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Operating and assembly instruction

Type: Twin NG

Serial-No.: P9.....



Content

Data Sheet

Dimension Drawing (optional)

Certificates (optional)

Instruction Handbook

Additional Valid Documents:

Exploded View Drawing with Parts List

Accessories (optional)

Drive Unit Documentation (optional)



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1. Safety Instructions

1.1 Important instructions

- Read the operating instructions before installation and commissioning.
- It is essential to observe the safety instructions included.
- Do not put a damaged machine into operation.

The notes on safe and undisturbed operation are designated as follows:

Signal word	Meaning	Consequences if disregarded
 DANGER	Imminent danger	Death or serious personal injuries
 WARNING	Potentially dangerous situation	Death or serious personal injuries
 CAUTION	Potentially dangerous situation	Minor personal injuries
NOTICE	Possible damage to property	Damage to property
NOTE	Useful information, Ease of handling	

Tab. 1: Hazard warnings, their general meaning and consequences if disregarded

1.2 Qualified personnel

The operating company must instruct the operator by means of this Operating Manual. The minimum age is 16 years. An experienced person must supervise young persons and trainees during work on the machine.

All work may only be carried out by trained specialists and those with knowledge of this documentation.

All mechanical work may only be carried out by trained specialists. For the purposes of this documentation, skilled personnel are persons who are familiar with the design, mechanical installation, troubleshooting and maintenance of the machine (pump) and have the following qualifications:

- Training in the field of mechanics (e.g. mechanic or mechatronics technician).

All electrotechnical work may only be carried out by a qualified electrician. Qualified electricians within the meaning of these operating instructions are persons who are familiar with electrical installation, commissioning, troubleshooting and maintenance and have the appropriate qualifications:

- Apprenticeship in the field of electrical engineering (e.g. electrician or mechatronics technician).



All work in other areas, transport, storage, operation and disposal may only be carried out by persons who are familiar with these operating instructions and have received appropriate training.

1.3 Reference to further documentation

Legally binding laws, standards, directives and regulations of the respective operating country must be observed and monitored. The standards and guidelines applied to this machine (pump) can be found in the declaration of compliance/installation. The following additional documents, if applicable, are an integral part of these operating instructions (see Tab. 2):

Document	Description
Data sheet	Technical data, performance and operating limits, operating conditions
Dimensional drawing	Dimensioned drawing with fixing points
Certifications	Declaration of compliance or declaration of installation Test certificates EN10204 - on request: Certificate of compliance 2.1 Factory certification 2.2 Acceptance test certificate 3.1 and/or 3.2
Spare parts lists	Exploded drawing with spare parts
Accessories documentation	Installation instructions for accessories
Drive unit documentation	Installation instructions for the drive unit
Declaration of decontamination	Send machine for repair - on request

Tab. 2: Reference to further documentation

1.4 General safety instructions

Read these safety instructions carefully.

In the interest of better legibility of the operating instructions, the following safety instructions are not repeated in most cases. In the case of dangers whose consequences are not foreseeable or obvious, or whose consequences are traditionally underestimated, a warning is issued again.

The pump is designed to be safe and does not pose a hazard under normal operation and normal use. Nevertheless, many steps involve dangers that can only be avoided by taking the right approach or knowing the danger.



 **DANGER**

Danger from rotating or moving machine parts.

Death or severe injuries.

- Only carry out work on the machine when it is at a standstill.
- Before commissioning or after work on the pump, fit all protective devices.
- Do not carry out cleaning, maintenance or repair work until the drive or control system has been disconnected from the power supply and secured against unauthorised switching on (padlock).



 **DANGER**

During operation, the pump contains pressurised machine parts or pressurised liquids.

Death or severe injuries.

- Only carry out the necessary work when the pump is at a standstill.
- Before opening the pump, depressurise the system.
- Do not run the medium/liquid with the pump against closed shut-off devices. The screw pump is a rotating positive displacement pump and can build up a very high pressure. The developing pressure with the delivery line shut can reach the multiple of the permissible system pressure.



 **DANGER**

Live parts can cause a fatal electric shock.

Death or severe injuries.

- The machine must only be connected by qualified personnel.

Electromagnetic interference or voltage surges in the power supply.

Death or severe injuries.

- In case of electromagnetic interference, voltage surges in the power supply or power failure, the pump must be returned to a safe condition.
- The return of energy must not lead to a restart of the pump.
- When the pump is installed in the facility, this source of danger must be realised and implemented through the facility control system.
- Employees must be instructed accordingly.



DANGER

Tampering, temptations to tamper, circumvention and overriding of protective devices

Death or severe injuries.

- *If any temptations to tamper are discernible during operation of the WANGEN Twin NG, notify your supervisor immediately.*
- *Tampering endangers yourself and others.*
- *It is prohibited to use spare actuators or spare keys.*
- *It is prohibited to start or operate the WANGEN Twin NG without permanently installed guards.*
- *Employees must be instructed accordingly.*



WARNING

Improper handling of the pump during transport/lifting/removal.

Personal injury due to falling and/or tilting load.

- *Pump or parts thereof can be very heavy and must be moved with a suitable lifting device.*
- *Observe the centre of gravity and the maximum weight of the load.*
- *Only use suitable slings with sufficient load-bearing capacity.*
- *Only use the attachment points provided.*
- *Do not stand under the load to be lifted or set down.*
- *Do not stand between stationary objects (floor/wall) and suspended load.*
- *Keep surrounding people out of the danger area.*



CAUTION

Heavy load of the individual components during disassembly/assembly of the pump.

Slight injuries to limbs or irreversible injuries to the entire body.

- *Use protective gloves and safety shoes.*
- *Use suitable lifting gear (e.g. round slings, chains and load hooks with corresponding load capacity).*
- *Screw the eyebolt into the hole provided in the component to be dismantled or assembled and hang it on the load hook of the lifting crane, e.g. to move it or secure it against falling.*
- *Provide and use suitable supports for stopping the components.*
- *Provide sufficient space for disassembly/assembly.*



CAUTION

Leakages on seals, e.g. mechanical seals, gear oil, quench medium or leaking pipes, can lead to slippery surfaces.

Risk of injury.

- *Replace seals or remove leaks.*
- *Wipe up leaked liquid immediately and dispose of it properly.*



CAUTION

Hot surface due to dry running of the pump or unfavourable conditions.

Risk of burns.

- *Only touch hot surfaces with suitable protective gloves.*
- *Switch off the pump and let it cool down.*
- *Avoidance of unfavourable conditions.*
- *Ensure supply of pumped liquid.*



CAUTION

Incorrectly connected pipes can spray out (hot and/or dangerous) liquids under pressure. Hose assemblies can hit or flake off during pressure pulses.

Risk of injury.

- *Pipelines may only be connected by qualified personnel (industrial mechanics, metalworkers, mechatronics engineers, etc).*
- *Correctly connect all process connections before switching on the pump. Wear safety glasses.*
- *Wipe up leaked liquid immediately and dispose of it properly.*

NOTICE

Loading the pump with objects or boarding the pump - especially the coupling guard - by persons can lead to damage. Safe operation of the pump is then no longer guaranteed.

Possible damage to property.

- *Loading the pump with objects is prohibited.*
- *It is prohibited for persons to enter or climb onto the pump.*
- *It is prohibited for persons to enter or climb onto the clutch/coupling protection.*



NOTICE

Failure to observe the limit values shortens the service life of the pump.

Possible damage to property.

- *Operate the pump according to the limit values.*
- *Do not operate the pump beyond the specified speed range.*
- *The contents of solids in the pumped medium must not exceed the specified limit values for grain size and solids content.*
- *Take suitable measures to prevent foreign matter (metal parts, stones, etc.) from entering the pump.*

NOTICE

Running the pump under alternating load shortens the service life of the pump.

Possible damage to property.

- *Permanent application of alternating load to the pump (i.e. constant alternation between clockwise and counterclockwise rotation and starting under increased torque) reduces the service life of the pump and gear due to heavy load on the rotating parts and the seal and must be avoided.*

NOTE

- *When opening the pump, observe the regulations for handling the pumped medium.*

1.5 Special safety instructions for pumps with heating jacket

The pump housing of these pumps is designed with a double jacket and connections for the flow of a heating medium. For the inlet and outlet of the heating circuit, the connections facing away from the nozzle must always be used for optimum circulation. The connections on the connecting piece side are then available for venting or pressure measurement. The heating jacket can also be used as a cooling jacket.

NOTICE

Apply an overpressure of up to 6 bar to the housing of the heating jacket.

Possible damage to property.

- *The housing is normally designed for an overpressure of 6 bar, unless another internal pressure is permitted in the data sheet.*



CAUTION

Do not exceed the permissible nominal pressure of the housing.

Risk of burns due to hot steam.

- Use suitable pressure relief devices.
- When the pressure limiting device responds, the excess pressure must be safely switched to a pressureless state through the relief opening and discharged.
- No shut-off devices may be arranged in the area of the relief opening.
- Operate the heating circuit exclusively with water.
- Wear safety glasses.

1.6 Intended use

This machine (pump) is intended for commercial use in the food, cosmetics¹, chemical and pharmaceutical industries and may only be used in accordance with these operating instructions to convey the agreed pumped media.

The operating points mentioned in the pump specification (data sheet) (temperature, flow rate, pressure, speed, viscosity of the pumped medium, etc.) are to be understood as limit values and must not be exceeded.

Safe operation can only be guaranteed if the limit values are observed and a technically flawless pump is used.

A change in the delivery conditions (e.g. delivery rate, delivery path, pressure level, pipe diameter, restrictors) can lead to greatly changed operating conditions. In this case, the new operating conditions must be compared with the specifications in the data sheet. It is necessary to consult with the manufacturer if the changed conditions should exceed the data contained in the data sheet.

Deployment in the Ex area is prohibited unless not expressly intended for this purpose.

1.7 Predictable misuse

We expressly warn of obvious mishandling:

- Only use the pump to deliver the specified medium (see data sheet).
- Do not operate the pump beyond the specified speed range.
- Do not use the stationary pump as a shut-off device.
- Do not operate the pump against closed pressure lines.
- Only suitably trained specialist personnel may operate the pump and carry out setup/maintenance work.
- Do not carry out any maintenance work while the pump is in operation - in particular loosen the screw connections of coupling guard, pipe connections, etc. only when the pump is at a standstill.
- The pump may only be operated if all safety devices are in place and covers are fitted - the pump must be properly installed and fully functional.
- The pump must not be loaded with objects or climbed on by persons.
- Do not operate the pump in hazardous areas.

1 The term "food industry" is used in these operating instructions to represent the food/beverage and dairy industries.



1.8 Usage limitations

NOTICE

Greases cause EPDM² to swell in mechanical seals and sealing rings.

Possible damage to property.

- Depending on the grease concentration and the corresponding temperature, media containing grease can cause the EPDM material to swell. EPDM swells even at low temperatures in environments with a high grease content.
- Otherwise the resistance of the sealing material is no longer guaranteed.
- The milk grease content of the pumped medium must not exceed 8 %.

NOTICE

Acidic and basic cleaning agents cause the material FKM²/FPM to swell in mechanical seals and sealing rings.

Possible damage to property.

- For pumps with sealing rings and mechanical seals made of FKM/FPM, the basic and acid cleaning agents must not exceed a concentration of 3 % (further information is given, for example, in DIN 11483-2³).
- The durability of the sealing materials is otherwise no longer guaranteed.

NOTE

- In the event of non-compliance with these points or the use of unsuitable cleaning agents, the manufacturer of the pump assumes no liability or warranty/claims for defects in the event of damage.

Damage prevention with regard to sealing materials is already carried out in the planning phase by Pumpenfabrik Wangen GmbH. Due to the intensive consultation, suitable sealing materials are recommended and used in the pumps depending on the application. The recommendations and sealing materials used for the pump can be found in the data sheet.

1.9 Sound emission

Each pump is manufactured and tested according to the currently valid technical documentation. The weighted continuous sound pressure level is normally < 70 dB(A). Drive unit and piping are not included. Cavitation-free operation and proper attachment of the pump unit to a torsion-resistant steel structure are assumed.

2 Material designation according to ASTM-D 1418-76:
EPDM = ethylene-propylene-diene rubber
FKM = fluorinated rubber (obsolete: FPM)

3 DIN 11483-2 "Dairy machinery and equipment - Cleaning and disinfection - Part 2: Consideration of Influences on Elastomeric Sealing Materials" of September 2011



2. General description of the WANGEN Twin NG

2.1 Main components of the WANGEN Twin NG 180

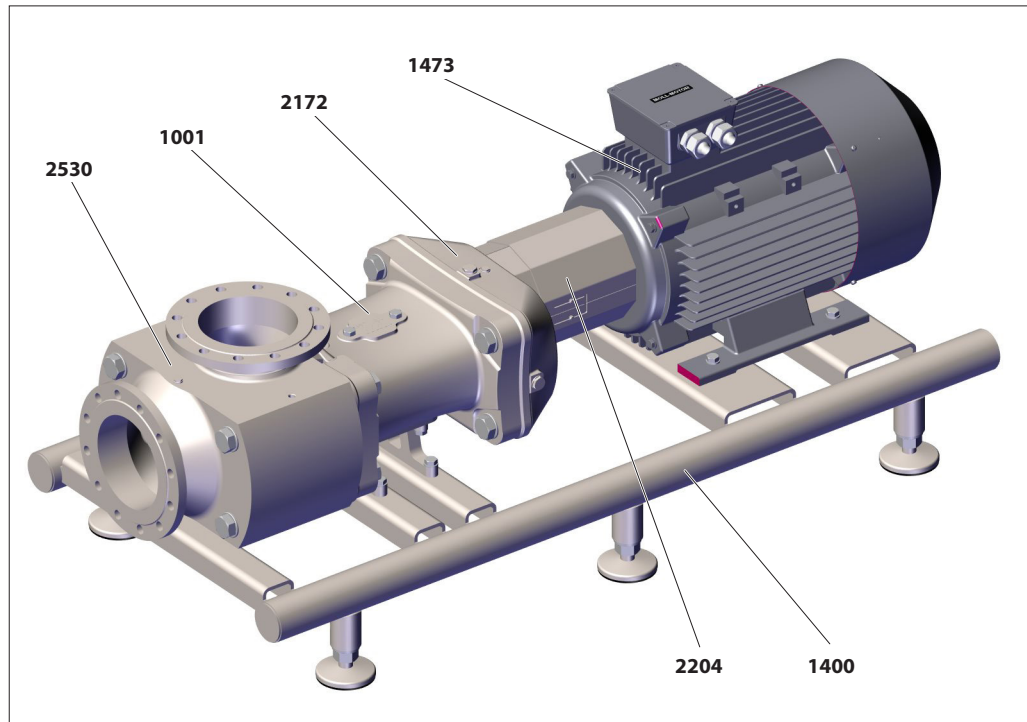


Fig. 1: View of the WANGEN Twin NG 180 with sliding coupling protection (standard version)

The WANGEN Twin NG consists of the following components:

Main components of the WANGEN Twin NG 180	
1001	Bearing housings
1400	Base frame
1473	Drive
2172	Gear housing
2204	Coupling and coupling protection (standard version)
2530	Pump housing (with heating jacket, optional)

Tab. 3: Components of the WANGEN Twin NG 180 (see Fig.Fig. 1)



2.2 General description

Screw pumps are rotary displacement pumps for conveying low to high viscosity media. The WANGEN Twin NG has two spindles. It is characterised by the contactless running of the spindles. Contact with the housing is also avoided. The spindles are fastened by means of intermeshing gear wheels. These gears make it easy to adjust the required backlash of the spindles.

The drive spindle and output spindle are mounted outside the pump chamber and do not come into contact with the pumped medium. The compact design and low-pulsation delivery are further advantages of the screw pump.

Screw pumps used in the food and beverage industry are designed and manufactured in accordance with the recommendations of DIN EN 1672-2 "Food processing machinery, general principles for design". Corrosion-resistant materials suitable for cleaning and/or disinfection are used for the spare parts which come into contact with the medium of these pumps.

For pumps in the food industry, elastomer materials and seals are used in accordance with the recommendations of the BfR (Federal Institute for Risk Assessment), the European Regulation on Consumer Goods and the Regulation of the European Parliament (1935/2004/EC) and the US FDA (Food and Drug Administration) guidelines.

The pumps and pump units are built in compliance with the safety and health requirements of the EC Machinery Directive. Once the requirements have been met, either the EC declaration of compliance (with CE marking) or, in the case of incomplete machines, a declaration of installation is issued for each machine.

The declaration of compliance issued by Pumpenfabrik Wangen GmbH applies to the delivered machine in connection with the intended use of the drive unit specified in the data sheet (geared motor, gear unit for mounting an IEC standard motor with defined power and torque as drive source of the pump).

The customer alone is responsible for any subsequent interventions or changes to the machine and must then ensure compliance with the EC directives themselves.

2.3 How the pump works

The screw pump belongs to the group of positive displacement pumps. The screw pump consists of two or more counter rotating rotors which are enclosed by a housing. The shape of the displacers of a rotor is similar to that of a spindle screw with left-hand and right-hand threads. The displacers of the counter rotating rotors mesh with each other with helical teeth. The cavity between the rotors and the housing forms a closed conveying chamber which is sealed by gap seals. Precise processing is a precondition for the optimum effect of the gap seals and thus for the delivery pressure of the pump.

During rotor rotation, the conveying chamber moves and transports the medium axially from the suction side (inlet) to the discharge side (outlet). If several conveying chambers are arranged in series, in which the medium is transported, higher conveying pressures are achieved.

The delivery volume of the screw pump depends on the outside and inside diameter of the screw spindle, the pitch and the number of gears.

This pump type is particularly suitable for non-compressible media to generate high pressures.

1 Excluded from DIN EN 1672-2 are pipe connections, which generally require special cleaning measures and must be cleaned manually by the operator. If the pipe connections comply with DIN 11864, there is no hygiene risk according to DIN EN 1672-2 and the operator does not have to define any special cleaning measures.



2.4 Packaging

WANGEN pumps are shipped in one-way packaging.

2.5 Transport



WARNING

Improper handling of the pump during transport/lifting/removal.

Personal injury due to falling and/or tilting load.

- *Pump or parts thereof can be very heavy and must be moved with a suitable lifting device.*
- *Observe the centre of gravity and the maximum weight of the load.*
- *Only use suitable slings with sufficient load-bearing capacity.*
- *Only use the attachment points provided.*
- *Do not stand under the load to be lifted or set down.*
- *Do not stand between stationary objects (floor/wall) and suspended load.*
- *Keep surrounding people out of the danger area.*

NOTICE

Possible damage to property.

- *Lift the pump with a forklift truck - Place the fork under the base frame at the level of the engine foot and pump foot.*
- *Alternative: Lifting the pump with base frame and drive - as shown in Fig. 2 - with round slings.*
- *Alternative: Lifting of the pump with base frame and drive by means of a traverse.*
- *The two eyebolts on the bearing housing can be used to support the load.*
- *Never lift the entire pump by the eyebolt on the gear housing. This attachment point is only provided for the gear unit housing.*
- *Never lift the pump in the coupling area.*
- *Always transport screw pumps in horizontal position.*
- *Depending on the drive unit, screw pumps can be top-heavy.*

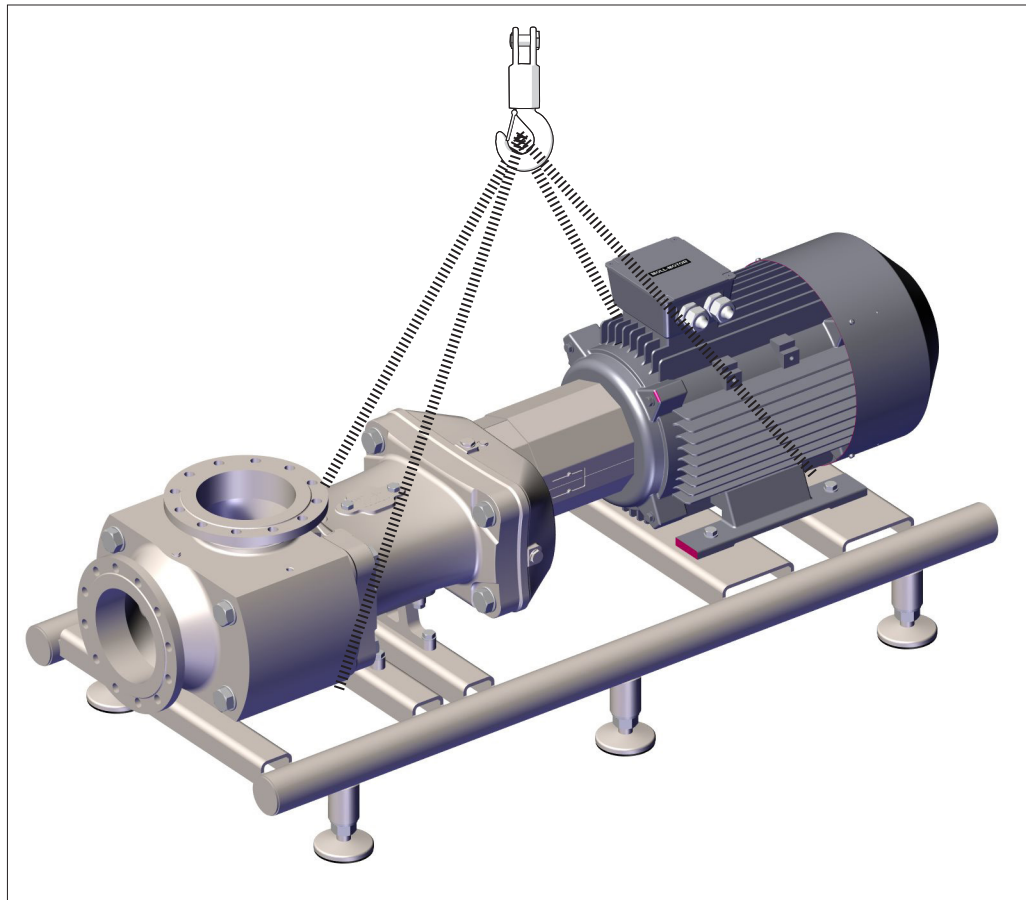


Fig. 2: Suspension possibility for the transport of the WANGEN Twin NG

NOTE

- *Report any transport damages immediately to the transport company.*
- *Do not start up a damaged machine (pump).*

2.6 Storage

WANGEN pumps are sufficiently preserved under normal ambient conditions.

In case of prolonged storage, the following measures are recommended:

- Protect the pump from dust, dirt, water, direct sunlight, frost and other harmful environmental influences.
- During downtimes of more than six months, manually turn the screw spindles to keep the seals lubricated.
- When using water as quench medium for the shaft seal ring, drain water.
- Store the pump in a dry place.

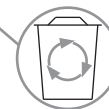


2.7 Disposal

Economy, quality and environmental awareness are the guidelines for our actions. These principles are reflected in all areas of our company. The machines of Pumpenfabrik Wangen GmbH are characterised by high product quality, long service life and environmental compatibility. In order to avoid environmental pollution as far as possible in the event of disposal Tab. 4, the raw materials listed are to be returned to the production process beyond the life cycle of a pump (recycling management).

Raw material		Disposal as
high-grade steel	complete pump (see data sheet)	scrap
steel	complete pump (see data sheet)	scrap
plastics (elastomers)	o-rings	residual waste
	Parts of the mechanical seal (Silicon carbide SiC)	residual waste
	shaft seal ring	residual waste
grease	radial groove ball bearing	observe local regulations
oil	gear housing	observe local regulations

Tab. 4: Materials of the pump and their disposal



2.7 Disposal according to WEEE Directive 2012/19/EU



Electrical accessories of the pump are covered by the WEEE Directive 2012/19/EU. Dispose of them according to the national regulations of your country. Further information can be obtained from the branch offices responsible for you, authorised service partners and the field service staff of Pumpenfabrik Wangen GmbH.

WEEE-Registration number: DE 76603041

An updated list of all branches and service partners can be found on our homepage:

- <https://www.wangen.com/de/vertriebspartner/>
- <https://www.wangen.com/de/service/servicepartner.php>

2.7 Recycling according to Packaging Directive 94/62/EC



Parts of the packaging of the pump and its accessories fall under the European Packaging Directive 94/62/EC. Recycle them according to the national regulations of your country.

<https://www.gruener-punkt.de/>

Note on the German Packaging Act:

Pumpenfabrik Wangen GmbH is registered as a manufacturer with the German packaging register LUCID under the following number DE3264622079629.



3. Setup/mounting and installation

3.1 General information

NOTE

- *The torsion-resistant base frame is recommended for installation and fastening of the screw pump.*
- *Observe maximum tightening torques for specified pump components (see Tab. 6).*

Measurements	Tightening torque* for screw connections
M 8	25 Nm
M 10	49 Nm
M 12	85 Nm
M 16	210 Nm
M 20	425 Nm

* Values according to DIN EN 24014, strength class 8.8 and friction coefficient 0.14

Tab. 5: Assembly of bolted connections - general tightening torques for ISO bolted connections

NOTE

- *If the points, notes, information etc. described in the chapter 3 are not observed, the pump manufacturer accepts no liability or warranty/claims for defects in the event of damage to both the system and the machine.*



3.2 Specifications for torques for specified components

The following torques for screw connections are specified for certain components:

Tightening torques for specified components		[Nm]
Serial number	fixed component	Construction size 180
1008	Cylinder head screw bearing cover	80
1016	Hexagon head screw bearing housing	450
1041	Hexagon head screw cover	450
1526	Shaft nut	190
2177	Hexagon head screw for output shaft	280
2180	Spindle screw	350
2205	Hexagon head screw for pump foot	120
2258	Cheese head screw for gear housing	200
2259	Hexagon head screw for sealing bracket	35
2186	Cylinder head screw for gear hub	65
(1526)	Grub screw of the locknut	8
2534	Hose nozzle	45

Tab. 6: Assembly of screw connections for specified components - For reference to F-number, see chapter "10. Exploded views - Spare parts list"

3.3 Pipelines

The correct dimensioning of the pressure-side pipeline is decisive in order to avoid unnecessary pressure build-up when pumping viscous media. Orientation is given by the dimension of the pump flanges.

The (delivery) pressure specified in the data sheet must not be exceeded with regard to the pressure resistance of the pipeline (see chapter "3.6 Pressure conditions in the pump housing").

- Flush the piping system and feeding devices before installation.
- Remove foreign matter.
- If possible, lay the suction line in such a way that it is not possible to empty the line when the pump is at a standstill (shut-off devices, siphon, etc.). This prevents dry running when starting up.
- Flange the pump to the pipeline via elastic seals/compensators so that a tight connection is created and no impermissible forces act on the pump.
- For the removal of the pump and for maintenance provide shut-off devices and fittings in the pressure and suction line.
- Provide safety valves or pressure monitoring directly behind the pump (pressure side) (if necessary also on the suction side).



NOTICE

Possible damage to property.

- Do not brace pipes on the pump.
- Install pipelines with as little force and torque as possible.
- Do not load bolted connections with moments that cause the machine (pump) to be tightened or loosened.
- Incorrect connection of pipes can lead to the splashing out of liquids/flapping pipes.

3.4 Installation and mounting of horizontal pumps

The installation and fastening of the WANGEN Twin NG 180 is carried out exclusively with the base frame.

NOTICE

Possible damage to property when setting up the WANGEN Twin NG 180 - Impermissible vibrations during pump operation - consequential damage.

- The foundation must absorb its own weight and all operating forces and guarantee the stability of the pump.
- To set up the pump (with base frame), the subsurface/foundation must be firm, level and horizontal, e.g.:
 - sufficiently dimensioned, flat concrete slab
 - torsion-resistant, vibration-free, flat steel construction.
- The base frame with articulated foot must be aligned horizontally using suitable aids - no impermissible forces must be exerted on the pump.
- The pump must be securely and firmly connected to the base frame with all the holes provided for this purpose.
- The base frame - pump connections must be made with M16 bolts.

3.5 Installation of the standard articulated foot

The standard hinged foot has a transition from the foot plate to the thread, so this hinged foot is easy to clean. The rubber embedded in the joint foot is FDA-compliant and therefore approved for use in the food industry. The articulated foot can compensate for unevenness and slopes of floors and equipment of up to 10°.

- Cracks in the floor or unevenness similar to cracks must not be bridged with the hinged foot during installation. First seal cracks in the installation area.
- To mount the feet, lift the base frame/pump with suitable means.
- To mount the feet, lightly lubricate the thread with mounting grease (remove excess grease after mounting).



- When installing the base frame (with through thread/bore), the standard articulated base with two nuts and two washers is used (see Fig. 3):
 - one pair (nut/washer) each below the base frame for positioning.
 - one pair (nut/washer) each above the base frame for securing or countering.
- The vertical positioning is carried out with a wrench - observe the Tab. 7 dimensioning .
- Place the base frame/pump on the floor/foundation and fine tune after mounting all articulated feet. All articulated feet must be seated on the floor/foundation so that the weight of the base frame and pump is evenly distributed on all the articulated feet.
- Tighten lock nut.

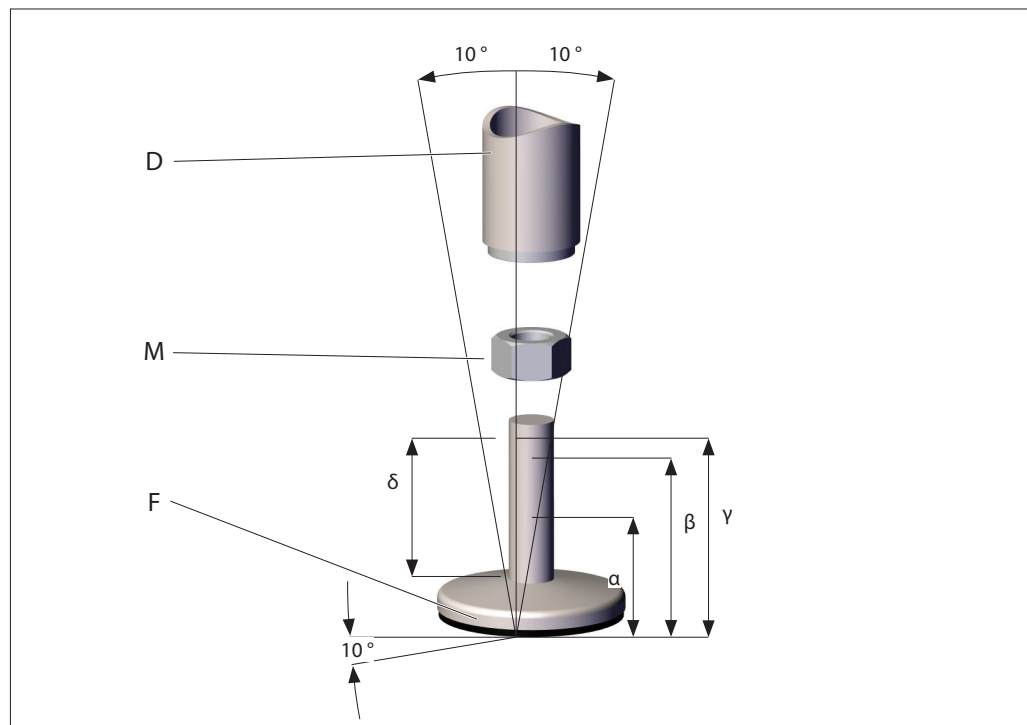




Fig. 3: Standard articulated foot – Dimensions see Tab. 7 – D: Spacer tube; F: Articulated foot; M: Nut; S: Disc; α , β , γ , δ : see Tab. 7

Dimension Articulated foot	α Minimum length [mm]	β Maximum length [mm]	γ Total length [mm]	δ Compensation height max. [mm]
Standard design	89	109	133	97
Spacer tube D	--	--	126	--

Tab. 7: Dimensioning of the standard articulated foot



3.6 Pressure conditions in the pump housing

	 DANGER
	<p>Design internal pressure of the WANGEN Twin NG 180: max. 16 bar - provided the data sheet did not allow any other internal pressure.</p> <p>If pipes and flanges are not designed for the appropriate pressure, there is a risk of them bursting. Death or severe injuries.</p> <ul style="list-style-type: none"> • <i>The entire system (pipes, flanges, pressure vessels, etc.) must be designed for the corresponding pressure.</i> • <i>The (delivery) pressure specified in the data sheet must not be exceeded with regard to the pressure resistance of the pipeline.</i>

3.7 Operation and maintenance space requirements

NOTE
<ul style="list-style-type: none"> • <i>Provide free space on the pump to allow maintenance work without removing the entire pump (see dimension sheet, see Tab. 8).</i> • <i>Assembly fittings and shut-off devices before/after the pump simplify the assembly/disassembly of the pump.</i> • <i>Allow space for sufficient ventilation of the drive unit motor (see Tab. 9).</i>

Space for operation and maintenance work	recommended working area
on the drive unit	min. 1 times the length of the drive
per pump side	min. 0.8 m

Tab. 8: Recommended clearance for maintenance work on the pump

Space for drive unit waste heat during operation	recommended minimum clearances
Fan guard drive unit - wall	min. 0.3 m (1.0 m)*
top side drive unit - ceiling	min. 1.0 m

Ensure adequate ventilation. Avoid sucking in the heated exhaust air again, even from adjacent units. Overheating can cause damage to the pump.
A minimum distance of 1.0 m is Recommended for higher engine power.

Tab. 9: Recommended free space for the waste heat of the drive unit



3.8 Electric connection

The generally applicable installation regulations for low-voltage electrical equipment must be observed when installing electrical systems. Refer to the operating manual of the motor manufacturer. For inverter-fed motors, the wiring instructions in the operating manual of the frequency converter must also be observed. The same applies when using a soft starter.



DANGER

Live parts can cause a fatal electric shock.

Danger to life.

- *The machine must only be connected by qualified personnel.*
- *Ensure voltage-free operation.*
- *Observe circuit details and other information on the motor nameplate and circuit diagram in the terminal box.*



DANGER

Danger of being pulled in due to rotating machine parts.

Death or severe injuries.

- *Do not perform any work while the pump is running.*
- *Disconnect the power supply and secure against unintentional switching back on.*
- *Switch off and lock the main switch.*

NOTICE

Possible damage to property.

- *Alignment of the drive data (nameplate) with the local conditions. The mains voltage and frequency must match.*
- *Check the phase sequence for the direction of rotation of the motor - the pump must run in the specified direction of rotation according to the data sheet. This prevents damage to the spindles and housings or loss of power.*
- *The PTC thermistor of the geared motor must be connected to a PTC motor protector or to a frequency inverter with PTC input (available as an option).*
- *Soft starters or frequency inverters must be suitable for high starting currents - use oversized devices for heavy starting.*
- *Provide an EMERGENCY OFF device to be able to stop the pump in dangerous situations.*



NOTICE

Do not mount coupling on drive shaft with hammer blows.

Damage to parts, inadmissible deformation.

- Use a mounting device or heat the coupling half to approx. 80 °C (remove elastomer star before) and mount the coupling half warm.
- The coupling halves must be aligned with each other.
- For a permanent trouble-free operation of the coupling, the coupling for the case of application (power, rotation speed, start-up frequency, changes to power and working machines) must be designed according to the design layout specifications (DIN 740-2).
- For the coupling selection, the admissible maximum speed and the admissible maximum bore must be considered.
- It is recommended to subject the coupling to a visual check at least once a year. In this case, special attention is to be paid to the status of the coupling cams.

When assembling the drive (cf. Fig. 4) with the pump, it is essential to observe the maximum

- Ⓐ = axial displacement
- Ⓑ = angular misalignment and
- Ⓒ = radial displacement

according to the information Tab. 11 provided. It involves maximum values which may not occur simultaneously. In case of simultaneous occurrence of radial and angular misalignment, the admissible displacement values may only be used proportionally:

Example: $\text{Max. misalignment}_{\text{total}} = 30\%_{\text{Angular misalignment}} + 70\%_{\text{Radial misalignment}}$

Displacements of the coupling parts with respect to each other due to an inaccurate alignment with installation, which result from distorted machine frame or from thermal expansion and shaft bowing.

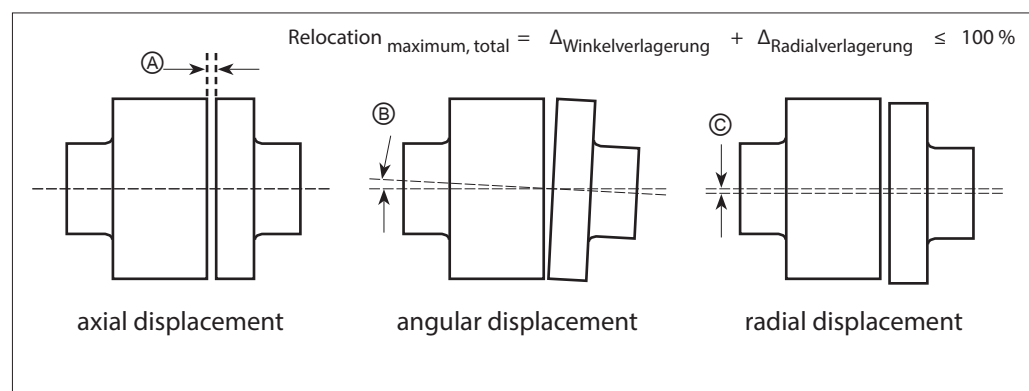


Fig. 4: Different possibilities of relocation: Axial, angular and radial misalignment or maximum permissible proportional misalignment value calculation



Type designation/ max. permissible hub bore diameter			28, 28/38	38, 38/45	42	48	55
Ⓐ	max. axial displacement	[mm]	1.5	1.5	2.0	2.0	2.0
Ⓑ	max. angular displacement	[°]	1.0	1.0	1.0	1.0	1.0
Ⓒ	max. radial displacement	[mm]	0.25	0.25	0.32	0.32	0.38
max. wear limit of elastomer starwheels (abrasion)		[mm]	3	3	4	4	5

Tab. 11: Information on maximum permissible misalignment values when assembling the couplings drive/pump and information on wear limit; applies at 1,500 min⁻¹ and for elastomer starwheels with hardness 92 Shore A

NOTICE

Durability of elastomer mating in couplings.

Wear, material damage to the elastomer starwheel.

- *The flexibility or elasticity is achieved by the deformation of damping rubber parts (elastomer starwheels), whose service life depends strongly on the extent of the displacement values to be compensated.*
- *Permanently high temperatures can cause changes to the elastomer starwheel, which impair elasticity and torque transferability.*
- *Exceeding the maximum displacement values leads to damage to the coupling.*
- *Contact with aggressive liquids/oils, ozone effect, too high/low ambient temperature cause a physical change of the elastomer star.*

3.10 Shaft seal

Different shaft seal can be installed in the screw pumps. Reference is made to the data sheet for details.

The optimum selection of the Shaft protection sleeve seal or materials used for the WANGEN Twin NG depends primarily on the type of media to be sealed. The individually adapted selection must be made through careful consultation and in direct cooperation with Pumpenfabrik Wangen GmbH.

Shaft seals must be installed with extreme care. Sound knowledge of how the shaft seal works is essential. Sliding surfaces must not be damaged or have burrs and scratches. The installation location must be free of dust and dirt. The space between the mechanical seal and the surrounding housing or between the double-acting mechanical seals is called the sealing chamber.

For this reason, Pumpenfabrik Wangen GmbH has developed a pre-assembled and compact mechanical seal cartridge (GRD cartridge) that is easy to operate and maintain as standard. This prevents assembly errors and damage, which occur more frequently with conventional mechanical seals. The GRD cartridge offers outstanding performance in demanding applications.

A prerequisite for a shaft seal that functions reliably over a long service life is that the limits or operating conditions for the selected seal specified in the data sheet are not exceeded at any time.



3.10.1 GRD cartridge - single-acting

The single-acting GRD cartridge consists essentially of a sliding ring and a counter ring, which are axially pressed against each other by a spring. A fluid-filled sealing gap ($< 1 \mu\text{m}$) forms between the two sealing surfaces of the sliding and counter ring and acts as a lubricating film. This lubricating film forms from the pumped medium in the pump. If this lubricating film breaks off, dry running occurs. Dry running destroys the undercarriage seal within a few seconds.

Lubrication by the pumped medium fulfils two important tasks. It reduces friction between the sliding ring and counter ring and acts as a coolant to dissipate the frictional heat.

NOTICE

Material damage to single-acting mechanical seal.

High wear or destruction of the mechanical seal due to dry running of the pump.

- *Ensure supply of pumped liquid.*

The wear of the sliding surfaces is automatically compensated for by shifting. The undercarriage seal is therefore maintenance-free.

3.10.2 GRD cartridge - double-acting

The double-acting GRD cartridge requires a barrier fluid in the sealing chamber. A distinction is made between two designs:

Back-to-back design

Two single-acting mechanical seals are arranged opposite each other on the back side to form a double-acting mechanical seal.

Tandem design

Two single-acting mechanical seals are arranged one behind the other in their direction of action (oriented in the same direction) to form a double-acting mechanical seal.

The sealing of the sealing liquid against the product chamber (pumped medium) and the atmosphere is effected by a rotating sliding ring and a stationary counter ring. The lubricating film in the fluid-filled sealing gap between the sliding and counter rings on the product and atmosphere side is formed by the clean barrier fluid. Lubrication by the barrier fluid fulfils two important tasks. It reduces friction between the sliding ring and counter ring and acts as a coolant to dissipate the frictional heat. Product leakage into the atmosphere is excluded during normal operation.

As a rule, the pumps are delivered fully assembled with built-in hose nozzles for connecting the GRD cartridge to the buffer/seal pressure vessel. For certain designs, special designs or special quench media¹, however, it is possible that screw plugs have been used instead of hose nozzles for transport.

- Before putting the pump into operation, the screw plugs must be replaced with the hose nozzles supplied.
- Connect the double-acting GRD cartridge to the buffer/seal pressure vessel.
- If necessary, put the quench medium in the sealing chamber of the double-acting GRD cartridge under (required) pressure.

1

"Quench medium" or "quench" is the generic term for the buffer fluid or barrier fluid.



- The pressure of the sealing liquid must be approx. 1-2 bar or 10 % higher than the back pressure on the media side. The pressure is important for the contact pressure of the sealing surfaces.
- The sealing chamber must be vented before commissioning the pump.
- Make sure that the quench medium is compatible with the product.

3.10.3 Leakage

Leakage is the most important criterion for shaft sealing. The leakage of a shaft seal depends on many factors. Leakage is generally significantly higher during running-in than afterwards in uniform operation.

With many liquids, e.g. water, the low leakage evaporates and vaporises in the atmosphere. Even small leaks are unacceptable with toxic or environmentally-harmful liquids. In such cases, double-acting mechanical seals with a sealing liquid are standardly used.

Due to legal regulations, leaks must be constantly monitored to protect the environment. For maintenance or cleaning cycles, the monitoring of loss flushing in the form of a visual flow measurement or back pressure monitoring carried out by means of sensors is recommended. It is advisable to check for leaks at standstill if all secondary leakage possibilities are to be excluded. Defects on secondary seals or sliding surfaces are thus quickly visible. In principle, however, it is not possible to transfer the results of the standstill tests to operating conditions. In order to prevent a leakage situation, it is important to regularly check and/or replace the visible O-ring of the GRD cartridge during maintenance and inspection intervals or repairs.

Possible causes of failure mechanical seals	
Dry run	Thermal shock load
Counter ring installed obliquely	Mechanical shock load
Deposits on sliding surfaces	Wear of the sliding surfaces
Dirt, oil or grease on sliding surfaces	Corrosion on sliding surfaces or springs
Improper installation	Axial misalignment
Pump affected by vibrations - lack of stiffness of the pump foundation	Tensile, compressive and bending loads on the pipe connections
Structure of a product layer in front of and/or below the secondary seal	Damaged/destroyed secondary seals
O-ring of the secondary seal hangs on the mating sliding surface after a longer rest period when the pump is started up.	

Tab. 12: Possible causes leading to failure or excessive leakage of the mechanical seals



3.10.4 Shaft sealing accessories - buffer reservoir

Double-acting mechanical seals or double-acting GRD cartridges can be supplied with a buffer reservoir. They serve as buffer reservoir² (pressureless) for the quench medium on site.

The buffer reservoir is only intended to perform the tasks specified in the data sheet. Any other or further use is not considered as intended. The operating and design data or other information are listed in the data sheet.

A sight glass for level monitoring, a refill opening and connections are fitted to the container as standard.

The return connection (from the mechanical seal to the buffer reservoir) is made via the connections on the side of the buffer reservoir. The seal supply connection (inlet from the buffer reservoir to the mechanical seal) is attached to the bottom of the buffer reservoir. The liquid exchange between the buffer reservoir and the mechanical seal is effected by a natural thermal convection flow³.

These connections can be used for checking and cleaning. Depending on customer requirements, the buffer reservoir can be equipped with connections for additional equipment (pressure, temperature and/or level indicator/level switch) after consultation with the pump manufacturer.

The buffer reservoir is delivered as a complete unit. Accessories are, if possible, pre-assembled. A quench medium is not filled in - this must be filled in and adjusted by the customer/fitter on site. Make sure that the buffer fluid suitable for food or compatible with the product. The purpose of the quench medium (buffer liquid) is to lubricate, cool or heat the inner mechanical seal and to flush out primary leakage.

NOTE

Thermal convection current:

- The liquid exchange between the buffer reservoir and the mechanical seal is effected by a natural thermal convection flow, which transports particles in the form of thermal energy. The cause of this circulation is a temperature gradient or the resulting difference in density.*

Friction on the sliding and counter rings generates heat, which is absorbed by the quench medium in the sealing chamber. This heats up and the density of the quench medium decreases. This generates a buoyancy flow that conveys the quench medium from the sealing chamber to the buffer/seal pressure vessel. Heat is released back into the environment on the way to the buffer/seal pressure vessel and in the buffer/seal pressure vessel. The temperature drops or the quench medium cools down, whereby the density increases again.

The cooler and denser quench medium in the buffer/seal pressure vessel sinks and is fed back to the seal via the seal supply connection. The convection circuit is closed.

2 The liquid is called a buffer fluid if its pressure is lower than the process pressure (pressure of the product before the internal mechanical seal).

3 In technical literature/Internet, natural thermal convection flow is also known under the mistakenly used term "thermosiphon" or "thermosiphon principle". In the actual "thermosiphon principle", the effect of a siphon (as it is known in the curved form under a wash basin) is used to reduce or avoid the cooling of e.g. a boiler. The warm water collects on the upper pipe section of the siphon, the colder water collects on the lower bend of the pipe. This reduces or completely interrupts the natural convection flow. This effect of reduced or completely interrupted convection flow is just not desired in the buffer/seal pressure vessel.

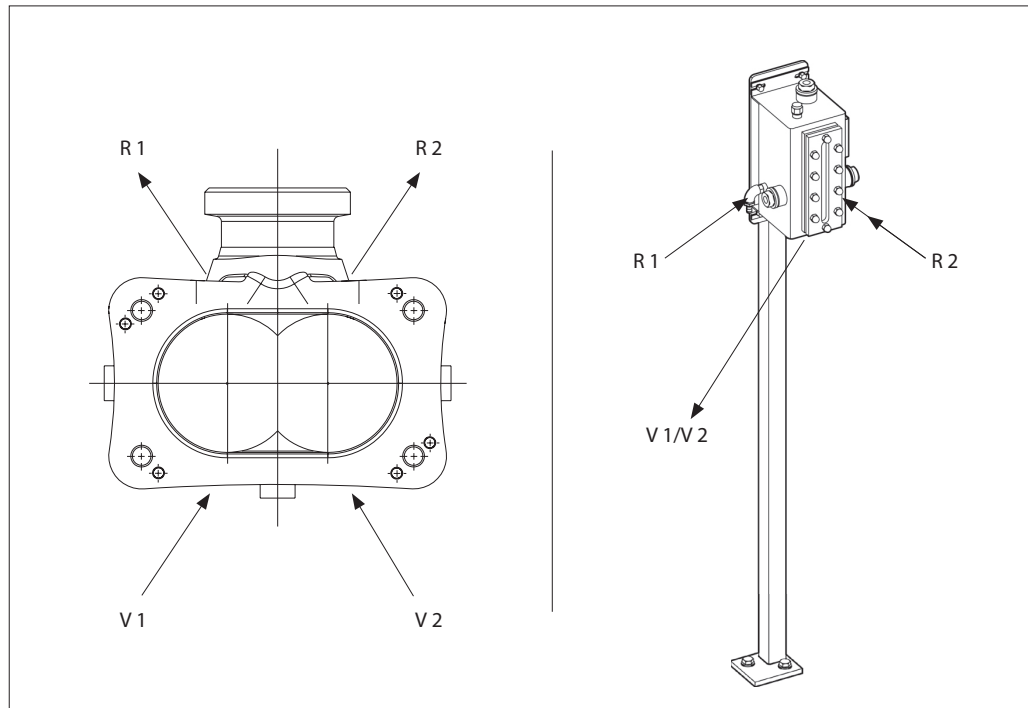


Fig. 5: Quench medium connections for mechanical seals on the housing of the WANGEN Twin NG and buffer reservoir. Supply connection V1 and V2 (from the receiver tank to the mechanical seal) and return connection R1 and R2 (from the mechanical seal to the buffer reservoir)

3.10.5 Accessories for shaft seals – seal pressure vessels

Buffer reservoirs that can be pressurised are called "seal pressure vessels". Double-acting mechanical seals or double-acting GRD cartridges can be supplied with a seal pressure vessel. They serve as storage containers for the sealing liquid⁴ (quench medium) on site.

The applied seal pressure should be set 1 to 2 bar or approx. 10 % higher than the pressure prevailing in the pumped medium. Any pressure fluctuations that occur must also be taken into account here.

The purpose of the quench medium (sealing liquid) is to lubricate, cool or heat the inner mechanical seal and to minimise leakage.

Refer to chapters and "3.10.4 Shaft sealing accessories - buffer reservoir" chapters "7.9 Maintenance shaft seals" for information on the function, connection and filling of the seal pressure vessel.

4 The liquid is called barrier fluid or pressurised barrier fluid if its pressure is greater than the process pressure (product pressure upstream of the internal mechanical seal).

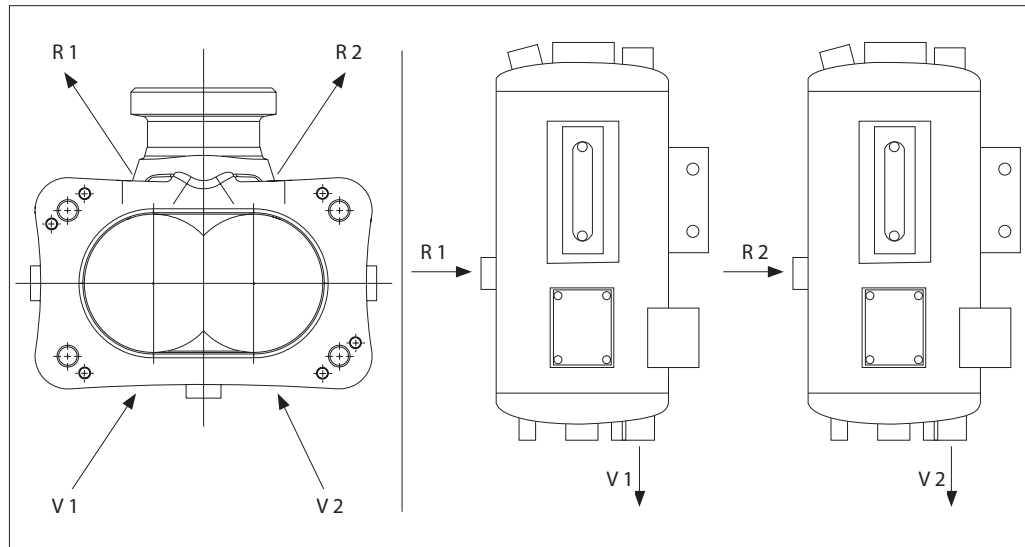


Fig. 6: Quench medium connections for mechanical seals on the housing of the WANGEN Twin NG and seal pressure vessels (using the Chetra 6 LSK as an example). Supply connection V1 and V2 (from seal pressure vessel to mechanical seal) and return connection R1 and R2 (from mechanical seal to seal pressure vessel). The direction of the arrow indicates the correct flow direction of the quench medium. Each GRD cartridge of the WANGEN Twin NG 180 must be connected to its own pressure vessel.

NOTICE

Each double mechanical seal/GRD cartridge of the WANGEN Twin NG 180 must be connected to its own pressure vessel.

- Each seal can thus be optimally supplied and cooled.
- Each seal can be individually monitored via pressure switch, level switch and temperature display.
- If a defect occurs in the seal, it can be traced back to the corresponding seal.
- When installed correctly, a natural convection current is generated.

3.10.6 Installation of buffer and seal pressure vessels:

- According to DIN EN ISO 21049, the buffer /seal pressure vessel must be mounted with a support approx. 1 - 2 m above - max. 1 m to the side of the pump. Instead of using a support, the buffer/seal pressure vessel can also be mounted on the wall.
- The connection between the buffer/seal pressure vessel and the mechanical seal is made with hoses or pipes (preferably made of stainless steel) depending on temperature and quench medium.
- The supply and return lines must have a minimum nominal diameter of 8 mm; they must not show any bends or constrictions - ideally make bends in 45° with a radius of > 100 mm.
- Each seal on the WANGEN Twin NG 180 must be connected separately to a buffer/seal pressure vessel to provide a natural convection flow.
- For forced convection flows with cooling, e.g. by an external pump or water management system, the seals can be connected in series. The distance between the buffer/seal pressure vessel can then be smaller.



- No significant additional stresses such as vibrations or connecting forces must act on the buffer/seal pressure vessel or mechanical seal.
- Observe the permissible pressure and temperature specifications on the nameplate and data sheet.

NOTE

- *It is recommended to cool the sealing chamber/quench medium by an external cooler or by a seal pressure vessel with integrated cooling coil - not to increase the sealing chamber pressure - if the temperature of the quench medium in the sealing chamber exceeds the boiling temperature under atmospheric pressure.*

NOTICE

Supply and return lines must be continuously falling or rising. Hose connections must not form a wave or sag.

Elimination of convection currents by unintentional thermosiphon effect².

- *Natural convection current is interrupted.*
- *Cooling of the quench medium no longer takes place or is severely restricted.*
- *The temperature of the quench medium at the gap inlet of the seal must be sufficiently far below the quench medium boiling temperature when the sealing chamber pressure is applied.*
- *High speeds can generate steam or gas bubbles in the sealing chamber. When the total critical bubble volume is exceeded, they lie in front of the gap inlet of the mechanical seal and block the access of the quench medium to the gap.*
- *Mechanical seal is no longer sufficiently lubricated and cooled.*
- *Dry running of the mechanical seal possible - mechanical seal is destroyed.*

3.10.7 Quench medium: Buffer fluid - barrier fluid

The quench medium must meet various requirements:

- Cooling
- Lubrication
- Food and product compatibility.

Only quench media suitable for foodstuffs are used in the factory. Quench media must be renewed and replaced at regular intervals.

The quench media used must not exceed the boiling point or must be operated far below the boiling point - they must not start to "boil". At the boiling point (at given pressure conditions) the liquid phase changes into the gaseous phase. The boiling point depends on the molar mass of a substance and the strength of the binding forces.



Examples of quenching media used at the factory and their properties:

Quench medium	distilled water	(pipe) water
pos. characteristic	very good cooling	very good cooling
neg. characteristic	poor lubrication	poor lubrication
boiling point <small>at 1013.25 hPa</small>	100 °C	100 °C
uninterrupted operation	evaporates, regular refilling	evaporates, regular refilling
food compatibility	yes	yes

Tab. 13: Quench medium: Distilled water and (pipe) water

If the quench medium used in the mechanical seals exceeds the boiling point, (gas) bubbles form and the lubrication of the mechanical seal is hindered or completely prevented.

Quench medium	Glycerin-water mixture	Glycol-water mixture
Pos. characteristic	good cooling and lubrication	good cooling and lubrication
azeotropic mixture	yes	yes
boiling point (pure substance) <small>at 1013.25 hPa</small>	Glycerine 290 °C; decomposes	Glycol 190 °C
boiling point substance-water mixture	boiling point is significantly lower - note boiling point curve	boiling point is significantly lower - note boiling point curve
observe substance ratio	yes	yes
during continuous operation	water evaporates, regular refilling	water evaporates, regular refilling
area of application	up to max. 150 °C	up to max. 150 °C
food compatibility	yes	yes

Tab. 14: Quench medium: Azeotropic mixtures of substances



Requirements for quench medium:	(pipe) water
The tap water used as quench medium should meet the requirements of the Drinking Water Ordinance (TrinkwV).	
The responsible operator is required to ensure the proper operation of the drinking water installation including the necessary maintenance of the drinking water installation.	
The responsible operator must be aware of the risks that may result from the operation of the drinking water installation.	
The prerequisite for compliance with hygiene requirements is a hygienically-perfect delivery condition of both the purchased drinking water and all components of the drinking water installation.	
The generally accepted rules of technology must be observed. These are aimed at protecting human health from the adverse effects that can result from water pollution.	
Impairments can result from microbiological, chemical and/or physicochemical changes in drinking water.	
Water hardness	max. 10 °dH *1
*1 1 °dH (German hardness) corresponds to 0.1783 mmol/l CaCO ₃ or 0.357 meq/l	
A higher CaCO ₃ - or MgCO ₃ -content leads to lime precipitates under unfavourable operating conditions, which can cause increased wear and/or failure of the mechanical seals. Increased wear already occurs at a particle size of 2 - 5 µm. Precipitates of this particle size can settle on the seal gap of the mechanical seals.	

Tab. 15: Requirements for the quench medium (pipe) water

Some of the quench media used are so-called azeotropic mixtures. In azeotropic mixtures (e.g. water-glycerin) the boiling temperature of the mixture is lower or higher than the boiling temperature of the pure starting components at a certain molar ratio (and given pressure). These relationships are shown in phase diagrams or boiling point curves. In azeotropic mixtures, the boiling point curves are usually determined empirically.

Below some usable quench media with their properties are listed:

The operator of the system must determine which quench medium is used.



3.11 Optional accessories

3.11.1 Accessories for buffer and seal pressure vessels

Optionally available accessories for buffer and seal pressure vessels	
external pump	Is connected between the GRD cartridge and the buffer/seal pressure vessel. This forces convection flow - convection flow results from pressure differences. GRD cartridges can thus be connected in series. The distance between the buffer/seal pressure vessel 1 - 2 m above the pump can be smaller.
external cooling/heating coil	For cooling/heating up the quench medium.
buffer/seal pressure vessel with integrated cooling/heating coil	Or cooling/heating up the quench medium inside the buffer/seal pressure vessel.
heat exchanger	For cooling the quench medium.
water management system	For setting the optimum flow rate of mechanical seals.
manual refill pump	For filling the quench medium during operation - even in pressurised systems. Avoidance of unnecessary downtimes.
Accessories must be mounted in accordance with the operating instructions enclosed.	

Tab. 16: Optionally available accessories for buffer and seal pressure vessels

3.11.2 Pump accessories

Optional accessories	
speed measuring device	pressure indication
dry-running protection device	fill level indicator
temperature sensor and temperature display	level switch
Accessories must be mounted in accordance with the operating instructions enclosed.	

Tab. 17: Optional pump accessories



4. Directional flow of the medium

The flow direction of the medium depends on several factors (see Fig. 7):

- Direction of rotation of the drive of the screw spindle pump.
- Nozzle orientation of the pump casing.
- Position pins arranged on the pump housing.
- Spindle orientation.

The interaction of the 4 factors results in the delivery direction of the medium to be transported (see Fig. 7, Fig. 8 and Tab. 18) and thus also the pressure or suction side.

4.1 Direction of rotation of the screw spindle pump drive

The direction of rotation of the pump drive determines the delivery direction. The direction of rotation is indicated in the data sheet and on the pump nameplate. The conveying direction is always towards the pressure side.

The direction of rotation of the screw spindle pump drive can be done as follows:

- left
- left and right
- right.

4.2 Nozzle orientation of the pump casing

The nozzle orientation of the pump housing is in the installation position

- Position "UP" or
- Position "DOWN".

4.3 Position pin arrangement on pump housing

NOTICE

Possible damage to property.

- *An incorrect combination of position pin arrangement and direction of rotation of the pump will cause damage to the pump casing and spindles.*
- *The correct arrangement of the position pins, direction of rotation, spindle orientation and housing socket position is specified in the data sheet.*

Loss of performance.

- *An incorrect nozzle orientation in relation to the spindle orientation leads to performance losses in pump operation.*

The arrangement of the position pins on the pump housing must only be carried out in the approved positions.

- Position X
- Position Y or
- Position Z

are carried out. These are marked in colour.



Nozzle orientation of the pump casing		Orientation "UP" or Orientation "DOWN"	
Position pin arrangement on pump housing		Permissible arrangements of the position pins:	
		Yellow	= Position X
		Black	= Position Z
		Green	= Position Y
UP			
DOWN			
		Position of housing connection piece	
		UP	DOWN
Direction of rotation of the drive or drive spindle	left		Position X
	left/right		Position Z
	right		Position Y
		Position X	Position Y
		Position Z	Position Z
		Position Y	Position X

Fig. 7: Relationship between the direction of rotation of the drive, the nozzle orientation of the pump casing, the arrangement of the positioning pins on the pump casing and the delivery direction of the medium to be transported.

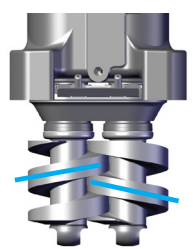
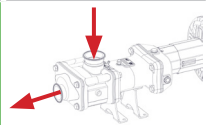
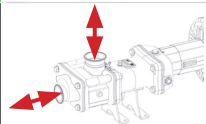
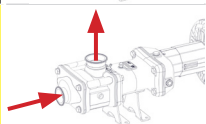


4.4 Spindle orientation

The spindles of the drive and output can be mounted in two orientations to each other:

- A spindle orientation (see Fig. 8) and
- B spindle orientation (see Tab. 18).

The conveying direction of the medium is determined by the interaction of the spindle orientation with the nozzle orientation, the direction of rotation of the drive and the arrangement of the positioning pins.

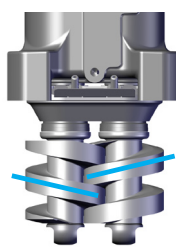
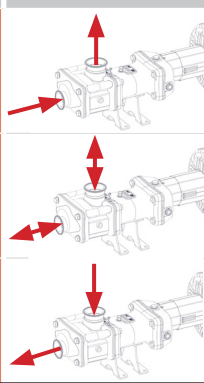
Construction size #180	A - Spindle orientation				
	DN 125/5"		DN 200/8"		
Nozzle connection size on the pump housing	Nozzle orientation on the pump housing permissible		Nozzle orientation on the pump housing		flow direction
Rotational direction Drive	up	down	impermissible up	permissible down	
left	Pos. X	Pos. Y	--	Pos. Y	
left/right	Pos. Z	Pos. Z	--	Pos. Z	
right	Pos. Y	Pos. X	--	Pos. X	

Pin position

-- impermissible nozzle orientation

Fig. 8: A spindle orientation: Connection between the direction of rotation of the drive, permissible / impermissible nozzle orientation of the pump housing in conjunction with the nozzle port size, position of the dowel pins on the pump housing and the resulting conveying direction of the medium to be transported.



Construction size #180	B - Spindle orientation					
	Nozzle connection size on the pump housing	DN 125/5"		DN 200/8"		
	Nozzle orientation on the pump housing permissible		Nozzle orientation on the pump housing		flow direction	
Rotational direction Drive	up	down	permissible up	impermissible down		
left	Pos. X	Pos. Y	Pos. X	--	Pin position	
left/right	Pos. Z	Pos. Z	Pos. Z	--		
right	Pos. Y	Pos. X	Pos. Y	--		
<div style="display: flex; align-items: center;"> <div style="width: 20px; height: 10px; background-color: #c00000; margin-right: 5px;"></div> -- impermissible nozzle orientation </div>						

Tab. 18: B spindle orientation: Connection between the direction of rotation of the drive, permissible / impermissible nozzle orientation of the pump housing in conjunction with the nozzle port size, position of the dowel pins on the pump housing and the resulting conveying direction of the medium to be transported.



5. Commissioning and decommissioning

5.1 Before pump commissioning

NOTE

- Before commissioning, observe the safety instructions in chapter 1.
- Before commissioning, observe chapter 4.

The pumps of Pumpenfabrik Wangen GmbH are normally delivered completely pre-assembled from the factory. All fluids for filled joints, mechanical seals or grease lubrication of roller bearings or ball bearings are available. In the event of adverse weather conditions (e.g. winter), the sealing unit is not supplied with a liquid consisting of water (see data sheet; see chapter "5.1.2 Sealing unit").

Before (initial) commissioning:

- Check pump and pump parts for damage (visual inspection).
- Clean pump and accessories before first use.
- Safety devices (covers, limit switches, safety valve, level indicator, etc.) properly installed and tested for function.
- Check the information on the pump name plate for compliance with the information for the area of application.
- Check for firm locking with base plate or provided device.
- Check for fully opened pressure side valves and gate valves.

5.1.1 Bearing/gear housing

- Check the vent screw on the bearing housing for correct seating (see chapter "9.11 Bearing for input and output shaft").
- Check oil level at gear unit housing and top up if necessary through screw plug (see chapter "9.10 Gearbox").

5.1.2 Sealing unit

As a rule, the pumps are delivered with a built-in bleed screw.

For certain designs, custom-made products or special sealing media, however, it is possible that the GRD cartridge has been fitted with a screw plug for transport.

- Before putting the pump into operation, the screw plug in the GRD cartridge must be replaced with the supplied vent screw. The vent screw must be fitted at the highest point of the GRD cartridge (depending on the installation position of the pump).
- Connect double-acting mechanical seal to barrier pressure vessel (inlet and outlet through connections on housing ring). If necessary, replace the screw plug on the seal receptacle with the supplied hose nozzles.
- Check the shaft seal ring of the double mechanical seal for correct filling: Quench medium (see data sheet) and level.
- If necessary, place the quench medium in the sealing chamber of the double-acting mechanical seal under the required pressure using the barrier pressure vessel.
- The pressure of the sealing liquid must be approx. 1-2 bar or 10 % higher than the back pressure on the media side.
- The sealing chamber must be vented before commissioning the pump.
- Make sure that the quench medium is compatible with the product.



NOTICE

Damage to mechanical seal/shaft seal during commissioning after prolonged downtime.

Destruction of seals due to gumming/lack of lubrication.

- *When commissioning the pump after a long period of downtime, turn the screw spindles manually to lubricate the seals.*
- *Start the pump slowly (low speed range).*

NOTICE

Material damage to the double mechanical seal.

Destruction of the sealing unit due to lack of quench medium.

- *Double mechanical seals must be connected to a seal pressure supply.*
- *Ensure supply of quench medium.*
- *Vent the sealing chamber.*
- *Seals on the product and atmospheric side must be covered or lubricated with the quench medium.*

5.1.3 Template/barrier pressure vessel

- see chapter "7.9 Maintenance shaft seals"
- see chapter "7.10 Maintenance of buffer/seal pressure vessel"
- Check for damage.
- Check for leaks (especially after prolonged storage).
- Rinse the receiver/barrier pressure vessel to remove any impurities.
- Function control of the additionally installed measuring instruments and monitoring units.
- Fit mechanical seal supply connections and return connections.
- Open any existing shut-off valves completely.
- Fill the quench medium into the pressure vessel; observe the filling level.
- Vent pipes and sealing chamber.
- Set the sealing pressure for the double-acting sealing unit on the sealing pressure vessel: 1 - 2 bar or 10 % above operating pressure (see data sheet).
- When using additional devices with three-phase current, ensure that the correct direction of rotation and thus the correct flow direction of the quench medium is set. The pipe, which becomes warm during commissioning, must lead to the return connection of the receiver/seal-off pressure vessel.



5.2 Pump commissioning

Ensure during commissioning:

- Check the direction of rotation of the pump for correct setting.
- Pump filled with pumped medium.
- Check the delivery direction of the medium for correct flow direction.
- Run pump at nominal pressure - operational settings (see data sheet).
- Check the pump and pipes for leaks.
- Fully open valves/sliders on the pressure and suction side.
- If necessary, create commissioning protocol.

NOTICE

Closed pressure line.

The screw spindle pump is a positive displacement pump which can build up a very high pressure. The developing pressure with the delivery line shut can reach the multiple of the permissible system pressure.

- *Severe damage to facility components.*
- *Danger to persons.*
- *Do not operate the pump against closed pressure lines.*
- *Install overpressure protection device.*

5.3 Decommissioning/dismantling pump



⚠ DANGER

During operation, the pump has live, pressurised, rotating or moving machine parts.

Death or severe injuries.

- *The machine must only be taken out of service by qualified personnel.*
- *Ensure that the unit is de-energised and secured against unintentional reconnection.*
- *Only carry out the necessary work when the pump is at a standstill.*
- *Ensure that the pump and auxiliary systems are depressurised before opening.*

To shut down the pump, the following steps must be carried out:

- Close valves and sliders on pressure and suction side.
- Drain pump, collect leaking fluid and dispose of properly.
- Let pump cool.
- Disconnection of the electrical system by qualified personnel.
- Observe the regulations of the drive unit manufacturer.
- Thoroughly clean the pump immediately, especially if:
 - It is a food pump
 - the pumped medium tends to settle/cool down
 - the medium to be pumped cures by chemical reaction
 - if the pump is to be stored outdoors and the pumped medium may freeze due to weather conditions.



- Shut down and disassemble the pump.
- Remove connections from auxiliary systems and accessories (receiver/barrier pressure vessel, temperature sensor, pressure sensor, etc.).
- Collect leaking quench medium and dispose of it properly.
- If necessary, drain gear oil and dispose of properly.
- Remove the pump from the piping system.
- Install suitable intermediate parts in the system.
- Open the pump cover to dry.
- Store the pump and pump parts in a dry place and protect them from direct environmental influences.

5.4 Send pump for repair

Before the pump can be sent for repair, the following steps must be carried out:

- Drain the pump completely and clean it thoroughly.
- Close all openings.
- Send pump with completed decontamination declaration to the manufacturer Pumpenfabrik Wangen GmbH. The decontamination declaration is available on request from Pumpenfabrik Wangen GmbH.
- To improve coordination of work, inform the manufacturer in advance of shipping.

Pumpenfabrik Wangen GmbH
Simoniusstr. 17
D - 88239 Wangen im Allgäu

Telephone:
Fax:
Email:

+49(0)7522/997-0
+49(0)7522/997-108
spareparts@wangen.com

NOTE

- *Repair work is only carried out with the decontamination declaration at hand.*
- *The decontamination declaration is available on request from Pumpenfabrik Wangen GmbH.*



WARNING

Improper handling of the pump during transport.

Personal injury due to falling and/or tilting load.

- *Observe the centre of gravity and the maximum weight of the load.*
- *Only use suitable slings.*
- *Only use attachment points provided.*



6. Cleaning method for screw spindle pumps

6.1 Overview of cleaning processes

Hygienic aspects are of immense importance for pumps designed to deliver food¹ - such as the WANGEN Twin NG. Pumps must be clean before commissioning and before each production run. How the system/pump is to be cleaned depends on the type of pumped medium and its production conditions.

The efficiency of cleaning is largely determined by the mode of action of mechanical, chemical and thermal processes and depends on the type of soiling. Knowledge of bacteria (e.g. occurrence, structure, vegetative reproduction and spore formation); acids/alkalis and cleaning agents, the combination of which or how these can be optimally coordinated, is decisive for the success of the cleaning.

NOTE

Several options are available for cleaning the pumps:

- COP (Cleaning Out of Place) procedure (see Annex).
- CIP cleaning process (Cleaning In Place).

and in addition:

- SIP sterilisation process (Sterilisation In Place).

A reproducible cleaning process is determined on the basis of the operational requirements - cleaning agents to be used, pressure, temperature, (persistence) time, concentration and flow speed. COP/CIP cleaning and SIP sterilisation processes can be optimised by validation and by close observation and documentation of the process(es). Cleaning must be carried out safely, as very strong chemical cleaning agents are standardly used, which can endanger persons, the environment or the machine.

NOTE

- *The correlations between cleaning efficiency/sterilisation and microorganisms are described in more detail in the Annex to these operating instructions.*
- *For all cleaning/sterilisation processes, the operator of the system/pump is responsible for ensuring successful cleaning.*
- *Almost every company has developed its own CIP cleaning process/SIP sterilisation process, which is specially adapted to the medium being pumped.*
- *In the event of doubt, contact the pump manufacturer WANGEN Pumpen and make sure that the pump is suitable for the selected cleaning procedure.*

1 The term "food" is used in these operating instructions to refer to food/beverages and dairy products in general.



6.2 CIP cleaning process in general

In the CIP (Cleaning In Place) process, the pump and associated piping are cleaned on site without disassembling them. In process engineering facilities, the CIP cleaning process runs fully automatically - the production process is switched over to the cleaning process. The cleaning process is carried out in steps defined by the facility operator (see chapter "6.4 Procedure of a CIP cleaning/SIP sterilisation process"). The cleaning fluid flows through the system in a cleaning circuit. Potential hazards or contaminations can be avoided by following the CIP cleaning procedure (and validation).

This cleaning process must be carried out:

- Before the pump is used for the first time.
- Between two production runs or batch change.
- After installation of new spare parts which come into contact with the medium.
- After operations, i.e. before prolonged standstill.
- After long standstill, before recommissioning.

The relevant parameters that are relevant for the cleaning effect are explained in more detail in the annex.

6.3 SIP sterilisation process

The SIP sterilisation process (Sterilisation In Place) is an extension of the CIP cleaning process by an additional stage - sterilisation. The sterilisation of the pump/facility is usually carried out through the same circuit as the CIP cleaning process.

The sterilisation or SIP sterilisation process begins after the COP/CIP cleaning process has been completed. Surviving microorganisms are killed in the pump/facility according to the current state of the art with the help of saturated pure steam at high temperatures. The cleaning effect can be increased by adding chemical disinfectants (usually on an acid basis). Drying with sterile air then takes place.

NOTE

General information about sterilisation.

- *The CIP cleaning procedure must be successfully applied before sterilisation begins - this reduces the (initial) number of microorganisms.*
- *During sterilisation, only certain microorganisms are removed, and only to a certain extent.*
- *During a sterilisation process, the same conditions must prevail at every point of the pump/facility.*
- *There is no universal sterilisation procedure. The choice of method depends on the type and extent of microbial contamination*
- *A maximum of 99 % disinfection can only be achieved. Complete certainty that after a certain heating period all microorganisms have been killed due to sterilisation cannot be achieved.*



6.4 Procedure of a CIP cleaning/SIP sterilisation process

Temperature setting:	to be specified by the operator
Time limit:	to be specified by the operator
Turbulent flow speed vs. <small>optimal</small> :	1.5 - 2.1 m/s
Concentration	to be specified by the operator/observe the instructions of the detergent manufacturer

CIP cleaning process

1. The production cycle, e.g. between two production runs, is normally completed by rinsing the pump and pipes with (drinking) water at the start of the cleaning process.
 - Removal of product residues (structural dirt and dirt cover).
 - Temperature range: normally 10 - 20 °C, max. 70 °C
2. Alkaline rinsing with NaOH,
 - Dissolving of sugar, grease, proteins, adhesive dirt.
 - Concentration target: 1 - 2 wt. %.
 - Temperature range: 60 - 80 °C
 - Time: 10 - 20 min
3. Intermediate rinsing with (drinking) water
 - Rinse out lye and dissolved dirt.
 - Temperature range: max. 70 °C
 - Time: 5 - 10 min
4. Rinsing with acid cleaner (HNO₃ or H₃PO₄)
 - Removal of mineral deposits and limescale deposits caused by hard water. Rinsing with acid cleaner can be done several times.
 - Concentration target: 0.5 - 1.5 % by weight
 - Temperature range: 50 - 70 °C
 - Time: 5 - 10 min
5. Flushing with drinking water
 - Rinse out acid and dissolved dirt.
 - Temperature range: normally 10 - 20 °C, max. 70 °C
 - Time: 5 - 10 min

SIP sterilisation process (see chapter "6.3 SIP sterilisation process")

6. sterilisation
 - If necessary.
 - Killing of all remaining microorganisms by saturated pure steam (or hot water).
7. Rinsing with drinking water
 - If necessary.
 - It must be ensured that all cleaning agent residues have been removed.
 - Only drinking water may be left in the pump/system.
 - Recontamination due to inadequate water quality must be ruled out.
8. Drying with hot air
 - If necessary.



6.5 Cleaning of sealing materials (elastomers)

The CIP cleaning process/SIP sterilisation process causes strong clogging of the elastomers. So the cleaning agents used must be matched to each other with regard to the concentration of acid/alkaline, exposure time and temperature.

The suitability of the cleaning agents used must be considered for the respective application. Other conditions may also be suitable in consultation with the sealant and cleaning agent manufacturer.

The occurrence of prematurely worn elastomeric sealing materials (e.g. O-rings) can have the following causes:

- Frequent product changes.
- Too high detergent concentration (motto: "A lot helps a lot").
- Temperatures too high.
- Too long exposure times of the cleaning chemicals (e.g. stand disinfection over the weekend).
- The "wrong" combination of cleaning procedure, detergent concentration, temperature and exposure time (see e.g. DIN 11483-2).
- Demand for shorter cleaning intervals, therefore use "sharper" cleaning agents.
- Replacement of old seals by "wrong" new ones (substitution products of unknown origin or other seal types).
- Use of replacement seals that have already been damaged by prolonged or improper storage (ageing processes).

Damage to seals and O-rings must therefore be subjected to careful analysis in order to correctly assess and avoid defects in the use or treatment of sealing materials.

The following points should be observed for damage prevention:

- Damage prevention with regard to sealing materials is already carried out in the planning phase by Pumpenfabrik Wangen GmbH. Due to intensive consultation, suitable sealing materials are recommended and used in the pump, depending on the application.
- Ordered stockpiling of original replacement seals and original O-rings is recommended.
- Detailed documentation of maintenance work should be a matter of course: The replacement of used or damaged sealing materials must be traceable. The procurement of replacement material must be based exactly on the specifications of the original parts, otherwise there may be unpleasant surprises.
- In the event of doubt regarding detergents and seal materials, seek the advice of seal manufacturers and suppliers of detergents and disinfectants. Manufacturers and the above-mentioned suppliers dedicate themselves to this matter in close cooperation and make their know-how available.
- Sealing components and O-rings are to be regarded as wearing parts that do not have eternal durability and reusability, especially due to their high mechanical stress.
- Seals should therefore be replaced as a precaution during normal maintenance intervals.
- The costs for sealing components and O-rings have no noticeable influence when carrying out maintenance work.



6.6 Specifications for WANGEN Pumps - SIP sterilisation process

NOTICE

Pump damage.

- *The WANGEN pump used for the SIP process must be designed and approved for this purpose (see data sheet).*

Disclaimer:

- *In the event of non-compliance with this requirement, the manufacturer of the pump will not assume any liability or warranty/claims for defects in the event of damage.*

NOTE

- *Pumps which are connected to a SIP sterilisation process must be equipped with a pressure monitoring device which switches off the system immediately in the event of a pressure drop of 0.5 bar.*
- *After a pressure drop, the system must be re-sterilised (see chapter "6.6.1 Pressure drop in SIP sterilisation process").*

NOTICE

Possible damage to property due to exceeded temperature during the SIP sterilization process

- *Special features (cleaning agents, temperature) regarding the material resistance must be observed.*
- *Temperatures in the SIP sterilisation process must not exceed the following limits depending on the elastomers used:*
 - **Elastomers with NBR:** $T_{max.}: 110\text{ °C}$
 - **Elastomers with EPDM:** $T_{max.}: 121\text{ °C}$
 - **Elastomers with FPM/FKM:** $T_{max.}: 135\text{ °C}$.
- *Liability on the part of the pump manufacturer for material damage or consequential damage due to the use of excessively high temperatures or disregard of the material resistance of the cleaning agents used in the SIP sterilisation process is excluded.*

The pump/facility operator is responsible for validating the effectiveness of the SIP sterilisation process. The following points list only some aspects of the procedure that require particular attention:

- The entire pump/facility system is heated using saturated (ultrapure) steam.
- The introduction of (ultrapure) steam into the pump/facility system must be carried out in such a way that air inclusions are excluded. Air inclusions create an air cushion, which means that sterilisation in this area is inadequate. The air or air inclusions must be reliably removed from the system.
- Suitable aids for the discharge of condensate must be used in the system to prevent water accumulation. WANGEN pumps do not have their own condensate drain.



- The (ultrapure) steam must be condensate-free. Moisture favours microbial growth.
- At the end of the SIP sterilisation process, sterile air or nitrogen (or other suitable gases) must be introduced at a defined overpressure to replace the collapsing steam due to rapid cooling. It is important to establish this exchange in order to prevent the generation of a vacuum.
 - The creation of a vacuum causes a pressure drop in the system.
 - A vacuum would again attract microorganisms through the ambient air after completion of the process.
 - Rapid cooling must be avoided in order to avoid creating conditions that could lead to steam collapse.
 - The use of compressed air can reduce the risk of vacuum. When compressed air is used, it must be free of water, oil and particles.
 - If a pressure drop is detected, the pump must be sterilised again (see chapter “6.6.1 Pressure drop in SIP sterilisation process”).
 - Sterile air or nitrogen is used for cooling and drying the pump/facility system.
 - The defined overpressure is important for maintaining sterility until the new production is activated. This effectively prevents contamination by microorganisms penetrating the closed system.
- The steam must be free of particles such as rust or limescale deposits.
- Temperature sensors must be placed on the pump/system to monitor the sterilisation conditions - a temperature of 121 °C must be maintained at all points for 20 minutes for the sterilisation process.
- During sterilisation, temperature and pressure must be kept constant for the above reasons.
- It must be ensured that the cleaning agents used in the CIP cleaning process can be safely separated from the SIP sterilisation process. Recontamination with cleaning agents of an already cleaned and sterilised pump/pipeline must be excluded.

6.6.1 Pressure drop in SIP sterilisation process

After a pressure drop in the SIP sterilisation process, the WANGEN pumps must be sterilised in accordance with the following specifications.

Duration t:	10 - 30 min
Steam pressure p_{Steam} :	2.2 - 3.2 bar
Maximum temperature:	
• Elastomers with NBR:	$T_{\text{max.}}$: 110 °C
• Elastomers with EPDM:	$T_{\text{max.}}$: 121 °C
• Elastomers with FKM:	$T_{\text{max.}}$: 135 °C
Drying T_{min} :	83 °C
Duration T_{min} :	20 min



6.7 Specifications WANGEN Pumps - Cleaning external surfaces

The application conditions for cleaning the external surfaces of WANGEN pumps depend on the type and degree of soiling.

NOTE

- *Observe the recommendations of the cleaning manufacturer - especially the recommendations for concentration of the cleaning agent.*

The outer surfaces of the WANGEN pumps must be cleaned as follows:

- Rinse external surfaces with water. Temperature: ~40 °C²
- Use commercially available alkaline foam cleaner (with food approval).
 pH value: pH > 7
 Concentration: 2.0 to 5.0 %
- Spray the pump with alkaline foam cleaner and let it act.
 Contact time: 5 to 20 min
- Remove foam cleaner with hot water.
 Temperature: max. 100 °C
- Clean with a steam jet until impurities are removed.
 Pressure: low to medium
 Nozzle/pump distance: 200 - 300 mm
- Clean stubborn dirt using a soft brush or a soft plastic scraper.

2 Water temperature > 60 °C must be avoided, as natural proteins are denatured at this temperature and are much more difficult to remove.



7. Service and maintenance



DANGER

Danger of being pulled in due to rotating machine parts and danger due to unintentional restarting of the pump.

Death or severe injuries.

- *Do not perform any work while the pump is running.*
- *Disconnect the connection to the power supply.*
- *Switch off and lock the main switch.*

7.1 Maintenance after commissioning

After 50 hours (operating hours¹), all screw connections (screw connections, pipe connections, installation and fastening) of the pump or pump unit must be checked and, if necessary, retightened - then checked weekly.

7.2 Inspection and maintenance instructions - general

The wear on the pump is significantly influenced by different media and pressure specifications. The required inspection and maintenance intervals must be adapted to the specific system (see Tab. 19 and Tab. 20).

Before starting maintenance work, the pump must be completely emptied and cleaned.

NOTE

- *When opening the pump, observe the regulations for handling the pumped medium.*

7.3 Notes on service and maintenance

The WANGEN Twin NG pumps are designed in such a way that impermissible contamination, e.g. by microorganisms, is largely avoided. The operator is responsible for examining the hazards and carrying out the necessary tests and maintenance in order to reduce the risks.

The inspection and maintenance intervals are adapted to the hygiene requirements of food pumps:

- After 100 hours or every six months at the latest (see Tab. 20):
Then check the spindle screws and O-rings every 100 hours. If the 100 hours are not reached in half a year, the test must be carried out every six months.
If dirt is detected under one of the two O-rings, the following steps must be carried out:
 - Remove all parts in this sector in contact with the medium, i.e. both spindles, spindle screws with O-ring.
 - Carefully clean or disinfect all parts.

1 Bh = Abbreviation for operating hour; technical time unit for measuring the active operating time of a machine.



- Clean and disinfect exposed input and output shafts.
- The cleaning procedure to be used must be determined by the operator (see chapter “6. Cleaning method for screw spindle pumps”).
- Replace both O-rings of the spindle screws.
- After cleaning, no traces of corrosion or scuffing must be visible on the input or output shafts, otherwise the affected parts must be replaced.

Inspection intervals	Assembly	Work to be carried out
weekly	gear housing	Visual inspection: <ul style="list-style-type: none"> • Check oil level • refill if necessary
weekly	bearing	<ul style="list-style-type: none"> • pay attention to unfamiliar noises
weekly	GRD cartridge	Visual inspection: <ul style="list-style-type: none"> • Pay attention to any leakage • pay attention to unfamiliar noises
weekly	pump	Visual inspection: <ul style="list-style-type: none"> • Document conveying capacity and adjustment with data sheet • Check/retighten screw connections
weekly	quenching system: receiver buffer/seal pressure vessel	Visual inspection: <ul style="list-style-type: none"> • constant set point sealing pressure, • 1-3 bar Pressure differential to nominal pressure Pump housing • Loss of quench medium (level) • contamination • If necessary, replace quench medium and check GRD cartridge seal • Check/retighten screw connections
weekly	shaft seal ring	Visual inspection: <ul style="list-style-type: none"> • Leakage • In the event of strong leakage consult manufacturer or replace the shaft seal ring

Tab. 19: Inspection intervals

- After 500 cleaning cycles or after 1 year at the latest (see Tab. 20):
Then check the GRD cartridge and O-rings every 500 cleaning cycles or after 1 year at the latest.
If contamination is detected on the atmosphere side of the GRD cartridge, the following step must be carried out:
 - Remove the GRD cartridge and replace it with a new one.
- After the first 250 hours, then every 3,000 hours, after 1 year at the latest: see chapter “7.4 Lubricants for gears and bearings”.



Inspection and Maintenance intervals	Assembly	Work to be carried out
after 100 hours or every six months at the latest	spindle screw and o-ring	visual inspection: <ul style="list-style-type: none"> • attrition • soiling • leak
after the first 250 hours, then every 3,000 hours, after 1 year at the latest	gear housing	change gear oil (food compatible)
monthly	pump housing	check for: <ul style="list-style-type: none"> • Tightening torque of spindle screw
after 6 months	quenching system: buffer/barrier pressure vessel	change the quench medium
after 1 year	shaft seal ring	replace shaft seal ring
after 500 cleaning cycles or at the latest after 1 year	pump housing and GRD cartridge	replace O-rings or replace GRD cartridge
after 7,300 hour; Shortened intervals for difficult operating conditions	gearboxes and bearings	replace bearing and gearbox
according to specifications of the drive unit documentation	drive	check for: <ul style="list-style-type: none"> • wear lubricate bearing

Tab. 20: Maintenance intervals

7.4 Lubricants for gears and bearings

The gear unit is provided with a food-compatible high-performance gear oil at the factory. The lubricant must be replaced after commissioning:

- 250 hours, after
- every 3,000 hours or after 1 year at the latest.

The oil level on the gear unit housing must be checked weekly for level and oil quality. A dark, almost opaque oil must be renewed.



NOTICE

Type of gear oil - Approval - Properties - Prohibition of mixing.

- Only use gear oil approved for the food industry - according to FDA guideline 21 CFR §178.3570 - approval: NSF-H1/USDA-H1/InS-H1.
- Use the prescribed type of gear oil - viscosity ISO VG 68.
- Gear oils with different properties and/or from different manufacturers must not be mixed and used with each other.
- Do not mix synthetic and mineral gear oils.

Work to be carried out - Replenish gear oil:

- Stop pump or check in idle state.
- Wait approx. 3 minutes until the oil has collected.
- Read off filling level.
- Open the screw plug (gear housing top side).
- Fill gear oil (food compatible) up to the maximum level indicator.
- Clean the screw plug and close it again.

Work to be carried out - Change gear oil:

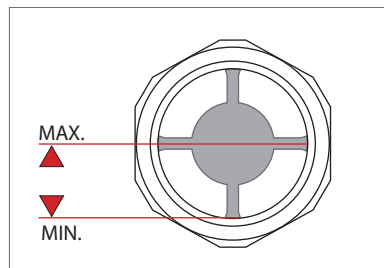


Fig. 9: Filling level of oil level gauge

- Shut down the pump.
- Open the screw plug (upper side of gear housing) and clean the magnetic pin.
- Place a suitable drip tray under the underside of the gear unit housing.
- Open the screw plug (underside of the gear housing) and clean the magnetic pencil.

- Drain gear oil completely.
- Screw in the lower screw plug.
- Fill with new gear oil (food-compatible up to the maximum level indicator of oil level gauge).
- Screw in the upper screw plug.

7.4.1 Approved gear oil grade

The use of lubricants in the food industry is subject to the strictest regulations in the USA. The US standard has also increasingly become the European standard. Food approval is examined and regulated by two authorities:

- FDA (Food and Drug Administration, Positive List) 21 CFR §178.3570
- NSF (National Sanitation Foundation) or USDA (United States Department of Agriculture)

Pumpenfabrik Wangen GmbH exclusively uses the following gear oil types with H1 approval (see Tab. 21) for applications in the food industry at the factory.



Lubricants, approved according to: NSF-H1/USDA-H1/InS-H1		
Make factory-set	Type of gear oil	viscosity
Castrol	Optileb Hy 68	ISO VG 68
alternative makes	Type of gear oil	viscosity
AVIA	AVIAFOOD GEAR 68	ISO VG 68
Mobil	Mobil DTE FM 68	ISO VG 68

Tab. 21: Gear oil type used at the factory or alternatives with H1 approval

7.4.2 Filling quantities of gear oil

Filling quantities of gear oil	
Pumps of the size	Quantity gear oil [l]
WANGEN Twin NG 180	2.8

Tab. 22: Filling quantity gear oil

7.4.3 Lubricant for assembly

For the assembly of the pump parts, Pumpenfabrik Wangen GmbH uses the following lubricants with H1 approval as lubricants only for applications in the food industry:

Lubricants, approved according to: NSF-H1		
Make factory-set	Lubricant	Use of the
Fuchs Lubritech	Cassida Grease RLS 2	high-grade steel
clover	Barrierta® L 55/2	O-rings

Tab. 23: Lubricants used at the factory

Alternatively, other lubricants with NSF-H1 approval can be used.

7.5 Lubricant for bearings of the drive

See manufacturer's drive documentation.



7.6 Thread locking paste

The following paste is used in the factory to secure (and seal) threaded connections:

Thread locking paste				
Make factory-set	Curing ¹⁾	firmness	viscosity	Threaded connection up to
Loctite 2400	anaerobic	medium-strength	medium viscosity	M36
Weiconlock AN 302-70	anaerobic	high-strength	medium viscosity	M20
Weiconlock AN 302-72	anaerobic	high-strength	higher viscosity	M56

¹⁾ Curing depending on material, gap, temperature and activator.

Tab. 24: Thread locking paste used in the factory

The thread locking paste hardens under exclusion of air in contact with metal surfaces and thus prevents independent unscrewing due to shocks and vibrations. It is particularly suitable for more passive surfaces such as stainless steel.

Application

- For **through holes**, apply several drops to the bolt where the nut will be located.
- For **blind holes**, apply several drops inside along the thread to the bottom of the hole.
- For **sealing applications**, apply 360° thread locking paste in a ring on the beginning of the thread of the external thread - leaving the first thread free. For larger threads and gaps, adjust thread locking paste accordingly.

NOTE

- *If the metal surface is inactive or the curing speed is too slow, spray all threads with a suitable activator and allow to dry.*
- *Cured thread locking paste can be removed by swelling with a sealant and adhesive remover and subsequent mechanical cleaning.*
- *If the surfaces to be bonded are previously cleaned with an aqueous cleaning system, it must be ensured that the compatibility between cleaner and thread locking paste is ensured. In some cases aqueous cleaners can impair the curing or the properties of the thread locking paste.*



7.7 Gearbox and bearing maintenance

The bearings and gearbox of the pump run in an oil bath (see chapter "7.4 Lubricants for gears and bearings"). Pumpenfabrik Wangen GmbH recommends the replacement of bearings and gear units after

- 7,300 hours.
- under difficult operating conditions, the replacement must be carried out at shorter intervals, e.g. in the case of
 - large temperature fluctuations.
 - large pressure fluctuations.

7.8 Maintenance of shaft seals - General

- see chapter "7.9 Maintenance shaft seals".
- see chapter "7.10 Maintenance of buffer/seal pressure vessel".
- Permanent leakage (medium emerges from the lower housing opening).
 - The wear of the seal rings.
 - Wear or damage to the elastomer rings.
- Replace the shaft seal regularly (at least once a year).
- Replace elastomer rings (O-rings) regularly (at least once a year).

7.9 Maintenance shaft seals

Different mechanical seals (GRD cartridges) can be installed in the WANGEN Twin NG. For details, see the data sheet.

The optimum selection of the shaft seal or materials used depends primarily on the type of media to be sealed, the rotational speed, the pressure and the operating temperature. The WANGEN Twin NG is supplied with a user-friendly mechanical seal cartridge.

The selection must be made by careful consultation and in direct cooperation with Pumpenfabrik Wangen GmbH.

7.9.1 Mechanical seal - single-acting

The single-acting GRD cartridge is approved for both directions of rotation.

The wear of the sliding surfaces is automatically compensated for by shifting. The GRD cartridge is therefore maintenance-free.

- Replace defective GRD cartridge with a new one.

7.9.2 Mechanical seal - double-acting

The double-acting GRD cartridge is approved for both directions of rotation. With double-acting GRD-cartridges, a quench medium (buffer/sealing liquid) is required in the sealing chamber. Product leakage into the atmosphere is excluded during normal operation.

- see chapter "7.10 Maintenance of buffer/seal pressure vessel"
- Check the connections (hose nozzle) of the double GRD cartridge for tightness.
- The sealing chamber must be filled with a product compatible quench medium.
- Check the filling level of the buffer/seal pressure vessel and refill if necessary.
- If necessary, apply the required pressure to the quench medium in the sealing chamber.
- The pressure of the sealing liquid must be approx. 1-2 bar or 10 % higher than the back pressure on the media side.
- Replace defective GRD cartridge with a new one.
- After maintenance work on the shaft seal, the sealing chamber and lines must be vented.



7.10 Maintenance of buffer/seal pressure vessel

7.10.1 Maintenance intervals

every day:

- Check the fill level of the quench medium in the buffer/seal pressure vessel at least once a week - if necessary, the fill level can be monitored through a level indicator.
- If necessary, top up quench medium.
- Check and note the operating pressure/temperature.
- Check for leakage from mechanical seal/connections/pipes.

monthly:

- Renew quench medium regularly, at least every 6 months.
- Replace contaminated quench medium (foreign matter, colour changes, etc.).
- If filters are present, inspect them and replace them if they are dirty.
- Any discoloration of the quench medium or contamination of the filter may indicate leakage of the internal mechanical seal. Check mechanical seal.

after 5 years:

- The manufacturer of the buffer/seal pressure vessel recommends a complete internal and external inspection as well as an inspection of all accessories.

7.10.2 Minimum - Maximum level

- See figure Fig. 10
- See figure Fig. 11

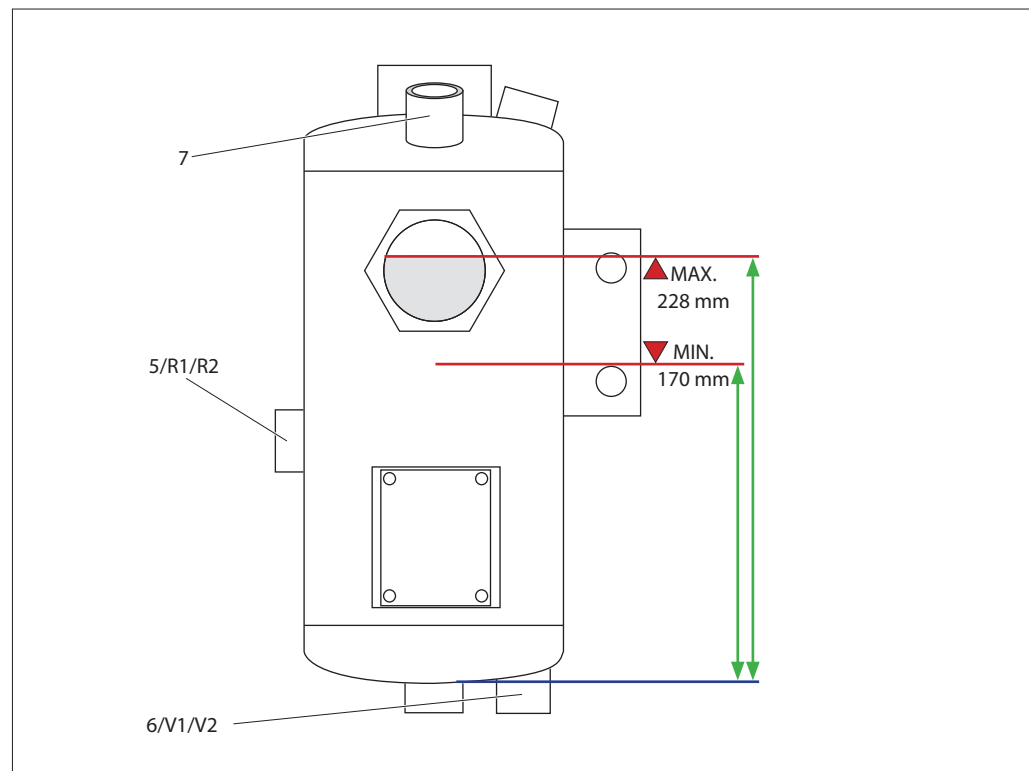


Fig. 10: Chetra 3LS" pressure vessel with connection options - front view. For the complete designation of the individual parts see chapter "10.10 Chetra 3 LS pressure vessel"



NOTICE

Depending on the buffer/seal pressure vessel used, the quench medium:

- Moves between minimum and maximum level (level indicator on sight glass).
- The quench medium level must never fall below the minimum level during operation, otherwise the circulation of the convection flow is interrupted.
- High consumption of the quench medium or an overflow of the buffer reservoir indicates wear of the seal rings or damage to the secondary seals.
- Filling the buffer/seal pressure vessel must be bubble-free.



WARNING

Risk of injury due to quench medium escaping under pressure or bursting seal pressure vessel.

Serious injuries and property damage.

- Maintenance work on the buffer/seal pressure vessel may only be carried out with the pump stationary - the flush tank may be under pressure (up to 25 bar).
- Maintenance work on the flush tank may only be carried out when depressurised.

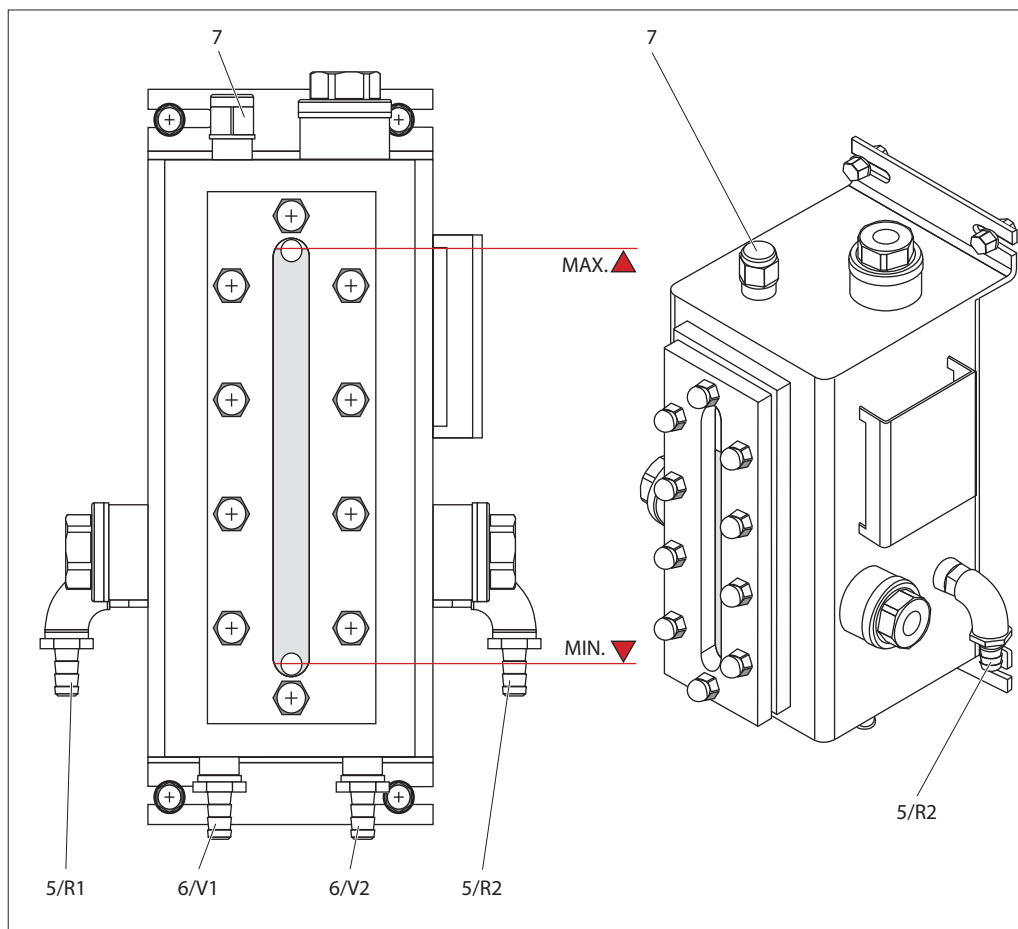


Fig. 11: Buffer reservoir with connection options - front view and angled view. For the complete designation of the individual parts see chapter "10.12 Simon 3 LSQ storage container"



7.10.3 Repairs to the buffer/seal pressure vessel

- Repairs to the buffer/seal pressure vessel may only be carried out by qualified personnel.
- Only use original spare parts.
- Welding on the buffer/seal pressure vessel as well as any work which results in a reduction of the wall thickness is prohibited.

7.10.4 Leakage

If leakage is detected, the following steps must be taken:

- Relieve the pressure on the pressurised seal pressure vessel.
- Take the buffer/seal pressure vessel out of operation.
- In the depressurized state, the screw connections of the connections must be tightened.
- If the leakage is not remedied by this measure, the O-rings/seals must be replaced.
- Clean sealing surfaces - Sealing surfaces must not be damaged.
- Use new O-rings/seals.
- Tighten screw connections carefully.

7.10.5 Filling and venting of buffer/seal pressure vessel

NOTE

Procedure: Vent the pipeline through the buffer reservoir:

- *Open the bleed screw (7) for the buffer reservoir (see Fig. 11).*
- *The line can be vented through the (opened) venting screw. If necessary, loosen the vent valve of the sealing unit. If this does not lead to the desired result:*
 - *"Procedure: Fill the buffer reservoir or use "Bleed entire system".*
- *Close the bleed screw of the buffer reservoir.*

NOTE

Procedure: Fill the buffer/seal pressure vessel or bleed the entire system (see Fig. 10 and Fig. 11):

The following procedure ensures 100 % venting of the sealing chamber/mechanical seal/pipeline - of the entire circuit - and bubble-free filling:

- *Loosen the return connection on the buffer/seal pressure vessel (R1 or R2).*
- *Slowly fill in quench medium via the filler neck (at the top of the vessel) until quench medium emerges at the opened vessel opening (R1 or R2).*
- *Use a plug to close the buffer/seal pressure vessel opening and continue filling until quench medium escapes at the end of the opened pipeline.*
- *Screw the pipe to the buffer/seal pressure vessel (R1 or R2).*
- *Fill the buffer/seal pressure vessel with quench medium to maximum level.*
- *If necessary, close the vent valve of the sealing unit again.*
- *If necessary, close the venting screw of the buffer reservoir or filler neck of the buffer pressure container again.*
- *Apply the required pressure to the seal pressure vessel (use inert gases only).*



7.10.6 Pressurisation of the seal pressure vessel

- Connect gas supply.
- Blow air out of the sealing pressure vessel by injecting nitrogen - vent through filling nozzle. Close the opening again.
- Adjust nitrogen to the required pressure using a pressure regulator.

7.10.7 Pressure relief at the seal pressure vessel

- Release the gas pressure using a pressure regulator.

7.10.8 Trouble-free operation of buffer/seal pressure vessels

Information for trouble-free operation of the buffer/seal pressure vessel:

- If shut-off valves (ball valves) are present, they must be open.
- Quench medium in the buffer/seal pressure vessel must always be above the minimum level.
- The viscosity² of the quench medium should be < 10 cSt (at operating temperature) to create a natural convection flow.
- For forced convection flow, viscosity should be < 20 cSt.
- The temperature of the quench medium should be at least 40 °C below the boiling temperature.
- The cooling effect of the quench medium depends on the circulation. Suitable auxiliary units (pump, cooling pipes, etc.) improve the dissipation of heat.
- If necessary, the quench medium must be cooled or heated.

NOTE

Pumpenfabrik Wangen GmbH recommends monitoring:

- *The filling level at the buffer/seal pressure vessel is controlled by a level switch.*
- *The pressure of the sealing pressure vessel through a manometer.*
- *The temperature of the sealing pressure vessel by means of a thermometer.*

Pumpenfabrik Wangen GmbH recommends the use of the optionally available manual refill pump for the sealing pressure vessel. This means that the quench medium can also be refilled in the pressurised system - during operation. Unnecessary downtimes are avoided.

Cleaning instructions







The cleaning of buffer/seal pressure vessel and pipes depends on the medium being pumped. The quench medium must be disposed of properly when emptying the container and the pipes. When rinsing the tank, the rinsing liquid must be disposed of properly. The rinsing medium must be compatible with the quench medium.

When using the CIP/SIP cleaning process for food pumps, the operator's specifications must be applied.

2 Stokes (St) = unit of kinematic viscosity. Legal SI-unit: m²/s; in practice the unit cSt (centistokes) is used.
Conversion: 1 St = 10⁻⁴ m²/s = 1 cm²/s
1 cSt = 10⁻⁶ m²/s = 1 mm²/s



8. Faults and their elimination

	<p style="text-align: center;"> DANGER</p> <p>Danger of being pulled in due to rotating machine parts. Death or severe injuries.</p> <ul style="list-style-type: none"> • Do not perform any work while the pump is running. • If a fault occurs, stop the pump immediately. • Disconnect the connection to the power supply. • Switch off and lock the main switch.
	<p style="text-align: center;"> WARNING</p> <p>Risk of injury from fluid escaping under pressure. Serious injuries and risk of burns</p> <ul style="list-style-type: none"> • Stop the pump immediately in the event of a fault. • Drain pump - if possible. • Reduce pressure. • Let pump cool. • Check the pump and system after troubleshooting - before restarting the pump.
	<p style="text-align: center;"> CAUTION</p> <p>Danger of cuts/crushing when removing sharp-edged foreign bodies from the screw spindles. Screw spindles can twist each other Risk of injury.</p> <ul style="list-style-type: none"> • Wear protective gloves when troubleshooting.

Faults on pumps and pump units can basically be of a hydrodynamical, mechanical or electrical nature.

8.1 Electric faults

Faults in the electric drive of the pumps or the pump unit can have numerous causes (power supply, dimensioning of the drive unit, motor protection, etc).

To eliminate faults in connection with the electric drive unit, please refer to the enclosed operating and maintenance instructions of the drive unit manufacturer.



8.2 Check list for mechanical and hydrodynamic faults

A selection of possible faults is Tab. 25 shown in:

Type of fault	Possible cause	Removal
Pump does not start	Jam by foreign matter	Remove foreign matter
	Deposits at shutdown	Clean pump immediately
	Medium cures (due to temperature/chemical conditions)	
	Solids content too high	Check pumping conditions, Change project planning, if necessary
	System pressure too high, Shut-off devices partly closed, Clogging in piping	Compare nominal pressure of the pump with system conditions, Change the project planning, if necessary, Fully open shut-off devices, Eliminate blockage
Delivery rate decreases or is not reached any longer	Shut-off devices partly closed , Clogging in piping	Fully open shut-off devices, Eliminate blockage
	Screw spindles worn	replace
	Trapped air in medium	Check suction line, medium supply and seals
	Seals defective	Replace seals
Pump does not suck	wrong direction of rotation	Correct the direction of rotation, Observe direction arrow
	Spindles mounted incorrectly	Install according to operating instructions
	Suction line clogged	clean
	Pump or filter clogged	Clean pump/filter
	Suction line draws air	Seal the pipe, Check filling level e.g. in tank
	Dry run	Ensure supply of pumped liquid
Loud pump noise	Bearing damage	Replace bearing, Check pump for damage
	Foreign matter in the medium	Remove foreign matter, Check pump for damage
	Cavitation, Rotational speed too high or suction pipe too narrow, clogged	Check project planning, choose lower speed if necessary, Increase pipe line cross-section



Type of fault	Possible cause	Removal
Mechanical seal leaks	Wear on seal rings	Replace mechanical seal
	Pressure in suction housing too high	Reduce pressure
	Springing by medium (medium sits in the spring of the seal) prevents the adjustment of the seal rings.	Clean the mechanical seal regularly, Select a different shaft seal ring, or install mechanical seal with sealing pressure
	Medium is based on the seal rings	
Mechanical seal quench leaks on the atmosphere side	shaft seal of the seal worn out	Replace the shaft seal ring and shaft mounting
Mechanical seal quench leaks on product side	Cavitation	Check the pressure in the pump housing to see if it is too low compared to the vapour pressure of the medium
		Monitoring of the valves during pump operation, whether completely open
		Pipe overgrown, clean pipe

Tab. 25: Possible mechanical and hydrodynamic disturbances and their causes

8.3 Ordering spare parts

The machines (pumps) of Pumpenfabrik Wangen GmbH are subject to the highest demands in everyday use. Our pumps are designed so that as few components as possible come into contact with aggressive or abrasive media during operation. The number of elements to be replaced is thus limited.

The purchase and use of the WANGEN original spare parts at fair prices pays dividends - benefit from our many years of know-how. This means that you can supply your customers on time and meet the highest quality standards with these long-lasting machines. If there is a problem with an original WANGEN spare part, you can rely on us: Pumpenfabrik Wangen GmbH offers an excellent maintenance and spare parts service if required.

Use our contact possibilities through spare parts hotline, email and our homepage.

We only guarantee original WANGEN spare parts supplied by us. We expressly draw your attention to the fact that spare parts and accessories not supplied by us have not been tested and approved by us. WANGEN original spare parts and accessories authorised by the manufacturer ensure the safety of your employees, trouble-free operation and the longevity of our pumps.

Pumpenfabrik Wangen GmbH shall not be liable for any damage caused by the use of non-WANGEN original spare parts and accessories.



Please note that special manufacturing and delivery specifications often exist for components or parts and that we always offer you spare parts according to the latest technical state. International safety standards must be observed.

Our pumps are known for their ease of maintenance.

You can repair your machine yourself (see chapter "1.2 Qualified personnel") and change spare parts or you can rely on the skills of our local specialist to do the work for you. Our extensive service network guarantees you fast and reliable support.

You also have the option of having your pump repaired at our factory (see chapter "5.4 Send pump for repair").

All the parts you need in one package

We have combined the most common wear parts into spare parts packages for you (see chapter "10. Exploded views - Spare parts list"). The use of spare parts packages makes it possible to plan machine maintenance in advance, so you can avoid surprises and missing parts or longer-term downtime. No more time spent searching for and ordering individual spare parts - Our spare parts packages represent a cost-effective and customer-specific solution.

Since the spare parts packages only contain original parts, you avoid the risk of using spare parts that are similar to the original parts. Externally identical components and parts can differ considerably, e.g. with regard to composition and product properties.

When ordering spare parts: please state

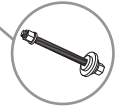
- serial number of the pump and
- specify the spare part number (see chapter "10. Exploded views - Spare parts list").

The necessary information can be found on the name plate of the machine or in the associated operating instructions technical documentation. No liability is assumed for incorrect deliveries due to defective information.

Please send your spare parts order to the following address:

Spare parts hotline:	+49(0)7522/997-896
Email for Spare Parts:	ersatzteile@wangen.com
Homepage - Spare Parts Service:	http://www.spareparts@wangen.com

Pumpenfabrik Wangen GmbH	Telephone:	+49(0)7522/997-0
Simoniusstr. 17	Fax:	+49(0)7522/997-108
D - 88239 Wangen im Allgäu	Email:	mail@wangen.com



9. Disassembly and assembly

NOTE

- *Special tools are required for Disassembly and Assembly. These are represented in the text with the letter "T" (for tool) and a four-digit tool number, e.g. T0106.*
- *In the annex there is a tool table where you can find the tool number, an illustration of the tool and the corresponding designation.*
- *You can order these tools from Pumpenfabrik Wangen GmbH by specifying the Tool number.*



DANGER

Danger of being pulled in due to rotating machine parts and danger due to unintentional restarting of the pump.

Death or severe injuries.

- *Do not perform any work while the pump is running.*
- *Disconnect the connection to the power supply.*
- *Switch off and lock the main switch.*



WARNING

Improper handling when disassembling/assembling the pump from the system, when transporting or when disconnecting the pump/motor from the base frame.

Personal injury due to falling and/or tilting load.

- *Observe the centre of gravity and the maximum weight of the load.*
- *Only use suitable slings.*
- *Only use attachment points provided.*



CAUTION

Heavy load of the individual components during disassembly/assembly of the pump. Risk of injury due to sharp-edged components.

Slight injuries to limbs or irreversible injuries to the entire body.

- *Use protective gloves and safety shoes.*
- *Use suitable lifting gear (e.g. round slings, chains and load hooks with corresponding load capacity).*
- *Screw the eyebolt into the hole provided in the component to be dismantled or assembled and hang it on the load hook of the lifting crane, e.g. to move it or secure it against falling.*
- *Provide and use suitable supports for stopping the components.*
- *Provide sufficient space for disassembly/assembly.*



NOTE

Disassembly/assembly procedure:

- *To carry out maintenance and repair work on the pump, the pump with drive and base frame should be completely removed from the system.*
- *Park the pump/drive/base frame in a suitable place (no obstacles in the working area, level non-slip floor, sufficient lighting, good ergonomic conditions, large working area, good ventilation, if necessary outside Ex-area, etc.) using a heavy-duty crane or forklift or suitably designed lift truck.*
- *Repair the pump at a suitable workplace, repair the pump and re-align the pump during assembly.*
- *Individual parts of the pump are very heavy and should only be moved with suitable lifting equipment in order to avoid high physical loads/overloading in accordance with Labour Protection Law (ArbSchG) or Load Handling Regulation (LasthandhabV).*
- *After completion of the maintenance and repair work, reinstall the pump/drive/base frame in the system.*

NOTE

- *During assembly, it is essential to observe the tightening torques for specified components in Tab. 6 (chapter 3.2).*
- *Observe maximum tightening torques for screw Tab. 5 connections.*

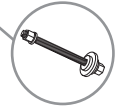
NOTE

- *Always replace seals that may come into contact with food during maintenance or repair work.*
- *Disposal of the old seal in accordance with local disposal regulations.*
- *Documentation on the renewal of seals is a matter of course.*
- *If it is discovered during maintenance or repair work that seals are damaged (e.g. by abrasion, mechanical damage, chemical damage from cleaning agents, swollen, porous, etc.), the parts of the pump behind the seal must also be cleaned using the appropriate cleaning procedure (see chapter "6. Cleaning method for screw spindle pumps").*

9.1 Buffer and seal pressure vessels

9.1.1 Disassembly

- Close any shut-off valves between the buffer/seal pressure vessel.
- Expansion of the pressurised seal pressure vessel in accordance with the manufacturer's operating instructions supplied.



- Disconnect the return lines (R1 and R2 from the pump to the buffer/seal pressure vessel, see Fig. 5 and see Fig. 6) to the top of the seal receptacle.
- Disconnect the supply connection (V1 and V2 of the buffer/seal pressure vessel to the seal unit, see Fig. 5 and see Fig. 6) on the underside of the gasket holder.
- Collect leaking quench medium and dispose of it properly.
- Properly close hose or pipe connections to prevent complete emptying of the buffer/seal pressure vessel - if not desired.

9.1.2 Assembly:

- According to DIN EN ISO 21049, the buffer/seal pressure vessel must be installed approx. 1 - 2 m above the pump - natural convection (circulation of the quench medium) is optimally excited at this magnitude.
- The connection between the buffer/seal pressure vessel and the sealing unit is made with hoses or pipes (preferably made of stainless steel) with a minimum nominal diameter of 8 mm, depending on the temperature and the buffer liquid.
- It is recommended to connect each seal with its own pipes to its own buffer/seal pressure vessel so that a natural convection flow can be created.
- For forced convection flows with cooling, e.g. by an external pump or water management system, the seals can be connected in series. The distance between the buffer/seal pressure vessel can then be smaller.
- No significant additional stresses, e.g. vibrations or connection forces, may act on the buffer/seal pressure vessel.
- Connect the supply connection (V1 and V2 of the buffer/seal pressure vessel to the seal unit, see Fig. 5 and see Fig. 6) on the underside of the gasket holder.
- Connect the return lines (R1 and R2 from the pump to the buffer/seal pressure vessel, see Fig. 5 and see Fig. 6) to the top of the seal receptacle.
- Open any shut-off valves between the buffer/seal pressure vessel.
- Replace or top up quench medium.
- Completely vent and check the hose connections and pipelines via buffer/seal pressure vessel.



NOTICE

Supply and return lines to the buffer/seal pressure vessel must be designed to fall or rise continuously. Hose connections must not form a wave or sag.

Prevention of convection currents by unintentional thermosiphon effect (see chapter "3.10.4 Shaft sealing accessories - buffer reservoir").

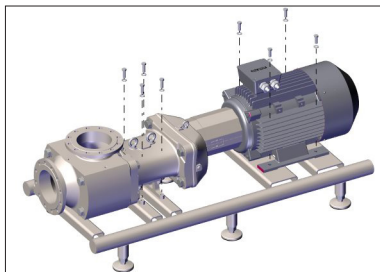
- *Natural convection current is interrupted.*
- *Cooling of the buffer liquid no longer takes place or is severely restricted.*
- *Mechanical seal is no longer sufficiently lubricated and cooled.*
- *Dry running of the mechanical seal possible - mechanical seal is destroyed.*

- Vent the buffer/seal pressure vessel in accordance with the manufacturer's operating instructions supplied.
- Pressurise the seal pressure vessel in accordance with the manufacturer's operating instructions supplied.

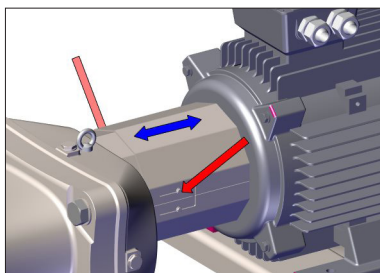
9.2 Drive and coupling protector

9.2.1 Disassembly

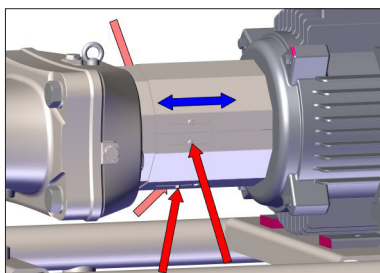
See Chapter 9, Instructions "Disassembly/assembly procedure:"

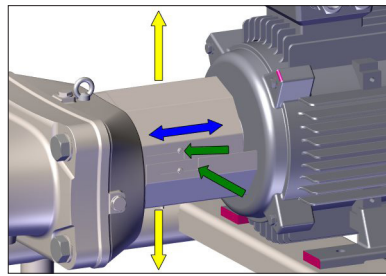


- Disconnect the pump or drive from the base frame

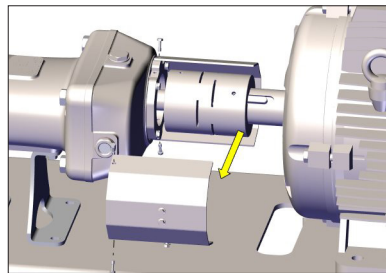


- Loosen the screws on the side of the coupling protection (top and bottom, red arrows) so that the coupling guard can be moved (blue arrows) - do not unscrew.

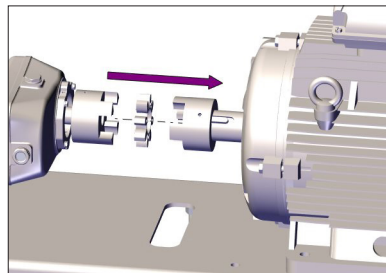




- Move the coupling guard to the stop (green arrows).
- Lift coupling guard up and down (yellow arrows).



- Loosen the screw connections of the non-displaceable coupling guard (side shells) at the top and bottom.
- Remove side shells (yellow arrow).



- Remove pump from drive (arrow).
- Place pump and drive on suitable surfaces (e.g. wooden blocks).
- Extract the elastomer core and keep it.

9.2.2 Assembly

Assembly is carried out in the reverse order of disassembly:

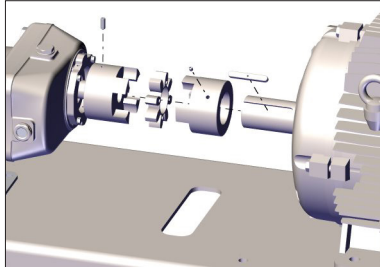
- Insert elastomer core in the coupling (renew if necessary).
- Connect the pump to the drive - The drive should be secure on a suitable surface.
- Align the pump to the drive (see chapter "3.9 Drive and coupling elements").
- Connect the screw connections of the pump to the drive and tighten (observe the tightening torques Tab. 5).



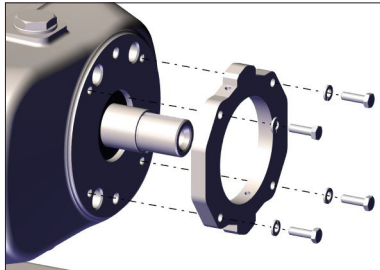
9.3 Coupling

9.3.1 Disassembly

- Remove drive and coupling protector (see chapter 9.2).



- Turn the drive shaft until the threaded pin in the coupling claw can be reached.
- Loosen set screws on both coupling claws.
- Pull the clutch claw off the drive shaft with the puller.
- Press off and remove both feather keys from the drive shaft with the aid of a screw that can be screwed in.



- Loosen the hexagonal screws of the flange plate (coupling protection).
- Remove the flange plate.

9.3.2 Assembly

Assembly is carried out in the reverse order of disassembly:

- Insert feather key in drive shaft.
- Lightly grease drive shaft.
- Slide the coupling element onto the drive shaft.

NOTICE

Do not mount coupling on drive shaft with hammer blows.

Damage to parts, inadmissible deformation.

- Use wind-on equipment or warm the coupling half to approx. 80 °C (remove rubber parts beforehand) and mount coupling half warm.
- The coupling halves must be aligned with each other.
- For a permanent trouble-free operation of the coupling, the coupling for the case of application (power, rotation speed, start-up frequency, changes to power and working machines) must be designed according to the design layout specifications (DIN 740-2).
- For the coupling selection, the admissible maximum speed and the admissible maximum bore must be considered.
- It is recommended to subject the coupling to a visual check at least once a year. In this case, special attention is to be paid to the status of the coupling cams.



- Screw in threaded pin in coupling element and tighten.
- Mount drive and coupling protector (see chapter 9.2).

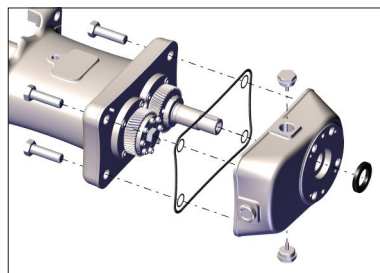
9.4 Gear housing

NOTE

- *It is recommended to check or replace the shaft seal during maintenance work on the gearbox housing.*
- *Replace the shaft seal at least once a year.*

9.4.1 Disassembly

- Remove drive and coupling protector (see chapter 9.2).
- Remove coupling (see chapter "9.3 Coupling").



- Drain gear oil: Open the upper and lower screw plug with sealing ring on the gearbox housing and catch leaking gearbox oil.
 - Release hexagon bolts on bearing housing and remove.
 - Carefully pull gearbox housing off bearing housing - if necessary, light blow with plastic hammer - Gearbox housing is adjusted with cylindrical pins.
-
- Seal (O-ring) Remove gearbox housing.
 - Remove the seals (O-rings) of the hexagon bolts.
 - Press shaft seal out of gearbox housing.



9.4.2 Assembly

Assembly is carried out in the reverse order of disassembly:

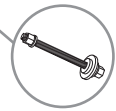
- Clean sealing surfaces of bearing housing and gearbox housing.
- Clean seat of shaft seal and drive shaft.
- Lightly grease the shaft seal ring and carefully press it into the gear unit housing with the assembly cone (T0102) - the tension spring of the shaft seal ring points into the gear unit housing.
- Insert new seal (O-ring) on gearbox housing.
- Install new gasket (O-ring) gaskets on the gearbox housing.
- Push the gear housing over the drive shaft and insert it into the dowel pins (dowel pins adjust the gear housing).
- Screw in hexagon bolts on gearbox housing and tighten crosswise - observe tightening torque (see Tab. 6).
- Screw in lower plug with new gasket in gearbox housing and tighten.
- Fill in gear oil (see chapter "7.4 Lubricants for gears and bearings").
- Screw in top plug with new gasket in gearbox housing and tighten.
- Mount the coupling on the drive shaft (see chapter "9.3 Coupling").
- Mount drive and coupling protector (see chapter 9.2).

NOTICE

Shaft seal assembly.

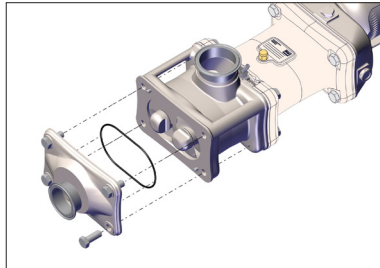
The shaft seal rings the gear housing against the environment on the exiting shaft.

- *The shaft seal, shaft and housing bore must be clean.*
- *Lightly lubricate the shaft seal and shaft for easier installation.*
- *Mount the shaft seal with mounting aids in such a way that the press-in force is as close as possible to the outer diameter.*
- *The sealing lip of the shaft seal must not be damaged during installation - Use mounting sleeve.*
- *When pressing the shaft seal into the housing bore, do not tilt the shaft seal.*
- *The shaft seal must be parallel to the shaft.*
- *Do not fit the shaft seal in the housing bore with hammer blows.*

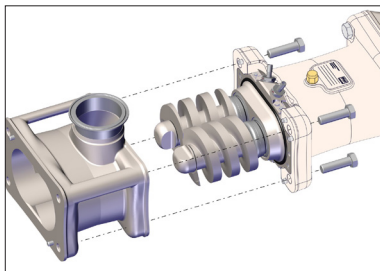


9.5 Cover and pump housing

9.5.1 Disassembly



- Loosen the screws on the cover of the pump housing.
- Remove the cover and seal (O-ring) from the pump housing – the cover is adjusted with cylindrical pins.



- Loosen screws of the bearing housing - pump housing.
- Remove the pump housing – the pump housing is adjusted with dowel pins (see chapter "4. Directional flow of the medium").
- Remove seal (O-ring).

9.5.2 Assembly

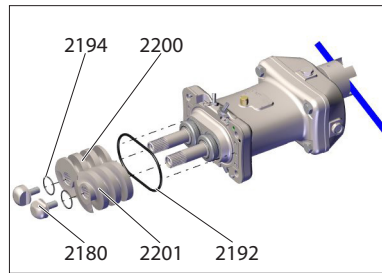
Assembly is carried out in the reverse order of disassembly:

- Clean cover and seal seat.
- Insert the new seal (O-ring) into the cover - check for correct fit - Do not push the seal out of the groove either inwards or outwards during installation.
- Place the cover on the pump casing using the appropriate positioning pins (see chapter "4. Directional flow of the medium").
- Screw in the screws and tighten them crosswise - observe the tightening torque (see Tab. 6).

9.6 Screw spindles

9.6.1 Disassembly

- If present, release the pressure from the seal pressure vessel (see chapter "9.1 Buffer and seal pressure vessels").
- If present, loosen the connections for the buffer/seal pressure vessel on the bearing housing (see chapter "9.1 Buffer and seal pressure vessels").
- Remove drive and coupling protector (see chapter 9.2).
- Remove cover and pump housing (see chapter "9.5 Cover and pump housing").



- Loosen spindle screws (2180) and unscrew (T0106) - Lock drive shaft with a steel mandrel (shown in blue) - Insert steel mandrel between the claws of the coupling on the pump side.
- Remove seals (O-rings, 2194) from spindle screws. (If not already done, remove the seal (2192) from the pump casing.)

- Remove the screw spindles (2200 and 2201) from the shaft. When mounting the screw spindles, they must be synchronised with the drive gears. It is recommended to dismantle the gearbox before installing the screw spindles (see chapter "9.4 Gear housing").
- Check screw spindles, shafts and pump housing for damage and clean - replace if necessary.

9.6.2 Assembly

Assembly is carried out in the reverse order of disassembly:

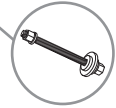
- Screw spindles, shafts and pump casing must be clean.
- Lightly grease the hubs of the screw spindles and drive/output shaft with approved lubricant (see chapter "7.4.3 Lubricant for assembly").
- Replace the seal (both O-rings, 2194) of the spindle screws and insert it into the greased groove of the spindle screws - make sure that it is correctly seated. The O-rings must not escape from the groove either inwards or outwards.

Synchronise screw spindles:

- see chapter "9.7 Synchronise screw spindles".

Continuation of assembly:

- Tighten the spindle screws of the input shaft and the output shaft (T0106) - Hold the input shaft with a steel mandrel (shown in blue; illustration in chapter 9.6.1) - Insert the steel mandrel between the claws of the coupling on the pump side and hold it steady - Observe the tightening torque (see Tab. 6).
- Check the gap dimension between the spindles again. If the values have changed compared to the documented values, the setting procedure (chapter "9.7 Synchronise screw spindles") must be repeated.
- Replace seal (O-ring, 2194) and insert into groove of bearing housing - ensure correct seating.
- Slide the pump housing over the screw spindles into the position pins (see chapter "4.3 Position pin arrangement on pump housing").
- Mount the cover (see chapter "9.5 Cover and pump housing").
- If available, fit a buffer/seal pressure vessel (see chapter "9.1 Buffer and seal pressure vessels").



NOTE

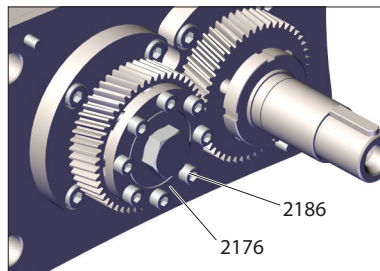
- *Always push the screw spindles onto the shaft in pairs.*
- *Make sure that the spindles are arranged correctly.*
- *Screw spindles may have to be synchronised through the drive gears.*

9.7 Synchronise screw spindles

One of the advantages of the WANGEN Twin NG series is that the screw spindles are synchronised at the factory and that, thanks to the "fast-X-change" patent, the screw spindles do not need to be synchronised again if only the screw spindles are replaced. They synchronise automatically. During maintenance or assembly, the screw spindles can simply be plugged on without having to make any further manual adjustments.

The situation is different if, for example, the bearings are also replaced - then the screw spindles have to be synchronised and adjusted again with the drive gears.

To synchronise the screw spindles with the drive gears, the gearbox housing must first be dismantled (see chapter "9.4 Gear housing").



- Loosen the cap screws (2186) so that the gear hub (2176) can be moved.
- Arrange interlocking screw spindles in pairs so that they lie on one level (red markings, see Fig. 12).
- Push both screw spindles together onto the input and output shafts (blue arrows, see Fig. 12) - Pay attention to the arrangement of the screw spindles - see chapter "4. Directional flow of the medium".
- Screw both spindle screws into the input and output shafts and tighten them alternately - at first lightly by hand - hold both shafts and spindles only by hand.
- Use a feeler gauge to adjust the gap between the spindles of the two screw spindles (green arrows); specify the gap dimension: 0.2 mm.
- Check and document the gap dimension at all touching coils of the screw spindles.
- Tighten cap screws (2186) alternately crosswise after setting the specified gap dimension - observe tightening torque (see Tab. 6).
- Mount the gear unit housing (see chapter "9.4 Gear housing").
- Mount the coupling on the drive shaft (see chapter "9.3 Coupling").
- Continuation of assembly - Chapter 9.6.2.

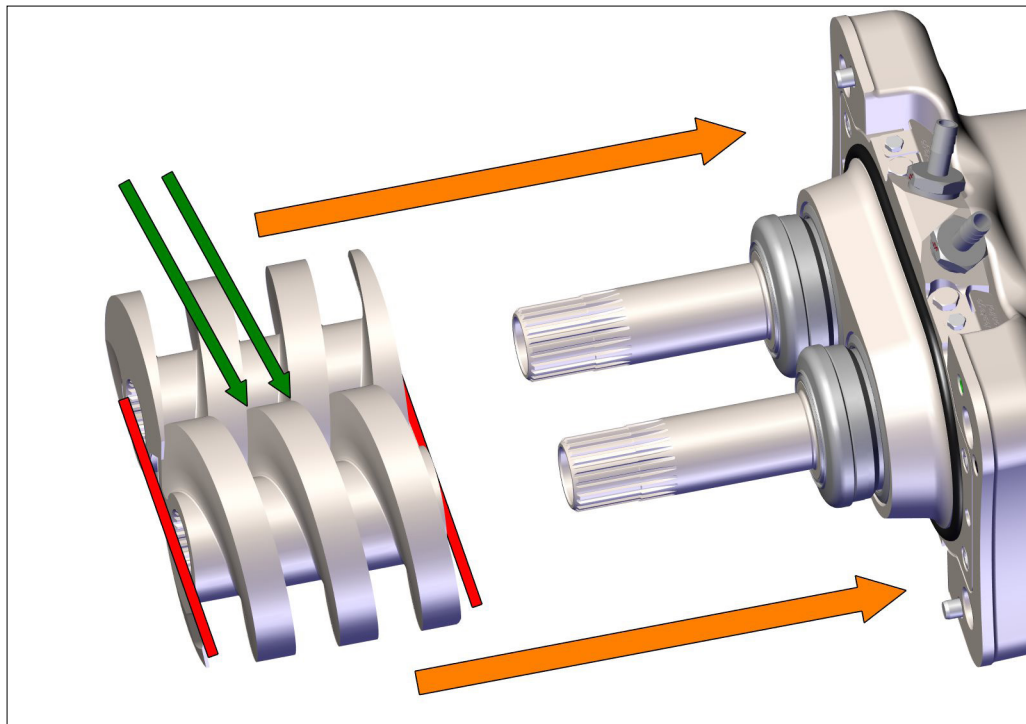


Fig. 12: Sliding on the screw spindles in pairs

9.8 Pump housing arrangement

See chapter "4. Directional flow of the medium".

NOTICE

Possible damage to property.

- *Incorrect combination of positioning pins and direction of rotation of the pump will cause damage to the pump casing and spindles.*
- *The information on the direction of rotation, spindle orientation and housing connection position are given in the data sheet.*
- *The correct and permissible arrangement of the position pins can be found in the chapter "4. Directional flow of the medium".*

Loss of performance.

- *An incorrect nozzle orientation in relation to the spindle orientation leads to performance losses in pump operation.*

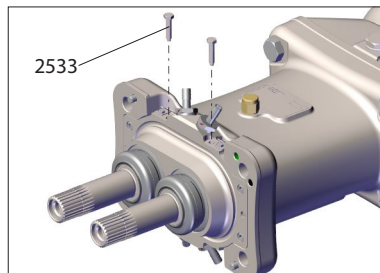


9.9 Mechanical seal cartridge

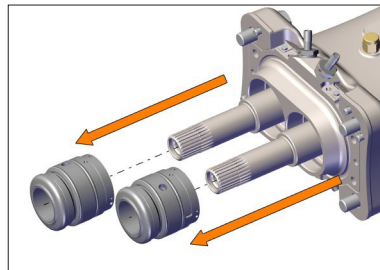
When a new mechanical seal cartridge (GRD cartridge) is supplied, it is equipped with a transport lock. On the side facing away from the product, three clamps are fastened with hexagon socket screws. The transport lock must be removed before this GRD cartridge can be used. The supplied O-ring must be inserted into the groove where the transport lock is attached after the transport lock has been removed.

9.9.1 Disassembly of GRD cartridge - single-acting/double-acting

- If present, release the pressure from the seal pressure vessel (see chapter "9.1 Buffer and seal pressure vessels").
- If present, loosen the connections for the receiver/seal pressure vessel on the bearing housing (see chapter "9.1 Buffer and seal pressure vessels").
- Remove cover and pump housing (see chapter "9.5 Cover and pump housing").
- Remove the screw spindles (see chapter "9.6 Screw spindles").

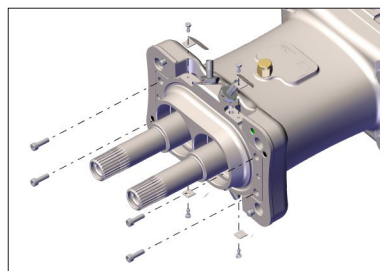


- Loosen the fixing screws (2533) on the seal receptacle - Position the GRD cartridge in the seal receptacle.

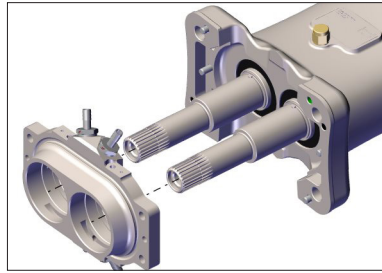


- Remove both GRD cartridges from the shaft and from the seal receptacle.

The following work steps are necessary for further dismantling of the gasket receptacle:



- Loosen the Savetix hexagon head screws (2287) on the gasket receptacle and remove them with the safety catch (2286).
- Loosen and remove the cap screws of the gasket receptacle.

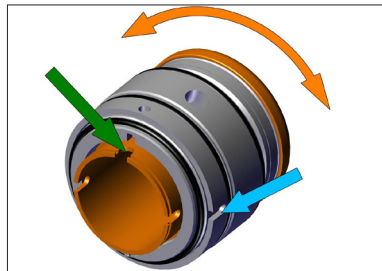


- Seal receptacle can be removed.

9.9.2 Assembly

Assembly is carried out in the reverse order of disassembly:

- Clean the input and output shafts, seal retainer and bearing housing - all parts must be clean.
- Lightly grease the input/output shaft and seal retainer with approved lubricant (see chapter "7.4.3 Lubricant for assembly").
- Insert the gasket receptacle into the bearing housing through the two dowel pins and fasten to the bearing housing using cap screws.

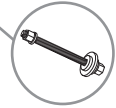


- In order for the new GRD cartridges to be inserted, each GRD cartridge must be rotated manually (orange twist arrow) so that the positioning pin (dark blue arrow in Fig. 13) of the seal receptacle and the positioning groove (light blue arrow) of the GRD cartridge mesh. In addition, the driving pin (red arrow in Fig. 13) of the drive/output shaft and the driving groove (green arrow) of the GRD cartridge must mesh (see Fig. 13).

- The orange marked part of the GRD cartridge can be rotated manually.
- Carefully slide the specifically adjusted GRD cartridges over the input and output shafts - ensure that the GRD cartridges are correctly oriented - the end with the driving groove points in the direction of the bearing housing - and press in (T0103).

NOTE

- *The driving pin of the drive/output shaft engages in the driving groove of the inner rotating sliding ring.*
- *Positioning pins which engage in the positioning groove (long groove) of the outer stationary seal ring are always located on the outside the seal retainer in the 9 o'clock/15 o'clock position.*
- *The positioning pins make it easy to find the correct position of the outer stationary glide ring to be able to screw in the fixing screws.*
- *The holes for the fixing screws then point upwards.*
- *When mounting the GRD cartridge, align the positioning groove of the outer stationary seal face outwards and slide it onto the shaft.*



- The positioning/driver slot and positioning/driver pin interlock noticeably.
- Secure and tighten the position of the GRD cartridge with fixing screws.
- Mount the Savetix hexagon head screws (2287) and the safety guard (2286) to the seal receptacle.

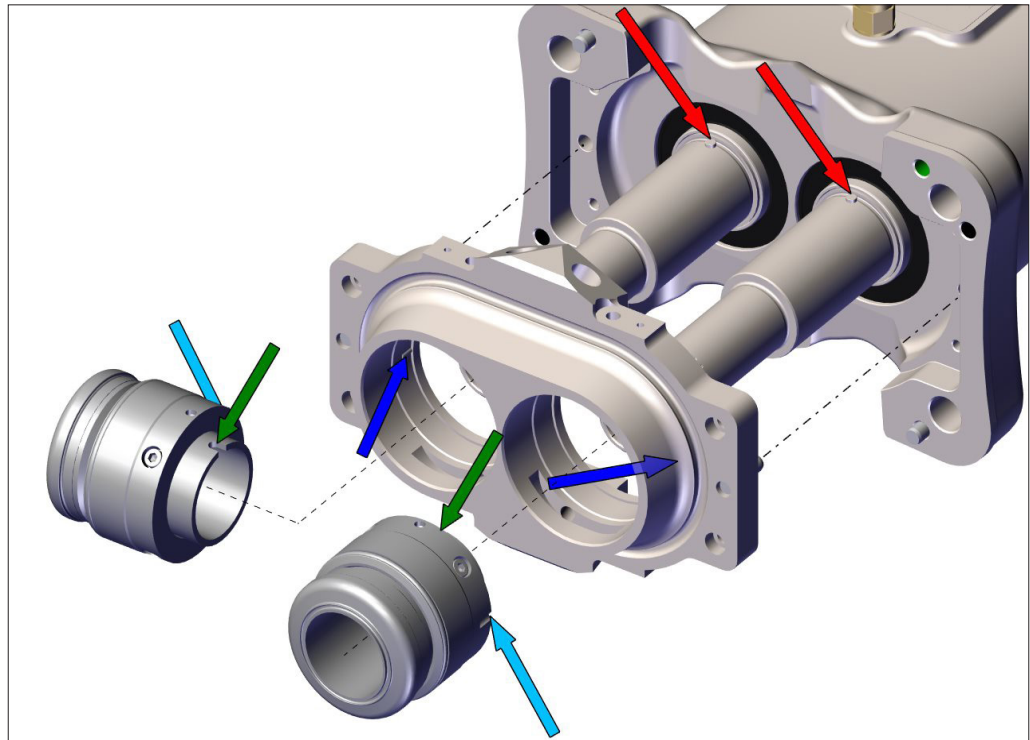


Fig. 13: Positioning slot (light blue), positioning pin (dark blue), driver slot (green) and driver pin (red)

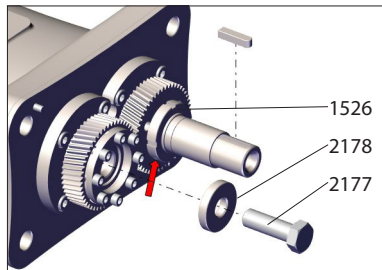
- Mount the screw spindles (see chapter "9.6 Screw spindles").
- Mount cover and pump housing (see chapter "9.5 Cover and pump housing").
- If available, mount connections for buffer/seal pressure vessel on the bearing housing (see chapter "9.1 Buffer and seal pressure vessels").
- If available, apply pressure to the sealing pressure system (see chapter "9.1 Buffer and seal pressure vessels").



9.10 Gearbox

9.10.1 Disassembly

- If present, release the pressure from the seal pressure vessel (see chapter "9.1 Buffer and seal pressure vessels").
- If present, loosen the connections for the buffer/seal pressure vessel on the bearing housing (see chapter "9.1 Buffer and seal pressure vessels").
- Remove drive and coupling protector (see chapter 9.2).
- Drain gearbox oil and collect in suitable container (see chapter "9.4 Gear housing").
- Remove gearbox housing.
- Remove cover and pump housing (see chapter "9.5 Cover and pump housing").
- Remove the screw spindles (see chapter "9.6 Screw spindles").
- Remove GRD cartridges (see chapter "9.9 Mechanical seal cartridge").

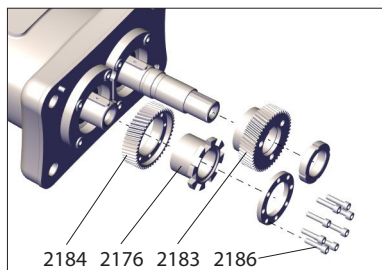


- Remove the spring key from the drive shaft.
- Place the socket spanner (T0111) on the output shaft (on the screw spindle side) in order to loosen the hexagon head screw (2177) - counterhold.
- Loosen the hexagon head screw (2177) of the output shaft and remove it with the washer (2178).
- Loosen the threaded pin (red arrow) of the Shaft nut (1526) - unscrew by one to two turns/ completely.

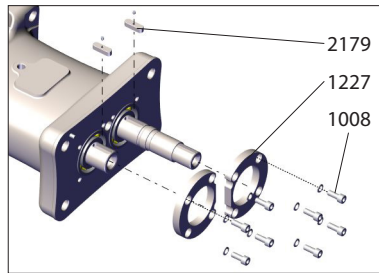
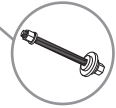
NOTICE

Possible damage to property.

- *Always loosen the threaded pin of the Shaft nut before dismantling the Shaft nut, otherwise the thread of the drive shaft will be damaged.*



- Loosen and remove the Shaft nut of the drive shaft with a socket spanner (T0109).
- Loosen cap screws (2186) and remove together with clamping ring.
- Pull gear wheel (2183) with puller (T0110) off the drive shaft.
- Pull gear wheel (2184) with hub (2176) off the output shaft (T0110).



- Loosen cap screws (1008) and remove with washers and bearing cover (1227).
- Remove the spring keys (2179) from the input/output shaft.

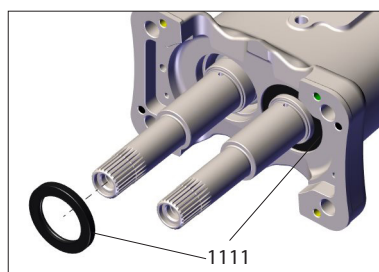
9.10.2 Assembly

Assembly is carried out in the reverse order of disassembly.

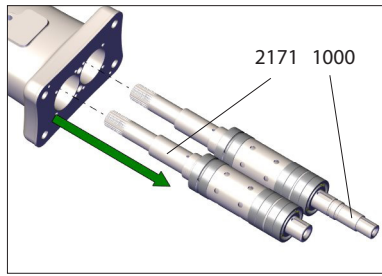
9.11 Bearing for input and output shaft

9.11.1 Disassembly

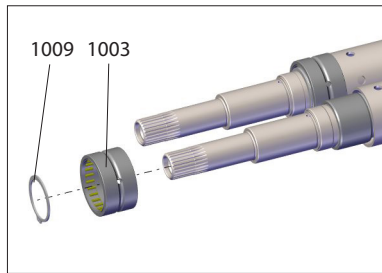
- If present, release the pressure from the seal pressure vessel (see chapter "9.1 Buffer and seal pressure vessels").
- If present, loosen the connections for the buffer/seal pressure vessel on the bearing housing (see chapter "9.1 Buffer and seal pressure vessels").
- Remove drive and coupling protector (see chapter 9.2).
- Drain gearbox oil and collect in suitable container (see chapter "9.4 Gear housing").
- Remove gearbox housing.
- Remove cover and pump housing (see chapter "9.5 Cover and pump housing").
- Remove the screw spindles (see chapter "9.6 Screw spindles").
- Remove GRD cartridges (see chapter "9.9 Mechanical seal cartridge").
- Remove the gear unit (see chapter "9.10 Gearbox").



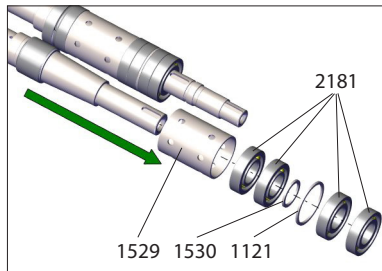
- Use a hook extractor to pull the shaft seal ring rings (1111) out of the bearing housing - this destroys the shaft seal ring rings and they must be replaced.



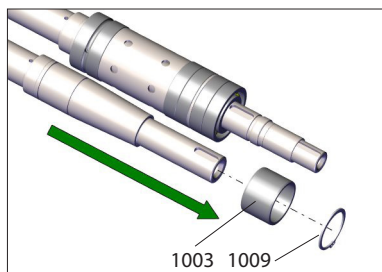
- Press out drive shaft (1000) and output shaft (2171) one after the other in the direction of the drive (green arrow) on a press.
- The design of the input shaft and output shaft is identical and is described below using the output shaft as an example.



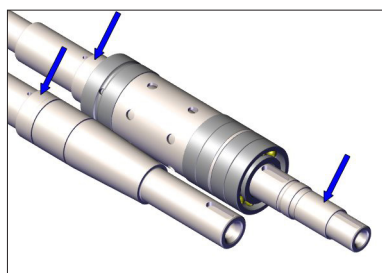
- Remove Circlip (1009) with Circlip pliers.
- Remove the needle bearing outer ring (1003) from the output shaft using a pulling device.



- Press the two angular contact Ball bearings (2181), spacer rings (1121 and 1530) and again the two angular contact Ball bearings (2181) out of the output shaft in the direction of the input side (green arrow) one after the other on a press.
- Remove the spacer sleeve (1529) from the output shaft.



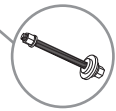
- Remove Circlip (1009) with Circlip pliers.
- Remove the needle bearing inner ring (1003) from the output shaft using a puller (green arrow).



- Shaft protection sleeves (blue arrows) cannot be removed without damaging the input/output shaft.

9.11.2 Assembly

Assembly is carried out in the reverse order of disassembly. The design of the input shaft and output shaft is identical and is described below using the output shaft as an example.



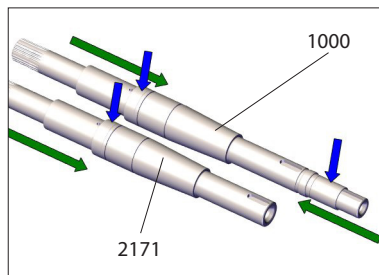
NOTE

- Secure the two driving pins (2541) with a high-strength thread locking paste such as Weiconlock AN 302-70. (See Chapter "10.9 Seal retainer")

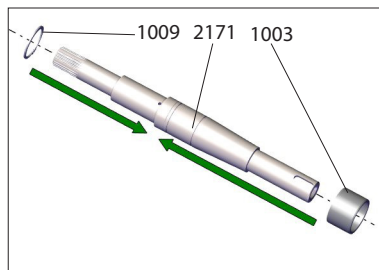
NOTICE

Possible damage to property.

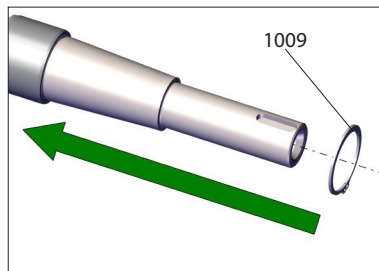
- Clean individual parts of the bearing before starting Assembly.
- Check individual parts for damage and wear and replace if necessary.
- Replace Shaft seal rings.



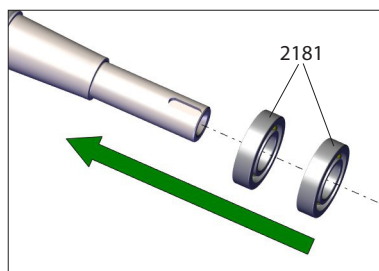
- Heat the shaft protection sleeves (blue arrows) to 120 °C and push them onto the input/output shaft as far as they will go (green arrows).



- Fit outer Circlip (1009) to output shaft (2171).
- Lightly grease the output shaft with lubricant.
- Press the needle bearing inner ring (1003) from the spring key side onto the output shaft.



- Install the inner circlip (1009) to the output shaft.



- Press angular contact Ball bearing (2181) - 2 x onto output shaft - one after the other and individually.



NOTICE

Possible damage to property.

- *Align spacer sleeves and spacer rings precisely - otherwise they will be destroyed when the drive/output shaft is pressed in.*

NOTE

- *Observe the mounting position of the angular contact Ball bearings.*
- *Install angular contact Ball bearings in O arrangement - torque loads are thus better absorbed.*
- *Press only on the inner rings of the bearings.*

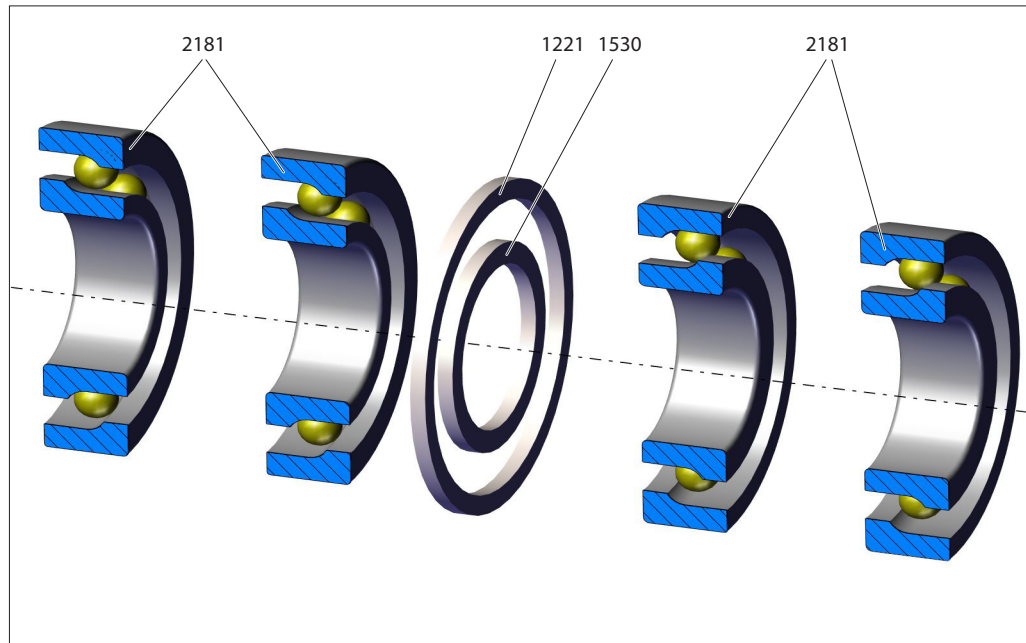
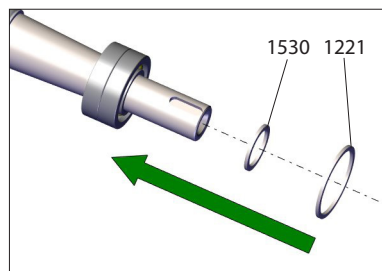
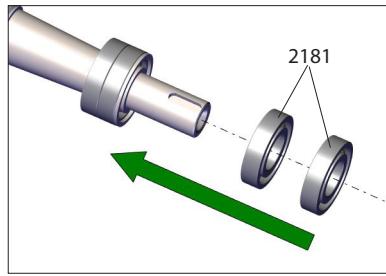


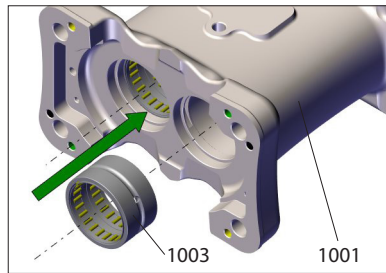
Fig. 14: Cross section through the angular contact ball bearing in double O arrangement or tandem O-tandem arrangement with spacer ring. 1221 spacer ring; 1530 spacer ring; 2181 angular contact ball bearings



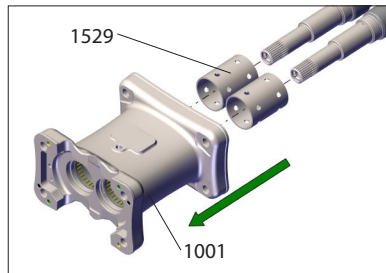
- Push the spacer rings (1530 and 1221) onto the output shaft.



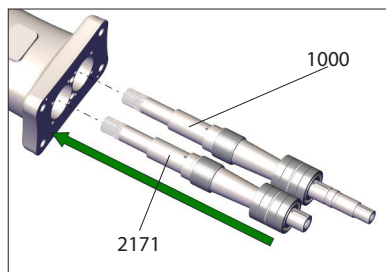
- Press angular contact Ball bearing (2181) onto output shaft (2 x) - one after the other and one at a time.
- Lightly grease the bearing surfaces of the bearing housing with lubricant.



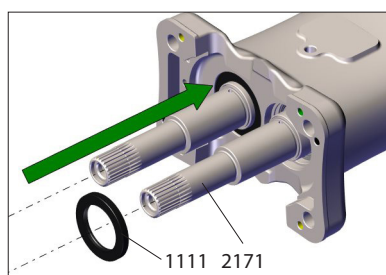
- Insert outer ring of needle bearing (1003) into bearing housing (1001).



- Carefully insert the spacer sleeve (1529) into the bearing housing.



- Carefully insert the output shaft from the input side into the bearing housing and outer ring of the needle bearing.
- Press the output shaft with press - only on the outside the angular contact Ball bearing - in as far as it will go - the last angular contact Ball bearing protrudes approx. 1 mm from the bearing housing.

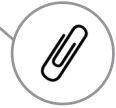


- Grease the shaft seal ring rings (1111) and carefully push them with the mounting bush (T0101) over the toothed ends of the shaft and press them into the bearing housing - the tension spring of the shaft seal ring points into the bearing housing.
- Mount input shaft as output shaft.
- Mount the gear unit (see chapter "9.10 Gearbox").

- Mount GRD cartridges (see chapter "9.9 Mechanical seal cartridge")
- Mount the screw spindles (see chapter "9.6 Screw spindles").
- Synchronise screw spindles (see chapter "9.7 Synchronise screw spindles").



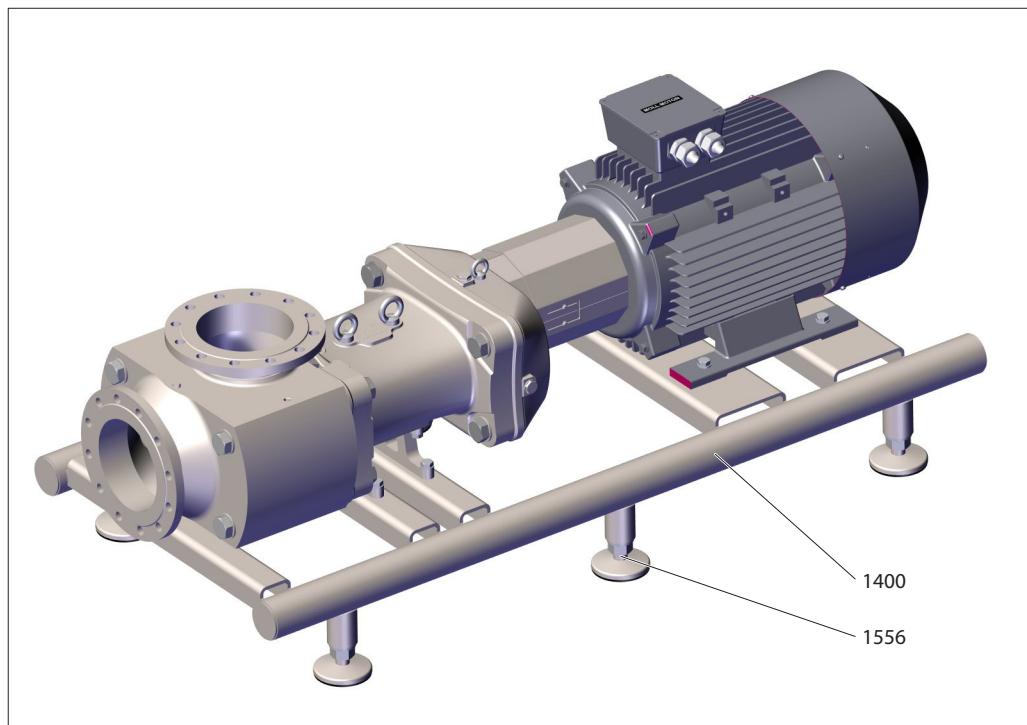
- Mount cover and pump housing (see chapter "9.5 Cover and pump housing").
- Mount the gear unit housing (see chapter "9.4 Gear housing").
- Mount the coupling (see chapter "9.3 Coupling").
- Mount coupling guard and actuator (see chapter "9.2 Drive and coupling protector").
- Fill up with gear oil (see chapter "9.4 Gear housing").
- If available, mount connections for buffer/seal pressure vessel on the bearing housing (see chapter "9.1 Buffer and seal pressure vessels").
- If available, apply pressure to the sealing pressure system (see chapter "9.1 Buffer and seal pressure vessels").



10. Exploded views - Spare parts list

For WANGEN Twin NG 180

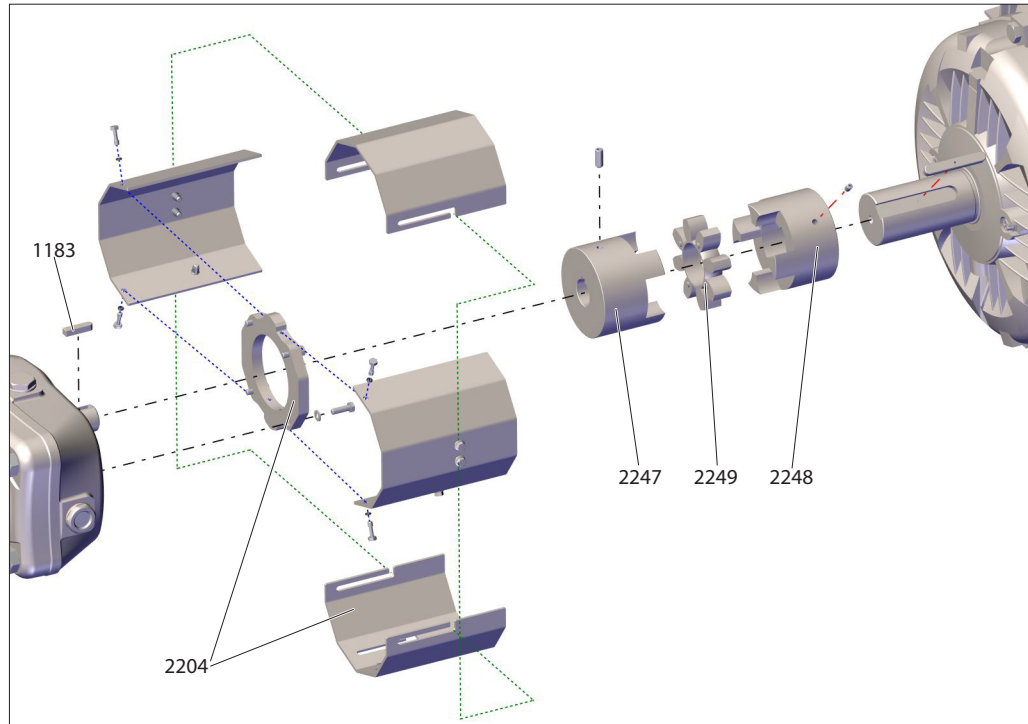
10.1 Installation with base frame



Number	Quantity	Designation Installation base frame
1400	1	Base frame
1556	6	Machine foot (incl. 2x nut/2x washer)

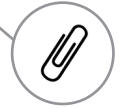


10.2 Coupling and coupling protection

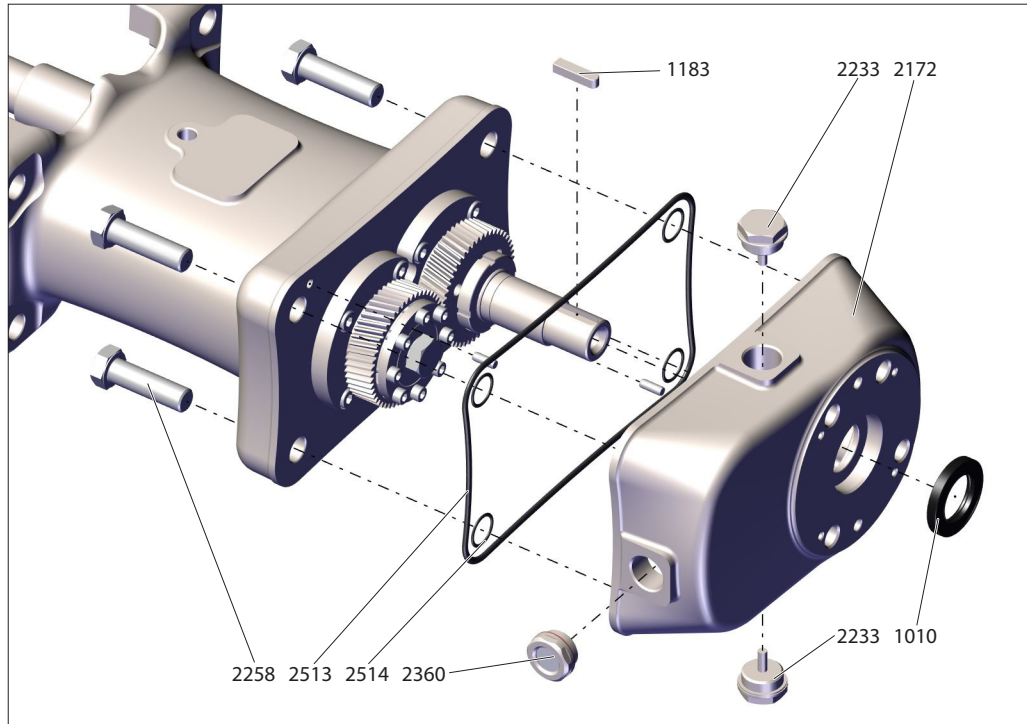


Number	Quantity	Designation Coupling
1183	1	Spring key
2247	1	Coupling claw incl. grub screw
2248	1	Coupling claw incl. grub screw
2249	1	Coupling for elastomer star

Number	Quantity	Designation Coupling protection (standard version)
2204	1 sentence	Coupling protection
	consisting of	
	2	solid plate
	2	sliding plate
	1	flange
	4	Savetix screws
	4	slices
	4	Hex bolts



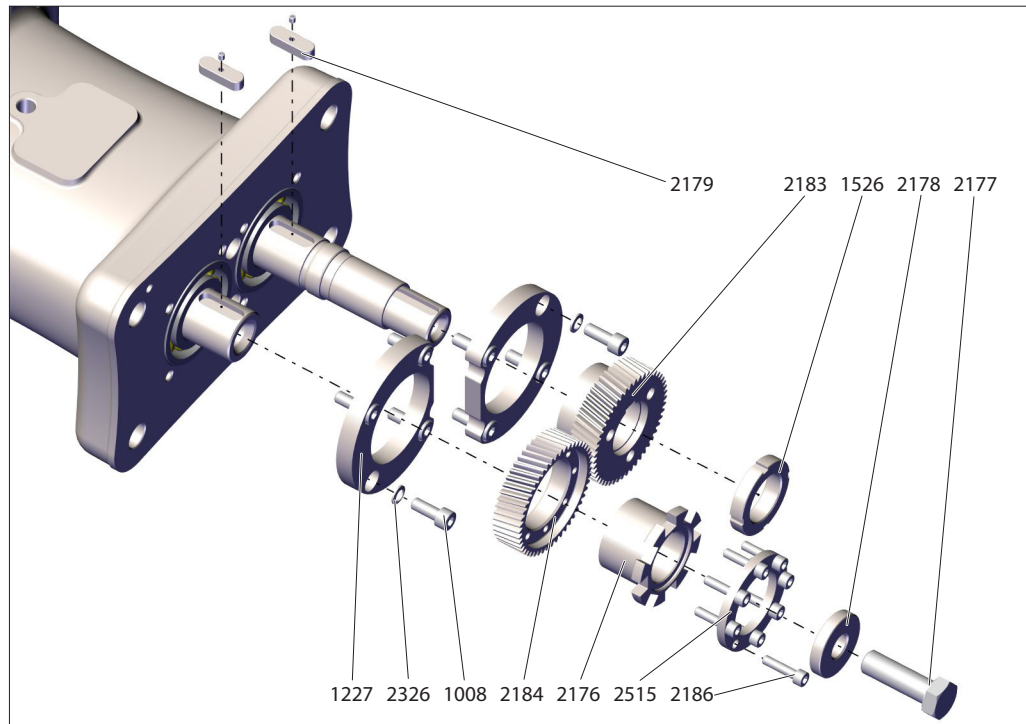
10.3 Gear housing



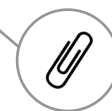
Number	Quantity	Designation Gear housing
1010	1	Shaft seal ring
1183	1	Spring key
2172	1	Gear housing
2233	2	Sealing screw
2258	4	Hex. screw
2360	1	Oil level gauge
2513	1	O-ring
2514	4	O-ring



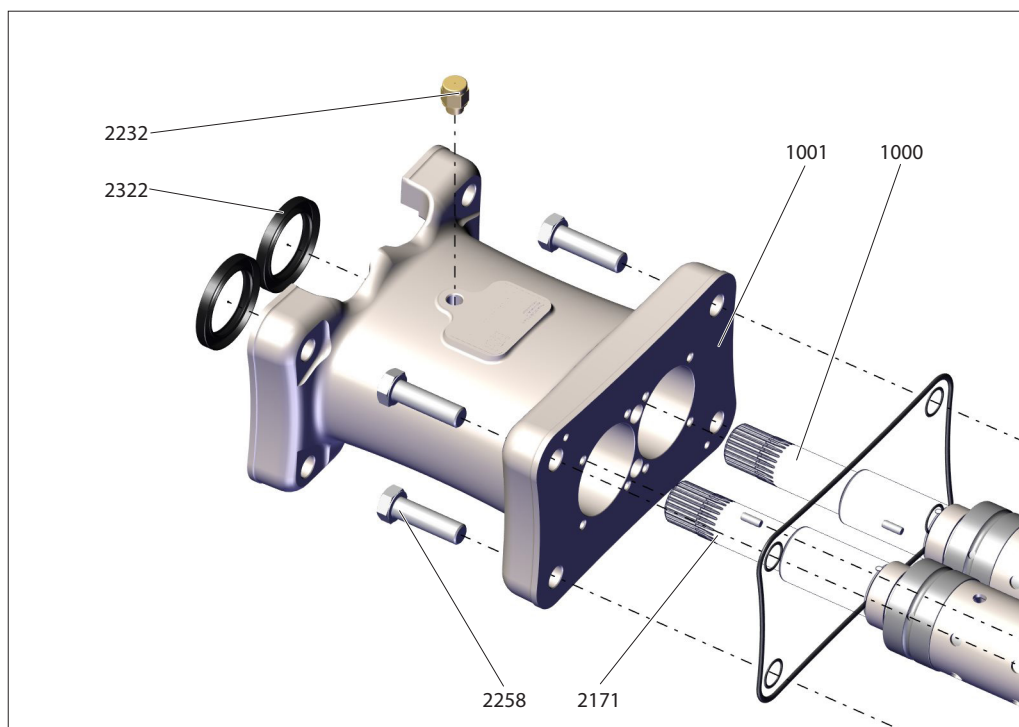
10.4 Gearbox



Number	Quantity	Designation Gearbox
1008	8	Cylinder screws
1227	2	Bearing caps
1526	1	Shaft nut (with grub screw)
2176	1	Hub for helical gear
2177	1	Hex. screw
2178	1	Tension washer
2179	2	Spring key
2183	1	Helical gear for drive
2184	1	Helical gear for output
2186	8	Cylinder head screw
2326	8	Washer
2515	1	Clamping ring synchronisation



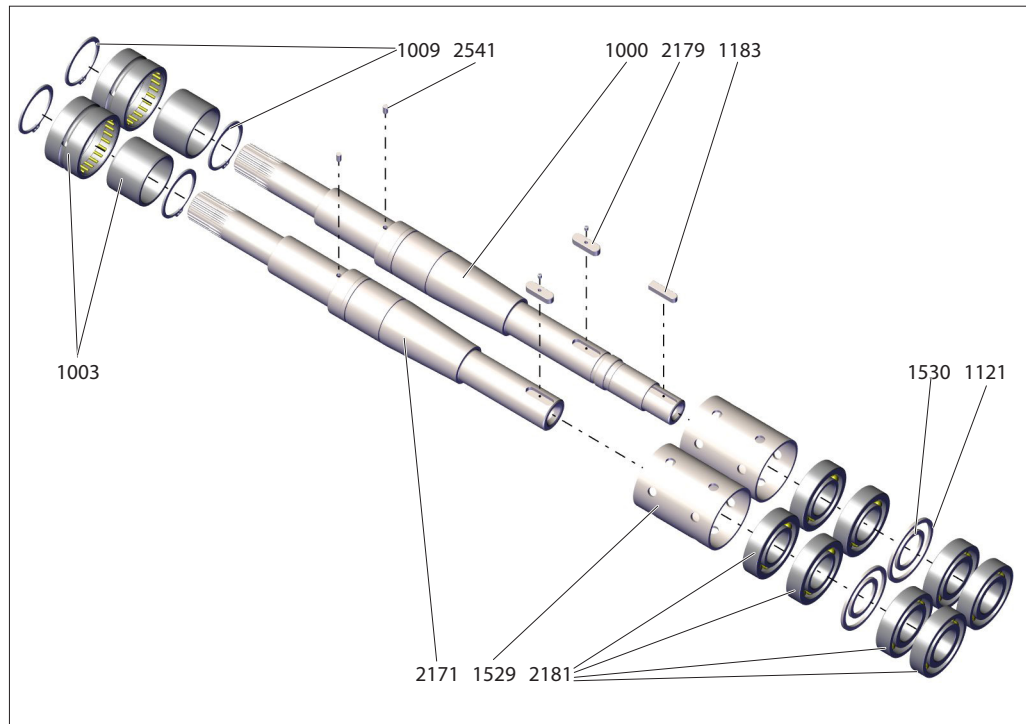
10.5 Bearing housings



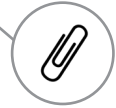
Number	Quantity	Designation Bearing housings
1000	1	Drive shaft
1001	1	Bearing housings
2171	1	Output shaft
2232	1	Vent valve
2258	4	Hex. screw
2322	2	Shaft seal ring



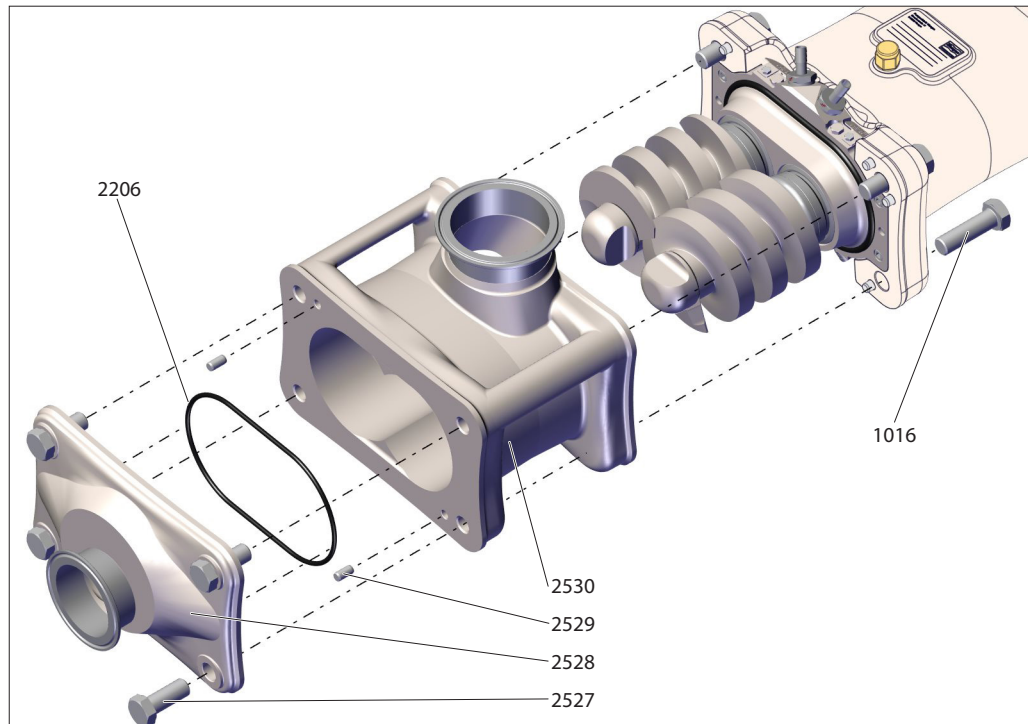
10.6 Bearing



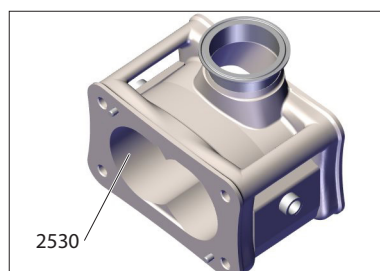
Number	Quantity	Designation Bearing
1000	1	Drive shaft incl. shaft protection sleeve
1003	2	Needle bearings (outer ring and inner ring)
1009	4	Seeger ring
1121	2	Spacer ring
1183	1	Spring key
1529	2	Spacer sleeve
1530	2	Spacer ring
2171	1	Output shaft incl. shaft protection sleeve
2179	2	Spring key
2181	8	Angular ball bearing
2541	2	Driving pin



10.7 Pump housing



Number	Quantity	Designation Pump housing
1016	4	Hex. screw
2206	1	O-ring
2527	4	Hex. screw
2528	1	Cover
2529	2	Positioning pin
2530	1	Pump housing

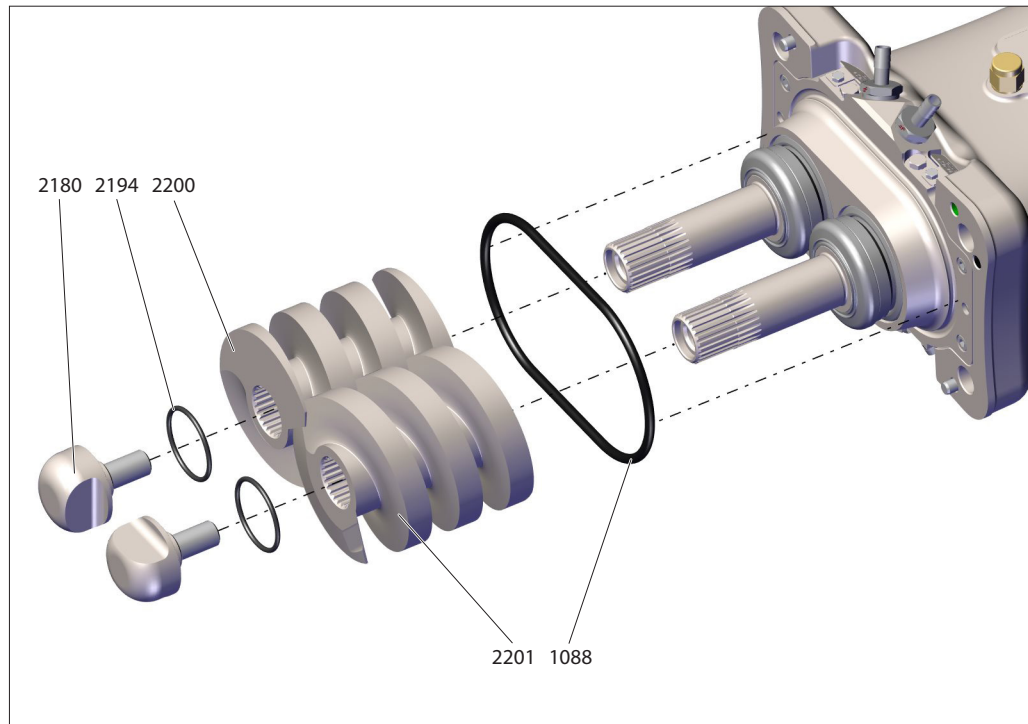


Pump housing with heating jacket/cooling jacket

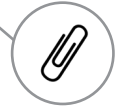
- with side-mounted connections for inlet and outlet of hot or cold water.
- with drain plug at the bottom.



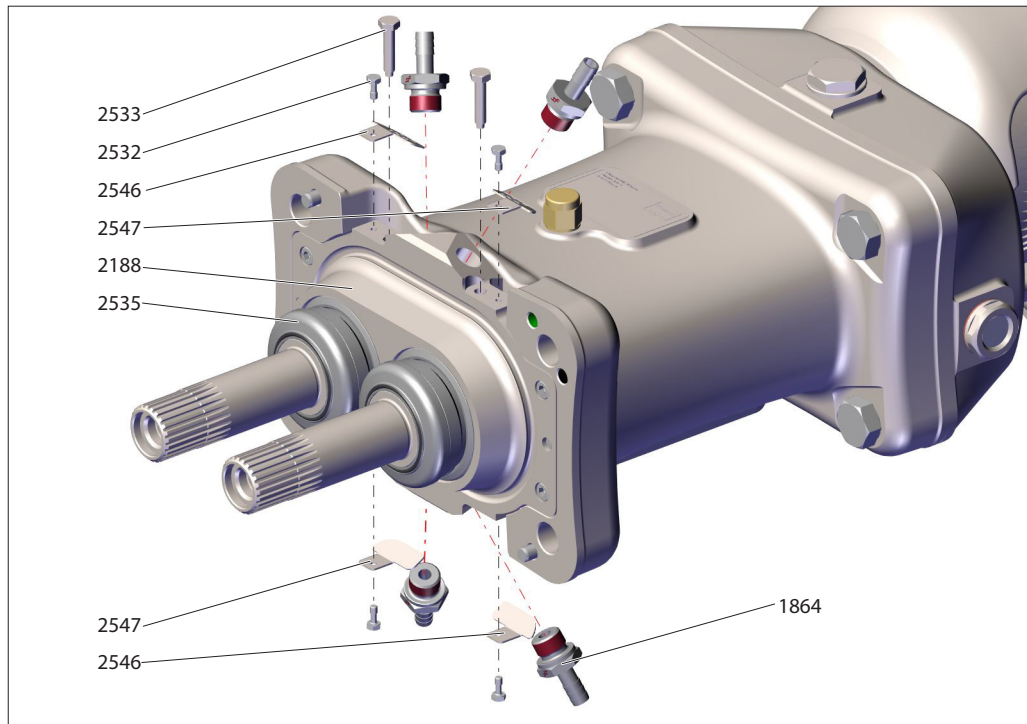
10.8 Pump set



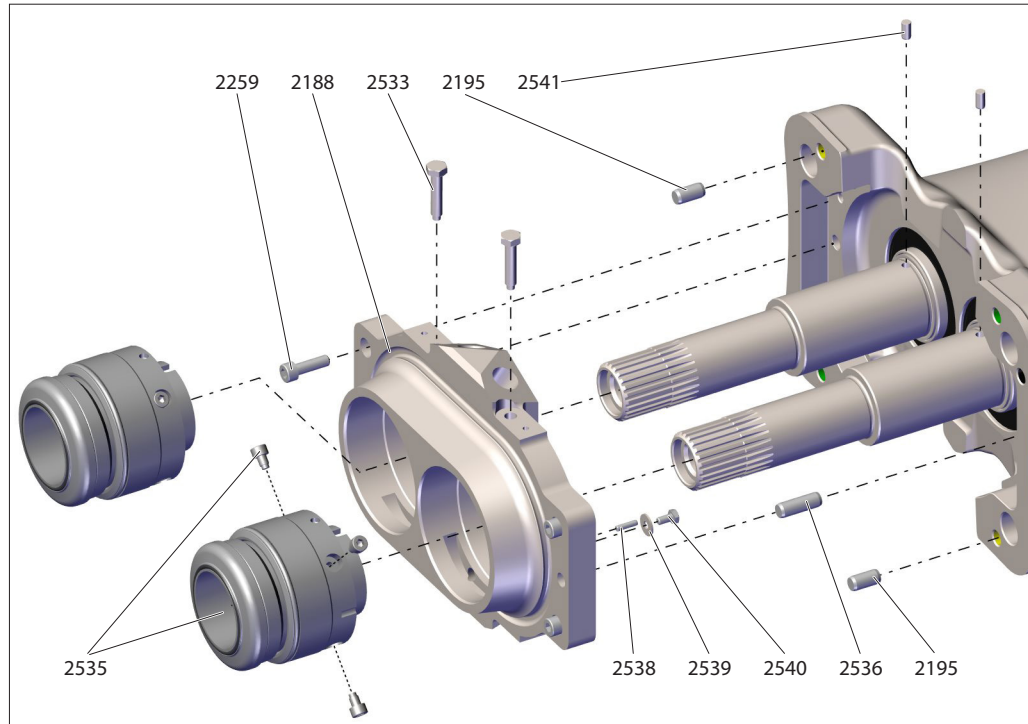
Number	Quantity	Designation Pump housing
1088	1	O-ring
2180	2	Spindle screws
2194	2	O-ring
2200	1	Screw spindle, right
2201	1	Screw spindle, left



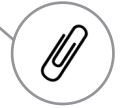
10.9 Seal retainer



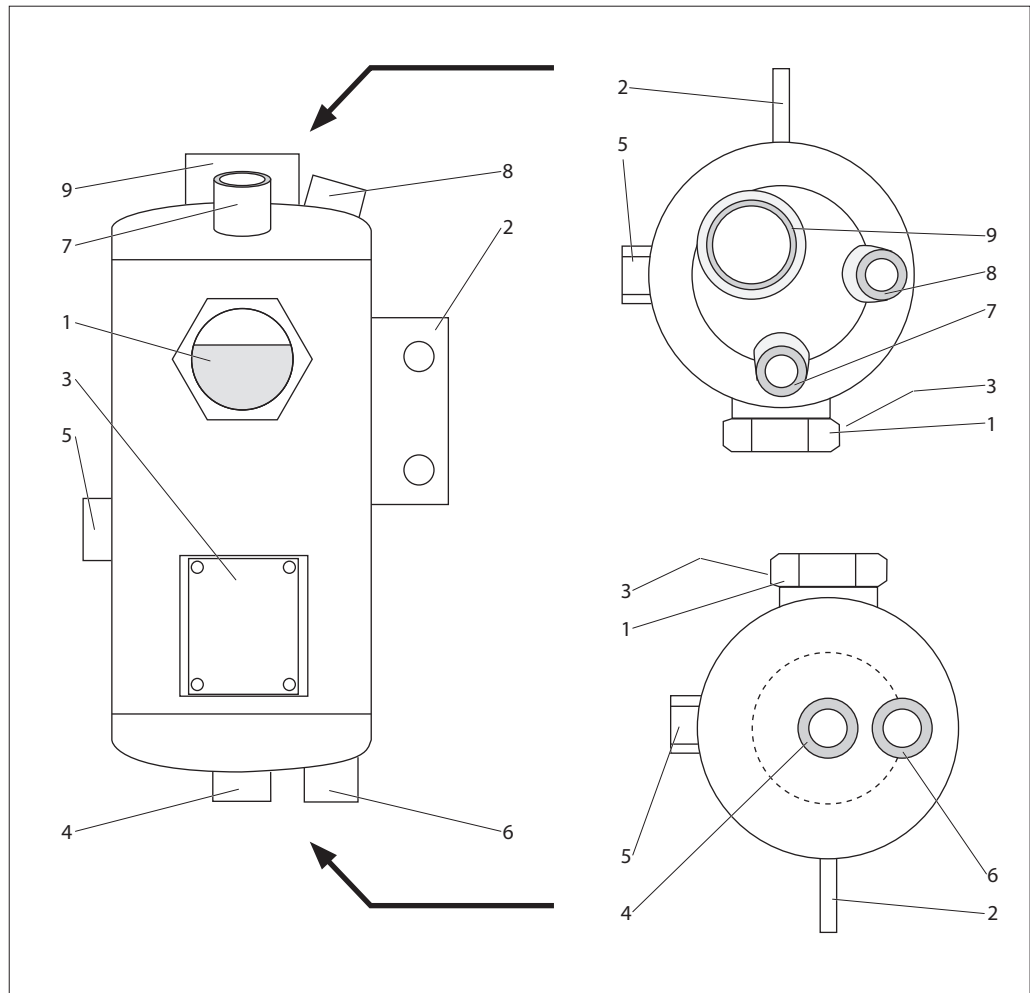
Number	Quantity	Designation Seal retainer
1864	4	Hose nozzle
2188	1	Seal retainer
2532	4	Hexagon head screw, Savetix
2533	2	Fixing screw
2535	2	Mechanical seal (GRD cartridge)
2546	2	Intervention protection, right
2547	2	Intervention protection, left



Number	Quantity	Designation Seal retainer
2188	1	Seal retainer
2195	2	Position pin for flow direction
2259	4	Cylinder head screw
2533	2	Fixing screw
2535	2	Mechanical seal (GRD cartridge)
2536	2	Positioning pin
2538	2	Positioning pin
2539	2	Washer
2540	2	Hex. screw
2541	2	Driving pin



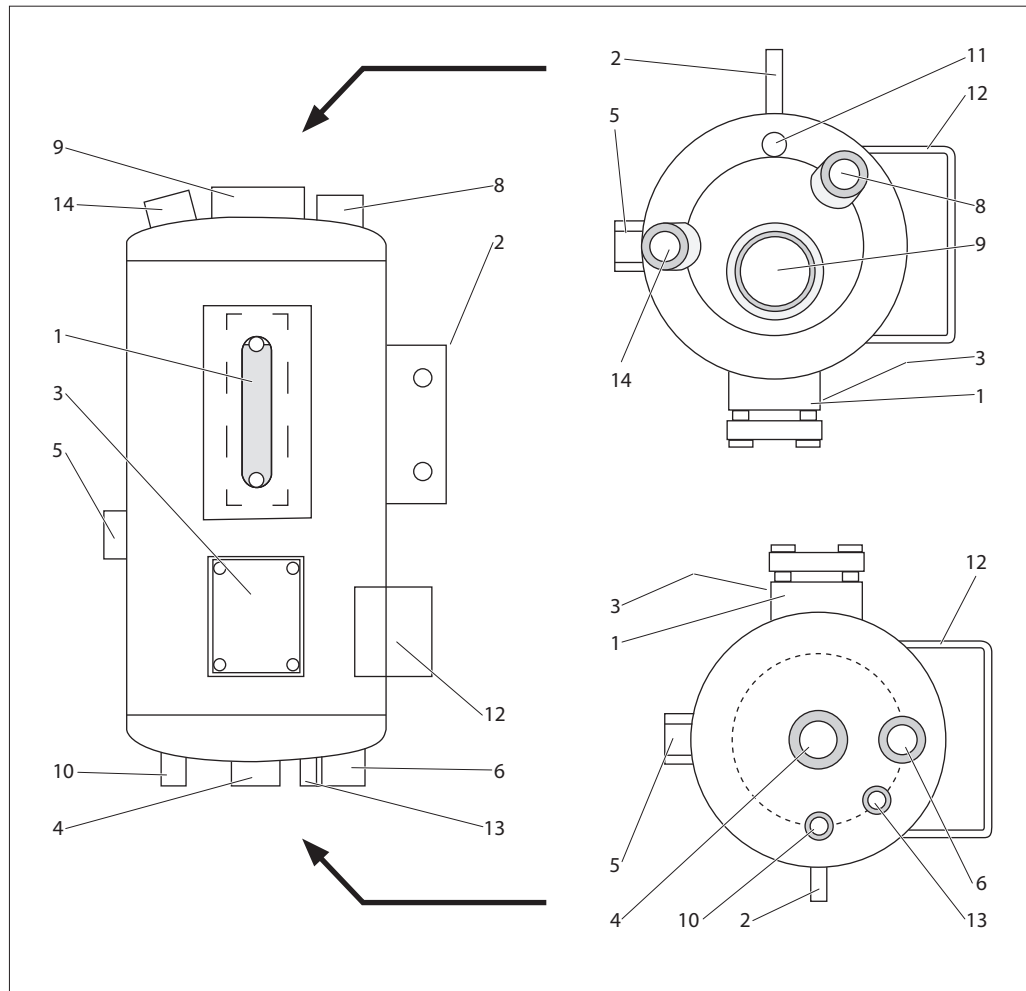
10.10 Chetra 3 LS pressure vessel



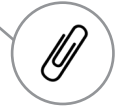
Number	Quantity	Description of the sealing pressure vessel "Chetra 3 LS".
1	1	Sight glass
2	2	Mounting
3	1	Nameplate
4	1	Drainage
5/R1/R2	1	Return connection
6/V1/V2	1	Supply connection
7	1	Vent
8	1	Pressurisation
9	1	Connection level switch



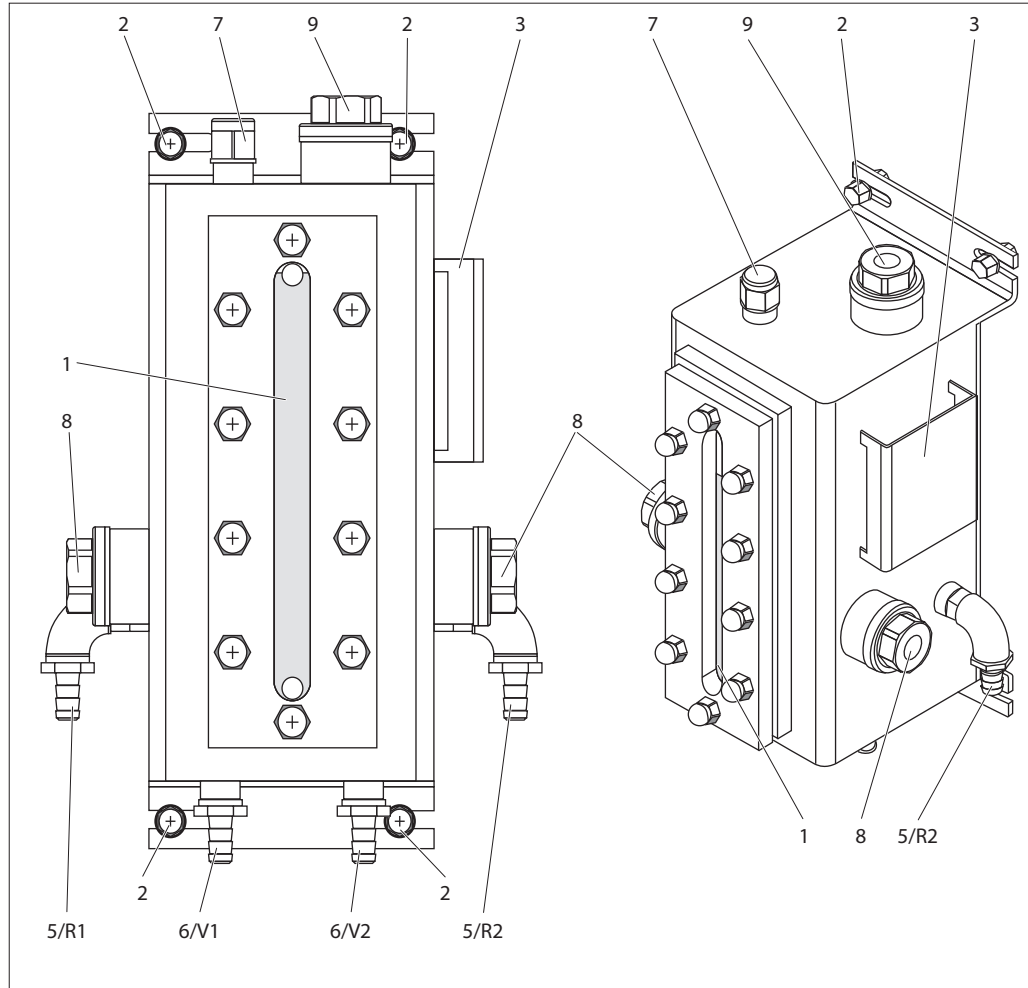
10.11 Chetra 6 LSK pressure vessel



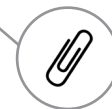
Number	Quantity	Designation of the barrier pressure vessel "Chetra 6 LSK"
1	1	Sight glass
2	2	Mounting
3	1	Nameplate
4	1	Drainage
5/R1/R2	1	Return connection
6/V1/V2	1	Supply connection
7	-	-
8	1	Pressurisation
9	1	Connection level switch
10	1	Cooling water inlet
11	1	Cooling water outlet
12	1	Attachment of hand refill pump
13	1	Connection of hand refill pump
14	1	Connection of reserve/connection filling



10.12 Simon 3 LSQ storage container



Number	Quantity	Description of sealing pressure vessel "Simon 3 LSQ"
1	1	Sight glass
2	2	Mounting
3	1	Nameplate
4	-	-
5/R1/R2	1	Return connection
6/V1/V2	1	Supply connection/draining
7	1	Vent
8	2	Connection reserve
9	1	Connection level switch/filling connection



Annex



11. Cleaning method for screw spindle pumps

11.1 Overview of cleaning processes

Hygienic aspects are of immense importance for pumps designed to deliver food¹, cosmetics, chemicals or pharmaceuticals - such as the WANGEN Twin NG. Pumps must be clean before commissioning and before each production run. How the system/pump is to be cleaned depends on the type of pumped medium and its production conditions.

The efficiency of cleaning is largely determined by the mode of action of mechanical, chemical and thermal processes and depends on the type of soiling. Knowledge of bacteria (e.g. occurrence, structure, vegetative reproduction and spore formation); acids/alkalis and cleaning agents, the combination of which or how these can be optimally coordinated, is decisive for the success of the cleaning.

NOTE

Several options are available for cleaning the pumps:

- COP (Cleaning Out of Place) cleaning process.
- CIP (Cleaning In Place) cleaning process.

and in addition:

- SIP sterilisation process (Sterilisation In Place).

There are two concepts for the CIP cleaning process:

- **"Loss Cleaning"**: The cleaning agents are discarded immediately after use. This process is mostly used for heavy soiling. The cleaning solution is always fresh at the beginning of the cleaning process.
- **"Batch cleaning"**: In this process, the cleaning solution is reused after the first cleaning cycle - the cleaning solution is hardly contaminated at all. Less detergent is used to recover the cleaning solution and the water and energy consumption is lower.

A reproducible cleaning process is determined on the basis of the operational requirements - cleaning agents to be used, pressure, temperature, (persistence) time, concentration and flow speed. COP/CIP cleaning and SIP sterilisation processes can be optimised by validation and by close observation and documentation of the process(es). In principle, it must be clarified how many cleaning cycles are necessary per cleaning process. A process specifically tailored to a particular product or application influences the entire production cycle and can shorten the cleaning time or extend the production time.

NOTE

In general, there are three different layers of dirt:

- Structural dirt (from 2 mm thickness).
- Dirt cover (up to 2 mm thickness).
- Adhesive dirt (dirt film).

Cleaning must be carried out safely, as very strong chemical cleaning agents are standardly used, which can endanger persons, the environment or the machine.

1 The term "food" is used in these operating instructions to refer to food/beverages and dairy products in general.



Intensive studies are currently being carried out into new cleaning and disinfection technologies. The aim is to minimise environmental pollution by reducing the use of conventional cleaning agents or by cutting energy consumption.

NOTE

- *For all cleaning/sterilisation processes, the operator of the system/pump is responsible for ensuring successful cleaning.*
- *Almost every company has developed its own CIP cleaning process/SIP sterilisation process, which is specially adapted to the medium being pumped.*
- *In the event of doubt, contact the pump manufacturer WANGEN Pumpen and make sure that the pump is suitable for the selected cleaning procedure.*

11.2 COP cleaning process



DANGER

Danger of being pulled in due to rotating machine parts and danger due to unintentional restarting of the pump.

Death or severe injuries.

- *Do not perform any work while the pump is running.*
- *Disconnect the connection to the power supply.*
- *Switch off and lock the main switch.*

In the COP (Cleaning Out of Place) cleaning process, the pump is disassembled into individual parts. These individual parts are washed manually with suitable cleaning agents. In the subsequent reassembly process, new soiling of the individual parts must be avoided or the cleaning process must be repeated.

After removing the contamination, the individual parts can be sterilised in a further processing stage, e.g. in an autoclave (see chapter “11.4 SIP sterilisation process”).

11.3 CIP-cleaning process in general

The CIP (Cleaning In Place) cleaning process eliminates the need to dismantle the pump into its individual parts. In process engineering facilities, the CIP cleaning process runs fully automatically - the production process is switched over to the cleaning process. The WANGEN pump and associated piping is cleaned on site. The cleaning process is carried out in steps defined by the facility operator (see chapter “6.4 Procedure of a CIP cleaning/SIP sterilisation process”). The cleaning fluid flows through the system in a cleaning circuit. Potential hazards or contaminations can be avoided by following the CIP cleaning procedure (and validation).



This cleaning process must be carried out:

- Before the pump is used for the first time.
- Between two production runs or batch change.
- After installation of new spare parts which come into contact with the medium.
- After operations, i.e. before prolonged standstill.
- After long standstill, before recommissioning.

Four parameters ("Sinner's circle") are relevant for the cleaning effect, which are explained in more detail in the following sub

s. All four parameters are interconnected and interdependent. This does not mean that each of the four parameters must be equally represented in order to achieve a good cleaning result - but rather that, if one parameter is changed, the other three parameters may have to be adjusted in order to achieve a comparable cleaning effect.

11.3.1 Mechanical cleaning effect

In the CIP cleaning process, the first parameter to act is the mechanical component - the shear force or wall shear stress exerted by the flow. The flow transports the cleaning solution to the contaminated area (surface), reacts with it, removes the contamination (structural dirt and dirt cover) and extracts it from the pump/facility.

Demands on the flow:

- Flow must be turbulent.
- Optimum flow speed: $1.5 \leq v \leq 2.1 \text{ m/s}$.
- Flows which hit an expansion point, e.g. in the pipe, lose their flow speed. A turbulence zone is formed - shear force and shear stress decrease. An excessively low flow speed can lead to cleaning problems.

11.3.2 Chemical cleaning effect

In order to remove impurities from surfaces, the second parameter to be used is the chemical component. The spectrum of cleaning agents ranges from:

- pure chemicals: e.g. sodium hydroxide, nitric acid or phosphoric acid.
- to commercially available, ready-made cleaning agents of complex composition.
- pure chemicals with the addition of additives.



WARNING

Risk of injury from caustic alkalis or acids.

Corrosive and irritating effects on the skin, eye damage and/or severe injuries - depending on the detergent used, depending on the concentration of caustic solution or acid.

- *Observe the hazard information and safety data sheets of the cleaning agents used.*
- *Use protective clothing, gloves and goggles.*



Main components of all ready-made cleaning agents

1. Alkaline cleaner - lye:
 - e.g. caustic soda lye (sodium hydroxide, NaOH); 1 - 2 wt. %².
 - Dissolves mainly organic impurities such as fat, sugar, proteins and adhesive dirt.
2. Acid Cleaner - Acid
 - e.g. nitric acid (HNO₃); 0.5 - 1.5 %³ by weight or phosphoric acid (H₃PO₄).
 - Acids dissolve inorganic compounds, e.g. minerals (CaCO₃) and
 - acids also dissolve fat, sugar proteins and adhesive dirt to a certain degree.

Other optional components:

3. bleach
 - e.g. sodium hypochlorite (NaOCl), or hydrogen peroxide (H₂O₂)
4. chelating agents
 - bind e.g. alkaline earth ions like Ca²⁺, Mg²⁺, Fe^{2+/3+}, Mn²⁺ and can thus reduce the water hardness.
5. surfactants
 - reduce the surface tension so that the surface of the dirt can be better wetted and cleaning becomes more efficient.

Cleaning agents must be dosed with sufficient precision that an optimum cleaning result is achieved. The manufacturer's dosage instructions for the cleaning agents must be strictly adhered to. Overdosing or underdosing leads to an inadequate cleaning result.

For this it is important to know the initial concentration⁴ of the cleaning agent. The desired concentration required for the cleaning process is achieved by adding the appropriate amount of water.

Due to increasing cleaning requirements, there is a trend towards automatic process control with continuous process monitoring. The addition of detergents or surfactants, for example, is automatically controlled in order to obtain and guarantee optimum cleaning results.

11.3.3 Thermal cleaning effect⁵

The third parameter used is the thermal force - heat. Due to higher thermal energy in the system, the molecules of water or cleaning solution move faster and are deposited at the interfaces of the dirt particles - the cleaning effect increases. Adhesive dirt can be removed by heat.

However, depending on the type of contamination, the cleaning temperature must not be set too high, otherwise the opposite effect may occur. Chemical reactions in the dirt layers can lead to denaturation or cross-linking, which makes it difficult to dissolve impurities. For example, proteins begin to denature at temperatures of 60 °C and above.

As a general rule, the pump/system must be cleaned at the same temperature as it was used for processing food or products.

2 If an excessively high NaOH concentration is used, cross-linking of proteins can occur - these are more difficult to dissolve.

3 The use of higher-concentration nitric acid can attack polymers and stainless steel.

4 The unit of concentration used in the industry is percent [%], more precisely percent by weight [% by weight] - unless otherwise stated. At this point, it is important to distinguish between weight percent [% by weight] and volume percent [% by volume].

5 The temperature specifications of the individual defined cleaning steps must be determined and validated by the operator.



11.3.4 Time⁶

Time as the fourth parameter is the length of time during which mechanical, chemical and thermal cleaning can take effect. Most surfaces become clean even if the optimum cleaning temperature or concentration of the cleaning agent is not used and the optimum flow speed is not maintained - the entire cleaning process then has to run for a correspondingly long time.

11.4 SIP sterilisation process

The SIP sterilisation process (Sterilisation In Place) or SIP disinfection process is an extension of the CIP cleaning process by an additional stage - sterilisation or disinfection. The sterilisation of the pump/facility is usually carried out through the same circuit as the CIP cleaning process.

The sterilisation or SIP sterilisation process begins after the COP/CIP cleaning process has been completed. Surviving microorganisms (bacteria, viruses, spores - in every stage of development) are killed in the pump/facility according to the current state of the art with the help of saturated pure steam at high temperatures. The cleaning effect can be increased by adding chemical disinfectants (usually on an acid basis). Drying with sterile air then takes place.

NOTE

General information about sterilisation.

- *During sterilisation/disinfection (decontamination and partial sterilisation) only certain microorganisms are removed and only to a certain extent.*
- *During a sterilisation process, the same conditions must prevail at every point of the pump/facility.*
- *There is no universal sterilisation procedure. The choice of process depends on the type and extent of microbial contamination: thermal, chemical, radiation and filtration - the process described here refers to sterilisation by saturated steam - humid heat.*
- *The ideal case is 100 % disinfection - the ideal case is never achieved in practice. A maximum disinfection rate of only 99 % can be achieved (see note Probabilities of the death rate of microorganisms during sterilisation: Decimal reduction time D_T). Complete certainty that after a certain heating period all microorganisms have been killed due to sterilisation cannot be achieved.*
- *The initial bacterial count is an important factor in sterilisation, especially the initial bacterial count of the heat-resistant endospores of bacteria (see reference endospores/ endospore-forming bacteria) - the reduction of the number of microorganisms (reduction of the bacterial count) is achieved by the CIP cleaning process successfully carried out previously.*
- *When sterilising by heat, a heating and cooling phase must be passed through. In these phases, microorganisms also pass through lethal temperatures, but they are not as effective as the higher temperature in the holding or plateau phase (~20 min). This heating and cooling phase also contributes to sterilisation.*

⁶ The times for the individual defined cleaning steps must be determined and validated by the operator.



NOTE

Probabilities of the death rate of microorganisms during sterilisation:

- Typically, sterilisation requires that the number of resident microorganisms be reduced by six orders of magnitude (**SAL Value = 10^{-6}**).
SAL value: [Sterility Assurance Level] The probability of the presence of a viable micro-organism equal to or less than $1:10^{-6}$.
- The duration of sterilisation must be at least six times the "**decimal reduction time D_T (D_T value)**" ($6D_T$). This is the period [unit: min] in which nine tenths (90 %) of a population die, i.e. a microorganism has a 10 % probability of survival when exposed to these conditions. The probability that it will be killed in the next decimal reduction time $2D_T$ is 90 % again - the probability that it will be killed within this second decimal reduction time ($2D_T$) only increases to 99 % overall.
- This means the following: Complete certainty that after a certain heating period all microorganisms have been killed due to sterilisation cannot be achieved.
- The D_T value is a characteristic value for the heat sensitivity of microorganisms. The D_T value is determined experimentally. It is dependent on:
 - Type of microorganisms.
 - Developmental stage in which the microorganism is located.
 - Ambient environment.
 - Temperature.
- The death rate of microorganisms (expressed by the "**Z-value**") increases with temperature - the decimal reduction time D_T thus decreases. This Z-value [Unit: °C] indicates the amount by which the temperature must be increased in order to reduce the D_T value to one tenth - i.e. to increase the killing effect tenfold (factor of 10).
- When sterilising by heat, a heating and cooling phase must be passed through. In these phases, microorganisms also pass through lethal temperatures, but are not as effective as the higher temperature in the holding phase (~20 min). This heating and cooling phase also contributes to sterilisation.
- In order to have a simple measure for the overall effect (mortality rate due to sterilisation, incl. heating and cooling phase as well as holding phase (plateau phase)), the "**F-value**" was introduced. It is a measure of the sum of all killing effects during the entire heating process expressed as time equivalent [Unit: min] for a reference temperature.
- In practice, reference is made to the F_0 value, which is defined as follows:
 - 10-fold mortality rate or $1/10$ - D_T value
 Z-value: 10.1 °C
 - At a reference temperature of: 121.1 °C (rounded: 121 °C).
 - An F_0 value of 8 therefore means that the entire heating process on microorganisms with Z value = 10 has the same killing effect as heating at 121.1 °C and a duration of 8 min.
- The decimal reduction times and mortality rate on temperature increase are characteristic for various microorganisms.

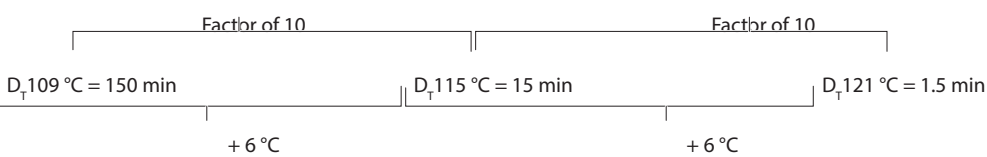


D_T and Z values for some spore-forming bacterial species during sterilisation			
Microorganism	D_T value for		Z value
	115 °C	121 °C	[°C]
<i>Geobacillus stearothermophilus</i> (germ)	10 - 24 min	1.5 - 4.0 min	6 - 7
<i>Bacillus atrophaeus</i> (germ)	2.2 min	0.4 - 0.7 min	8 - 13
<i>Clostridium sporogenes</i>	2.8 - 3.6 min	0.8 - 1.4 min	12
<i>Clostridium botulinum</i>	--	0.2 min	10

Calculation example on the basis of the lead germ: *Geobacillus stearothermophilus*

measured output bacterial count: $N_0 = 10^3$
 desired bacterial count (standard requirement): $N_g = 10^{-6}$
 Formula: $n = \log N_0 - \log N_g$
 $n = \log 10^3 - \log 10^{-6}$
 $n = 3 - (-6) = 9$
 Calculation of F-value: $F = n \times D_{T(121\text{ °C})}$ $F = 9 \times 1.5 = 13.5 \text{ min}$
 Safety margin "overkill procedure": +1.5 min
 Sterilisation time D_T: **15 min**

Z value: Temperature change [°C] required to change the D_T value by a factor of 10.
 Z value *Geobacillus stearothermophilus* = 6 °C



Tab. 26: D_T and Z values for some spore-forming bacterial species during sterilisation and sample calculation (simplified) for the leading bacterium *Geobacillus stearothermophilus*

NOTE

Microorganisms.

- Microorganisms are microscopically small creatures that are usually not visible to the naked eye as individuals. Most microorganisms are unicellular organisms, including small cell organisms of corresponding size. Microorganisms include bacteria, many fungi (e.g. moulds), yeasts, microalgae and protozoa. Although viruses are not regarded as living beings, they are usually counted as microorganisms because of their size.
- Microorganisms are ubiquitous, i.e. they occur everywhere. 70 % of all life on earth consists of microorganisms.
- Microorganisms (e.g. lactic acid bacteria or baker's yeasts) are used to produce food (e.g. cheese and dough) or antibiotics.



NOTE

Continued: Microorganisms...

- *Pathogenic microorganisms can cause severe to fatal food poisoning and diseases in humans and animals.*
- *Microorganisms vary greatly in their size and structure (e.g. structure of cell walls) and thus vary in their resistance to external influences such as heat.*
- *There is a fundamental difference in the mechanisms of damage:*
 - Viruses with no metabolism of their own.
 - Microorganisms with their own metabolism (bacteria, fungi).
- *The stage of development in which the microorganism finds itself has a critical influence on its heat resistance:*
 - Cells in the growth phase are much more susceptible to heat.
 - Cells in the stationary phase are much more resistant to heat.
- *Microorganisms such as bacteria multiply in the vegetative form, i.e. by cell or nucleus division, for an unlimited period of time, as long as favourable environmental and nutritional conditions are present.*
- *Spore formation (sporulation) is triggered by adverse environmental conditions (e.g. lack of food, stress, excessive concentration of metabolic products or other unfavourable growth conditions). Sporulation usually occurs at the end of exponential growth - at this point the nutrient supply is reduced due to the high cell density of the bacteria.*

NOTE

Viruses.

- *In the case of viruses, a distinction must be drawn between "naked/unenveloped" viruses and "enveloped" viruses:*
 - "Naked" viruses: consist only of a nucleocapsid.
 - "Naked" viruses can be inactivated by physical influences such as temperature, UV radiation or ionising radiation.
 - "Naked" viruses are more resistant to heat.
 - "Enveloped" viruses: consist of a nucleocapsid and an outer shell of proteins, carbohydrates and phosphate-containing lipids.
 - Like "naked" viruses, "enveloped" viruses can be inactivated by physical influences such as temperature, UV radiation or ionising radiation. In addition, protein denaturants can inactivate the "enveloped" virus.
 - "Enveloped" viruses are more susceptible to heat. Even at temperatures of 55 - 70 °C of humid heat, the virus envelopes are denatured.
 - Since viruses are neither "germs" nor resident microorganisms, the terms "sterile" or "killed" are not used in virology. The term virus inactivation is used. This refers to the loss of infectivity of viruses due to the effects of heat or radiation, for example.



NOTE

Endospores/endospore-forming bacteria.

- *Endospore-forming bacteria are among the major contributors to food spoilage and food-borne diseases. They occur ubiquitously and can contaminate food in almost every processing step.*
- *(Endo-)spores of bacteria occupy a special position:*
 - In biology, a spore is a stage in the development of living beings. The spore consists of only one cell or a few cells and is used, among other things, for asexual reproduction and spread. Spores are formed, for example, by bacteria, protozoa, fungi, algae, mosses and ferns. Spores are often formed in large numbers. The metabolism of the spores can be restricted or completely suspended.
 - (Endo-)spores are permanent forms.
 - (Endo-)spores are used to survive dry periods.
 - (Endo-)spores, due to their strong dehydration (max. water content: 25 %) and the storage of dipicolinic acid in complex with calcium ions (Ca-dipicolinate), are particularly resistant to external influences such as heat, dehydration, chemicals etc. (only for heat-resistant endospores). The higher the Ca-dipicolinate content in the cell, the higher the resistance to heat.
 - In dry soil samples, about 90 % of the spores lose their viability in 50 years; some endospores can remain dormant for thousands of years and still be germinable.
 - The spore mantle (outer layer of the endospores) is the main reason for the chemical resistance - it is usually impermeable to chemical substances such as acids, bases, oxidising and organic solutions.
 - Endospores have multi-layer membrane sheaths (up to six sheaths).
 - Endospores are formed by certain (gram-positive) bacteria of the genus *Clostridium* and *Bacillus*. Gram-positive bacteria have a thick multilayer cell wall as a characteristic - Gram-negative bacteria, on the other hand, have only a thin single-layer cell wall.
 - Endospores do not show any metabolism.
 - Endospore formation is triggered e.g. by lack of food, stress or other unfavourable growth conditions within the microorganism - and is completed e.g. in bacilli after approx. 8 hours. Only one endospore develops per cell (in rare cases up to seven endospores). Once the process of endospore formation has begun, this process can no longer be stopped, even if the environmental conditions become favourable again.
 - When the growth conditions become favourable again, an endospore develops into a spore again within a few minutes (germination) and the process of vegetative propagation starts all over again. In this process, the spore loses its properties - for example, its high resistance to heat is lost. The process of germination is irreversible.
 - The process of germination and transformation into a vegetative cell takes place in phases:
Phase I: The process of germination is often triggered by heating for ten minutes at 60 - 100 °C for a short time. The envelope of the endospore becomes more permeable and, like other bacteria, can be killed by heat. Phase II: In this phase, the cell absorbs water again and swells. The Ca-dipicolinate complex characteristic of endospores is released again and dissolved. Phase III: In this phase, the cell grows and a vegetative cell is formed which is identical to the original mother cell before sporulation. This again has the ability to grow and multiply.



NOTE

Sterilisation.

- *In order to achieve a lasting effect of sterilisation, it must be ensured that the moist heat also reaches the microorganisms - dirt and protective layers must overlap and thus shield the microorganisms as little as possible. The exposure times are considerably extended if microorganisms are protected from heat by organic or inorganic material.*
- *Humid heat is much more effective than dry heat at the same temperature - air is a worse heat conductor than water vapour. So higher temperatures and longer exposure times are required for sterilisation in dry condition.*
- *Proteins (protein) are denatured much more easily in humid heat than in dry heat.*
- *The denaturation of the proteins already starts at 55 - 60 °C. By adding moisture (e.g. steam) and pressure, denaturation can start earlier. Due to their cell wall structure, various microorganisms have greater resistance to denaturation (60 - 70 °C). [Denaturation is the loss of the native protein structure. The polypeptide chains wind up under the influence of heat, lose their natural structure and form random arrangements. Proteins thereby lose their properties such as water binding capacity.]*
- *The pH value in the range of 6 - 8 is generally regarded as the optimum in the heat tolerance of microorganisms. Bacteria have the highest tolerance to heat at a pH value of 6 - 7, yeasts and moulds at a pH value of 3 - 6. Above and below this optimum, the sensitivity of microorganisms to heat increases. This means that the dwell time at the same temperature required for killing becomes shorter.*
- *The effect of heat tolerance as a function of pH value is most apparent at low temperatures and generally decreases with increasing temperature - with the exception of endospores. Endospores show a significant influence of the pH value even at temperatures of 120 - 130 °C.*
- *The germination of spores or endospores [(endo)spores] can only be prevented if the optimum sterilization conditions are achieved.*
- *It must be ensured that the (endo)spores are actually dead and not just extremely inactive. For this reason, the sterilisation parameters must be adapted to the currently most stable known endospores. This is regarded as the so-called "leading germ or test germ" for successful sterilisation. According to current knowledge, these are the endospores of:*

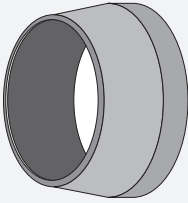
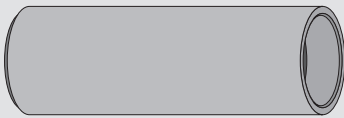
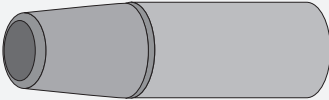
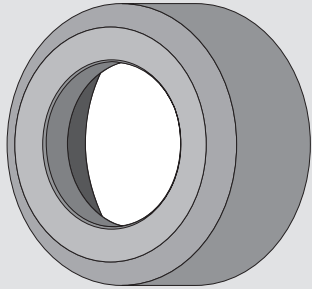

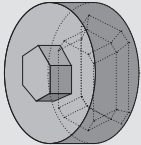

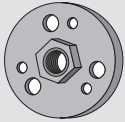
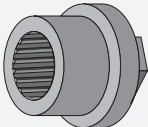
"Geobacillus stearothermophilus"

Temperature:	121 °C
Time:	15 min
Pressure:	1 bar

Not a pathogen - it is not pathogenic either to humans or to animals.



12. Tool table WANGEN Twin NG 180

Tool number/ Tool number	Tool/ Tool	Description/ Description
T0100		Mounting cone: Shaft seal ring bearing housing <i>Mounting cone: Shaft seal ring bearing housing</i>
T0101		Mounting bush: Shaft seal ring bearing housing <i>Mounting bush: Shaft seal ring bearing housing</i>
T0102		Mounting cone: Shaft seal ring gear housing <i>Mounting cone: Shaft seal ring gear housing</i>
T0103		Mounting bush: Mechanical seal cartridge <i>Mounting bush: mechanical seal cartridge</i>
T0104		Mounting bush: Shaft seal ring <i>Mounting bush: Shaft seal ring</i>
T0106		Spindle wrench <i>Spindle wrench</i>
T0109		Socket spanner: Groove nut <i>Socket spanner: Groove nut</i>
T0110		Puller: Helical gear <i>Puller: Helical gear</i>
T0111		Socket spanner: Input/output shaft <i>Socket spanner: Drive shaft/driven shaft</i>