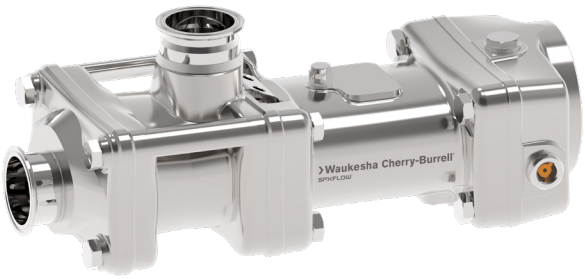
Waukesha Cherry-Burrell®

INSTRUCTION MANUAL

WTS

Rotary positive displacement Twin screw pump



FORM NO.: 95-03107

REVISION: 10/2023

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Table of Contents

1. Warranty 10
1.1 Shipping Damage or Loss . . . 10
1.2 Warranty Claim . . . 10

2. General Information 11
2.3 Warnings . . . 11
2.4 Symbols and indicators . . . 11
2.5 Abbreviations . . . 12
2.6 Reference documents . . . 12

3. Safety instructions 13
3.1 Intended use . . . 13
3.2 Foreseeable misuse . . . 13
3.3 Noise emissions . . . 13
3.4 Personnel qualifications and operating phases . . . 14
3.4.1 Special requirements . . . 14
3.4.2 Basic requirements . . . 14
3.5 Personal protective equipment . . . 14
3.6 Conversions, modifications and spare parts . . . 14
3.7 Residual risks . . . 15
3.7.1 Rotating and moving machine parts . . . 15
3.7.2 Pressurized pump . . . 15
3.7.3 Pressurized hot/dangerous liquids . . . 15
3.7.4 Live electrical parts . . . 16
3.7.5 Manipulating the safety devices . . . 16
3.7.6 Suspended loads during transport . . . 16
3.7.7 Danger of being crushed . . . 16
3.7.8 Hot surfaces . . . 16
3.7.9 Slippery surfaces caused by leaks . . . 16
3.7.10 Pumps with a heating jacket: Exceeding the nominal pressure . . . 17
3.7.11 Sharp-edged components and foreign objects . . . 17
3.7.12 Dangerous substances . . . 17
3.7.13 High temperatures during the cleaning process . . . 17
3.8 Danger to equipment . . . 17
3.8.1 Fat . . . 17
3.8.2 Acidic and alkaline cleaning agents . . . 17
3.8.3 Aggressive materials . . . 17
3.8.4 Unsuitable lubricants . . . 18
3.8.5 Mechanical risks . . . 18
3.8.6 Avoiding damage during assembly/mounting/installation . . . 18
3.8.7 Avoiding damage during operation . . . 19
3.8.8 Avoiding damage during assembly/dismantling . . . 19
3.8.9 Non-permitted electrical parameters . . . 19
3.8.10 Thermal risks . . . 20
3.9 Danger of hygiene risks . . . 20
3.9.1 Defective elastomer (O-rings) . . . 20

4. Description 22
4.1 WTS 104/130 main components . . . 22
4.2 General description . . . 23
4.3 Pump operating principle . . . 24

5. Transport, packaging and storage 25
5.1 Transport . . . 25
5.2 Packaging . . . 26
5.3 Storage . . . 26

6. Positioning/securing and integrating 27
6.1 General information . . . 27
6.2 Space needed for operating and servicing . . . 27
6.3 WTS connection in a 3-A/EHEDG certified system . . . 27
6.4 Pressure conditions in the pump housing . . . 28
6.4.1 Pump housing with heating jacket . . . 28
6.5 Pipelines . . . 28
6.6 Installing and securing the pumps . . . 29
6.7 Electrical connection . . . 29
6.8 Assembling the drive and coupling components . . . 30
6.8.1 Drive . . . 30
6.8.2 Fitting the coupling components . . . 30
6.8.3 Assembling the pump (coupling components) and drive . . . 31
6.9 Contact or coupling guard . . . 32
6.10 Shaft seal . . . 32
6.10.1 Mechanical seal cartridge – single-acting . . . 32
6.10.2 Mechanical seal cartridge – double-acting . . . 32
6.10.3 Leaks . . . 33
6.10.4 Loss and circulation flushing . . . 33
6.10.5 Shaft seal quench medium . . . 34
6.10.6 Requirements when tap water is used as the quench medium . . . 34

7. Medium's flow direction 36
7.1 Rotational direction of the screw spindle pump drive . . . 36
7.2 Nozzle orientation on the pump housing . . . 36
7.3 Position pin arrangement on the pump housing . . . 36
7.4 WTS 70 spindle orientation . . . 38
7.5 WTS 104/130 spindle orientations . . . 39

8. Starting and stopping 41
8.1 Starting . . . 41
8.1.1 Preparing the pump for its initial start-up . . . 41
8.1.2 Starting the pump . . . 42
8.2 Stopping the pump . . . 42
8.2.1 Stopping the pump . . . 42
8.2.2 Depressurizing the pump . . . 42
8.2.3 Emptying the pump . . . 42
8.2.4 Disconnecting the pump . . . 42

9. Cleaning process for screw spindle pumps 44
9.1 Before carrying out the cleaning work . . . 44
9.2 Cleaning the external surfaces . . . 44
9.3 Cleaning/sterilizing the internal surfaces . . . 45
9.4 Cleaning specific components after dismantling . . . 45
9.5 Cleaning special components . . . 46
9.6 Cleaning the storage/sealing pressure tank . . . 47
9.6.1 Cleaning the outside . . . 47
9.6.2 Cleaning the internal surfaces/lines . . . 47

10. Service and repairs 48
10.1 Preliminary activities . . . 48
10.2 Requirements . . . 48
10.2.1 General requirements . . . 48
10.2.2 Gear oil . . . 48
10.2.3 Drive bearing lubricant . . . 48
10.2.4 Thread locking paste . . . 48
10.3 Preventing premature elastomer wear . . . 49
10.4 Inspection intervals . . . 50
10.5 Service intervals . . . 51
10.5.1 Service intervals for elastomers that are in contact with the product . . . 52
10.6 Servicing the spindle screw and O-rings . . . 52

10.7 Drain or replace the gear oil . . . 52
10.8 Refilling with gear oil . . . 52
10.9 Servicing the mechanical seal . . . 53
10.10 Sending a pump for repair . . . 54

11. Trouble shooting 55
11.1 Possible causes of shaft seal leaks . . . 55
11.2 Electrical faults . . . 55
11.3 Pump malfunctions . . . 56
11.4 Ordering spare parts . . . 58

12. Assembling and dismantling 59
12.1 Preliminary activities . . . 59
12.2 Tools needed . . . 59
12.3 Handling elastomers . . . 60
12.4 Drive and "Motor adapter" coupling guard . . . 60
12.4.1 Dismantling . . . 60
12.4.2 Assembling . . . 61
12.5 Drive and standard coupling guard . . . 62
12.5.1 Dismantling . . . 62
12.5.2 Assembling . . . 63
12.6 Gearbox housing . . . 63
12.6.1 Dismantling . . . 63
12.6.2 Assembling . . . 64
12.7 Cover and pump housing . . . 65
12.7.1 Dismantling . . . 66
12.7.2 Assembling . . . 66
12.8 Solid pump housing . . . 67
12.9 Screw spindles . . . 67
12.9.1 Dismantling . . . 67
12.9.2 Assembling . . . 68
12.10 Synchronizing the screw spindles . . . 69
12.11 Pump housing arrangement . . . 70
12.12 Mechanical seal cartridge / seal retainer . . . 70
12.12.1 Preparing a new mechanical seal cartridge . . . 70
12.12.2 Dismantling the mechanical seal cartridge / seal retainer . . . 71
12.12.3 Assembling the mechanical seal cartridge / seal retainer . . . 73
12.13 Dismantling a single-acting mechanical seal cartridge . . . 74
12.13.1 Dismantling . . . 74
12.13.2 Assembling . . . 75
12.14 Dismantling a double-acting mechanical seal cartridge . . . 76
12.14.1 Dismantling . . . 76
12.14.2 Assembling . . . 78
12.15 Gearing . . . 79
12.15.1 Dismantling . . . 79
12.15.2 Assembling . . . 80
12.16 Bearing, input and output shafts . . . 80
12.16.1 Dismantling . . . 81
12.16.2 Assembling . . . 82

13. Disposal 86

14. Pump Dimensions 87

15. Part list 88
15.1 Base plate - Standard version . . . 88
15.2 Drive . . . 88
15.3 Coupling and Motor adapter coupling guard . . . 89
15.4 Coupling and standard coupling guard . . . 90
15.5 Gearbox housing . . . 91
15.6 Gearing . . . 92

15.7 Bearing housing . . . 94
15.8 Pump housing . . . 95
15.9 Pump housing with heating / cooling jacket . . . 96
15.10 Pump set . . . 96
15.11 Seal retainer . . . 98
15.12 Pump mounting foot . . . 101
15.13 Mechanical seal cartridge – Single-acting . . . 102
15.14 Mechanical seal cartridge – Double-acting . . . 103
15.15 Mechanical seal cartridge options . . . 104
15.16 WTS Pump Seal Kits . . . 104

16. Cleaning / sterilization processes 106
16.1 General information . . . 106
16.2 COP cleaning process . . . 106
16.3 CIP cleaning process . . . 106
16.3.1 Cleaning-relevant parameters . . . 106
16.3.2 Mechanical cleaning effects . . . 106
16.3.3 Chemical cleaning effects . . . 107
16.3.4 Thermal cleaning effects . . . 107
16.3.5 Time . . . 107
16.4 SIP sterilization process: . . . 107
16.4.1 General sterilization information . . . 107
16.4.2 SIP sterilization specifications . . . 108
16.4.3 A pressure drop during a SIP sterilization process . . . 109
16.5 COP cleaning process sequence . . . 109
16.5.1 Conditions . . . 109
16.5.2 COP cleaning process . . . 109
16.6 CIP cleaning / SIP sterilization process sequences . . . 110
16.6.1 Conditions . . . 110
16.6.2 CIP cleaning process . . . 110
16.6.3 SIP sterilization process . . . 111

17. Tool list and tightening torques 112
17.1 WTS 70, 104 and 130 tool table . . . 112
17.2 Tightening torques . . . 114
17.2.1 Tightening torques for specified components . . . 114
17.2.2 Tightening torques for screw connections in concrete . . . 114
17.2.3 Tightening torques for general screw connections . . . 115

18. Assembly aid for a mechanical seal cartridge 116
18.1 Tools T0114 / T0120 / T0121 . . . 116
18.2 Mechanical seal cartridge inside the tool . . . 116
18.3 View of the tool . . . 117
18.4 Handling the assembly aid . . . 117

19. Accessories (optionally available) 119
19.1 Pump accessories . . . 119

20. Marking/ Labels on the pump 120

1. Warranty

LIMITED WARRANTY: Unless otherwise mutually agreed to in writing, (a) SPX FLOW US, LLC (SPX FLOW) goods, auxiliaries and parts thereof are warranted to the Buyer against defective workmanship and material for a period of twelve (12) months from date of installation or eighteen (18) months from date of delivery, whichever expires first, and (b) SPX FLOW services are warranted to Buyer to have been performed in a workman-like manner for a period of ninety (90) days from the date of performance. If the goods or services do not conform to the warranty stated above, then as Buyer's sole remedy, SPX FLOW shall, at SPX FLOW's option, either repair or replace the defective goods or re-perform defective services. If Buyer makes a warranty claim to SPX FLOW and no actual defect is subsequently found, Buyer shall reimburse SPX FLOW for all reasonable costs which SPX FLOW incurs in connection with the alleged defect. Third party goods furnished by SPX FLOW will be repaired or replaced as Buyer's sole remedy, but only to the extent provided in and honored by the original manufacturer's warranty. Unless otherwise agreed to in writing, SPX FLOW shall not be liable for breach of warranty or otherwise in any manner whatsoever for: (i) normal wear and tear; (ii) corrosion, abrasion or erosion; (iii) any good or services which, following delivery or performance by SPX FLOW, has been subjected to accident, abuse, misapplication, improper repair, alteration (including modifications or repairs by Buyer, the end customer or third parties other than SPX FLOW), improper installation or maintenance, neglect, or excessive operating conditions; (iv) defects resulting from Buyer's specifications or designs or those of Buyer's contractors or subcontractors other than SPX FLOW; or (v) defects resulting from the manufacture, distribution, promotion or sale of Buyer's products; (vi) damage resulting from the combination, operation or use with equipment, products, hardware, software, firmware, systems or data not provided by SPX FLOW, if such damage or harm would have been avoided in the absence of such combination, operation or use; or (vii) Buyer's use of the goods in any manner inconsistent with SPX FLOW's written materials regarding the use of such product. In addition, the foregoing warranty shall not include any labor, dismantling, re-installation, transportation or access costs, or other expense associated with the repair or replacement of SPX FLOW goods.

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1.1 Shipping Damage or Loss

If equipment is damaged or lost in transit, file a claim at once with the delivering carrier. The carrier has a signed Bill of Lading acknowledging that the shipment has been received from SPX FLOW in good condition.

SPX FLOW is not responsible for the collection of claims or replacement of materials due to transit shortage or damages.

1.2 Warranty Claim

All warranty claims should initially be directed to the SPX FLOW authorized distributor (Distributor) from whom Buyer purchased the product(s) in question. Warranty claims must have a Returned Material Authorization (RMA) from the Distributor or SPX FLOW or returns will not be accepted. The Distributor and SPX FLOW will assess the product(s) and make any necessary or appropriate repairs or replace the product, as determined by SPX FLOW in its sole discretion, in accordance with the above warranty statement. If it is determined that any necessary repairs for the product(s) are not covered by warranty, Buyer will be contacted prior to the performance of such repairs or the return or destruction or such product(s), as applicable.

Claims for shortages or other errors must be made in writing to SPX FLOW or Distributor, as applicable, within ten (10) days after delivery. This does not include transit shortage or damages. Failure to give such notice shall constitute acceptance and waiver of all such claims by Buyer.

2. General Information

This operating manual is a part of the pump.

- ▶ Keep this operating manual safely during the pump's service life
- ▶ Ensure that this operating manual can always be accessed by your operating and maintenance personnel
- ▶ Pass on this operating manual and declarations of conformity as well as any other certificates to any subsequent owner or user of this pump
- ▶ Always update this operating manual with each supplement received from the manufacturer

2.3 Warnings

Warnings are used in this operating manual to warn you about the risk of personal injuries or damaging the equipment.

- ▶ Always read and abide by these warnings
- ▶ Follow all actions marked with a warning symbol and a warning word

Warning symbols and warning words	Meaning	Consequences if ignored
⚠ DANGER	Dangerous to people: Imminent danger	Death or severe personal injuries
⚠ WARNING	Dangerous to people: Potentially dangerous situation	Death or severe personal injuries
⚠ CAUTION	Possible equipment damage	Equipment damage

Tab. 2.1: Warnings

2.4 Symbols and indicators

Symbol	Meaning
▫	Bullet point, not included in a specific sequence
▶	Activity consisting of several steps, but not in a specific sequence
1. **2. ..**	Activity consisting of several steps to be completed in a specific sequence
	Useful hint, makes the activity easier
☑	Activity completed – condition for the following activity
	Information to be especially adhered to for pumps certified under the 3-A standard

Tab. 2.2: Symbols and indicators

2.5 Abbreviations

Abbreviation	Meaning
Bh	Operating hours
CIP	Cleaning In Place
COP	Cleaning Out of Place
cST	Centistokes
dH	German hardness
EPDM	Elastomer material: Ethylene propylene diene (monomer) rubber
FKM	Elastomer material: Fluoro rubber
NBR	Acrylonitrile butadiene rubber
SIP	Sterilization In Place

Tab. 2.3: Abbreviations list

2.6 Reference documents

The following additional documents are – where applicable – an integral part of this operating manual, see "Tab. 2.4: Reference documents" on Page 12.

Document	Description/Content
Technical data sheet	Technical data, performance and operating limits, operating conditions provided for an approved pump configuration or pump application.
Pump layout dimension	See Chapter "14. Pump Dimensions" on Page 87
Certificates	▫ Declaration of Conformity / Incorporation ▫ Food certification according to 1935/2004/EU or FDA (optional) ▫ 3-A Certificate
Accessories documentation	Assembly/operating instructions for the accessories (optional)
Drive documentation	Assembly/operating instructions for the drive (optional)
Decontamination declaration	Sending the pump for repair (upon request)

Tab. 2.4: Reference documents

Please contact customer service if any relevant documents are missing from the product packaging shown in the table above.

3. Safety instructions

The pump is designed to be safe and it does not pose a hazard if used as intended. Nevertheless, ignoring the operating instructions might result in danger to personnel or equipment damage.

- ▶ Only use the pump for its intended purpose and if it is in perfect technical condition
- ▶ Only use the pump with its safety devices fitted
- ▶ Abide by the limit values and all other specifications as per the technical data sheet
- ▶ Stop the pump immediately and eliminate the problem in the event of malfunctions or operating changes
- ▶ Carry out all specified cleaning and maintenance activities

3.1 Intended use

The pump is intended for the following uses:

- ▫ Use in these commercial sectors:
  - ▫ Food industry (food, beverage, dairy)
  - ▫ Cosmetics
  - ▫ Chemicals
  - ▫ Pharmaceutics
- ▫ Conveying the pumped media specified in the technical data sheet
- ▫ Operating within the operating points (temperature, flow rate, direction of flow, pressure, speed, viscosity) specified in the technical data sheet
- ▫ 3-A certified pump must only be operated with a single-acting mechanical seal
- ▫ An EHEDG certified pump may be operated with a single-acting or a double-acting mechanical seal

Changing the pumping conditions (e.g. flow rate, conveying path, flow direction, pressure level, pipe diameter, throttling devices, etc.) might result in greatly changed operating conditions.

1. If the pumping conditions were changed, you should compare the new operating conditions with the specifications listed in the technical data sheet
2. Contact the manufacturer if the changed conditions go beyond the information given in the technical data sheet

The storage tank is used solely as a non-pressurized quench medium storage tank.
The sealing pressure tank acts solely as a pressurized quench medium storage tank.

3.2 Foreseeable misuse

The following usage is **not** allowed:

- ▫ Changing the specified pumped medium (see technical data sheet) without prior consultation with SPX FLOW
- ▫ Carrying out service work during pump operation – especially loosening screw connections for the coupling protector, pipe connections, etc.
- ▫ Operating the pump without guards and covers fitted – the pump must be properly installed and fully functional
- ▫ Using the pump as a climbing aid or loading objects on it
- ▫ When stopped: Using it as a shut-off device
- ▫ Operating it against closed pressure lines
- ▫ Fitting double-acting mechanical seals in 3-A certified pumps
- ▫ Use in potentially explosive areas – unless the manufacturer has approved the device and marked it as Ex on the nameplate
- ▫ Exceeding the 12 bar pressure limit when changing the medium's pumping direction (conveying against the cover or left/right pump rotation) without prior consultation with the manufacturer

3.3 Noise emissions

The rated continuous sound pressure level is usually < 70 dB(A). Drive and piping are not included here. Cavitation-free operation and correct pump fastening are assumed.

3.4 Personnel qualifications and operating phases

3.4.1 Special requirements

Activities	Required personnel qualifications
Mechanical work:	
▫ Design ▫ Mechanical installation ▫ Starting and stopping ▫ Troubleshooting ▫ Repairs ▫ Service	▫ Trained mechanics specialist ▫ Familiar with the mechanical activities involved in each operating phase ▫ Knows this operating manual ▫ Trained by SPX FLOW ▫ For fitting a shaft seal: In-depth shaft sealing knowledge
Electro-technical work:	
▫ Installation ▫ Starting and stopping ▫ Troubleshooting ▫ Repairs	▫ Qualified electrician, e.g. electrician or mechatronics technician ▫ Knows this operating manual ▫ Familiar with the electrical work on the pump ▫ Trained by SPX FLOW
All other work:	
▫ Transport ▫ Storage ▫ Operation ▫ Operating ▫ Cleaning ▫ Disposal	▫ Instructed by a responsible person from the operating company ▫ Knows this operating manual

Tab. 3.1: Special requirements

3.4.2 Basic requirements

- ▶ Ensure that the following basic requirements for personnel are met:
  - ▫ Personnel have been instructed with regard to the operating instructions
  - ▫ Minimum age is 16 years
  - ▫ Young people or trainees must always be supervised by a qualified person when working

3.5 Personal protective equipment

The following personal protective equipment is required:

- ▫ Safety goggles
- ▫ Protective gloves
- ▫ Safety shoes
- ▫ Protective clothing

3.6 Conversions, modifications and spare parts

Unauthorized modifications to the pump or unsuitable spare parts are a safety hazard. Serious or even fatal injuries might occur during all operating phases.

- ▶ Never convert or modify the pump without first consulting the manufacturer
- ▶ Only use original spare parts from the manufacturer

3.7 Residual risks

3.7.1 Rotating and moving machine parts

There is a risk of limbs being pulled in, crushed or even sheared when working on the pump.
The risk is especially high if the pump has stopped due to a fault and it starts up again unexpectedly after the fault has been rectified. Typical faults include electromagnetic interference, voltage surges in the power supply or a power failure.
This might result in serious or even fatal injuries.

- ▶ Before starting any cleaning, repair or service work on the pump:
  - ▶ Switch off the pump
  - ▶ Disconnect the drive or controller from the power supply
  - ▶ Secure the drive or controller with a padlock against unauthorized switching back on
  - ▶ Depressurize the system
  - ▶ Only use a suitable tool to remove the protective cover over the drive components
- ▶ Refit all of the safety devices after you have finished working on the pump

3.7.2 Pressurized pump

There is a risk that parts of the system will burst if the entire system (pipeline, flange or sealing pressure tank, etc.) is not designed for the corresponding pump pressure during operation. This might result in severe injuries or even death.

- ▫ The internal pressures in the WTS 70, 104 and 130 models must be as follows:
  - ▫ 20 bar maximum during continuous operation
  - ▫ 25 bar maximum during brief operation
- ▫ There are other pressure limits for all models that depend on the connecting pieces/flanges being used
  - ▶ Note the standard specified for the connection pieces/flanges in the technical data sheet
- ▶ The piping and flanges must be dimensioned for the corresponding pressure:
  - ▶ Ensure that the pumping pressure listed in the technical data sheet is not exceeded with regard to the pipeline's pressure resistance.
  - ▫ For example, when using a sealing pressure tank approved for 25 bar pressure, the pump's maximum operating pressure can be 23 – 24 bar.

3.7.3 Pressurized hot/dangerous liquids

The pumped medium inside the pump and the quench medium can be under pressure during operation. In particular, the pressure can be up to 25 bar, but this depends on the sealing pressure tank being used. Incorrect handling might result in pumped medium or quenching medium spraying out and causing serious or fatal injuries.

Possible danger sources:

- ▫ Risk of pipes and flanges that were not designed for the pressure bursting.
- ▫ Incorrectly connected pipelines
- ▫ Pump running against closed shut-off devices. The built up pressure can be a multiple of the permitted system pressure
- ▫ Working on the pump when the pump is still pressurized
- ▫ Hose lines bursting due to pressure pulses

Risk prevention:

- ▶ Ensure that the system is rated for the appropriate pressure
- ▶ Provide an overpressure protection device
- ▶ Ensure that the pumping pressure as per the technical data sheet is not exceeded
- ▶ Only qualified personnel are allowed to connect up the pipelines
- ▶ Before switching on the pump:
  - ▶ Connect all processing connections correctly
  - ▶ Wear safety goggles
- ▶ Ensure that the pump will not be running against closed shut-off devices
- ▶ Before starting any cleaning, repair or service work on the pump or the sealing pressure tank:
  - ▶ Switch off the pump
  - ▶ Depressurize the system
  - ▶ Leave the pump to cool down
  - ▶ In the event of a fault: empty the pump if possible
- ▶ When troubleshooting: Always check the system before restarting

3.7.4 Live electrical parts

The risk of an electric shock always exists if you touch live parts.

- ▶ Only a qualified electrician is allowed to connect up the pump
- ▶ Ensure that no voltage is present before making the electrical connection
- ▶ Ensure that the circuit information on the motor's nameplate matches the circuit diagram in the terminal box
- ▶ Before starting any cleaning, repair or service work on the pump:
  - ▶ Switch off the pump
  - ▶ Secure the drive or controller with a padlock against unauthorized switching back on
- ▶ Provide an EMERGENCY STOP device to be able to stop the pump in dangerous situations

3.7.5 Manipulating the safety devices

Manipulating the safety devices is a safety risk. Serious or even fatal injuries might occur during all operating phases.

- ▶ Ensure that the pump will only be operated with the safety devices fitted
- ▶ Never modify the safety devices
- ▶ Inform your supervisor if you suspect that the safety devices have been manipulated
- ▶ Never use spare controls or spare keys

3.7.6 Suspended loads during transport

Incorrect transport might cause the pump to tip over or drop down. The risk is intensified if the drive unit makes the pump top-heavy. Personnel might be crushed or hit by the falling load. This might result in serious or even fatal injuries.

- ▶ Note the pump's center of gravity and maximum weight
- ▶ Use suitable lifting equipment to lift and transport the pump
- ▶ Only use suitable slings with sufficient load-bearing capacity
- ▶ Only suspend the pump from the provided lifting points
  - ▶ Do not lift the pump solely by the ring bolts of the drive unit/pump housing
    - ▫ These suspension points are only intended for the motor and/or gears or pump housing
- ▶ The pump must always be transported in a horizontal position
- ▶ Never stand underneath a suspended load
- ▶ Never stand between fixed objects (floor/wall) and the suspended pump
- ▶ Ensure that there are no other people in the danger area

3.7.7 Danger of being crushed

Certain pump components are very heavy. A danger of being crushed exists when assembling or dismantling the pump.

- ▶ Always wear protective gloves during troubleshooting, service or repair work
- ▶ Note the weight of the separate components
- ▶ Use suitable tools
- ▶ Use suitable supports to put the pump and drive down on

3.7.8 Hot surfaces

The pump can become hot due to dry running or unfavorable conditions. The risk of being burnt exists if you touch its surface.

- ▶ Avoid unfavorable conditions: In particular you must ensure adequate cooling and lubrication, compliance with the permitted speed range as well as adequate ventilation
- ▶ Ensure that there is a permanent pumped medium supply
- ▶ Switch off the pump and allow it to cool down before touching it
- ▶ Touch hot surfaces only if you are wearing protective gloves

3.7.9 Slippery surfaces caused by leaks

Leaks in seals, e.g. in mechanical seals, gear oil, quench medium or leaking lines can cause slippery surfaces. People might slip over and injure themselves. Take the following measures in the event of leaks:

- ▶ Eliminate the leaks
- ▶ Replace any defective seals
- ▶ Wipe up any spilled liquid immediately and dispose of it correctly

3.7.10 Pumps with a heating jacket: Exceeding the nominal pressure

Hot water vapor might escape if the permitted nominal pressure is exceeded in pumps with heating jackets. Personnel might be burned.

- ▶ Use suitable pressure limiting devices
- ▶ Ensure that the overpressure can be released safely through the depressurizing opening if the pressure limiting device activates
- ▶ Never install any shut-off devices in the release opening area
- ▶ Operate the heating/cooling circuit solely with water. Never exceed the heating jacket casing's permitted nominal pressure
  - ▫ The housing is normally designed for an overpressure of 6 bar
- ▶ Always wear safety goggles during start-up

3.7.11 Sharp-edged components and foreign objects

The risk of being cut exists when working on the pump.

Possible danger sources:

- ▫ Remove any sharp-edged foreign bodies found on the screw spindle.
- ▫ Sharp-edged components during pump assembly/dismantling

Risk prevention

- ▶ Always wear protective gloves during troubleshooting, service or repair work

3.7.12 Dangerous substances

Cleaning agents can cause caustic or irritating effects, depending on the concentration being used. This can result in serious eye and skin injuries. Contact between the pumped medium and unsuitable gear oil or unsuitable quenching medium can damage your health.

- ▶ Abide by the instructions given in the safety data sheets for the cleaning agents being used
- ▶ Wear suitable protective clothing, protective gloves and protective goggles when cleaning
- ▶ Only use gear oil and a quenching medium that has been approved for use in the food industry

3.7.13 High temperatures during the cleaning process

When cleaning the pump or cleaning the pump's separate components, the cleaning solution being used (e.g. water; water with cleaning agents) can have high temperatures. In general, cleaning at higher temperatures ($50 < x < 100$ °C) gives better results than at lower temperatures. Higher temperatures are used when using cleaning machines for industrial parts or when cleaning specific components manually.

There is a risk of being burnt or scalded if you come into contact with hot liquids or vapor.

Risk prevention:

- ▶ Wear personal protective equipment
- ▶ Wear suitable heat-protection gloves for the cleaning
- ▶ If high temperatures are not needed: Reduce the temperature in the cleaning bath

3.8 Danger to equipment

3.8.1 Fat

Fat causes the EPDM material in a mechanical seals and seals to swell. This can cause equipment damage. Pumped media containing fat can cause the EPDM material to swell, depending on the fat concentration and the temperature. EPDM swells even at low temperatures in a very fatty environment. The resistance of the sealing materials can no longer be guaranteed.

- ▶ Ensure that the milk fat content in the pumped medium never exceeds 8 %

3.8.2 Acidic and alkaline cleaning agents

Acidic and basic cleaning agents cause the FKM material to swell in mechanical seals and seal rings. This can cause equipment damage.

- ▶ For pumps with seal rings and mechanical seals made from FKM: Ensure that acidic and alkaline cleaning agents never exceed a maximum concentration of 3 %.

3.8.3 Aggressive materials

Aggressive liquids, oils and the effects of ozone change the physical properties of the elastomer star in the coupling.

- ▶ Protect the elastomer from external effects caused by aggressive substances
- ▶ Fit the coupling guard correctly

3.8.4 Unsuitable lubricants

The pump can be damaged by unsuitable lubricants.

- ▶ Do not mix gear oils with different properties and/or those from different manufacturers
- ▶ Never mix mineral and synthetic gear oils
- ▶ Use only gear oil and lubricants approved for use in the food industry:
  - FDA (21CFR178.3570)
  - NSF-H1 / USDA_H1 / INS-H1

3.8.5 Mechanical risks

Mechanical risks such as excessive force, torques, pressures or vibrations can damage the pump, heating jacket casing, gears, coupling and seals.

The following danger sources are also critical:

- Incorrect lifting during transport
- Unsuitable foundations (e.g. cracks)
- Coupling aligned deficiently, e.g. after maintenance or servicing work
- Incorrect alignment, mounting and pump assembly, articulated foot, components and pipelines.
- Using the pump as a climbing aid (especially the coupling protection) or loading objects on it
- Wrong rotational direction
- Exceeding the permitted speed
- Constantly alternating load (change of rotational direction and starting-up under increased torque)
- Dirt and scratches on shaft seal rings, shaft seals and bearings
- Excessive pressure – excessive pressures can occur in the following situations:
  - Static internal pressure >25 bar WTS 70 and WTS 104
  - Static internal pressure >20 bar WTS 130
  - Pressures from the system – in which the pump is integrated – that act on the pump
  - Pressures > 12 bar against the cover when the medium is being pumped in the flow direction or when the pump is running clockwise/counterclockwise, see Chapter 7 on Page 36 .
- Pumped medium or quench medium pressure is too high
- Grain sizes and the proportion of solids in the pumped medium is too large
- Pumps with a heating jacket: Heating circuit pressure is too high
- Vapor or gas bubbles can form in the sealing chamber if the speed is too fast
  - Bubbles will settle in front of the gap in the mechanical seal and block access by the quenching medium
  - The mechanical seal has been damaged due to a lack of lubrication and cooling

3.8.6 Avoiding damage during assembly/mounting/installation

- ▶ Ensure that the foundations meet all the requirements listed in this operating manual
- ▶ Ensure that the pump is correctly secured in accordance with this operating manual
- ▶ For pumps with a mobile stand: Ensure that its position does not change
- ▶ Assemble the pipelines free of any forces and torques and do not support them on the pump
- ▶ Note the correct nozzle orientation
- Double-acting mechanical seals:
  - ▶ Connect the mechanical seal to the storage/sealing pressure tank
  - ▶ Use a suitable quench medium
  - ▶ Ensure that there is a quench medium supply available
  - ▶ Vent the sealing chamber
  - ▶ Ensure that the shaft seals on the product and atmosphere sides are lubricated with the quenching medium
- When using storage/sealing pressure tanks:
  - ▶ Route the supply and return lines so that they drop or rise continuously. In particular, you must ensure that **no** kinks form in the hose lines
    - Otherwise, the natural convection current will be interrupted
    - Supply liquid cooling will no longer occur or it will be severely restricted
  - ▶ Prevent line narrowing or lines of unequal length
  - ▶ Fill the storage/sealing pressure tank so that it is bubble-free
  - ▶ Ensure that the quench medium filling level is between minimum and maximum
  - ▶ In the event of unusually high quench medium consumption or the storage tank overflows: Inspect the shaft seal for wear

3.8.7 Avoiding damage during operation

- Operate the pump in compliance with the permitted limit values
- Pump with heating jacket: Apply a maximum of 6 bar to the housing
- Never operate the pump continuously under changing loads
- Prevent dry running
- Ensure that the grain size and proportion of solids in the pumped medium never exceed the defined limit values
- Ensure that no foreign objects (e.g. metal parts or stones) get into the pump
- Never use the pump and coupling guard as a climbing aid or load objects on them

3.8.8 Avoiding damage during assembly/dismantling

- Ensure that the installation site is free of dust and dirt
- Note the correct nozzle orientation
  - Incorrect nozzle orientation in relation to the screw spindle orientation will result in performance losses during pump operation
- Handle the shaft seal (mechanical seal) with care
  - Scratches on the separate parts of the mechanical seal will result in the complete mechanical seal being damaged
  - Ensure that the contact surfaces of the slide rings and counter rings are clean
  - The springs are loose in the mechanical seal's gland and can they can fall out during assembly/dismantling
  - **Never** operate the mechanical seal with missing springs
- Ensure that the positioning pin arrangement matches the rotational direction
  - An incorrect positioning pin arrangement and rotational direction combination will result in the pump housing and the spindles being damaged
- Assemble the coupling correctly in accordance with this operating manual
  - **Never** use a hammer to mount the coupling on the drive shaft
  - Use an industrial heat gun for the heating (650 °C)
  - Ensure that you comply with the coupling's maximum permitted displacement values
- Ensure that the shaft seals, shafts and housing bore-holes are clean
- Be careful when installing the shaft seals:
  - Ensure that the shaft seal ring is seated in a parallel plane to the shaft
  - **Do not** tilt the shaft seal ring or use a hammer to push it in
  - Ensure the press-in force is applied close to the outer diameter
  - **Do not** damage the sealing lip during assembly
  - Use an assembly cone, see Chapter 17.1 on Page 112
- Always loosen the shaft nut's grub screw before you dismantle the shaft nut
  - The drive shaft's thread will be damaged if you do not do this first.
- Note the following points when fitting the bearings:
  - Ensure that the separate parts of the bearing are clean
  - Precisely align the spacer sleeve/rings, shaft sleeve and angular ball bearing
    - This will prevent any damage from occurring when the input/output shafts are pressed in
- Ensure that the pump/drive/separate components are supported by suitable supports (e.g. blocks of wood) and that they are secured against accidental tipping over
- Use suitable lifting gear, e.g. for the drive or for heavy pump housings made from solid material

3.8.9 Non-permitted electrical parameters

The pump's service life will be reduced if incorrect drive data is used.

The following danger sources are also critical:

- Drive data listed on the nameplate does not match the local conditions
- Starting currents are too high
- Ensure that the mains voltage and frequency match the local conditions
- Ensure that the phase sequence is correct for the motor's rotational direction
- Connect the gearing motor's PTC thermistor sensor to the PTC tripping device/frequency converter for the PTC input.
- Ensure that the soft starters or frequency converters are suitable for use with high starting currents.
  - Use oversized devices for heavy starting
- Provide an emergency-stop device

3.8.10 Thermal risks

Temperatures that are too high can reduce the durability of the mechanical seal, gears, bearings and elastomer in the coupling.

The following danger sources are also critical:

- Displacement is too high
- Dry running
- Inadequate quench medium cooling due to the lack of a convection flow
  - There is a risk that the quench medium will reach boiling temperature at the seal's gap inlet
- Lack of quench medium
- Bubbles forming in the storage/sealing pressure tank
- Gum forming or insufficient lubrication, especially when starting up after a long stoppage
- Unsuitable gear oil
- Temperature too high or exposure to vapor was too long during cleaning

▶ Plan for enough space to ensure adequate drive motor ventilation
▶ Prevent the heated exhaust air from adjacent units from being sucked back in
▶ Ensure that the lubrication is correct
▶ In particular, route the supply and return lines so that they drop or rise continuously – ensure that no kinks form if hose lines are being used
▶ Never exceed the maximum permitted temperatures and exposure time during cleaning
  - Higher temperatures together with cleaning agents can damage the workpiece surface of the separate components (corrosion, etching)
  - Higher temperatures can create more residue on the workpiece surface as the liquid will evaporate when single components are removed from the hot bath
- When starting up after a long stoppage:
  ▶ Rotate the screw spindles manually
    - This lubricates the mechanical seals
  ▶ Start up the pump slowly

▶ Use a suitable quench medium
  - The quench medium must never exceed the boiling point

3.9 Danger of hygiene risks

3.9.1 Defective elastomer (O-rings)

The following can occur if elastomers (O-rings) in contact with the product fail and no longer seal reliably as intended:

- Quench medium get into the pumped medium
- Pumped medium get into spaces, gaps, grooves or the quench medium

Elastomer failure, e.g. due to:

- Mechanical loads
- Changing environmental effects
- Thermomechanical stress
- Radiation
- Moisture and/or chemical substances (e.g. from cleaning)
- Thermo-oxidative aging: Elastomer softens or hardens
- Elastomer swells
- Aging
- Incorrect storage or handling
- A combination of the above points

Consequences:

- Pumped food/material is adulterated/contaminated by the quench medium.
- Pump components that do not primarily come into contact with the pumped material are adulterated/contaminated by the pumped material
- If defective elastomers or impurities/contaminants are not detected, then microorganisms such as spores or endospore-forming bacteria, yeasts or molds and their toxic metabolic products (mycotoxins) can form
- Unrecognized impurities/contaminants can "break through"
- Mycotoxins and pathogenic microorganisms can be ingested by humans through food and cause mycotoxicoses (diarrhea, vomiting, adversely affect the immune system, damaged kidneys and liver or promote the development of cancer, etc.) or cause severe to fatal food poisoning and cause

diseases in humans and animals

Risk prevention:

- Failure of elastomers in contact with the product must be prevented
  - Use a product-compatible quench medium, see Chapter 6.10.5 on Page 34.
  - Pay attention to the cleaning of special components, see Chapter 9.5 on Page 46.
  - During maintenance and repair work, clean the components that come into contact with the product before installation and replace them if necessary, see Chapter 9.4 on Page 45 and 9.5 on Page 46.
  - During maintenance and repair work, the O-rings that come into contact with the product should be replaced as a precaution, see Chapter 9.5 on Page 46 and 10.6 on Page 52.
  - Note and comply with the inspection and maintenance intervals for elastomers that come into contact with the product, see Chapter 10.4 on Page 50 and 10.5 on Page 51.
    - Adapt the inspection and maintenance intervals to the specific system if necessary.
  - Note the cleaning and sterilization processes, see Chapter 9 on Page 44 and 16 on Page 106
  - Inspect the components that came into contact with the product for signs of damage, replace as necessary
  - Document the cleaning, maintenance and repair work on components that come into contact with the product
  - Validate the cleaning and sterilization work defined by the operator or 3-A standard or EHEDG specifications and adapt to meet the system-specific requirements if necessary

4. Description

4.1 WTS 104/130 main components

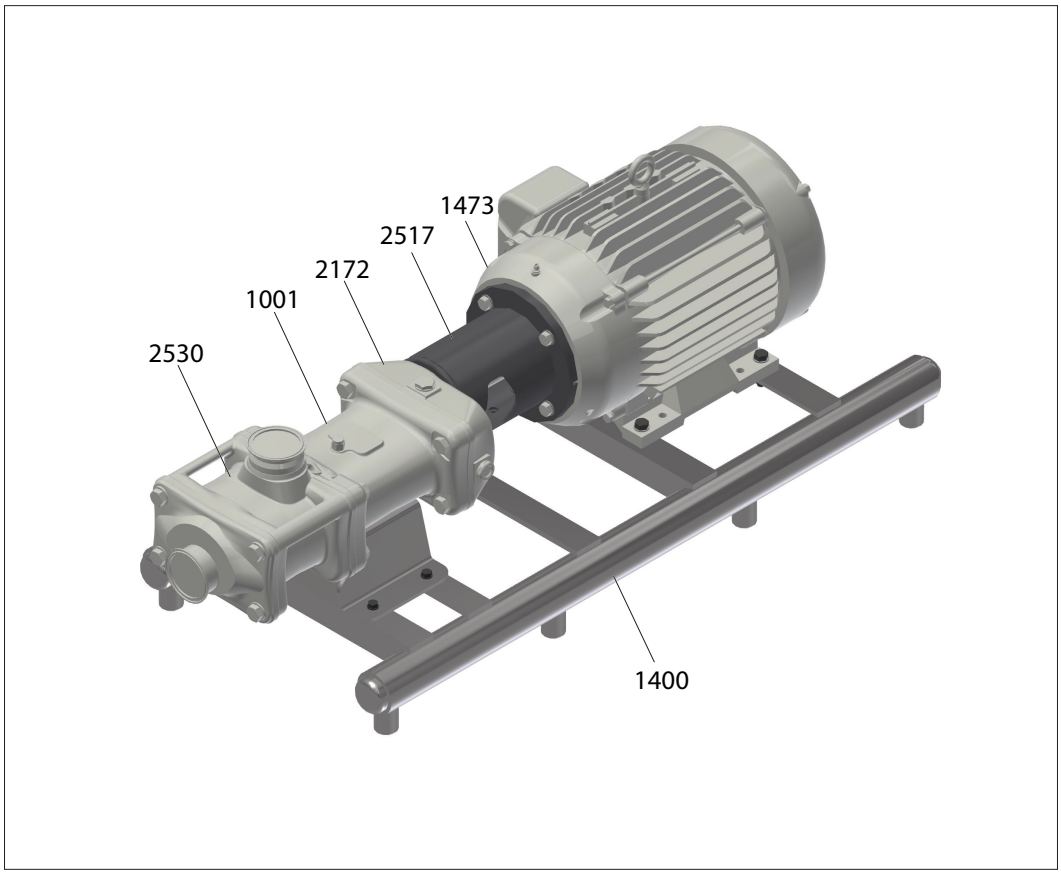


Fig. 4.1: View of a WTS with a coupling guard (Motor adapter)

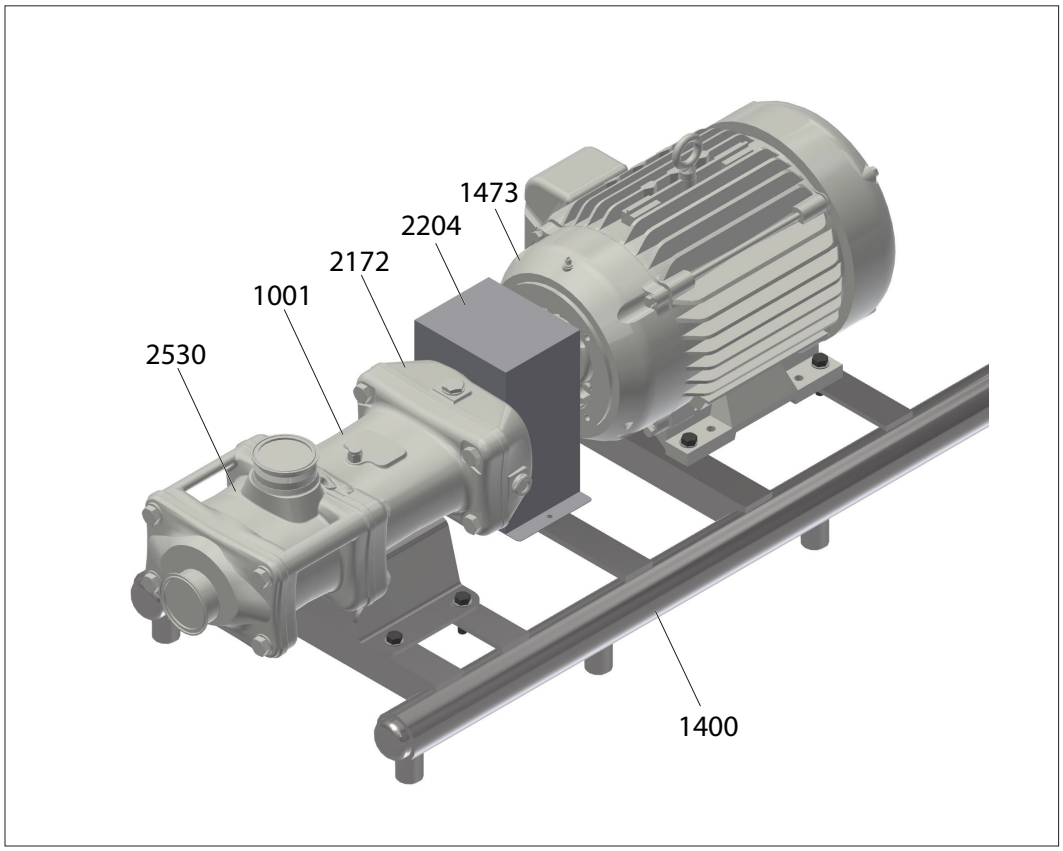


Fig. 4.2: View of a WTS with a coupling guard (standard version)

A WTS consists of the following main components:

WTS main components	
1001	Bearing housing
1400	Baseplate
1473	Drive
2172	Gearbox housing
2204	Standard coupling guard (optional)
2530	Pump housing
2517	“Motor adapter” coupling guard

Tab. 4.2: WTS main components, see Fig. 4.1 on Page 22 and Fig. 4.2 on Page 22

4.2 General description

Screw pumps are rotating positive-displacement pumps for pumping low to high-viscosity media used in the commercial sector.
A WTS has two spindles. The spindles are rotated by intermeshing gears, see Fig. 4.3 on Page 23. Use the gears to set up the backlash needed for the spindles.
The input and output shafts are installed outside the pumping chamber and they do not come into contact with the pumped medium during normal operation.

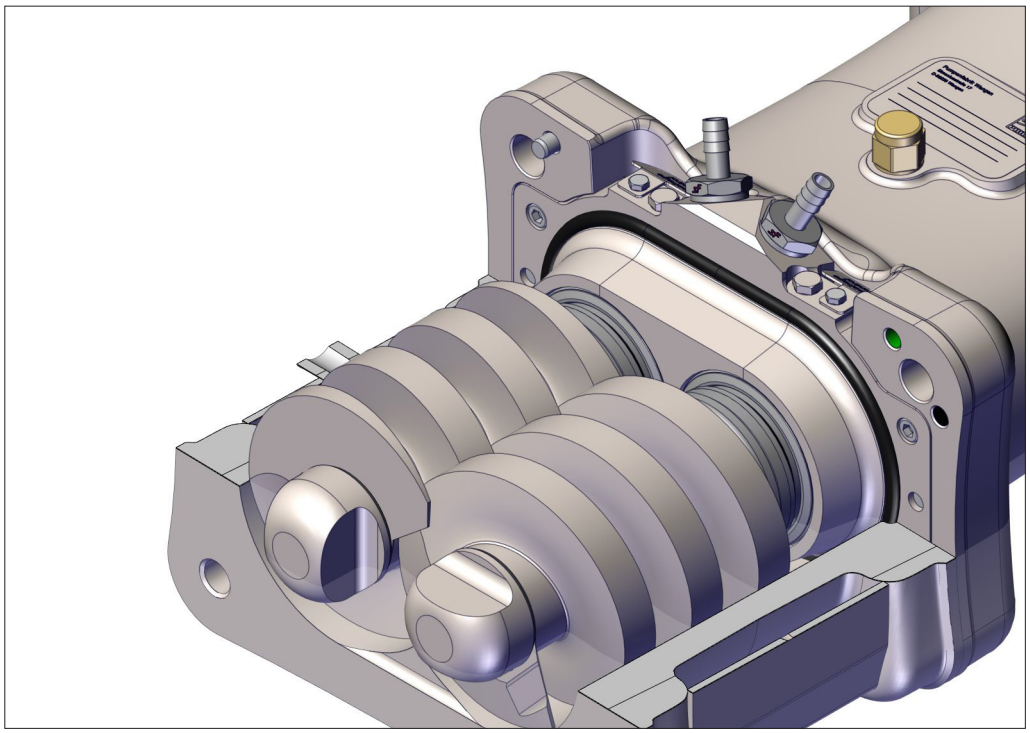


Fig. 4.3: Helical screw spindles

4.3 Pump operating principle

A screw spindle pump consists of two counter-rotating rotors enclosed inside a housing. The shape of a displacer on a rotor resembles that of a spindle screw with left-hand and right-hand threads. The counter-rotating displacer on the rotors mesh with the helical gears, see Fig. 4.3 on Page 23.
The cavity between the rotors and the housing forms a closed pumping chamber that is sealed off by gap seals. The pumping chamber moves as the rotor rotates and it transports the pumped medium axially from the suction side (inlet) to the pressure side (outlet).

5. Transport, packaging and storage

⚠WARNING

Risk of being crushed by a falling and/or a tipping load due to the pump being handled incorrectly during transport.
Death or severe personal injuries

- *Only use suitable lifting equipment (chains, ropes, slings) with sufficient load-bearing capacity for transporting and lifting the load*
- *Determine the load's weight and center of gravity*
- *Lift the pump as shown schematically*
  ***Never** lift the pump solely by the eyebolts on the drive unit or those on the pump casing. These suspension points are only intended for the motor and/or the transmission unit.*
- *A maximum sling angle of $_{max.}$ < 60° must never be exceeded*
  - *The angle formed from the direction of one line from the sling and an imaginary vertical line is called the sling angle*
- *Never stand beneath the suspended pump or between fixed objects (floor/wall)*
- *The pump must always be transported in a horizontal position*
- *Ensure that there are no other people in the danger area*

5.1 Transport

- Suspend the pump from the recommended suspension points

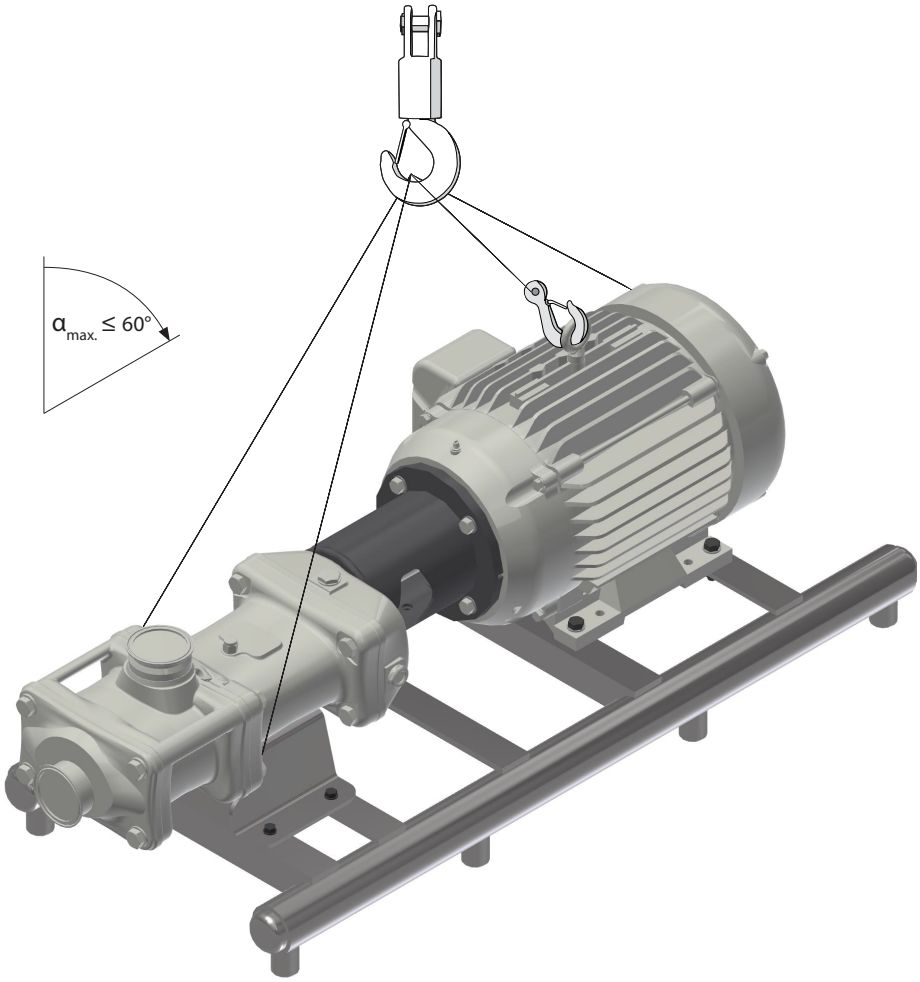


Fig. 5.1: Suspension option for transporting a WTS Pump

▶ *Report any transport damage immediately to the transport company*

5.2 Packaging

Pumps are shipped in disposable packaging.

5.3 Storage

Pumps are adequately preserved for normal ambient conditions.

For longer storage please note:

- ▶ Store the pump in a dry place
- ▶ Always protect the pump from dust, dirt, moisture, heat (direct sunlight, radiators or other heat sources), frost and other harmful environmental conditions
- ▫ If you were using water as the quench medium for the shaft seal
  - ▶ Drain the water
- ▫ If the downtime will exceed six months:
  - ▶ Rotate the screw spindles manually to keep the shaft seals lubricated

6. Positioning/securing and integrating

6.1 General information

- A torsionally rigid baseplate is recommended for mounting and securing the screw spindle pump
- Use the hole diameter in the base plate and the holes in the housing foot as orientation for securing the pump (screw connection, suitable anchor dowels)

▶ Note the maximum tightening torques defined for the pump components, see Chapter 17.2.1 on Page 114.

▶ Note the maximum tightening torques for securing the pump to the concrete, see Chapter 17.2.2 on Page 114

6.2 Space needed for operating and servicing

▶ Provide adequate space to allow for service work without having to remove the entire pump, see Tab. 6.1 on Page 27.

▶ Use assembly fitting pieces and shut-off devices on the pressure and suction lines to simplify assembling/dismantling the pump in/from the system

▶ Plan for enough space to ensure adequate drive ventilation, see Tab. 6.2 on Page 27.

▶ Prevent the heated exhaust air from adjacent units from being sucked back in

Space needed for the operating and service work	Recommended space
By the drive	At least 1 x the length of the drive
Each side of the pump	At least 0.8 m

Tab. 6.1: Recommended clearance for carrying out service work on the pump

Space for drive's waste heat during operation	Recommended minimum distances
Fan cover drive – wall	At least 0.3 m (1.0 m)*
Top of drive – ceiling	At least 1.0 m
* A minimum distance of 1.0m is recommended with higher engine power.	

Tab. 6.2: Recommended clearance for the waste heat from the drive

6.3 WTS connection in a 3-A/EHEDG certified system

The WTS only conforms in connection with the flange and seal combinations according to:

- *3-A Sanitary Standards* or the reference contained in the EHEDG position paper, see Chapter 7.3 on Page 36 and 8.1 on Page 41.
- *the Position Paper from the EHEDG Working Group Certification: "Easy cleanable pipe couplings and process connections"*

in their currently valid versions.

The operator is responsible for complying with and implementing the specifications:

▶ Adjust the flange and seals on the pressure and suction nozzles accordingly

6.4 Pressure conditions in the pump housing

- ▶ Take note of the pressure conditions in the pump housing and in the system when integrating the pump in the system
- ▫ The internal pressures in the WTS 70, 104 and 130 models must be as follows:
  - ▫ 20 bar maximum during continuous operation
  - ▫ 25 bar maximum during brief operation
- ▫ The pump's maximum permitted internal pressure might be further reduced depending on the connection nozzles being used on the suction and pressure sides
  - ▶ Note the standard specified for the connection pieces/flanges in the technical data sheet
- ▶ Design the entire system (pump, pipelines, flanges, sealing pressure tank, etc.) for the corresponding pressure
  - ▫ For example, when using a sealing pressure tank approved for a pressure of 25 bar, the pump's maximum operating pressure can be 23 – 24 bar.
- ▶ Note the maximum permitted delivery pressure of ≤ 12 bar if the pumped medium is supplied against the pump cover (2528, see Chapter 15.8 on Page 95) or if the pump is operated counterclockwise/clockwise, see Chapter 7 on Page 36.
  - ▫ Load cases in which a delivery pressure > 12 bar is needed when pumping against the pump cover must be assessed and approved separately by the application engineering department at SPX FLOW
    - ▶ Contact the manufacturer

6.4.1 Pump housing with heating jacket

A heating jacket is optionally available for the WTS. Supplying an externally heated or cooled liquid enables the pumped medium to be heated or cooled and kept at a constant temperature.
The pump housing and the heating jacket form a single unit.

Nozzles fitted on the heating jacket:
- ▫ 2 nozzles at both ends: Inlet and outlet opening connections for heating/cooling liquid
- ▫ 1 nozzle at top: Optional use (e.g. venting or pressure measuring)
- ▫ 1 nozzle at bottom: Drainage opening for heating/cooling liquid

Permitted operating conditions with a heating jacket	
Heating medium	Water, Water vapor
Pressure $_{maximum}$	6 bar
Temperature $_{maximum}$	150 °C
Lower/upper temperature range	Depends on the elastomer being used (O-rings)

Tab. 6.3: Heating jacket operating conditions

6.5 Pipelines

Correct dimensioning of the pressure-side pipeline is crucial for avoiding an unnecessary pressure build-up when pumping viscous media. The dimensions of the pump flanges provide orientation.
- ▶ Never exceed the delivery pressure with regard to the pipeline's pressure resistance
- ▶ Note the space requirement details, see Tab. 6.1 on Page 27
- ▶ Flush the pipeline system and supply devices before installing them
- ▶ Remove any impurities
- ▶ Avoid dry running during start-up by installing the suction line so that it cannot run dry when the pump is stopped (shut-off devices, siphon, etc.). Flange the pump to the pipeline using elastic seals/compensators so that a tight connection is created and no undue forces can act on the pump
  - ▶ Note the EHEDG/3-A Sanitary Standard specifications as necessary
- ▶ Install the pipeline so that it is **not** supported by the pump
- ▶ Provide shut-off devices and adapters in the pressure and suction lines for removing and servicing the pump

- ▶ Provide safety or pressure monitoring valves directly downstream from the pump on the pressure side
- ▶ Provide additional safety or pressure monitoring valves on the suction side if needed
- ▶ Never load screwed connections with torques that will result in the pump loosening or tightening

6.6 Installing and securing the pumps

A WTS is installed and secured horizontally and sizes 70, 104 and 130 can be mounted:
- ▫ On a baseplate
- ▫ As a tripod installation
- ▫ On a mobile stand

- ▶ Note the maximum tightening torques for securing it in concrete
- ▶ Note the maximum tightening torques defined for the pump components
- ▶ Ensure that the foundations can absorb its own weight and all of the operating forces
- ▶ Ensure that the pump is will always be stable
- ▶ Ensure that the foundation is firm, level and horizontal (e.g. with an adequately dimensioned level concrete slab or a torsionally rigid, vibration-free and level steel structure)
- ▶ Provide the number of screw connections and suitable (concrete) anchoring dowels that correspond with the diameter and number of drill holes at the foot of the housing/baseplate
- ▫ With mobile stand:
  - ▶ Use a level concrete slab
  - ▶ Check the pump's position at least 1 x per week
  - ▶ The pump must be re-installed on a base plate if position changes are seen
- ▶ Use suitable tools to align the pump or baseplate horizontally
- ▶ If necessary, use standard articulated foot or articulated foot as per the 3-A standard
- ▶ Connect the pump securely and firmly to all the holes provided on the baseplate/concrete slab/ torsion-resistant steel structure.

6.7 Electrical connection

⚠ DANGER

Live parts can cause a fatal electric shock

☑ Take note of the instructions in Chapters 3.7.4 on Page 16 and 3.8.9 on Page 19

☑ Generally applicable installation regulations for low-voltage electrical equipment always apply when installing electrical systems
☑ Abide by the motor manufacturer's operating instructions
☑ The wiring instructions in the frequency converter's operating manual must also be applied with converter-fed motors

- ▶ Only qualified personnel are allowed to connect up the pump
- ▶ Lock and secure the main switch
- ▶ Secure the pump against it being switched back on unintentionally
- ▶ Compare the drive data on the nameplate with the circuit diagram in the terminal box and the local conditions:
  - ▶ Ensure that the mains voltage and frequency match
  - ▶ If in doubt, contact your local energy supply company
  - ▶ Comply with the local and national regulations on site
- ▶ Check the phase sequence for the motor's rotational direction
  - ▶ Ensure that the pump runs in the stipulated rotational direction (see technical data sheet)
- ▶ Connect the gearing motor's PTC thermistor sensor to the PTC tripping device or frequency converter for the PTC input (available as an option)
- ▶ Design the soft starter or frequency converter for high starting currents – use oversized devices for heavy starting

- ▶ Provide an EMERGENCY STOP device to be able to stop the pump in dangerous situations

Terminal box connections

The following connection versions are commonly used in the EU:

	Mains frequency		Frequency converter			
Winding voltage	50 Hz	60 Hz	50 Hz	87 Hz	60 Hz	104 Hz
230/400V	Y	Y	Y	Δ	Y	Δ
400/690V	Δ	Δ	Δ	-	Δ	-
Y = star connection			Δ = delta connection			

Tab. 6.4: Usage options for motors

- ▶ Abide by the instructions given in the drive manufacturer's operating manual when using outside the EU

6.8 Assembling the drive and coupling components

6.8.1 Drive

The pump is normally delivered fully assembled, i.e. it includes the drive.

- ▶ Note the following information if the drive has to be retrofitted
- ▶ Use a coupling to connect the drive to the pump's drive shaft

⚠WARNING

The pump and drive can be both heavy and top-heavy.

- ▶ *Use suitable lifting gear*
- ▶ *To avoid the risk of tipping by placing wooden blocks underneath*

6.8.2 Fitting the coupling components

The pump's drive shaft is connected to the drive via a flexible claw coupling that includes an elastomer star. To a certain extent this allows for axial, radial and angular displacements (misalignment) as well as sudden loads or unwanted vibrations.
The elastomer star's relatively wide compressed area keeps the surface pressure low. This means that the elastomer star can often be overloaded without it wearing out or losing its initial loading.

- ▶ For permanent and trouble-freecoupling operation you must ensure that the coupling is suitable for the application (power, speed or maximum permitted speed, starting frequency and starting torque changes, etc.)
- ▶ To assemble the coupling, use a pulling device or heat the coupling half to approx. 80 °C (remove the elastomer star beforehand)
  - ▶ Mount the hot coupling on both drive shafts:
    - ▫ Pump's input shaft
    - ▫ Input shaft from drive

6.8.3 Assembling the pump (coupling components) and drive

☑ Use a suitable hoist/wooden blocks to secure the pump in place
☑ Coupling component mounted on the pump's input shaft
☑ Coupling component mounted on the input shaft from the drive

▶ Insert the elastomer star between the two halves of the coupling before assembling the pump/drive
▶ When assembling the pump and drive, you must comply with the maximum permitted displacement values a (axial displacement), b (angular displacement) and c (radial displacement) as per Fig. 6.2 or Tab. 6.5
  ▫ These are maximum values that must not occur simultaneously. If radial and angular displacement occur simultaneously, then the permitted displacement values are only to be used proportionally:

For example: Maximum displacement$_{Total}$ = 30 %$_{Angular\ displacement}$ + 70 %$_{Radial\ displacement}$

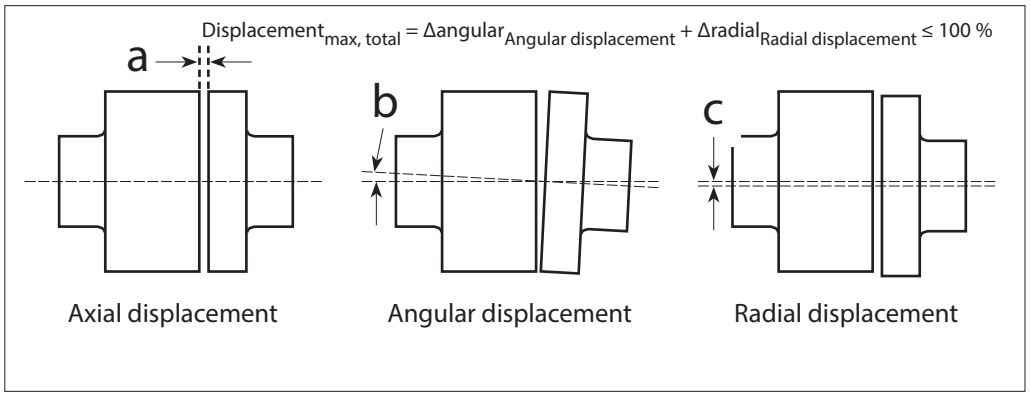


Fig. 6.2: Displacement options and maximum permitted proportional displacement value calculation

Maximum permitted displacement values when assembling the pump/drive couplings and information about the wear limit (applies to 1,500 rpm and for elastomer stars with a hardness of 92 Shore A):

	Type name/ Max. permitted hub borehole diameter		28, 28/38	38, 38/45	42	48	55
a	Max. axial displacement	[mm]	1.5	1.5	2.0	2.0	2.0
b	Max. angular displacement	[°]	1.0	1.0	1.0	1.0	1.0
c	Max. radial displacement	[mm]	0.25	0.25	0.32	0.32	0.38
	Max. elastomer star wear limit (abrasion)	[mm]	3	3	4	4	5

Tab. 6.5: Maximum permitted displacement values

Displacement of the coupling parts relative to each other can result from imprecise alignment during assembly, machine frames that are too soft or thermal expansion and shaft deflection.

▶ Increase the service life of damping rubber parts (elastomer star) by keeping the compensated displacement values low
▶ Prevent permanently high temperatures
▶ Prevent contact with aggressive liquids/oils, exposure to ozone, too high/low ambient temperatures
▶ We recommend that you visually inspect the coupling at least once a year
  ▶ Pay special attention to the condition of the coupling cams
▶ Ensure that both halves of the coupling are aligned with each other after you have assembled the pump and drive:

- SPX FLOW recommends using a laser-assisted shaft alignment tool (to be provided by the operator)
- The displacement value tolerance ranges for the angle and the offset of 0.35 mm/100 mm already provide sufficiently accurate results

▶ Abide by the operating instructions for the shaft alignment system being used

6.9 Contact or coupling guard

The input shaft and the claw coupling rotate at high speed when the pump is running. These drive components must be covered with a coupling guard that prevents access to the rotating drive shaft.

▶ Fit a contact /coupling guard before starting the pump
▶ Ensure that the hex or Savetix bolts on the contact/coupling guard are tight and secure
▶ Ensure that the contact/coupling guard can only be removed using a tool

6.10 Shaft seal

▶ Note the information in the technical data sheet for more details about the shaft seal mounted in the pump
▶ Abide by the specifications as per the 3-A standard or the EHEDG specifications for shaft sealing

- Ensure that the following points are complied with:
  - The person who assembles the shaft seal (mechanical seal cartridge) has in-depth knowledge about how it works
  - ▶ Do not exceed the limits or operating conditions specified in the technical data sheet for the selected shaft seal
  - ▶ Carry out the assembly carefully
  - ▶ Ensure that the sliding surfaces are not damaged nor do they have any burrs or scratches
  - ▶ Ensure that the installation site is free of dust and dirt

The single-acting mechanical seal cartridge essentially consists of a slide ring and a counter ring, which are pressed together axially by a spring. A liquid-filled sealing gap (< 1 µm), forms between the slide ring's and counter ring's two sealing surfaces and this acts as a lubricating film.
The double-acting mechanical seal consists of two single-acting mechanical seals connected in series.

6.10.1 Mechanical seal cartridge – single-acting

- The single-acting mechanical seal cartridge's lubricating film is formed from the pumped medium inside the pump
- Dry running will occur if this lubricating film stops – dry running will destroy the mechanical seal cartridge within a few seconds
- Lubrication by the pumped medium fulfills two important tasks:
  - Reduces friction between the slide ring and the counter ring
  - Acts as a coolant that dissipates the frictional heat
- Sliding surface wear is automatically compensated for by moving up. This makes the mechanical seal cartridge service-free.

6.10.2 Mechanical seal cartridge – double-acting

- A quench medium is required in the sealing chamber[1] of the double-acting mechanical seal cartridge
- Quench medium sealing – in the direction of the product space (pumped medium) and the atmosphere – is created by the rotating slide ring and the stationary counter ring
- The lubricating film between the two mechanical seals at the product and the atmosphere ends is formed by the clean quenching medium
- Lubrication by the pumped medium fulfills two important tasks:
  - Reduces friction between the slide ring and the counter ring
  - Acts as a coolant that dissipates the frictional heat
- A product leak into the atmosphere is excluded during normal operation

1 Sealing chamber: Space between the two single-acting mechanical seals

- ▶ Replace the sealing screws with the supplied hose nozzles before starting the pump
- ▶ Connect the double-acting mechanical seal cartridge to the storage/sealing pressure tank
- ▶ Fill the double-acting mechanical seal cartridge or storage/sealing pressure tank with quenching medium
- ▶ Ensure that the quench medium is product compatible
- ▶ Vent the sealing chamber through the storage/sealing pressure tank before starting the pump
- ▶ Put the quenching medium in the sealing chamber of the double-acting mechanical seal cartridge under the required pressure if necessary
- ▶ Ensure that the quench medium pressure is approx. 1 – 2 bar higher than the back-pressure on the pumped medium side

6.10.3 Leaks

Leaks are the most important criterion regarding shaft sealing. It is usually significantly higher during running-in than afterwards during steady operation.

Even small leaks are unacceptable with regard to toxic liquids or liquids that are harmful to health and the environment. Leaks must be continually monitored to protect the environment. Defects on secondary seals or sliding surfaces will become visible if a leak test is run during a standstill. Results from the standstill tests cannot be transferred to the operating conditions.

- ▶ Use double-acting mechanical seals with sealing pressure with toxic liquids or liquids that are harmful to health or the environment
- ▶ Continuously monitor for leaks
- ▶ Run a stopped leak test if all secondary leak possibilities are to be ruled out
- ▶ Regularly check and/or replace the visible O-ring in the mechanical seal cartridge during maintenance and inspection intervals or repairs to prevent a leak situation from arising, see Chapter 10.5.1 on Page 52.

6.10.4 Loss and circulation flushing

Double-acting mechanical seals can be operated with loss or circulation flushing for better cooling.

- ▶ Make the connection as shown in Fig. 6.3 and Fig. 6.4

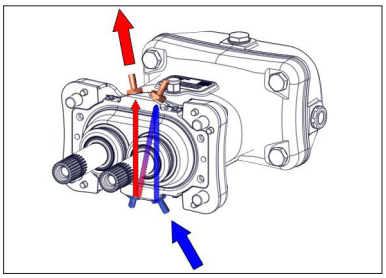


Fig. 6.3: Loss flushing

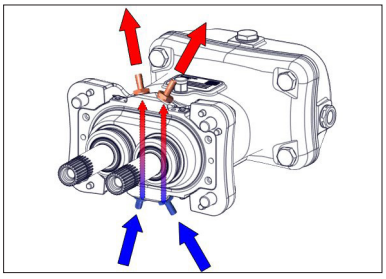


Fig. 6.4: Circulation flushing and connection to storage or sealing pressure tank

6.10.5 Shaft seal quench medium

Quench medium properties:

- Cooling
- Lubricating
- Food or product compatibility

Examples of quench media used in the factory and their properties:

Quench medium	Mixture	
	Glycerin-water	**Glycol-water**
Positive property	Good cooling and lubrication	
Azeotropic substance mixture	Yes	
Boiling point (pure substance) $_{\text{at 1013.25 hPa}}$	Glycerin 290 °C; disintegrates	Glycol 190 °C
Boiling point Substance and water mixture	Boiling point is significantly lower - Note boiling point curve	
Note the quench medium's mass ratio	Yes	
In continuous operation	Water content evaporates, regular refilling	
Usage	Up to a maximum of 150 °C	
Food compatibility	Yes	

Tab. 6.6: Quench medium: Azeotropic substance mixture

Quench medium	Distilled water	Tap water
Positive property	Excellent cooling	
Negative property	Poor lubrication	
Boiling point $_{\text{bei 1013,25 hPa}}$	100 °C	
Continuous operation	Evaporates, regular refilling	
Food compatibility	Yes	

Tab. 6.7: Quench medium: Distilled water and tap water

Only quench media suitable for use with food are used in the factory, see Tab. 6.6 and Tab. 6.7. The system operator must determine which quench medium will be used.

- ▶ Replace and renew the quench medium at regular intervals
- ▶ Ensure that the quench medium being used never exceeds its boiling point

If the quench medium used in the mechanical seals exceeds its boiling point, then (gas) bubbles will form and this will interrupt or completely prevent the mechanical seal from being lubricated.Some of the quench media used are so-called azeotropic substance mixtures, see Tab. 6.6. If azeotropic substance mixtures (e.g. water-glycerin) are used, the boiling temperature of the substance mixture will be lower or higher than the boiling temperature of the pure starting components at a specific molar ratio (and given pressure). These relationships are determined empirically and they are shown in phase diagrams or boiling point curves.

6.10.6 Requirements when tap water is used as the quench medium

☑ Water hardness: max. 10 dH (1 dH corresponds to 0.1783 mmol/l $CaCO_3$ or 0.357 mval/l)

Under unfavorable conditions, a higher $CaCO_3$ or $MgCO_3$ content will result in limescale deposits, which can cause increased wear and/or mechanical seal failures. Increased wear occurs with 2 – 5 µm particle sizes. Deposits from these particle sizes can settle in the sealing gap in the mechanical seals.

Implement the following measures if tap water is to be used as the quench medium:

- Ensure that the tap water complies with the regional regulations for drinking water.
- Ensure that the drinking water and all of the components used in the drinking water installation are hygienically safe
- Ensure that there are no microbiological, chemical and/or physicochemical changes in the drinking water

7. Medium’s flow direction

The mediums flow direction depends on several factors (see Fig. 7.1)
- Direction of the screw pump's rotation drive (see Chapter 7.1)
- Nozzle orientation on the pump housing (see Chapter 7.2)
- Positioning of the positioning pins on the pump housing (see Chapter 7.3)
- Spindle orientation (see Chapters 7.4 and 7.5)

The interaction between these factors determines the flow direction of the medium that will be transported (see Fig. 7.2, Fig. 7.3 and Fig. 7.4) as well as the pressure or suction side.

The specified rotational direction, the correct spindle arrangement, the nozzle orientation and the flow direction are all listed in the technical data sheet.

Attention!
- A wrong positioning pin arrangement and pump rotational direction combination will damage the pump housing and the spindles
- A change in the medium’s flow direction (i.e. when the pumped medium is pumped against the cover or when the pump rotates left/right) can result in the 12 bar maximum permitted pumping pressure being exceeded and this will damage the bearing
- Load cases where a pumping pressure > 12 bar is needed when pumping against the pump cover must be assessed and approved separately by SPX FLOW application engineering department
  - ▶ Contact the manufacturer

7.1 Rotational direction of the screw spindle pump drive

The pump drive’s rotational direction determines the flow direction:
- Left
- Left and right
- Right

The pumping direction is always towards the pressure side.

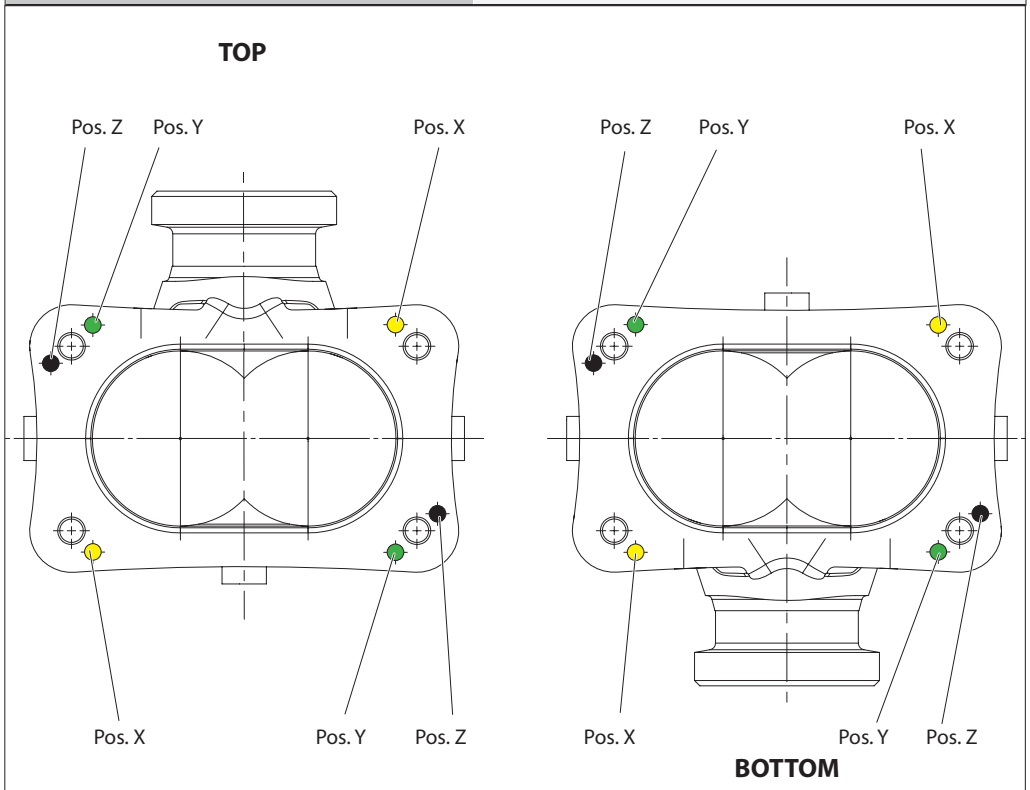
7.2 Nozzle orientation on the pump housing

Incorrect nozzle orientation will result in a reduced output.
- ▶ Select the nozzle orientation on the pump housing (see Fig. 7.1)
  - TOP position
  - BOTTOM position

7.3 Position pin arrangement on the pump housing

- ▶ Choosing the positioning pin arrangements on the pump housing (see Fig. 7.1)
  - Position X
  - Position Y
  - Position Z

Pump housing nozzle orientation	"**TOP**" orientation or "**BOTTOM**" orientation
Positioning pin arrangement on the pump housing	Permitted positioning pin arrangement: Yellow = Position X Black = Position Z Green = Position Y



			Housing nozzle position	
			TOP	**BOTTOM**
Drive rotational direction	Left		Position X	Position Y
or	Left/Right		Position Z	Position Z
Drive spindle	Right		Position Y	Position X

Fig. 7.1: Factors that affect the flow direction of the medium that will be transported

7.4 WTS 70 spindle orientation

- Selecting input and output spindle orientation (see Fig. 7.2):
  - A spindle orientation
  - B spindle orientation

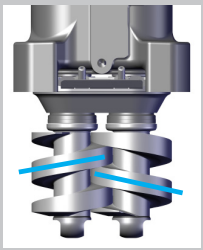
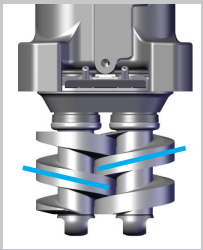
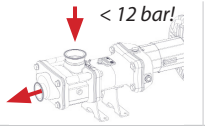
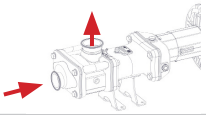
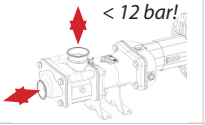
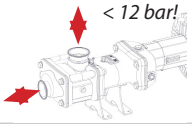
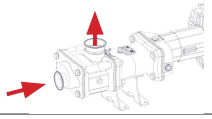
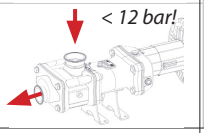
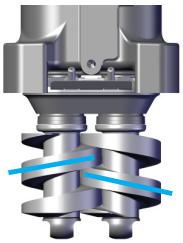
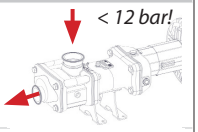
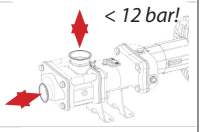
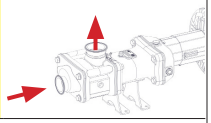
Size #70				Spindle orientation	
				A	B
Nozzle connecti-on size on the pump housing	DN 40/1 ½" DN 65/2 ½"				
Rotational direction Drive	Nozzle orientation on the pump housing Permitted			Flow direction	
	Top	Bottom			
Left	Pos. X	Pos. Y	Pin position		
left / right	Pos. Z	Pos. Z			
Right	Pos. Y	Pos. X			
< 12 bar! Note the 12 bar pressure limit when the pumped medium's flow direction is against the cover					

Fig. 7.2: A and B spindle orientations for a WTS 70

7.5 WTS 104/130 spindle orientations

- Selecting the input and output spindle orientations:
  - A spindle orientation (see Fig. 7.3)
  - B spindle orientation (see Fig. 7.4)

Size #104/#130	A – spindle orientation				
Nozzle connection size on the pump housing	#104: DN 65/2 ½"		#104: DN 80/3"		
	#130: DN 100/4"		#130: DN 125/5"		
	Nozzle orientation on the pump housing Permitted		Nozzle orientation on the pump housing		
Rotational direction Drive	Top	Bottom	Prohibited Top	Permitted Bottom	Flow direction
Left	Pos. X	Pos. Y	--	Pos. Y	
left / right	Pos. Z	Pos. Z	--	Pos. Z	
Right	Pos. Y	Pos. X	--	Pos. X	

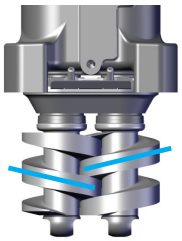
Pin position

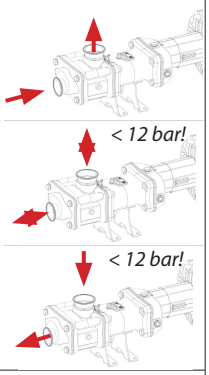
-- Prohibited nozzle orientation

< 12 bar! Note the 12 bar pressure limit when the pumped medium's flow direction is against the cover

Fig. 7.3: A spindle orientation for WTS 104 and WTS 130

Size #104/#130	B spindle orientation				
Nozzle connection size on the pump housing	#104: DN 65/2 ½"			#104: DN 80/3"	
	#130: DN 100/4"			#130: DN 125/5"	
	Nozzle orientation on the pump housing Permitted			Nozzle orientation on the pump housing	
Rotational direction Drive	Top	Bottom	Pin position	Permitted Top	Prohibited Bottom
Left	Pos. X	Pos. Y		Pos. X	--
left / right	Pos. Z	Pos. Z		Pos. Z	--
Right	Pos. Y	Pos. X		Pos. Y	--





-- Prohibited nozzle orientation

< 12 bar! Note the 12 bar pressure limit when the pumped medium's flow direction is against the cover

Fig. 7.4: B spindle orientation for WTS 104 and WTS 130

8. Starting and stopping

8.1 Starting

Condition upon delivery:

- Fully assembled pump
- There is lubricating fat in the angular ball bearing
- Transmission and bearing housings are filled with gear oil
- No quenching medium in double-acting mechanical seal
  - In the event of adverse weather conditions: No quench medium in the sealing unit
- Storage/sealing pressure tank is neither fitted nor filled with a quench medium

8.1.1 Preparing the pump for its initial start-up

Preliminary activities

1. Wear personal protective equipment
2. Inspect the pump and all pump parts for signs of damage (visual inspection)
3. Clean the pump and its accessories before the initial start-up
4. Ensure that all of the safety devices (covers, limit switches, safety valve, level indicator, etc.) are installed correctly and that they are working
5. Ensure that the pump is designed for its intended use (see operating conditions in the technical data sheet)
6. Ensure that the pump is securely affixed to the baseplate
7. Check that the pressure, suction and slider valves are fully open

Working steps on the bearing/gear housings

1. Check that the venting screw on the bearing housing is correctly seated
2. Check the oil level indicator on the gearbox housing and top up if necessary through the sealing screw (2233)

Working steps on the sealing unit

- A single-acting mechanical seal has been installed if the mechanical seal cartridge was supplied with a plastic sealing screw:
  - ▶ Compare it with the technical data sheet
  - The connection to a storage/sealing pressure system is not needed
- A double-acting mechanical seal has been installed if there are hose nozzles on the seal retainer:
  - ▶ Compare it with the technical data sheet
  - ▶ Either connect a loss flushing system to the seal retainer/hose nozzles, see Fig. 6.3 on Page 33
  - ▶ Or connect a storage/sealing pressure tank to the seal retainer/hose nozzle, see Fig. 6.4 on Page 33
3. Check the sealing unit for correct filling and level: Quench medium (see technical data sheet)
4. If necessary, use the sealing pressure tank (sealing liquid pressure: approx. 1 – 2 bar higher than the back-pressure on the pumped medium side) to apply the required pressure to the quenching medium in the sealing chamber in the double-acting mechanical seal
5. Vent the sealing chamber and lines

Working steps on the storage/sealing pressure tank

1. Inspect for any damage
2. Check for leaks (especially after prolonged storage)
3. Flush the storage/sealing pressure tank to remove any contaminants
4. Check any additionally-attached measuring devices and monitoring units
5. Attach the supply and return connections
6. Fully open the shut-off valve if necessary
7. Fill with a product-compatible quenching medium – note the filling level
8. Use the storage/sealing pressure tank to vent the lines and sealing chamber
9. Set up the sealing pressure for the double-acting shaft seal on the sealing pressure tank: 1 – 2 bar above the operating pressure (see technical data sheet)
10. If you are using an external forced circulation system:
    - ▶ Ensure that the correct rotational direction (correct flow direction) is set up for the quench medium

- The pipe that heats up during the start-up must go to the return connection on the storage/ sealing pressure tank

8.1.2 Starting the pump

☑ The pump's rotational direction is set correctly
☑ The pump is filled with pumped medium
☑ The medium's flow direction is set in the correct flow direction
☑ Install an overpressure protection device if necessary

Working steps when starting up

1. Fully open the valves/sliders on the pressure and suction sides
2. The initial start-up: Run the pump at nominal pressure (see technical data sheet for the operating settings)
3. When starting up after a long downtime:
   - Rotate the pump manually to keep the shaft seals lubricated
   - Run the pump slowly (lowest speed)
4. Check the pump and pipes for leaks
5. Create a start-up report if necessary

8.2 Stopping the pump

8.2.1 Stopping the pump

1. Use the system controller to stop the pump's drive (switch it off)
2. If a nonreturn valve has not been installed: Close the shut-off valves (pressure and suction sides) after the rotor has stopped turning
3. If necessary:
   - Empty the pump
   - Depressurize the pump
   - Depressurize the sealing pressure tank
   - Disconnect the pump from the power supply
   - Lock and secure the main switch
   - Leave the pump to cool down
   - Clean the pump
4. Follow the drive manufacturer's instructions

8.2.2 Depressurizing the pump

Use the sliders or valves to release the pressure inside the pump via the upstream/downstream system sections (suction/pressure sides).

1. Slowly open the upstream and downstream sliders/valves
2. Release the pressure carefully
3. Always shut the slider/valve after depressurizing

8.2.3 Emptying the pump

1. Open the shut-off devices on the suction side so that the pump can only suck in air after it has been switched on again
2. Open the shut-off devices on the pressure side
3. Allow the pump to run for a few more revolutions until the pumping chambers have been emptied
4. Close the shut-off devices on the pressure and suction sides again

8.2.4 Disconnecting the pump

Preliminary activities

▶ Only start the necessary work after the pump has stopped
▶ Ensure that the pump and its auxiliary systems have been depressurized before opening it
▶ Disconnect the pump from the power supply and secure it against it being switched back on
▶ Abide by the drive manufacturer's instructions

Working steps when disconnecting the pump

1. Shut off the valves/sliders on the pressure and suction sides

2. Depressurize the pump
3. Empty the pump, collect the escaping liquid and dispose of it correctly
4. Leave the pump to cool down
5. Clean the pump immediately in the following cases:
   - For food pumps
   - If the pumped liquid tends to settle/harden
   - If the pumped medium hardens due to a chemical reaction
   - The pumped liquid might freeze if the pump is stored outdoors
6. Shut down the pump and remove it from the system
7. Have the electrics disconnected by qualified personnel
8. Disconnect the connections from the auxiliary systems and accessories (storage/sealing pressure tank, temperature sensor, pressure sensor, etc.)
9. Collect and correctly dispose of any escaping quench medium
10. If necessary, drain the gear oil and dispose of it correctly
11. Disconnect the pump from the pipeline system
12. Install suitable connecting pieces in the system
13. Open the pump cover to dry it out

9. Cleaning process for screw spindle pumps

- *For more detailed information about the cleaning processes, see Chapter 16 on Page 106*
- *If in doubt, contact the manufacturer to ensure that the pump is suitable to undergo the selected cleaning process and, if necessary, any additional sterilization processes*
- *Take note of the maximum elastomer temperatures, see Chapter 16.4.3 on Page 109*

The pumps, which are used to convey food, cosmetic, chemical or pharmaceutical products, must be cleaned before they are started up and before each production run.
How the pump is to be cleaned depends on the type of pumped medium used and the production conditions. This is why the operator should define a repeatable cleaning process.
Cleaning should be undertaken by well-trained cleaning personnel who are well-aware of the problems associated with microorganisms, cleaning processes and cleaning agents as well as their effects on elastomers/metal surfaces and they are kept up to date with the latest technology/science.

Cleaning / sterilization process options
- COP cleaning process (Cleaning Out of Place)
- CIP cleaning process (Cleaning In Place)
- SIP sterilization process (Sterilization In Place)

9.1 Before carrying out the cleaning work

☑ Always wear personal protective equipment, see Chapter 3.5 on Page 14
☑ Shut down the pump and let it cool down, see Chapter 8.2.1 on Page 42
☑ Depressurize the pump, see Chapter 8.2.2 on Page 42
☑ Empty the pump, see Chapter 8.2.3 on Page 42
☑ Depressurize the sealing pressure tank /system if necessary
☑ Use suitable cleaning tools (e.g. do not use a brush that is too soft or too hard, a scraper, etc.)
☑ Always clean and disinfect the cleaning tools before starting the cleaning work

- Disconnect it from the power supply
- Lock the main switch in place against unintentional restarting
- Take note of the danger warnings and the safety data sheets for the cleaning agents being used
- Follow the detergent manufacturer's recommendations
- Only use cleaning agents that will not damage the sealing materials
- Clean and disinfect the cleaning tools before and after cleaning to prevent contamination
- Inspect the cleaning tools regularly for signs of damage or wear
- Replace a damaged or worn cleaning tool

9.2 Cleaning the external surfaces

☑ Use a commercial alkaline foam cleaner (with food approval)
(pH value: > 7, concentration: 2.0 to 5.0 %)
☑ Only use cleaning agents that will not damage the sealing materials

1. Rinse the pump's outer surfaces with water (approx. 40 °C)
2. Spray the pump with an alkaline foam cleaner and leave the cleaner on it for 5 to 20 minutes
3. Rinse the foam cleaner off using hot water (max. 100 °C)
4. Use a steam jet at low to medium pressure until the impurities are removed (distance from nozzle/pump: 200 to 300 mm)
5. Use a soft brush or a soft plastic scraper to remove any persistent impurities

9.3 Cleaning/sterilizing the internal surfaces

The CIP cleaning/SIP sterilization processes will have a severe affect on the elastomers. Therefore the cleaning agents used must match each other with regard to acidity/leach concentration, reaction time and temperature. The suitability of the cleaning agents to be used must be assessed for the relevant application.

- ☑ Only use cleaning agents that will not damage the sealing materials
- ☑ Use a commercial alkaline foam cleaner (with food approval) (pH value: > 7, concentration: 2.0 to 5.0 %)
- ☑ SIP sterilization process: The pump that will be used must have been designed and approved for a SIP sterilization process (see technical data sheet)
- ☑ SIP sterilization process: The pump that will be used must be fitted with a pressure monitoring device that will immediately switch the system off if the pressure drops by 0.5 bar

1. Clean the pump according to the appropriate cleaning process, see Chapter 16 on Page 106
2. After successful cleaning, sterilize the pump using the appropriate SIP sterilization process if necessary

9.4 Cleaning specific components after dismantling

- ▶ Clean the following components after dismantling:
  - ▫ Thread and mating thread
  - ▫ O-ring grooves
  - ▫ Round and flat seal seating positions
- ▶ Proceed as follows to clean a component:
  - ▶ If necessary, soak a component's contaminated areas with a cleaning agent
  - ▶ Clean contaminated areas mechanically using a soft brush
  - ▶ Rinse the cleaned areas
  - ▶ Ensure that the cleaned areas are clean
  - ▶ Repeat the cleaning if necessary

9.5 Cleaning special components

If one of the two or both of the **O-rings (9 and 2194**; see Fig. 9.1) on the input / output shafts fail or no longer seal reliably, then:

- The quench medium can get into the pumped medium and adulterate or contaminate the pumped medium
- The quench medium can get into the gaps in the pump and adulterate or contaminate the following components:
  - Spindle screw (2180) and threaded bolt (2180)
  - Input/output shafts (1000/2171)
  - Screw (2200/2201)
  - Mechanical seal cartridge (2535)

▶ Failure of both O-rings must be prevented

▶ Note the maintenance intervals

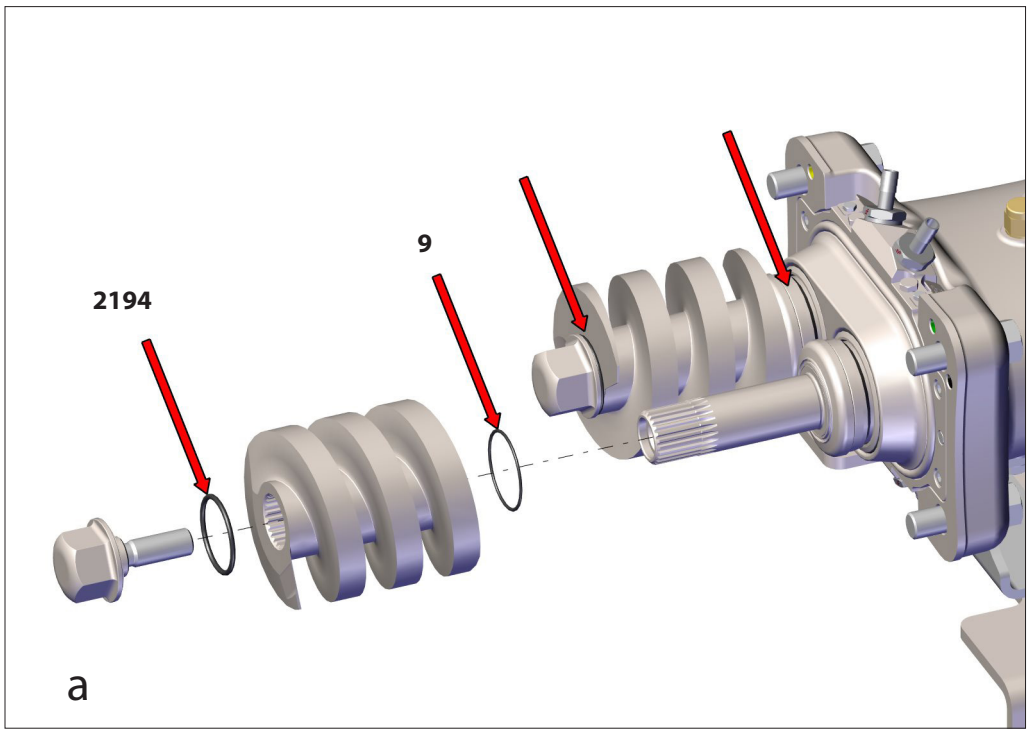


Fig. 9.1: Cleaning special components: Failure of O-ring 2194 and O-ring 9 on the input and output spindles

The following steps will be required in the event that these O-rings fail:

Dismantling and cleaning (see Fig. 9.2)**:**

1. Remove the cover (2528) from the pump housing, see Chapter 12.7 on Page 65 and 12.8 on Page 67
2. Dismantle the pump housing (2530), see Chapter
3. Dismantle the spindle screw (2180) with the O-ring (2194), see Chapter 12.9.1 on Page 67
   ▶ Dismantle the spindle screw's head and the threaded screw if necessary
     - The threaded screw is glued into the spindle screw's head by a high-strength thread-locking paste
4. Dismantle the screw (2200 or 2201), see Chapter 12.9.1 on Page 67
5. Dismantle the mechanical seal cartridge (2535), see Chapter 12.12.1 on Page 70
6. Dismantle the seal retainer (2188), see Chapter 12.12.1 on Page 70
7. Manually clean all of the dismantled parts (Nos. 1 – 6) as well as the input/output shafts (1000/2171) – validated cleaning as per 3-A standard specifications, see Chapters 16.2 on Page 106 and 16.3 on Page 106

Assembling:

- ▶ Assembling is carried out in the reverse sequence to dismantling, see Chapter 12.12.3 on Page 73
- ▶ Replace the O-rings
- ▫ Spindle screw (2180):
  - ▫ If the spindle screw head and threaded screw cannot be dismantled and cleaned:
    - ▶ Replace the spindle screw
  - ▫ If the spindle screw head and threaded screw can be dismantled and cleaned:
    - ▶ Glue the thread into spindle screw's head using high-strength thread-locking paste

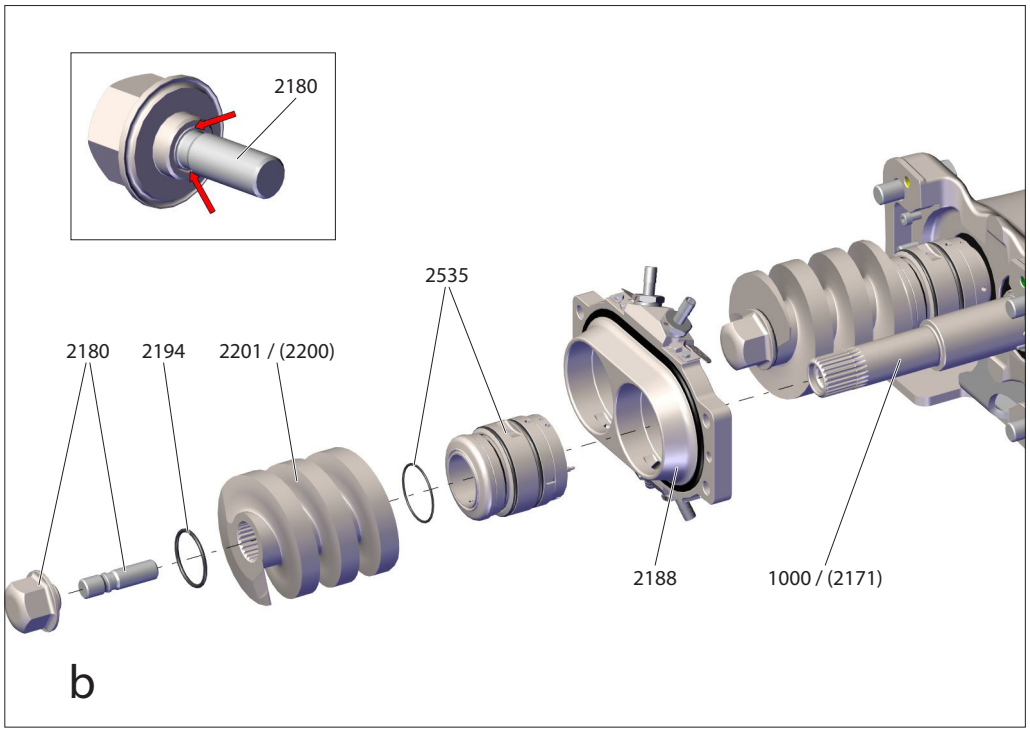


Fig. 9.2: Cleaning special components: Spindle screw, screw spindle, mechanical seal cartridge, seal retainer and input or output spindles

9.6 Cleaning the storage/sealing pressure tank

9.6.1 Cleaning the outside

- ▶ Cleaning the outer surfaces, see Chapter 9.2 on Page 44

9.6.2 Cleaning the internal surfaces/lines

- ☑ Rinsing medium must be compatible with the quench medium
- ☑ Abide by the operator's specifications

1. Drain the quench medium
2. Clean the internal surfaces using a suitable cleaning agent (will depend on the quenching medium being used)
3. Rinse the internal surfaces

10. Service and repairs

10.1 Preliminary activities

The following steps must be completed before starting any inspection or service work:
- Always wear personal protective equipment, see Chapter 3.5 on Page 14
- Stop the pump, see Chapter 8.2.1 on Page 42
  - Disconnect it from the power supply
  - Lock and secure the main switch
  - Depressurize the pressurized sealing pressure tank
  - Completely empty and clean the pump for all service work (except for work on the storage/sealing pressure tank)

10.2 Requirements

10.2.1 General requirements
- Only use original spare parts
- Document all of the inspection and service work

10.2.2 Gear oil
The gearbox and bearing housing were filled with food-grade high-performance oil in the factory.
- Only use oil that is approved for use in the food industry
  - (FDA guideline 21 CFR 178.3570 – Approval: NSF-H1/USDA-H1/InS-H1)
- Never mix mineral and synthetic oils
- Never mix and use oils with different properties and/or oils from different manufacturers

Brand	Gear oil	Viscosity
Castrol (used in the factory)	Optileb Hy 68	ISO VG 68
AVIA (alternative)	AVIAFOOD GEAR 68	ISO VG 68
Mobil (alternative)	Mobil DTE FM 68	ISO VG 68

Tab. 10.1: Gear oil used at the factory or alternatives with H1 approval

The manufacturer recommends using the following filling quantities for the gearbox and bearing housing:

Pump sizes	Filling quantity of gear oil for gearbox and bearing housings [l]
WTS 70	0.4
WTS 104	0.7
WTS 130	1.2

Tab. 10.2: Gear oil filling quantity

10.2.3 Drive bearing lubricant
- See drive documents provided by the manufacturer

10.2.4 Thread locking paste
- Ensure compatibility between the cleaner and the thread locking paste. If the parts were cleaned with an aqueous cleaning solution prior to the thread locking paste being applied, then the hardening or the thread locking paste's properties might be affected
- If metal surfaces are inactive or the hardening rate is too slow: Spray all threads with a suitable activator and allow them to dry
- For through holes: Apply several drops to the bolt where the nut will sit
- For blind holes: Apply several drops along the inside of the thread to the bottom of the hole
- For sealing applications: Apply thread locking paste as a 360° ring to the start of the external thread. Leave the first thread turn free

- For larger threads and gaps: Proportion the thread locking paste quantity accordingly
- Use sealant and adhesive remover to loosen any hardened thread locking paste and then use mechanical cleaning to remove it

The manufacturer recommends that the following thread locking pastes should be used:

Brand	Anaerobic	Harde-ning	Viscosity	Thread connection up to
Weiconlock AN 302-70	Anaerobic	High	Medium viscosity	M20
Loctite 2400	Anaerobic	Medium	Medium viscosity	M36
Weiconlock AN 302-72	Anaerobic	High	High viscosity	M56

Tab. 10.3: Thread locking pastes used in the factory

10.3 Preventing premature elastomer wear

- Avoid frequent product changes
- Avoid using temperatures that are too high, see Chapter 16.4.3 on Page 109
- The cleaning process, concentration, temperature and cleaning agent's reaction time must be precisely matched to each other
- Replace the seals (O-rings and shaft seals) as a precaution during regular service work
- Avoid too long and incorrect storage

10.4 Inspection intervals

▶ Inspection intervals must adapted to the specific system

Inspection interval	Assembling	Work to be carried out
Weekly	Gearbox housing	Visual inspection: ▶ Check oil level and oil quality ▶ Top up with gear oil if necessary ▶ Replace dark and almost opaque oil
	Bearing	▶ Listen for unusual noises
	Mechanical seal	Visual inspection: ▶ Listen for noises ▶ Look for leaks ▶ Consult the manufacturer or replace the mechanical seal if severe leaks occur
	Pump	Visual inspection: ▶ Document the pumping rate ▶ Compare the pumping rate with the technical data sheet
	Pump with mobile stand	▶ Check the position of the pump ▶ For position changes: Pump should be fitted with a permanent baseplate and/or fit articulated foot
	All screw connections	▶ Check screw connections and retighten as necessary
	Shaft seal ring / O-rings	Visual inspection: ▶ Look for leaks ▶ Consult the manufacturer or replace the mechanical seal rings/O-rings if severe leaks occur
	Storage/sealing pressure tank	Visual inspection: ▶ Check for constant set sealing pressure ▶ 1 – 2 bar pressure difference from the nominal pressure in the pump housing ▶ Check for loss of quench medium (filling level) and top up with quench medium if necessary ▶ Check for contaminated quench medium and replace the quench medium if necessary ▶ Check the mechanical seal, connections and pipelines for leaks

Tab. 10.4: Inspection intervals

10.5 Service intervals

▶ Service intervals must adapted to the specific system

Service interval	Assembling	Work to be carried out
After 50 operating hours	All screw connections	▶ Check screw connections and retighten as necessary
	Storage/sealing pressure tank	▶ Change the quench medium
After the first 250 operating hours, then every 3,000 operating hours / 1 year at the latest	Gearbox housing	▶ Change the gear oil ▶ Note the product compatibility
Monthly	Pump housing	▶ Check the spindle screw torque (2180)
Monthly To be set by the operator depending on the pumped medium / operating conditions	Screw spindles	▶ Check the gap size ▶ Replace screw spindles if pumping capacity is too low ▶ Replace screw spindles if damaged
Monthly / after 6 months at the latest	Shaft seal (mechanical seal) and storage/sealing pressure tank	▶ Change the quench medium ▶ Replace the quench medium if impurities are found ▫ If quench medium is contaminated: ▶ Check the shaft seal for dirt or replace it
After 500 cleaning cycles	Pump housing and mechanical seal	▶ Replace O-rings ▶ Check for contamination ▶ Service the mechanical seal if necessary
After 1 year	Shaft seal / O-rings	▶ Replace the shaft seal ring ▶ Replace the O-rings
After 5 years	Storage/sealing pressure tank	▶ Complete internal and external inspections (manufacturer's recommendation) ▶ Inspect all of the accessory parts
After 10,000 operating hours / shorten the intervals under difficult operating conditions	Gears and bearing	▶ Change the gears ▶ Replace the bearing
As per the drive manufacturer's instructions	Drive	▶ Inspect for wear ▶ Lubricate the bearing

Tab. 10.5: Service intervals

10.5.1 Service intervals for elastomers that are in contact with the product

▶ Service intervals must adapted to the specific system

Maintenance interval	Elastomer	Work to be carried out
After 100 operating hours/ 6 months at the latest	O-rings (2194 and 9) on the spindle screw and mechanical seal	▶ Check drive for dirt or leaks ▶ Replace the O-rings and spindle screw if necessary ▶ Clean as necessary
After 500 cleaning cycles		▶ Replace the O-rings ▶ Check for contamination ▶ Service the mechanical seal if necessary
After 1 year		▶ Replace the O-rings

Tab. 10.6: Service intervals for elastomers that are in contact with the product

10.6 Servicing the spindle screw and O-rings

☑ Preliminary activities must have been completed, see Chapter 10.1 on Page 48

1. Remove all parts that come into contact with the pumped medium (both spindles, spindle screws with O-rings)
2. Clean and disinfect each part
3. Clean and disinfect the exposed input and output shafts
4. Undertake the cleaning procedure defined by the operator, see Chapters 9 on Page 44 and 16 on Page 106 Replace any part showing signs of corrosion or scoring
5. Renew the O-rings on the spindle screws

10.7 Drain or replace the gear oil

☑ Preliminary activities must have been completed, see Chapter 10.1 on Page 48

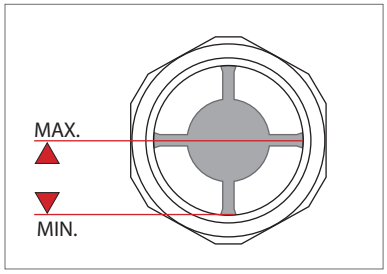


Fig. 10.1: Oil filling level glass

1. Place a suitable drip tray under the gearbox housing
1. Place a suitable drip tray under the gearbox housing
2. Open the sealing screw (2233) (top of gear housing)
3. Open the sealing screw (2233) (bottom of gear housing)
4. Fully drain the gear oil from the gear and bearing housings
5. Clean both screw plugs (magnetic pin)
6. Screw in and tighten the lower sealing screw
7. Refill with new gear oil up to the maximum level indicator
8. Screw in and tighten the top sealing screw

10.8 Refilling with gear oil

☑ Preliminary activities must have been completed, see Chapter 10.1 on Page 48

1. Wait approx. 3 min until the oil has collected in the tray
2. Read the filling level
3. Open sealing screw (top of gear housing)
4. Fill with gear oil up to the maximum level indicator
5. Clean the sealing screw (magnetic pin), screw back in and tighten

10.9 Servicing the mechanical seal

☑ Preliminary activities must have been completed, see Chapter 10.1 on Page 48
▶ See Chapters 12.12 on Page 70 and 12.14 on Page 76
▶ See exploded drawings in Chapter 15.13 on Page 102 to 15.14 on Page 103

The pump is delivered with either a single-acting or double-acting mechanical seal cartridge (see technical data sheet).

Note the following specifications for the mechanical seals:
- Only single-acting mechanical seals are to be used in 3-A certified pumps
  - Double-acting mechanical seals are not permitted
- Single-acting or double-acting mechanical seals can be used in EHEDG certified pumps

▶ Remove a defective mechanical seal and replace it with a new one

or:
1. Mechanical seal cartridge
2. Dismantle the mechanical seal cartridge down to its separate parts
3. Carefully clean and disinfect the mechanical seal cartridge's separate parts
4. Carry out the cleaning procedure defined by the operator
5. Replace all of the O-rings in the mechanical seal cartridge
6. Replace any parts showing signs of corrosion or scoring

Single-acting mechanical seal
- Approved for use in both rotational directions
- Sliding surface wear is automatically compensated for through moving up
- Service-free

Double-acting mechanical seal
- Approved for use in both rotational directions
- Quench medium (storage/sealing liquid) is needed in the sealing chamber
- Sliding surface wear is automatically compensated for through moving up
- Service-free
- Leaks are impossible during normal operation

1. Check the double-acting mechanical seal's connections (hose nozzle) for correct seating and connections
2. Fill the sealing chamber with a product-compatible quench medium
3. Check the level in the storage/sealing pressure tank and top up if necessary
4. Pressurize the quenching medium from the sealing pressure tank if necessary
   ▶ Check the sealing liquid pressure (approx. 1 – 2 bar higher than the back-pressure on the pumped medium side)
5. Always vent after completing the service work on the shaft seal (sealing chamber and lines).

10.10 Sending a pump for repair

The pump can be sent to the manufacturer for repair.

Carry out the following working steps before returning it:
1. Contact the manufacturer and inform them about the shipping
2. Fully empty the pump and then clean it thoroughly
3. Seal all of the openings
4. Send the pump with the fully completed decontamination declaration to Pumpenfabrik GmbH. The decontamination declaration is available from the manufacturer upon request.

Address:	SPX FLOW, Inc. 611 Sugar creek Road Delavan, WI 53115
Tel.:	(262) 728-1900 or (800) 252-5200
Fax:	(262) 728-4904 or (800) 252-5012
E-mail:	wcb@spxflow.com

11. Trouble shooting

Before starting any troubleshooting:
☑ Preliminary activities must have been completed , see Chapter 10.1 on Page 48

11.1 Possible causes of shaft seal leaks

The shaft seal will not be working as intended in the event of major leaks. The following causes can be responsible for this:

- Dry running
- Counter ring installed lopsidedly
- Deposits on sliding surfaces
- Dirt, fat or oil on sliding surfaces
- Product layer build-up in front of and/or under the secondary seal
- The secondary seal sticks on the counter-sliding surface when the pump is started up after a long rest period
- Wear/damage to the secondary seal
- Wear/damage on the sliding surfaces
- Corrosion on the sliding surfaces or springs
- Incorrect assembly
- Vibrations are affecting the pump
- Lack of rigidity in the pump foundation
- Thermal shock loading
- Mechanical shock loading
- Axis misalignment / bearing damage

11.2 Electrical faults

▶ See the drive manufacturer's operating and maintenance manual

11.3 Pump malfunctions

Fault type	Possible cause	Elimination
Drive does not start	Power supply missing	▶ Check power supply
	Drive is defective	▶ Check drive
	Motor protection switch has tripped out	▶ Check electrical lines and drive for short circuits
Motor protection switch trips out	Drive is defective	▶ Check drive, replace drive if necessary
	Pressure is too high	▶ Reduce the pressure
	Blockage caused by impurities or a sticky pumped medium	▶ Remove any impurities
	Incorrect connection type	▶ Check that the connection is per the manufacturer's specifications
Pump does not start	Blocked by impurities	▶ Remove the impurities
	Deposits build up during a standstill	▶ Clean the pump immediately after a standstill
	Pumped medium hardens (due to temperature/chemical conditions)	
	Solids content is too high	▶ Check pumping conditions, change the project work if necessary
	System pressure is too high	▶ Compare the pump's nominal pressure against the system conditions, change the project work if necessary
Flow rate decreases or is no longer reached	Shut-off devices partially closed	▶ Fully open the shut-off devices
	Pipeline is blocked	▶ Clear the blockage
	Screw spindle is worn	▶ Check the gap size ▶ Replace screw spindle if necessary
	Air pockets in the pumped medium	▶ Check suction line, media supply and mechanical seal
	Defective mechanical seal	▶ Replace mechanical seal

Tab. 11.1: Possible malfunctions, causes and their elimination

Fault type	Possible cause	Elimination
Defects in the pump casing	Cavitation	▶ Ensure that there is a constant pumped medium inflow ▶ Check whether shut-off devices are fully open during pump operation
Loud pump noise	Damaged bearing	▶ Replace the angular ball bearing ▶ Replace the needle bearing ▶ Inspect the pump for damage
	Impurities in the pumped medium	▶ Remove any impurities ▶ Inspect the pump for damage
	Cavitation, speed too high or suction pipe too narrow/ clogged	▶ Check project work, select a lower speed if necessary ▶ Increase pipe cross-section ▶ Clear the blockage
Pump is not sucking in	Wrong rotational direction	▶ Correct the rotational direction, note the direction arrow
	Screw spindles installed incorrectly	▶ Install the screw spindle (spindle orientation) as per the operating manual
	Suction line is clogged	▶ Clean the suction line
	Suction line is drawing in air	▶ Seal the line ▶ Check the filling level, e.g. in the tank
	Dry running	▶ Ensure there is a pumped medium supply
Mechanical seal is leaking	Worn O-ring or mechanical seal	▶ Replace O-ring or mechanical seal
	Pressure inside the pump casing is too high	▶ Reduce the pressure
	Pumped medium settles in the mechanical seal's spring and this prevents any mechanical seal adjustment	▶ Clean the mechanical seal regularly
	Pumped medium builds up on the mechanical seals	

Tab. 11.1 continued: Possible malfunctions, causes and their elimination

11.4 Ordering spare parts

- The manufacturer recommends that you only use original spare parts

The information needed for ordering spare parts can be found on the machine's name plate, in the associated operating manual or in the technical data sheet.

▶ Always state the following information when ordering spare parts:
  - Pump's serial number
  - Spare part number, see Chapter 15 on Page 88

Contact options for ordering spare parts:

Address:	SPX FLOW, Inc. 611 Sugar creek Road Delavan, WI 53115
Tel.:	(262) 728-1900 or (800) 252-5200
Fax:	(262) 728-4904 or (800) 252-5012
E-mail:	wcb@spxflow.com

12. Assembling and dismantling

The following apply in general to assembling/dismantling:

- ▶ Clean the components and inspect for signs of damage before assembling the pump
- ▶ Never use damaged components
- ▶ Provide suitable lifting equipment to lift or secure the pump, pump housing and drive
- ▶ Any eyelets attached to the drive are only intended for lifting the drive – not for lifting the entire pump
- ▶ Use suitable supports (e.g. wooden blocks) to support the pump/pump housing/drive/separate components and secure them against tipping over
- ▶ Replace the O-rings and shaft seals
- ▶ Collect the oil from the gear and bearing housings and dispose of it correctly

12.1 Preliminary activities

The following steps must be completed before starting any inspection or service work:

1. Always wear personal protective equipment, see Chapter 3.5 on Page 14
2. Stop the pumped medium supply
3. Stop the pump, see Chapter 8.2.1 on Page 42
   - ▶ Disconnect it from the power supply
   - ▶ Lock and secure the main switch
4. Fully depressurize the pressure in the sealing pressure tank/sealing unit
5. Fully depressurize the pressurized pump, see Chapter 8.2.2 on Page 42
6. Fully empty and clean the pump, see Chapter 8.2.3 on Page 42
7. Carrying out the assembling/dismantling work

12.2 Tools needed

Special tools are needed for the assembling and dismantling.

They are identified in the following chapters by the letter "T" (for Tool) and a four-digit tool number, e.g. T0038. If different tools are needed for the different pump versions, then the tool numbers are separated by a slash "/":

- ▫ WTS 70: First tool number
- ▫ WTS 104: Second tool number
- ▫ WTS 130: Third tool number

Information about the tool's number and name as well as a corresponding image of the tool can be found in the Chapter 17 on Page 112
You can order these tools from SPX FLOW by stating the tool number.

- ▶ *Note the maximum tightening torques defined for the pump components, see Chapter 17.2.1 on Page 114*
- ▶ *Note the torques for the general screw connections, see Chapter 17.2.3 on Page 115*

12.3 Handling elastomers

- ▶ Elastomers (O-rings, shaft seals, etc.) that might come into contact with the food must be replaced during repair or servicing work
- ▶ Dispose of old elastomer in accordance with your local regulations
- ▶ Document when elastomers are renewed
- ▶ In the event of damaged elastomers (e.g. due to abrasion, mechanical damage, etc.) clean each part of the pump located behind the shaft seal

⚠CAUTION

- ▶ *Ensure that the O-ring is not pushed in or out of the groove during assembly*

12.4 Drive and "Motor adapter" coupling guard

WTS 70, WTS 104 and WTS 130:

Tools:
☑ Use a suitable base for supporting the drive and the pump (e.g. wooden blocks)

Conditions:
☑ Preliminary activities must have been completed, see Chapter 12.1 on Page 59

- ▶ See exploded-view drawing in Chapter 15.3 on Page 89

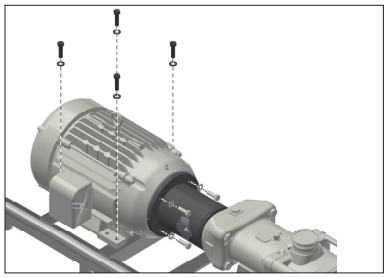
12.4.1 Dismantling

⚠ DANGER

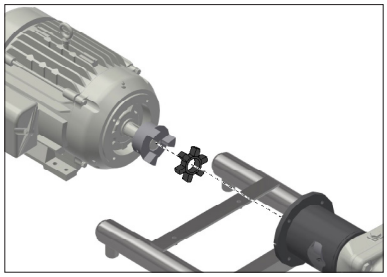
- ▶ *To avoid serious injury, DO NOT install, clean, service, or repair the pump unless all power is off and locked out and the pump is de-pressurized.*
- ▶ *To avoid serious injury, shut off and drain product from the pump prior to disconnecting piping.*
- ▶ *Danger of tipping over: Secure the pump and drive (e.g., use wooden blocks).*

⚠WARNING

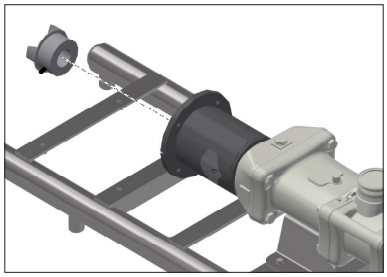
- ▶ *The pump components and piping may contain sharp edges. Handle the screws carefully because edges may be sharp. Wear gloves while installing and servicing the pump to help avoid injuries from these hazards.*



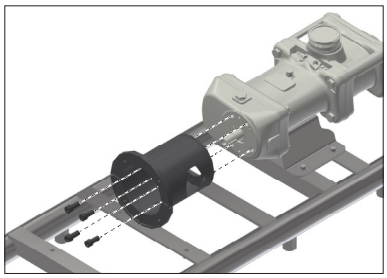
1. Remove the connections from the pump to the system's pipelines.
2. Remove the coupling guard screw that is attached to the drive.
3. Remove the bolt from the drive, which is attached to the baseplate.



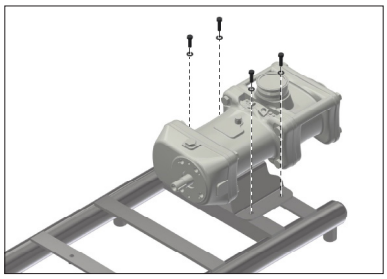
4. Move the drive away from the pump.
5. Place the drive on a suitable base (e.g. wooden blocks).
6. Remove and store the elastomer star.



7. Loosen the grub screw and remove pump shaft coupling.



8. Remove the coupling guard screw that is attached to the pump.
9. Remove the coupling guard.



10. Remove the bolt from the pump, which is attached to the baseplate.
11. Lift up the pump from the baseplate and place it on a suitable base (e.g., wooden blocks).

12.4.2 Assembling

- *It is not necessary to align the pump to the drive with a "Motor adapter" version*

Assembling is carried out in the reverse sequence to dismantling:

1. Screw the coupling guard onto the gear housing
2. Insert the elastomer star in the coupling (replace if necessary)
3. Connect the drive to the pump
   - ▶ Claw coupling: Set up the axial displacement by positioning the claw coupling, see Chapter 6.8.3 on Page 31
4. Connect and tighten the screw connection between the drive and the pump.

12.5 Drive and standard coupling guard

WTS 70, WTS 104 and WTS 130:

Tools:
☑ Use a suitable base for supporting the drive and the pump (e.g. wooden blocks)

Conditions:
☑ Preliminary activities must have been completed, see Chapter 12.1 on Page 59

▶ See exploded drawings in Chapters 15.4 on Page 90

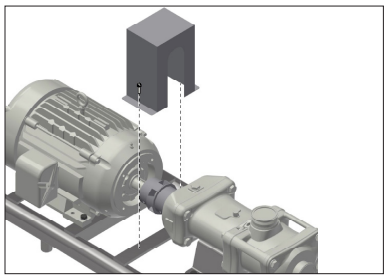
12.5.1 Dismantling

⚠ DANGER

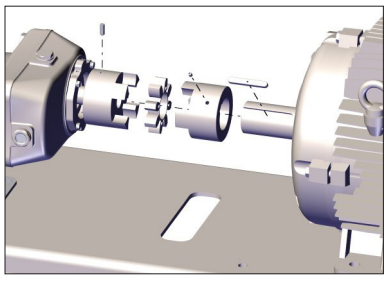
- ▶ *To avoid serious injury, DO NOT install, clean, service, or repair the pump unless all power is off and locked out and the pump is de-pressurized.*
- ▶ *To avoid serious injury, shut off and drain product from the pump prior to disconnecting piping.*
- ▶ *Danger of tipping over: Secure the pump and drive (e.g., use wooden blocks).*

⚠WARNING

- ▶ *The pump components and piping may contain sharp edges. Handle the screws carefully because edges may be sharp. Wear gloves while installing and servicing the pump to help avoid injuries from these hazards.*



1. Remove the connections from the pump to the system's pipelines.
2. Remove the coupling guard screw.
3. Lift up the coupling guard and place on a suitable place.



4. Remove the bolt from drive which is attched to the baseplate.
5. Move the drive away from the pump.
6. Place the drive on a suitable base (e.g. wooden blocks).
7. Remove and store the elastomer star.
8. Rotate the drive shaft until you can access the grub screws in the clutch claw.
9. Undo the threaded pins in both clutch claws
10. Use the puller to detach the clutch claws from the drive shafts.

12.5.2 Assembling

Assembling is carried out in the reverse sequence to dismantling:

1. Insert the key in the drive shaft
2. Lightly apply fat to the drive shaft
3. Slide the coupling guard onto the drive shaft
   - ▶ Either use a winder or
   - ▶ Heat the coupling half to approx. 80 °C (remove the elastomer beforehand) and assemble

⚠CAUTION

- ▶ *Never use a mallet to mount the coupling on the input shaft*
- ▶ *Ensure that the coupling halves are aligned with each other*

4. Screw the threaded pins into the coupling element and tighten
5. Fit the drive and coupling guard.

12.6 Gearbox housing

WTS 70, WTS 104 and WTS 130:

Tools:

☑ Rubber mallet
☑ T0047 / T0088

Conditions:

☑ Preliminary activities must have been completed, see Chapter 12.1 on Page 59
☑ Drive dismantled, see Chapters 12.4 on Page 60 and 12.5 on Page 62
☑ Coupling dismantled, see Chapter 12.5 on Page 62

- ▶ See exploded-view drawing in Chapter 15.5 on Page 91

- ▫ *We recommend that you inspect or replace the shaft seal ring during service work on the gear housing*

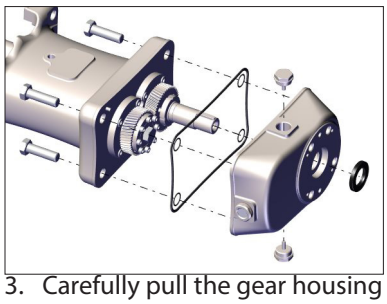
12.6.1 Dismantling

⚠ DANGER

- ▶ *To avoid serious injury, DO NOT install, clean, service, or repair the pump unless all power is off and locked out and the pump is de-pressurized.*
- ▶ *To avoid serious injury, shut off and drain product from the pump prior to disconnecting piping.*

⚠WARNING

- ▶ *The pump components and piping may contain sharp edges. Handle the screws carefully because edges may be sharp. Wear gloves while installing and servicing the pump to help avoid injuries from these hazards.*



1. Fully drain the oil from the gear and bearing housing
   - ▶ Open the upper and lower sealing screws (2233) with sealing rings on the gear housing
   - ▶ Collect and correctly dispose of any escaping oil
2. Undo and remove the hexagon screws on the bearing housing
3. Carefully pull the gear housing off of the bearing housing
   - ▶ Tap lightly with a rubber mallet if necessary
   - ▫ Gear housing is adjusted by the cylinder pins
4. Remove O-ring from gear housing
5. Remove the O-rings on the hexagon screws
6. Press shaft sealing ring out of the gear housing
   - ▫ This will destroy the shaft seal ring

12.6.2 Assembling

Assembling is carried out in the reverse sequence to dismantling:

1. Clean the sealing surfaces on the bearing and gear housings
2. Clean shaft seal ring seat and the drive shaft
3. Lightly apply fat to the shaft seal ring and then carefully press it into the gear housing using a mounting cone (T0047 / T0088)
   - ▫ The shaft seal ring's tension spring points into the gear housing.

⚠CAUTION

- ▶ *Ensure that the shaft seal ring sits plane-parallel to the input shaft*
- ▶ *Do not tilt it when pressing it in*
- ▶ *Do not use mallet taps to press in the shaft seal ring*
- ▶ *Ensure the press-in force is applied close to the outer diameter*
- ▶ *Do not damage the sealing lip during assembly*

4. Place the O-ring on the gear housing
5. Place the hexagon screw O-rings on the gear housing
6. Slide the gear housing over the drive shaft and onto the cylinder pins
   - ▫ Use the cylinder pins to adjust the gear housing
7. Screw the hexagon screws into the gear housing and tighten them crosswise
8. Screw the lower sealing screw with a new seal into the gear housing and tighten – note the torque, see Tab. 17.1 on Page 114
9. Refill the gear and bearing housings with oil
10. Screw the upper sealing screw with a new seal into the gear housing and tighten – note the torque.

12.7 Cover and pump housing

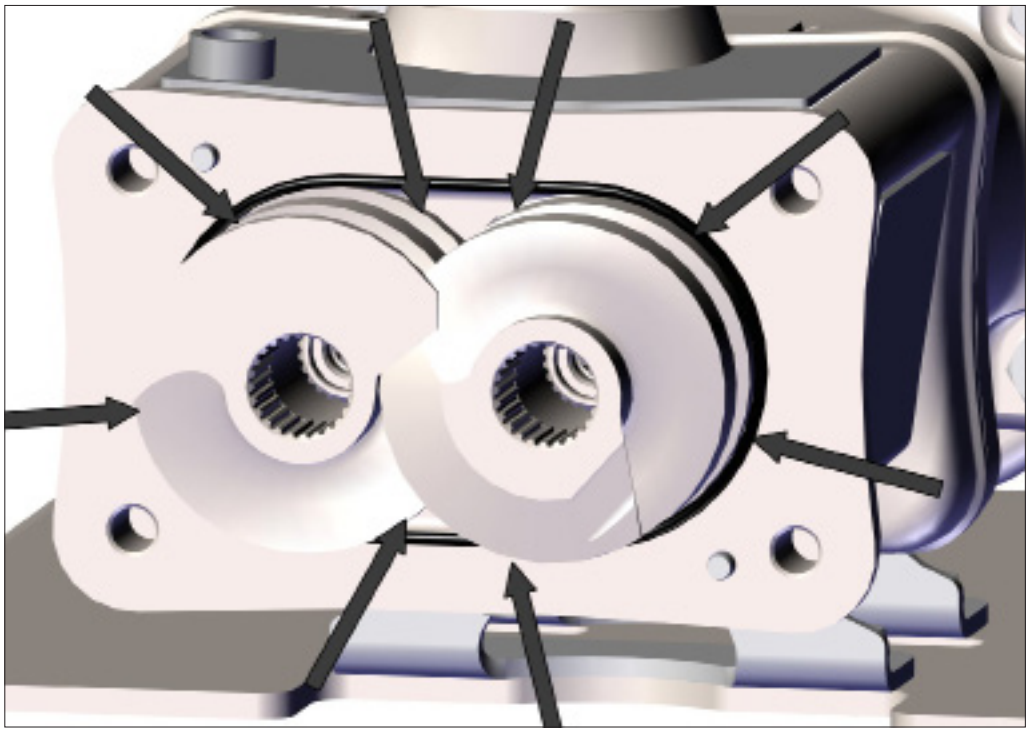


Fig. 12.1: Put protective film around screw spindles during the assembling and dismantling work

- *We recommend that you insert a protective foil (provided by the operator) between the pump housing and the screw spindles when carrying out assembling or dismantling work*
  - *This will prevent any abrasive marks (forming on screw spindles and the inner surface of the pump housing)*

Tools:
☑ Suitable lifting gear
☑ Use a suitable base for supporting the pump housing (e.g. wooden blocks)
☑ Rubber mallet

Conditions:
☑ Preliminary activities must have been completed, see Chapter 12.1 on Page 59
☑ Pump removed from the system / connecting pipe in front of the pump

Pump housing sizes	Connecting flange size	Weight [kg] Cast metal housing	Weight [kg] Solid material
WTS 70	DN40	12	20
WTS 70	DN65	12	20
WTS 104	DN65	18	32
WTS 104	DN80	18	32
WTS 130	DN100	26	50
WTS 130	DN125	25	46

Tab. 12.1: Different pump housing weights

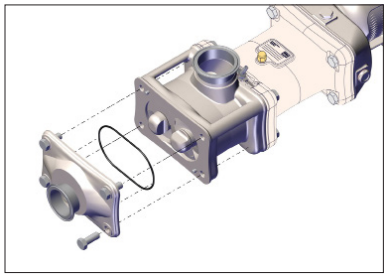
12.7.1 Dismantling

⚠ DANGER

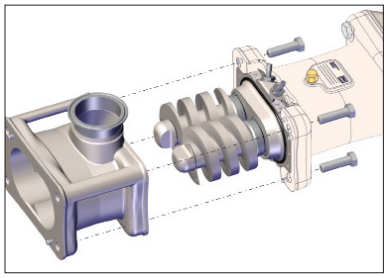
- ▶ *The pump contains internal moving parts. DO NOT put hands or fingers into the pump body ports or drive area at any time during operation. To avoid serious injury, DO NOT install, clean, service, or repair pump unless all power is off and locked out and the pump is de-pressurized.*
- ▶ *To avoid serious injury, DO NOT install, clean, service, or repair the pump unless all power is off and locked out and the pump is de-pressurized.*
- ▶ *To avoid serious injury, shut off and drain product from the pump prior to disconnecting piping.*

⚠WARNING

- ▶ *The pump components and piping may contain sharp edges. Handle the screws carefully because edges may be sharp. Wear gloves while installing and servicing the pump to help avoid injuries from these hazards.*



1. Undo the screw connection on the pump housing's cover
2. Remove the cover and O-ring from the pump housing
   - ▶ Tap lightly with a rubber mallet if necessary
   - ▫ Cover is adjusted by the cylinder pins
3. Slide the protective film inbetween the pump housing and the screw spindles
4. Undo the screw connections between the bearing and pump housings
5. **Warning!** Danger of tipping – support the pump housing or use lifting gear to secure it against tipping over



6. Remove the pump housing
   - ▶ Tap lightly with a rubber mallet if necessary
   - ▫ Pump housing is adjusted by the key pins
7. Remove O-ring.

12.7.2 Assembling

Assembling is carried out in the reverse sequence to dismantling:

1. Clean cover and seal seat
2. Insert the O-ring in the cover
3. Clean the pump housing (inside)
4. Push the pump housing (with protective film) over the screw spindles and screw it onto the bearing housing
5. Remove the protective film
6. Place the cover on the appropriate positioning pins on the pump housing, see Chapter 7 on Page 36

7. Screw in the hexagon screws (1016 and 2527) and tighten them crosswise – note the torque, see Tab. 17.1 on Page 114; see Chapter 15.8 on Page 95

12.8 Solid pump housing

☑ Note the weight, see Tab. 12.1 on Page 65

There is a hexagon screw with seal at both ends of a "solid pump housing"The following working steps must be completed before the pump housing can be dismantled and lifted safely:
1. Undo the hexagon screw with seal
2. Screw a suitable eyebolt into the thread (operator's side)
3. Attach a suitable sling to the solid pump housing and then use a suitable lifting device
4. Other dismantling/assembling, see Chapter 12.7 on Page 65
5. Replace the eyebolts with hexagonal screws with seals after dismantling/assembling

12.9 Screw spindles

Tools:
☑ T0162 / T0163 /T0163 for hexagon spindle screws (newer pump models)
☑ Steel mandrel

Conditions:
☑ Preliminary activities must have been completed, see Chapter 12.1 on Page 59
☑ Pump removed from the system / connecting pipe in front of the pump

WTS 70 (special stainless steel version) and WTS 104/130):
☑ Drive and coupling guard dismantled, see Chapter 12.4 on Page 60 and 12.5 on Page 62
☑ Coupling dismantled, see Chapter 12.4 on Page 60 and 12.5 on Page 62
☑ Gear housing dismantled, see Chapter 12.6 on Page 63

Conditions for continuing (for all versions)
☑ Cover and pump housing dismantled, see Chapter 12.7 on Page 65

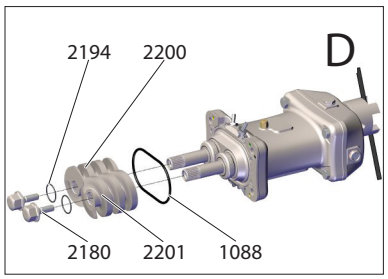
12.9.1 Dismantling

⚠ DANGER

- *The pump contains internal moving parts. DO NOT put hands or fingers into the pump body ports or drive area at any time during operation. To avoid serious injury, DO NOT install, clean, service, or repair pump unless all power is off and locked out and the pump is de-pressurized.*
- *To avoid serious injury, DO NOT install, clean, service, or repair the pump unless all power is off and locked out and the pump is de-pressurized.*
- *To avoid serious injury, shut off and drain product from the pump prior to disconnecting piping.*

⚠WARNING

- *The pump components and piping may contain sharp edges. Handle the screws carefully because edges may be sharp. Wear gloves while installing and servicing the pump to help avoid injuries from these hazards.*



1. Undo the spindle screws (2180) and then unscrew them (T0162 / T0163 / T0163)
   - ▶ Lock the drive shaft with a steel mandrel D, do this by inserting the steel mandrel inbetween the claws on the pump-end coupling
2. Remove the O-rings (2194) from the spindle screws
3. Remove the O-ring (1088) on the seal retainer
4. Pull the screw (2200 and 2201) off of the input/output shafts.
5. Inspect the screw spindles, shafts and pump housing for damage and clean – replace if necessary.

12.9.2 Assembling

- ▶ *Always push the screw spindles onto the shafts in pairs.*
- ▶ *Ensure that the spindles are arranged correctly and that the correct conveying direction will be used (see Chapter 6 on Page 27 as well)*
- ▶ *Screw spindles might have to be synchronized using the drive gears*

Assembling is carried out in the reverse sequence to dismantling:

Conditions:

☑ Screw spindles, spindle screws, seal retainer, mechanical seal cartridge, input/output shafts, cover and pump housing were all cleaned

1. Renew both O-rings (2194) on the spindle screws
2. Place the O-Rings (2194) in the grooves in the spindle screws

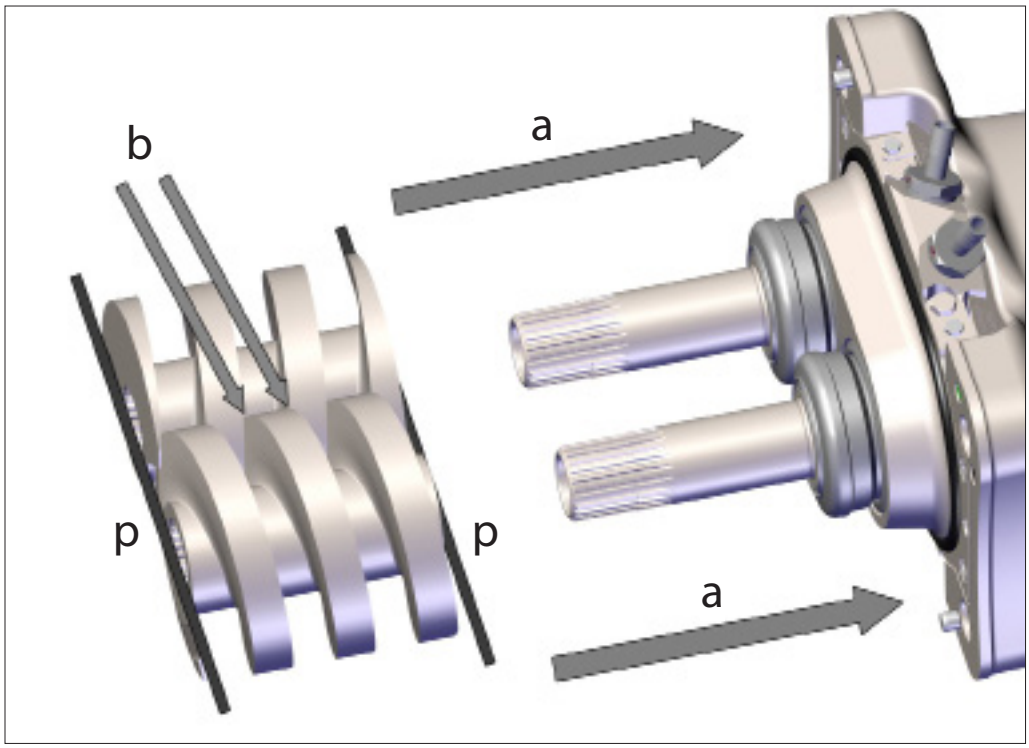


Fig. 12.2: The screw spindles are pushed on in pairs

3. Push the screw spindles in pairs onto the input/output shafts (arrow a in Fig. 12.2 on Page 68)
4. Tighten the spindle screws (2180) by hand.
   - ▫ When they stop against the screw spindles:
     - ▶ Tighten alternately with "feeling" using wrenches (T0162 / T0163 / T0163)

- ► Ensure that the screw spindles do not press against each other and scratch each other

5. If both screw spindles are lying flat (p marks in Fig. 12.2 on Page 68) on both mechanical seal cartridges and there is also a gap (arrow b in Fig. 12.2 on Page 68) between the two screw spindles:
   - ► Tighten both spindle screws (2180) on the input and output shafts (T0162 / T0163 / T0163) – note the torque, see Tab. 17.1 on Page 114
   - ► Use a steel mandrel D to lock the input shaft, see Fig. in Chapter 12.9.1 on Page 67
   - ► Do this by inserting a steel mandrel between the claws on the pump-end coupling
   - ► Use a feeler gage to check the gap on the screw spindle flanks
6. If only one of the two screw spindles is lying flat against the mechanical seal cartridge and the other screw spindle has a gap between the mechanical seal cartridge and the screw spindle:
   - ► Synchronize the screw spindles, see Chapter 12.10 on Page 69
   - ► Check the gap between the spindles
   - ▫ If the values have changed compared to the documented values:
     - ► Repeat the synchronization process, see Chapter 12.10 on Page 69
7. Insert the O-ring (1088) in the groove in the seal retainer
   - ► Ensure that it is seated correctly
8. Slide the pump housing over the screw spindles and onto the positioning pins
   - ► Check the positioning of the positioning pins, see Chapter 7.3 on Page 36

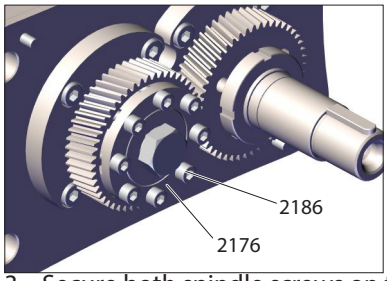
12.10 Synchronizing the screw spindles

Tools:
☑ Feeler gage

Conditions:
☑ Preliminary activities must have been completed, see Chapter 12.1 on Page 59
☑ Pump removed from the system / connecting pipe in front of the pump

WTS 70 (special stainless steel version) and WTS 104/130):
☑ Drive and coupling guard dismantled, see Chapter 12.4 on Page 60 and 12.5 on Page 62
☑ Coupling dismantled, see Chapter 12.4 on Page 60 and 12.5 on Page 62
☑ Gear housing dismantled, see Chapter 12.6 on Page 63

Conditions for continuing (for all versions)
☑ Cover and pump housing dismantled, see Chapter 12.7 on Page 65



1. Arrange the interlocking screw spindles in pairs so that they are at one level (p markings in Fig. 12.2 on Page 68)
2. Push the two screw spindles together onto the input/output shafts (arrow a in Fig. 12.2 on Page 68)
   - ► Pay attention to how the screw spindles are arranged
3. Secure both spindle screws on the input and output shafts:
   - ► Ensure that the screw spindles do not touch
     4. Screw in the spindle screws
     5. Tighten alternately by hand
   - ► Do this by holding both shafts and spindles in your hands
6. Lock the cylinder screws (2186) so that the hub (2176) can be moved
7. Use a feeler gage to set the gap between the spindles on the two screw spindles. (arrow b in Fig. 12.2 on Page 68)
   - ▫ Default gap: 0.2 mm
8. Check and document the gaps on all of the screw spindle flanks that are almost touching
9. Fit the synchronization clamping ring (2515) and fasten it with the cylinder screw (2186)
   - ► Tighten the cylinder screws alternately by hand

10. Tighten the cylinder screws (2186) crosswise after setting the gaps as stipulated – note the torque, see Tab. 17.1 on Page 114
11. Repeat working step 8
    - Synchronizing the screw spindles has been successfully completed when both screw spindles lie flat against the two mechanical seals
    - Carry out the following working steps if there is still a gap between the mechanical seal cartridge and the screw spindle after or during synchronization

If the output shaft's spur gear must be offset:

12. Mark the tooth on the output spur gear and the corresponding counterpoint on the bearing cover (1227) with a marker pen to create a reference point for offsetting the spur gear
13. Remove the key from the input shaft
14. Undo the output shaft's hexagon screw (2177) and remove it with the washer (2178).
    ▶ Place the socket wrench (T0039 / T0040 / T0041) on the output shaft (on the screw spindle end) to hold it in place
15. Only pull off the output spur gear (2184) and hub (2176) (T0009 / T0112 / T0113) until the two spur gears (2183 and 2184) no longer mesh
16. Offset the output spur gear by one tooth (in the left or right direction)
17. Use a rubber mallet to drive the output spur gear and hub back onto the output shaft
18. Repeat work steps 7 to 9
    - Synchronizing the screw spindles has been successfully completed when both screw spindles lie flat against the two mechanical seals
    - Repeat steps 15 to 18 if there is still a gap between the mechanical seal cartridge and the screw spindle
19. Fit the synchronization clamping ring (2515) and fasten it with the cylinder screw (2186)
    ▶ Tighten the cylinder screws alternately by hand
20. Repeat working step 10

12.11 Pump housing arrangement

The orientation of the nozzle housing and the arrangement of the positioning pins on the pump housing are also responsible for the pumped medium's flow direction.

▶ *Note the conveying direction specifications (see Chapter 6 on Page 27)*

12.12 Mechanical seal cartridge / seal retainer

The following instructions apply to both single-acting and double-acting mechanical seal cartridges, see Chapter 12.12.1 on Page 70 to 12.12.3 on Page 73

12.12.1 Preparing a new mechanical seal cartridge

When a new mechanical seal cartridge is delivered, it has a transport lock fitted to it. Three brackets are attached with hexagon socket screws on the end facing away from the product. The transport lock must be removed before this mechanical seal cartridge can be used.

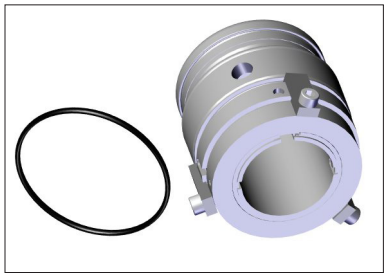
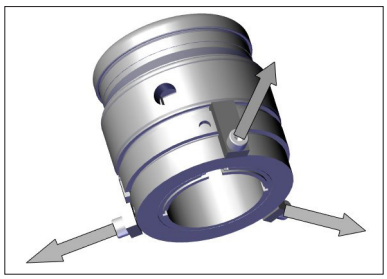
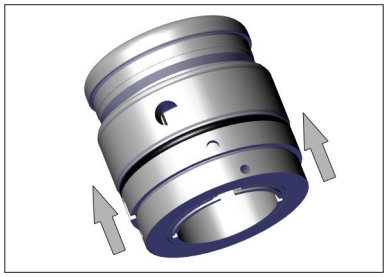


Fig. 12.3: Delivery condition of a new mechanical seal cartridge (single-acting / double-acting)



1. Undo the hexagon socket screws (3 x)
2. Remove the screws and the transport lock



3. Insert the O-ring in the groove where the transport lock was attached

12.12.2 Dismantling the mechanical seal cartridge / seal retainer

Tools:
☑ T0081 / T0085 / T0089
☑ Steel mandrel

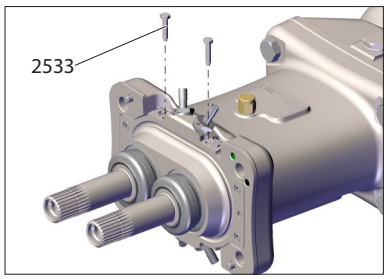
Conditions:
☑ Preliminary activities must have been completed, see Chapter 12.1 on Page 59
☑ Pump removed from the system / connecting pipe in front of the pump
☑ Cover and pump housing dismantled, see Chapter 12.7 on Page 65
☑ Screw spindle dismantled, see Chapter 12.9 on Page 67
☑ Drive shaft locked with a steel mandrel (10 – 12 mm) through a hole in the pump end's coupling claw

⚠ DANGER

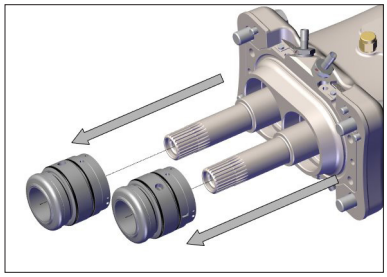
- ▶ *The pump contains internal moving parts. DO NOT put hands or fingers into the pump body ports or drive area at any time during operation. To avoid serious injury, DO NOT install, clean, service, or repair pump unless all power is off and locked out and the pump is de-pressurized.*
- ▶ *To avoid serious injury, DO NOT install, clean, service, or repair the pump unless all power is off and locked out and the pump is de-pressurized.*
- ▶ *To avoid serious injury, shut off and drain product from the pump prior to disconnecting piping.*

⚠WARNING

- ▶ *The pump components and piping may contain sharp edges. Handle the screws carefully because edges may be sharp. Wear gloves while installing and servicing the pump to help avoid injuries from these hazards.*



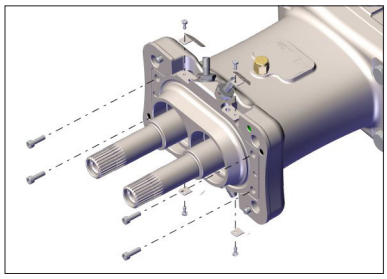
1. Undo the fixing screws (2533) on the seal retainer



2. Pull both mechanical seal cartridges off the input/output shafts and out of the seal retainer

- If the mechanical seal cartridge jams in the seal retainer:
  - ▶ Dismantle the mechanical seal cartridge together with the seal retainer
  - ▶ Push out the mechanical seal cartridge from the back of the seal retainer

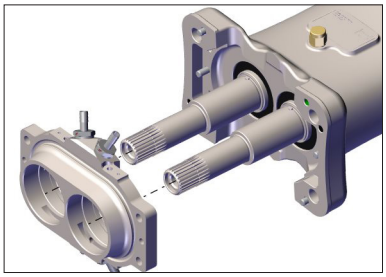
Complete the following working steps to fully dismantle the seal retainer



3. Undo the Savetix screws (2532) on the seal retainer

4. Remove the Savetix hexagon screws and the contact guard (2286)

5. Loosen and remove the cylinder screws in the seal retainer



6. Remove the seal retainer

7. Clean the seal retainer, mechanical seal cartridges, input/output shafts and bearing housing

12.12.3 Assembling the mechanical seal cartridge / seal retainer

Assembling is carried out in the reverse sequence to dismantling or use the alternative assembly working steps:

Conditions:

☑ Input and output shafts, seal retainer and bearing housing have been cleaned
☑ Replace the mechanical seal cartridge if necessary

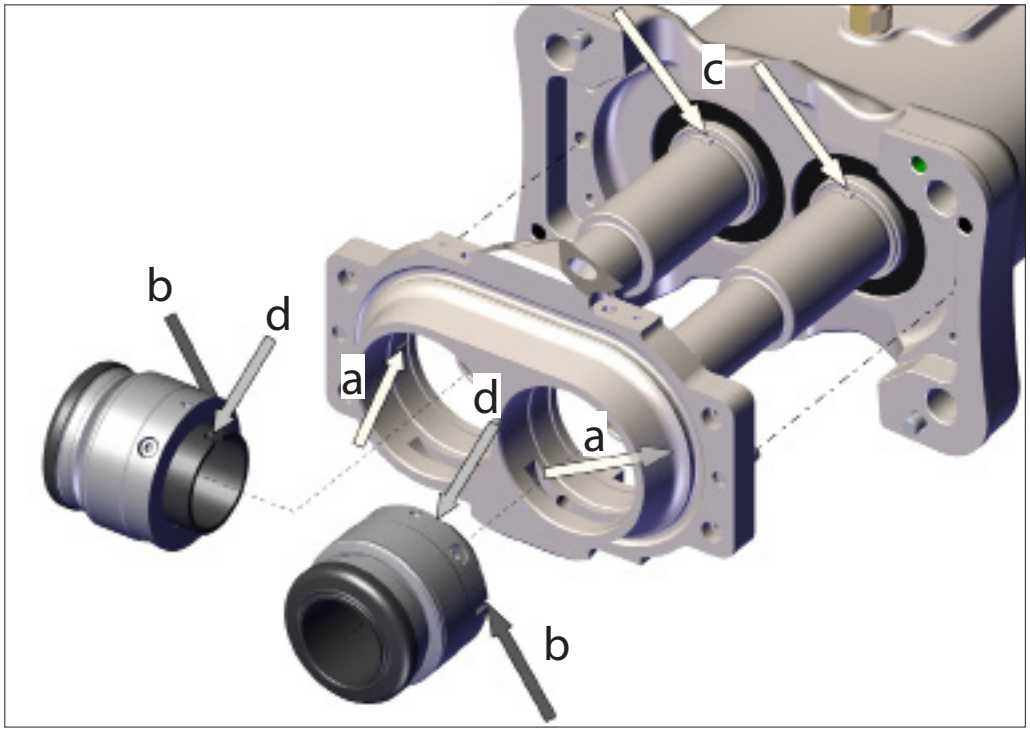
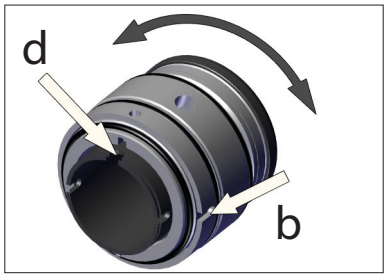


Fig. 12.4: Positioning pin a, Positioning groove b, Drive pin c and Drive nut d

1. Lightly apply fat to the input/output shafts and the seal retainer using an approved lubricant
2. Insert the seal retainer in the bearing housing
   ▶ Positioning is realized using the aligning pin 2536, see Chapter 15.13 on Page 102
3. Use the cylinder screws (2259) to fasten the seal retainer onto the bearing housing



4. Turn the mechanical seal cartridges manually (turning arrow) so that the positioning pin 2538 (see Chapter 15.13 on Page 102; arrow a in Fig. 12.4 on Page 73) in the seal retainer engages with the positioning groove (arrow b) in the mechanical seal cartridge. Ensure that the driver pin 2541 (arrow c) for the input/output shafts slides into the drive groove (arrow d) in the mechanical seal cartridge
5. Carefully push the adjusted mechanical seal cartridges over the input and output shafts
   ▶ Take note of the correct orientation of the mechanical seal cartridges
      ▫ The end with the drive groove points in bearing housing direction

- ▫ *The drive pins on the input/output shafts engage the drive grooves in the inner rotating slide rings*
- ▫ *Positioning pins that engage the positioning grooves (long groove) in the outer stationary slide rings always sit on the outside of the seal retainer in the 9 o'clock/3 o'clock positions*
- ▫ *The positioning pins make it easy to find the correct position on the outer stationary slide rings to screw in the fixing screws*
  - ▫ *The holes for the fixing screws point upwards*
- ▶ *When fitting the mechanical seal cartridge, you should align the positioning groove in the outer stationary mechanical seal to the outside and then slide it onto the shaft*

6. Press in the mechanical seal cartridge (T0081 / T0085 / T0089)
   - Positioning/drive groove and position/drive pin should visibly engage in each other
7. Use the fixing screws to secure and tighten the position of the mechanical seal cartridge
8. Fit the Savetix hexagon screws (2532) and contact guard (2546 / 2547) on the seal retainer

Alternative assembly working steps: Insert the mechanical seal cartridge into the non-installed seal retainer

1. Lightly apply fat to the input/output shafts and the seal retainer using an approved lubricant
2. Turn the mechanical seal cartridges manually (turning arrow) so that when the mechanical seal cartridge is being inserted in the seal retainer, positioning pin 2538 (see Chapter 15.13 on Page 102; arrow a in Fig. 12.4 on Page 73) in the seal retainer engages with the positioning groove (arrow b) in the mechanical seal cartridge
   - ▶ Take note of the correct orientation of the mechanical seal cartridges and the seal retainer
   - ▶ Insert the mechanical seal cartridges into the seal retainer and press them in (T0081 / T0085 / T0089)
3. Push the pre-assembled seal retainer (with both mechanical seal cartridges) over the input and output shafts and up to the bearing bracket stop
   - Drive groove and drive pin should visibly engage in each other
4. Use the fixing screws to secure and tighten the position of the mechanical seal cartridge
5. Fit the Savetix hexagon screws (2532) and contact guard (2546 / 2547) on the seal retainer

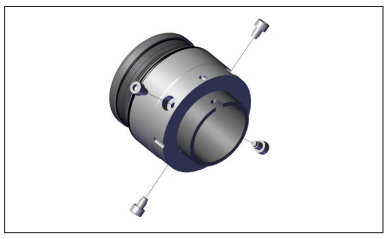
12.13 Dismantling a single-acting mechanical seal cartridge

⚠CAUTION

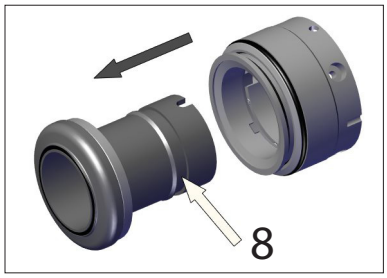
- ▶ *Ensure that separate parts of the mechanical seal cartridges are not scratched or damaged*
- ▶ *Avoid any contamination, e.g. dust, fingerprints, etc.*
- ▶ **Never** *operate mechanical seals with missing springs or without their springs*

▶ See exploded-view drawing in Chapter 12.14 on Page 76

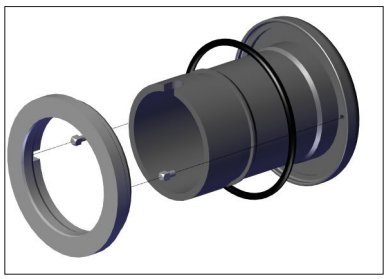
12.13.1 Dismantling



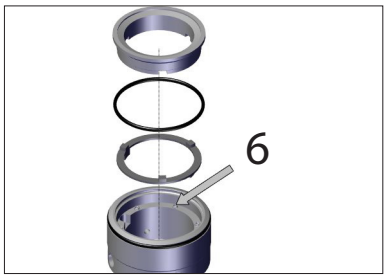
1. Undo the cylinder screws
   - As locking paste was applied to the cylinder screws, the locking paste will be destroyed when they are unscrewed
   - The cylinder screws engage in the groove in the shaft sleeve 8, but they are not firmly connected to it
   - The shaft sleeve can be turned



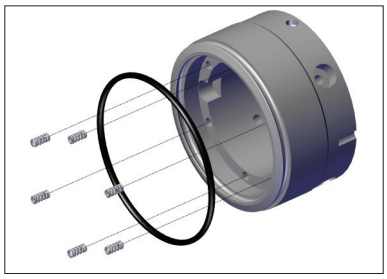
2. Completely remove the locking paste from the cylinder screw's thread and where the cylinder screw was seated
3. Press the shaft sleeve and rotating slide ring out of the gland



4. Separate the rotating slide ring from the shaft sleeve
   - The two pins that position the rotating slide ring are loosely seated in the square notches in the rotating slide ring or in the shaft sleeve
5. Remove the pins
6. Remove the O-rings from the shaft sleeve or the rotating slide ring



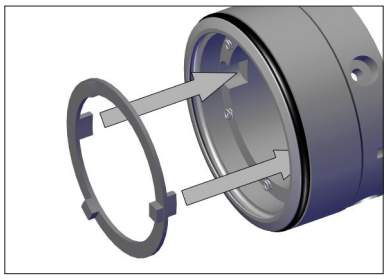
7. Prevent the springs 6 from falling out of the gland in an uncontrolled way by placing the mechanical seal cartridge in an upright position
8. Remove the stationary counter ring from the gland
9. Remove the O-ring from the stationary counter ring or remove it from the gland



10. Remove the pressure ring from the gland
11. Take the springs out of the gland
    - The springs are loose in the gland
12. Remove the O-ring from the gland's outer rim

12.13.2 Assembling

Reassembling the single-acting mechanical seal cartridge is carried out in the reverse order to dismantling it.
The following points must also be noted:



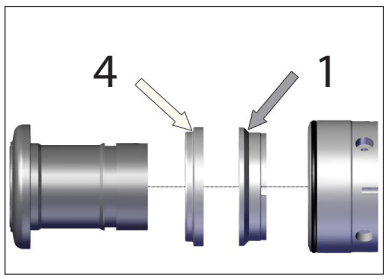
1. Clean all of the parts before assembling them
2. Replace the O-rings
3. Replace the slide ring and counter ring as necessary
4. Take note of the correct orientation of the pressure ring:
   - The two lugs must point towards the inside of the gland
   - The two lugs on the pressure ring sit in the two notches during assembly

- *The slide ring and counter ring can be made from different materials, depending on the design*

▶ *Ensure that the slide ring and counter ring are correctly arranged in the mechanical seal cartridge*

Rotating slide ring properties:
- *Stepped profile* 4
- *Smaller than a counter ring*

Stationary slide ring properties:
- *Slanted profile* 1
- *Three notches that engage with the lugs on the pressure ring*
- *Wider than a slide ring*



5. Ensure that the arrangement is correct when installing the stationary counter ring 1 or a rotating slide ring 4

6. Apply medium-strength locking paste to the cylinder screw and then screw it in

12.14 Dismantling a double-acting mechanical seal cartridge

- *The manufacturer recommends using a suitable clamping device/assembly aid when dismantling the mechanical seal cartridge*
- *Two people will be needed for the following working steps if this is not available*

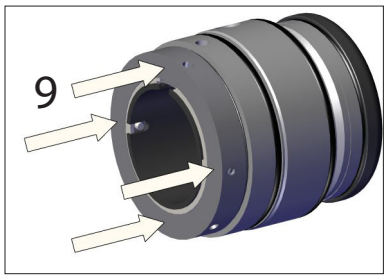
Tools:
☑ Clamping device/assembly aid, see Chapter 18 on Page 116
☑ Circlip pliers

▶ See exploded-view drawing in Chapter 15.14 on Page 103

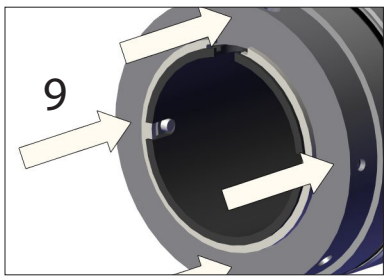
⚠CAUTION

- ▶ *Ensure that separate parts of the mechanical seal cartridges are not scratched or damaged*
- ▶ *Avoid any contamination, e.g. dust, fingerprints, etc.*
- ▶ **Never** *operate mechanical seals with missing springs or without their springs*

12.14.1 Dismantling

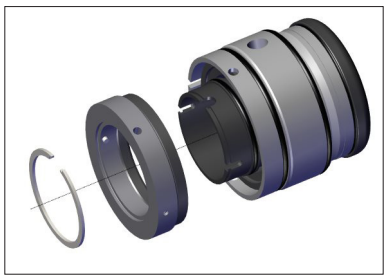


1. Press the mechanical seal cartridge's housing 9 together evenly (arrows) until the drive pin makes contact with the shaft sleeve
   - The locking ring will be exposed

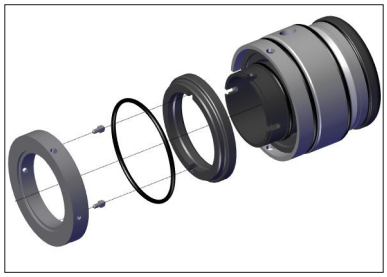


2. Use the circlip pliers to remove the circlip

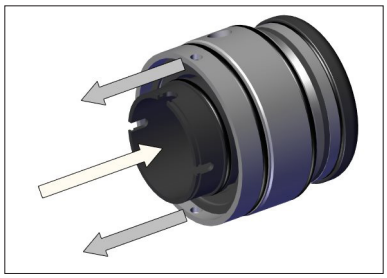
3. Remove the mechanical seal cartridge from the assembly aid if necessary



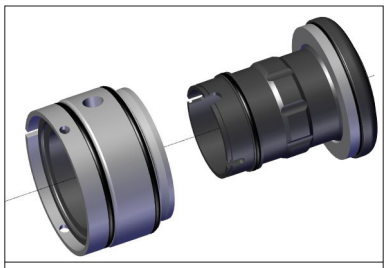
4. Remove the housing and the rotating slide ring



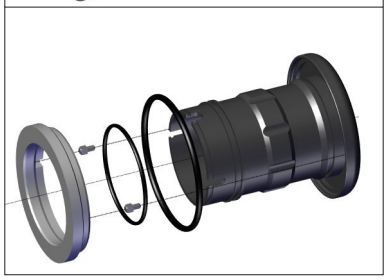
5. Separate the rotating slide ring from the housing
   - The two pins that position the rotating slide ring are loosely seated in the square notch in the rotating slide ring or in the housing
6. Remove the pins



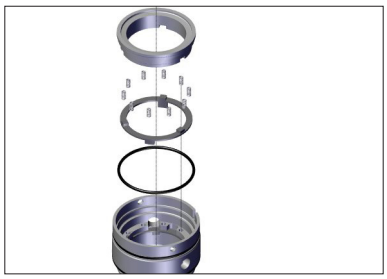
7. Remove the O-ring from the rotating slide ring
8. Press the shaft sleeve and rotating slide ring out of the gland



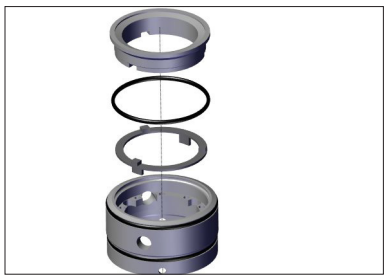
9. Separate the rotating slide ring from the shaft sleeve
   - The two pins that position the rotating slide ring are loosely seated in the square notches in the rotating slide ring or in the shaft sleeve
10. Remove the pins



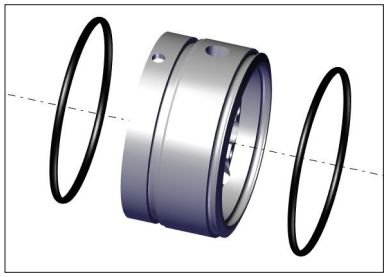
11. Remove the O-rings from the shaft sleeve or the rotating slide ring



12. Prevent the springs from falling out of the gland in an uncontrolled way by placing the mechanical seal cartridge in an upright position
13. Remove the stationary counter ring and O-ring from the gland
14. Remove the O-ring from the stationary counter ring
15. Remove the pressure ring from the gland
16. Remove the springs
    - The springs are loose in the gland



17. Turn the mechanical seal cartridge by 180° and then place it in an upright position
18. Remove the stationary counter ring from the gland
19. Remove the O-ring from the gland's groove
20. Remove the pressure ring from the gland



21. Remove the O-rings on the outside of the gland

12.14.2 Assembling

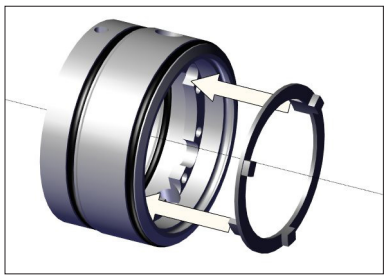
Reassembling the double-acting mechanical seal cartridge is carried out in the reverse order to dismantling it.
The following points must also be noted:

- *The slide ring and counter ring can be made from different materials, depending on the design*
- *The two slide rings are usually made from the same material and are identical in shape*

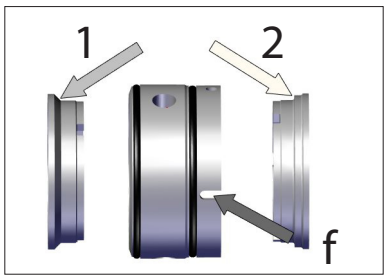
▶ *Ensure that the slide ring and counter ring are correctly arranged in the mechanical seal cartridge*

Rotating slide ring's properties 5***:***
- *Sits on the end facing the pumped medium or the atmospheric end*
- *Stepped profile*
- *Two square notches for the pins (see position number* 14*, Chapter 15.15 on Page 104*

Properties of the two stationary counter rings 1 ***and*** 2***:***
- *Sits on the end facing away from the pumped medium or the atmospheric end*
- *Stepped shape (*2*) and slanted profile (*1*)*
- *Three square notches for the pressure ring lugs*
- *Engages in the elongated notch in the gland (*f*)*

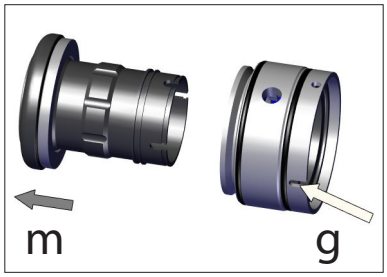


1. Clean all of the parts before assembling them
2. Replace the O-rings
3. Replace the slide ring and counter ring as necessary
4. Take note of the correct orientation of the pressure ring:
   - The two lugs must point towards the inside of the gland
   - The two lugs on the pressure ring sit as mirror images of each other in the two notches during assembly



5. Ensure that ey are arranged correctly when you install the two stationary counter rings (1 and 2)

6. Ensure correct arrangement of the gland end
   - The end of the gland facing away from the pumped medium can be identified by the elongated notch on the gland (arrow f)



7. Ensure that the three notches on the stationary counter rings fit on the lugs on the pressure rings (arrow g)

8. When inserting the shaft sleeve, you must ensure that the shaft sleeve or gland is correctly oriented
   - End facing the pumped medium (arrow m)

12.15 Gearing

Tools:
☑ T0009 / T0112 / T0113
☑ T0017 / T0029 / T0030
☑ T0039 / T0040 / T0041

Conditions:
☑ Preliminary activities must have been completed, see Chapter 12.1 on Page 59
☑ Pump removed from the system / connecting pipe in front of the pump

WTS 70 (special stainless steel version) and WTS 104/130):
☑ Drive and coupling guard dismantled, see Chapter 12.4 on Page 60 and 12.5 on Page 62
☑ Coupling dismantled, see Chapter 12.4 on Page 60 and 12.5 on Page 62
☑ Gear housing dismantled, see Chapter 12.6 on Page 63

Conditions for continuing (for all versions)
☑ Cover and pump housing dismantled, see Chapter 12.7 on Page 65
☑ Screw spindle dismantled, see Chapter 12.9 on Page 67
☑ Mechanical seal and seal retainer have been dismantled, see Chapter 12.12.2 on Page 71

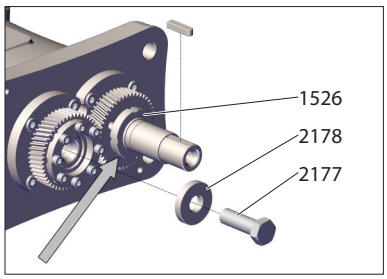
12.15.1 Dismantling

⚠ DANGER

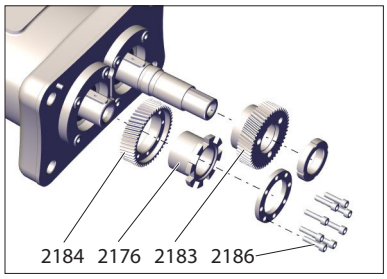
- *To avoid serious injury, DO NOT install, clean, service, or repair the pump unless all power is off and locked out and the pump is de-pressurized.*
- *To avoid serious injury, shut off and drain product from the pump prior to disconnecting piping.*

⚠WARNING

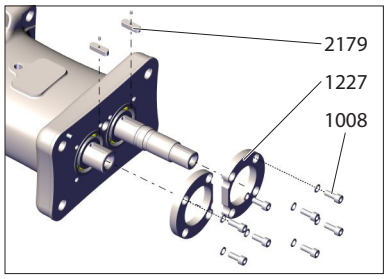
- *The pump components and piping may contain sharp edges. Handle the screws carefully because edges may be sharp. Wear gloves while installing and servicing the pump to help avoid injuries from these hazards.*



1. Remove the key from the input shaft
2. Place the socket wrench (T0039 / T0040 / T0041) on the output shaft (at the screw spindle end) to hold it in place and then undo hexagon screw (2177)
3. Undo hexagon screw (2177) on the output shaft
4. Remove hexagon screw (2177) and washer (2178).
5. Loosen the grub screw (gray arrow) on the shaft nut (1526):
   ► Unscrew by one or two turns



6. Use a socket wrench (T0017 / T0029 / T0030) to undo and remove the shaft nut from the input shaft
7. Undo the cylinder screws (2186)
8. Remove the cylinder screws (2186) and clamping ring
9. Use the puller (T0009 / T0112 / T0113) to pull the spur gear (2183) off of the input shaft
10. Pull the spur gear (2184) and hub (2176) off the output shaft (T0009 / T0112 / T0113)



11. Undo the cylinder screws (1008)
12. Remove the cylinder screws (1008), washers and bearing cover (1227)
13. Remove the keys (2179) from the input/output shafts

12.15.2 Assembling

Assembling is carried out in the reverse sequence to dismantling:

12.16 Bearing, input and output shafts

- *The WTS 70 and WTS 104 have a drive pin (2541) on the input and output shafts – they do not have to be dismantled*
  - *The WTS 130 does not have these two drive pins*
- *When dismantling the drive pins:*
  ► *Completely remove all of the locking paste residue*
- *When installing the drive pins:*
  ► *Use the high-strength thread-locking paste to glue in the drive pins*

Tools:

☑ Hooked puller
☑ Circlip pliers
☑ Puller
☑ T0010 / T0019 / T0020
☑ T0011 / T0031 / T0032
☑ T0012 / T0033 / T0034

☑ T0080 / T0084 / T0087
☑ T0091 / T0093 / T0094
☑ T0092 / T0095 / T0096

Conditions:
☑ Preliminary activities must have been completed, see Chapter 12.1 on Page 59
☑ Pump removed from the system / connecting pipe in front of the pump

WTS 70 (special stainless steel version) and WTS 104/130):
☑ Drive and coupling guard dismantled, see Chapter 12.4 on Page 60 and 12.5 on Page 62
☑ Coupling dismantled, see Chapter 12.4 on Page 60 and 12.5 on Page 62
☑ Gear housing dismantled, see Chapter 12.6 on Page 63

Conditions for continuing (for all versions)
☑ Cover and pump housing dismantled, see Chapter 12.7 on Page 65
☑ Screw spindle dismantled, see Chapter 12.9 on Page 67
☑ Mechanical seal and seal retainer have been dismantled, see Chapter 12.12.2 on Page 71
☑ Gears dismantled, see Chapter 12.15 on Page 79

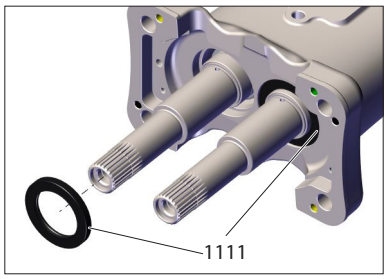
12.16.1 Dismantling

⚠ DANGER

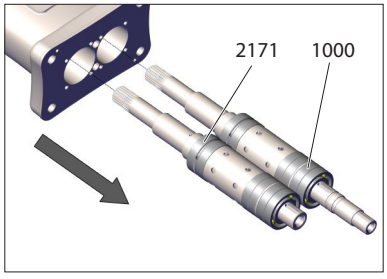
- ▶ *To avoid serious injury, DO NOT install, clean, service, or repair the pump unless all power is off and locked out and the pump is de-pressurized.*
- ▶ *To avoid serious injury, shut off and drain product from the pump prior to disconnecting piping.*

⚠WARNING

- ▶ *The pump components and piping may contain sharp edges. Handle the screws carefully because edges may be sharp. Wear gloves while installing and servicing the pump to help avoid injuries from these hazards.*

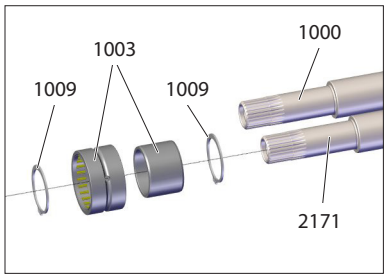


14. Use a hook puller to pull the shaft sealing rings (1111) out of the bearing housing
    - ▫ The shaft sealing rings will be destroyed by this process and they must be replaced

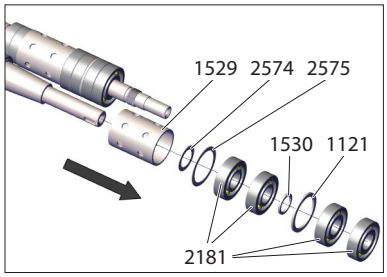


15. Using a press to press out the input shaft (1000) and output shaft (2171) one after the other in the drive direction

- *The input and output shafts are available in two versions:*
  - *up to 02/2020: without a removable shaft protection sleeve*
  - *from 02/2020: with a removable shaft protection sleeve*
- *In the version up to 02/2020, the shaft protection sleeve cannot be removed without destroying the shaft protection sleeve and the input and output shafts*
- *The dismantling process for the input and output shafts / with and without a removable shaft protection sleeve is identical and is described in the working steps 16 to 22 where the output shaft is used as the example*

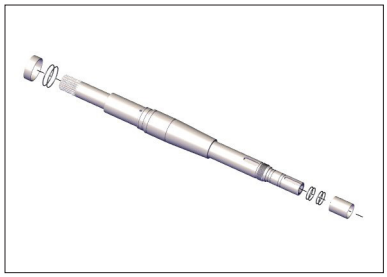


16. Use the circlip pliers to remove the outer circlip (1009)
17. Use a puller to pull the needle bearing's outer ring (1003) off of the output shaft
18. Use a puller to pull the needle bearing's inner ring (1003) off the output shaft
19. Remove the Inner circlip (1009)



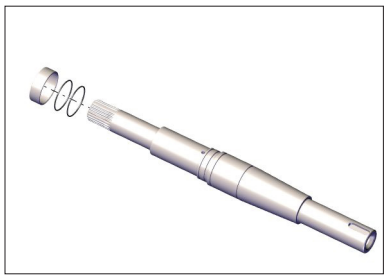
20. Using a press to press out each angular ball bearing (2181) and spacers (1121 and 1530) one after the other from the output shaft in the direction of the drive end
21. Remove shims 2574 and 2575:
    - Only fitted with WTS 70
22. Remove the spacer sleeve (1529) from the output shaft

Version: Removable shaft protection sleeve



Input shaft:

23. Pull off the shaft protection sleeve on the input end
24. Remove the O-rings (4 x)
25. Pull off the shaft protection sleeve on the bearing end
26. Remove the O-rings (2 x)



Output shaft:

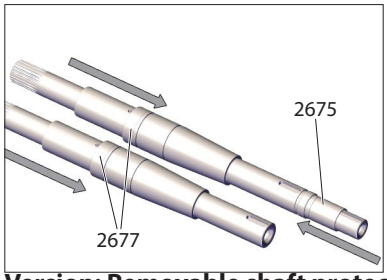
27. Pull off the shaft protection sleeve on the bearing end
28. Remove the O-rings (2 x)

12.16.2 Assembling

Conditions:

☑ Dismantled parts and bearing housing have been cleaned
☑ Separate parts have been inspected for wear/damage, replaced if necessary
☑ Replace the shaft seal ring and the O-rings
☑ Replace the shaft seal ring and the O-rings
☑ Replace the shaft protection sleeve if necessary

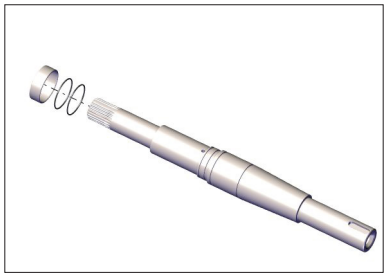
Version: Non-removable shaft protection sleeve



29. Heat the shaft protection sleeves (2675 and 2677) inductively to 120 °C

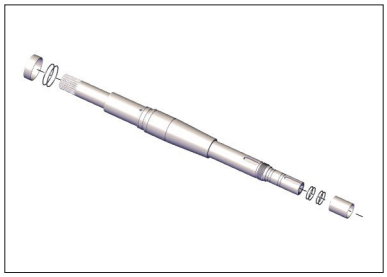
30. Push the shaft protection sleeves with assembly sleeves (T0091 / T00093 / T0095 or T0092 / T0094 / T0096) without any lubricant and without any gaps onto the input/output shafts up to the stop

Version: Removable shaft protection sleeve



Output shaft:

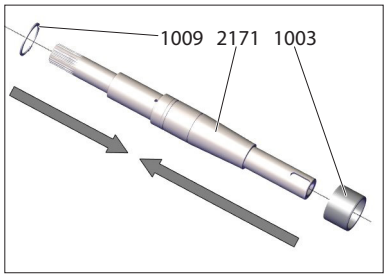
1. Insert the O-rings in the groove at the bearing end (2 x)
2. Push the shaft protection sleeves without any lubricant and without any gaps up to the stop



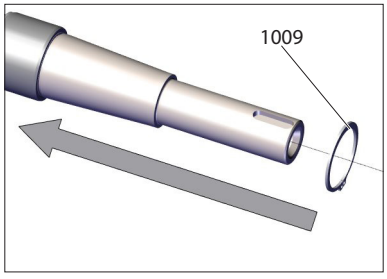
Input shaft:

3. Insert the O-rings in the groove at the bearing end (2 x)
4. Pull off the shaft protection sleeve at the bearing end
5. Insert the O-rings in the groove at the drive end (2 x)
6. Push the shaft protection sleeves without any lubricant and without any gaps up to the stop at the drive end

The assembly process for the input and output shafts / with and without a removable shaft protection sleeve is identical and is described in the following where the output shaft is used as the example



7. Fit the outer circlip (1009) on the output shaft (2171)
8. Lightly apply fat to lubricate the output shaft
9. Use the pressure plate (T0010 / T0019 / T0020) to press the needle bearing inner ring (1003) onto the output shaft from the key side
   ► or inductively heat the needle bearing's inner ring to 120 °C and slide it onto the output shaft



10. Fit the inner circlip (1009) on the output shaft

⚠CAUTION

- ▶ *Note the installation position of the angular ball bearings*
- ▶ *Install the angular ball bearings in an O arrangement*
  - ▫ This ensures that the moment load is absorbed better
- ▶ *Only press on the angular ball bearing's iinner ring when assembling*

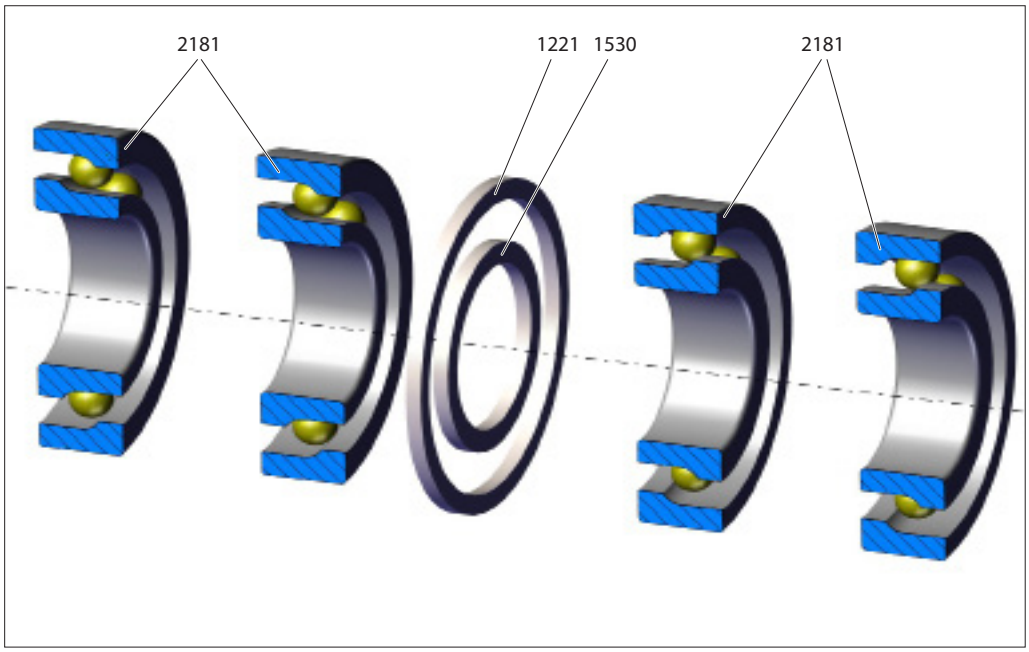
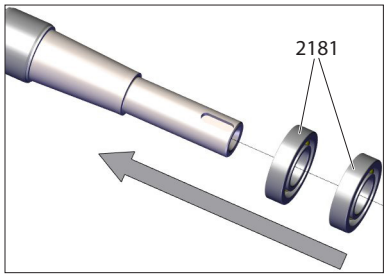
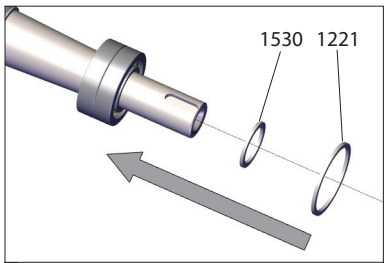


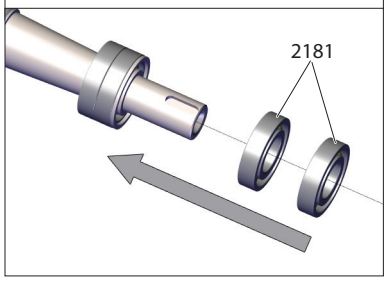
Fig. 12.5: Correct angular ball bearing arrangement: Double O arrangement or tandem O tandem arrangement
1221 Spacer; 1530 Spacer; 2181 Angular ball bearing



11. Use the pressure plate (T0012 / T0033 / T0034) to press the angular ball bearings (2181)) one after the other onto the output shaft (2 x)

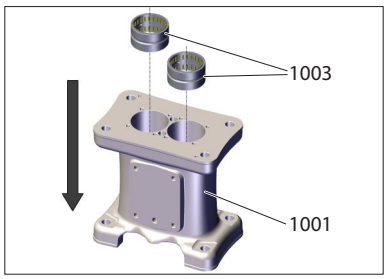


12. Slide the spacers (1530 and 1221) onto the output shaft



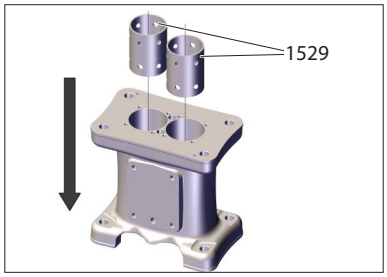
13. Use the pressure plate (T0012 / T0033 / T0034) to press the angular ball bearings (2181)) one after the other onto the output shaft (2 x)

14. Lightly apply fat to lubricate the bearing housings



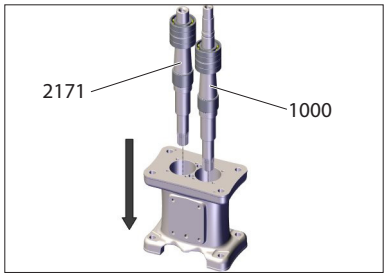
15. Stand the bearing housing vertically
    - ▫ Drive end points upwards

16. Insert the needle bearing (1003) with outer ring and mounting sleeve (T0011 / T0031 / T0032) carefully in the bearing housing (1001)
    - ► Insert the needle bearing and outer ring from the drive end



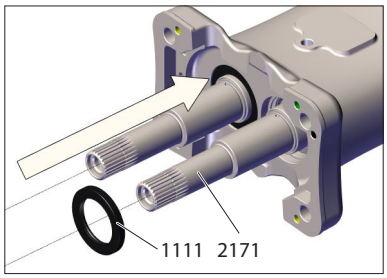
17. Insert the spacer sleeve (1529) carefully in the bearing housing

18. Use your finger to move all the needles in the needle bearing's outer ring outwards



19. Insert the output shaft carefully in the bearing housing and needle bearing's outer ring from the drive end
    - ► When inserting you must ensure that the needles are not tilted by the inner ring on the output shaft

20. Use a press to press the output shaft in up to the stop:
    - ▫ The last angular ball bearing protrudes approx. 1 mm from the bearing housing



21. Lubricate the shaft sealing ring (1111)

22. Slide the assembly sleeve (T0079 / T0083 / T0086) over the output shaft and up to the stop
    - ▫ The tapered end of the mounting sleeve points towards the drive

23. Carefully slide the shaft seal ring over the toothed ends of the shaft and onto the assembly sleeve (T0079 / T0083 / T0086)

24. Press the shaft seal ring with the assembly sleeve (T0080 / T0084 / T0087) into the bearing housing
    - ▫ The shaft seal ring's tension spring points towards the bearing housing

25. Remove both of the assembly sleeves after you have pressed it in

26. Refill the gear and bearing housings with oil

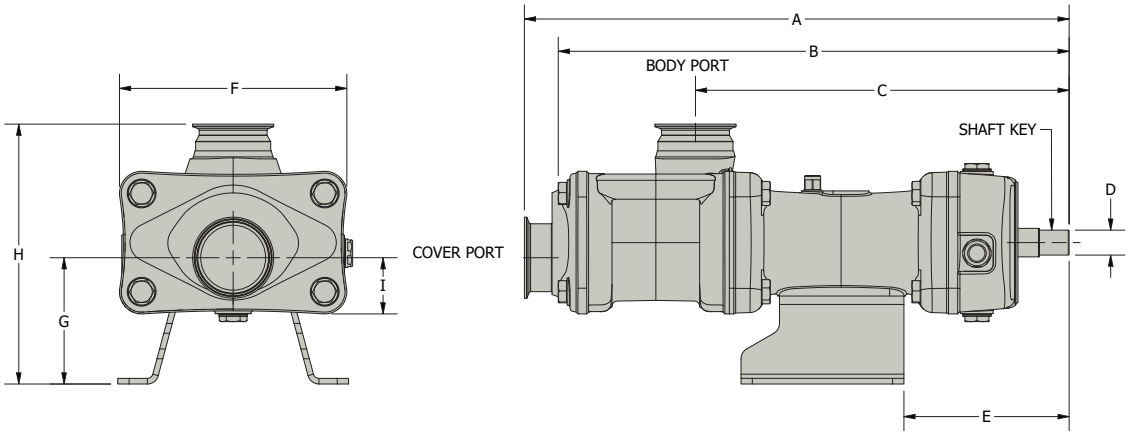
13. Disposal

The pump and its components must be disposed of in accordance with the following table:

Material		Dispose of as
Stainless steel	Complete pump (see Technical data sheet)	Scrap metal (recycling)
Steel	Complete pump (see Technical data sheet)	Scrap metal (recycling)
Plastic (Elastomer)	O-rings	Residual waste
	Shaft seal	Residual waste
Ceramics	Part of the mechanical seal cartridge (silicon carbide SiC)	Residual waste
Fat	Angular ball bearing	Abide by the local regulations
Oil	Gearbox housing	Abide by the local regulations

Tab. 13.1: Pump's materials and their disposal

14. Pump Dimensions



SIZE		A	B	C	D	E	F	G	H	I
WTS 070	IN	20.45	19.15	13.82	0.78	5.43	8.37	5.79	11.13	2.16
	MM	519.3	486.3	350.8	Ø 20	137.9	212.6	147	283	55
WTS 104	IN	24.07	22.57	16.51	1.10	7.30	10.05	5.58	11.49	2.48
	MM	611.5	573.5	419.5	Ø 28	177.3	255.24	142	292	63.1
WTS 130	IN	28.50	24.51	18.38	1.37	8.25	11.77	5.60	11.92	3.04
	MM	724.05	622.55	467.05	Ø 35	210	299.2	142.2	303	77.3

SIZE	Cover Port	Body Port	Weight
WTS 070	2.5 in	2.5 in	132.3 lbs
	63.5 mm	63.5 mm	60 kg
WTS 104	3 in	3 in	199.3 lbs
	76.2 mm	76.2 mm	90.4 kg
WTS 130	4 in	4in	280 lbs
	63.5 mm	63.5 mm	127 kg

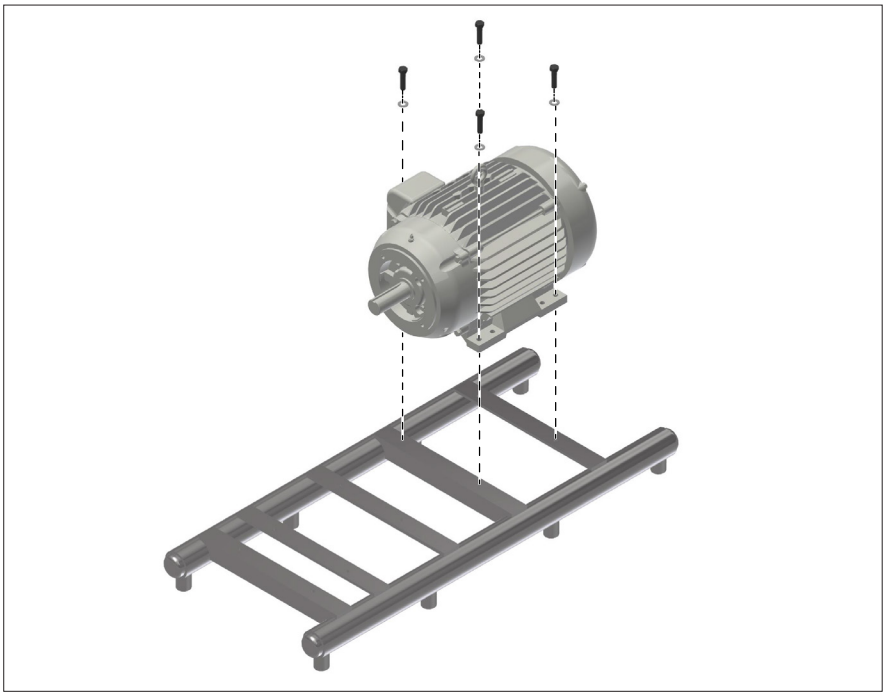
15. Part list

15.1 Base plate - Standard version

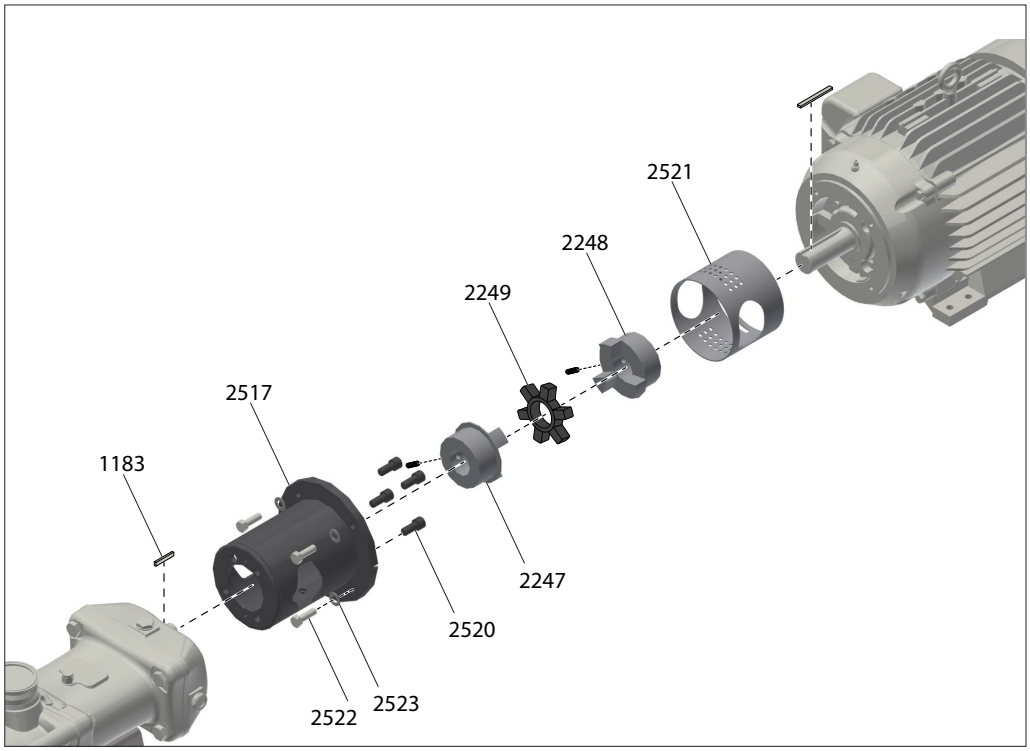
Note: Contact customer service for the pump part number.

15.2 Drive

Note: Contact customer service for the pump part number.



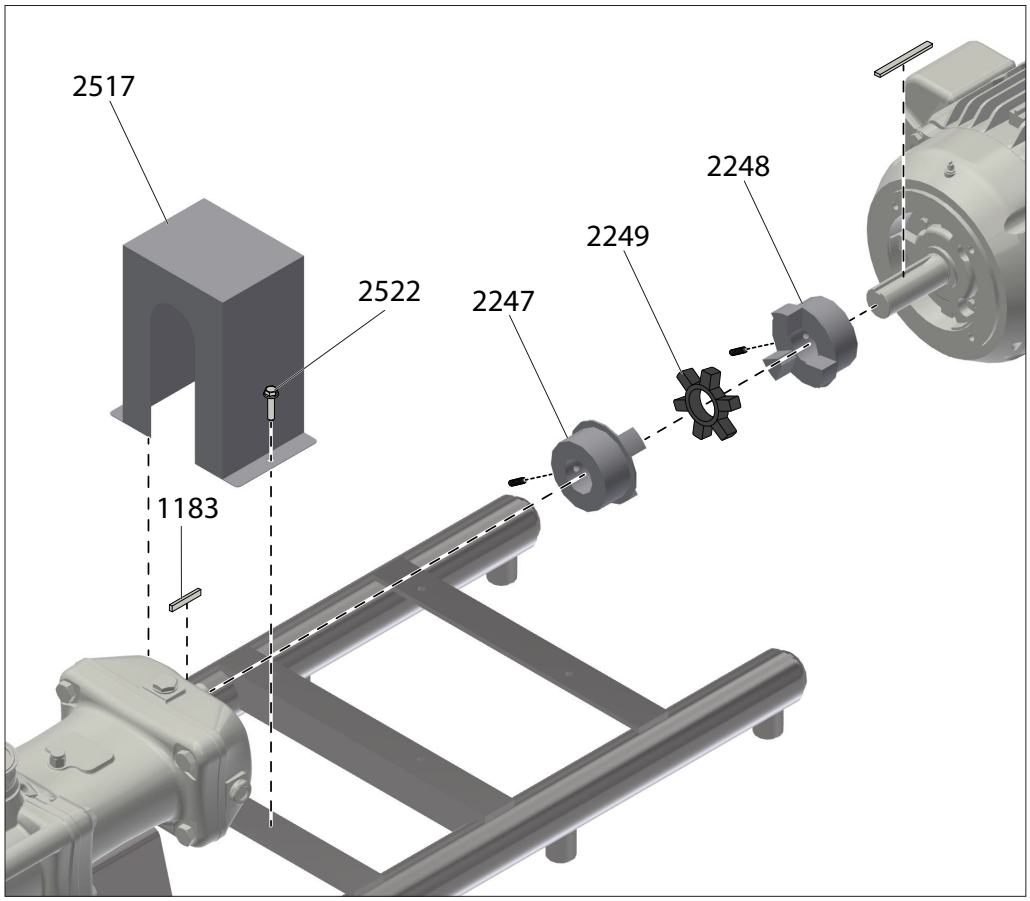
15.3 Coupling and Motor adapter coupling guard



Number	Quantity	Description	Note
1183	1	Key	1
2247	1	Coupling claw including grub screw (pump side)	1
2248	1	Coupling claw including grub screw (input side)	1
2249	1	Elastomer star coupling	1
2517	1	Coupling guard	1
2521	1	Contact protection	1
2522	4	Hexagon screw	1
2520	4	Cylinder screw	1
2523	4	Washer	1
Not shown:			
2516	2	Positioning pin	1

Note: 1. Contact customer service with the serial number of the pump for part number.

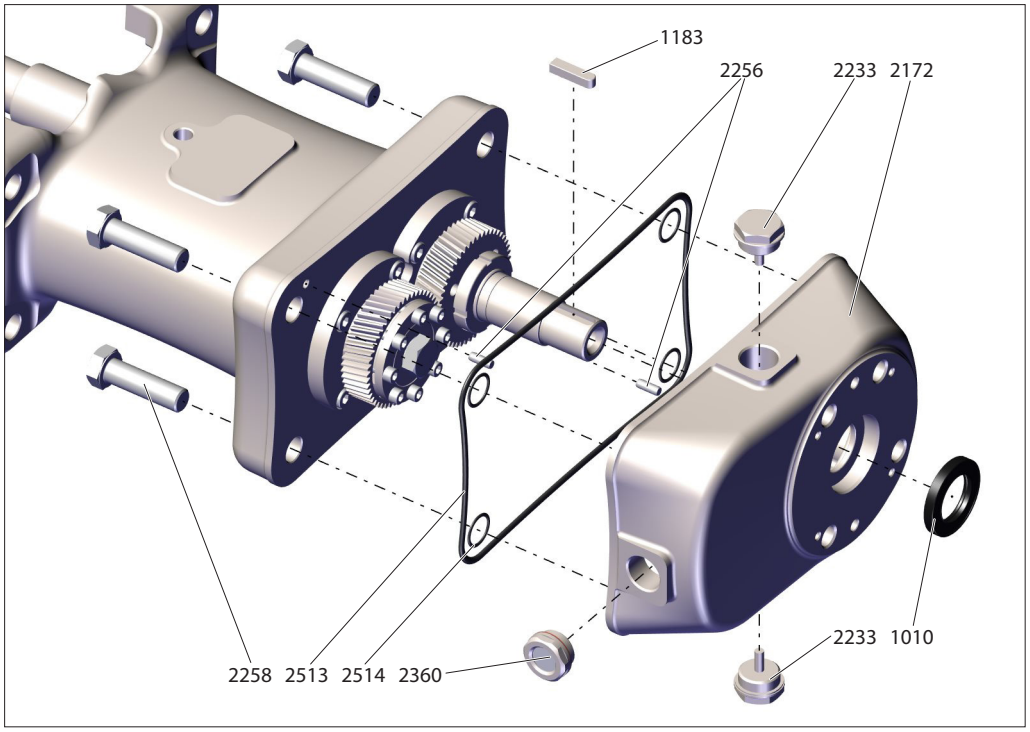
15.4 Coupling and standard coupling guard



Number	Quantity	Description	Note
1183	1	Key	1
2247	1	Coupling claw including grub screw (pump side)	1
2248	1	Coupling claw including grub screw (input side)	1
2249	1	Elastomer star coupling	1
2517	1	Coupling guard	1
2522	4	Hexagon screw	1
Not shown:			**1**
2516	2	Positioning pin	1

Note: 1. Contact customer service with the serial number of the pump for part number.

15.5 Gearbox housing

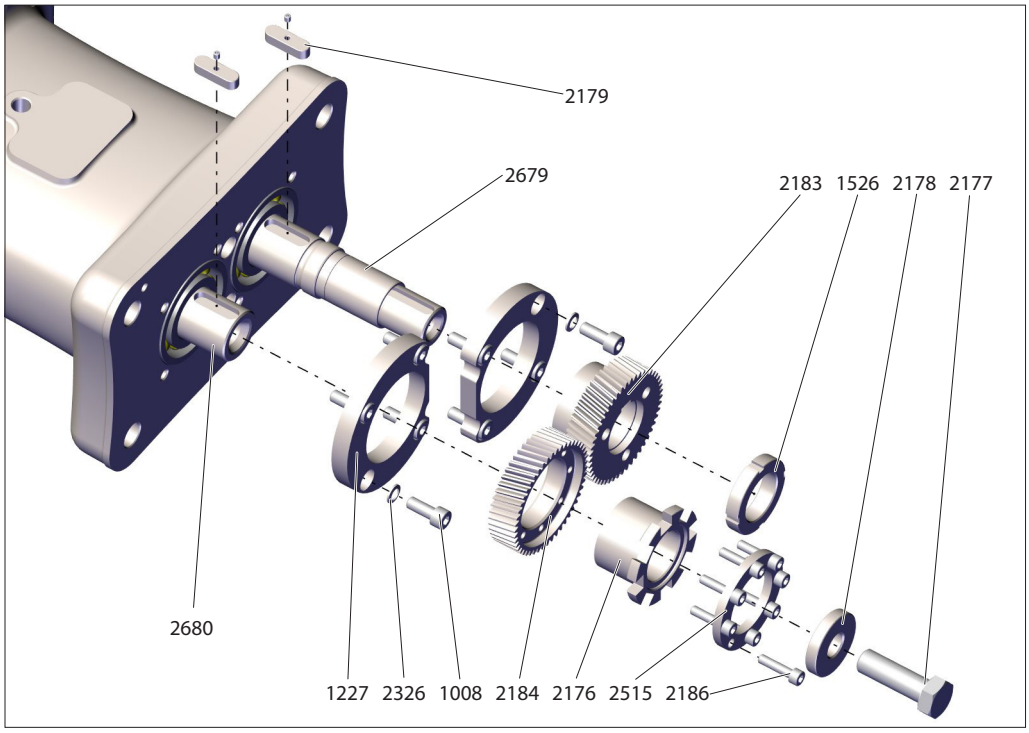


WTS70			
Number	**Part No.**	**Quantity**	**Description**
-	**WTS52929**	**1**	**Gearcase assembly**
1010	WTS45652	1	Shaft seal ring
1183	WTS44745	1	Key
2172	WTS51886	1	Gearbox housing
2233	WTS45452	2	Sealing screw
2256	WTS20285	2	Cylinder pin
2258	WTS12648	4	Hexagon screw
2360	WTS27115	1	Oil level glass
2513	WTS45471	1	O-ring
2514	WTS45470	4	O-ring

WTS104			
Number	**Part No.**	**Quantity**	**Description**
-	**WTS52653**	**1**	**Gearcase assembly**
1010	WTS45564	1	Shaft seal ring
1183	WTS45587	1	Key
2172	WTS47179	1	Gearbox housing
2233	WTS45452	2	Sealing screw
2256	WTS20285	2	Cylinder pin
2258	WTS12647	4	Hexagon screw
2360	WTS27115	1	Oil level glass
2513	WTS45472	1	O-ring
2514	WTS45470	4	O-ring

WTS130			
Number	**Part No.**	**Quantity**	**Description**
-	**WTS52652**	**1**	**Gearcase assembly**
1010	WTS46320	1	Shaft seal ring
1183	WTS44741	1	Key
2172	WTS47177	1	Gearbox housing
2233	WTS45452	2	Sealing screw
2256	WTS45725	2	Cylinder pin
2258	WTS45724	4	Hexagon screw
2360	WTS27115	1	Oil level glass
2513	WTS45732	1	O-ring
2514	WTS46428	4	O-ring

15.6 Gearing

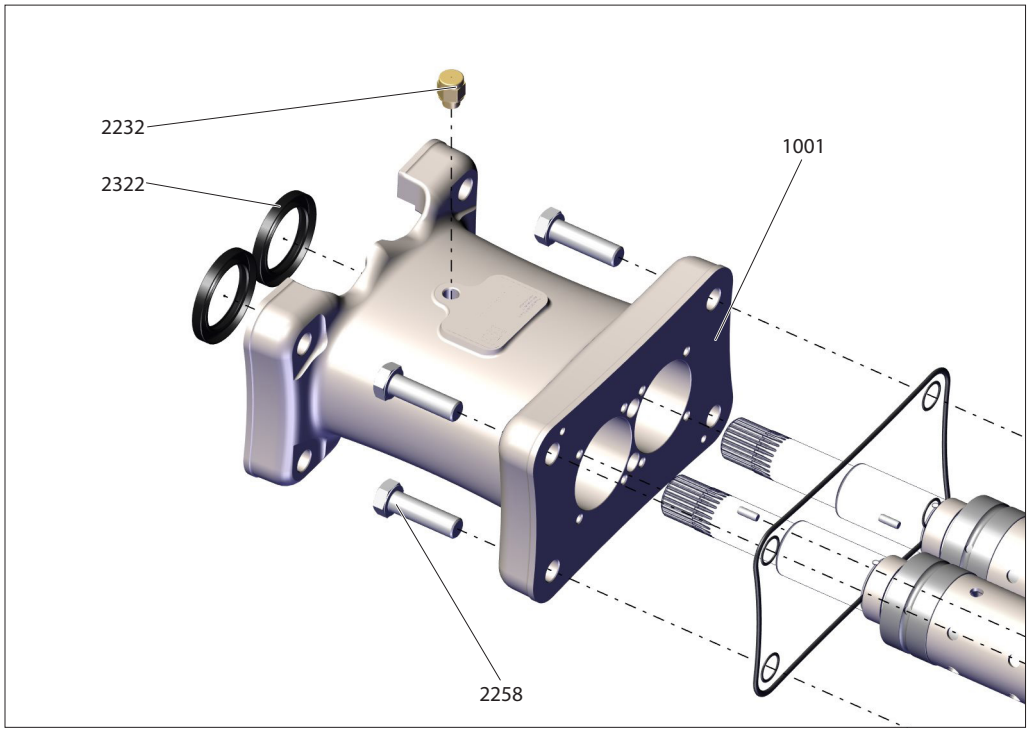


WTS70			
Number	**Part No.**	**Quantity**	**Description**
1008	WTS42484	8	Cylinder screws- Bearing cover
1227	WTS40057	2	Bearing cover
1526	WTS41999	1	Shaft nut (with grub screw)
2176	WTS45418	1	Hub (for spur gear)
2177	WTS45646	1	Hexagonal screw (includes spring washer)
2178	WTS40061	1	Clamping washer
2179	WTS44746	2	Key
2183	WTS40058	1	Input spur gear
2184	WTS40059	1	Output spur gear
2186	WTS45645	6	Cylinder screw- Synchronization ring
2326	WTS41281	8	Washer
2515	WTS45419	1	Synchronization clamping ring
2679	WTS52768	1	Input shaft
2680	WTS52769	1	Output shaft

WTS104			
Number	**Part No.**	**Quantity**	**Description**
1008	WTS42484	8	Cylinder screws- Bearing cover
1227	WTS28990	2	Bearing cover
1526	WTS42000	1	Shaft nut (with grub screw)
2176	WTS45415	1	Hub (for spur gear)
2177	WTS44569	1	Hexagonal screw
2178	WTS45414	1	Clamping washer
2179	WTS45606	2	Key
2183	WTS45308	1	Input spur gear
2184	WTS45309	1	Output spur gear
2186	WTS45597	8	Cylinder screw- Synchronization ring
2326	WTS41281	8	Washer
2515	WTS45416	1	Synchronization clamping ring
2679	WTS52773	1	Input shaft
2680	WTS52774	1	Output shaft

WTS130			
Number	**Part No.**	**Quantity**	**Description**
1008	WTS42484	8	Cylinder screws- Bearing cover
1227	WTS28923	2	Bearing cover
1526	WTS42001	1	Shaft nut (with grub screw)
2176	WTS45689	1	Hub (for spur gear)
2177	WTS44569	1	Hexagonal screw
2178	WTS44855	1	Clamping washer
2179	WTS45913	2	Key
2183	WTS45692	1	Input spur gear
2184	WTS45691	1	Output spur gear
2186	WTS45723	8	Cylinder screw- Synchronization ring
2326	WTS41281	8	Washer
2515	WTS45690	1	Synchronization clamping ring
2679	WTS52775	1	Input shaft
2680	WTS52776	1	Output shaft

15.7 Bearing housing

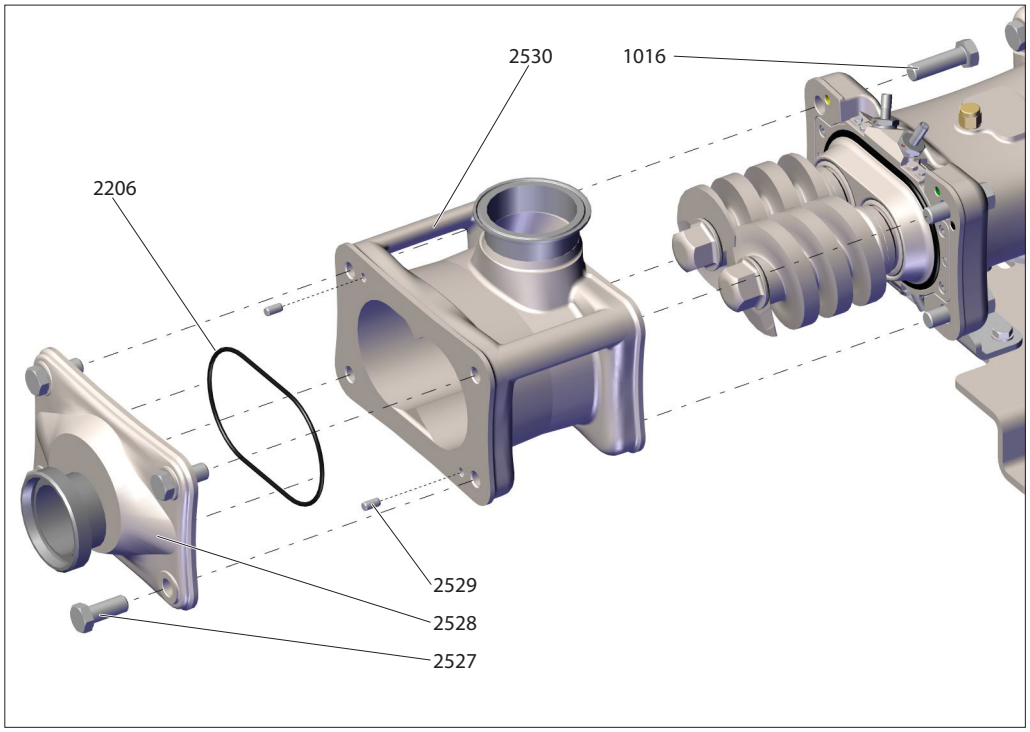


WTS70			
Number	**Part No.**	**Quantity**	**Description**
1001	WTS47111	1	Bearing housing
2232	WTS42074	1	Venting valve
2258	WTS12648	4	Hexagon screw
2322	WTS46320	2	Shaft seal ring
Not shown:			
2285	WTS28318	1	Dummy plug (for PT100)

WTS104			
Number	**Part No.**	**Quantity**	**Description**
1001	WTS47175	1	Bearing housing
2232	WTS42074	1	Venting valve
2258	WTS12647	4	Hexagon screw
2322	WTS46321	2	Shaft seal ring
Not shown:			
2285	WTS28318	1	Dummy plug (for PT100)

WTS130			
Number	**Part No.**	**Quantity**	**Description**
1001	WTS47173	1	Bearing housing
2232	WTS42074	1	Venting valve
2258	WTS45724	4	Hexagon screw
2322	WTS46322	2	Shaft seal ring
Not shown:			
2285	WTS28318	1	Dummy plug (for PT100)

15.8 Pump housing



WTS70			
Number	**Part No.**	**Quantity**	**Description**
1016	WTS12647	4	Hexagon screw
2206	WTS46452	1	O-ring FPM- Standard
2206	WTS46453	1	O-ring EPDM
2527	WTS12857	4	Hexagon screw
2528	POA	1	Cover
2529	WTS27224	2	Positioning pin
2530	POA	1	Pump housing / pump housing with heating jacket

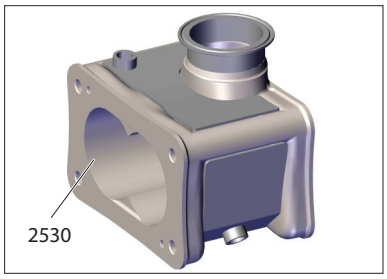
WTS104			
Number	**Part No.**	**Quantity**	**Description**
1016	WTS12647	4	Hexagon screw
2206	WTS41661A	1	O-ring FPM- Standard
2206	WTS46458	1	O-ring EPDM
2527	WTS12857	4	Hexagon screw
2528	POA	1	Cover
2529	WTS27224	2	Positioning pin
2530	POA	1	Pump housing / pump housing with heating jacket

WTS130			
Number	**Part No.**	**Quantity**	**Description**
1016	WTS45724	4	Hexagon screw
2206	WTS46464	1	O-ring FPM- Standard
2206	WTS46465	1	O-ring EPDM
2527	WTS12654	4	Hexagon screw
2528	POA	1	Cover
2529	WTS27224	2	Positioning pin
2530	POA	1	Pump housing / pump housing with heating jacket

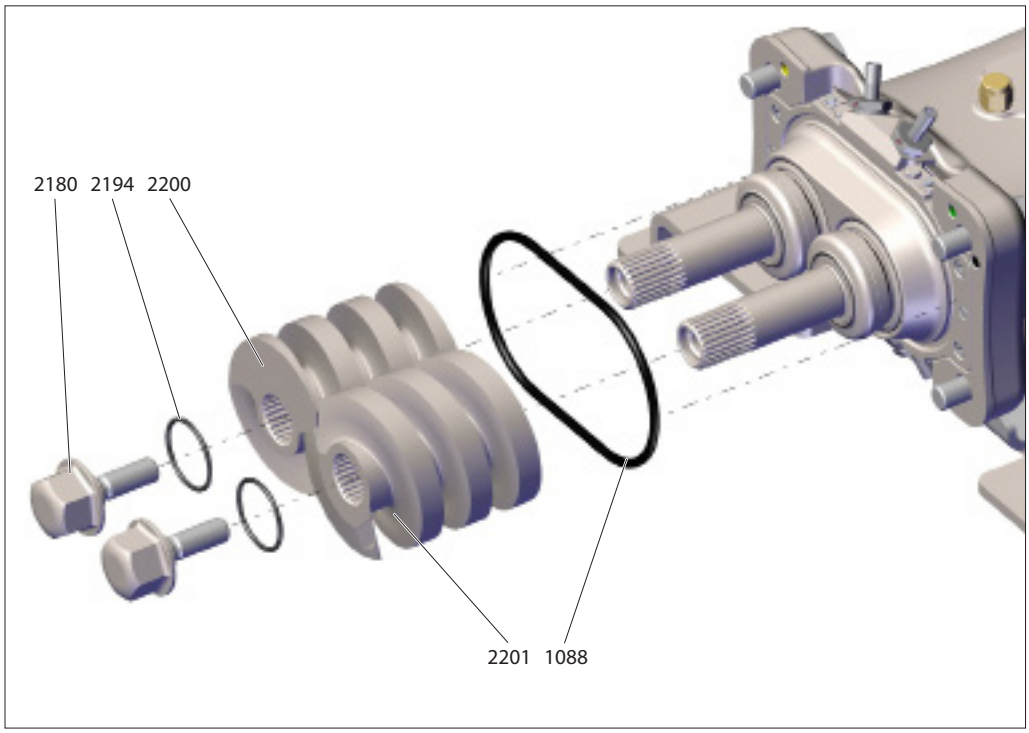
Note: POA- Contact customer service with the serial number of the pump for part number.

15.9 Pump housing with heating / cooling jacket

- with side-mounted inflow and outflow connections for hot and cold water
- with bottom-mounted drainage screw
- with top-mounted pressure/temperature sensor connection



15.10 Pump set

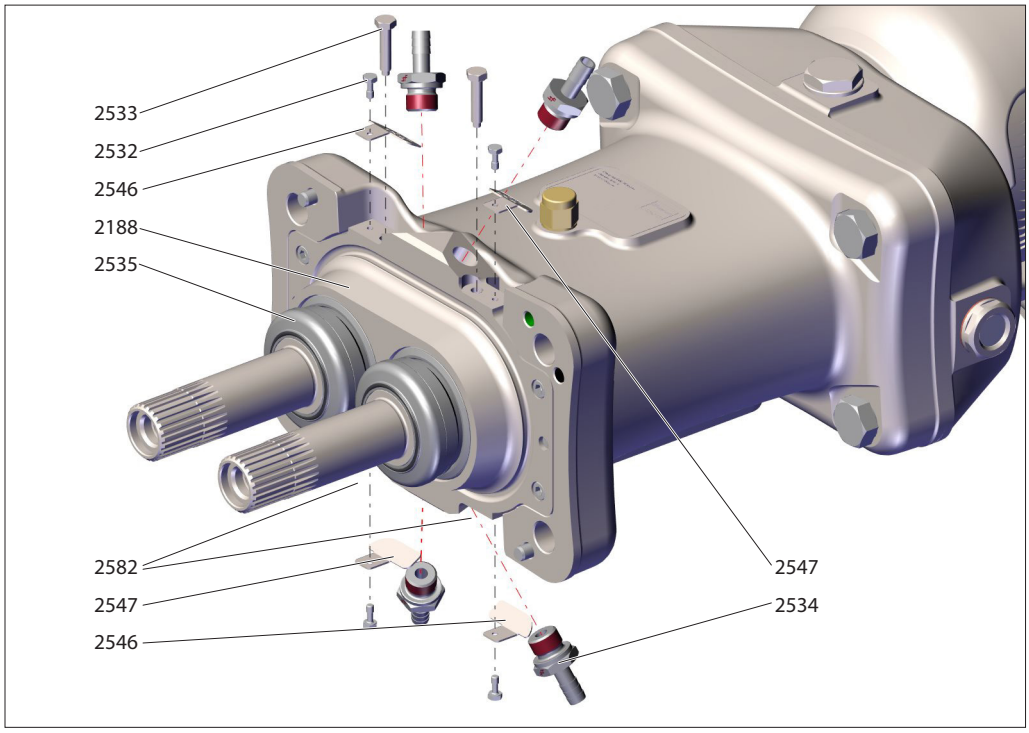


WTS70			
Number	**Part No.**	**Quantity**	**Description**
1088	WTS46450	1	O-ring FPM- Standard
1088	WTS53602	1	O-ring EPDM
2180	WTS47248	2	Spindle screw
2194	WTS46454	2	O-ring FPM- Standard
2194	WTS46455	2	O-ring EPDM
2200	WTS44792	1	Screw, left turning 43-1- Standard
2200	WTS46371	1	Screw, left turning 29-1
2200	WTS52114	1	Screw, left turning 22-1
2201	WTS44791	1	Screw, right turning 43-1- Standard
2201	WTS46369	1	Screw, right turning 29-1
2201	WTS52113	1	Screw, right turning 22-1

WTS104			
Number	**Part No.**	**Quantity**	**Description**
1088	WTS42090A	1	O-ring FPM- Standard
1088	WTS52174A	1	O-ring EPDM
2180	WTS47249	2	Spindle screw
2194	WTS29034A	2	O-ring FPM- Standard
2194	WTS46461A	2	O-ring EPDM
2200	WTS45845	1	Screw, left turning 53-1- Standard
2200	WTS44420	1	Screw, left turning 36-1
2200	WTS52112	1	Screw, left turning 27-1
2201	WTS45844	1	Screw, right turning 53-1- Standard
2201	WTS44419	1	Screw, right turning 36-1
2201	WTS52111	1	Screw, right turning 27-1

WTS130			
Number	**Part No.**	**Quantity**	**Description**
1088	WTS46462	1	O-ring FPM- Standard
1088	WTS46463	1	O-ring EPDM
2180	WTS47249	2	Spindle screw
2194	WTS29034A	2	O-ring FPM- Standard
2194	WTS46461A	2	O-ring EPDM
2200	WTS43970	1	Screw, left turning 65-1- Standard
2200	WTS46232	1	Screw, left turning 44-1
2200	WTS52108	1	Screw, left turning 33-1
2201	WTS43969	1	Screw, right turning 65-1- Standard
2201	WTS46231	1	Screw, right turning 44-1
2201	WTS52107	1	Screw, right turning 33-1

15.11 Seal retainer



WTS70				
Number	**Part No.**	**Quantity**	**Description**	**Note**
2188	WTS46164	1	Seal retainer	
2195	WTS27224	2	Positioning pin (for flow direction)	
2259	WTS12711	4	Cylinder screw	
2532	WTS40721	4	Hexagon screw, Savetix	
2533	WTS46153	2	Fixing screw	
2534	WTS17112	4	Hose nozzle	
2535	-	2	Mechanical seal cartridge	1
2536	WTS45644	2	Alignment pin	
2538	WTS45520	2	Cylinder pin	
2539	WTS45506	2	Washer	
2540	WTS45505	2	Hexagon screw	
2541	WTS45509A	2	Drive pin	
2546	WTS45595	2	Contact protection, right	
2547	WTS45594	2	Contact protection, left	
2550	WTS45523	4	Sealing screw	
Not shown:				
2582	WTS12695	2	Hexagon screw (at bottom of seal retainer)	

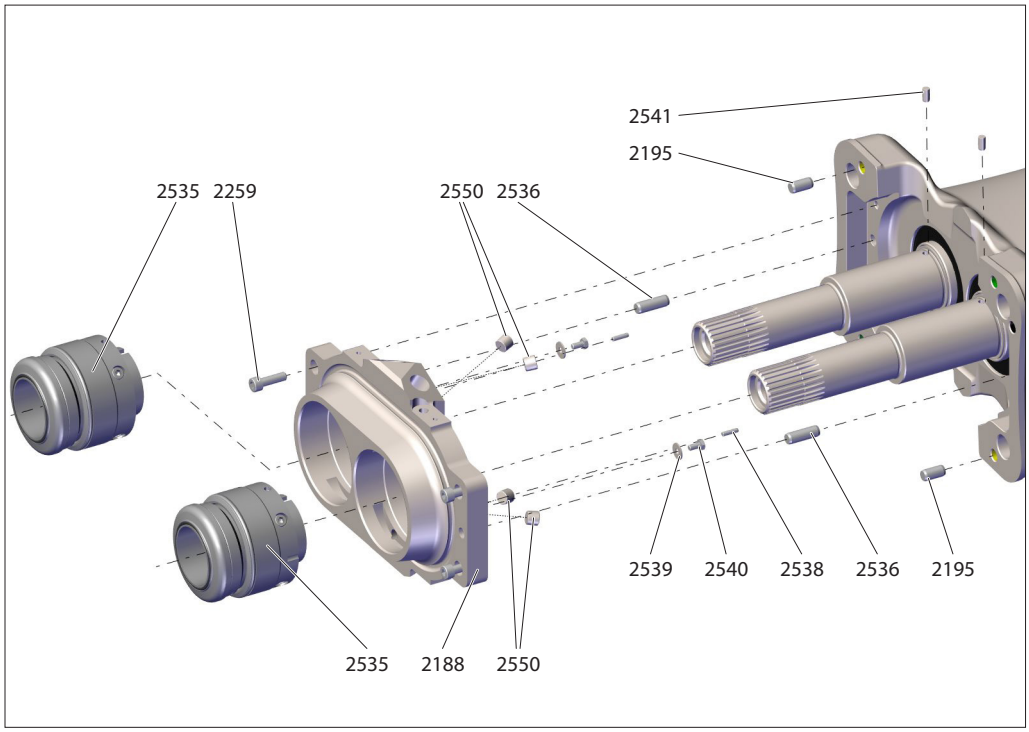
Note: 1. See Chapter "15.15 Mechanical seal cartridge options" on Page 104 for more details

WTS104				
Number	**Part No.**	**Quantity**	**Description**	**Note**
2188	WTS46122	1	Seal retainer	
2195	WTS27224	2	Positioning pin (for flow direction)	
2259	WTS12711	4	Cylinder screw	
2532	WTS40721	4	Hexagon screw, Savetix	
2533	WTS45477B	2	Fixing screw	
2534	WTS46505	4	Hose nozzle	
2535	-	2	Mechanical seal cartridge	1
2536	WTS45599	2	Alignment pin	
2538	WTS45520	2	Cylinder pin	
2539	WTS45506	2	Washer	
2540	WTS45505	2	Hexagon screw	
2541	WTS45509A	2	Drive pin	
2546	WTS45498	2	Contact protection, right	
2547	WTS45497	2	Contact protection, left	
2550	WTS45523	4	Sealing screw	
Not shown:				
2582	WTS52368	2	Hexagon screw (at bottom of seal retainer)	

Note: 1. See Chapter "15.15 Mechanical seal cartridge options" on Page 104 for more details

WTS130				
Number	**Part No.**	**Quantity**	**Description**	**Note**
2188	WTS46429	1	Seal retainer	
2195	WTS27224	2	Positioning pin (for flow direction)	
2259	WTS12711	4	Cylinder screw	
2532	WTS40721	4	Hexagon screw, Savetix	
2533	WTS45916	2	Fixing screw	
2534	WTS46505	4	Hose nozzle	
2535	-	2	Mechanical seal cartridge	1
2536	WTS45599	2	Alignment pin	
2538	WTS45520	2	Cylinder pin	
2539	WTS45506	2	Washer	
2540	WTS45505	2	Hexagon screw	
2546	WTS45498	2	Contact protection, right	
2547	WTS45497	2	Contact protection, left	
2550	WTS45523	4	Sealing screw	
Not shown:				
2582	WTS50652	2	Hexagon screw (at bottom of seal retainer)	

Note: 1. See Chapter "15.15 Mechanical seal cartridge options" on Page 104 for more details



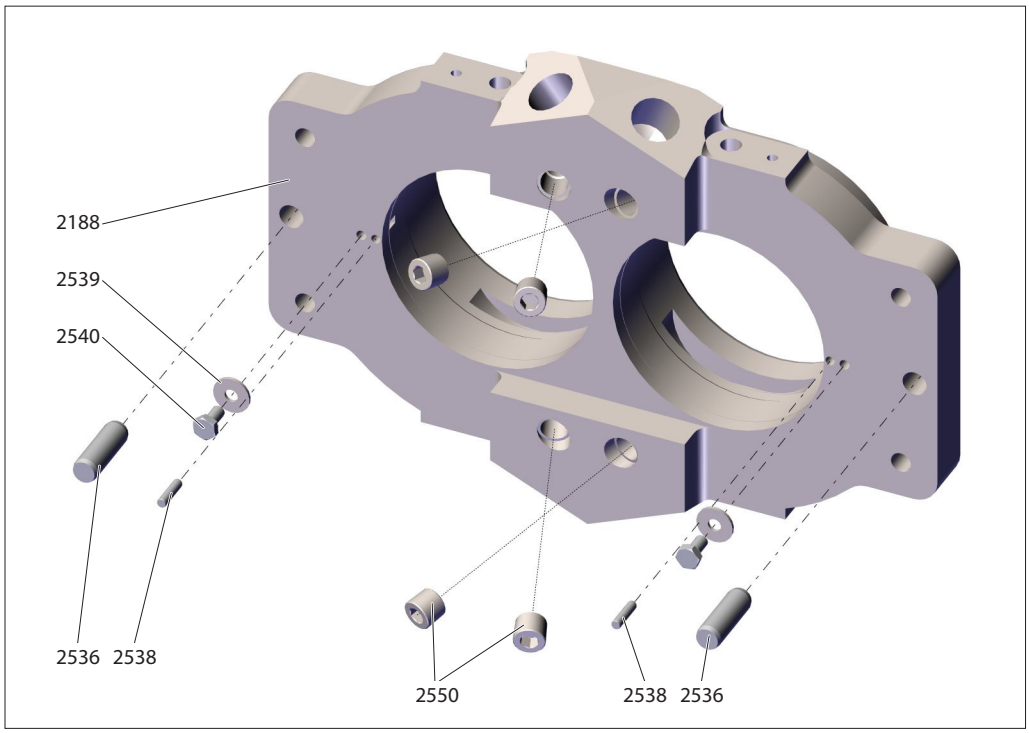
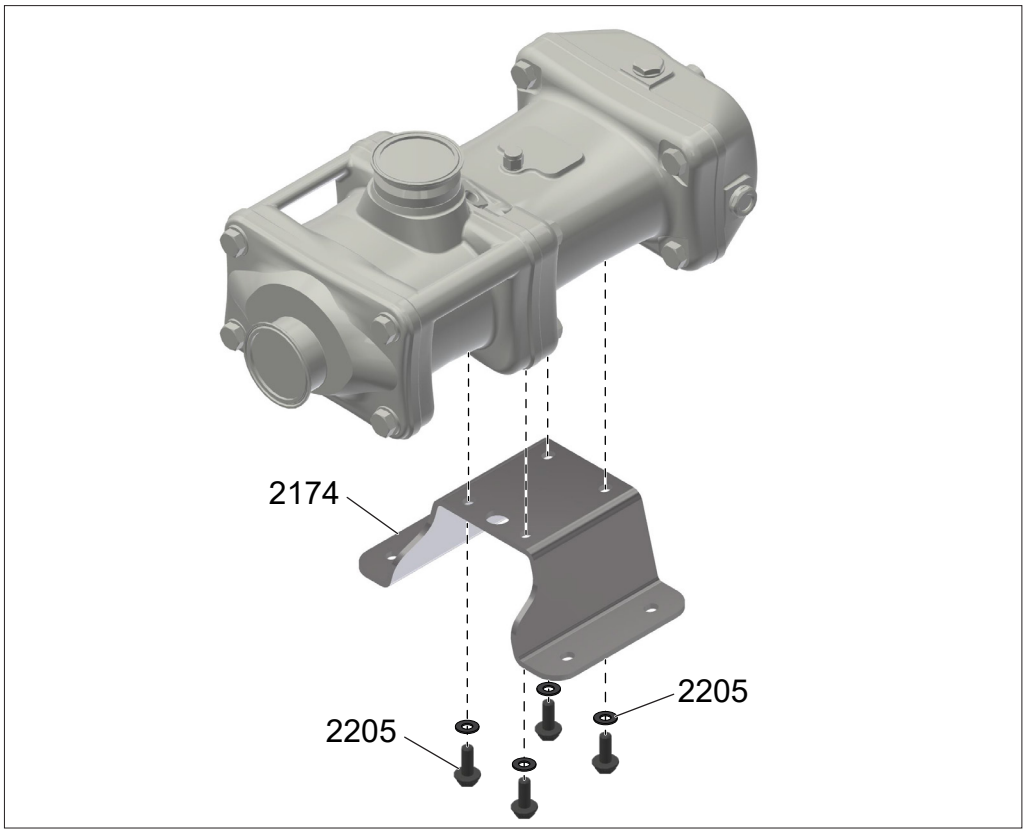


Fig. 15.6: Rear seal retainer 2188

15.12 Pump mounting foot



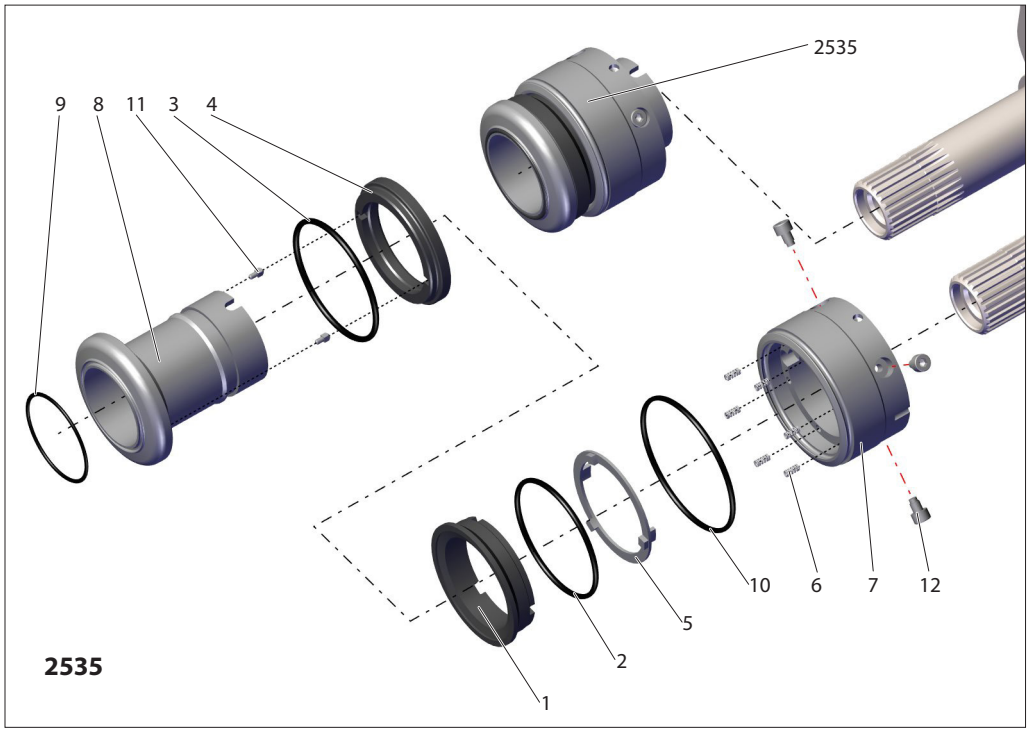
Note: The WTS70 has three mounting holes, and the WTS104 and WTS130 have four mounting holes.

WTS70			
Number	**Part No.**	**Quantity**	**Description**
2174	WTS54281	1	Pump mounting foot
2205	WTS43026	2	Hexagonal screw
2205	WTS48180	1	Hexagonal screw
2205	WTS10950	3	Washer

WTS104			
Number	**Part No.**	**Quantity**	**Description**
2174	WTS45467	1	Pump mounting foot
2205	WTS12744	4	Hexagonal screw
2205	WTS11196	4	Washer

WTS130			
Number	**Part No.**	**Quantity**	**Description**
2174	WTS46439	1	Pump mounting foot
2205	WTS12744	4	Hexagonal screw
2205	WTS11177	4	Washer

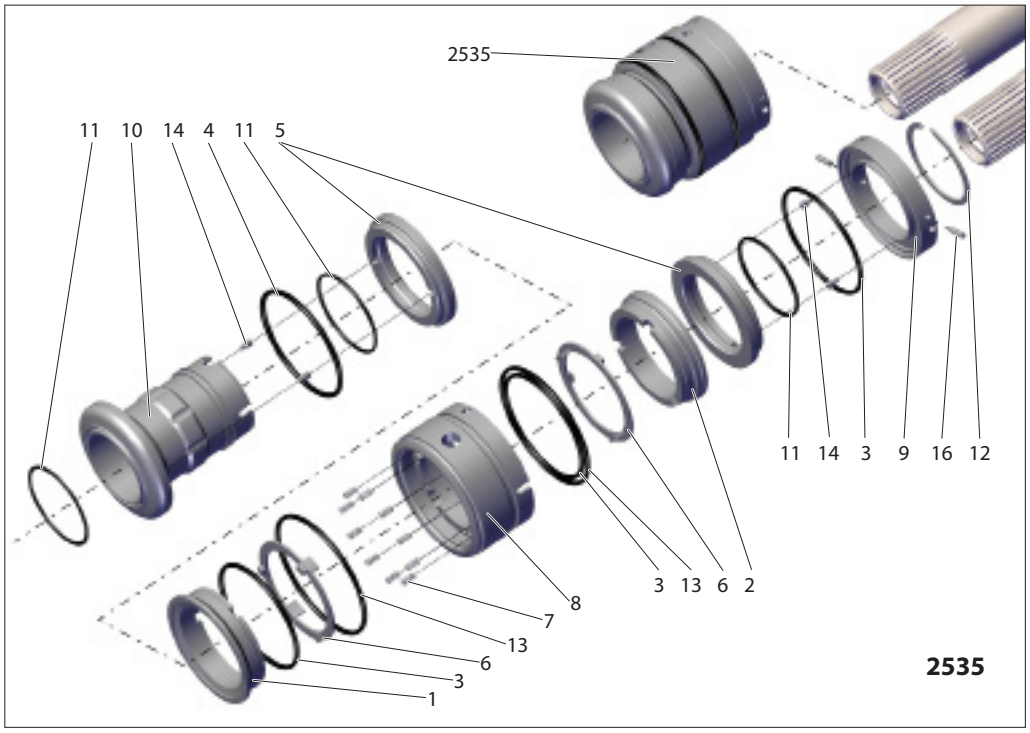
15.13 Mechanical seal cartridge – Single-acting



WTS70/WTS104/WTS130			
Number	**Quantity**	**Description**	**Note**
2535	2	Mechanical seal cartridge	1
consisting of:			
1	1	Counter ring, stationary	2
2	1	O-ring	2
3	1	O-ring	2
4	1	Slide ring, rotating	2
5	1	Pressure ring	2
6	6	Spring	2
7	1	Latch	2
8	1	Shaft sleeve	2
9	1	O-ring	2
10	1	O-ring	2
11	2	Pin	2
12	4	Cylinder screw	2

Note: 1. See Chapter "15.15 Mechanical seal cartridge options" on Page 104 for more details
2. Contact customer service with the serial number of the pump for part number.

15.14 Mechanical seal cartridge – Double-acting



WTS70/WTS104/WTS130			
Number	**Quantity**	**Description**	**Note**
2535	2	Mechanical seal cartridge	1
consisting of:			
1	1	Counter ring, stationary	2
2	1	Counter ring, stationary	2
3	3	O-ring	2
4	1	O-ring	2
5	2	Slide ring, rotating	2
6	2	Pressure ring	2
7	6	Spring	2
8	1	Latch	2
9	1	Casing	2
10	1	Shaft sleeve	2
11	3	O-ring	2
12	1	Circlip	2
13	2	O-ring	2
14	4	Pin	2
16	2	Drive pin	1
--	3	Transport safety device with cylinder screws (not shown)	

Note: 1. See Chapter "15.15 Mechanical seal cartridge options" on Page 104 for more details
2. Contact customer service with the serial number of the pump for part number.

15.15 Mechanical seal cartridge options

Without Knife edge						
Number	Description		Part No.			Quantity
			WTS70	WTS104	WTS130	
2535	MECH. SEAL CARTRIDGE-SGL	SiC-SiC-FKM	WTS45672	WTS45671	WTS45957	2
		SiC-SiC-EPDM	WTS51909	WTS47254	WTS52408	2
2535	MECH. SEAL CARTRIDGE-DBL	SiC-SiC-FKM	WTS45666	WTS45479	WTS45954	2
		SiC-SiC-EPDM	WTS52167	WTS52168	WTS52153	2

With Knife edge on Medium side (KM)						
Number	Description		Part No.			Quantity
			WTS70	WTS104	WTS130	
2535	MECH. SEAL CARTRIDGE-SGL	TC-TC-FKM	WTS45959	WTS45958	WTS45960	2
		TC-TC-EPDM	WTS52405	WTS52406	WTS52409	2
2535	MECH. SEAL CARTRIDGE-DBL	TC-TC-FKM-SiC	WTS52274	WTS52278	WTS52280	2
		TC-TC-EPDM-SiC	WTS52404	WTS52407	WTS52410	2

With Knife edge on Atmosphere side (KA)						
Number	Description		Part No.			Quantity
			WTS70	WTS104	WTS130	
2535	MECH. SEAL CARTRIDGE-DBL	SiC-SiC-FKM-TC	WTS52277	WTS52279	WTS52281	2
		SiC-SiC-EPDM-TC	WTS46543	WTS46549	WTS46555	2

15.16 WTS Pump Seal Kits

WTS 70/WTS 104/ WTS 130		
Number	Quantity	Description
WTS54239	1	CONVERSION KIT, O-RING EPDM WTS070
WTS54248	1	CONVERSION KIT, O-RING FPM WTS070
WTS54251	1	CONVERSION KIT, O-RING EPDM WTS104
WTS54252	1	CONVERSION KIT, O-RING FPM WTS104
WTS54255	1	CONVERSION KIT, O-RING EPDM WTS130
WTS54256	1	CONVERSION KIT, O-RING FPM WTS130

O-ring kits for mechanical seals only - WTS 70		
Number	Quantity	Description
WTS52327	2	KIT, O-RINGS /SGL MECH SEAL EPDM
WTS52330	2	KIT, O-RINGS /DBL MECH SEAL EPDM
WTS52323	2	KIT, O-RINGS /SGL MECH SEAL FPM
WTS52325	2	KIT, O-RINGS /DBL MECH SEAL FPM

O-ring kits for mechanical seals only - WTS 104		
Number	**Quantity**	**Description**
WTS52328	2	KIT, O-RINGS /SGL MECH SEAL EPDM
WTS52331	2	KIT, O-RINGS /DBL MECH SEAL EPDM
WTS46774	2	KIT, O-RINGS /SGL MECH SEAL FPM
WTS46775	2	KIT, O-RINGS /DBL MECH SEAL FPM

O-ring kits for mechanical seals only - WTS 130		
Number	**Quantity**	**Description**
WTS52329	2	KIT, O-RINGS /SGL MECH SEAL EPDM
WTS52332	2	KIT, O-RINGS /DBL MECH SEAL EPDM
WTS52324	2	KIT, O-RINGS /SGL MECH SEAL FPM
WTS52326	2	KIT, O-RINGS /DBL MECH SEAL FPM

Gearcase seal components - WTS 70/WTS 104/WTS 130		
Number	**Quantity**	**Description**
WTS54249	2	MAINT. KIT, SHAFT SEAL RINGS FKM WTS 70
WTS54250	2	MAINT. KIT, GCASE SEAL/SLEEVE FKM WTS 70
WTS54253	2	MAINT. KIT, SHAFT SEAL RINGS FKM WTS104
WTS54254	2	MAINT. KIT, GCASE SEAL/SLEEVE FKM WTS104
WTS54258	2	MAINT. KIT, SHAFT SEAL RINGS FKM WTS130
WTS54259	2	MAINT. KIT, GCASE SEAL/SLEEVE FKM WTS130

16. Cleaning / sterilization processes

16.1 General information

The following cleaning and sterilization processes can be used for cleaning the pumps:

- COP cleaning process (Cleaning Out of Place)
- CIP cleaning process (Cleaning In Place)
- SIP sterilization process (Sterilization In Place)

The pumps must always be cleaned before they are started and before each production run. How the pump is to be cleaned depends on the type of pumped medium that was used and its production conditions.
According to operating specifications, the operator must define a repeatable cleaning process (cleaning agents to be used, pressure, temperature, duration time, concentration and flow rate). COP/CIP cleaning processes or SIP sterilization processes are continuously optimized through validation, monitoring and documenting the process/results.

16.2 COP cleaning process

The pump must be dismantled down to its separate parts. The separate parts are to be either washed manually using suitable cleaning agents or fed into an industrial parts cleaning machine, e.g. in a (hot water) parts washing machine/ultrasonic machine.
Renewed contamination must be avoided when reassembling or else the cleaning process will have to be repeated. Sterilizing the separate parts can take place after the COP cleaning process has been completed, e.g. in an autoclave.

▶ Use the COP cleaning process to “clean special components”, see Chapter 9.5 on Page 46
▶ See Chapter “16.5 COP cleaning process sequence” on Page 109

16.3 CIP cleaning process

The pump and its associated piping are not dismantled but cleaned in place. This is done automatically in processing plants. The cleaning liquid flows through the system in a separate cleaning circuit in this case. The operator must define the cleaning sequence steps, see Chapter “16.6 CIP cleaning / SIP sterilization process sequences” on Page 110

A CIP cleaning process must be carried out in the following situations:
- Before using the pump for the first time
- Inbetween two production runs or batch changes
- After installing new contact-making spare parts
- After using it before a known long stoppage
- Before restarting after a longer stoppage

Two concepts are used in the CIP cleaning process:
- "Lost cleaning": The cleaning agents must be discarded immediately after use. This method is mainly used with heavy contamination. The cleaning solution is always fresh when you start cleaning.
- "Batch cleaning": The cleaning solution is reused after the first cleaning cycle. Less cleaning agent is used during cleaning solution recovery so the water and power consumptions are reduced.

16.3.1 Cleaning-relevant parameters

Four parameters are relevant for the cleaning effect ("Sinner's circle") and they are explained in greater detail in Chapters 16.3.2 on Page 106 and 16.3.5 on Page 107. All four parameters are interconnected and dependent on each other. The four parameters do not have to act equally in order to realize a good cleaning result. If one parameter is changed, then the other three parameters might have to be adjusted in order to realize a comparable cleaning effect.

16.3.2 Mechanical cleaning effects

Cleaning through the shear force exerted by the flow or wall shear stress. The flow transports the cleaning solution into the contaminated area (surface), reacts with it, loosens the contamination (structural dirt and covering dirt) and then transports it out of the pump.

Flows that encounter a widening point, e.g. in a pipe, will lose their flow velocity. This will create a swirling zone. The shearing force and shearing stress will be reduced as a result of this. A flow rate that is too low might cause cleaning problems.

Flow requirements:
- The flow must be turbulent
- Optimum flow rate: $1.5 \leq v \leq 2.1$ m/s

16.3.3 Chemical cleaning effects

Using chemical agents to clean surfaces. Cleaning agents must be dosed carefully so that an optimum cleaning result is realized. It is vital that you always comply with the manufacturer's dosage instructions. Overdosing or underdosing will result in an unsatisfactory cleaning result.

Chemical cleaning agents:
- Pure chemicals: e.g. sodium hydroxide, nitric acid and phosphoric acid
- Commercially prepared cleaning agents have a complex composition
- Pure chemicals plus additives

16.3.4 Thermal cleaning effects

Cleaning using thermal power or heat. Heat increases the cleaning effect because the molecules in the water/cleaning solution move faster and are deposit themselves on the dirt particles. Adhesive dirt can be removed by heat.
Denaturation can occur if the cleaning temperatures are too high and this makes it difficult to remove contaminants. The pump should be cleaned at the same temperature that was used when the food/products were processed.

16.3.5 Time

Duration to be used for the cleaning process. Any failings in the mechanical, chemical or thermal parameters can be compensated for during the duration of the cleaning process.

16.4 SIP sterilization process:

The pump must be sterilized/disinfected. Pump sterilization is carried out according to the CIP cleaning process and it is usually run using the same “separate” circuit. Microorganisms that are still active are killed by saturated pure vapor at high temperatures. The cleaning effect can be increased by adding chemical disinfectants. Use sterile air to dry the pump.

16.4.1 General sterilization information

- A CIP cleaning process must have been run successfully before you start the sterilization process
- Sterilization/disinfection only removes specific microorganisms and they are only removed to a certain extent
- The same conditions must prevail at every point within the pump during the sterilization process
- A universal sterilization process does not exist. Choosing which process to use will depend on the type and extent of the microbial contamination
- 99 % sterilization is the maximum that can be realized
- Moist heat is significantly more effective at the same temperature as compared to dry heat. Air is a poorer heat conductor than water vapor. This is why higher temperatures and longer reaction times are needed for dry-state sterilization
- The initial bacterial count is an important factor in sterilization, especially the initial bacterial count of the heat-resistant endospores in the bacteria. The number of microorganisms will be reduced if a CIP cleaning process (germ count reduction) is successfully run beforehand
- A pH value in the 6 – 8 range is generally considered to be optimum with regard to the heat tolerance of microorganisms. Bacteria show the highest tolerance to heat at a pH value of 6 – 7, whereas yeasts and molds do so at a pH value of 3 – 6. The sensitivity of the microorganisms to heat increases above and below these optimum values. This means that the residence time needed to kill them at the same temperature will be shorter
- The effect of heat tolerance as a function of pH is most evident at low temperatures and it generally decreases as the temperature increases – with the exception of endospores. The effect of the pH value on endospores can be clearly seen at temperatures of 120° – 130 °C

Heat resistance of some organisms		
Organism	**Temperature [°C]**	**Time [min]**
Pathogenic streptococci, listeria, polio viruses	61.5	30
Majority of vegetative bacteria, yeasts, molds, all viruses (except hepatitis B)	80	30
Hepatits B viruses, most fungal spores	100	5 – 30
Bacillus anthracis spores (anthrax pathogens)	105	5
Geobacillus stearothermophilus-spores	121	15
Prions (proteins)	132	60

Tab. 16.1: Heat resistance of some organisms depends on temperature and time

- It must be ensured that the endospores are actually killed. This is the reason why the sterilization parameters have to be adjusted to work with the most stable endospores that are currently known. They are considered to be so-called "key microbes or test microbes" for successful sterilization processes. According to current knowledge, these include the endospores in:

  "*Geobacillus stearothermophilus*"
  Temperature: 121 °C
  Time: 15 min
  Pressure: 1 bar

16.4.2 SIP sterilization specifications

The pump operator is responsible for validating the effectiveness of the SIP sterilization process.

Relevant process aspects:

- The pump must have been designed and approved for the SIP sterilization process
- The pump must have a pressure monitoring device fitted to it for the SIP sterilization process. It must shut down the system immediately if the pressure drops by 0.5 bar
- Any special material resistance features must always be taken into consideration (cleaning agent, temperature)
- The entire system must be heated with saturated pure vapor The pure vapor must be introduced in a way that ensures that air pockets are excluded
- Suitable aids for draining the condensate must be used to prevent water from accumulating. The pump does not have its own condensate drain
- The pure vapor must be free of condensate. Moisture promotes microbial growth
- Sterile air or nitrogen (or other suitable gases) must be introduced at a defined overpressure to replace the collapsing vapor in order to complete the SIP sterilization process. This replacement process will prevent the creation of a vacuum that would cause a pressure drop in the system
- The pump must be sterilized again if a pressure drop is detected, see Chapter 16.4.3 on Page 109
- Sterile air or nitrogen is used for cooling and drying the system
- Temperature sensors must be placed on the pump/system to monitor the sterilization conditions. For the sterilization process, a temperature of 121 °C (key microbe: *Geobacillus stearothermophilus*) must be maintained at all points for 20 minutes
- The cleaning agents used in the CIP cleaning and SIP sterilization processes must be safely separated from each other. The possibility of recontamination by cleaning agents from a pump/pipe that has already been cleaned and sterilized must be eliminated

16.4.3 A pressure drop during a SIP sterilization process

WTS pumps must always be sterilized after a pressure drop occurs during a SIP sterilization process. The following parameters must be noted:

Duration of sterilization	t:	10 – 30 min
Steam pressure	p_{Vapor}:	2.2 – 3.2 bar
Maximum SIP temperature:		
▫ EPDM elastomer material:	T_{SIP} max.:	121 °C
▫ FKM elastomer material:	T_{SIP} max.:	135 °C
Drying	T_{min}:	83 °C
Drying period	T_{min}:	20 min

- *Vapor pressure and temperature must correlate with each other, the limiting factor remains the maximum SIP temperature $T_{SIP\ max}$*
- *The maximum temperature at which the elastomer begins to chemically decompose is usually exceeded during a SIP sterilization process. Thermal wear affects the elastomer. The elastomer's (O-ring) service life will be reduced by every CIP/SIP process*
- *Damage to seals and O-rings caused by SIP processes needs careful analysis* in order to correctly assess and prevent errors when using or handling elastomers
- *SPX FLOW recommends using suitable elastomer materials for the intended application*

16.5 COP cleaning process sequence

16.5.1 Conditions

Temperature parameter:	to be defined by the operator
Time parameter:	to be defined by the operator
Cleaning agent:	to be defined by the operator
Concentration parameter	to be defined by the operator/note the parameters given by the cleaning agent manufacturer

☑ Wear personal protective equipment
☑ Wear suitable heat-protective gloves for the cleaning

⚠WARNING

There is a risk of being burnt or scalded if you come into contact with hot liquids or vapor

16.5.2 COP cleaning process

1. Soak a contaminated component
   - ▫ Product residues will be loosened (structural dirt and covering dirt)
   - ▫ Use a suitable cleaning agent
   - ▫ Temperature range: normally 10 – 20 °C, max. 70 °C
   - ▫ Time parameter: to be defined by the operator

2. Use a soft brush or sponge to clean a contaminated component
   - ▫ Product residues are to be removed (structural dirt and covering dirt)
   - ▶ Never use a wire brush or hard material for the cleaning
   - ▶ Avoid scratching or damaging the dirty component
   - ▶ Continue the cleaning procedure until the contamination is no longer visible

3. Use drinking water to rinse off the cleaned component
   - ▫ The dissolved contamination will be removed

- Temperature range: max. 70 °C
- Time parameter: 1 – 2 min

4. Use NaOH to rinse an alkaline
   - Sugar, fat, proteins and adhesive dirt will be removed
   - Concentration parameter: 1 – 2 % weight
   - Temperature range: 60° – 80 °C
   - Time parameter: 10 – 20 min

5. Rinse using drinking water
   - Leach and dissolved contamination will be removed
   - Temperature range: max. 70 °C
   - Time parameter: 5 – 10 min

6. Rinse with an acid cleaner (CH_3COOH, HNO_3 or H_3PO_4)
   - Repeat rinsing if necessary
   - Mineral deposits and lime scale will be removed
   - Concentration parameter: 0.5 – 1.5 % weight
   - Temperature range: 50° – 70 °C
   - Time parameter: 5 – 10 min

7. Rinse using drinking water
   - Acidity and dissolved contamination will be removed
   - Temperature range: normally 10° – 20 °C, max. 70 °C
   - Time parameter: 5 – 10 min
   - ▶ Ensure that all of the cleaning agent residues are removed
   - ▶ Ensure that there is only drinking water in the pump/system
   - ▶ Ensure that recontamination cannot be caused by unsatisfactory water quality

8. Dry using hot air
   - Cleaned components will be dried

16.6 CIP cleaning / SIP sterilization process sequences

16.6.1 Conditions

Temperature parameter:	to be defined by the operator
Time parameter:	to be defined by the operator
Turbulent flow velocity	$v_{optimum}$: 1.5 – 2.1 m/s
Concentration parameter	to be defined by the operator/note the parameters given by the cleaning agent manufacturer

16.6.2 CIP cleaning process

1. Complete the production cycle by flushing out the pump and pipes with drinking water
   - Product residues are to be removed (structural dirt and covering dirt)
   - Temperature range: normally 10° – 20 °C, max. 70 °C

2. Use NaOH to rinse an alkaline
   - Sugar, fat, proteins and adhesive dirt will be removed
   - Concentration parameter: 1 – 2 % weight.
   - Temperature range: 60° – 80 °C
   - Time parameter: 10 – 20 min

3. Rinse using drinking water
   - Leach and dissolved contamination will be removed
   - Temperature range: max. 70 °C
   - Time parameter: 5 – 10 min

4. Rinse with an acid cleaner (HNO_3 or H_3PO_4)
   - ▶ Repeat rinsing if necessary

- Mineral deposits and lime scale will be removed
- Concentration parameter: 0.5 – 1.5 % weight
- Temperature range: 50° – 70 °C
- Time parameter: 5 – 10 min

5. Rinse using drinking water
   - Acidity and dissolved contamination will be removed
   - Temperature range: normally 10° – 20 °C, max. 70 °C
   - Time parameter: 5 – 10 min
   - ▶ Ensure that all of the cleaning agent residues are removed
   - ▶ Ensure that there is only drinking water in the pump/system
   - ▶ Ensure that recontamination cannot be caused by unsatisfactory water quality

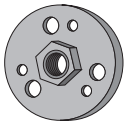
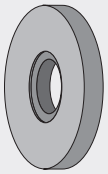
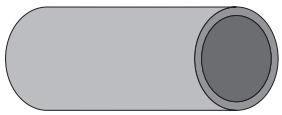
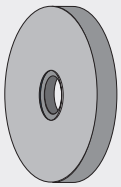
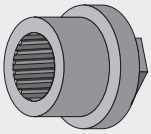
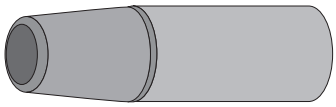
16.6.3 SIP sterilization process

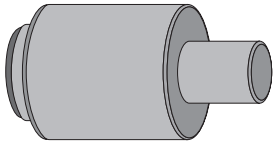
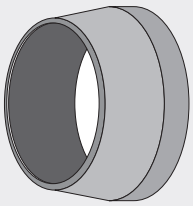
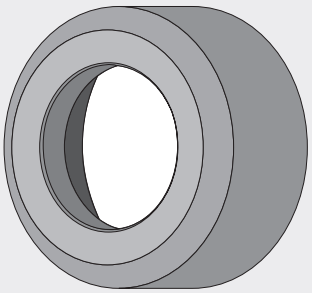
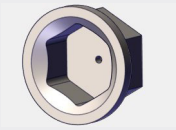
6. Run a sterilization
   - The operator must determine the type of sterilization process to be used
   - Any microorganisms still present will be killed by saturated pure vapor (or hot water)

7. Dry using hot air
   - The cleaned pump will be dried

17. Tool list and tightening torques

17.1 WTS 70, 104 and 130 tool table

Tool number	Part Number	Tool	Description	Pump type Twin
T0009	WTS95434		Puller: Helical gear	70
T0112	WTS95745			104
T0113	WTS95746			130
T0010	WTS95534		Pressure plate: Needle bearing inner ring	70
T0019	WTS95535			104
T0020	WTS95536			130
T0011	WTS95553		Mounting bush: Needle bearing outer ring	70
T0031	WTS95548			104
T0032	WTS95551			130
T0012	WTS95537		Pressure plate: Ball bearing	70
T0033	WTS95538			104
T0034	WTS95539			130
T0017	WTS95532		Socket spanner: Groove nut	70
T0029	WTS95533			104
T0030	WTS95577			130
T0039	WTS95445		Socket spanner: Input shaft / output shaft	70
T0040	WTS95444			104
T0041	WTS95443			130
T0046	WTS95581		Mounting cone: Shaft seal ring gear housing	70
T0047	WTS95582			104
T0088	WTS95496			130
T0055	WTS95701		Press-fitting mandrel: Shaft seal ring	70

Tool number	Part number	Tool	Description	Pump type Twin
T0082 T0077	WTS46076 WTS95697		Press-fitting mandrel: Shaft seal ring	104 130
T0079 T0083 T0086	WTS95490 WTS95491 WTS95492		Mounting cone: Shaft seal ring bearing housing	70 104 130
T0080 T0084 T0087	WTS95493 WTS95494 WTS95495		Mounting bush: Shaft seal ring bearing housing	70 104 130
T0081 T0085 T0089	WTS95710 WTS95709 WTS95711		Mounting bush: mechanical seal cartridge	70 104 130
T0091 T0093 T0095	WTS95714 WTS95716 WTS95718		Mounting bush: Shaft protection sleeve	70 104 130
T0092 T0094 T0096	WTS95715 WTS95717 WTS95719		Mounting bush: Shaft protection sleeve	70 104 130
T0097 T0098 T0099	WTS95720 WTS95721 WTS95722		Mounting bush: Shaft seal ring	70 104 130
T0162 T0163	WTS53326 WTS53325		Spindle wrench*	70 104 / 130

17.2 Tightening torques

17.2.1 Tightening torques for specified components

▶ *See Chapter 15 on Page 88 for more detailed information about the specified F-numbers*

The following screw connection torques are defined for specific components:

Tightening torques for specified components		[Nm]		
F-number	**Specified component**	Size 70	Size 104	Size 130
1008	Bearing cap cylinder screw	20	20	20
1016	Bearing housing hexagon screw	120	150	150
1526	Shaft nut	60	150	190
2177	Output shaft hexagon screw	60	200	250
2180	Spindle screw	100	150	150
2205	Pump foot hexagon screw	44	44	44
2233	Gear housing sealing screw	10	10	10
2258	Gear housing hexagon screw	70	100	100
2259	Seal retainer hexagon socket screw	15	15	15
2186	Hub (helical gear) cylindrical screw	8	8	8
(1526)	Shaft nut threaded pin	8	4	8
2520	Coupling casing cylindrical screw	70	100	100
2527	Cover hexagon screw	120	150	150
2534	Hose nozzle	35	45	45

Tab. 17.1: Tightening torques defined for the components

17.2.2 Tightening torques for screw connections in concrete

(values as per DIN EN 24014)

Dimensions	Friction coefficient	Strength class	Tightening torque [Nm]
M10	0.14	8.8	50
M12	0.14	8.8	90
M16	0.14	8.8	220
M20	0.14	8.8	430

Tab. 17.2: Tightening torques for screw connections in concrete

17.2.3 Tightening torques for general screw connections

(values as per DIN EN 24014)

Dimensions	Friction coefficient	Strength class	Tightening torque [Nm]
M8	0.14	8.8	25
M10	0.14	8.8	49
M12	0.14	8.8	85
M16	0.14	8.8	210
M20	0.14	8.8	425

Tab. 17.3: Tightening torques for ISO screw connections

18. Assembly aid for a mechanical seal cartridge

18.1 Tools T0114 / T0120 / T0121

The tool is used to make assembling/dismantling of double-acting mechanical seal cartridges easier. It consists of lower and upper sections. Both sections are screwed together.

Tool number	Description	Pump type
T0114	Montagehilfe Gleitringdichtungs-Patrone Assembly aid for mechanical seal cartridge	70
T0120		104
T0121		130

18.2 Mechanical seal cartridge inside the tool

Inserting the mechanical seal cartridge inside the tool

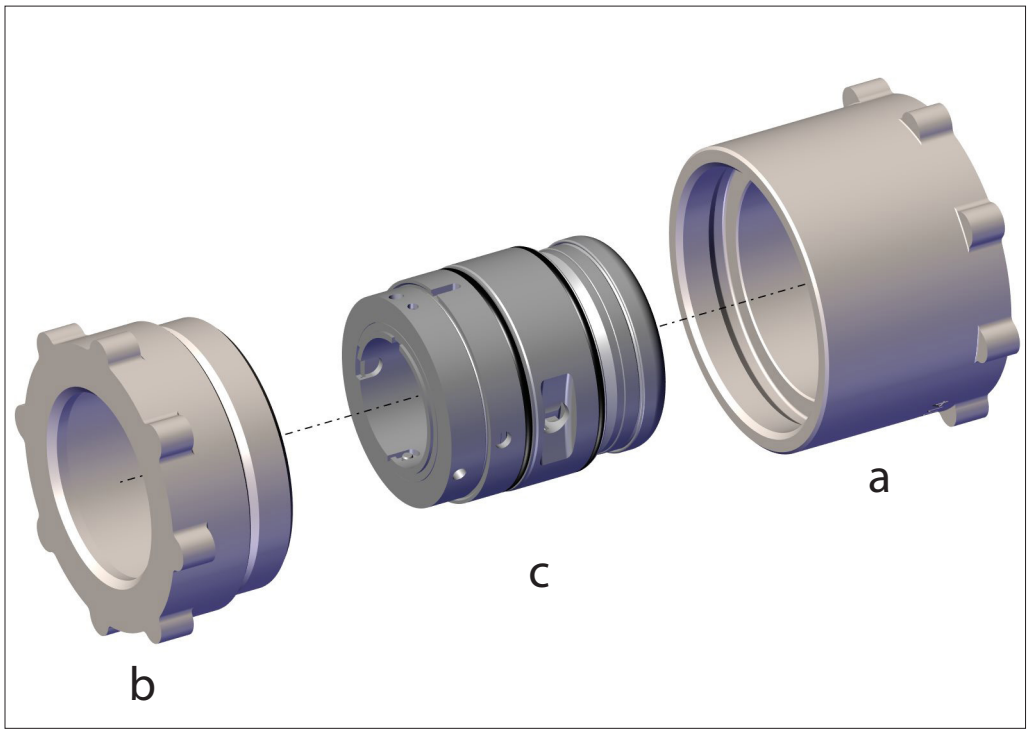
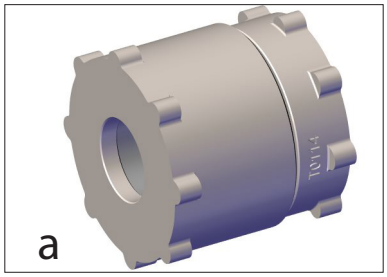


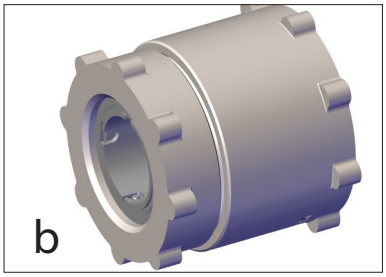
Fig. 18.1: Inserting the mechanical seal cartridge correctly in the assembly aid
a Lower tool section b Upper tool section c Mechanical seal cartridge

18.3 View of the tool

View of the tool with correctly inserted mechanical seal cartridge:



View from bottom



View from top

18.4 Handling the assembly aid

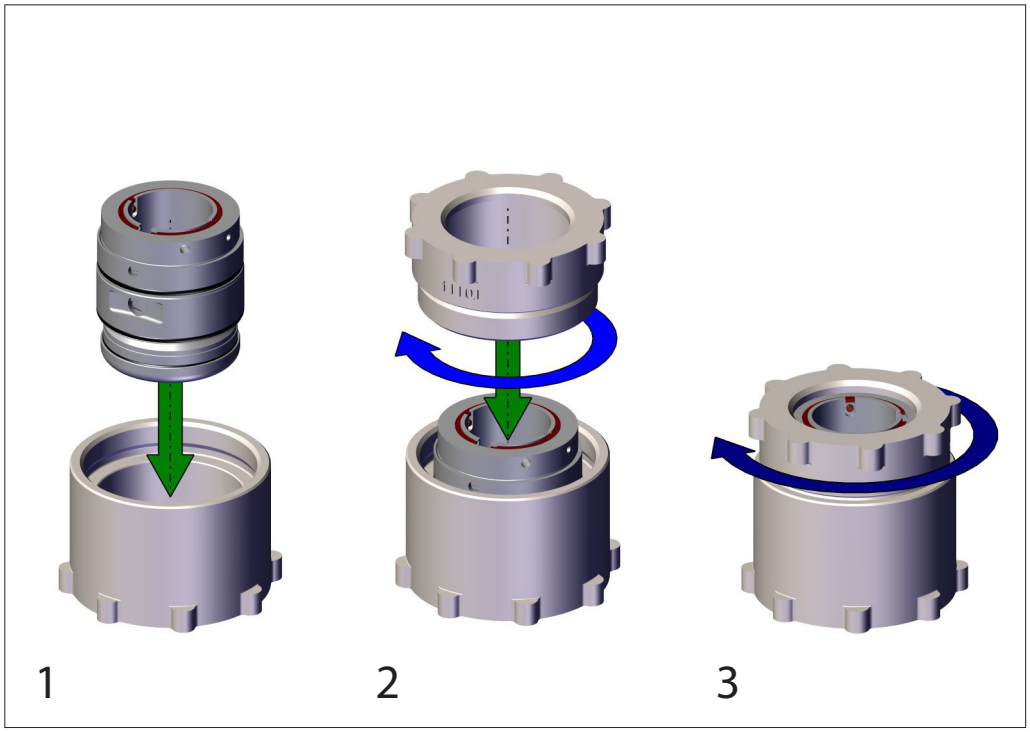


Fig. 18.2: Using the assembly aid to dismantle a mechanical seal cartridge

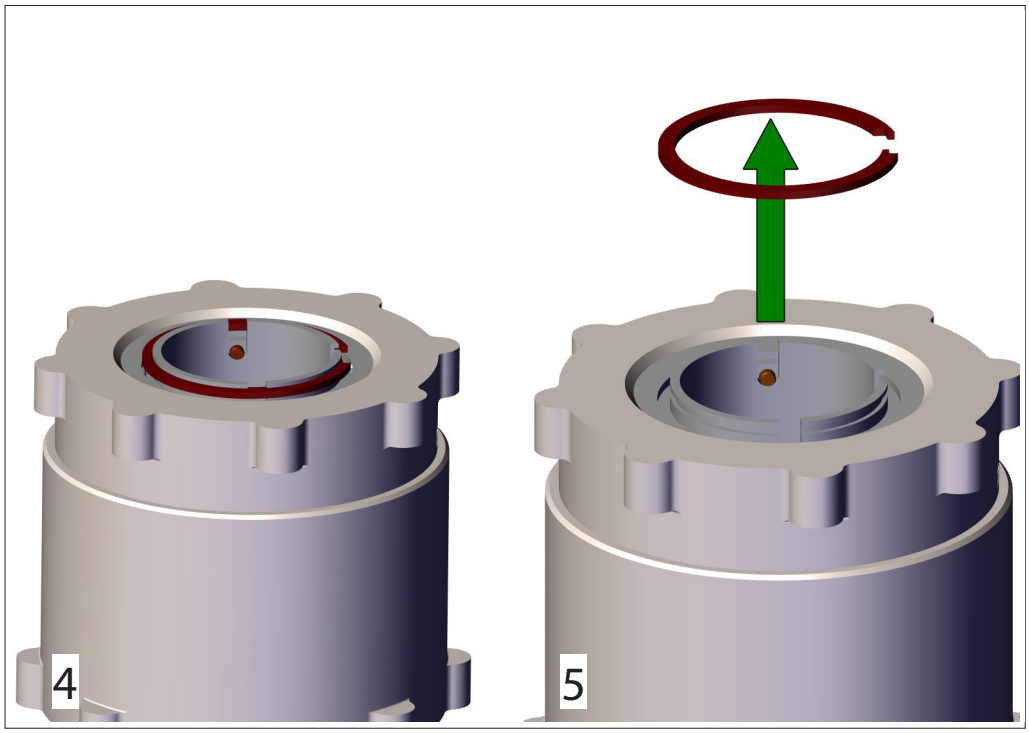


Fig. 18.2 continued: Using the assembly aid to dismantle a mechanical seal cartridge

After correctly inserting the mechanical seal cartridge into the assembly aid's lower section, screwing down the upper section will compress the mechanical seal cartridge so that the mechanical seal cartridge's retaining ring can be easily removed or inserted.

1. Do this by screwing the upper section onto the lower section down to the stop (drive pin/casing in the shaft sleeve's groove)
2. Now loosen both tool sections from each other and remove the dismantled or fully assembled mechanical seal

19. Accessories (optionally available)

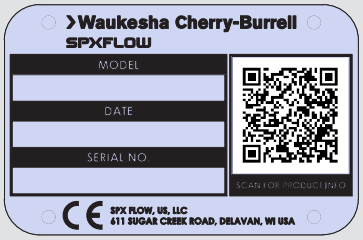
19.1 Pump accessories

Optionally available accessories	
Speed measuring device	Pressure indicator
Dry running protection device	Level indicator
Temperature sensor and temperature display	Level switch
Accessories must be installed in accordance with the enclosed operating instructions.	

Tab. 19.1: Pump accessories

20. Marking/ Labels on the pump

The following marking/ labels can be found on the pump:

Sr. Number	Symbol	Symbol's meaning
1		Danger of being pulled in unexpectedly (de/en)
2		Danger of being pulled in unexpectedly (ANSI)
3		Hot surface
4		Grounding
5		Pumped medium's flow direction
6		SPX FLOW name plate

Tab. 20.1: Marking/ Labels on the pump

Waukesha Cherry-Burrell®

WTS

Rotary positive displacement
Twin screw pump

SPXFLOW®

SPX FLOW, Inc.
611 Sugar creek Road
Delavan, WI 53115

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Improvements and research are continuous at SPX FLOW, Inc. Specifications may change without notice.

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