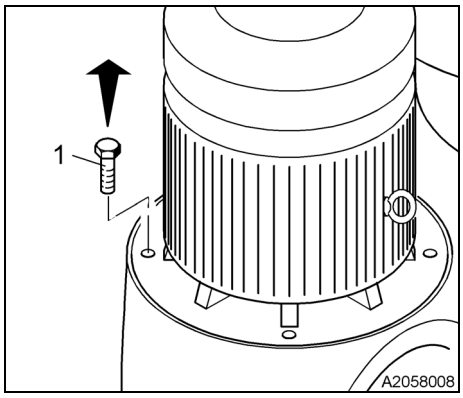


Fig. 215

- Undo hex head screws 1.

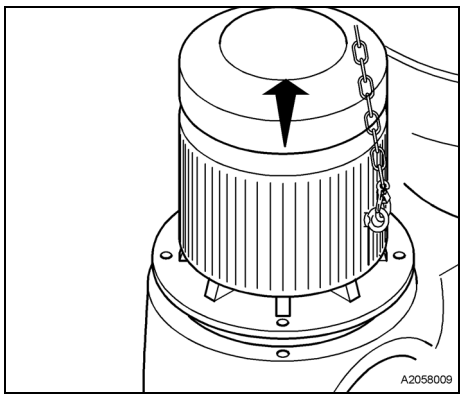


Fig. 216

- Pull the motor out of the flange guide by means of the hoist (approx. 5 mm).
  (Dive belt is slackened!)
- Pull the drive belt off the flat belt pulley (centrifugal clutch) downwards.

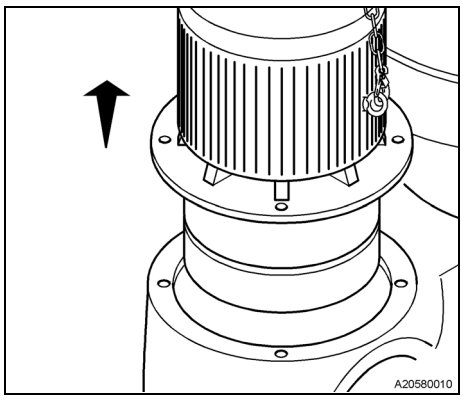


Fig. 217

- Lift the motor with fluid clutch out of the lower section of the frame.

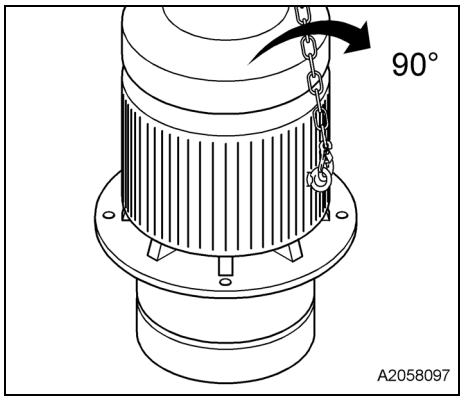


Fig. 218

- Turn the motor together with the centrifugal clutch 90° (upside down) with the aid of the hoist.
- Prevent part from overturning and rolling away.

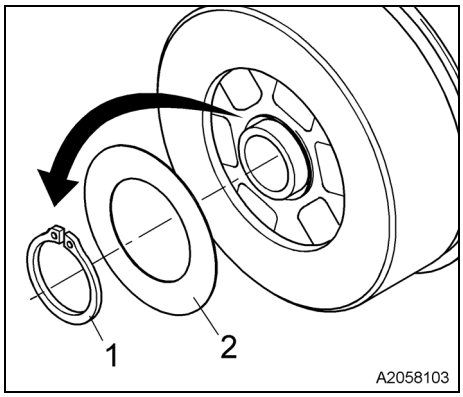


Fig. 219

- Undo retaining ring 1.
- Take off washer 2.

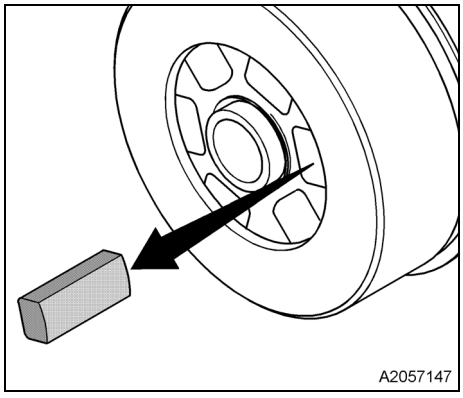


Fig. 220

- Pull the clutch shoes out of the clutch driver.

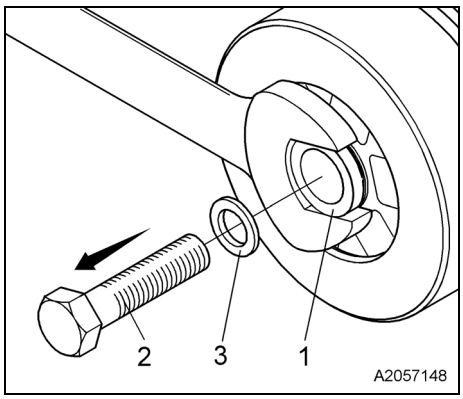


Fig. 221

- Arrest the clutch driver 1 with an open-ended wrench.
- Unscrew hex head screw 2 from the motor shaft end.
- Take off washer 3.

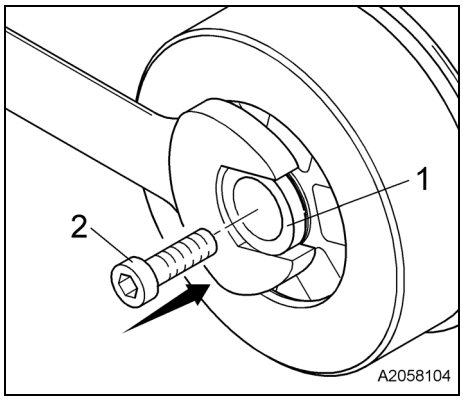


Fig. 222

- Arrest the clutch driver 1 with an open-ended wrench and,

  for protecting the motor shaft end:
- Screw threaded pin 2 (M 10x20) into the threading of the motor shaft end.

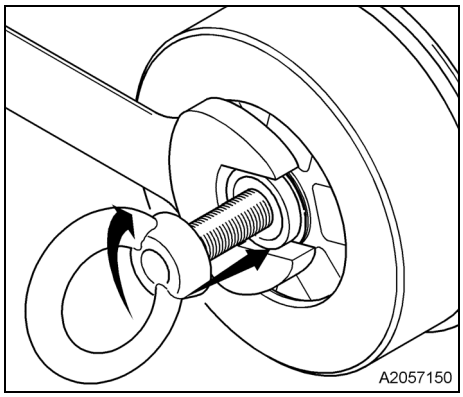


Fig. 223

- Screw the eye bolt into the clutch driver.
- Arrest the clutch driver with an open-ended wrench.
- Force the centrifugal clutch off the motor shaft end by turning the eye bolt **clockwise**.

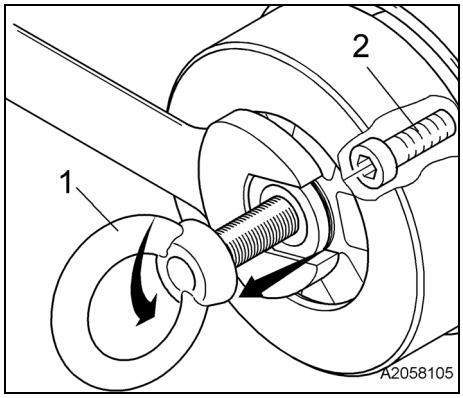


Fig. 224

- Remove eye bolt 1 from the clutch driver and cylindrical screw 2 from the motor shaft end.

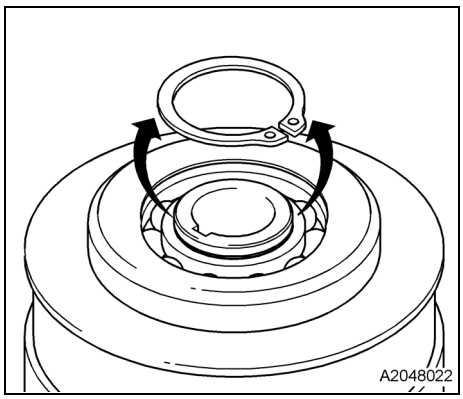


Fig. 225

- Take the retaining ring out of the clutch driver groove.

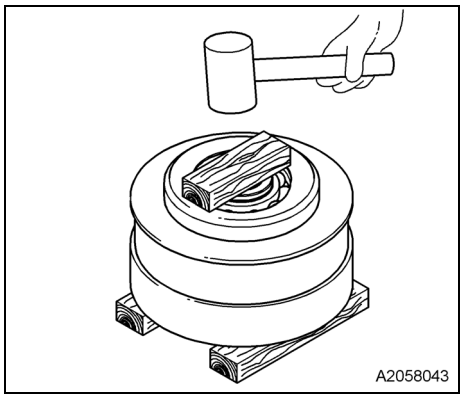


Fig. 226

- Place the clutch drum on a wooden base.
- Position wooden block.
- Drive the clutch driver downwards by means of light hammer blows.
- Loosen the clutch driver from the seat of the two ball bearings.

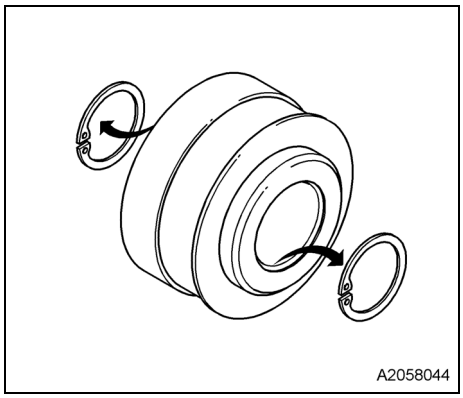


Fig. 227

- Take the retaining rings out of the clutch drum grooves.

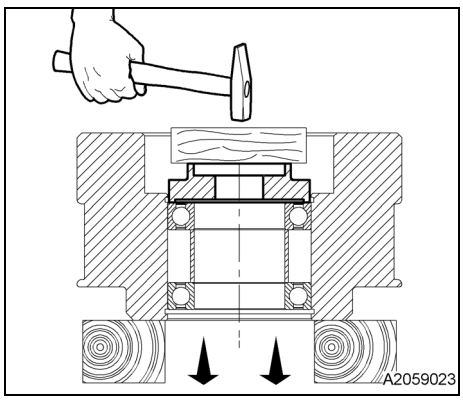


Fig. 228

- Turn the clutch pulley through 180° and
- place it on wooden supports as shown.
- Drive the grooved ball bearing and spacer bush out of the clutch pulley.

Tools:
Disk (Ø 86 – 94 mm)
Wooden block
Hammer

4.6.5 Fitting the spindle assembly

- Pay special attention to section **4.6.1.**
- **For dimensions of the parts see 4.6 - exploded view**.

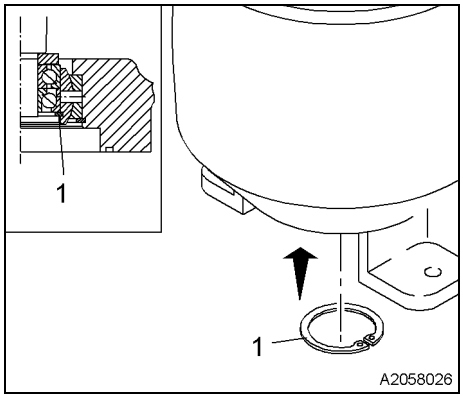


Fig. 229

If necessary:

- Insert retaining ring 1 in the pivoting bearing groove.

Tool:
commercially available inner snap pliers with offset jaws

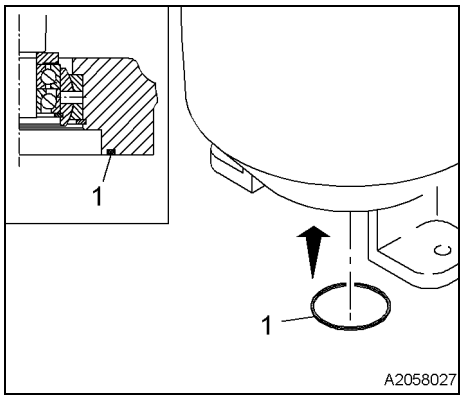


Fig. 230

If necessary:

- Insert gasket 1 in the groove in the lower section of frame.

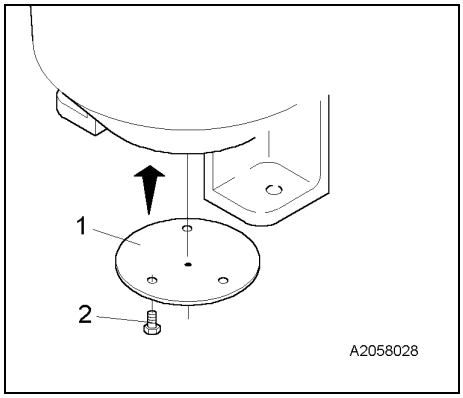


Fig. 231

If necessary:

- Bolt tight bearing cover 1 (with hex head screw glued in with Loctite) with three hex head screws 2.

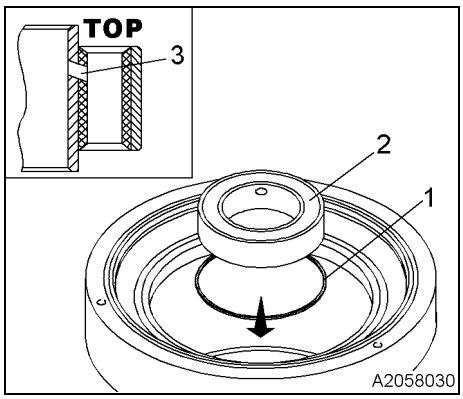


Fig. 232

- Insert gasket 1 in the groove in the lower section of frame.
- Fit rubber-metal cushion 2.

  Pay attention to the correct fitting position of the rubber-metal cushion!
  The two opposite **inner** holes 3 of the rubber-metal cushion **must be directed upwards**.

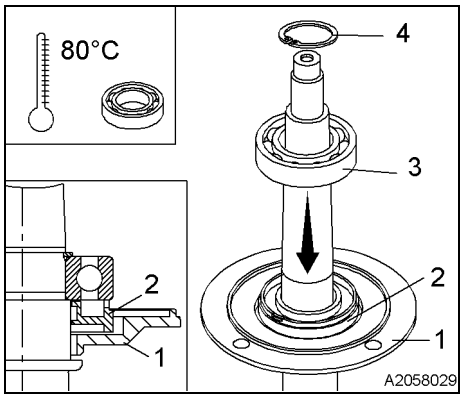


Fig. 233

- Turn spindle through 180° (upside down).
- Mount bearing covers 1 and 2.
  Pay attention to the correct fitting position of the bearing cover!
- Grooved ball bearing 3
  – Heat in oil to 80 °C and
  – slide onto the spindle.
- Insert retaining ring 4 in the spindle groove.

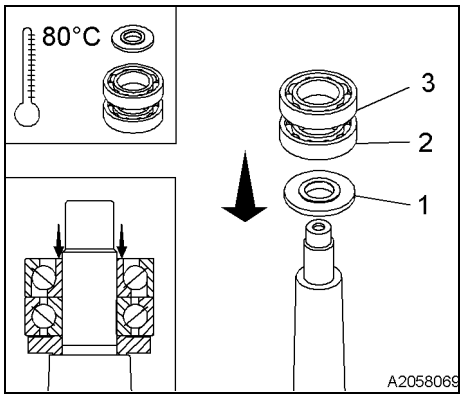


Fig. 234

- Ball bearing protection ring 1 grooved ball bearing 2, and angular contact ball bearing 3 :
  – Heat in oil to 80 °C and
  – slide onto the spindle.

Bearing damage is caused by incorrect fitting!

- When fitting angular contact ball bearing 3 on the spindle, make sure that the **narrow rim** of the ball bearing inner ring faces **upwards** to the spindle end.

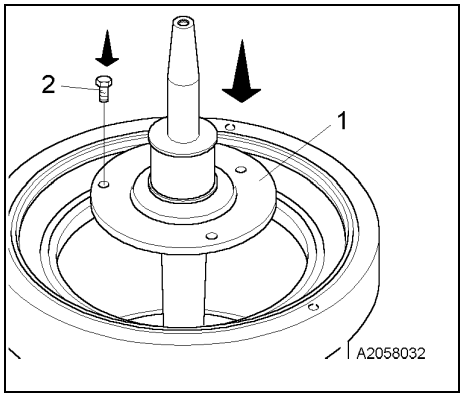


Fig. 235

- Install the assembled spindle assembly 1 in the lower section of frame and
- Bolt tight with the three hex head screws 2.

4.6.6 Fitting the centrifugal clutch

- **Pay special attention to section 4.6.1.**
- **For dimensions of the parts see** 4.6 - **exploded view**.

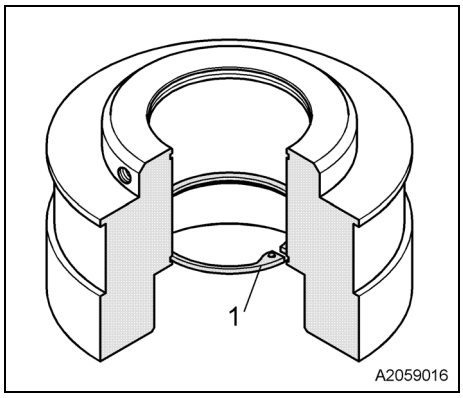


Fig. 236

- Clean the clutch pulley.
- Insert retaining ring in lower groove.
- **Check:**
  – correct fitting of retaining ring 1.

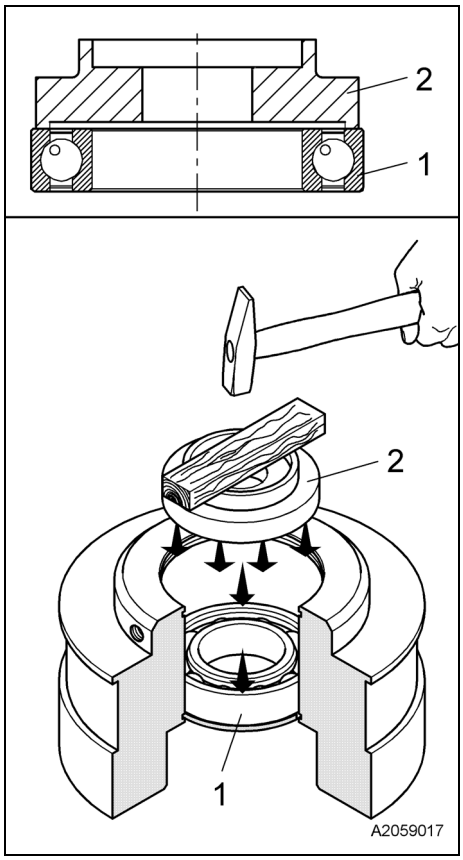


Fig. 237

- **Carefully** drive grooved ball bearing 1 with a disk 2 up to the retaining ring.
  Disk 2 may only contact the outer ring of grooved ball bearing 1.

Tools:
Disk (Ø 86 – 94 mm)
Wooden block
Hammer

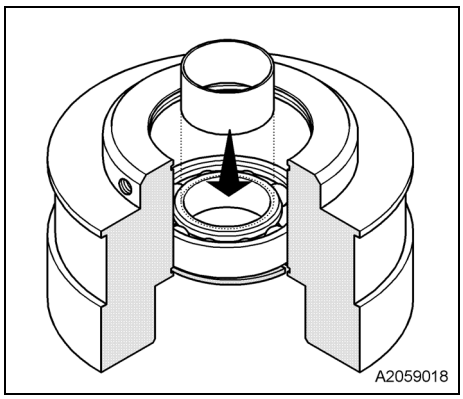


Fig. 238

- Place distance bush on the ball bearing inner ring.

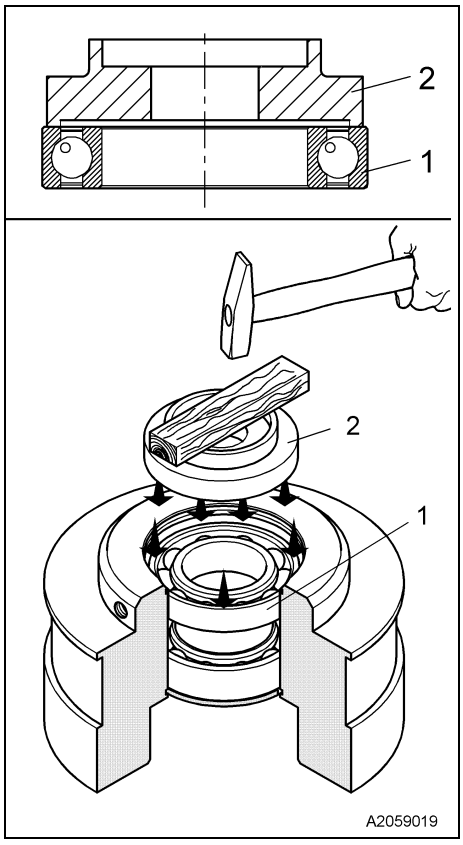


Fig. 239

- **Carefully** drive grooved ball bearing 1 with a suitable disk 2 up to the distance bush.
  Disk 2 may only contact the outer ring of grooved ball bearing 1.

Tools:
Disk (Ø 86 – 94 mm)
Wooden block
Hammer

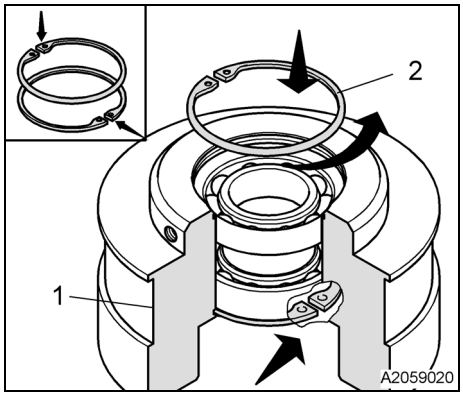


Fig. 240

- Insert retaining ring 2 **180° offset** relative to retaining ring 1 in the upper groove **(danger of imbalance!)**.

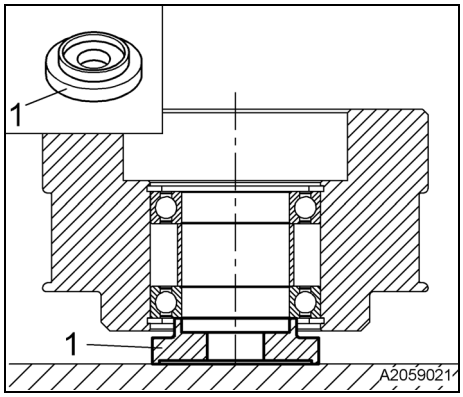


Fig. 241

- Turn clutch pulley with fitted grooved ball bearings through 180°.
- Place the ball bearing **inner ring** on disk 1.

Tool:
Disk (Ø 61 – 69 mm)

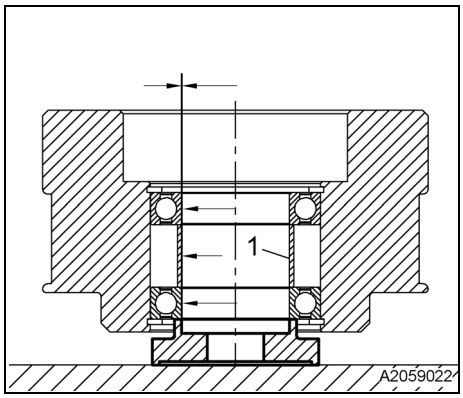


Fig. 242

- Distance bush 1 must be flush with the **inner rings** of the two grooved ball bearings.

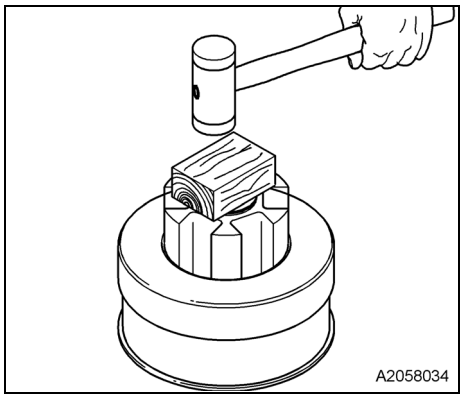


Fig. 243

- **Carefully** hammer the clutch driver into the grooved ball bearing with light blows using a rubber hammer.

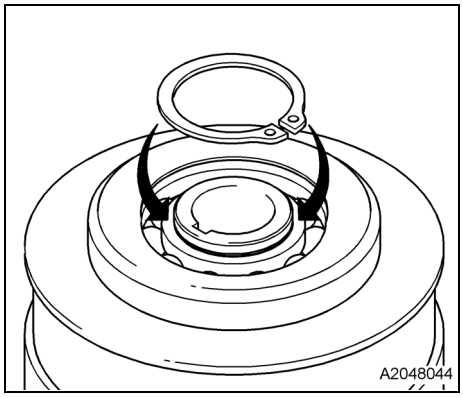


Fig. 244

- Turn the clutch pulley through 180°.
- Fit the retaining ring in the groove of the clutch driver.

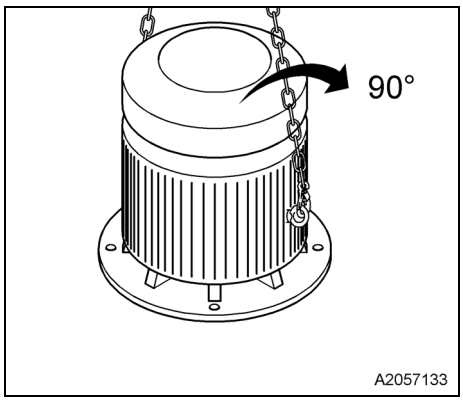


Fig. 245

- Turn the motor through 90° with the aid of the hoist.
- Prevent part from overturning and rolling away.

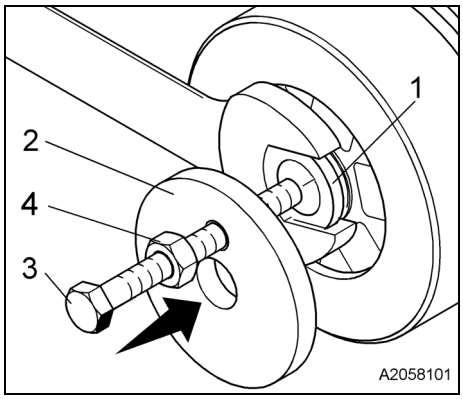


Fig. 246

- Fit the assembled centrifugal clutch on the motor shaft end.
- Pay attention to the feather key groove.
- Arrest the clutch driver 1 with an open-ended wrench.
- Insert plate 2 - as shown - and
- screw hex head screw 3 (M 10x200) together with hexagon nut 4 (M10) into the motor shaft end.

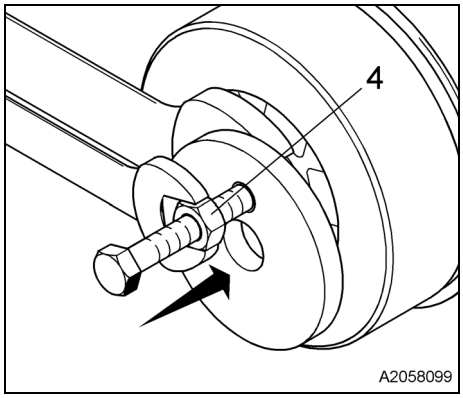


Fig. 247

- Pull the centrifugal clutch onto the motor shaft end as far as it will go, by turning hexagon nut 4 with a second open-ended wrench.

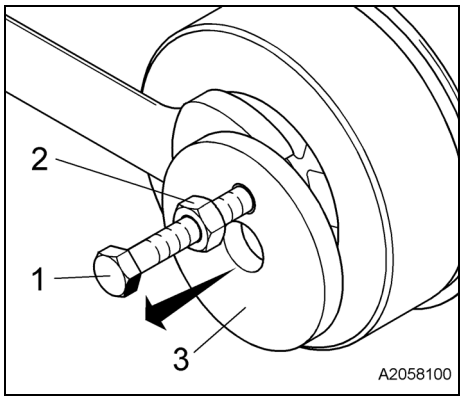


Fig. 248

- Undo hex head screw 1 together with hexagon nut 2 and
- remove plate 3.

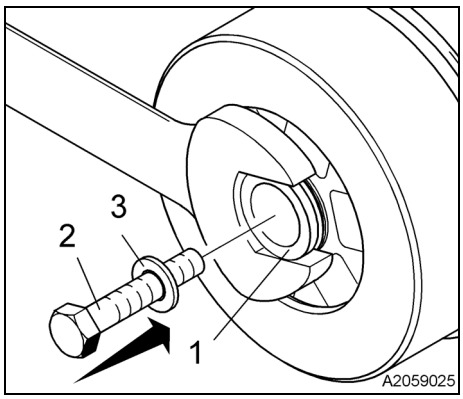


Fig. 249

With driver 1 arrested:

- Provide hex head screw 2 (M 10x65) with washer 3 and thread it into the motor shaft end.

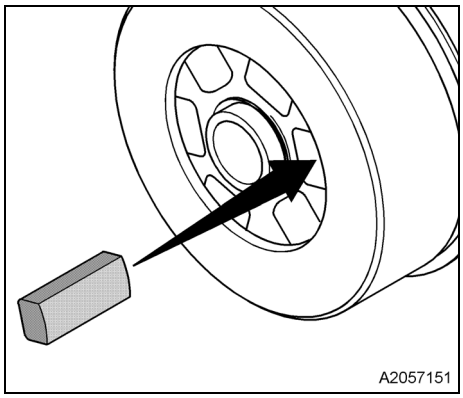


Fig. 250

- Fit clutch shoes.
- Make sure that the clutch shoes are evenly spaced (see sect. **4.5**).

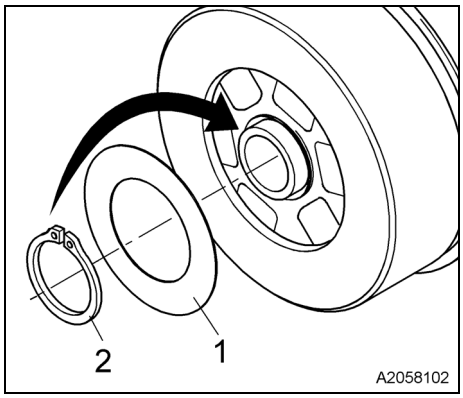


Fig. 251

- Insert washer 1.
- Fit the retaining ring 2 in the groove of the clutch driver.

4.6.7 Fitting the motor

- **Pay special attention to section 4.6.1.**

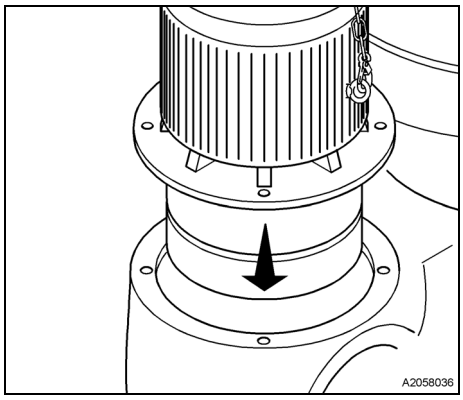


Fig. 252

- **Carefully** place the motor with pre-assembled centrifugal clutch on lower section of frame by means of a hoist.
- Do not yet let the motor flange lock into the frame opening.

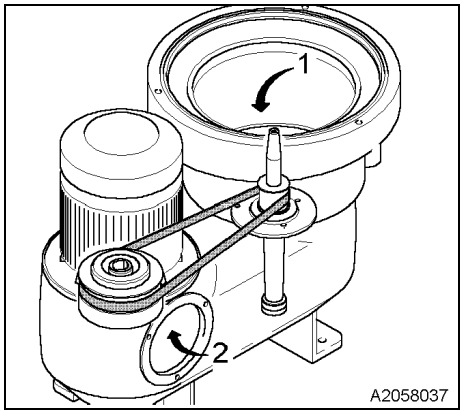


Fig. 253

- Degrease the belt contact surfaces of the spindle and clutch drum.
- Fit the drive belt:
  - through upper section of frame opening 1 and
  - through brake housing opening 2 (centrifugal clutch).

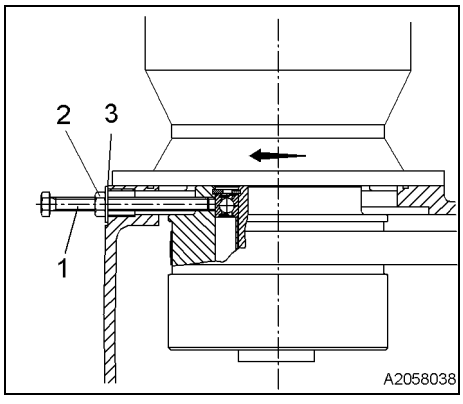


Fig. 254

- Screw hex head screw 1 (M 10 x 120) with hexagon nut 2 and washer 3 through the frame bore into the taphole of the centrifugal clutch.
- **To avoid damage to the grooved ball bearing:**
  - do **not** screw in hex head screw 1 all the way.
- Tension the drive belt by turning hex head nut 2 **clockwise** until the motor flange locks into the frame opening.

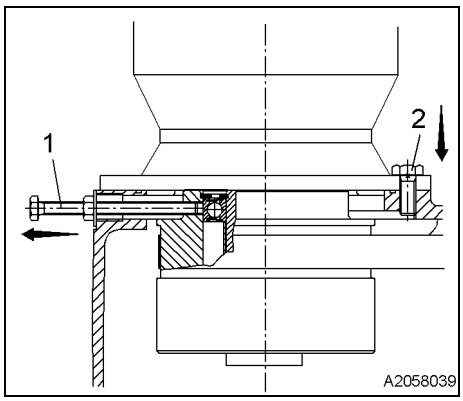


Fig. 255

- Fasten the motor with four hex head screws 2 (M 12 x 30).
- Unscrew hex head screw 1 (with hexagon nut and washer) from the centrifugal clutch.
- Remove the hoist.

Note:

Due to the design concept used, the spindle is at an inclined angle relative to the opposite side of the motor when the drive belt has not been fitted or tensioned (see Fig. 256, pos. 2)

The spindle is pulled into the centric axis when the belt is tensioned (see Fig. 256, pos 1)!

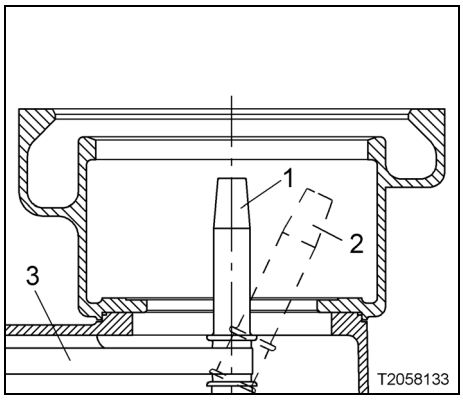


Fig. 256

- Check
  - that the spindle 1 can be turned **easily**.
  - **whether the spindle has been pulled into the centric axis by tensioning the drive belt 3 (see Fig. 162).**

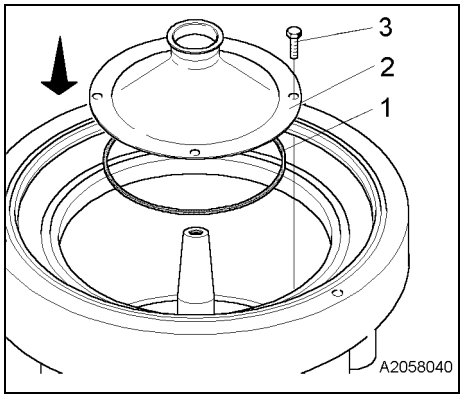


Fig. 257

- Insert gasket 1 in the upper section of frame.
- Fit operating-water feeding system 2 and
- bolt tight with four hex head screws 3 (M 8 x 12).

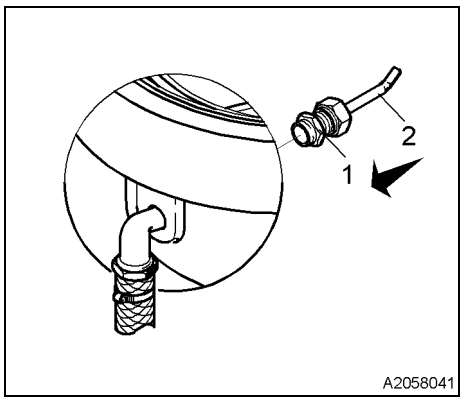


Fig. 258

- Fit the operating water connection in the upper section of frame:
  – Screw in union 1 with pipe 2.

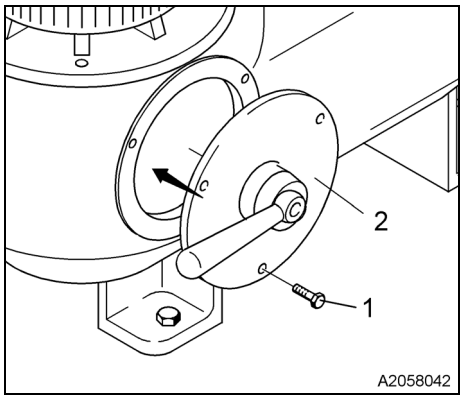


Fig. 259

- Fit brake and brake housing 2 to the lower section of the frame with three hex head screws 1 (M 8 x 20).

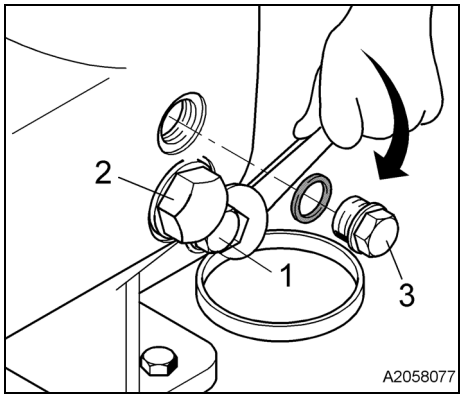


Fig. 260

- Screw in oil drain screw 1 with fitted gasket.
- Screw in the sight glass 2.
- Fill in oil as described in section 4.2.3 and
- screw in sight glass 3 with gasket.

Danger to life and limb through electric current!
- Have the motor connected by an authorized electrician!

4.7 Height adjustment

For reasons of operating reliability, adjustment of
- **bowl height**
- **and centripetal pump play**

must be performed with particular care.

4.7.1 Bowl height

The bowl height
- **must not be adjusted on this separator!**
- **may only be measured with fitted drive belt!**

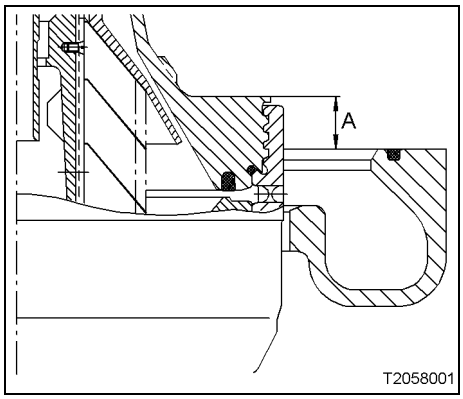


Fig. 261

The control dimension **A**
– is **25.5** ±2 **mm**
– between upper edge of bowl lock ring and upper section of frame.

A bowl height check is necessary, e.g.
- after replacing the drive parts,
- after fitting another bowl,
- after fitting a different centripetal pump,
- as soon as the centripetal pump exhibits grinding marks.

If it does prove necessary to readjust the bowl height, consult the factory.

4.7.2 Centripetal pump clearance

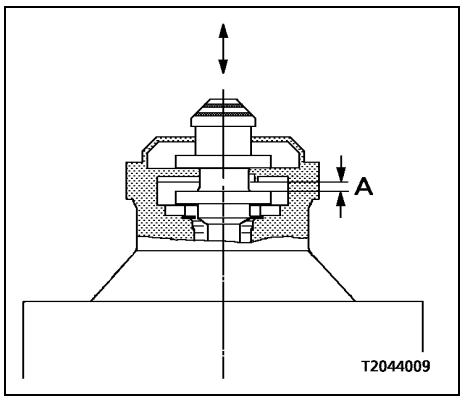


Fig. 262

- Move the centripetal pump axially to and fro in the centripetal pump chamber.
- Measure the total clearance **A** (approx. 8 mm).
- Close the hood.
- **Check:**
  - Is the hood correctly seated on the frame rim?
  - Are the hood screws **tight**?

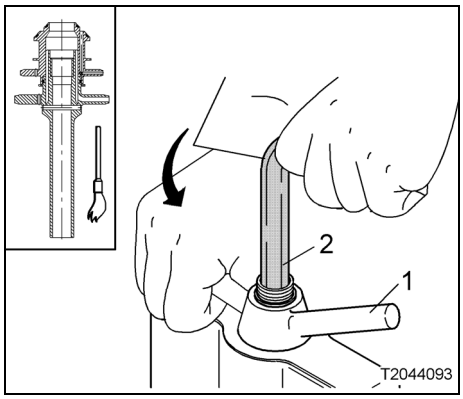


Fig. 263

- Lightly grease the threads of the centripetal pump as specified in the lubrication chart.
- Fit handle connection piece 1 in the centripetal pump.
- Hold the centripetal pump with offset wrench 2.
- Screw the handle connection piece into the centripetal piece as far as it will go **(left-hand thread).**

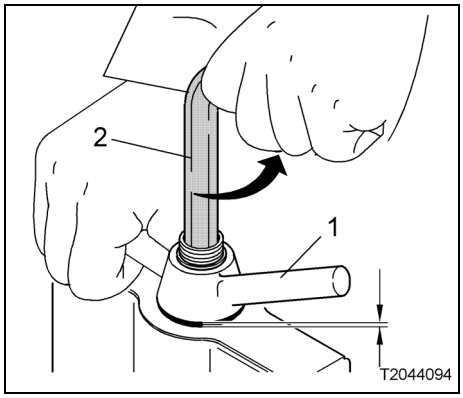


Fig. 264

- Hold the handle connection piece 1,
- Turn the offset wrench 2 until the handle connection piece is slightly raised from the hood (approx. 0.5 mm).

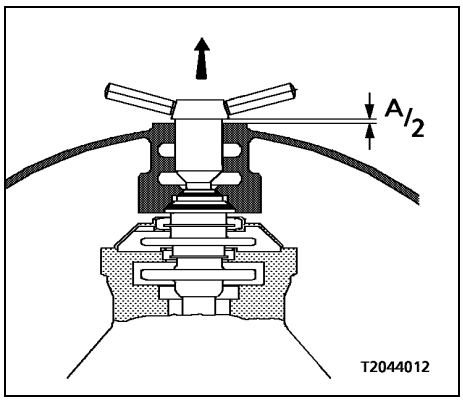


Fig. 265

- Raise the handle connection piece as far as it will go.
- Measure the axial play:
  $A_{/2}$ = 2 - 5 mm

4.8 Final checks after assembling the separator

Before starting the separator

Perform the following checks after assembling and before starting the separator depending on the scope of the repair work:

Checks	Section
1. Bowl height	4.7.1
2. Oil level in drive chamber	4.2.3
3. Direction of rotation of the bowl	4.1.4
4. Bowl speed	4.1.5
5. Starting time of bowl / current consumption	4.1.5
6. Running characteristics of the separator	3.8.1
7. Suction line of the product pump (if installed) for leakage	

When starting the separator

Perform the following checks after carrying out repairs:

Checks	Section
1. Temperature of product	
2. Observe discharges for water, solids and oil to see if the bowl is operating correctly.	3.3

4.9 Before a long-term shut-down of the separator

- Thoroughly clean the separator (see sect. 4.3.2 and 4.3.3).
- Dry and grease the clean bowl parts and all unvarnished machine parts to avoid corrosion damage.
- Store the clean, greased bowl in a dry place until reuse.
- Store the gaskets in a cool, dry, dust-free dark room to prevent them from becoming brittle.
- Take off the drive belt.
- Check if the shut-off valves for water leak.
- If necessary, disconnect the water lines to prevent damage by dripping water.

Preserving the separator:

- Drain the lube oil.
- Fill the drive chamber with a slushing oil, e.g. Shell oil S.7294 (SAE 30/SAE 50), to the middle of the sight glass.
- Let the separator run **without bowl** for approx. 1 minute to make sure that all drive parts are coated with slushing oil.

4.10 Before restarting

- Drain the slushing oil.
  Observe the local regulations on disposal of the slushing oil.

- Check gaskets.
  Replace damaged, very swollen, hardened or brittle gaskets **immediately**.

- Assemble bowl (see section 4.3.6).

- Check the ball bearings of the spindle and centrifugal clutch.
  When damaged, replace the ball bearings **immediately** !

- Fit drive belt (see section 4.6.5 or 4.6.7).
- Fill the drive chamber with the specified lube oil as specified in section 4.2.3.

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4.11 Standard tools

are commercially available tools to be supplied by the customer.

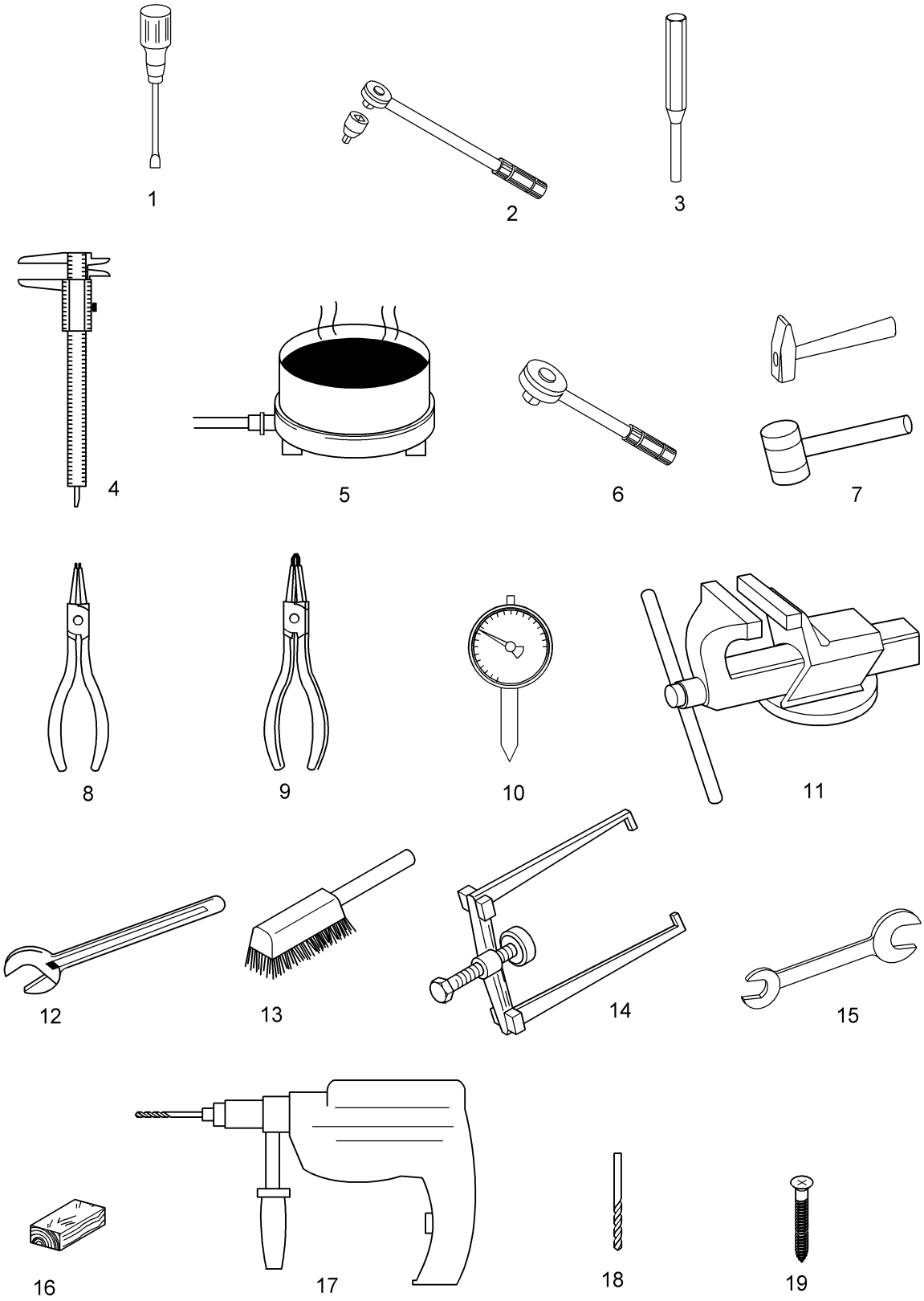

Fig. 266

Pos.	Designation
1	Screwdriver
2	Torque wrench with socket (0 - 200 Nm)
3	Pin punch (Ø 3 mm)
4	Calliper gauge
5	Electric oil heater for ball bearings
6	Ratchet
7	Standard hammer and mallet
8	Inner snap pliers with offset jaws (Ø 40 mm)
9	Outer snap pliers (Ø 35 mm)
10	Hand tachometer
11	Vice
12	Wrench, adjustable
13	Brushes
14	Puller (200 x 200 mm)
15	Open-ended wrench (various sizes)
16	Wooden blocks
17	Drill
18	Drill bit (Ø 2 mm)
19	Wooden screws (max. Ø 4 mm x 50 mm length)

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5 Accessories

5.1 Solenoid valve block

The solenoid valve block consists of two 2/2-way solenoid valves with servo control. They are equipped with a manual override for testing purposes.

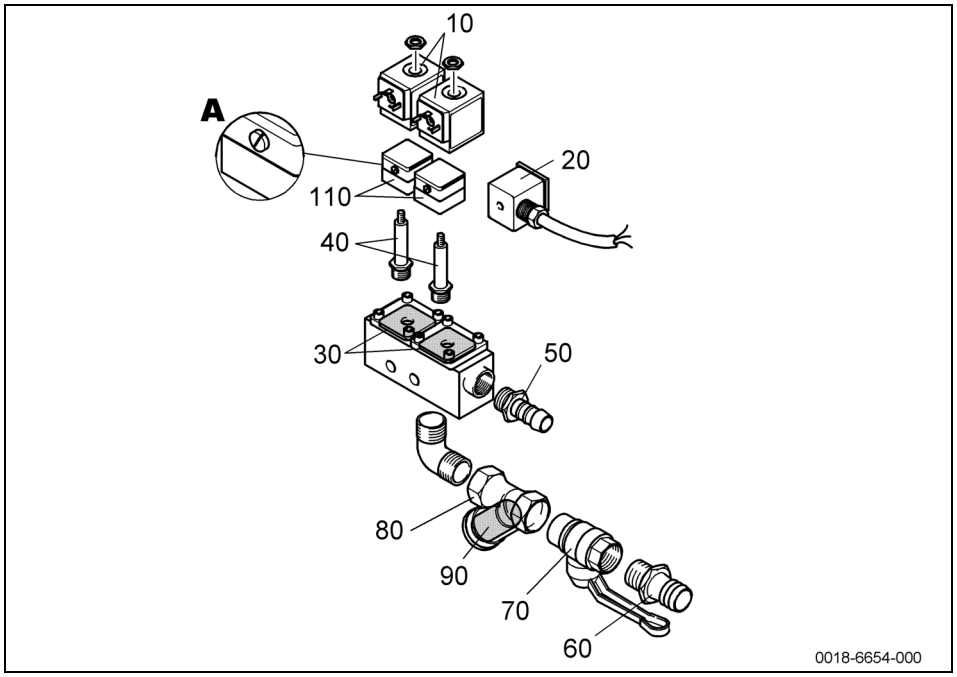

Fig. 267

10 Magnet coil
20 Coupler socket
30 Diaphragm
40 Magnet core
50 Hose outlet
60 Hose outlet
70 Sleeve-type ball valve
80 Strainer, compl.
90 Filter insert
110 Housing with manual override
A Manual override

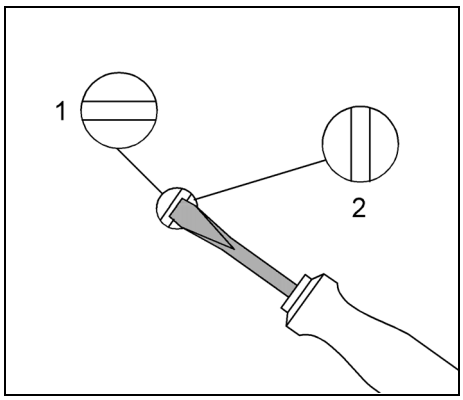

Fig. 268

Manual override A

The manual override can only be actuated with a screwdriver!

1 closed
2 open

Technical data

Part-No.		0018-6654-000
Operating principles		2/2-way valve normally closed
Nominal width		13 mm
Material:	Gasket	EPDM
	Housing	CuZn
Line connection:	Input	G 3/4 in sleeve
	Output	G 1/2 in sleeve
Coil size		32 mm
Voltage		24 V DC
Rating		8 W
Pressure	Medium	0.2 -16 bar
Coupler socket		with built-in electronics, 24 VDC, LED and free-wheeling diode with fitted cable (1.5 m long)
Temperature:	Medium	-10 to +80 °C (14 – 176 °F)
	Ambient	max. +35 °C (95 °F)

In case of electrical faults

- Switch off main switch.
- Shut off main valve for operating water.

Problem	Cause	Action
Valve does not function.	Control unit is defective.	Contact service backup support.
	Wire break in the connecting terminal.	Replace wire.
	Connecting terminal on the connector block is loose.	Tighten the screw of the connecting terminal.
	Bad contact on the connecting terminal.	Clean or replace the contact.
	Coupler socket loose.	Tighten coupler socket.
	Magnet coil defective.	Replace the solenoid head.
	Diaphragm defective.	Replace diaphragm.

5.2 Pressure switch

The pressure switch **PAL** (**P**ressure **A**larm **L**ow)
- is included in the standard equipment,
- is fitted in the product discharge line,
- switches in case of a drop in pressure,
- is maintenance-free.

The pressure switch **PAH** (**P**ressure **A**larm **H**igh)
- is optionally fitted in the product discharge line (not standard supply schedule!),
- is fitted in the water discharge as standard,
- switches in case of an increase in pressure,
- is maintenance-free.

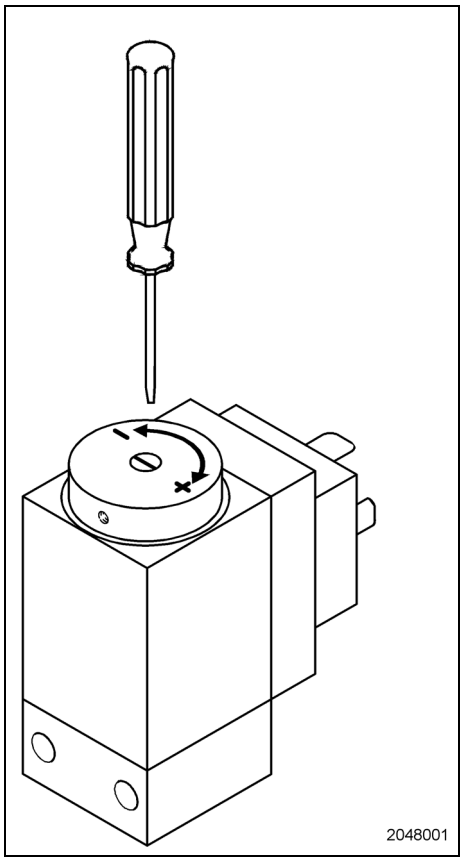

Fig. 269

Setpoint adjustment

Must a setpoint adjustment be made?
If yes:
- Alter the setpoint using a screwdriver.
  Adjustment: 0.5 bar/revolution

Note:
By adapting the status signal “0” or “1” to the control with the indicating pressure on the pressure gauge, the setting on the pressure gauge can be read off. (See control unit instruction manual.)

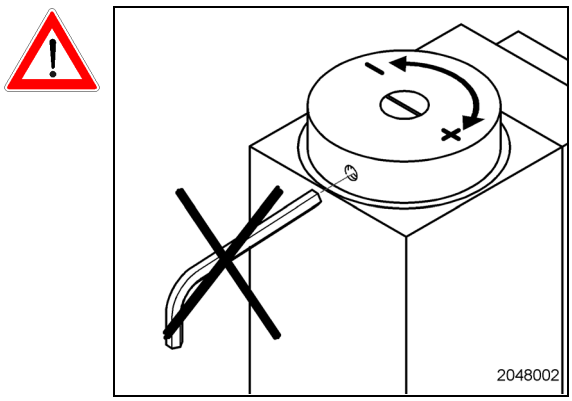

Fig. 270

- **The stud screw at the side must not be loosened!**

Factory setting of the switching points

Product discharge		Water discharge
Pressure switch		Pressure switch
PAL	**PAH** (option)	**PAH**
1.0 bar (1)	3.0 bar (2)	1.0 bar

(1) The product discharge pressure on the pressure gauge (separator) must be **0.5 to 1 bar** above the switching point.
(2) The product discharge pressure on the pressure gauge (separator) must be **0.5 to 1 bar** below the switching point.

See process data sheet for order-specific settings (order documentation).

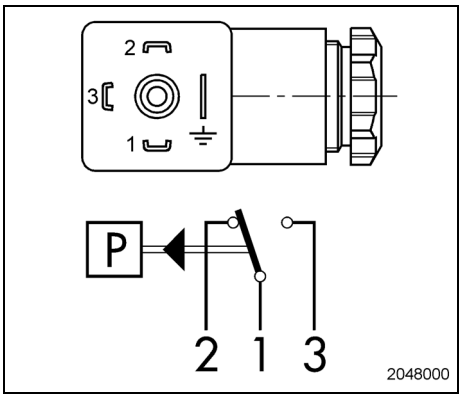

Fig. 271

Function of the switching contact

- P Pressure
- PAL Connect terminal 1 – 3
- PAH Connect terminal 1 – 2

Technical data

Part-No. – pressure switch	0005-4315-000
Working pressure:	0 to 6 bar
Enclosure	IP 65
Standard	DIN 43650-A
Cable	1.5 m marine cable type MGG-J, 3 x 1.5 mm²
Medium temperature	–25 to +120 °C (–13 to +248 °F)

6 Parts list

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Guide to ordering spare parts

A rapid and correct supply of spare parts can only be guaranteed if your order includes the following details:

- Separator model — see nameplate
  e.g. OSD 6-91-067
- Serial-No. — see nameplate
  e.g. 9000-223
- Designation — see parts list
  e.g. frame
- Part-No. — see parts list
  e.g. 2050-1100-020
  The part number is also marked on almost all the individual parts.

Only when ordering spare parts for bowls:

- Bowl S/N — see bowl lock ring, bowl bottom or bowl shell
  if different from the machine serial number.

Only required when ordering pare parts for pump and pump connection parts:

- Model and number of pump — see pump nameplate

The details **must** be complete when the part number ends with a letter (e.g. 2050-6600-L), since this indicates that the parts are available in different designs.

Fig. 272

- **Use only genuine spare parts from Westfalia Separator.**
  The use of non-genuine parts leads to:
  – safety risks,
  – less durability and availability,
  – increased service requirement.
  If a safety risk occurs, this may have legal consequences for the responsible persons. In such cases, Westfalia Separator accepts no liability or warranty claims.

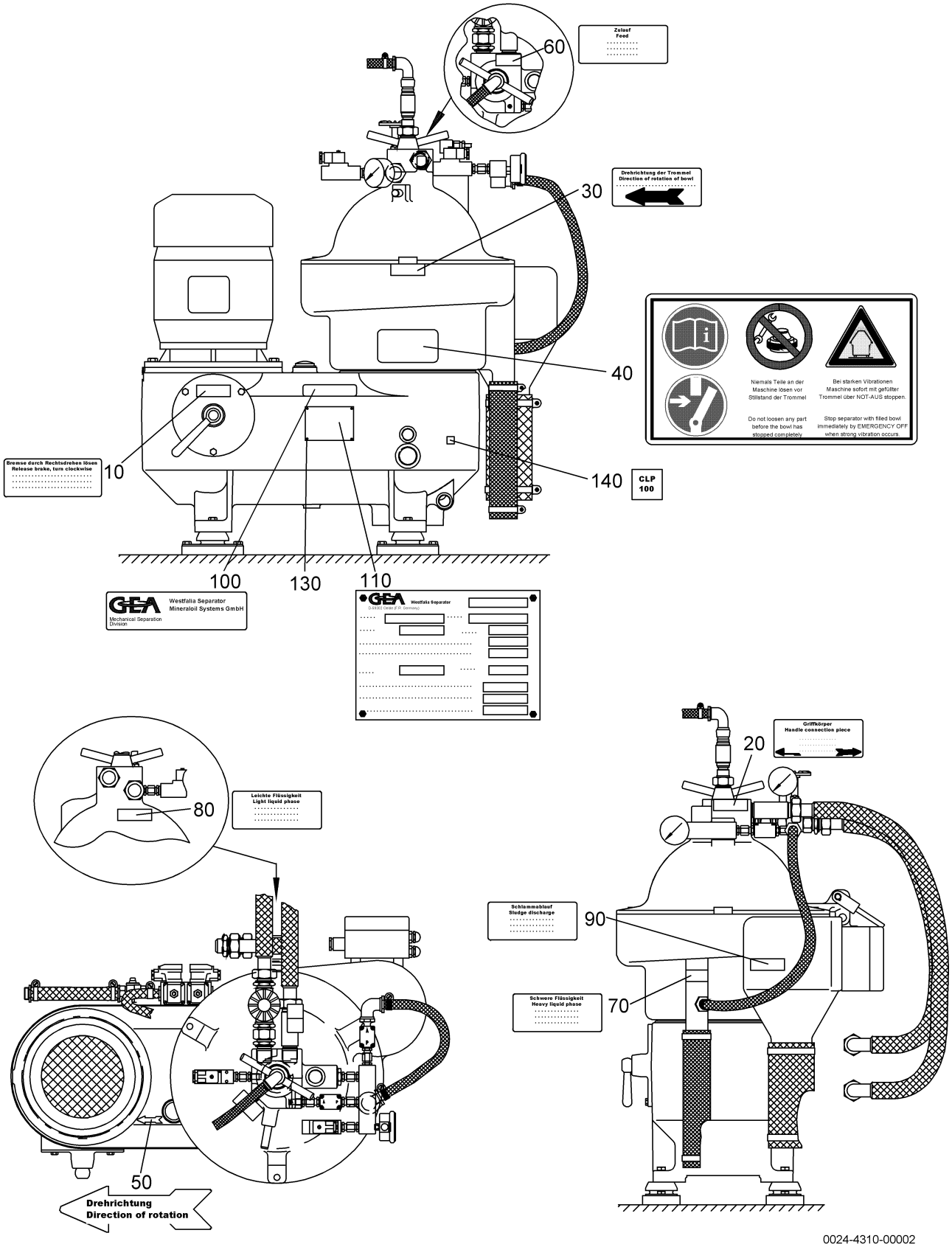
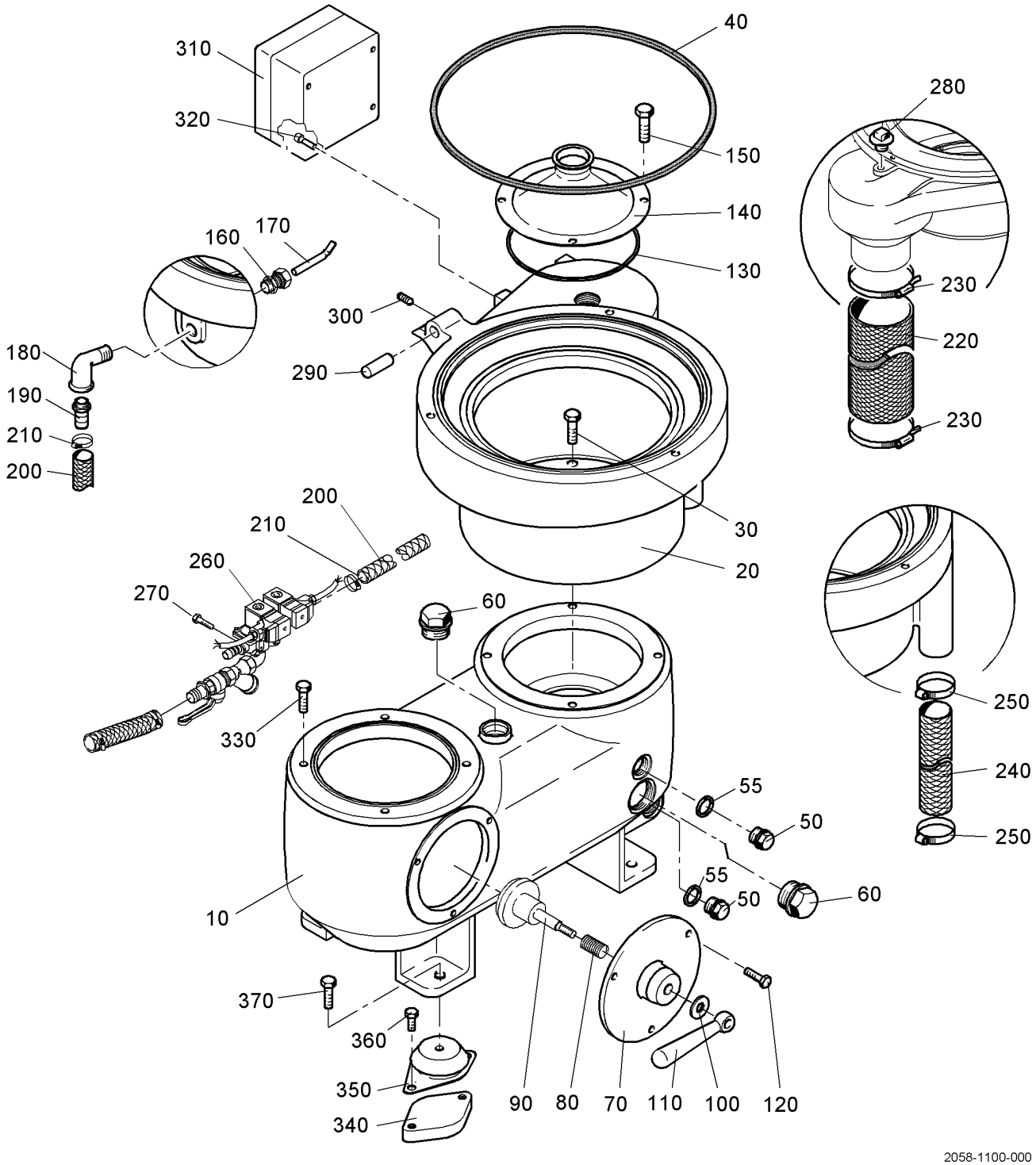

60
Zulauf
Feed
30
Drehrichtung der Trommel
Direction of rotation of bowl
40
Niemals Teile an der Maschine lösen vor Stillstand der Trommel
Do not loosen any part before the bowl has stopped completely
Bei starken Vibrationen Maschine sofort mit gefüllter Trommel über NOT-AUS stoppen.
Stop separator with filled bowl immediately by EMERGENCY OFF when strong vibration occurs.
Bremse durch Rechtsdrehen lösen
Release brake, turn clockwise
10
140
CLP
100
100
130
110
Westfalia Separator
Mineraloil Systems GmbH
Mechanical Separation
Division
Westfalia Separator
80
Leichte Flüssigkeit
Light liquid phase
20
Griffkörper
Handle connection piece
Schlammablauf
Sludge discharge
90
Schwere Flüssigkeit
Heavy liquid phase
70
50
Drehrichtung
Direction of rotation
0024-4310-00002

Fig. 273

Pos.	Part Number	Qty.		Designation
-	**0024-4310-010**	**1**		**Set of plates**
10	0024-6324-000	1		Adhesive plate
20	0024-6327-000	1		Adhesive plate
30	0024-6326-000	1		Adhesive plate
40	0024-6426-000	1		Plate
50	0024-6071-000	1		Decal "arrow"
60	0024-6330-000	1		Adhesive plate
70	0024-6329-000	1		Adhesive plate
80	0024-6328-000	1		Adhesive plate
90	0024-6325-000	1		Adhesive plate
100	0024-6334-000	1		Maker's nameplate
110	0024-3413-010	1		Nameplate
130	0026-1571-300	4		Grooved drive stud
140	0024-5049-000	1		Adhesive plate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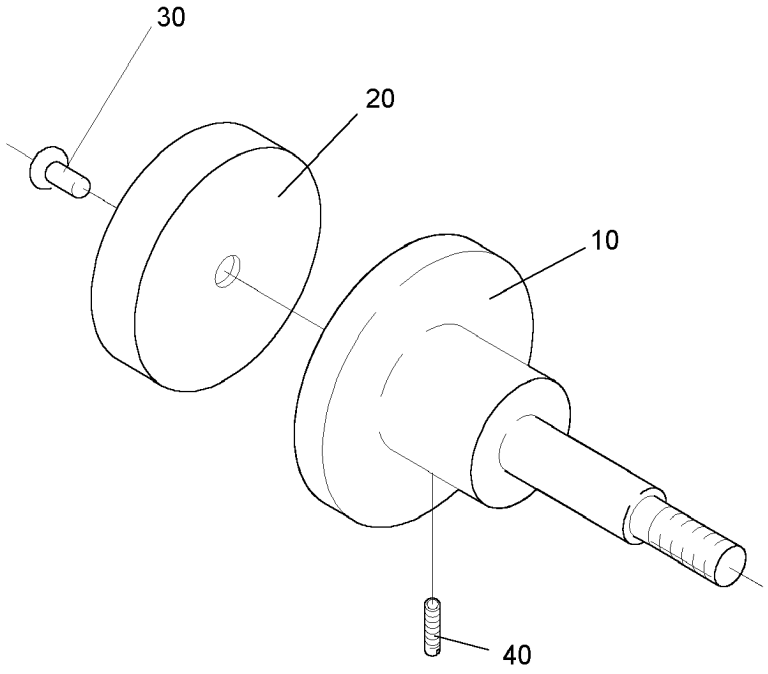
2058-1100-000

Fig. 274

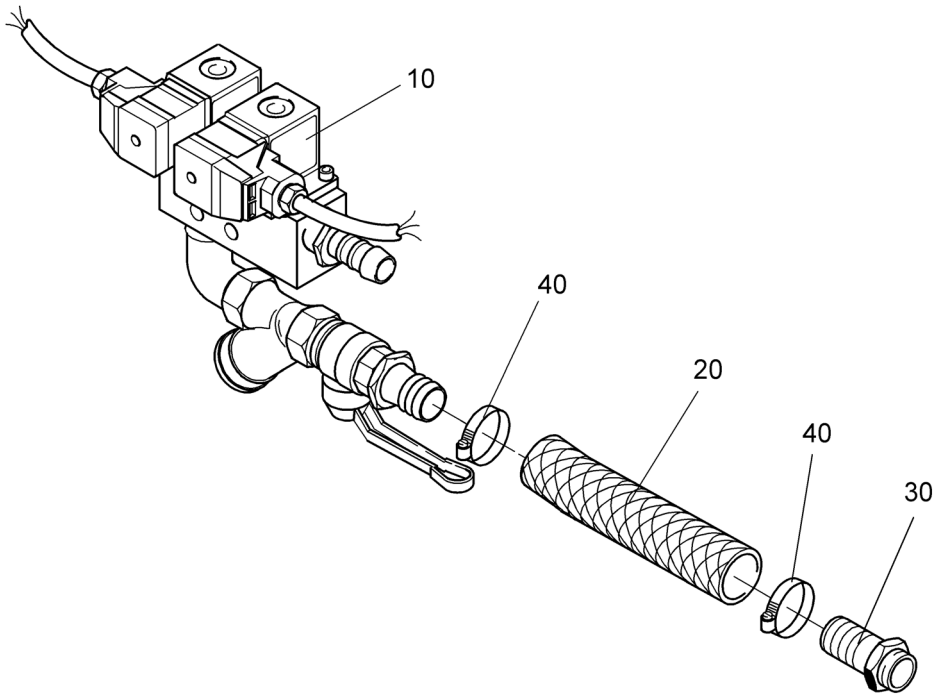
Pos.	Part-No.	Qty.		Designation
-	**2058-1100-000**	**1**		**Frame, compl.**
10	2058-1001-000	1		Lower section of frame
20	2058-1002-000	1		Upper section of frame
30	0019-6970-400	4		Hex head screw
40	0007-3378-750	1		Gasket
50	0019-8910-030	2		Screw plug
55	0007-1796-550	2		Gasket
60	0001-1457-800	2		Sight glass
70	2058-1038-000	1		Brake housing
80	0006-4193-300	1		Cylindrical pressure spring
90	see page 174	1		Brake bolt, complete
100	0026-2407-300	1		Disk
110	0021-3525-000	1		Tapered handle
120	0019-6903-150	3		Hex head screw
130	0007-2825-750	1		Gasket
140	2058-1219-000	1		Operating water feeding system
150	0019-6900-300	4		Hex head screw
160	0018-2477-030	1		Screw coupling
170	2058-1464-000	1		Pipe
180	0018-0021-260	1		Angle
190	0018-1796-600	1		Hose outlet
200	0018-2786-758	0.500 m		Hose
210	0018-3816-300	2		Hose clip
220	0018-6744-710	1		Hose
230	0018-3804-300	2		Hose clip
240	0018-6479-710	1		Hose
250	0018-3817-300	2		Hose clip
260	see page 175	1		Solenoid valve block
270	0019-6498-300	2		Hex head screw
280	0018-0992-260	1		Plug
290	0026-0994-400	1		Cylindrical pin
300	0019-9046-400	1		Threaded pin
310	0005-1538-280	1		Terminal box
320	0019-6110-300	4		Allen screw
330	0019-6970-400	4		Hex head screw
340	2058-1467-000	4		Plate
350	0021-3308-750	4		Machine foot
360	0019-6933-300	8		Hex head screw
370	0019-6972-300	4		Hex head screw



2058-1031-000

Fig. 275

Pos.	Part-No.	Qty.		Designation
-	**2058-1031-000**	**1**		**Brake bolt, complete**
10	2058-1039-000	1		Brake bolt
20	0021-3301-980	1		Brake lining
30	0019-2111-400	1		Countersunk screw
40	0019-6310-300	1		Threaded pin



2048-8105-000

Fig. 276

Pos.	Part-No.	Qty.		Designation
-	**2048-8105-020**	**1**		**Solenoid valve block, complete**
10	see page 176	1		Solenoid valve block
20	0018-2793-758	0.190 m		Hose
30	0018-1797-600	1		Hose outlet
40	0018-3814-310	2		Hose clip

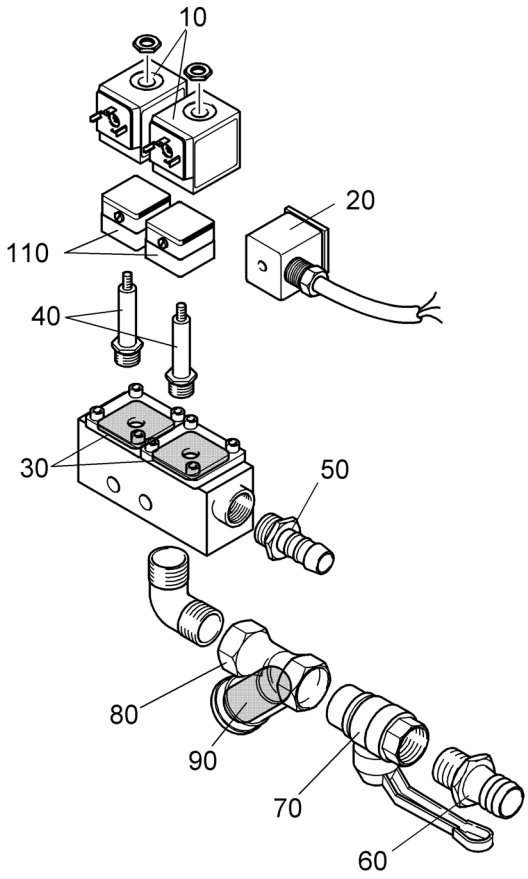


Fig. 277

Pos.	Part Number	Qty.		Designation
-	**0018-6654-000**	**1**		**Solenoid valve block, compl.**
10	0018-6654-010	2		Magnet coil
20	0018-5118-040	2		Coupler socket
30	0018-5947-820	2		Diaphragm
40	0018-3695-000	2		Magnet core
50	0018-1796-600	2		Hose outlet
60	0018-1797-600	1		Hose outlet
70	0018-1763-630	1		Sleeve-type ball valve
80	0018-2523-600	1		Strainer, compl.
90	0018-2523-300	1		Filter insert
100	0018-6654-030	1	**(1)**	Set of gaskets
110	0018-6654-040	2		Housing with manual override

(1) This position is not illustrated.

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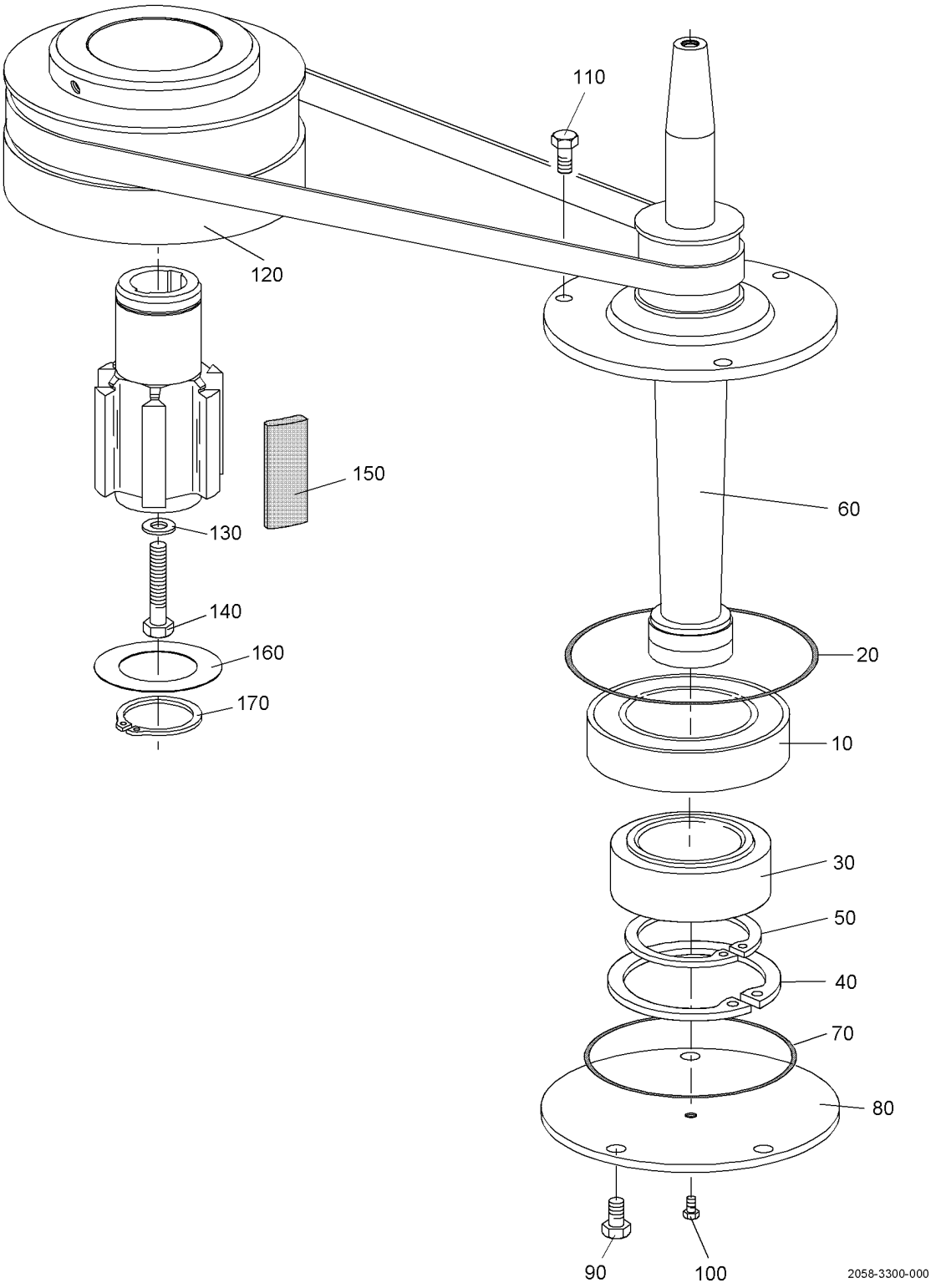
110
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2058-3300-000

Fig. 278

Pos.	Part Number	Qty.		Designation
-	**2058-3300-000**	**1**		**Drive, complete**
10	0008-3533-000	1		Rubber-metal cushion
20	0007-2581-750	1		Gasket
30	0011-8040-010	1		Pivoting bearing, complete
40	0026-5849-170	1		Retaining ring
50	0026-5834-170	1		Retaining ring
60	see page 180			Set of drive parts
70	0007-2608-750	1		Gasket
80	2050-3375-010	1		Bearing cover
90	0019-6933-300	3		Hex head screw
100	0019-6839-300	1		Hex head screw
110	0019-6933-300	3		Hex head screw
120	see page 185	1		Centrifugal clutch, compl.
130	0026-2418-400	1		Washer
140	0019-6517-300	1		Hex head screw
150	see page 179		(1)	Clutch shoe, compl.
160	2057-3367-000	1		Washer
170	0026-6011-170	1		Retaining ring

(1) The number of clutch shoes depends on the driving force necessary for the centrifuge and on the motor speed. See sect. 145H4.5.

Clutch shoes

Hz	Clutch shoe	Qty.
50	0021-3293-870	3
60	0021-3293-870	2

IMPORTANT:
The number of clutch shoes depends on the driving power and speed of the motor. See section 4.5.

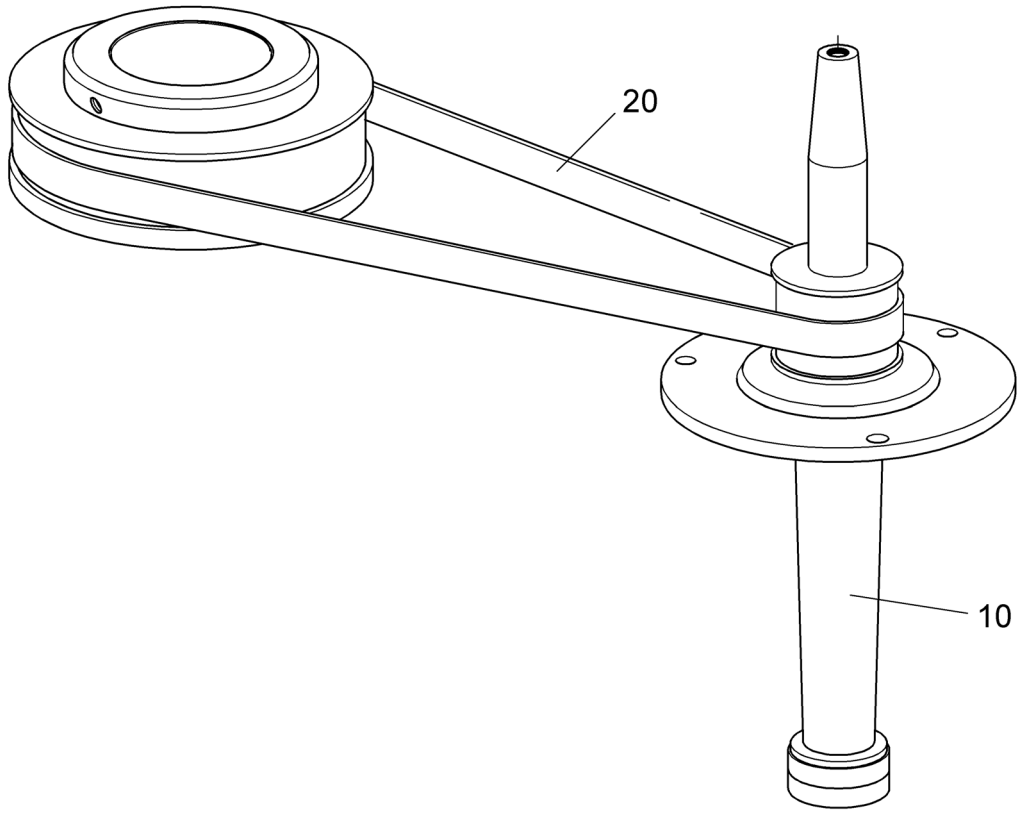

Fig. 279

Pos.	Part Number	Qty.		Designation
-	**2058-3050-000**	**1**		**Set of drive parts – 50 Hz**
10	See page 183	1		Spindle assembly
20	0021-3345-900	1		Drive belt

Pos.	Part Number	Qty.		Designation
-	**2058-3060-000**	**1**		**Set of drive parts – 60 Hz**
10	See page 183	1		Spindle assembly
20	0021-3344-900	1		Drive belt

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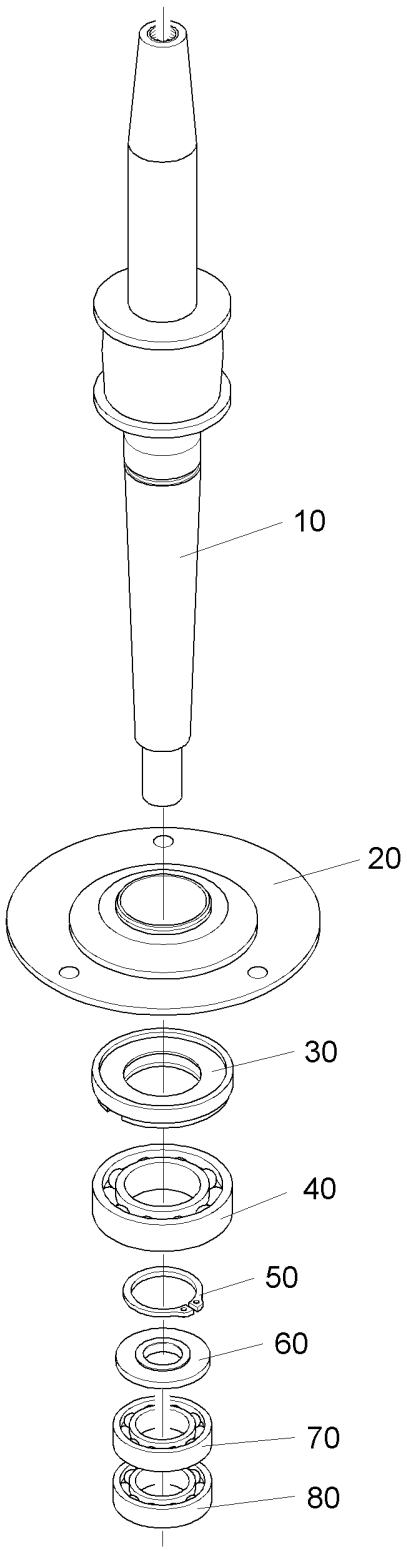


Fig. 280

Pos.	Part Number	Qty.		Designation
-	**2058-3429-040**	**1**		**Spindle, complete - 50 Hz**
10	2058-3410-000	1		Spindle
20	2058-3375-000	1		Bearing cover
30	2058-3375-010	1		Bearing cover
40	0011-6207-000	1		Grooved ball bearing
50	0026-5866-170	1		Retaining ring
60	0008-1708-010	1		Ball bearing protection ring
70	0011-6203-000	1		Grooved ball bearing
80	0011-7203-250	1		Angular contact ball bearing

Pos.	Part Number	Qty.		Designation
-	**2058-3429-050**	**1**		**Spindle, complete - 60 Hz**
10	2058-3410-010	1		Spindle
20	2058-3375-000	1		Bearing cover
30	2058-3375-010	1		Bearing cover
40	0011-6207-000	1		Grooved ball bearing
50	0026-5866-170	1		Retaining ring
60	0008-1708-010	1		Ball bearing protection ring
70	0011-6203-000	1		Grooved ball bearing
80	0011-7203-250	1		Angular contact ball bearing

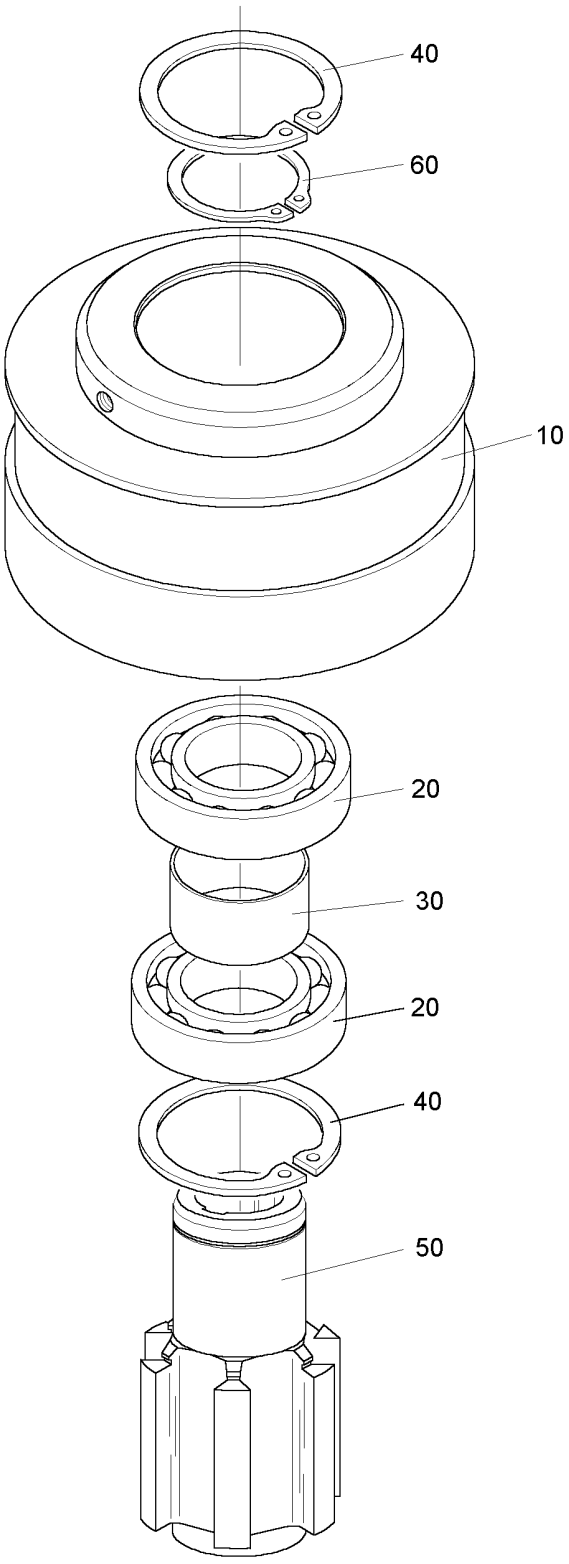
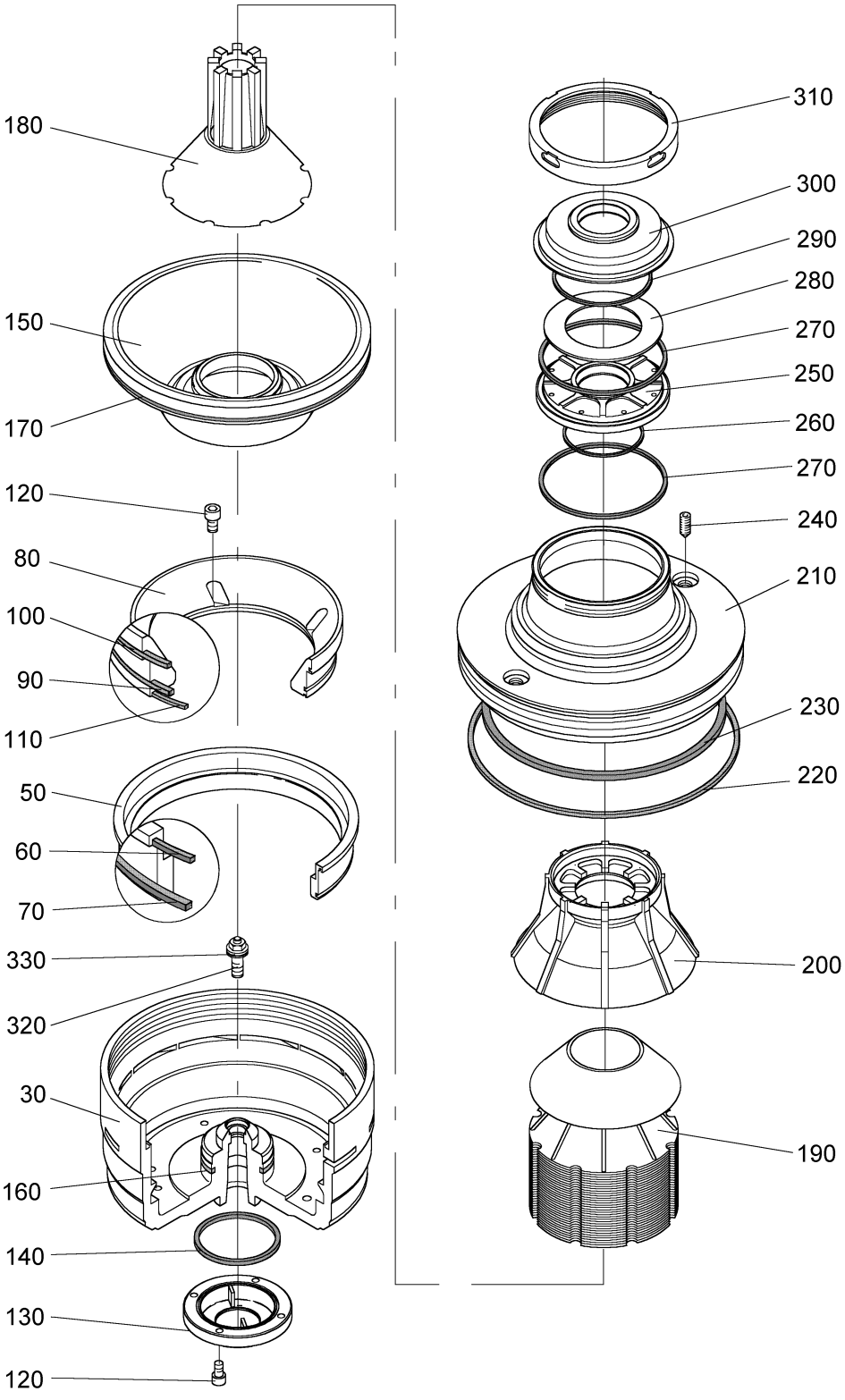


Fig. 281

Pos.	Part-No.	Qty.		Designation
-	**2058-3385-000**	**1**		**Centrifugal clutch, complete**
10	2058-3365-000	1		Clutch drum
20	0011-6012-680	2		Grooved ball bearing
30	0026-2501-400	1		Distance bush
40	0026-0851-170	2		Retaining ring
50	as per order	1	(1)	Clutch driver
60	0026-6011-170	1		Retaining ring

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


180
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260
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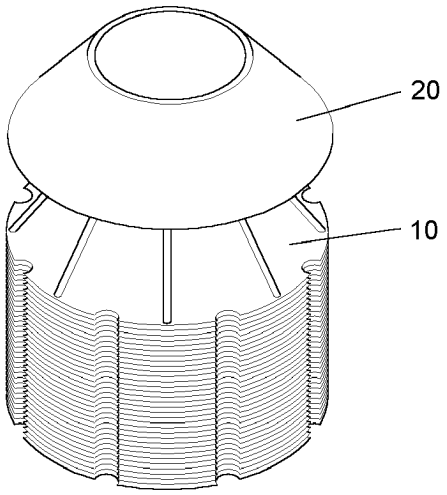
240
210
230
220
200
190
2058-6600-020

Fig. 282

Pos.	Part Number	Qty.		Designation
-	**2058-6600-510**	**1**		**Bowl, complete**
30	2058-6604-000	1	(1)	Bowl bottom, compl.
50	2058-6503-000	1		Annular piston
60	0007-3543-840	1		Gasket
70	0007-3541-750	1		Gasket
80	2058-6426-000	1		Closing chamber bottom
90	0007-2129-760	1		Gasket
100	0007-3541-750	1		Gasket
110	0007-2825-750	1		Gasket
120	0019-6122-400	8		Allen screw
130	2048-6698-020	1	(1)	Water chamber bottom
140	0007-1860-750	1		Gasket
150	2058-6501-000	1		Sliding piston
160	0007-2385-760	1		Gasket
170	0007-2421-750	1		Gasket
180	2058-6620-000	1	(1)	Distributor, compl.
190	see page 188	1		Disk stack, complete
200	2058-6652-010	1	(1)	Separating disk
210	2058-6611-000	1	(1)	Bowl top
220	0007-2706-750	1		Gasket
230	0007-3542-840	1		Gasket
240	0019-6324-400	2		Threaded pin
250	2058-6642-030	1		Centripetal pump chamber cover
260	0007-1987-750	1		Gasket
270	0007-1861-750	2		Gasket
280	2059-6691-030	1		Set of regulating rings
290	0007-1997-750	1		Gasket
300	2146-6642-000	1		Centripetal pump chamber cover
310	2168-6631-020	1		Lock ring
320	0019-0960-360	1		Spindle screw
330	0007-2393-750	1		Gasket

(1) 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.

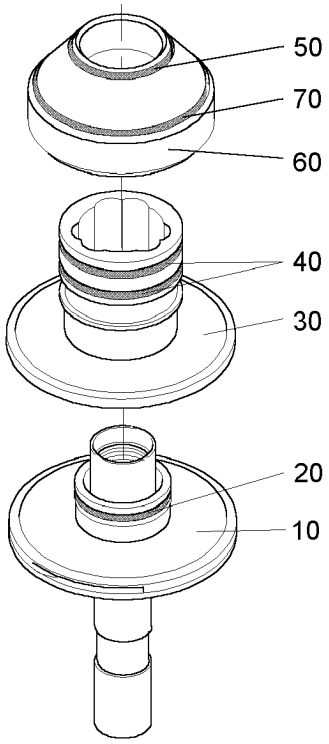


2146-6660-010

Fig. 283

Pos.	Part-No.	Qty.		Designation
-	**2146-6660-010**	**1**		**Disk stack, complete**
10	2146-6663-010	78		Disks, compl.
20	0028-0088-308	2		Disk

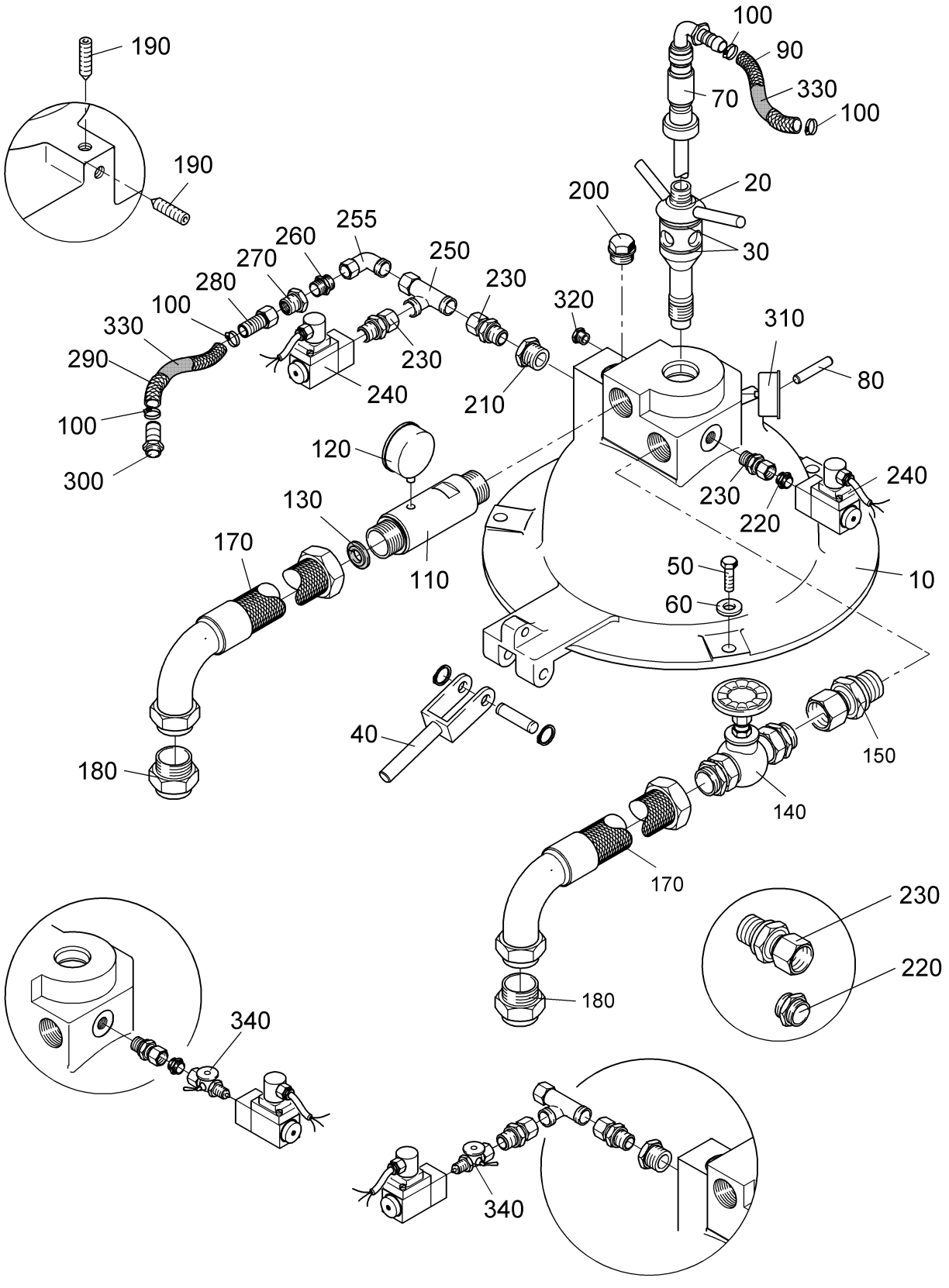
IMPORTANT:
The number of disks depends on the bowl version.
The total number of disks required for your application, e.g. **84**/**1** (**84** = number of disks without spacers, **1** = number of blind disks) is stamped on the blind disk.



2146-2213-000

Fig. 284

Pos.	Part Number	Qty.		Designation
-	**2058-2213-060**	**1**		**Centripetal pump, compl.**
10	2058-2241-020	1		Centripetal pump, compl.
20	0007-1936-750	1		Gasket
30	2168-2337-020	1		Sensing liquid pump
40	0007-1904-750	2		Gasket
50	0007-2925-750	1		Gasket
60	2142-2239-000	1		Spacer ring
70	0007-2485-750	1		Gasket


190
190
100
90
70
330
100
200
20
30
255
260
270
250
280
230
100
320
310
330
230
290
240
210
80
100
120
240
300
230
220
130
170
110
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10
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40
150
180
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170
230
220
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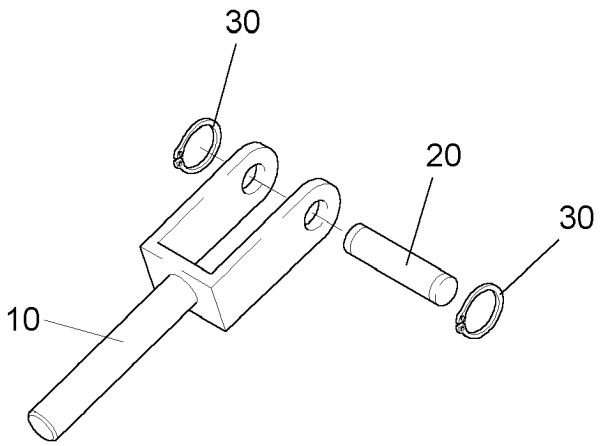
340
340
2058-8800-020

Fig. 285

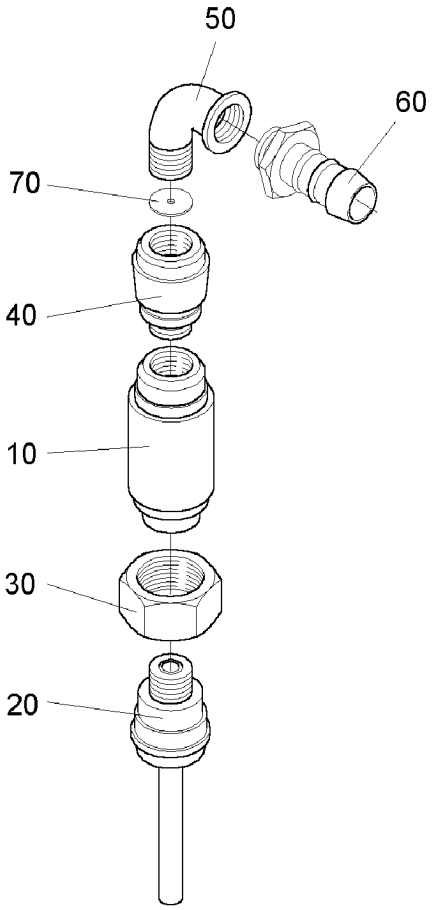
Pos.	Part Number	Qty.		Designation
-	**2058-8800-020**	**1**		**Hood, complete**
10	2058-8808-000	1		Hood
20	2171-2191-020	1		Handle connection piece
30	0007-1936-750	2		Gasket
40	see page 192	1		Retaining ring, compl.
50	0019-6970-400	3		Hex head screw
60	0026-1371-300	3		Washer
70	see page 193	1		Water feed line, compl.
80	0026-0994-400	1		Cylindrical pin
90	0018-2786-758	1		Hose
100	0018-3816-300	4		Hose clip
110	2048-7095-000	1		Connection piece
120	as per order	1		Flowmeter
130	as per order	1		Washer
140	see page 194	1		Valve, complete
150	0018-6999-030	1		Screwed socket
170	see page 195	2		Corrugated hose, compl.
180	0018-6652-000	2		Connector
190	0019-6307-150	2		Threaded pin
200	0019-1423-030	1		Threaded plug
210	0018-1479-400	1		Reducing connector
220	0018-2461-030	1		Cable gland
230	0018-3273-030	3		Screwed socket
240	0005-4315-000	2		Pressure switch
250	0018-3540-030	1		Adjustable L-connector
255	0018-1061-030	1		Angular screw coupling
260	2179-8846-000	1		Union with pre-set valve
270	0018-5168-030	1		Reducing connector
280	0018-3064-600	1		Hose outlet
290	0018-2786-758	0.750 m		Hose
300	0018-1796-600	1		Hose outlet
310	0001-0279-600	1		Pressure gauge
320	0019-8904-300	1		Screw plug
330	0005-4378-808	0.500 m		Protective hose
340	as per order	2		Pressure gauge cock



0026-2101-170

Fig. 286

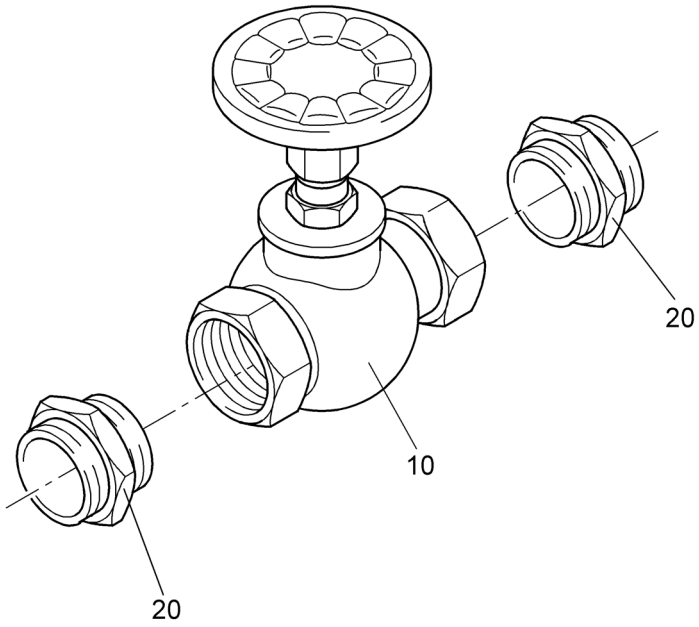
Pos.	Part-No.	Qty.		Designation
-	**0026-2101-000**	**1**		**Retaining bracket, compl.**
10	0026-2095-020	1		Stirrup
20	0026-0721-090	1		Bolt
30	0026-5856-170	2		Retaining ring



2144-8816-000

Fig. 287

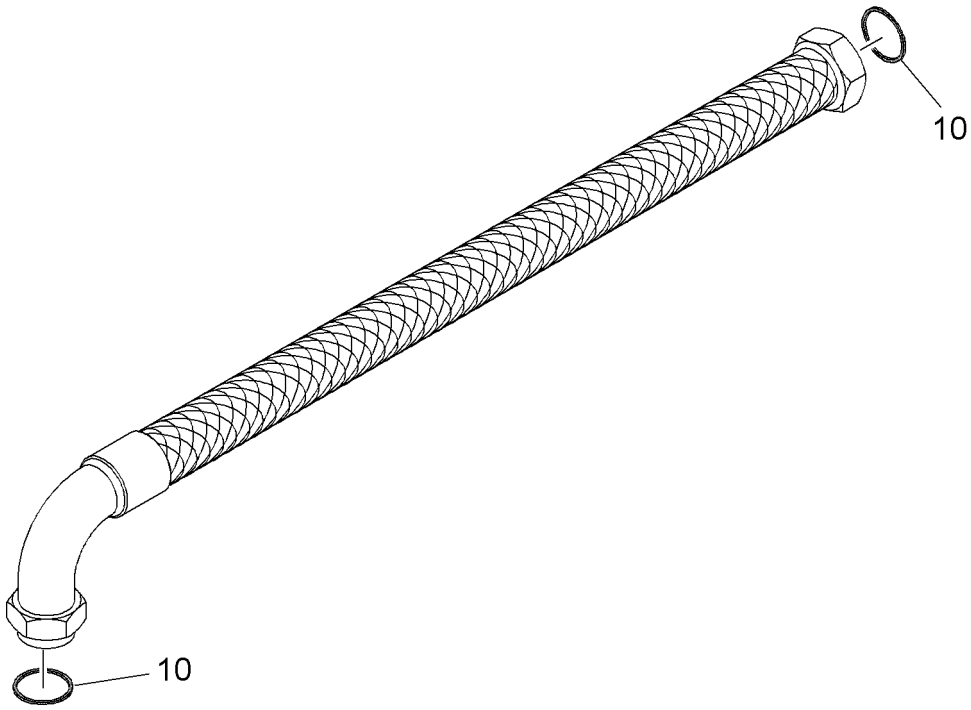
Pos.	Part-No.	Qty.		Designation
-	**2144-8816-000**	**1**		**Water feed line, compl.**
10	0018-6282-600	1		Non-return valve, compl.
20	2168-8448-000	1		Pipe
30	0013-1006-260	1		Coupling nut
40	0018-2015-000	1		Breather
50	0018-0021-260	1		Angle
60	0018-1796-600	1		Hose outlet
70	2144-1092-000	1		Disk



2058-8280-000

Fig. 288

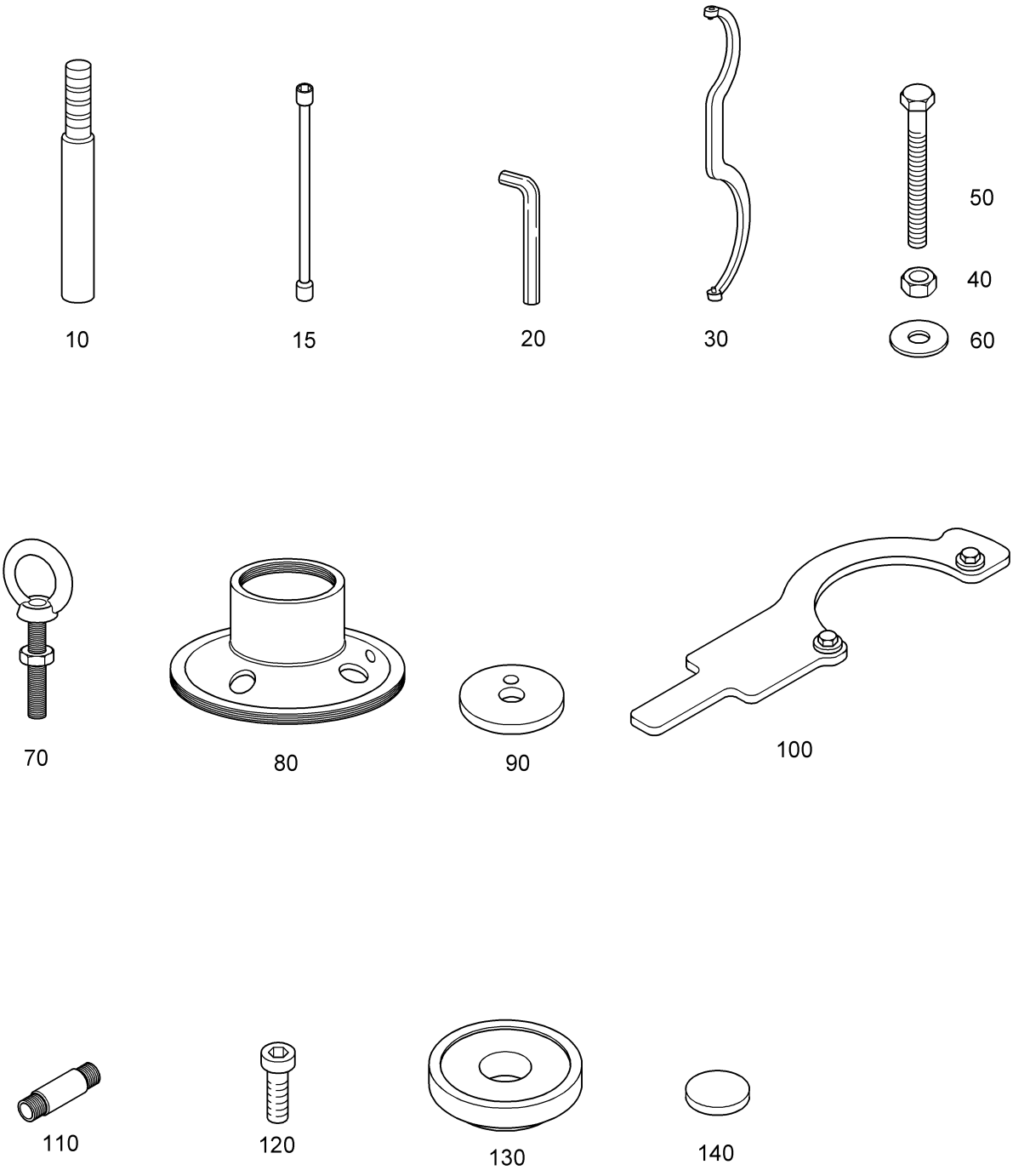
Pos.	Part Number	Qty.		Designation
-	**2058-8280-000**	**1**		**Valve, complete**
10	0018-2990-650	1		Check valve
20	0018-6035-030	2		Connector



0018-6656-100

Fig. 289

Pos.	Part Number	Qty.		Designation
-	**0018-6656-100**	**1**		**Corrugated hose, compl.**
10	0007-1729-830	2		Gasket



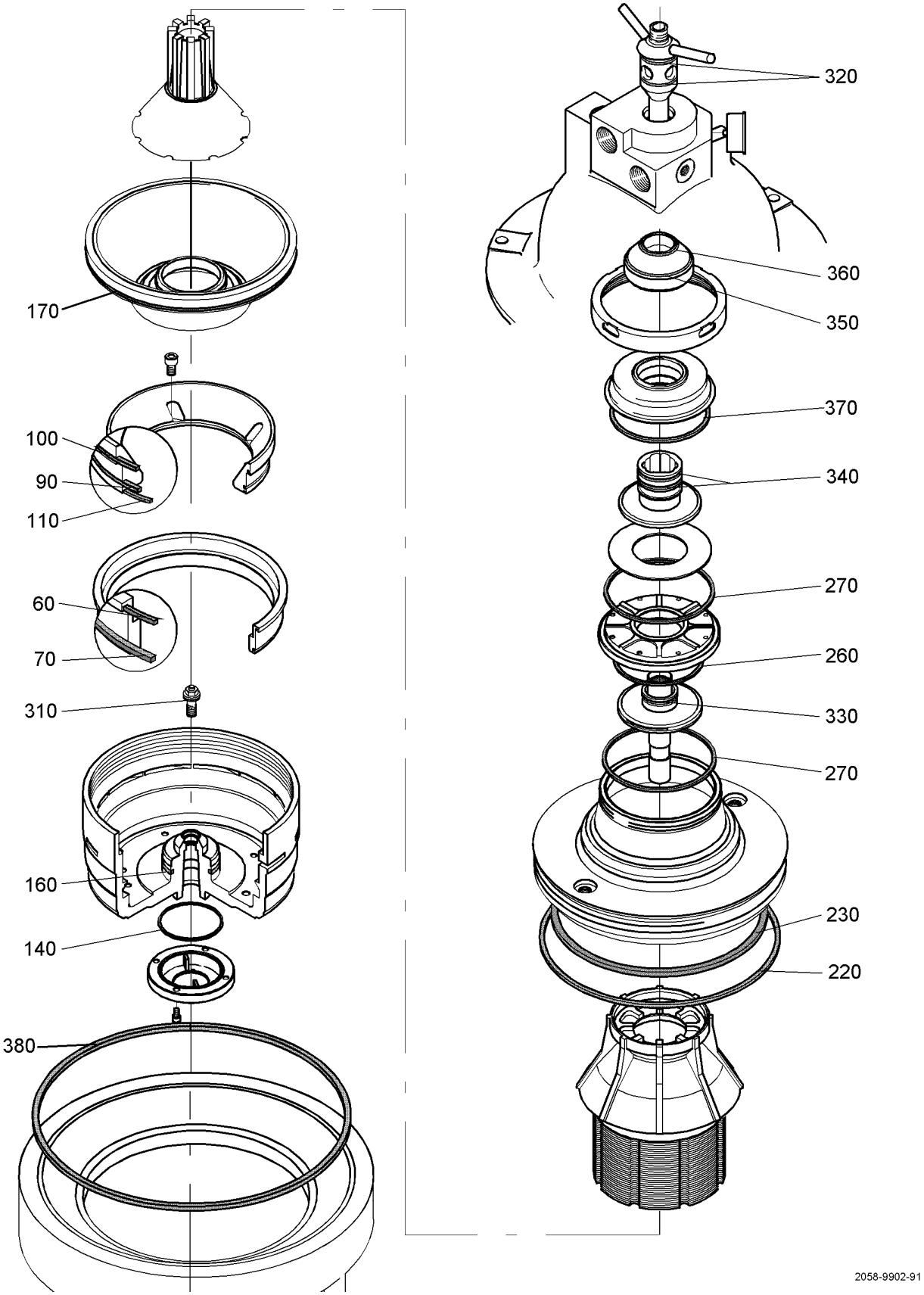
2058-9901-020

Fig. 290

The tools delivered are stated in the packing list.

Pos.	Part Number	Qty.		Designation
-	**2058-9901-020**	**1**		**Set of tools and accessories**
10	0003-0644-300	1		Mallet
15	0003-0596-320	1		Socket wrench, complete
20	0003-3796-320	1		Offset wrench
30	0003-3685-000	1		Double hook wrench, compl.
40	0013-0279-300	1		Hexagon nut
50	0019-6959-300	1		Hex head screw
60	0026-0356-300	1		Washer
70	2047-9982-000	1		Eye bolt, complete
80	2058-9822-000	1		Bell-shaped piece
90	2058-9881-000	1		Plate
100	2058-9943-000	1		Ring spanner, complete
110	0018-2916-050	1		Double nipple (transporting the separator)
120	0019-6142-400	1		Allen screw
130	2058-9939-000	1		Washer
140	2142-9935-000	1		Pressure piece

Pos.	Part-No.	Qty.		Designation
				Lubricants (hazardous materials!)
-	0015-0082-000	1		Lubricating grease (100 g)
-	0015-0003-080	1		Lube oil CLP 100 - mineral (2.5 l)


320
360
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370
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270
260
330
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230
220
170
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90
110
60
70
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160
140
380
2058-9902-91

Fig. 291

Pos.	Part Number	Qty.		Designation
-	**2058-9902-110**	**1**		**Set of spare parts "bowl/hood“ (operation: 1 year or 8000 hours)**
60	0007-3543-840	1		Gasket
70	0007-3541-750	1		Gasket
90	0007-2129-760	1		Gasket
100	0007-3541-750	1		Gasket
110	0007-2825-750	1		Gasket
140	0007-1860-750	1		Gasket
160	0007-2385-760	1		Gasket
170	0007-2421-750	2		Gasket
220	0007-2706-750	2		Gasket
230	0007-3542-840	1		Gasket
260	0007-1987-750	2		Gasket
270	0007-1861-750	4		Gasket
310	0007-2393-750	2		Gasket
320	0007-1936-750	4		Gasket
330	0007-1936-750	2		Gasket
340	0007-1904-750	4		Gasket
350	0007-2485-750	2		Gasket
360	0007-2925-750	2		Gasket
370	0007-1997-750	2		Gasket
380	0007-3378-750	1		Gasket
390	0015-0082-000	1	(1)	Lubricating grease (100 g)

(1) This position is not illustrated.

IMPORTANT:
The specified number of gaskets has been adapted to take account of the respective maintenance intervals (see maintenance schedule).
Only one gasket may be inserted per groove!

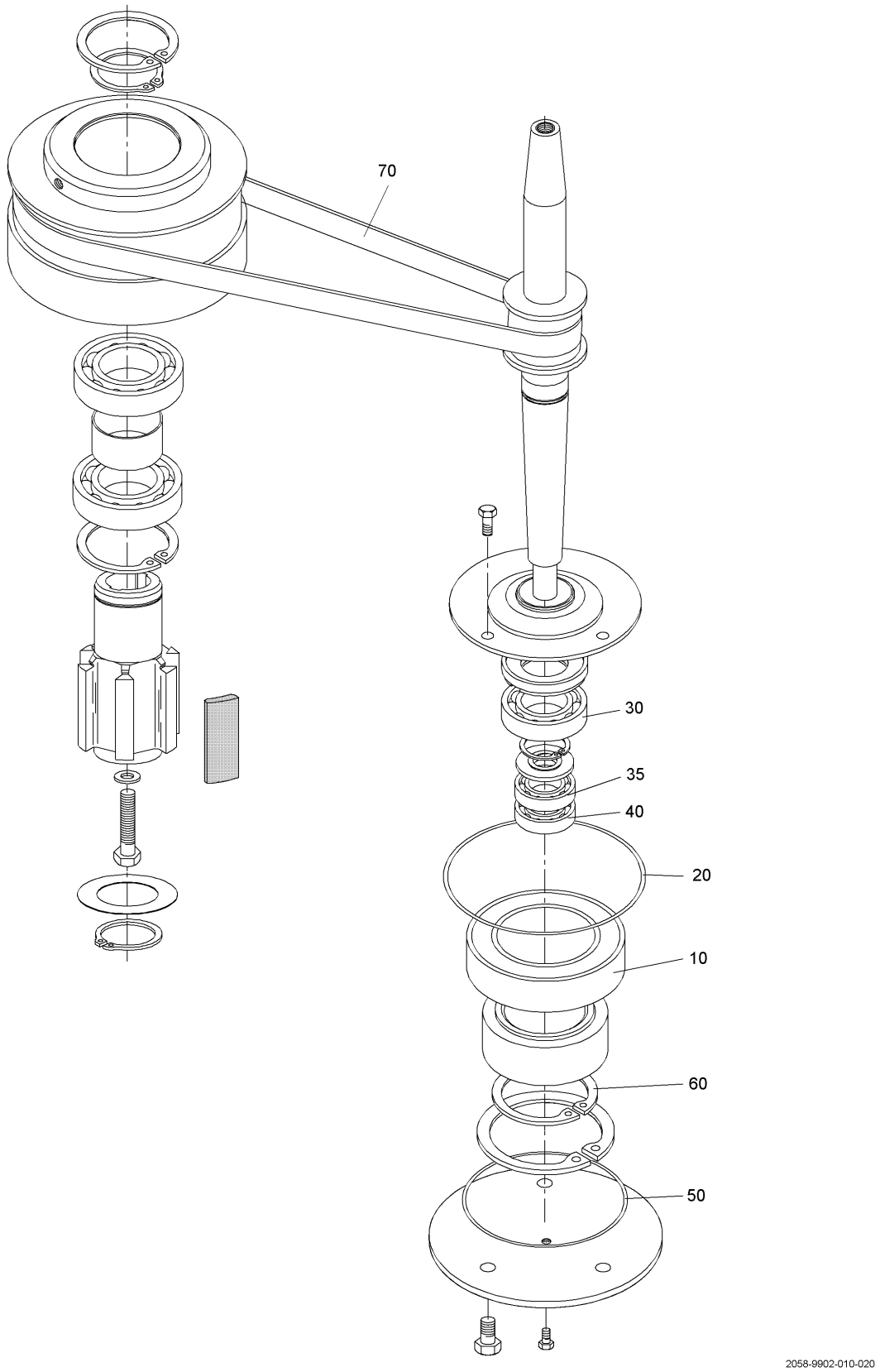

Fig. 292

Pos.	Part Number	Qty.		Designation
-	**2058-9902-120**	**1**		**Set of spare parts "drive" – 50 Hz (operation: 1 year or 8000 hours)**
10	0008-3533-000	1		Rubber-metal cushion
20	0007-2581-750	1		Gasket
30	0011-6207-000	1		Grooved ball bearing
35	0011-6203-000	1		Grooved ball bearing
40	0011-7203-250	1		Angular contact ball bearing
50	0007-2608-750	1		Gasket
60	0026-5834-170	1		Retaining ring
70	0021-3345-900	1		Drive belt

Pos.	Part Number	Qty.		Designation
-	**2058-9902-130**	**1**		**Set of spare parts "drive" – 60 Hz (operation: 1 year or 8000 hours)**
10	0008-3533-000	1		Rubber-metal cushion
20	0007-2581-750	1		Gasket
30	0011-6207-000	1		Grooved ball bearing
35	0011-6203-000	1		Grooved ball bearing
40	0011-7203-250	1		Angular contact ball bearing
50	0007-2608-750	1		Gasket
60	0026-5834-170	1		Retaining ring
70	0021-3344-900	1		Drive belt

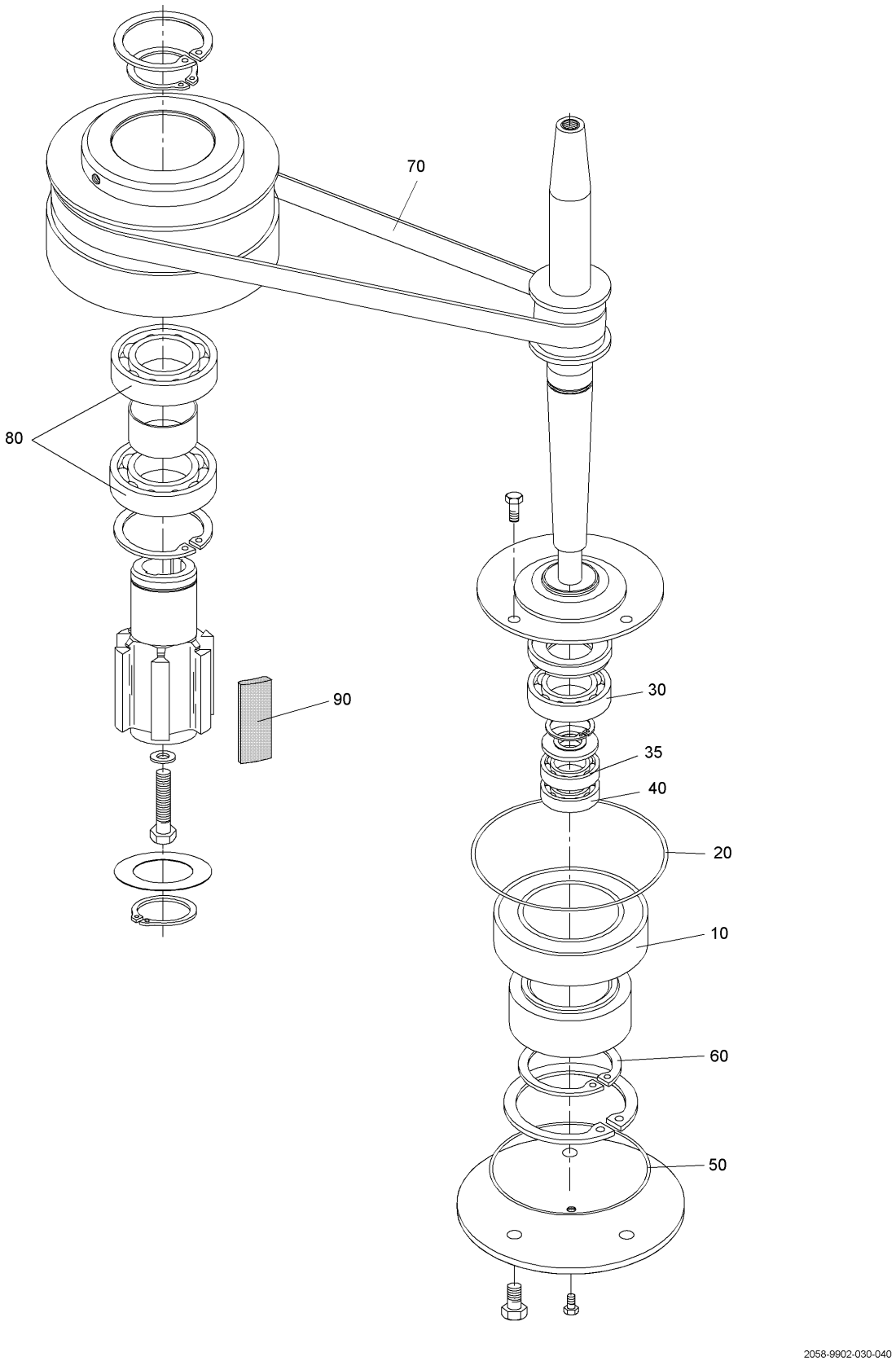

Fig. 293

Pos.	Part-No.	Qty.		Designation
-	**2058-9902-030**	**1**		**Set of spare parts "drive" – 50 Hz (operation: 2 years or 16000 operating hours)**
10	0008-3533-000	1		Rubber-metal cushion
20	0007-2581-750	1		Gasket
30	0011-6207-000	1		Grooved ball bearing
35	0011-6203-000	1		Grooved ball bearing
40	0011-7203-250	1		Angular contact ball bearing
50	0007-2608-750	1		Gasket
60	0026-5834-170	1		Retaining ring
70	0021-3345-900	1		Drive belt
80	0011-6012-680	2		Grooved ball bearing
90	0021-3293-870	3		Clutch shoe

Pos.	Part Number	Qty.		Designation
-	**2058-9902-140**	**1**		**Set of spare parts "drive" – 60 Hz (operation: 2 years or 16,000 operating hours)**
10	0008-3533-000	1		Rubber-metal cushion
20	0007-2581-750	1		Gasket
30	0011-6207-000	1		Grooved ball bearing
35	0011-6203-000	1		Grooved ball bearing
40	0011-7203-250	1		Angular contact ball bearing
50	0007-2608-750	1		Gasket
60	0026-5834-170	1		Retaining ring
70	0021-3344-900	1		Drive belt
80	0011-6012-680	2		Grooved ball bearing
90	0021-3293-870	2		Clutch shoe

Note
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