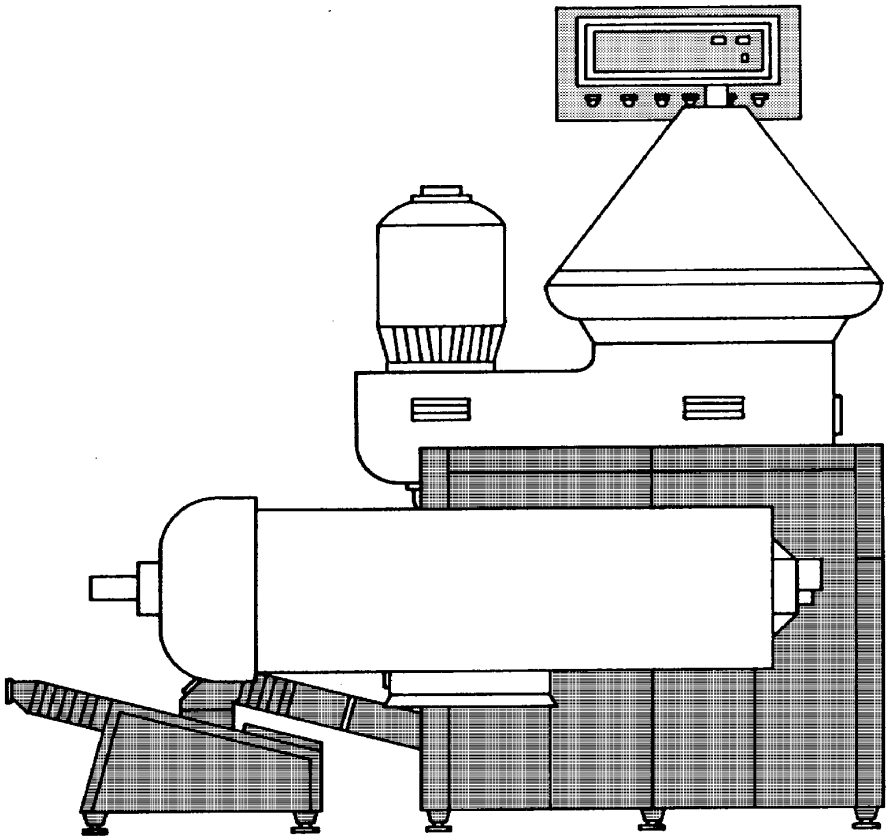
Geschäftsbereich
Mechanische Trenntechnik

Westfalia Separator AG

Instruction manual

No.:	**2294-9001-020**
Edition:	**0504**
Description:	**Centrifugal Separator with self-cleaning bowl**
Model:	**RSE 200-01-776**



Subject to modification!

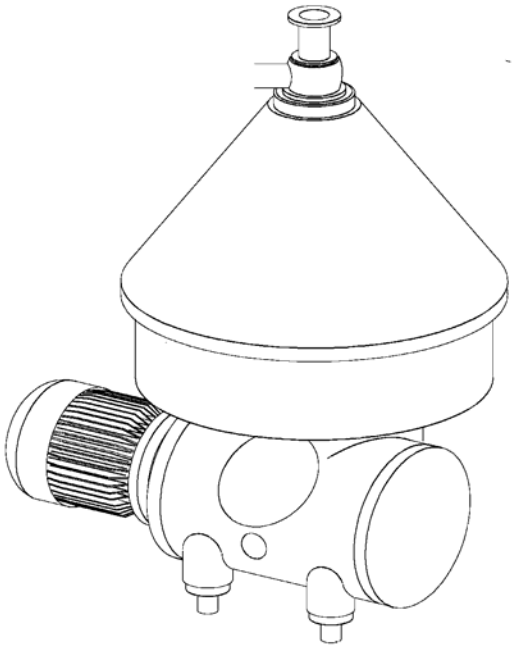


Fig. 1

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

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			

For your safety

- **Observe accident prevention regulations.**

  The local safety and accident prevention regulations apply unconditionally to the operation of the separator.

- **Refer to the instruction manual.**

  Follow only the instructions given in this manual.

- **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 the 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 personnel or if the machine is not applied in accordance with the intended use.
  Westfalia Separator AG shall not be liable for damage which occurs as a result of non-compliance with the above. Warranty and liability conditions in the Conditions of Sale and Delivery of Westfalia Separator AG are not extended by the above.

Note on the symbols used in the instruction manual

As a result of the continuous adaptation of our instruction manuals to new standards, “mixed” documents may be produced which contain both old and new safety symbols. Below is an explanation of the meaning of the symbols used in the manuals.

Special attention must be paid to all passages in a manual marked with safety symbols. The operation described after such a symbol must be carried out with utmost care.

New symbols:



Caution

This symbol indicates potential danger to persons. (danger to life, risk of injury)



Attention!

This symbol indicates potential risk to risks for machine, material and environment.



Instruction manual

This symbol draws attention to the fact that at this point additional manuals must be read and observed.



NOTE

This symbol does not indicate safety precautions but rather information for a better understanding of the machine.

Old symbols:



- **Strictly adhere to instructions marked with this symbol.**

  This avoids damage or destruction of the separator and other equipment.



- **Take special care when carrying out operations marked with this symbol**

  otherwise danger to life.

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Notizen
Anotaciones
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1.1 Fundamental safety precautions

These general safety precautions form part of the overall documentation package furnished with the separator. They contain information which is important for safe handling of separators.

Every person assigned the responsibility of installing, operating, maintaining and repairing the separator must have read and understood the documentation, in particular the chapter **safety precautions**.

Maintenance and repair work may only be carried out by the user to the extent described in this instruction manual. The user must ensure that all work is carried out by suitably qualified personnel (see also “Qualification of the personnel”).

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.

The instruction manual and further documentation required for the operation of the separator / plant must be complete and kept in the vicinity of the separator for ready access by the operating personnel. It must be available to the operators at all times. Damaged and/or illegible parts must be replaced.

1.2 Symbols and abbreviations used

In the following instruction manual, concrete safety precautions are given to draw attention to the non-avoidable residual risks when operating the machine.

The symbols and warning signs used in the instruction manual correspond to the symbols used in standard sets of regulations. They are described in detail in the chapter **Safety precautions** and are intended to draw attention to potential danger sources to minimise the risk of accidents for persons and / or damage to property.

1.2.1 Concrete safety precautions and symbols used

These residual risks involve hazards for

- persons
- product and machine
- environment.

The symbols used in the instruction manual are above all designed to draw attention to the safety precautions.



Caution

This symbol indicates potential danger to persons.
(danger to life, risk of injury)



Attention!

This symbol indicates potential risks to machine, material and environment.

The most important aim of the safety precautions is to prevent damage to persons.

- When the warning triangle in front of a safety precaution bears the caption “Caution", risks for machine, material and environment are not excluded.
- When the warning triangle in front of the safety precaution bears the caption “Attention”, risks to persons are not to be expected.

The respective symbol used cannot replace the text of the safety precaution. Therefore, always read the complete text!

1.2.2 Further symbols for information

The following symbols are not safety precautions but represent information and notes to enable better understanding of the machine or plant and processes.



Instruction manual

This symbol draws attention to the fact that at this point additional manuals must be read and observed.

- If the stop sign with the caption “Instruction manual” is in front of a note, another furnished manual must be referred to and the instructions and notes observed.



NOTE

This symbol does not indicate safety precautions but rather information for a better understanding of the machine.

- When the info symbol with the caption “Note” is adjacent to a text, the reader is given useful tips, explanations and notes on the machine, plant or its processes.

1.2.3 Correct usage

The separator is used for the separation of media with different densities.

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

The separator is designed

- in accordance with the chemical and physical properties of the product specified for correct usage of the separator and
- in accordance with the method of application contractually agreed with Westfalia Separator AG.
-

The separator may be operated only in the agreed areas and with the parameters specified in the documentation or a datasheet which is part of the documentation.

Any operating mode deviating herefrom is not proper and correct and can cause damage to persons and property.

In particular, only products may be used which conform to the specifications on the separator nameplate.

The instructions, notes and specifications in the instruction manual must be followed.

1.2.4 Incorrect usage

All operating modes not detailed under **correct usage** are considered to be **incorrect usage.**

- Products not specified in the documentation or on a datasheet furnished with the documentation may not be used.
- Constructional alterations may not be made to the separator, fittings and other accessories.
- Use only those operating materials specified in the technical data or technical specifications (lubricating greases, cleaning agents, operating liquids etc.)!
- Process parameters such as
  - admissible pressures
  - admissible temperatures
  - admissible flow rates
  - torques
  - settings

which are specified in the user information or a datasheet furnished with the user information must not be exceeded.

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



NOTE

Westfalia Separator shall not accept liability for damage arising from incorrect usage.

1.2.5 Unauthorized modification work

No conversion work or modifications may be carried on the separator or plant by the user.

Conversions or modifications on the separator or plant can

- endanger life and limb of the user or third parties.
- impair the operating safety of the separator.
- lessen the efficiency of the separator / plant.
- result in damage to the separator itself or other components within the plant.



NOTE

Westfalia Separator shall not accept liability for damage arising from unauthorized conversion or modification to the separator or plant.

1.2.6 Use of non-genuine spare parts

Safety risks can arise from the use of non-genuine spare parts. In addition, the durability of such parts is frequently significantly lower which leads to a higher maintenance requirement and lower plant availability.

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.

- Damaged separator parts must be replaced by new genuine spare parts from Westfalia Separator.

1.2.7 Obligations of the user

The separator corresponds to the state-of-the-art of the year of its construction. It makes possible a high level of safety when operated for its correct intended use.

In practical operation, however, the high safety standard can only be maintained through compliance with all required measures. The user must therefore practice the required care and diligence in planning these measures and monitoring their execution.

The use must in particular comply with national legislation and directives.

The user must, for example, ensure that

- the separator is applied only for the intended use (see section **Correct usage)**.
- the separator is operated only in a perfect functional condition and the function of the safety devices is regularly checked.
- necessary personal protective gear is available and worn by operating, maintenance and repair personnel.
- the instruction manual is always available at the separator site in a complete and legible condition.
- only qualified and authorized personnel operate, maintain and repair the separator.
- this personnel receives regular instruction on all relevant issues relating to industrial safety and is familiar with the instruction manual and, in particular, the safety precautions contained in it.
- all safety and warning signs are not removed and remain legible.
- a plant instruction on conduct at the workplace is issued by the user and made known to the personnel.
- in Germany the local accident prevention regulations of the employer's liability insurance association are complied with.
- safe access to the machine is assured for maintenance and repair work, for example by means of catwalks and working platforms.
- the corresponding statutory safety regulations for the protection of life and health are adhered to.



NOTE

Assembly and commissioning personnel of Westfalia Separator have been directed to abort operations when statutory safety regulations at the site of deployment are not fulfilled and there is a risk to life and health.

- The user must ensure that the required hoists, devices and aids are available to ensure safe handling of the separator during assembly work.

1.2.8 Qualification of the personnel

The separator may only be operated, maintained and repaired by trained personnel.

The user of the separator is responsible for training.

The personnel must likewise receive instruction in the required accident prevention measures and know and understand the plant instructions.

The user must deploy personnel who are capable of

- fulfilling the requirements to be met by the personnel for operating the separator.
- reading the markings on the separator and the instruction manual.

The personnel must be trained to carry out the following operations on the separator:

- Operation
- Maintenance
- Repair

The user is acting with gross negligence when he deploys untrained, unsuitable personnel for work on the separator and knowingly exposes the personnel to a life-threatening risk.

Operation of the separator or plant by untrained or unauthorized personnel can result in

- danger to life and limb of the user or third parties.
- impairment of or damage to the separator or plant or other assets of the user.
- reduction of the efficiency of the separator or plant.

Westfalia Separator shall accept no liability for damage caused by unqualified or unauthorized personnel.

Westfalia Separator offers a comprehensive range of training measures. Contact Westfalia Separator or one of its authorized representatives for further information.

1.3 Special safety precautions

The following safety precautions apply for separators and plant components delivered by Westfalia Separator.

1.3.1 Safety markings on the separator

The following warnings are attached to the separator as safety markings. The safety markings must always be in perfect condition. They are part of the user information.

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

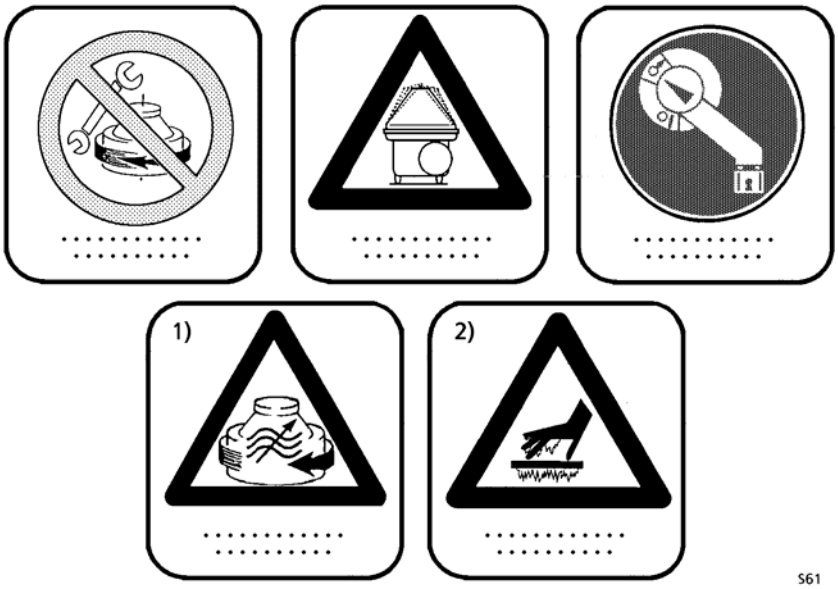


Fig. 2

1) Only in case of frequency converter operation

2) Only in case of hot operation

The position of safety markings on the separator is illustrated in chapter **"Design and function"**.

Meaning of the safety markings



This safety marking means:
Do not carry out maintenance or repair work on the separator before the bowl has come to a standstill.

Danger of injury due to rotating machine parts!



This safety marking means:
Attention in the case of unusual noises or vibrations on the separator!
Follow the instructions in the instruction manual!
Danger to life and limb through rotating machine parts!



This safety marking means:
Before working on the separator and electrical plant components:
Disconnect power to the separator and plant components and secure against unintentional switching on!
Danger of injury through electrical current and unintentional start-up of the separator!



This safety marking means:
Attention, do not manipulate the frequency converter (electronic speed adjustment)! Setting the parameters on the frequency converter may only be carried out by qualified specialists. The admissible maximum bowl speed as stated on the nameplate may not be exceeded! When starting the machine, for example after replacing drive parts, the bowl speed must be checked.
The separator may only be operated with an additional independent device for speed limiting.

Risk of damage to the separator!



This safety marking means:
Attention, the surfaces of the separator and plant components can be hot or cold.

Danger of injury through hot or cold surfaces!

1.3.2 Position of safety devices on the separator

Special safety devices such as sensors are customer-specific and must not be changed.

1.3.3 The main switch on the control cabinet

Precise information on the position of the main switch on the control cabinet is given in the electrical documentation.
The control cabinet is installed in accordance with the installations of the user. The position of the main switch must therefore be taken from the plant instruction of the user.

1.3.4 EMERGENCY-OFF switches

EMERGENCY-OFF switches are located in the control cabinet.
Precise information on the position of the EMERGENCY-OFF switches is given in the electrical documentation.
The control cabinet is installed in accordance with the installations of the user. The position of the EMERGENCY-OFF switches must therefore be taken from the plant instructions of the user.

1.3.5 Checking the EMERGENCY-OFF and safety devices

The safety devices must be correctly installed and checked for functionality before start-up.

1.3.6 Special risks of a separator

The separator is equipped with a high-speed rotating metal bowl which represents a danger potential not to be underestimated on account of the rotational energy which can pose a danger for the installation and persons working in the installation when not properly handled.



CAUTION!

Switch off the separator before carrying out maintenance or repair work.
Wait, observe and check that all rotating parts are at a standstill.
Do not reach into the rotating drive section or bowl!
Do not loosen any part before the bowl has come to a standstill!

Risk of injury and danger to life through rotating parts.

Standstill should not be checked using only one source of information (e.g. speed indicator) but must be backed up by at least one further checking device. It must always be reckoned with that the first used indicating option for standstill will provide false information because, for example, the electronics have failed or the belt or gear in the drive is defective.

The following options are available for checking standstill on separators depending on the version:

- Electric speed indicator
- Revolution indicator or sight glass on the gear cover
- The inspection port on the hood enables a direct view onto the bowl. In addition, checking is possible by removing the gear cover or opening the frame port on the bowl side.

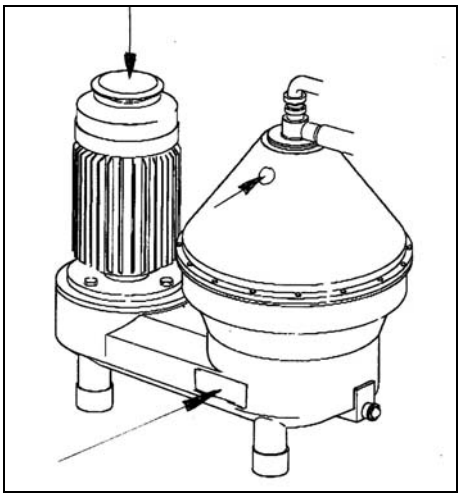


Fig. 3

Revolution visual check on machines with belt drive.

You can observe whether the machine is at a standstill at the points marked with the arrows.

We reserve the right to carry out design modifications.

NOTE

Observing the motor fan is not a reliable method of checking standstill because the motor or fan can already be at a standstill when the separator bowl is still rotating.

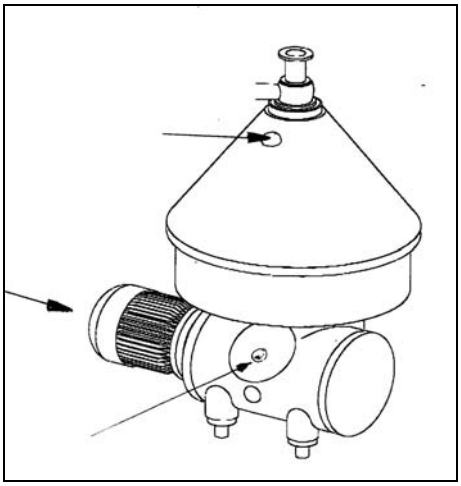


Fig. 4

Revolution visual check on machines with gear.

You can observe whether the machine is at a standstill at the points marked with the arrows.

We reserve the right to carry out design modifications.

NOTE

Observing the motor fan is not a reliable method of checking standstill because the motor or fan can already be at a standstill when the separator bowl is still rotating.

During cleaning programs (steam sterilization and CIP), very high temperatures are reached on the surfaces of the separator and piping.



CAUTION!

During cleaning programs, the surfaces of the separator and pipes are very hot.

Danger of burns!

With some products, the separator has to be cooled. As a result, temperatures of up to minus 30 °C are reached on the surfaces of the separator and pipes.



CAUTION!

When the cooling is switched on, the surfaces of the separator and pipes can get very cold.

Danger of frostbite!



CAUTION!

When the noise level of the separator is too high, noise-dampening ear protectors must be worn.

Danger of hearing damage!



CAUTION!

During all maintenance and repair work on the separator, the fittings and pipes may spit out hot, caustic liquids.

Danger of causticization of skin and eyes!

1.3.7 Special product hazards

- In the case of products which have to be allocated to a specific hazard class, adhere to the corresponding local safety precautions when handling these products.
- Follow the local plant instructions and wear the required protective gear.
- In the event of accidents, keep to the local rules of conduct when handling products of the respective hazard classes and take appropriate first-aid measures when injury is involved.
- If necessary, notify the in-house task forces immediately when an accident occurs (fire-brigade, medics, plant security, disposal teams etc.) so that further action can be taken.

1.3.8 Special hazards caused by cleaning liquid

Only those chemicals may be used for the chemical cleaning process (CIP) which are specified in the user information or a datasheet issued with the user information.



CAUTION!

High temperatures are reached during cleaning! Surfaces of separator hood and pipes are hot!

Danger of burns!

- Follow the local plant instructions and wear the required protective gear.
- Keep to the local procedures when handling acids and lyes to avoid accidents and take appropriate first-aid measures if injuries do occur.
- If necessary, notify task forces immediately when an accident occurs (fire-brigade, medics, plant security, disposal teams etc.) so that further action can be taken.

1.3.9 Notes on the use of protective equipment

To avoid danger to life and limb, the specified protective gear must be worn by operating, maintenance and repair personnel in line with the

- local accident regulations
- instructions of the user and
- the **safety precautions** described in this instruction manual.

The following protective gear must be worn when in the vicinity of or working on the separator



Wear ear protection!

Wear ear protection during operation of the separator!
(noise emissions 84 dB(A) or higher)



Wear protective gloves!

Wear protective gloves when working on hot or cold surfaces of separator and piping.
(possible temperature ranges <-10 to >80°C or <14 to >176 °F)



Wear protective goggles!

Wear protective goggles when working on pipes and fittings.
(Possible residues of caustic liquids in valves and pipes and piping system not relieved from pressure)

1.3.10 Safety precautions for transport

- For loading and unloading operations, use only hoists and load carrying equipment with adequate lifting power (the weight of the separator is specified in the documentation or a datasheet furnished with the documentation).



CAUTION!

When transporting and assembling machine parts:

Danger of crushing!

- Transport the separator only with **removed** bowl.
- Lift the separators correctly only in accordance with the specifications in the user information (lifting points etc.) using a hoist!
- Do not use damaged or incomplete load carrying equipment.
- Appoint a competent instructor for the lifting process!
- When using load carrying equipment and hoists, observe the statutory regulations and safety regulations.
- Use only a suitable transport vehicle with adequate lifting power!
- Reliably secure the load. Use suitable lifting points.
- After loading, provide the separator with devices which prevent a shift in position (sliding, moving).

1.3.11 Safety precautions for start-up

- Check that all screwed connections are tight.

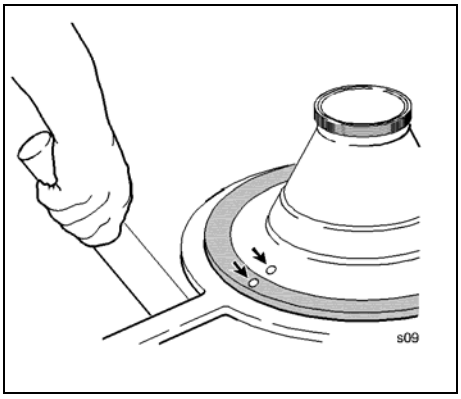


Fig. 5

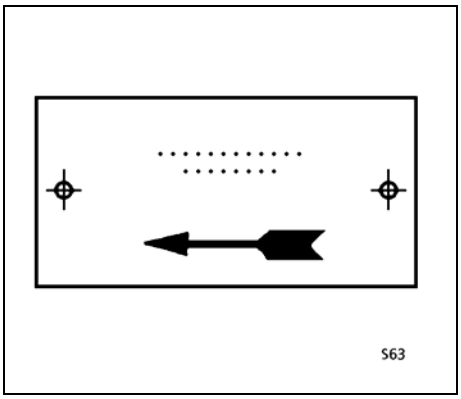
- Check that the lock rings on the bowl are tight.
- Pay particular attention to the bowl lock ring: After tightening the bowl, the adjusting marks must be in the specified position (e.g. “O” marks on the bowl parts, see figure).

CAUTION!

Pay attention to the correct adjustment of the disk compression!

An incorrect disk compression can lead to severe imbalance which can in turn result in damage to the separator and danger to life and limb of the user!

- Follow the instructions on bowl assembly in the chapter **Maintenance and repair**.

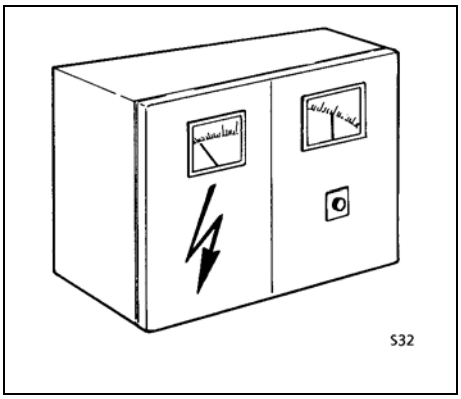


- The direction of rotation of the bowl must correspond to the direction of rotation arrow on the frame or solids catcher.

The **direction of rotation** of the bowl is normally **clockwise** when looked at from above.

- The separator may only be operated with protection devices conforming to EN 294.
- Carry out all testing and checking operations in accordance with the commissioning instructions in the instruction manual.

1.3.12 Safety precautions for the electrical installation



- The local 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 statutory regulations; e.g. in the EU the EG guidelines:

1.3.13 Safety precautions for operation

- Never carry out work on the separator when the bowl is rotating.
- **Do not loosen any part before the bowl has come to a standstill!**
- When unusual noises or vibrations occur, press **EMERGENCY-OFF** immediately and leave the danger zone.

When unusual noises or vibrations occur:



– Never initiate a bowl ejection!
– Evacuate the room!
– Do not enter the room again until the bowl has come to a standstill!

Danger to life and limb through machine parts being thrown around!

- 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.

1.3.14 Safety precautions for maintenance and repair

- Observing the maintenance intervals and user information is decisive for the service life and permanent operating readiness of the separator.
- The maintenance intervals depend on the operating conditions. Especially highly stressed parts of the separator must be regularly checked. Adapt the maintenance intervals to the operating conditions!
- Timely maintenance of the separator is essential for safe operation.

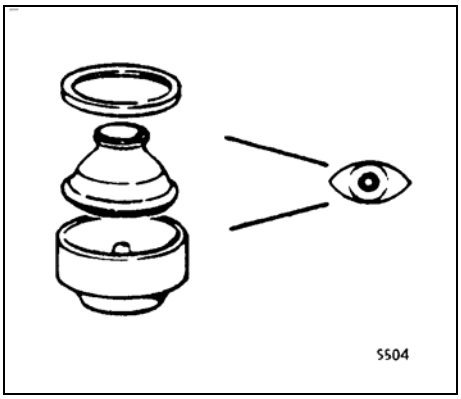


Fig. 6

Especially highly stressed parts of the separator such as
– bowl lock ring,
– bowl bottom,
– bowl top
must be regularly checked (at least once a year) as specified in the maintenance schedule to assure safe and efficient operation.



Fig. 7

When carrying out maintenance and repair work:

- **Do not climb onto or stand on the machine or parts of the machine!**

Danger of injury through slipping or falling down!

- Repairs to the separator may only be carried out by service technicians from Westfalia Separator or personnel trained and certified by Westfalia Separator.

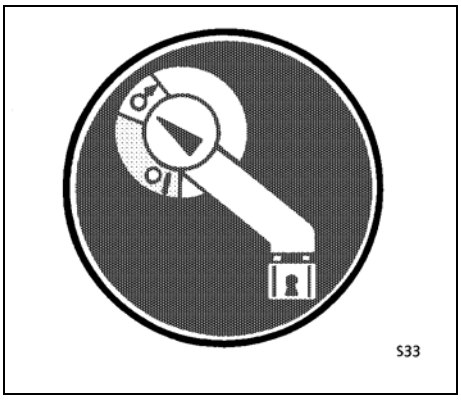


Fig. 8

- During maintenance and repair work, make sure that the main switches are switched off and secured against restarting.
- Make sure that other persons do not have the possibility to start the machine before the maintenance or repair work is finished.

- Make sure that the rotating parts of the separator (drive, bowl) are at a standstill before carrying out maintenance and repair work.
-
- When the machine is defective, a warning sign must be attached and the separator must be secured against unauthorized starting.

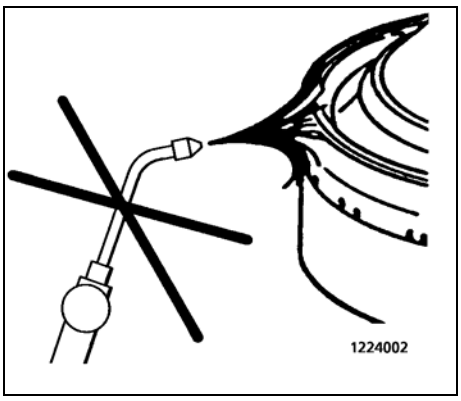


Fig. 9

- **Do not heat bowl parts with a naked flame to facilitate dismantling work.**

Structural changes in the material of the bowl parts which affect the operating safety of the machine may result!

- **Do not weld bowl parts.**

- Do not weld hood and solids catcher parts of steam-sterilizable separators.

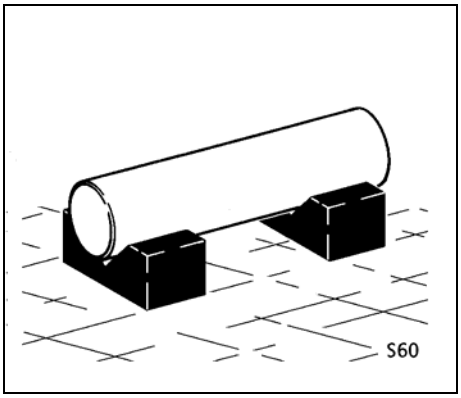


Fig. 10

- Place the dismantled separator parts on suitable surfaces (rubber, wood etc.).
- Take appropriate steps to prevent machine parts from overturning and rolling away.

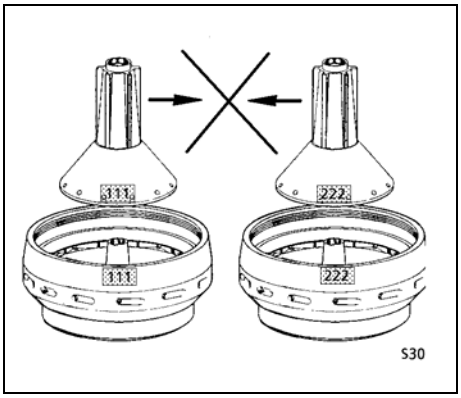


Fig. 11

- When carrying out assembly work on several separators, be careful not to interchange parts of different bowls! Each bowl must be balanced with its respective components.

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

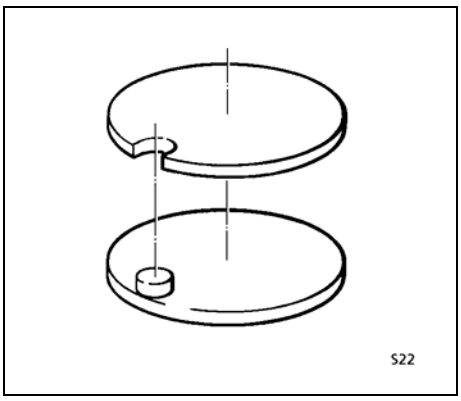


Fig. 12

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

The separator may not be operated when locking devices and marks on the bowl parts are damaged.

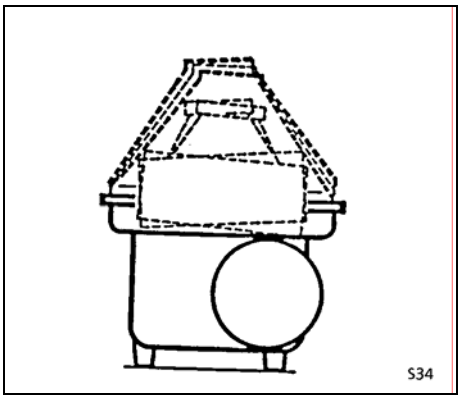


Fig. 13

- After fitting certain bowl parts (e.g. bowl bottom, bowl top) the bowl must be re-balanced.

Bowl balancing may be carried out only by specialists from Westfalia Separator or specialist workshops authorized by Westfalia Separator!

If in doubt, consult the service department of Westfalia Separator.

- Do not manipulate speed-altering devices such as frequency converters so that the maximum admissible bowl speed (see nameplate or “technical data” in the instruction manual) is not exceeded.
- Ensure that monitoring devices (e.g. overspeed monitors etc.) are not manipulated or damaged and check their function in accordance with the instructions in chapter **“Maintenance and repair – maintenance schedule”**.

- When carrying out maintenance and repair work, carry out a visual check of the separator components. Have the components checked for damage through **corrosion** and **erosion** by **authorized specialists** and proceed in accordance with the instructions in chapter **“Maintenance and repair – inspections”**.



Caution

The separator must be shut down immediately when damage due to corrosion or erosion is detected!

There is a risk of damage to the separator and a danger to life and limb of the user through machines parts flying around.

In case of doubt, contact Westfalia Separator!

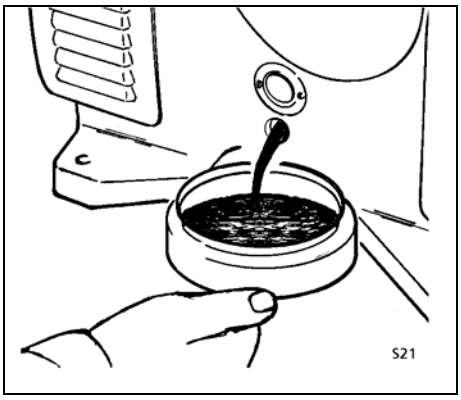


Fig. 14

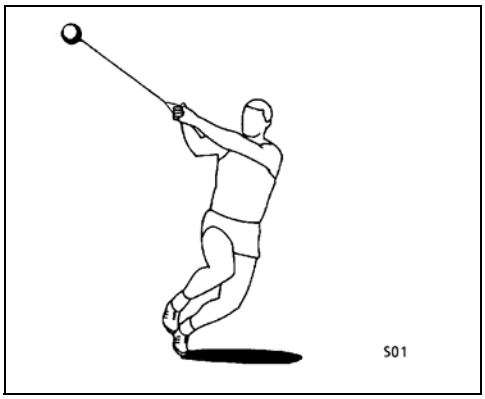
- Follow the instructions when handling waste oils and comply with the disposal regulations when replacing lubricants in the chapter **"Maintenance and repair"** of the instruction manual.

- After maintenance and repair work on the separator, refit all protective devices.

1.4 Additional notes

1.4.1 Operating principles

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



High centrifugal forces are produced in the rotating bowl of the separator.

Fig. 15

Under the influence of the centrifugal forces, separation of the liquid mixture and/or ejection of the solids particles takes place within a very short space of time.

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.

1.4.2 Bowl speed and product

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

- Temperature
- Density of the fluid and solid components
- Aggressiveness of the product as regards corrosion and erosion (influences 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.

1.4.3 Operations on the separator

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

Special attention must be given to:

- Assembly
- Starting
- Maintenance and servicing

1.4.4 Assembly

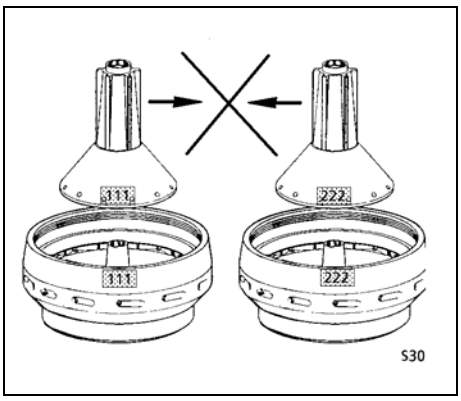


Fig. 16

- If the plant has several centrifuges, be careful not to interchange parts of different bowls since each bowl has been balanced individually.
  The parts are marked with the serial number of the machine or with the last three digits of the serial number.

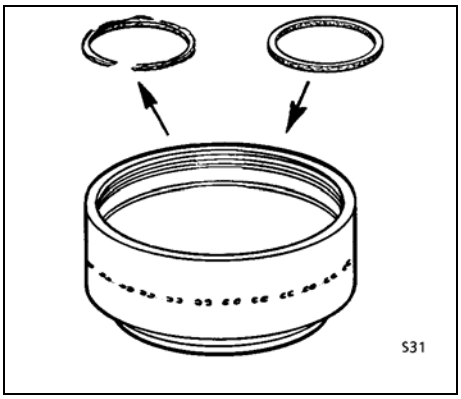


Fig. 17

- Replace damaged parts by new or reconditioned parts.

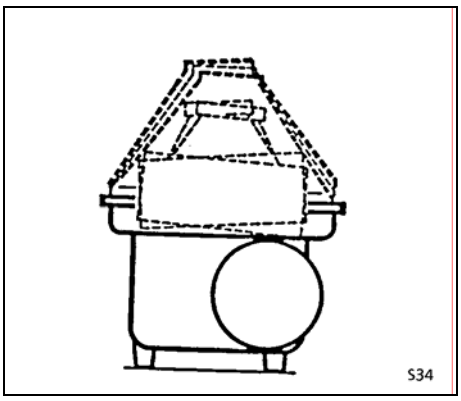


Fig. 18

- After installing certain critical spare bowl parts, the bowl must be re-balanced. (for further details, see bowl assembly)

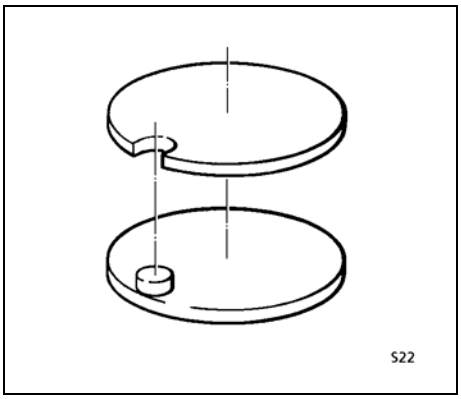


Fig. 19

- Some bowl parts must be arranged in fixed positions relative to one another.
- Locking devices and alignment marks must be in perfect condition. Otherwise, the bowl may not be operated.

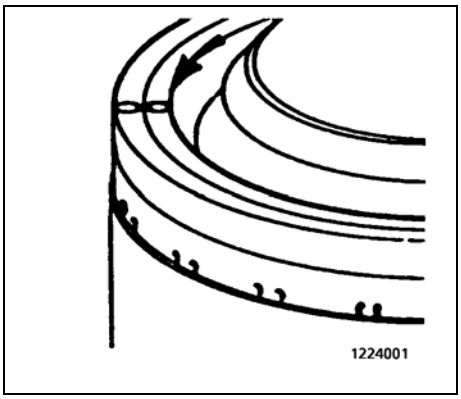


Fig. 20

- 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. (for further details, see bowl assembly)

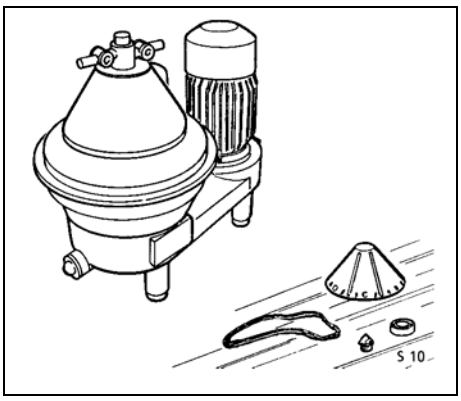


Fig. 21

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

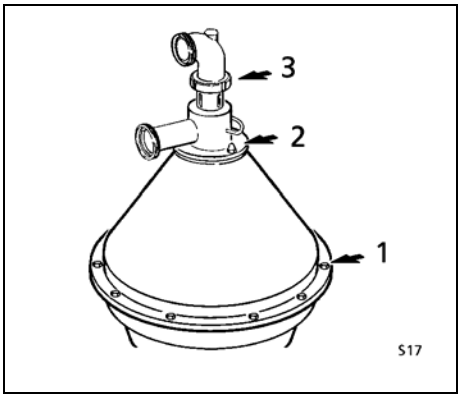


Fig. 22

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

1.4.5 Before start-up

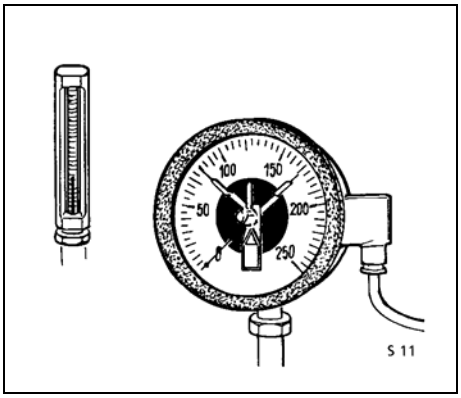


Fig. 23

- Check that 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.

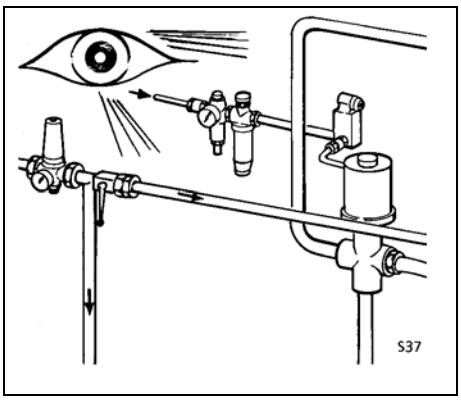


Fig. 24

- 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 new or reconditioned parts.

1.4.6 Starting

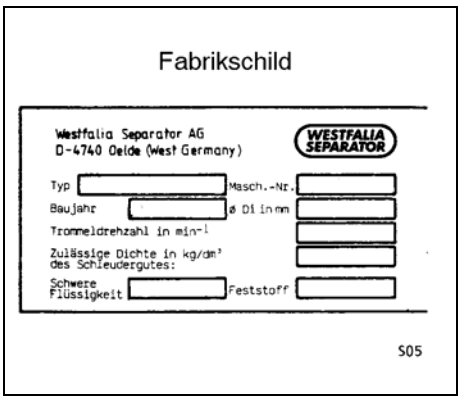


Fig. 25

- Refer to chapter ”operation”.
- Note nameplate. The values for
  – bowl speed
  – density of the heavy liquid
  – density of solids (centrifugally dry)
  are maximum values and must not be exceeded.

1.4.7 Maintenance

1.4.8 Corrosion

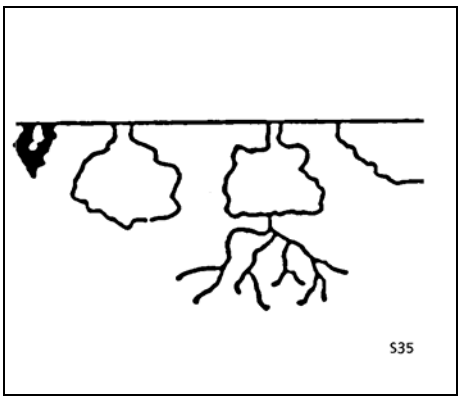
Corrosion can also affect bowl parts made of stainless steel. This corrosion can be flat-spread or pit- or crack-shaped and merits special attention.

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 using non-destructive techniques. At the initial stage pitting corrosion is generally caused by chlorine ions.

Depending on the stressing of the part, pitting corrosion can result in crack formation.



Possible formation of pitting corrosion.

Fig. 26

Such pittings can only be investigated by a materials expert.

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

Contact your nearest Westfalia Separator representative for a thorough examination.

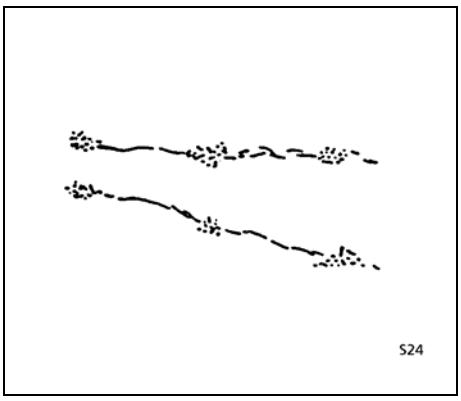
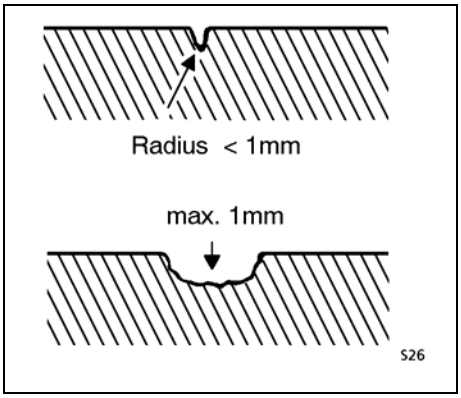


Fig. 27

Pittings

Such pittings should be investigated by a materials expert.

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



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

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

1.4.9 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 high-stressed bowl material.

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

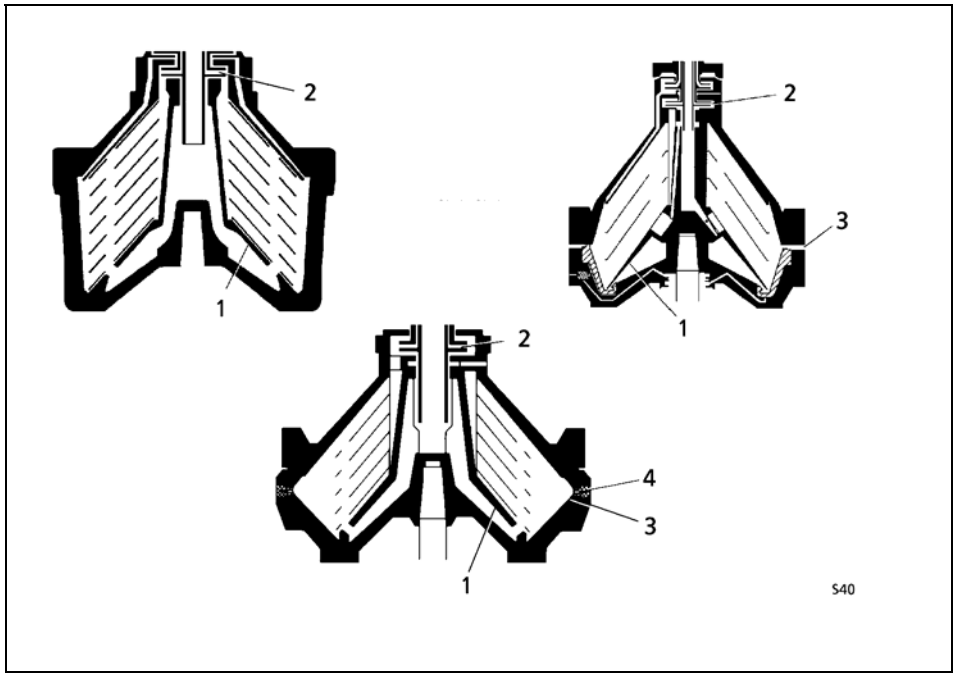


Fig. 28

The surfaces most susceptible to erosion are:

1) The bottom of the distributor
2) The centripetal pump (cavitation)
3) All surfaces in the area of the solids discharge ports
4) The nozzles

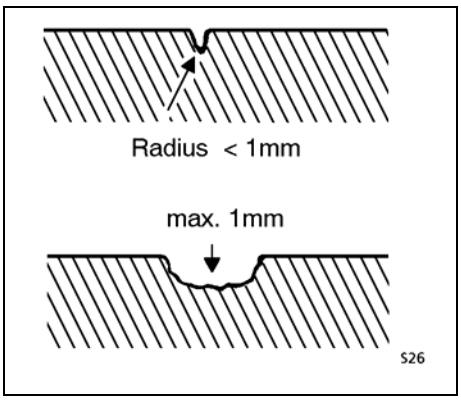


Fig. 29

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

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

1.5 Sight glasses

NOTE

When the wall thickness of a sight glass or sight glass housing has decreased by more than 10 %, the centrifugal mixer may not be operated again until the sight glass and / or sight glass housing have been replaced.

Consequently, all sight glasses in the feed and discharges of separators as well as all other sight glasses in its environment must be checked for wear on a regular basis. More detailed information on this is given in the DIN standards 7097 and 7080.

1.6 Steam sterilization

Separators which are designed for steam sterilization may only be sterilized with hot steam when the machine is at standstill.
Maximum steam overpressure: **see boilerplate**

Attention:
Hoods and solids catchers of steam-sterilizable separators are pressure vessels and may not be welded (consult the factory).

- To prevent burns:
  - Cordon off the separator and steam-carrying plant components to prevent persons coming into contact with them (chains, barriers etc.).
  - Attach a yellow warning light that blinks to indicate that sterilization is in progress.

1.7 Operation with hazardous materials

Extra special care must be taken when working on separators that are processing caustic substances such as acids and lyes or other dangerous products.

Machines that are operated with caustic substances are marked with the following safety sticker.



This safety marking means:

Caution!
Wear protective equipment whenever working on the separator.
Caustic substances can be a risk to life and limb and cause damage to machines and installation plants.

Danger of injury through caustic substances!

The stickers must always be in perfect condition.

- Clean dirty stickers.
- Replace damaged stickers.

In addition to observing the standard safety precautions that apply when working on separators, protective equipment must be worn when working on separators fed with dangerous products to avoid injuries.

Protective equipment consists of, for example:



NOTE

– Face screen
– Protective suit
– Protective gloves
– Protective boots
– Apron, etc.

1.8 Solids vessel blockage

The solids vessel can block during:

- start-up or shut-down,
- running production or
- a cleaning cycle.

Remedy:

- Switch off the installation in accordance with the installations.
- Put on the prescribed personal protective clothing and equipment.



CAUTION!

Switch off the separator before carrying out maintenance or repair work. Wait, observe and check that all rotating parts are at a standstill.

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

When operating the separator with hazardous products, there is a danger of fatal injury!

- Loosen the screw coupling of the solids pump and empty the solids vessel as far as possible.
- Open the inspection cover and remove the blockage from above. For this purpose, use a suitable tool since the vessel may contain caustic substances.
- Once the work is finished, carefully close and firmly tighten all screw couplings.

2 Installation

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2.2.1 Fastening the frame....50

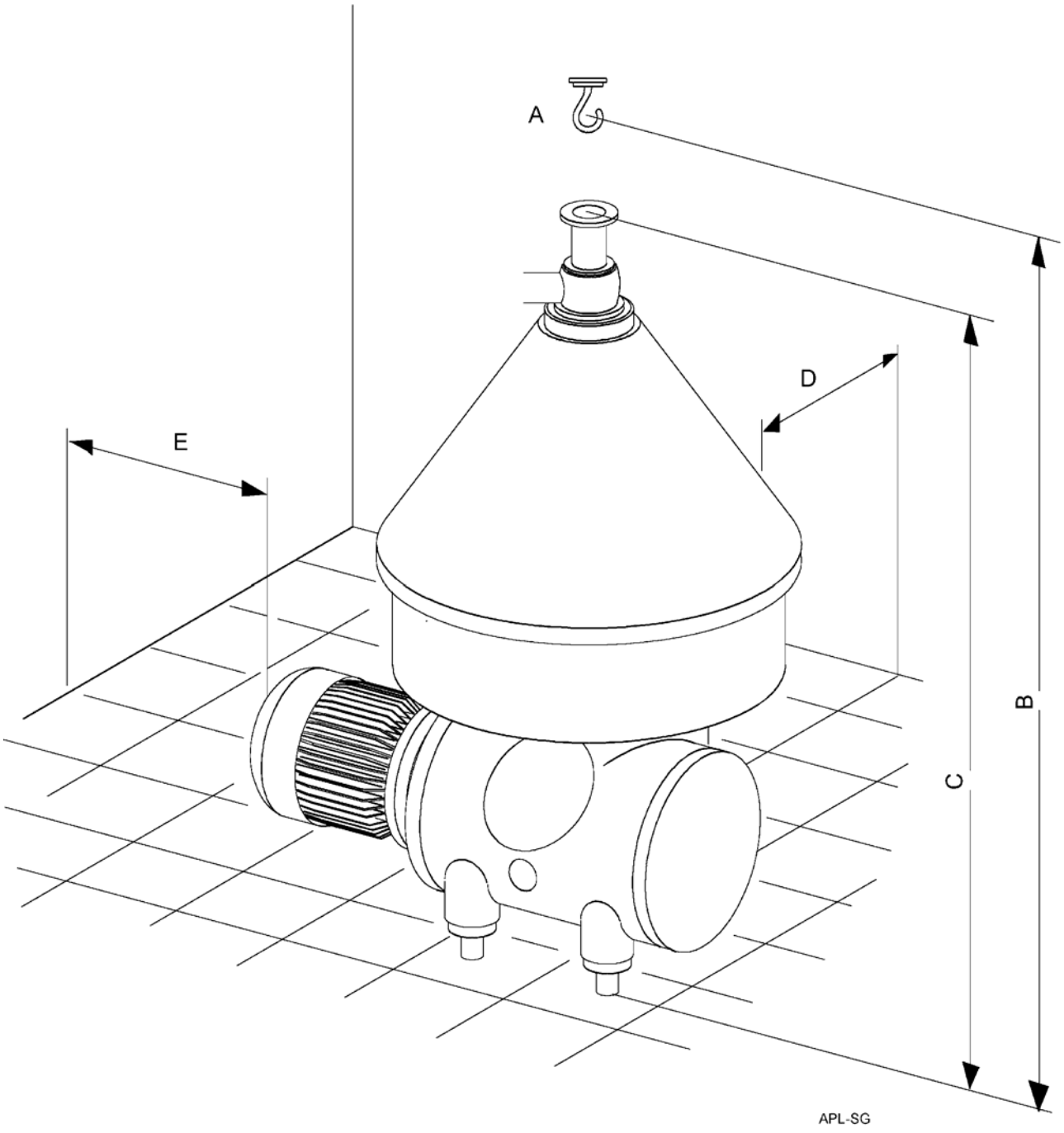


Fig. 30

Subject to modification- note project-specific dimensioned drawing!

A = Minimum lifting capacity for hoist for removing the bowl 1500 kg
B = Minimum height for hoist for removing the bowl 3000mm
C = Overall height approx. ca. 2400mm
D = Minimum lateral clearance approx. 800 mm
E = Recommended minimum space for removing the motor approx. 600 mm

Weights	
Frame with upper section/catcher without bowl	approx. 1100 kg
Bowl	approx. 950 kg
Hood	approx. 400 kg
Motor	approx.350 kg

Attention! Subject to modification – detailed dimensions are given in the furnished project–specific dimensioned drawing.

2.1 Transport

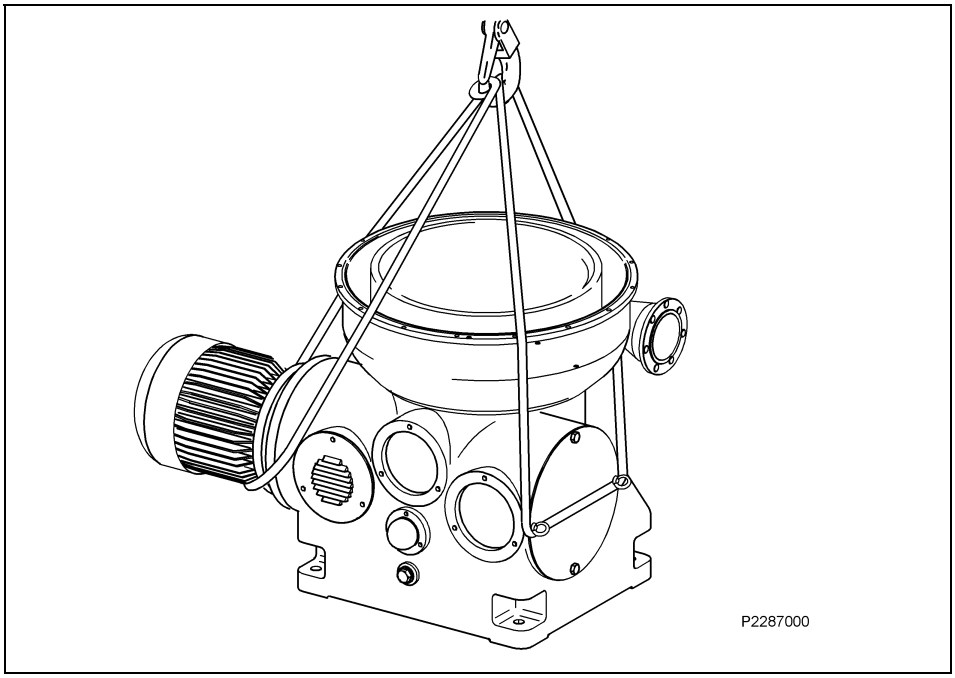


Fig. 31

Caution!

Avoid accidents by using suitably rated hoists for transport and installation.



CAUTION!

Note that the stationary hoist where the centrifuge is to be installed is usually only designed for removing and installing the bowl.

Use only adequately dimensioned hoists for transporting the frame.



NOTE

The weights of frame and bowl are specified in the dimensioned drawing or in the data sheet.

NOTE

Before transporting the separator, dismantle the motor protective hood (see diagram below).

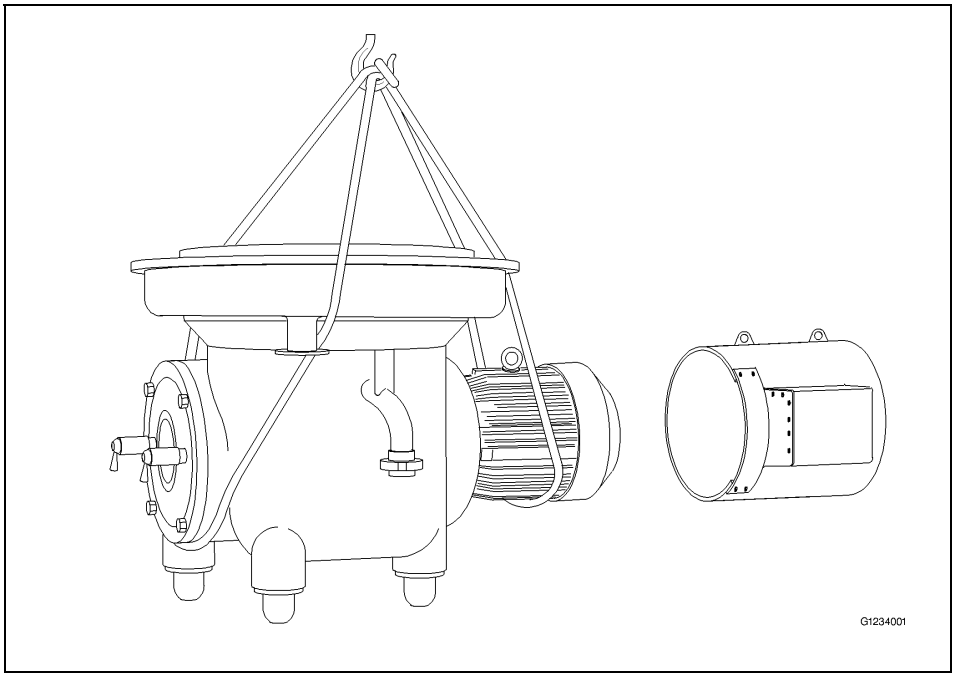


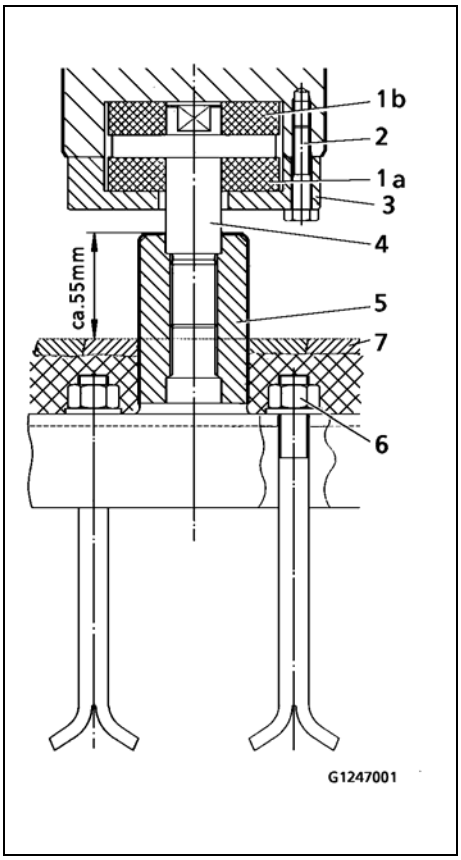
Fig. 32

- Depending on the machine design, attach the transport ropes in accordance with Fig. 31 or Fig. 32 and hang into the load hook of the hoist.
- Wind one piece of rope twice around the hook to prevent the ropes from slipping.
- Do **not** suspend the machine from the eye bolt on the motor.
- When lowering the separator, make sure it touches down gently.

2.2 Installation

- When installing the separator, make sure that sufficient room is available to operate and dismantle the machine (see dimensioned drawing).
- Do not install a shut-off valve in the frame drain and do not connect this frame drain to a piping system. The operating water must be able to discharge freely into a sewer or sludge tank, e. g. via a funnel.
- Otherwise water will enter into
  - the inside of the upper section of the frame and brakes the bowl, or
  - it can also seep down through the neck bearing into the gear chamber and damage the gear.
- Install a suitable dimensioned hoist for fitting and removing the bowl. The weights of the bowl are specified in the dimensioned drawing or in the data sheet.
- Connect the feed and discharge lines to the fixed piping by means of flexible compensators. Vibrations occurring during start-up and slowing-down of the machine are thus absorbed

2.2.1 Fastening the frame



1 Rubber cushion
2 Screw
3 Flange
4 Bolt
5 Foundation frame
6 Anchor bolt
7 Floor

Fig. 33

- Screw bolt 4 into the four cams of foundation frame 5 **as far as it will go.**
- Embed the foundation frame in the floor 7 so that the mounting blocks of the frame protrude from the floor by about 55 mm.
- Make sure that the mounting blocks are **absolutely level**. For fastening the foundation frame use anchor bolts 6.
- Remove bolts.
- Place the first rubber-metal cushion 1a and flange 3 on bolts 4.
- Screw in bolts again **as far as they will go.**
- Place the second rubber-metal cushion 1b on the bolts and place the separator on the bolts.
- Bolt flange 3 to the separator frame with screws 2.

NOTE

The dynamic forces of each individual installation foot act together as torque on the foundation.
The bearing forces are specified in the project-specific dimensioned drawing.
The load on the foundation by the separator must be calculated and verified. The foundation must be designed to withstand this load.
If necessary, the foundation must be reinforced.

3 Lubrication

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3.1.2 Oil check 52
3.1.3 Oil quantity 53
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3.3 Motor bearings 54

3.1 Bearings and gear

All bearings of the separator are splash-lubricated by:

– -Immersion of the toothed rim of the wormwheel in the central oil bath. (All bearings are splashed with oil due to centrifugal force.)

3.1.1 Oil quality

As lubricating oil use only industrial gear oils designated

- CLP 220 - according to DIN 51502
- CC 220 - according to ISO 3498

The lubricating oil must meet the following requirements:

Additives giving increased protection against corrosion and increased resistance to aging.		
Corrosion protection properties on steel:	degree of corrosion 0	DIN 51355/B
Corrosion effect on copper:	degree of corrosion 1	DIN 51759-100 A3
Additives for decreasing wear and increasing the load–carrying capacity.		
Basic requirement:	”FZG” gear rig test A/16,6/90 as per DIN 51534 load grade > 12	
Demulsifying power: min	< 60	DIN 51599
Viscosity at 40 °C mm²/s (cSt)	220 ± 22	

The gear oil designated "Separator lubricating oil CLP 220" (WS part-no. 0015-0014-080) which we have subjected to extensive tests meets the above requirements and should be used.



Attention

Do not use mineral motor car oils or motor oils.

3.1.2 Oil check

- Check oil level daily!



Attention

Check from time to time if oil contains water.
To do this, loosen oil drain screw and allow a small amount of oil to drain out.

- If the oil shows a milky colouring (emulsification) an immediate oil change is necessary.

3.1.3 Oil quantity

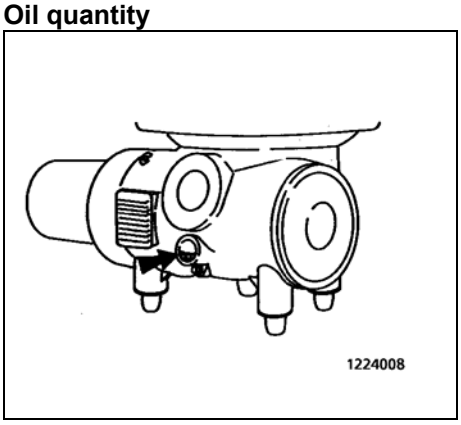


Fig. 34

Before the initial start-up of the separator:

- remove gear sight glass and fill gear chamber with oil.

Amount: See data sheet
Minimum oil level:
slightly above middle of sight glass.
Maximum oil level:
up to upper third of sight glass



Attention

During operation the oil level must never be allowed to sink below the middle of the sight glass; refill oil when necessary.

3.1.4 Oil change

- Make first oil change after about 250 operating hours; then
- change oil every 500 operating hours. However be sure not to wait longer than 6 months to change the oil.
- Each time when changing the oil, thoroughly clean gear chamber and flush it with thin-bodied oil before filling in new oil.
- Remove all metal particles from inner walls and corners of the gear chamber.
- Do not use fluffy cleaning rags or cotton waste.
- Clean sight glass.

3.2 Bowl parts

Before assembling the bowl, apply a thin film of one of the lubricants specified below to threads and contact surfaces of

- bowl bottom,
- piston,
- bowl top,
- lock rings, etc.

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

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

For separators operating in the **chemical industry** we suggest using:

- Molykote G
- Molykote G Rapid
- Gleitmo 800

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

N. B.:



Attention

When assembling make sure the gaskets made of the special material EPDM (Ethylene- propylene- diene- caoutchouc) do not come into contact with mineral oils and greases as this would cause the gaskets to swell.

- Silicon greases can be used for these gaskets to facilitate assembly.
- The greased surfaces must be free from sand and filings.
  Otherwise the surfaces can become scored.
- Also marks caused by knocks to threads, bearing and guide surfaces of the bowl parts can lead to seizing.
- Therefore, the threads, contact and guide surfaces must always be checked after cleaning.

3.3 Motor bearings



Instruction manual

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

4 Motor connection

4.1 Three-phase AC motor 56
4.2 Direction of rotation of the bowl 59
4.3 Bowl speed 59
4.4 Starting time of the bowl 61
4.5 Speed measuring device 61
4.6 Electronic vibration monitoring 61

4.1 Three-phase AC motor

All separators are driven by three-phase motors. Depending on the construction, the following drive variants are available:

- Direct drive
  - with frequency converter
- Gear drive
  - with fluid or centrifugal clutch
- Belt drive
  - with controlled torque motor
  - with frequency converter
  - with clutch



NOTE

The technical specifications on the motor supplied are given in the data-sheets supplied with the documentation, the motor nameplate and / ort he documentation of the motor manufacturer.
The switching devices must be rated for the starting current of the motor.

Starting currents

Depending on the different drive and motor types, different starting currents are required for starting a separator.

- with frequency converter approx. rated current
- with fluid or centrifugal clutch approx. 1.5 – 2 times rated current
- with controlled torque approx. 2 – 3 times rated current

Motor protection

- If the motor is equipped with a PTC thermistor, it must be connected to the corresponding tripping device.
- Lay the measuring circuit line (tripping device-motor) as a separate control line.



Attention!

Lubrication

If the motor is equipped with a re-lubricating device, it must be re-lubricated at regular intervals in accordance with the specifications of the motor manufacturer on the motor nameplate.

Motor with frequency converter (FC)

Pay attention to the following when operating the separator with frequency converter:

Attention!

- **The separator must never be started without frequency converter.**

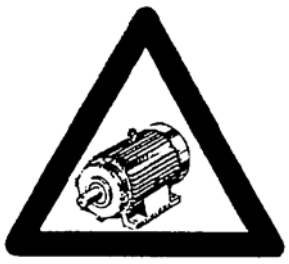
- The frequency on the frequency converter must be selected so that the maximum admissible bowl speed is not exceeded. The admissible bowl speed is indicated on the nameplate of the separator.

NOTE

The frequency converter has a frequency limiter to prevent operating at inadmissibly high bowl speeds. In addition, a speed sensor is installed on the separator which sends pulses to the control system for monitoring the bowl speed. The controls switch off the separator when the ceiling speed is exceeded.
The separator must only be operated with this auxiliary device.
The ceiling speed must be set to 5% above rated speed (see separator nameplate).

Important measures to take during commissioning:

- Check the correct setting of the monitoring devices in accordance with the circuit diagram and setting instructions.
- Check the speed of the drive spindle:
- Test the safety circuit.
- Attach the following safety stickers and check that they are properly attached and in good condition:



– Frequency converter operation!
Attention
Residual voltage possible P3373003

Fig. 35



Fig. 36



CAUTION!

- **Before carrying out maintenance or repair work on the motor, bear in mind that there may still be residual voltage.**

In this connection, refer to the documentation of the frequency converter manufacturer and have safety measures implemented by suitable personnel.

4.2 Direction of rotation of the bowl



CAUTION!

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

If the direction of rotation is wrong, the wiring of the motor power supply lead must be checked for conformity with the circuit diagram and changed accordingly. This may only be carried out by an authorised specialist.

4.3 Bowl speed

The bowl speed has been defined to assure operating safety as a function of the densities of the centrifugally dry solids and the clarified liquid.

The bowl speed and maximum admissible densities are stated on the nameplate of the separator. When processing products with densities higher than those stated on the nameplate, consult the factory.



CAUTION!

- **The bowl speed stated on the separator nameplate must not be exceeded.**

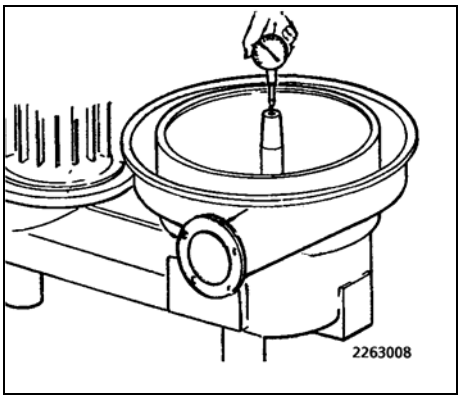


Fig. 37

In the case of separators with belt drive:
Check the spindle speed with a hand tachometer:

- after replacing the drive belt and/or the belt pulleys.

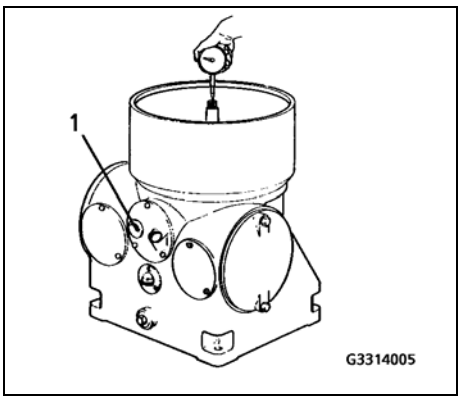


Fig. 38

In the case of separators with gear:
Check the spindle speed with a hand tachometer:

- after replacing the gear.

When a revolution indicator disk 1 is fitted, it

- indicates that the separator is in operation
- shows the direction of rotation.
- monitors the operating speed

NOTE

The spindle speed must be checked before the first start-up and before fitting the bowl.

4.4 Starting time of the bowl



NOTE

Specifications on the starting time of the bowl are given in the enclosed data sheets.

- Make sure that the bowl reaches its rated speed within the starting time and that this speed is maintained during operation.

Separators with a motor controlled by frequency converter can be re-started any time.



IMPORTANT

The following applies for separators with controlled torque motors:

Re-starting after the motor has reached a constant operating temperature is permitted only after 60 minutes.

Non-observance of this instruction can lead to overheating of the clutch or motor.

4.5 Speed measuring device

When the separator is equipped with a speed measuring device, detailed explanations are given in the documentation furnished with the separator control.

4.6 Electronic vibration monitoring

Electronic vibration monitoring systems protect the separator against inadmissibly high vibration levels.

If certain preset limit values are exceeded, an alarm is given and follow-up measures are initiated.

Vibration monitoring of the bowl spindle

On some separators, a further proximity switch for additional vibration monitoring of the bowl spindle is fitted. When bowl imbalance occurs (= vibratory motion of the spindle), this information is transmitted to a downstream evaluating unit and/or indicator and the necessary follow-up measures are initiated.

Note
Notes
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Notes
Note

5 Bowl

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5.9 Fitting the piston valves 98
5.10 Disk stack compressing device 99

5.1.1 Special risks of a separator

The separator is equipped with a high-speed rotating metal bowl which represents a danger potential not to be underestimated on account of the rotational energy which can pose a danger for the installation and persons working in the installation when not properly handled.



CAUTION!

Switch off the separator before carrying out maintenance or repair work.
Wait, observe and check that all rotating parts are at a standstill.
Do not reach into the rotating drive section or bowl!
Do not loosen any part before the bowl has come to a standstill!

Risk of injury and danger to life through rotating parts.

Standstill should not be checked using only one source of information (e.g. speed indicator) but must be backed up by at least one further checking device. It must always be reckoned with that the first used indicating option for standstill will provide false information because, for example, the electronics have failed or the belt or gear in the drive is defective.

The following options are available for checking standstill on separators depending on the version:

- Electric speed indicator
- Revolution indicator or sight glass on the gear cover
- The inspection port on the hood enables a direct view onto the bowl. In addition, checking is possible by removing the gear cover or opening the frame port on the bowl side.

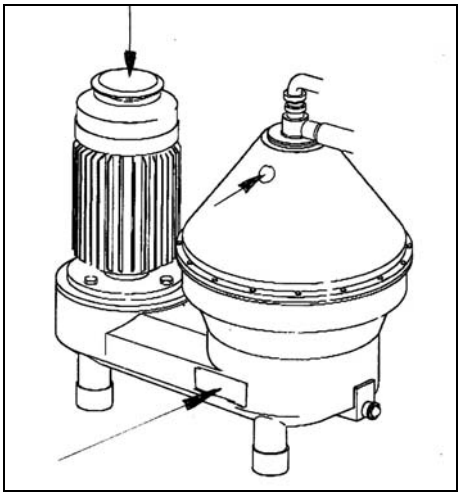


Fig. 39

Revolution visual check on machines with belt drive.

You can observe whether the machine is at a standstill at the points marked with the arrows.

We reserve the right to carry out design modifications.



NOTE

Observing the motor fan is not a reliable method of checking standstill because the motor or fan can already be at a standstill when the separator bowl is still rotating.

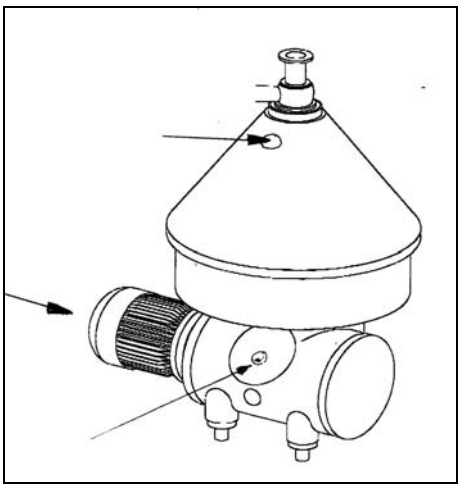


Fig. 40

Revolution visual check on machines with gear.

You can observe whether the machine is at a standstill at the points marked with the arrows.

We reserve the right to carry out design modifications.

NOTE

Observing the motor fan is not a reliable method of checking standstill because the motor or fan can already be at a standstill when the separator bowl is still rotating.

During cleaning programs (steam sterilization and CIP), very high temperatures are reached on the surfaces of the separator and piping.

CAUTION!

During cleaning programs, the surfaces of the separator and pipes are very hot.

Danger of burns!

With some products, the separator has to be cooled. As a result, temperatures of up to minus 30 °C are reached on the surfaces of the separator and pipes.

CAUTION!

When the cooling is switched on, the surfaces of the separator and pipes can get very cold.

Danger of frostbite!

CAUTION!

When the noise level of the separator is too high, noise-dampening ear protectors must be worn.

Danger of hearing damage!

CAUTION!

During all maintenance and repair work on the separator, the fittings and pipes may spit out hot, caustic liquids.

Danger of causticization of skin and eyes!

5.1.2 Safety precautions for maintenance and repair

- Observing the maintenance intervals and user information is decisive for the service life and permanent operating readiness of the separator.
- The maintenance intervals depend on the operating conditions. Especially highly stressed parts of the separator must be regularly checked. Adapt the maintenance intervals to the operating conditions!
- Timely maintenance of the separator is essential for safe operation.

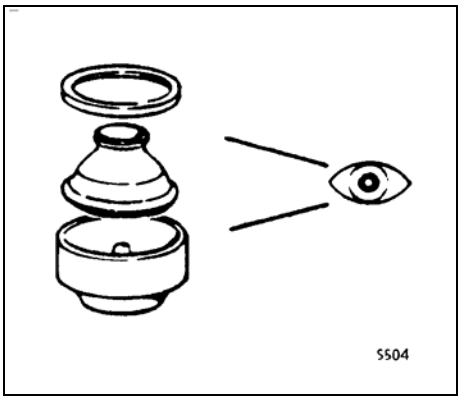


Fig. 41

Especially highly stressed parts of the separator such as
- bowl lock ring,
- bowl bottom,
- bowl top

must be regularly checked (at least once a year) as specified in the maintenance schedule to assure safe and efficient operation.



Fig. 42

When carrying out maintenance and repair work:

- **Do not climb onto or stand on the machine or parts of the machine!**

Danger of injury through slipping or falling down!

- Repairs to the separator may only be carried out by service technicians from Westfalia Separator or personnel trained and certified by Westfalia Separator.

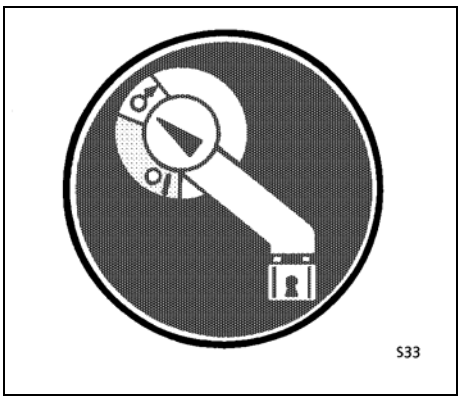


Fig. 43

- During maintenance and repair work, make sure that the main switches are switched off and secured against restarting.
- Make sure that other persons do not have the possibility to start the machine before the maintenance or repair work is finished.

- Make sure that the rotating parts of the separator (drive, bowl) are at a standstill before carrying out maintenance and repair work.
-
- When the machine is defective, a warning sign must be attached and the separator must be secured against unauthorized starting.

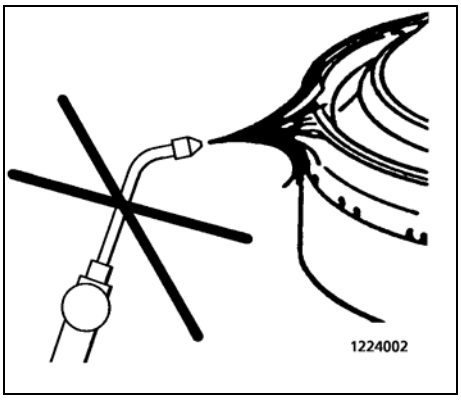


Fig. 44

- **Do not heat bowl parts with a naked flame to facilitate dismantling work.**

Structural changes in the material of the bowl parts which affect the operating safety of the machine may result!

- **Do not weld bowl parts.**

- Do not weld hood and solids catcher parts of steam-sterilizable separators.

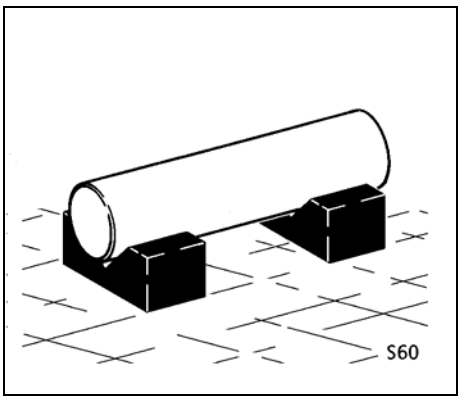


Fig. 45

- Place the dismantled separator parts on suitable surfaces (rubber, wood etc.).
- Take appropriate steps to prevent machine parts from overturning and rolling away.

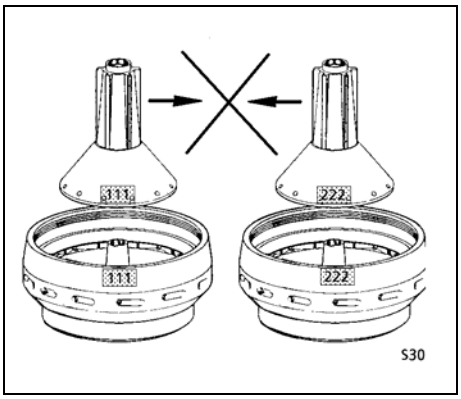


Fig. 46

- When carrying out assembly work on several separators, be careful not to interchange parts of different bowls! Each bowl must be balanced with its respective components.

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

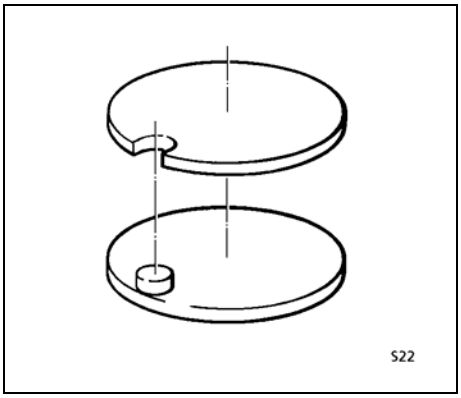


Fig. 47

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

The separator may not be operated when locking devices and marks on the bowl parts are damaged.

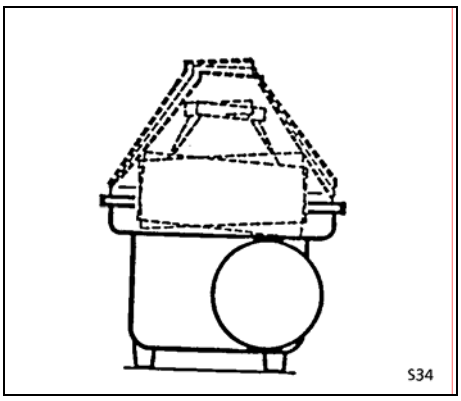


Fig. 48

- After fitting certain bowl parts (e.g. bowl bottom, bowl top) the bowl must be re-balanced.

Bowl balancing may be carried out only by specialists from Westfalia Separator or specialist workshops authorized by Westfalia Separator!

If in doubt, consult the service department of Westfalia Separator.

- Do not manipulate speed-altering devices such as frequency converters so that the maximum admissible bowl speed (see nameplate or “technical data” in the instruction manual) is not exceeded.
- Ensure that monitoring devices (e.g. overspeed monitors etc.) are not manipulated or damaged and check their function in accordance with the instructions in chapter **“Maintenance and repair – maintenance schedule”**.

- When carrying out maintenance and repair work, carry out a visual check of the separator components. Have the components checked for damage through **corrosion** and **erosion** by **authorized specialists** and proceed in accordance with the instructions in chapter **“Maintenance and repair – inspections”**.



Caution

The separator must be shut down immediately when damage due to corrosion or erosion is detected!

There is a risk of damage to the separator and a danger to life and limb of the user through machines parts flying around.

In case of doubt, contact Westfalia Separator!

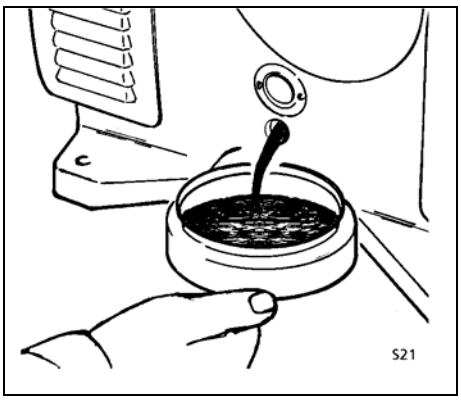


Fig. 49

- Follow the instructions when handling waste oils and comply with the disposal regulations when replacing lubricants in the chapter **"Maintenance and repair"** of the instruction manual.

- After maintenance and repair work on the separator, refit all protective devices.

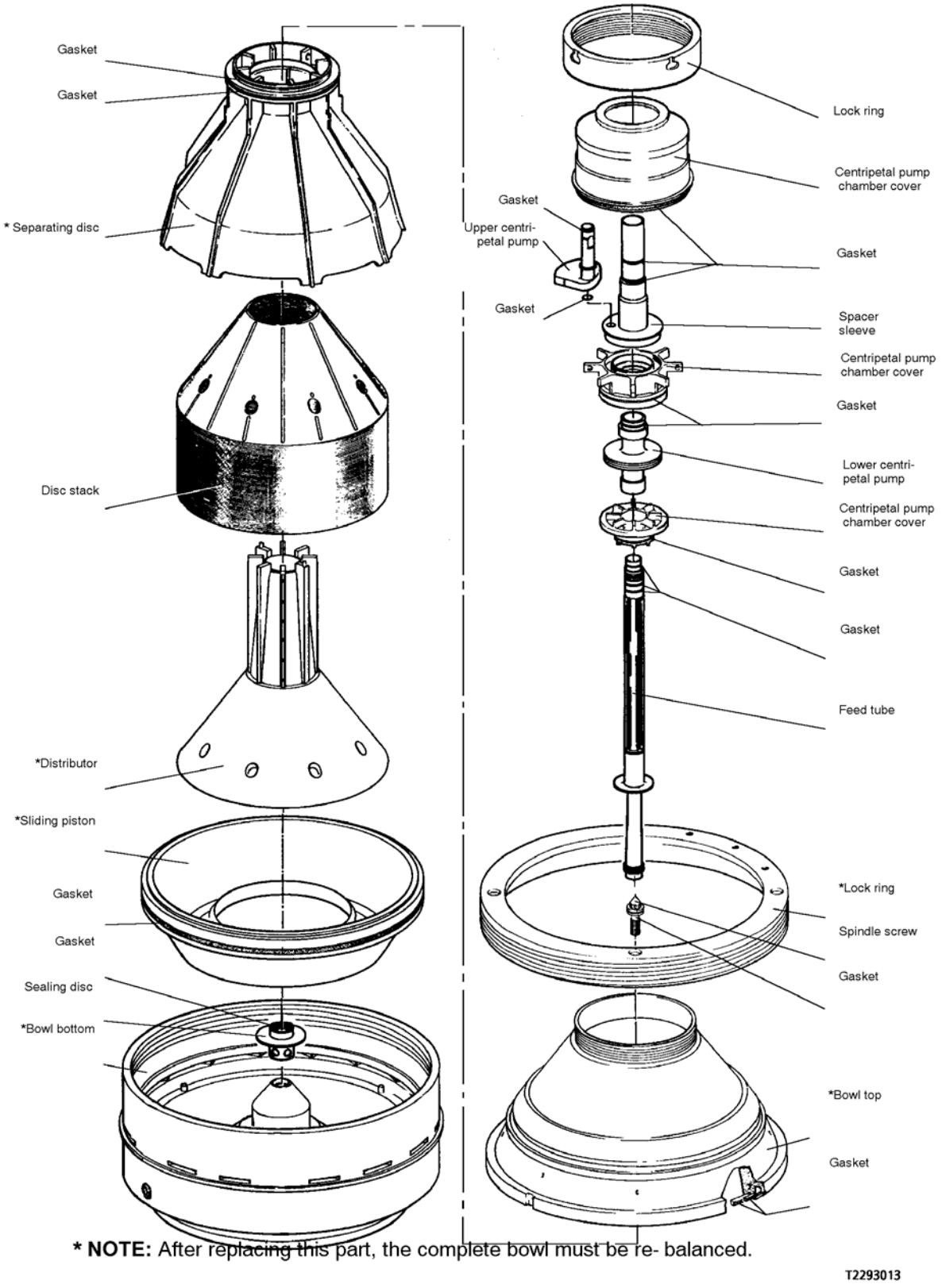

Gasket
Gasket
* Separating disc
Disc stack
*Distributor
*Sliding piston
Gasket
Gasket
Sealing disc
*Bowl bottom
Lock ring
Centripetal pump chamber cover
Gasket
Upper centri-petal pump
Gasket
Spacer sleeve
Centripetal pump chamber cover
Gasket
Lower centri-petal pump
Centripetal pump chamber cover
Gasket
Gasket
Feed tube
*Lock ring
Spindle screw
Gasket
*Bowl top
Gasket
* NOTE: After replacing this part, the complete bowl must be re- balanced.
T2293013

Fig. 50

5.2 Important hints

The clarifier bowl rotates at a very high speed.
Hence, forces are produced which can endanger the operating safety of the bowl in case of

- incorrect assembly or
- inadequate cleaning of the bowl.

The instructions for assembly must therefore be followed exactly.

The following points should also be observed:

- Before fitting the bowl parts thoroughly clean, grease or lubricate (3.2) the following and check for impact marks:



Guide and contact surfaces

- Bowl lock ring

- Note that lubricating surfaces are clean.
- When fitting the bowl parts, make sure that the "O" marks on all parts are in line with each other.
  (Only then will the parts fit correctly over arresting pins and guide ribs).
- Avoid damage when fitting and removing parts by
  - exact positioning.
  - avoiding diagonal pull.
  - selecting the lower lifting speed of the hoist.



- Only use correctly rated, fully functional hoists.
- Do not use force to fit or remove parts.

- Before fitting gaskets, check the gaskets and gasket grooves for cleanness and wear.
- After fitting, check that the gaskets
  - are not twisted.
  - fit evenly into their grooves.
- Handle all bowl parts with care.
- Always place them on a rubber mat or pallet.

In the case of a plant with several clarifiers:



Do not interchange parts of 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.

5.3 Removing the feed and discharge connections

- Switch off the main switch and lock it so that it cannot be switched on again.

Attention!
To prevent accidents, do not loosen any parts before the bowl has come to a standstill!

Standstill of bowl is signaled by
- LED „bowl standstill" or
- the speed indicator in the control unit or in the motor control, or
- the revolution indicator, or
- standstill of the gear, to be seen through the sight glass in the frame.

- Be sure to replace worn gaskets immediately.
- For tools, see chapter 12.
- Stop compressed-air supply.

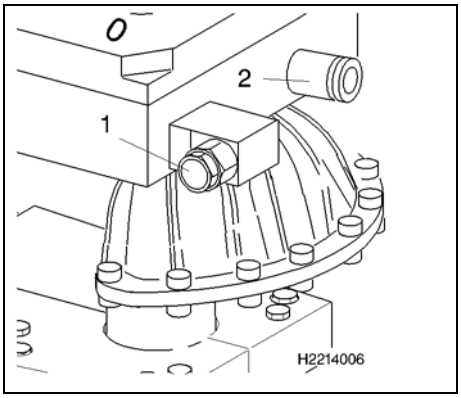


Fig. 51

- Disconnect current supply line 1 and compressed-air supply line 2.
  Note:
  This has to be done **before** removing the protecting cases **- danger of crushing!**

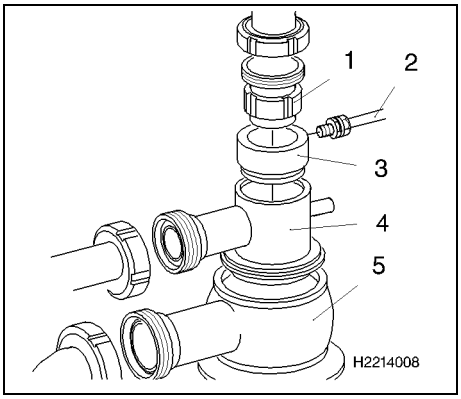


Fig. 52

- Disconnect the feed and discharge lines.
- Remove current supply to contact pressure gauge and sight glass illumination.
- Unscrew vent line 2.
- Unscrew connection piece 1.
- Lift off the following components:
  - vent piece 3,
  - upper discharge 4,
  - lower discharge 5.

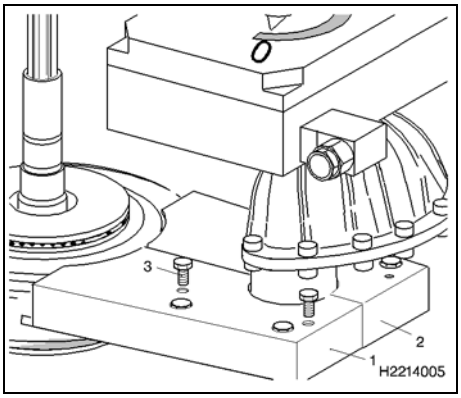


Fig. 53

- Unscrew hex head screws 3.
- Remove protecting-case halves 1 and 2.

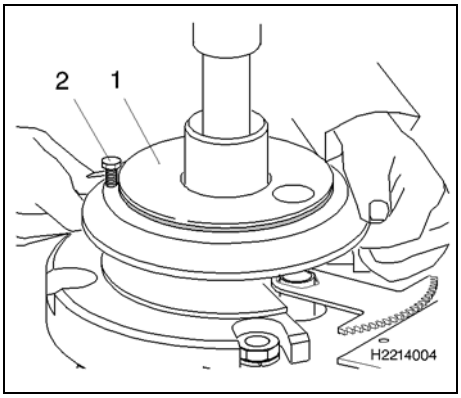


Fig. 54

- Lift off ring 1 or, if required, detach it by threading hex head screws into the tapholes provided.

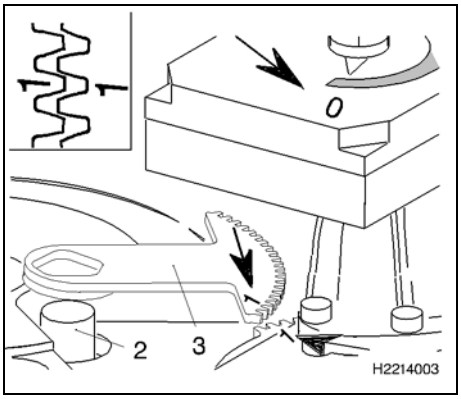


Fig. 55

- Remove toothed segment 3.

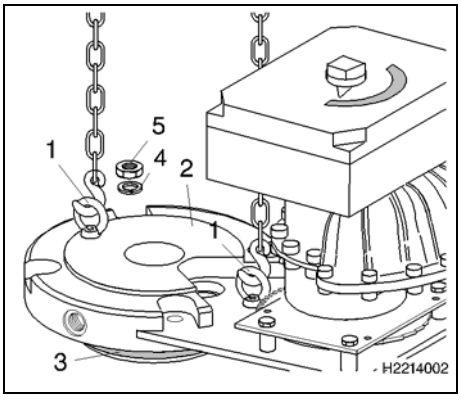


Fig. 56

- Unscrew hexagon nuts 5.
- Thread two eye bolts 1 into the tapholes.
- Lift off ring 2 together with swivel-type actuator. For the transport, use lifting device, if required (correct application is shown on **Fig. 58**).

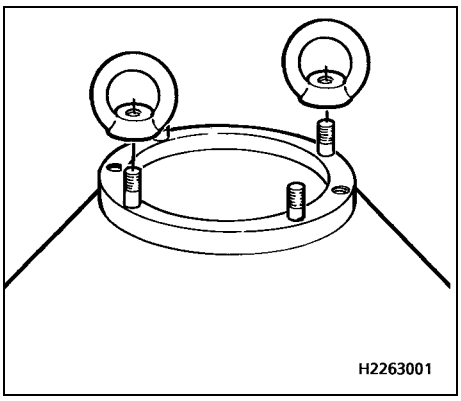


Fig. 57

- Screw two ring nuts opposite each other onto the studs of the hood.

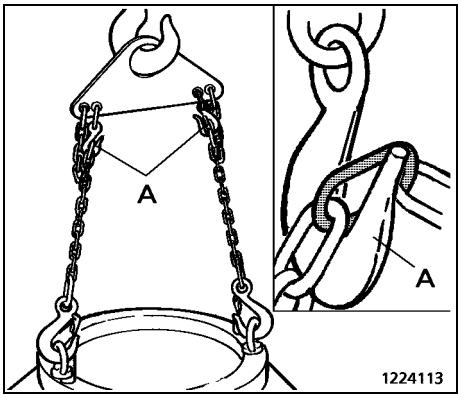


Fig. 58

- Unscrew the fastening screws of the hood.
- Shorten the chains of the lifting device.
- Hang the shortened lifting device into the lifting-eye nuts and lift off the hood.

5.4 Dismantling the bowl

- Switch off and lock the main switch.

Caution!
To prevent accidents, do not loosen any part of the machine until the bowl has come to a standstill!

Standstill of the bowl is indicated
- by the LED "bowl standstill" or
- by the speed indicator in the control unit or in the motor control or
- revolution indicator or
- gear standstill, visible through the sight glass on the frame.

- Replace worn gaskets immediately.
- For tools see chapter 12.
- Release brake before opening the bowl.

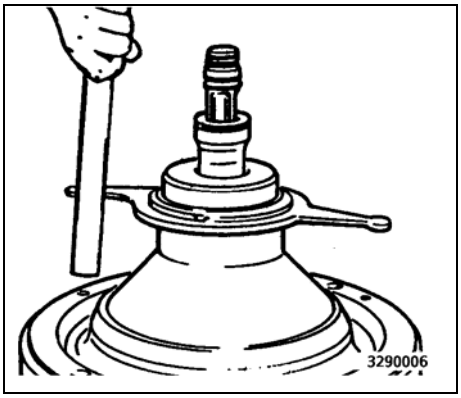


Fig. 59

- Unscrew centripetal pump chamber lock ring by lightly hammering against the handle of the annular wrench **(left-hand thread).**
- Lift off centripetal pump lock ring.

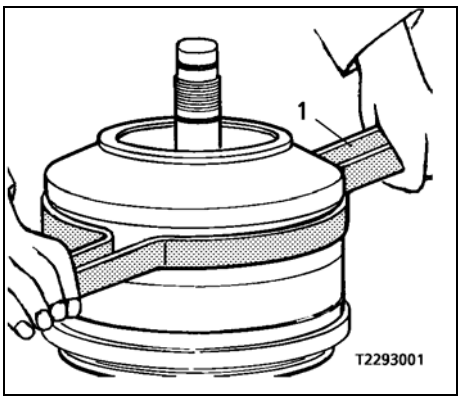


Fig. 60

- Lift off centripetal pump chamber cover using lifting tongs 1.

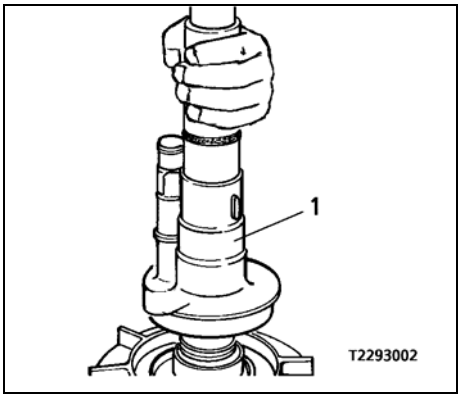


Fig. 61

- Pull off distance sleeve 1.

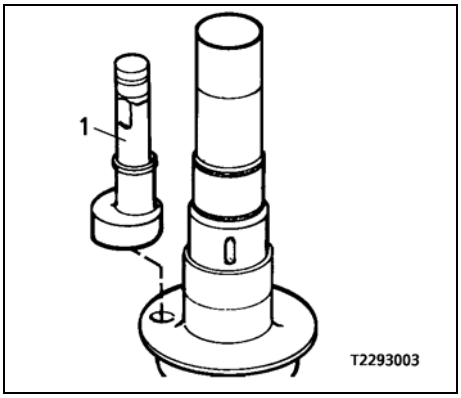


Fig. 62

- Remove upper centripetal pump 1.

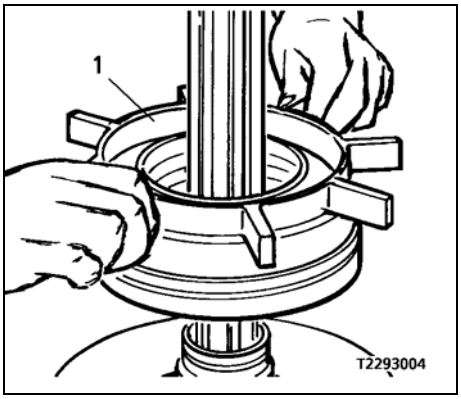


Fig. 63

- Lift off centripetal pump chamber cover 1.

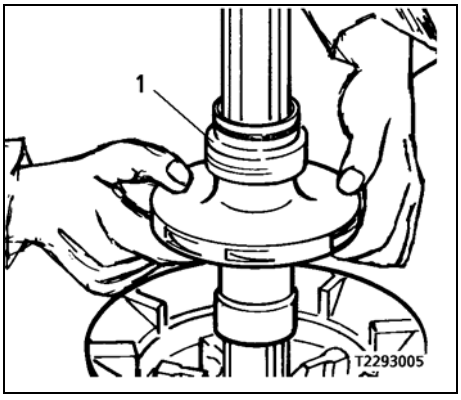


Fig. 64

- Pull off lower centripetal pump 1.

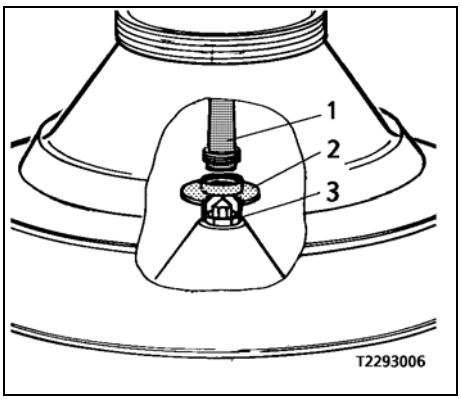


Fig. 65

- Place feed tube 1 with hydrodisk on hexagon 3 in the bowl bottom.
- Unscrew feed tube 1 from hydrodisk 2 by hand **(left-hand thread)**.

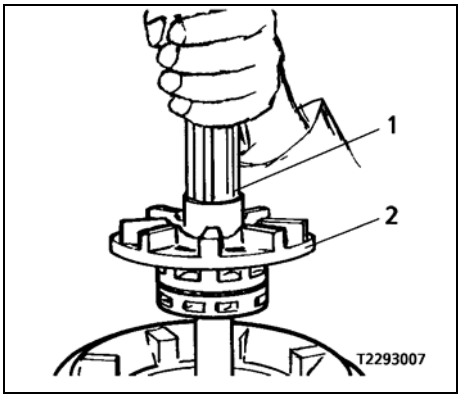


Fig. 66

- Lift out feed tube 1 with centripetal pump chamber 2.

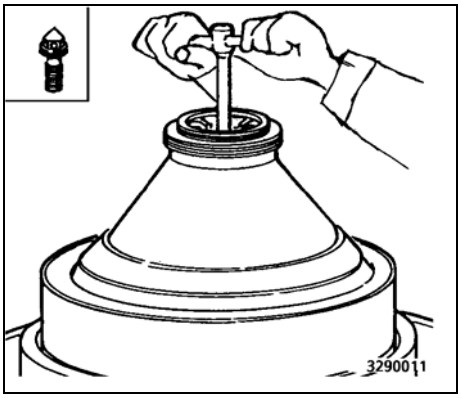


Fig. 67

- Unscrew spindle screw with wrench **(left-hand thread).**

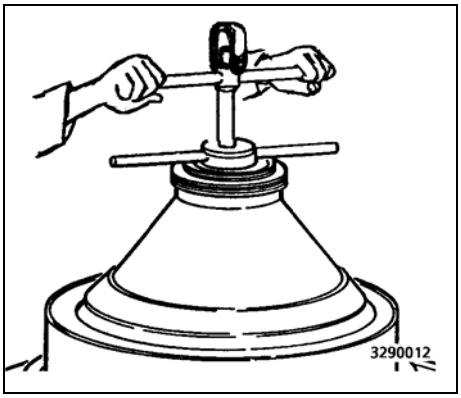


Fig. 68

- Force the bowl off the spindle cone using the jack (distributor/bowl).

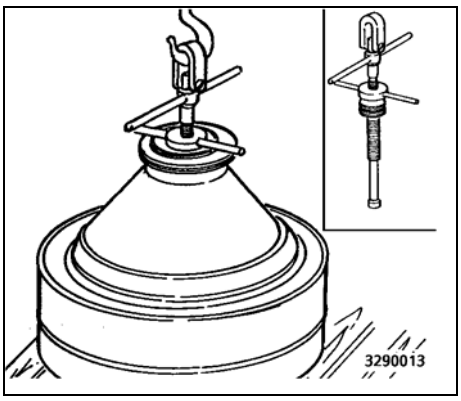


Fig. 69

- Place the bowl on a rubber mat or wooden pallet for further dismantling.

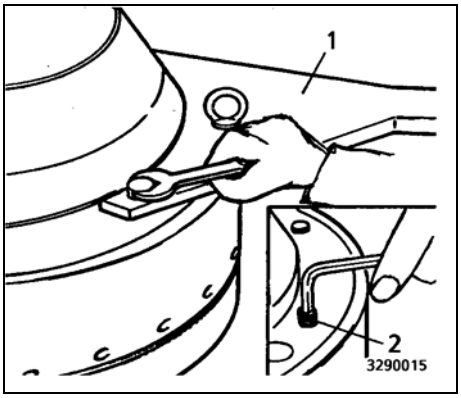


Fig. 70

- Unscrew threaded pins 2 out of the bowl lock ring.
- Fit wrench 1. Screw in screws of the wrench tightly.

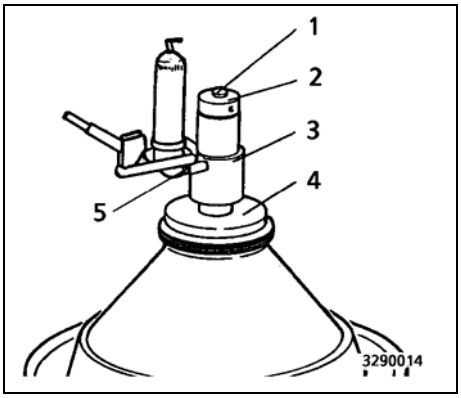


Fig. 71

Mount compressing device:

- Place disk 4 onto bowl top.
- Screw bolt 1 as far as it will go into the bowl bottom **(left-hand thread).**
- Insert hydraulic part 3 into the centering recess of the disk.
- Screw on threaded ring 2 until its upper edge is flush with end thread of bolt 1 **(left-hand thread).**

To prevent damage to threads:

- **Screw in threaded bolt as far as it will go.**
- **Screw on threaded ring until end of thread.**

If the threaded ring cannot be screwed down completely, then the piston and the cylinder of the compressing device are too far apart.

In this case:

- Bring piston and cylinder back into their starting position:
  - Loosen pressure relief screw 5 by two turns.
  - Move the pump lever to its lowest position.
  - Screw on threaded ring until end of thread.
- Tighten screw connections of the compressing device.
- Close pressure relief screw 5.

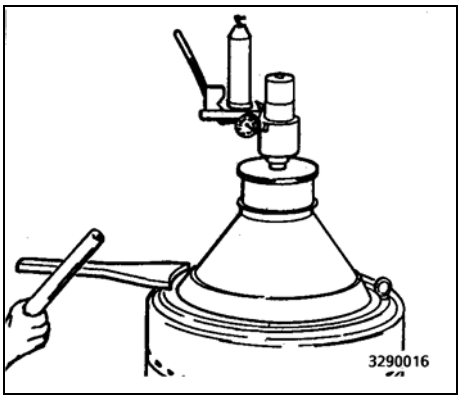


Fig. 72

- Compress disk stack to facilitate loosening of the bowl lock ring.
  Pressure: 250 bar
- Loosen the bowl lock ring by hammering against the handle of the wrench with a mallet **(left-hand thread).**

- **If the lock ring is jammed, heat the upper part of the bowl bottom with steam or hot water.**
  Other heat sources such as soldering lamp or welding torch may not be used.

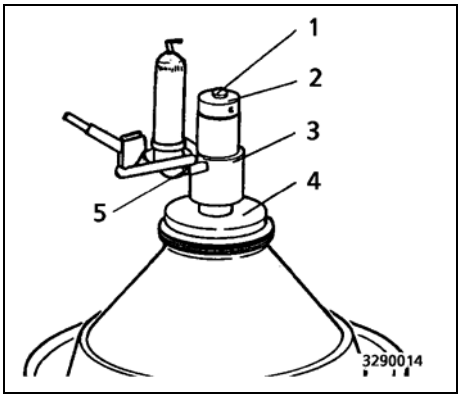


Fig. 73

Remove the compressing device:

- Move pump lever of compressing device down as far as it will go to prevent it from jumping back.
- Loosen pressure relief screw 5.
- Unscrew threaded ring 2 **(left-hand thread).**
- Remove hydraulic part 3 with disk 4.
- Unscrew bolt 1 **(left-hand thread).**

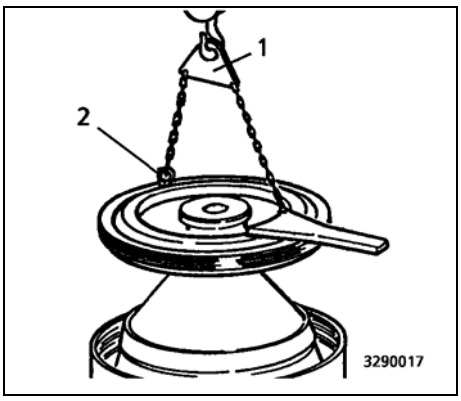


Fig. 74

- Unscrew bowl lock ring completely and lift it out using device 1 and eye bolt 2.

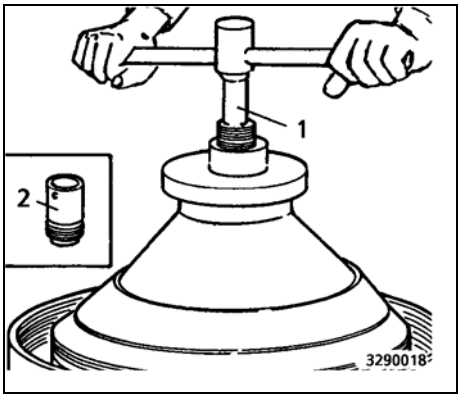


Fig. 75

- Screw pressure piece 2 of the lifting device (bowl top) into the distributor neck.
- Screw lifting device 1 onto the bowl top.
- Force the bowl top off the bowl bottom by turning the spindle clockwise and remove it.
- Unscrew pressure piece from the distributor neck.

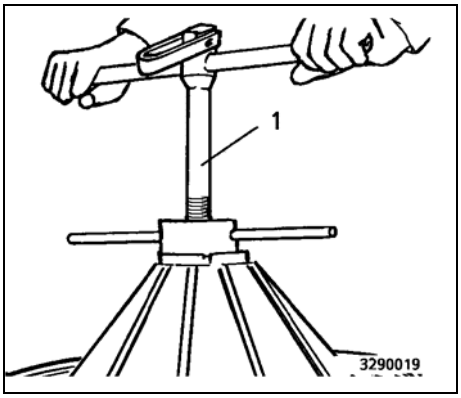


Fig. 76

- Screw lifting device 1 into the distributor.
- Press off distributor together with disk stack by turning the spindle clockwise.
- Lift out distributor with disk stack.

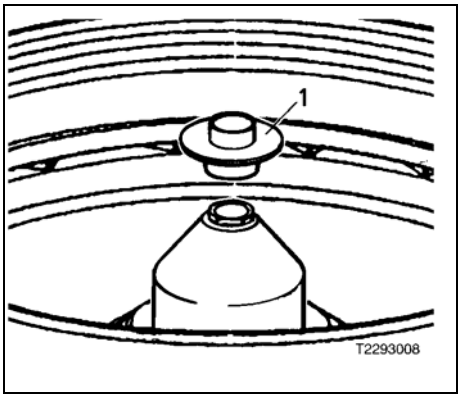


Fig. 77

- Take out hydrodisk 1.

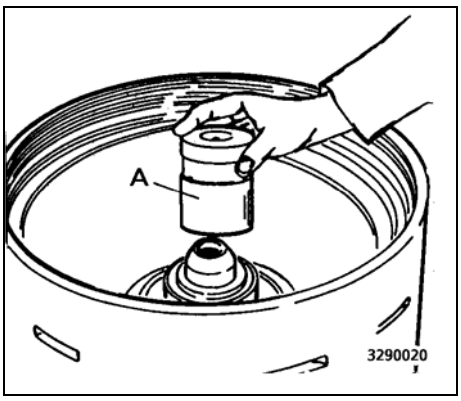


Fig. 78

- Place pressure piece A of lifting device (sliding piston) on the hub of the bowl bottom.
- Grease outer surface of the pressure piece.

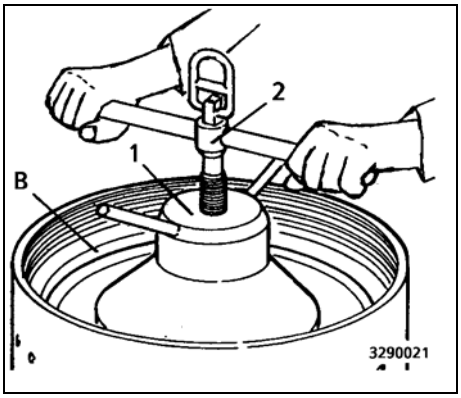


Fig. 79

- Screw lifting device 1 onto the sliding piston.
- Force sliding piston off the bowl bottom by turning threaded soindle 2 clockwise.
- Lift off sliding piston.
- Make sure that sealing lip B of the sliding piston does not get damaged.

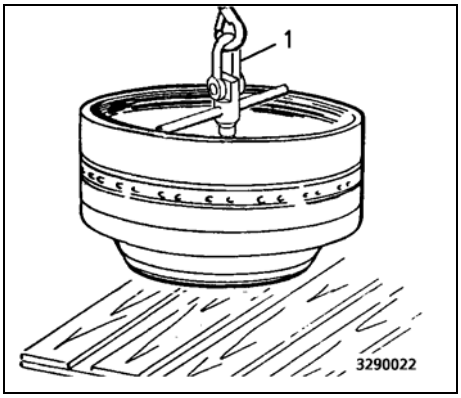


Fig. 80

- Use jack 1 for transporting the bowl bottom.

5.5 Assembling the bowl

- Assemble the bowl on a rubber mat or wooden pallet.
- For lubricating the threaded areas and guide surfaces of the bowl parts, refer to 3.2.

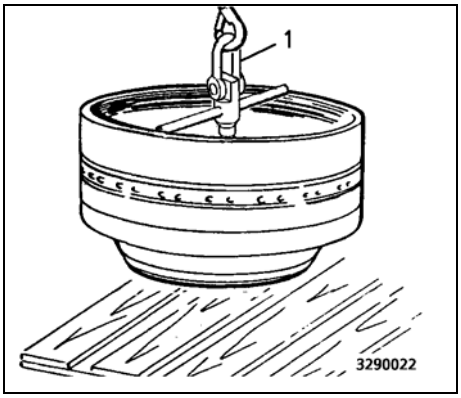


Fig. 81

- Use jack 1 for transporting the bowl bottom.

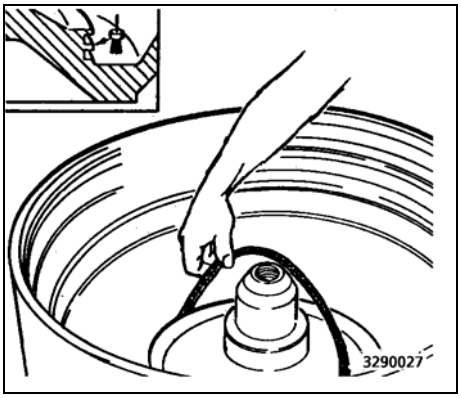


Fig. 82

- Thoroughly clean the two gasket grooves in the bowl bottom and apply a thin film of grease.
- Insert the gaskets into the grooves in the bowl bottom.

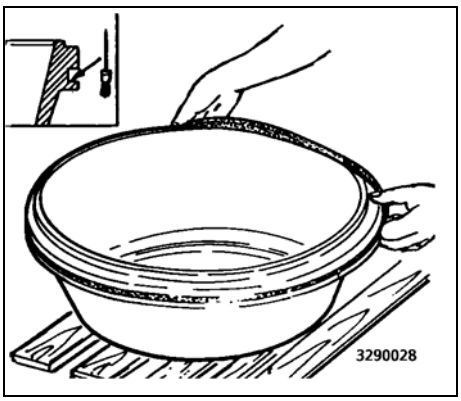


Fig. 83

- Thoroughly clean gasket groove in the sliding piston and apply a thin film of grease.
- If the gasket to be fitted is new, it must be stretched equally all the way round until its outer diameter almost corresponds to the outer diameter of the groove in the sliding piston.
- Insert gasket into the groove of the sliding piston.

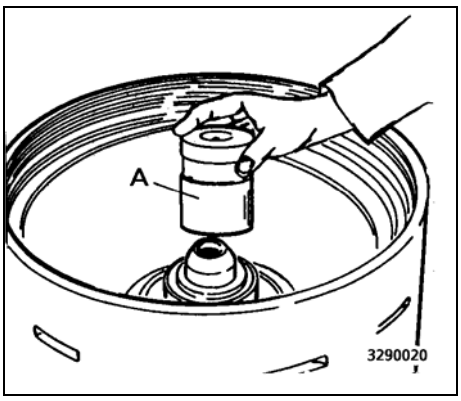


Fig. 84

- Place pressure piece A of the lifting device (sliding piston) on the hub of the bowl bottom.

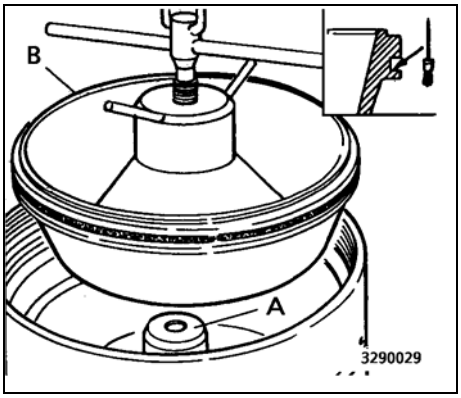


Fig. 85

- Grease guide surfaces of the sliding piston and bowl bottom.
- Insert the sliding piston using lifting device so that the "O" marks are perfectly aligned.
- Lower the sliding piston slowly by turning the jackscrew anti-clockwise until the arresting pins of the bowl bottom catch into the holes of the sliding piston. If necessary, wriggle the piston until it snaps into position.

- **Be careful not to damage sealing lip B of the sliding piston.**
- **After inserting the sliding piston take out pressure piece A.**

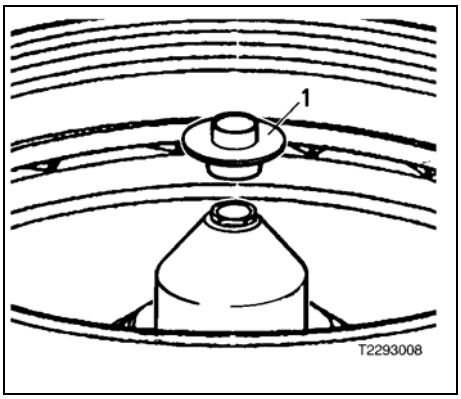


Fig. 86

- Insert hydrodisk 1.

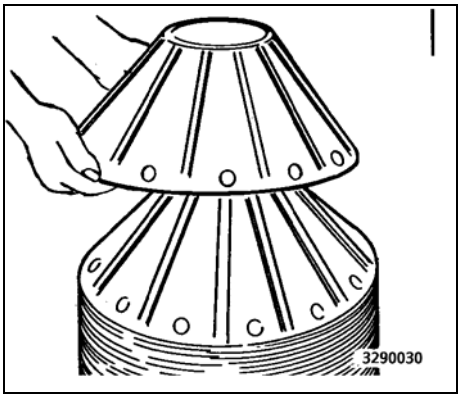


Fig. 87

- Stack the disks onto the neck of the distributor in numerical order, beginning with number 1.

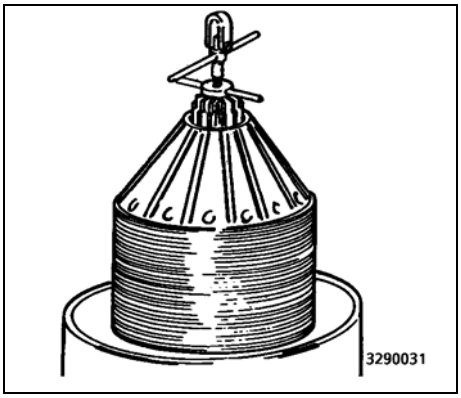


Fig. 88

- Grease the contact surfaces.
- Install distributor together with disks in the bowl bottom.

  The "O" marks on the bowl bottom and distributor must be aligned; the arresting pins in the bowl bottom will then catch into the holes of the distributor.

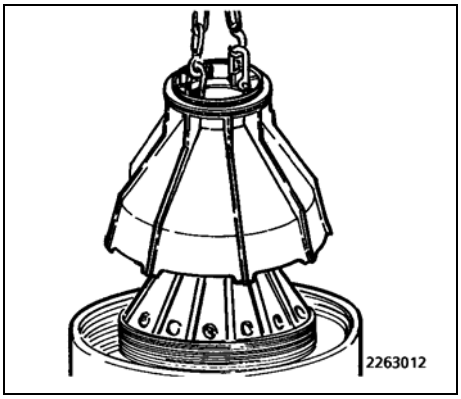


Fig. 89

- Install separating disk with inserted gaskets.

  The "O" marks on the separating disk and bowl bottom must be aligned.

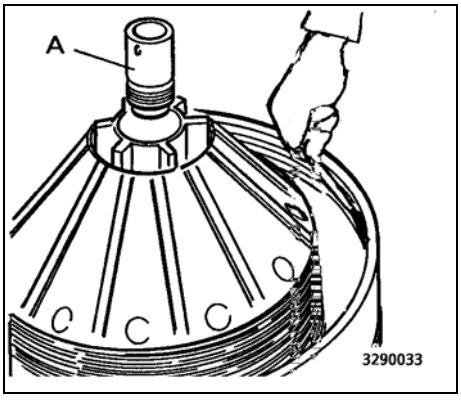


Fig. 90

- Clean and grease guide surfaces and threads of the bowl bottom.
- Screw pressure piece A into the distributor neck as a support for the lifting device (bowl top).

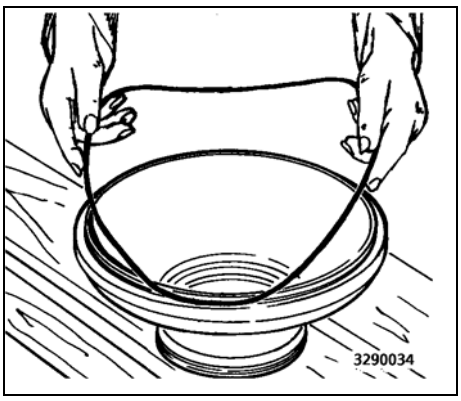


Fig. 91

- Insert gaskets into the grooves of the bowl top.
  If the main bowl gasket has to be replaced, see **5.7**
- Clean and grease guide surfaces of the bowl top.

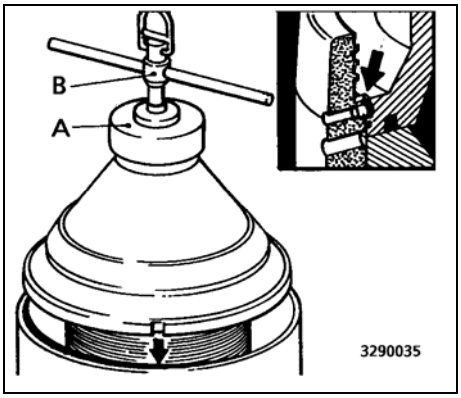


Fig. 92

- Place bowl top on bowl bottom using lifting device A.
  Slowly lower the bowl top by turning jackscrew B anticlockwise.
  Make sure that the arresting piece of the bowl bottom catches into the groove of the bowl top.
  The "O" marks of both parts must be aligned.
- Unscrew pressure piece from the distributor neck.

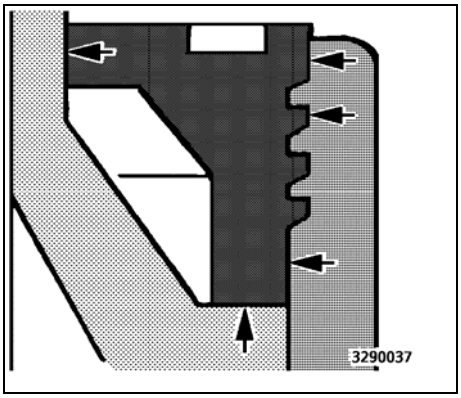


Fig. 93

- Check and grease threads as well as contact and guide surfaces (see arrows).

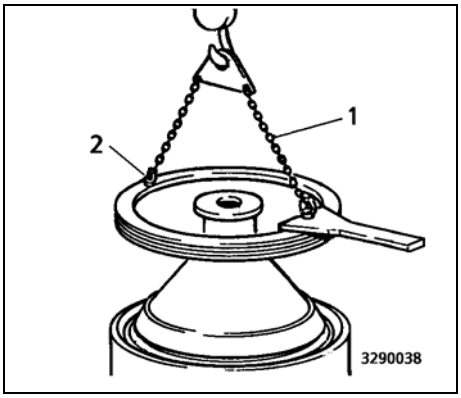


Fig. 94

- Place bowl lock ring on the bowl bottom using lifting device 1 and eye bolt 2.
- First screw in bowl lock ring using the wrench by hand **(left-hand thread).**

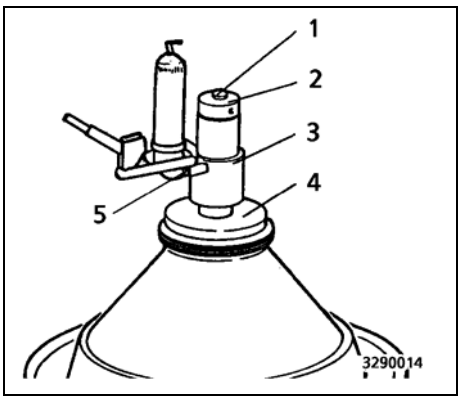


Fig. 95

Mount compressing device:

- Place disk 4 onto bowl top.
- Screw bolt 1 as far as it will go into the bowl bottom **(left-hand thread).**
- Insert hydraulic part 3 into the centering recess of the disk.
- Screw on threaded ring 2 until its upper edge is flush with end thread of bolt 1 **(left-hand thread).**

To prevent damage to threads:

- **Screw in threaded bolt as far as it will go.**
- **Screw on threaded ring until end of thread.**

If the threaded ring cannot be screwed down completely, then the piston and the cylinder of the compressing device are too far apart.

In this case:

- Bring piston and cylinder back into their starting position:
  - Loosen pressure relief screw 5 by two turns.
  - Move the pump lever to its lowest position.
  - Screw on threaded ring until end of thread.
- Tighten screw connections of the compressing device.
- Close pressure relief screw 5.

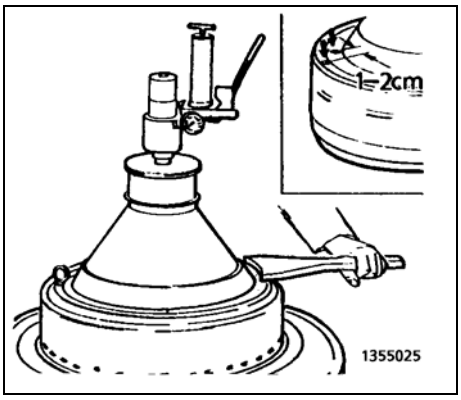


Fig. 96

Compressing the disk stack:

Pressure must be gradually applied to the disk stack until the max. disk compression of 250 bar is attained.

Each pressure increase should be approx. 150 bar.

After each pressure increase, tighten bowl lock ring further.

When the max. disk compression of 250 bar has been reached, the "O" mark on the bowl lock ring must be approx. 1 - 2 cm apart from the "O" mark on the bowl bottom.

If the maximum pressure is not attained and grease flows out of the stroke limiting hole, bolt 1 has not been screwe far enough into the bowl bottom.
The compressing device is not ready for use again until bolt 1 and threaded ring 2 have been brought back into the position as described above.

When compressing the disc stack, make sure that the arresting piece of the bowl bottom snaps into the groove of the bowl top and that the bowl top does not become tilted when lowered.

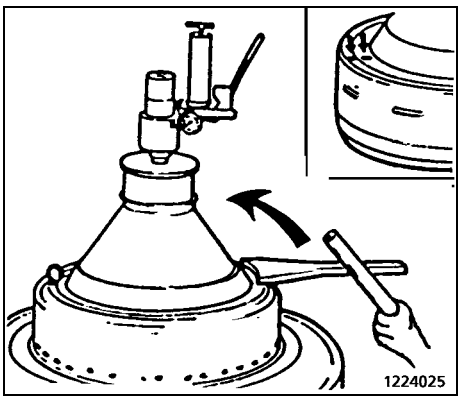


Fig. 97

- Hit wrench handle with the mallet **to obtain "O" mark alignment (left-hand thread).**

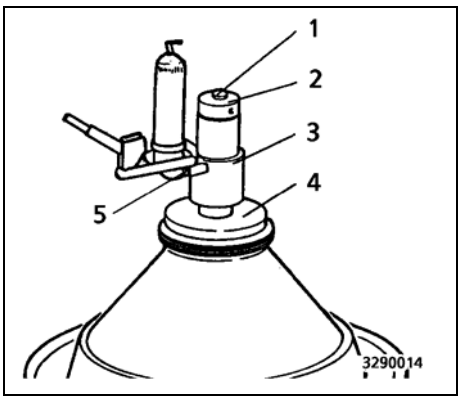


Fig. 98

Remove the compressing device:

- Move pump lever of compressing device down as far as it will go to prevent it from jumping back.
- Loosen pressure relief screw 5.
- Unscrew threaded ring 2 **(left-hand thread).**
- Remove hydraulic part 3 with disk 4.
- Unscrew bolt 1 **(left-hand thread).**

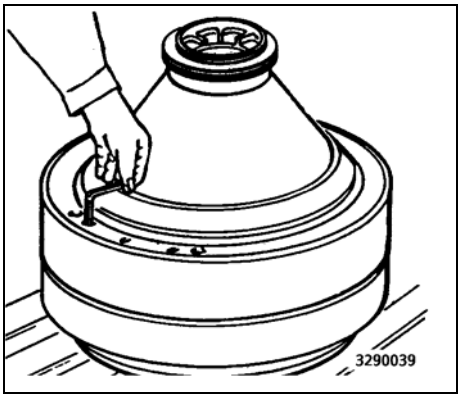


Fig. 99

- Unscrew the three hex head screws of the wrench and remove it.
- Unscrew the eye bolt.
- Glue the four threaded pins into the lock ring with Loctite 241 and screw in until they are **flush** using an Allen wrench.

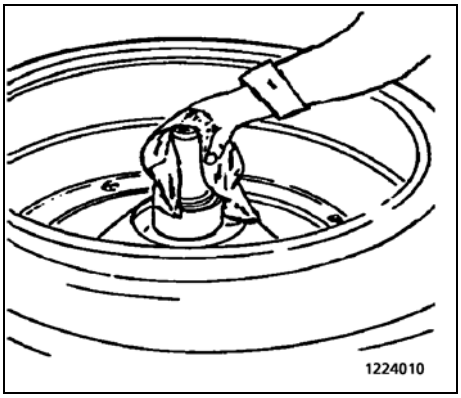


Fig. 100

- Before placing the bowl on the spindle, oil the upper part of the spindle (thread and cone).
- **Clean and dry** the conical part of the spindle and the inside of the bowl hub with a cloth to ensure proper fitting.

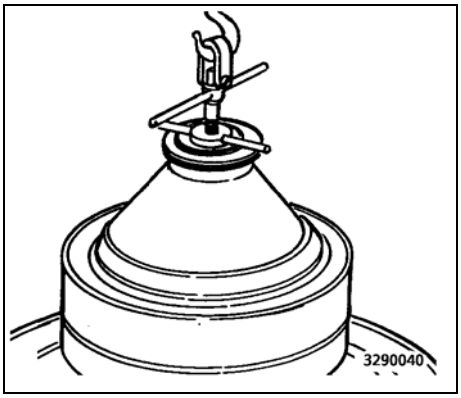


Fig. 101

- Place bowl on the spindle by means of lifting device (distributor).

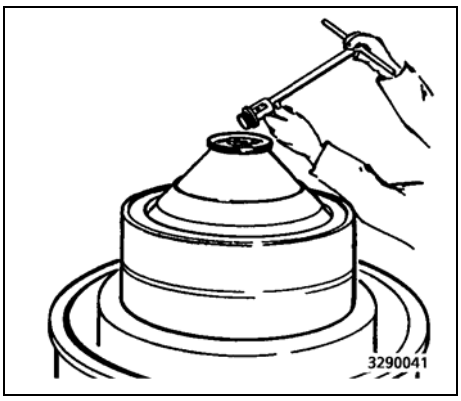


Fig. 102

- Screw spindle screw with inserted gasket firmly into the spindle **(left-hand thread).**

5.5.1 Fitting the centripetal pump

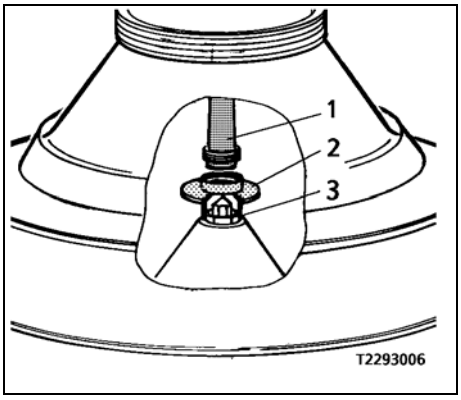


Fig. 103

- Screw feed tube 1 with inserted gasket into hydraulic disk 2 in the bowl bottom, by hand, and tighten firmly **(left-hand thread).**

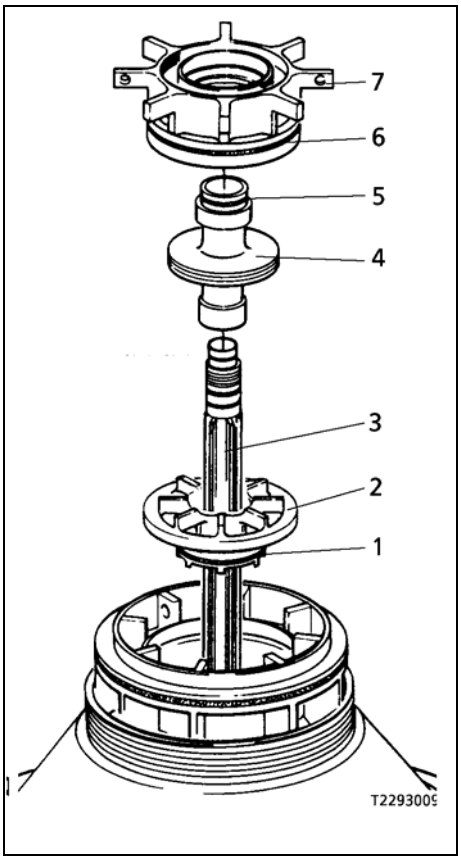


Fig. 104

- Place on centripetal pump chamber cover 2 with inserted gasket 1.
  Pay attention to correct positioning!
- 3 **Lift** feed tube and slip on lower centripetal pump 4 with inserted gasket 5.
  Pay attention to correct positioning!
- Place on centripetal pump chamber cover 7 with inserted gasket 6.
  Pay attention to correct positioning!

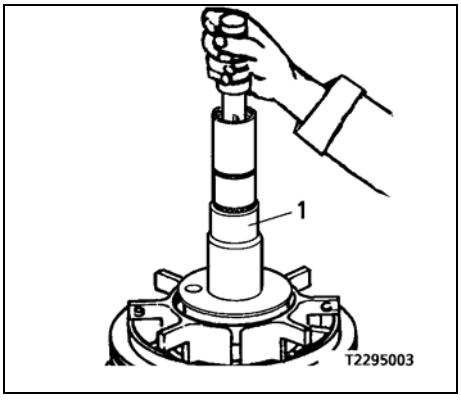


Fig. 105

- Lift feed tube.
- Slip on distance sleeve 1.
  Pay attention to correct positioning. If required, check if the centripetal pump components are assembled correctly.

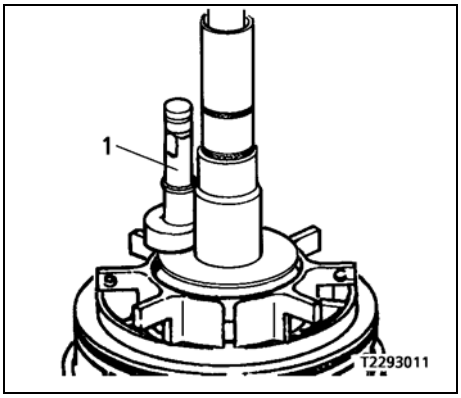


Fig. 106

- Clean upper centripetal pump 1 and grease the guide surfaces lightly (3.2).
- Insert upper centripetal pump 1 with fitted-in gaskets and incline it towards the bowl centre.

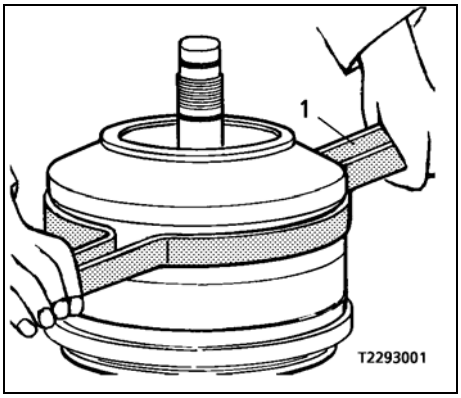


Fig. 107

- Place on centripetal pump chamber cover with inserted gasket.
  Pay attention to correct positioning!
  The "O" marks must be aligned.

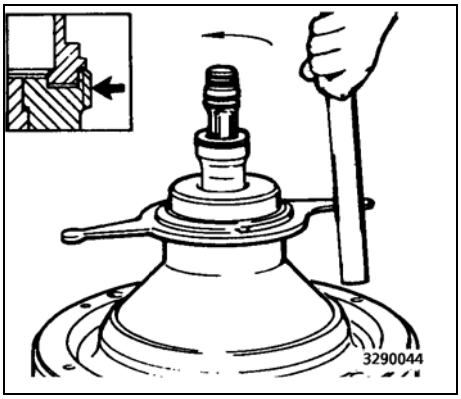


Fig. 108

- Clean and grease threads on bowl top and in the lock ring.
- Screw on the lock ring by hand and tighten it by hammering against the handle of the annular wrench **(left-hand thread).**

5.5.2 Installing the swivel-type actuator

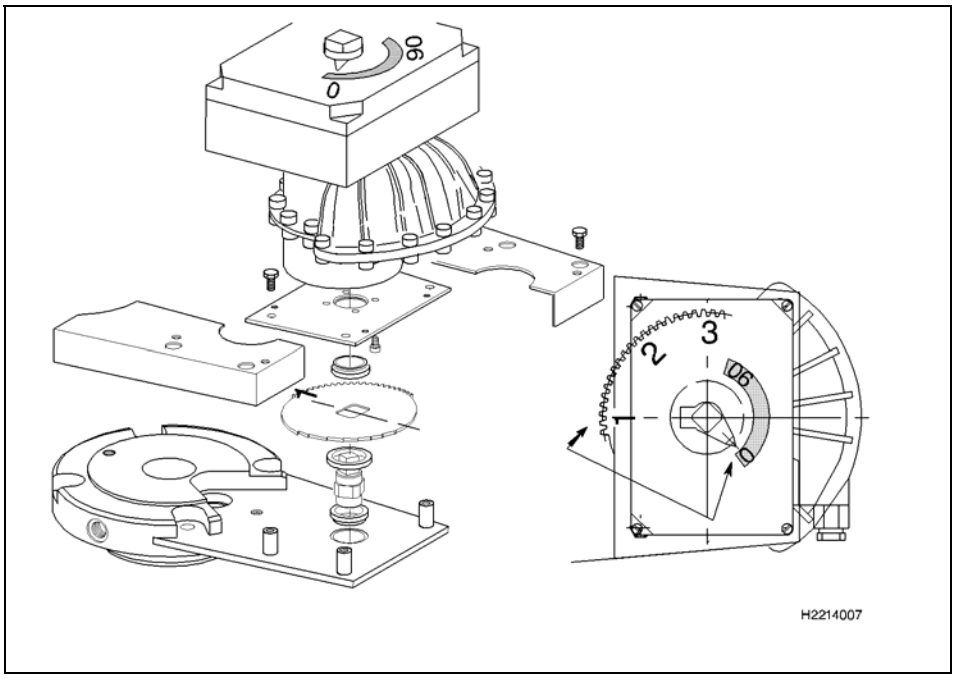


Fig. 109

Exploded view of the swivel-type actuator

The swivel-type actuator need not be dismantled when the bowl is to be removed. If, however, the swivel-type actuator has to be dismantled in order to replace a defective component, the bowl has to be removed and reinstalled as shown in Fig. Fig. 109.

Also keep in mind the following points:

- The pointer indicating the angle of setting must be on "0".
- Place on the drive pinion as shown in Fig. Fig. 109.

5.6 Assembling the feed and discharge connections

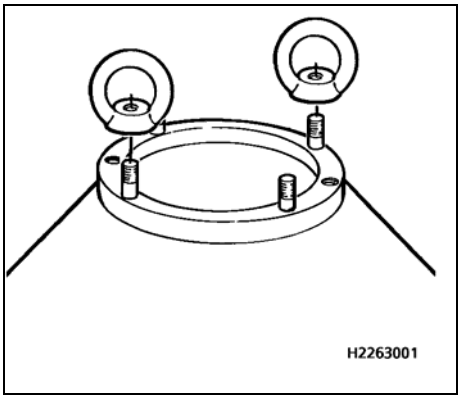


Fig. 110

- Screw two ring nuts opposite each other onto the studs of the hood.

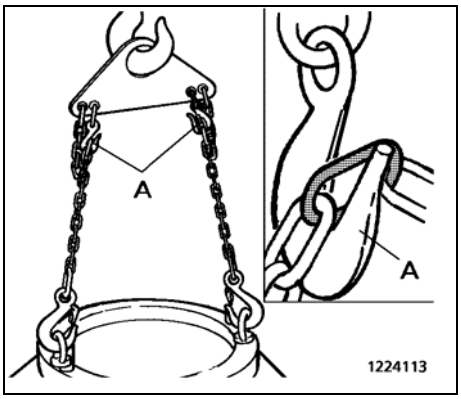


Fig. 111

- Shorten the chains of the lifting device.
  The chain link must be put crosswise on hook A (see adjacent small figure)!
- Hang the shortened lifting device into the lifting-eye nuts and place the hood on the solids collector.
- Bolt hood and solids collector together using hex head screws.

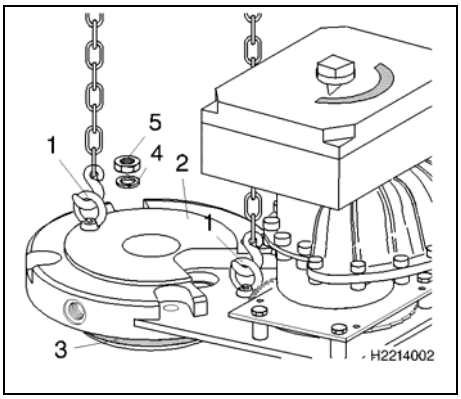


Fig. 112

- Thread two eye bolts 1 into ring 2.
- Insert gasket 3.
- Place on ring 2 together with the swivel-type actuator.
- Fasten ring 2 by means of hex head screws 5 with installed lock washers 4.

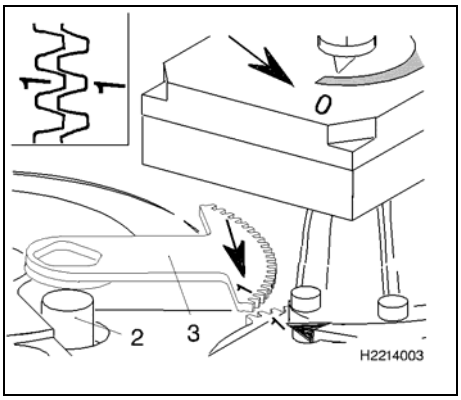


Fig. 113

- The pointer must be on "0" (see arrow).
- Place toothed segment 3 on centripetal pump 2 (watch for "O" mark position).
- Insert toothed segment 3 so that the marks of the teeth of segment 3 and of the drive pinion are placed opposite to each other (see arrows in figure).
  For this purpose, the centripetal pump has to be turned while the toothed segment is to be held in a slightly inclined position.

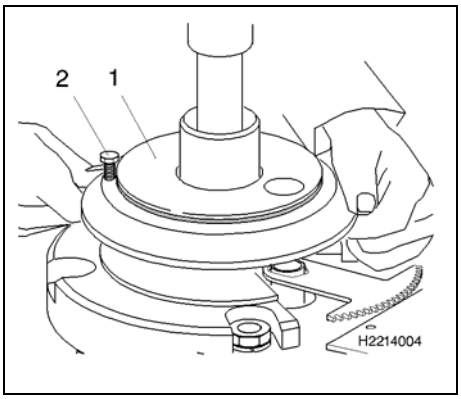


Fig. 114

- Undo screw 2.
- Place on ring 1 with inserted gasket. The ring must be perfectly seated; if it is not, the toothed segment has not been properly fitted.

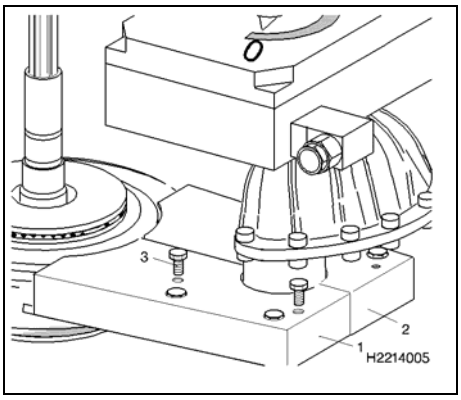


Fig. 115

- Place on protecting-case halves 1 and 2, and fasten them with hex head screws 3.

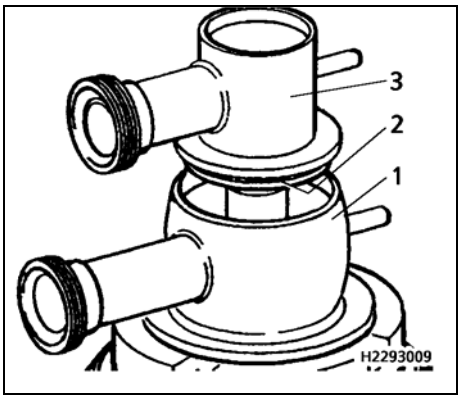


Fig. 116

- Install lower discharge 1.
- Install upper discharge 3 (with inserted gasket 2)

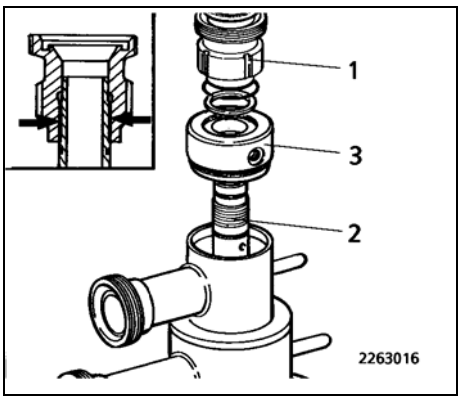


Fig. 117

- Apply a thin film of grease to the threads on feed tube 2 and in connection piece 1.
- Place on vent piece 3 with inserted gaskets.
- Screw connection piece 1 (with inserted gasket) on centripetal pump 2 and tighten firmly.

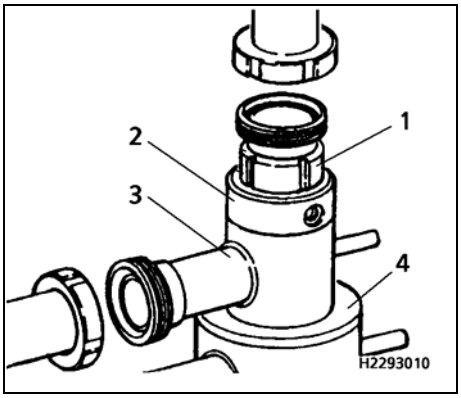


Fig. 118

- Connect the feed and discharge lines.
- Connect the vent line.

- Carry out the electrical connection of the contact pressure gauge.
- Install the sight glass illumination.

Stop

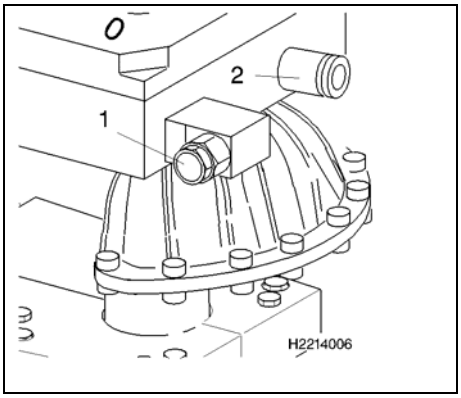


Fig. 119

- Connect current supply 1 and compressed-air supply 2.
  Note:
  The protecting cases must be in place - danger of crushing!

5.7 Replacing the main bowl gasket (bowl top)

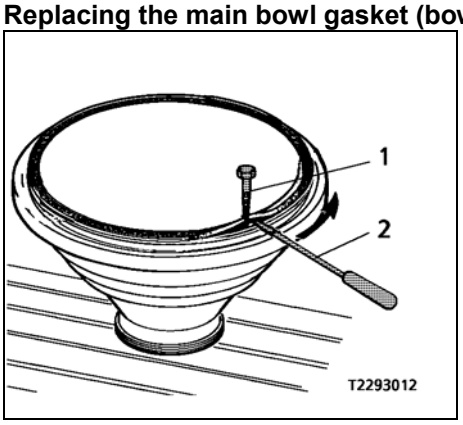


Fig. 120

Removal

- Screw wooden screw 1 into the gasket.
- Lever out the gasket with screwdriver 2.

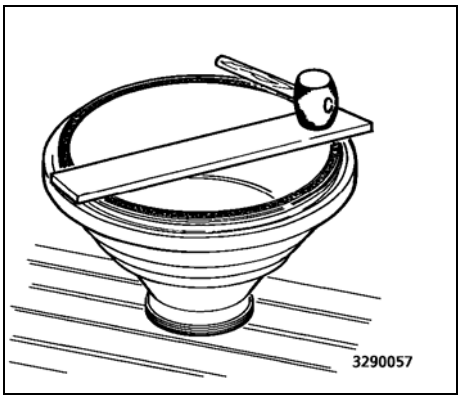


Fig. 121

Fitting

- Insert the gasket in the cleaned groove of the bowl top (with the narrow side towards the bowl top).
- Drive the gasket evenly into the groove.

  If the diameter of the gasket is too small, place it in a water bath of 70 - 80 °C for about 5 minutes. The gasket will then assume its original dimensions.

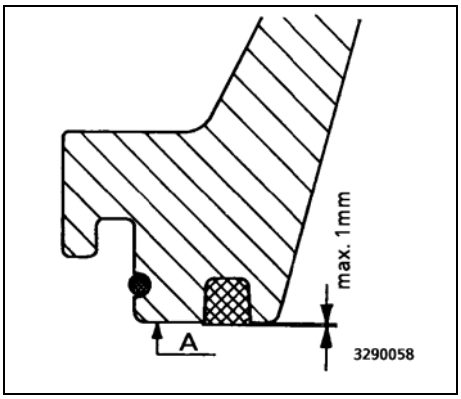


Fig. 122

- Drive the gasket into the groove so far that the sealing area of the gasket does not protrude above surface "A" of the bowl top by more than 1 mm.

5.8 Removing the piston valves

- Remove the piston valves **once a month** for cleaning.
- At the same time, check the gaskets and replace them if necessary.

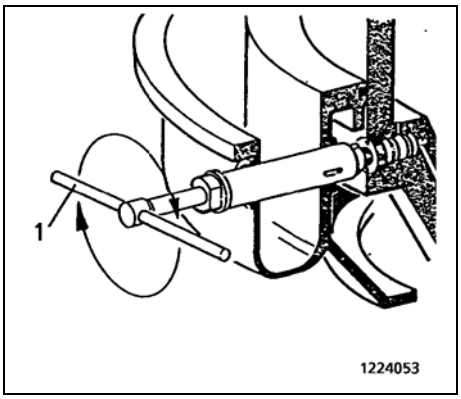


Fig. 123

- Screw wrench 1 into the piston valve.

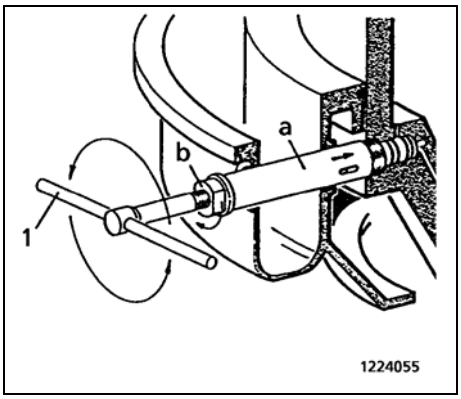


Fig. 124

- Introducepins of bush **a**of wrench 1 into the holes of the piston valve.
- Tighten collar nut **b**.
- Unscrew piston valve from bowl bottom using wrench 1.

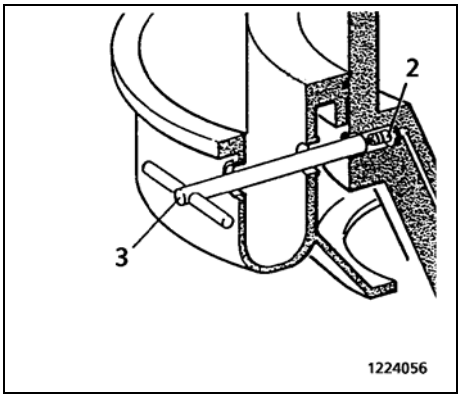


Fig. 125

If valve piston 2 should become stuck in the bowl bottom when removing the valve:

- Screw wrench 3 into the valve piston.
- Remove the valve piston from the bowl bottom using the wrench.

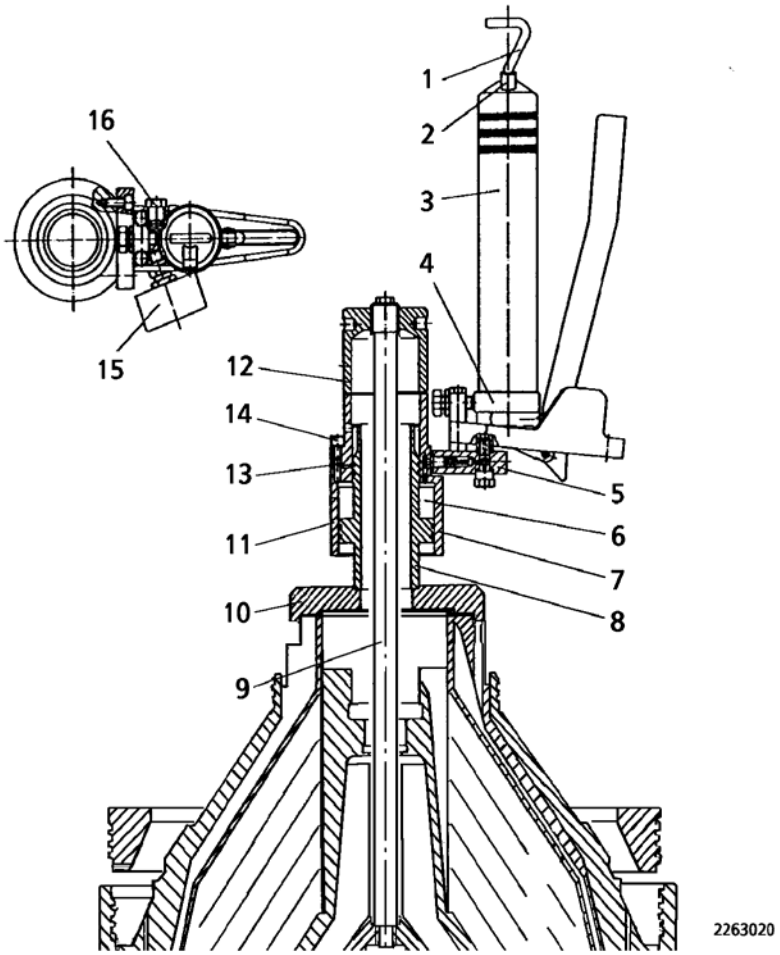
5.9 Fitting the piston valves

For fitting, proceed in reverse order of removal.

NOTE:

- Moisten gaskets.
- Grease threads.
- Screw in the valve as far as it will go. Hoever, do **not** screw it in **too tightly**.
- The front face of the valve housing must be flush with the outer wall of the bowl bottom.

5.10 Disk stack compressing device



1 Filling device
2 Clamp piece
3 Grease cartridge
4 Pump head
5 Non- return valve
6 Pressure chamber
7 Hydraulic cylinder
8 Piston
9 Bolt
10 Disk
11 Hydraulic part
12 Threaded ring
13 Stroke limiting hole
14 Vent screw
15 Pressure gauge (0- 600 bar)
16 Pressure relief screw

Fig. 126

Operating principles

The pump presses grease at a high pressure into pressure chamber 6.

The increase in pressure in the pressure chamber displaces piston 8 relative to hydraulic cylinder 7.

The hydraulic part 11 (piston, hydraulic cylinder) is bolted securely to the bowl bottom by means of bolt 9 and threaded ring 12.

When the pressure increases in pressure chamber 6, piston 8 is forced downwards.

The force produced is transferred to the bowl top via the disk 10. The disk stack is compressed.

Required pressure:	250 - 300 bar
Max. pressure:	320 bar

Pump

The pump produces a pressure of max. 400 bar. It consists of:

- Pump head
- Grease cartridge
- Filling device
- Non-return valve

Filling the grease cartridge

Filling the grease cartridge: 450 g special grease K2R

The grease cartridge of the compressing device is filled with special grease before delivery.

- Actuate clamp piece 2 and pull the filling device 1 upwards.
- Unscrew grease cartridge 3 from pump head 4.
- Fill in grease, approx. 450 g.
- Screw grease cartridge 3 into pump head 4.

Actuate clamp piece 2 and push filling device 1 into grease cartridge 3.

Fill the grease cartridge only with WS special grease K2R.

Malfunction

If there is no build-up of pressure, the following must be checked:

- Is the pressure relief screw 16 screwed in tightly?
- Is there enough K2R grease in the grease cartridge?
- Has piston 8 travelled too far out of hydraulic cylinder 7?

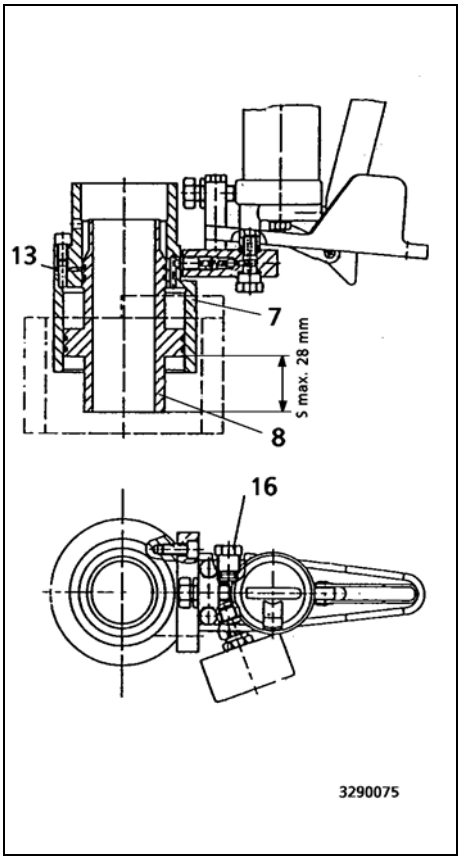


Fig. 127

If this is the case:

- Unscrew pressure relief screw 16 by a few turns.
- Press piston 8 back into hydraulic cylinder 7. This must be done in the absence of pump pressure.
- **Firmly** re-tighten pressure relief screw 16.

7 Hydraulic cylinder
8 Piston
9 Bolt
16 Pressure relief screw

- If grease oozes out through the stroke limiting hole 13, bolt 9 and threaded ring 12 have not been screwed into their final position, and the stroke is too long.

6 Technical information

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6.1 Design features

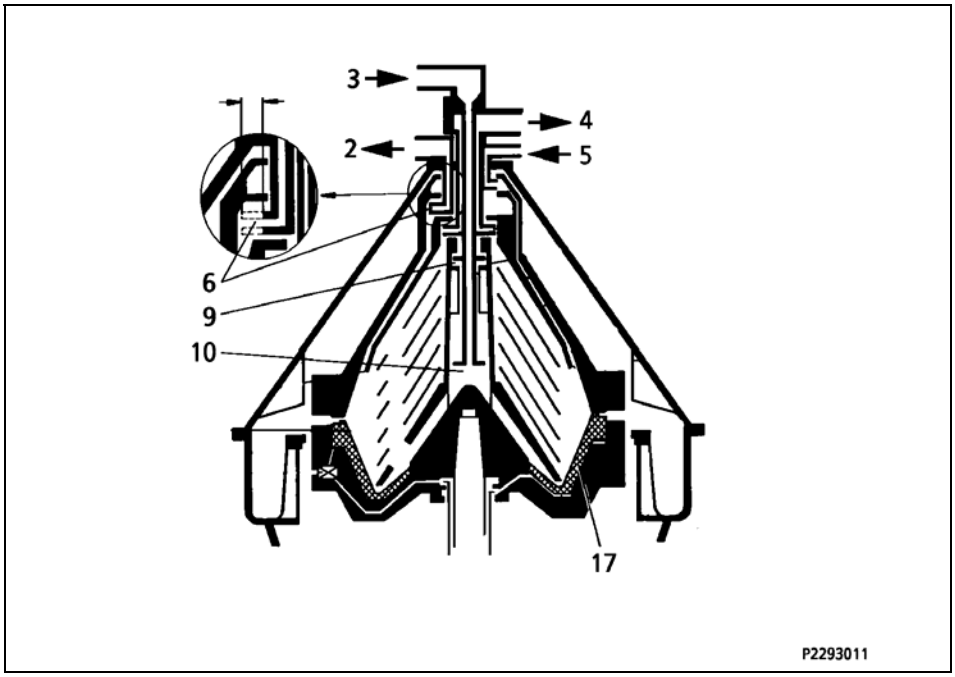


Fig. 128

- **Self-cleaning bowl:**
  - The bowl can be emptied during operation by means of a hydraulically actuated piston 17.
- **Closed feed and discharge of the product phases:**
  - The feed is through a closed line system.
  - To observe the product, sight glasses are fitted in feed 3, clean oil discharge 4 and in the discharge of the heavy phase 2.
  - A pressure switch monitors the discharge pressure of the light phase.
  - Soap or gums are discharged through a closed discharge pipe.
- **"Fine Tuner":**
  - With the aid of the "Fine Tuner", the separating zone in the disk stack can be altered while the machine is running. By this means the separator can be optimally adapted to changes in the product (e.g. different oil types). In addition the separating zone can be briefly displaced towards the centre during start-up and bowl ejections, thereby preventing oil from flowing over the outer diameter of the separating disk.
- **Hydrohermetic feed:**
  - The product is gently fed through feed 10 into the bowl with overpressure.
- **"Vapour seal":**
  - A hydrohermetic seal 9 prevents the oil from becoming turbid due to contact with vapours from the inlet chamber.

- "Bowl Flush":
- Liquid can be fed into the outer solids space through a separate channel 5. By this means surplus caustic or acid can be flushed out or a highly viscous heavy phase can be diluted and more easily discharged from the bowl.

6.2 Operating principles of the bowl

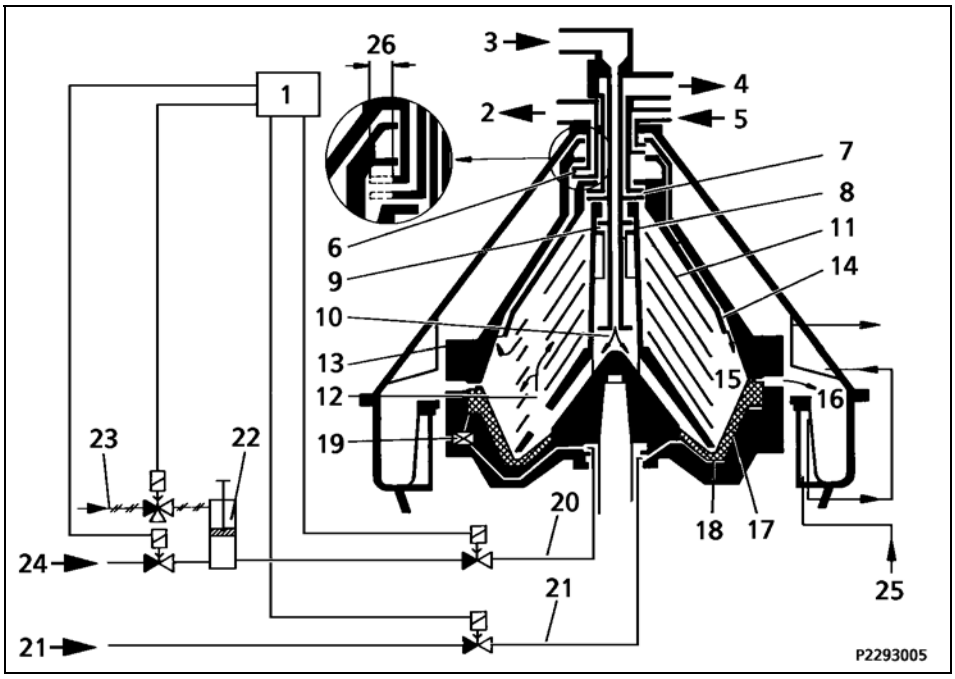


Fig. 129

1 Control unit
2 Discharge (heavy phase)
3 Feed
4 Discharge (light phase)
5 Flush water connection (”Bowl flush”)
6 Centripetal pump - heavy component (fine tuner)
7 Centripetal pump - light component
8 Distributor
9 ”Vapour seal”
10 Hydrohermetic feed”
11 Disc stack
12 Rising channels
13 Separating disk channels
14 Flush water channel (”Bowl flush”)
15 Solids holding space
16 Solids ejection ports
17 Sliding piston
18 Closing chamber
19 Piston valve
20 Opening-water
21 Closing-water
22 Metering piston
23 Control air
24 Filling water / opening water
25 Cooling medium

The bowl is applied for the separation of mixtures which consist of
- a liquid (oil) and
- pasty substances (soapstock or gums), with simultaneous separation of the solids contained in the mixture.

The product

- flows through feed 3 into the bowl,
- is clarified in disk stack 11.

The disk stack consists of a large number of conical disks placed on top of one another.

Due to the narrow disk interspaces

- the liquid is split up into thin layers,
- the settling distance is minimised.

The light component

- is forced to the centre of the bowl,
- then flows to the centripetal pump chamber cover,
- is discharged under pressure by centripetal pump 7,
- is then led off through the discharge pipe 4.

The heavy component

- is forced towards the bowl periphery,
- then flows to the centripetal pump chamber cover,
- is discharged under pressure by centripetal pump 6,
- and then led off under gravity through a discharge pipe.

The solids particles

- are flung against the underside of the disk above,
- slide towards the periphery into the solids space 15,
- and are periodically ejected through the solids ejection ports 16.

The solids ejection is initiated by the control unit 1.

6.3 Operating principles of the hydraulic system of the bowl

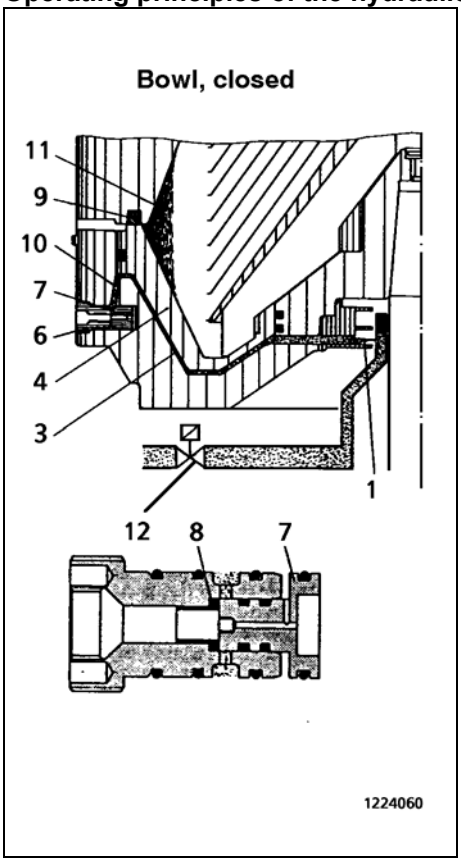


Fig. 130

Closing the bowl

When the bowl has reached its rated speed, solenoid valve 12 for closing water is opened briefly several times. The closing water flows into the closing chamber 3 beneath the sliding piston 4.

Due to the rotation, pressure builds up in the closing chamber. This pressure creates force in axial direction which presses the sliding piston against gasket 9 of bowl top, thus closing the solids holding space 11 during the separation process. Closing chamber 3 is sealed by valve piston 7 which is pressed through centrifugal force against gasket 8 and thus closes discharge hole 10. In order to compensate for closing water losses, closing water and filling water are supplied every 5 mins for 1sec via an interval switching arrangement.

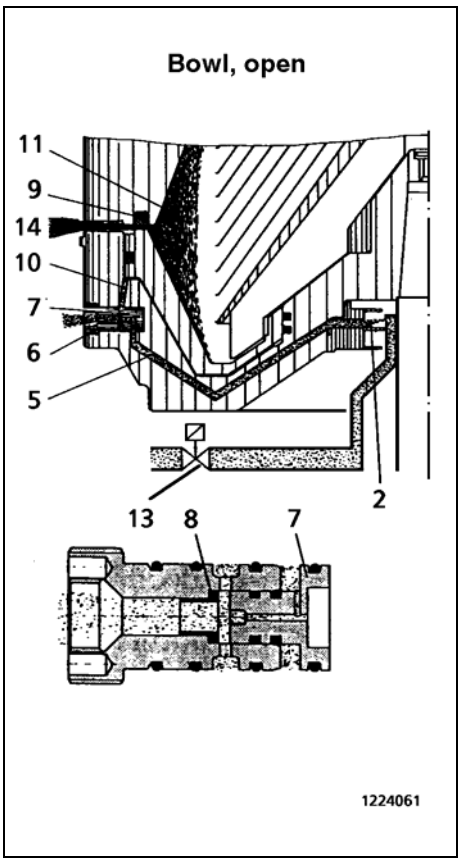


Fig. 131

Opening the bowl (ejection)

To empty the solids holding space opening water 13 is added which flows from injection chamber 2 through feed hole 5 to piston valve 6. Due to hydraulic opening of the valve the water discharges from the closing chamber through hole 10: for partial ejection the closing chamber empties partially, for total ejection it empties completely.

As the liquid level recedes the closing pressure acting on the underside of the sliding piston decreases quickly. As soon as it is smaller than the opening pressure acting on the upper side of the piston, the sliding piston is pressed downwards, thus opening the ejection ports in the bowl bottom: the solids are then ejected instantaneously through the ejection ports 14 of the bowl.

Once the ejection has taken place,

- opening-water valve 13 closes
- closing-water valve 12 opens.

Piston valve 6 re-seals discharge hole 10 and the closing chamber fills with water again. The sliding piston is forced back into closed position.

6.4 Operating-water connection

The operating-water connection is equipped with solenoid valves, pressure reducer and pressure switch.

The function of the pressure switch is to monitor the operating-water pressure. If the pressure drops below a preset minimum value, an alarm is given and the separation program interrupted.

Operating-water connection:	1 1/4 in		
Operating-water pressure (with open closoing-water valve)	$P_{min.}$	=	2,0 bar
	$P_{max.}$	=	2,5 bar
Operating-water capacity:		=	4 000 l/h
Air pressure for metering unit:	$P_{min.}$	=	4 bar
	$P_{max.}$	=	6 bar

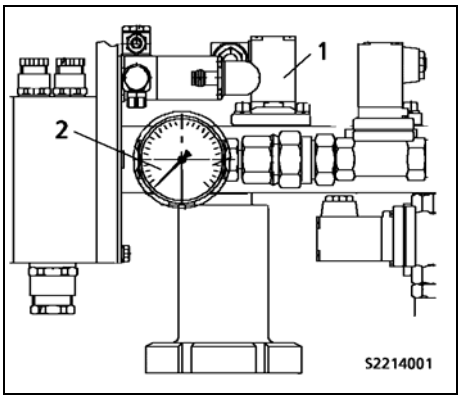


Fig. 132

Note:

Prior to a partial ejection there is a brief water pressure increase in the operating-water connection. This can be read off on pressure gauge 2.

Adjust the air pressure for the metering unit so that the heightened water pressure is lower than the maximum pressure marked on solenoid valve 1.

- If the setting is wrong no partial ejection is possible.

Standard operating-water values:

- Suspended material in operating water max 10 mg/l
- Particle size: max. 50 µm
- Hardness: ≤ 12 °dH separating temperatures of up to 55°C
  ≤ 6 °dH at separating temperatures above 55°C

  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-value: 6,5 - 7.5

6.4.1 Solenoid valves

The solenoid valves incorporated in the operating-water system are 2/2-way straight-way diaphragm valves with internal piloting.
The solenoid coil is entirely embedded in epoxy resin which ensures protection against moisture, good dissipation of heat, and perfect electrical insulation.
The valves are fully tropicalized.

Maintanance

The solenoid valves do not require special maintenance.

Electrical faults

- Shut off main valve for operating-water.

Fault	Cause	Remedies
Valve does not function.	Control unit defective.	Contact servicing staff.
	Connecting terminal on terminal strip is loose.	Tighten screw of connecting terminal.
	Coupler socket loose or leaks.	Tighten coupler socket and replace gasket, if necessary.
	Solenoid coil defective.	Replace complete solenoid head.

6.5 Swivel-type actuator for control of the centripetal pump

The swivel-type actuator is controlled by means of an electric unit signal. As auxiliary anergy, instrument air (dry and free of dust) is required.

Air pressure:	P_{min} = 4bar
	P_{max} = 6 bar
Flow rate:	approx. 93 Nl/min

- The centripetal–pump diameters required
  a) for operation (≈ large diameter) and
  b) for start–up / partial ejection (≈ small diameter) are entered on the control unit.

  The values entered are transformed to a certain electric signal. This signal causes the centripetal pump to enter into the desired position. The actual position can be read from the separator.

7 Operation

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7.1 Prior to start–up

Note:

- Instruction manual of the respective control unit.
- Safety precautions in chapter 1.
- Subject to process–specific deviations.
- Only feed product which conforms to the specifications on the nameplate.

- **Check that**
  - the machine has been correctly installed.
  - the bowl is fitted.
  - the bowl lock rings have been tightened securely.
  - the fastening screws on the hood and on the feed and discharge housing are tightened securely.
  - the mechanical brake is applied.
  - the frame drains are open.
  - the oil level is up to middle of sight glass.
  - all electrical connections are duly installed.
- Open hand shut–off valves in the supply lines for:
  - operating–water,
  - compressed air
- Set the air pressure on the pressure reducer for the metering cylinder to 4–5 bar.
- Set the air pressure on the pressure reducer for the swivel–type actuator to 4–6 bar.

7.2 Starting

- Switch on main switch on control unit (position **I**):

The LED "control unit ON" flashes to signal that the control unit is ready for operation.
The buttons "product", "partial ejection" and "total ejection" are not released until the signal "motor in operation" is on (see LED in motor mimic diagram).

- Start motor.
  After a pre-set delay time of 10 minutes, closing water is supplied automatically; the bowl closes.
- After a further 2 minutes the bowl can be heated up with water.
- Switch-over from water to product.

7.3 Closing of bowl:

After having switched over from acceleration to operation, two total ejections are carried out automatically in order to close the bowl. Unless this program has been activated, the two total ejections have to be initiated manually by pressing the corresponding function key.

To prevent water losses, closing water is injected every 5 minutes for one second.

All program time settings are variable.

Closing-water injection is indicated by an LED in the separator symbol on the timing unit.

7.4 Water run after start-up

Check if

- metering unit is adjusted on the operating-water connection.
- program times are adjusted on the control unit in accordance with the operating conditions (see section 7.5.3 and IM Control Unit).

- Feed water to separator.
- Check the bowl for leakage:
  - Bowl leakage is shown by an increase in the power consumption of the motor which is indicated on the ammeter.
  - In case of bowl leakage,
- stop water run,
- operate key „Total ejection".
  - Re-fill bowl with water and check again if bowl is watertight.
  - If the bowl cannot be closed after several trials,
- operate „Total ejection" key.
- let bowl run warm **for max. 15 minutes without supplying water.** While doing so, the polyamid gasket in the groove will adapt to the sealing surface of the sliding piston.
  - Then fill the bowl with water again and check if it is watertight.
  - If the bowl is still leaky,
- shut down the separator via „Normal Off".
- dismantle the bowl **after standstill** and check polyamid gasket, gaskets of the hydraulic system, etc.
- The ejection process is indicated by LEDs in the valve symbols on the mimic display.

7.5 Bowl ejection

When to empty the bowl?

The intervals at which solids ejections have to take place depend on the solids content and on the nature of the process liquid.

If possible, the solids holding space should not be filled to the brim.

As soon as the separating or clarifying efficiency decreases, a partial ejection has to be triggered.

7.5.1 Program control

A PLC control unit is used for the automatic program control of the separator.

For further details refer to the manual "Control unit".

7.5.2 Partial ejection

Partial ejection means the ejection of part of the solids from the bowl. Product feed is not interrupted during partial ejection.

To prevent any carry-over, the "Fine Tuner" is contracted before a partial ejection and is extended to its normal operating position once the partial ejection is finished. This operation is initiated by the control unit (see functional diagram, 7.5.3).

The volume to be ejected can be set during operation.

For partial ejection, opening water is fed to the hydraulic system via the metering device.

The amount of solids to be ejected is primarily determined by the opening water volume. This volume is set on the metering device.

To determine the volume of solids ejected, fill the bowl with water and measure the volume of ejected water.

The quantity of ejected material can easily be determined by means of the feed rate and of the pressure reduction occurred the light-phase discharge line.

Check the quantity of solids ejected in a partial ejection during normal operation or during operation with water, proceeding as follows:

Example: Feed rate: 18,000 l/h

Pressure reduction:approx. 1.4 sec.

Flow rate per second: 18,000 l/h : 3,600 s/h = 5 l/s

5 l/s x 1.4 s = 7 l.

This means that it will take 1.4 seconds until the bowl is filled up again. During this period, 7 liters of liquid flow into the bowl. This quantity corresponds to the amount of liquid that was ejected from the bowl during partial ejection.

Setting the volume to be ejected:

Use the adjusting screw on the metering device.

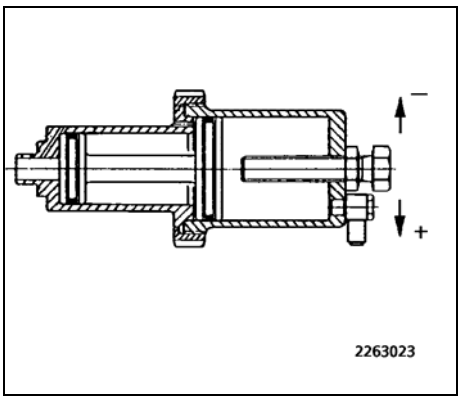


Fig. 133

- Reduce ejection volume.
  - **Open** the opening-water valve to displace the water which cannot be compressed from the bowl. Otherwise the increase in pressure would destroy the pressure gauge and the piston rod.
  - Turn adjusting screw clockwise
  - Close the opening-water valve.
- Increase ejection volume:
  - Turn adjusting screw anti-clockwise.

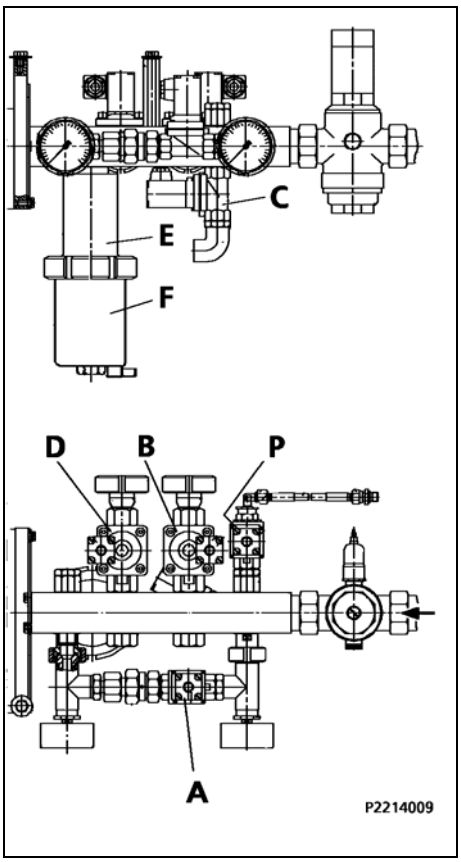


Fig. 134

Function of the metering device

The metering device E is filled with water via filling valve A after each solids ejection.

For partial ejection chamber F is supplied with compressed air.

Through actuating the opening water valve D the adjusted water volume is displaced by air pressure and fed to the hydraulic system of the bowl.

A Solenoid valve for filling water
B Solenoid valve for closing-water
C Solenoid valve for hood flush water
D Solenoid valve for opening-water
E Metering device
F Air chamber
P Solenoid valve for cooling water

Program sequence

Also refer to section 7.5.3

After the program time "Separation - Partial Ejection" has elapsed, a partial ejection is initiated automatically which is then repeated at identical intervals.

Before each partial ejection the solenoid valve C "Hood flush water" opens for 10 approx. seconds. This time can be preset as the program time "Pre-flushing". Water is sprayed into the hood to prevent the solids to be ejected from sticking to the walls.

For solids ejection the solenoid valves B "Closing water" and D "Opening water" open for 1 second. This time can be preset as the program time "Partial ejection".

The solenoid valve B "Closing water" remains open for a further 5 seconds after the ejection. The time is set via "Closing". At the same time the hood flush water valve stays open for the time "Post-flushing".

The "Separation" program can be interrupted by pressing the "Partial ejection" button. A partial ejection is then triggered. After termination of this forced partial ejection the control program automatically switches back to "Separation".

Before each partial ejection, the "Fine Tuner" is set to a small centripetal-pump diameter (see 7.5.3-"Ta").

After each ejection, the centripetal pump is reset to its large diameter as soon as the pre-set waiting period is elapsed (see 7.5.3 - "Tb").

These periods are adjustable.

Adjusting the program times:
Program times**... secs** are process-related and must be set before start-up.

Program time	
Pre–flushing	approx. 10 secs Pre–flushing of hood/solids collector
Partial ejection	1 secs This determines the opening time of the opening–water valve. This time must be longer than the displacement time of the opening water from the metering unit. The ejected solids volume depends on the preset volume in the metering unit.
Secondary flushing	approx. 20 secs Flushing the hood and solids collector after an ejection
Closing	5 secs Addition of closing water after an ejection
Metering device	3 secs Continued control of air for metering device after partial ejection.
Filling water	2 secs Delayed filling water supply after partial ejection.
Total ejection	10 secs (not variable) Addition of opening water during total ejection.
Waiting	approx. 60 secs Waiting time after total ejection for speed recovery of bowl.
Delay of ejection after contracting the centripetal pump (Ta)	depending of throughput [1)] Displacing the separating zone inwards, in order to get more heavy phase into the bowl
Delay in extending the centripetal pump after ejection (Tb)	depending on throughput [1)] Filling up the bowl with heavy phase
Delay in extending the centripetal pump (Tc)	depending on throughput [1)] When starting with product, the bowl must be filled with heavy phase until no carry–over will occur when the centripetal pump is extended.

1) the higher the throughput, the shorter must be the time

7.5.3 Function diagram of partial ejection

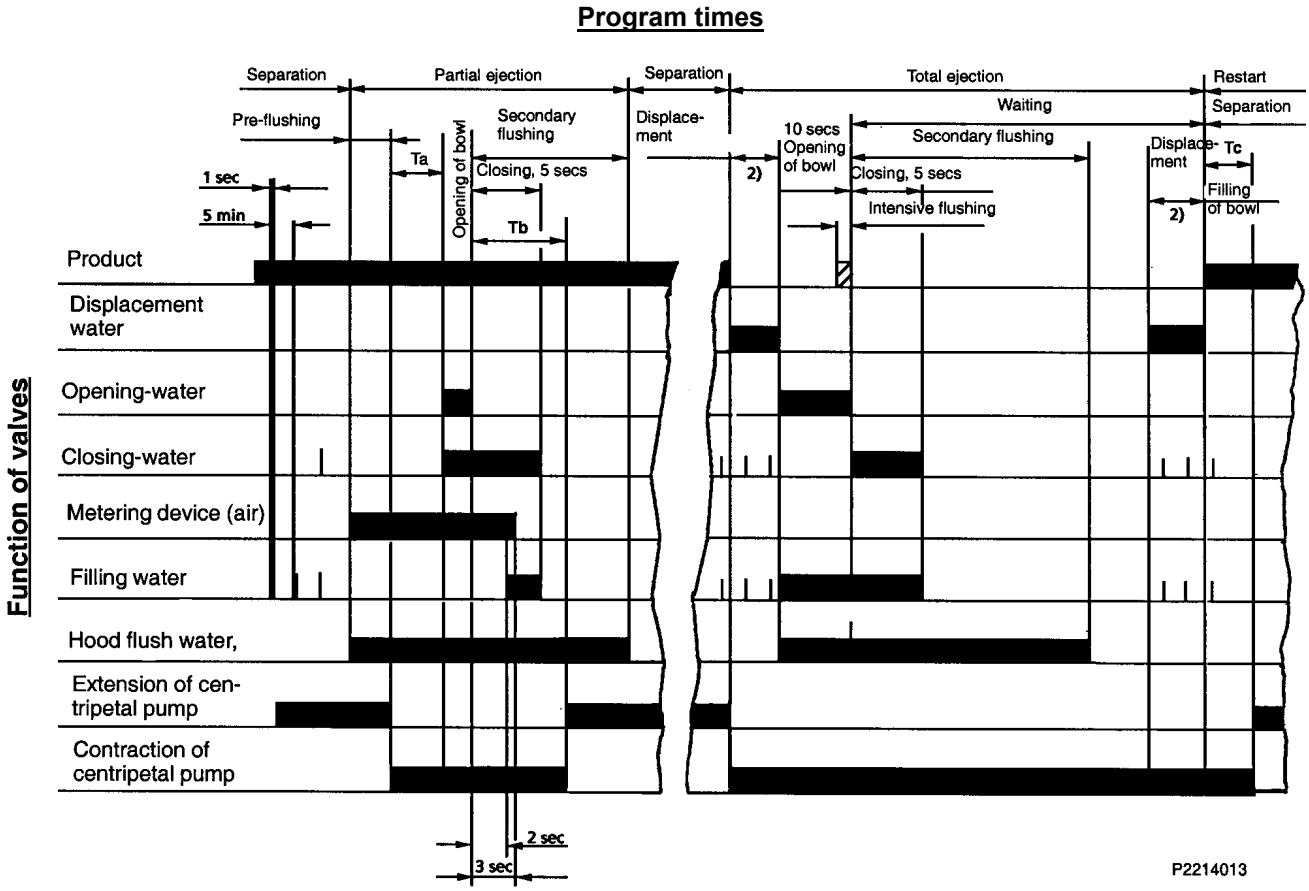


Fig. 135

Setting the program times: See control unit manual

1) When the waiting period for resuming the bowl speed has elapsed, no automatic switch–over to ”separation” will take place.
2) These functions are provided in the control unit and can be adjusted if an automatic water valve has been installed.

Ta Delay of ejection after contracting the centripetal pump)

Tb Delay in extending the centripetal pump after ejection

Tc Delay in extension of centripetal pump (after starting with product).

7.5.4 Total ejection

Total ejections during cleaning-in-place can only be performed by hand on the control unit. (Automatic Ceaning-In-Place is only possible with a separate CIP control system, see corresponding leaflet.)

During a total ejection the whole bowl contents are ejected.

Never initiate a total bowl ejection when the machine is vibrating severely (bowl unbalance).

To trigger a total ejection, press function key "Total ejection".

If installation has been carried out correctly (see connection diagram of control unit) the feed pump is automatically switched off when the "Total ejection" key is pressed and starts again automatically about 1 minute after the total ejection. Interrupting the feed to the bowl by switching off the feed pump is necessary so that the bowl speed, which drops slightly during a total ejection, can stabilize again.

After renewed filling of the bowl (observe increasing discharge pressure on separator) a further total ejection can be triggered by again pressing the "Total ejection" key.

If the feed pump is not automatically switched off during a total ejection, switch it off by hand and switch it on again 1 minute after the total ejection.

7.5.5 Bowl ejections (manual)

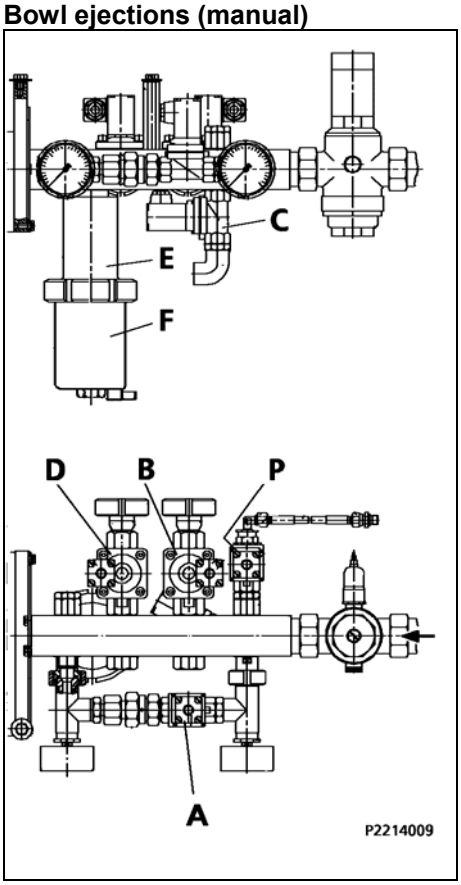


Fig. 136

In the case of failure of the control unit or defective solenoid valves, the separator can be manually controlled as follows:

Partial ejection

- Open closing-water valve B and fill-up valve A manually by means of hand lever.
- Open opening-water valve D briefly (approx. 1 sec.).
- After partial ejection leave closing-water valve B open.

Total ejection

- Stop product pump.
- Open closing-water valve B and fill-up valve A manually by means of hand lever.
- Open opening-water valve D by means of hand lever until the ejection noise has stopped.
- Then close opening-water valve D and fill-up valve A; leave closing-water valve B open.
- Re-start product pump 1 minute after total ejection.

7.6 Adjusting the separation efficiency

To achieve perfect separation of the liquid mixture, the bowl must be adjusted to the different densities.

- To do this,
  - first adjust the "Fine Tuner" (7.6.1)
  - and then the hydrohermetic feed system (7.6.4).
  - Then carry out final adjustment of the "Fine Tuning" (7.6.5).

7.6.1 Adjusting the "Fine Tuner"

The bowl is adjusted to the different densities of the mixture by altering the diameter of the "Fine Tuner".

The required diameter of the "Fine Tuner" can be determined using the formula below.

The general rule of thumb is:
- Small "Fine Tuner" diameter with a low density difference,
- Large "Fine Tuner" diameter with a large density difference.

When separating pasty substances, the diameter of the "Fine Tuner" not only depends on the densities of the two components but also on the flow characteristics of the heavy component.
In almost all cases a larger diameter of the "Fine Tuner" should be selected than is actually required by the difference in densities of the light liquid and the heavy pasty component.

7.6.2 Determining the "Fine Tuner" by calculation

The formula below can be used to calculate the diameter of the "Fine Tuner". Bear in mind that the densities depend on the temperature. When determining the diameter of the "Fine Tuner", those densities must be entered which correspond to the separating temperature.

$g_{heavy\ phase}$	= 1.0484 kg/dm^3	$D_{oil–centrip.\ p}$	= 110 mm (immersed)
g_{oil}	= 0.88 kg/dm^3	$D_{separating\ zone}$	= 412 mm (middle of rising channnel)

$$\gamma_{heavy\ phase}\ (D_{separating\ zone}{}^2 - D_{heavy\ phase}{}^2 = \gamma_{oil}\ (D_{separating\ zone}{}^2 - D_{oil}{}^2)$$

Therefore $D_{heavy\ phase}$ is determined by the following formula:

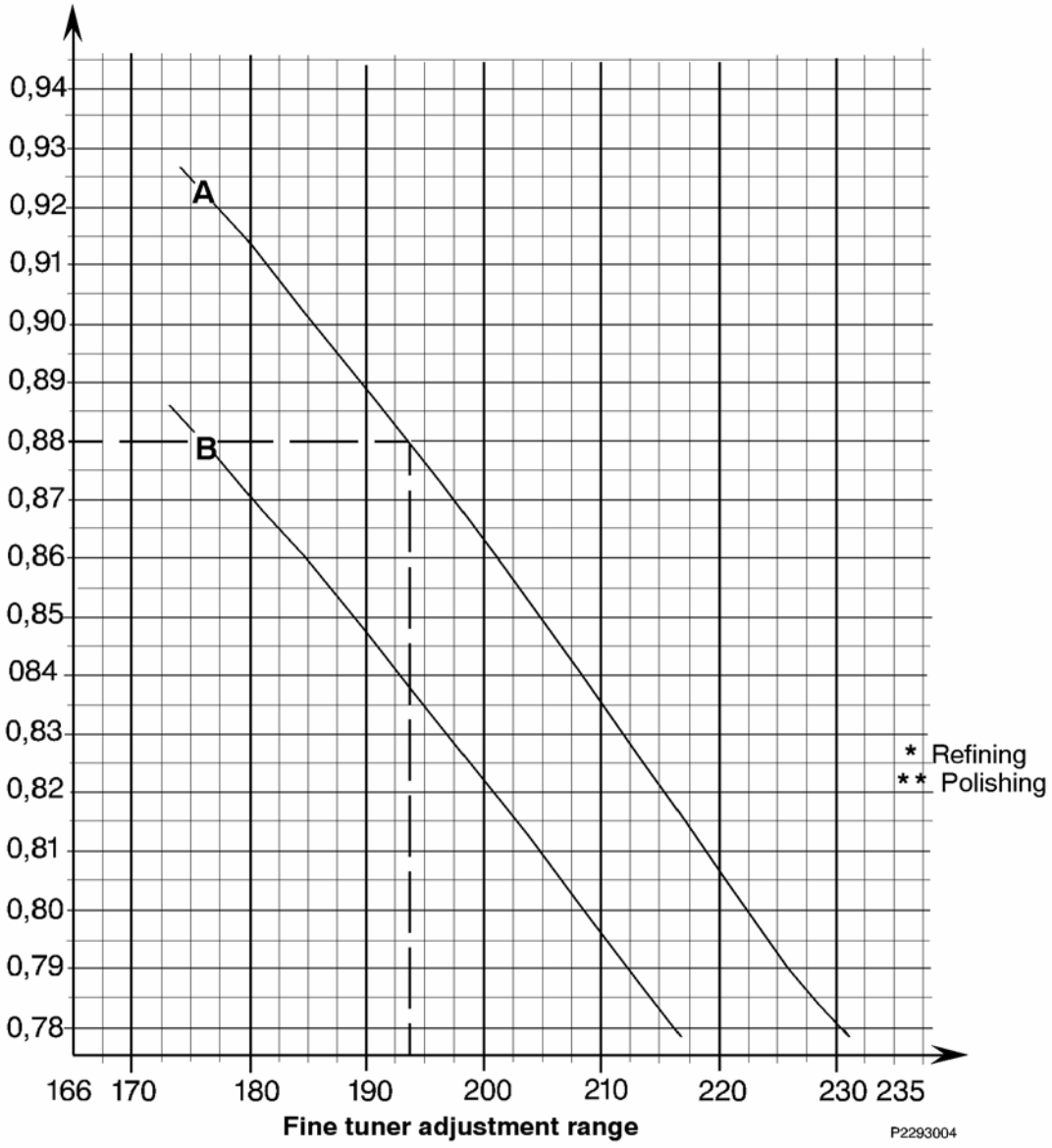
$$D_{heavy\ phase} = \sqrt{D_{sep.\ zone}{}^2 - \frac{\gamma_{oil}}{\gamma_{heavy\ phase}} \times (D_{sep.\ zone}{}^2 - D_{Oil\ centrip.\ pump}{}^2)}$$

From the position of the separation zone which forms in the bowl between the light and heavy liquid you will be able to judge whether the proper diameter of the "Fine Tuner" has been selected. The middle of the separation zone is the separation line which can almost always be seen on the underside of the discs after opening the bowl. It is sufficient to check a few of the upper discs.

The separation line should pass through the outer third of the disc holes (rising channels).

A: γ_S= 1, 0484 kg/m^3

B: γ_S= 1, 00 kg/m^3



Example

To be determined: Diameter of the "Fine Tuner"

Given: g $_{oil}$= 0.88 kg/dm^3

Determined: for refining: 194 mm

Fig. 137

7.6.3 Preliminary adjustment

Adjustment of the separating efficiency of the machine is done by entering the desired centripetal-pump diameter on the control unit.

First select a diameter that is smaller than the required one. This will provide more security against carry-over when the hydrohermetic feed is being adjusted.

Possible adjustments:

- Entering the large diameter: max. **235**
  - Thus, the working diameter of the "Fine Tuner" is set (calculated as per **7.6.2**), which means that this setting will be used during separation.
- Entering the small diameter: min. **166**.
  - Thus, the position into which the "Fine Tuner" will be brought during start-up and ejection is determined.
    A diameter of approx. 180 mm should be taken for reference.

7.6.4 Adjusting the hydrohermetic feed

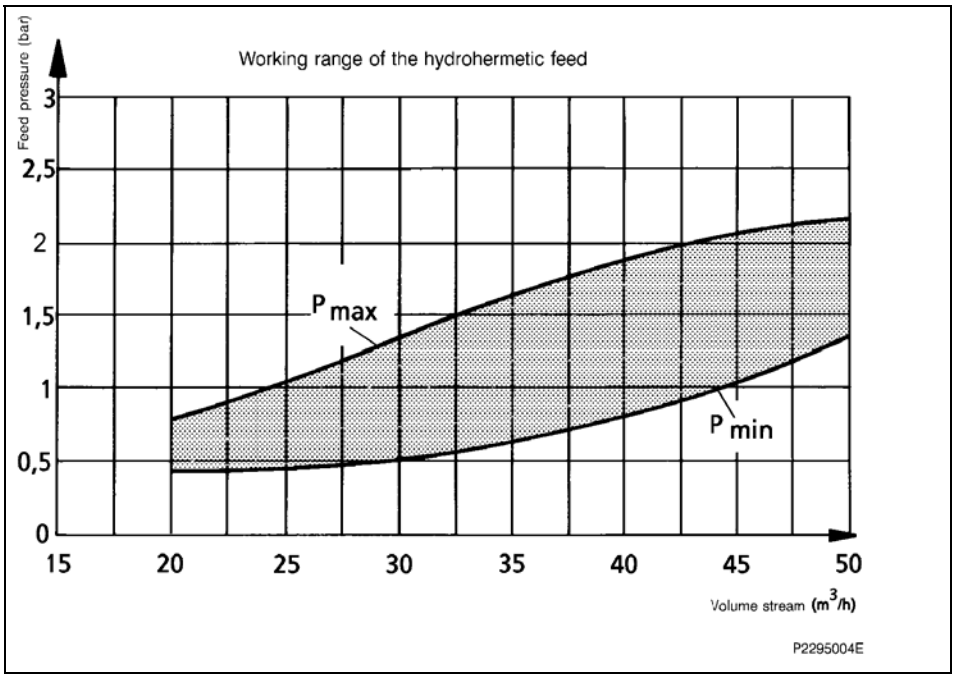


Fig. 138

The values shown in the diagram are based on measuremens with turbine oil and water. They should be considered as reference only. When treating other products, the range of operation might be different.

- Determine feed capacity.
- Determine feed pressure from the above diagram.
- Adjust the determined feed pressure by throttling the light-phase (oil) discharge.

Note:

- If the feed pressure exceeds the permissible value P_{max}, there will be an overflow into the heavy phase.
- if the pressure falls below P_{min}, the system is not sufficiently filled, the hydrohermetic feed does not work.

7.6.5 Final adjustment of separating efficiency

- After having finally adjusted the hydrohermetic feed, carry out final adjustment of the "Fine Tuner".
- Set the optimum separating effect by entering the large centripetal-pump diameter.

– The light phase contains part of the heavy phase.	☞ Increase the Diameter of the ”Fine Tuner”.
– The heavy phase contains part of the light phase.	☞ Reduce the diameter of the ”Fine Tuner” or check the discharge pressure to make sure that no overflow from light to heavy phase has occurred.

Note:

- The light-phase centripetal pump is only needed for adjusting the hydrohermetic feed.
  - The hyrohermetic feed is throughput-dependent, i.e. it has to be readjusted when as soon as the throughput changes (7.6.4).
- The "Fine Tuner" is intended for setting the separating zone.

7.7 Product run

- **Prior to feeding oil, supply cold or hot water to the bowl, depending on process conditions,** until the separating temperature is reached (this is of particular importance when treating oils that tend to emulsify).
- Then stop process water supply.
  The water forms a water seal in the bowl which prevents the oil from discharging through the water outlet.
- Open the hand shut-off valve in the product feed line, if provided.
- Press „Product ON" key:
  - Switch on the separation program.
  - Oil metering pump on or product valve open.
- Adjust the throughput capacity.
  - The "Fine Tuner" is positioned for a small centripetal-pump diameter. Carry-over is thus prevented.
    As soon as enough heavy phase has formed inside the bowl, the centripetal pump is positioned for a large diameter. The period to be provided for this step can be preset (see 7.5.3).
- Throttle the pressure in the oil discharge line so that the hydrohermetic feed will work (7.6.4).
- Carry out final adjustment of the "Fine tuner" (7.6.5).
  After the pressure switch on the clean oil side has responded the LED „PAL" goes out. Monitoring of the clean oil discharge is disabled for the program time „delay discharge pressure". The program time starts with „Separation".
  If the pressure switch responds during separation the product feed valve closes automatically or the oil metering pump is switched off and the separation program is interrupted.
  The LED „PAL" flashes.
  Be sure to feed process water again before restarting with product.
  The **throughput capacity of the separator** (i.e. supplied liquid volume per unit of time) depends on
  - the viscosity,

- the temperature,
- the difference in densities of the liquid components to be separated,
- the nature of the heavy component to be separated,
- the desired degree of purity of the light component.

- In the case of longer interruptions in operation, e.g. due to no product supply, we recommend carrying out one or two partial ejections by pressing the „Partial ejection" key to avoid compacting of the heavy phase in the bowl.



- The bowl must not run for longer than 15 minutes without liquid supply as otherwise the bowl material could heat up to an unpermissible degree.

The separation program including the partial ejections is carried out automatically by the control unit.

The running program can be interrupted by pressing the „Partial ejection" key which triggers a bowl ejection immediately.

The function diagram shows the program sequence for partial and total ejections.
The program sequence is indicated in the mimic diagram of the control unit by means of LEDs.

7.8 Shutting down the separator

- Flush the installation with water:
  - Close product feed or stop product pump,
  - displace the product contained in the bowl with water.
  - Carry out a total ejection by actuating the "Total ejection" key on the control unit.
  - In case of imbalance close the bowl and shut down the separator with bowl filled.
  - Flush the installation thoroughly with water.
- Switch off the motor.



- **The bowl can be braked mechanically.**
- **Do not loosen any part before the bowl has come to a standstill!**
- The bowl has not stopped rotating until
  - the gear sight glass looks clear and the worm wheel has ceased rotating, or,
  - the revolution indicator, if provided, has stopped moving.

8 Cleaning

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8.1 Cleaning-in-place

After use, the Separator must be cleaned in place.
During CIP cleaning solution is circulated through the system.

Attention!

Make sure that the cleaning solution emerging from the discharge lines of the separator cannot be lead into the product lines.

- Set changeover valves, if provided, accordingly.
- If no changeover valves are provided, the plant has to be set up accordingly.



- **For this purpose, proceed as follows:**
  - Switch off the separator and secure it against restart,
  - make sure that all pipelines are **absolutely empty**
  - Close the valves in the feed and discharge.

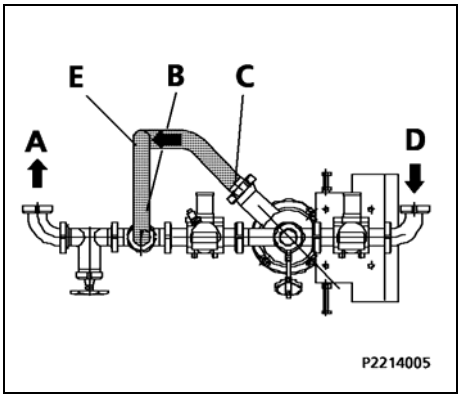


Fig. 139

- Disconnect discharge C.
- Remove the blind nut in discharge B.
- Install pipeline E.
- Remove product feed line D and connect the CIP feed line instead.
- Remove product discharge line D and connect the CIP discharge line instead.
- Arrange the frame drain and the solids collector outlet so as to prevent CIP liquid from flowing into the product tank or the sewer.

- Switch control unit to CIP mode:
  - The separation program is not in operation.

To prevent corrosion damage, only approved detergents should be used.

Example:	Henkel	– 2 % caustic (P3 Super LA)
	Bayer	– 2 % caustic (Trosilin M alkaline)
		– Acid solution 0.5% (Trosilin M acid)

The following cleaning program is recommended:

Program sequence	Duration of the individual program steps
1. **Pre–rinsing** Feed volume:approx. 5 m^3/h Displacing the approx. with hot water	2 – 5 minutes
2. **Flushing with caustic** **Temperature: 70 – 80** °C Feed volume: approx. 5 m^3/h 2% caustic soda (NaOH) (chloride–free) Dissolving the residual sludge Emptying the pipeline with water Total ejection	20 minutes
3. **Flushing with caustic** **Temperature: 70 – 80** °C Feed volume: approx. 5 m^3/h 2% caustic soda (NaOH) (chloride–free) Dissolving the residual sludge Emptying the pipeline with water Total ejection	20 minutes
4. **Intermediate flushing** **Temperature: 70 – 80** °C Feed volume: approx. 5 m^3/h Hot water Total ejection	2 – 5 minutes
5. **Neutralization** **Temperature 65** °C Feed volume: approx. 5 m^3/h Neutralization with 0,5 % HNO_3 solution Emptying the pipeline with water Total ejection	20 minutes
6. **Subsequent flushing** **Temperature: 70 – 80** °C Feed volume: approx. 5 m^3/h Displacing the HNO_3 solution with water Total ejection	5 minutes approx. 30 seconds

The total ejections must be initiated by pressing a button.

The commands „Total ejection" can be automatically triggered from an external CIP control unit.

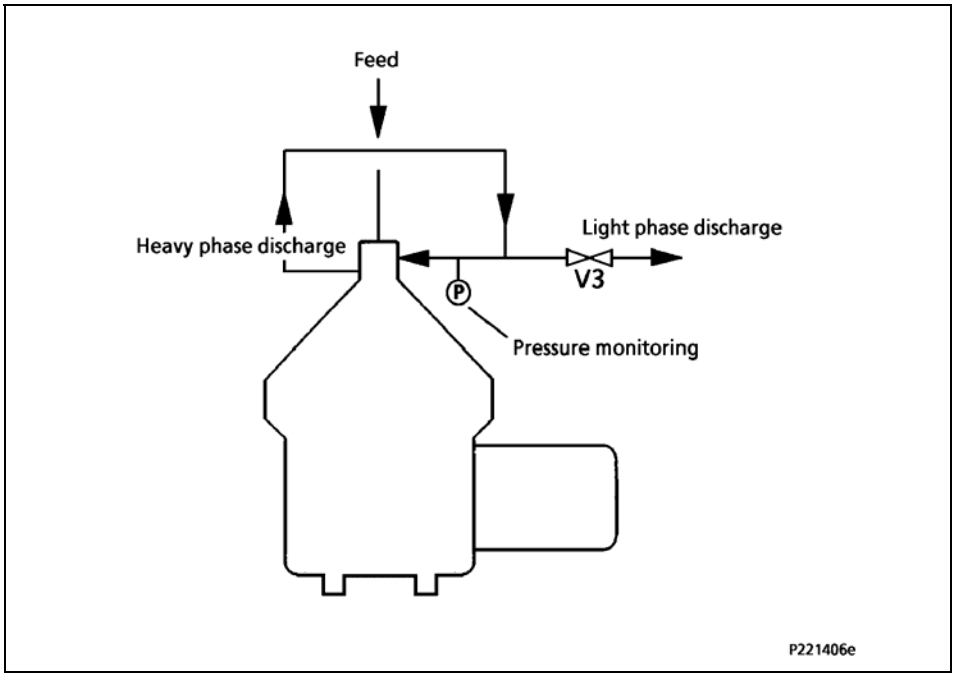


Fig. 140

To obtain perfect cleaning of the bowl, the system has to be connected as follows:

- The CIP solution is led into the feed.
- The liquid emerging from the heavy-phase discharge is diverted into the oil discharge. Thus, an internal circuit is formed whose throughput rate is greater than the feed rate. The volume that is fed flows off through the light-phase discharge.
- The oil discharge towards the tank is throttled (V3) as far as the motor current allows, or until overflow of the bowl occurs (I_{nom} of drive motor - see nameplate).
- The volume of circulating liquid is set **only** by means of the oil valve V3.

Attention!

To prevent overload of the motor, the rated current (I_{nom}) must not be exceeded.

8.2 Bowl

Self-cleaning bowls need not be taken apart for cleaning at the end of a run, unless the nature of the separated solids makes bowl dismantling for thorough cleaning necessary.

Experience will show how often the bowl has to be dismantled.

The following points are particularly important:

- During the first few months of operation, the lock rings should be removed every two weeks for greasing the threads, to prevent seizing.

Later on, the greasing intervals may be extended.
However the bowl should be dismantled at least every two months for thorough cleaning of the inner bowl parts.

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

- All bowl parts have fine tolerances; it is therefore important that all parts are cleaned thoroughly and are free from burrs.
- Place bowl parts on a rubber mat or wooden grating, never on a stone floor.
- Remove gaskets from the bowl parts and clean grooves and gaskets to prevent corrosion.
  Replace damaged gaskets. Swollen gaskets should be left to dry at a warm place so that they can regain their original dimensions and can be re-used.
- Carefully clean the small holes in bowl bottom and the two bowl valves for the supply and discharge of the operating-water to ensure trouble-free performance of the solids ejections.
- Clean and wipe dry guide surfaces and threads of bowl parts and grease them. Spindle cone and inside of bowl hub should be oiled and then wiped clean and dry with a smooth rag.
- The solids collector and solids collector bottom should also be cleaned every time.
- Re-assemble bowl immediately after cleaning. Otherwise the bowl parts must be protected against dust and dirt.

8.3 Frame

When cleaning the frame:

- Never expose the machine to a direct water jet. It must be cleaned by hand, with a sponge or cloth.
  This applies especially to the motor, even if it is enclosed.

8.4 Operating-water feeding system

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

8.5 Gear chamber

- Whenever changing the oil, clean the gear chamber thoroughly with thin-bodied oil.
- Remove metal particles from walls and corners.
- Do Not use fluffy cleaning rags or cotton waste.

8.6 Prior to a long-term shut-down

- Clean the separator thoroughly (8.2 and 8.3).
- Wipe dry and grease all bowl parts and all unvarnished machine parts.
- Keep the cleaned and greased bowl at a dry place until re-use.
- Store the gaskets in a cool and dry, dustfree room, protected from direct daylight, to prevent them from getting brittle.

Prepare the separator as follows:

- Drain the lube oil.
- Fill gear chamber with a corrosion-protecting oil, e.g. SHELL Ensis 30, up to middle of sight glass.

- Run the separator without bowl for about 2-3 minutes so that all gear parts are covered with corrosion-protecting oil.
  (**Strictly adhere to the start-up regulations!)**
- The upper spindle end must be
  - oiled by hand
  - protected with neck bearing cover 3.
- Check liquid shut-off valves for tightness, if necessary, disconnect the feed lines.
- Stop operating-water supply by closing the main valve (to prevent water from breaking in after inadvertant opening of the shut-off device).

To obtain permanent protection against corrosion, run the separator every three months without bowl for about 2-3 minutes
(**Strictly adhere to the start-up regulations!)**

Before re-using the separator:

- Drain the corrosion-protecting oil.
- Fill gear chamber with lube oil (3.1.1) until oil level is slightly above middle of sight glass.
- Run the separator without bowl for about 2-3 minutes
  (**Strictly adhere to the start-up regulations!)**.

9 Drive

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9.1.1 Special risks of a separator

The separator is equipped with a high-speed rotating metal bowl which represents a danger potential not to be underestimated on account of the rotational energy which can pose a danger for the installation and persons working in the installation when not properly handled.



CAUTION!

Switch off the separator before carrying out maintenance or repair work.
Wait, observe and check that all rotating parts are at a standstill.
Do not reach into the rotating drive section or bowl!
Do not loosen any part before the bowl has come to a standstill!

Risk of injury and danger to life through rotating parts.

Standstill should not be checked using only one source of information (e.g. speed indicator) but must be backed up by at least one further checking device. It must always be reckoned with that the first used indicating option for standstill will provide false information because, for example, the electronics have failed or the belt or gear in the drive is defective.

The following options are available for checking standstill on separators depending on the version:

- Electric speed indicator
- Revolution indicator or sight glass on the gear cover
- The inspection port on the hood enables a direct view onto the bowl. In addition, checking is possible by removing the gear cover or opening the frame port on the bowl side.

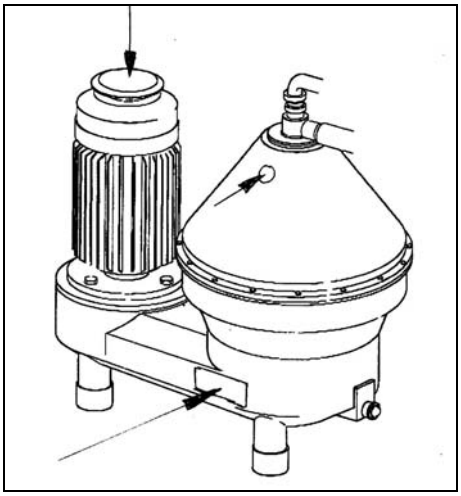


Fig. 141

Revolution visual check on machines with belt drive.

You can observe whether the machine is at a standstill at the points marked with the arrows.

We reserve the right to carry out design modifications.



NOTE

Observing the motor fan is not a reliable method of checking standstill because the motor or fan can already be at a standstill when the separator bowl is still rotating.

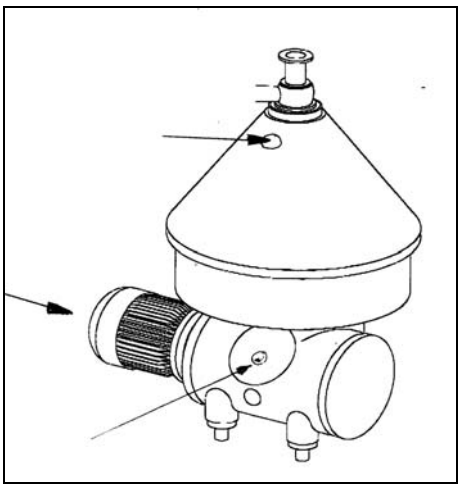


Fig. 142

Revolution visual check on machines with gear.

You can observe whether the machine is at a standstill at the points marked with the arrows.

We reserve the right to carry out design modifications.

NOTE

Observing the motor fan is not a reliable method of checking standstill because the motor or fan can already be at a standstill when the separator bowl is still rotating.

During cleaning programs (steam sterilization and CIP), very high temperatures are reached on the surfaces of the separator and piping.

CAUTION!

During cleaning programs, the surfaces of the separator and pipes are very hot.

Danger of burns!

With some products, the separator has to be cooled. As a result, temperatures of up to minus 30 °C are reached on the surfaces of the separator and pipes.

CAUTION!

When the cooling is switched on, the surfaces of the separator and pipes can get very cold.

Danger of frostbite!

CAUTION!

When the noise level of the separator is too high, noise-dampening ear protectors must be worn.

Danger of hearing damage!

CAUTION!

During all maintenance and repair work on the separator, the fittings and pipes may spit out hot, caustic liquids.

Danger of causticization of skin and eyes!

9.1.2 Safety precautions for maintenance and repair

- Observing the maintenance intervals and user information is decisive for the service life and permanent operating readiness of the separator.
- The maintenance intervals depend on the operating conditions. Especially highly stressed parts of the separator must be regularly checked. Adapt the maintenance intervals to the operating conditions!
- Timely maintenance of the separator is essential for safe operation.

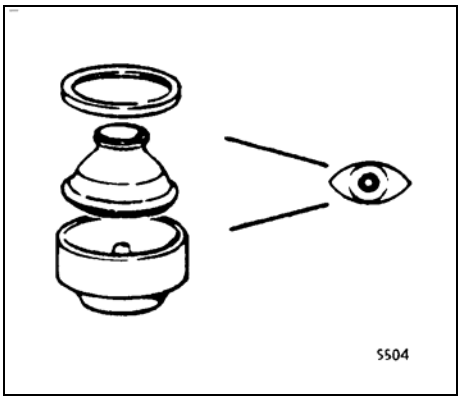


Fig. 143

Especially highly stressed parts of the separator such as
- bowl lock ring,
- bowl bottom,
- bowl top

must be regularly checked (at least once a year) as specified in the maintenance schedule to assure safe and efficient operation.



Fig. 144

When carrying out maintenance and repair work:

- **Do not climb onto or stand on the machine or parts of the machine!**

Danger of injury through slipping or falling down!

- Repairs to the separator may only be carried out by service technicians from Westfalia Separator or personnel trained and certified by Westfalia Separator.

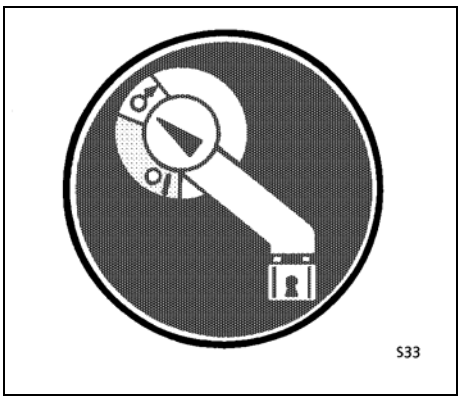


Fig. 145

- During maintenance and repair work, make sure that the main switches are switched off and secured against restarting.
- Make sure that other persons do not have the possibility to start the machine before the maintenance or repair work is finished.

- Make sure that the rotating parts of the separator (drive, bowl) are at a standstill before carrying out maintenance and repair work.
-
- When the machine is defective, a warning sign must be attached and the separator must be secured against unauthorized starting.

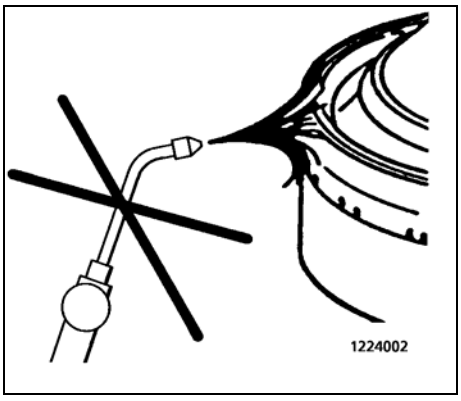


Fig. 146

- **Do not heat bowl parts with a naked flame to facilitate dismantling work.**

Structural changes in the material of the bowl parts which affect the operating safety of the machine may result!

- **Do not weld bowl parts.**

- Do not weld hood and solids catcher parts of steam-sterilizable separators.

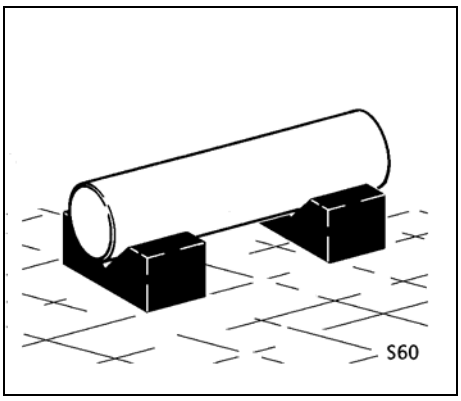


Fig. 147

- Place the dismantled separator parts on suitable surfaces (rubber, wood etc.).
- Take appropriate steps to prevent machine parts from overturning and rolling away.

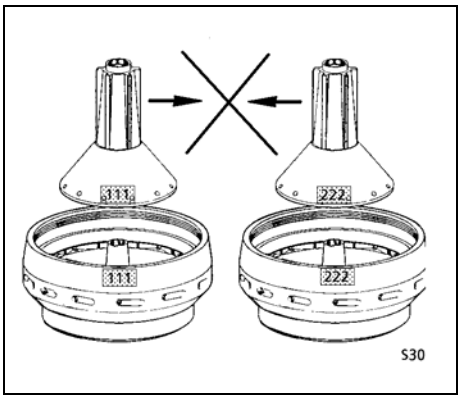


Fig. 148

- When carrying out assembly work on several separators, be careful not to interchange parts of different bowls! Each bowl must be balanced with its respective components.

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

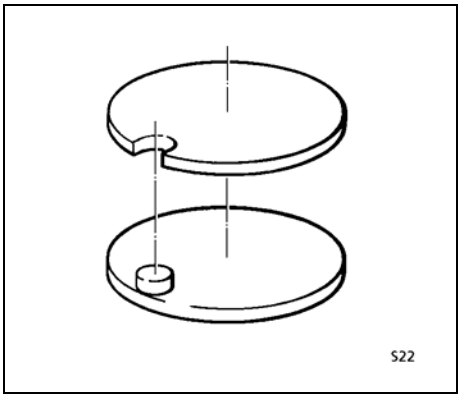


Fig. 149

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

The separator may not be operated when locking devices and marks on the bowl parts are damaged.

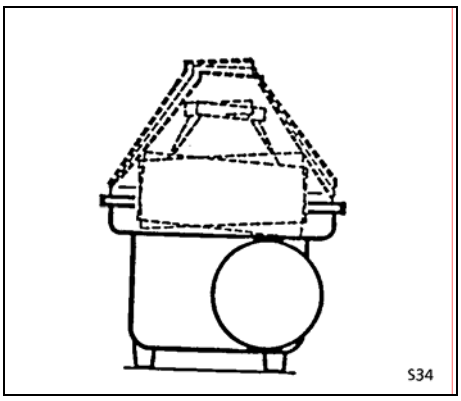


Fig. 150

- After fitting certain bowl parts (e.g. bowl bottom, bowl top) the bowl must be re-balanced.

Bowl balancing may be carried out only by specialists from Westfalia Separator or specialist workshops authorized by Westfalia Separator!

If in doubt, consult the service department of Westfalia Separator.

- Do not manipulate speed-altering devices such as frequency converters so that the maximum admissible bowl speed (see nameplate or “technical data” in the instruction manual) is not exceeded.
- Ensure that monitoring devices (e.g. overspeed monitors etc.) are not manipulated or damaged and check their function in accordance with the instructions in chapter **“Maintenance and repair – maintenance schedule”**.

- When carrying out maintenance and repair work, carry out a visual check of the separator components. Have the components checked for damage through **corrosion** and **erosion** by **authorized specialists** and proceed in accordance with the instructions in chapter **“Maintenance and repair – inspections”**.



Caution

The separator must be shut down immediately when damage due to corrosion or erosion is detected!

There is a risk of damage to the separator and a danger to life and limb of the user through machines parts flying around.

In case of doubt, contact Westfalia Separator!

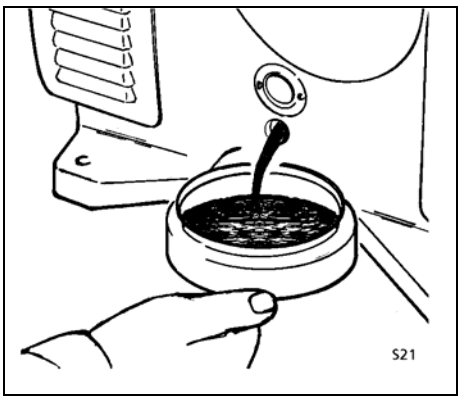


Fig. 151

- Follow the instructions when handling waste oils and comply with the disposal regulations when replacing lubricants in the chapter **"Maintenance and repair"** of the instruction manual.

- After maintenance and repair work on the separator, refit all protective devices.

9.2 Dismantling the vertical gear parts

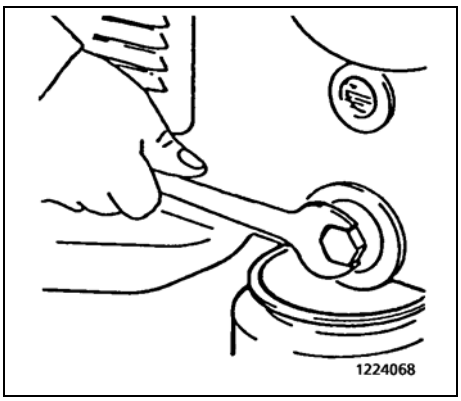


Fig. 152

- Dismantling the bowl.
- Loosen oil drain screw and drain oil into oil pan.

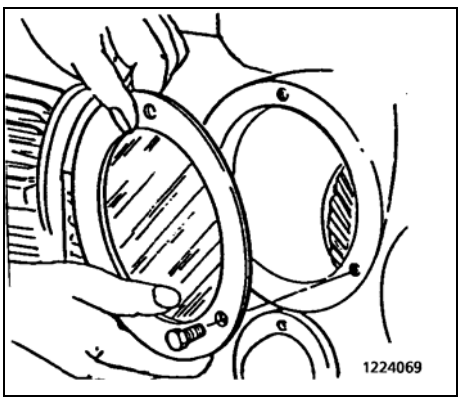


Fig. 153

- Unscrew hex head screws.
- Remove gear sight glass or revolution indicator.

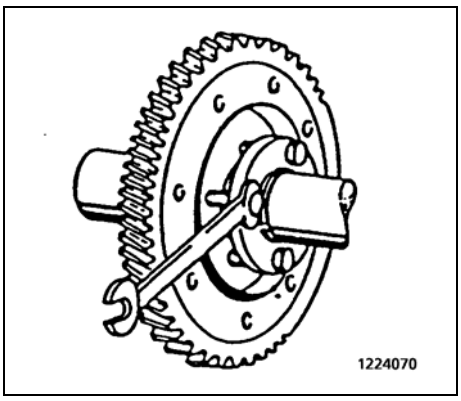


Fig. 154

- Loosen hex head screws in clamp plates of worm wheel.

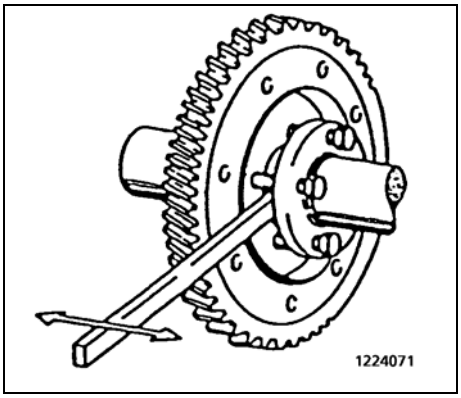


Fig. 155

- Slacken clamp plates until the worm wheel can be moved on worm wheel shaft.
- Push worm wheel to the clutch side.

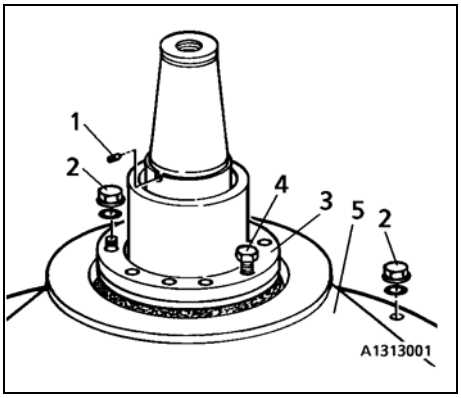


Fig. 156

- Unscrew Allen screws 1 out of sleeve/spindle.
- Unscrew cap nuts 2 of the operating water feeding device.
- Press off ring 3 with hex head screws 4 (M8) which are screwed into the two puller holes.
- Remove protective cover 5.

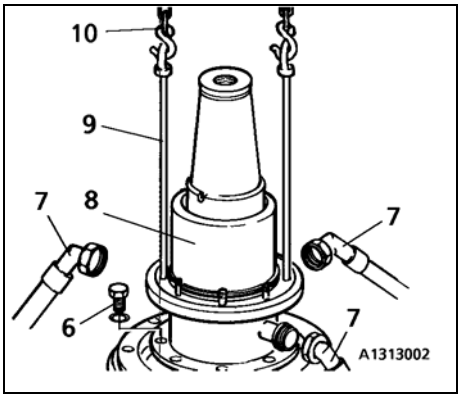


Fig. 157

- Unscrew hex head screws 6.
- Disconnect hoses 7 of the operating water feeding device.
- To pull the operating water 8 feeding device off the spindle:
  - Screw the threaded spindle of the puller device 9 into the taphole and
  - pull off using lifter 10.

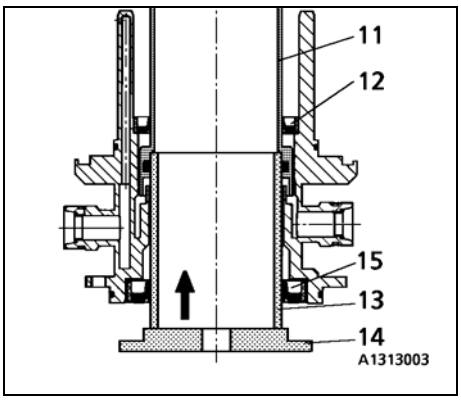


Fig. 158

- Dismantle upper sealing ring 12 and spindle cap 11 with sleeve 13 and centering 14.
- Force out the lower gasket 15 with a screwdriver.

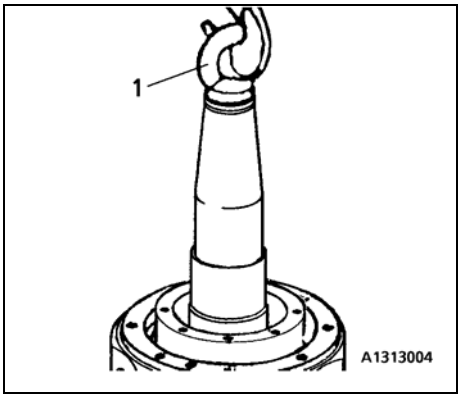


Fig. 159

- Pull out spindle upwards using spindle lifter 1.

9.2.1 Dismantling the neck bearing bridge

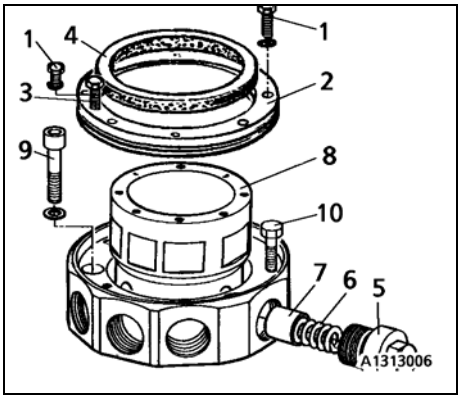


Fig. 160

- Undo screws on ring 2 and force off the ring.
- Dismantle gasket 4.
- Dismantle threaded plugs 5, springs 6 and spring pistons 7.
- Remove neck bearing pressure ring 8.
- Unscrew Allen screws 9.
- Force off neck bearing bridge using hex head screws 10.

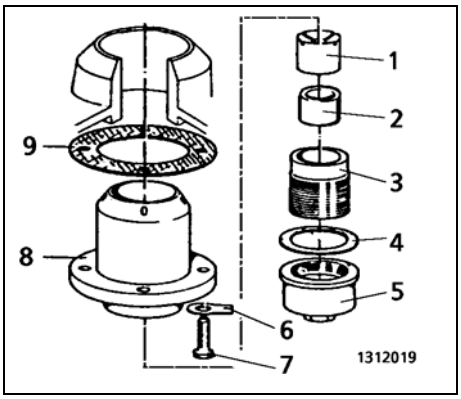


Fig. 161

- Unscrew bottom bearing cap 5 and remove gasket 4.
- Unscrew bottom bearing threaded piece 3 and remove it together with spring column 2 and bottom bearing pressure piece 1.

- In case the bottom bearing housing 8 must be replaced:
  - straighten tab washers 6,
  - unscrew hex head screws 7.
  - Screw two screws 7 into the tapholes of bottom bearing housing
  - force out bottom bearing housing by pressing it downwards.

9.2.2 Removal of ball bearing and worm

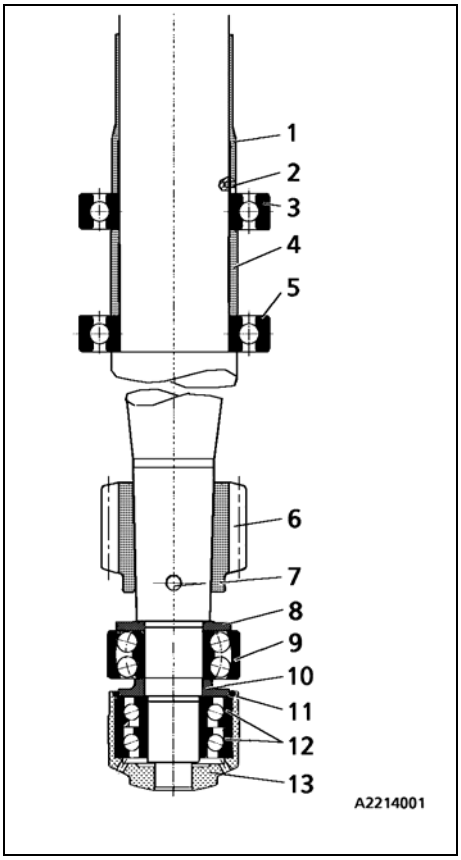


Fig. 162

- Pull out the following components using a commercially available puller:
  - Ball bearing protection ring 10, angular contact ball bearings 12 and bottom bearing housing 13,
  - Ball bearing protection ring 8 and pendulum ball bearings 9.
- Knock out cylindrical notched pin 7.
- Remove worm 6.
- Unscrew screw 2 and remove sleeve 1.
- Grooved ball bearings 3 and 5 and sleeve 4.
- Press snap ring 11 out of the groove of bottom bearing housing.
- Remove angular contact ball bearing 12 from bottom bearing housing 13.

9.3 Installing the vertical gear parts

Proceed in reverse order of removal (9.2). **and according to the following instructions:**

- Watch for "O" mark position.
- When the worm on the spindle is worn, the worm wheel will have to be replaced at the same time.

Prior to installing the vertical gear parts

- thorougly clean the gear chamber (8.5).

Check condition of the ball bearings on the spindle. Be sure only to use ball bearings fulfilling the WS quality standard - see parts list.

- **For safety reasons, replace ball bearings on worm spindle every 5 000 operating hours.**
- Before fitting the ball bearings, heat them up in oil to approx. 80 °C.
- Replace the two angular contact ball bearings always at the same time.

Important!

The angular contact ball bearings may be axially charged in one direction only. They have to be inserted so that the **large shoulder of the inner ring of each bearing** shows upwards (towards the bowl).

If the bearings are not correctly positioned, they will be prematurely destroyed!

Each time when having installed the vertical gear parts,

- install the bowl and check its height
- **for possible re-adjustment (**9.4**).**

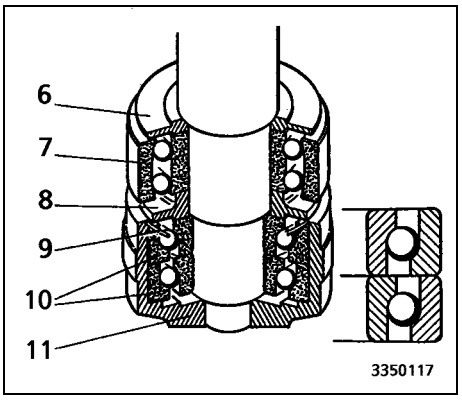


Fig. 163

Install the bearings:

- the angular contact ball bearings must be
  – warmed up,
  – then pushed onto the spindle.
- Slip snap ring 9 over the ball bearings.
- Let the ball bearings cool down.
- Slide bottom bearing housing 11 over the ball bearings.
- Press snap ring 9 into the groove of the bottom bearing pressure housing.
- Install worm spindle without neck bearing bridge.

Important!
Insert worm spindle without hitting on top of the spindle. If necessary, deburr the bottom bearing housing with a fine emery cloth.

9.3.1 Assembling the neck bearing bridge

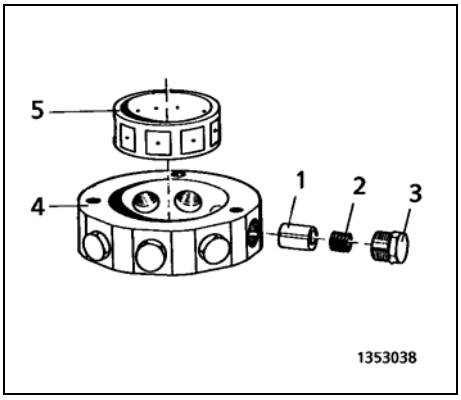


Fig. 164

- Insert pressure ring 5 in neck bearing bridge 4 (recesses of pressure ring must be in line with bores of neck bearing bridge).
- Put neck bearing springs 2 into spring pistons 1.
- Grease spring pistons thoroughly.
- Thread in plugs 3 with
  - spring pistons 1 and
  - neck bearing springs 2 so that pressure ring 5 lies centrically in neck bearing bridge 4.
- Then tighten the plugs evenly and crosswise.

Before fitting the neck bearing bridge, check the gaskets for proper condition.

9.3.2 Fitting the spring column into the bottom bearing

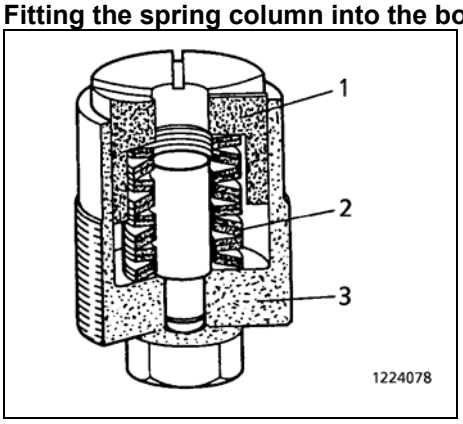


Fig. 165

- Slide cup springs 2 onto bolt of bottom bearing threaded piece 3 as illustrated in the adjacent figure:
  – two springs in a set,
  – eight sets altogether.
- Insert bottom bearing pressure piece 1 into bottom bearing threaded piece 3, sliding it over the cup springs.

9.3.3 Fitting the operating water feeding device

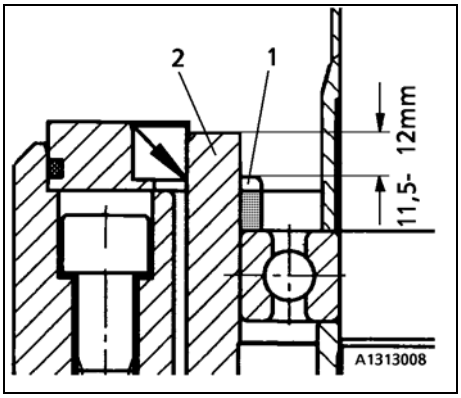


Fig. 166

- Before fitting the operating water feeding device, the distance between the cams of distance ring 1 and the pressure ring 2 must be checked.

  Distance cam distance ring to pressure ring

  < 11.5 mm - file off cam.

  > 12 mm - Weld on cam or order new distance ring from the factory stating the dimension of the required cam height.

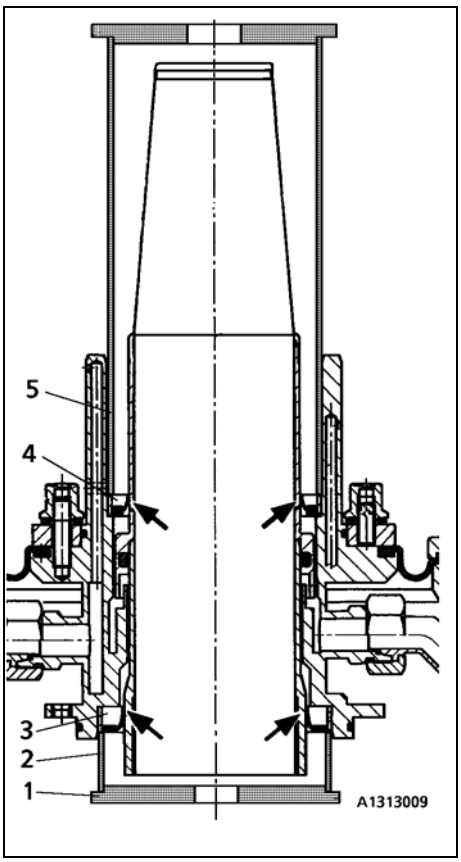


Fig. 167

Fitting the sealing rings:

- Fit the lower sealing ring 3 with sleeve 2 and centering disc 3.
- Assemble operating water feeding device.
- Fit upper sealing ring 4 with sleeve 5 and centering disk 1.

  Make sure the sealing rings are positioned correctly! (see arrows)
- Then proceed in reverse order of removal.

9.4 Bowl Height

The bowl height is adjusted at the factory before the separator is shipped.

9.4.1 Inspection

The bowl height must be checked for re-adjustment

- before the first start of the separator,
- after re-assembling the vertical gear parts,
- after exchanging the bowl,
- after exchanging the centripetal pump,
- as soon as the centripetal pump shows any grinding marks.

Prerequiste to correct bowl height adjustment is that

- the bowl is properly closed,
  (the "O" marks on bowl lock ring and on bowl bottom must be in line with each other.)
- the hood is properly seated on the solids collector,
- the fastening screws of the hood are tight,
- the upper centripetal pump is screwed onto the lower centripetal pump as far as it will go,
- the centripetal pumps are screwed into the disk as far as it will go.

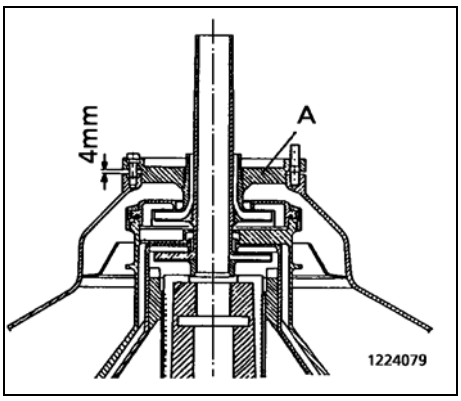


Fig. 168

The bowl height is correct when the disk A with screwed-in centripetal pumps can be raised by about 4 mm. Otherwise the bowl height has to be re-adjusted.

Distance between disk and hood

< 5 mm, bowl is too low.
> 6 mm, bowl is too high.

9.4.2 Adjusting

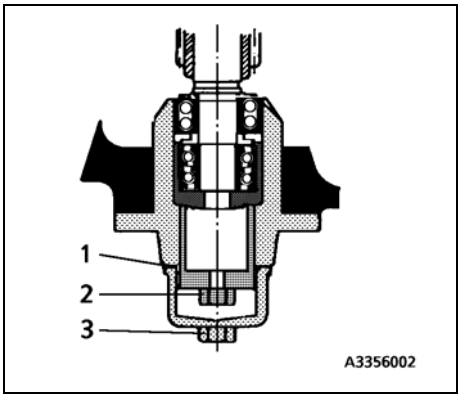


Fig. 169

- Unscrew the bottom bearing cap 3.
- Take off gasket 1.
- Adjust the bowl height by turning bottom bearing threaded piece 2. (1 revolution - 2 mm)

  Bowl is too low »» *turn bottom bearing threaded piece clockwise.*

  Bowl is too high »»*turn bottom bearing threaded piece anti-clockwise*.

- Finally screw on bottom bearing cap 3 with fitted gasket 1. Ensure that the bottom bearing threaded piece does not rotate.

After adjusting the bowl height, the distance between the cams of the distance ring and the pressure ring (9.3.3)!

9.5 Removal of the horizontal gear parts

Work on electric lines may only be carried out by a qualified electrician under observation of the safety regualtions.

For removal of the horizontal gear parts proceed according to the following sections:

9.5.1 Motor

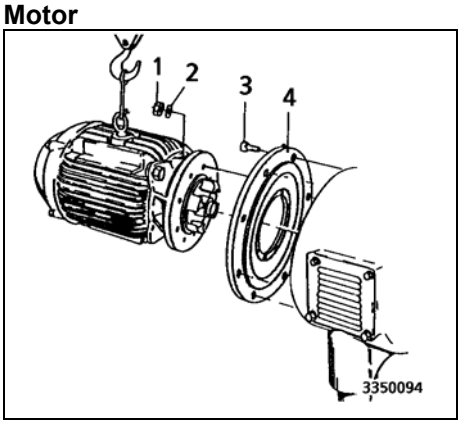


Fig. 170

- Disconnect motor.
- Suspend motor from a suitable hoist, tighten rope.
- Unscrew hexagon nuts 1.
- Remove lock washers 2.
- Remove motor together with cam hub.
- Unscrew Allen screws 3.
- Remove intermediate flange 4.

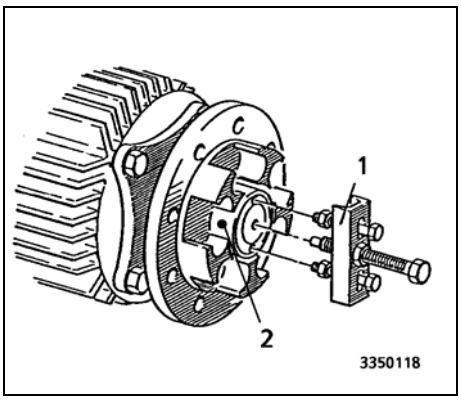


Fig. 171

Removing the cam hub:

- Remove threaded pin 2.
- Pull hub off the motor shaft end using device 1.

9.5.2 Fluid clutch

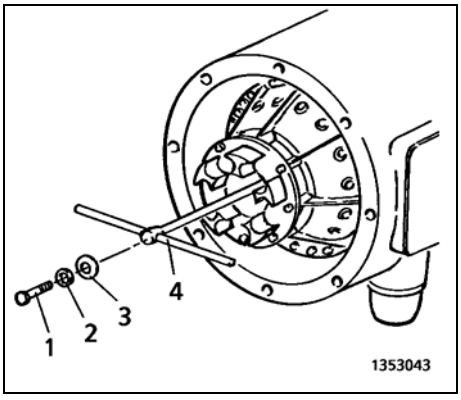


Fig. 172

- Unscrew hex head screw 1. Note tension of cup spring 3 !
- Remove washer 2 and cup spring 3.
- To remove fluid clutch from cone of worm wheel shaft use device 4.

9.5.3 Worm wheel shaft

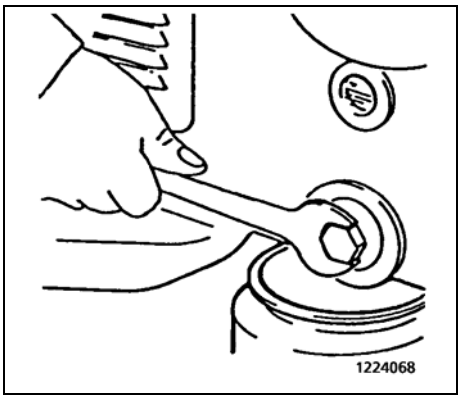


Fig. 173

- Loosen oil drain screw.
- Drain oil into oil cup.

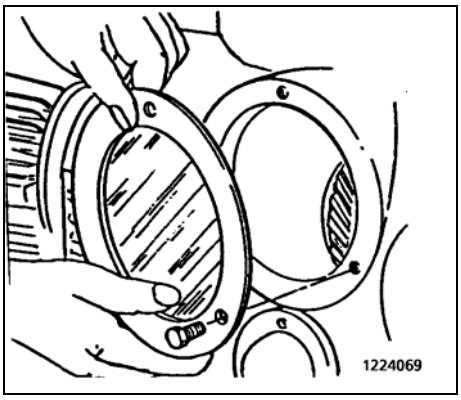


Fig. 174

- Unscrew hex head screws.
- Remove gear sight glass or revolution indicator.

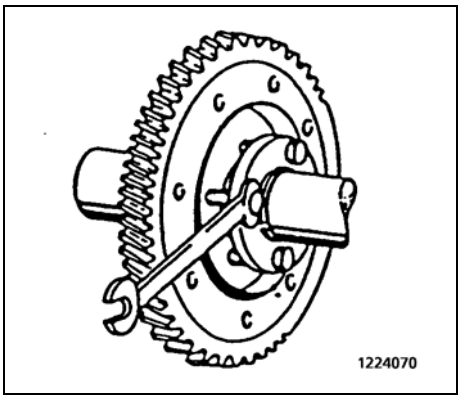


Fig. 175

- Loosen hex head screws in clamp plates of worm wheel.

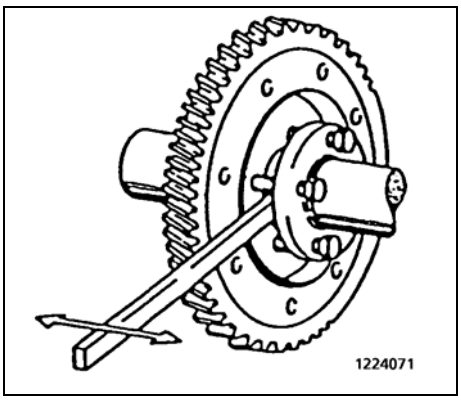


Fig. 176

- Slacken clamp plates until the worm wheel can be moved on worm wheel shaft.
- Push worm wheel to the clutch side.

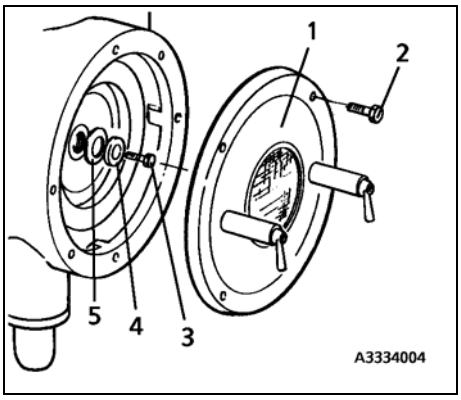


Fig. 177

- Unscrew allen screws 2.
- Remove fan cover 1.
- Unscrew hex head screw 3 from worm wheel shaft. Note tension of cup spring!
- Remove centering disc 4 and cup spring 5.

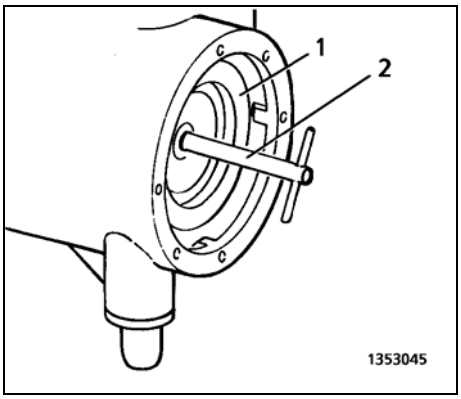


Fig. 178

- Remove brake pulley 1 from cone of worm wheel shaft using device 2 (fluid clutch/brake pulley).

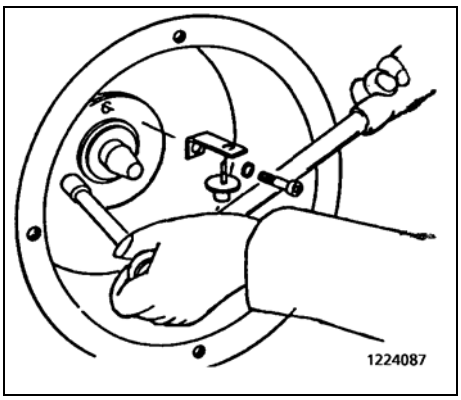


Fig. 179

- Unscrew Allen screws from bearing cover (brake side)
- Remove holder and proximity switch.

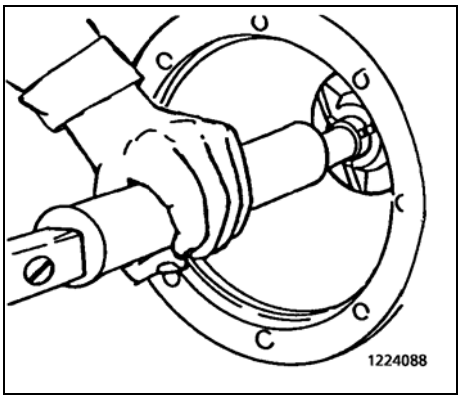


Fig. 180

- Place a hard wooden block against worm wheel shaft.
- Drive out worm wheel shaft together with ball bearing, nut and bearing cover towards *brake side*. (Shaft must have completely loosened from the ball bearing on the motor side).

- Pull out the worm wheel shaft by hand; while doing so, hold worm wheel to prevent damage to gear teeth.
- Take worm wheel with clamp plates out of the gear housing.

9.5.4 Removing the grooved ball bearing (motor side)

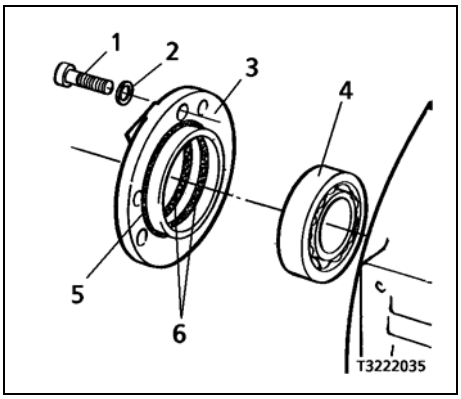


Fig. 181

- Unscrew hex head screws 1 and remove lock washers 2.
- Remove bearing cover 3 together with sealing rings 6 and gasket 5.
- Drive out the ball bearing from the gear chamber side by placing a brass mandrel on the inner ring of the ball bearing.

9.5.5 Removing the angular contact ball bearing (brake side)

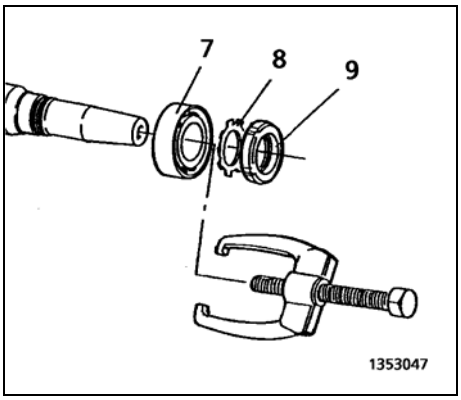


Fig. 182

- Lift tab of washer 8 out of groove of nut 9.
- Loosen and unscrew grooved nut using the pivoted hook wrench.
- Remove tab washer 8.
- Withdraw angular contact ball bearing 7 from worm wheel shaft using a commercial pulling device.

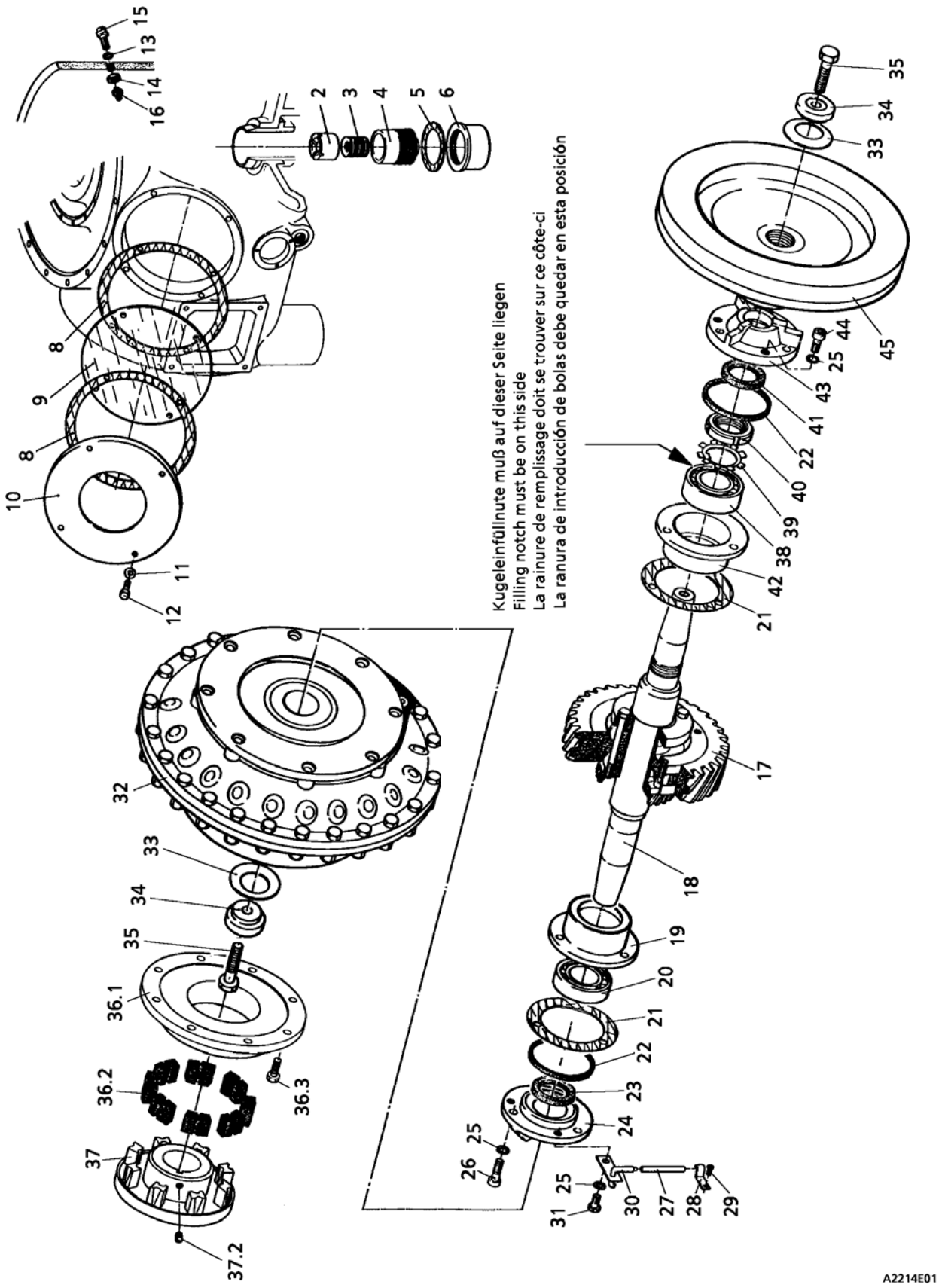

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Filling notch must be on this side
La rainure de remplissage doit se trouver sur ce côte-ci
La ranura de introducción de bolas debe quedar en esta posición
A2214E01

Fig. 183

9.6 Re-assembly of the horizontal gear parts

Note:

For safety reasons replace ball bearings of worm wheel shaft every 10 000 operating hours.

Fit angular contact ball bearing 38 onto worm wheel shaft 8. Note: Filling notch of bearing must face the brake side.

- Fit tab washer 39.
- Tighten grooved nut 40.
- Bend one tab of washer into a groove of the nut so that self-loosening of the nut is impossible.
- Install grooved ball bearing 20 into bearing housing 19. Fit bearing cover 24 and fasten with hex head screws 26.
- Install worm wheel assembly 17 with clamp plates into the gear housing (the flange must face the brake side).

The worm wheel has been balanced in the factory as complete assembly.

Therefore,

the clamp plates and the toothed rim must not be rotated on the wheel body

– and component parts must not be replaced individually.

When the toothed rim is worn and needs replacement, the entire worm wheel with clamp plates must be replaced. The worm of the spindle must be replaced at the same time.

- Introduce worm wheel shaft 18 into the separator frame from the brake side and slide on the worm wheel.
- Place a hard wooden block against the worm wheel shaft and tap it lightly with a hammer until angular contact ball bearing 38is tightly seated in the housing.
- Install bearing cover 43 with inserted sealing ring 41 and gasket 22.
- Tighten bearing cover 43 with hex head screws 44 (lock washers 25 placed underneath).
  Required Torque: 45 Nm.

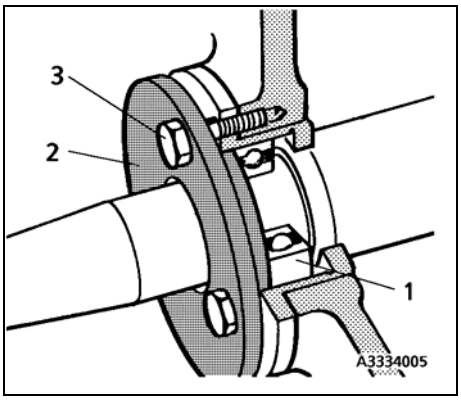


Fig. 184

Installing the grooved ball bearing (motor side) into its final position:

- Remove bearing cover 24.
- Fit grooved ball bearing 1 evenly against collar of worm wheel shaft using
  – device 2 and
  – hex head screws 3.
- Unscrew hex head screws 3.
- Remove device 2.

- Install bearing cover 24 with inserted sealing ring 23 and gasket 22.
- Tighten bearing cover 24 with hex head screws 26 (including washers 25).

- Push worm wheel towards brake side until it rests against shoulder of worm wheel shaft.
- Tighten the screws in both clamp plates evenly and crosswise. **Required torque: 45 Nm.**
- The end of the worm wheel shaft must be
  - greased thinly,
  - cleaned and wiped dry with a rag.
- Place brake pulley 45 onto cone of worm wheel shaft.
- Fasten brake pulley using head head screw 35, washer 34 and cup spring 33. **Required torque: 150 Nm.**
- Place fluid clutch 32 onto cone of worm wheel shaft.
- Fasten fluid clutch 32 by means of hex head screw 35, washer 34 and cup spring 33.
- **Required torque: 150 Nm**

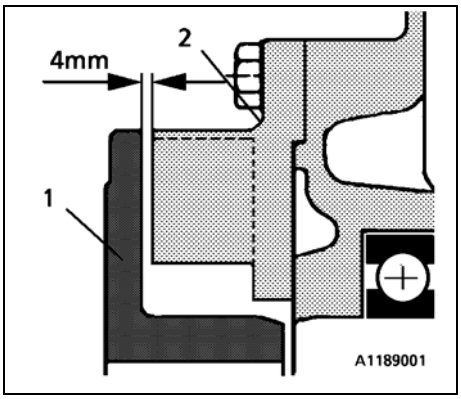


Fig. 185

When fitting the motor, note:

The distance between cam hub 1 and fluid clutch 2 must be **4 mm**.

Check the distance after fitting

- another motor,
- another cam hub,
- fluid clutch,
- another worm wheel shaft.

If readjustment becomes necessary:

- Displace cam hub on the motor shaft.
- Re-drill motor shaft for threaded pin.

Fill:

- gear chamber in accordance with chapter 3.1.

Check:

- direction of rotation of bowl (4.2).
- spindle speed with a hand tachometer (4.3).

Running-in:

- When using new gear parts (worm wheel, worm*let the clarifier run for approx. one hour **without bowl.**
  While running in the gear parts, switch the motor on and off several times.

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10 Fluid clutch

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10.1 General

The fluid clutch (Turbo Clutch)

- transmits the power from motor to gear,
- gradually brings the bowl to it rated speed,
- eliminates premature wear on gear parts and on motor.

The motor power is transmitted by means of a closed oil circuit between a primary wheel driven by the motor shaft and a secondary wheel driving the worm wheel shaft of the clarifier.

The fluid clutch must be filled with the correct amount of oil (10.2), to ensure that the bowl reaches its rated speed within its starting time (4.4).

If the clutch contains	
not enough oil:	too much oil:
• Starting time of bowl too long. • Slippage too great.	• Starting time of bowl too short. • Overload of motor and gear.

- The oil in the clutch has to be changed
  - every 5 000 working hours
  - on the occasion of an inspection and when replacing the ball bearings of the worm spindle and worm wheel shaft.

The clutch requires:

approx. 6,25 litres of oil when using a n = 1455 rpm motor

apprrox. 5,5 litres of oil when using a n = 1745 rpm motor

For checking the oil level, proceed according to the instructions in sect 10.2**.**

Be sure to use only the type of oil specified in sect. 10.4.

10.2 Checking the oil level

- The oil level has to be checked
  - before the initial start-up of the clarifier,
  - every time after re-filling of oil,
  - once a month since in the course of time small oil losses may occur.
  - **Note: Check oil level only after oil has cooled down!**

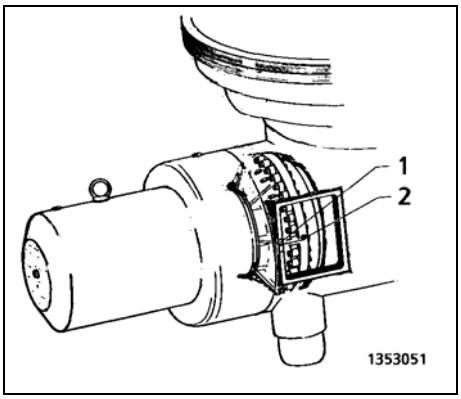


Fig. 186

Brand new clarifier:

Mark on oil level plate 1 must be in line with lower edge of taphole 2. Oil level must then be up to the lower edge of taphole 2 .
If a replacement clutch is installed, the existing oil level indicator plate is no longer valid and must be re-adjusted according to the instructions given in chapter "clarifier with replacement clutch".

For checking the oil level, proceed as follows:

The clarifier still has its original clutch:

- Remove the ventilation grid so that the oil level indicator plate can be seen.
- Turn the fluid clutch until threaded plug 2 can be unscrewed without oil flowing out.
- Unscrew threaded plug with a wrench.
- Then turn clutch until the lower edge of receiving hole for threaded plug and the mark of the oil level plate are in line with each other (see 10.2).

In this position, the oil is just about to overflow.

If this is not the case, refill oil as described under 10.3.

The clarifier has a replacement clutch:

- If the clutch is replaced, then the original oil level indicator plate is no longer valid!
- The clutch has been filled with the correct amount of oil if the peak power consumption when the machine is starting up reaches a level which is twice as high as the rated power consumption.
- If an exact measurement of power consumption is not possible, then the correct amount of oil can be determined by measuring the speed of the horizontal drive shaft in the clarifier.
  When the clarifier is operating at its rated throughput, the shaft should be rotating at approx.
  1 420 rpm - (50 Hz) or at
  1 710 rpm - (60 Hz).
- If the peak power consumption or the speed of the shaft is much higher than these figures, then there is too much oil in the clutch.
- If they are much lower than these figures, then there is not enough oil.
- Once the correct amount of oil has been established, the oil level indicator plate must be re-set accordingly.

10.3 Re-filling of oil

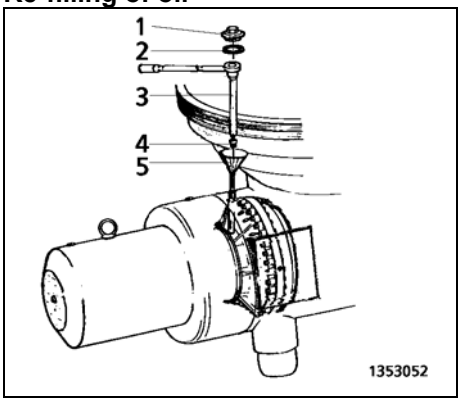


Fig. 187

- Unscrew lock screw 1.
- Unscrew oil fill screw 4 with wrench 3.
  Pour in oil using funnel 5.
- Check oil level (10.2)
- Screw in lock screw including gasket 2 **tighly.**

10.4 Type of oil

For filling the fluid clutch use only

steam turbine oil TDL 32 (WS part-no. 0015-0050-090)

This oil complies with the following specification deviating to some extent from DIN:

Designation	Lubricating oil TDL 32 - DIN 51515 (steam turbine oil with additives giving increased protection against corrosion and increased resistance to aging.
Kinematic viscosity	32 ± 3,2 mm^2/s (cSt) at 40 °C
Density / 15 °C	max. 0,900 g/ml
Pour point	≤ 9°C
Open flash point	≥ 210°C to Cleveland
Corrosive effect on – copper – steel	 degree of corrosion 2 - 100 A3 according to DIN 51759 degree of corrosion 0 - A according to DIN 51585
Aging characteristics	Increase of the neutralization number after 1000 h max. 2,0 mg KOH/g oil according to DIN 51587

The following branded oil meets this requirement: **Shell Turbo Oil T 32.**



Steam turbine oils TDL 32 of other brands may be used provided they comply with the above specification.

Each clarifier is supplied with an amount of TDL 32 oil which is sufficient for one filling.

10.5 Dismantling

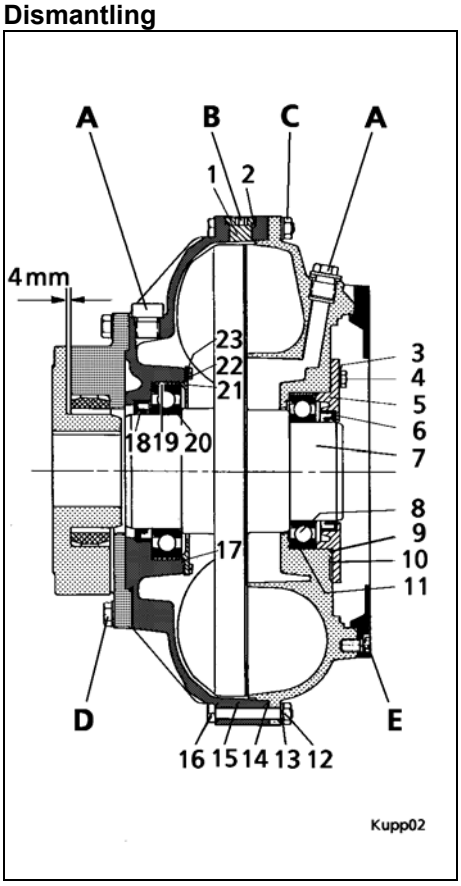


Fig. 188

The fluid clutch should not be dismantled on site.
If damage occurs, the clutch should be returned to the manufacturer for repair to assure correct fitting of the spare parts and, hence, proper functioning of the clutch.
On request, a spare clutch can be placed at your disposal.

If, however, you decide to remove leakage of the clutch on site, we recommend to check first the sealing ring 6 and to replace it, if necessary.

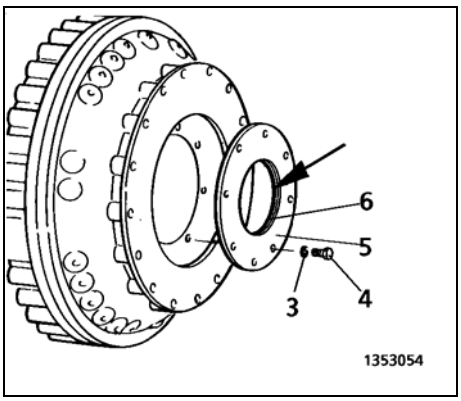


Fig. 189

Removal of sealing ring 6

- Unscrew screws 4 with lock washers 3 and remove sealing ring cover 5.
- Force out sealing ring 6 using a screwdriver.
- Now check the sealing ring and replace it when its sealing lip is no more soft and pliable.

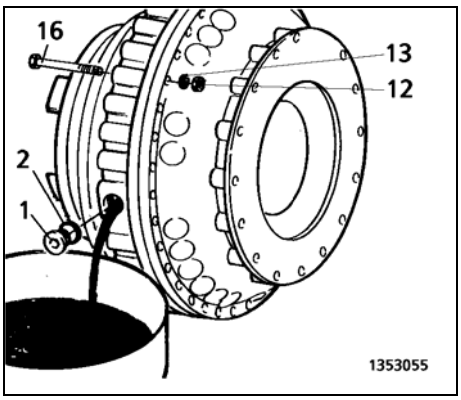


Fig. 190

Removal of sealing ring 18 and ball bearing

- Unscrew threaded plug 1 together with gasket 2.
- Drain the oil.
- Unscrew hexagon nuts 12.
- Take out screws 16 and lock washers 13.

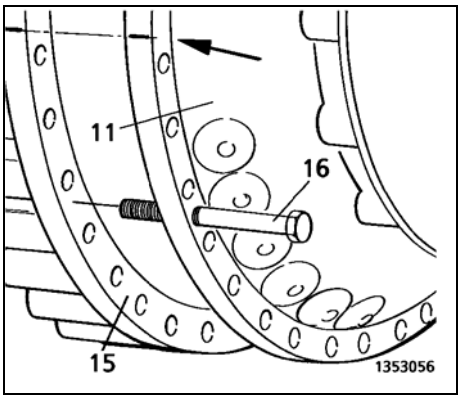


Fig. 191

- Screw two screws 16 into the tapholes of the primary wheel 11.
- Force primary wheel off the clutch casing 15. Secondary wheel remains in primary wheel.
  Before dismantling be sure to mark:
  – clutch casing 15 and
  – primary wheel 11.
  (After re-assembly marks must be aligned - otherwise unbalance).

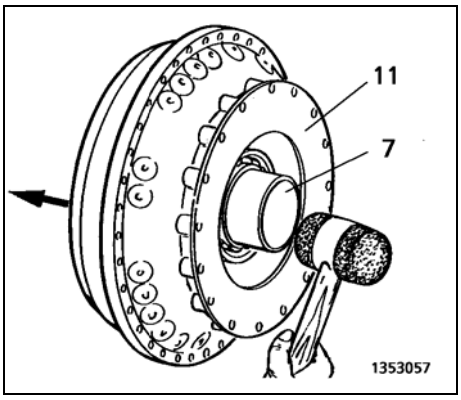


Fig. 192

- Separate primary wheel 11 from secondary wheel 7 by rapping with a rubber hammer against hub of secondary wheel. Ball bearing 8 remains in primary wheel 11.

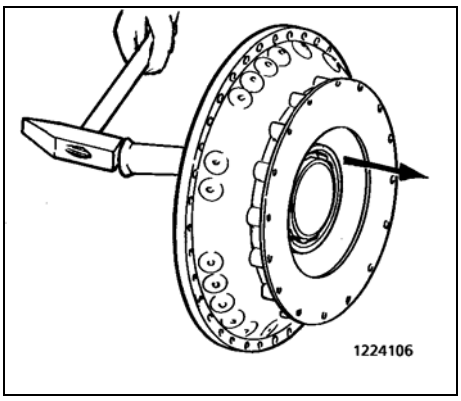


Fig. 193

- Use mandrel and hammer to drive ball bearing 8 out of primary wheel 11.

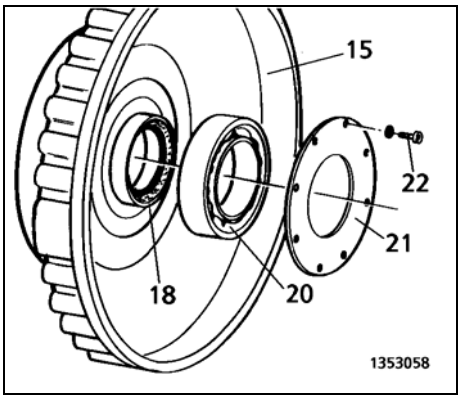


Fig. 194

- Unscrew Allen screws 22 from clutch casing 15.
- Remove oil retaining ring 21.
- Drive ball bearing 20 and sealing ring 18 out of the clutch casing using a mandrel and hammer.

10.6 Re-assembly

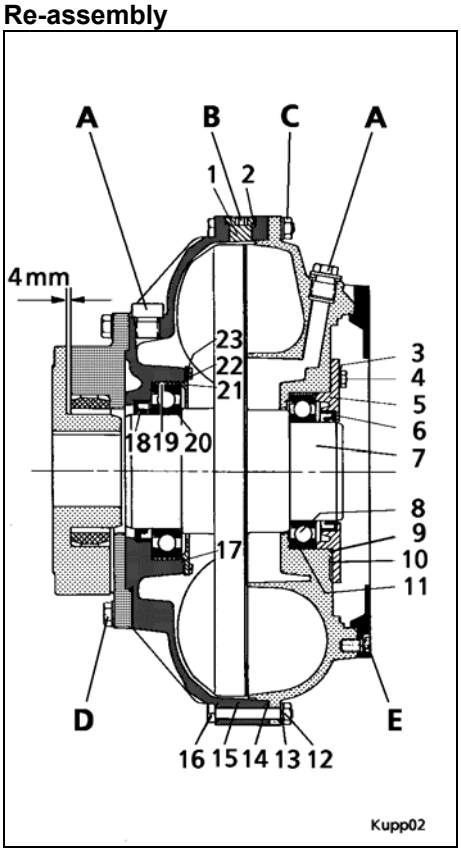


Fig. 195

For re-assembly of the fluid clutch proceed in reverse order of dismantling.
The following should be kept in mind.

Torque:
A = 150 Nm
B = 95 Nm
C = 46 Nm
D = 80 Nm
E = 40 Nm.

Glue screws Pos. E using Loctite 245.

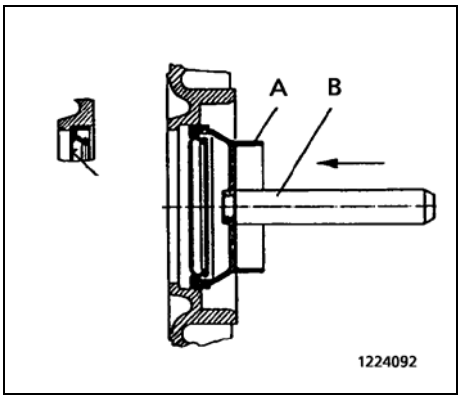


Fig. 196

- Moisten sealing rings.
- Screw bolt B into disk A and attach it to sealing ring 18.
- Press sealing ring 18 into the clutch casing by lightly tapping on bolt B.
- Screw bolt B into the other side of disk A and press sealing ring 6 into sealing ring cover 5 proceeding in the same way as above.

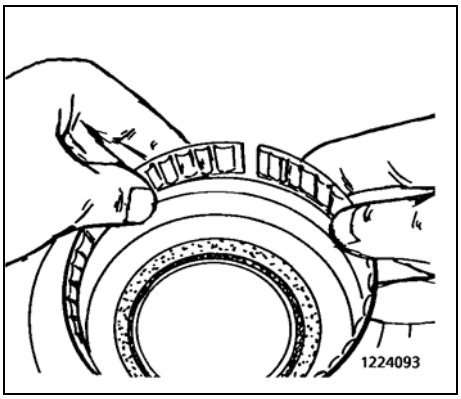


Fig. 197

- Insert spacer ring 19 into clutch casing 15.
- Insert spacer ring 10 into primary wheel 11.

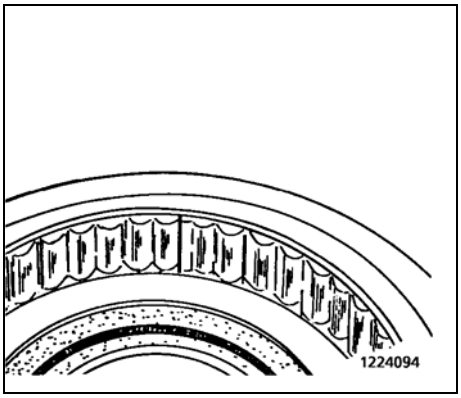


Fig. 198

Note:
The bevelled edge of each ring must snap into the groove of the bearing neck. This will ensure that the spacer rings cannot move axially.

- Press ball bearing 20 into the clutch casing and ball bearing 8 into the primary wheel.
  Check if the ball bearings pressed into the spacer rings have an absolutely tight fit. If this is not the case, the spacer rings have to be replaced.
- Apply some oil-resistant sealing compound (Atmosit or Kermon)to oil retaining ring 21.
- Then fasten oil retaining ring 21 to clutch casing with Allen screws 22. Be sure to fit lock washer 23.
- Insert gasket 9 into groove of primary wheel.
- Fasten cover 5 to primary wheel with hex head screws 4. Be sure to fit lock washers.

Press secondary hub with secondary wheel 7 into clutch casing. The surfaces contacting the sealing rings must be perfectly smooth to ensure oil-tightness of the fluid clutch. If necessary, re-polish contact surfaces.

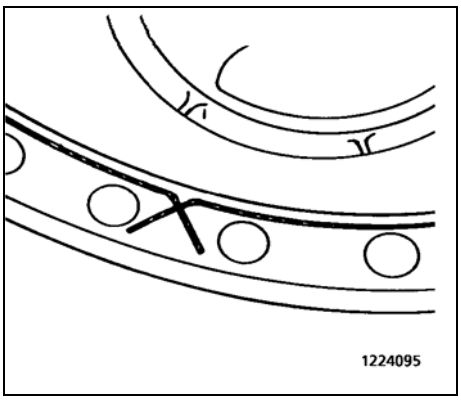


Fig. 199

- Grease Teflon packing cord 14 and place it on the sealing surface of the clutch casing. (next to the inner rim of the casing)
- Make sure cord ends are crossed.
  Sealing surfaces of primary wheel and clutch casing must be in perfect condition.
  Do not coat sealing surfaces with sealing compound.

- Press primary wheel on secondary hub so that the marks on primary wheel and clutch casing are in line with each other.

Screw primary wheel and clutch casing together.

After re-installation the clutch must be re-balanced!

- Fill clutch with oil.

11 Trouble shooting

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11.1 Fault detection - Mechanical function

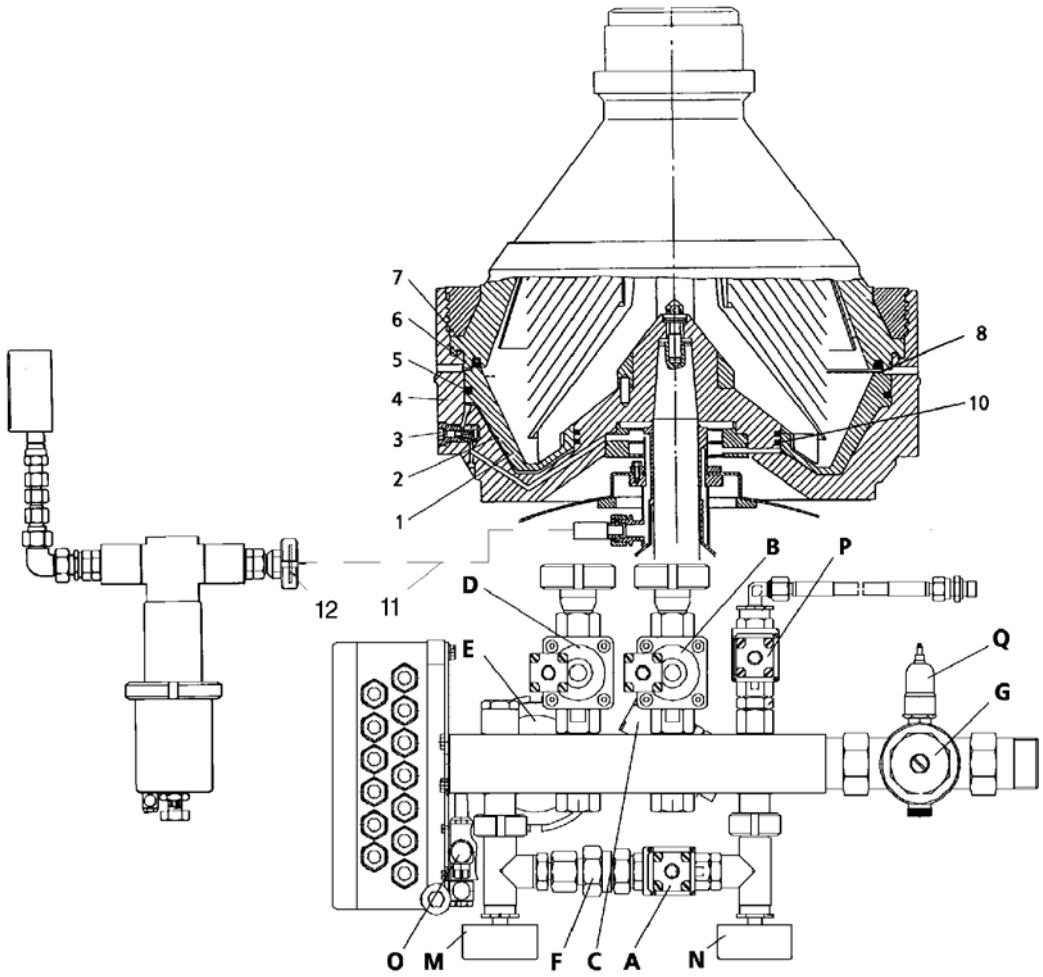
Fault	Possible causes	Remedies
The bowl does not come up to rated speed or takes too long to do so (see 4.3).	Brakes are on.	Release brakes by turning handles clockwise.
	Motor is incorrectly connected.	See wiring diagram.
	The fluid clutch does not contain enough oil or clutch is leaky.	Refill oil (see 10.3). Re-tighten nuts of screws on clutch. If sealing rings and do not seal properly, ask for a reconditioned clutch in exchange for your clutch.
	Bowl is too high or too low and, therefore, rubs against centripetal pump.	Adjust to proper bowl height (see 9.4).
	Clamp plates are not tight enough; worm wheel slips on shaft.	Tighten long hex head screws on worm wheel evenly and *firmly*. Tighten crosswise, by single turns, with a torque of 45 Nm.
	Product feed valve is open.	Close product feed valve.
The bowl speed drops during operation.	The fluid clutch does not contain enough oil.	Refill oil (see 10.3).
	Motor speed drops during operation.	Inspect motor and line voltage.
	Main bowl gasket in bowl top is damaged.	Replace the gasket (see sect. 5.7).
	Gaskets in bowl valves are damaged; the bowl loses sealing water.	Replace gaskets (5.8). Temporarily, the bowl can be kept closed by operating the manual lever of the solenoid valve for closing water.

Fault	Possible causes	Remedies
The bowl comes up to rated speed too quickly (in less than 8 minutes). Motor pulls too high a starting current.	The clutch contains too much oil.	Check oil level (see 10.2). Drain excess oil.
Uneven run of the separator.	Incomplete solids ejection. The remaining solids have deposited unevenly in the bowl.	Perform several partial ejections (7.5.2). If this does not improve conditions, close the bowl and fill it with water to attenuate the increased vibrations occurring during slowing-down of the bowl.Stop the separator. Apply brakes. If bowl is leaking, leave feed open. Clean bowl thoroughly. Remove protruding edges of bowl gasket with a knife (see sketch).
	Bowl is not properly assembled or, if plant has several separators, parts of different bowls may have been interchanged.	Assemble bowl properly (see 5.5).
	Tension of disc stack has slackened.	Make sure bowl lock ring is screwed on tightly (see 5.5). Check disc count. If necessary, add spare disc or compensating disc.
	The bowl is damaged and, therefore, out of balance.	Send the bowl to the factory for repair. Do not make your own repairs. **Do not weld or solder as this would weaken the bowl material - danger to life!**
	Neck bearing springs are weak or broken.	Replace all neck bearing springs.

Fault	Possible causes	Remedies
Uneven run of the separator (cont'd.).	Ball bearings are worn.	Replace damaged bearings. **IMPORTANT:** When replacing, use only the high precision ball bearings as specified in the Parts List.
Oil losses from the fluid clutch during the acceleration phase.	Insufficient cooling of the clutch during start-up	Check cooling of the clutch. Insert new fusible plug in clutch.
Bowl lock ring is difficult to loosen.	Bowl has not been dismantled at regular intervals (see 8.2).	Unscrewing of the bowl lock ring can be very much facilitated by blocking the bowl, which is accomplished by putting wedges between bowl bottom and solids collector.
Uneven run of the separator (cont'd.).	Gear parts are in bad condition as a result of 1. normal wear, 2. premature wear caused by: a) lack of oil * b) oil of too low a viscosity, * c) metal abrasives present in the lubricating oil due to the following possible causes: – viscosity of oil is too low, – oil has not been changed in time, – gear chamber has not been cleaned, d) replacement of one gear part only, instead of both parts. *) in general, recognized by blue tempering colour of gear parts.	Clean gear chamber thoroughly (see 8.5). Replace damaged gear parts (see chapter „Drive"). Change oil (see chapt. „Lubrication"). If necessary, change oil more often.

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11.2 Separational function

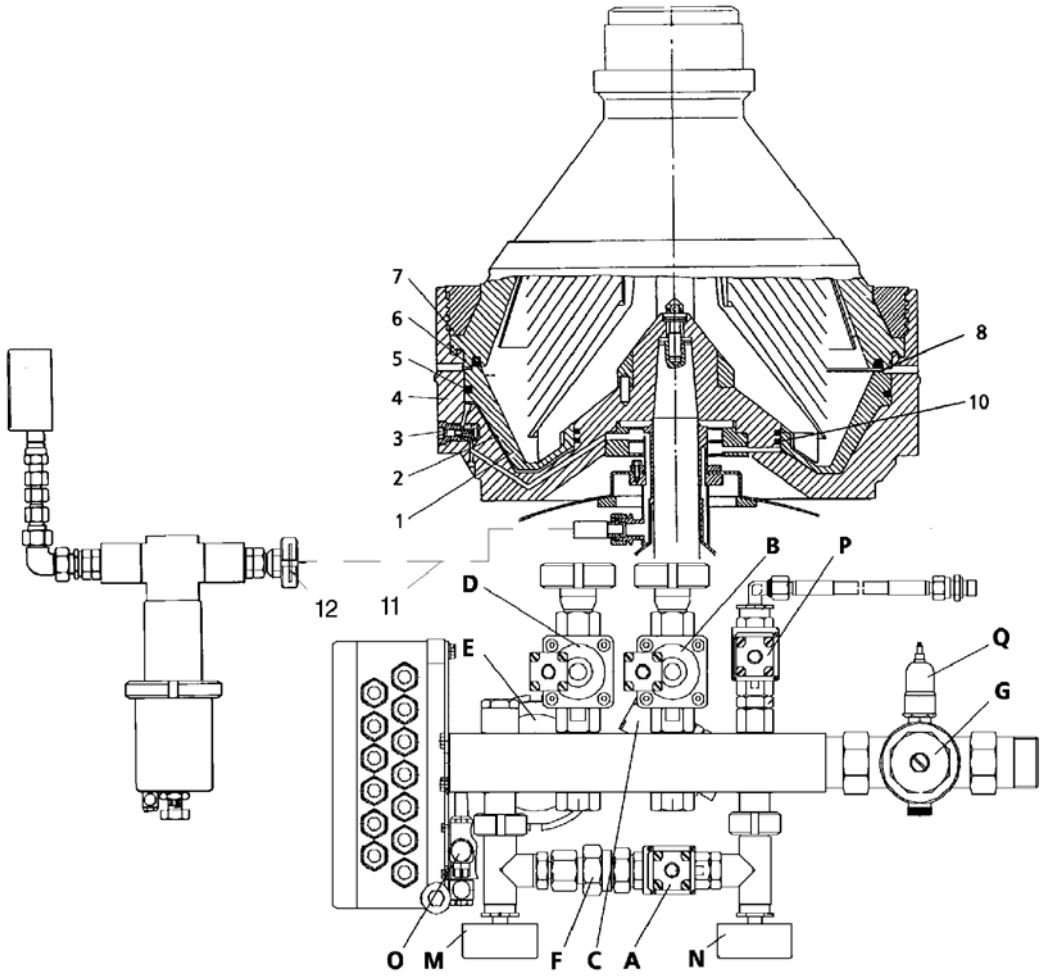


1	Sliding piston	**A**	Solenoid valve for filling water
2	Sealing chamber	**B**	Solenoid valve for closing water
3	Bowl valve	**C**	Solenoid valve for flush water for hood
4	Bowl bottom	**D**	Solenoid valve for opening water
5	Gasket (sliding piston)	**E**	Metering device
6	Gasket (bowl top)	**F**	Check valve
7	Main bowl gasket	**G**	Water pressure reducer
8	Sealing lip (sliding piston)	**M**	Pressure gauge for opening water
10	Gasket (bowl bottom)	**N**	Pressure gauge for closing water
11	Operating- water feeding device	**O**	Pilot valve for metering device
12	Gasket (operating water)	**P**	Clutch cooling water
		Q	Pressure guard for operating water

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Fig. 200

Fault	Possible causes	Remedies
Ejected solids contain too much process liquid.	Too high an amount of ejected solids.	Reduce amount of ejected solids.
	Bowl is leaking.	See below.
The bowl does not close at all. IMPORTANT: In this case close product feed or interrupt separation process.	The operating-water supplied is not enough, because:	
	- The water pressure in the supply line to the operating-water connection is too low.	Check line pressure. While the valves are open, the pressure must be at least 2 bar.
	- Water discharge holes in top of operating-water feed 11 are partly clogged due to scale.	Clean water discharges holes.
	- Strainer in water pressure reducer G of operating-water line is clogged.	Clean strainer.
	- Operating-water feed 11 is leaking	Check lines, screw couplings and gaskets.
	- The operating-water feed 11 is clogged.	Clean operating-water feed.
	Gasket 12 has not been inserted or is damaged.	Install or replace gasket.
	Gaskets of piston valves 3 are damaged.	Remove valves. Install new gaskets.
	Gasket 5 in sliding piston is damaged or its edges have been frayed through the up- and down movement of the piston.	Replace damaged gasket. If, however, only the edges of the gasket are frayed and the gasket is not damaged otherwise, it can be re-used after grinding it off with an emery wheel.



1	Sliding piston	**A**	Solenoid valve for filling water
2	Sealing chamber	**B**	Solenoid valve for closing water
3	Bowl valve	**C**	Solenoid valve for flush water for hood
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10	Gasket (bowl bottom)	**N**	Pressure gauge for closing water
11	Operating- water feeding device	**O**	Pilot valve for metering device
12	Gasket (operating water)	**P**	Clutch cooling water
		Q	Pressure guard for operating water

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Fig. 201

Fault	Possible causes	Remedies
The bowl does not close and open properly.	Gasket 5 in sliding piston does not fit properly at all points of the guide surfaces, thus failing to seal properly.	If necessary, stretch gasket. Before installing the gasket lightly grease groove in sliding piston.
	Gasket 7 in bowl top is damaged.	Replace gasket .
	Gaskets 10 in bowl bottom have not been inserted or are damaged.	Insert gaskets or replace them.
	Gasket 5 in sliding piston is uneven in height.	Replace gasket. The difference in height on a gasket must not exceed 0.25 mm.
	Sealing surface 8 of sliding piston is damaged.	Replace the sliding piston.
The bowl does not open at all or not completely.	Dirt or rubber particles have settled between sliding piston 1 and bowl bottom 4.	Clean bowl parts. Round off edges of gaskets. Replace damaged gaskets. Grease guide surfaces with the special lubricating paste supplied.
	Closing chamber 2 between bowl bottom and sliding piston is soiled.	Remove sliding piston 1 and clean closing chamber.
	The drill holes in bowl valves 3 are clogged.	Remove the valves and clean them.
	The bowl receives no or too little opening water for the following reasons (check gauge M does not indicate):	
	- Non-return valve F is dirty or defective.	Clean or replace non-return valve.
	- Solenoid valve A or D is defective.	Replace solenoid valve.
	- Air pressure for metering unit E is too low.	Increase air pressure to > 4 bar.
	- Opening periods of solenoid valves are not adjusted correctly.	Check program times on control unit (see function diagram).

Fault	Possible causes	Remedies
The bowl opens during separation.	Solenoid valve B is defective.	Check solenoid valve.
	No closing-water pulses.	Check operating unit and closing-water valve.

12 Lubrication and maintenance

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12.1 Lubrication chart

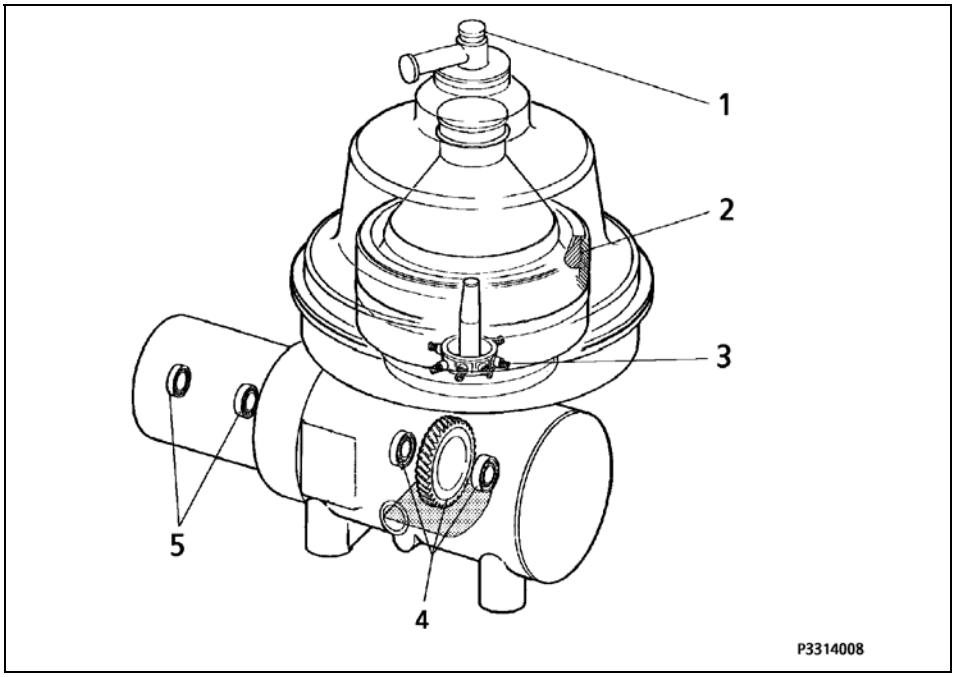


Fig. 202

No. in Fig.	Lubricant		Lubrication interval		Lubrication qty.	Lubrication point
	DIN	ISO	per year	after hours		
1	Klüber grease KSB 8			as required	10 cm^3	Threads and fittings
2	Klüber grease KSB 8			before each assembly	150 cm^3	Threads and sliding surfaces of bowl
3	Roller bearing grease K3K		2x	1 500	20 cm^3	Neck bearing springs, spring pistons.
4	Roller bearing grease K3K		2x	1 500	10 cm^3	Manually–operated parts (valves, tools, etc.).
5	Lube oil CLP 220 DIN 51502	CC 220	2x	see siehe 3.1.4	see **3.1.3**	Gear chamber
6	Steam turbine oil TDL 32 DIN 51502			see **10.1**	see **10.4**	Fluid clutch
7	according to manufac-turer's instructions			acc. manufacturer's instructions	acc. manufacturer's instructions	Motor bearings

12.2 Maintenance schedule

after operating hours						OPERATIONS	every			
250	750	1500	3000	5000	10 000		week	3 months	6 months	1 year
LUBRICATION SCHEDULE										
●						First oil change after initial start-up, and thorough cleaning of gear chamber.				
						Check oil level.	●			
	●					Oil change and thorough cleaning of gear chamber. *			●	
		●				Lubrication of individual operating elements such as brake piston, etc. *			●	
whenever dismantling						Grease threads, contact and guide surfaces of bowl parts .	whenever dismantling			
acc. to instructions of manufacturer						Re-grease or replace bearings of drive motor.	acc. to instructions of manufacturer			
MAINTENANCE SCHEDULE										
Cleaning										
●						Clean piston valves .				
	●					Clean strainer in operating-water line.			●	
			●			Clean outlet bores of operating-water feeding device.				
		●				Dismantle and thoroughly clean the bowl. Be sure also to clean the bores and chambers of the hydraulic system.		●		
Check										
		●				Remove and check bowl gaskets. Clean grooves for gaskets and check them for corro-sion.		●		
		●				Check starting time and rpm of spindle (bowl speed).			●	
		●				Check thickness of brake liners. Check neck bearing springs and spring pistons.			●	
●						Check oil level in fluid clutch.	4 weeks			
			●			Check toothing of worm wheel gear.				●
		●				Bowl inspection. Check threads of lock rings for corrosion and erosion.				
			●			Check land between solids ejection ports.				
Replacement										
				●		Replace neck bearing springs.				
					●	Fill fluid clutch with fresh oil.				
				●		Replace ball bearings on worm spindle.				
					●	Replace ball bearings of worm wheel shaft.				

* Keep to maintenance intervals even if the operating hours have not been reached.

12.2.1 Guide to ordering spare parts

Rapid and correct supply of spare parts can only be guaranteed if your order includes the following information:

• Separator model	see separator nameplate e.g. MSD 200-01-076
• Serial-No.	see separator nameplate e.g. 1724-035
• Designation	see order-specific parts catalogue
• Part-No.	see order-specific parts catalogue

The following information is required only when ordering bowl parts:

• Bowl S/N	since it may be different from the serial number of the machine. It can be found on the bowl lock ring, bowl bottom and bowl top.

Information only required when ordering spares for pump and pump connection parts.:

• Type and number of pump	see pump nameplate

The information must be complete in order to avoid incorrect deliveries.

12.2.2 Use of non-genuine spare parts



Fig. 203

- **Use only genuine spare parts from Westfalia Separator.**
  The use of non-genuine parts leads to:
  – safety risks
  – less durability of these parts
  – reduced availability of the separator
  – increased maintenance requirement.

HINWEIS

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.

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13 Datasheet

13.1 Datasheet 179

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13.1 Datasheet

This datasheet contains data important fort he safe operation and assembly of the separator. It is only valid when no datasheet in accordance with DIN/EN 12547 is enclosed with the complete set of documentation.



NOTE

Subject to modification!
If a datasheet conforming to DIN/EN 12547 is enclosed with the complete set of documentation, the datasheet in the instruction manual is null and void.

Minimum lifting capacity of hoist for removing the bowl kg	**1500**Kg
Minimum height of hoist for removing the bowl:	**3000**mm
Overall height of the separator.	**ca. 2400**mm
Bowl speed:	**Bowl speed**
	1/min (See also separator name-plate)
Starting time:	**7-9** min
Run-down time:	**?** min
Motor data:	(see motor name-plate)
Oil quantity for gear chamber:	**5,5** L



Westfalia Separator AG

Take the Best – Separate the Rest

A company of mg technologies group

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