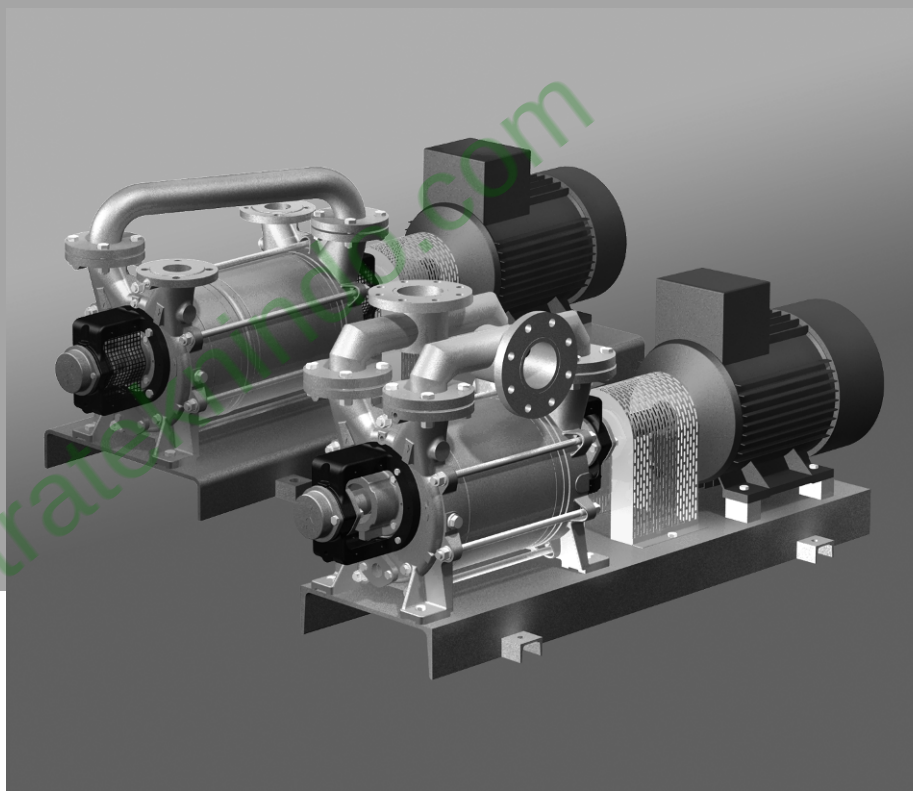

Operating Instructions

VU/VH Series

VU 20 - 1600
VH 20 - 1600
Liquid Ring Vacuum Pumps

English translation of original operating instructions

CE Documentation

It is imperative to read the operating instructions prior to commissioning!

This document as well as all documents included in the appendix is not subject to any update service!

Subject to technical changes.

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02/2010	01/2010	1096.0799

Index

1 Important basic information

These operating instructions form part of the technical documentation of the system in accordance with the EC machinery directive.

CE

These operating instructions comply with machinery directive 2006/42/EC of the European Parliament and the Council on the approximation of the laws, regulations and administrative provisions of the Member States relating to machinery, Appendix I, Paragraph 1.7.4.

These operating instructions are addressed to the person in charge of the plant, who is obliged to provide them to the staff responsible for system set-up, connection, operation and maintenance.

He must ensure that all information included in the operating instructions and the enclosed documents have been read and understood.

The operating instructions must be kept at a designated and easily accessible place and consulted at the slightest doubt.

The manufacturer does not accept liability for damage to persons, animals, objects or the system itself incurred by improper use, non-observance or incomplete observance of the safety precautions included in these operating instructions or by modifications to the system or use of improper spare parts.

These instructions

- form part of the pump/aggregate
- apply to all series mentioned herein
- describe safe and proper operation during all operational phases
- must be stowed safely throughout the entire service life of the machine
- must be handed over to future owners of the machine

Scope of supply

- Liquid ring vacuum pump
- Operating instructions
- Motor (optional)
- Coupling/coupling guard (optional)
- Base plate (optional)
- Accessories (optional):
  - separator
  - gas ejector
  - ball check valves
  - vacuum check valve
  - drainage valve

Technical support address

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Warranty and liability

Generally, the “General Conditions of Sale and Delivery” of Speck Pumpen Vakuumtechnik GmbH apply.
They were provided to the operator at the time of contract conclusion at the latest.

Warranty and liability claims arising from personal injury and material damage are excluded if one of the following conditions applies:

- improper use of the liquid ring vacuum pump
- improper mounting, commissioning, operation and maintenance of the liquid ring vacuum pump
- operation of the liquid ring vacuum pump despite defective safety devices
- non-observance of the notes in the operating instructions
- unauthorized constructional changes to the liquid ring vacuum pump
- inadequate maintenance, repair and servicing measures
- catastrophic events caused by foreign bodies or acts of God

1.1 Target groups

Target group	Task
Operator	► Keep these instructions available at the location of the system, also for later consultation. ► Advise staff to read and observe these instructions and the provided documents, particularly the safety precautions and warnings. ► Observe additional provisions and regulations related to the system.
Qualified staff, assembler	► Read, observe and adhere to these operating instructions and all applicable documents, particularly the safety precautions and warnings.

Tab. 1 Target groups and their tasks

1.2 Applicable documents

Document	Purpose
ATEX additional instructions	Operation in potentially explosive areas (only applicable to vacuum pumps designed for use in potentially explosive areas)
Declaration of conformity	Conformity with standards

Tab. 2 Applicable documents

1.3 Warnings and symbols

Warning	Security level	Consequences of non-observance
⚠ DANGER	imminently hazardous situation	death, severe personal injuries
⚠ WARNING	potentially hazardous situation	death, severe personal injuries
⚠ CAUTION	potentially dangerous situation	minor personal injuries
CAUTION	potentially dangerous situation	material damage

Tab. 3 Warnings and consequences of non-observance

Symbol	Meaning
⚠	Safety sign ► Observe all measures marked with the safety sign to avoid personal injuries or death.
⚠	Safety sign ► Observe all measures marked with the safety sign to avoid personal injuries or death by electric shock.
►	Instruction for action
1., 2., …	Multi-step instruction for action
✓	Pre-requisite
→	Cross-reference
ⓘ	Information, note

Tab. 4 Symbols and meaning

1.4 Terminology

Term	Meaning
Pump	Liquid ring vacuum pump without drive, components or accessories
Aggregate	Complete liquid ring vacuum pump including pump, drive, components and accessories
Auxiliary operating systems	Devices for operating the vacuum pump aggregate
Separator	Device for separating gaseous from liquid media
Gas ejector	Device for operating the vacuum pump aggregate for deep vacuum
Vacuum check valve	Device for limiting the created vacuum
Drainage valve	Device for limiting the filling level in the vacuum pump

Tab. 5 Terminology and meaning

2 Safety

ⓘ The manufacturer does not accept liability for damage resulting from non-observance of the overall documentation.

2.1 Intended use

- Observe all provisions included in the operating instructions.
- Observe all safety instructions.
- Comply with inspection and maintenance intervals.
- Use the aggregate exclusively for delivery of the permissible media to be pumped.
  (→ General technical data, page 38)
- Operate the pump/aggregate with permissible operating liquid only (→ General technical data, page 38).
- Prevent dry running:
  - The sealing rings of the mechanical seals will be damaged within only few seconds.
  - Ensure that the pump/aggregate is always operated with sufficient operating liquid, never without operating liquid.
- Prevent cavitation:
  - Insert a vacuum check valve.
  - Comply with the temperature limits of the operating liquid and the medium to be pumped.
  - Observe the limit values for inlet pressure and pressure difference.
  - Do not operate the pump when the fitting in the suction pipe is closed.
- Prevent overheating:
  - Do not operate the pump/aggregate when fittings are closed.
- Prevent motor damage:
  - Observe the maximum flow rate for delivery of liquid.
  - Observe the switching frequency of the aggregate.
  - The motor protection switch must not be set to a value above nominal current.
- Any use other than the intended use must be agreed with the manufacturer.

2.2 Possible misuse

- Observe the operating limits of the pump/aggregate concerning temperature, pressure, speed, density and viscosity (→ Operating limits, page 35).
- The higher the density of the operating liquid, the higher the motor power consumption. Observe the permissible density to protect the aggregate against overload.
- When delivering solid laden liquids, observe the solid content limit values (→ General technical data, page 38).
- Do not combine multiple limit values.
  (→ Operating limits, page 35)
- Prevent sudden pressure changes of the gas to be extracted.
- Prevent sudden temperature changes of the gas to be extracted or operating liquid.
- Do not use in rooms where explosive gas may be present unless the pump/aggregate has been expressly intended for such purpose.
- Do not extract, deliver or compact explosive, inflammable, aggressive or toxic media unless the aggregates have been expressly intended for such purpose.
- Unauthorized opening of the pump/aggregate results in the forfeiture of any and all claims for defects.

2.3 General safety instructions

ⓘ The following provisions must be observed prior to executing any works.

2.3.1 Product safety

The pump/the aggregate have been designed in accordance with state-of-the-art technology and the generally acknowledged rules on safety.
Yet, operation of this pump/aggregate may present a threat to the life or physical health of the user or third parties and impair the pump/aggregate and other property.

- Only operate the pump/aggregate in a technically flawless condition and in accordance with the provisions, safety precautions and warnings included in these operating instructions.
- Keep these operating instructions as well as all supplied documents complete and legible and ensure that they can be accessed by staff at all times.
- Refrain from any operating methods which may put staff or uninvolved third parties at risk.
- In case of defects having safety implications:
  shut down the pump/aggregate immediately and consult the person in charge to rectify the defect.
- In addition to the overall documentation, all legal or other safety and accident prevention regulations as well as all applicable standards and guidelines of the respective country of operation must be observed.

2.3.2 Obligations of the operator

2.3.2.1 Safety-conscious working

- Only operate the pump/aggregate in a technically flawless condition and in accordance with the provisions, safety precautions and warnings included in these operating instructions.
- Ensure and verify compliance with:
  - intended use
  - legal or other safety and accident prevention regulations
  - safety regulations applying to handling hazardous substances
  - applicable standards and guidelines of the respective country of operation
- Provide for protective equipment.

2.3.2.2 Staff qualification

- Ensure that staff involved in pump/aggregate operation has read and understood these operating instructions and all applicable documents, particularly all safety, maintenance and servicing information, prior to starting work.
- Define clear roles and responsibilities and arrange for staff monitoring.
- All works must only be carried out by technically qualified staff:
  - assembly, servicing, maintenance works
  - works on electrical equipment
- Staff undergoing training must only work on the pump/aggregate under the supervision of technically qualified staff.

2.3.2.3 Safety devices

- Provide for the following safety devices and ensure their proper functioning:
  - for hot, cold and moving parts: on-site protection against contact with the pump/aggregate
  - when electrostatic charging is likely to occur: provide for grounding

2.3.2.4 Warranty

- During the warranty period, conversion works, repairs and modifications are subject to approval by the manufacturer.
- Use original parts or parts approved by the manufacturer only.

2.3.3 Obligations of the staff

- Notes attached to the pump/aggregate must be observed and kept legible, e.g. arrows indicating the direction of rotation, symbols indicating fluid connections.
- Guards for protection against contact with hot, cold and moving parts must not be removed during operation.
- If required, use protective equipment.
- Do not expose parts of the body to the vacuum.
- Works on the pump/aggregate must only be carried out at standstill.
- Prior to carrying out any assembly or maintenance works, de-energize the motor and protect it against restart.
- Having completed all works on the pump/aggregate, duly re-assemble the safety devices.

2.4 Residual risks

⚠ WARNING

ⓘ Long and loose hair may become entangled in the protective covers of the motor and the shaft coupling.

ⓘ The rotating pump shaft between the bearing bracket and the shaft sealing casing may catch and wind up long and loose hair.

► Wear a hairnet!

ⓘ Risk of injuries caused by flying objects, which were inserted in the openings of the motor fan cover or in the openings of the coupling protection.

► Do not insert any objects!

ⓘ Risk of burns/scalds when getting in contact with hot surfaces or hot media!

► Do not touch!

► Wear protective gloves!

ⓘ Risk of injuries caused by operating liquid escaping from a defective mechanical seal!

► Shut down the pump!

► Repair the pump!

2.5 Special risks

2.5.1 Potentially explosive area

- (→ ATEX additional instructions)

2.5.2 Dangerous media to be pumped

- When dealing with dangerous media to be pumped (e.g. hot, inflammable, explosive, toxic, hazardous to health), observe the safety regulations applying to handling hazardous substances.
- Use protective equipment when carrying out any works on the pump/aggregate.

3 Design and functioning

3.1 Marking

3.1.1 Nameplate

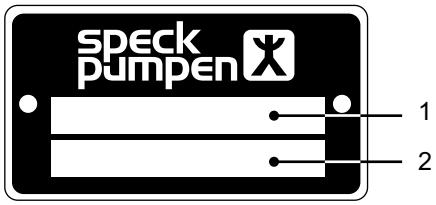


Fig. 1 Nameplate (example)

1 Pump type
2 Plant number

3.1.2 ATEX plate

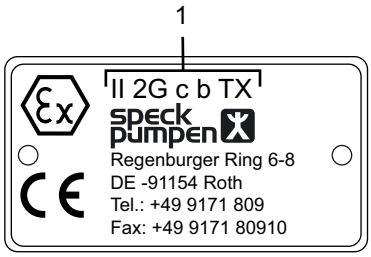


Fig. 2 ATEX plate (example)

1 Explosion protection mark

3.1.3 Pump type code

	VU	300	53	10	0000
	VH	300	53	10	0000
1					
2					
3					
4					
5					

Fig. 3 Pump type code (example)

1 Series
2 Size
3 Mechanical seal
4 Material design code
5 Counting number

3.2 General description

The pumps of the VU series are horizontal, single-stage liquid ring vacuum pumps with radial suction/pressure connection. The internal control of the media to be pumped is realized by means of inter casings.

The VU 20 – 1600 types are liquid ring vacuum pumps in base plate version. The electrical drive is connected to the pump shaft (3) via a coupling. The pump shaft (3) is mounted in ball bearings (4) on both sides. Usually, pump and motor are mounted onto one base plate. Two maintenance-free mechanical seals (5) in the shaft sealing casings are used to seal the pump shaft.

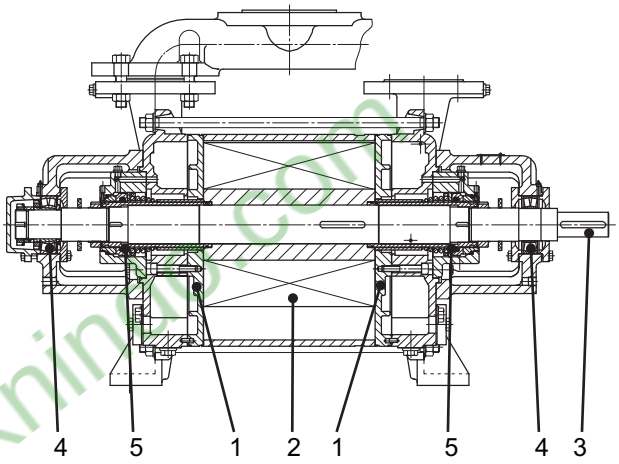


Fig. 4 Description VU

1 Inter casings
2 Impeller
3 Motor/pump shaft
4 Rolling bearing
5 Mechanical seal

The VH 20 - 1600 types are two-stage liquid ring vacuum pumps in base plate version.

The electrical drive is connected to the pump shaft (3) via a coupling. The pump shaft (3) is mounted in ball bearings (4) on both sides. Usually, pump and motor are mounted onto one base plate. Two maintenance-free mechanical seals (5) in the shaft sealing casings are used to seal the pump shaft (3).

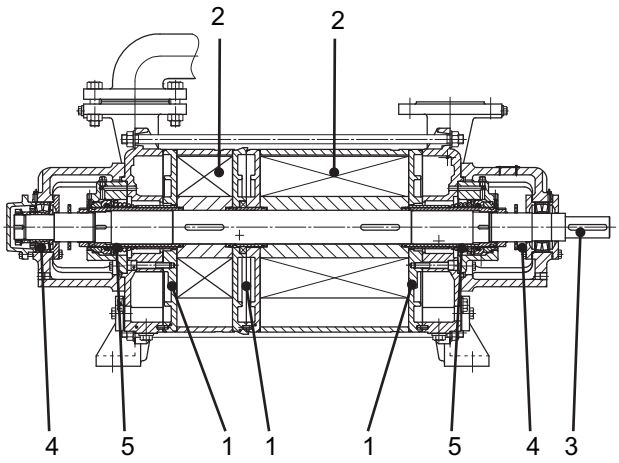


Fig. 5 Description VH

1 Inter casings
2 Impeller
3 Motor/pump shaft
4 Rolling bearing
5 Mechanical seal

Pumps of the VU/VH series allow for the delivery of small volumes of liquids. The discharged operating liquid can be re-used when using a separator.

3.3 Design and functional principle

The vacuum pump is operated in accordance with the liquid ring principle. The impeller is positioned off-centre in the cylindrical pump casing. It transfers the drive power to a liquid ring, which forms concentrically to the casing when the vacuum pump is started.

The gaseous medium remaining in the casing distributes around the impeller due to the lower density in the hub area. As the impeller is positioned off-centre to the casing, the available space for the gas between the surface of the liquid and the hub becomes crescent-shaped.

This way, the remaining space for the gas between the blades expands and shrinks during each rotation.

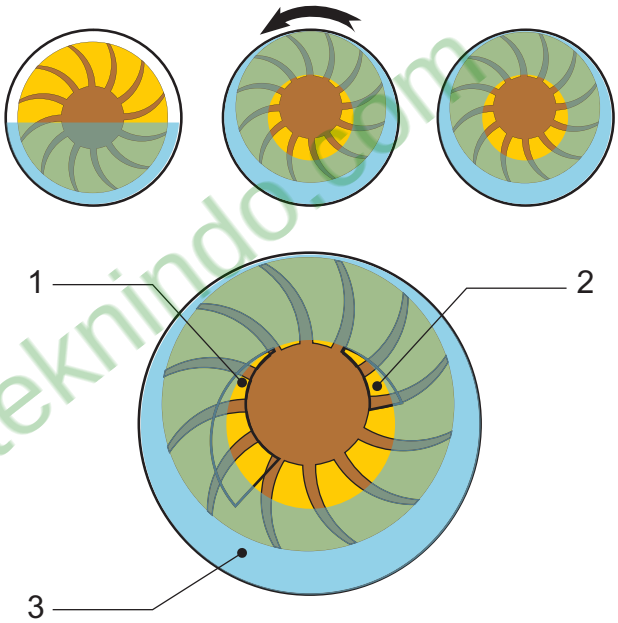


Fig. 6 Functional principle of liquid ring vacuum pumps

1 Suction opening
2 Pressure opening
3 Liquid ring

The arrangement of suction and pressure openings in the inter casing allows for the suction, compression and discharge of gas. The liquid both serves the sealing between the individual impeller chambers and the absorption of heat produced during compression.

The vacuum pump must be permanently supplied with operating liquid during operation as a portion of the liquid continuously escapes from the pump together with the gas. The discharged operating liquid can be separated from the gas by means of a downstream separator and re-used.

3.4 Shaft sealing

3.4.1 Mechanical seal

ⓘ Mechanical seals may slightly leak for functional reasons.

- Single-acting mechanical seal, not pressure-relieved, dependent of the direction of rotation (standard),
- Double-acting mechanical seal, not pressure-relieved, independent of the direction of rotation.
- Special seals.

3.4.2 Packing gland

ⓘ Packing glands slightly leak for functional reasons.

- Packing gland

4 Transport, storage and disposal

ⓘ The following accident prevention regulations have to be observed prior to following transport and handling regulations:

- BGV D8 winches, lifting and pulling devices
- BGV D6 load lifting devices

4.1 Transport

ⓘ Observe weight data (→ Weight, page 38)

4.1.1 Unpacking and inspection on delivery

1. Unpack the pump/aggregate on delivery and inspect it for transport damage.
2. Report any transport damage to the manufacturer immediately.
3. Dispose of packaging material according to local regulations.

4.1.2 Manual transport

⚠ CAUTION

Risk of injuries caused by lifting heavy loads!

Observe the permissible weights for lifting and carrying machine components.

Type	Sex	Age	Rate per shift		
			rarely < 5%	repeatedly 5 - 10%	frequently > 10 - 35%
		[Years]	[kg]	[kg]	[kg]
Lifting	Men	– 16	20	13	-
		17 - 19	35	25	20
		20 - 45	55	30	25
		> 45	50	25	20
Lifting	Women	- 16	13	9	-
		17 - 19	13	9	8
		20 - 45	15	10	9
		> 45	13	9	8
Carrying	Men	- 16	20	13	-
		17 - 19	30	20	15
		20 - 45	50	30	20
		> 45	40	25	15
Carrying	Women	- 16	13	9	-
		17 - 19	13	9	8
		20 - 45	15	10	9
		> 45	13	9	8
Lifting and carrying	Expectant mothers		10 (5) (legal draft)	5 (legal draft)	
Source: Bavarian State Office for Occupational Safety, Occupational Medicine and Safety Technology					

Tab. 6 Maximum weights for manual lifting

► Suitable lifting gear and means of transport must be used for components exceeding the max. weight!

4.1.3 Transport with lifting gear

⚠ DANGER

Risk of death or contusions from falling goods to be transported!

► Select lifting gear in accordance with the total weight to be transported.

► Transport the pump/aggregate in horizontal position only.

► Never suspend the pump/aggregate to the free shaft end or the ring lug of the motor.

► Attach the lifting gear in accordance with the following figures.

► Do not stand under suspended loads.

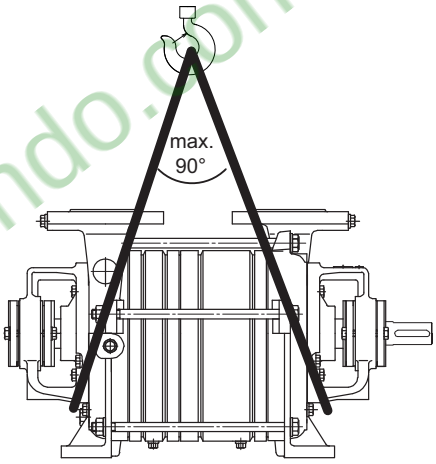


Fig. 7 Attaching lifting gear to the pump

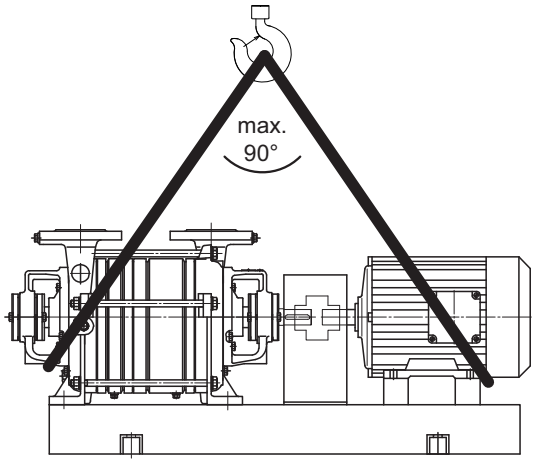


Fig. 8 Attaching lifting gear to the aggregate

► Lift the pump/aggregate accordingly.

4.2 Storage

Pumps/aggregates treated by the factory have been provided with an anticorrosive coating. When properly stored indoors, the pump/aggregate is protected for a maximum of 3 months. In case of longer storage periods, the pump/aggregate has to be treated with a preserving agent again (→ 4.3 Preservation).

For storing pumps/aggregates which have already been in use the preparations specified in Section 4.3 Preservation must be made.

Applied preserving agents (→ page 44)

CAUTION

Risk of material damage caused by improper storage!

► Store the pump/aggregate accordingly.

1. Close all openings with blank flanges, plugs or plastic covers.
2. Make sure the storage room meets the following conditions:
   - dry
   - frost-free
   - vibration-free
   - protected
   - constant humidity
3. Turn the pump shaft once per month.
4. Make sure the pump shaft and bearing change their rotational position in this process.

4.3 Preservation

ⓘ Not necessary for rust-proof material

CAUTION

Risk of material damage caused by improper preservation!

► Properly apply preserving agent to the inside and outside of the pump.

1. Select a preserving agent in accordance with the type and duration of storage (→page 44)
2. Use preserving agents in accordance with the manufacturer's specifications.
3. Coat all bare metal components positioned inside and outside the pump/aggregate with preserving agent.
4. Treat the impeller gap with a preserving agent.

4.3.1 Preserving inside the system

CAUTION

Risk of material damage caused by improper preservation!

Shut down the aggregate (→ Shut down, page 20)

► Use appropriate collecting trays, position of drainage bores (U_e, U_{e1}) (→ Dimension drawings, page 45 et seq.)

- Unscrew the screw plugs of all drainage bores (U_e, U_{e1}).
- Drain the operating liquid (water).
- Occasionally rotate the pump shaft/motor shaft towards the direction of rotation of the pump.
- Continue with this process until no more liquid escapes.
- Plug all drainage bores with screw plugs and new seals.
- Remove the pipes from the suction, pressure and process water connections.
- Plug the outlet nozzle and the process water connection by means of blank flanges/screw plugs.
- Fill in preserving agent into the open inlet nozzle. Observe-filling volumes (→Filling volumes preservation, page 44).
- Plug the inlet nozzle with a blank flange.
- Switch the aggregate shortly on and off to allow for a proper distribution of the preserving agent.
- Unscrew the screw plugs of all drainage bores (U_e) and the operating liquid connection (U_B).
- Drain the preserving agent into collecting trays.
- Occasionally rotate the pump shaft/motor shaft towards the direction of rotation of the pump.
- Continue with this process until no more preserving agent escapes.
- Close the suction, pressure and operating liquid connection (U_B) using transport or sealing covers.
- Plug all drainage bores (U_e, U_{e1}) with screw plugs and new seals.

4.3.2 Preserving outside the system

CAUTION

Risk of material damage caused by improper preservation!

► Shut down the aggregate (→Shut-down, page 20; Return to manufacturer, page 22)

ⓘ Use appropriate collecting trays, position of drainage bores (U_e, U_{e1}) (→ Dimension drawings, page 45 et seq.)

- Plug all drainage bores (U_e, U_{e1}) with screw plugs.
- Close the operating liquid connection (U_B) using blank flanges/screw plugs.
- Fill in preserving agent into the open inlet or outlet nozzle until the agent becomes visible. Observe the filling volumes (→Filling volumes preservation, page 44).
- Occasionally rotate the pump shaft/motor shaft towards the direction of rotation of the pump.
- Continue this process until the preserving agent appears approx. 30 mm below the upper edge of the inlet/outlet nozzle.
- Unscrew the screw plugs of all drainage bores (U_e) and the operating liquid connection (U_B).
- Drain the preserving agent into collecting trays.
- Occasionally rotate the pump shaft/motor shaft towards the direction of rotation of the pump.
- Continue with this process until no more preserving agent escapes.
- Close the suction, pressure and operating liquid connection (U_B) using transport or sealing covers.
- Plug all drainage bores (U_e, U_{e1}) with screw plugs and new seals.

4.4 Removing preserving agent

ⓘ Only required for treated pumps/aggregates.

CAUTION

Risk of bearing damage caused by excessive water pressure or splash water!

► Do not treat bearing areas with water or steam jet.

CAUTION

Risk of seal damage caused by improper cleaning agents!

► Ensure that cleaning agents do not harm the seals.

1. Use cleaning agents which are appropriate for your respective application.
2. Rinse off preserving agent and collect it together with the rinsing agent.
3. Dispose of preserving agent according to local regulations.
4. For storage periods exceeding 6 months:
   - Replace elastomer components made of EP rubber (EPDM).
   - Check all elastomer components (O-rings, shaft sealings) for proper elasticity and replace if required.

4.5 Disposal

⚠ WARNING

Risk of intoxication and environmental damage caused by media to be pumped!

► Prior to disposing the pump/aggregate:

- Collect escaping media to be pumped and dispose of separately in accordance with local regulations.
- Neutralize residues of media to be pumped in the pump/aggregate.
- Remove preserving agent (→ page 13)
- Disassemble plastic parts and dispose of in accordance with local regulations.

► Assign an authorized company to dispose of the pump/aggregate to prevent the risk of environmental damage!

5 Set-up and connection

For pumps/aggregates in potentially explosive areas
(→ ATEX additional instructions)

CAUTION

Risk of material damage caused by contamination!

► Do not remove transport locks until immediately before setting up the pump/aggregate.

► Do not remove covers, transport and sealing caps until immediately before the connection of the pipes to the vacuum pump.

5.1 Preparing set-up

5.1.1 Checking ambient conditions

► Make sure the required ambient conditions are maintained. (→ Ambient conditions, page 40).

For pump/aggregate set-up at an altitude of > 1000 m above sea level, consult the manufacturer.

5.1.2 Minimum clearances for heat dissipation

ⓘ Minimum clearances (→ Clearances for heat dissipation, page 40).

5.1.3 Preparing installation site

► Make sure the installation site meets the following conditions:

- the pump/aggregate is freely accessible from all sides
- sufficient space for installing/disassembling the pipes as well as for maintenance and repair works, particularly for installation/disassembly of the pump/aggregate and the motor, is provided for.
- the pump/aggregate is not exposed to external vibrations (bearing damage)
- frost protection

5.1.4 Preparing foundation and surface

ⓘ Set-up options:

- with concrete foundation
- with steel foundation frame
- without foundation

► Make sure foundation and surface meet the following conditions:

- level
- clean (free of oil, dust or other contaminations)
- load carrying capacity is in accordance with the dead weight of the aggregate and all operating forces
- adequate aggregate stability
- with concrete foundation:
  standard concrete of strength class B 25

5.1.5 Removing preserving agent

► If the pump/aggregate is commissioned directly after set-up and connection: remove preserving agent prior to set-up (→ Removing preserving agent, page 13).

5.2 Set-up with foundation

ⓘ Only possible with base plate.

CAUTION

Risk of material damage caused by distortion of the base plate!

► Position and fix the base plate on the foundation as follows.

5.2.1 Placing aggregate on foundation

✓ Auxiliary means, tools, material:

- foundation bolts (→ Set-up drawing)
- steel washers
- non-shrinking mortar grout
- spirit level

1. Lift the aggregate (→ Transport, page 11)
2. Hook the foundation bolts from below into the base plate fixing holes.

ⓘ Observe the manufacturer's specifications when using adhesive anchors.

3. Place the aggregate on the foundation.
   Insert the foundation bolts into the provided anchoring holes.

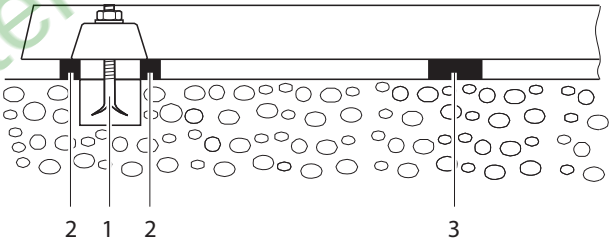


Fig. 9 Set-up with foundation

4. Use steel washers to align the aggregate to height and system dimensions as follows:
   - Place 1 steel washer (2) at the left and right hand side of each foundation bolt (1).
   - With > 750 mm clearances between the anchoring holes, an additional steel washer (3) must be positioned in the middle of each side of the base plate.
5. Make sure the steel washers are in surface contact with the base plate.
6. Use the integrated spirit level to check whether the pump/aggregate is level end to end and side to side with a maximum allowable tilt of 1 mm/m.
7. Repeat this process until the base plate has been correctly aligned.

5.2.2 Fixing aggregate

ⓘ Filling the base plate with mortar grout improves the dampening behaviour.

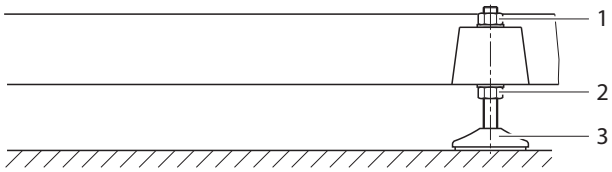
1. Fill the anchoring holes with mortar grout.
2. When the mortar grout has set, bolt down the base plate with the specified torque at three points (→Tightening torques, page 41).
3. Before tightening the remaining bolts, compensate for any unevenness in the surface using metal spacing shims next to each bolt.
4. Make sure the base plate is not distorted.

5.3 Set-up without foundation

ⓘ With base plate

✓ Auxiliary means, tools, material:

– wrench
– spirit level



1 Hexagon nut

2 Hexagon nut

3 Levelling foot

Fig. 10 Set-up without foundation

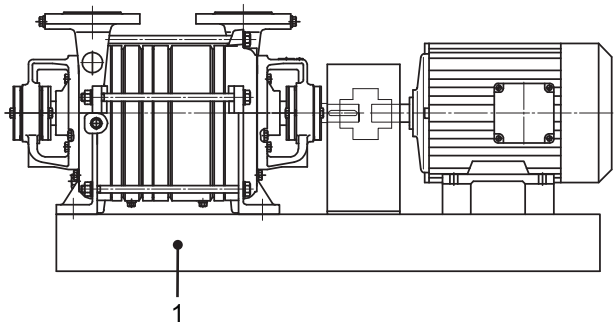
1. Lift the base plate with the aggregate (→ Transport with lifting gear, page 11).
2. Mount the four levelling feet as illustrated.
3. Position the aggregate on the surface.
4. Adjust the base plate height by means of the levelling feet as illustrated above:
   – Use the wrench to hold the hexagon nut at the levelling foot (3).
   – Loosen the hexagon nut (1).
   – The height can be adjusted by turning the hexagon nut (2).
   – Tighten the hexagon nut (1) (→ Tightening torques, page 41).
   – Use the integrated spirit level to check whether the pump/aggregate is level end to end and side to side with a maximum allowable tilt of 1 mm/m.
   – Repeat this process until the base plate has been correctly aligned.

5.4 Set-up on torsion-resistant level surface/frame

ⓘ Only possible with motor feet

✓ . Auxiliary means, tools, material:

– wrench



1 Surface/frame

Fig. 11 Set-up on level surface/frame

1. Mount the motor feet as illustrated (→ Dimension drawing, page 45 et seq.).
2. Position the aggregate on a torsion-resistant level surface/frame
3. Screw the aggregate to the surface/frame.

5.5 Motor installation

ⓘ Only necessary if aggregate set-up is completed at the installation site.

CAUTION

Risk of material damage caused by knocks and bumps!

► Do not tilt the coupling halves when slipping them on.

► Do not knock on or hit any pump components.

1. Apply a razor-thin layer of molybdenum disulfide (e.g. Molykote®) on the pump and motor shaft.
2. Insert fitting keys (if required).
3. Without mounting rig:
   – Remove the rubber buffers
   – Heat the coupling halves to approx. 100 °C
4. Slip on the pump and motor-side coupling halves until the shaft end is flush with the coupling hub.
   – Make sure to keep the required clearance between the coupling halves (→ Fine adjustment of coupling, page 16).
5. Tighten the grub screws on both coupling halves.
6. Lift the motor and put it down on the base plate.
7. Adjust the motor shaft to the height of the pump shaft using suitable shims for the motor.
8. Screw in and slightly tighten the motor screws.

5.6 Planning pipe system

5.6.1 Dimensioning supports and connections

CAUTION

Risk of material damage if the pipes apply excessive forces and torques to the pump/aggregate!

► Make sure the permissible values are complied with (→ DIN ISO 9908).

1. Calculate the piping forces and observe all operating conditions:
   – cold/warm
   – empty/filled
   – depressurized/pressurized
   – position changes
2. Make sure the pipe supports have permanent low-friction properties and do not seize up due to corrosion.
3. If required, provide for pipe compensators.

5.6.2 Specifying nominal diameter

ⓘ Size of suction/pressure connections (→ Operating connections, page 40)

► Keep the flow resistance in the pipes as low as possible.

1. Nominal suction pipe diameter ≥ nominal suction connection diameter
2. Nominal pressure pipe diameter ≥ nominal pressure connection diameter.

5.6.3 Specifying pipe lengths

3. Dimension the suction, pressure operating liquid pipes as short as possible.
4. Increase the pipe cross-sections when using long suction, pressure and operating liquid pipes.

ⓘ The pressure pipe must not rise more than 1 m vertically or diagonally upwards.

5.6.4 Changes in cross-section and direction

1. Avoid radii of curvature of less than 1.5 times the nominal pipe diameter.
2. Avoid sudden changes of cross-section and direction along the piping.

5.6.5 Safety and control devices

5.6.5.1 Avoid contamination

1. Integrate low-resistance filters in the suction pipe.
2. Install a differential pressure gauge with contact manometer to monitor the contamination process.

5.6.5.2 Avoiding backflow

► Install a ball check valve between the suction pipe and the suction connection of the aggregate to prevent operating liquid from flowing back into the suction pipe after aggregate shut-down.

5.6.5.3 Provisions for isolating and shutting off pipes

ⓘ For maintenance and repair works

► Provide for shut-off devices in the suction, pressure and process water pipes.

5.6.5.4 Provisions for measuring operating conditions

1. For pressure measuring: provide for manometers in the suction and pressure pipe.
2. Provide for a power sensor at the motor side.

5.7 Connecting pipes

5.7.1 Providing for clean piping

CAUTION

Risk of material damage caused by pump/aggregate contamination!

► Make sure contamination does not enter the pump/aggregate.

1. Clean all piping parts and fittings prior to assembly.
2. Make sure no flange seals project inwards.
3. Make sure no sealing material (sealing tape, adhesive) project inwards.
4. Remove any blank flanges, plugs, protective foils and/or protective paint from the flanges.

5.7.2 Installing suction pipe

1. Remove the transport and sealing covers from the pump/aggregate.
2. Avoid air pockets: lay out the pipes with a continuous slope down to the aggregate.
3. Make sure no seals project inwards.
4. Make sure no sealing material (sealing tape, adhesive) project inwards.
5. Install a ball check valve in the suction pipe to prevent operating liquid from flowing into the suction pipe at standstill.

5.7.3 Installing pressure pipe

1. Remove the transport and sealing covers from the pump/aggregate.
2. Install the pressure pipe
3. The pressure pipe must not rise more than 1 m vertically or diagonally upwards.
4. Avoid air pockets: lay out the pipes with a continuous slope from the aggregate.
5. Make sure no seals project inwards.
6. Make sure no sealing material (sealing tape, adhesive) project inwards.

5.7.4 Stress-free pipe connections

ⓘ For the layout of piping, observe VDMA standard sheet 24277 on stress-free pipe connections.

5.8 Fine adjustment of coupling

CAUTION

Risk of material damage caused by improper coupling adjustment!

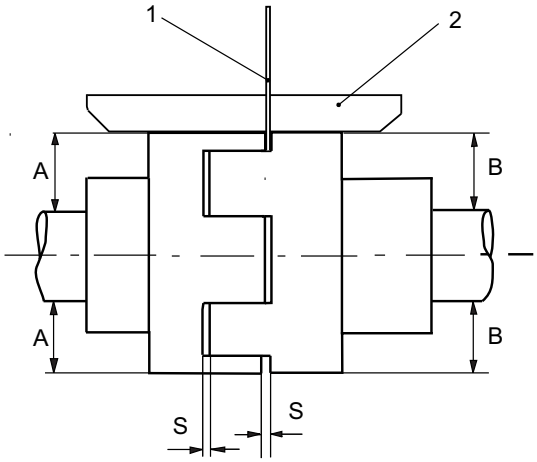
► Accurately adjust the motor to the pump in case of height, lateral or angular offset.

► For detailed information and special couplings: (→ Manufacturer's specifications).

5.8.1 Checking coupling adjustment

✓ Auxiliary means, tools, material:

– feeler gauge
– straightedge
– dial gauge (possible with couplings with spacer)
– other suitable tools, e.g. laser adjustment tool



1 Gauge

2 Straightedge

Fig. 12 Checking coupling adjustment

✓ Coupling protection has been disassembled.

1. Take the measurements at the circumference of the coupling in two planes with a 90° offset.
2. Check the light gap towards the outer diameter using a straightedge (1):
   – Position the straightedge over both coupling halves.
   – Adjust the motor if you detect a light gap at the outer diameter (→Motor adjustment, page 17).
3. Check the gap size using a feeler gauge (2):
   – Permissible gap size (→ Dimension drawing, page 45 et seq.).
   – Use a feeler gauge to measure the gap (A) between the coupling halves.
   – If the measured gap size is impermissible, adjust the motor (→ Motor adjustment, page 17).
4. Install the coupling protection.

5.9 Motor adjustment

1. Adjust the motor in a way which ensures that the coupling halves are accurately aligned and use adjustment shims if required.
2. Check the motor adjustment.
3. Repeat the adjustment process if height or angular offset have not yet been fully compensated.
4. Then, tighten the motor screws.

5.10 Electrical connection

⚠ RISK OF ELECTRIC SHOCK

Risk of death from electric shock!

► Any electrical works must be carried out by qualified electricians only.

► Observe the IEC 30364 (DIN VDE 0100) and for potentially explosive areas the IEC 60079 (DIN VDE 0165) standard.

⚠ DANGER

Risk of death from rotating parts!

► Make sure to only operate the aggregate with all covers (fan hood) installed.

5.10.1 Motor connection

ⓘ Observe the manufacturer's specifications for the motor.

1. Connect the motor in accordance with the circuit diagram.
2. Exclude any risk associated with electric power.
3. Install an Emergency-Stop button.

5.10.2 Checking direction of rotation

⚠ DANGER

Risk of death from rotating parts!

► Use protective equipment when carrying out any works on the aggregate.

► Keep an adequate distance to rotating parts.

CAUTION

Risk of material damage caused by dry running or incorrect direction of rotation!

► Pump filled with operating liquid up to the middle of the shaft (→ Filling, page 18).

1. Switch the aggregate on and immediately off again.
2. Check whether the direction of rotation of the motor is in accordance with the arrow indicating the direction of rotation on the aggregate.

ⓘ Wrong direction of rotation may result in damage and escape of operating liquid at the mechanical seal.

⚠ RISK OF ELECTRIC SHOCK

Risk of death from electric shock!

► Any electrical works must be carried out by qualified electricians only.

► Observe the IEC 30364 (DIN VDE 0100) and for potentially explosive areas the IEC 60079 (DIN VDE 0165) standard.

3. In case of deviating direction of rotation: Swap the two phases.

6 Operation

For pumps/aggregates in potentially explosive areas
(→ ATEX additional instructions)

6.1 Preparations for commissioning

6.1.1 Identifying pump type

► Identify the pump/aggregate type (→ Nameplate, page 9).

ⓘ Pump/aggregate types vary, e.g. with regard to material, suction capacity, type of shaft sealing, auxiliary operating systems.

6.1.2 Removing preserving agent

ⓘ Only required for treated pump.

► Remove preserving agent (→ Removing preserving agent, page 14).

6.1.3 Checking shut-down period

► Shut-down periods > 1 year: contact the manufacturer and ask for required measures.

► Shut-down periods < 1 year: take all steps as required for commissioning (→ Commissioning, page 18).

6.1.4 Filling

1. Remove the screw plug from port U_V (→ Dimension drawing, page 45 et seq.).
2. Fill the pump with operating liquid maximally up to the middle of the shaft.
3. When operating liquid escapes from port U_V, stop the filling process.
4. Screw the screw plug into port U_V (→ Dimension drawing, page 45 et seq.).
5. Open the fitting at the suction side.
6. Open the fitting at the pressure side.
7. Make sure all ports and connections are tight.

6.2 Commissioning

6.2.1 Switch-on

- ✓ Aggregate correctly set up and connected
- ✓ Motor correctly connected
- ✓ Coupling adjustment checked
- ✓ All connections stress-free and sealed
- ✓ If available: auxiliary operating systems ready for operation
- ✓ All safety devices installed and checked for proper functioning
- ✓ Pump/aggregate properly prepared and filled

⚠ DANGER

Risk of injuries caused by running aggregate!

► Do not touch the running aggregate.

► Do not carry out any works on the running aggregate.

⚠ RISK OF ELECTRIC SHOCK

Risk of death from electric shock!

► Any electrical works must be carried out by qualified electricians only.

► Observe the IEC 30364 (DIN VDE 0100) and for potentially explosive areas IEC 60079 (DIN VDE 0165) standards.

⚠ WARNING

Risk of injuries caused by vacuum or harmful media to be pumped and operating liquid!

Use protective equipment when carrying out any works on the pump/aggregate.

CAUTION

Risk of material damage caused by dry running!

► Make sure the pump has been properly filled.

CAUTION

Risk of cavitation when throttling down the suction flow!

Risk of cavitation when the fitting in the suction pipe is closed!

► Completely open the fitting at the suction side and do not use it for controlling the flow rate.

► Open the fitting at the pressure side.

CAUTION

Risk of material damage caused by a closed pressure pipe!

► Do not operate the aggregate when the fitting at the pressure side is closed.

► Observe the max.permissible operating limits (→ Operating limits, page 35).

- max.permissible pressure difference
- max.permissible compression pressure
- max.permissible operating liquid temperature
- max.permissible operating liquid viscosity
- max.permissible operating liquid density
- max.permissible temperature of the medium to be pumped

1. Open the fitting at the pressure side.
2. Ventilation port (if available): open the fitting.
3. Switch on the motor.
4. Operating liquid: open the fitting.
5. Open the fitting at the suction side.
6. Ventilation port (if available): Close the fitting as soon as the motor has reached its nominal speed.
7. Provide for a smooth running behaviour of the aggregate.
8. Check the aggregate and connection for tightness.

6.2.2 Switch-off

⚠ WARNING

Risk of injuries caused by vacuum or harmful media to be pumped and operating liquid!

► Use protective equipment when carrying out any works on the aggregate.

1. Operating liquid: close fitting.
2. Switch off the motor.
3. Ventilation port (if available): open the fitting.
4. Check all connecting screws and tighten if required (only after initial commissioning).

6.3 Setting the operating liquid flow rate

6.3.1 Continuous-flow cooling

► Switch on the aggregate.

► Set the pressure in the operating liquid pipe to max. 0.2 bar overpressure (→Diagram Fig. 13)

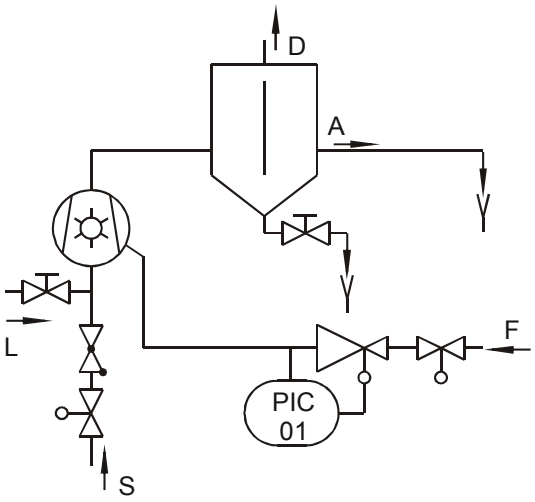


Fig. 13 Continuous-flow cooling

6.3.2 Open circulation cooling

► Switch on the aggregate.

► Set the pressure in the operating liquid pipe to max. 0.2 bar overpressure (→Diagram Fig. 14, 15, 16)

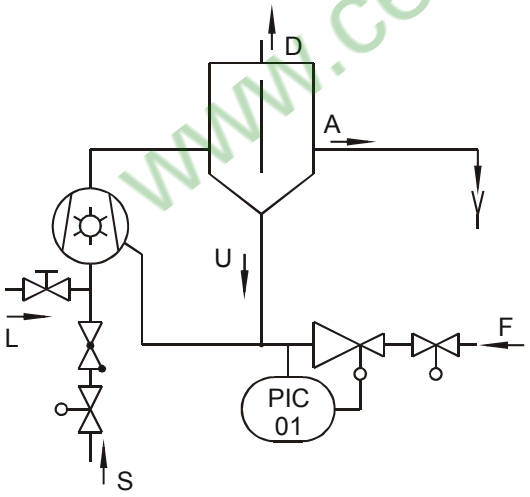


Fig. 14 Open circulation cooling

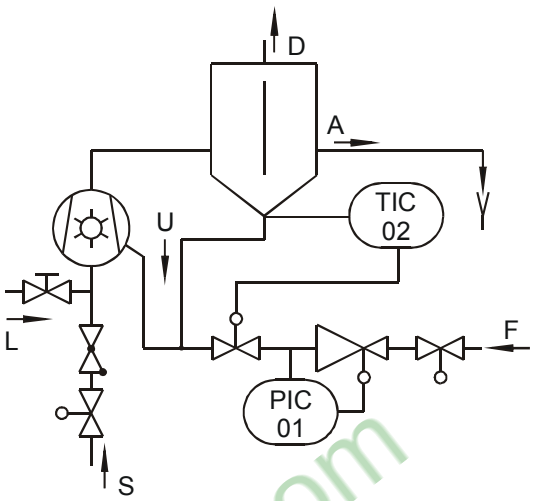


Fig. 15 Open circulation cooling with temperature control

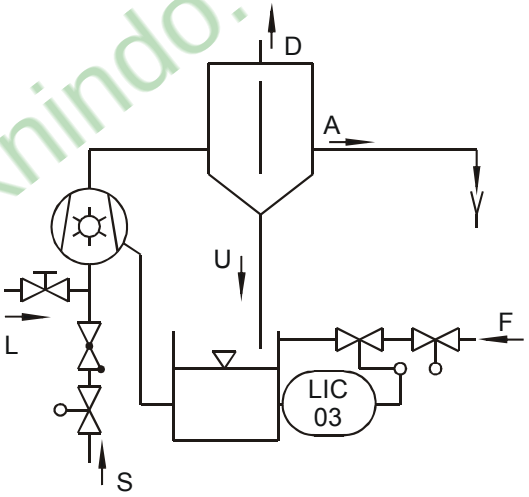


Fig. 16 Open circulation cooling with controlled liquid feed

► Observe the permissible operating liquid temperature (→Operating liquid, page 37)

6.3.3 Closed circulation cooling

► Switch on the aggregate.

► Set the pressure in the operating liquid pipe to a value which is 0.1 bar smaller than the compression pressure (→Diagram Fig. 17)

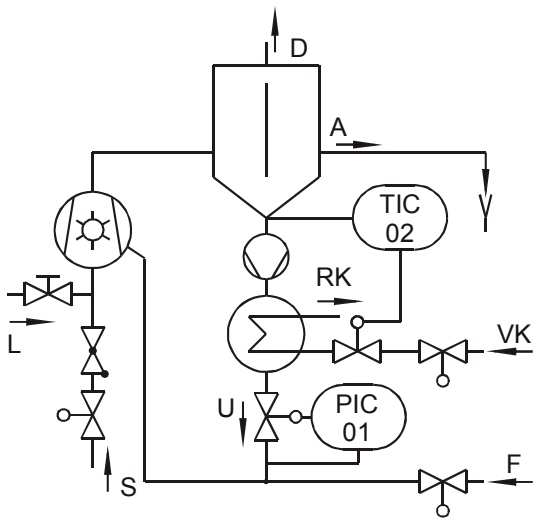


Fig. 17 Closed circulation cooling

► Observe the permissible operating liquid temperature (→Operating liquid, page 37)

Pos.	Meaning
S	Suction connection
L	Ventilation port
D	Pressure connection
A	Overflow
U	Circulation liquid
F	Fresh liquid
VK	Feed-in cooling agent
RK	Return cooling agent
TIC	Temperature
PIC	Pressure
LIC	Filling level

Tab. 7 Legend of symbols

6.4 Decommissioning

⚠ WARNING

Risk of injuries caused by vacuum or harmful media to be pumped and operating liquid!

► Use protective equipment when carrying out any works on the pump/aggregate.

► Reliably collect escaping media to be pumped and dispose of in an environmentally friendly way.

Implement the following measures when taking the pump/aggregate out of operation:

Pump/ aggregate is	Measure
shut down while remaining ready for operation	► Shortly operate (approx. 5 minutes) the aggregate at intervals of at least one month but not exceeding 3 months (→Commissioning, page 18).
shut down for a longer period of time	► Implement measures in accordance with the condition of the operating liquid (→ Tab.9 Measures depending on the behaviour of the operating liquid).
drained	► Close all fittings.
disassembled	► Disconnect the motor from the power supply and secure it against unauthorized switch-on.
stored	► Observe the measures to be implemented for storage (→Storage, page 12).

Tab. 8 Measures to be taken when putting the pump out of service

Operating liquid	Duration of shut-down (process-dependent)	
	Short	Long
Water	► Drain pump/ aggregate and separator.	► Drain pump/ aggregate and separator. ► Treat pump/ aggregate with a preserving agent (→ Preservation, page 12)
Other media	-	► Drain pump/ aggregate and separator. ► Treat pump/ aggregate with a preserving agent (→Preservation, page 12).

Tab. 9 Measures depending on the behaviour of the operating liquid

6.5 Re-commissioning

Shut-down periods > 1 year:

1. Prepare commissioning (→ Preparations for commissioning, page 18).
2. Perform commissioning procedures (→ Commissioning, page 18).
3. Monitor the aggregate following commissioning (→ Monitoring, page 21).

6.6 Operating stand-by aggregate

✓ Stand-by aggregate filled

ⓘ Operate the stand-by aggregate at least once per week.

7 Maintenance and servicing

ⓘ For pumps/aggregates in potentially explosive areas (→ ATEX additional instructions)

ⓘ A qualified service team provides support for assembly and repair works. Provide a certificate documenting the safety of the media to be pumped (DIN safety data sheet or certificate of conformity when ordering this service (→ Certificate of conformity, page 59).

7.1 Monitoring

ⓘ Inspection intervals depend on the operational strain on the pump/aggregate.

⚠ RISK OF ELECTRIC SHOCK

Risk of death from electric shock!

► Any electrical works must be carried out by qualified electricians only.

► Observe the IEC 30364 (DIN VDE 0100) and for potentially explosive areas the IEC 60079 (DIN VDE 0165) standard.

⚠ DANGER

Risk of injuries caused by running aggregate!

► Do not touch the running aggregate.

► Do not carry out any works on the running aggregate.

⚠ WARNING

Risk of injuries caused by vacuum and harmful media to be pumped and operating liquid!

► Use protective equipment when carrying out any works on the aggregate.

1. Check at appropriate intervals:
   - deposits on aggregate and separator (if available)
   - compliance with the operating liquid flow rate
   - compliance with the operating liquid temperature
   - compliance with the max.permissible compression pressure
   - compliance with the limit values applicable to the delivery of liquids
   - power consumption of the drive
   - contamination of the drive
   - contamination of filters (if available)
   - running noise of the rolling bearings (motors)
   - normal operating conditions unchanged
2. For trouble-free operation, ensure the following:
   - no dry running
   - tightness
   - no cavitation
   - open gate valves at the suction side
   - free and clean filters
   - no unusual running noise or vibrations
   - no impermissible leaks at the shaft sealing
   - proper functioning of the auxiliary operating systems (if available)
3. Check shaft sealing:

ⓘ Mechanical seals are maintenance-free sealing systems.

- In case of leaks: Have the mechanical seal with auxiliary seals replaced by service staff or the manufacturer. Check auxiliary operating systems (if available) for proper functioning or have them checked.

7.2 Lubrication intervals for rolling bearings

Pump types VU 20 – 220 and VH 20 – 400 are equipped with maintenance-free rolling bearings (sealed deep groove ball bearings).

Pump types VU 300 – 1600 and VH 500 – 1600 are equipped with rolling bearings which have to be maintained in regular intervals.

Type	Interval [h]	Amount of lubricant per bearing [g]
VU 300/450 VH 500/600	2000	8
VU 800 – 1600 VH 800 – 1600	2000	15

The lubrication intervals apply to bearing temperatures of up to 70°C. Temperature rises of 15°C require lubrication at half intervals.

For initial filling, a high-temperature grease containing a polyurea-based thickener by Fuchs (Renolit PU-FH 300) is used.

7.3 Rinsing off contaminations

⚠ DANGER

Risk of injuries caused by hot, harmful or environmentally hazardous media to be pumped!

► Do not rinse when delivering harmful or environmentally hazardous media with the aggregate.

► Use protective equipment when carrying out any works on the aggregate.

7.3.1 Minor fine-grained contamination

1. Switch on the aggregate.
2. Remove the screw plug U_e (→ Dimension drawing, page 45 et seq.).
3. Collect contamination and escaping operating liquid and dispose of in an environmentally-compatible way.
4. Screw in the screw plug.

7.3.2 Major fine-grained contamination

► Replace screw plug U_e by a fitting.

► Close fittings before switching on the aggregate.

► Fill the pump with operating liquid up to the middle of the shaft.

1. Switch on the aggregate.
2. Open the fittings for drainage.
3. Collect contamination and escaping operating liquid and dispose of in an environmentally-compatible way.

7.4 Preventing calcification

ⓘ Calcification results in excessive wear of moistened pump parts and increases the power consumption of the drive.

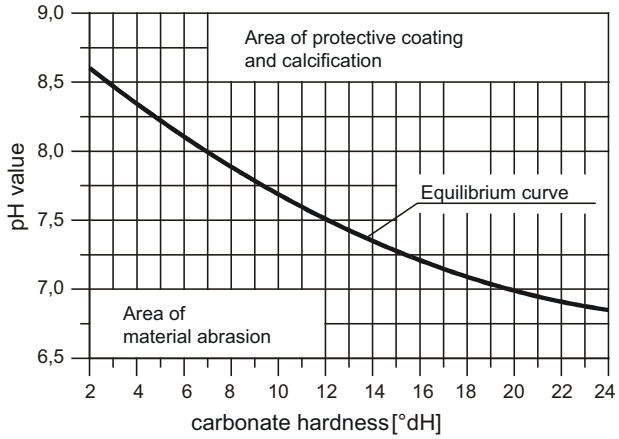


Fig. 18 Equilibrium characteristic

- Operating liquid: water
- Water temperature: 17°C

► pH value and carbonate hardness should intersect at a point which lies max. 0.2 above the equilibrium curve to avoid deposits and excessive corrosion in the aggregate.

► Treat the operating liquid with a suitable agent.

7.5 Disassembly

⚠ DANGER

Risk of injuries caused by running aggregate!

► Do not touch the running aggregate.

► Do not carry out any works on the running aggregate.

► Prior to carrying out any assembly or maintenance works, de-energize the motor and protect it against restart.

⚠ RISK OF ELECTRIC SHOCK

Risk of death from electric shock!

► Any electrical works must be carried out by qualified electricians only.

► Observe the IEC 30364 (DIN VDE 0100) and for potentially explosive areas the IEC 60079 (DIN VDE 0165) standard.

⚠ WARNING

Risk of injuries caused by vacuum and harmful media to be pumped and operating liquid!

► Use protective equipment when carrying out any works on the pump/aggregate.

► Make sure the pump/aggregate is depressurized.

► Drain the pump. Reliably collect operating liquid and media to be pumped and dispose of in an environmentally-compatible way.

7.5.1 Return to manufacturer

✓ Aggregate shut down
✓ Aggregate depressurized
✓ Pump completely drained
✓ Electrical connections isolated and motor secured against re-start
✓ Auxiliary operating systems shut down, depressurized and drained (if available)
✓ Connecting pipes removed
✓ Manometer lines, manometer and fixtures removed

1. Loosen fixing screws.
2. Lift the aggregate out of the system (→Transport, page 11).
3. Decontaminate pump/aggregate.
4. Attach transport and sealing cover.
5. Send a certificate of conformity.
   If required, request a certificate of conformity from the manufacturer.

7.5.2 Spare parts

ⓘ Spare parts are available from your supplier or the manufacturer.

The following data are required for spare part orders.

- Number of the pump/aggregate (→Name plate, page 9)
- Type of pump/aggregate (→Name plate, page 9)
- Item number of spare part (→Cross-sectional drawing, page 47 et seq.)
- Designation of spare part (→Cross-sectional drawing, page 47 et seq.)
- Number of spare parts

7.5.3 Pump/aggregate repairs

1. The following must be observed during assembly:
   – Worn parts must be replaced by original spare parts.
   – Seals must be replaced.
   – The required tightening torques must be observed (→9.2.10 Tightening torques, page 41).
2. Clean all parts.
3. Install the pump/aggregate inside the system (→ Set-up and connection, page 14).

7.5.4 Disassembly of VU 20/40, VH 20/40/60

ⓘ Cross-sectional drawing VU 20/40 → Cross-sectional drawing, page 47

ⓘ Cross-sectional drawing VH 20 - 60 → Cross-sectional drawing, page 57

✓ The pump has been removed from the system and is positioned in a clean and level assembly area.

1. Disassembly of bearing housing and suction casing
   - Bring the pump into an upright position (drive side pointing up).
   - Remove the fitting key (940) from the pump shaft (211).
   - Loosen the hexagon head screws (901.1) on the bearing cover (360), take off the bearing cover.
   - Loosen the hexagon nuts (920), remove the hexagon nuts and the casing bolts (563).
   - Pull the bearing housing (330) and the rolling bearing (320) off the pump shaft.
   - Remove the shaft sealing casing (441) from the suction casing (106).
2. Disassembly of mechanical seal (RU 1) (→ Preparations for assembly, page 26)
   - Pull the rotating unit of the mechanical seal (047) off the pump shaft (211).
   - Remove the suction casing (106) and pull the ring (500.2) off the pump shaft.
3. Disassembly of inter casings, stage casings and impellers
   - Pull the inter casing (137), stage casing (110) and impeller (230) off the pump shaft (211).
   - Remove the fitting key (940.1) from the pump shaft (211).

   Additional steps for VH 20/40/60
   - Pull the inter casings (137.1/137.2), stage casing (110) and impeller (230.1) off the pump shaft (211).
   - Remove the fitting key (940.1) from the pump shaft (211).
   - Remove the inter casing (137.3).
4. Disassembly of bearing housing and discharge casing
   - Rotate the pump 180° (drive side pointing down).
   - Loosen the hexagon head screws (901.1) on the bearing cover (360.1), take off the bearing cover.
   - Remove the locking ring (932) from the pump shaft (211).
   - Pull the bearing housing (330), rolling bearing (320) and ring (500.1) off the pump shaft (211).
   - Remove the shaft sealing casing (441) from the discharge casing (107).
5. Disassembly of mechanical seal (RU 2) (→ Preparations for assembly, page 26)
   - Remove the pump shaft (211) from the discharge casing (107).
   - Pull the rotating unit of the mechanical seal (047) and the ring (500.2) off the pump shaft (211).
6. Disassembly of mechanical seal (SU 1/2) (→ Preparations for assembly, page 26)
   - Push the stationary units of the mechanical seal (047/047.1) out of the shaft sealing casing (441).
7. Additional steps for VH 20/40/60

   Disassembly of central inter casings
   - Separate inter casings 137.1 and 137.2.
   - Remove the ring (500) and the packing gland (461) from the inter casings (137.1/137.2).

7.5.5 Disassembly of VU 80/140/220 VH 110/140/180

ⓘ Cross-sectional drawing VU 80 – 220 → Cross-sectional drawing, page 47

ⓘ Cross-sectional drawing VH 110 – 180 → Cross-sectional drawing, page 57

✓ The pump has been removed from the system and is positioned in a clean and level assembly area.

1. Disassembly of pipes (not applicable to VU 80/VH 110)
   - Loosen the hexagon nuts (920/920.1), remove the pipes (700/700.1) and seals (400).
2. Disassembly of bearing housing on the suction casing (drive side)
   - Remove the fitting key (940) from the pump shaft (211).
   - Loosen the hexagon head screws (901.1) on the bearing housing (330), pull the bearing housing with the ball bearing (320) off the pump shaft (211).
3. Disassembly of mechanical seal (RU 1) (→ Preparations for assembly, page 26)
   - Loosen the hexagon head screws (901.1) on the shaft sealing casing (441).
   - Pull the shaft sealing casing (441) and the rotating unit of the mechanical seal (047) off the pump shaft (211).
4. Disassembly of bearing housing on the discharge casing (non-drive side)
   - Loosen the hexagon head screws (901.1) and take off the bearing cover (360.1).
   - Loosen the lock washer (931.1) and the shaft nut (921) and pull them off.
   - Loosen the hexagon head screws (901.1) and pull the bearing housing (330) with the rolling bearing (320) off the pump shaft (211).
5. Disassembly of mechanical seal (RU 2) (→ Preparations for assembly, page 26)
   - Loosen the hexagon head screws (901.1) and pull the casing for the shaft sealing (441) off the pump shaft (211).
   - Pull the rotating unit of the mechanical seal (047.1) off the pump shaft (211).
6. Disassembly of suction casing
   - Rotate the pump 90° (drive side pointing up).
   - Loosen the hexagon nuts (920.1), remove the nuts and casing bolts (563).
   - Remove the suction casing (106).
7. Disassembly of stage casing and pump shaft
   - Remove the stage casing (110).
   - Remove the pump shaft (211) with the impeller (230).

   With VH 110/140/180
   - Remove the pump shaft (211) with the inter casings (137.1/137.2) and impellers (230/230.1).
   - Remove the stage casing (110.1).

8. Disassembly of impeller and pump shaft
   - Loosen the shaft nut (922) and the lock washer (931) at the drive side and, together with the impeller (230), pull them off the pump shaft (211).

   Additional steps for VH 110/140/180
   - Remove the fitting key (940.1) from the pump shaft (211).
   - Pull the inter casings (137.1/137.2) jointly off the shaft sleeve (523).
   - Pull the impeller (230.1) and the shaft sealing (523) off the pump shaft.
   - Pull the fitting key (940.1), the shaft nut (922) and the lock washer (931) off the pump shaft (211).
9. Disassembly of mechanical seal (SU 1/2) (→ Preparations for assembly, page 26)
   - Push stationary units of the mechanical seals (047/047.1) out of the shaft sealing casings (441).
10. Disassembly of inter casing of the suction/discharge casing
    - Loosen the hexagon socket head screw (914) in the suction/discharge casing (106/107).
    - Remove the inter casing (137/137.3) from the suction/discharge casing (106/107).

    Additional steps for VH 110/140/180
    - Separate the inter casings (137.1/137.2) in the centre.
    - Remove the packing gland (461) from the inter casing (137.1).

7.5.6 Disassembly of VU 300/450 VH 300/350/400

ⓘ Cross-sectional drawing VU 300/450
→ Cross-sectional drawing, page 52

ⓘ Cross-sectional drawing VH 300/350/400
→ Cross-sectional drawing, page 57

✓ The pump has been removed from the system and is positioned in a clean and level assembly area.

1. Disassembly of pipes (not applicable to VU 300)
   - Loosen the hexagon nuts (920), remove the pipes (700) with hexagon head screws (901) and seals (400.1).
2. Disassembly of bearing housing on suction casing (drive side)
   - Remove the fitting key (940.1) from the pump shaft (211).
   - Loosen the hexagon head screws (901.3), pull the bearing housing (330) with the rolling bearing (320) off the pump shaft (211).
   - Pull off the splash ring (507).
3. Disassembly of mechanical seal (RU 1) (→ Preparations for assembly, page 26)
   - Loosen the hexagon head screws (901.2). Pull the shaft sealing casing (441) and the rotating unit of the mechanical seal (047) off the pump shaft (211).
   - Pull off the spacer sleeve (525).
4. Disassembly of bearing housing on discharge casing (non-drive side)
   - Loosen the hexagon head screws (901.1). Pull the bearing cover (360.1) off the pump shaft (211).
   - Loosen the lock washer (931.1) and the shaft nut (921) and pull them off.

   Additional steps for VU 300/450
   - Pull the ring (500) off the pump shaft (211).
   - Loosen and pull off the withdrawal sleeve (531) by tightening the supplied shaft nut (921.1).
   - Loosen the screws (901.3), pull the bearing housing (330) with the ball bearing (320.1) and the ring (500.1) off the pump shaft (211).
   - Pull off the splash ring (507).
5. Disassembly of mechanical seal (RU 1) (→ Preparations for assembly, page 26)
   - Loosen the hexagon head screws (901.2), pull the shaft sealing casing (441) and the rotating unit of the mechanical seal (047.1) off the pump shaft (211).
   - Pull off the spacer sleeve (525).
6. Disassembly of suction casing
   - Rotate the pump 90° (drive side pointing up).
   - Loosen the nuts (920/920.1), remove the nuts and the casing bolts (563).
   - Remove the suction casing (106).
7. Disassembly of stage casing and pump shaft
   - Remove the stage casing (110).
   - Remove the pump shaft (211) with the impeller (230).

   With VH 300/350/400
   - Remove the pump shaft (211) with the inter casings (137.1/137.2) and impellers (230/230.1).
   - Remove the stage casing (110.1).
8. Disassembly of impeller and pump shaft
   - Loosen and remove the shaft nut (922) and the lock washer (931) at the drive side.
   - Pull the impeller (230) off the shaft.

   Additional steps for VH 300/350/400
   - Remove the fitting key (940) from the pump shaft (211).
   - Pull the inter casings (137.1/137.2) jointly off the shaft protection sleeve (523).
   - Pull the impeller (230.1) and the shaft protection seal (523) off the pump shaft (211).
   - Pull the fitting key (940.1), the lock washer (931) and the impeller nut (922) off the pump shaft (211).
9. Disassembly of mechanical seal (SU 1/2) (→ Preparations for assembly, page 26)
   - Push the stationary units of the mechanical seal (047/047.1) out of the shaft sealing casings (441).
10. Disassembly of inter casing of suction/discharge casing
    - Loosen the hexagon socket head screw (900/900.1) on the suction/discharge casing (106/107).
    - Remove the inter casing (137/137.3) from the suction/discharge casing (106/107).

    Additional steps for VH 300/350/400
    - Separate the central inter casings (137.2/137.1)

11. Disassembly of valve flaps

    Not applicable to VH 300/350/400

    VU 450 inter casings (137/137.3)

    VU 300 inter casing (137.3)

    – Loosen the hexagon head screws (901.5) on the inter casing (137/137.3).
    – Remove the stop plate (598/598.1) and the flap valve (746).

7.5.7 Disassembly of VU 500/600/800/1200/1600

ⓘ Cross-sectional drawing VU 500 - 1600
→ Cross-sectional drawing, page 56

ⓘ Cross-sectional drawing VH 500 - 1600
→ Cross-sectional drawing, page 58

✓ The pump has been removed from the system and is positioned in a clean and level assembly area.

1. Disassembly of pipes (not applicable to VU 800)

    – Loosen the hexagon nuts (920), remove the pipes (700/700.1), the hexagon head screws (901) and the seals (400.1).

2. Disassembly of bearing housing on suction casing (drive side)

    – Remove the fitting key (940) from the pump shaft (211).
    – Loosen the hexagon head screws (901.2/901.4), pull the bearing housing (330) with the rolling bearing (320) off the pump shaft.

    VU/VH 500/600

    – Pull off the splash ring.

3. Disassembly of mechanical seal (RU1) (→ Preparations for assembly, page 26)

    – Loosen the hexagon head screws (901.1/901.2). Pull the shaft sealing casing (441) and the rotating unit of the mechanical seal (047) off the pump shaft.
    – Pull off the spacer sleeve (525).

4. Disassembly of bearing housing on discharge casing (non-drive side)

    – Loosen the hexagon head screws (901.1). Remove the bearing cover (360.2).
    – Loosen the lock washer (931.1) and the shaft nut (921.1) on the pump shaft (211) and pull them off.
    – Pull off the ring (500.1).
    – Loosen and pull the withdrawal sleeve (531) off the pump shaft by tightening the supplied shaft nut (921).
    – Loosen the screws (901.2/901.4), pull off the bearing housing (330) with the rolling bearing (320.1) and the ring (500).

    VU/VH 500/600

    – Pull off the splash ring (507).

5. Disassembly of mechanical seal (RU2) (→ Preparations for assembly, page 26)

    – Loosen the hexagon head screws (901.1/901.2), pull the shaft sealing casing (441) and the rotating unit of the mechanical seal (047.1) off the pump shaft (211).
    – Pull off the spacer sleeve (525).

6. Disassembly of suction casing

    – Rotate the pump 90° (drive side pointing up).
    – Loosen the nuts (920/920.1), remove the nuts and the casing bolts (563).
    – Remove the suction casing (106).

7. Disassembly of stage casing and pump shaft

    – Remove the stage casing (110)
    – Remove the pump shaft (211) with the impeller (230)

    VH 500/600/800/1200/1600

    – Remove the pump shaft (211) with the inter casings (137.1/137.2) and impellers (230/230.1).
    – Remove the stage casing (110.1).

8. Disassembly of impeller and pump shaft

    – Loosen and remove the impeller nut (922) and the lock washer (931) at the drive side.
    – Pull the shaft protection sleeve (524) and the impeller (230) off the pump shaft (211).

    Additional steps for VH 500/600/800/1200/1600

    – Remove the fitting key (940) from the pump shaft.
    – Pull the inter casings (137.1/137.2) jointly off the shaft protection sleeve (524.1).
    – Pull the impeller (230.1) and the shaft protection seal (524.1) off the pump shaft.

    – Pull the fitting key (940), the lock washer (931) and the impeller nut (922) off the pump shaft (211).

9. Disassembly of mechanical seal (SU 1/2) (→ Preparations for assembly, page 26)

    – Push stationary units of the mechanical seals (047/047.1) out of the shaft sealing casings (441).

10. Disassembly of inter casing of the suction/discharge casing

    – Loosen the hexagon socket head screw (914) in the suction/discharge casing (106/107).
    – Remove the inter casing (137/137.1) from the suction/discharge casing (106/107).

    Additional steps for VH 500/600/800/1200/1600

    – Separate the central inter casings (137.1/137.2)
    – Remove the packing gland (461) from the inter casing (137.2).

11. Disassembly of valve flaps

    Not applicable to VH 500/600/800/1200/1600

    VU 600/1200/1600 inter casings (137/137.3)

    VU 800 inter casing (137)

    – Loosen the hexagon head screws (901.4) on the inter casing (137/137.3).
    – Remove the stop plate (598/598.1) and the flap valve (746).

7.5.8 Preparations for assembly

CAUTION

Improper assembly results in pump damage!

- ► Assemble the pump in accordance with the principal rules of mechanical engineering.
- ► Use original spare parts only.
- ► For pump assembly, consult the corresponding cross-sectional drawing.
- ► Assemble the pump in a clean and level assembly area.

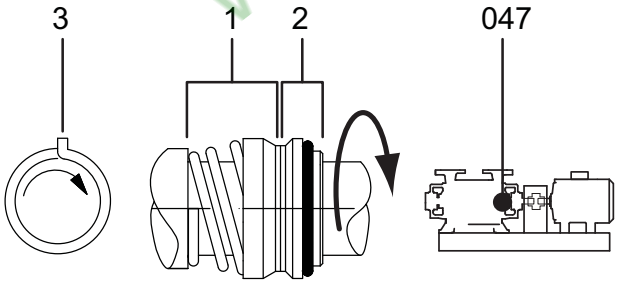
The following must be observed during assembly:

- Replace seals.
- Install only clean parts.
- Install only inspected and flawless parts.
- Apply Molykote® lubricant to all threads and fits (except for sealing fits).
- Provide all sealing surfaces with liquid sealing compound shortly before insertion. Use e.g. Epple 33 sealing compound.
- Make sure not to enter foreign bodies or excessive sealing compound into the pump.
- All marks must be aligned with each other.
- Keep the sliding surfaces of the mechanical seal free of dirt and grease.
- Observe the required tightening torques. (→ Tightening torques, page 41)

ⓘ Marks are placed on the inter casings and the suction/discharge casings.

ⓘ VU/VH 80 – 1600:
the total air gap per stage between the front ends of the impeller and the inter casings amounts to approx. 0.33 mm. The total air gap must also be ensured when replacing parts. Inter casings and impellers must be adjusted to each other if required.

ⓘ Please verify that the spring of mechanical seal 047 must always be right-handed while that of mechanical seal 047.1 must be left-handed (refer to Fig.19 and 20).

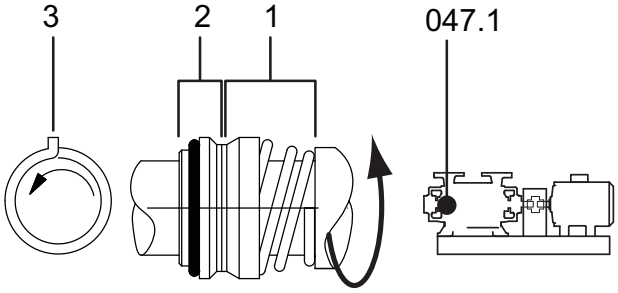


1 rotating unit (047/RU)

2 stationary unit (047/SU)

3 right-handed spring (View towards mechanical seal)

Fig. 19 Mechanical seal shaft rotating clockwise (viewing direction towards pump)



1 rotating unit (047/RU)

2 stationary unit (047/SU)

3 left-handed spring (view towards mechanical seal)

Fig. 20 Mechanical seal shaft rotating counterclockwise (viewing direction towards motor)

7.5.9 Assembly of VU 20/40, VH 20/40/60

ⓘ Cross-sectional drawing VU 20/40 → Cross-sectional drawing, page 55

ⓘ Cross-sectional drawing VH 20/40/60 → Cross-sectional drawing, page 57

ⓘ Assembly preparations

- Press-fit the radial seal ring (421) into the bearing housing (330) (sealing lip opposite the bearing seat).
- Apply a thin layer of grease to the sealing lip.
- Press-fit the mechanical seals (047/SU and 047.1/SU) into the shaft sealing casings (441). Apply lubricant (water, alcohol) to the auxiliary seal of the stationary unit before press-fitting it. Manually push the stationary unit into the shaft sealing casing (441).

1. Assembly of bearing housing and mechanical seal
   - Vertically clamp the pump shaft (211) with the drive side pointing down.
   - Push the ring (500.2) onto the pump shaft (211).
   - Moisten the auxiliary seal of the rotating unit (047.1) with lubricant (grease containing PTFE).
   - Push the rotating unit (047.1) onto the pump shaft (211) by a screwing movement in the sense of winding of the spring.
   - Adjust the shaft sealing casing (441) to the bearing housing (330), deflect and compress it.
   - Push both parts (330/441) onto the pump shaft.
   - Push the ring (500.1) onto the pump shaft.
   - Press the rolling bearing (320) onto the pump shaft and use the locking ring (932) to fix it.
   - Adjust the bearing cover (360.1) to the bearing housing (330), deflect and fasten it by means of hexagon head screws (901.1).
2. Discharge casing and inter casing
   - Clamp in the bearing housing (330) and the pump shaft (211) with the drive side pointing up.
   - Adjust the inter casing (137.3) to the discharge casing (107) (marks), deflect and compress it.
   - Push both parts (107/137.3) onto the pump shaft, adjust and put them down on the shaft sealing casing (441).

3. Assembly of inter casings, stage casings and impellers
   - Fix the fitting key (940.1) in the pump shaft.

   VU 20/40
   - Push the impeller (230) onto the pump shaft.

ⓘ The impeller blades must be tilted in the direction of rotation.
   - Force the stage casing (110) into the inter casing (137.3).

   VH 20/40/60
   - Push the impeller (230.1) onto the pump shaft.

ⓘ The impeller blades must be tilted in the direction of rotation.
   - Force the stage casing (110.1) into the inter casing (137.3).
   - Insert the packing gland (461) and the ring (500) into the inter casing (137.2).
   - Insert the packing gland (461) into the inter casing (137.1).
   - Adjust the inter casing (137.1) to the inter casing (137.2) (marks), deflect and compress it.
   - Push both inter casings (137.1/137.2) onto the pump shaft, adjust them to the discharge casing (marks) and put them down on the stage casing (110.1).
   - Fix the fitting key (940.1) in the pump shaft.
   - Push the impeller (230) onto the pump shaft.

ⓘ The impeller blades must be tilted in the direction of rotation.
   - Force the stage casing (110) into the inter casing (137.1) (with VH 60: adjust mark).

4. Suction casing and inter casing
   - Adjust the inter casing (137) to the suction casing (106) (marks), deflect and compress it.
   - Push both parts (106/137) onto the pump shaft (211), adjust and put them down on the stage casing (110).

5. Assembly of mechanical seal and shaft sealing casing
   - Push the ring (500.2) onto the pump shaft (211).
   - Moisten the auxiliary seal of the rotating unit (047.1) with lubricant (grease containing PTFE).
   - Push the rotating unit (047) onto the pump shaft (211) by a screwing movement in the sense of winding of the spring.
   - Adjust the shaft sealing casing (441) to the suction casing (106), deflect it and put it down.

6. Assembly of bearing housing and floating bearing
   - Adjust the the bearing housing (330) to the shaft sealing casing (441), deflect it and put it down.
   - Insert the casing bolts (563) and slightly fasten them with hexagon nuts (920).
   - Press-fit the rolling bearing (320) into the bearing housing (330).
   - Force the bearing cover (360) into the bearing housing (330) and adjust, fasten by means of hexagon head screws (901.1).
   - Insert the fitting key (940) into the pump shaft (211).
   - Horizontally position the pump on a level surface and adjust it using the pump feet.
   - Tighten the casing bolts (563) and hexagon nuts (920) crosswise.
   - Verify unobstructed movement of the pump. Manually rotate the pump shaft.

   Additional steps for VH 60
   - Put down seals (400/400.1) and connecting pipe (700) on the suction/discharge casing, fasten with hexagon head screws (901) and hexagon nuts (920).

7.5.10 Assembly of VU 80/140/220 VH 110/140/180

ⓘ Cross-sectional drawing VU 80 – 220
→ Cross-sectional drawing, page 55

ⓘ Cross-sectional drawing VH 110 – 180
→ Cross-sectional drawing, page 57

1. Assembly of inter casings on suction/discharge casing
   - Adjust the inter casing (137) (marks) and force it into the suction casing (106).
   - Adjust the inter casing (137.3) (marks) and force it into the discharge casing (107).
   - Screw hexagon socket head screws (914) through the suction/discharge casing into the inter casings (137/137.3) and fasten them.

   Additional steps for VH 110/140/180
   - Insert the packing gland (461) into the inter casing (137.1)
   - Adjust the inter casings (137.1/137.2) (mark), deflect and compress them.

2. Assembly of impeller and pump shaft
   - Push the lock washer (931) onto the non-drive side of the pump shaft.
   - Screw the impeller nut (922) onto the pump shaft (211).
   - Insert the fitting key (940.1) into the pump shaft.
   - Vertically clamp the pump shaft (211) with the drive side pointing up.

   VU 80/140/220
   - Push the impeller (230) onto the pump shaft (211).

ⓘ The impeller blades must be tilted in the direction of rotation.

   VH 110/140/180
   - Push the impeller (230.1) onto the pump shaft (211).

ⓘ The impeller blades must be tilted in the direction of rotation.
   - Push the shaft sleeve (523) onto the pump shaft (211).
   - Push the inter casings (137.1/137.2) jointly over the shaft sleeve (523) .
   - Insert the fitting key (940.1) into the pump shaft.
   - Push the impeller (230) onto the pump shaft.

ⓘ The impeller blades must be tilted in the direction of rotation.
   - Push the lock washer (931) onto the pump shaft.
   - Screw the impeller nut (922) onto the pump shaft (211).
   - Set the impellers in accordance with adjustment dimension L by turning the impeller nuts.
   - Following the setting procedure, secure the impeller nuts (922) using lock washers (931).

3. Assembly of stage casing and pump shaft
   - Horizontally clamp the discharge casing (107) (inter casing on top).

   VU 80/140/220
   - Insert the complete pump shaft (drive side pointing up) into the discharge casing (107), put down on inter casing (137.3).
   - Force the stage casing (110) into the inter casing (137.3).

   VH 110/140/180
   - Adjust the inter casing (110.1) (marks) and compress it into the suction casing (137.3).
   - Insert the complete pump shaft (211, drive side pointing up) into the discharge casing (107).
   - Adjust the inter casings (marks), put them down on the stage casing (110.1).
   - Force the stage casing (110) into the inter casing (137.1).
4. Assembly of suction casing
   - Adjust the suction casing (106) (marks) and force it onto the stage casing (110).
   - Secure the casing bolts (563). Slightly fasten them with hexagon nuts (920.1).
5. Assembly of mechanical seal (drive side)
   - Moisten the auxiliary seal of the rotating unit (047) with lubricant (grease containing PTFE).
   - Push the rotating unit (047) onto the pump shaft (211) by a screwing movement in the sense of winding of the spring.
   - Moisten the auxiliary seal of the stationary unit with lubricant (alcohol, water).
   - Manually press the stationary unit (047) into the shaft sealing casing (411).
   - Adjust the shaft sealing casing (441) (observe the flushing channel), force it into the suction casing (106) and fasten it to the suction casing (106) by means of hexagon head screws (901.1).
6. Assembly of bearing housing on the suction casing (drive side)
   - Force the bearing cover (360.2) into the bearing housing (330) and adjust it, fasten with hexagon head screws (901.1).
   - Push the bearing housing (330) over the pump shaft (211), force it into the suction casing (106) and fasten with hexagon head screws (901.1).
   - Press the rolling bearing (320) onto the pump shaft (211).
   - Force the bearing cover (360) into the bearing housing (330), adjust it and fasten with hexagon head screws (901.2).
   - Insert the fitting key (940) into the pump shaft.
7. Assembly of mechanical seal (non-drive side)
   - Rotate the pump 180° (drive side pointing down).
   - Moisten the auxiliary seal of the rotating unit (047.1) with lubricant (grease containing PTFE).
   - Push the rotating unit (047.1) onto the pump shaft (211) by a screwing movement in the sense of winding of the spring.
   - Moisten the auxiliary seal of the stationary unit with lubricant (alcohol, water).
   - Manually press the stationary unit (047.1) into the shaft sealing casing (411).
   - Adjust the shaft sealing casing (441) (observe the flushing channel), force it into the discharge casing (107) and fasten it to the discharge casing (106) with hexagon head screws (901.1).
8. Assembly of bearing housing on the discharge casing (non-drive side)
   - Force the bearing cover (360.2) into the bearing housing (330) and adjust it, fasten with hexagon head screws (901.1).
   - Force the bearing housing (330) into the discharge casing (107) and fasten with hexagon head screws (901.1).
   - Press the rolling bearing (320) onto the pump shaft (211).
   - Push the lock washer (931.1) onto the pump shaft.
   - Screw the shaft nut (921) onto the pump shaft, fasten and secure with lock washer (931.1).
   - Force the bearing cover (360.1) into the bearing housing (330), adjust it and slightly fasten with hexagon head screws (901.1).
9. Pump adjustment
   - Rotate the pump 90° (horizontal position).
   - Adjust the pump on level ground.
   - Tighten the casing bolts (563) and hexagon nuts (920.1) crosswise.
10. Set the impeller position (non-drive side)
    - Loosen the hexagon head screws (901.1) on the bearing cover (360.2).
    - Fasten the hexagon head screws (901.1) on the bearing cover (360.1) until the impeller is in contact with the inter casing (suction casing).
    - Start the gauge at the front (drive side) of the pump shaft.
    - Loosen the hexagon head screws (901.1) on the bearing cover (360.1).
    - Fasten the hexagon head screws (901.1) on the bearing cover (360.2) until the impeller is in contact with the inter casing (discharge casing).
    - Halve the determined measure X and adjust the pump shaft/impeller by half the measure X (towards drive side).
    - Fasten the pump shaft/impeller in this position by evenly tightening the hexagon head screws (901.1) on the bearing covers (360.1/360.2).
    - Verify unobstructed movement of the pump. Manually rotate the pump shaft.
11. Pipe assembly

    Not applicable to VU 80/VH 110
    - Put the seals (400) and pipes (700) onto the suction/discharge flanges, fasten them with hexagon head screws (901) and hexagon nuts (920).

7.5.11 Assembly of VU 300/450, VH 300/350/400

ⓘ Cross-sectional drawing VU 300/450
→ Cross-sectional drawing, page 55

ⓘ Cross-sectional drawing VH 300/350/400
→ Cross-sectional drawing, page 57

1. Assembly of valve flaps

   Not applicable to VH 300/350/400

   VU 450 inter casing (137/137.3)

   VU 300 inter casing (137.3)
   - Put the stop plate (598/598.1) and the flap valve (746) onto the inter casings (137/137.1).
   - Screw the hexagon head screws (901.5) with the screw locking into the inter casings (137/137.3).

2. Assembly of inter casings on suction/discharge casing

   – Adjust the inter casing (137) (marks) and compress it into the suction casing (106).
   – Adjust the inter casing (137.3) (marks) and compress it into the discharge casing (107).
   – Screw hexagon socket head screws (914) through the suction/discharge casing into the inter casings (137/137.3) and fasten them.

   Additional steps for VH 300/350/400

   – Adjust the inter casings (137.1/137.2) (mark), deflect and compress them.

3. Assembly of impeller and pump shaft

   – Push the lock washer (931) onto the non-drive side of the pump shaft.
   – Screw the impeller nut (922) onto the pump shaft (211).
   – Insert the fitting key (940.1) into the pump shaft.
   – Vertically clamp the pump shaft with the drive side pointing up.

   VU 300/450

   – Push the impeller (230) onto the pump shaft.

ⓘ The impeller blades must be tilted in the direction of rotation.

   VH 300/350/400

   – Push the impeller (230.1) onto the pump shaft.

ⓘ The impeller blades must be tilted in the direction of rotation.

   – Push the shaft sleeve (523) onto the pump shaft.
   – Push the inter casings (137.1/137.2) jointly over the shaft sleeve (523).
   – Insert the fitting key (940.1) into the pump shaft.
   – Push the impeller (230) onto the pump shaft.

ⓘ The impeller blades must be tilted in the direction of rotation.

   – Push the lock washer (931) onto the pump shaft.
   – Screw the impeller nut (922) onto the pump shaft.
   – Set the impellers in accordance with adjustment dimension L by turning the impeller nuts.
   – Following the setting process, secure the impeller nuts (922) using lock washers (931).

4. Assembly of stage casing and pump shaft

   – Horizontally clamp the discharge casing (107) (inter casing on top).

   VU 300/450

   – Insert the complete pump shaft (drive side pointing up) into the discharge casing (107), put down on inter casing (137.3).
   – Force the stage casing (110) into the inter casing.

   VH 300/350/400

   – Force the stage casing (110.1) into the inter casing (137.3).
   – Insert the complete pump shaft (drive side pointing up) into the discharge casing (107).
   – Adjust the inter casings (marks), force them onto the stage casing (110.1) and put them down.
   – Force the stage casing (110) into the inter casing (137.1).

5. Assembly of suction casing

   – Adjust the suction casing (106) (marks) and force it onto the stage casing (110).
   – Secure the casing bolts (563). Slightly fasten them with hexagon nuts (920.1).

6. Assembly of mechanical seal (drive side)

   – Moisten the auxiliary seal of the rotating unit (047) with lubricant (grease containing PTFE).
   – Push the rotating unit (047) onto the pump shaft (211) by a screwing movement in the sense of winding of the spring.
   – Moisten the auxiliary seal of the stationary unit with lubricant (alcohol, water).
   – Manually press the stationary unit (047) into the shaft sealing casing (411).
   – Adjust the shaft sealing casing (441) (observe the flushing channel), force it into the suction casing (106) and fasten it with hexagon head screws (901.1).
   – Push the splash ring (507) onto the pump shaft.

7. Assembly of bearing housing on suction casing (drive side)

   – Force the bearing cover (360.2) into the bearing housing (330) and adjust it, fasten with hexagon head screws (901.1).
   – Push the bearing housing (330) over the pump shaft (211), force it into the suction casing (106) and fasten with hexagon head screws (901.1).
   – Press the ball bearing (320) onto the pump shaft. With VU 300/450, the ball bearings have to be lubricated prior to pressing them onto the shaft.
   – Force the bearing cover (360) into the bearing housing (330), adjust it and fasten with hexagon head screws (901.2).
   – Insert the fitting key (940) into the pump shaft.

8. Assembly of mechanical seal (non-drive side)

   – Rotate the pump 180° (drive side pointing down).
   – Moisten the auxiliary seal of the rotating unit (047.1) with lubricant (grease containing PTFE).
   – Push the rotating unit (047.1) onto the pump shaft (211) by a screwing movement in the sense of winding of the spring.
   – Moisten the auxiliary seal of the stationary unit with lubricant (alcohol, water).
   – Manually press the stationary unit (047.1) into the shaft sealing casing (411).
   – Adjust the shaft sealing casing (441) (observe the flushing channel), force it into the discharge casing (107) and fasten it with hexagon head screws (901.1).

9. Assembly of bearing housing on the discharge casing (non-drive side)

   – Force the bearing cover (360.2) into the bearing housing (330) and adjust it, fasten with hexagon head screws (901.1).
   – Force the bearing housing (330) into the discharge casing (107) and fasten with hexagon head screws (901.1).
   – Push the ring (500.1) onto the pump shaft (211).

   VH 300/350/400

   – Press the rolling bearing (320) onto the pump shaft (211).
   – Push the lock washer (931.1) onto the pump shaft (211).
   – Screw the shaft nut (921) onto the pump shaft (211), fasten and secure with lock washer (931.1).

   VU 300/450

   – Lubricate the rolling bearing (320.1) and press-fit into the bearing housing (330).
   – Push the withdrawal sleeve (531), the ring (500) and the lock washer onto the pump shaft (211).
   – Screw on the shaft nut (921), provide for appropriate bearing clearance and secure the shaft nut with a lock washer (931.1).
   – Force the bearing cover (360.1) into the bearing housing (330), adjust it and slightly fasten with hexagon head screws (901.1).

10. Pump adjustment
    - Position the pump horizontally and adjust it on level ground.
    - Tighten the casing bolts (563) and hexagon nuts (920.1) crosswise.
11. Set the impeller position (non-drive side)
    - Loosen the hexagon head screws (901.1) on the bearing cover (360.2).
    - Fasten the hexagon head screws (901.1) on the bearing cover (360.1) until the impeller is in contact with the inter casing (suction casing).
    - Start the gauge at the front (drive side) of the pump shaft.
    - Loosen the hexagon head screws (901.1) on the bearing cover (360.1).
    - Fasten the hexagon head screws (901.1) on the bearing cover (360.2) until the impeller is in contact with the inter casing (discharge casing).
    - Halve the determined measure X and adjust the pump shaft/impeller by half the measure X (towards drive side).
    - Fasten the pump shaft/impeller in this position by evenly tightening the hexagon head screws (901.1) on the bearing covers (360.1/360.2).
    - Verify unobstructed movement of the pump. Manually rotate the pump shaft.
12. Pipe assembly

    Not applicable to VU 300
    - Put the seals (400) and pipes (700) onto the suction/discharge flange. Fasten them with hexagon head screws (901) and hexagon nuts (920).

7.5.12 Assembly of VU/VH 500/600/800/1200/1600

ⓘ Cross-sectional drawing VU 500/600/800/1200/1600
→ Cross-sectional drawing, page 56

ⓘ Cross-sectional drawing VH 500/600/800/1200/1600
→ Cross-sectional drawing, page 58

1. Assembly of valve flaps

   Not applicable to VH 500/600/800/1200/1600 and VU 500

   VU 600/1200/1600 inter casings (137/137.3)

   VU 800 inter casing (137.3)
   - Put the stop plate (598/598.1) and the flap valve (746) onto the inter casings (137/137.1).
   - Screw the hexagon head screws (901.5) with screw locking (Loctite®) into the inter casings.
2. Assembly of inter casings to suction/discharge casing
   - Adjust the inter casing (137) (marks) and force it into the suction casing (106).
   - Adjust the inter casing (137.3) (marks) and force it into the discharge casing (107).
   - Screw hexagon socket head screws (914) through the suction/discharge casing into the inter casings and fasten them.

   Additional steps for VH 800/1200/1600
   - Adjust the inter casings (137.1/137.2) (mark), deflect and compress them.

   Additional steps for VH 500/600
   - Insert the packing gland (461) into the inter casing (137.2).
   - Adjust the inter casings (137.1/137.2) (mark), deflect and compress them.
3. Assembly of impeller and pump shaft
   - Insert fitting keys (940/940.1) into the pump shaft (211) (non-drive side).
   - Insert an O-ring (412) into the groove of the shaft protection sleeve (524).
   - Push the shaft protection sleeve (524) and the lock washer (931) onto the pump shaft.
   - Screw the impeller nut (922) onto the pump shaft.
   - Vertically clamp the pump shaft with the drive side pointing up.

   VU 500/600/800/1200/1600
   - Push the impeller (230) onto the pump shaft.

   ⓘ The impeller blades must be tilted in the direction of rotation.

   VH 500/600/800/1200/1600
   - Push the impeller (230.1) onto the pump shaft.

   ⓘ The impeller blades must be tilted in the direction of rotation.
   - Insert O-rings (412) into the grooves of the shaft protection sleeve (524.1).
   - Push the shaft protection sleeve (524.1) onto the pump shaft.
   - Push the inter casings (137.1/137.2) jointly over the shaft protection sleeve (523) .
   - Insert the fitting key (940) into the pump shaft.
   - Push the impeller (230) onto the pump shaft.

   ⓘ The impeller blades must be tilted in the direction of rotation.
   - Insert the fitting key (940.1) into the pump shaft.
   - Insert an O-ring (412) into the groove of the shaft protection sleeve (524).
   - Push the shaft protection sleeve and the lock washer (931) onto the pump shaft.
   - Screw the impeller nut (922) onto the pump shaft.
   - Set the impellers in accordance with adjustment dimension L by turning the impeller nuts.
   - Following the setting process, fasten the impeller nuts and secure them with the lock washers.
4. Assembly of stage casing and pump shaft
   - Horizontally clamp the discharge casing (107) (inter casing on top).

   VU 500/600/800/1200/1600
   - Insert the complete pump shaft (drive side pointing up) into the discharge casing (107), put down on inter casing (137.3).
   - Force the stage casing (110) into the inter casing (137.3).

   VH 500/600/800/1200/1600
   - Force the stage casing (110.1) into the inter casing (137.3).
   - Insert the complete pump shaft (drive side pointing up) into the discharge casing (107).
   - Adjust the inter casings (137.2/137.1) (marks), force them onto the stage casing (110.1) and put them down.
   - Force the stage casing (110) into the inter casing (137.1).
5. Assembly of suction casing
   - Adjust the suction casing (106) (marks) and force it onto the stage casing (110).
   - Secure the casing bolts (563). Fasten them with hexagon nuts slightly (920.1).

6. Assembly of mechanical seal (drive side)
   - Push the spacer sleeve (525) onto the shaft protection sleeve (524).
   - Moisten the auxiliary seal of the rotating unit (047) with lubricant (grease containing PTFE).
   - Push the rotating unit (047) onto the shaft protection sleeve (524) by a screwing movement in the sense of winding of the spring.
   - Moisten the auxiliary seal of the stationary unit with lubricant (alcohol, water).
   - Push the stationary unit (047) into the shaft sealing casing (411).
   - Adjust the shaft sealing casing (441) (observe the flushing channel), force it into the suction casing (106) and fasten it with hexagon head screws (901.1).

   VH 500/600
   - Push the splash ring (507) onto the pump shaft.
7. Assembly of bearing housing on suction casing (drive side)
   - Force the bearing cover (360.2) into the bearing housing (330), adjust and fasten it to the bearing housing by means of hexagon head screws (901.1).
   - Push the bearing housing over the pump shaft (211), force it into the suction casing (106) and fasten with hexagon head screws (901.4).
   - Lubricate the rolling bearing (320) and press it onto the pump shaft.
   - Force the bearing cover (360) into the bearing housing, adjust it and fasten with hexagon head screws (901.1).
   - Insert the fitting key (940) into the pump shaft.
8. Assembly of mechanical seal (non-drive side)
   - Rotate the pump 180° (drive side pointing down).
   - Push the spacer sleeve (525) onto the shaft protection sleeve (524).
   - Moisten the auxiliary seal of the rotating unit (047.1) with lubricant (grease containing PTFE).
   - Push the rotating unit (047.1) onto the shaft protection sleeve (524) by a screwing movement in the sense of winding of the spring.
   - Moisten the auxiliary seal of the stationary unit with lubricant (alcohol, water).
   - Push the stationary unit (047.1) into the shaft sealing casing (411).
   - Adjust the shaft sealing casing (observe the flushing channel), force it into the discharge casing (107) and fasten with hexagon head screws (901.1).

   VH 500/600
   - Push the splash ring (507) onto the pump shaft.
9. Assembly of bearing housing on discharge casing (non-drive side)
   - Force the bearing cover (360.2) into the bearing housing (330), adjust it and fasten with hexagon head screws (901.1).
   - Force the bearing housing into the discharge casing (107) and fasten with hexagon head screws (901.4).
   - Push the ring (500) onto the pump shaft.
   - Lubricate the rolling bearing (320.1) and press-fit into the bearing housing.
   - Push the withdrawal sleeve (531), the ring (500.1) and the lock washer (931.1) onto the pump shaft.
   - Screw on the shaft nut (921.1), provide for an appropriate bearing clearance and secure the shaft nut with a lock washer (931.1).
   - Force the bearing cover (360.2) into the bearing housing, adjust it and slightly fasten with hexagon head screws (901.3).
10. Pump adjustment
    - Position the pump horizontally and adjust it on level ground.
    - Tighten the casing bolts (563) and hexagon nuts (920.1) crosswise.
11. Set the impeller position (non-drive side)
    - Loosen the hexagon head screws (901.3) on the bearing cover (360.3).
    - Fasten the hexagon head screws (901.3) on the bearing cover (360.2) until the impeller is in contact with the inter casing (suction casing).
    - Start the gauge at the front (drive side) of the pump shaft.
    - Loosen the hexagon head screws (901.3) on the bearing cover (360.2).
    - Fasten the hexagon head screws (901.3) on the bearing cover (360.1) until the impeller is in contact with the inter casing (discharge casing).
    - Halve the determined measure X and adjust the pump shaft/impeller by half the measure X (towards drive side).
    - Fasten the pump shaft/impeller in this position by evenly tightening the hexagon head screws (901.3) on the bearing covers (360.1/360.2).
    - Verify unobstructed movement of the pump. Manually rotate the pump shaft.
12. Pipe assembly

    Not applicable to VU 800
    - Put the seals (400) and pipes (700) onto the suction/discharge flange. Fasten with hexagon head screws (901) and hexagon nuts (920).

8 Troubleshooting

⚠ DANGER

Risk of injuries caused by running aggregate!

► Do not touch the running aggregate.

► Do not carry out any works on the running aggregate.

► Prior to carrying out any assembly or maintenance works, de-energize the motor and protect it against restart.

⚠ DANGER

Risk of death from electric shock!

► Works on the electrical equipment must only be carried out by a qualified electrician.

⚠ WARNING

Risk of injuries caused by vacuum and harmful media to be pumped and operating liquid!

► Use protective equipment when carrying out any works on the pump/aggregate.

► Ensure that the pump/aggregate is depressurized.

► Drain the pump. Reliably collect operating liquid and media to be pumped and dispose of in an environmentally-compatible way.

If the machine operator is not able to rectify occurring defects himself, he has to call the person responsible for machine maintenance.

If the maintenance staff is not able to rectify the defect, the manufacturer has to be informed accordingly. The manufacturer will provide troubleshooting support if he gets a detailed description of the defect.

Technical support address

Speck Pumpen Vakuumtechnik GmbH

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PO Box 1453, 91142 Roth / Germany

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Fax: +49 (0) 9171 809 10
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Internet: www.speck-pumps.de

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Defect	Cause	Rectification
Motor does not start	**Motor**	
	One phase of the power supply is interrupted	► Check the power supply, check the motor
	Two phases of the power supply are interrupted	► Check the power supply
	The motor protection switch has tripped	► Switch on the motor protection switch
	The motor is blocked	► Check the motor
	Pump is blocked	
	Impeller/inter casing is subject to corrosion	► Use rost remover to overcome the blockage of the pump
	Ice inside the pump (solidified operating liquid)	► Carefully heat up and defrost the pump
	Contaminations or foreign bodies inside the pump	► Flush/disassemble the pump, clean it
	Pump calcification	► Descale the pump
	Blocked/defective impeller	► Provide for a correct gap size of the inter casing/impeller or replace
	Defective motor bearing	► Replace the motor bearing

Defect	Cause	Rectification
Motor protection triggered	Short-circuit in the motor winding	► Check the motor winding
	Motor protection switch has not been correctly set/is defective	► Check setting/replace the motor protection switch
	Motor overload	► Check/reduce the operating liquid flow rate
	Excessive backpressure in the outlet nozzle	► Reduce backpressure
	Excessive share of liquid in the suction flow	► Reduce the share of liquid
	Blocked suction-side fitting	► Open the suction-side fitting.
	Motor or vacuum pump blocked	► Motor does not start
Excessive power consumption of the motor	Motor overload	► Check/reduce the operating liquid flow rate
	Excessive backpressure in the outlet nozzle	► Reduce backpressure
	Excessive share of liquid in the suction flow	► Reduce the share of liquid
	Blocked suction-side fitting	► Open the suction-side fitting
	Density/viscosity of the operating liquid is too high	► Use an operating liquid complying with the density recommended in the data sheet. Contact the manufacturer
	Impeller rubs against the inter casing	► Disassemble the pump, properly set the inter casing/impeller gap size
	Pump contamination/calcification	► Flush/descale/disassemble the pump, clean it
Vacuum pump does not produce vacuum	Lacking operating liquid	► Check the operating liquid supply
	Leak in the suction pipe	► Check/seal the suction pipe and connections
	Wrong direction of rotation of the motor	► Check direction of rotation/swap the 2 phases if need be
Insufficient vacuum	Leak in the system	► Check the system, seal leaking spots
	Excessive operating liquid flow rate	► Reduce operating liquid flow rate
	Insufficient operating liquid flow rate	► Increase operating liquid flow rate
	Operating liquid too hot	► Cool down the operating liquid
	Leak in the suction pipe	► Check/seal the suction pipe and connections
	Wrong direction of rotation of the motor	► Check direction of rotation/swap the 2 phases if need be
	Motor speed is too low	► Increase speed, contact the manufacturer
	Gas or liquid channels subject to calcification	► Descale/disassemble the pump, clean
	Internal components are subject to wear	► Replace the affected components
	Worn-out control valve	► Replace the control valve
	Worn-out shaft sealing	► Replace the shaft sealing
	Amount of drained liquid too small	► Provide for free drainage of the liquid and ensure that the connections are not obstructed
	Pump has not been correctly dimensioned	► Replace the pump
Strange noise	Pump cavitation	► Install an anti-cavitation valve or ► Equip the suction pipe with a ventilation valve
	Excessive share of steam in the suction flow	► Reduce the share of steam or provide for condensation upstream the vacuum pump
	Suction-side fitting is closed (excessive inlet pressure)	► Open the suction-side fitting or provide for cavitation protection
	Excessive operating liquid flow rate	► Reduce operating liquid flow rate
	Excessive speed	► Reduce speed, contact the manufacturer

Defect	Cause	Rectification
Leak in the vacuum pump	Defective shaft sealing	► Replace the shaft sealing
	Defective casing sealing	► Provide the vacuum pump with new sealing
	Worn-out casing components	► Replace the affected components
	Loosened connecting screws/screw plugs	► Tighten the screws, replace the sealing
Vacuum pump does not run smooth	Excessive operating liquid flow rate	► Reduce operating liquid flow rate
	Overload in the pipe system	► Check the pipe connections/pump fixation/bearing clearance of the pipe clamps
	Air pocket in the pipe	► Change the pipe system layout
	Vacuum pump distorted/improperly adjusted	► Check adjustment/re-adjust
	Resonance vibrations in the pipe system	► Check the pipe connections and, if required, use a compensator
	Imbalanced impeller	► Balance/replace impeller
	Deposits on the impeller	► Clean/replace impeller
	Defective vacuum pumps or motor bearing	► Replace vacuum pumps or motor bearing

Tab. 10 Troubleshooting

9 Technical data

9.1 Operating limits

- Inlet pressure
- Compression pressure
- Pressure difference
- Medium to be pumped
- Operating liquid
- Speed
- Switching frequency

VU 20/40					
Pressure		[mbar]	Operating liquid		
Min. inlet pressure		150	Temperature		[°C]
Perm. compression pressure		1000		Max.	100
Perm. pressure difference				Min.	- 10
	Max.	1500	Density		[kg/m^3]
	Min.	200		Max.	1200
Medium to be pumped			Viscosity		[mm^2/s]
Temperature		[°C]		Max.	90
	Dry	200	Speed		[min^{-1}]
	Saturated	100		Max.	3500

Tab. 11 Operating limits VU 20/40

VU 80/140/220					
Pressure		[mbar]	Operating liquid		
Min. inlet pressure		150	Temperature		[°C]
Perm. compression pressure		1200		Max.	100
Perm. pressure difference				Min.	- 10
	Max.	1500	Density		[kg/m^3]
	Min.	200		Max.	1200
Medium to be pumped			Viscosity		[mm^2/s]
Temperature		[°C]		Max.	90
	Dry	200	Speed		[min^{-1}]
	Saturated	100		Max.	1750

Tab. 12 Operating limits VU 80/140/220

VU 300/450/500/600					
Pressure		[mbar]	Operating liquid		
Min. inlet pressure		120	Temperature		[°C]
Perm. compression pressure		1500		Max.	80
Perm. pressure difference				Min.	- 10
	Max.	1500	Density		[kg/m^3]
	Min.	200		Max.	1200
Medium to be pumped			Viscosity		[mm^2/s]
Temperature		[°C]		Max.	90
	Dry	200	Speed		[min^{-1}]
	Saturated	100		Max.	1750

Tab. 13 Operating limits VU 300/450/500/600

VU 800/1200/1600					
Pressure		[mbar]	Operating liquid		
Min. inlet pressure		120	Temperature		[°C]
Perm. compression pressure		1500		Max.	80
Perm. pressure difference				Min.	- 10
	Max.	1600	Density		[kg/m^3]
	Min.	200		Max.	1200
Medium to be pumped			Viscosity		[mm^2/s]
Temperature		[°C]		Max.	90
	Dry	200	Speed		[min^{-1}]
	Saturated	100		Max.	1750

Tab. 14 Operating limits VU 800/1200/1600

VH 20/40/60					
Pressure		[mbar]	Operating liquid		
Min. inlet pressure		33	Temperature		[°C]
Perm. compression pressure		2000		Max.	100
Perm. pressure difference				Min.	- 10
	Max.	1400	Density		[kg/m^3]
	Min.	200		Max.	1200
Medium to be pumped			Viscosity		[mm^2/s]
Temperature		[°C]		Max.	90
	Dry	200	Speed		[min^{-1}]
	Saturated	100		Max.	3500

Tab. 15 Operating limits VH 20/40/60

VH 110/140/180					
Pressure		[mbar]	Operating liquid		
Min. inlet pressure		33	Temperature		[°C]
Perm. compression pressure		1500		Max.	100
Perm. pressure difference				Min.	- 10
	Max.	1500	Density		[kg/m^3]
	Min.	200		Max.	1200
Medium to be pumped			Viscosity		[mm^2/s]
Temperature		[°C]		Max.	90
	Dry	200	Speed		[min^{-1}]
	Saturated	100		Max.	1750

Tab. 16 Operating limits VH 110/140/180

VH 300/350/400/500/600					
Pressure		[mbar]	Operating liquid		
Min. inlet pressure		33	Temperature		[°C]
Perm. compression pressure		1500		Max.	80
Perm. pressure difference				Min.	- 10
	Max.	1500	Density		[kg/m^3]
	Min.	200		Max.	1200
Medium to be pumped			Viscosity		[mm^2/s]
Temperature		[°C]		Max.	90
	Dry	200	Speed		[min^{-1}]
	Saturated	100		Max.	1750

Tab. 17 Operating limits VH 300/350/400/500/600

VH 800/1200/1600					
Pressure		[mbar]	Operating liquid		
Min. inlet pressure		33	Temperature		[°C]
Perm. compression pressure		1500		Max.	80
Perm. pressure difference				Min.	- 10
	Max.	1600	Density		[kg/m^3]
	Min.	200		Max.	1200
Medium to be pumped			Viscosity		[mm^2/s]
Temperature		[°C]		Max.	90
	Dry	200	Speed		[min^{-1}]
	Saturated	100		Max.	1200

Tab. 18 Operating limits VH 800/1200/1600

9.1.1 Media to be pumped

- dry and wet gases which are not explosive, inflammable, aggressive or toxic
- air or air-steam mixtures
  - which are free of solids
  - which contain small amounts of light particulate matters

9.1.2 Operating liquid

- water having a pH value of 6 to 9, free of solids
- for other pH values or operating liquids, please consult the manufacturer

9.1.3 Switching frequency

The max.switching frequency of 20 switching cycles per hour should not be exceeded.

9.2 General technical data

The following data refer to standard values. For deviating data, please consult the manufacturer.

9.2.1 Weight

Type	Weight [kg]	Type	Weight [kg]
VU 20	20	VH 20	23
VU 40	21	VH 40	24
VU 80	48	VH 60	31
VU 140	63	VH 110	62
VU 220	82	VH 140	77
VU 300	110	VH 180	86
VU 450	155	VH 300	139
VU 500	190	VH 350	151
VU 600	215	VH 400	163
VU 800	360	VH 500	215
VU 1200	470	VH 600	240
VU 1600	520	VH 800	450
		VH 1200	570
		VH 1600	640

Tab. 19 Weight

9.2.2 Sound level

Type	1m measured surface sound pressure level L [dB (A)] *	
	50 Hz	60 Hz
VU 20/40	66	67
VU 80/140/220	65	66
VU 300/450	66	68
VU 500/600	76	79
VU 800/1200/1600	79	80
VH 20/40/60	66	67
VH 110/140/180	65	66
VH 300/350/400	66	66
VH 500/600	76	79
VH 800/1200/1600	79	80
* Measured surface sound pressure level in acc. with DIN EN ISO 3744, at 1 m distance with average throttling (80 mbar abs.) and connected pipes, tolerance ± 3 dB (A)		

Tab. 20 Sound pressure level

9.2.3 Drive power

Type	Rated motor power [kW]		Rated motor speed [min^{-1}]		Direction of rotation as seen from the drive
	50 Hz	60 Hz	50 Hz	60 Hz	
VU 20	1.1	1.5	2850	3450	clockwise
VU 40	1.5	2.2	2850	3450	clockwise
VU 80	3.0	4.0	1450	1750	clockwise
VU 140	4.0	5.5	1450	1750	clockwise
VU 220	5.5	7.5	1450	1750	clockwise
VU 300	7.5	11.0	1450	1750	clockwise
VU 450	11.0	15.0	1450	1750	clockwise
VU 500	15.0	18.5	1450	1750	clockwise
VU 600	18.5	22.0	1450	1750	clockwise
VU 800	22.0	30.0	975	1175	clockwise
VU 1200	30.0	45.0	975	1175	clockwise
VU 1600	45.0	55.0	975	1175	clockwise

Type	Rated motor power [kW]		Rated motor speed [min^{-1}]		Direction of rotation as seen from the drive
	50 Hz	60 Hz	50 Hz	60 Hz	
VH 20	1.1	1.5	2850	3450	clockwise
VH 40	1.5	2.2	2850	3450	clockwise
VH 60	2.2	3.0	2850	3450	clockwise
VH 110	3.0	4.0	1450	1750	clockwise
VH 140	4.0	5.5	1450	1750	clockwise
VH 180	5.5	7.5	1450	1750	clockwise
VH 300	7.5	11.0	1450	1750	clockwise
VH 350	11.0	15.0	1450	1750	clockwise
VH 400	15.0	22.0	1450	1750	clockwise
VH 500	15.0	22.0	1450	1750	clockwise
VH 600	18.5	30.0	1450	1750	clockwise
VH 800	30.0	37.0	975	1175	clockwise
VH 1200	37.0	45.0	975	1175	clockwise
VH 1600	45.0	75.0	975	1175	clockwise

Tab. 21 Drive power

9.2.4 Operating liquid

Water

- having a pH value of 6 to 9, free of solids (e.g. sand)
- for deviating pH values or operating liquids, please consult the manufacturer

9.2.4.1 Flow rate

9.2.4.2 Delivery of liquids

– maximum permissible delivery of water via the inlet nozzle

9.2.4.3 Filling volume

Type	Flow rate [l/min] 80 mbar/ 15 °C	Max. liquid delivery [m^3/h]	Filling volume up to middle of the shaft [l]
VU 20	4.8	0.29	0.9
VU 40	5.6	0.33	1.0
VU 80	12.8	0.7	3.5
VU 140	12.8	0.7	4.5
VU 220	28.6	1.7	5.5
VU 300	27.5	1.6	8
VU 450	45.8	2.7	12
VU 500	54	3.2	12
VU 600	58	3.5	14
VU 800	62	3.7	32
VU 1200	100	6.0	35
VU 1600	107	6.4	38

Type	Flow rate [l/min] 80 mbar/ 15 °C	Max. liquid delivery [m^3/h]	Filling volume up to middle of the shaft [l]
VH 20	5.8	0.35	1.0
VH 40	5.8	0.35	1.2
VH 60	7.1	0.43	1.4
VH 110	15.0	0.9	4.0
VH 140	15.0	0.9	5.5
VH 180	16.7	1.0	7
VH 300	45.8	3.0	9
VH 350	50	3.0	10
VH 400	50	3.0	12
VH 500	45	2.7	16
VH 600	45	2.7	19
VH 800	117	7	36
VH 1200	117	7	47
VH 1600	117	7	54

Tab. 22 Filling volumes

9.2.5 Medium to be pumped

- Gases and vapours, dry or wet which are not explosive, inflammable, aggressive or toxic
- air or air-steam mixtures
  - which are free of solids
  - which contain small amounts of light particulate matters

For explosive, inflammable, aggressive or toxic gases and vapours, please consult the manufacturer.

9.2.6 Operating connections

Type	Process water connection		Suction connection		Pressure connection	
	Size	Shape	Size	Shape	Size	Shape
VU 20/40 VH 20/40/60	G 3/8“	Thread	G 1 1/4“	Thread	G 1 1/4“	Thread
VU 80/140 VH 110/140/180	G ½“	Thread	DN 40	Flange	DN 40	Flange
VU 220	G ½“	Thread	DN 50	Flange	DN 50	Flange
VU 300 VH 300/350/400	G 1“	Thread	DN 50	Flange	DN 50	Flange
VU 450 VH 500/600	G 1“	Thread	DN 65	Flange	DN 65	Flange
VU 500/600	G 1“	Thread	DN 100	Flange	DN 100	Flange
VU 800/1200/ 1600 VH 800/1200/ 1600	G 2“	Thread	DN 100	Flange	DN 100	Flange

Tab. 23 Operating connections

9.2.7 Mechanical seal

All pumps offer mechanical seals with integrated flush.
Typical features are

- single seal
- not pressure-relieved
- conical spring
- dependent on the direction of rotation

Special versions

- double-acting mechanical seals
- cartridge units
- packing glands

9.2.8 Ambient conditions

ⓘ Operation under other ambient conditions has to be agreed with the manufacturer.

Temperature [°C]	Relative humidity [%]		Set-up altitude above sea level [m]
	long-term	short-term	
+5 to +40	≤ 85	≤ 100	≤ 1000

Tab. 24 Ambient conditions

9.2.9 Clearances for heat dissipation

Type	Min. clearance fan hood – adjacent surface [mm]
VU 20/40 VH 20/40/80	35
VU 80/140/220/300 450/500/600/800 VH 110/140/180/300 350/400/500/600	55
VU 1200 VH 800/1200	75
VU /VH 1600	100

Tab. 25 Clearances for heat dissipation

9.2.10 Tightening torques

9.2.10.1 For screws and nuts

► Tighten the screws by means of a torque wrench.

ⓘ The following values apply to new screws and nuts.

Size	Property class	Tightening torque [Nm]
M 5	8.8	5.7
M 6	8.8	9.9
M 8	8.8	25
M 10	8.8	51
M 12	8.8	89
M 16	8.8	215
M 20	8.8	420

Tab. 26 Tightening torques for screws and nuts

9.2.10.2 For screws in cast-iron casings

ⓘ The following values apply to new screw plugs (steel, brass) in cast-iron casings (EN-GJL-250, CuZn).

Size	Property class	Tightening torque [Nm]
M 5	8.8	4.0
M 6	8.8	8.5
M 8	8.8	12
M 10	8.8	25
M 12	8.8	40
M 16	8.8	90

Tab. 27 Tightening torques for screws in cast-iron casings

9.2.10.3 For stainless steel screws in stainless steel casings

► Tighten the screws by means of a torque wrench.

ⓘ The following values apply to new stainless steel screws.

Size	Property class	Tightening torque [Nm]
M 5	A2/A4	4.2
M6	A2/A4	7.3
M 8	A2/A4	17.5
M 10	A2/A4	35
M 12	A2/A4	60
M 16	A2/A4	144
M 20	A2/A4	281

Tab. 28 Tightening torques for stainless steel screws in stainless steel casings

9.2.10.4 For screw plugs

► Tighten the screws by means of a torque wrench.

ⓘ The following values apply to new screw plugs (steel, brass) in cast-iron casings (EN-GJL-250, CuZn).

Size	Tightening torque [Nm]
G 1/8 A	9
G 1/4 A	20
G 3/8 A	40
G 1/2A	53
G 3/4 A	93
G 1 A	133

Tab. 29 Tightening torques for screw plugs in cast-iron casings

► Tighten the screws by means of a torque wrench.

ⓘ The following values apply to new stainless steel screw plugs

Size	Tightening torque [Nm]
G 1/8 A	12
G 1/4 A	23
G 3/8 A	46
G 1/2A	60
G 3/4 A	120
G 1 A	200

Tab. 30 Tightening torques for stainless steel screw plugs

9.2.10.5 Tightening torques for cylindrical pipe nipples

ⓘ The following values apply to new pipe nipples in cast-iron casings (EN-GJL-250, CuZn).

Size	Tightening torque [Nm]
G 1/8 A	12
G 1/4 A	23
G 3/8 A	46
G ½ A	60
G ¾ A	120
G 1 A	206
G 1 ½ A	380
G 2	535

Tab. 31 Tightening torques for pipe nipples

9.2.10.6 Impeller nuts

(→ Cross-sectional drawing, Item 922)

Type	Dimension	Tightening torque [Nm]
VU/VH 80 – 220	M 40x1.5	110
VH 300 - 350	M 45x1.5	170
VU 300/450	M 52x1.5	264
VU/VH 500/600	M 54x1.5	290
VU/VH 800 – 1600	M 78x2	600

Tab. 32 Tightening torques for impeller nuts

9.2.10.7 Shaft nuts

(→ Cross-sectional drawing, Item 921)

Type	Dimension	Tightening torque [Nm]
VU/VH 80 – 220	M 30 x 1.5	31
VH 300 - 350	M 40 x 1.5	75
VU 300/450 VU/VH 500/600	M 45 x 1.5	108
VU/VH 800 – 1600	M 60 x 2	260

Tab. 33 Tightening torques for shaft nuts

9.2.10.8 Casing bolts

(→ Cross-sectional drawing, Item 563)

Casing bolt dimension	Tightening torque [Nm]
M 6	8.5
M 8	12
M 10	25
M 12	40
M 16	90
M 20	120
M 24	140

Tab. 34 Tightening torques for casing bolts

9.3 Conical pipe fittings

The above specified tightening torques do not apply to conical screw-in threads. Here, tightness is not achieved by using a specific tightening torque but by additional sealing material (e.g. sealing tape, adhesive).

9.4 Permissible forces/torques acting on the pump nozzles

Nominal width	Pump nozzle	
	M_x, M_y, M_z [Nm]	F_x, F_y, F_z [N]
DN 6	20	65
DN 8	27	88
DN 10	35	110
DN 15	44	140
DN 20	55	177
DN 25	70	222
DN 40	100	320
DN 50	140	430
DN 65	170	510
DN 80	200	600
DN 100	255	770

Tab. 35 Permissible forces/torques acting on the pump nozzles

9.4.1 Adjustment dimensions

9.4.1.1 Impeller gap VU 20–40/ VH 20-60

Type	1st stage	2nd stage
VU 20	0.14 mm +0.02	
VU 40	0.14 mm +0.02	
VH 20	0.14 mm +0.02	0.10 mm +0.01
VH 40	0.14 mm +0.02	0.14 mm +0.02
VH 60	0.14 mm +0.02	0.14 mm +0.02

Tab. 36 Gap sizes of impeller gap VU 20–40/ VH 20-60

9.4.1.2 Impeller gap VU/ VH 80-1600

The total gap size is approx. 0.33 mm per stage.

9.4.1.3 Impeller position VU/VH 80-1600

Type	Adjustment dimension [l]
VH 110 - 180	226.0
VH 300 - 400	326.5
VU 300 - 450	331.5
VH 500 - 600	364.0
VH 800 - 1600	507.0

Tab. 37 Impeller position VU/VH 80-1600

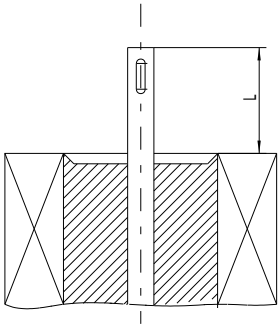

Fig. 21 Impeller position VU/VH 80-1600

9.4.1.4 Shaft bearing clearance

Pump types VU 20 – 220 and VH 20 – VH 400 are equipped with sealed deep groove ball bearings. These bearings are maintenance-free and need not be adjusted.

Pump types VU 300 – 1600 and VH 500 – 1600 are equipped with spherical roller bearings. Versions with cylindrical bores need not be adjusted. Spherical roller bearings are not maintenance-free and must therefore be re-lubricated.

Spherical roller bearings with conical bore and C3 clearance

Type	Axial shift withdrawal sleeve		Smallest permissible clearance
	min.	max.	
VU 300/450/500/600 VH 500/600	0.4	0.45	0.030
VU/VH 800/1200/1600	0.45	0.6	0.040

Tab. 38 Shaft bearing clearance

9.5 Lubricants

Lubrication grease:

High-temperature grease containing a polyurea-based thickener by Fuchs (Renolit PU-FH 300).

Pump type	Amount of lubricant per bearing [g]
VU 300/450 VH 500/600	8
VU 800 – 1600 VU 800 – 1600	15

Tab. 39 Lubricants

9.6 Preserving agents

ⓘ Rivolta preserving agent (recommended) or comparable products

Type of storage	Period of storage [months]	Inside/outside preservation	Repeat inside/outside treatment [months]
in closed, dry and dust-free rooms	1–3	Rivolta K.S.P.130	3
	> 3		(→ 1.2 Applicable documents, page 4).

Tab. 40 Preserving agents

9.6.1 Preservation filling volumes

Type	Filling volume inside system [l]	Filling volume outside system [l]
VU 20	0.8	approx. 1.8
VU 40	0.9	approx. 2
VU 80	3.4	approx. 7
VU 140	4.3	approx. 9
VU 220	5.3	approx. 11.2
VU 300	7.7	approx. 16.5
VU 450	11.7	approx. 25
VU 500	11.7	approx. 25
VU 600	13.5	approx. 29
VU 800	31	approx. 65
VU 1200	34	approx. 72
VU 1600	36.5	approx. 78

Tab. 41 Preservation filling volumes VU

Type	Filling volume inside system [l]	Filling volume outside system [l]
VH 20	0.9	approx. 2.0
VH 40	1.1	approx. 2.4
VH 60	1.2	approx. 2.6
VH 110	3.8	approx. 8
VH 140	5.2	approx. 11
VH 180	6.7	approx. 14
VH 300	8	approx. 17.5
VH 350	9	approx. 18.5
VH 400	11	approx. 24
VH 500	13	approx. 29
VH 600	17	approx. 37
VH 800	30	approx. 65
VH 1200	41	approx. 87
VH 1600	48	approx. 101

Tab. 42 Preservation filling volumes VH

9.7 Test pressure for pressure test

Use water for the pressure test. The maximum permissible pressure is 3 bar.

9.8 Accessories

Accessories included within the scope of supply are listed on the delivery note.

10 Appendix

ⓘ The appendix contains:

- dimensions of the individual aggregates (dimension drawings)
- spare parts designation and position (cross-sectional drawings)
- certificate of conformity
- EC declaration of conformity

10.1 Dimension drawing VU 20/40

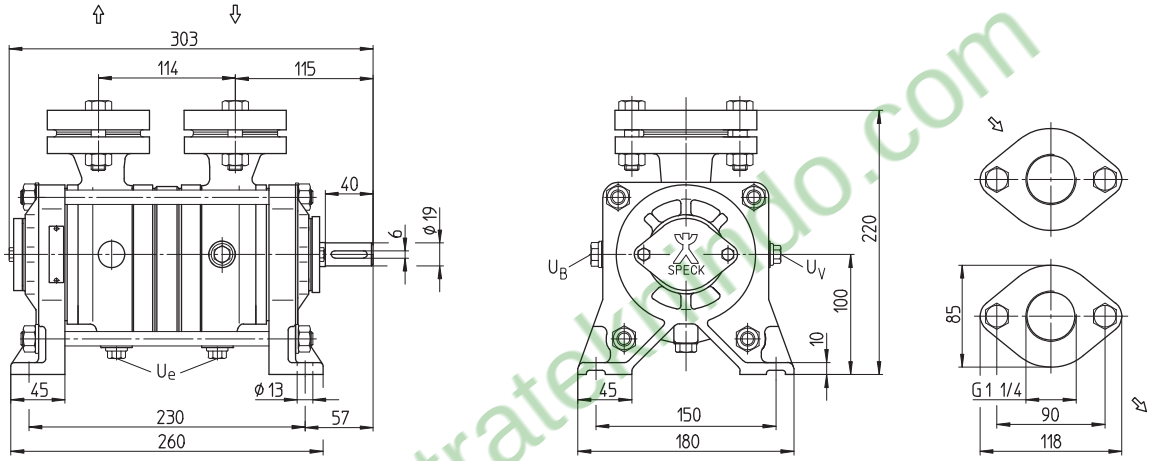

Fig. 22 Dimension drawing VU 20

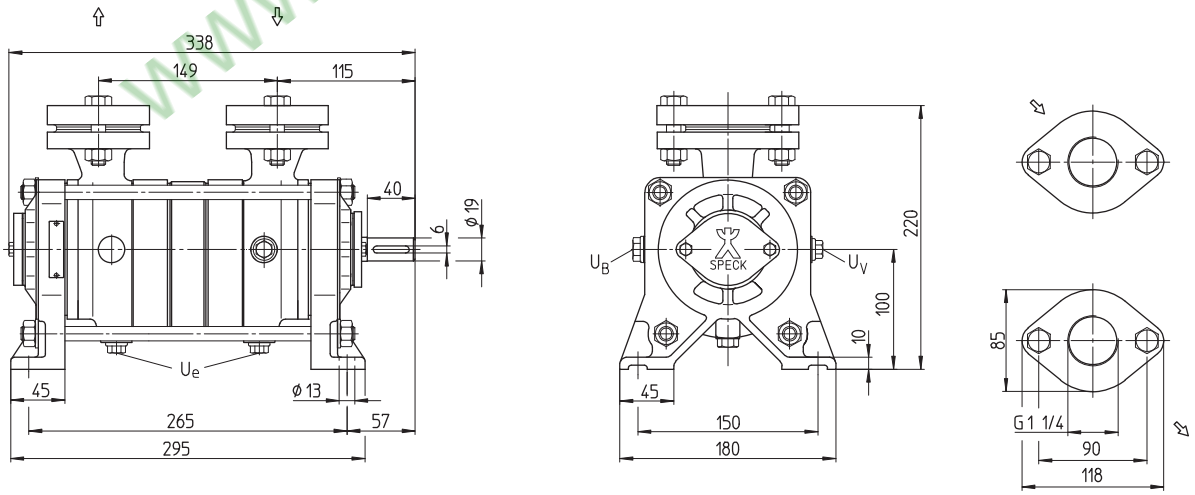

Fig. 23 Dimension drawing VU 40

Designation	Explanation
U_B	Operating liquid connection
U_e	Drainage (screw plug)
U_V	Drainage valve connection

Tab. 43 Connections VU 20/40

10.2 Dimension drawing VU 80/140/220

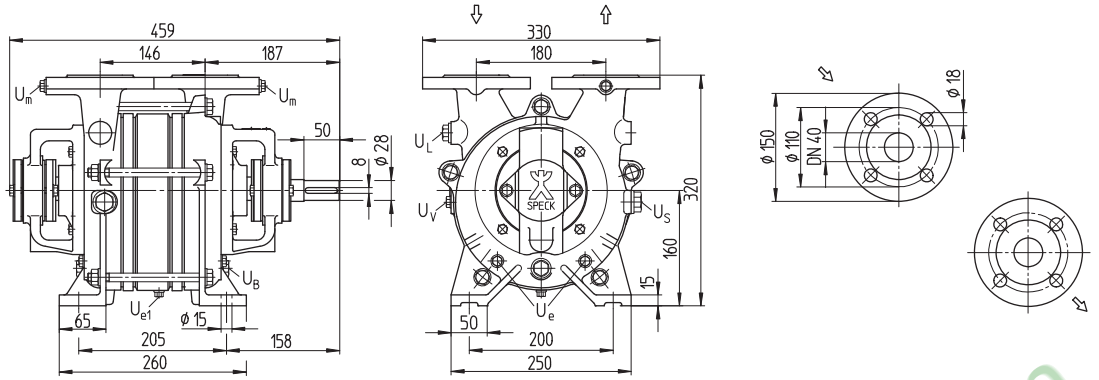

Fig. 24 Dimension drawing VU 80

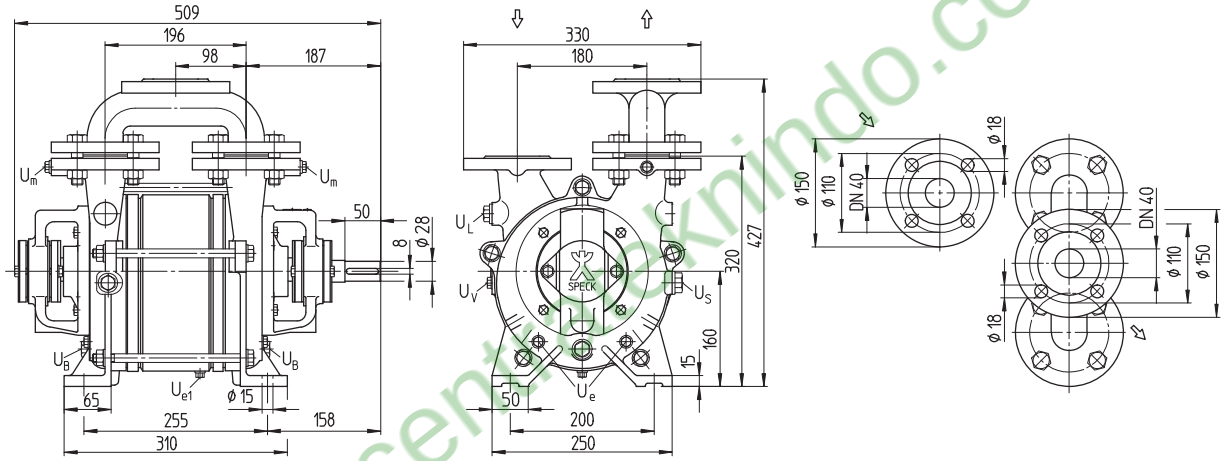

Fig. 25 Dimension drawing VU 140

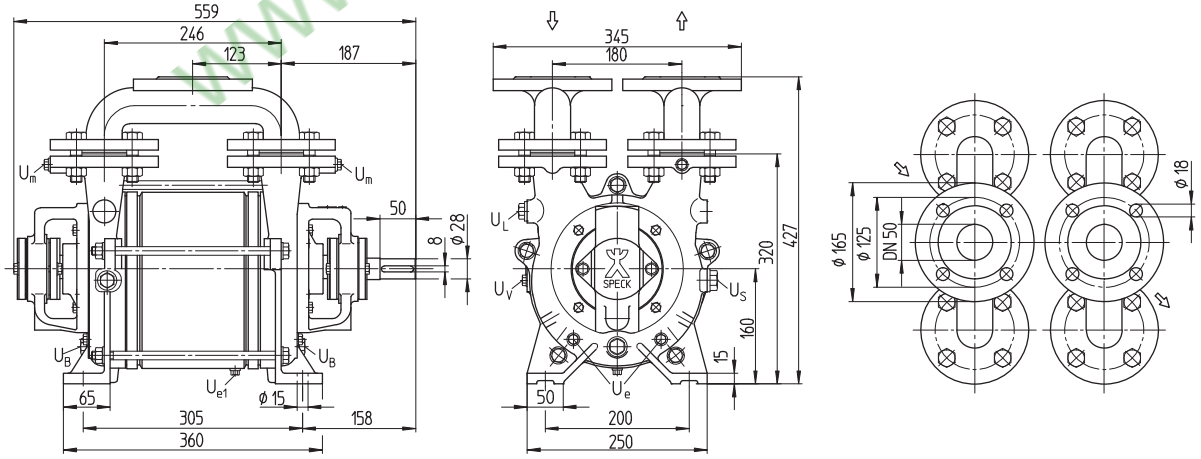

Fig. 26 Dimension drawing VU 220

Designation	Explanation
U_B	Operating liquid connection
U_e /U_{e1}	Drainage (screw plug)
U_L	Ventilation valve connection

U_m	Manometer connection
U_S	Sensor connection
U_V	Drainage valve connection

Tab. 44 Connections VU 20/40

10.3 Dimension drawing VU 300/450

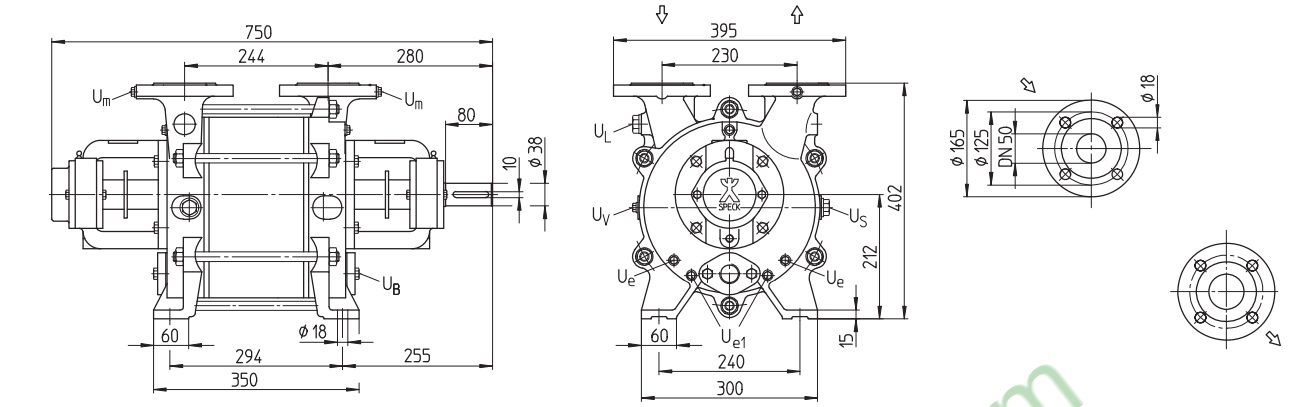

Fig. 27 Dimension drawing VU 300

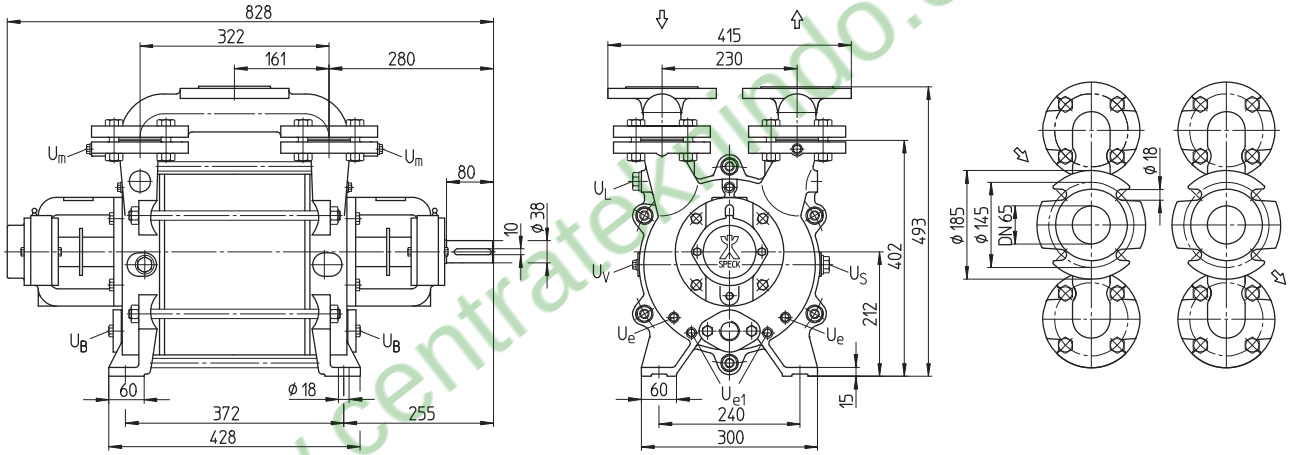

Fig. 28 Dimension drawing VU 450

Designation	Explanation
U_B	Operating liquid connection
U_e /U_{e1}	Drainage (screw plug)
U_L	Ventilation valve connection
U_m	Manometer connection
U_S	Sensor connection
U_V	Drainage valve connection

Tab. 45 Connections VU 300/450

10.4 Dimension drawing VU 500/600

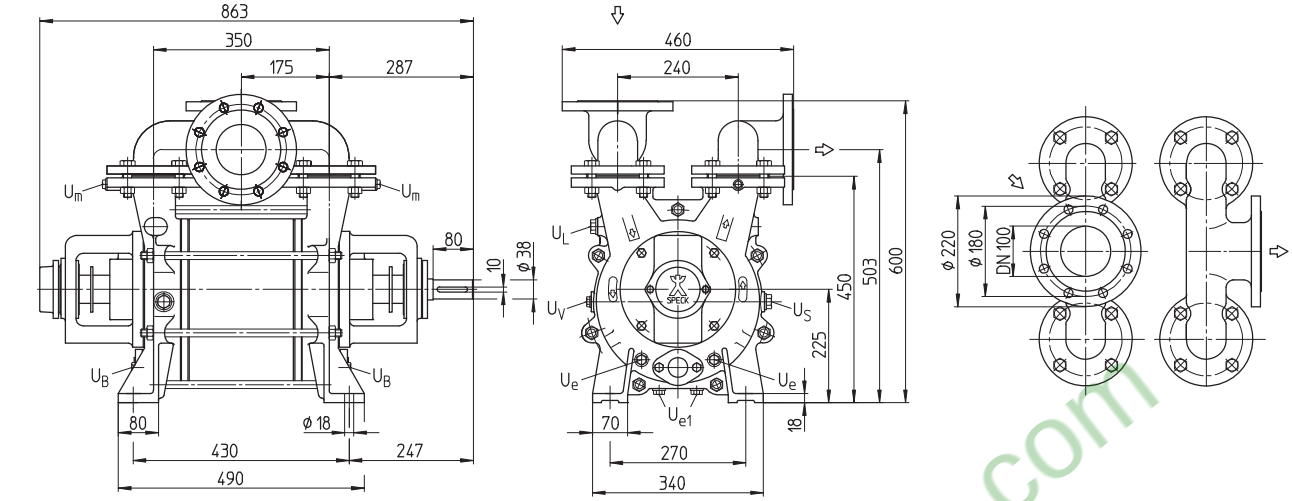

Fig. 29 Dimension drawing VU 500

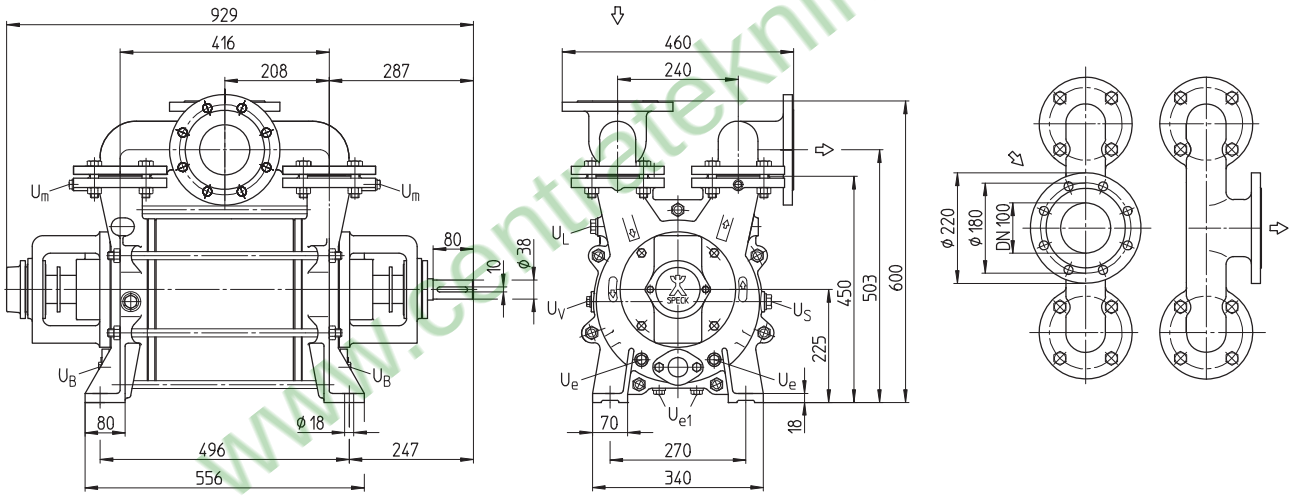

Fig. 30 Dimension drawing VU 600

Designation	Explanation
U_B	Operating liquid connection
U_e /U_{e1}	Drainage (screw plug)
U_L	Ventilation valve connection
U_m	Manometer connection
U_S	Sensor connection
U_V	Drainage valve connection

Tab. 46 Connections VU 500/600

10.5 Dimension drawing VU 800/1200/1600

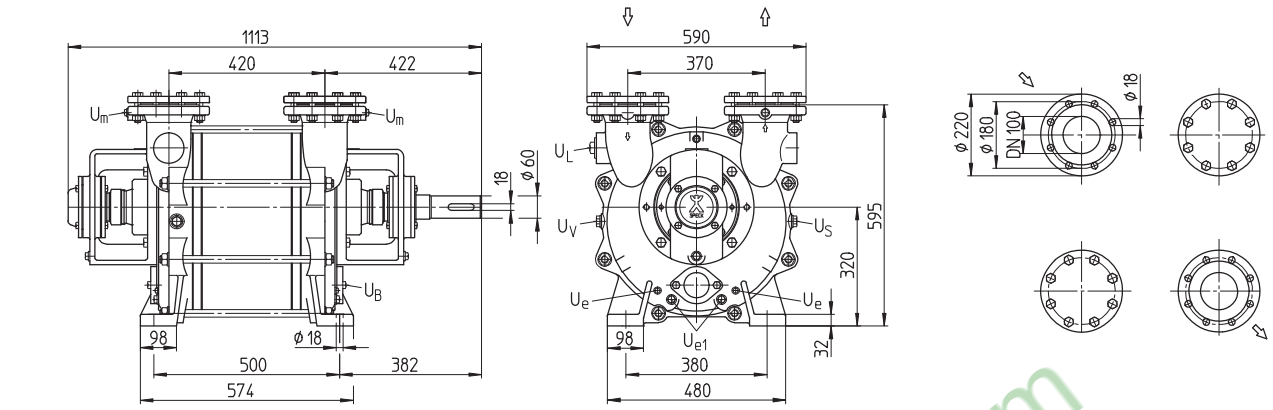

Fig. 31 Dimension drawing VU 800

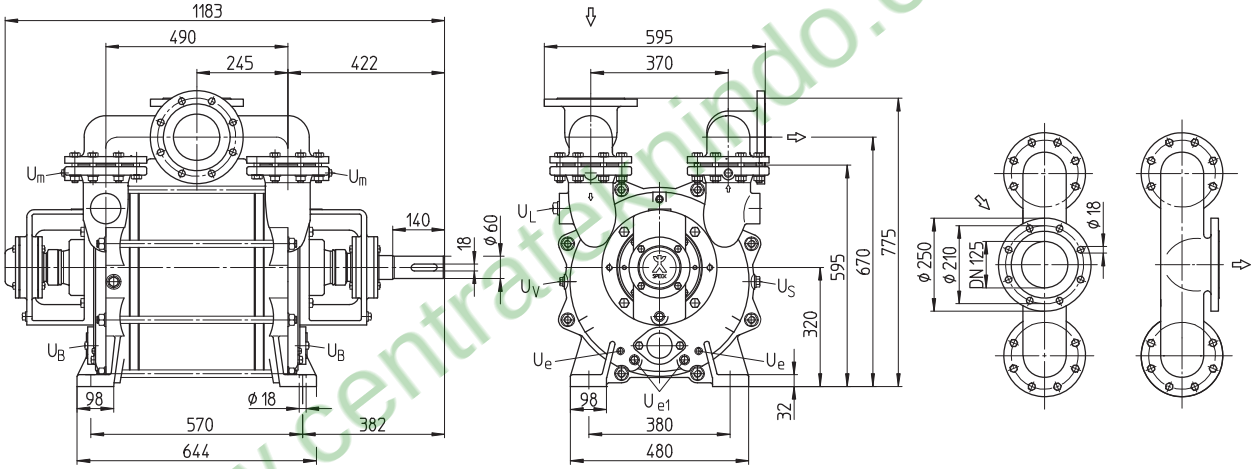

Fig. 32 Dimension drawing VU 1200

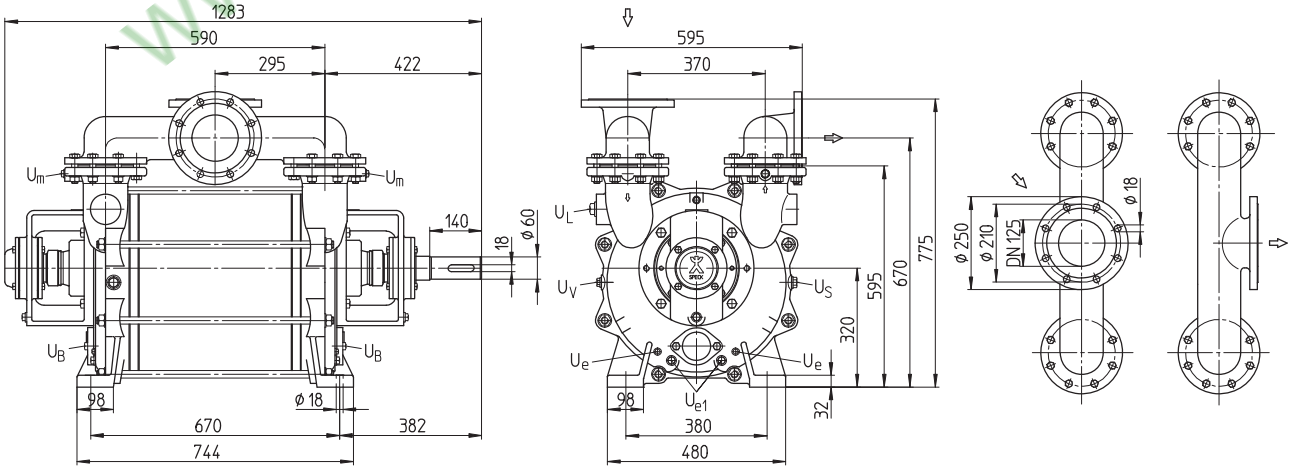

Fig. 33 Dimension drawing VU 1600

Designation	Explanation
U_B	Operating liquid connection
U_e /U_{e1}	Drainage (screw plug)
U_L	Ventilation valve connection

U_m	Manometer connection
U_S	Sensor connection
U_V	Drainage valve connection

Tab. 47 Connections VU 800/1200/1600

10.6 Dimension drawing VH 20/40/60

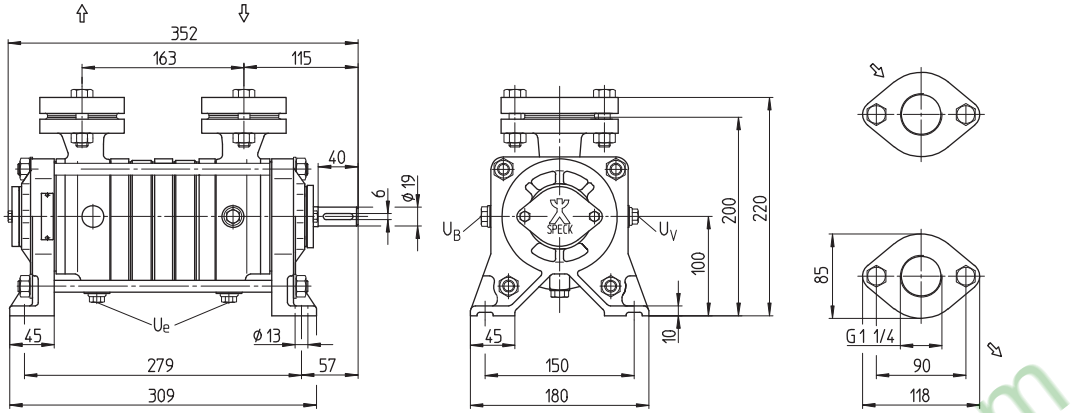

Fig. 34 Dimension drawing VH 20

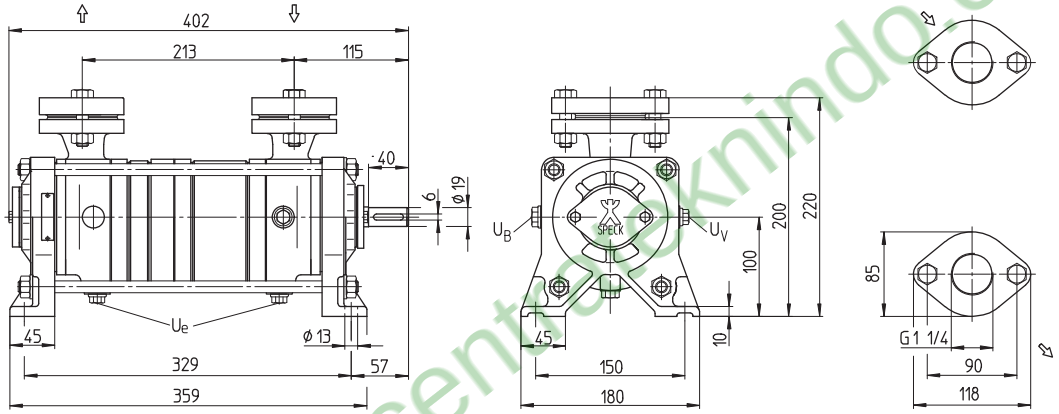

Fig. 35 Dimension drawing VH 40

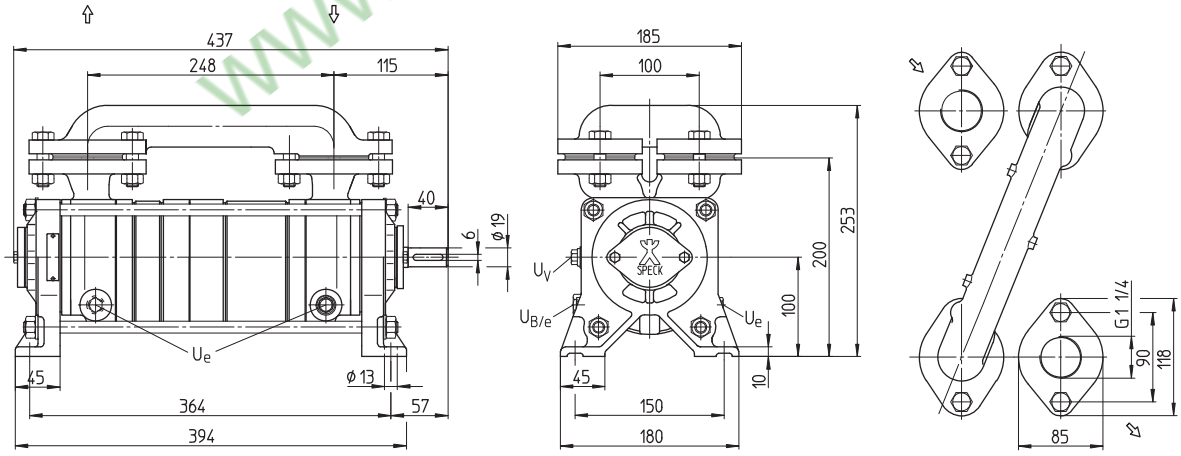

Fig. 36 Dimension drawing VH 60

Designation	Explanation
U_B	Operating liquid connection
U_e /U_{e1}	Drainage (screw plug)
U_L	Ventilation valve connection

U_m	Manometer connection
U_S	Sensor connection
U_V	Drainage valve connection

Tab. 48 Connections VH 20/40/60

10.7 Dimension drawing VH 110/140/180

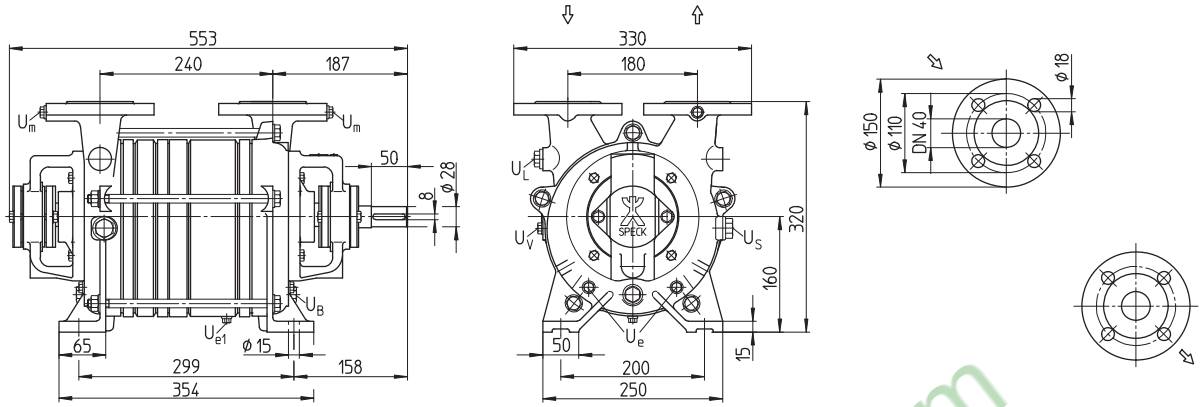

Fig. 37 Dimension drawing VH 110

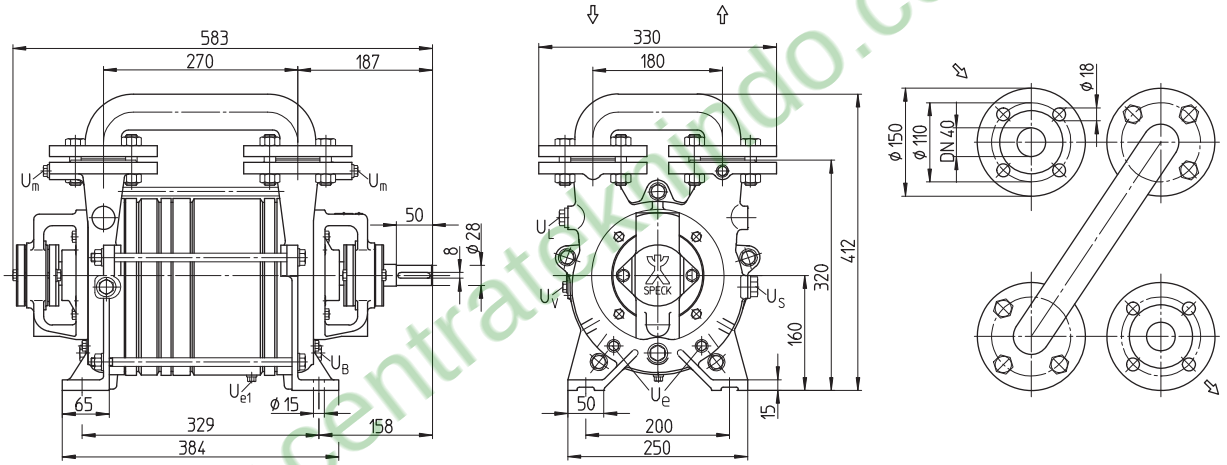

Fig. 38 Dimension drawing VH 140

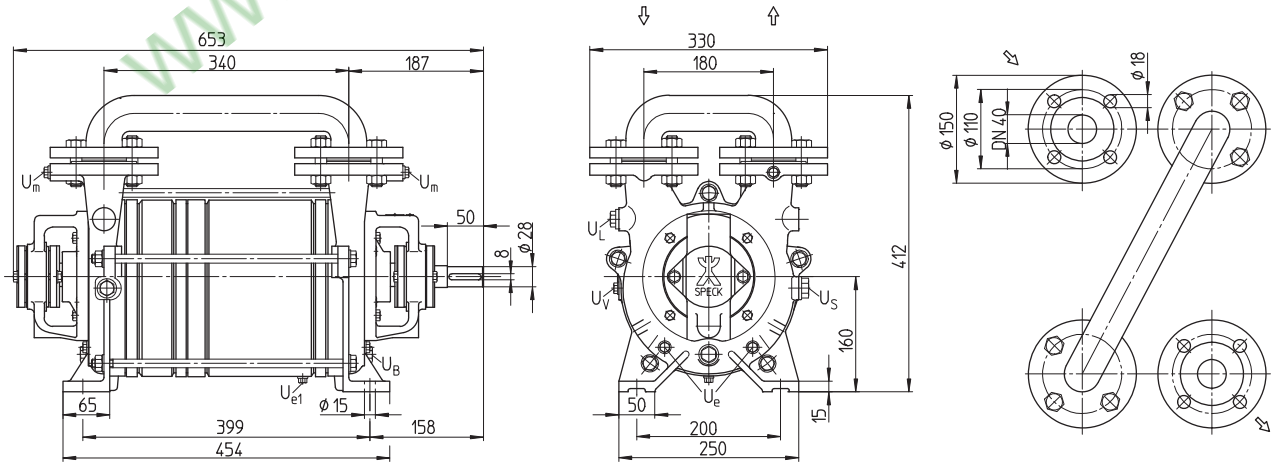

Fig. 39 Dimension drawing VH 180

Designation	Explanation
U_B	Operating liquid connection
U_e /U_{e1}	Drainage (screw plug)
U_L	Ventilation valve connection

U_m	Manometer connection
U_S	Sensor connection
U_V	Drainage valve connection

Tab. 49 Connections VH 110/140/180

10.8 Dimension drawing VH 300/350/400

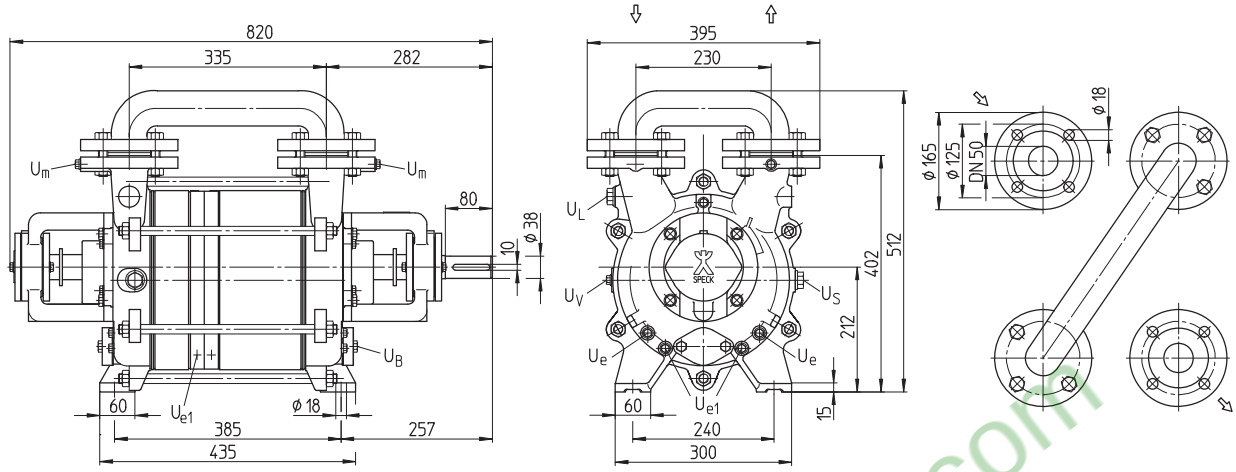

Fig. 40 Dimension drawing VH 300

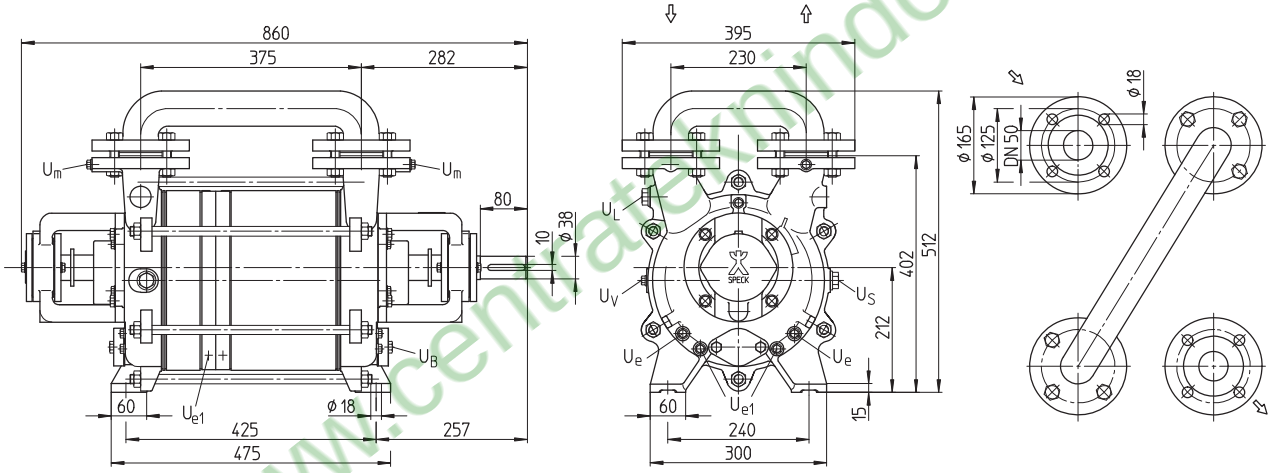

Fig. 41 Dimension drawing VH 350

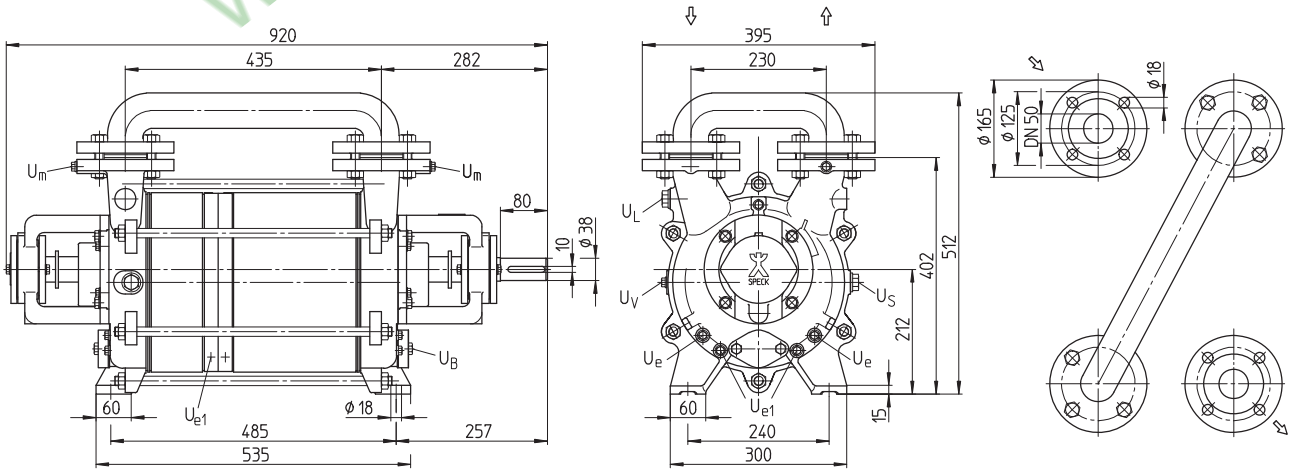

Fig. 42 Dimension drawing VH 400

Designation	Explanation
U_B	Operating liquid connection
U_e /U_{e1}	Drainage (screw plug)
U_L	Ventilation valve connection

U_m	Manometer connection
U_S	Sensor connection
U_V	Drainage valve connection

Tab. 50 Connections VH 300/350/400

10.9 Dimension drawing VH 500/600

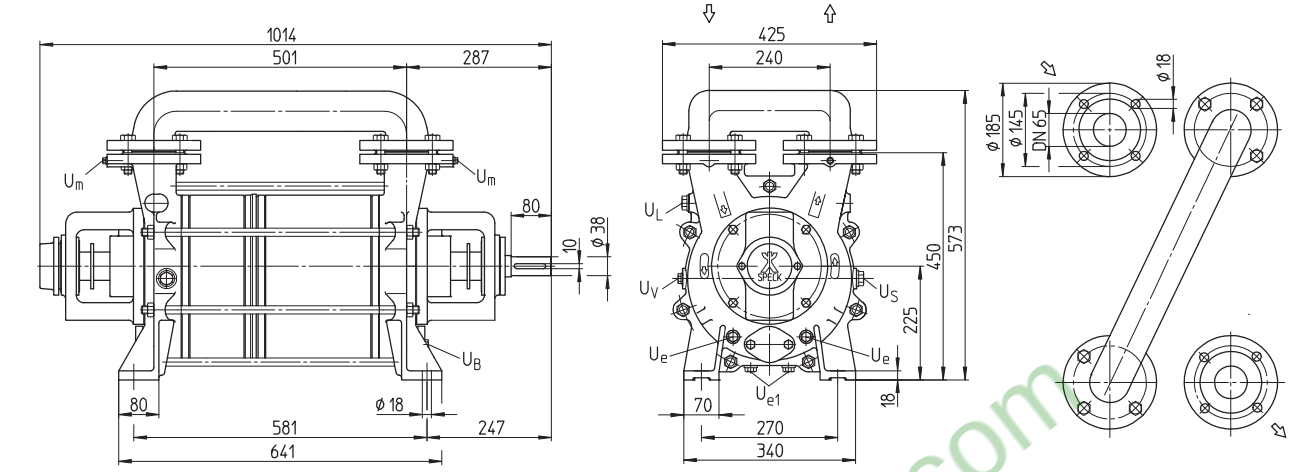

Fig. 43 Dimension drawing VH 500

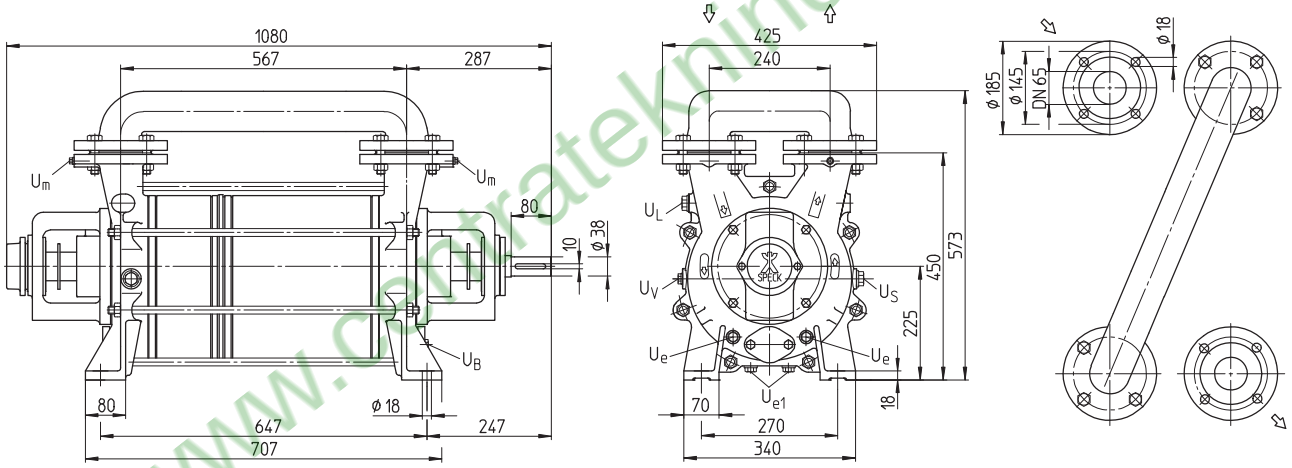

Fig. 44 Dimension drawing VH 600

Designation	Explanation
U_B	Operating liquid connection
U_e / U_{e1}	Drainage (screw plug)
U_L	Ventilation valve connection
U_m	Manometer connection
U_S	Sensor connection
U_V	Drainage valve connection

Tab. 51 Connections VH 500/600

10.10 Dimension drawing VH 800/1200/1600

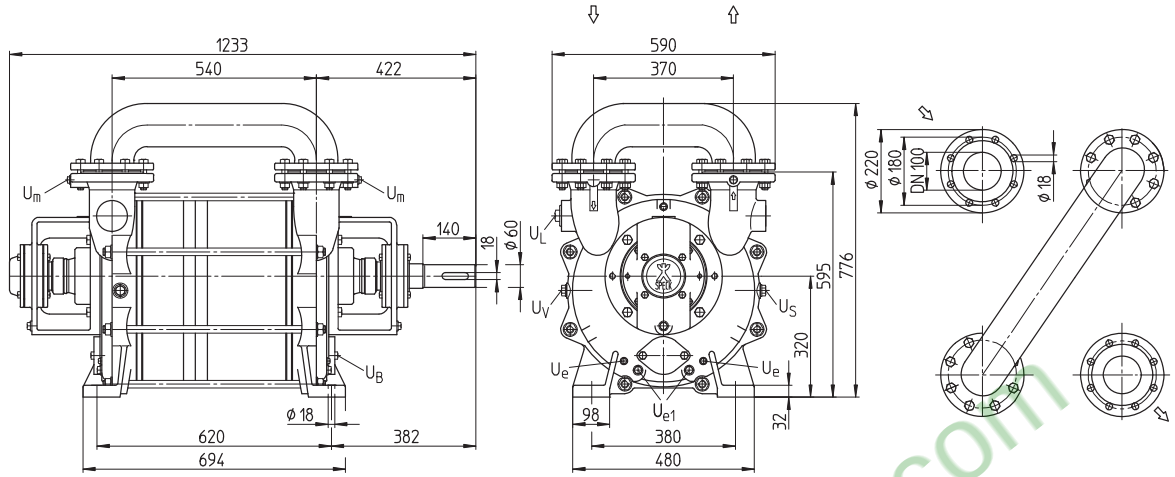

Fig. 45 Dimension drawing VH 800

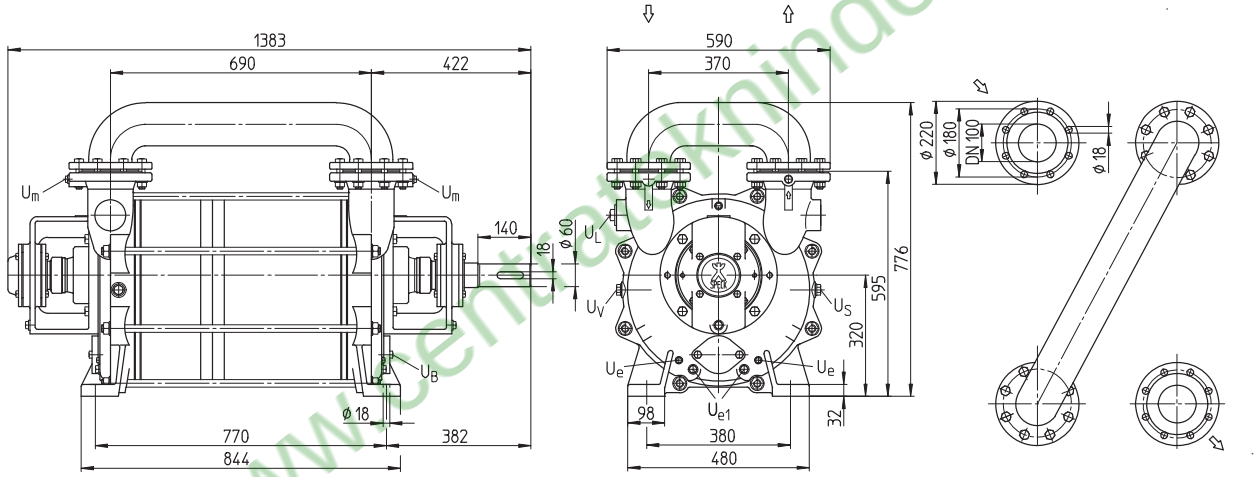

Fig. 46 Dimension drawing VH 1200

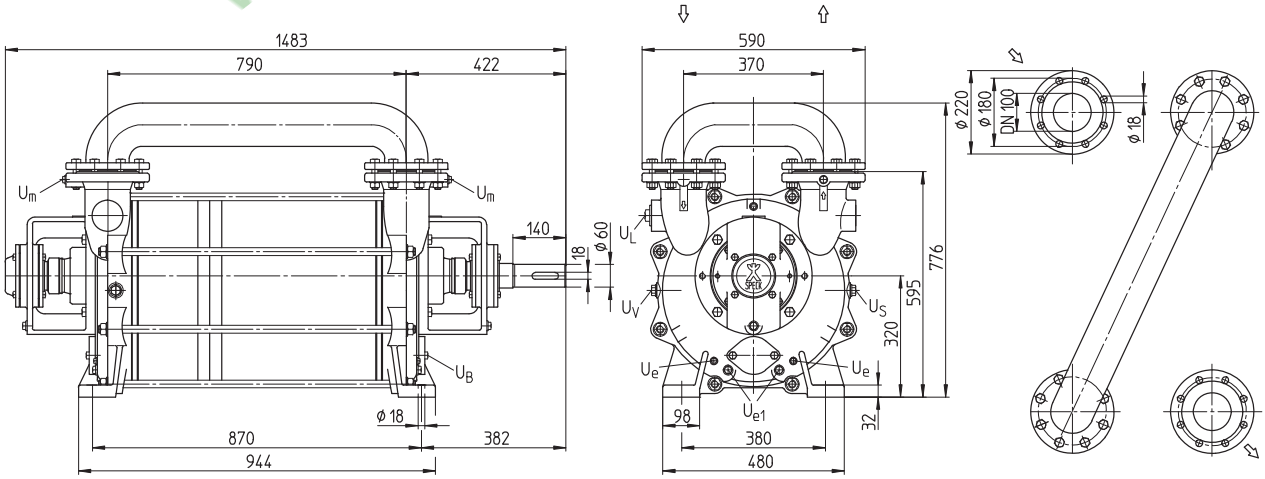

Fig. 47 Dimension drawing VH 1600

Designation	Explanation
U_B	Operating liquid connection
U_e /U_{e1}	Drainage (screw plug)
U_L	Ventilation valve connection

U_m	Manometer connection
U_S	Sensor connection
U_V	Drainage valve connection

Tab. 52 Connections VH 800/1200/1600

10.11 Cross-sectional drawing VU 20-450

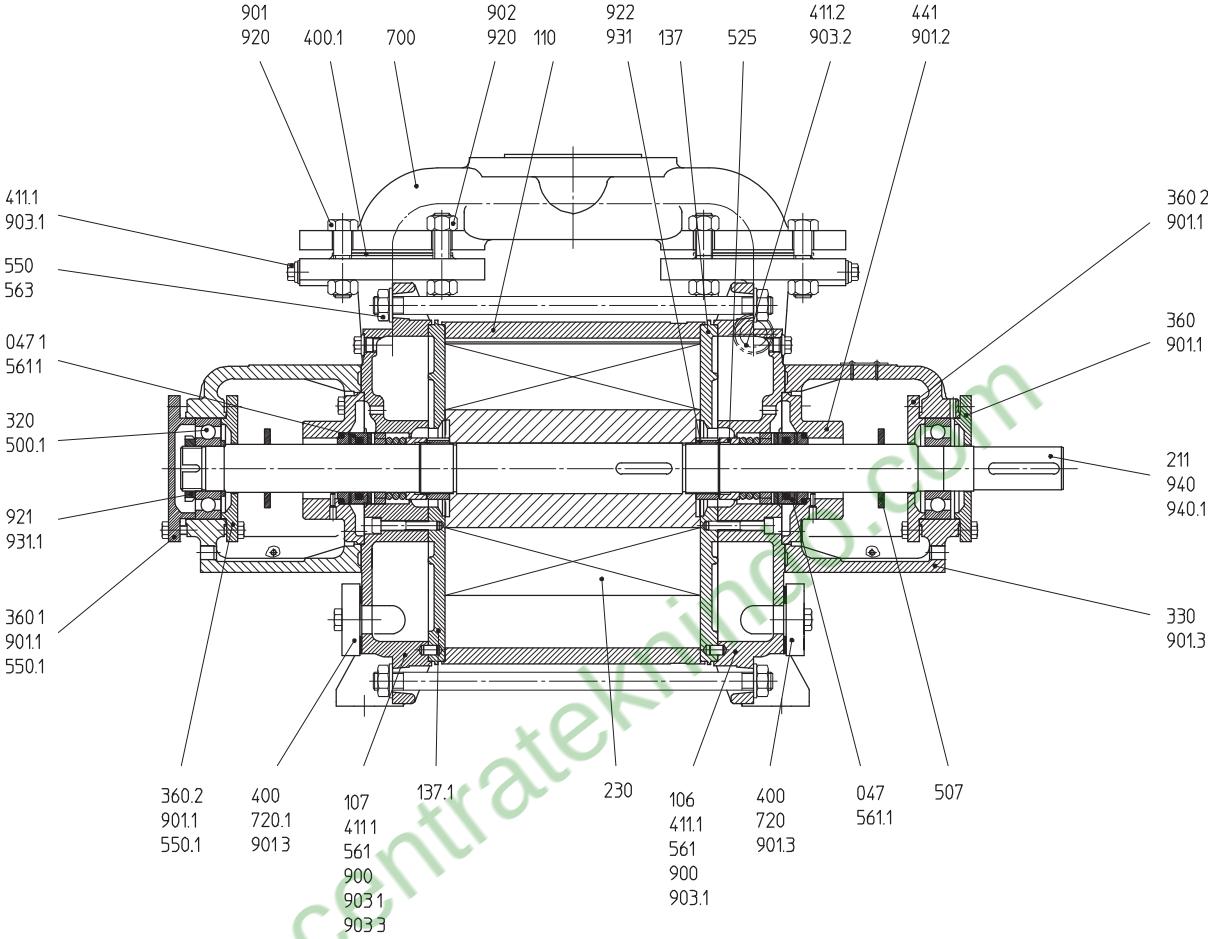

Fig. 48 Cross-sectional drawing VU 20-450

No.	Designation
047/.1	Mechanical seal
106	Suction casing
107	Discharge casing
110	Stage casing
137/.1	Inter casing
211	Shaft
230	Impeller
320	Rolling bearing
330	Bearing housing
360.-2	Bearing cover
400/.1	Sealing
411	Sealing ring
441	Shaft sealing casing
500/.1	Ring
507	Splash ring
525	Spacer sleeve

550/.1	Disc
561/.1	Cylindrical pin
563	Casing bolt
700	Pipe
720/.1	Counter flange
900	Hexagon socket head screw
901-.3	Hexagon head screw
902	Stud bolt
903.1-.3	Screw plug
920	Hexagon nut
921	Shaft nut
922	Impeller nut
931/.1	Lock washer
940/.1	Fitting key

Tab. 53 Parts list VU 20-450

10.12 Cross-sectional drawing VU 500 - 1600

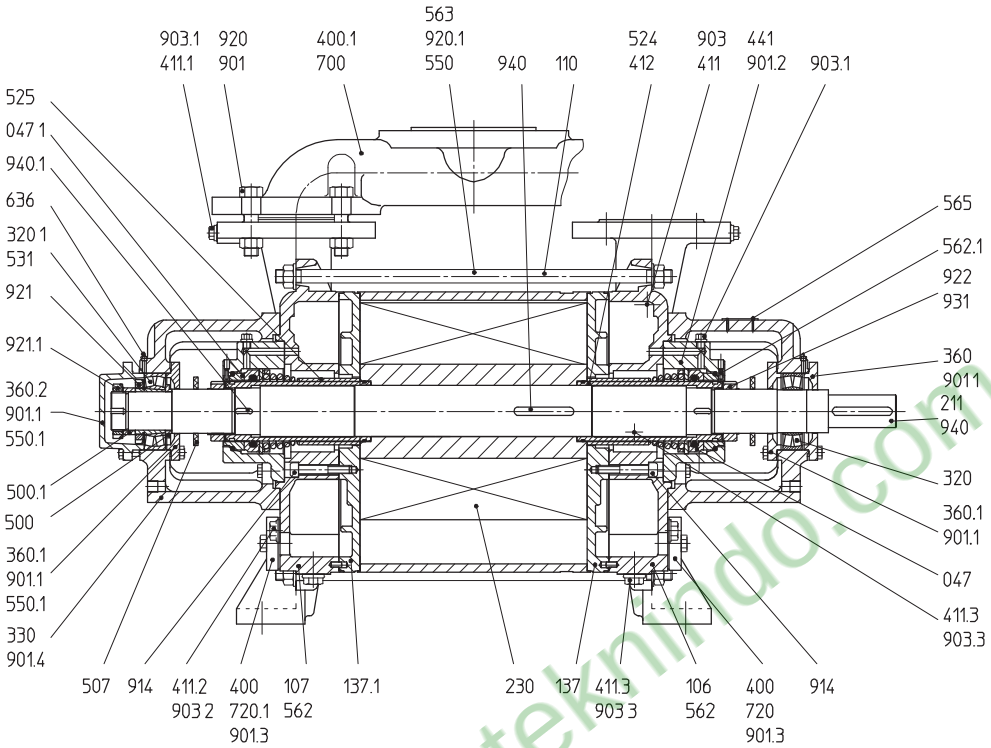

Fig. 49 Cross-sectional drawing VU 500-1600

No.	Designation
047/.1	Mechanical seal
106	Suction casing
107	Discharge casing
110	Stage casing
137/.1	Inter casing
211	Shaft
230	Impeller
320/.1	Rolling bearing
330	Bearing housing
360.-2	Bearing cover
400/.1	Sealing
411-.3	Sealing ring
412	O-ring
441	Shaft sealing casing
500/.1	Ring
507	Splash ring
524	Shaft protection sleeve
525	Spacer sleeve
531	Withdrawal sleeve
550/.1	Disc
562/.1	Cylindrical pin
563	Casing bolt
565	Riveted bolt
636	Lubrication nipple
700	Pipe
720/.1	Counter flange
901-.4	Hexagon head screw
903-.3	Screw plug
914	Hexagon socket head screw
920/.1	Hexagon nut
921/.1	Shaft nut
922	Impeller nut
931/.1	Lock washer
940/.1	Fitting key

Tab. 54 Parts list VU 500-1600

10.13 Cross-sectional drawing VH 20 – 400

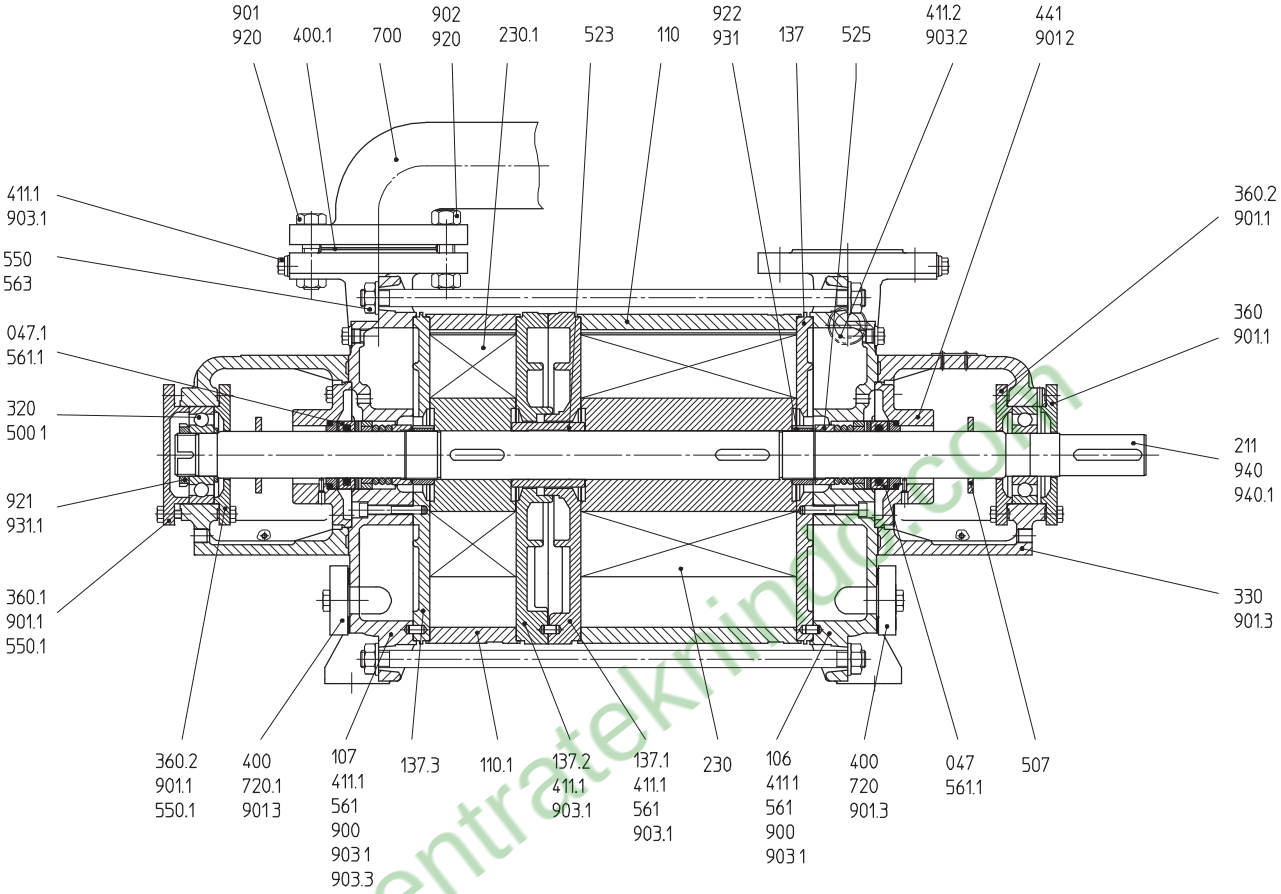

Fig. 50 Cross-sectional drawing VH 20-400

No.	Designation
047/.1	Mechanical seal
106	Suction casing
107	Discharge casing
110/.1	Stage casing
137-.3	Inter casing
211	Shaft
230/.1	Impeller
320	Rolling bearing
330	Bearing housing
360.-2	Bearing cover
400/.1	Sealing
411.1/.2	Sealing ring
441	Shaft sealing casing
500/.1	Ring
507	Splash ring
523	Spacer sleeve
525	Spacer sleeve
550/.1	Disc
561/.1	Cylindrical pin
563	Casing bolt
700	Pipe
720/.1	Counter flange
900	Hexagon socket head screw
901-.3	Hexagon head screw
902	Stud bolt
903.1-.3	Screw plug
920	Hexagon nut
921	Shaft nut
922	Impeller nut
931/.1	Lock washer
940/.1	Fitting key

Tab. 55 Parts list VH 20-400

10.14 Cross-sectional drawing VH 500 – 1600

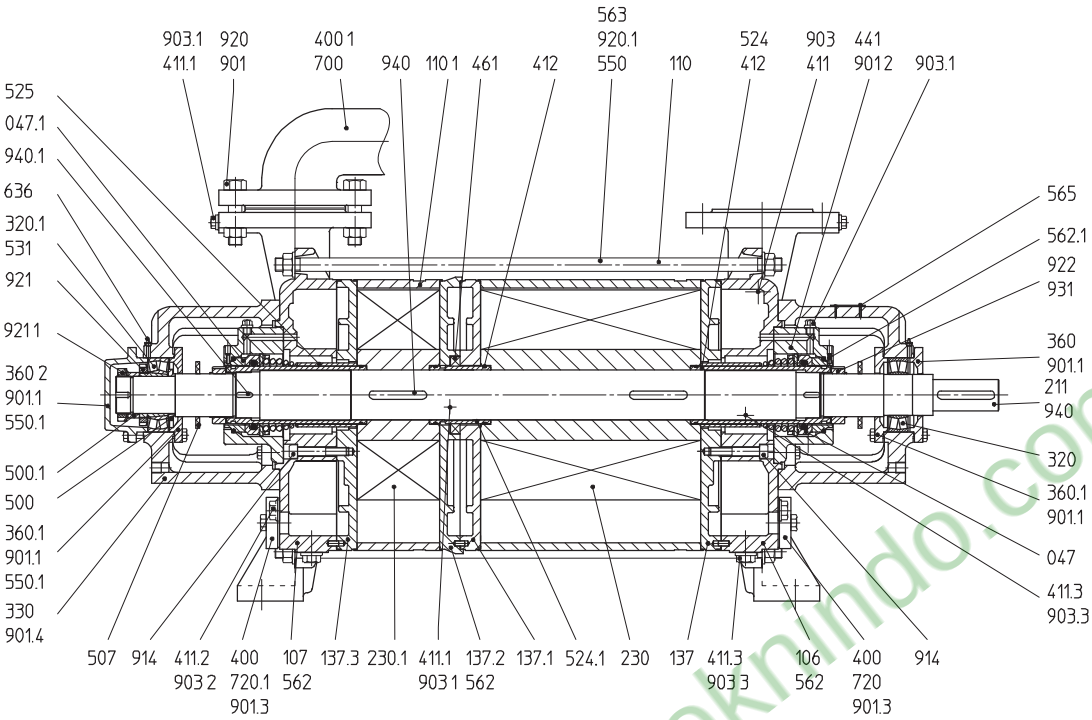

Fig. 51 Cross-sectional drawing VH 500-1600

No.	Designation
047/.1	Mechanical seal
106	Suction casing
107	Discharge casing
110/.1	Stage casing
137-.3	Inter casing
211	Shaft
230/.1	Impeller
320/.1	Rolling bearing
330	Bearing housing
360.-2	Bearing cover
400/.1	Sealing
411-.3	Sealing ring
412	O-ring
441	Shaft sealing casing
461	Packing gland
500/.1	Ring
507	Splash ring
524/.1	Shaft protection sleeve
525	Spacer sleeve
531	Withdrawal sleeve
550/.1	Disc
562/.1	Cylindrical pin
563	Casing bolt
565	Riveted bolt
636	Lubrication nipple
700	Pipe
720/.1	Counter flange
901-.4	Hexagon head screw
903-.3	Screw plug
914	Hexagon socket head screw
920/.1	Hexagon nut
921/.1	Shaft nut
922	Impeller nut
931	Lock washer
940/.1	Fitting key

Tab. 56 Parts list VH 500-1600

10.15 Certificate of conformity

ⓘ Please copy this form and return it to the manufacturer together with the pump/aggregate.

Certificate of conformity

The pump/pump aggregate including accessories for which we, the undersigned, have placed an inspection/repair order or which has been returned by us together with this certificate of conformity,

Designation: _____

Type: _____

Serial number: _____

☐ has not been in contact with hazardous substances.

☐ has been used in the area of application of: _____

☐ and has been in contact with the following harmful substances or substances subject to mandatory labelling:

Trade name	Chemical designation	Properties (e.g. toxic, inflammable, caustic)

☐ The pump/aggregate has been completely drained, flushed and cleaned both inside and outside in accordance with the operating instructions.

☐ Further handling of the pump/aggregate does not require special safety precautions.

☐ The following safety precautions must be observed when handling the pump/aggregate:

_____

_____

_____

☐ Safety data sheets in accordance with national regulations are enclosed.

Legally binding statement

We herewith certify that all data given above are correct and complete and that I, the undersigned, am in a position to confirm this.

We acknowledge our liability towards the contractor for any damage arising from incomplete or incorrect data.

We agree to hold harmless the contractor against damage claims of third parties due to incomplete or incorrect data.

We know that, independent of this statement, we have to take direct liability towards third parties, which particularly refers to the staff of the contractor responsible for handling, repair and maintenance.

City, date: _____ **Name:** _____

Company stamp: _____ **Signature:** _____

Tab. 57 Certificate of conformity

10.16 EC declaration of conformity

EG - Konformitätserklärung

EC declaration of conformity
Déclaration „CE“ de conformité

speck pumpen
Vakuumtechnik GmbH
zertifiziert nach DIN EN ISO 9001 :2008

im Sinne der EG-Richtlinie Maschinen 2006/42/EG, Anhang IA
as defined in machinery directive 2006/42/EEC, annex IA
conformément à la directive "CE" relative aux machines 2006/42 CEE, annexe IA

Hiermit erklären wir, dass das Pumpenaggregat
We herewith declare that the pump unit
par la présente nous déclarons que letype de pompe

Bauart: **V 1 / V 6 / VI8 / VI15**
type **V / VM /VG / VN / VZ 30 – 180 / VGI**
VU/VH 20-60
VU/VH 80-1600 / VZ110G - VZ180G

in der gelieferten Ausführung, folgenden einschlägigen Bestimmungen entspricht:
corresponds to the following relevant provisions / correspond aux dispositions pertinentes suivantes

- **EG-Maschinenrichtlinie 2006/42/EG**
  machinery directive 2006/42/EEC / directive „CE“ relative aux machines 2006/42
- **Die Schutzziele der Niederspannungsrichtlinie werden gemäß Anhang I, Nr. 1.5.1 der Maschinenrichtlinie 2006/42/EG eingehalten.**
  The protection objectives of the low-voltage directive are realized according annex I, No. 1.5.1 of the EC-Machinery directive 2006/42/EG
  Les objectifs protection de la directive basse-tension sont respectées conformément à appendice I, n° 1.5.1. de la directive CE relatives aux machines 2006/42/EG
- **Elektromagnetische Verträglichkeit – Richtlinie 2004/108/EG**
  Electromagnetic compatibility – directive 2004/108/EG
  Compatibilité électromagnétique – directive 2004/108/EG

Angewendete harmonisierte Normen, insbesondere
harmonized standards applied, in particular / normes harmonisés utilisées, notamment

- DIN EN 809
- EN ISO 14121-1
- DIN EN 60034-1

Bei einer mit uns nicht abgestimmten technischen Änderung der oben genannten Bauarten, verliert diese Erklärung ihre Gültigkeit.
If the above mentioned series are technically modified without our approval, this declaration shall no longer be applicable.
Si les gammes mentionnées ci-dessus sont modifiées sans notre approbation, cette déclaration perdra sa validité.

Bevollmächtigter für die Zusammenstellung der technischen Unterlagen ist:
Authorized representative for the completion of the technical documentation:
Mandataire pour le complément de la documentation technique est:

Herbert Mader
SPECK PUMPEN
Vakuumtechnik GmbH
Regensburger Ring 6-8
91154 Roth

Roth, 29.12.2009
Ort,Datum
place/lieu / date

ppa. Dr.-Ing. Pierre Hähre
(Unterschrift Ltg. Konstruktion)
(signature Technical Director)
(signature Directeur de Construction)

SPECK PUMPEN Vakuumtechnik GmbH
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Ust. ID. Nr. DE228540220 St.-Nr. 241/142/50623
Geschäftsführer: Wolfgang Krüger

Formblatt: 0221V
Artikel-Nr.: 1096.0198

Erstellt: T. Hahn/A.Eschenbacher
Geprüft: Dr.-Ing. P. Hähre
Stand: 29.12.2009