SPX®
WHERE IDEAS MEET INDUSTRY

INSTRUCTION MANUAL

TopLobe

ROTARY LOBE PUMPS

A.0500.251 – IM-TL/15.00 EN (11/2011)

ORIGINAL INSTRUCTIONS
READ AND UNDERSTAND THIS MANUAL PRIOR TO OPERATING
OR SERVICING THIS PRODUCT.

Johnson Pump®

EC-Declaration of conformity

(according to EC Machinery Directive 2006/42/EC, Annex IIA)

Manufacturer
SPX Flow Technology Sweden AB
P.O. Box 1436
SE-701 14 Örebro
Sweden

We hereby guarantee that **TopLobe rotary lobe pumps**

type:	TL1/0039	TL3/0234
	TL1/0100	TL3/0677
	TL1/0139	TL3/0953
	TL2/0074	TL4/0535
	TL2/0234	TL4/2316
	TL2/0301	TL4/3497

comply with the EC Machinery Directive 2006/42/EC, Annex I.

Manufacturer Declaration

(according to EC Machinery Directive 2006/42/EC, Annex IIB)

The product must not be put into service until the machinery into which it is to be incorporated has been declared conform with the provisions of the Directive.

Örebro, Sweden, 1 January 2010

Michael Strålman
Managing Director

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1.0 Introduction

1.1 General

The range of TopLobe rotary lobe pumps are manufactured by SPX, and are sold and marketed by a network of authorized distributors.

This instruction manual contains necessary information of the TopLobe pumps and must be read carefully before installation, service and maintenance. The manual must be kept easily accessible by the operator.

Important!
If it is proposed to modify the system/duty or to use the pump for transporting liquids with other characteristics than for which the pump was originally selected always consult your local supplier.

For additional information regarding the TopLobe pumps, please contact your local supplier.

1.1.1 Intended Use

The TopLobe Rotary Lobe Pumps are exclusively intended for pumping liquids, especially in beverage and food installations as well as in comparable applications of the chemical, pharmaceutical and health care industries.

Its use is permissible only within the admissible pressure and temperature margins and under consideration of chemical and corrosive influences.

Any use exceeding the margins and specifications set forth, is considered to be not intended. Any damage resulting therefrom is not within the responsibility of the manufacturer. The user will bear the full risk.

Attention: *Improper use of the pumps leads to:*

- damage
- leakage
- destruction.
- Failures in the production process are possible

1.2 Receipt, storage and handling

1.2.1 Receipt, storage

Check the consignement for damage immediately on arrival. In case of damage, clearly mark upon the carrier's paperwork (with a brief description of the damage) that the goods have been received in a damaged condition. Notify your local supplier.

Always state the pump model and serial number when asking for assistance. This information can be obtained from the pump name plate which is located on the pump gearbox.

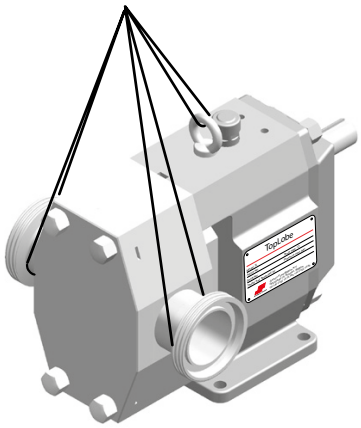
Should the nameplate be unreadable or missing, the serial number is also stamped on the gearbox and the rotor case. If the pump is not installed immediately, it must be stored in a suitable environment.

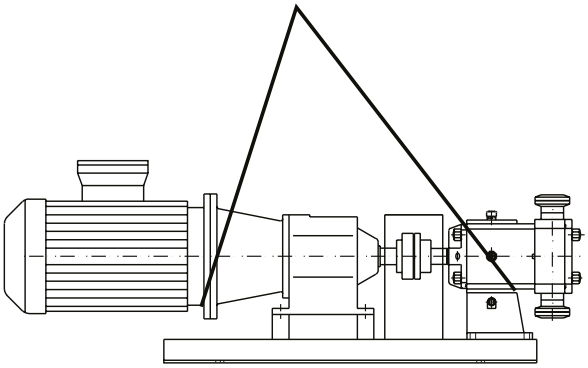
1.2.2 Handling

Caution must be taken when lifting the pump. All parts with a weight of more than 20 kg must be lifted using lifting slings and suitable lifting devices.

Lifting eye fitted to pump must only be used to lift the pump, not the pump with drive and/ or baseplate.

If the pump is baseplate mounted, the baseplate must be used for all lifting purposes. When using slings, they must be safely and securely attached. (1.3 Safety instructions)





1.3 General safety instructions

1.3.1 General

This information must be read carefully before installation, operation or servicing and always readibly be available to the pump operator.

Instructions which can affect personal safety if not followed, are marked with this symbol ⚠

Instructions to be considered for safe operations or to protect the pump/pump unit are marked with this symbol ATTENTION

When ATEX pump/pump unit is supplied, the separate ATEX manual must be considered Ex

⚠ ▪ Incorrect installation, operation or maintenance of the equipment can cause serious personal injury and/or damage to the equipment and will invalidate the warrenty.

⚠ ▪ Never operate the pump if the pump cover or suction and discharge pipework are not in place. Likewise, never operate the pump if other protection such as coupling and touch guards are missing or incorrectly fitted.

⚠ ▪ Never stick your fingers inside the rotor case, connections to the casing or in the end cover if there is any possibility that the pump shafts may rotate. This can lead to serious personal injury.

⚠ ▪ Do not exceed the pump's maximum operating pressure, speed or temperature. Do not modify the operating parameters/system for which the pump was orginally delivered without first consulting your local supplier.

⚠ ▪ Pump installation and operation must always comply with prevailing health and safety regulations.

ATTENTION ▪ Some sort of safety equipment should be connected to the pump, system or the drive to prevent the pump from exceeding maximum allowable pressure. The safeguard system must be configured to handle reverse flow where applicable.
Do not operate the pump with a closed/blocked discharge unless a safety relief valve is incorporated. If an integrated safety relief valve is incorporated into the pump, do not allow extended periods of recirculation through the relief valve.

⚠ ▪ The installation of the pump/pump unit must be sturdy and stabile. Pump orientation must be considered with respect to drainage requirements. Once mounted, check the alignment between the pump and the drive assembly. Misalignment of the pump, drive and shaft coupling will result in unnecessary wear, increased operating temperatures and noisier operation.

ATTENTION ▪ Fill the pump´s and drive´s gearboxes with the recommended lubricants and amounts. Change the lubricants at the recommended intervals.

ATTENTION ▪ Before operating the pump, make sure that it and the pipe system are clean and free from debris and that all the valves in the suction and discharge pipelines are fully opened. Make sure that all pipework connected to the pump is fully supported and correctly aligned. Misalignment and/or excessive loads will cause severe damage to the pump.

▪ Make sure that the pump rotation is correct for the desired flow direction.

ATTENTION ▪ Do not install the pump into a system where it may run dry (i.e. without a supply of pumped media) unless it is equipped with a flushed shaft seal arrangement, complete with a fully operational flushing system.

ATTENTION ▪ Install pressure gauges/sensors in conjuction with the pump's suction and discharge connections to monitor the pump's pressure.

- Caution must be taken when lifting the pump, appropriate lifting devices should be used if possible. Lifting rings fitted to the pump are only to be used for lifting the pump, not for lifting the pump with drive and/or baseplate. For baseplate mounted pumps the baseplate is to be used for all lifting purposes. If slings are used for lifting, they must be safely and securely attached.

- Do not attempt maintenance work or disassembly of the pump or pump unit without making sure that the power switch to the drive unit (electric, hydraulic or pneumatic) is locked and cannot be switched on. Depressurize and purge any pressure relief valve and/or shaft seal flushing system. Check that any other associated equipment is turned off and disconnected. Allow the pump and components to cool down to a safe handling temperature.

- Do not attempt to dismantle a safety/pressure relief valve whose spring pressure has not been relieved, is connected to a pressurized gas/air supply or mounted on a pump in operation. Serious personal injury and/or damage to the pump may occur.

- Do not attempt to loosen or remove the pump cover, connections to the pump, shaft seal housings, pressure/temperature control devices or other components until you are sure that such actions will not lead to the unsafe escape of any pressurized media.

ATTENTION

- The pump installation must allow for safe routine maintenance and inspection (check for leakage, change of lubricants, pressure monitoring, etc) and provide adequate ventilation to prevent overheating.

- Pumps and/or drive units can produce sound levels in excess of 85dB(A) under unfavorable operating conditions. When necessary, personal protection against noise must be used. See the curves for sound levels in “Section 3.6”.

- Avoid any contact with hot parts of the pumps or drive units which may cause personal injury. If the surface temperature of the system exceeds 60°C, the system must be marked with a warning sign of “hot surface”. Operating conditions with temperature control devices (jacketed, electrically heated, etc), bad installation or poor maintenance can promote unnormally high temperatures on pumps and/or drive units.

ATTENTION

- When cleaning, either manually or by CIP method, the operator must ensure that a suitable procedure is used in accordance with the system requirements. During a CIP cleaning cycle, a pump differential pressure of between 2 and 3 bar is recommended to ensure that suitable velocities are reached in the pump head. The exterior of the pumps should be cleaned periodically.

Pumps must always be installed and operated in compliance with prevailing national and local health and safety regulations and legislation. The pump must be completely isolated from the pipe work and drive motor before any maintenance work is to be undertaken. In the event of hazardous products the system, as well as the pump, must be drained. Never operate the pump without the pump cover.

Always follow all applicable safety measures when manually cleaning the pump:

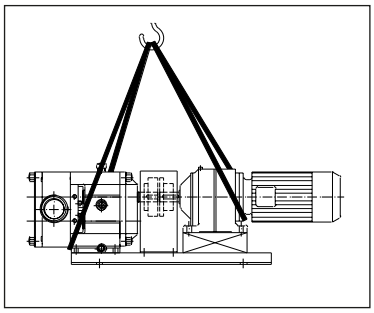
- Drive unit must be shut down so that it cannot be started.
- Any compressed air controlled, mounted safety relief valve must be closed and depressurized.
- Connections to flushed mechanical seals must be closed and depressurized.
- The pump and pipe work must be drained and depressurized.

Equipment that is incorrectly installed, operated in a dangerous manner or is poorly maintained poses a potential safety hazard. If all reasonable safety measures are not followed, serious personal injury and material damage may occur.

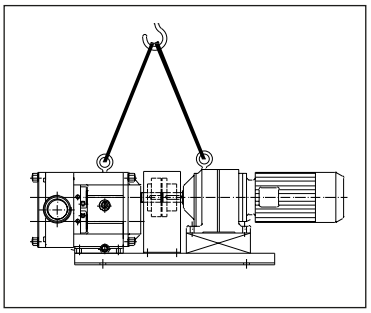
1.3.2 Pump units

1.3.2.1 Pump unit handling

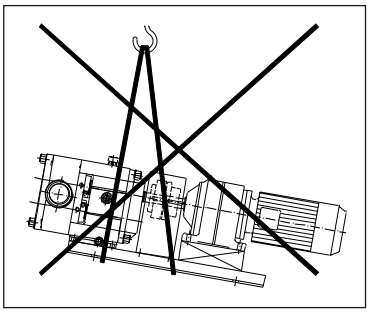
Use an overhead crane, forklift or other suitable lifting device.



Secure lifting slings around the front part of the pump and the back part of the motor. Make sure that the load is balanced before attempting the lift. NB! Always use two lifting slings.



If there are lifting rings on both the pump and the motor the slings may be fastened to these.
***NB!** Always use two lifting slings.*



Warning
Never lift the pump unit with only one fastening point. Incorrect lifts can result in personal injury and/or damage to the unit.

1.3.2.2 Installation

All pump units should be equipped with a locking safety switch to prevent accidental start during installation, maintenance or other work on the unit.

Warning
The safety switch must be turned to off and locked before any work is carried out on the pump unit. Accidental start can cause serious personal injury.

The pump unit must be mounted on a level surface and either be bolted to the foundation or be fitted with rubber-clad feet.

The pipe connections to the pump must be stress-free mounted, securely fastened to the pump and well supported. Incorrectly fitted pipe can damage the pump and the system.

Warning
Electric motors must be installed by authorized personnel in accordance with EN60204-1. Faulty electrical installation can cause the pump unit and system to be electrified, which can lead to fatal injuries.

Electric motors must be supplied with adequate cooling ventilation. Electric motors must not be enclosed in airtight cabinets, hoods etc.

Dust, liquids and gases which can cause overheating and fire must be diverted away from the motor.

Warning
Pump units to be installed in potentially explosive environments must be fitted with an Ex-class (explosion safe) motor. Sparks caused by static electricity can give shocks and ignite explosions. Make sure that the pump and system are properly grounded. Check with the proper authorities for the existing regulations. A faulty installation can lead to fatal injuries.

1.3.2.3 Before commissioning the pump unit

Read the pump's operating and safety manual. Make sure that the installation has been correctly carried out according to the relevant pump's manual.

Check the alignment of the pump and motor shafts. The alignment may have been altered during transport, lifting and mounting of the pump unit. For safe disassembly of the coupling guard see below: Disassembly/assembly of the coupling guard.

Warning

The pump unit must not be used with other liquids than those for which it was recommended and sold. If there are any uncertainties contact your supplier. Liquids, for which the pump is not appropriate, can damage the pump and other parts of the unit as well as cause personal injury.

1.3.2.4 Disassembly/assembly of the coupling guard

The coupling guard is a fixed guard to protect the users and operator from fastening and injuring themselves on the rotating shaft/shaft coupling. The pump unit is supplied with factory mounted guards with certified maximum gaps in accordance with standard DIN EN ISO 13857.

Warning

The coupling guard must never be removed during operation. The locking safety switch must be turned to off and locked. The coupling guard must always be reassembled after it has been removed. Make sure to also reassemble any extra protective covers. There is a risk of personal injury if the coupling guard is incorrectly mounted.

a) Turn off and lock the power switch.

b) Disassemble the coupling guard.

c) Complete the work.

d) Reassemble the coupling guard and any other protective covers. Make sure that the screws are properly tightened.

1.3.2.5 Name plate – CE Declaration of Conformity

Always quote the serial number on the name plate together with questions concerning the pump unit, installation, maintenance etc.

When changing the operating conditions of the pump please contact your local supplier to ensure a safe and reliable working pump.

This also applies to modifications on a larger scale, such as a change of motor or pump on an existing pump unit.

1.4 Pump designation

Example:

TL	2/	0234-	40/	06-	1	1-	GB1	1-	V	V	S
1	2	3	4	5	6	7	8	9	10	11	12

1. Pump family name
TL = TopLobe

2. Gearbox size
1, 2, 3, 4

3/4. Hydraulics indicated with displacement volume per revolution and connection diameter

	Displacement volume per revolution (in dm^3)	Connection diameter Standard pump	Enlarged inlet
TL1/0039	0.039	25	25/40
TL1/0100	0.100	25	25/40
TL1/0139	0.139	40	40/50
TL2/0074	0.074	25	25/40
TL2/0234	0.234	40	40/50
TL2/0301	0.301	50	–
TL3/0234	0.234	40	40/50
TL3/0677	0.677	50	50/80
TL3/0953	0.953	80	80/100
TL4/0535	0.535	50	50/80
TL4/2316	2.316	100	–
TL4/3497	3.497	150	–

5. Connection type

01 Hygienic threaded connection to DIN 11851/DIN 405
02 PN16 flanges to DIN 2633
03 PN25 flanges to DIN 2634
04 Threaded connection to ISO 2853
05 Threaded connection for dairy industry BS 4825
06 SMS 1145 threaded connections
07 Clamp to ISO 2852
08 Flanges to ANSI B16,5 – 150 lbs
09 Flanges to ANSI B16,5 – 300 lbs
10 Gas thread ISO 7/1
11 DS 722 thread
12 Clamp to SMS 3017 (Triclamp)
13 NPT thread to ASA B2.1
14 Clamp to DIN 32676

6. Lobe

1 Trilobe in stainless steel

Example:

TL	2/	0234-	40/	06-	1	1-	GB1	1-	V	V	S
1	2	3	4	5	6	7	8	9	10	11	12

7. Pump cover

1	Cover
2	Cover with relief valve – Spring loaded
3	Cover with relief valve – Spring loaded - air lifted
4	Cover with relief valve – Air loaded - air lifted
5	Cover with jacket
6	Cover with relief valve – Spring loaded with jacket
7	Cover with relief valve – Spring loaded - air lifted with jacket
8	Cover with relief valve – Air loaded - air lifted with jacket

8. Seals

GW1	Single mechanical seal SiC to SiC
GB1	Single mechanical seal SiC to Carbon
GW2	Single mechanical seal SiC to SiC quench/flush
GB2	Single mechanical seal SiC to Carbon quench/flush
L1	Hard lip seal
L2	Hard lip seal with flushing
DW2	Double mechanical seal SiC to SiC to Carbon
DB2	Double mechanical seal Carbon to SiC to Carbon
O1	Single O-ring seal
DO2	Double O-ring seal with flushing

9. Feet

1	Horizontal
2	Vertical for thread connection
3	Horizontal with shaft in bottom drive position
4	Vertical for flange connection

10. Kits for different O-ring material for the hydraulic part

V	FPM
E	EPDM
VF	FPM-FDA approved
EF	EPDM - FDA approved
T	PTFE lined O-rings approved
C	Chemraz®
K	* Kalrez®

11. Kits for different O-ring materials for seals

V	FPM
E	EPDM
VF	FPM-FDA approved
EF	EPDM - FDA approved
T	PTFE lined O-rings approved
C	Chemraz®
K	* Kalrez®

12. Special execution

For details please contact your supplier.
Position deviating from standard marked with X

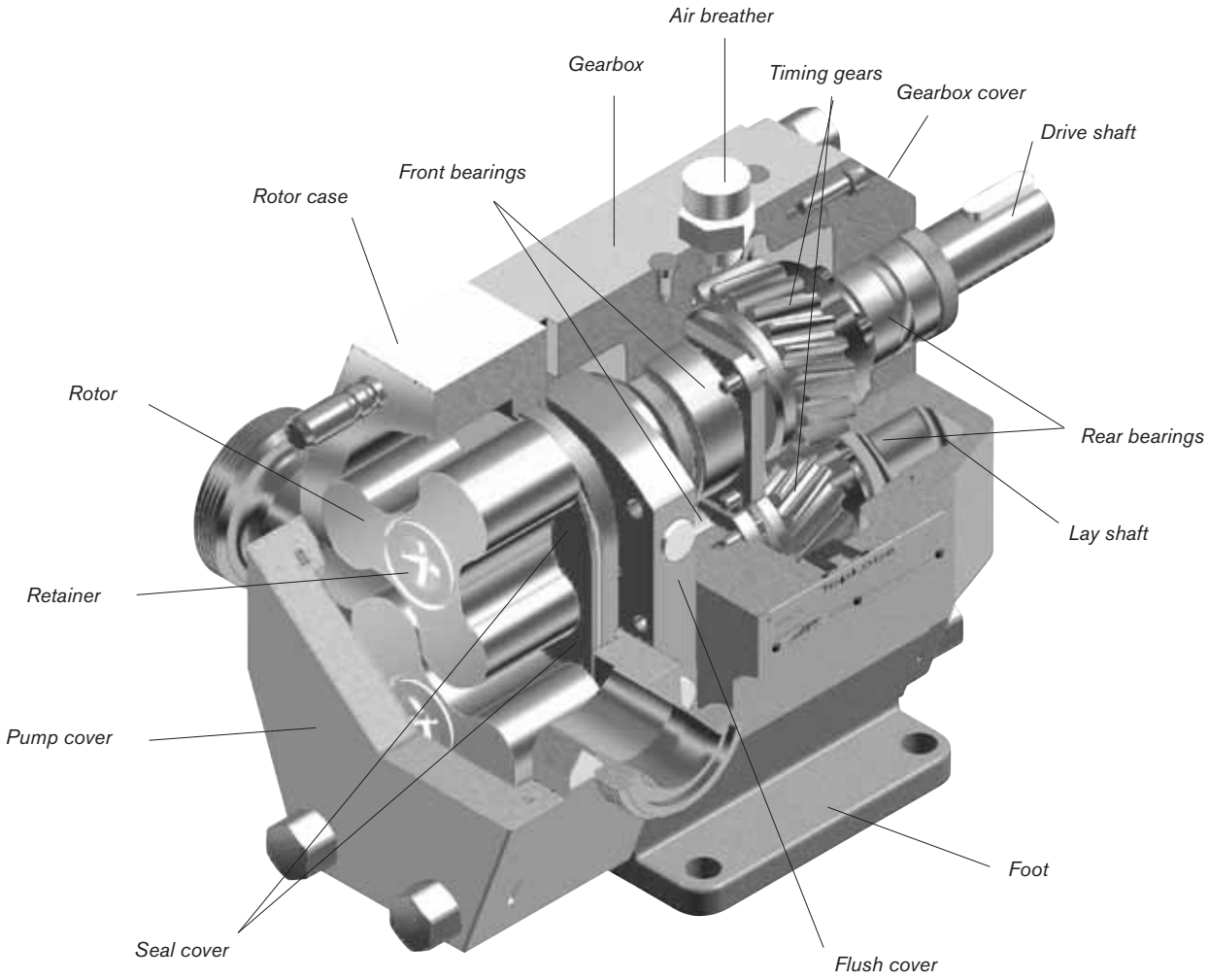
** Kalrez is a registered trademark of DuPont Performance Elastomers.*

1.5 Pump model and serial number

If you require further information regarding the TopLobe pumps, please contact your local supplier quoting the pump model and serial number. This information is stated on the nameplate which is attached to the pump gearbox. If the nameplate is damaged or missing, the serial number is also stamped on the gearbox and rotorcase.

1.6 Pump standard parts

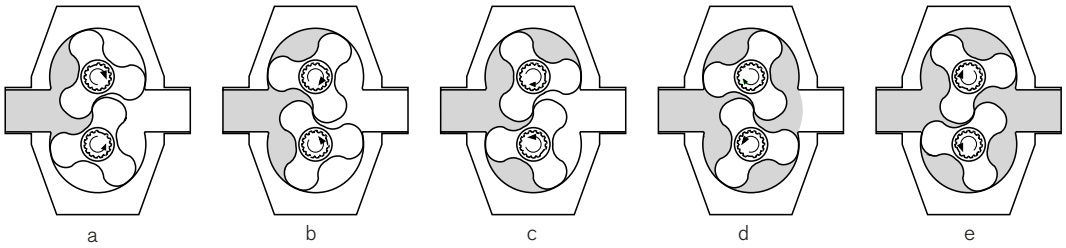
To avoid mistakes kindly always use the following terms for the different pump parts



2.0 Function, construction, installation

2.1 Operating principle

Liquid is drawn into the pump as the rotors disengage, forming cavities. The liquid is transported in the cavity of the rotors around the periferi of the rotor case. Liquid is pressured out from the pump as the rotors engage, closing the cavities.



2.2 Operating parameters

The maximum pressure and speed operating data are given in the table below. In practice these performance data can be limited by the nature of the pumped media and/or the design of the system in which the pump is installed.

Pump type	Max pump speed [rpm]	Swept volume [dm³]	Theoretical capacity at max speed and Δp = 0 bar [m³/h]	Max differential pressure [bar]	Max operating pressure [bar]	Max torque on shaft end [Nm]	Max liquid temperature °C
TL1/0039	1450	0.039	3.4	22	25	53	70
TL1/0100	950	0.100	5.7	12	15	53	70
TL1/0139	950	0.139	7.9	7	10	53	70
TL2/0074	1450	0.074	6.5	22	25	108	70
TL2/0234	950	0.234	13.3	12	15	108	70
TL2/0301	950	0.301	17.1	7	10	108	70
TL3/0234	1200	0.234	16.8	22	25	400	70
TL3/0677	720	0.677	29.2	12	15	400	70
TL3/0953	720	0.953	41.2	7	10	400	70
TL4/0535	950	0.535	30.5	22	25	1200	70
TL4/2316	600	2.316	83.4	12	15	1200	70
TL4/3497	600	3.497	125.9	7	10	1200	70

Max pump speed = n_{max}
Swept volume = Vi

Theoretical capacity at max speed and Δp = 0 bar = Qth_{max}

Max differential pressure = Δp_{max}
Max operating pressure = p_{max}
Max torque on shaft end = T_{max}

The pump is not to be exposed to rapid temperature changes to avoid damage through sudden expansion/contraction of the pump components.

Pumps for handling abrasive liquids (causing wear) should be selected with care. Please contact your local supplier for advice.

Important!

If it is proposed to modify the system/duty or to use the pump for transporting liquids with other characteristics than for which the pump was originally selected always consult your supplier.

2.3 System design and installation

When a pump is to be incorporated in a system, it is considered good practice to, as far as possible, minimise the length of the pipes and the number of pipe fittings (tees, unions, bends etc.) and the restrictions. When designing the suction lines, particular care should be taken. These should be as short and straight as possible, using a minimum of pipe fittings to achieve a good product flow to the pump. Always consider the following when designing a system:

1. Ensure there is space enough around the pump to allow for:
   a) Routine check and maintenance of the complete pump unit, seal area, drive motor, etc.
   b) Good ventilation for the drive to avoid overheating.
2. Both the suction and the discharge ports must be provided with valves. During check-up procedures or maintenance work, the pump must be isolated from the system.

ATTENTION 3. The system design, pipes and other equipment must have independant supports to avoid heavy loads on the pump. In the case of pipe work or other equipment relying on the pump fixings for support, there is a big risk for serious damage to the pump.

4. For positive displacement pumps as TopLobe it is recommended to install some safeguards, for example:
   a) Built-on safety relief valves
   b) External pressure relief valve system for recirculation to tank or suction side of the pump.
   c) Torque device in the system, mechanical or electrical.
   d) Rupture disc in the discharge pipework.

   If the system can be ruined by reversed flow direction, safeguards must be considered for both directions of rotation/flow.

ATTENTION 5. It is considered good practice to thoroughly clean all pipework and associated equipment from the suction port to the discharge port before installation of pump. This is to avoid the risk of debris entering the pump and causing damage.

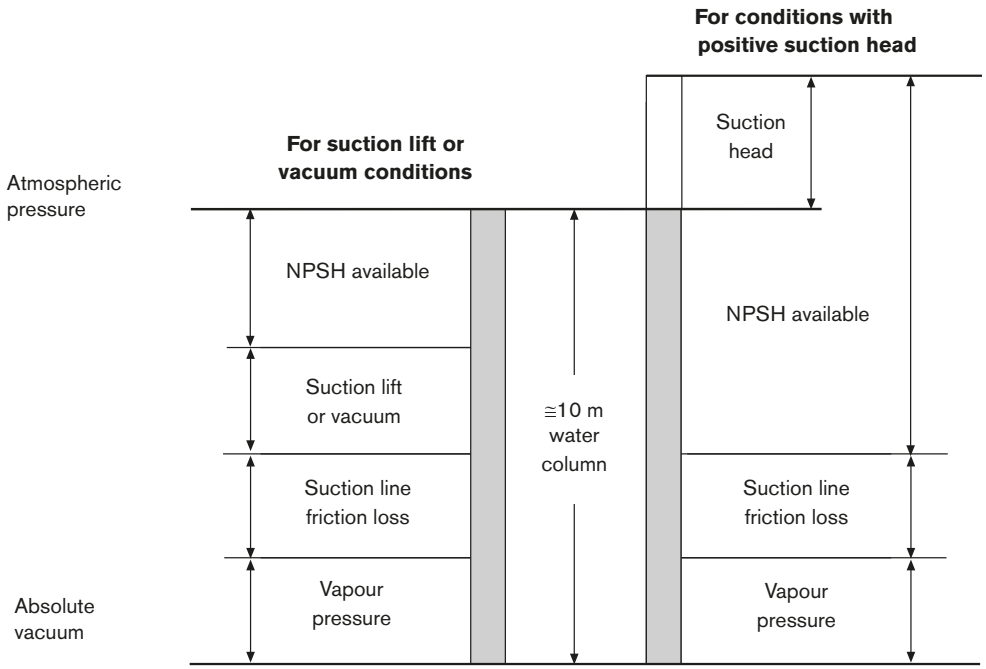
ATTENTION 6. If possible, pressure gauges should be placed at the suction port and the discharge port of the pump, so that the system pressures can be monitored. These gauges give a clear indication of changes in the operating conditions. If a relief valve is incorporated in the system the gauges will be necessary for setting and checking the function of the valve.

ATTENTION 7. It is very important that the suction condition at the pump inlet meets the NPSH required of the pump. Failure to observe this can cause cavitation, which leads to a noisy operation, reduced flow and mechanical damage on the pump and associated equipment.

ATTENTION The NPSH available from the system must always exceed the NPSH required by the pump. If the following guidelines are observed it should ensure the best possible suction conditions.

- The suction line should have at least the same diameter as the pump connections.
- The suction line should be as short as possible.
- Use a minimum of bends, tees and pipework restrictions.
- The calculations to determine the NPSH available from the system should be carried out for the worst condition, see vacuum table.
- If a filter is used on the suction pipe, check pressure drop at the actual flow. This is important to avoid cavitation which can damage the pump.

Please contact your local supplier if you require information on the pump or system NPSH characteristics.



Vacuum table

8. When installing a pump complete with drive motor and baseplate the following guidelines must be observed:

   a) The most suitable drive for the TopLobe pumps is to use a motor with direct coupling. Please contact your local supplier if using some other method.

   b) Flexible couplings must always be used and aligned correctly within the limits recommended by the coupling manufacturer. Turn the shaft at least one full rotation to control the alignment of the coupling and that the shaft rotates smoothly.

   c) Couplings must always be enclosed in a suitable guard to prevent contact with rotating parts which could cause personal injury. Such guards must be of suitable material - see point d - and be of sufficiently rigid design to prevent contact with the rotating parts during normal operation.

   d) When installing pump sets in flammable or explosive environments or for handling flammable or explosive media, special consideration must be given not only regarding the security of the drive unit enclosure, but also for the materials used both in couplings and guards to eliminate the risk of explosion.

   e) The base plate must be secured to a flat level surface to avoid misalignment and distortion. When the baseplate is fastened in position, the alignment must be checked again, see point b.

   f) If the pump is driven by an electric motor, check that the motor and other electrical equipment are compatible with the drive and that the wiring is correct, i.e. Direct On-Line, Star Delta etc. Ensure that all components are correctly electrically grounded.

2.3.1 Installations with CIP-systems, Cleaning In Place

The TopLobe pumps are constructed so that they easily can be cleaned with CIP-methods for cleaning of processing plants. To achieve the necessary fluid velocities within the pump when cleaning we recommend a differential pressure of 2-3 bars across the pump.

Recommendation: A built-on safety relief valve with air lift, creates the possibility to achieve a full flow in the pipe work without using separate by-pass piping.

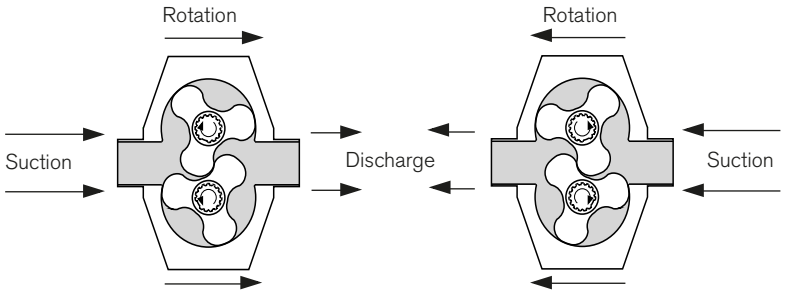
2.3.2 Installations with SIP-systems, Sterilising In Place

TopLobe pumps are capable of handling a SIP-process. Contact your local supplier for information regarding the temperatures needed for the process, as temperature has an effect on the clearances in the pump.

Equipment components may need sterilising, i.e. heating to high temperatures (up to 140°C) to kill organisms still remaining on the surface of the equipment. Sterilising is done by using steam or pressurised, heated water.

2.4 Start

- Make sure that all associated equipment is clean and free from debris and that all pipe connections are secure and correctly sealed.
- For pumps fitted with quenched/flushed product seals check that all required services for flushing purposes are in place and connected. They must give sufficient flow and pressure for the flushing purposes. Contact your supplier for advice. For seal plans, see chapter 11.0. Check the lubrication for the pump and drive. The TopLobe pumps are delivered without oil and should be filled to the level of the oil level glass. See “Section 3.2’’ regarding pump oil capacities and grades.
- If an external relief valve is incorporated in the system, check that it is set correctly. It is considered good practice to set the relief valve lower than the system design pressure. After commissioning, the relief valve should be reset to the required setting for the application. The required setting should never exceed the lower of either the pumps maximum pressure rating or the system design pressure setting for the application. The required setting should never exceed the lower of either the pumps maximum pressure rating or the system design pressure.
- Check that the valves are completely open on both inlet and outlet and that the pipelines are free from obstructions. The TopLobe pumps are of the positive displacement type and should therefore never be operated against a closed valve, as this would result in pressure overload, damages on the pump and possibly damage on the pump system.
- Check that the drive shaft has the correct direction of rotation for required flow, see figure below.



Direction of rotation

- Before starting the pump, make sure that there is liquid on the suction side. This is very important for pumps with unflushed product seals as these sealing arrangements must never run dry.
- Before operating the pump, briefly start and stop it to check the direction of rotation and to make sure that there are no obstructions of the function. Keep a visual check on the suction and discharge pressure gauges and monitor the pump temperature and absorbed power.

2.5 Shutdown

When shutting the pump down the valves on the suction and discharge side must be closed. Following precautions must be taken:

- The power is shut off and the starting device locked so that the pump cannot be started.
- The pneumatic relief valve is purged.
- The connections for the flushed mechanical seals are shut off and depressurised.
- The pump and pipelines must be empty and de-pressurised.

See chapter “4.0 Disassembly and assembly instructions’’ before undertaking any work on the pump.

2.6 Routine maintenance

- Check the oil level regularly.
- Change the oil once a year or every 3000 operating hours, whichever comes first.
- For lubricant capacities and grades, see “Section 3.2’’.
- Measure vibration and temperature, these factors can indicate bearing failure.
- Control the quality of the oil. Change the oil if contaminated with water, etc.
- Regularly check for leakages

2.7 Typical CIP (Cleaning In Place) cycle

CIP relies on the circulation of fluid through the system at velocity and temperature. Velocity is required to generate turbulence in order to dislodge debris whilst temperature is required for the fluids to clean effectively.

Velocity is normally about 2 metres/second (6 feet/second). The need of velocity can depend on the pumped liquid, the process and the system to be cleaned. A centrifugal pump is often used to circulate the cleaning fluids as the required velocity is often beyond the scope of a PD pump. It is advised to have minimum 2 bar pressure over the PD pump during the CIP cycle.

The typical CIP cycle:

Step 1 Pre-rinse. Cold water – 5 minutes – removes product debris.

Step 2 Detergent wash. Normally sodium hydroxide (Caustic) alkaline based – 30 to 45 minutes at 75°C to 95°C – removes carbohydrates, proteins, fats.

Step 3 Rinse. Cold water – 5 minutes – removes detergent residues.

Step 4 Acid wash. Nitric or phosphoric acid – 15 to 30 minutes at 60°C – removes mineral salt residues and neutralizes.

Step 5 Final rinse. Cold water – 5 minutes – removes acid residues.

Cycle times, temperatures, fluids and concentrations of fluids used will vary depending on the product, process and system. Further, additional washes may be introduced.

2.8 Typical COP (Cleaning Out of Place) cycle

A typical COP cycle:

a. Clean the exterior of the pump with a soft brush and warm water (60°C) with a detergent.

b. Remove front cover, retainers and rotors, stationary and rotating seals including O-rings.

c. Clean all removed parts with a soft brush and cold water until the parts are visual clean.

d. Clean the internals of the rotor case with a soft brush and cold water until the internals are visual clean

e. If needed make an additional cleaning cycle using warm water and a soft detergent at 60°C.

f. Flush all parts thereafter during a few minutes with clean water

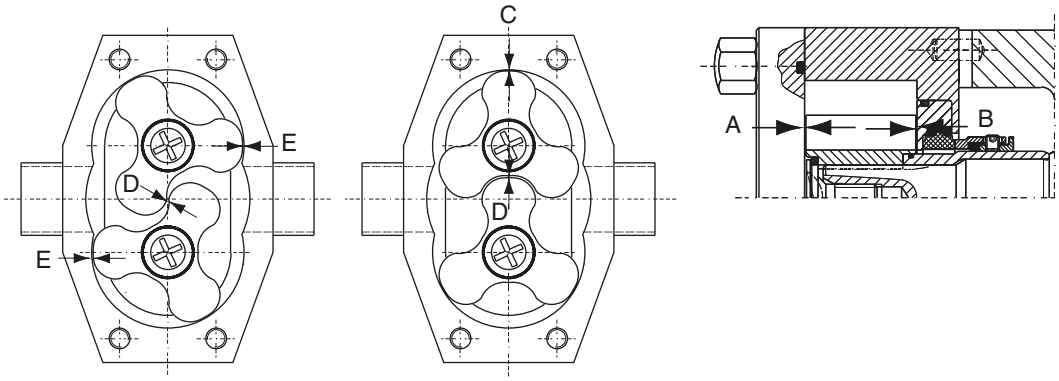
g. If additional cleaning method is needed please contact your supplier for further details.

2.9 Trouble shooting chart

Symptom									Causes	Actions
No flow	Irregular flow	Low capacity	Pump over-heats	Motor over-heats	Exessive rotor wear	Exessive seal wear	Noise/, Vibra-tions	Seizure	Pump stalls on start up		
.										Incorrect direction of rotation	Reverse motor
.										Pump not primed	Expel gas from suction line/pump chamber and prime
.	.	.					.			Insufficient NPHS available	Increase suction line dia and static suction head Simplify suction line and reduce length Reduce pump speed and product temperature
		.	.					.		Product vapourising in suction line	
	.	.					.			Air entering suction line	Remake pipework joints
.	.	.					.			Gas in suction line	Expel gas from suction line/pump chamber
	.	.					.			Insufficient static suction head	Raise product level to increase static suction head
			.	.			.		.	Product viscosity too high	Decrease pump speed/increase product temperature
		.								Product viscosity too low	Increase pump speed/decrease product temperature
		.	.		.		.		.	Product temperature too high	Cool product/pumping chamber
				.					.	Product temperature too low	Heat product/pumping chamber
					.	.	.	.		Unexpected solids in product	Clean the system/fit strainer on suction side of pump
		.	.	.	.		.	.	.	Discharge pressure too high	Check for blockages/simplify discharge line
			.	.	.		.	.		Rotorcase strained by pipework	Check pipe alignment/support pipework
				.			.			Pump speed too high	Decrease pump speed
		.								Pump speed too low	Increase pump speed
			.	.	.	.	.	.		Seal flush inadequate	Increase seal flush to required pressure/flow
			.	.	.	.	.	.	.	Bearing/timing gear wear	Replace worn components

3.0 Technical data

3.1 Rotor clearances



A = Axial clearance lobe / front cover
B = Axial clearance lobe / back side rotorcase
C = Radial clearance lobe / rotorcase top and bottom
D = Clearance lobe / lobe
E = Radial clearance lobe / rotorcase at inlet and outlet

3.1.1 Rotors in duplex steel

Dimensions in mm

Pump type	A 70°C	B 70°C	C 70°C	D 70°C	E 70°C
TL1/0039	0.100	0.100	0.120	0.21	0.24
	±0.025	±0.065	±0.050	±0.04	±0.03
TL1/0100	0.125	0.125	0.16	0.21	0.32
	±0.025	±0.065	±0.04	±0.04	±0.03
TL1/0139	0.125	0.125	0.16	0.21	0.32
	±0.025	±0.065	±0.04	±0.04	±0.03
TL2/0074	0.125	0.125	0.17	0.22	0.36
	±0.025	±0.065	±0.06	±0.05	±0.04
TL2/0234	0.150	0.150	0.16	0.16	0.36
	±0.025	±0.065	±0.05	±0.05	±0.04
TL2/0301	0.175	0.175	0.21	0.16	0.41
	±0.025	±0.065	±0.05	±0.05	±0.04
TL3/0234	0.175	0.175	0.26	0.27	0.52
	±0.025	±0.065	±0.06	±0.06	±0.04
TL3/0677	0.200	0.200	0.21	0.22	0.42
	±0.025	±0.065	±0.05	±0.06	±0.04
TL3/0953	0.225	0.225	0.31	0.22	0.61
	±0.025	±0.065	±0.05	±0.06	±0.04
TL4/0535	0.200	0.200	0.27	0.32	0.54
	±0.025	±0.065	±0.06	±0.06	±0.04
TL4/2316	0.300	0.300	0.39	0.31	0.84
	±0.025	±0.065	±0.05	±0.06	±0.04
TL4/3497	0.300	0.300	0.59	0.31	1.04
	±0.025	±0.065	±0.05	±0.06	±0.04

3.2 Lubricants

Recommended oils

Pump operating temperature	
Standard execution **-20°C to +130°C /** (-4°F to +266°F)	**Special execution** **+130°C to 200°C /** (+266°F to 392°F)
BP Energol GR - XP150	BP GRS15
Castrol Alpha SP150	Castrol Alpha SN150
Mobil Gear 629	Mobil Glycoyle 30
Shell Omala 150	Shell Tivela WA
Texaco Meropa 150	Texaco Synlube SAE90
Esso Spartan EP150	Esso IL1947

The pump will not be supplied pre-filled with oil therefore this table must be used to select recommended oil.

Oil changing: Oil level must be checked with the pump static.
First change: After 150 hours of operation, thereafter every 3000 hours of operation.
Oil filling: Fill with oil through the filler plug to the level indicated in the oil level glass.

Oil volume

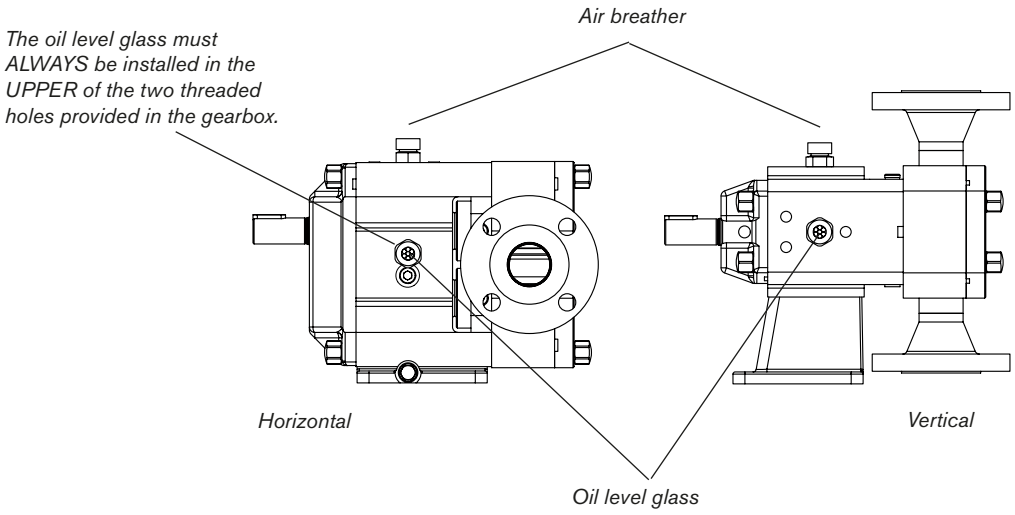
Pump	Horizontal connection	Vertical connection
TL1	0.23 lit	0.17 lit
TL2	0.37 lit	0.32 lit
TL3	1.20 lit	0.96 lit
TL4	2.24 lit	1.71 lit

After filling up oil, check the oil level in the oil level glass.

Location of the oil level glass and the air breather

When the pump is mounted in the horizontal position (e.g. the pipe joints are in the horizontal plane) the oil level glass must ALWAYS be installed in the UPPER of the two threaded holes provided in the gearbox. This will guarantee, on inspection, that the oil level will reach the gearbox bearings. The lower hole is to be plugged with the standard plug, position 0915. The oil level glass is always installed as described above on delivery from SPX.

If the customer, after delivery, decides to turn the pump “upside down” in order to have the drive shaft in a different position, then the above instructions must be followed.

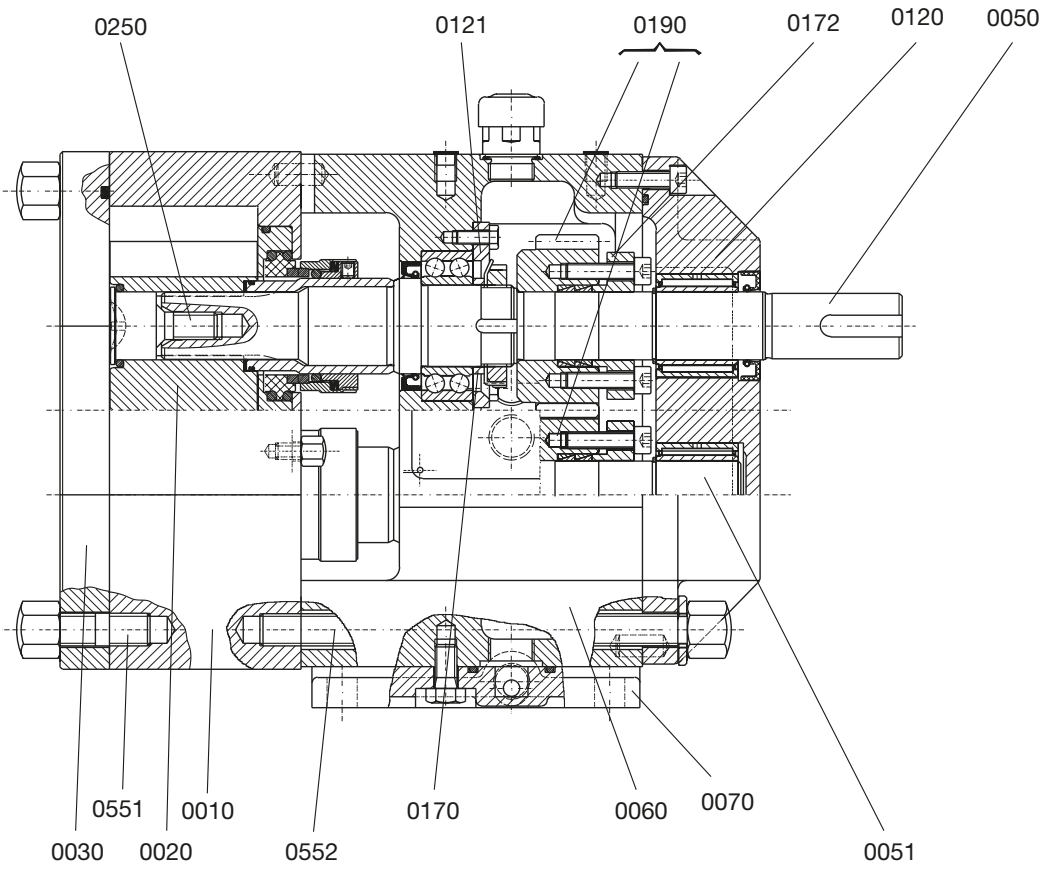


3.3 Material specification

3.3.1 Machined parts – Pump

Pos.	Description	Europe		USA	Pump type			
		DIN	W.-No.		TL1	TL2	TL3	TL4
0010	Rotor case	EN 10213-4	1.4409	A351 CF3M	x	x	x	x
0020	Rotor	EN 10088-3	1.4460	AISI 329(L)	x	x	x	x
0030	Pump cover	EN 10088-3	1.4404	AISI 316L	x	x	x	x
0050 0051	Drive shaft Lay shaft	EN 10088-3	1.4460	AISI 329(L)	x	x	x	x
0060	Gearbox	EN 1561	0.6020	A278 - 30	x	x	x	x
0070	Foot	EN 1561	0.6020	A278 - 30	x	x	x	x
0120	Gearbox cover	EN 1561	0.6020	A278 - 30	x	x	x	x
0121	Bearing cover	EN 10025-2	1.0038	A570 - 36	x	x	–	–
		EN 10083-1	1.1191	SAE 1045	–	–	x	x
0170	Spacer sleeve	EN 10025-2	1.0570	SAE 5120	x	x	–	–
0172	Pressure flange	EN 10083-1	1.1191	SAE 1045	x	x	–	–
0190	Gear, 1 pair	EN 10025-2	1.5732	SAE 3415	x	x	x	x
0250	Retainer	EN 10088-3	1.4460	AISI 329(L)	x	x	x	x
0551	Stud bolt	EN ISO 3506		ISO 3269	x	x	x	x
0552	Stud bolt	EN 20898-2		ISO 898-1	x	x	x	x

Reference catalogue: Stahlschlüssel 2001 (steel page 250-256 / stainless steel age 492-494

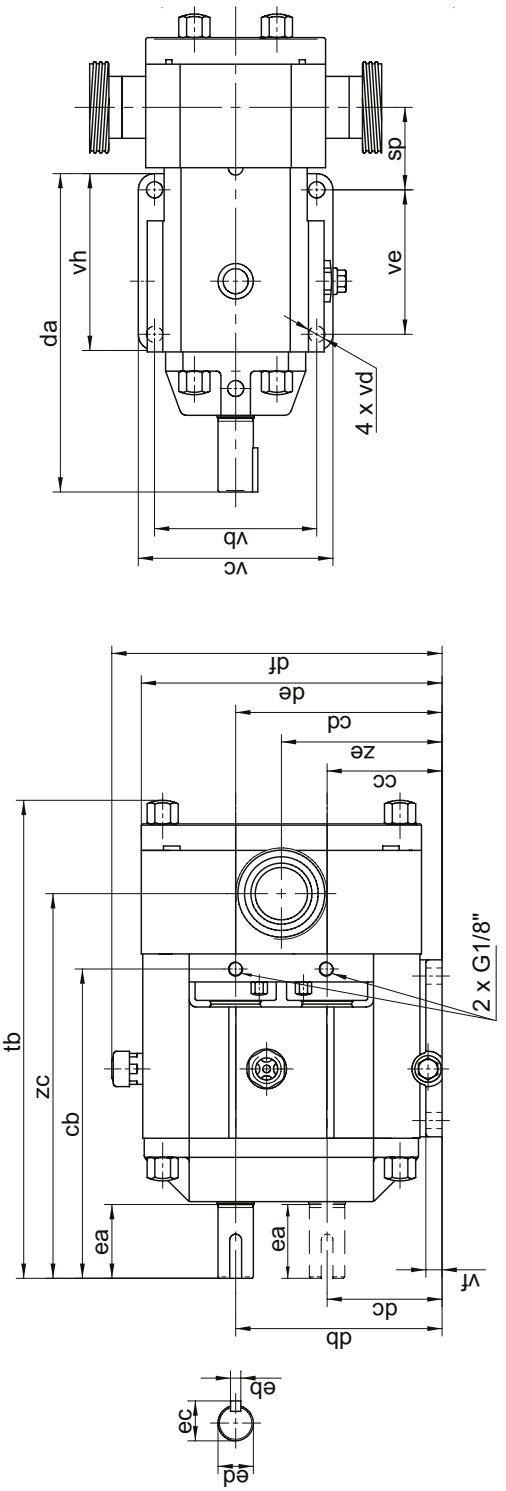


3.4 Dimensional drawings and weights

3.4.1 Standard – Horizontal

Flanges, see 3.4.4

Pump shown with seal flush – Broken line shaft shows position for bottom drive version



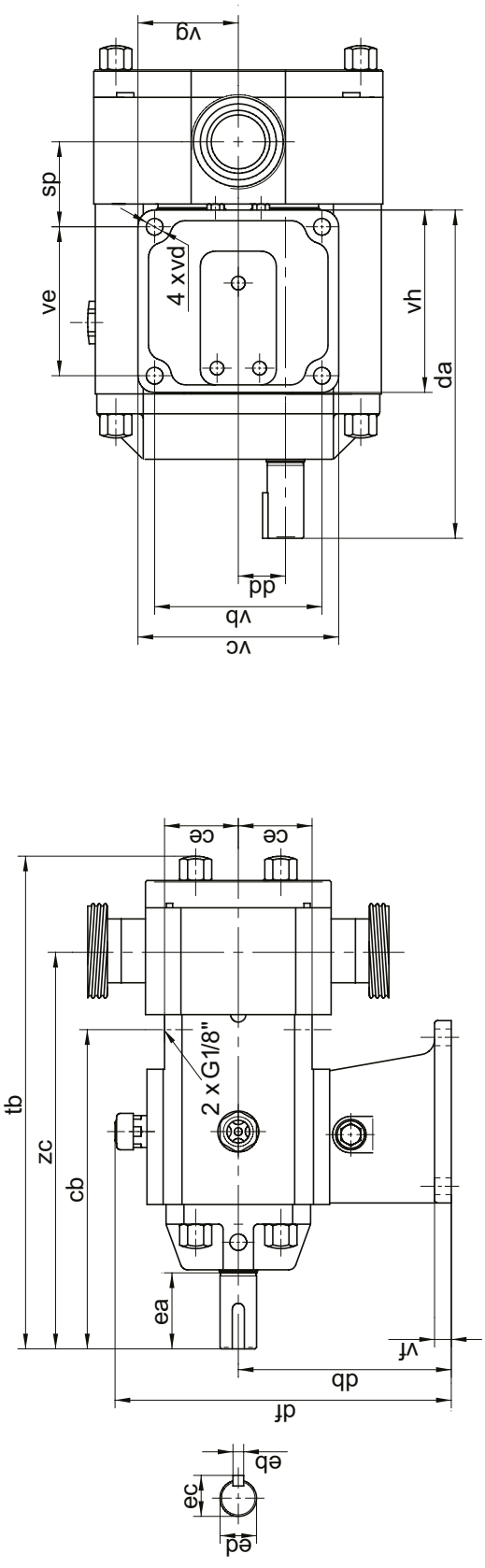
Dimensions in mm

Pump type	cb	cc	cd	da	db	dc	de	df	ea	eb	ec	ed	sp	tb	vb	vc	vd	ve	vf	vh	zc	ze
TL1/0039	177	71	115	181	118	68	172	195	40	6	21.5	19	45.8	261	100	122	11	83	11	105	216	93
TL1/0100	177	71	115	181	118	68	172	195	40	6	21.5	19	42.3	261	100	122	11	83	11	105	212	93
TL1/0139	177	71	115	181	118	68	172	195	40	6	21.5	19	48.8	273	100	122	11	83	11	105	219	93
TL2/0074	210	78	140	216	140	78	204	227	50	8	27	24	55.8	313	110	132	11	98	11	120	261	109
TL2/0234	210	78	140	216	140	78	204	227	50	8	27	24	49.9	313	110	132	11	98	11	120	255	109
TL2/0301	210	78	140	216	140	78	204	227	50	8	27	24	55.9	325	110	132	11	98	11	120	261	109
TL3/0234	280	118.5	188.5	285	200	107	287	310	80	10	41	38	67.8	401	170	198	13	130	16	158	339	153.5
TL3/0677	280	118.5	188.5	285	200	107	287	310	80	10	41	38	61.8	401	170	198	13	130	16	158	333	153.5
TL3/0953	280	118.5	188.5	285	200	107	287	310	80	10	41	38	73.4	423	170	198	13	130	16	158	344	153.5
TL4/0535	467	139.5	235.8	423	250	125	354.5	377.5	110	16	59	55	121.2	608	230	270	17	214	20	254	524	187.5
TL4/2316	418	139.5	235.5	423	250	125	354.5	377.5	110	16	59	55	96.4	608	230	270	17	214	20	254	499	187.5
TL4/3497	418	139.5	235.5	423	250	125	354.5	377.5	110	16	59	55	122.4	660	230	270	17	214	20	254	525	187.5

Regarding dimensions and weights of separate valves, see Chapter 14.0

3.4.2 Vertical mounting – thread connection

Flanges, see 3.4.4.



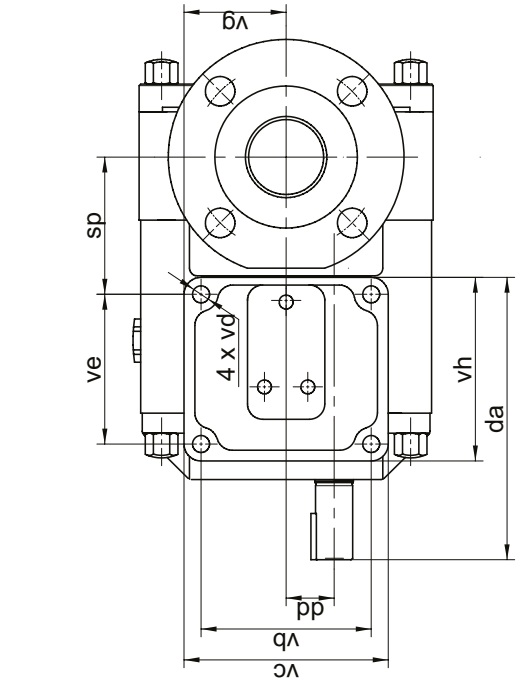
Dimensions in mm

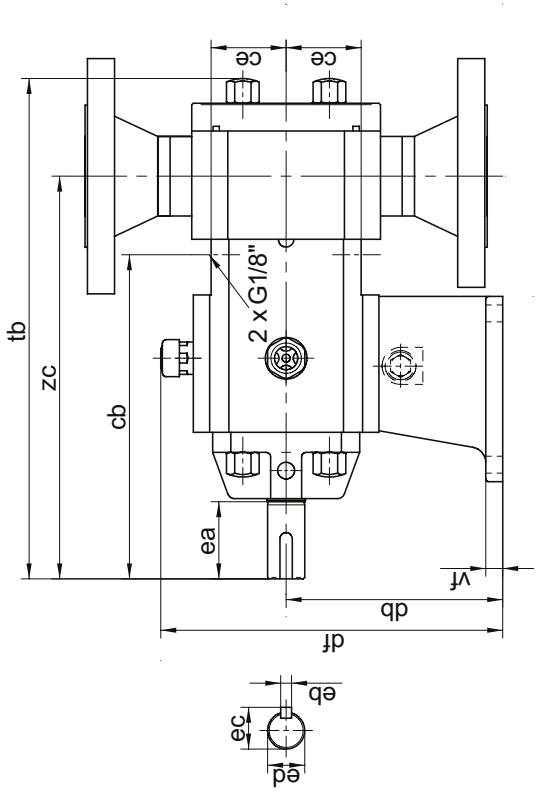
Pump type	cb	ce	da	db	dd	df	ea	eb	ec	ed	sp	tb	vb	vc	vd	ve	vf	vg	vh	zc
TL1/0039	177	42	181	118	25	195	40	6	21.5	19	45.8	261	100	122	11	83	11	61	105	216
TL1/0100	177	42	181	118	25	195	40	6	21.5	19	42.2	261	100	122	11	83	11	61	105	212
TL1/0139	177	42	181	118	25	195	40	6	21.5	19	48.8	273	100	122	11	83	11	61	105	219
TL2/0074	210	48.5	216	140	31	227	50	8	27	24	55.8	313	110	132	11	98	11	66	120	261
TL2/0234	210	48.5	216	140	31	227	50	8	27	24	49.9	313	110	132	11	98	11	66	120	255
TL2/0301	210	48.5	216	140	31	227	50	8	27	24	55.9	325	110	132	11	98	11	66	120	261
TL3/0234	280	70	285	200	46.5	310	80	10	41	38	67.8	401	170	198	13	130	16	99	158	339
TL3/0677	280	70	285	200	46.5	310	80	10	41	38	61.8	401	170	198	13	130	16	99	158	333
TL3/0953	280	70	285	200	46.5	310	80	10	41	38	73.4	423	170	198	13	130	16	99	158	344
TL4/0535	467	88	423	250	62.5	377.5	110	16	59	55	121.2	608	230	270	17	214	20	135	254	524
TL4/2316	418	88	423	250	62.5	377.5	110	16	59	55	96.4	608	230	270	17	214	20	135	254	499
TL4/3497	418	88	423	250	62.5	377.5	110	16	59	55	122.4	660	230	270	17	214	20	135	254	525

Regarding dimensions and weights of separate valves, see Chapter 14.0

3.4.3 Vertical mounting – flange conncection

Flanges, see 3.4.4.





Dimensions in mm

Pump type	cb	ce	da	db	dd	df	ea	eb	ec	ed	sp	tb	vb	vc	vd	ve	vf	vg	vh	zc
TL1/0039	177	42	153	118	25	195	40	6	21.5	19	73.8	261	100	122	11	83	11	61	105	216
TL1/0100	177	42	153	118	25	195	40	6	21.5	19	70.2	261	100	122	11	83	11	61	105	212
TL1/0139	177	42	153	118	25	195	40	6	21.5	19	76.8	273	100	122	11	83	11	61	105	219
TL2/0074	210	48.5	183	140	31	227	50	8	27	24	88.8	313	110	132	11	98	11	66	120	261
TL2/0234	210	48.5	183	140	31	227	50	8	27	24	82.9	313	110	132	11	98	11	66	120	255
TL2/0301	210	48.5	183	140	31	227	50	8	27	24	88.9	325	110	132	11	98	11	66	120	261
TL3/0234	280	70	246	200	46.5	310	80	10	41	38	106.8	401	170	198	13	130	16	99	158	339
TL3/0677	280	70	246	200	46.5	310	80	10	41	38	100.8	401	170	198	13	130	16	99	158	333
TL3/0953	280	70	246	200	46.5	310	80	10	41	38	112.4	423	170	198	13	130	16	99	158	344
TL4/0535	467	88	357	250	62.5	377.5	110	16	59	55	187.2	608	230	270	17	214	20	135	254	524
TL4/2316	418	88	357	250	62.5	377.5	110	16	59	55	162.4	608	230	270	17	214	20	135	254	499
TL4/3497	418	88	357	250	62.5	377.5	110	16	59	55	188.4	660	230	270	17	214	20	135	254	525

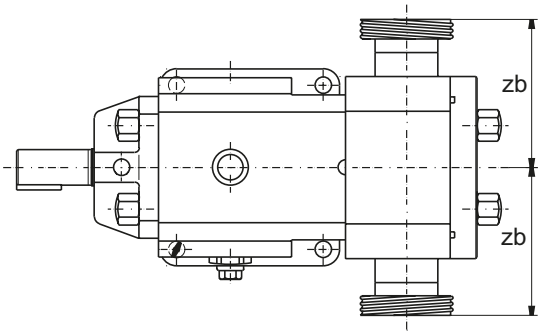
Regarding dimensions and weights of separate valves, see Chapter 14.0

3.4.4 Flanges

1 = All thread connections (DIN, SMS, DS, BS, ISO, GAS Thread, NPT Thread) and all clamp connections (ISO, SMS, DIN)

2 = All flanges DIN (PN16, PN25) and ANSI (class 150/class 300)

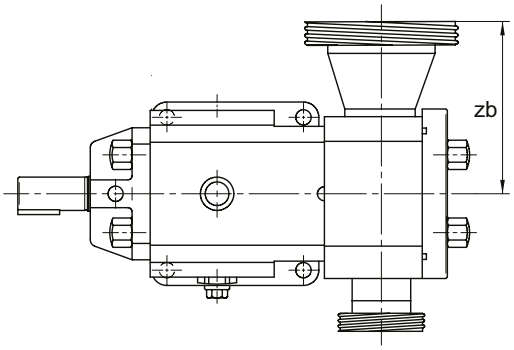
3.4.4.1 Standard pump



Dimensions in mm

Pump type	1 zb	2 zb
TL1/0039	89	121
TL1/0100	89	121
TL1/0139	89	121
TL2/0074	98	130
TL2/0234	98	130
TL2/0301	98	130
TL3/0234	124	156
TL3/0677	124	156
TL3/0953	134	166
TL4/0535	159	191
TL4/2316	159	189
TL4/3497	159	189

3.4.4.2 Enlarged inlet



Dimensions in mm

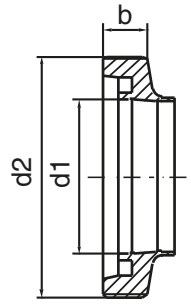
Pump type	Enlarged inlet	1 zb	2 zb
TL1/0039	20/40	115	147
TL1/0100	25/40	115	147
TL1/0139	40/50	115	147
TL2/0074	25/40	124	156
TL2/0234	40/50	124	156
TL2/0301	–	98	–
TL3/0234	40/50	151	183
TL3/0677	50/80	161	193
TL3/0953	80/100	161	191
TL4/0535	50/80	185	217
TL4/2316	–	–	–
TL4/3497	–	–	–

3.4.5 Thread and clamp connections

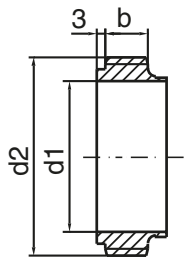
Dimension table, see next page.

Thread connections

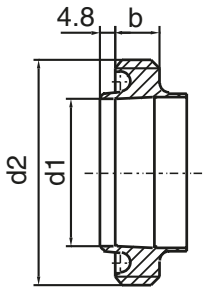
DIN 11851/
DIN 405



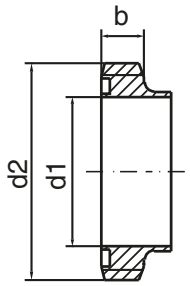
ISO 2853



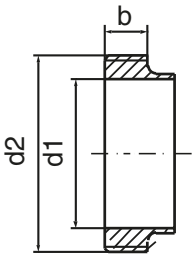
BS 4825



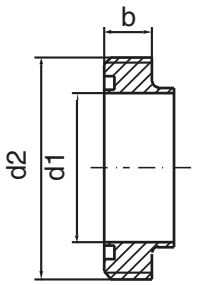
SMS 1145



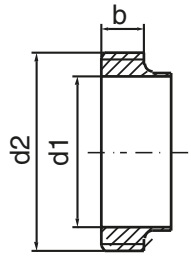
GAS THREAD



DS 722

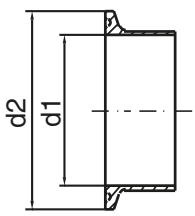


NPT THREAD

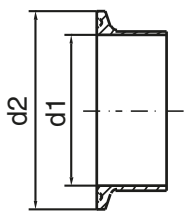


Clamp connections

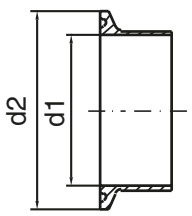
ISO 2852



SMS 3017

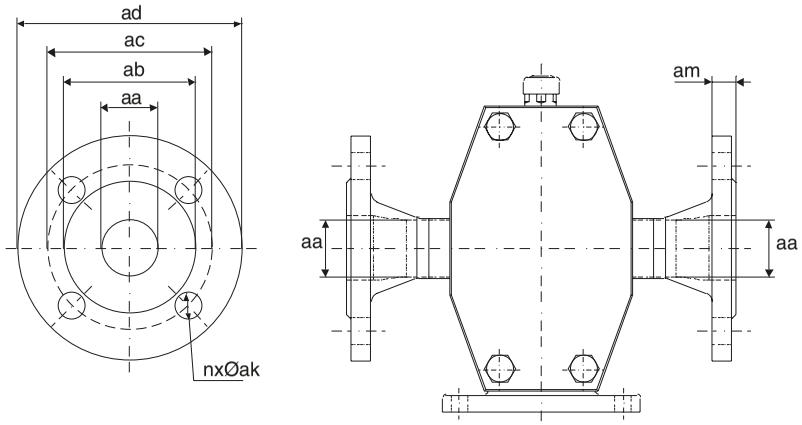


DIN 32676



Dimensions in mm

		TL1/0039 TL1/0100	TL1/0139	TL2/0074	TL2/0234	TL2/0301	TL3/0234	TL3/0677	TL3/0953	TL4/0535	TL4/2316	TL4/3497
Thread connections												
DIN 11851/ DIN 405	d2	Rd 52x1/6	Rd 65x1/6	Rd 52x1/6	Rd 65x1/6	Rd 78x1/6	Rd 65x1/6	Rd 78x1/6	Rd 110x1/6	Rd 78x1/6	Rd 130x1/6	Rd 190x1/6
	d1	26	38	26	38	50	38	50	81	50	100	150
	b	14	14	14	14	14	14	14	20	14	20	24
ISO 2853	d2 ±0.08	37.05	52.6	37.05	52.6	64.08	52.6	64.08	91.11	64.08	–	–
	d1	22.6	37.6	22.6	37.6	48.5	37.6	48.5	72.9	48.5	–	–
	b	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	–	–
BS 4825	d2 ±0.15	45.56	58.26	45.56	58.26	72.56	58.26	72.56	97.97	72.56	123.37	–
	d1	22.2	34.9	22.2	34.9	47.6	34.9	47.6	73	47.6	97.6	–
	b	14.3	14.3	14.3	14.3	14.3	14.3	14.3	14.3	14,3	14,3	–
SMS 1145	d2	Rd 40x1/6	Rd 60x1/6	Rd 40x1/6	Rd 60x1/6	Rd 70x1/6	Rd 60x1/6	Rd 70x1/6	Rd 98x1/6	Rd 70x1/6	Rd 132x1/6	–
	d1	22.6	35.5	22.6	35.5	48.5	35.5	48.5	72	48.5	97.6	–
	b	11	15	11	15	15	15	15	19	15	25	–
GAS THREAD ISO 7/1	d2	R 1"	R 1.1/2"	R 1"	R 1.1/2"	R 2"	R 1.1/2"	R 2"	R 3"	R 2"	R 4"	R 6"
	d1	22.6	37.6	22.6	37.6	48.5	37.6	48.5	72	48.5	97.6	150
	b	14	14	14	14	14	14	14	20	14	20	20
DS 722	d2	Rd 44x1/6	Rd 58x1/6	Rd 44x1/6	Rd 58x1/6	Rd 72x1/6	Rd 58x1/6	Rd 72x1/6	Rd 100x1/6	Rd 72x1/6	–	–
	d1	22.6	35.5	22.6	35.5	48.5	35.5	48.5	72	48.5	–	–
	b	13.5	13.5	13.5	13.5	15.5	13.5	15.5	16.5	15.5	–	–
NPT THREAD ASA B 2.1	d2	1" NPT	1.1/2" NPT	1" NPT	1.1/2" NPT	2" NPT	1.1/2" NPT	2" NPT	3" NPT	2" NPT	4" NPT	6" NPT
	d1	22.6	37.6	22.6	37.6	48.5	37.6	48.5	72	48.5	97.6	150
	b	14	14	14	14	14	14	14	20	14	20	20
Clamp connections												
ISO 2852	d2	50.5	64	50.5	64	64	64	64	91	64	119	–
	d1	22.6	37.6	22.6	37.6	48.5	37.6	48.5	72.9	48.5	97.6	–
SMS 3017	d2	50.5	50.5	50.5	50.5	64	50.5	64	91	64	119	–
	d1	22.6	35.6	22.6	35.6	48.5	35.6	48.5	72.9	48.5	97.6	–
DIN 32676	d2	50.5	50.5	50.5	50.5	64	50.5	64	106	64	119	–
	d1	26	38	26	38	50	38	50	81	50	100	–



Dimensions in mm

		TL1/0039	TL1/0100	TL1/0139	TL2/0074	TL2/0234	TL2/0301	TL3/0234	TL3/0677	TL3/0953	TL4/0535	TL4/2316	TL4/3497
aa		20	22.6	37.6	22.6	37.6	48.5	37.6	48.5	72	48.5	97.6	150
ab	PN16	–	68	88	–	88	102	–	102	138	–	158	212
	PN25	68	–	–	68	–	–	88	–	–	102	–	–
	ANSI Class 150	–	50.8	73	–	73	92.1	–	92.1	127	–	157.2	215.9
	ANSI Class 300	50.8	–	–	50.8	–	–	73	–	–	92.1	–	–
ac	PN16	–	85	110	–	110	125	–	125	160	–	180	240
	PN25	85	–	–	85	–	–	110	–	–	125	–	–
	ANSI Class 150	–	79.4	98.4	–	98.4	120.7	–	120.7	152.4	–	190.5	241.3
	ANSI Class 300	88.9	–	–	88.9	–	–	114.3	–	–	127	–	–
ad	PN16	–	115	150	–	150	165	–	165	200	–	220	285
	PN25	115	–	–	115	–	–	150	–	–	165	–	–
	ANSI Class 150	–	108	127	–	127	152.4	–	152.4	190.5	–	228.6	279.4
	ANSI Class 300	124	–	–	124	–	–	155.5	–	–	165	–	–
nxØak	PN16	–	4xØ14	4xØ18	–	4xØ18	4x∆18	–	4xØ18	8xØ18	–	8xØ18	8xØ22
	PN25	4xØ14	–	–	4xØ14	–	–	4xØ18	–	–	4xØ18	–	–
	ANSI Class 150	–	4xØ15.9	4xØ15.9	–	4xØ15.9	4x∆19.1	–	4xØ19.1	4xØ19.1	–	8xØ19.1	8xØ22.2
	ANSI Class 300	4xØ20	–	–	4xØ20	–	–	4xØ22	–	–	8xØ20	–	–
am	PN16	–	16	16	–	16	18	–	18	20	–	20	22
	PN25	18	–	–	18	–	–	18	–	–	20	–	–
	ANSI Class 150	–	14.3	17.5	–	17.5	19.1	–	19.1	23.8	–	23.8	25.4
	ANSI Class 300	17.5	–	–	17.5	–	–	20.6	–	–	22.4	–	–

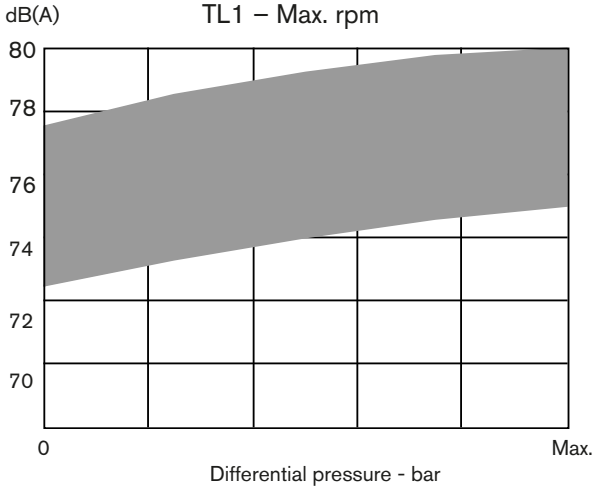
3.5 Weights

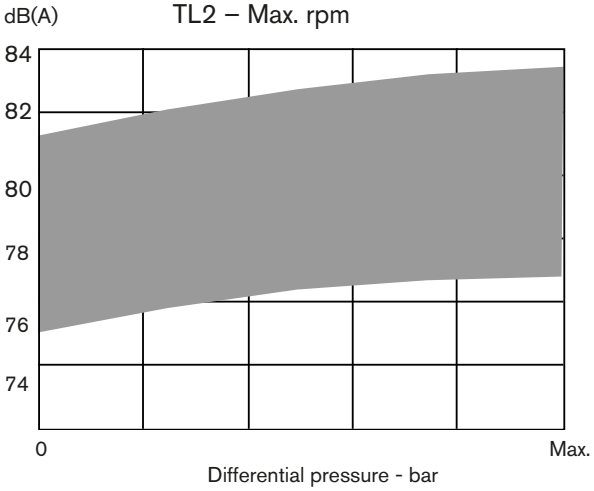
3.5.1 Weights standard pump

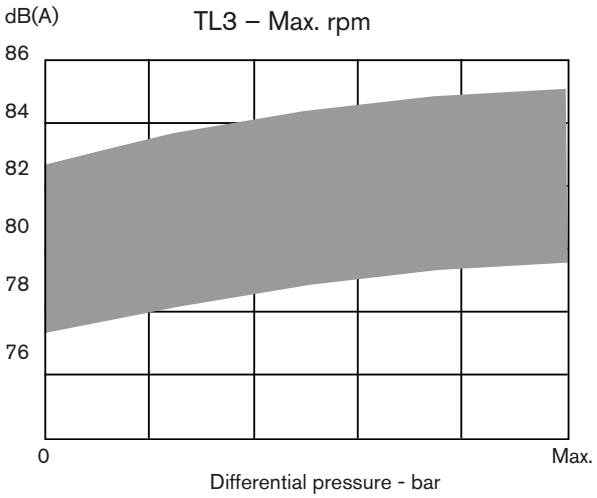
Pump type	Standard pump weight	Vertical mounting weight
TL1/0039	17	17
TL1/0100	17	17
TL1/0139	18	18
TL2/0074	27	27.5
TL2/0234	27	27.5
TL2/0301	28	28.5
TL3/0234	69	71.5
TL3/0677	70	72.5
TL3/0953	72	74.5
TL4/0535	188	197
TL4/2316	188	197
TL4/3497	188	197

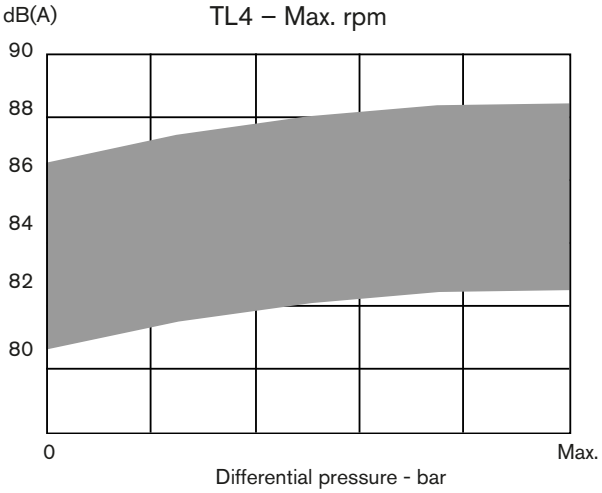
All weights in daN, mass is kg

3.6 Sound level









3.7 Solid particles

Pump type	Nominal internal diameter connection [mm]	Max theoretical particle size [mm]	Recommended max particle size [mm]
TL1/0039	20	9.8	3
TL1/0100	26	20.6	7
TL1/0139	38	20.6	7
TL2/0074	26	12.2	4
TL2/0234	38	25.6	9
TL2/0301	50	25.6	9
TL3/0234	38	18.4	6
TL3/0677	50	38.5	13
TL3/0953	81	38.5	13
TL4/0535	50	21.8	7
TL4/2316	100	45.6	15
TL4/3497	150	45.6	15

4.0 Disassembly and assembly instruction

4.1 Tools to be used

Type	Size or range	TL 1	TL 2	TL 3	TL 4
Combination spanner	8 mm		x		
Combination spanner	10 mm	x	x	x	x
Combination spanner	17 mm	x			
Combination spanner	19 mm		x		
Combination spanner	20 mm	x	x	x	x
Combination spanner	24 mm	x	x	x	x
Combination spanner	30 mm				x
Hexagon key	3 mm	x			
Hexagon key	4 mm	x	x	x	x
Hexagon key	5 mm	x	x	x	
Hexagon key	6 mm	x		x	x
Hexagon key	7 mm	x	x	x	x
Hexagon key - Socket driven	4 mm	x			
Hexagon key - Socket driven	5 mm	x	x	x	
Hexagon key - Socket driven	6 mm	x		x	x
Hexagon key - Socket driven	8 mm		x		
Hexagon key - Socket driven	10 mm	x	x	x	x
Hexagon key - Socket driven	17 mm	x			
Hexagon key - Socket driven	19 mm		x		
Hexagon key - Socket driven	20 mm	x	x	x	x
Hexagon key - Socket driven	24 mm	x	x	x	x
Hexagon key - Socket driven	30 mm				x
Torque wrench	Adjustable up to min 40 NM	x			
Torque wrench	Adjustable up to min 70 NM		x		
Torque wrench	Adjustable up to min 170 NM			x	
Torque wrench	Adjustable up to min 350 NM				x
Depth micrometer	0 – 25 mm	x	x	x	x
Feeler gauge set	–	x	x	x	x
Socket for rotor retainer	Supplied with pump	x	x	x	x
Hooker spanner	HN5	x			
Hooker spanner	HN6		x		
Hooker spanner	HN9			x	
Hooker spanner	HN15				x
Soft-faced mallet	–	x	x	x	x
Steel hammer	Small	x	x	x	x
Circlip pliers	–	x	x	x	
Screw driver	–	x	x	x	x
Ball bearing extractor	–	x	x	x	x

A selection of special tools is available, see chapter 5.0

4.2 General instructions

Assembly and disassembly may be performed by qualified personnel only. Always wear the appropriate safety clothing. Make sure that the personnel is properly instructed and educated.

Insufficient or wrong assembly and disassembly can lead to the pump malfunction. SPX is not liable for accidents and damage caused by non-compliance with the guidelines.

Always work in a clean surrounding. Keep all highly sensitive parts such as seals, bearings, etc. in their original packaging as long as possible.

Use a stainless steel work surface.

For maintenance and repair use only appropriate tools that are in good condition.

Check that the parts to be used have not been damaged during transport.

Never work on the pump in operation. In case of a disassembled pump, avoid any contact with the rotors when turning the shaft manually.

Do not forget that the pump can be started even when the pump cover has been removed for e.g. cleaning. Never run the pump without pump cover.

After disassembly carefully clean the parts and check them for damage, especially the mounting surfaces, and replace all damaged parts.

All parts fitted together at the disassembly must stay together when reinstalled, especially the rotors, shafts, bearings and shims.

4.3 O-rings and lip seals

When working with lip seals or O-rings, take care not to damage them as they pass over any sharp edges of splines, threads, etc. Be sure that the O-rings are not twisted in the groove when installing.

All O-rings and sealing lips should be lightly lubricated with a suitable lubricant before fitting, e.g. soap water.

For O-rings made of PTFE, it is advised to heat them up in hot water before placement. A warmed up O-ring becomes more soft, thus easier to install.

4.4 Shutdown

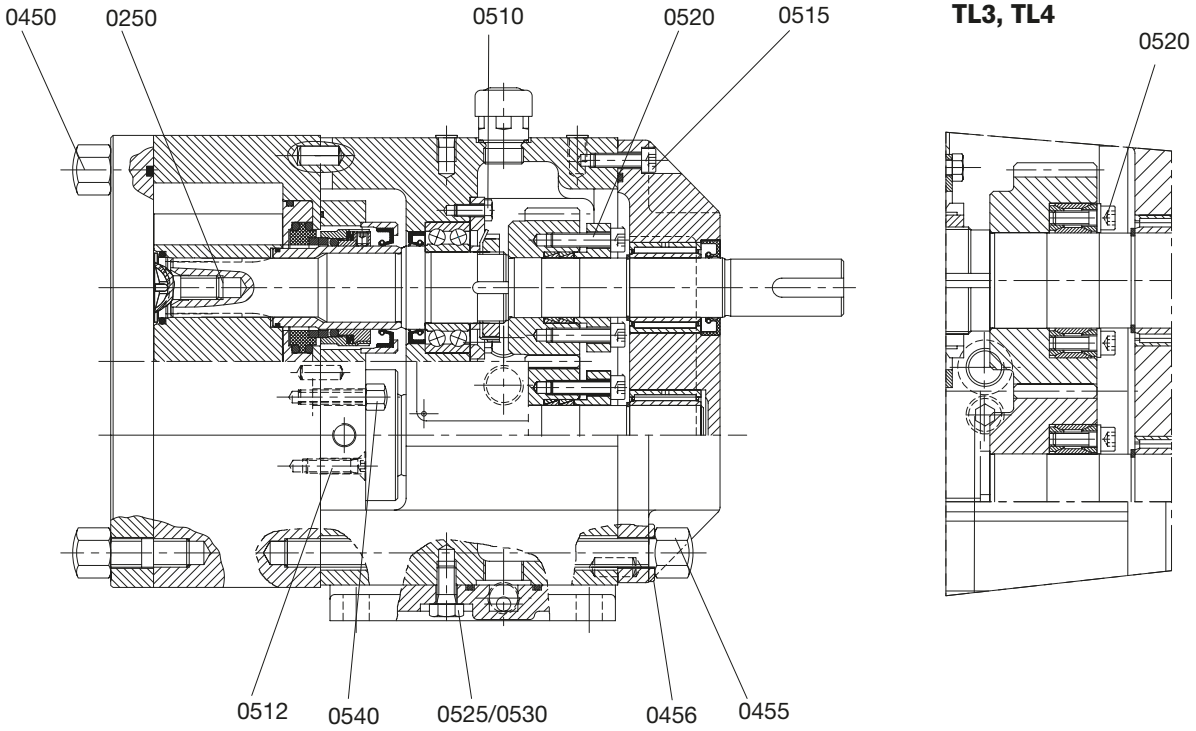
Before starting the maintenance or inspection, follow the next steps to shut down the pump.

1. Stop the pump. To prevent the motor from starting while you are working on the pump follow the procedure below:
   a) Turn off the pump at the electrical cabinet
   b) Set the pump circuit breaker to off
   c) Secure the circuit breaker from switching on with a lock. If not possible take the fuses with you to the working place. Sign the electrical cabinet “out of work”
   d) Remove, if necessary, the protection around the mechanical coupling only when the pump has come to a complete standstill.
2. Let the pump cool down to the ambient temperature, if suitable for the liquid being pumped.
3. Isolate and depressurise flushed product auxiliary services.
4. Close both suction and discharge valves.
5. Drain and purge the pump head and pipe work.
6. Clean the pump externally before disassembly.

4.5 Tightening torque [Nm] for nuts and screws

		TL1		TL2	
Pos.	**Description**	**Dimension**	**Torque**	**Dimension**	**Torque**
0250	Retainer	M10 (X-3CrNiMoN27.5.2)	36	M10 (X-3CrNiMoN27.5.2)	36
0450	Cap nut	M10-M-DIN917 (A4)	41	M12-M-DIN917 (A4)	71
0455	Cap nut	M10-M-DIN917 (A4)	41	M12-M-DIN917 (A4)	71
0510	Screw	M 5X 12-M-(8.8)	4.9	M 5X 12-M-(8.8)	4.9
0512	Screw	M 6X 20-DIN7991-(A4)	8.5	M 6X 25-DIN7991-(A4)	8.5
0515	Screw	M 6X 16-M-(A4)	8.5	M 6X 20-M-(A4)	8.5
0520	Screw	M 5X 20-M-DIN912 (12.9)	8.5	M 6X 25-M- (12.9)	14
0525	Screw	M 8X 16-M-(8.8)	20.6	M 8X 16-M-(8.8)	20.6
0525	Screw	M 8X 30-M-(8.8)	20.6	M 8X 30-M-(8.8)	20.6
0540	Cap nut	M 6-M-DIN917 (A4)	8.5	M 6-M-DIN917 (A4)	8.5

		TL3		TL4	
Pos.	**Description**	**Dimension**	**Torque**	**Dimension**	**Torque**
0250	Retainer	M16 (X-3CrNiMoN27.5.2)	147	M16 (X-3CrNiMoN27.5.2)	147
0450	Cap nut	M16-M-DIN917 (A4)	172	M20-M-DIN917 (A4)	347
0455	Cap nut	M16-M-DIN917 (A4)	172	M20-M-DIN917 (A4)	347
0510	Screw	M 6X 16-M-(8.8)	8.5	M 8X 20-M-(8.8)	20.6
0512	Screw	M 8X 30-M-(A4)	20.6	M 8X 30-M-(A4)	20.6
0515	Screw	M 8X 25-M-(A4)	20.6	M 8X 30-M-(A4)	20.6
0520	Screw	M 6X 18-M-DIN912 (12.9)	14	M 8X 22-M-DIN912 (12.9)	21
0525	Screw	M 8X 16-M-(8.8)	20.6	M 12X 20-M-(8.8)	71
0525	Screw	M 8X 30-M-(8.8)	20.6	M 12X 40-M-(8.8)	71
0530	Screw	–	–	M 16X 25-M-(8.8)	172
0530	Screw	–	–	M 16X 35-M-(8.8)	172
0540	Cap nut	M 6-M-DIN917 (A4)	8.5	M 6-M-DIN917 (A4)	8.5

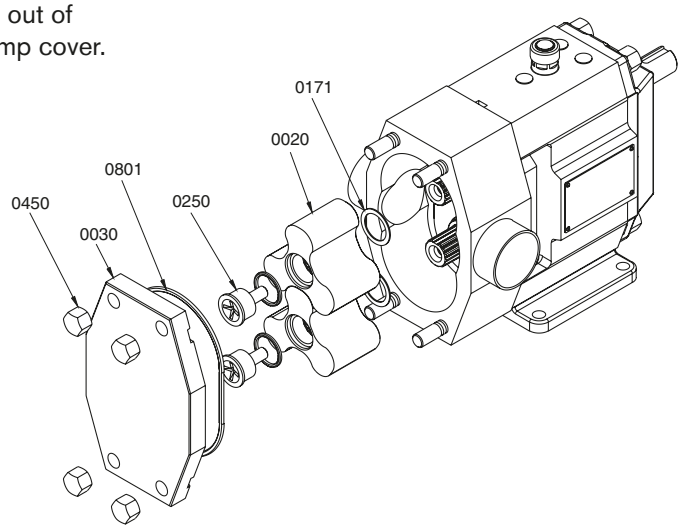


4.6 Disassembly

See also section 4.2 General instructions, section 4.3 O-rings and lip seals, 4.4 Shut down and 4.5 Tightening torque for nuts and screws.

4.6.1 Pump cover and rotor removal

Do not forget that liquid may still flow out of the rotor case when removing the pump cover.



1. Remove the cap nuts (0450).
2. Grooves are provided along the circumference to permit removing pump cover (0030) with aid of e.g. a screwdriver. Check the O-ring (0801).
3. Lock rotors (0020) against rotation by putting a block of soft material between them.
4. Unscrew retainer (0250) counter clockwise by using the retainer tool.
5. Remove the rotor (0020).

Retainer tool

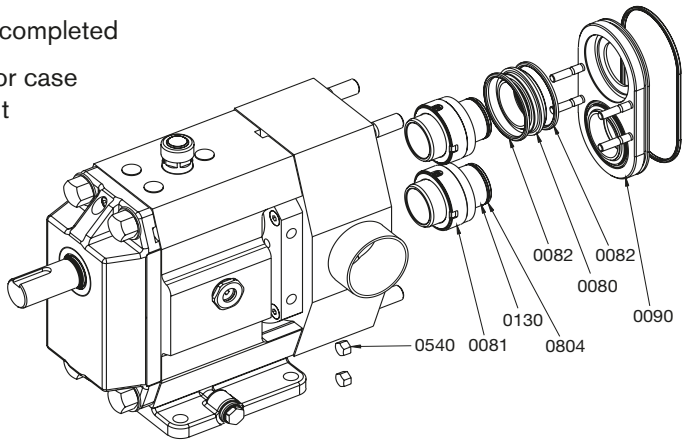
Note! If lip seals are installed, the shaft sleeves might come out together with the rotor. Take care not to drop the shaft sleeves.

6. Make sure that the shims (0171) remain in place.
7. Remove the second rotor in the same way.

4.6.2 Disassembly of seals

Only if section 4.6.1 has been completed

It is possible to remove the rotor case including seal assembly without dismantling the seals first.



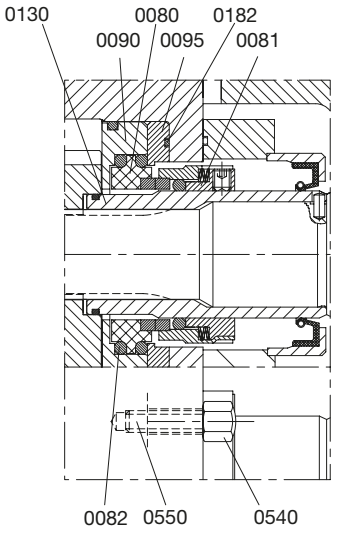
4.6.2.1 Single mechanical seal

1. Unscrew the cap nuts (0540) from the stud bolts (0550).
2. Remove the seal cover (0090) by pushing from the rear end on the stud bolts (0550).
3. Remove the stationary part (0080) and O-rings (0082) of both mechanical seals from seal cover.

Pumps without positioning plate (0095), go to point 5

Pumps with positioning plate (0095) – TL2/0074 + TL3/0234

4. Remove positioning plate (0095) and O-ring (0182) from the rotor case
5. Remove the shaft sleeves (0130) together with the rotating part of the mechanical seal.
6. Remove the rotating part of the seal (0081) from each shaft sleeve

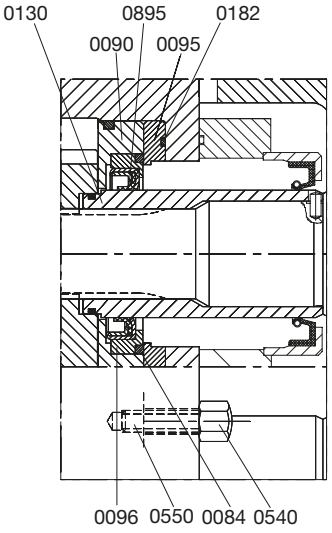


4.6.2.2 Lip Seal

1. Unscrew the cap nuts (0540) from the stud bolts (0550).
2. Remove the seal cover (0090) by pushing from the rear end on the stud bolts.
3. Remove the shaft sleeves (0130).
4. Remove lip seal (0895), support ring for lip seal (0096) and O-ring (0084) (and O-ring 0082 on TL4) from the seal cover.
   For TL3 positions (0096) and (0084) not applicable.

Pumps with positioning plate (0095) – TL2/0074 + TL3/0234

5. Remove positioning plate (0095) and O-ring (0182) from the rotor case.

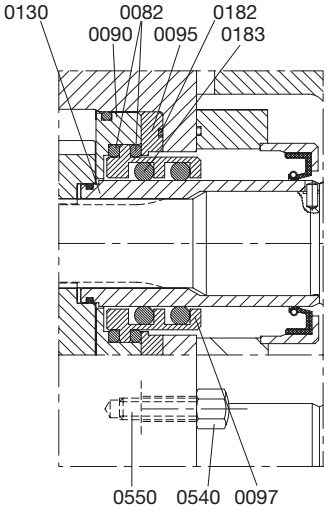


4.6.2.3 O-ring seal

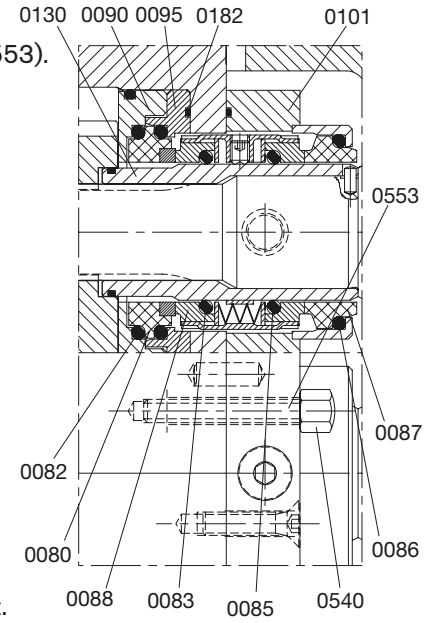
1. Unscrew the cap nuts (0540) from the stud bolts (0550).
2. Remove the seal cover (0090) by pushing from the rear end on the stud bolts.
3. Remove the shaft sleeves (0130).
4. Remove support ring with O-ring seal (0097, 0183) and O-rings (0082) from the seal cover.

Pumps with positioning plate (0095) – TL2/0074 + TL3/0234

5. Remove positioning plate (0095) and O-ring (0182) from the rotor case.



4.6.2.4 Double mechanical seal



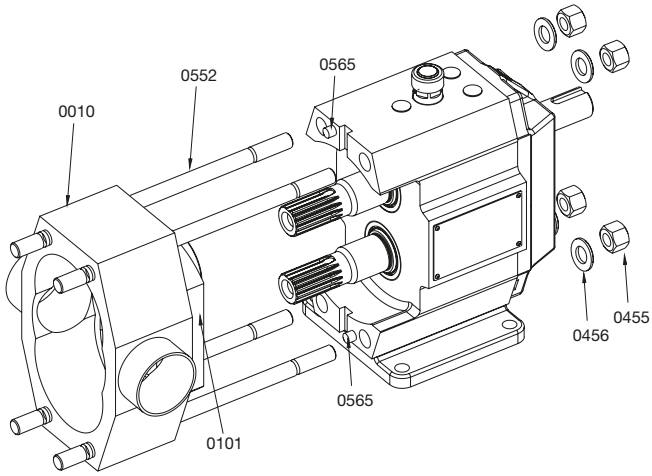
1. Unscrew the cap nuts (0540) from the stud bolts (0553).
2. Remove the seal cover (0090) by pushing from the rear end on the stud bolts.
3. Remove the first stationary part (0080) and O-rings (0082) of both mechanical seals from seal cover.

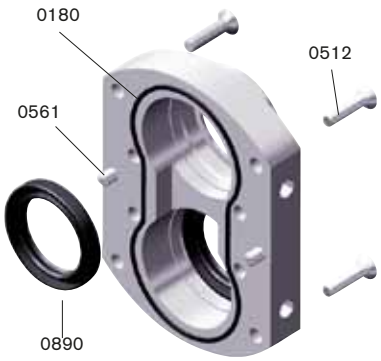
Pumps without positioning plate (0095), got to point 5

Pumps with positioning plate (0095) – TL2/0074 + TL3/0234

4. Remove positioning plate (0095) and O-ring (0182) from the rotor case.
5. Remove the shaft sleeves (0130) together with the complete rotating part of the mechanical seal.
6. Take care not to loose the springs of the rotating part. ***(TL2/0074, TL2/0234, TL2/0301, TL3/0234, TL3/0677, TL3/0953, TL4/0535, TL4/2316, TL4/3497)***
7. Remove the second stationary part (0087) of the mechanical seal with O-rings (0086) from the flushing cover (0101).
8. Remove both seal faces of the rotating parts (0088) with O-rings (0083 and 0085) from the shaft sleeves.
9. Remove the drivers of the rotating part from the shaft sleeves.

4.6.3 Rotor case and Flushing cover disassembly





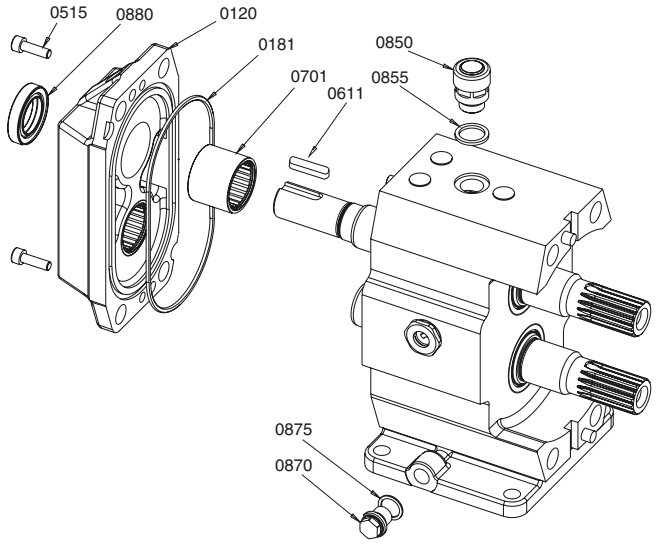
1. Unscrew the cap nuts (0455) on the back of the pump. Remove the washers (0456).
2. Remove rotor case (0010) by tapping with a plastic hammer on the stud bolts (0552).

Note! *If a flushing cover (0101) is installed, it can be disassembled from the rotor case by removing the screws (0512) after disassembly of the rotor case. The flushing cover is positioned with pins (0561).*

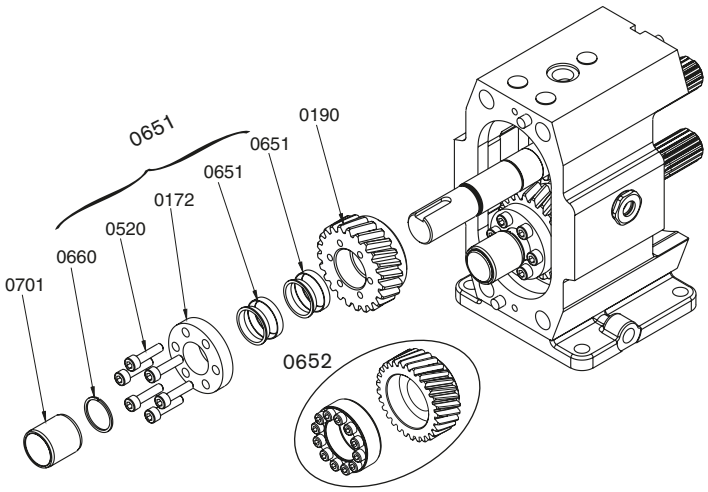
For flushing cover service, remove lip seals (0890) and O-ring (0180).

4.6.4 Gearbox disassembly

Only if section 4.6.1 – 4.6.3 have been completed.



1. Remove key (0611).
2. Remove oil drain plug (0870) with sealing ring (0875) and open the air breather (0850) with sealing ring (0855), drain oil into an appropriate container.
3. Untighten the screws (0515).
4. Remove gearbox cover (0120). Grooves are provided along the circumference to permit removing cover with aid of e.g. a screwdriver. Pay attention to the bearings (0701), lip seal (0880) and O-ring (0181).



TL1, TL2

5. Untighten the screws (0520) crosswise in several steps to release the locking elements (0651) from the gear.

TL3, TL4

5. Loosen the screws of the locking assembly (0652) crosswise in several steps to release it from the gear. The locking assembly is self releasing.

TL1, TL2, TL3

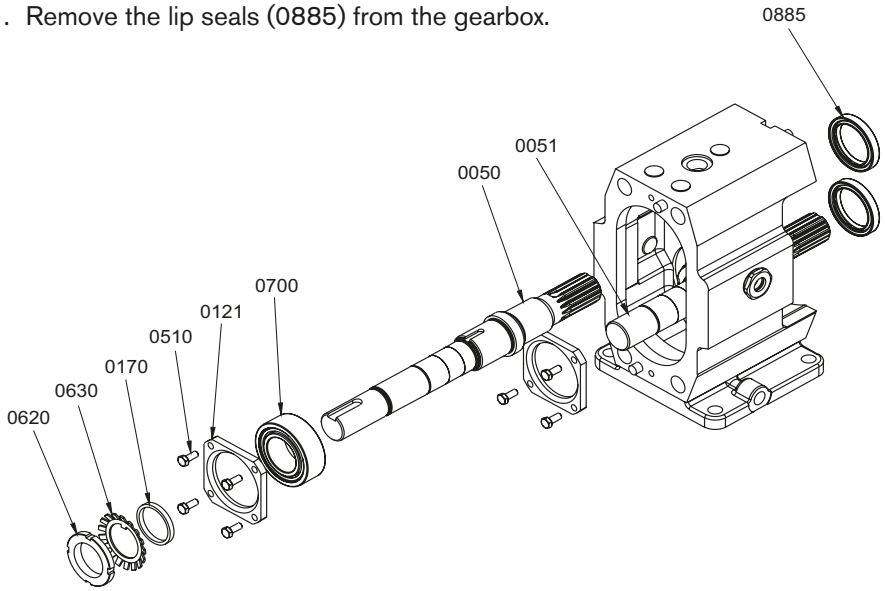
6. Remove the circlips (0660) from the shaft.
   Remove the inner ring of the bearing (0701) from the shaft by using an arm puller.

TL4

6. Remove the cylinder bearing from the shaft.

Common for TL1, TL2, TL 3 and TL4

7. Remove the gear (0190) together with the locking elements (0651) from the shaft. (For TL3, TL4 locking assembly (0652).
   If necessary, hit gear with plastic hammer to loosen the locking elements.
8. Do this for both shafts.
9. Remove the screws (0510) and bearing covers (0121).
10. Pull out the shaft while tapping with a plastic hammer smoothly on the rotor side of the shaft.
11. Remove the lip seals (0885) from the gearbox.



TL1, TL2

12. Unlock the locking washer (0630) by bending the tooth straight.
13. Unlock the locking nut (0620)
14. Remove the locking washer and spacer sleeve (0170) from the shaft. The bearing (0700) can now be removed from the shaft.

TL3

12. Unlock the locking washer (0630) by bending the tooth straight.
13. Unlock the locking nut (0620)
14. Remove the locking washer from the shaft. The bearing (0700) can now be removed from the shaft.

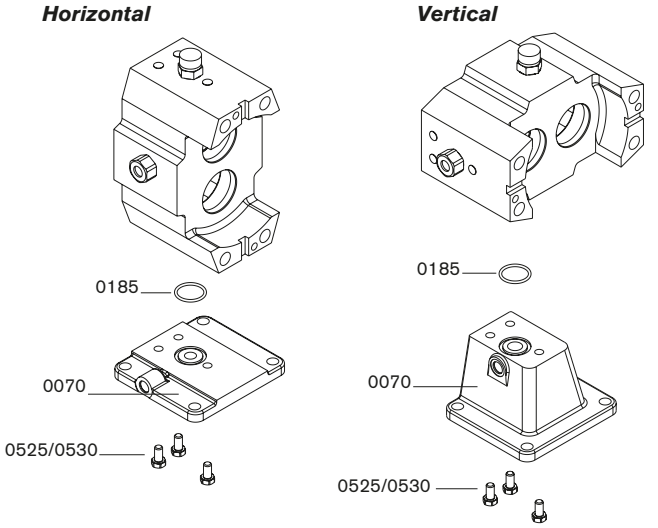
TL4

12. Loosen the set screws of the locking nut (0620)
13. Unlock the locking nut (0620). The bearing (0700) can now be removed from the shaft.

Notes! *If the bearing (0700) need to be replaced, also the needle bearing (0701) should be replaced. In this case, remove the needle bearings from the gearbox cover by using Tool (ball bearing extractor).*

4.6.5 Foot disassembly

1. Remove screws (0525 and/or 0530) and the foot (0070).
   Pay attention to O-ring (0185).

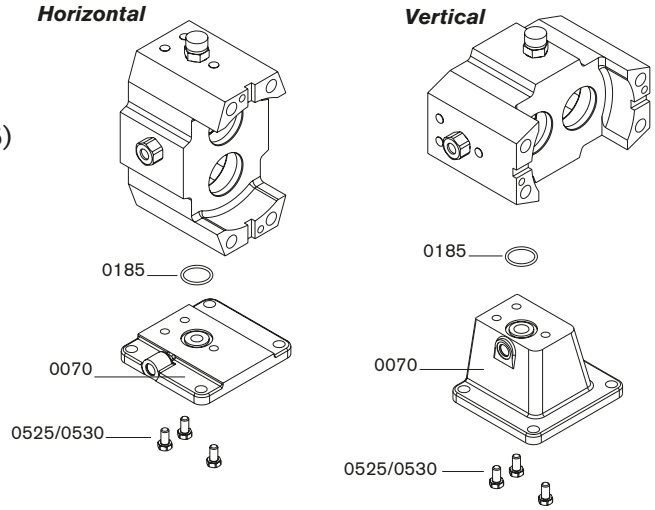


4.7 Assembly

See also section 4.2 General instructions, section 4.3. O-rings and lip seals and 4.5 Tightening torque for nuts and screws.

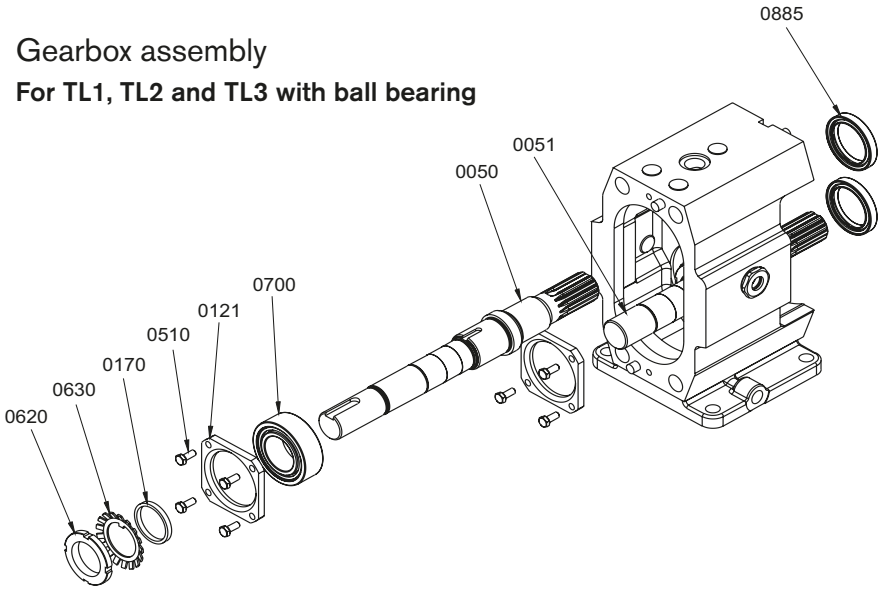
4.7.1 Foot assembly

1. Put the O-ring (0185) in the foot.
   Place the foot on the gearbox and tighten with screws (0525) and/or (0530).
2. Secure the screws with Loctite 243.



4.7.2 Gearbox assembly

For TL1, TL2 and TL3 with ball bearing

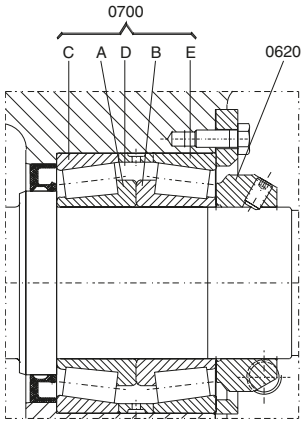


1. Position the lip seals (0885) inside the gearbox.
2. Heat the bearings (0700) up to 100°C. Fit the bearing to the lay shaft (0051) ensuring it is pushed properly against the shaft shoulder.
3. TL1 and TL2. Put the spacer sleeve (0170) over the lay shaft (0051).
4. Secure the bearing with locking washer (0630) and the nut (0620). Use Loctite 243 to glue the nut (0620) on the shaft. Secure the nut by bending one tooth of the locking washer.
5. Fit the second bearing on the drive shaft (0050) in the same way.
6. Insert both shafts with the bearings into the gearbox while tapping smoothly on the external bearing ring. (Pay attention to position of drive shaft.) Be sure not to damage the seals (0885).

Continue with point 7.

For TL4 with taper roller bearing

1. Position the lip seals (0885) inside the gearbox.
2. Heat the bearing inner rings with rollers (A and B) up to 100°C. Fit the inner rings to the lay shaft (0051) ensuring they are pushed properly against the shaft shoulder.
3. Secure the bearing inner rings with the nut (0620). Secure the nut by tightening the set screws with torque 18 Nm.
4. Fix the bearing inner rings on the drive shaft (0050) in the same way.
5. Remove the first two bearing outer rings (C) from the lay shaft and drive shaft in the gearbox together with the two bearing intermediate rings (D). Insert both shafts in the gearbox and put the last two outer rings (E) in place.



Note! *Be sure that the outer and intermediante rings are always assembled with the original bearing.*

6. Be sure not to damage the seals (0885).

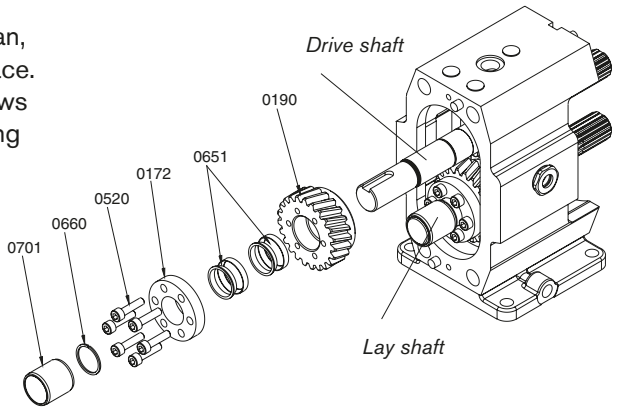
Continue with point 7.

Common for TL1, TL2, TL3 and TL4

7. Place bearing covers (0121) and secure them with the screws (0510).
8. Secure the screws with Loctite 243.

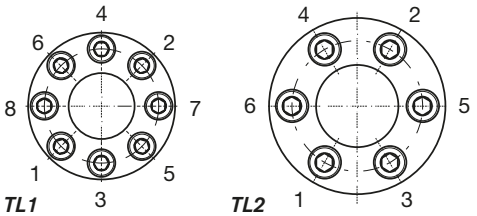
TL1 and TL2

9. Place the gear (0190), with locking elements (0651) and pressure flange (0172) on the lay shaft.
10. Check that the locking elements are clean, lubricate them with oil and fit them in place. Use a torque wrench to tighten the screws (0520) with the specified torque following the tightening sequence shown below.



Tightening torque

Pump	Description	M [Nm]
TL1	Hexagon screw DIN 912 M5x20 (12.9)	8.5
TL2	Hexagon screw DIN 912 M6x25 (12.9)	14

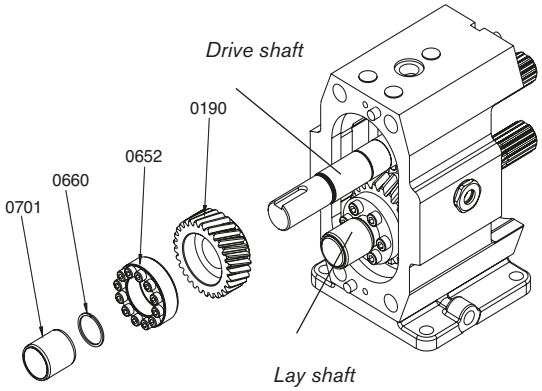


11. Now tighten the screws (0520) of the locking element in the same way as described for the lay shaft.
12. Place the gear (0190), with locking elements (0651) and pressure flange (0172) on the drive shaft.
13. Position the shafts by turning the drive shaft manually as shown in fig "Rotor position" (next page). Put the shaft sleeves and rotors on the shaft. Fix the rotors with the retainer.
14. Check the clearances between the rotors after tightening the locking elements. See section 3.1 Rotor clearances.
15. Put the circlips (0660) on the shaft
16. Heat inner ring of the bearing (0701) up to 100°C and push them on both shafts against the circlips.

Continue with point 18.

TL3 and TL4

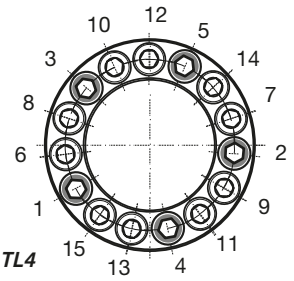
10. Place the gear (0190) with locking assembly (0652) on the lay shaft.
11. Use a torque wrench to tighten the screws of the locking assembly with the specified torque following the tightening sequence shown below.
12. Place the gear (0190) with locking assembly (0652) on the drive shaft.



13. Position the shafts by turning the drive shaft manually as shown in fig "Rotor position". Put the shaft sleeves and rotors on the shaft. Fix the rotors with the retainer.
14. Now tighten the screws of the locking assembly in the same way as described for the lay shaft.

Tightening torque

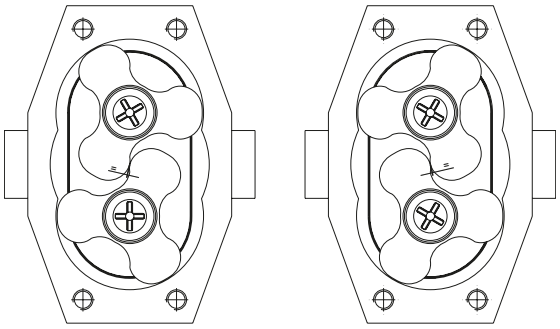
Pump	Description	M [Nm]
TL3	Hexagon screw DIN 912 M6x18 (12.9)	14
TL4	Hexagon screw DIN 912 M8x22 (12.9)	21



TL3, TL4

15. Check the clearances between the rotors, in all rotor positions, after tightening the locking elements. See section 3.1 for Rotor clearances.

“Rotor position”



Only TL3

16. Put the circlips (0660) on the shaft.

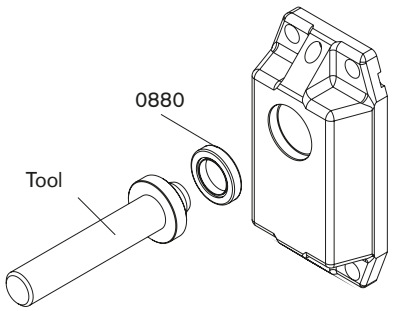
TL3 and TL4

17. Heat inner ring of the bearing (0701) up to 100°C and push them on both shafts. (For TL3 against the circlips).

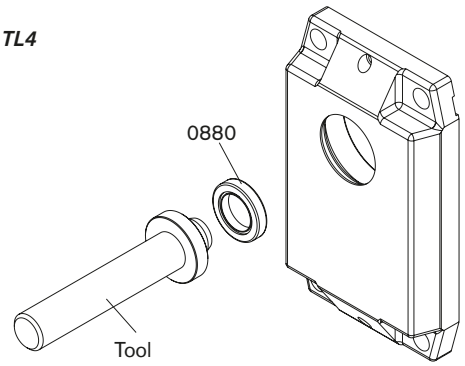
Continue with point 18.

18. Place the lip seal (0880) in the gearbox cover by using tool.

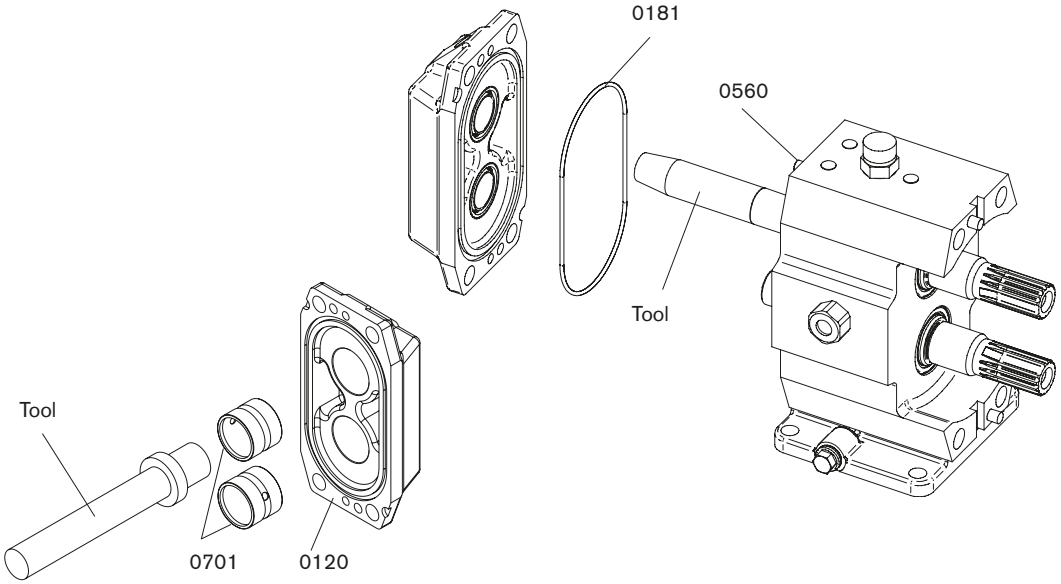
TL1, TL2, TL3



TL4



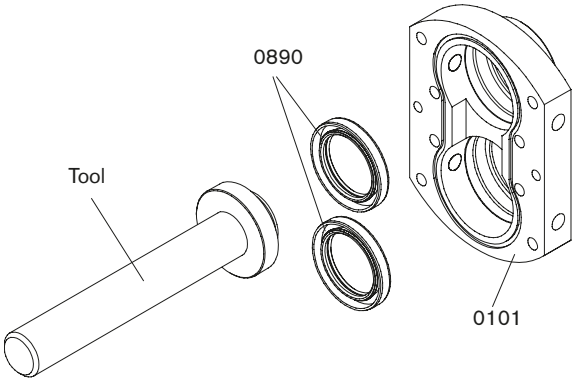
19. Press the external ring of the bearing (0701) by using a tool into the gearbox cover (0120). Surface of the bearing should be aligned with the surface of the gearbox cover.
20. Put the gearbox cover by using tool into position by smoothly tapping with a plastic hammer on the cover. Be sure that the pins (0560) and the O-rings (0181) are in the correct position.



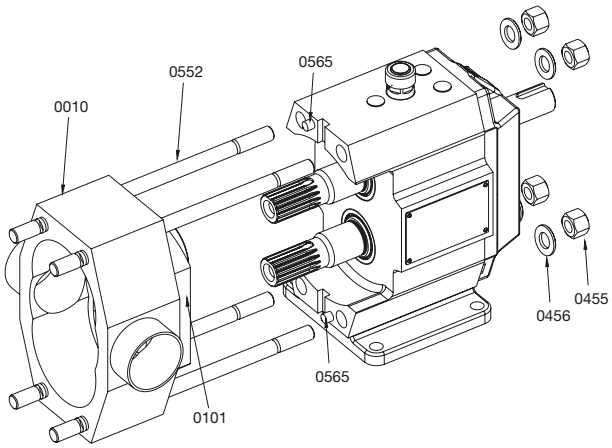
21. Check proper running of the gears (no "heavy points") by measuring axial run out of the gears (max 0.05 mm).
22. If the gears cannot be turned smoothly remove the gearbox cover and re-adjust the gears. If necessary measure the axial run out of the gears
23. Secure the gearbox cover with the screws (0515).
24. Place key (0611).
25. Fit the oil drain plug (0870) and oil level glass (0860) and fill the gearbox with oil. See section 3.2 Lubricants.
26. Fit the air breather (0850).

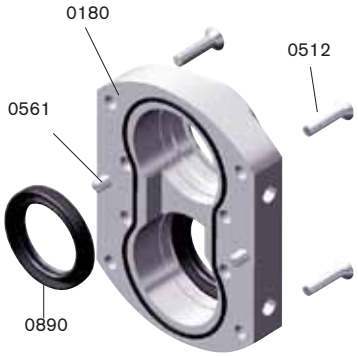
4.7.3 Flushing cover assembly

1. Install the lip seals (0890) in the flushing cover (0101) by using tool.
2. Install the flushing cover (0101) and O-ring (0180) in the rotor case (0010) with the screws (0512). Be sure that the pins (0561) are in the correct position.



Extra for TL4 with flushing cover
Fit the V-seals (0925) on the shaft ensuring they are pushed properly against the back of flushing cover.





4.7.4 Rotor case assembly

1. Screw the stud bolts (0552) in the rotor case in case they have been removed.
2. Put the rotor case in position by smoothly tapping with a plastic hammer on it. Be sure that the pins (0565) are in correct position.
3. Place the washers (0456) and tighten the cap nuts (0455) on the stud bolts (0552).

Note! Be sure to tighten the cap nuts (0455) with the correct torque
(See section 4.5 Tightening torques for nuts and screws).

Extra for TL4 with flushing cover

Ensure that the V-seals are pushed properly against the back of flushing cover.

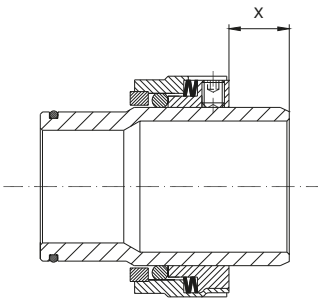
4.7.5 Seal assembly

4.7.5.1 Single mechanical seal - general

1. Put O-ring (0083) in the rotating part (0081) of the seal. Position the rotating part on the shaft sleeve to the correct setting distance (see table).

TL4
When assembling the rotating part of the seal on the shaft sleeve, position the set screws of the seal over the radial holes on the shaft sleeve.

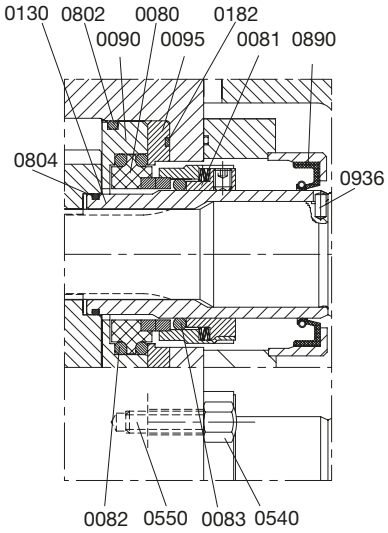
When replacing the shaft sleeve drill radial holes 1 mm deep, Ø 5 mm through threaded holes in rotating part of the seal, finally locking with the set screw, using Loctite 648.



Pump type	Burgmann *) x [mm]	Roplan **) x [mm]	Pump type	Burgman *) x [mm]
TL1/0039	15.9	–	TL3/0234	32
TL1/0100	9.9	–	TL3/0677	20
TL1/0139	9.9	–	TL3/0953	20
TL2/0074	25	29.4	TL4/0535	63.9
TL2/0234	13	17.4	TL4/2316	14.9
TL2/0301	13	17.4	TL4/3497	14.9

*) *Seal marking: Burgmann*
**) *Seal marking: Roplan*

4.7.5.2 Single mechanical seal



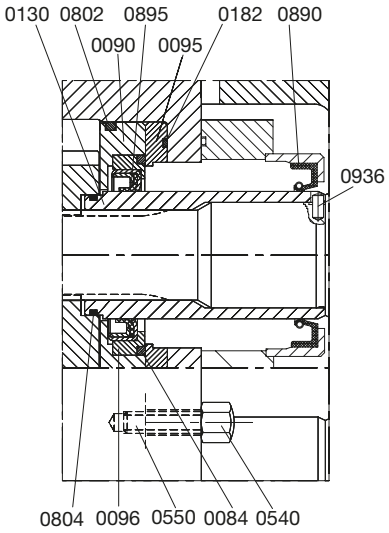
1. See point 1 in section 4.7.5.1
2. Put the shaft sleeve (0130) with the O-ring (0804) on the shaft. Check the position of the lip seal (0890) in case of a flushing cover. Do this for each shaft.
3. Check that pins (0936) fit in the groove of the shaft sleeve.

For pumps without positioning plate (0095), go to point 5.

Pumps with positioning plate (0095)

4. Place the positioning plate (0095) with O-ring (0182) in the rotor case.
5. Place both stationary parts (0080) with O-rings (0082) in the seal cover (0090). Take care not to damage the O-rings.
6. Position the seal cover with O-ring (0802) in the rotor case and secure it with cap nuts (0540) on the stud bolts (0550).

4.7.5.3 Lip seal



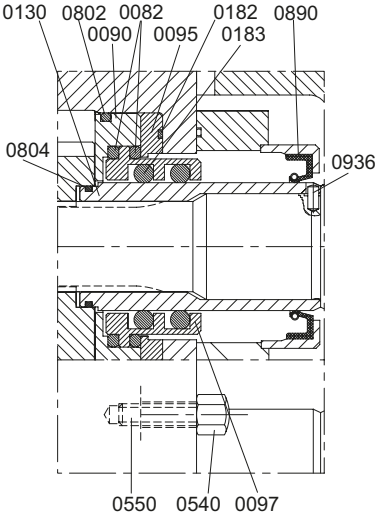
1. Place lip seals (0895) by using Loctite 648 in support rings (0096). Next put both support rings with O-rings (0084) into seal cover (0090). **For TL3 positions (0096) and (0084) not applicable.**

For pumps without positioning plate (0095), go to point 3.

Pumps with positioning plate (0095)

2. Place the positioning plate (0095) with O-ring (0182) in the rotor case.
3. Position the seal cover with O-ring (0802) in the rotor case and secure it with cap nuts (0540) on the stud bolts (0550).
4. Put the shaft sleeves (0130) with the O-ring (0804) on the shaft. Check the position of the lip seal (0890) in the case of a flush cover.
5. Check that the pins (0936) fit in the groove shaft sleeve.

4.7.5.4 O-ring seal



1. Place O-ring seals (0183) in support rings (0097). Next place both support rings with O-rings (0082) into the seal cover (0090).

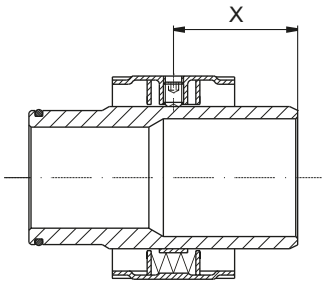
For pumps without positioning plate (0095) go to point 3.

Pumps with positioning plate (0095)

2. Place the positioning plate (0095) with O-ring (0182) in the rotor case.
3. Position the seal cover with O-ring (0802) in the rotor case and secure it with cap nuts (0540) on the stud bolts (0550).
4. Put the shaft sleeves (0130) with the O-ring (0804) on the shaft. Check the position of the lip seal (0890) in the case of a flushing cover.
5. Check that the pins (0936) fit in the groove shaft sleeve.

4.7.5.5 Double mechanical seal

1. Position the drivers of the rotating parts on the shaft sleeve. Setting dimension – see figure below with table.



Pump type	X [mm]
TL2/0074	30.2
TL3/0234	36.85
TL4/0535	71.9
TL4/2316	22.9
TL4/3497	22.9

Pump type	X [mm]
TL2/0234	22.6
TL2/0301	22.6
TL3/0677	28
TL3/0953	28

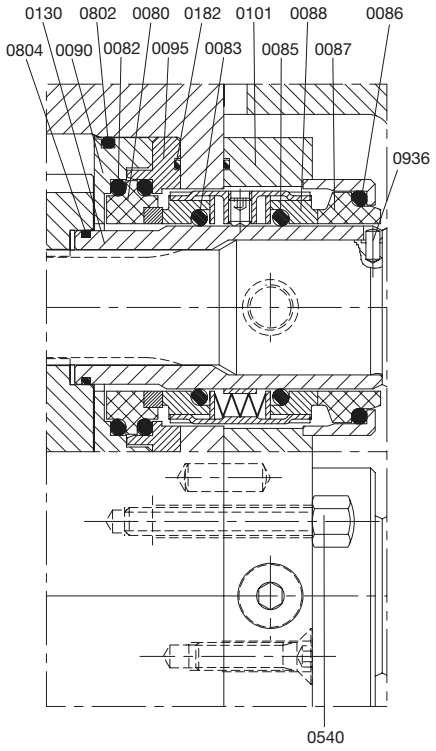
Above types do not have any positioning plate (0095)

2. Push the seal faces (0088) with O-rings (0083 and 0085) from both sides over the shaft sleeve (0130) into the driver.
3. Place the stationary parts of the mechanical seal (0087) with O-ring (0086) into the flushing cover (0101). Check that the O-ring (0086) does not come out on the gearbox side.
4. Place both stationary parts (0080) with O-rings (0082) in seal cover (0090). Take care not to damage the O-rings.
5. Put the sleeves with the O-rings (0804) and rotating part of the seal on the shafts.
6. Check that pins (0936) fit in the groove of the shaft sleeve.
7. **TL2/0074 and TL3/0234**
   Place the positioning plate (0095) with O-ring (0182) in the rotor case.
8. Position the seal cover with O-ring (0802) in the rotor case and secure it with cap nuts (0540) on the stud bolts (0550).

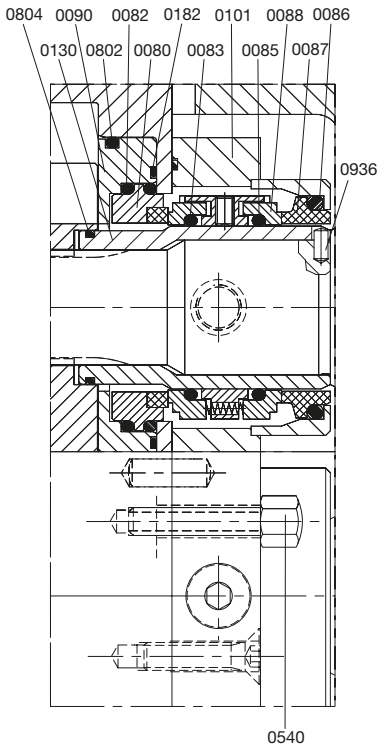
TL4

When assembling the rotating part of the seal on the shaft sleeve, position the set screws of the seal over the radial holes on the shaft sleeve. When replacing the shaft sleeve drill radial holes 1 mm deep, Ø 5 mm through threaded holes in rotating part of the seal, finally locking with the set screw, using Loctite 648.

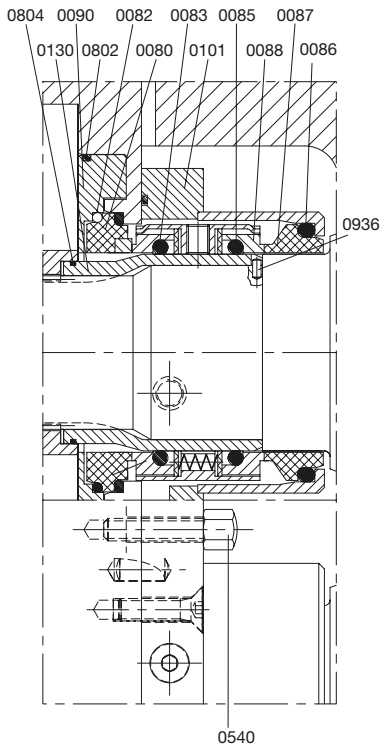
TL2/0074, TL3/0234



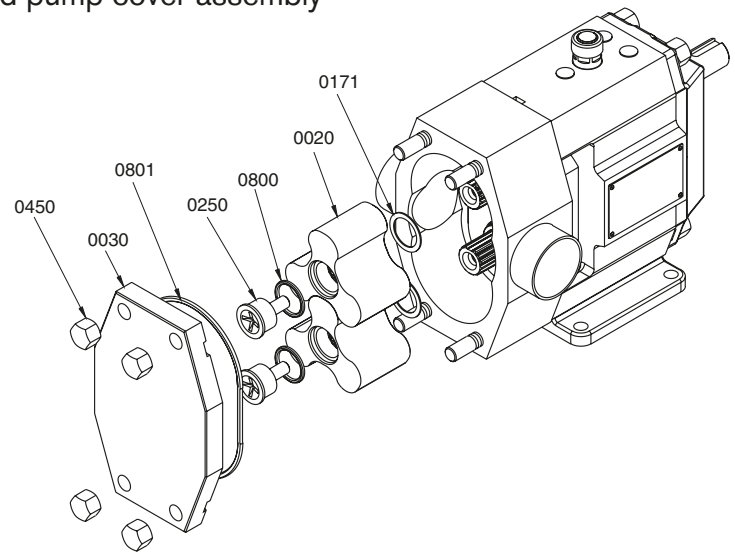
TL2/0234, TL2/0301, TL3/0677, TL3/0953



TL4/0535, TL4/2316, TL4/3497



4.7.6 Rotor and pump cover assembly



1. Place the shims (0171) in chamber in the rotors.
2. Place the rotors (0020) on the shaft. The rotor for the drive shaft is marked with a Δ.
3. Block the rotors against each other by putting a block of soft material between the rotors.
4. Tighten the retainer (0250) clockwise with the correct torque (see section 4.5 Tightening torques for nuts and screws) by using the retainer tool.

Retainer tool

5. Measure the distance between the lobe surface and the mounting surface of the pump cover (0030). Next remove the lobe and peel off the necessary number of layers from the shim (0171) to adjust the distance to the setting dimension given in the table in section 3.1. (Thickness of one layer is 0.05 mm).
6. Reassemble the shim (0171) and rotors (0020), put the O-ring (0800) on the retainer and tighten the retainer (on TL4 use Loctite 243) clockwise with specified torque.
7. Assemble and adjust the second rotor in the same way.
8. Check the clearance between the rotors and the rotor case, see table in section 3.1 Rotor clearances.
9. Place the pump cover (0030) on the rotor case. Be sure that the O-ring (0801) stays in the groove and is not squeezed between pump cover and rotor case.
10. Secure the pump cover with the cap nuts (0450).

5.0 Special tools

5.1 General

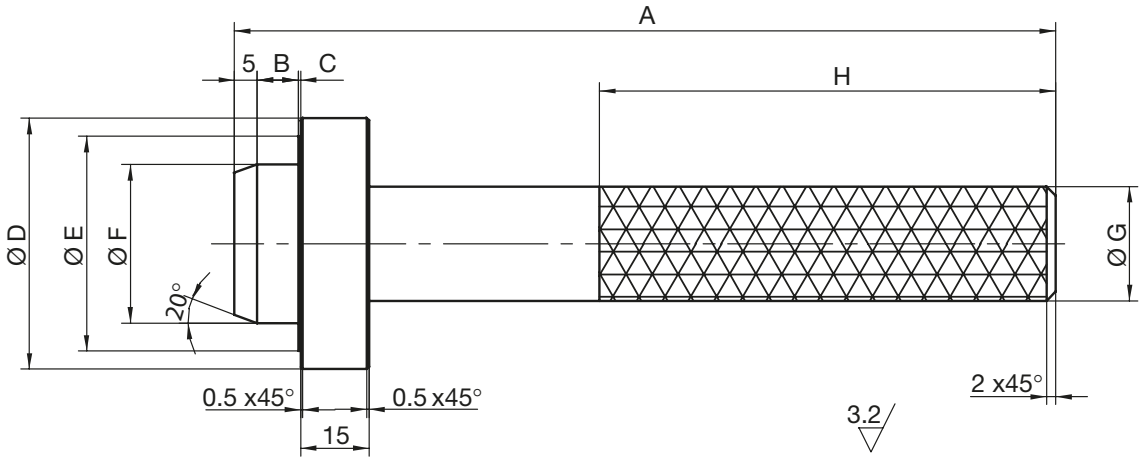
There are a number of special tools available to facilitate assembly of the pumps. By using these tools the risk of damaging sealing element is reduced and the time needed for maintenance and/or repair will be shorter.

These tools can be ordered from SPX or produced in the own workshop.

The article numbers for ordering are indicated in the tables under each drawing/picture together with the dimensions of the tool (if applicable).

5.2 Assembly tool for lip seals

Place: Gearbox
Purpose: For fitting the lip seals into the gearbox (see section 4.7.2)



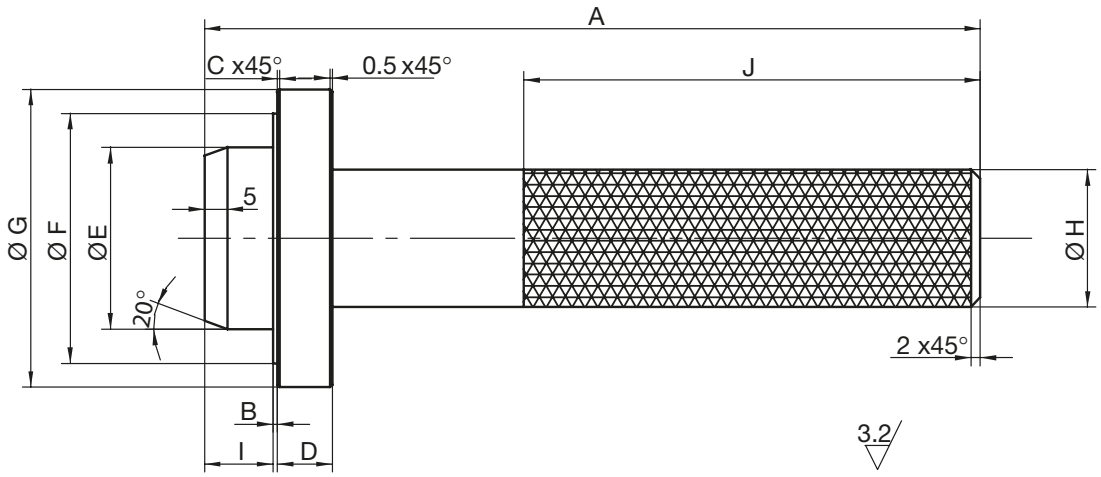
Dimensions in mm

Pump type	Art. No.	A	B	C	D	E	F	G	H
TL1	3.95604.11	160	9	0.5 ±0.1	46.8 +0.1 0	41.9 0 -0.1	29.6 ±0.2	25	100
TL2	3.95605.11	180	9	0.5 ±0.1	54.8 +0.1 0	46.9 0 -0.1	34.6 ±0.2	25	100
TL3	3.95606.11	200	10	1 ±0.1	84.8 +0.1 0	71.9 0 -0.1	54.6 ±0.2	30	120
TL4	3.95607.11	250	10	1 ±0.1	119.8 +0.1 0	109.9 0 -0.1	84.6 ±0.2	30	150

5.3 Assembly tool for lip seal

Place: Gearbox cover

Purpose: For fitting the lip seal into the gearbox cover (see section 4.7.2)



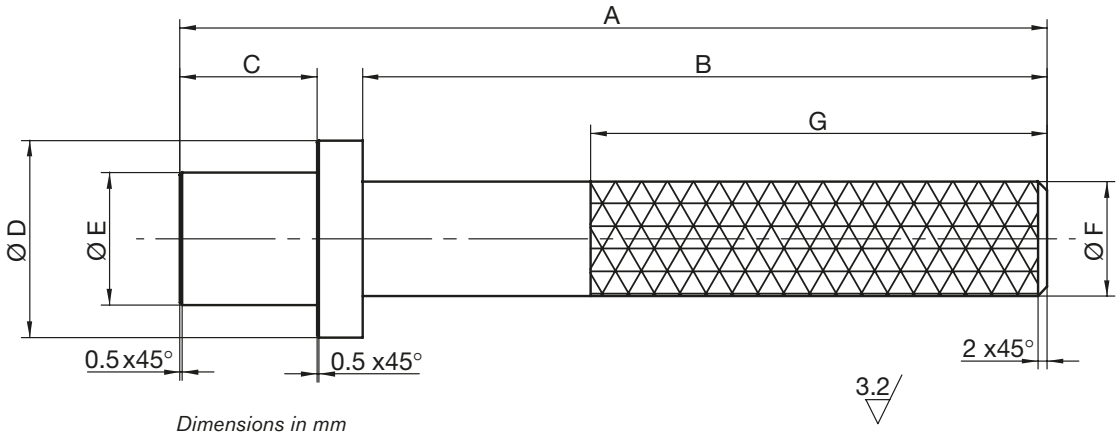
Dimensions in mm

Pump type	Art. No.	A	B	C	D	E	F	G	H	I	J
TL1	3.95608.11	150	1 ±0.1	0.5	10	19.6 ±0.1	34.5 ±0.1	40	25	15	100
TL2	3.95609.11	150	–	0.5	10	24.6 ±0.2	–	45	25	15	100
TL3	3.95610.11	170	1 ±0.1	0.5	12	39.6 ±0.2	54.5 ±0.1	65	30	15	100
TL4	3.95611.11	180	–	–	12	59.5 ±0.2	–	84.9 0 -0.1	30	8	110

5.4 Assembly tool for needle bearings

Place: Gearbox cover

Purpose: For fitting the external ring of the bearing into the gearbox cover (see section 4.7.2)



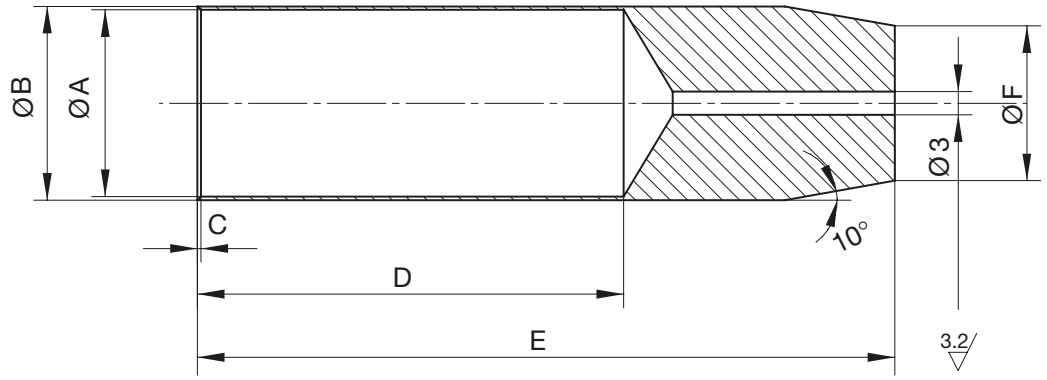
Dimensions in mm

Pump type	Art. No.	A	B	C	D	E	F	G
TL1	3.95600.11	150	120	20	37	23.9 0 -0.1	25	70
TL2	3.95601.11	190	150	30	43	28.9 0 -0.1	25	100
TL3	3.95602.11	200	160	30	60	44.9 0 -0.1	30	100
TL4	3.95603.11	200	160	28	109.8	71.9 0 -0.1	30	100

5.5 Assembly tool for cover

Place: Gearbox

Purpose: For fitting the gearbox cover on the gearbox (see section 4.7.2)



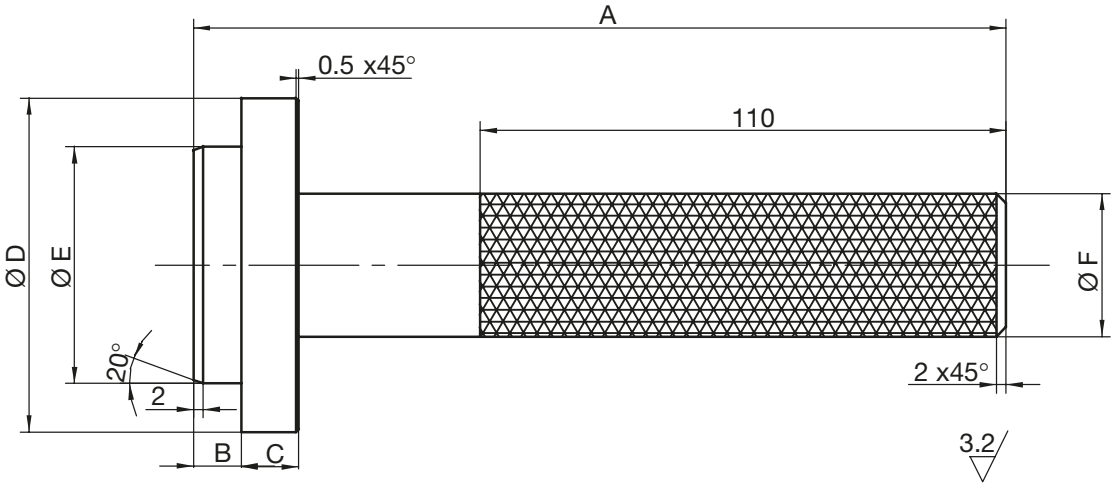
Dimensions in mm

Pump type	Art. No.	A	B	C	D	E	F
TL1	3.95632.11	19.1 ±0.03	20 +0.1 +0.2	0.45 x45°	45	90	15
TL2	3.95633.11	24.1 ±0.03	25 +0.1 +0.2	0.45 x45°	55	90	20
TL3	3.95634.11	38.1 ±0.03	40 +0.1 +0.2	0.95 x45°	85	120	30
TL4	3.95635.11	55.1 ±0.03	60 +0.1 +0.2	2.45 x45°	115	155	50

5.6 Assembly tool for lip seals

Place: Flushing cover

Purpose: For fitting the lip seal into the flushing cover (see section 4.7.3)

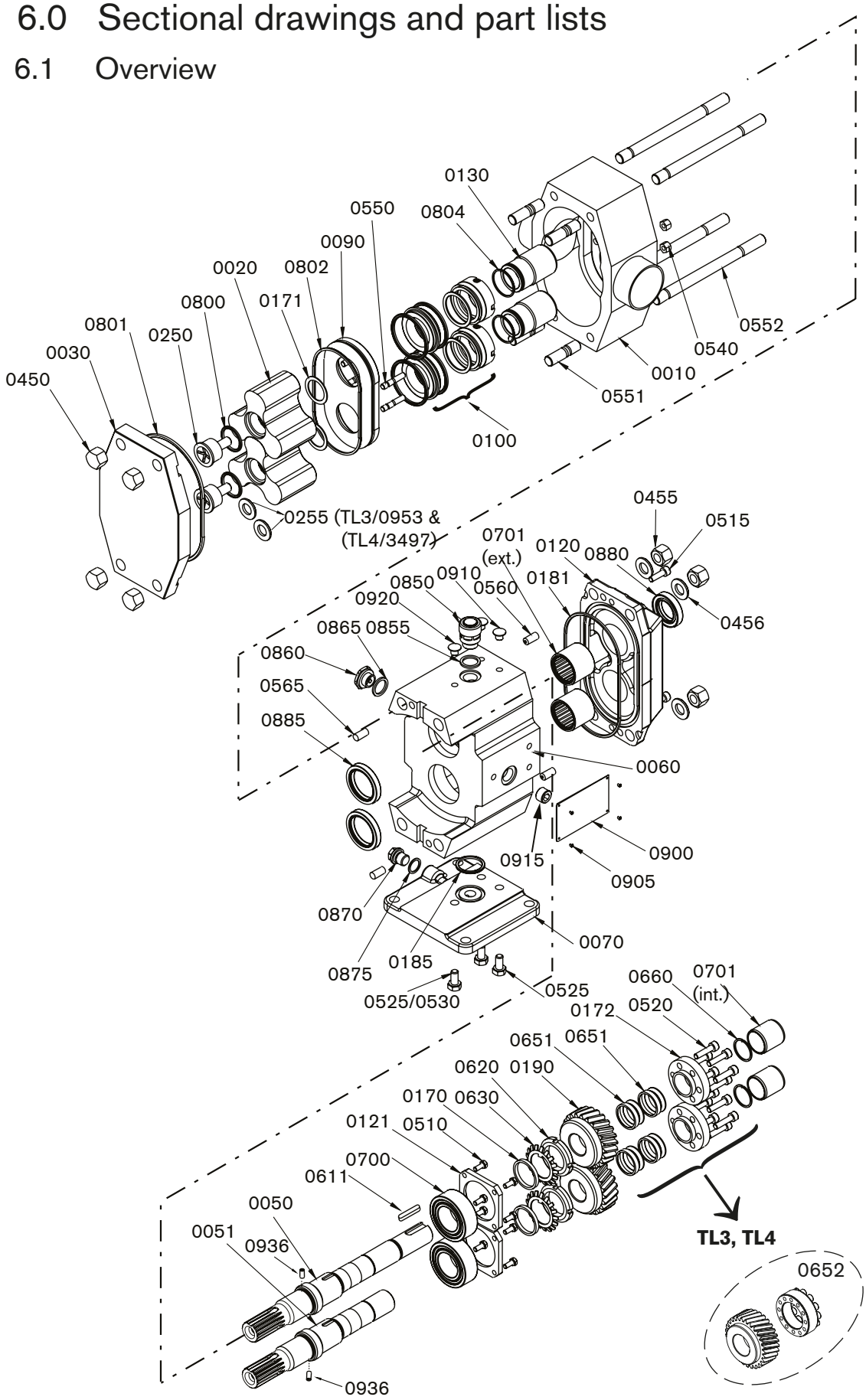


Dimensions in mm

Pump type	Art. No.	A	B	C	D	E	F
TL1	3.95612.11	170	8	10	41.9 0 -0.1	29.6 ±0.2	25
TL2	3.95613.11	170	8	10	46.9 0 -0.1	34.6 ±0.2	25
TL3	3.95614.11	170	10	12	69.9 0 -0.1	69.9 ±0.2	30
TL4	3.95615.11	175	10	12	89.9 0 -0.1	89.9 ±0.2	30

6.0 Sectional drawings and part lists

6.1 Overview



6.2 Recommended spare parts

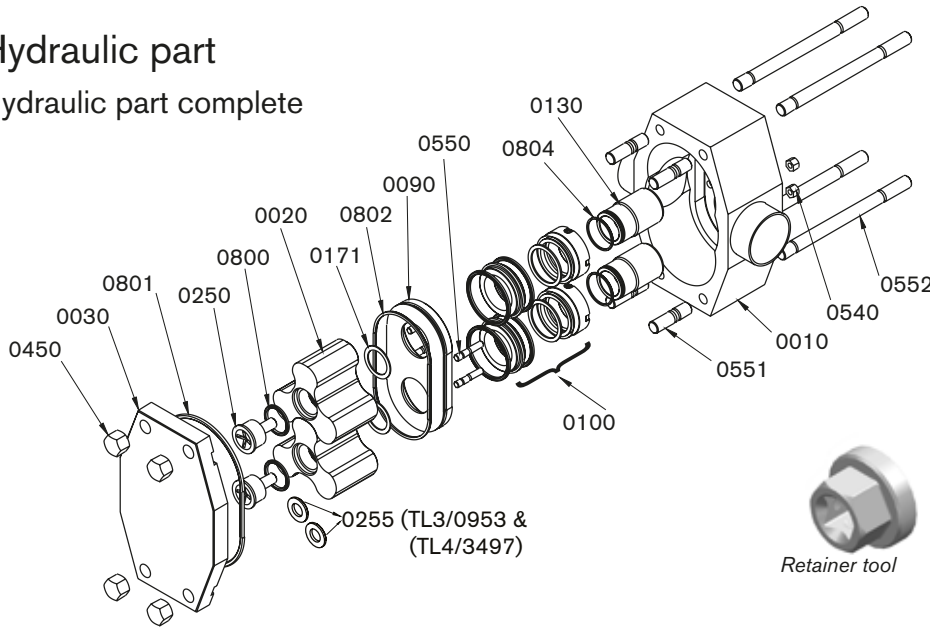
Pos.	Nos./ pump	Description	For preventie service for the next coming 3 years	Complete overhaul
0010	1	Rotor case		
0020	2	Rotor		x
0030	1	Pump cover		
	1	Pump cover for heating		
0032	1	Pump cover valve		
	1	Pump cover valve for heating		
0050	1	Drive Shaft		
0051	1	Lay Shaft		
0060	1	Gearbox		
0070	1	Foot - horizontal		
	1	Foot - vertical		
0090	1	Seal cover		
0095	1	Positioning plate		
0096	2	Support ring for lip seal		
0097	2	Support ring		
0101	1	Flush cover		
0120	1	Gearbox cover		
0121	2	Bearing cover		
0130	2	Shaft sleeve		x
0170	2	Spacer sleeve (TL1, TL2 only)		
0171	2	Shim	x	x
0172	2	Pressure flange (TL1, TL2 only)		
0175	1	Support ring spring		
0190	1	Gear, set		x
0200	1	Valve head		
0210	1	Baseplate		
0220	1	Cylinder		
0230	1	Piston		
0240	1	Cover spring loaded		
	1	Cover spring loaded - air lifted		
	1	Cover air loaded - air lifted		
0250	2	Retainer		x
0251	1	Spring adjusting screw		
0255	2	Spring washer		
0260	1	Spacer sleeve		
0450	4	Cap nut		x
0455	4	Cap nut		
0456	4	Washer		
0510	8	Screw		
0512	4	Screw		
0515	2	Screw		
0520	16	Screw (TL1)		
	12	Screw (TL2)		
0522	1	Screw		
0523	4	Screw		
0525	3	Screw (TL1, TL2, TL3)		
	2	Screw (TL4)		
0530	1	Screw		
0540	2	Cap nut (TL1)		
	4	Cap nut (TL2, TL3)		
	6	Cap nut (TL4)		
0543	1	Spring adjusting plate		
0550	2	Stud bolt (TL1)		
	4	Stud bolt (TL2, TL3)		
	6	Stud bolt (TL4)		
0551	4	Stud bolt		
0552	4	Stud bolt		
0553	2	Stud bolt (TL1)		
	4	Stud bolt (TL2, TL3)		
	6	Stud bolt (TL4)		

6.2.1 Recommended spare parts

Pos.	Nos./ pump	Description	For preventive service for the next coming 3 years	Complete overhaul
0560	2	Pin		
0561	2	Pin		
0562	1	Pin		
0565	2	Pin		
0611	1	Key	x	x
0620	2	Locking nut		
0630	2	Locking washer (TL1, TL2, TL3 only)		x
0651	2	Locking elements		x
0652	2	Locking assembly		x
0660	2	Circlip (TL1, TL2, TL3 only)		x
0700	2	Bearing		x
0701	2	Needle Bearing (TL1, TL2, TL3 only)		x
0701	2	Cylinder Bearing (TL4 only)		x
0750	1	Spring		
0850	1	Air breather		x
0860	1	Oil level glass		
0870	1	Drain plug		
0900	1	Name plate		
0905	6	Rivet		
0910	3	Plastic plug (TL1, TL2, TL3)		
	4	Plastic plug (TL4)		
0915	1	Plug		
0920	1	Plastic plug (TL4)		
0921	1	Plastic plug		
0922	1	Plastic plug		
0923	1	Plug		
0930	1	Protection plate		
0931	1	Screw		
0933	2	Plug		
0934	2	Plastic plug		
0936	2	Pin (TL2, TL3, TL4 only)		
	1	Retainer tool		
	1	Key protector		
	1	O-ring kit for the hydraulic part	x	x
	1	Service kit for gearbox	x	x
	2	Shaft seals complete	x	x
	1	O-ring kit for shaft seal	x	x
If applicable:				
	1	Kit for flush covers	x	x
	1	Service kit for quench and flush	x	x

6.3 Hydraulic part

6.3.1 Hydraulic part complete



Retainer tool

TL1, TL2

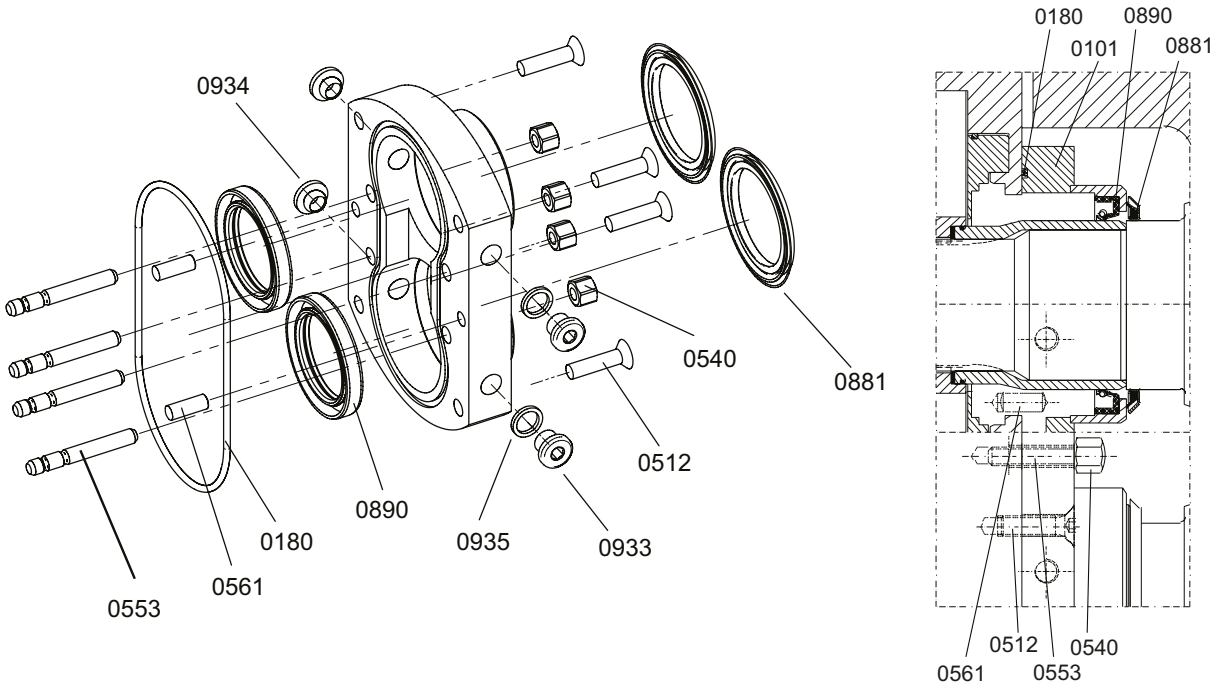
Pos.	Nos./ pump	Description	TL1/0039	TL1/0100	TL1/0139	TL2/0074	TL2/0234	TL2/0301
0010	1	Rotor case	see 6.3.3 Rotor case options					
0020	2	Rotor	3.94388.11	3.94389.31	3.94390.31	3.94404.11	3.94405.31	3.94406.31
0030	1	Pump cover	see 6.3.4 Pump cover options					
0090	1	Seal cover	see 7.0 -11.0					
0100	2	Seal	see 7.0 -11.0					
0130	2	Shaft sleeve	see 7.0 -11.0					
0171	2	Shim	3.94520.11			3.94480.11		
0250	2	Retainer	3.94391.31		3.94392.31	3.94407.31		3.94408.31
0450	4	Cap nut	0.0205.784			0.0205.785		
0540		Cap nut	see 7.0 -11.0					
0550		Stud bolt	see 7.0 -11.0					
0551	4	Stud bolt	0.0012.921			3.94549.11		
0552	4	Stud bolt	0.0012.680			0.0012.682		
0800	2	O-ring	see O-ring kit for hydraulic part with/without safety relief valve					
0801	1	O-ring	see O-ring kit for hydraulic part with/without safety relief valve					
0802	1	O-ring	see O-ring kit for hydraulic part with/without safety relief valve					
0804	2	O-ring	see O-ring kit for hydraulic part with/without safety relief valve					
	1	Retainer tool	3.94550.31			3.94550.31		

TL3, TL4

Pos.	Nos./ pump	Description	TL3/0234	TL3/0677	TL3/0953	TL4/0535	TL4/2316	TL4/3497
0010	1	Rotor case	see 6.3.3 Rotor case options					
0020	2	Rotor	3.94419.11	3.94420.31	3.94421.41	3.94451.11	3.94452.31	3.94453.41
0030	1	Pump cover	see 6.3.4 Pump cover options					
0090	1	Seal cover	see 7.0 -11.0					
0100	2	Seal	see 7.0 -11.0					
0130	2	Shaft sleeve	see 7.0 -11.0					
0171	2	Shim	3.94521.31			3.94588.31		
0250	2	Retainer	3.94422.31		3.94423.31	3.94454.31		3.94455.31
0255	2	Spring washer	–		0.0354.022	–		0.0354.021
0450	4	Cap nut	0.0205.787			0.0205.789		
0540		Cap nut	see 7.0 -11.0					
0550		Stud bolt	see 7.0 -11.0					
0551	4	Stud bolt	0.0012.950			0.0012.978		
0552	4	Stud bolt	3.94444.11			3.94560.11		
0800	2	O-ring	see O-ring kit for hydraulic part with/without safety relief valve					
0801	1	O-ring	see O-ring kit for hydraulic part with/without safety relief valve					
0802	1	O-ring	see O-ring kit for hydraulic part with/without safety relief valve					
0804	2	O-ring	see O-ring kit for hydraulic part with/without safety relief valve					
	1	Retainer tool	3.94551.31			3.94555.31		

6.3.2 TopKits Options

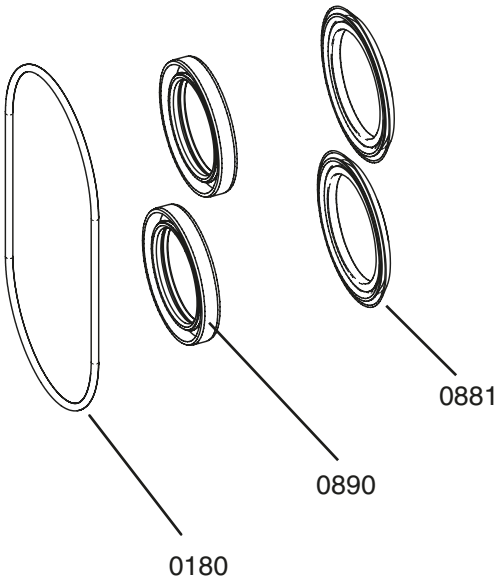
6.3.2.1 Kit for flush covers

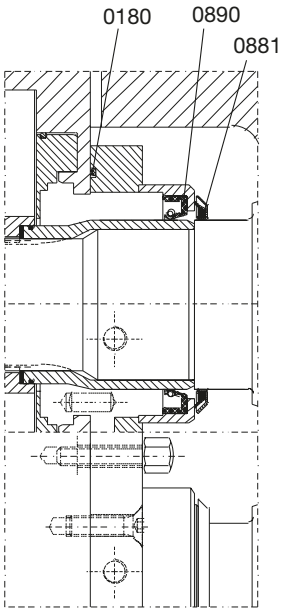


Pressure of the flushing: 0.5 bar max.

Pos.	Nos./ pump	Description	TL1/0039	TL1/0100 TL1/0139	TL2/0074	TL2/0234 TL2/0301	TL3/0234	TL3/0677 TL3/0953	TL4/0535	TL4/2316 TL4/3497
Kit for flush cover			**3.01948.11**	**3.01948.12**	**3.01949.11**	**3.01949.12**	**3.01950.11**	**3.01950.12**	**3.01951.11**	
0101	1	Flush cover	3.94396.11		3.94413.11		3.94428.11		3.94460.12	
0180	1	O-ring	0.2173.865		0.2173.940		0.2173.947		0.2173.866	
0512	4	Screw	0.0254.345		0.0254.346		0.0254.362		0.0254.362	
0540	2	Cap nut	0.0205.782		–		–		–	
	4	Cap nut	–		0.0205.782		0.0205.782		–	
	6	Cap nut	–		–		–		0.0205.783	
0553	2	Stud bolt	0.0012.905	0.0012.903	–		–		–	
	4	Stud bolt	–		0.0012.907	3.94487.11	0.0012.908	3.94488.11	–	
	6	Stud bolt	–		–		–		0.0012.604	
0561	2	Pin	0.0490.084		0.0490.084		0.0490.084		0.0490.754	
0881	2	V-seal	–		–		–		0.2230.468	
0890	2	Lip seal NBR/SS	0.2234.339		0.2234.497		0.2234.527		0.2234.385	
0933	2	Plug	0.0625.061		0.0625.061		0.0625.061		0.0625.061	
0934	2	Plastic plug	3.94615.11		3.94615.11		3.94615.11		3.94615.11	
0935	2	Sealing ring	4A3483.113		4A3483.113		4A3483.113		4A3483.113	

6.3.2.2 Service kit for quench/flush

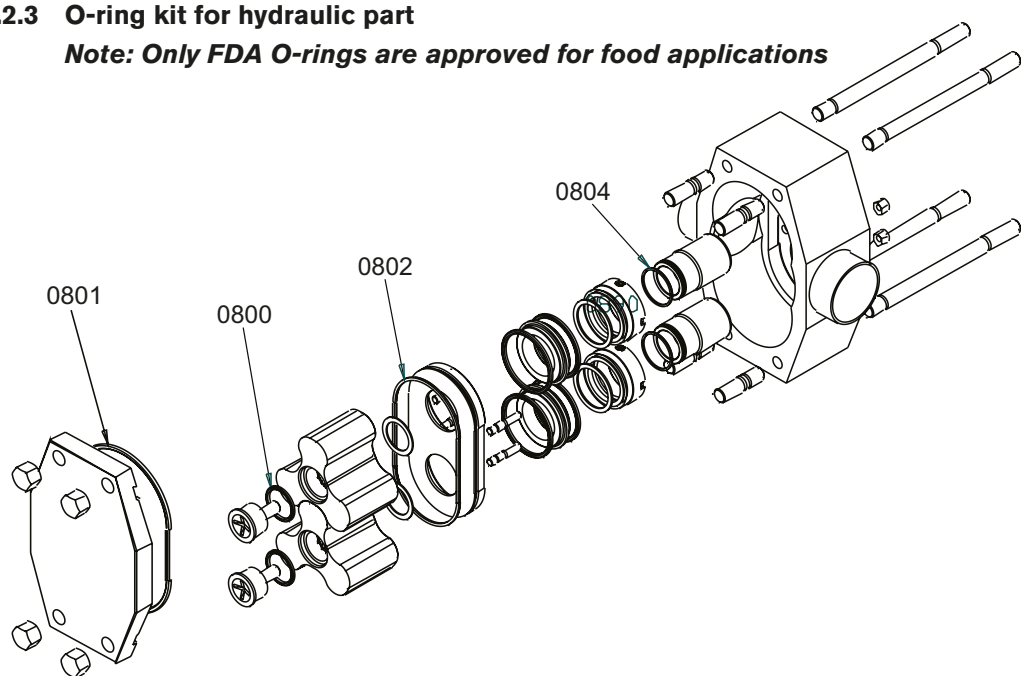




Pos.	Nos./ pump	Description	TL1	TL2	TL3	TL4
Service kit for quench/flush			**3.01948.21**	**3.01949.21**	**3.01950.21**	**3.01951.21**
0180	1	O-ring	0.2173.865	0.2173.940	0.2173.947	0.2173.866
0881	2	V-seal	–	–	–	0.2230.468
0890	2	Lip seal NBR/SS	0.2234.339	0.2234.497	0.2234.527	0.2234.385

6.3.2.3 O-ring kit for hydraulic part

Note: Only FDA O-rings are approved for food applications

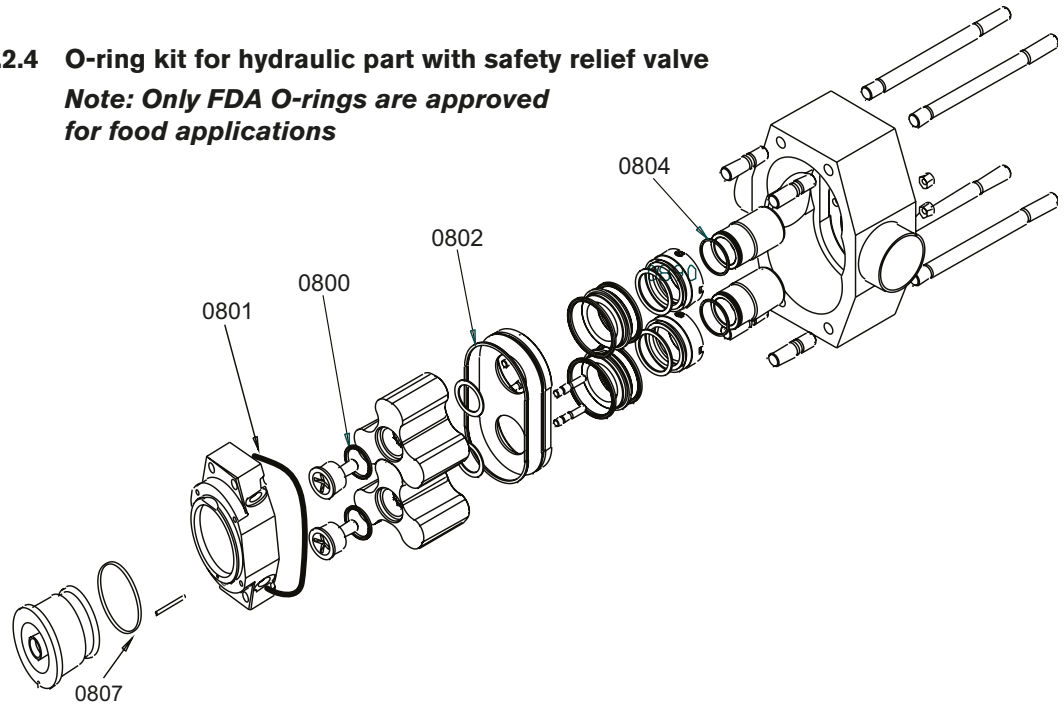


Pos.	Nos./ pump	Description	TL1	TL2	TL3	TL4
O-ring kit FPM			**3.01819.11**	**3.01822.11**	**3.01825.11**	**3.01828.11**
0800	2	O-ring	0.2173.934	3.91864.11	0.2173.939	0.2173.950
0801	1	O-ring	0.2173.935	0.2173.937	0.2173.902	0.2173.965
0802	1	O-ring	0.2173.903	0.2173.948	0.2173.858	0.2173.966
0804	2	O-ring	0.2173.936	0.2173.938	0.2173.904	0.2173.914
O-ring kit EPDM			**3.01819.12**	**3.01822.12**	**3.01825.12**	**3.01828.12**
0800	2	O-ring	0.2173.038	0.2173.074	0.2173.083	0.2173.141
0801	1	O-ring	0.2173.104	0.2173.112	0.2173.126	0.2173.253
0802	1	O-ring	0.2173.210	0.2173.202	0.2173.217	0.2173.254
0804	2	O-ring	0.2173.022	0.2173.025	0.2173.240	0.2173.255
O-ring kit FPM-FDA			**3.01819.18**	**3.01822.18**	**3.01825.18**	**3.01828.18**
0800	2	O-ring	0.2174.880	0.2174.871	0.2174.895	0.2174.913
0801	1	O-ring	0.2174.881	0.2174.870	0.2174.910	0.2174.916
0802	1	O-ring	0.2174.882	0.2174.869	0.2174.911	0.2174.918
0804	2	O-ring	0.2174.883	0.2174.868	0.2174.912	0.2174.919
O-ring kit EPDM-FDA			**3.01819.16**	**3.01822.16**	**3.01825.16**	**3.01828.16**
0800	2	O-ring	0.2173.535	0.2173.501	0.2173.508	0.2173.517
0801	1	O-ring	0.2173.502	0.2173.542	0.2173.549	0.2173.557
0802	1	O-ring	0.2173.533	0.2173.531	0.2173.550	0.2173.558
0804	2	O-ring	0.2173.536	0.2173.543	0.2173.540	0.2173.513
O-ring kit PTFE			**3.01819.13**	**3.01822.13**	**3.01825.13**	**3.01828.13**
0800	2	O-ring	0.2173.808	0.2173.804	0.2173.800	0.2173.811
0801	1	O-ring	0.2173.809	0.2173.805	0.2173.952	0.2173.812
0802	1	O-ring	0.2173.953	0.2173.806	0.2173.836	0.2173.813
0804	2	O-ring	0.2173.810	0.2173.807	0.2173.954	0.2173.814
O-ring kit CHEMRAZ®			**3.01819.14**	**3.01822.14**	**3.01825.14**	**3.01828.14**
0800	2	O-ring	0.2173.717	0.2173.721	0.2173.725	0.2173.732
0801	1	O-ring	0.2173.718	0.2173.722	0.2173.726	0.2173.733
0802	1	O-ring	0.2173.719	0.2173.723	0.2173.727	0.2173.734
0804	2	O-ring	0.2173.720	0.2173.724	0.2173.728	0.2173.735
*** O-ring kit KALREZ®**			**3.01819.15**	**3.01822.15**	**3.01825.15**	**3.01828.15**
0800	2	O-ring	0.2173.600	0.2173.604	0.2173.608	0.2173.612
0801	1	O-ring	0.2173.601	0.2173.605	0.2173.609	0.2173.613
0802	1	O-ring	0.2173.602	0.2173.606	0.2173.610	0.2173.614
0804	2	O-ring	0.2173.603	0.2173.607	0.2173.611	0.2173.615

** Kalrez is a registered trademark of DuPont Performance Elastomers.*

6.3.2.4 O-ring kit for hydraulic part with safety relief valve

Note: Only FDA O-rings are approved for food applications

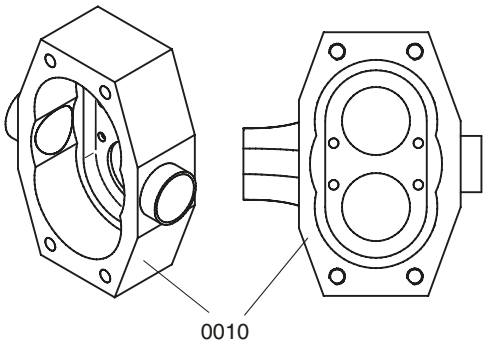


Pos.	Nos./ pump	Description	TL1/0039	TL1/0100 TL1/0139	TL2/0074	TL2/0234 TL2/0301	TL3/0234	TL3/0677 TL3/0953	TL4/0535	TL4/2316 TL4/3497
O-ring kit FPM			**3.01819.21**	**3.01819.31**	**3.01822.21**	**3.01822.31**	**3.01825.21**	**3.01825.31**	**3.01828.21**	**3.01828.31**
0800	2	O-ring	0.2173.934	0.2173.934	3.91864.11	3.91864.11	0.2173.939	0.2173.939	0.2173.950	0.2173.950
0801	1	O-ring	0.2173.935	0.2173.935	0.2173.937	0.2173.937	0.2173.902	0.2173.902	0.2173.965	0.2173.965
0802	1	O-ring	0.2173.903	0.2173.903	0.2173.948	0.2173.948	0.2173.858	0.2173.858	0.2173.966	0.2173.966
0804	2	O-ring	0.2173.936	0.2173.936	0.2173.938	0.2173.938	0.2173.904	0.2173.904	0.2173.914	0.2173.914
0807	1	O-ring	0.2173.974	0.2173.973	0.2173.906	0.2173.969	0.2173.977	0.2173.976	0.2173.976	0.2173.980
O-ring kit EPDM			**3.01819.22**	**3.01819.32**	**3.01822.22**	**3.01822.32**	**3.01825.22**	**3.01825.32**	**3.01828.22**	**3.01828.32**
0800	2	O-ring	0.2173.038	0.2173.038	0.2173.074	0.2173.074	0.2173.083	0.2173.083	0.2173.141	0.2173.141
0801	1	O-ring	0.2173.104	0.2173.104	0.2173.112	0.2173.112	0.2173.126	0.2173.126	0.2173.253	0.2173.253
0802	1	O-ring	0.2173.210	0.2173.210	0.2173.202	0.2173.202	0.2173.217	0.2173.217	0.2173.254	0.2173.254
0804	2	O-ring	0.2173.022	0.2173.022	0.2173.025	0.2173.025	0.2173.240	0.2173.240	0.2173.255	0.2173.255
0807	1	O-ring	0.2173.087	0.2173.091	0.2173.143	0.2173.149	0.2173.154	0.2173.169	0.2173.169	0.2173.179
O-ring kit FPM-FDA			**3.01819.28**	**3.01819.38**	**3.01822.28**	**3.01822.38**	**3.01825.28**	**3.01825.38**	**3.01828.28**	**3.01828.38**
0800	2	O-ring	0.2174.880	0.2174.880	0.2174.871	0.2174.871	0.2174.895	0.2174.895	0.2174.913	0.2174.913
0801	1	O-ring	0.2174.881	0.2174.881	0.2174.870	0.2174.870	0.2174.910	0.2174.910	0.2174.916	0.2174.916
0802	1	O-ring	0.2174.882	0.2174.882	0.2174.869	0.2174.869	0.2174.911	0.2174.911	0.2174.918	0.2174.918
0804	2	O-ring	0.2174.883	0.2174.883	0.2174.868	0.2174.868	0.2174.912	0.2174.912	0.2174.919	0.2174.919
0807	1	O-ring	0.2174.920	0.2174.922	0.2174.923	0.2174.875	0.2174.926	0.2174.828	0.2174.828	0.2174.930
O-ring kit EPDM - FDA			**3.01819.26**	**3.01819.36**	**3.01822.26**	**3.01822.36**	**3.01825.26**	**3.01825.36**	**3.01828.26**	**3.01828.36**
0800	2	O-ring	0.2173.535	0.2173.535	0.2173.501	0.2173.501	0.2173.508	0.2173.508	0.2173.517	0.2173.517
0801	1	O-ring	0.2173.502	0.2173.502	0.2173.542	0.2173.542	0.2173.549	0.2173.549	0.2173.557	0.2173.557
0802	1	O-ring	0.2173.533	0.2173.533	0.2173.531	0.2173.531	0.2173.550	0.2173.550	0.2173.558	0.2173.558
0804	2	O-ring	0.2173.536	0.2173.536	0.2173.543	0.2173.543	0.2173.540	0.2173.540	0.2173.513	0.2173.513
0807	1	O-ring	0.2173.503	0.2173.537	0.2173.544	0.2173.510	0.2173.551	0.2173.519	0.2173.519	0.2173.528
O-ring kit PTFE			**3.01819.23**	**3.01819.33**	**3.01822.23**	**3.01822.33**	**3.01825.23**	**3.01825.33**	**3.01828.23**	**3.01828.33**
0800	2	O-ring	0.2173.808	0.2173.808	0.2173.804	0.2173.804	0.2173.800	0.2173.800	0.2173.811	0.2173.811
0801	1	O-ring	0.2173.809	0.2173.809	0.2173.805	0.2173.805	0.2173.952	0.2173.952	0.2173.812	0.2173.812
0802	1	O-ring	0.2173.953	0.2173.953	0.2173.806	0.2173.806	0.2173.836	0.2173.836	0.2173.813	0.2173.813
0804	2	O-ring	0.2173.810	0.2173.810	0.2173.807	0.2173.807	0.2173.954	0.2173.954	0.2173.814	0.2173.814
0807	1	O-ring (*)	0.2173.736	0.2173.737	0.2173.738	0.2173.731	0.2173.739	0.2173.740	0.2173.740	0.2173.741
O-ring kit CHEMRAZ®			**3.01819.24**	**3.01819.34**	**3.01822.24**	**3.01822.34**	**3.01825.24**	**3.01825.34**	**3.01828.24**	**3.01828.34**
0800	2	O-ring	0.2173.717	0.2173.717	0.2173.721	0.2173.721	0.2173.725	0.2173.725	0.2173.732	0.2173.732
0801	1	O-ring	0.2173.718	0.2173.718	0.2173.722	0.2173.722	0.2173.726	0.2173.726	0.2173.733	0.2173.733
0802	1	O-ring	0.2173.719	0.2173.719	0.2173.723	0.2173.723	0.2173.727	0.2173.727	0.2173.734	0.2173.734
0804	2	O-ring	0.2173.720	0.2173.720	0.2173.724	0.2173.724	0.2173.728	0.2173.728	0.2173.735	0.2173.735
0807	1	O-ring	0.2173.736	0.2173.737	0.2173.738	0.2173.731	0.2173.739	0.2173.740	0.2173.740	0.2173.741
*** O-ring kit KALREZ®**			**3.01819.25**	**3.01819.35**	**3.01822.25**	**3.01822.35**	**3.01825.25**	**3.01825.35**	**3.01828.25**	**3.01828.35**
0800	2	O-ring	0.2173.600	0.2173.600	0.2173.604	0.2173.604	0.2173.608	0.2173.608	0.2173.612	0.2173.612
0801	1	O-ring	0.2173.601	0.2173.601	0.2173.605	0.2173.605	0.2173.609	0.2173.609	0.2173.613	0.2173.613
0802	1	O-ring	0.2173.602	0.2173.602	0.2173.606	0.2173.606	0.2173.610	0.2173.610	0.2173.614	0.2173.614
0804	2	O-ring	0.2173.603	0.2173.603	0.2173.607	0.2173.607	0.2173.611	0.2173.611	0.2173.615	0.2173.615
0807	1	O-ring	0.2173.627	0.2173.628	0.2173.629	0.2173.623	0.2173.630	0.2173.631	0.2173.631	0.2173.632

(*) Pos. 0807 in O-ring kit PTFE is of Chemraz®

** Kalrez is a registered trademark of DuPont Performance Elastomers.*

6.3.3 Rotor case options



TL1, TL2

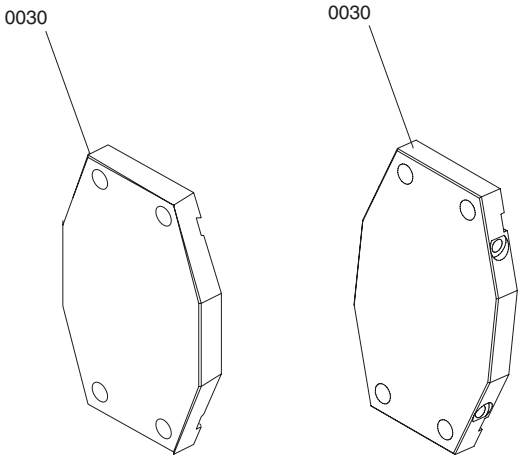
Pos.	Nos./ pump	Description	TL1/0039	TL1/0100	TL1/0139	TL2/0074	TL2/0234	TL2/0301
0010	1	Rotor case	3.14030.11	3.14031.11	3.14032.11	3.14033.11	3.14034.11	3.14035.11
	1	Rotor case enlarged inlet	3.14030.21	3.14031.21	3.14032.21	3.14033.21	3.14034.21	–

TL3, TL4

Pos.	Nos./ pump	Description	TL3/0234	TL3/0677	TL3/0953	TL4/0535	TL4/2316	TL4/3497
0010	1	Rotor case	3.14040.11	3.14041.11	3.14042.11	3.14048.11	3.14049.11	3.14050.11
	1	Rotor case enlarged inlet	3.14040.21	3.14041.21	3.14042.21	3.14048.21	–	–

6.3.4 Pump cover

6.3.4.1 Flat pump cover

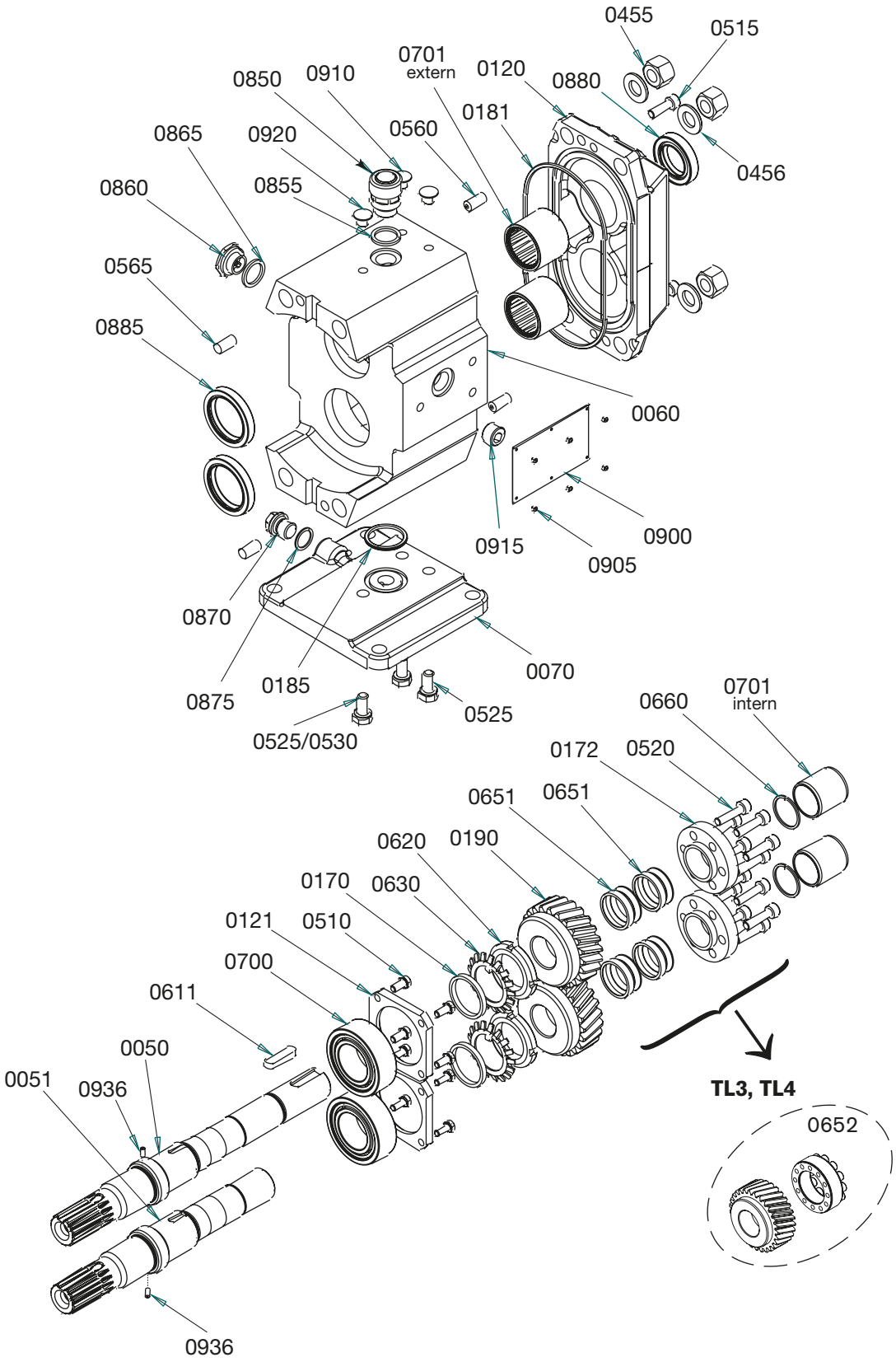


Pump cover *Pump cover with heating jacket*

Pos.	Nos./ pump	Description	TL1	TL2	TL3	TL4
0030	1	Pump cover	3.94387.11	3.94403.11	3.94418.11	3.94449.11
	1	Pump cover for heating	3.94387.12	3.94403.12	3.94418.12	3.94449.12

6.4 Gearbox

6.4.1 Gearbox, complete



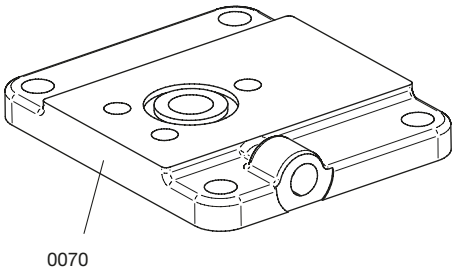
6.4.1.1 Parts list – Gearbox

Pos.	Nos./ pump	Description	TL1	TL2	TL3/0234 TL3/0677	TL3/0953	TL4/0535 TL4/2316	TL4/3497
0050	1	Drive shaft	3.94380.11	3.94398.11	3.94415.11	3.94415.31	3.94445.11	3.94445.31
0051	1	Lay shaft	3.94381.11	3.94399.11	3.94416.11	3.94416.31	3.94446.11	3.94446.31
0060	1	Gearbox	3.14036.11	3.14038.11	3.14043.11		3.14046.11	
0070	1	Foot – horizontal	3.14051.11	3.14052.11	3.14053.11		3.14057.11	
	1	Foot – vertical	3.14054.12	3.14055.11	3.14056.11		3.14058.11	
0120	1	Gearbox cover	3.14037.11	3.14039.11	3.14044.11		3.14047.11	
0121	2	Bearing cover	3.94382.11	3.94400.11	3.94417.11		3.94557.11	
0170	2	Spacer sleeve	3.94383.11	3.94401.11	–		–	
0172	2	Pressure flange	3.94384.11	3.94402.11	–		–	
0181	1	O-ring	0.2172.902	0.2172.906	0.2172.623		0.2172.632	
0185	1	O-ring - vertical	0.2172.929	–	–		––	
	1	O-ring	0.2172.541	0.2172.541	0.2172.541		0.2172.541	
0190	1	Gear, set	3.01817.11	3.01820.11	3.01823.11		3.01827.11	
0455	4	Cap nut	0.0205.784	0.0205.785	0.0205.787		0.0205.789	
0456	4	Washer	0.0350.200	0.0350.201	0.0350.202		0.0350.203	
0510	8	Screw	0.0251.428	0.0251.428	0.0251.202		0.0141.916	
0515	2	Screw	0.0252.135	0.0252.137	0.0252.189		0.0252.191	
0520	16	Screw	0.0251.890	–	–		–	
	12	Screw	–	0.0251.899	–		–	
0525	3	Screw – horizontal	0.0141.082	0.0141.082	0.0141.082		-	
	2	Screw – horizontal	–	–	–		0.0141.164	
	3	Screw – vertical	0.0251.234	0.0251.234	0.0251.234			
	2	Screw – vertical	–	–	–		0.0251.280	
0530	1	Screw – horizontal	–	–	–		0.0141.246	
	1	Screw – vertical	–	–	–		0.0251.325	
0560	2	Pin	0.0490.102	0.0490.102	0.0490.103		0.0490.139	
0565	2	Pin	0.0490.102	0.0490.102	0.0490.103		0.0490.139	
0611	1	Key	0.0502.025	0.0502.036	0.0502.052		0.0502.089	
0620	2	Locking nut	0.0243.005	0.0243.006	0.0243.009		0.0243.114.1	
0630	2	Locking washer	0.0383.005	0.0383.006	0.0383.009		–	
0651	2	Locking elements	0.0983.011	–	–		–	
	4	Locking elements	–	0.0983.013	–		–	
0652	2	Locking assembly	–	–	0.0983.120		0.0983.129	
0660	2	Circlip	3.94436.11	3.94442.11	3.81648.11		–	
0700	2	Bearing	3.94437.11	3.94443.11	0.3431.669		0.3428.890	
0701	2	Needle bearing	0.3425.459	0.3425.461	0.3425.467		–	
	2	Cylinder bearing	–	–	–		0.3428.575	
0850	1	Air breather	3.94438.11	3.94438.11	3.94438.11		3.94438.11	
0855	1	Sealing ring	3.94962.11	3.94962.11	3.94962.11		3.94962.11	
0860	1	Oil level glass	3.94439.11	3.94439.11	3.94439.11		3.94439.11	
0865	1	Sealing ring	3.94962.11	3.94962.11	3.94962.11		3.94962.11	
0870	1	Drain plug	0.0625.062	0.0625.062	0.0625.062		0.0625.063	
0875	1	Sealing ring	0.2198.001	0.2198.001	0.2198.001		0.2189.460	
0880	1	Lip seal	0.2234.918	0.2234.919	0.2234.920		0.2234.921	
0885	2	Lip seal	0.2234.903	0.2234.909	0.2234.916		0.2234.917	
0900	1	Name plate	4.0030.133	4.0030.132	4.0030.134		4.0030.134	
0905	6	Rivet	0.0337.102	0.0337.102	0.0337.102		0.0337.102	
0910	3	Plastic plug	3.94481.11	3.94481.11	3.94481.11		–	
	4	Plastic plug	–	–	–		3.94562.11	
0915	2	Plug	0.0602.017	0.0602.017	0.0602.017		0.0602.017	
0920	1	Plastic plug	–	–	–		3.94563.11	
0936	2	Pin	-	0.0490.641	0.0490.641		0.0490.641	
	1	Key protector	3.94665.11	3.94666.11	3.94667.11		3.94668.11	

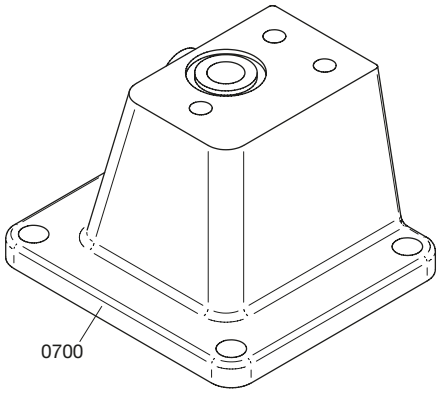
See 6.4.3 Service kit for gearbox

6.4.2 Feet options

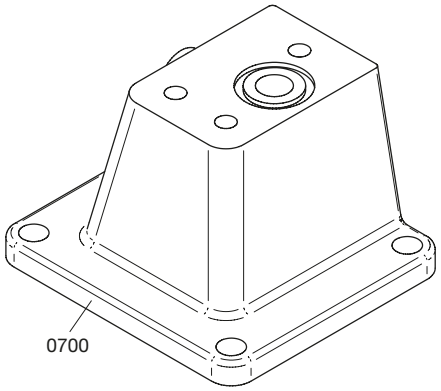
Foot – Horizontal



Foot – Vertical for clamps and thread connections

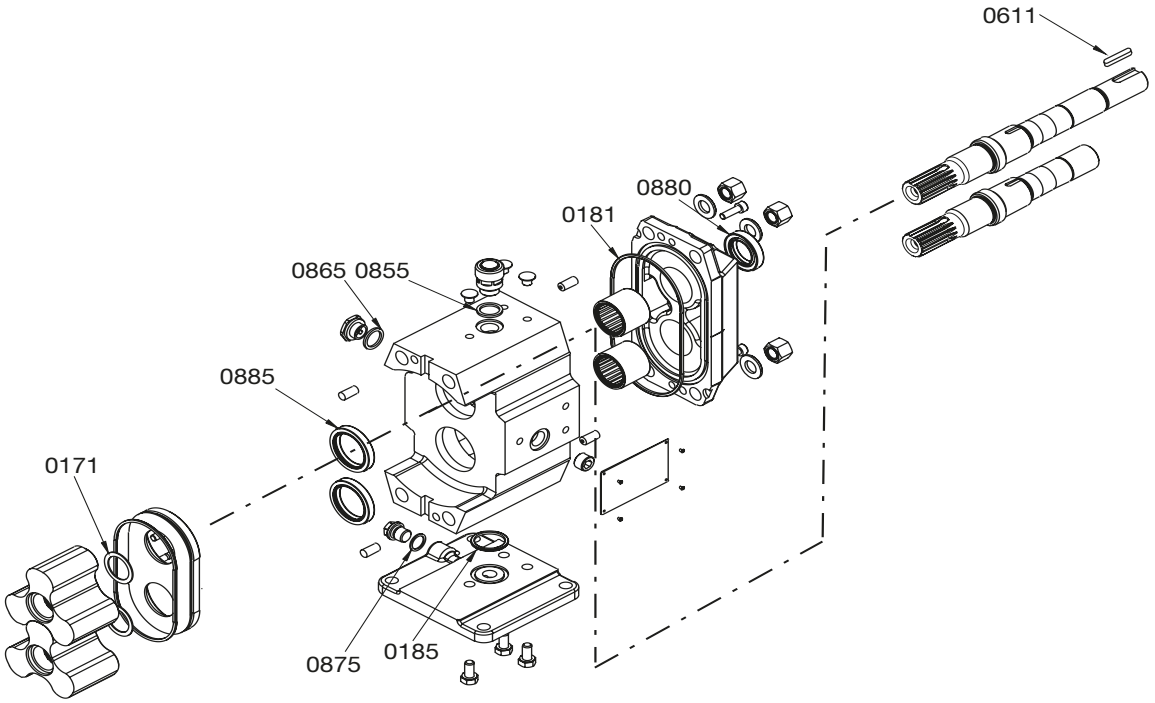


Foot – Vertical for flanges



Pos.	Nos. / pump	Description	TL1	TL2	TL3	TL4
0070	1	Foot – horizontal	3.14051.11	3.14052.11	3.14053.11	3.14057.11
0070	1	Foot – vertical thread connection	3.14054.12	3.14055.11	3.14056.11	3.14058.11
0070	1	Foot – vertical flange connection	3.14054.14	3.14055.12	3.14056.12	3.14058.12

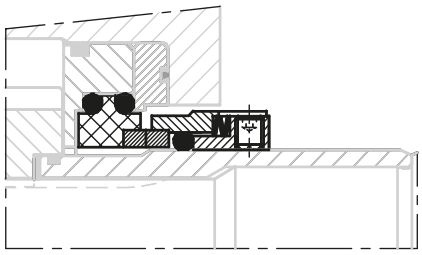
6.4.3 Service kit for gearbox



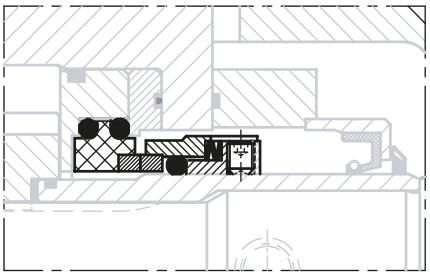
Pos.	Nos./ pump	Description	TL1	TL2	TL3	TL4
Serivce kit for gearbox			**3.01818.11**	**3.01821.11**	**3.01824.11**	**3.01826.11**
0171	2	Shim	3.94520.11	3.94480.11	3.94521.11	3.94588.11
0181	1	O-ring	0.2172.902	0.2172.906	0.2172.623	0.2172.632
0185	1	O-ring	0.2172.929	0.2172.541	0.2172.541	0.2172.541
0611	1	Key	0.0502.025	0.0502.036	0.0502.052	0.0502.089
0855	1	Sealing ring	3.94962.11	3.94962.11	3.94962.11	3.94962.11
0865	1	Sealing ring	3.94962.11	3.94962.11	3.94962.11	3.94962.11
0875	1	Sealing ring	0.2198.001	0.2198.001	0.2198.001	0.2189.460
0880	1	Lip seal	0.2234.918	0.2234.919	0.2234.920	0.2234.921
0885	2	Lip seal	0.2234.903	0.2234.909	0.2234.916	0.2234.917

7.0 Single mechanical seal

7.1 General information



Without flushing



With flushing

Design

- Balanced mechanical seal.
- The stationary seal face is built into the seal cover, which is assembled in the rotor case from the front end, and is locked against rotation by the friction forces of two O-rings.
- The spring loaded rotating seal face is assembled into the driver which is locked on the shaft sleeve by means of set screws. The seal face is locked in the driver by means of lips and slots.
- Suitable for two directions of rotation.
- Small seal faces prevent solidifying of medium between faces (reduced seal faces so called ''knife edge seals'' are available on demand).
- Seal faces are mounted flexibly in O-rings.
- Seal faces are available in two different material combinations.
- Enclosed spring outside of pumped medium (can be flushed).
- Low pressure quench or flushing is possible if the pump is equipped with the flush cover including extra lip seals.

Technical data

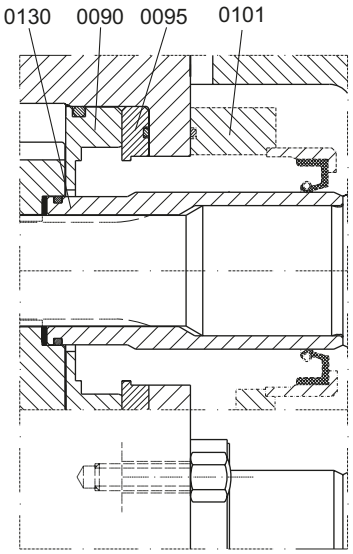
Materials of mechanical seal faces:	GW1 and GW2: SiC (Q1) - SiC (Q1 GB1 and GB2: SiC (Q1) - Carbon (B)
Materials of O-rings:	Fluorocarbon FPM FPM-FDA (V1 i.e. certified food quality) EPDM (E) EPDM-FDA (E1 i.e.certified food quality) PTFE lined (T) Perfluor Chemraz® (C) * Perfluor Kalrez® (K)
Material of lip ring (optional):	Nitrile rubber (P)
Maximum temperature:	200°C or up to the temperature limit of the pump
Maximum pressure:	23 bar or up to the operating pressure limit of the pump
Hydrostatic test pressure:	25 bar (for mechanical seal)
Maximum pressure of quench/flushing medium:	0.5 bar

** Kalrez is a registered trademark of DuPont Performance Elastomers.*

7.2 Machined parts – Seal assembly parts and flush covers

Pos.	Description	Europe		USA	Pump type			
		DIN	W.-nr.		TL1	TL2	TL3	TL4
0090	Seal cover	EN 10088-3	1.4404	AISI 316L	x	x	x	x
0095	Positioning plate	EN 10088-3	1.4460	AISI 329(L)	–	x	x	–
0101	Flush cover	EN 10088-3	1.4404	AISI 316L	x	x	x	x
0130	Shaft sleeve	EN 10088-3	1.4460	AISI 329(L)	x	x	x	x

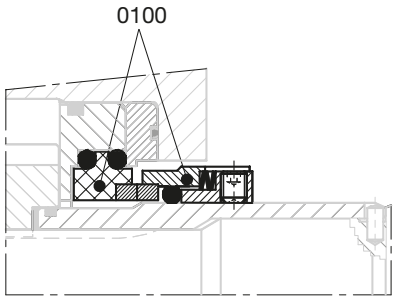
Reference catalogue: Stahlschlüssel 2001 (steel page 250-256 / stainless steel page 492-494)



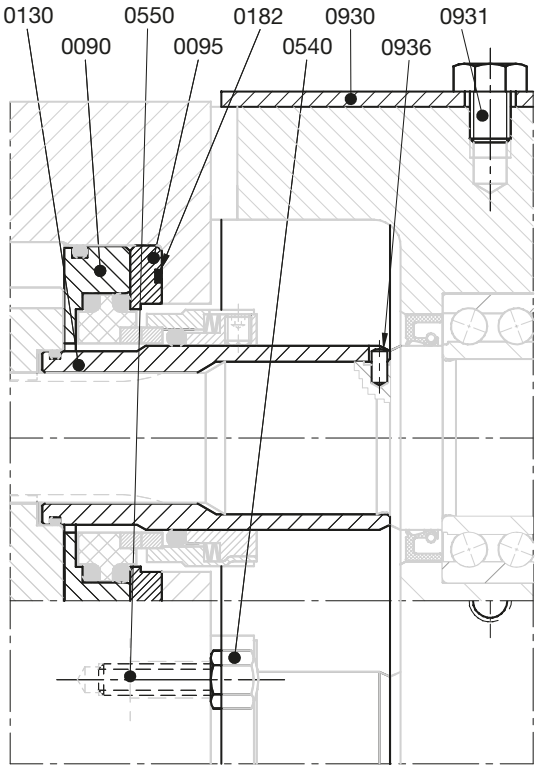
7.3 Seal options

7.3.1 Single mechanical seal

Note: Only FDA O-rings are approved for food applications



Single mechanical seal, complete



Common parts single mechanical seal

Single mechanical seal, complete

Pos.	Nos./ pump	Description	TL1	TL2	TL3	TL4
0100	2	Single mech seal Sic/Sic/FPM	3.94497.11	3.94500.11	3.94503.11	3.94556.11
0100	2	Single mech seal Sic/C/FPM	3.94497.14	3.94500.14	3.94503.14	3.94556.14
0100	2	Single mech seal Sic/Sic/EPDM	3.94497.12	3.94500.12	3.94503.12	3.94556.12
0100	2	Single mech seal Sic/C/EPDM	3.94497.15	3.94500.15	3.94503.15	3.94556.15
0100	2	Single mech seal Sic/Sic/PTFE	–	3.94500.17	3.94503.17	3.94556.17
0100	2	Single mech seal Sic/C/PTFE	–	3.94500.19	3.94503.19	3.94556.19
0100	2	Single mech seal Sic/Sic/Chemraz®	3.94497.13	3.94500.13	3.94503.13	3.94556.13
0100	2	Single mech seal Sic/C/Chemraz®	3.94497.16	3.94500.16	3.94503.16	3.94556.16
0100	2	* Single mech seal Sic/Sic/Kalrez®	3.94497.18	3.94500.18	3.94503.18	3.94556.18
0100	2	* Single mech seal Sic/C/Kalrez®	3.94497.20	3.94500.20	3.94503.20	3.94556.20
0100	2	Single mech seal Sic/Sic/FPM-FDA	3.94497.25	3.94500.25	3.94503.25	3.94556.25
0100	2	Single mech seal Sic/C/FPM-FDA	3.94497.26	3.94500.26	3.94503.26	3.94556.26
0100	2	Single mech seal Sic/Sic/EPDM-FDA	3.94497.21	3.94500.21	3.94503.21	3.94556.21
0100	2	Single mech seal Sic/C/EPDM-FDA	3.94497.22	3.94500.22	3.94503.22	3.94556.22

** Kalrez is a registered trademark of DuPont Performance Elastomers.*

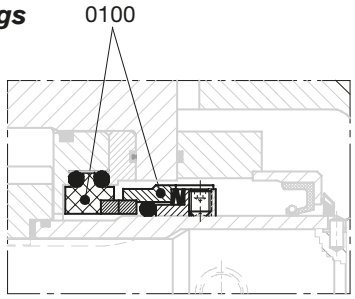
Common parts for single mechanical seal

Pos.	Nos./ pump	Description	TL1/0039	TL1/0100 TL1/0139	TL2/0074	TL2/0234 TL2/0301	TL3/0234	TL3/0677 TL3/0953	TL4/0535	TL4/2316 TL4/3497
0090	1	Seal cover	3.94393.11		3.94409.11		3.94424.11		3.94456.11	
0095	1	Positioning plate	–		3.94410.11	–	3.94425.11	–	–	
0130	2	Shaft sleeve	3.94489.11	3.94394.11	3.94485.11	3.94411.11	3.94491.11	3.94426.11	3.94596.11	3.94458.11
0182	1	O-ring	–		0.2173.940	–	0.2173.947	–	–	
0540	2	Cap nut	0.0205.782		–		–		–	
	4	Cap nut	–		0.0205.782		0.0205.782		–	
	6	Cap nut	–		–		–		0.0205.783	
0550	2	Stud bolt	0.0012.900	3.94441.11	–		–		–	
	4	Stud bolt	–		0.0012.901	3.94441.11	0.0012.901	3.94441.11	–	
	6	Stud bolt	–		–		–		3.94561.11	
0930	1	Protection plate	3.94913.11		3.94914.11		3.94915.11		3.94982.11	3.94916.11
0931	1	Screw	0.0138.940		0.0138.940		0.0138.986		0.0138.974	
0936	2	Pin	–		0.0490.641		0.0490.641		0.0490.641	

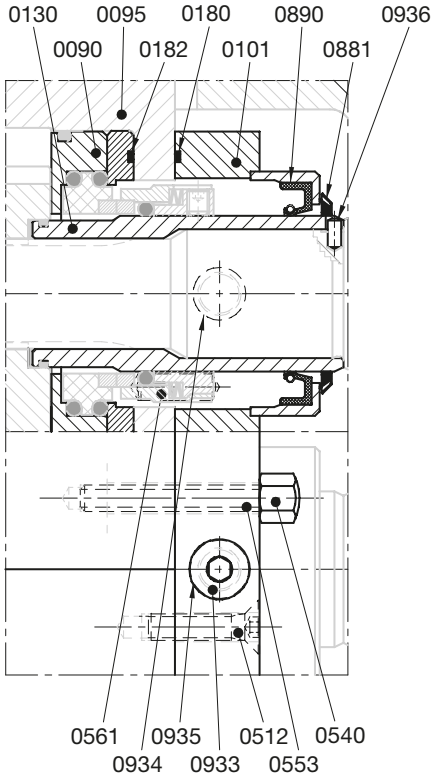
See 7.4 O-ring kit for single mechanical seal with/without flushing.

7.3.2 Single mechanical seal with quench/flush

Note: Only FDA O-rings are approved for food applications



Single mechanical seal, complete



Common parts single mechanical seal

Single mechanical seal, complete

Pos.	Nos./ pump	Description	TL1	TL2	TL3	TL4
0100	2	Single mech seal Sic/Sic/FPM	3.94497.11	3.94500.11	3.94503.11	3.94556.11
0100	2	Single mech seal Sic/C/FPM	3.94497.14	3.94500.14	3.94503.14	3.94556.14
0100	2	Single mech seal Sic/Sic/EPDM	3.94497.12	3.94500.12	3.94503.12	3.94556.12
0100	2	Single mech seal Sic/C/EPDM	3.94497.15	3.94500.15	3.94503.15	3.94556.15
0100	2	Single mech seal Sic/Sic/PTFE	-	3.94500.17	3.94503.17	3.94556.17
0100	2	Single mech seal Sic/C/PTFE	-	3.94500.19	3.94503.19	3.94556.19
0100	2	Single mech seal Sic/Sic/Chemraz®	3.94497.13	3.94500.13	3.94503.13	3.94556.13
0100	2	Single mech seal Sic/C/Chemraz®	3.94497.16	3.94500.16	3.94503.16	3.94556.16
0100	2	* Single mech seal Sic/Sic/Kalrez®	3.94497.18	3.94500.18	3.94503.18	3.94556.18
0100	2	* Single mech seal Sic/C/Kalrez®	3.94497.20	3.94500.20	3.94503.20	3.94556.20
0100	2	Single mech seal Sic/Sic/FPM-FDA	3.94497.25	3.94500.25	3.94503.25	3.94556.25
0100	2	Single mech seal Sic/C/FPM-FDA	3.94497.26	3.94500.26	3.94503.26	3.94556.26
0100	2	Single mech seal Sic/Sic/EPDM-FDA	3.94497.21	3.94500.21	3.94503.21	3.94556.21
0100	2	Single mech seal Sic/C/EPDM-FDA	3.94497.22	3.94500.22	3.94503.22	3.94556.22

** Kalrez is a registered trademark of DuPont Performance Elastomers.*

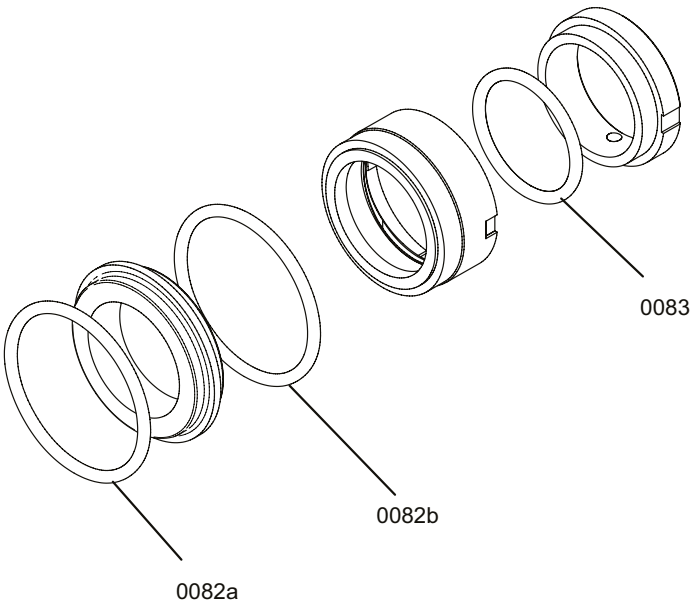
Common parts for single mechanical seal

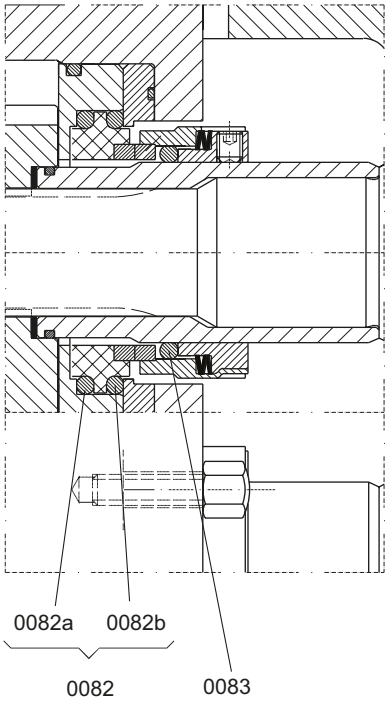
Pos.	Nos./ pump	Description	TL1/0039	TL1/0100 TL1/0139	TL2/0074	TL2/0234 TL2/0301	TL3/0234	TL3/0677 TL3/0953	TL4/0535	TL4/2316 TL4/3497
0090	1	Seal cover	3.94393.11		3.94409.11		3.94424.11		3.94456.11	
0095	1	Positioning plate	–		3.94410.11	–	3.94425.11	–	–	
0101	1	Flush cover	3.94396.11		3.94413.11		3.94428.11		3.94460.12	
0130	2	Shaft sleeve	3.94489.11	3.94394.11	3.94485.11	3.94411.11	3.94491.11	3.94426.11	3.94596.11	3.94458.11
0180	1	O-ring	0.2173.865		0.2173.940		0.2173.947		0.2173.866	
0182	1	O-ring	–		0.2173.940	–	0.2173.947	–	–	
0512	4	Screw	0.0254.345		0.0254.346		0.0254.362		0.0254.362	
0540	2	Cap nut	0.0205.782		–		–		–	
	4	Cap nut	–		0.0205.782		0.0205.782		–	
	6	Cap nut	–		–		–		0.0205.783	
0553	2	Stud bolt	0.0012.905	0.0012.903	–		–		–	
	4	Stud bolt	–		0.0012.907	3.94487.11	0.0012.908	3.94488.11	–	
	6	Stud bolt	–		–		–		0.0012.604	
0561	2	Pin	0.0490.084		0.0490.084		0.0490.084		0.0490.754	
0881	2	V-seal	–		–		–		0.2230.468	
0890	2	Lip seal NBR/SS	0.2234.339		0.2234.497		0.2234.527		0.2234.385	
0933	2	Plug	0.0625.061		0.0625.061		0.0625.061		0.0625.061	
0934	2	Plastic plug	3.94615.11		3.94615.11		3.94615.11		3.94615.11	
0935	2	Sealing ring	4A3483.113		4A3483.113		4A3483.113		4A3483.113	
0936	2	Pin	–		0.0490.641		0.0490.641		0.0490.641	

See 7.4 O-ring kit for single mechanical seal with/without quench/flush.

7.4 O-ring kit for single mechanical seal with/without quench/flush

Note: Only FDA O-rings are approved for food applications





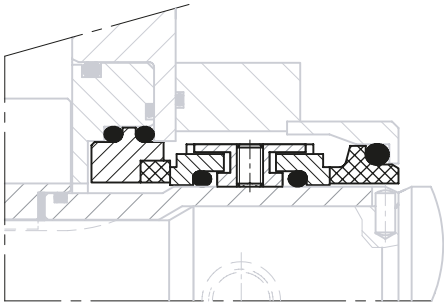
Pos.	Nos./ pump	Description	TL1	TL2	TL3	TL4
O-ring kit FPM			**3.01803.11**	**3.01804.11**	**3.01805.11**	**3.01806.11**
0082	4	O-ring	0.2173.901	0.2173.929	0.2173.942	0.2173.967
0083	2	O-ring	0.2173.941	0.2173.925	0.2173.927	0.2173.968
O-ring kit EPDM			**3.01803.12**	**3.01804.12**	**3.01805.12**	**3.01806.12**
0082	4	O-ring	0.2173.051	0.2173.085	0.2173.251	0.2173.099
0083	2	O-ring	0.2173.043	0.2173.080	0.2173.086	0.2173.145
O-ring kit FPM-FDA			**3.01803.18**	**3.01804.18**	**3.01805.18**	**3.01806.18**
0082	4	O-ring	0.2174.884	0.2174.873	0.2174.888	0.2174.890
0083	2	O-ring	0.2174.885	0.2174.887	0.2174.889	0.2174.891
O-ring kit EPDM - FDA			**3.01803.16**	**3.01804.16**	**3.01805.16**	**3.01806.16**
0082	4	O-ring	0.2173.538	0.2173.545	0.2173.552	0.2173.559
0083	2	O-ring	0.2173.539	0.2173.546	0.2173.553	0.2173.560
O-ring kit PTFE			**–**	**3.01804.13**	**3.01805.13**	**3.01806.13**
0082a	2	O-ring	–	0.2173.815	0.2173.802	0.2173.817
0082b	2	O-ring (*)	–	0.2173.929	0.2173.942	0.2173.967
0083	2	O-ring	–	0.2173.961	0.2173.963	0.2173.818
O-ring kit CHEMRAZ®			**3.01803.14**	**3.01804.14**	**3.01805.14**	**3.01806.14**
0082	4	O-ring	0.2173.708	0.2173.710	0.2173.712	0.2173.729
0083	2	O-ring	0.2173.709	0.2173.711	0.2173.713	0.2173.730
*** O-ring kit KALREZ®**			**3.01803.15**	**3.01804.15**	**3.01805.15**	**3.01806.15**
0082	4	O-ring	0.2173.624	0.2173.616	0.2173.619	0.2173.622
0083	2	O-ring	0.2173.625	0.2173.617	0.2173.620	0.2173.626

(*) Pos. 0082b in O-ring kit PTFE is of FPM

** Kalrez is a registered trademark of DuPont Performance Elastomers.*

8.0 Double mechanical seal

8.1 General



Design

- Balanced mechanical seal.
- The product side stationary seal face is built into the seal cover which is assembled in the rotor case from the front end and the atmopheric side stationary seal face is built into the flush cover.
- Both stationary seal faces are locked against rotation by the friction forces of O-rings.
- The spring loaded rotating seal faces are assembled into the driver which is locked on the shaft sleeve by means of set screws. The seal faces are locked in the driver by means of lips and slots.
- Suitable for two directions of rotation.
- Small seal faces prevents solidifying of medium between faces (reduced seal faces, so called ''knife edge seals'' are available on demand).
- Quenched of flushed, pressurized or unpressurized.

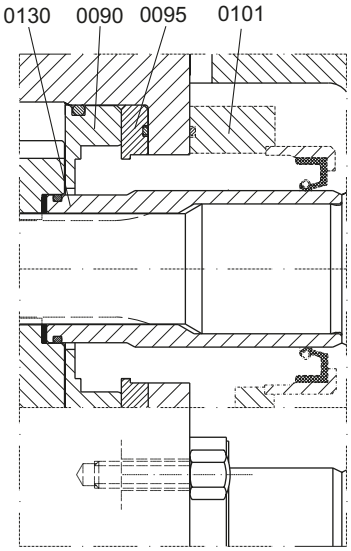
Technical data

Materials:	DW2: SiC (Q1) - SiC (Q1) and SiC (Q1) - Carbon (B) atmospheric side DB2: SiC (Q1) - Carbon (B) and SiC (Q1) - Carbon (B) atmospheric side
Materials of O-rings:	Fluorocarbon FPM FPM-FDA (V1 i.e. certified food quality) EPDM (E) EPDM-FDA (E1 i.e.certified food quality) PTFE lined (T) Perfluor Chemraz® (C) * Perfluor Kalrez® (K)
Temperature:	200°C or up to the temperature limit of the pump
Maximum pressure:	16 bar or up to the operating pressure limit of the pump
Hydrostatic test pressure:	25 bar (for mechanical seal)
Maximum pressure of quench/flushing medium:	16 bar
Pressurised seal:	The pressure of quench/flush medium should be 1 bar/10% higher than the process pressure
Unpressurised seal:	Pressure is lower than or equal to the processing pressure

** Kalrez is a registered trademark of DuPont Performance Elastomers.*

8.2 Machined parts – Seal assembly parts and flush covers

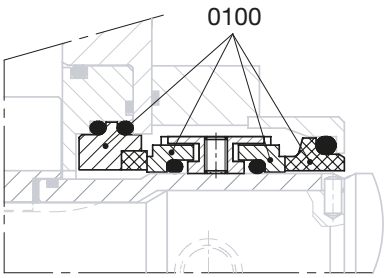
Pos.	Description	Europe		USA	Pump type			
		DIN	W.-nr.		TL1	TL2	TL3	TL4
0090	Seal cover	EN 100808-3	1.4404	AISI 316L	x	x	x	x
0095	Positioning plate	EN 10088-3	1.4460	AISI 329(L)	–	x	x	–
0101	Flush cover	EN 10088-3	1.4404	AISI 316L	x	x	x	x
0130	Shaft sleeve	EN 10088-3	1.4460	AISI 329(L)	x	x	x	x



8.3 Seal options

8.3.1 Double mechanical seal M74-D60 – TL2/0074 and TL3/0234

Double mechanical seal M74-D60, complete

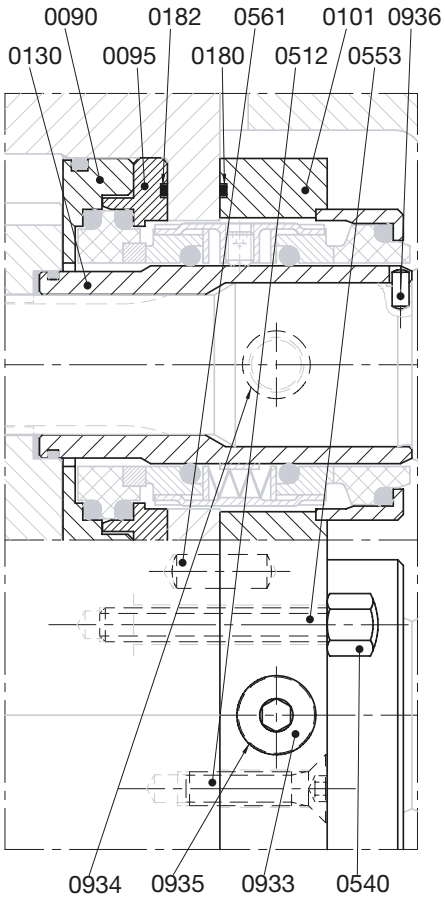


Pos.	Nos./ pump	Description	TL2/0074	TL3/0234
0100	2	Double mech seal C/Sic/C/FPM	3.94509.14	3.94513.14
0100	2	Double mech seal Sic/Sic/C/FPM	3.94509.11	3.94513.11
0100	2	Double mech seal C/Sic/C/EPDM	3.94509.15	3.94513.15
0100	2	Double mech seal Sic/Sic/C/EPDM	3.94509.12	3.94513.12
0100	2	Double mech seal C/Sic/C/PTFE	3.94509.19	3.94513.19
0100	2	Double mech seal Sic/Sic/C/PTFE	3.94509.17	3.94513.17
0100	2	Double mech seal C/Sic/C/Chemraz®	3.94509.16	3.94513.16
0100	2	Double mech seal Sic/Sic/C/Chemraz®	3.94509.13	3.94513.13
0100	2	* Double mech seal C/Sic/C/Kalrez®	3.94509.20	3.94513.20
0100	2	* Double mech seal Sic/Sic/C/Kalrez®	3.94509.18	3.94513.18
0100	2	Double mech seal C/Sic/C/FPM-FDA	3.94509.26	3.94513.26
0100	2	Double mech seal Sic/Sic/C/FPM-FDA	3.94509.25	3.94513.25
0100	2	Double mech seal C/Sic/C/EPDM-FDA	3.94509.21	3.94513.21
0100	2	Double mech seal Sic/Sic/C/EPDM-FDA	3.94509.22	3.94513.22

Note: Only FDA O-rings are approved for food applications

** Kalrez is a registered trademark of DuPont Performance Elastomers.*

Common parts double mechanical seal M74-D60

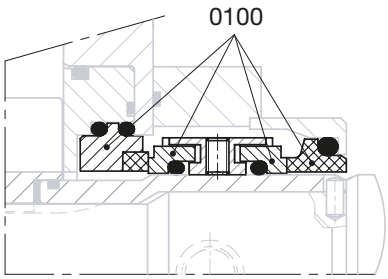


Pos.	Nos./ pump	Description	TL2/0074	TL3/0234
0090	1	Seal cover	3.94409.12	3.94424.12
0095	1	Positioning plate	3.94410.12	3.94425.12
0101	1	Flush cover	3.94413.11	3.94428.11
0130	2	Shaft sleeve	3.94485.11	3.94491.11
0180	1	O-ring	0.2173.940	0.2173.947
0182	1	O-ring	0.2173.940	0.2173.947
0512	4	Screw	0.0254.346	0.0254.362
0540	4	Cap nut	0.0205.782	0.0205.782
0553	4	Stud bolt	0.0012.907	0.0012.908
0561	2	Pin	0.0490.084	0.0490.084
0933	2	Plug	0.0625.061	0.0625.061
0934	2	Plastic plug	3.94615.11	3.94615.11
0935	2	Sealing ring	4A3483.113	4A3483.113
0936	2	Pin	0.0490.641	0.0490.641

See 8.4 O-ring kit for double mechanical seal

8.3.2 Double mechanical seal M74-D60 – TL4/0535, TL4/2316 and TL4/3497

Double mechanical seal M74-D60, complete

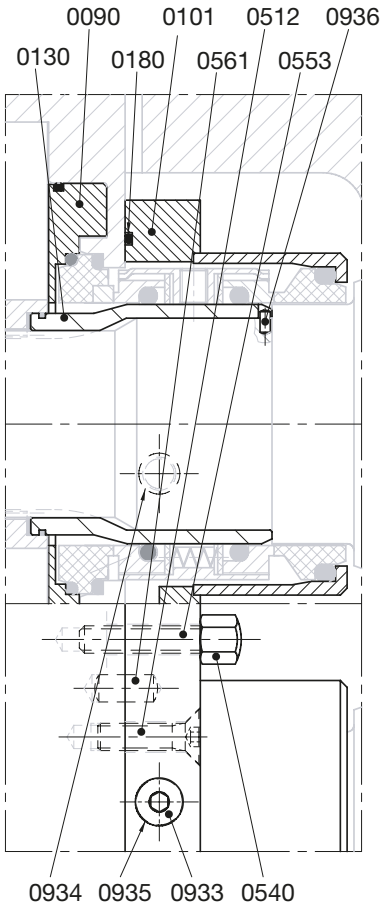


Pos.	Nos./ pump	Description	TL4
0100	2	Double mech seal C/Sic/C/FPM	3.94564.14
0100	2	Double mech seal Sic/Sic/C/FPM	3.94564.11
0100	2	Double mech seal C/Sic/C/EPDM	3.94564.15
0100	2	Double mech seal Sic/Sic/C/EPDM	3.94564.12
0100	2	Double mech seal C/Sic/C/PTFE	3.94564.19
0100	2	Double mech seal Sic/Sic/C/PTFE	3.94564.17
0100	2	Double mech seal C/Sic/C/Chemraz®	3.94564.16
0100	2	Double mech seal Sic/Sic/C/Chemraz®	3.94564.13
0100	2	* Double mech seal C/Sic/C/Kalrez®	3.94564.20
0100	2	* Double mech seal Sic/Sic/C/Kalrez®	3.94564.18
0100	2	Double mech seal C/Sic/C/FPM-FDA	3.94564.26
0100	2	Double mech seal Sic/Sic/C/FPM-FDA	3.94564.25
0100	2	Double mech seal C/Sic/C/EPDM-FDA	3.94564.21
0100	2	Double mech seal Sic/Sic/C/EPDM-FDA	3.94564.22

Note: Only FDA O-rings are approved for food applications

** Kalrez is a registered trademark of DuPont Performance Elastomers.*

Common parts double mechanical seal M74-D60

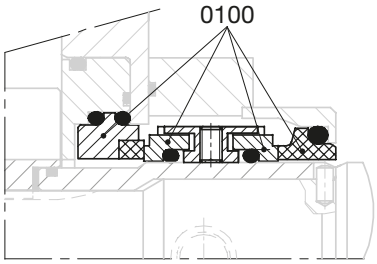


Pos.	Nos./ pump	Description	TL4/0535	TL4/2316 TL4/3497
0090	1	Seal cover	3.94456.11	3.94456.11
0101	1	Flush cover	3.94460.11	3.94460.11
0130	2	Shaft sleeve	3.94596.11	3.94458.11
0180	1	O-ring	0.2173.866	0.2173.866
0512	4	Screw	0.0254.362	0.0254.362
0540	6	Cap nut	0.0205.783	0.0205.783
0553	6	Stud bolt	0.0012.604	0.0012.604
0561	2	Pin	0.0490.102	0.0490.754
0933	2	Plug	0.0625.061	0.0625.061
0934	2	Plastic plug	3.94615.11	3.94615.11
0935	2	Sealing ring	4A3483.113	4A3483.113
0936	2	Pin	0.0490.641	0.0490.641

See 8.4 O-ring kit for double mechanical seal

8.3.3 Double mechanical seal M74-D61 – TL2/0234, TL2/0301, TL3/0677, TL3/0953

Double mechanical seal M74-D61, complete

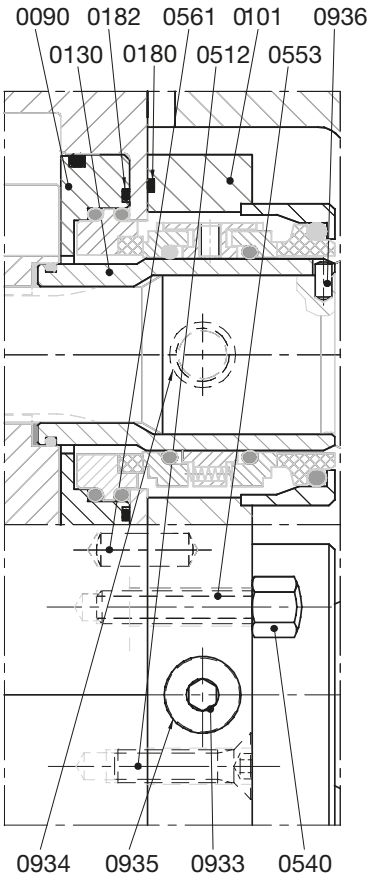


Pos.	Nos./ pump	Description	TL2/0234 TL2/0301	TL3/0677 TL3/0953
0100	2	Double mech seal C/Sic/C/FPM	3.94924.11	3.94926.11
0100	2	Double mech seal Sic/Sic/C/FPM	3.94925.11	3.94927.11
0100	2	Double mech seal C/Sic/C/EPDM	3.94925.15	3.94927.15
0100	2	Double mech seal Sic/Sic/C/EPDM	3.94925.12	3.94927.12
0100	2	Double mech seal C/Sic/C/PTFE	3.94925.19	3.94927.19
0100	2	Double mech seal Sic/Sic/C/PTFE	3.94925.17	3.94927.17
0100	2	Double mech seal C/Sic/C/Chemraz®	3.94925.16	3.94927.16
0100	2	Double mech seal Sic/Sic/C/Chemraz®	3.94925.13	3.94927.13
0100	2	* Double mech seal C/Sic/C/Kalrez®	3.94925.20	3.94927.20
0100	2	* Double mech seal Sic/Sic/C/Kalrez®	3.94925.18	3.94927.18
0100	2	Double mech seal C/Sic/C/FPM.FDA	3.94924.26	3.94926.26
0100	2	Double mech seal Sic/Sic/C/FPM-FDA	3.94925.25	3.94927.25
0100	2	Double mech seal C/Sic/C/EPDM-FDA	3.94925.21	3.94927.21
0100	2	Double mech seal Sic/Sic/C/EPDM-FDA	3.94925.22	3.94927.22

Note: Only FDA O-rings are approved for food applications

** Kalrez is a registered trademark of DuPont Performance Elastomers.*

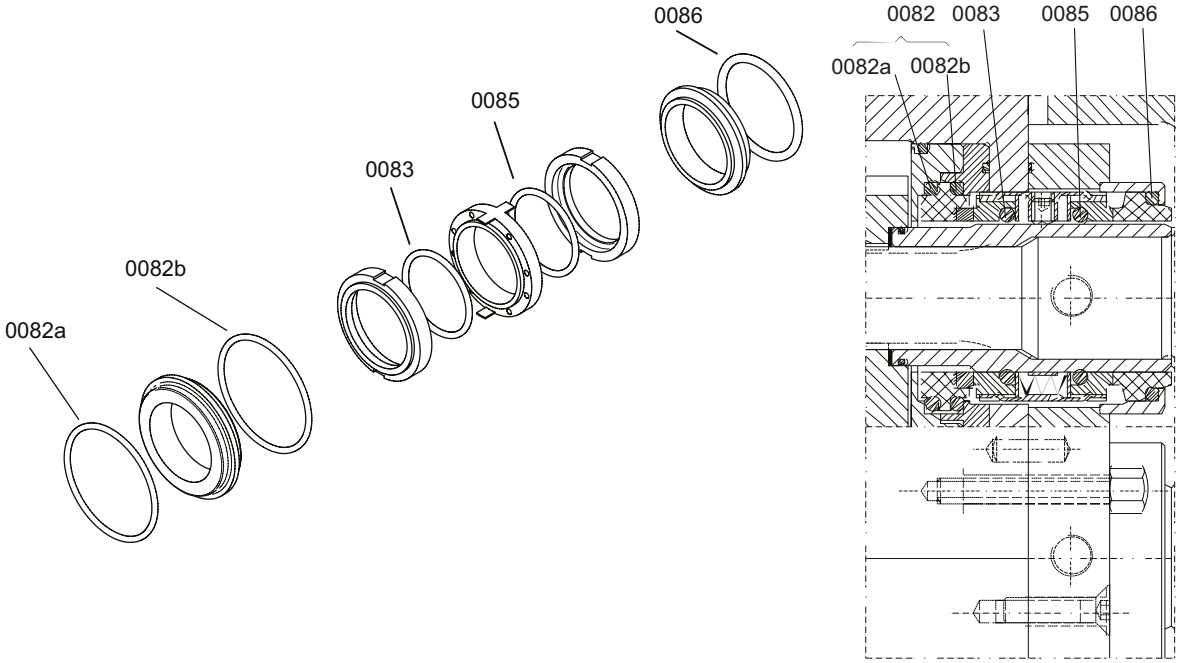
Common parts double mechanical seal M74-D61



Pos.	Nos./ pump	Description	TL2/0234 TL2/0301	TL3/0677 TL3/0953
0090	1	Seal cover	3.94409.13	3.94424.13
0101	1	Flush cover	3.94413.12	3.94428.12
0130	2	Shaft sleeve	3.94411.11	3.94426.11
0180	1	O-ring	0.2173.940	0.2173.947
0182	2	O-ring	0.2173.859	0.2173.921
0512	4	Screw	0.0254.346	0.0254.362
0540	4	Cap nut	0.0205.782	0.0205.782
0553	4	Stud bolt	3.94487.11	3.94488.11
0561	2	Pin	0.0490.084	0.0490.084
0933	2	Plug	0.0625.061	0.0625.061
0934	2	Plastic plug	3.94615.11	3.94615.11
0935	2	Sealing ring	4A3483.113	4A3483.113
0936	2	Pin	0.0490.641	0.0490.641

See 8.4 O-ring kit for double mechanical seal

8.4 O-ring kit for double mechanical seal



Pos.	Nos./ pump	Description	TL2/0074	TL2/0234 TL2/0301	TL3/0234	TL3/0677 TL3/0953	TL4
O-ring kit FPM			**3.01812.11**	**3.01812.21**	**3.01813.11**	**3.01813.21**	**3.01837.11**
0082	4	O-ring	0.2173.929	0.2173.861	0.2173.942	0.2173.863	0.2173.967
0083	2	O-ring	0.2173.925	0.2173.862	0.2173.927	0.2173.864	0.2173.968
0085	2	O-ring	0.2173.925	0.2173.862	0.2173.927	0.2173.864	0.2173.968
0086	2	O-ring	0.2173.944	0.2173.939	0.2173.945	0.2173.995	0.2173.969
O-ring kit EPDM			**3.01812.12**	**3.01812.22**	**3.01813.12**	**3.01813.22**	**3.01837.12**
0082	4	O-ring	0.2173.085	0.2173.311	0.2173.251	0.2173.090	0.2173.099
0083	2	O-ring	0.2173.080	0.2173.046	0.2173.086	0.2173.056	0.2173.145
0085	2	O-ring	0.2173.080	0.2173.046	0.2173.086	0.2173.056	0.2173.145
0086	2	O-ring	0.2173.252	0.2173.083	0.2173.371	0.2173.088	0.2173.149
O-ring kit FPM-FDA			**3.01812.18**	**3.01812.28**	**3.01813.18**	**3.01813.28**	**3.01837.18**
0082	4	O-ring	0.2174.873	0.2174.893	0.2174.888	0.2174.896	0.2174.890
0083	2	O-ring	0.2174.887	0.2174.894	0.2174.889	0.2174.897	0.2174.891
0085	2	O-ring	0.2174.887	0.2174.894	0.2174.889	0.2174.897	0.2174.891
0086	2	O-ring	0.2174.892	0.2174.895	0.2174.899	0.2174.898	0.2174.875
O-ring kit EPDM - FDA			**3.01812.16**	**3.01812.26**	**3.01813.16**	**3.01813.26**	**3.01837.16**
0082	4	O-ring	0.2173.545	0.2173.561	0.2173.552	0.2173.563	0.2173.559
0083	2	O-ring	0.2173.546	0.2173.562	0.2173.553	0.2173.564	0.2173.560
0085	2	O-ring	0.2173.546	0.2173.562	0.2173.553	0.2173.564	0.2173.560
0086	2	O-ring	0.2173.548	0.2173.508	0.2173.555	0.2173.512	0.2173.510
O-ring kit PTFE			**3.01812.13**	**3.01812.23**	**3.01813.13**	**3.01813.23**	**3.01837.13**
0082a	2	O-ring	0.2173.815	0.2173.837	0.2173.802	0.2173.802	0.2173.817
0082b	2	O-ring (*)	0.2173.929	0.2173.861	0.2173.942	0.2173.863	0.2173.967
0083	2	O-ring	0.2173.961	0.2173.838	0.2173.963	0.2173.839	0.2173.818
0085	2	O-ring (*)	0.2173.925	0.2173.862	0.273.927	0.273.864	0.2173.968
0086	2	O-ring (*)	0.2173.944	0.2173.939	0.2173.945	0.2173.995	0.2173.969
O-ring kit CHEMRAZ®			**3.01812.14**	**3.01812.24**	**3.01813.14**	**3.01813.24**	**3.01837.14**
0082	4	O-ring	0.2173.710	0.2173.766	0.2173.712	0.2173.768	0.2173.729
0083	2	O-ring	0.2173.711	0.2173.767	0.2173.713	0.2173.769	0.2173.730
0085	2	O-ring	0.2173.711	0.2173.767	0.2173.713	0.2173.769	0.2173.730
0086	2	O-ring	0.2173.715	0.2173.725	0.2173.716	0.2173.746	0.2173.731
*** O-ring kit KALREZ®**			**3.01812.15**	**3.01812.25**	**3.01813.15**	**3.01813.25**	**3.01837.15**
0082	4	O-ring	0.2173.616	0.2173.657	0.2173.619	0.2173.659	0.2173.622
0083	2	O-ring	0.2173.617	0.2173.658	0.2173.620	0.2173.660	0.2173.626
0085	2	O-ring	0.2173.617	0.2173.658	0.2173.620	0.2173.660	0.2173.626
0086	2	O-ring	0.2173.618	0.2173.608	0.2173.621	0.2173.637	0.2173.623

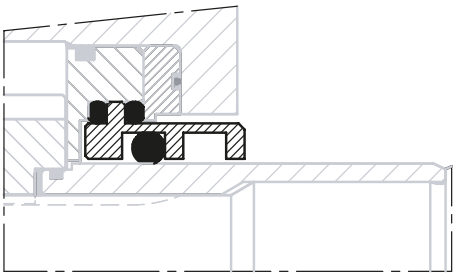
Note: Only FDA O-rings are approved for food applications

(*) Pos. 0082b, 0085, 0086 in O-ring kit PTFE are of FPM

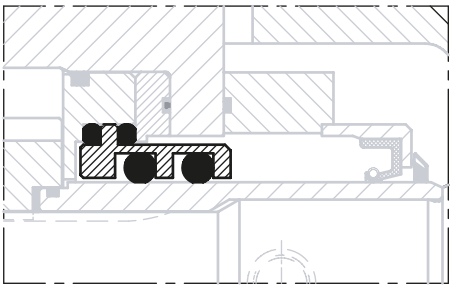
** Kalrez is a registered trademark of DuPont Performance Elastomers.*

9.0 Single and Double O-ring seal

9.1 General information



Single



Double

Design

- The removable O-ring holder (containing the O-rings) is built into the seal cover, which is assembled in the rotor case from the front end, and locked by the friction forces of O-rings.
- The O-rings are running on the rotating shaft sleeve which is locked on the shaft.
- Seal faces on the shaft sleeve coated with tungsten carbide.
- Suitable for two directions of rotation
- Double arrangement quenched or flushed, pressurised or unpressurised.

Technical data

Materials of O-rings: Fluorocarbon FPM
FPM-FDA (V1 i.e. certified food quality)
EPDM (E)
EPDM-FDA (E1 i.e.certified food quality)
PTFE lined (T)
Perfluor Chemraz® (C)
* Perfluor Kalrez® (K)

Temperature: Up to the temperature limit of the pump

Maximum pressure: Up to the operating pressure limit of the pump

Maximum pressure of quench/flushing medium: 0.5 bar

Circumferential speed: Less than 0.5 m/s

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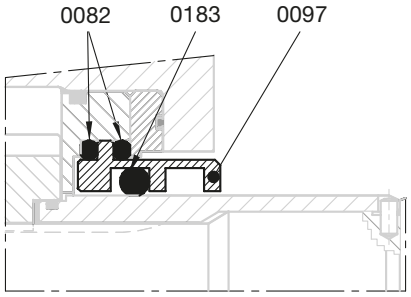
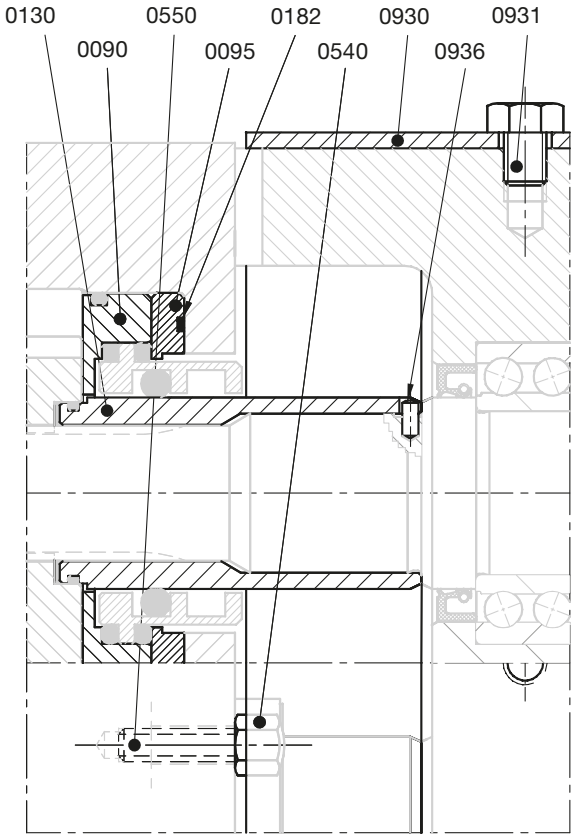
9.2 Seal options

9.2.1 Single O-ring seal



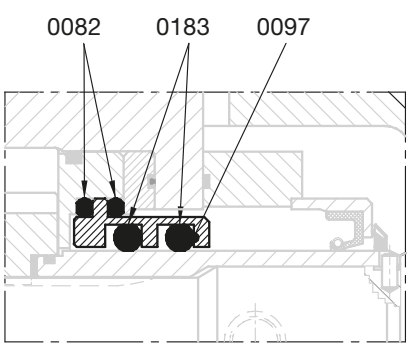
Single O-ring seal, complete



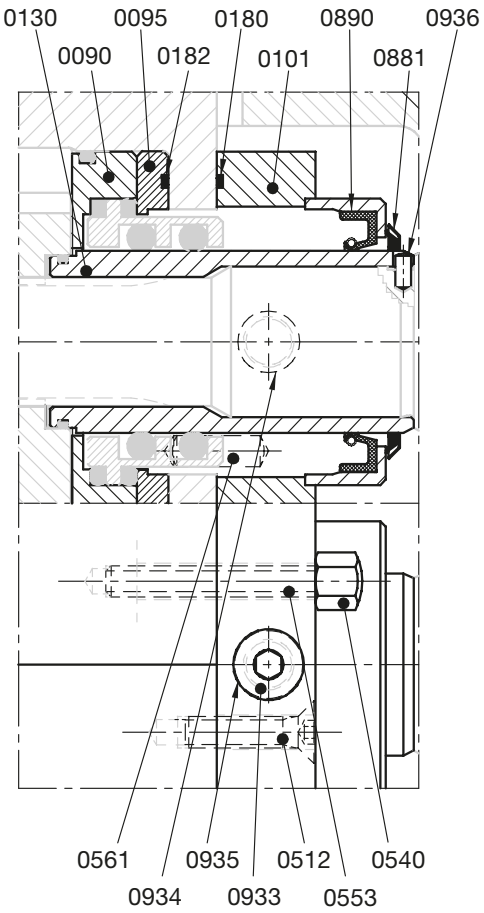
Common parts single O-ring seal

Pos.	Nos./ pump	Description	TL1/0039	TL1/0100 TL1/0139	TL2/0074	TL2/0234 TL2/0301	TL3/0234	TL3/0677 TL3/0953	TL4/0535	TL4/2316 TL4/3497
0082	4	O-ring	see 9.3.1 O-ring kit for single O-ring seal							
0090	1	Seal cover	3.94393.11		3.94409.11		3.94424.11		3.94456.11	
0095	1	Positioning plate	–		3.94410.11	–	3.94425.11	–	–	
0097	2	Support ring	3.94672.11		3.94673.11		3.94674.11		3.94675.11	
0130	2	Shaft sleeve	3.94490.12	3.94395.12	3.94486.12	3.94412.12	3.94492.12	3.94427.12	3.94597.12	3.94459.12
0182	1	O-ring	–		0.2173.940	–	0.2173.947		–	
0183	2	O-ring	see 9.3.1 O-ring kit for single O-ring seal							
0540	2	Cap nut	0.0205.782		–		–		–	
	4	Cap nut	–		0.0205.782		0.0205.782		–	
	6	Cap nut	–		–		–		0.0205.783	
0550	2	Stud bolt	0.0012.900	3.94441.11	–		–		–	
	4	Stud bolt	–		0.0012.901	3.94441.11	0.0012.901	3.94441.11	–	
	6	Stud bolt	–		–		–		3.94561.11	
0930	1	Protection plate	3.94913.11		3.94914.11		3.94915.11		3.94982.11	3.94916.11
0931	1	Screw	0.0138.940		0.0138.940		0.0138.986		0.0138.974	
0936	2	Pin	–		0.0490.641		0.0490.641		0.0490.641	

9.2.2 Double O-ring seal with quench/flush



Double O-ring seal, complete



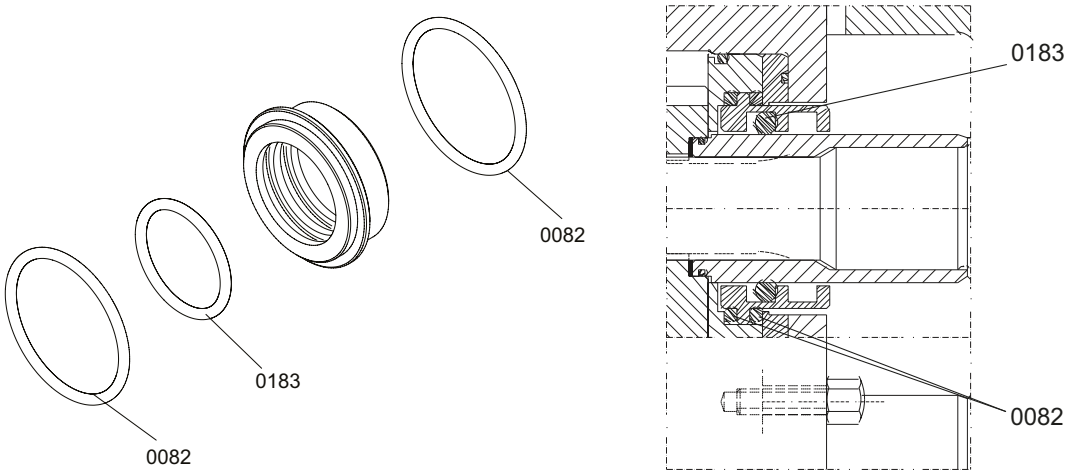
Common parts double O-ring seal

Pos.	Nos./ pump	Description	TL1/0039	TL1/0100 TL1/0139	TL2/0074	TL2/0234 TL2/0301	TL3/0234	TL3/0677 TL3/0953	TL4/0535	TL4/2316 TL4/3497
0082	4	O-ring	see 9.3.2 O-ring kit for double O-ring seal							
0090	1	Seal cover	3.94393.11		3.94409.11		3.94424.11		3.94456.11	
0095	1	Positioning plate	–		3.94410.11	–	3.94425.11	–	–	
0097	2	Support ring	3.94672.11		3.94673.11		3.94674.11		3.94675.11	
0101	1	Flush cover	3.94396.11		3.94413.11		3.94428.11		3.94460.12	
0130	2	Shaft sleeve	3.94490.12	3.94395.12	3.94486.12	3.94412.12	3.94492.12	3.94427.12	3.94597.12	3.94459.12
0180	1	O-ring	0.2173.865		0.2173.940		0.2173.947		0.2173.866	
0182	1	O-ring	–		0.2173.940	–	0.2173.947	–	–	
0183	4	O-ring	see 9.3.2 O-ring kit for double O-ring seal							
0512	4	Screw	0.0254.345		0.0254.346		0.0254.362		0.0254.362	
0540	2	Cap nut	0.0205.782		–		–		–	
	4	Cap nut	–		0.0205.782		0.0205.782		–	
	6	Cap nut	–		–		–		0.0205.783	
0553	2	Stud bolt	0.0012.905	0.0012.903	–		–		–	
	4	Stud bolt	–		0.0012.907	3.94487.11	0.0012.908	3.94488.11	–	
	6	Stud bolt	–		–		–		0.0012.604	
0561	2	Pin	0.0490.084		0.0490.084		0.0490.084		0.0490.102	
0881	2	V-seal	–		–		–		0.2230.468	
0890	2	Lip seal NBR/SS	0.2234.339		0.2234.497		0.2234.527		0.2234.385	
0933	2	Plug	0.0625.061		0.0625.061		0.0625.061		0.0625.061	
0934	2	Plastic plug	3.94615.11		3.94615.11		3.94615.11		3.94615.11	
0935	2	Sealing ring	4A3483.113		4A3483.113		4A3483.113		4A3483.113	
0936	2	Pin	–		0.0490.641		0.0490.641		0.0490.641	

9.3 O-ring kit

9.3.1 O-ring kit for single O-ring seal

Note: Only FDA O-rings are approved for food applications

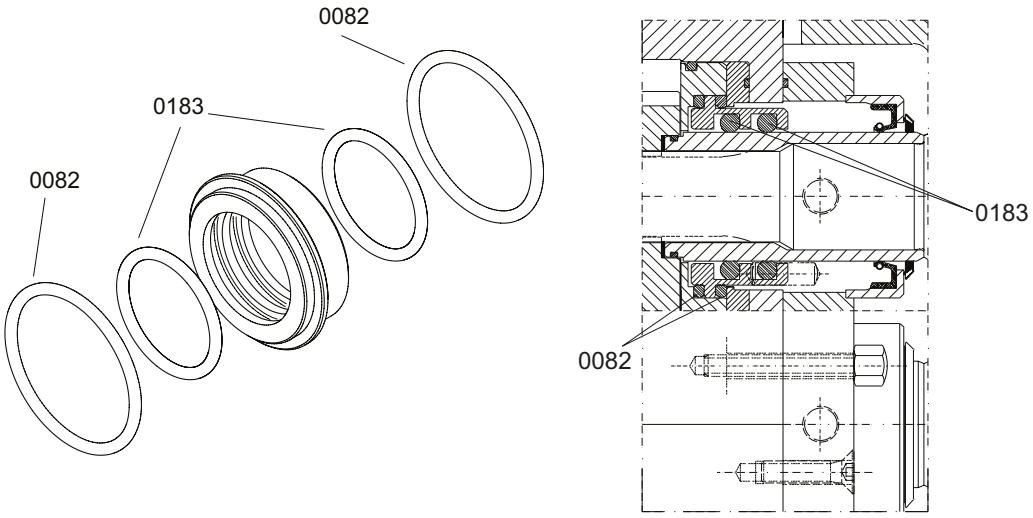


Pos.	Nos./ pump	Description	TL1	TL2	TL3	TL4
O-ring kit FPM			**3.01932.11**	**3.01933.11**	**3.01934.11**	**3.01935.11**
0082	4	O-ring	0.2173.901	0.2173.929	0.2173.942	0.2173.967
0183	2	O-ring	3.92159.11	0.2173.925	0.2173.909	0.2173.968
O-ring kit EPDM			**3.01932.12**	**3.01933.12**	**3.01934.12**	**3.01935.12**
0082	4	O-ring	0.2173.051	0.2173.085	0.2173.251	0.2173.099
0183	2	O-ring	0.2173.077	0.2173.080	0.2173.139	0.2173.145
O-ring kit FPM-FDA			**3.01932.18**	**3.01933.18**	**3.01934.18**	**3.01935.18**
0082	4	O-ring	0.2174.884	0.2174.873	0.2174.888	0.2174.890
0183	2	O-ring	0.2174.874	0.2174.887	0.2174.872	0.2174.891
O-ring kit EPDM - FDA			**3.01932.16**	**3.01933.16**	**3.01934.16**	**3.01935.16**
0082	4	O-ring	0.2173.538	0.2173.545	0.2173.552	0.2173.559
0183	2	O-ring	0.2173.541	0.2173.546	0.2173.556	0.2173.560
O-ring kit PTFE			**3.01932.13**	**3.01933.13**	**3.01934.13**	**3.01935.13**
0082	4	O-ring	0.2173.951	0.2173.815	0.2173.802	0.2173.817
0183	2	O-ring	0.2173.830	0.2173.831	0.2173.832	0.2173.818
O-ring kit CHEMRAZ®			**3.01932.14**	**3.01933.14**	**3.01934.14**	**3.01935.14**
0082	4	O-ring	0.2173.708	0.2173.710	0.2173.712	0.2173.729
0183	2	O-ring	0.2173.764	0.2173.711	0.2173.765	0.2173.730
*** O-ring kit KALREZ®**			**3.01932.15**	**3.01933.15**	**3.01934.15**	**3.01935.15**
0082	4	O-ring	0.2173.624	0.2173.616	0.2173.619	0.2173.622
0183	2	O-ring	0.2173.655	0.2173.617	0.2173.656	0.2173.626

** Kalrez is a registered trademark of DuPont Performance Elastomers.*

9.3.2 O-ring kit for double O-ring seal

Note: Only FDA O-rings are approved for food applications

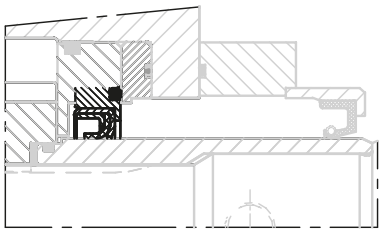


Pos.	Nos./ pump	Description	TL1	TL2	TL3	TL4
O-ring kit FPM			**3.01936.11**	**3.01937.11**	**3.01938.11**	**3.01939.11**
0082	4	O-ring	0.2173.901	0.2173.929	0.2173.942	0.2173.967
0183	4	O-ring	3.92159.11	0.2173.925	0.2173.909	0.2173.968
O-ring kit EPDM			**3.01936.12**	**3.01937.12**	**3.01938.12**	**3.01939.12**
0082	4	O-ring	0.2173.051	0.2173.085	0.2173.251	0.2173.099
0183	4	O-ring	0.2173.077	0.2173.080	0.2173.139	0.2173.145
O-ring kit FPM-FDA			**3.01936.18**	**3.01937.18**	**3.01938.18**	**3.01939.18**
0082	4	O-ring	0.2174.884	0.2174.873	0.2174.888	0.2174.890
0183	4	O-ring	0.2174.874	0.2174.887	0.2174.872	0.2174.891
O-ring kit EPDM - FDA			**3.01932.16**	**3.01933.16**	**3.01934.16**	**3.01935.16**
0082	4	O-ring	0.2173.538	0.2173.545	0.2173.552	0.2173.559
0183	4	O-ring	0.2173.541	0.2173.546	0.2173.556	0.2173.560
O-ring kit PTFE			**3.01936.13**	**3.01937.13**	**3.01938.13**	**3.01939.13**
0082	4	O-ring	0.2173.951	0.2173.815	0.2173.802	0.2173.817
0183	4	O-ring	0.2173.830	0.2173.831	0.2173.832	0.2173.818
O-ring kit CHEMRAZ®			**3.01936.14**	**3.01937.14**	**3.01938.14**	**3.01939.14**
0082	4	O-ring	0.2173.708	0.2173.710	0.2173.712	0.2173.729
0183	4	O-ring	0.2173.764	0.2173.711	0.2173.765	0.2173.730
*** O-ring kit KALREZ®**			**3.01936.15**	**3.01937.15**	**3.01938.15**	**3.01939.15**
0082	4	O-ring	0.2173.624	0.2173.616	0.2173.619	0.2173.622
0183	4	O-ring	0.2173.655	0.2173.617	0.2173.656	0.2173.62

** Kalrez is a registered trademark of DuPont Performance Elastomers.*

10.0 Hard lip seal

10.1 General



Design

- The removable support ring (containing the lip seal) is built into the seal cover, which is assembled in the rotor case from the front end, and locked by the friction force of an O-ring.
- The lip seal is running on the rotating shaft sleeve which is locked on the shaft.
- Seal faces on the shaft sleeve are coated with tungsten carbide.
- Suitable for two directions of rotation.
- Low pressure quench or flushing possible if the pump is equipped with the flush cover including extra lip seals.

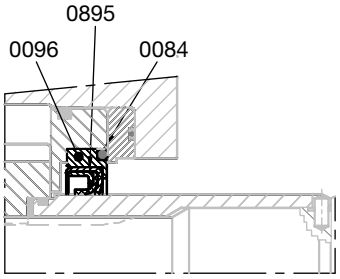
Technical data

Materials of O-rings:	Fluorocarbon FPM EPDM (E) PTFE lined (T) Perfluor Chemraz® (C) * Perfluor Kalrez® (K)
Temperature:	Up to the temperature limit of the pump
Maximum pressure:	10 bar
Maximum pressure of quench/flushing medium:	0.5 bar
Unpressurised seal:	Pressure is lower than or equal to the process pressure

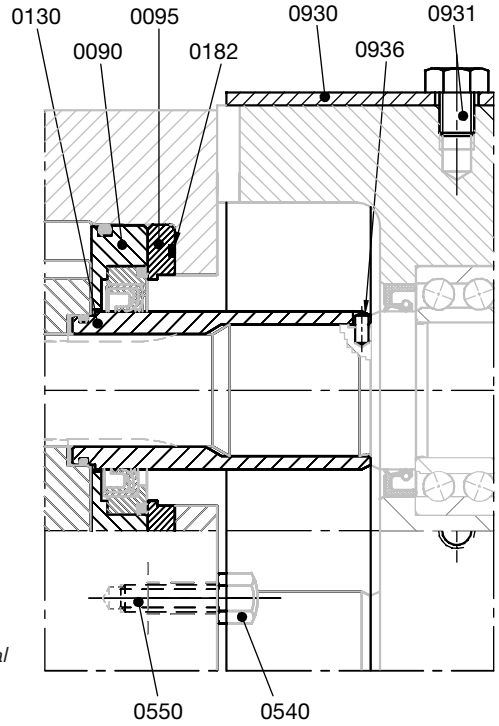
** Kalrez is a registered trademark of DuPont Performance Elastomers.*

10.2 Seal options

10.2.1 Hard lip seal – TL1, TL2, TL3



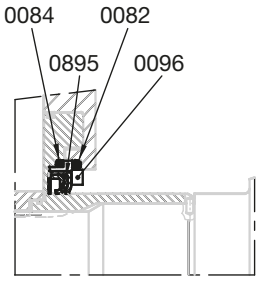
Hard lip seal, complete



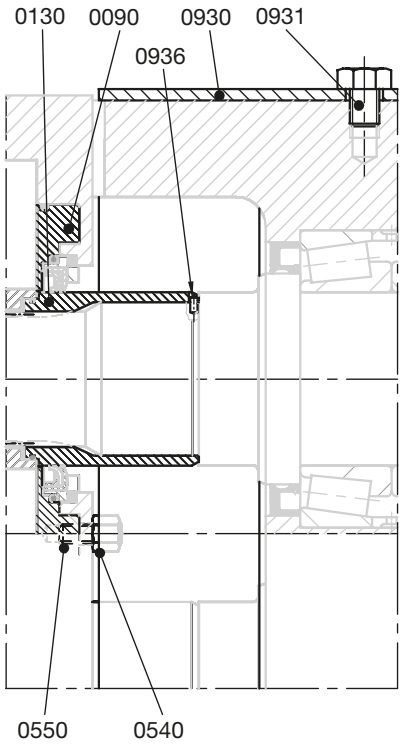
Common parts hard lip seal

Pos.	Nos./ pump	Description	TL1/0039	TL1/0100 TL1/0139	TL2/0074	TL2/0234 TL2/0301	TL3/0234	TL3/0677 TL3/0953
0084	2	O-ring	see 10.3 O-ring kit for hard lip seal with/without flushing					
0090	1	Seal cover	3.94393.11		3.94409.11		3.94424.14	
0095	1	Positioning plate	–		3.94410.11	–	3.94425.11	–
0096	2	Support ring for lip seal	3.94493.11		3.94484.11		–	
0130	2	Shaft sleeve	3.94490.12	3.94395.12	3.94486.12	3.94412.12	3.94492.12	3.94427.12
0182	1	O-ring	–		0.2173.940	–	0.2173.947	–
0540	2	Cap nut	0.0205.782		–		–	
	4	Cap nut	–		0.0205.782		0.0205.782	
0550	2	Stud bolt	0.0012.900	3.94441.11	–		–	
	4	Stud bolt	–		0.0012.901	3.94441.11	0.0012.901	3.94441.11
0895	2	Lip seal	see 10.3 O-ring kit for hard lip seal with/without flushing					
0930	1	Protection plate	3.94913.11		3.94914.11		3.94915.11	
0931	1	Screw	0.0138.940		0.0138.940		0.0138.986	
0936	2	Pin	–		0.0490.641		0.0490.641	

10.2.2 Hard lip seal – TL4



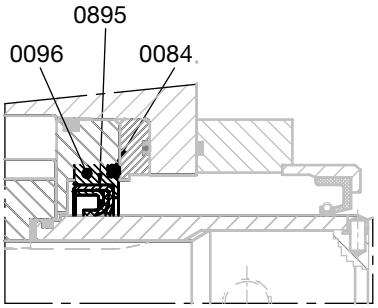
Hard lip seal, complete



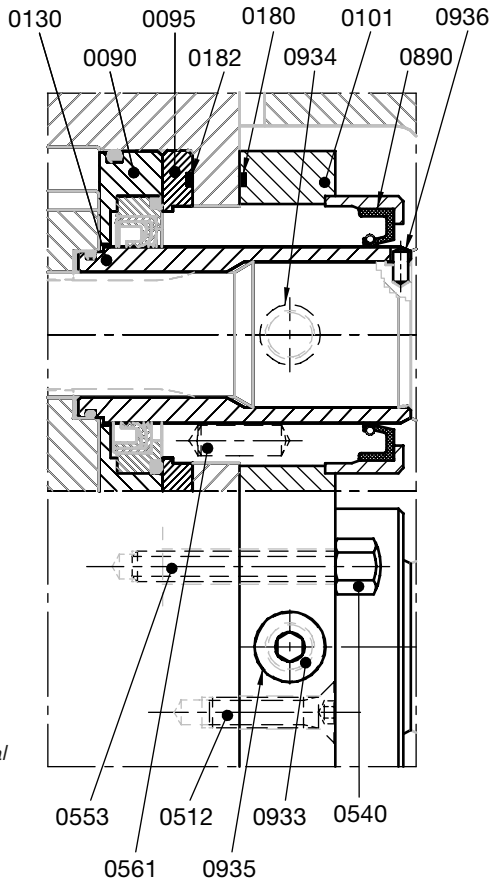
Common parts hard lip seal

Pos.	Nos./ pump	Description	TL4/0535	TL4/2316 TL4/3497
0082	2	O-ring	see 10.3 O-ring kit for hard lip seal with/without flushing	
0084	2	O-ring		
0090	1	Seal cover	3.94456.11	
0096	2	Support ring for lip seal	3.94593.11	
0130	2	Shaft sleeve	3.94597.12	3.94459.12
0540	6	Cap nut	0.0205.783	
0550	6	Stud bolt	3.94561.11	
0895	2	Lip seal	see 10.3 O-ring kit for hard lip seal with/without flushing	
0930	1	Protection plate	3.94982.11	3.94916.11
0931	1	Screw	0.0138.974	
0936	2	Pin	0.0490.641	

10.2.3 Hard lip seal with quench/flush – TL1, TL2, TL3



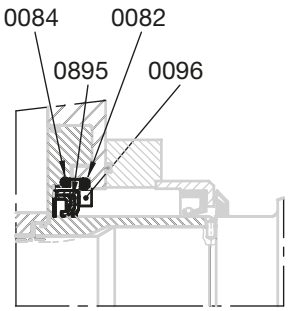
Hard lip seal with quench/flush, complete



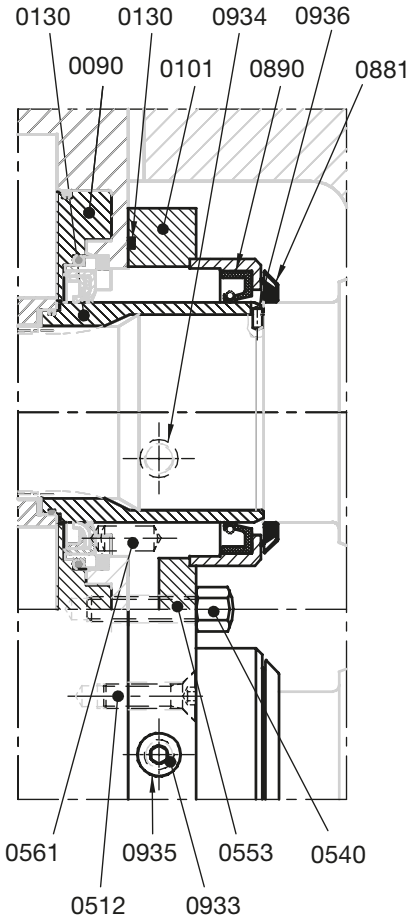
Common parts hard lip seal

Pos.	Nos./ pump	Description	TL1/0039	TL1/0100 TL1/0139	TL2/0074	TL2/0234 TL2/0301	TL3/0677 TL3/0234	TL3/0953
0084	2	O-ring	see 10.3 O-ring kit for hard lip seal with/without flushing					
0090	1	Seal cover	3.94393.11		3.94409.11		3.94424.14	
0095	1	Positioning plate	–		3.94410.11	–	3.94425.11	–
0096	2	Support ring for lip-seal	3.94493.11		3.94484.11		–	
0101	1	Flush cover	3.94396.11		3.94413.11		3.94428.11	
0130	2	Shaft sleeve	3.94490.12	3.94395.12	3.94486.12	3.94412.12	3.94492.12	3.94427.12
0180	1	O-ring	0.2173.865		0.2173.940		0.2173.947	
0182	1	O-ring	–		0.2173.940	–	0.2173.947	–
0512	4	Screw	0.0254.345		0.0254.346		0.0254.362	
0540	2	Cap nut	0.0205.782		–		–	
	4	Cap nut	–		0.0205.782		0.0205.782	
0553	2	Stud bolt	0.0012.905	0.0012.903	–		–	
	4	Stud bolt	–		0.0012.907	3.94487.11	0.0012.908	3.94488.11
0561	2	Pin	0.0490.084		0.0490.084		0.0490.084	
0890	2	Lip seal	0.2234.339		0.2234.497		0.2234.527	
0895	2	Lip seal	see 10.3 O-ring kit for hard lip seal with/without flushing					
0933	2	Plug	0.0625.061		0.0625.061		0.0625.061	
0934	2	Plastic plug	3.94615.11		3.94615.11		3.94615.11	
0935	2	Sealing ring	4A3483.113		4A3483.113		4A3483.113	
0936	2	Pin	–		0.0490.641		0.0490.641	

10.2.4 Hard lip seal with quench/flush – TL4



Hard lip seal with quench/flush, complete

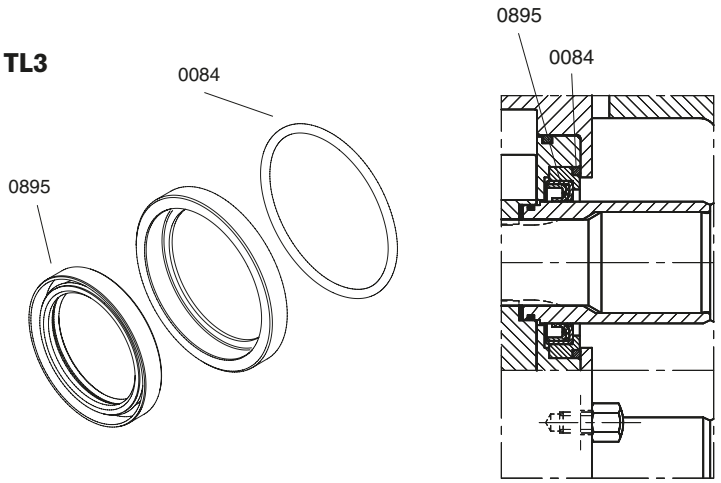


Common parts hard lip seal with quench/flush

Pos.	Nos./ pump	Description	TL4/0535	TL4/2316 TL4/3497
0082	2	O-ring	see 10.3 O-ring kit for hard lip seal with/without flushing	
0084	2	O-ring		
0090	1	Seal cover	3.94456.11	
0096	2	Support ring for lip-seal	3.94593.11	
0101	1	Flush cover	3.94460.12	
0130	2	Shaft sleeve	3.94597.12	3.94459.12
0180	1	O-ring	0.2173.866	
0512	4	Screw	0.0254.362	
0540	6	Cap nut	0.0205.783	
0553	6	Stud bolt	0.0012.604	
0561	2	Pin	0.0490.754	
0881	2	V-seal	0.2230.468	
0890	2	Lip seal	0.2234.385	
0895	2	Lip seal	see 10.3 O-ring kit for hard lip seal with/without flushing	
0933	2	Plug	0.0625.061	
0934	2	Plastic plug	3.94615.11	
0935	2	Sealing ring	4A3483.113	
0936	2	Pin	0.0490.641	

10.3 O-ring kit for hard lip seal with/without quench/flush

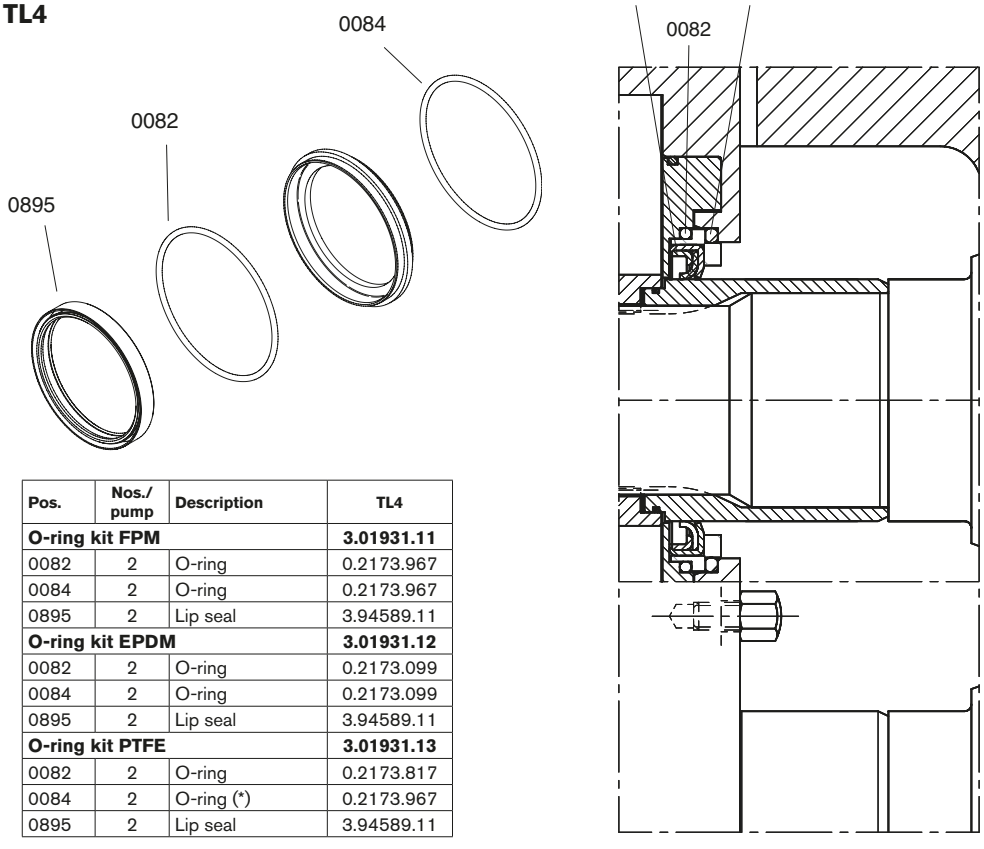
TL1, TL2, TL3



Pos.	Nos./ Pump	Description	TL1	TL2	TL3*	TL3
O-ring kit FPM			**3.01928.11**	**3.01929.11**	**3.01930.11**	**–**
0084	2	O-ring	0.2173.904	3.90223.11	0.2173.990	–
0895	2	Lip seal	3.94517.11	3.94518.11	3.94519.11	3.95723.11
O-ring kit EPDM			**3.01928.12**	**3.01929.12**	**3.01930.12**	**–**
0084	2	O-ring	0.2173.240	0.2173.055	0.2173.243	–
0895	2	Lip seal	3.94517.11	3.94518.11	3.94519.11	3.95723.11

** Spare part kits for pumps manufactured before 2004.*

TL4



Pos.	Nos./ pump	Description	TL4
O-ring kit FPM			**3.01931.11**
0082	2	O-ring	0.2173.967
0084	2	O-ring	0.2173.967
0895	2	Lip seal	3.94589.11
O-ring kit EPDM			**3.01931.12**
0082	2	O-ring	0.2173.099
0084	2	O-ring	0.2173.099
0895	2	Lip seal	3.94589.11
O-ring kit PTFE			**3.01931.13**
0082	2	O-ring	0.2173.817
0084	2	O-ring (*)	0.2173.967
0895	2	Lip seal	3.94589.11

(*) Pos. 0084 in O-ring kit PTFE is of FPM

11.0 Quench and Flush connections

Several connection types for circulation of quench or flush on the shaft sealing are possible according to Seal plans 52, 53 and 54.

These connections are applied on TopLobe with single mechanical seal, double mechanical seal, O-ring seal and hard lip seal types with quench or flush options.

They can be connected in different ways. You will find the schemes on the next pages regarding seal plans.

Circulation happens by pressure difference or thermosyphon working (i.e. difference in temperature of the barrier liquid). Direction of flow is reversible but to facilitate venting, we advise to bring the outlet on top level.

Maximum differential pressure over seal faces (pressure of quench/flush medium):

- **Single mechanical seal, O-ring seal, Hard lip seal**
  The maximum pressure of the quench/flush medium is 0.5 bar due to the limitations of the applied lip seal.
- **Double mechanical seal, pressurised**
  The barrier liquid should have a pressure of at least 1 bar/10% higher than the differential pressure of the pump.

If you need more information, please contact your local distributor.

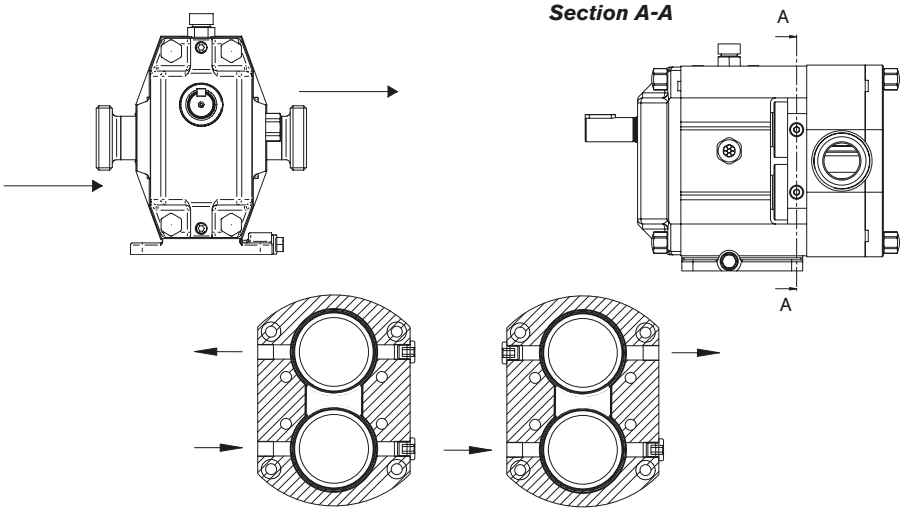
11.1 Seal plans

11.1.1 Pump connections in horizontal position

A) Seal plan 54 (circulation) or plan 62 (through flow)

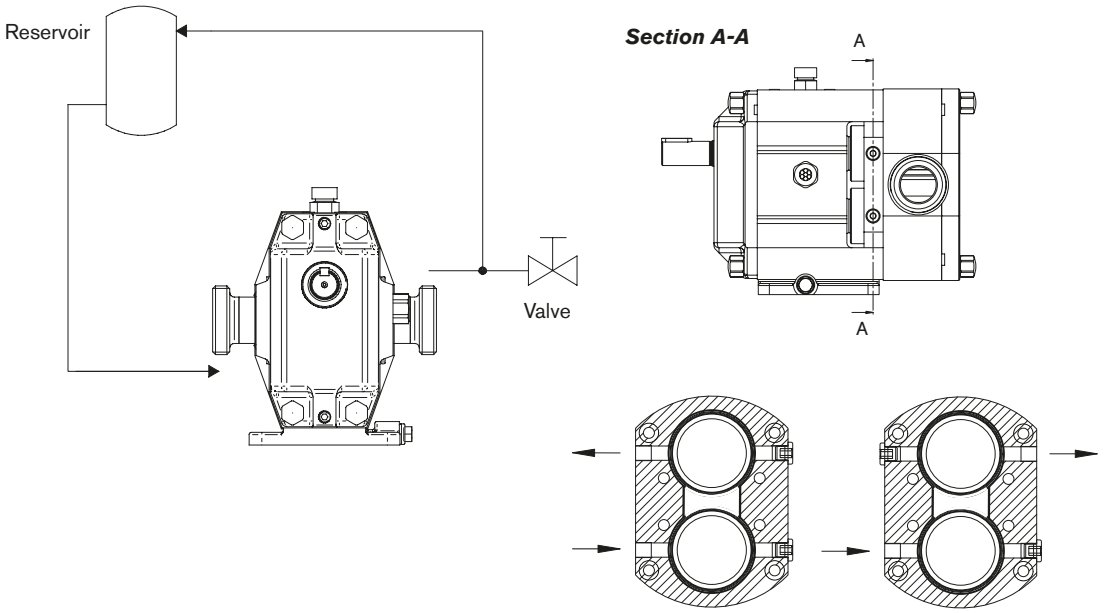
Use a pressurised external barrier fluid reservoir or system to clean fluid to the seal chamber.

Provide circulation by an external pressure system or pump.



B) Seal plan 52 – Unpressurised double seal

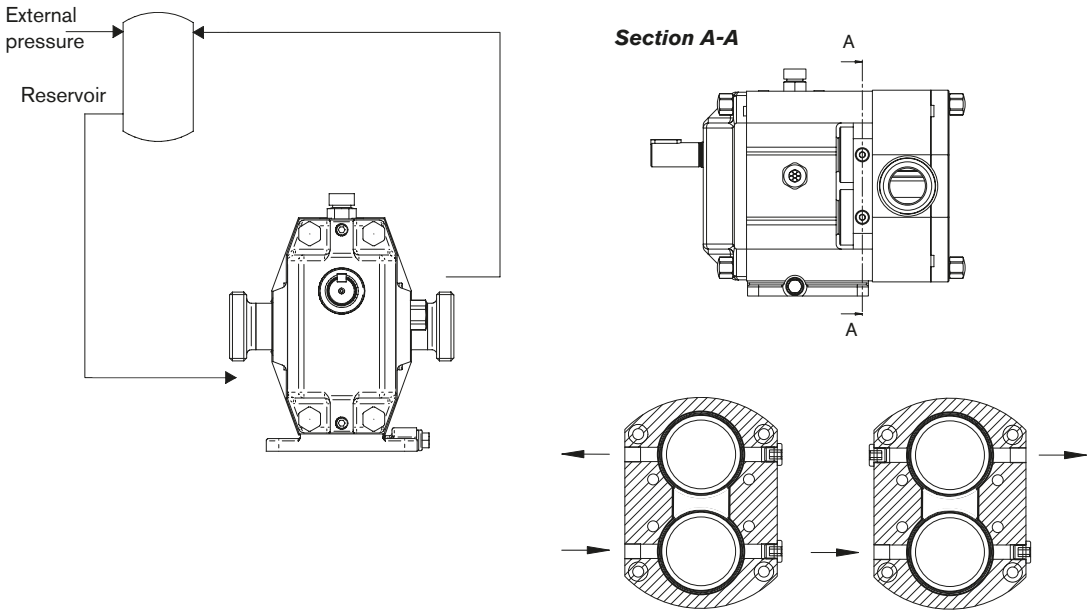
Use an external reservoir to provide unpressurised buffer fluid



C) Seal plan 53 – Pressurised double seal

Use a pressurised external reservoir to supply clean fluid to the seal chamber.

Reservoir pressure is greater than the sealing chamber process pressure.

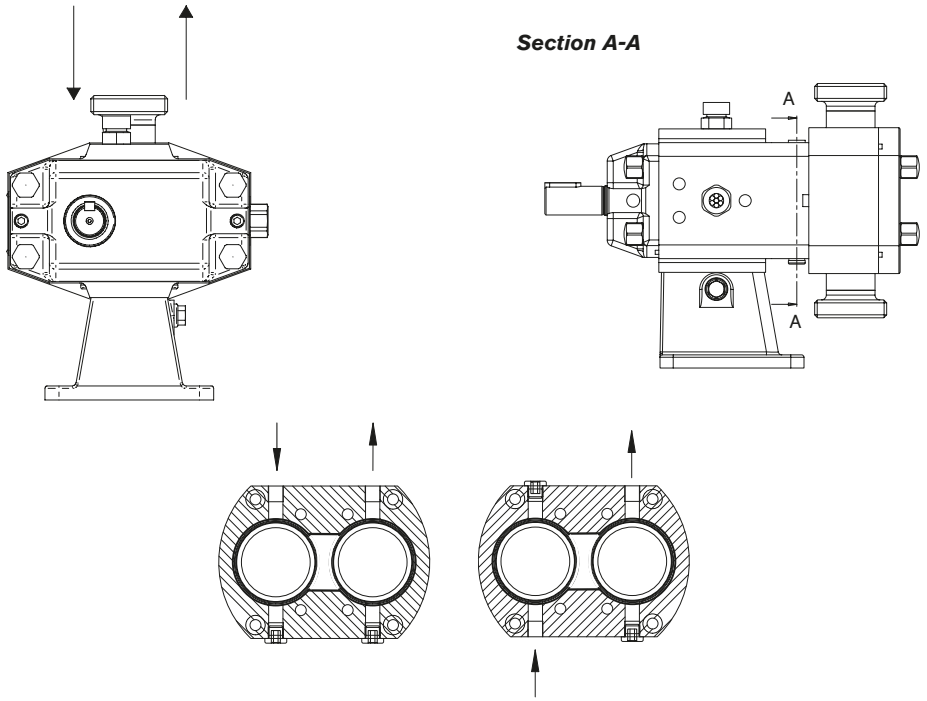


11.1.2 Pump connections in vertical position

A) Seal plan 54 (circulation) or plan 64 (through flow)

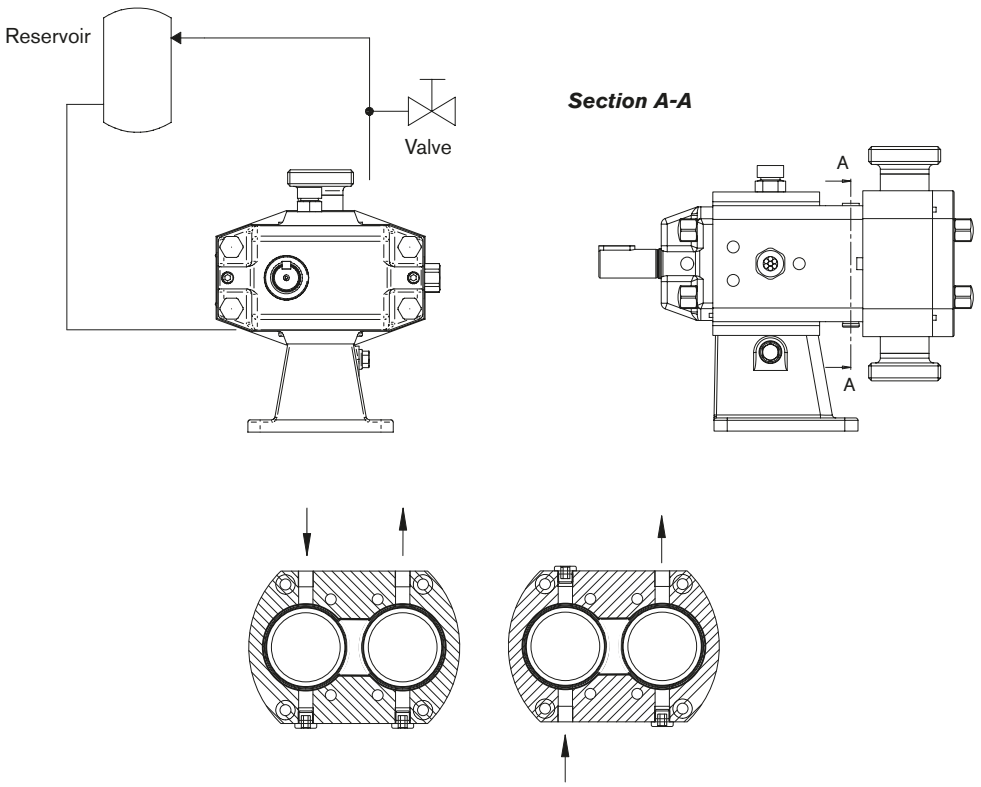
Use a pressurised external barrier fluid reservoir or system to clean fluid to the seal chamber.

Circulation is to be provided by an external pressure system or pump.



B) Seal plan 52 – Unpressurised double seal

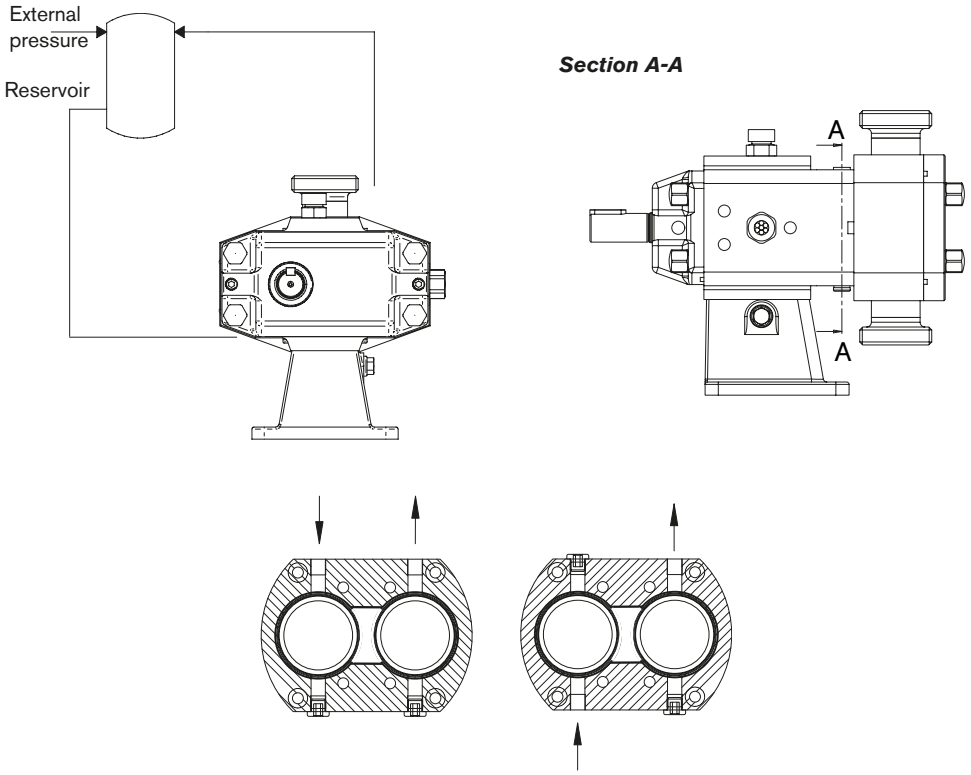
Use an external reservoir to provide unpressurised buffer fluid



C) Seal plan 53 – Pressurised double seal

Use a pressurised external barrier fluid reservoir to supply clean fluid to the seal chamber.

Reservoir pressure is greater than the sealing chamber process pressure.



12.0 Valves

12.1 Heating and cooling jackets

All TopLobe models can be supplied with pump covers with channels for heating or cooling.

Heating/cooling jacket

The reason for having this possibility is mainly used for bringing the medium inside the rotor case on temperature before starting up the pump. This option is not meant to heat, cool or maintain the temperature of the pumped medium in the process. The pre-heating or cooling of the pump cover should be integrated in the heating or cooling system of the installation.

The pump cover with or without safety relief valve for heating/cooling is provided with two holes drilled straight through the cover. The heat is transferred to the rotor case via the contact faces between cover and rotor case.

The heating/cooling channels in the pump cover together with the flush holes of the shaft seal are positioned in such a way that the required thermal effects on the built-on safety relief valve, rotor case and shaft seal are the best.

The pressure rating at the ports of the pump cover for heating/cooling is 10 bar and should not be exceeded without contacting your supplier for advice.

For start-up and shut-down procedures where heating/cooling devices are employed, the heating/cooling medium should circulate 20-45 minutes before start-up and/or shut-down. When CIP/SIP cycle is employed as a part of the process, the heating/cooling medium should continue to circulate during the cleaning/sterilizing process.

12.2 Built-on safety relief valves

TopLobe pumps can be supplied with following types of built-on safety relief valves.

	TL1	TL2	TL3	TL4
Spring loaded	x	x	x	–
Spring loaded - air lifted for CIP/SIP function	x	x	x	–
Air loaded - air lifted for process adjustment with CIP/SIP function	x	x	x	x

Note! *For the TL4 models only the air loaded version with CIP/SIP valve function can be supplied.*

Following pressure limitations are applicable for TopLobe pumps

Pump type	Max differential pressure [bar]	Max operating pressure [bar]
TL1/0039	22	25
TL1/0100	12	15
TL1/0139	7	10
TL2/0074	22	25
TL2/0234	12	15
TL2/0301	7	10
TL3/0234	22	25
TL3/0677	12	15
TL3/0953	7	10
TL4/0535	22	25
TL4/2316	12	15
TL4/3497	7	10

12.2.1 General description

Significant for all SPX safety relief valves is that the valve head is built directly into the pump cover. In this way the valve is of the highest hygienic design and easy to clean or check. The head has been designed to maximize the flow passage section and to minimize pressure losses as well as allow particles to pass through. When the valve head is opening, it creates a short cut between discharge and suction side of the pump. On the valves equipped with air-lift function the valve head can be opened to create a by-pass to reach the necessary flow-passage for CIP or SIP cleaning.

The valve head is covering part of the discharge side as well as the suction side of the pump. It is also covering most of the front face of the rotors. The pressure distribution in this area is depending on the properties of the pumped media. The differential pressure on the pump is influencing the load that is acting on the valve head. The set value of the spring or air pressure is balancing the valve head. The properties of the pumped media, the design of the application as well as the process influences the load acting on the valve head. These are the main reasons why the valve setting should not be done in the factory. The opening pressure of the safety relief valve is set to 0 bar from factory. The setting of the valve should be carried out on site under proposed duty conditions for which the pump and valve were selected.

When the differential pressure of the pump becomes higher than the valve settings, the valve head will open. Due to the large size of the valve head, the full capacity of the pump can pass through the valve from the discharge back to the suction side. With the correct setting it is not possible to overpressure the pump under no circumstances.

If the pump is working against a closed discharge valve the medium circulates inside the pump via the relief valve. The hydraulic power and the friction losses are transformed to thermal energy and the temperature of this relatively small volume of circulating fluid will rise if the pump continues to operate for an extended period of time. In severe cases this may result in temperatures exceeding the operating limits of the pump or in vaporization of the fluid, both of which should be avoided. For these reasons, the valve should only be used as a safety relief valve and not as flow control valve.

When the valve is activated an unforeseen operating condition has occurred. The reason for the system pressure increase should be investigated and corrected, as continuous operation of the pump with the valve open is not allowable and may cause severe damage to the pump.

Under no circumstances attempt should be made to dismantle a safety relief valve when the spring pressure is not relieved, when it is still connected to a pressurized air supply or is mounted on the pump while the pump is operating. Serious personal injury or pump damage may occur.

12.2.2 Safety relief valve - Spring Loaded

12.2.2.1 Spring Loaded

Fig. 1 and 2 are showing the design of the spring loaded safety relief valve. The valve head (A) is subjected to the fluid pressure in the rotor case on one side and by spring force on the other side. The spring is acting directly on the valve head.

By turning the spring adjusting screw (B) the compression of the spring is modified and the opening pressure of the safety relief valve can be adjusted.

To turn the spring adjusting screw (B), the retainer tool delivered with the pump must be used.

Fig. 1 shows the safety relief valve completely closed. The valve head (A) is in line with the front face of the pump cover. The valve has been adjusted by compressing the spring via the spring adjusting screw (B).

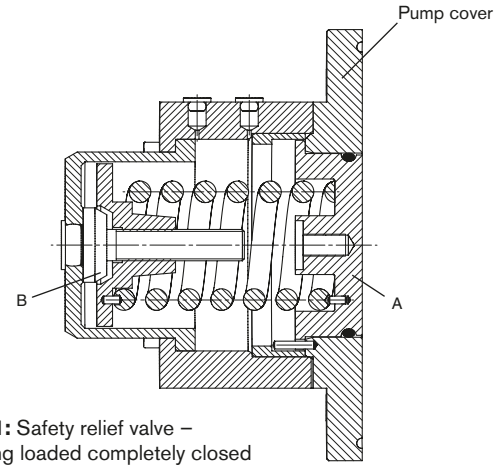


Fig 1: Safety relief valve –
Spring loaded completely closed

Fig. 2 shows the valve partly opened. The medium pressure inside the rotor case has forced the valve head (A) to the left against the force of the spring.

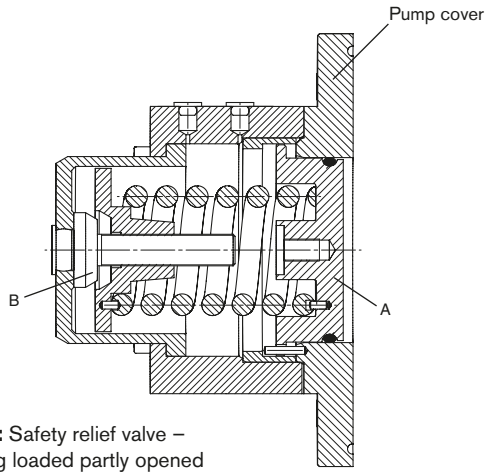


Fig 2: Safety relief valve –
Spring loaded partly opened

12.2.2.2 Spring loaded completely opened

Fig. 3 is showing the design of the spring loaded safety relief valve completely opened.

The medium pressure inside the rotor case has forced the valve head (A) completely to the left against the force of the spring.

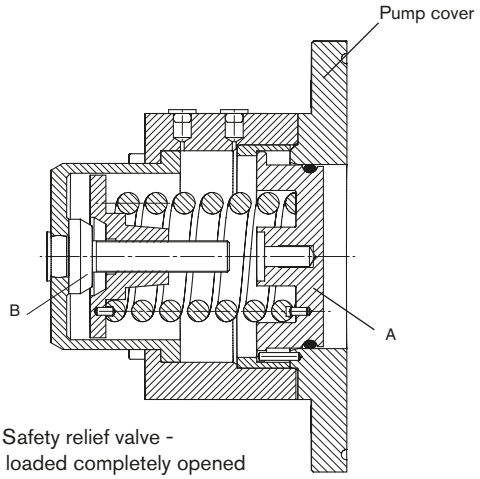


Fig 3: Safety relief valve -
Spring loaded completely opened

12.2.3 Safety relief valve - Spring loaded - air lifted

12.2.3.1 Spring loaded - air lifted

Fig. 4 and 5 are showing the design of the spring loaded - air lifted safety relief valve. The valve head (A) is subjected to the fluid pressure in the rotor case on one side and by spring force on the other side. The spring is not acting directly on the valve head (A) but via piston (C) and spacer sleeve (D).

By turning the spring adjusting screw (B) the compression of the spring is modified and the opening pressure of the safety relief valve can be adjusted. To turn the spring adjusting screw (B), the retainer tool delivered with the pump must be used.

Fig. 4 shows the safety relief valve completely closed. The valve head (A) is in line with the front face of the pump cover and the CIP/SIP valve cylinder is completely relieved.

The setting pressure of the valve has been adjusted by compressing the spring via the spring adjusting screw (B).

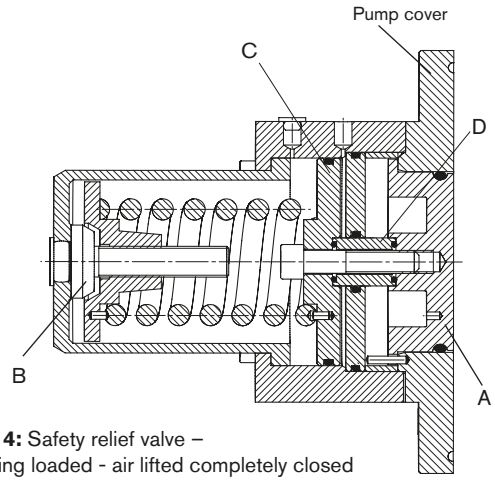


Fig 4: Safety relief valve –
Spring loaded - air lifted completely closed

Fig. 5 shows the valve partly opened. The medium pressure inside the rotor case has forced the valve head (A) to the left against the force of the spring via the distance sleeve and the CIP/SIP piston valve.

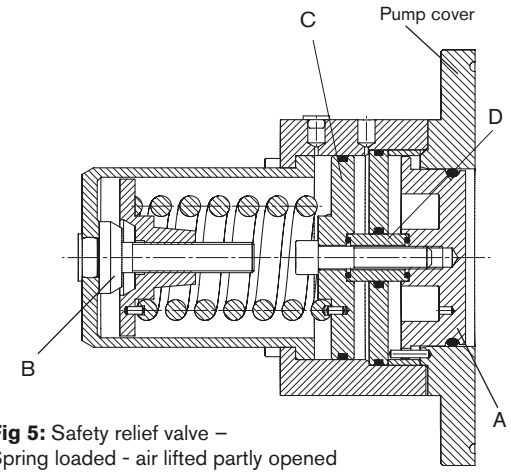


Fig 5: Safety relief valve –
Spring loaded - air lifted partly opened

12.2.3.2 Spring loaded - air lifted with CIP/SIP valve function

Fig. 6 shows the valve completely opened. The pressure inside chamber (ii) has forced the piston (C) and the valve head (A) which is connected to it to the left against the force of the spring.

To operate the CIP/SIP valve function chamber (ii) must be pressurized with 6 bar, which is the normal pressure of air supply systems. This way it is ensured that the valve is opening far enough for CIP/SIP cleaning purposes.

The pressure is acting on the CIP/SIP valve piston (C). By doing that the CIP/SIP valve piston (C) and the valve head (A) which is connected to it via the spacer sleeve (D) will move against the force of the spring.

To resume the safety relief valve function, cylinder (ii) must be completely relieved.

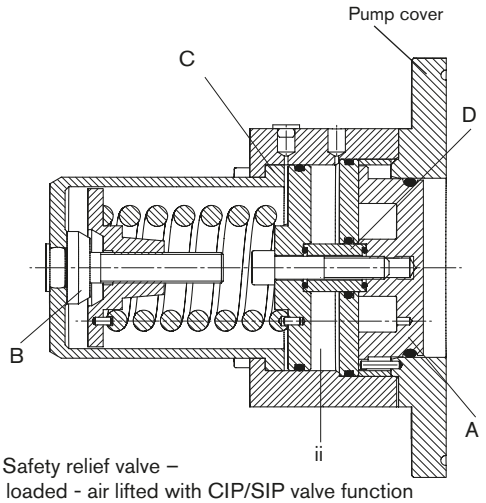
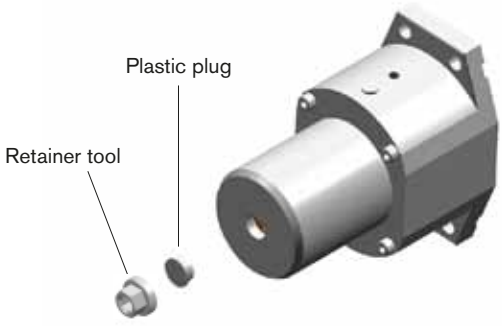


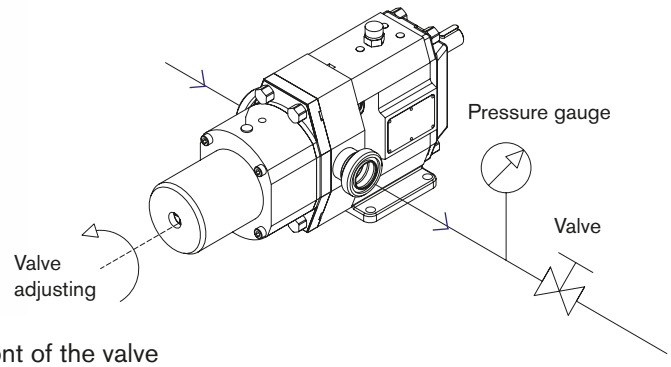
Fig 6: Safety relief valve – Spring loaded - air lifted with CIP/SIP valve function

12.2.4 Setting and operating – Spring loaded and spring loaded - air lifted

Since the opening pressure of the relief valve is depending on the viscosity of the pumped medium, the setting of the relief valve should be done while the pump is fitted in the installation. To be able to do so there must be a pressure gauge installed as close as possible to the pump discharge port and a valve must be foreseen in the discharge line to adjust the discharge pressure.

To adjust the set-pressure of valve do as follows:





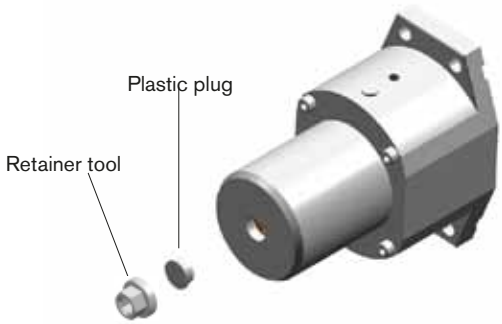
- Remove the plastic plug at the front of the valve
- Use the retainer tool to turn the adjusting screw counter-clockwise until the spring is completely relieved
- Connect the pressure gauge to the discharge line and open the discharge valve completely
- Start the pump
- Use the retainer tool to turn the adjusting screw clockwise until the maximum spring setting is reached (the valve is blocked). While doing this, check on the pressure gauge that the pressure does not rise above the maximum allowable pressure of the pump.

- Close the discharge valve slowly until the desired set-pressure is reached
- Use the retainer tool to turn the adjusting screw of the valve slowly counter clockwise until the discharge pressure is starting to drop away
- Check the proper setting of the valve by slowly opening and closing the discharge valve. The set-pressure of the relief valve can be increased by turning the adjusting screw clockwise and decreased by turning the adjusting screw counter-clockwise
- After setting the relief valve, open the discharge valve completely

Note: *If the valve is not adjusted according to the method described above the correct valve setting cannot be guaranteed and the pump might be damaged because of too high discharge pressure.*

If there is no possibility to connect a pressure gauge or there is no discharge valve foreseen in the installation, the valve can be pre-adjusted according to the procedure described below.

- Remove the plastic plug at the front of the valve
- Use the retainer tool to turn the adjusting screw counter-clockwise until the spring is completely relieved
- Turn the spring adjusting screw X number of turns clockwise in function of the desired opening pressure (see table below)



The values in the table are based on the assumption that the suction pressure is between 0.5 and 1 bar absolute. Please note that the values are a rough adjustment.

	TL1	TL2	TL3
Opening pressure pd (bar)	**Rotate adjusting screw X turns**	**Rotate adjusting screw X turns**	**Rotate adjusting screw X turns**
0	0.0	0.0	0.0
1	0.6	1.4	2.7
2	1.3	2.8	5.3
3	1.9	4.2	8.0
4	2.6	5.6	10.6
5	3.2	6.9	13.3
6	3.9	8.3	16.0
7	4.5	9.7	18.6
8	5.2	11.1	21.3
9	5.8	12.5	23.9
10	6.5	13.9	26.6
11	7.1	15.3	29.3
12	7.8	16.7	31.9
13	8.4	18.0	34.6
14	9.0	19.4	37.2
15	9.7	20.8	39.9
16	10.3	22.2	42.5
17	11.0	23.6	45.2
18	11.6	25.0	47.9
19	12.3	26.4	50.5
20	12.9	27.8	53.2
21	13.6	29.1	55.8
22	14.2	30.5	58.5

12.2.5 Safety relief valve – Air loaded - air lifted

12.2.5.1 Air loaded

Fig 7 and 8 are showing the design of the air loaded - air lifted safety relief valve.

The pressure in the control chamber (i) is keeping the valve head in balance with the medium pressure. If the force created by the medium pressure becomes higher than the force created by the control pressure acting on piston (B), the valve head (A) starts to move and the valve opens.

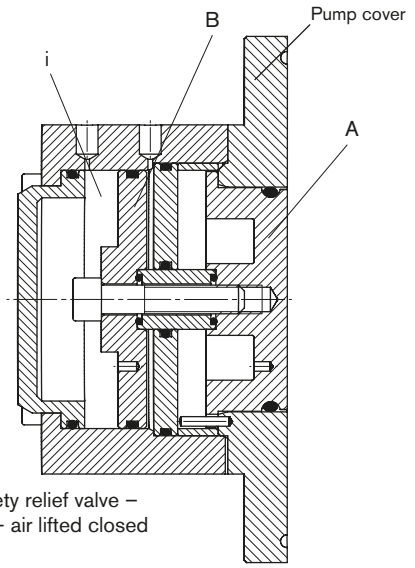


Fig 7: Safety relief valve – Air loaded - air lifted closed

While only part of the valve head (A) is loaded by the discharge pressure, the biggest portion of the valve head (A) is covered by the rotors (front clearances) or loaded by the relatively low suction pressure, the control pressure is working on the full surface of the control piston. That implies that the control pressure has to be set much lower than the opening pressure of the valve.
Indications of control pressures can be found on page 102. See table.

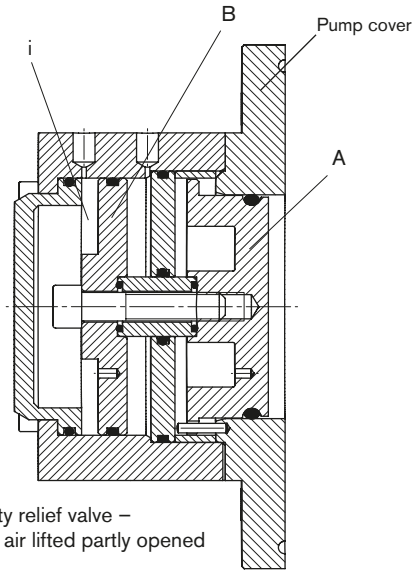


Fig 8: Safety relief valve – Air loaded - air lifted partly opened

12.2.5.2 Air loaded - air lifted with CIP/SIP valve function

Fig. 9 is showing the design of the air loaded - air lifted safety relief valve with CIP/SIP valve function.

To operate the CIP/SIP valve function chamber (ii) must be pressurized.

The pressure is acting on the rear face of the piston (B). By doing that, valve head (A) and piston (B) which are connected to each other, will move against the force created by the control pressure inside chamber (i).

If the control pressure is maintained during the CIP/SIP valve operation, the pressure needed to open the valve must be about 0.5 bar higher than the control pressure in chamber (i). To resume the safety relief valve function, chamber (ii) must be completely relieved.

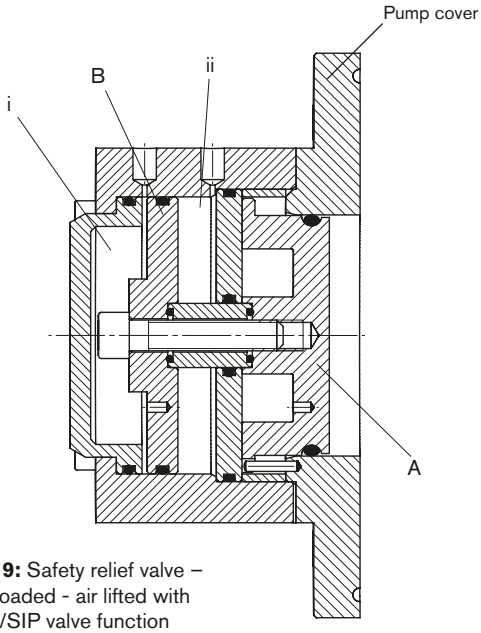
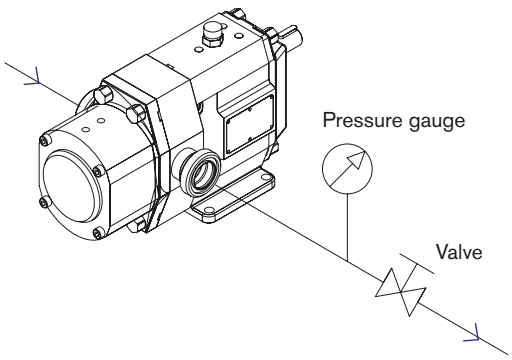


Fig 9: Safety relief valve – Air loaded - air lifted with CIP/SIP valve function

12.2.6 Setting and operating – Air loaded - air lifted safety relief valves

To adjust the set-pressure of valve do as follows:

- Make sure that the pressure in the control pressure cylinder and the air lift chamber is completely relieved.
- Connect the pressure gauge to the discharge line and open the discharge valve completely
- Start the pump
- Operate the air adjusting valve to slowly increase the control pressure of the valve until the maximum control pressure is reached. While doing this check that the discharge pressure is not rising above the maximum allowable pressure of the pump
- Close the discharge valve slowly until the desired set pressure is reached
- Operate the adjusting valve slowly to decrease the control pressure of the valve until the discharge pressure is starting to drop away
- Check the proper setting of the valve by slowly opening and closing the discharge valve. The set-pressure of the relief valve can be increased by increasing the control pressure and decreased by decreasing the control pressure



- After setting the relief valve, open the discharge valve completely

If the valve is not adjusted according to the method described above the correct valve setting cannot be guaranteed and the pump might be damaged because of too high discharge pressure.

If there is no possibility to connect a pressure gauge in the discharge line or there is no discharge valve foreseen in the installation, the valve setting might be approached by adjusting the control pressure to the values indicated in the table below.

Note: *Since the control pressure is depending on the nature of the pumped medium the values given in the table below must be interpreted as guidelines.*

TL1, TL2 – Control pressure

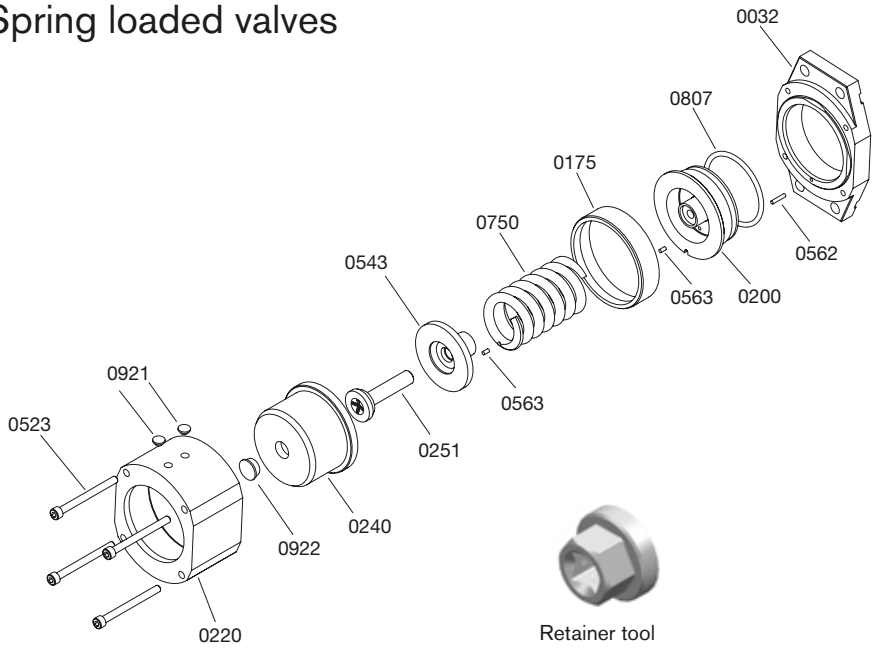
	TL1/0039	TL1/0100	TL1/0139	TL2/0074	TL2/0234	TL2/0301
Opening pressure (bar)	**Control pressure (bar)**					
1	0.2	0.3	0.3	0.2	0.3	0.3
2	0.4	0.6	0.6	0.4	0.6	0.6
3	0.6	0.9	0.9	0.7	0.9	0.9
4	0.8	1.2	1.2	0.9	1.2	1.2
5	1.0	1.5	1.5	1.1	1.5	1.5
6	1.2	1.8	1.8	1.3	1.8	1.8
7	1.4	2.1	2.1	1.5	2.1	2.1
8	1.6	2.3	–	1.8	2.3	–
9	1.7	2.6	–	2.0	2.6	–
10	1.9	2.9	–	2.2	2.9	–
11	2.1	3.2	–	2.4	3.2	–
12	2.3	3.5	–	2.6	3.5	–
13	2.5	–	–	2.9	–	–
14	2.7	–	–	3.1	–	–
15	2.9	–	–	3.3	–	–
16	3.1	–	–	3.5	–	–
17	3.3	–	–	3.7	–	–
18	3.5	–	–	4.0	–	–
19	3.7	–	–	4.2	–	–
20	3.9	–	–	4.4	–	–
21	4.1	–	–	4.6	–	–
22	4.3	–	–	4.8	–	–

TL3, TL4 – Control pressure

	TL3/0234	TL3/0677	TL3/0953	TL4/0535	TL4/2316	TL4/3497
Opening pressure (bar)	**Control pressure (bar)**					
1	0.2	0.4	0.4	0.4	0.2	0.3
2	0.4	0.7	0.7	0.5	0.7	0.7
3	0.7	1.1	1.1	0.7	1.1	1.1
4	0.9	1.4	1.4	0.9	1.4	1.4
5	1.1	1.8	1.8	1.2	1.8	1.8
6	1.3	2.1	2.1	1.4	2.2	2.2
7	1.5	2.5	2.5	1.6	2.6	2.6
8	1.7	2.8	–	1.9	2.9	–
9	2.0	3.2	–	2.1	3.3	–
10	2.2	3.5	–	2.4	3.7	–
11	2.4	3.9	–	2.6	4.0	–
12	2.6	4.2	–	2.8	4.4	–
13	2.8	–	–	3.1	–	–
14	3.0	–	–	3.3	–	–
15	3.3	–	–	3.5	–	–
16	3.5	–	–	3.8	–	–
17	3.7	–	–	4.0	–	–
18	3.9	–	–	4.2	–	–
19	4.1	–	–	4.5	–	–
20	4.3	–	–	4.7	–	–
21	4.6	–	–	4.9	–	–
22	4.8	–	–	5.2	–	–

13.0 Disassembly/Assembly

13.1 Spring loaded valves



13.1.1 Disassembly

1. Remove plastic plug (0922).
2. Release the spring (0750) by turning the spring adjusting screw (0251) counter clockwise using the retainer tool.

Warning

3. Remove screws (0523) by loosening them all one full turn.

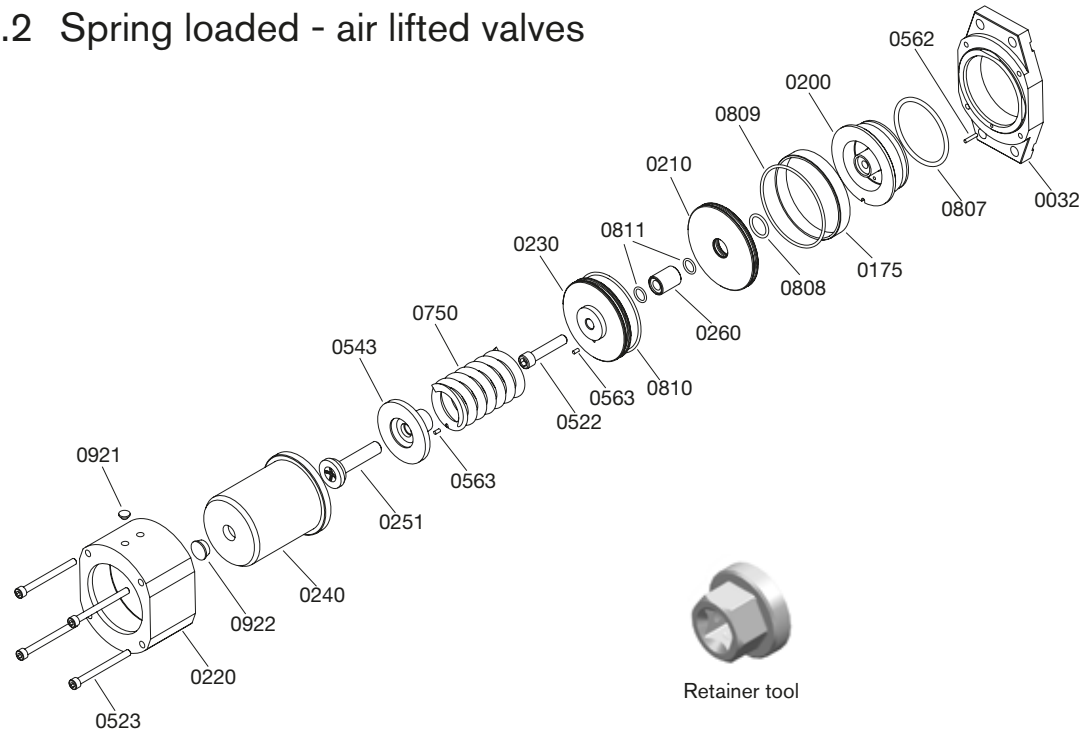
   If the cylinder (0220) stays in place (tap slowly with a plastic hammer on the cylinder) the spring (0750) is fully released and the screws can be removed.

   If the cylinder does not stay in place, first make sure that the spring will be released.
4. All components can now be removed from the cylinder (0220) and from the pump cover (0032).

13.1.2 Assembly

1. Screw the spring adjusting screw (0251) fully into the spring adjusting plate (0543).
2. If disassembled, place the two pins (0563) in the spring adjusting plate (0543) and in the valve head (0200) respectively. Place the pin (0562) in the same way in the pump cover (0032).
3. Place the O-ring (0807) on the outside of the valve head (0200) and push the valve head with O-ring into the pump cover (0032).
4. Put all components in place and tighten the screws (0523).

13.2 Spring loaded - air lifted valves



13.2.1 Disassembly

1. Remove plastic plug (0922).
2. Release the spring (0750) by turning the spring adjusting screw (0251) counter clockwise using the retainer tool.

Warning

3. Remove screws (0523) by loosening them all one full turn.

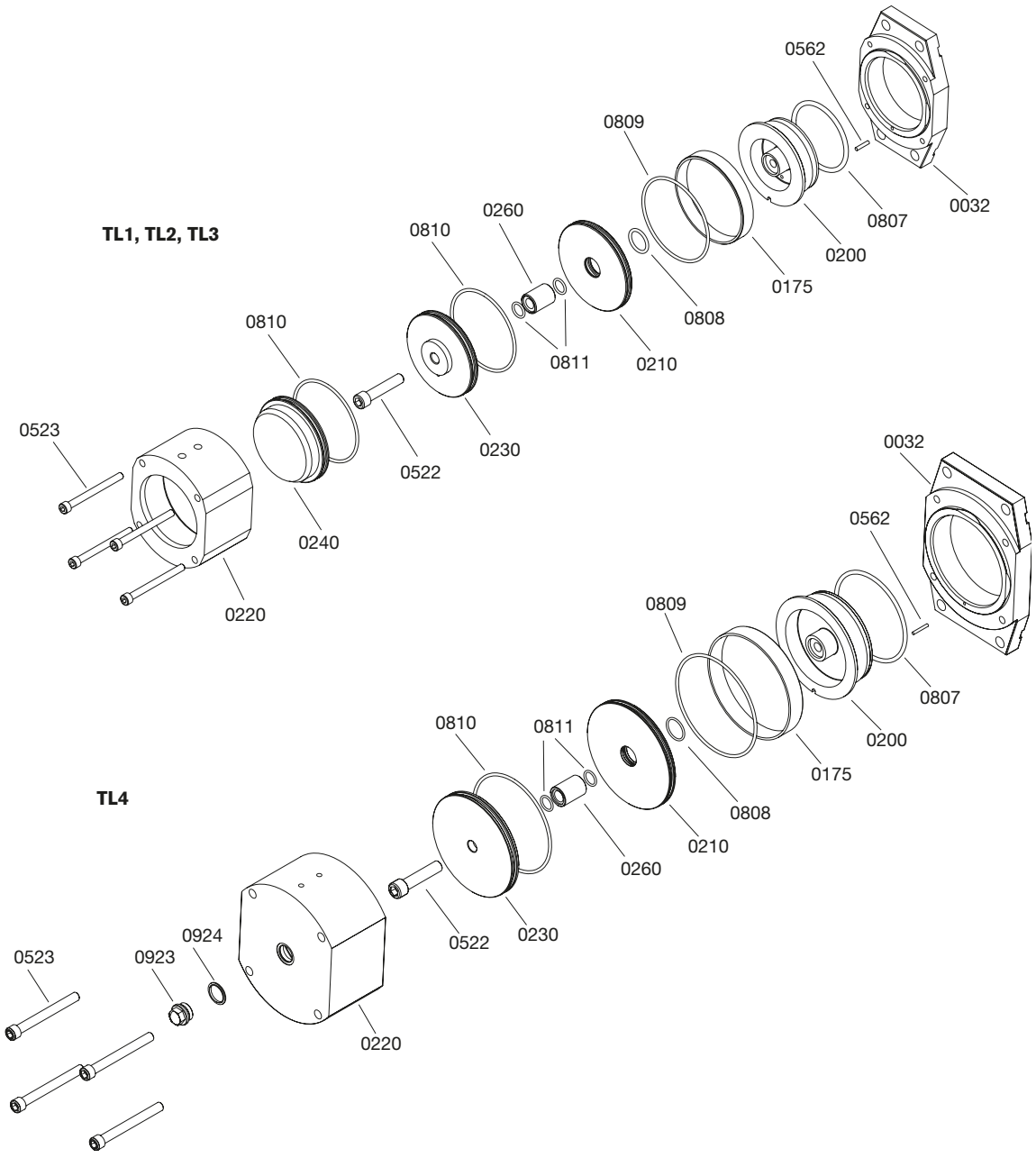
   If the cylinder (0220) stays in place (tap slowly with a plastic hammer on the cylinder) the spring (0750) is fully released and the screws can be removed.

   If the cylinder does not stay in place, first make sure that the spring will be released.
4. All components can now be removed from the cylinder (0220) and from the pump cover (0032).

13.2.2 Assembly

1. Screw the spring adjusting screw (0251) fully into the spring adjusting plate (0543).
2. If disassembled place the two pins (0563) in the spring adjusting plate (0543) and in the piston (0230) respectively. Place the pin (0562) in the same way in the pump cover (0032).
3. Place the piston (0230) together with the valve head (0200) by using the spacer sleeve (0260) with the O-rings (0811). Before tightening the screw (0522) ensure that the baseplate (0210) with O-ring (0808) is placed over the spacer sleeve (0260).
4. Put all components in place and tighten the screws (0523).

13.3 Air loaded - air lifted valves



13.3.1 Disassembly

1. Remove screws (0523).
2. All parts can now be removed from the cylinder (0220).

13.3.2 Assembly

1. If disassembled place the pin (0562) into the pump cover (0032).
2. Screw the piston (0230) together with the valve head (0200) by using the spacer sleeve (0260) with the O-rings (0811). Before tightening the screw (0522) ensure that the baseplate (0210) with O-ring (0808) is placed over the spacer sleeve (0260).
3. Put all components in place and tighten the screws (0523).

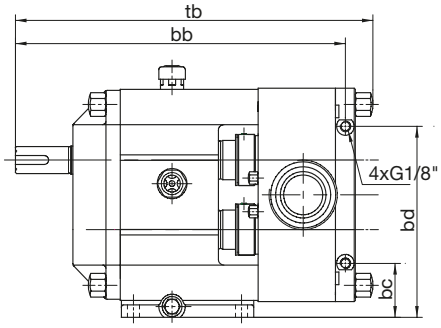
14.0 Dimensional drawings and weights

14.1 Safety relief valves with heating/cooling jacket

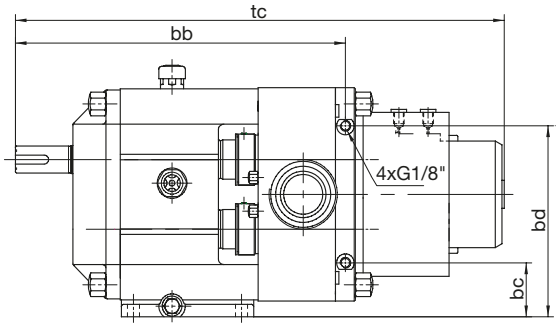
Dimension table, see next page

Horizontal mounting

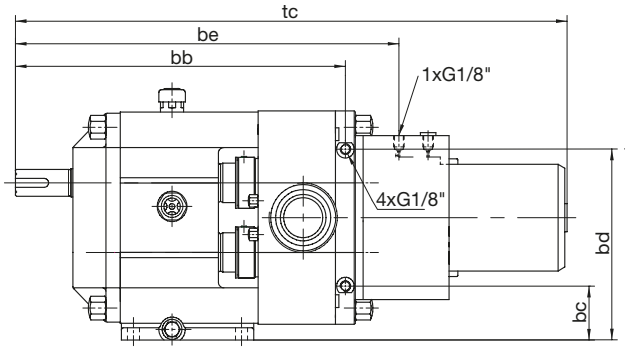
Jacket



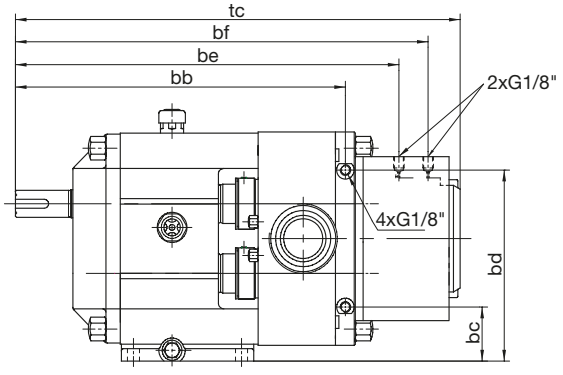
Relief valve – Spring loaded with jacket



Relief valve – Spring loaded – air lifted with jacket

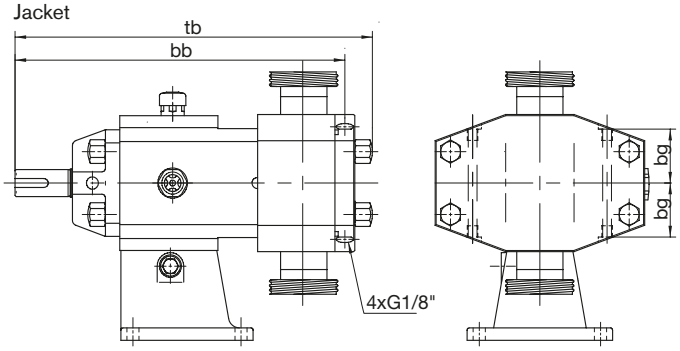


Relief valve – Air loaded – air lifted with jacket

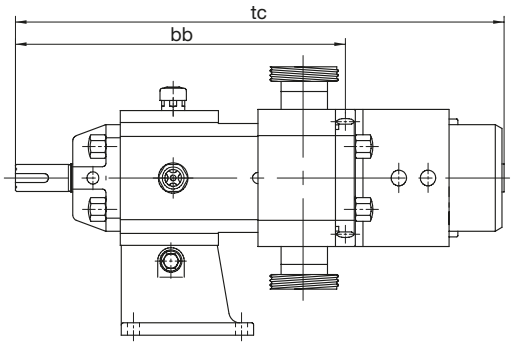


Vertical mounting

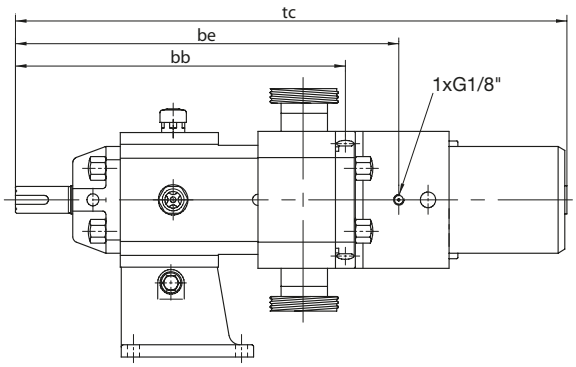
Jacket



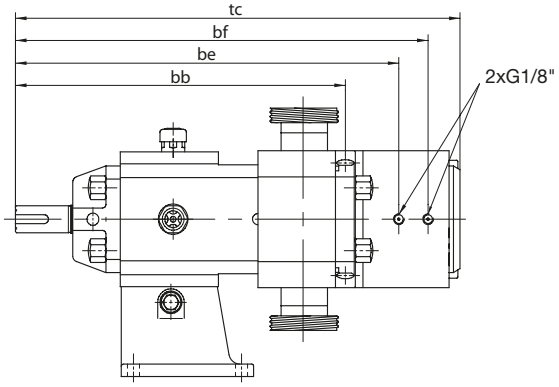
Relief valve – Spring loaded with jacket



Relief valve – Spring loaded – air lifted with jacket



Relief valve – Air loaded – air lifted with jacket



Dimensions – Safety relief valves with heating/cooling jacket

Dimensions in mm

Pump type		bb	bc	bd	be	bf	bg	tb	tc
TL1/0039	jacket	240	43	143	–	–	42	261	–
	spring loaded	240	43	143	–	–	42	–	363
	spring loaded - air lifted	240	43	143	278.5	–	42	–	410
	air loaded - air lifted	240	43	143	278.5	300	42	–	328
TL1/0100	jacket	240	43	143	–	–	42	261	–
	spring loaded	240	43	143	–	–	42	–	363
	spring loaded - air lifted	240	43	143	278.5	–	42	–	410
	air loaded - air lifted	240	43	143	278.5	300	42	–	328
TL1/0139	jacket	252	43	143	–	–	42	273	–
	spring loaded	252	43	143	–	–	42	–	375
	spring loaded - air lifted	252	43	143	290.5	–	42	–	422
	air loaded - air lifted	252	43	143	290.5	312	42	–	340
TL2/0074	jacket	288	48	170	–	–	48	313	–
	spring loaded	288	48	170	–	–	48	–	432
	spring loaded - air lifted	288	48	170	336.5	–	48	–	489
	air loaded - air lifted	288	48	170	336.5	363	48	–	392
TL2/0234	jacket	288	48	170	–	–	48	313	–
	spring loaded	288	48	170	–	–	48	–	432
	spring loaded - air lifted	288	48	170	336.5	–	48	–	489
	air loaded - air lifted	288	48	170	336.5	363	48	–	392
TL2/0301	jacket	300	48	170	–	–	48	325	–
	spring loaded	300	48	170	–	–	48	–	444
	spring loaded - air lifted	300	48	170	348.5	–	48	–	501
	air loaded - air lifted	300	48	170	348.5	375	48	–	404
TL3/0234	jacket	372	64.5	242.5	–	–	77	401	–
	spring loaded	372	64.5	242.5	–	–	77	–	585
	spring loaded - air lifted	372	64.5	242.5	439.5	–	77	–	657
	air loaded - air lifted	372	64.5	242.5	439.5	474	77	–	512
TL3/0677	jacket	372	64.5	242.5	–	–	77	401	–
	spring loaded	372	64.5	242.5	–	–	77	–	585
	spring loaded - air lifted	372	64.5	242.5	439.5	–	77	–	657
	air loaded - air lifted	372	64.5	242.5	439.5	474	77	–	512
TL3/0953	jacket	394	64.5	242.5	–	–	77	423	–
	spring loaded	394	64.5	242.5	–	–	77	–	607
	spring loaded - air lifted	394	64.5	242.5	461.5	–	77	–	679
	air loaded - air lifted	394	64.5	242.5	461.5	496	77	–	534
TL4/0535	jacket	568	72.5	302.5	–	–	101	608	–
	air loaded - air lifted	568	72.5	302.5	649	694	101	–	727
TL4/2316	jacket	568	72.5	302.5	–	–	101	608	–
	air loaded - air lifted	568	72.5	302.5	649	694	101	–	727
TL4/3497	jacket	620	72.5	302.5	–	–	101	660	–
	air loaded - air lifted	620	72.5	302.5	701	746	101	–	795

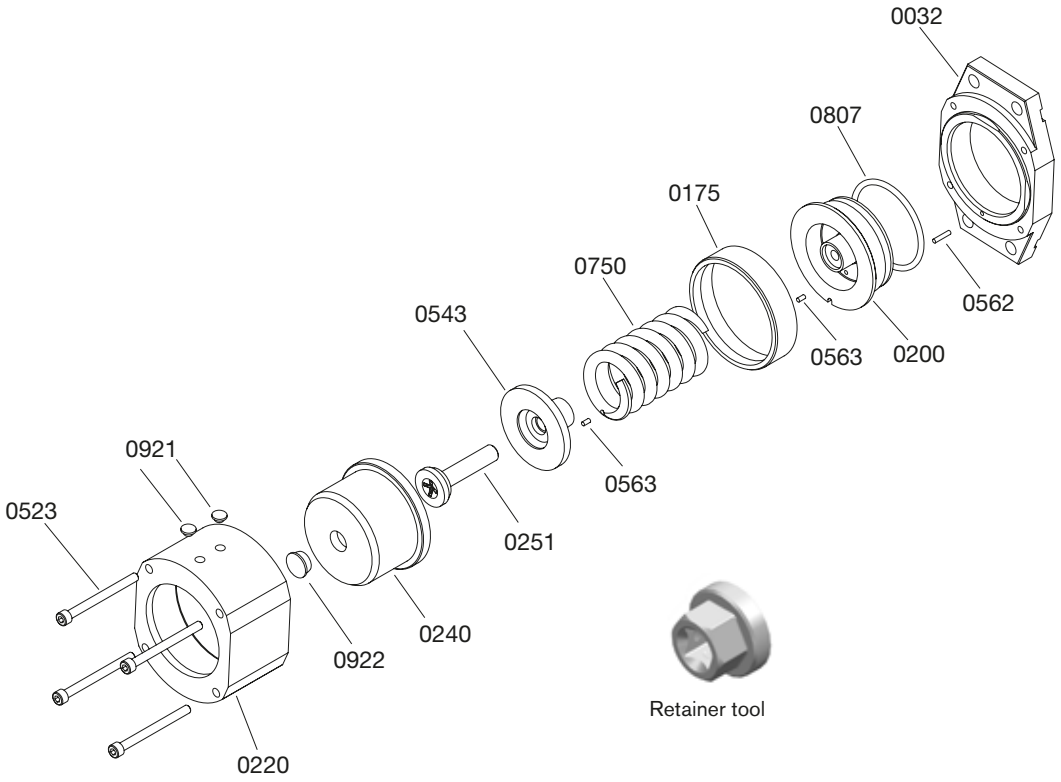
14.2 Weights safety relief valve

Pump type	Type of safety relief valve		
	Spring loaded	Spring loaded - air lifted	Air loaded - air lifted
TL1	5	5.5	4.5
TL2	11	12	10
TL3	27	30	25
TL4	–	–	62

All weights in daN, mass is kg

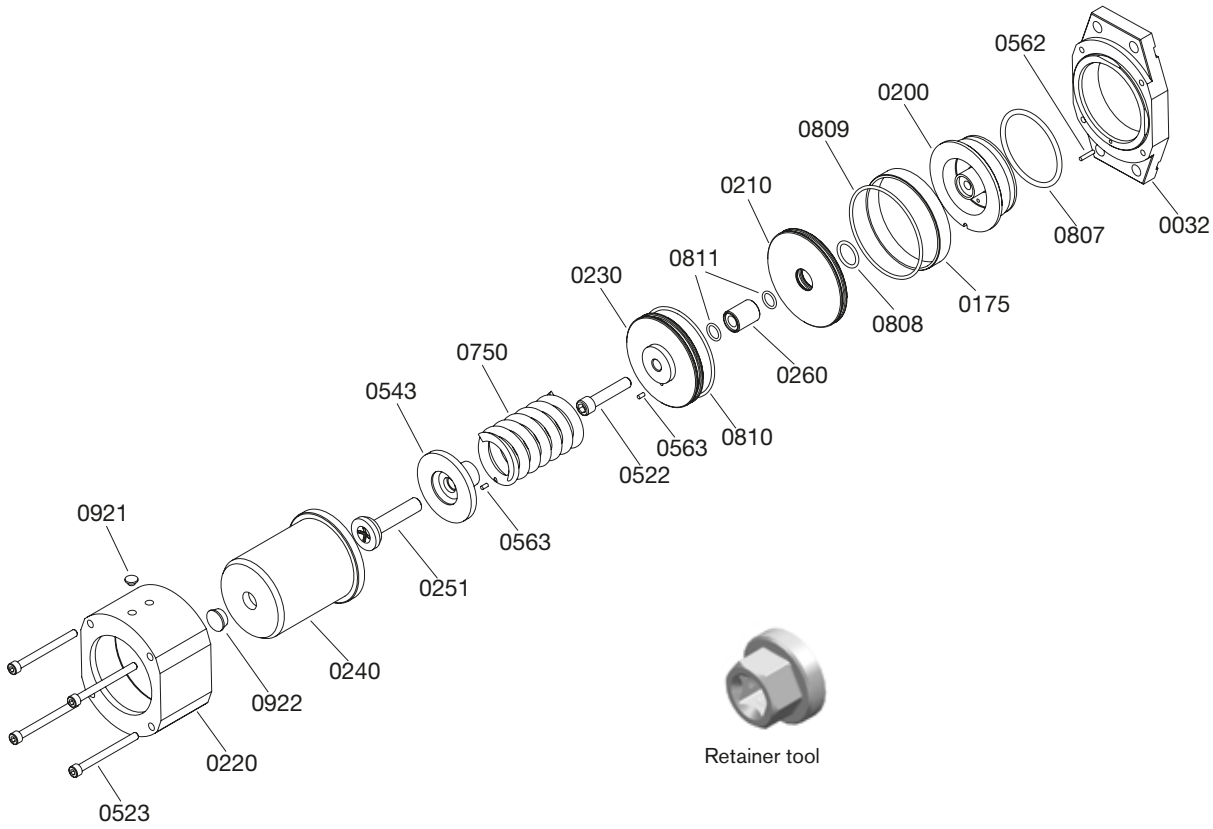
15.0 Sectional drawings and parts lists

15.1 Pump cover with safety relief valve – spring loaded



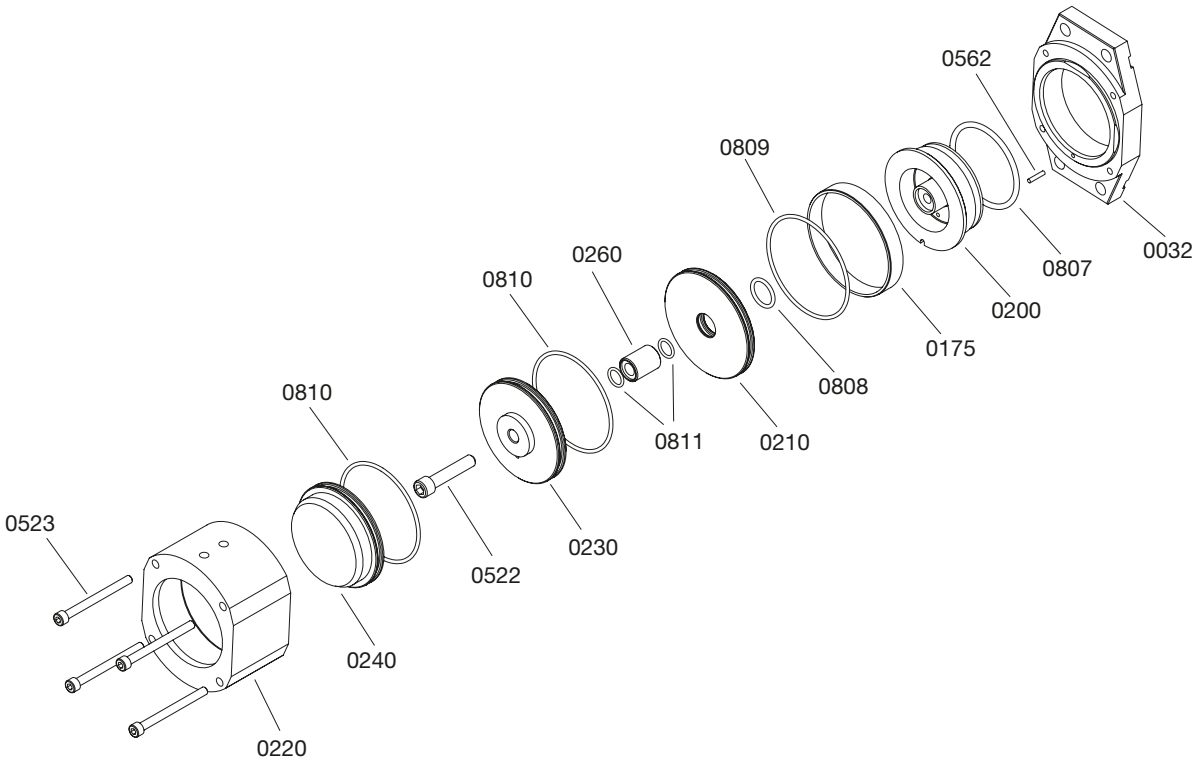
Pos.	Nos. / pump	Description	TL1/0039	TL1/0100 TL1/0139	TL2/0074	TL2/0234 TL2/0301	TL3/0234	TL3/0677 TL3/0953
Safety relief valve, complete			**3.01859.11**	**3.01859.21**	**3.01860.11**	**3.01860.21**	**3.01862.11**	**3.01862.21**
Safety relief valve with jacket, complete			**3.01859.51**	**3.01859.61**	**3.01860.51**	**3.01860.61**	**3.01862.51**	**3.01862.61**
0032	1	Pump cover valve	3.94622.11	3.94623.11	3.94598.11	3.94599.11	3.94637.11	3.94638.11
	1	Pump cover valve for heating	3.94622.12	3.94623.12	3.94598.12	3.94599.12	3.94637.12	3.94638.12
0175	1	Support ring spring	3.94627.11		3.94604.11		3.94642.11	
0200	1	Valve head	3.94624.11	3.94625.11	3.94601.11	3.94602.11	3.94639.11	3.94640.11
0220	1	Cylinder	3.94869.11		3.94606.11		3.94644.11	
0240	1	Cover spring loaded	3.94633.11		3.94610.11		3.94648.11	
0251	1	Spring adjusting screw	3.94613.21		3.94613.21		3.94651.21	
0523	4	Screw	0.0252.160		0.0252.212		0.0252.316	
0543	1	Spring adjusting plate	3.94636.11		3.94614.11		3.94652.11	
0562	1	Pin	0.0490.657		0.0490.659		0.0490.661	
0563	2	Pin	0.0490.653		0.0490.653		0.0490.654	
0750	1	Spring	3.94635.11		3.94612.11		3.94650.11	
0807	1	O-ring	O-ring kit for hydraulic part with safety relief valve, see 6.0 – Sectional drawings and parts list					
0921	2	Plastic plug	3.94615.11		3.94615.11		3.94615.11	
0922	1	Plastic plug	3.96075.11		3.96075.11		3.96076.11	
	1	Retainer tool	3.94550.31		3.94550.31		3.94551.31	

15.2 Pump cover with safety relief valve – spring loaded - air lifted



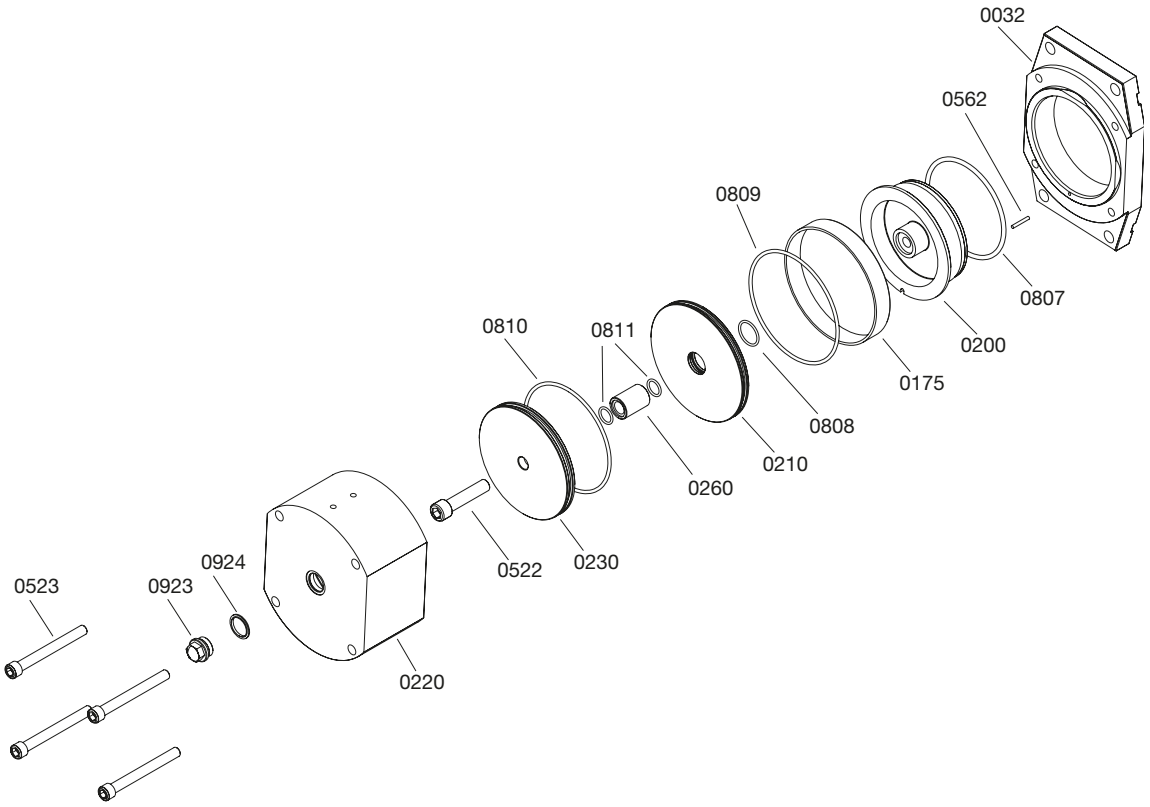
Pos.	Nos./ pump	Description	TL1/0039	TL1/0100 TL1/0139	TL2/0074	TL2/0234 TL2/0301	TL3/0234	TL3/0677 TL3/0953
Safety relief valve, complete			**3.01859.12**	**3.01859.22**	**3.01860.12**	**3.01860.22**	**3.01862.12**	**3.01862.22**
Safety relief valve with jacket, complete			**3.01859.52**	**3.01859.62**	**3.01860.52**	**3.01860.62**	**3.01862.52**	**3.01862.62**
0032	1	Pump cover valve	3.94622.11	3.94623.11	3.94598.11	3.94599.11	3.94637.11	3.94638.11
	1	Pump cover valve for heating	3.94622.12	3.94623.12	3.94598.12	3.94599.12	3.94637.12	3.94638.12
0175	1	Support ring	3.94626.11		3.94603.11		3.94641.11	
0200	1	Valve head	3.94624.11	3.94625.11	3.94601.11	3.94602.11	3.94639.11	3.94640.11
0210	1	Baseplate	3.94628.11		3.94605.11		3.94643.11	
0220	1	Cylinder	3.94869.11		3.94606.11		3.94644.11	
0230	1	Piston	3.94630.11		3.94607.11		3.94645.11	
0240	1	Cover spring loaded - air lifted	3.94631.11		3.94608.11		3.94646.11	
0251	1	Spring adjusting screw	3.94613.21		3.94613.21		3.94651.21	
0260	1	Spacer sleeve	3.94634.11		3.94611.11		3.94649.11	
0522	1	Screw	0.0252.249		0.0252.303		0.0252.410	
0523	4	Screw	0.0252.160		0.0252.212		0.0252.316	
0543	1	Spring adjusting plate	3.94636.11		3.94614.11		3.94652.11	
0562	1	Pin	0.0490.657		0.0490.659		0.0490.661	
0563	2	Pin	0.0490.653		0.0490.653		0.0490.654	
0750	1	Spring	3.94635.11		3.94612.11		3.94650.11	
0807	1	O-ring	O-ring kit for hydraulic part with safety relief valve, see 6.0 – Sectional drawings and parts list					
0808	1	O-ring	0.2173.934		3.91864.11		3.92159.11	
0809	1	O-ring	0.2173.967		0.2173.971		0.2173.986	
0810	1	O-ring	0.2173.917		0.2173.972		0.2173.978	
0811	2	O-ring	0.2173.975		3.91860.11		0.2173.979	
0921	1	Plastic plug	3.94615.11		3.94615.11		3.94615.11	
0922	1	Plastic plug	3.96075.11		3.96075.11		3.96076.11	
	1	Retainer tool	3.94550.31		3.94550.31		3.94551.31	

15.3 Pump cover with safety relief valve – air loaded - air lifted – TL1, TL2, TL3



Pos.	Nos./ pump	Description	TL1/0100 TL1/0039	TL1/0139	TL2/0234 TL2/0074	TL2/0301	TL3/0677 TL3/0234	TL3/0953
Safety relief valve, complete			**3.01859.13**	**3.01859.23**	**3.01860.13**	**3.01860.23**	**3.01862.13**	**3.01862.23**
Safety relief valve with jacket, complete			**3.01859.53**	**3.01859.63**	**3.01860.53**	**3.01860.63**	**3.01862.53**	**3.01862.63**
0032	1	Pump cover valve	3.94622.11	3.94623.11	3.94598.11	3.94599.11	3.94637.11	3.94638.11
	1	Pump cover valve for heating	3.94622.12	3.94623.12	3.94598.12	3.94599.12	3.94637.12	3.94638.12
0175	1	Support ring	3.94626.11		3.94603.11		3.94641.11	
0200	1	Valve head	3.94624.11	3.94625.11	3.94601.11	3.94602.11	3.94639.11	3.94640.11
0210	1	Baseplate	3.94628.11		3.94605.11		3.94643.11	
0220	1	Cylinder	3.94869.11		3.94606.11		3.94644.11	
0230	1	Piston	3.94630.11		3.94607.11		3.94645.11	
0240	1	Cover air loaded - air lifted	3.94632.11		3.94609.11		3.94647.11	
0260	1	Spacer	3.94634.11		3.94611.11		3.94649.11	
0522	1	Screw	0.0252.249		0.0252.303		0.0252.410	
0523	4	Screw	0.0252.160		0.0252.212		0.0252.316	
0562	1	Guiding pin	0.0490.657		0.0490.659		0.0490.661	
0807	1	O-ring	O-ring kit for hydraulic part with safety relief valve, see 6.0 – Sectional drawings and parts list					
0808	1	O-ring	0.2173.934		3.91864.11		3.92159.11	
0809	1	O-ring	0.2173.967		0.2173.971		0.2173.986	
0810	2	O-ring	0.2173.917		0.2173.972		0.2173.978	
0811	2	O-ring	0.2173.975		3.91860.11		0.2173.979	

15.4 Pump cover with safety relief valve – air loaded - air lifted – TL4



Pos.	Nos./ pump	Description	TL4/0535	TL4/2316 TL4/3497
Safety relief valve, complete			**3.01863.13**	**3.01863.23**
Safety relief valve with jacket, complete			**3.01863.53**	**3.01863.63**
0032	1	Pump cover valve	3.94653.11	3.94654.11
	1	Pump cover valve for heating	3.94653.12	3.94654.12
0175	1	Support ring	3.94657.11	
0200	1	Valve head	3.94655.11	3.94656.11
0210	1	Baseplate	3.94658.11	
0220	1	Cylinder	3.94659.11	
0230	1	Piston	3.94660.11	
0260	1	Spacer	3.94661.11	
0522	1	Screw	0.0252.474	
0523	4	Screw	0.0252.424	
0562	1	Guiding pin	0.0490.676	
0807	1	O-ring	O-ring kit for hydraulic part with safety relief valve, see 6.0 – Sectional drawings	
0808	1	O-ring	0.2173.982	
0809	1	O-ring	0.2173.983	
0810	2	O-ring	0.2173.984	
0811	2	O-ring	0.2173.985	
0923	1	Plug	3.94918.11	
0924	1	Sealing ring	3.94919.11	

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