SPX®

INSTRUCTION MANUAL

# TopGear H

## INTERNAL GEAR PUMPS

A.0500.351 – IM-TG H/07.02 EN (10/2015)

ORIGINAL INSTRUCTIONS

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

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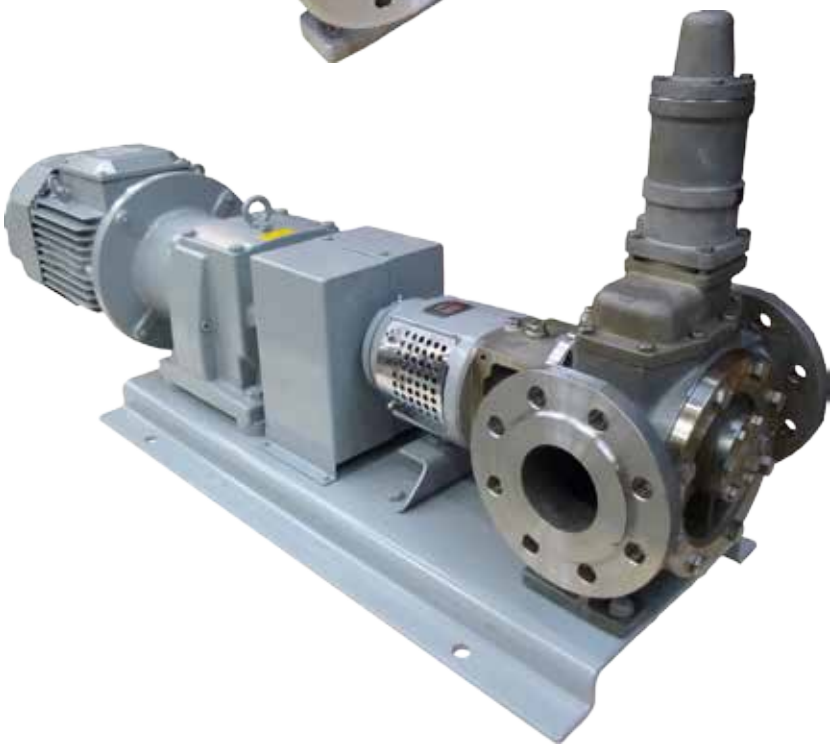


Johnson Pump®

# EC-Declaration of conformity

Machinery Directive 2006/42/EC, Annex IIA

**Manufacturer**
SPX Flow Technology Belgium NV
Evenbroekveld 2-6
BE-9420 Erpe-Mere
Belgium

Herewith we declare that

**TopGear H-range Gear Pumps**

Types: TG H2-32
TG H3-32
TG H6-40
TG H15-50
TG H23-65
TG H58-80
TG H86-100
TG H185-125
TG H360-150

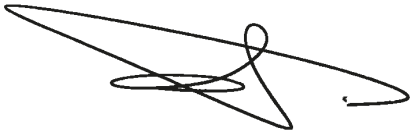
whether delivered without drive or delivered as an assembly with drive, are in conformity with the relevant provisions of the Machinery Directive 2006/42/EC, Annex I.

# Manufacturer Declaration

Machinery Directive 2006/42/EC, Annex IIB

The partly completed pump (Back-Pull-Out unit), member of the product family TopGear H-range gear pumps, is meant to be incorporated into the specified pump (unit) and may only be put into use after the complete machine, of which the pump under consideration forms part, has been declared to comply with the provisions of the Directive.

Erpe-Mere, 1 April 2014



Gerard Santema
General Manager

# Contents

# 1.0 Introduction

## 1.1 General

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

***Important!***
The pump must not be used for other purposes than recommended and quoted for without consulting your local supplier.

Liquids not suitable for the pump can cause damages to the pump unit, with a risk of personal injury.

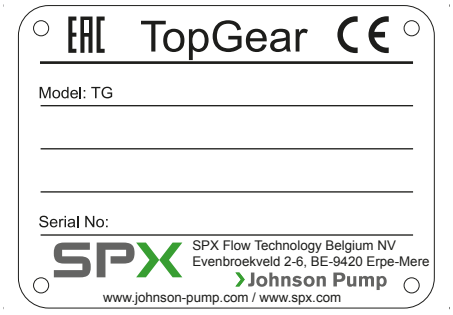
## 1.2 Reception, handling and storage

### 1.2.1 Reception

Remove all packing materials immediately after delivery. Check the consignment for damage immediately on arrival and make sure that the name plate/type designation is in accordance with the packing slip and your order.

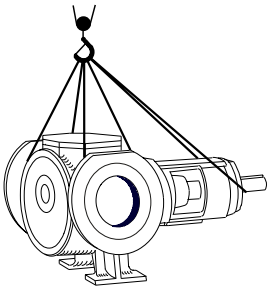
In case of damage and/or missing parts, a report should be drawn up and presented to the carrier at once. Notify your local supplier.

All pumps have the serial number stamped on a name plate.
This number should be stated in all correspondence with your local supplier.
The first digits of the serial number indicate the year of production.

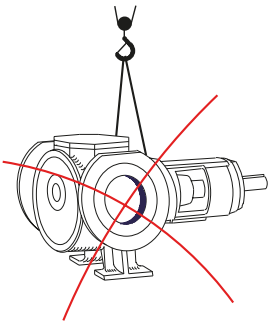



### 1.2.2 Handling

Check the mass (weight) of the pump unit. All parts weighing more than 20 kg must be lifted using lifting slings and suitable lifting devices, e.g. overhead crane or industrial truck. See section 6.6 Weights – Mass.



*Always use two or more lifting slings. Make sure they are secured in such a way as to prevent them from slipping. The pump unit should be in a straight fashion.*



*Never lift the pump unit with only two fastening points. Incorrect lift can cause personal injury and/or damage to the pump unit.*

### 1.2.3 Storage

If the pump is not commissioned immediately, the shaft should be turned a full turn once every week. This ensures a proper distribution of the conservating oil.

## 1.3 Safety

### 1.3.1 General

***Important!***
The pump must not be used for other purposes than recommended and quoted for without consulting your local supplier.

A pump must always be installed and used in accordance with existing national and local sanitary and safety regulations and laws.

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

- Always wear suitable safety clothing when handling the pump.

- Anchor the pump properly before start-up to avoid personal injury and/or damage to the pump unit.

- Install shut-off valves on both sides of the pump to be able to shut off the inlet and outlet before service and maintenance. Check to see that the pump can be drained without injuring anyone and without contaminating the environment or nearby equipment.
- Make sure that all movable parts are properly covered to avoid personal injury.

- All electrical installation work must be carried out by authorized personnel in accordance with EN60204-1 and/or local regulations. Install a lockable circuit breaker to avoid inadvertent starting. Protect the motor and other electrical equipment from overloads with suitable equipment. The electric motors must be supplied with ample cooling air.

  In environments where there is risk of explosion, motors classified as explosion-safe must be used, along with special safety devices. Check with the governmental agency responsible for such precautions.

- Improper installation can cause fatal injuries.
- Dust, liquids and gases that can cause overheating, short circuits, corrosion damage and fire must be kept away from motors and other exposed equipment.

- If the pump handles liquids hazardous for person or environment, some sort of container must be installed into which leakage can be led. All (possible) leakage should be collected to avoid contamination of the environment.
- Keep arrows and other signs visible on the pump.

- If the surface temperature of the system or parts of the system exceeds 60°C, these areas must be marked with warning text reading "Hot surface" to avoid burns.

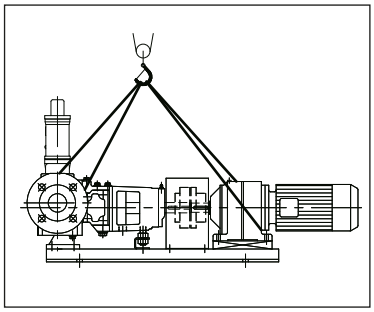
- The pump unit must not be exposed to rapid temperature changes of the liquid without prior pre-heating/pre-cooling. Big temperature changes can cause crack formation or explosion, which in turn can entail severe personal injuries.
- The pump must not operate above stated performance. See section 3.5 Main characteristics.
- Before intervening in the pump/system, the power must be shut off and the starting device be locked. When intervening in the pump unit, follow the instructions for disassembly/assembly, chapter 4.0. If the instructions are not followed, the pump or parts of the pump can be damaged. It will also invalidate the warranty.
- Gear pumps may never run completely dry. Dry running produces heat and can cause damage to internal parts such as bush bearings and shaft seal. When dry running is required, the pump has e.g. to be run a short time with liquid supply.

  ***Note!*** A small quantity of liquid should remain in the pump to ensure lubrication of internal parts. If there is a risk for dry running for a longer period, install a suitable dry running protection. Consult your local supplier.
- If the pump does not function satisfactorily, contact your local supplier.

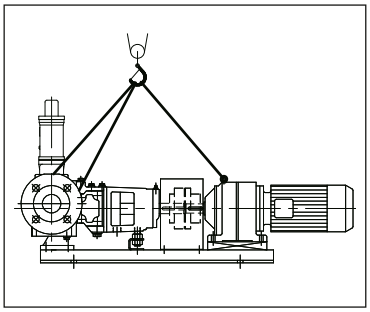
## 1.3.2 Pump units

### 1.3.2.1 Pump unit handling

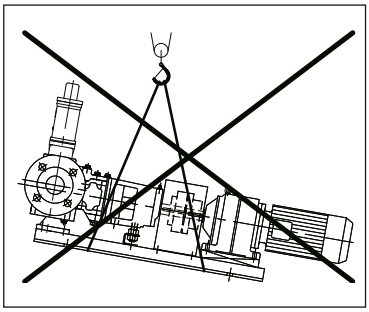
Use an overhead crane, forklift or other suitable lifting device.



*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 sales representative. 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.

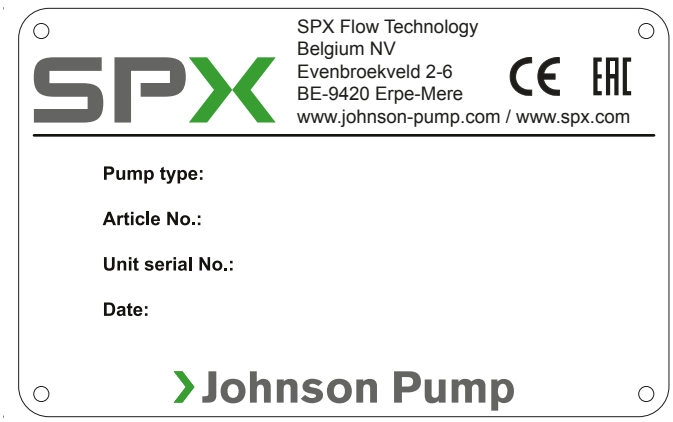
d) Reassemble the coupling guard and any other protective covers. Make sure that the screws are properly tightened.

### 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 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 Technical conventions

| Quantity | Symbol | Unit |
|---|---|---|
| Dynamic viscosity | $\mu$ | mPa.s = cP (Centipoise) |
| Kinematic viscosity | $\nu = \frac{\mu}{\rho}$ | $\rho$ = density $\left[\frac{kg}{dm^3}\right]$<br>$\nu$ = kinematic viscosity $\left[\frac{mm^2}{s}\right]$ = cSt (Centistokes) |
| ***Note!*** *In this manual only dynamic viscosity is used.* | | |
| Pressure | p | [bar] |
| | $\Delta p$ | Differential pressure = [bar] |
| | $p_m$ | Maximum pressure at discharge flange (design pressure) = [bar] |
| ***Note!*** *In this manual, unless otherwise specified - pressure is relative pressure [bar].* | | |
| Net Positive Suction Head | NPSHa | Net Positive Suction Head is the total absolute inlet pressure at the pump suction connection, minus the vapour pressure of the pumped liquid.<br>NPSHa is expressed in meter liquid column.<br>It is the responsibility of the user to determine the NPSHa value. |
| | NPSHr | Net Positive Suction Head Required is the NPSH determined, after testing and calculation, by the pump manufacturer to avoid performance impairment due to cavitation within the pump at rate capacity.<br>The NPSHr is measured at the suction flange, at the point where the capacity drop results in a pressure loss of at least 4%. |
| ***Note!*** *In this manual, unless otherwise specified, NPSH = NPSHr* | | |
| ***When selecting a pump, ensure that NPSHa is at least 1 m higher than the NPSHr.*** | | |

# 2.0 Pump description

TopGear H-pumps are rotary positive displacement pumps with internal gear. They are made of stainless steel, nodular iron or cast steel. TGH-pumps are assembled from modular elements, which allows a variety of constructions: different shaft sealings (packing and/or mechanical seal), heating/ cooling jackets (steam or thermal oil), several sleeve bearings, gear and shaft materials and mounted relief valve.

## 2.1 Type designation

The pump properties are encoded in the following type indication, which is to be found on the nameplate.

**Example:**

| TG | H | 58-80 | | R | 2 | S | S | BR | 5 | B | R5 | PQTC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |

| TG | H | 360-150 | FD | R | 5 | O | O | UR | 6 | U | R8 | GS WV |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |

1. **Pump family name**
   TG = TopGear

2. **Pump range name**
   H = High demanding applications

3. **Hydraulics indicated with displacement volume per 100 revolution (in $dm^3$) and nominal port diameter (in mm)**
   TG H2-32
   TG H3-32
   TG H6-40
   TG H15-50
   TG H23-65
   TG H58-80
   TG H86-100
   TG H185-125
   TG H360-150

4. **Application**
   Non-food
   FD Food

5. **Pump material**
   R Pump in stainless steel
   S Pump in carbon steel
   N Pump in nodular iron

6. **Port connection type**
   1 Thread connections
   2 PN25 flanges
   3 PN20 flanges to ANSI 150 lbs
   4 PN50 flanges to ANSI 300 lbs
   5 PN16 flanges to DIN 2533

7. **Jacket options for pump cover**
   O Pump cover without jackets
   S Pump cover with jacket and thread connection
   T Pump cover with jacket and flange connection

**8. Jacket options around shaft seal**

O Shaft seal without jackets

S Shaft seal with jacket and thread connection

T Shaft seal with jacket and flange connection

**9. Idler bush and idler materials**

SG Idler bush in hardened steel with idler in iron

CG Idler bush in carbon with idler in iron

BG Idler bush in bronze with idler in iron

HG Idler bush in ceramic with idler in iron

SS Idler bush in hardened steel with idler in steel

CS Idler bush in carbon with idler in steel

BS Idler bush in bronze with idler in steel

HS Idler bush in ceramic with idler in steel

US Idler bush in hard metal with idler in steel

BR Idler bush in bronze with idler in stainless steel

CR Idler bush in carbon with idler in stainless steel

HR Idler bush in ceramic with idler in stainless steel

UR Idler bush in hard metal with idler in stainless steel

**10. Idler pin materials**

2 Idler pin in hardened steel

5 Idler pin in nitrided stainless steel

6 Idler pin in hard coated stainless steel

**11. Bush on shaft materials**

S Bush in hardened steel

C Bush in carbon

H Bush in ceramic

U Bush in hard metal

B Bush in bronze

**12. Rotor and shaft materials**

G2 Rotor in iron and shaft in hardened steel

G5 Rotor in iron and shaft in nitrited stainless steel

G6 Rotor in iron and shaft in hard coated stainless steel for packing

G8 Rotor in iron and shaft in hard coated stainless steel for mechanical seal

N2 Rotor in nitrited nodular iron and shaft in hardened steel

N5 Rotor in nitrited nodular iron and shaft in nitrited stainless steel

N6 Rotor in nitrited nodular iron and shaft in hard coated stainless steel for packing

N8 Rotor in nitrited nodular iron and shaft in hard coated stainless steel for mechanical seal

R2 Rotor in stainless steel and shaft in hardened steel

R5 Rotor in stainless steel and shaft in nitrited stainless steel

R6 Rotor in stainless steel and shaft in hard coated stainless steel for packing

R8 Rotor in stainless steel and shaft in hard coated stainless steel for mechanical seal

**13. Shaft seal arrangements**

***Packing version without lantern ring***

| | |
|---|---|
| PO TC | PTFE graphited packing rings |
| PO AW | Aramide-white packing rings |
| PO CC | Graphite fibre packing rings |
| PO XX | Packing version parts – rings on request |

**Example:**

| TG | H | 58-80 | | R | 2 | S | S | BR | 5 | B | R5 | PQTC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |

| TG | H | 360-150 | FD | R | 5 | O | O | UR | 6 | U | R8 | GS WV |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |

**13. Shaft seal arrangements (cont'd)**

***Packing version with lantern ring***

| | |
|---|---|
| PQ TC | PTFE graphited packing rings |
| PQ AW | Aramide-white packing rings |
| PQ CC | Graphite fibre packing rings |
| PQ XX | Packing version parts – rings on request |

***Reverted packing version; chocolate execution***

| | |
|---|---|
| PR TC | Packing rings PTFE graphited |
| PR AW | Packing rings aramide-white |
| PR XX | Packing version parts – rings on request |

***Single mechanical seal Burgmann type MG12 to be used with set ring***

| | |
|---|---|
| GS AV | Single mechanical seal Burgmann MG12; Carbon/SiC/FPM (Fluorocarbon) |
| GS WV | Single mechanical seal Burgmann MG12; SiC/SiC/FPM (Fluorocarbon) |

***Single mechanical seal Burgmann type M7N***

| | |
|---|---|
| GS HV | Single mechanical seal Burgmann M7N; SiC/Carbon/FPM (Fluorocarbon) |
| GS HT | Single mechanical seal Burgmann M7N; SiC/Carbon/PTFE-wrapped |
| GS WV | Single mechanical seal Burgmann M7N; SiC/SiC/FPM (Fluorocarbon) |
| GS WT | Single mechanical seal Burgmann M7N; SiC/SiC/PTFE-FFKM |

*Remark: EPDM and FFKM (Chemraz®) O-ring sets available on request*

***Single mechanical seal option without mechanical seal***

| | |
|---|---|
| GS XX | Single seal parts – seal on request |

***Single mechanical seal cartridge***

| | |
|---|---|
| GCT WV | Cartex TN3 (with throttle bush); SiC/SiC/FPM (Fluorocarbon) |
| GCT WT | Cartex TN3 (with throttle bush); SiC/SiC/PTFE |
| GCQ WV | Cartex QN3 (with lip ring); SiC/SiC/FPM (Fluorocarbon) |
| GCQ WT | Cartex QN3 (with lip ring); SiC/SiC/PTFE |

*Remark: EPDM and FFKM (Chemraz®) O-ring sets available on request*

***Double mechanical seal cartridge***

| | |
|---|---|
| GCD WV BV | Cartex DN3; SiC/SiC/FPM (Fluorocarbon)-SiC/Carbon/FPM (Fluorocarbon) |
| GCD WT BV | Cartex DN3; SiC/SiC/PTFE-SiC/Carbon/FPM (Fluorocarbon) |

*Remark: EPDM and FFKM (Chemraz®) O-ring sets available on request*

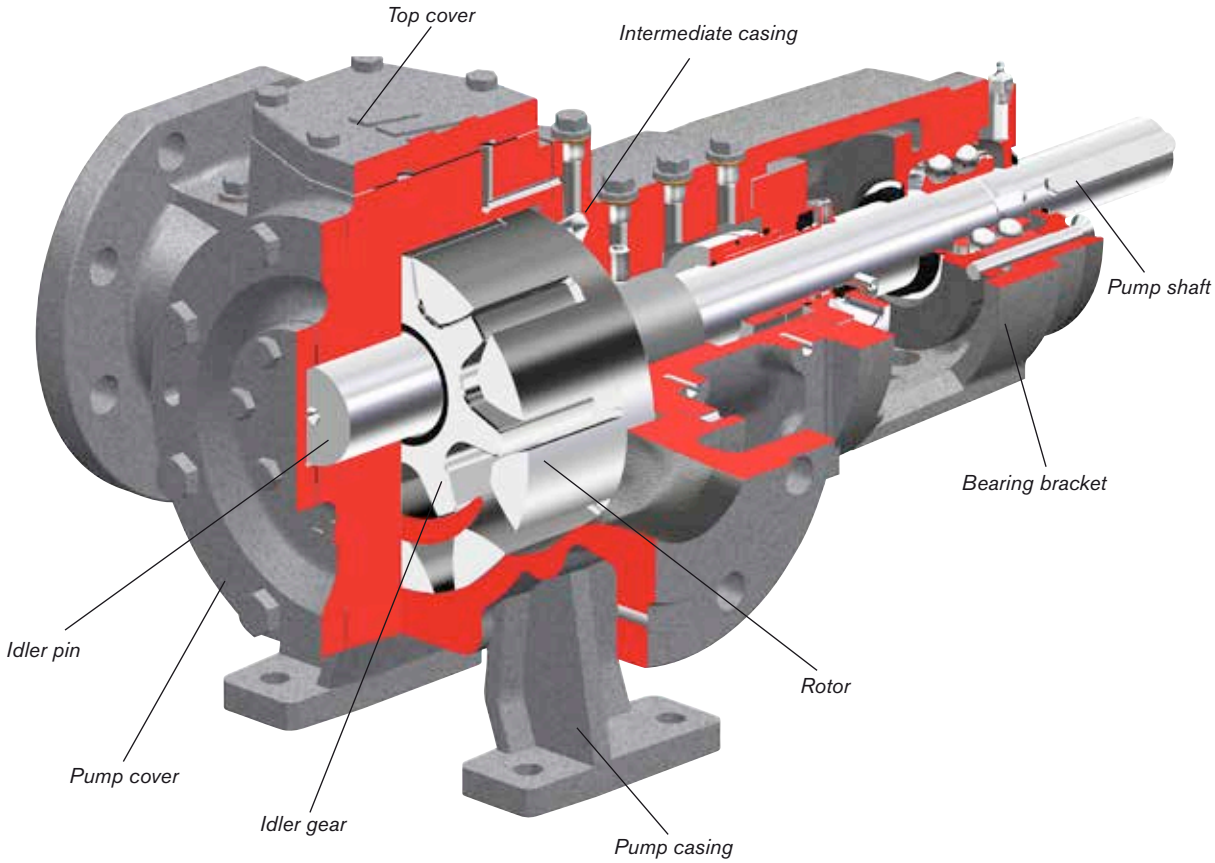
| | |
|---|---|
| GCX XX XX | Cartridge seal version without cartridge seal (cartridge seal on request) |
| GG XX XX | Double mechanical seal tandem version; without mechanical seals (seals on request) |
| GD XX XX | Double mechanical seal back-to-back version; without mechanical seals (seals on request) |

***Triple PTFE lip-seal cartridge***

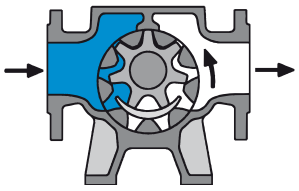
| | |
|---|---|
| LCT TV | Cartridge triple lip seal; PTFE seals / FKM Viton (Fluoroelastomer) o-rings |
| LCT XX | Cartridge triple lip seal; PTFE seals / no o-rings) |

# 3.0 General technical information

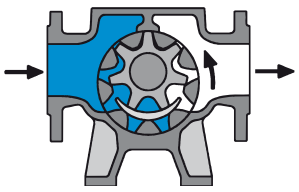
## 3.1 Pump standard parts



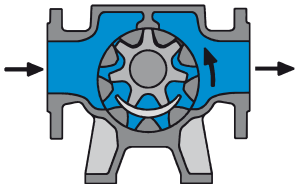

## 3.2 Operating principle



As the rotor and idler gear unmesh, an underpressure is created and the liquid enters the new created cavities.



Liquid is transported in sealed pockets to the discharge side. The walls of the pump casing and the crescent are creating a seal and separate suction from discharge side.



The rotor and idler gear mesh and liquid is being pushed into the discharge line.

Reversing the shaft rotation will reverse the flow through the pump as well.

### 3.2.1 Self-priming operation

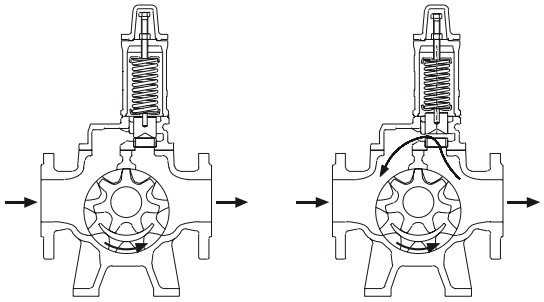
TopGear pumps are self-priming when sufficient liquid is present in the pump to fill up the clearances and the dead spaces between the teeth. (For self-priming operation see also section 3.18.6.2 Piping).

### 3.2.2 Safety relief valve – Working principle

The positive displacement principle requires the installation of a safety relief valve protecting the pump against overpressure. It can be installed on the pump or in the installation.

This safety relief valve limits the differential pressure ($\Delta p$) between suction and discharge, not the maximum pressure within the installation.

For example, as media cannot escape when the discharge side of the pump is obstructed, an over-pressure may cause severe damage to the pump.
The safety relief valve provides an escape path, rerouting the media back to the suction side when reaching a specified pressure level.



- The safety relief valve protects the pump against over-pressure only in one flow direction. The safety relief valve will **not** provide protection against over-pressure when the pump rotates in the opposite direction. When the pump is used in both directions, a double safety relief valve is required.
- An open safety relief valve indicates that the installation is not functioning properly. The pump must be shut down at once. Find and solve the problem before restarting the pump.
- When the safety relief valve is not installed on the pump, other protections against over-pressure have to be provided.
- ***Note!*** *Do not use the safety relief valve as a flow regulator. The liquid will circulate only through the pump and will heat up quickly.*

  *Contact your local supplier if a flow regulator is required.*

## 3.3 Sound

TopGear pumps are rotary displacement pumps. Because of the contact between internal parts (rotor/idler), pressure variations etc. they produce more noise than for example centrifugal pumps. Also the sound coming from drive and installation must be taken into consideration.
As the sound level at the operating area may exceed 85 dB(A), ear protection must be worn.
See also section 3.7 Sound level.

## 3.4 General performance

***Important!***
The pump is calculated for the liquid transport as described in the quotation. Contact your local supplier if one or several application parameters change.

Liquids not suitable for the pump can cause damages to the pump unit and imply risk of personal injury.

Correct application requires that consideration be given to all of the following:
Product name, concentration and density. Product viscosity, product particles (size, hardness, concentration, shape), product purity, product temperature, inlet and outlet pressure, RPM, etc.

## 3.5 Main characteristics

The pump size is designated by the displacement volume of 100 revolutions expressed in litres (or $dm^3$) but rounded followed by the nominal port diameter expressed in millimetres.

| TG H pump size | d (mm) | B (mm) | D (mm) | Vs-100 ($dm^3$) | n.max ($min^{-1}$) | n.mot ($min^{-1}$) | Q.th (l/s) | Q.th ($m^3/h$) | v.u (m/s) | v.i (m/s) | Δp (bar) | p.maw (bar) | p.test (bar) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2-32 | 32 | 13.5 | 65 | 1.83 | 1800 | | 0.5 | 2.0 | 6.1 | 0.7 | 16 | 20 | 30 |
| | | | | | | 1450 | 0.4 | 1.6 | 4.9 | 0.5 | | | |
| 3-32 | 32 | 22 | 65 | 2.99 | 1800 | | 0.9 | 3.2 | 6.1 | 1.1 | 16 | 20 | 30 |
| | | | | | | 1450 | 0.7 | 2.6 | 4.9 | 0.9 | | | |
| 6-40 | 40 | 28 | 80 | 5.8 | 1800 | | 1.7 | 6.3 | 7.5 | 1.4 | 16 | 20 | 30 |
| | | | | | | 1450 | 1.4 | 5.0 | 6.1 | 1.1 | | | |
| 15-50 | 50 | 40 | 100 | 14.5 | 1500 | | 3.6 | 13.1 | 7.9 | 1.8 | 16 | 20 | 30 |
| | | | | | | 1450 | 3.5 | 12.6 | 7.6 | 1.8 | | | |
| 23-65 | 65 | 47 | 115 | 22.7 | 1500 | | 5.7 | 20.4 | 9.0 | 1.7 | 16 | 20 | 30 |
| | | | | | | 1450 | 5.5 | 19.7 | 8.7 | 1.7 | | | |
| 58-80 | 80 | 60 | 160 | 57.6 | 1050 | | 10.1 | 36.3 | 8.8 | 2.0 | 16 | 20 | 30 |
| | | | | | | 960 | 9.2 | 33.2 | 8.0 | 1.8 | | | |
| 86-100 | 100 | 75 | 175 | 85.8 | 960 | 960 | 13.7 | 49.4 | 8.8 | 1.7 | 16 | 20 | 30 |
| 185-125 | 125 | 100 | 224 | 185 | 750 | | 23 | 83 | 8.8 | 1.9 | 16 | 20 | 30 |
| | | | | | | 725 | 22 | 80 | 8.5 | 1.8 | | | |
| 360-150 | 150 | 125 | 280 | 360 | 600 | | 36 | 130 | 8.8 | 2.0 | 16 | 20 | 30 |

**Legend**

d : port diameter (inlet and outlet port)
B : width of idler gear and length of rotor teeth
D : peripheral diameter of rotor (outside diameter)
Vs-100 : displaced volume pro 100 revolutions
n.max : maximum allowable shaft speed in rpm
n.mot : normal speed of direct drive electric motor (at 50Hz frequency)
Q.th : theoretical capacity without slip at differential pressure = 0 bar
v.u : peripheral velocity of rotor
v.i : velocity of liquid in the ports at Qth (inlet and outlet port)
Δp : maximum working pressure = differential pressure
p.maw : maximum allowable working pressure = design pressure
p.test : hydrostatic test pressure

### Maximum viscosity

| Shaft sealing type | Maximum viscosity (mPa.s) *) |
|---|---|
| **Packed gland PO, PQ, PR** | 80 000 |
| **Double mechanical seal** | |
| Back-to-back – GD and GCD pressurized | 80 000 |
| Tandem – GG and GCD not pressurized | 5 000 |
| **Single mechanical seal** | |
| GS with Burgmann MG12 | 3 000 |
| GS with Burgmann M7N | 5 000 |
| GCQ and GCT cartridge | 5 000 |
| **Triple PTFE lip-seal** | 80 000 |

*) *Remark:*
*Figures are for Newtonian liquids at operating temperature. The maximum allowable viscosity between the sliding faces of the mechanical seal depends on nature of liquid (Newtonian, plastic etc.), the sliding speed of the seal faces and the mechanical seal construction.*

## 3.6 Pressure

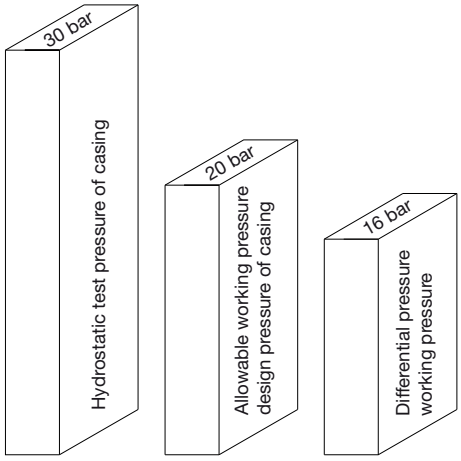
For performance on pressure, three kinds of pressures must be considered:

**Differential pressure or working pressure** (p) is the pressure on which the pump normally operates. The maximum differential pressure for all TopGear H-range pumps is 16 bar.

**Maximum allowable working pressure** (p.m) is the pressure on which the pump casing is designed and that can been achieved occasionally when the operating pressure rises over the normal operating pressure e.g. when the pump run with open relief valve.
In the TopGear H-range the design pressure is 20 bar i.e. 4 bar higher than the maximum differential pressure. It ensures higher safety such as is required in API676 for rotary positive displacement pumps.

**The hydrostatic test pressure** = 30 bar is the pressure on which the pump casing is tested. The test pressure is 1.5 times the design pressure.

Following figure gives a graphical presentation of the several kind of pressures.




## 3.7 Sound level

### 3.7.1 Sound level of a pump without drive

**Sound pressure level ($L_{pA}$)**

The following table gives an overview of the A-weightened sound pressure level, $L_{pA}$ emitted by a pump without drive, measured according to ISO3744 and expressed in decibels dB(A). The reference sound pressure is 20µPa.

The values depend on the position from where one measures and were therefore measured at the front of the pump, at distance of 1 meter from the pump cover and were corrected for background noise and reflections.

The values listed are the highest measured values under following operating conditions.

- Working pressure: up to 10 bar.
- Pumped medium: water, viscosity = 1 mPa.s
- —% $n_{max}$ = — % maximum shaft speed

| TG H pump size | $n_{max}$(min-1) | Lpa (dB(A)) | | | | Ls (dB(A)) |
|---|---|---|---|---|---|---|
| | | 25% $n_{max}$ | 50%$n_{max}$ | 75%$n_{max}$ | 100%$n_{max}$ | |
| 2-32 | 1800 | 51 | 62 | 68 | 72 | 9 |
| 3-32 | 1800 | 53 | 65 | 72 | 76 | 9 |
| 6-40 | 1800 | 57 | 68 | 76 | 80 | 9 |
| 15-50 | 1500 | 61 | 72 | 79 | 83 | 9 |
| 23-65 | 1500 | 63 | 75 | 81 | 85 | 10 |
| 58-80 | 1050 | 67 | 79 | 85 | 89 | 10 |
| 86-100 | 960 | 69 | 80 | 86 | 90 | 11 |
| 185-125 | 750 | 71 | 82 | 87 | 91 | 11 |
| 360-150 | 600 | 72 | 83 | 89 | 92 | 11 |

**Sound power level ($L_{WA}$)**
The sound power $L_W$ is the power emitted by the pump as sound waves and is used to compare sound levels of machines. It is the sound pressure Lp that act on a surrounding surface at distance of 1 meter.

$L_{WA} = L_{pA} + Ls$

The A-weightened sound power level $L_{WA}$ is also expressed in decibels dB(A).
The reference sound power is 1 pW (= $10^{-12}$ W). $L_S$ is the logarithm of the surrounding surface at distance of 1 metre from the pump, expressed in dB(A) and is listed in the last column of above table.

## 3.7.2 The sound level of the pump unit

The sound level of the drive (motor, transmission, . . .) must be added to the sound level of the pump itself to determine the total sound level of the pump unit. The sum of several sound levels must be calculated logarithmically.

For a quick determination of the total sound level the following table can be used:

| L1–L2 | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|
| L[f(L1–L2)] | 3.0 | 2.5 | 2.0 | 1.7 | 1.4 | 1.2 | 1.0 |

$L_{total} = L_1 + L_{corrected}$

where $L_{total}$ : the total sound level of the pump unit
$L_1$ : the highest sound level
$L_2$ : the lowest sound level
$L_{corrected}$ : term, depending on the difference between both sound levels

For more than two values this method can be repeated.

**Example:**
Drive unit : $L_1$ = 79 dB(A)
Pump : $L_2$ = 75 dB(A)
Correction : $L_1 - L_2$ = 4 dB(A)
According to the table : **$L_{corrected}$ = 1.4 dB(A)**
$L_{total}$ = 79 + 1.4 = 80.4 dB(A)

## 3.7.3 Influences

The real sound level of the pump unit can for several reasons deviate from the values listed in the tables above.

- Noise production decreases when pumping high viscosity liquids due to better lubricating and damping properties. Moreover the resistance torque of the idler is increasing due to higher liquid friction which results in lower vibration amplitude.
- Noise production increases when pumping low viscosity liquids combined with low working pressure because the idler can move freely (lower charge, lower liquid friction) and the liquid does not damp much.
- Vibrations in piping, vibrating of the base plate etc. will make the installation produce more noise.

## 3.8 Material options

### Overall temperature

The TG H range is designed for high temperatures. The overall temperatures for selected casing materials are shown in below table.

| TG H pump size | Minimum allowable temperature (°C) | | | Maximum allowable temperature (°C) | | |
|---|---|---|---|---|---|---|
| | Casing materials | | | Casing materials | | |
| | Stainless steel (R) | Carbon steel (S) | Nodular iron (N) | Stainless steel (R) | Carbon steel (S) | Nodular iron (N) |
| 2-32 | –40 | – | – | +200 | – | – |
| 3-32 | | | | | | |
| 6-40 | –40 | –30 | – | +250 | +300 | – |
| 15-50 | | | –25 | | | +300 |
| 23-65 | | | | | | |
| 58-80 | | | | | | |
| 86-100 | | | | | | |
| 185-125 | | | | | | |
| 360-150 | | | | | | |

***Remarks:***

1. *Maximum temperature of size TG H2-32 and TG H3-32 is limited to 200°C due to ball bearings type 2RS.*
2. *Temperature limits must be considered depending on the used materials for bearing bushes and shaft sealing.*

## 3.9 Jacket options

**S-jackets** are designed for use with saturated steam or with non-dangerous media. They are provided with cylindrical threaded connections according to ISO 228-I.

Maximum temperature: 200°C
Maximum pressure: 10 bar

Notice that the maximum pressure of 10 bar will be the limiting factor for use with saturated steam. Saturated steam at 10 bar gives a temperature of 180°C.

**T-jackets** are designed for use with thermal oil and apply to the DIN4754 safety standard for thermal oil transfer. This DIN standard specifies flange connections for temperature from 50°C upwards and jackets of ductile material for temperature from 200°C upwards. Both are provided in the T-design.
T-jackets could also be used for over heated steam or more dangerous media.
The flanges have a special shape with welding neck based on PN16 dimensions.

Maximum temperature: 300°C
Maximum pressure at 300°C: 12 bar

## 3.10 Internals

### 3.10.1 Bush materials

**Overview of bush materials and application field**

| Material Code | | S | C | B | H | U |
|---|---|---|---|---|---|---|
| Material | | Steel | Carbon | Bronze | Ceramic | Hard metal |
| Hydrodynamical lubrication | if yes | to maximum working pressure = 16 bar | | | | |
| | if no | 6 bar (*) | 10 bar (*) | 6 bar (*) | 6 bar (*) | 10 bar (*) |
| Corrosive resistance | | Fair | Good | Fair | Excellent | Good |
| Abrasive resistance | | Slight | None | None | Good | Good |
| Dry running allowed | | No | Yes | Moderate | No | No |
| Sensitive to thermal choc | | No | No | No | Yes dT<90°C | No |
| Sensitive to blistering in oil | | No | > 180°C | No | No | No |
| Oil aging | | No | No | > 150°C | No | No |
| Food processing allowed | | Yes | No (antimony) | No (lead) | No (traceability) | Yes |

*(*) These are not absolute figures. Higher or lower values possible in function of the application, expected lifetime etc*

## 3.10.2 Maximum temperature of internals

For some material combinations the general temperature performances must be limited.
The maximum allowable working temperature of internals depends on the combination of used materials and their thermal expansions and the interference fit to hold the bearing bush fixed.

- Some bush bearings have an extra locking screw. In this case the maximum allowable temperature is based on the most probable interference fit.
- In case the bearing bush has no locking screw because material and construction do not allow concentrated stress the maximum allowable temperature is based on the minimum interference fit.

**Maximum temperature (°C) of idler bush bearing material and idler material combinations**

| TG H pump size | Bush and Idler materials (°C) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Cast iron idler G | | | | Steel idler S | | | | | Stainless steel idler R | | | |
| | SG*) | CG | BG | HG | SS*) | CS | BS | HS | US | BR | CR | HR | UR |
| 2-32 | - | - | - | - | - | - | - | - | - | 200 | 200 | 200 | 200 |
| 3-32 | - | - | - | - | - | - | - | - | - | 200 | 200 | 200 | 200 |
| 6-40 | 300 | 280 | 240 | 240 | 300 | 250 | 300 | 200 | 240 | 300 | 250 | 200 | 240 |
| 15-50 | 300 | 280 | 240 | 240 | 300 | 250 | 300 | 200 | 240 | 300 | 250 | 200 | 240 |
| 23-65 | 300 | 300 | 250 | 240 | 300 | 280 | 300 | 200 | 240 | 300 | 280 | 200 | 240 |
| 58-80 | 300 | 300 | 250 | 240 | 300 | 280 | 300 | 200 | 240 | 300 | 280 | 200 | 240 |
| 86-100 | 300 | 300 | 250 | 280 | 300 | 280 | 300 | 240 | 240 | 300 | 280 | 240 | 240 |
| 185-125 | 300 | 300 | 250 | 300 | 300 | 280 | 300 | 260 | 240 | 300 | 280 | 260 | 240 |
| 360-150 | 300 | 300 | 250 | 300 | 300 | 280 | 300 | 260 | 240 | 300 | 280 | 260 | 240 |

**) Remark: Hardness relief of steel bush (S) and hardened steel pin (2) above 260°C*

**Maximum temperature (°C) of rotor bush bearing material and intermediate casing material combinations**

| Pump size TG H | Bush on shaft materials (°C) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Casing R – Stainless steel | | | | Casing S – Steel | | | | | Casing N – Nodular iron | | | | |
| | C | H | U | B | S*) | C | H | U | B | S*) | C | H | U | B |
| 2-32 | 200 | 200 | 200 | 200 | - | - | - | - | - | - | - | - | - | - |
| 3-32 | 200 | 200 | 200 | 200 | - | - | - | - | - | - | - | - | - | - |
| 6-40 | 250 | 150 | 240 | 250 | 300 | 280 | 260 | 240 | 300 | - | - | - | - | - |
| 15-50 | 250 | 150 | 240 | 250 | 300 | 280 | 280 | 240 | 300 | 300 | 300 | 300 | 240 | 300 |
| 23-65 | 250 | 150 | 240 | 250 | 300 | 280 | 280 | 240 | 300 | 300 | 300 | 300 | 240 | 300 |
| 58-80 | 250 | 150 | 240 | 250 | 300 | 280 | 280 | 240 | 300 | 300 | 300 | 300 | 240 | 300 |
| 86-100 | 250 | 150 | 240 | 250 | 300 | 280 | 280 | 240 | 300 | 300 | 300 | 300 | 240 | 300 |
| 185-125 | 250 | 150 | 240 | 250 | 300 | 280 | 280 | 240 | 300 | 300 | 300 | 300 | 240 | 300 |
| 360-150 | 250 | 150 | 240 | 250 | 300 | 280 | 280 | 240 | 300 | 300 | 300 | 300 | 240 | 300 |

**) Remark: Hardness relief of steel bush (S) and hardened steel shaft (2) above 260°C*

## 3.10.3 Operation under hydrodynamic lubrication conditions

Hydrodynamic lubrication could be important criteria for bush material selection.
If the bush bearings are running under the condition of hydrodynamic lubrication there is no more material contact between bush and pin or shaft and the lifetime cycle is increased importantly.
If there is no condition for hydrodynamic lubrication, the bush bearings make material contact with pin or shaft and the wear of these parts is to be considered.

The condition of hydrodynamic lubrication is fulfilled with the following equation:

**Viscosity * shaft speed / diff.pressure ≥ K.hyd**

with: viscosity [mPa.s]
shaft speed [rpm]
diff.pressure [bar]
K.hyd = design constant for each pump size.

| TG H pump size | K.hyd |
|---|---|
| 2-32 | 6000 |
| 3-32 | 7500 |
| 6-40 | 5500 |
| 15-50 | 6250 |
| 23-65 | 4000 |
| 58-80 | 3750 |
| 86-100 | 3600 |
| 185-125 | 2500 |
| 360-150 | 2000 |

### 3.10.4 Maximum torque of pump shaft and rotor material combination

*The maximum allowable torque* is a constant independent from speed and may not be exceeded to avoid damaging the pump i.e. pump shaft, rotor/shaft fitting and rotor teeth.

| TG H pump size | Mn (nominal torque) in Nm | | | Md (starting torque) in Nm | | |
|---|---|---|---|---|---|---|
| | G Rotor Iron | N Rotor Nitrided nodular iron | R Rotor Stainless steel | G Rotor Iron | N Rotor Nitrided nodular iron | R Rotor Stainless steel |
| 2-32 | 21 | – | 31 | 29 | – | 43 |
| 3-32 | 21 | – | 31 | 29 | – | 43 |
| 6-40 | 67 | 67 | 67 | 94 | 94 | 94 |
| 15-50 | 255 | 255 | 255 | 360 | 360 | 360 |
| 23-65 | 255 | 255 | 255 | 360 | 360 | 360 |
| 58-80 | 390 | 390 | 390 | 550 | 550 | 550 |
| 86-100 | 600 | 600 | 600 | 840 | 840 | 840 |
| 185-125 | 1300 | 1300 | 1300 | 1820 | 1820 | 1820 |
| 360-150 | 2000 | 2000 | 2000 | 2800 | 2800 | 2800 |

The nominal torque (Mn) has to be checked for the normal working conditions and the installed nominal motor torque (Mn.motor) but converted to the pump shaft speed.

The starting torque (Md) may not be exceeded during start up. Use this value for the maximum torque set of a torque limiter if installed on the pump shaft.

## 3.11 Mass moment of inertia

| TG H | 2-32 | 3-32 | 6-40 | 15-50 | 23-65 | 58-80 | 86-100 | 185-125 | 360-150 |
|---|---|---|---|---|---|---|---|---|---|
| J ($10^{-3}$ x kgm$^2$) | 0.25 | 0.30 | 0.75 | 3.5 | 6.8 | 32 | 54 | 200 | 570 |

## 3.12 Axial and radial clearances

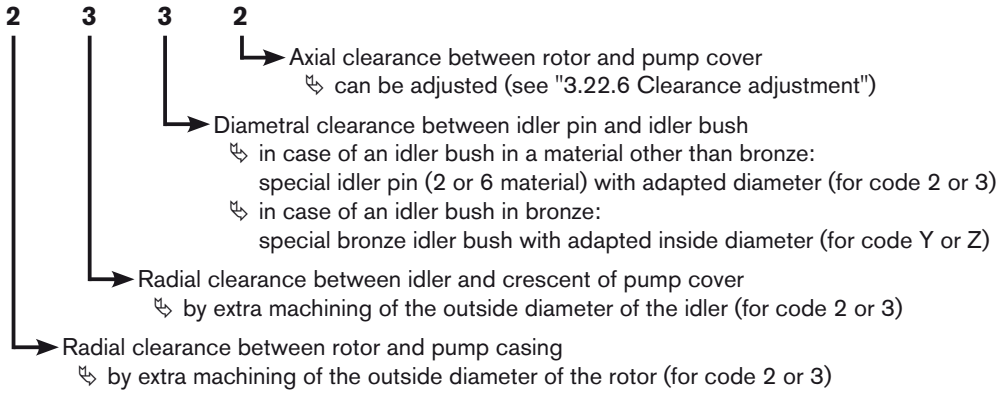
| TG H | 2-32 | 3-32 | 6-40 | 15-50 | 23-65 | 58-80 | 86-100 | 185-125 | 360-150 |
|---|---|---|---|---|---|---|---|---|---|
| Minimum (µm) | 80 | 80 | 90 | 120 | 125 | 150 | 165 | 190 | 225 |
| Maximum (µm) | 134 | 134 | 160 | 200 | 215 | 250 | 275 | 320 | 375 |

## 3.13 Extra clearances

To indicate required clearances a code of 4 digits, xxxx, is given on the order.
These digits refer to the following clearance classes:

C0 = Axial clearance between rotor and pump cover set at minimum
C1 = Standard clearance (not indicated because standard)
C2 = ~2 x standard clearance
C3 = 3 x standard clearance

The 4 digits indicate which clearance class is set for which part of the pump, e.g.: code 2 3 3 2




The code ''1'' always stands for ''normal'' and no special action is considered.

The indicated numbers in the tables below are average values in microns (µm).

**Radial clearance on rotor, idler outside diameter – Axial clearance on pump cover**

| Pump size | C0 (µm) axial clearance pumpcover set minimum | C1 (µm) normal | C2 (µm) = 2.2 x C1 | C3 (µm) = 3 x C1 |
|---|---|---|---|---|
| Code rotor | 1xxx | 1xxx | 2xxx | 3xxx |
| Code idler | x1xx | x1xx | x2xx | x3xx |
| Code pump cover assembly | xxx0 | xxx1 | xxx2 | xxx3 |
| TG H2-25 | 35 | 107 | 235 | 320 |
| TG H3-32 | 35 | 107 | 235 | 320 |
| TG H6-40 | 40 | 125 | 275 | 375 |
| TG H15-50 | 52 | 160 | 350 | 480 |
| TG H23-65 | 56 | 170 | 375 | 510 |
| TG H58-80 | 66 | 200 | 440 | 600 |
| TG H86-100 | 72 | 220 | 480 | 660 |
| TG H185-125 | 85 | 255 | 560 | 765 |
| TG H360-150 | 100 | 300 | 660 | 900 |

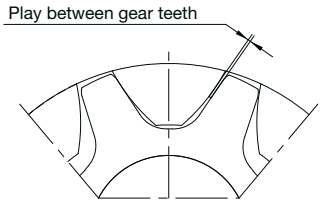
**Diametral clearance on pin / idler bearing**

| Pump size | C1 (µm) normal | C2 (µm) = 2 x C1 | C3 (µm) = 3 x C1 |
|---|---|---|---|
| Code for adapted 2 or 6 material pin (2 or 3) | xx1x | xx2x | xx3x |
| Code for adapted bronze idler bush (Y or Z) | xx1x | xxYx | xxZx |
| TG H2-25 | 90 | 180 | 270 |
| TG H3-32 | 90 | 180 | 270 |
| TG H6-40 | 110 | 220 | 330 |
| TG H15-50 | 150 | 300 | 450 |
| TG H23-65 | 160 | 320 | 480 |
| TG H58-80 | 240 | 480 | 720 |
| TG H86-100 | 275 | 550 | 825 |
| TG H185-125 | 325 | 650 | 975 |
| TG H360-150 | 400 | 800 | 1200 |

***Note!*** *the clearance between the idler pin and idler bush (3rd digit) should always be less or equal to the clearance on the idler (2nd digit). Otherwise there is a risk of contact between the idler and the crescent of the pump cover.*

## 3.14 Play between gear teeth

| TG H | 2-32 | 3-32 | 6-40 | 15-50 | 23-65 | 58-80 | 86-100 | 185-125 | 360-150 |
|---|---|---|---|---|---|---|---|---|---|
| Minimum (µm) | 320 | 320 | 320 | 360 | 400 | 400 | 400 | 440 | 440 |
| Maximum (µm) | 640 | 640 | 640 | 720 | 800 | 800 | 800 | 880 | 880 |




## 3.15 Maximum size of solid particles

| TG H | 2-32 | 3-32 | 6-40 | 15-50 | 23-65 | 58-80 | 86-100 | 185-125 | 360-150 |
|---|---|---|---|---|---|---|---|---|---|
| Size (µm) | 80 | 80 | 90 | 120 | 125 | 150 | 165 | 190 | 225 |

# 3.16 Shaft sealings

## 3.16.1 Packed gland

| TG H pump size | 2-32<br>3-32 | 6-40 | 15-50<br>23-65 | 58-80 | 86-100 | 185-125 | 360-150 |
|---|---|---|---|---|---|---|---|
| Shaft diameter | 16 | 22 | 32 | 40 | 45 | 55 | 65 |
| Section width 5x | 6 | 8 | 8 | 10 | 10 | 10 | 10 |
| Lantern ring width | 12 | 16 | 16 | 20 | 20 | 20 | 20 |

*Dimensions in mm*

## 3.16.2 Packing ring materials

***TC***

Most universal solution.
Woven shaft packing consisting of PTFE yarns with incorporated graphite and sliding matters (yarns GORE-GFO). Extreme low coefficient of friction, good thermal conductivity, high suppleness and volume stability. Suitable for general applications.

Application temperature: -200°C to +280°C
Chemical resistance: pH 0 – 14

***AW***

Strong fibres.
Woven shaft packing consisting of white elastic synthetic aramide yarns with silicon free lubricating matter. Wear resistant without damaging the shaft, high section density and structure strength, good sliding properties. Used where a strong yarn is necessary e.g. sugar solutions, polymers, resins, bitumen, paper industry etc. Chosen as standard for food applications.

Application temperature: -50°C to +250°C
Chemical resistance: pH 1 – 13

***CC***

Graphite fibres; dry running; high temperature.
Woven shaft packing consisting of pure graphite fibres without impregnation. Low coefficient of friction and good dry running properties. Used as wear resistant packing at high temperature.

Application temperature: -60°C to +500°C
Chemical resistance: pH 0 – 14

## 3.16.3 Mechanical seals

### 3.16.3.1 Mechanical seals according to EN12756 (DIN24960) – General information

In TopGear TG H version GS, short type KU or long type NU mechanical seals can be built in.
In the smallest pump sizes H2-32 and H3-32 only the short type KU can be built in.

In the double seal versions GG and GD only the short type KU can be built in. A double mechanical seal consist of two separately chosen single mechanical seals.

If GD type back-to-back double mechanical seal is chosen, attention must be paid for axial securing of the first stationary seat. Our pumps are provided for built in the axial securing of the stationary seat according to EN12756 (DIN24960). The exact securing ring must be delivered by the mechanical seal manufacturer together with the seals because the dimensions must be adapted to the form of the seat.

| TG H pump size | 2-32<br>3-32 | 6-40 | 15-50<br>23-65 | 58-80 | 86-100 | 185-125 | 360-150 |
|---|---|---|---|---|---|---|---|
| Shaft diameter | 16 | 22 | 32 | 40 | 45 | 55 | 65 |
| Short EN12756 (DIN 24960) | KU016 | KU022 | KU032 | KU040 | KU045 | KU055 | KU065 |
| L-1K (short KU) | 35 | 37.5 | 42.5 | 45 | 45 | 47.5 | 52.5 |
| Long EN12756 (DIN 24960) | – | NU022 | NU032 | NU040 | NU045 | NU055 | NU065 |
| L-1N (long NU) | – | 45 | 55 | 55 | 60 | 70 | 80 |

*Dimensions in mm*

**Performance**
Maximum performance such as viscosity, temperature and working pressure depends on the make of the mechanical seal and the used materials.
The following basic values can be taken into consideration.

**Maximum temperatures of elastomers**

| | |
|---|---|
| Nitrile (P): | 110°C |
| FPM (Fluorocarbon): | 180°C |
| PTFE (solid or PTFE wrapped): | 220°C |
| Chemraz®: | 230°C |
| Kalrez®*: | 250°C |

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

**Maximum viscosity for GS and GG type**

| | |
|---|---|
| 3000 mPas: | For single mechanical seals of light construction e.g. Burgmann MG12 |
| 5000 mPas: | For mechanical seals of strong torque construction (consult manufacturer). |

The maximum allowed viscosity between the sliding faces of the mechanical seal depends on the nature of the liquid (Newtonian, plastic etc.), the sliding speed of the seal faces and the mechanical construction.

**Maximum viscosity for GD type back-to-back double seal**
In contrast to single mechanical seals (GS) or double seals in tandem arrangement (GG) the sliding faces of the GD mechanical seal are lubricated by a barrier fluid under pressure which allows high viscous liquids to be pumped.

**Second sealing box type GG and GD maximum temperature and pressure**

| | |
|---|---|
| Maximum temperature of the second mechanical seal box: | 250°C |
| Maximum allowable pressure of the second mechanical seal box: | 16 bar. |

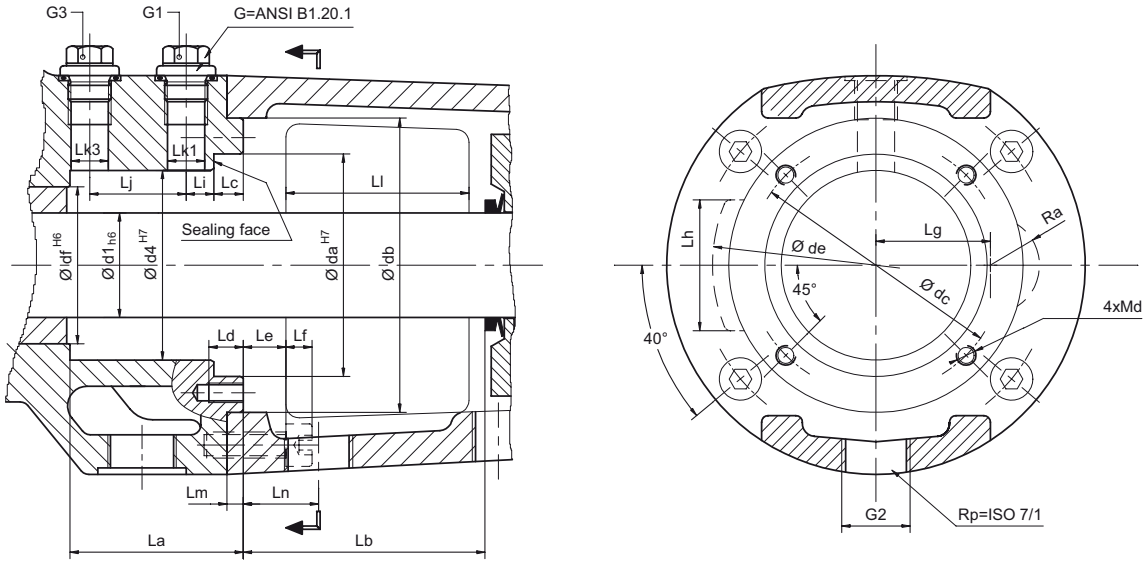
***Note!*** *The pressure before the first mechanical seal at pumped medium side is lower than the discharge pressure.*

**Food applications**
Special demanded Burgmann M7N (SiC-SiC seal faces and FDA approved FPM o-rings) seals can be used in food applications. Each one of these special demanded Burgmann M7N seals have a “confirmation for FDA-requirements” like the one in the “Declaration of Compliance for food contact materials” (see last pages of this manual).

### 3.16.3.2 Cartridge mechanical seals

In TopGear H ranges Universal Cartridge mechanical seals could be built in from pump size H6-40 to H360-150.
Several functions and more complicated constructions e.g. gas seals, API conformity etc. are possible. Contact your local supplier if you have a special application or special questions.
The end plate or the gland of the cartridge mechanical seal must be adapted to the built in dimensions of the TopGear pump. See figure next page.

## Built-in dimensions




| TG H pump size | Ød1 [mm] | Ød4 [mm] | Øda [mm] | Ødb [mm] | Ødc [mm] | Øde [mm] | Ødf [mm] | 4xMd [mm] | La [mm] | Lb [mm] | Lc [mm] | Ld [mm] | Le [mm] | Lf [mm] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2-32 | 16 | 32 | 39 | 60 | 49 | 66 | 28 | 4xM6 | 48 | 45 | 11.5 | 7.5 | 6 | 6 |
| 3-32 | 16 | 32 | 39 | 60 | 49 | 66 | 28 | 4xM6 | 48 | 45 | 11.5 | 7.5 | 6 | 6 |
| 6-40 | 22 | 45 | 52 | 74 | 62 | – | 38 | 4xM6 | 46 | 60 | 6 | 8.5 | 12 | 8 |
| 15-50 | 32 | 58 | 68 | 90 | 78 | – | 48 | 4xM6 | 53 | 72 | 9 | 9 | 13 | 8 |
| 23-65 | 32 | 58 | 68 | 90 | 78 | – | 48 | 4xM6 | 53 | 72 | 9 | 9 | 13 | 8 |
| 58-80 | 40 | 72 | 82 | 110 | 94 | – | 58 | 4xM8 | 56 | 90 | 6 | 12 | 15 | 12 |
| 86-100 | 45 | 77 | 87 | 120 | 104 | – | 63 | 4xM8 | 55 | 86 | 6 | 12 | 15 | 12 |
| 185-125 | 55 | 90 | 106 | 160 | 124 | 203 | 75 | 4xM8 | 58 | 117 | 6 | 14 | 16 | 16 |
| 360-150 | 65 | 105 | 120 | 170 | 142 | 180 | 88 | 4xM10 | 65 | 118 | 6 | 14 | 19 | 16 |

| TG H pump size | Lg [mm] | Lh [mm] | Ra [mm] | Li [mm] | Lj [mm] | ØLk1 [mm] | ØLk3 [mm] | Li [mm] | Lm [mm] | Ln [mm] | G1 | G3 | G2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2-32 | – | 30 | – | 11.5 | 20 | 8.8 | | 40 | 6 | 14 | G1/8” | | G3/8” |
| 3-32 | – | 30 | – | 11.5 | 20 | 8.8 | | 40 | 6 | 14 | G1/8” | | G3/8” |
| 6-40 | – | – | – | 8.5 | 24.5 | 11.8 | | 62.5 | 4 | 18 | G1/4” | | G3/8” |
| 15-50 | 35 | – | 15 | 8.5 | 28.5 | 11.8 | | 56 | 5 | 23 | G1/4” | | G1/2” |
| 23-65 | 35 | – | 15 | 8.5 | 28.5 | 11.8 | | 56 | 5 | 23 | G1/4” | | G1/2” |
| 58-80 | 40 | – | 23 | 9.5 | 30 | 11.8 | 19 | 70 | 5 | 30 | G1/4” | G1/2” | G3/4” |
| 86-100 | 45 | – | 15 | 9.5 | 29 | 11.8 | 19 | 70 | 5 | 30 | G1/4” | G1/2” | G3/4” |
| 185-125 | – | 95 | – | 10.5 | 31 | 11.8 | 19 | 90 | 6 | 29 | G1/4” | G1/2” | G3/4” |
| 360-150 | – | 74 | – | 13 | 36.5 | 11.8 | 19 | 95 | 6 | 36 | G1/4” | G1/2” | G3/4” |

## 3.16.4 Reverted packing execution for e.g. chocolate application

For chocolate pumping applications the PR version is designed.

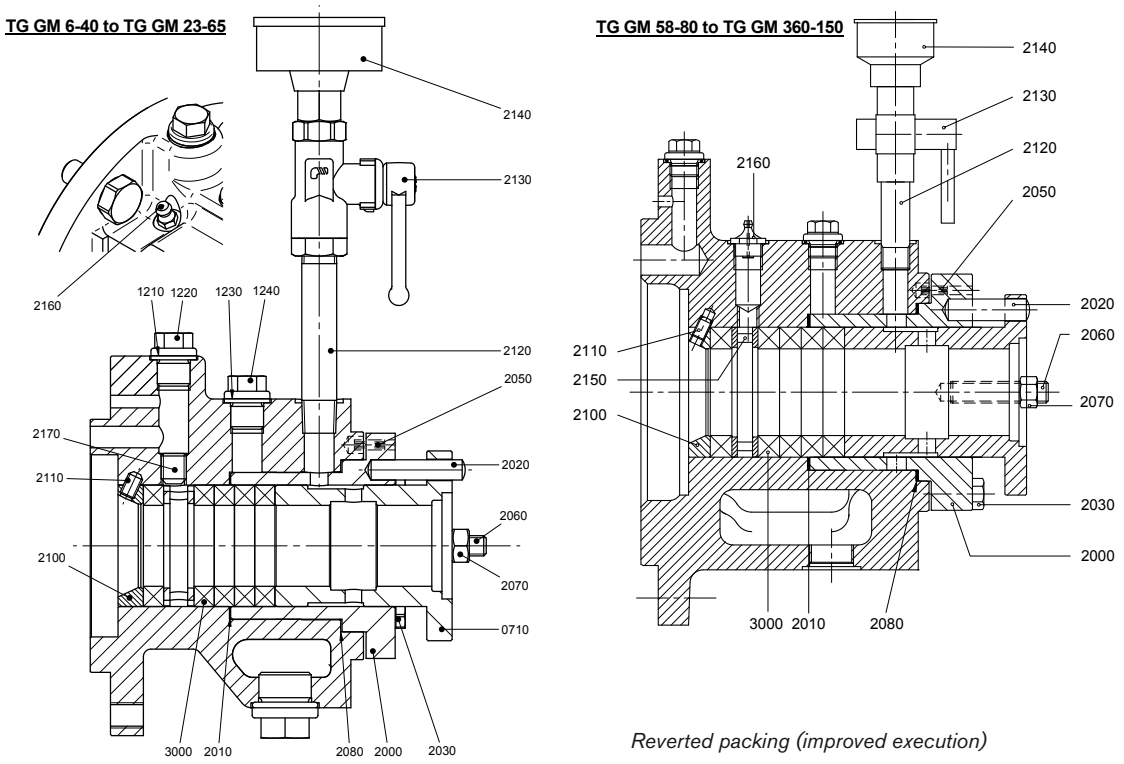
The pump shaft is sealed by means of packing rings and the bronze shaft bearing is placed outside the pumped medium and is designed to work as a packing gland. Because of the fact that, under normal conditions, the shaft bearing does not come into contact with the pumped medium, bronze can be used as material.

The bush bearing is greased by an external grease supply. The grease has to be provided by the end user because of compatibility with the pumped liquid.

Depending of the type of chocolate extra clearances are given on Rotor, Idler, Pump cover and Idler bush bearing. **For extra clearances see 3.13**.

| TG H pump size | 6-40 | 15-30<br>23-65 | 58-80 | 86-100 | 185-125 |
|---|---|---|---|---|---|
| Shaft diameter (mm) | 22 | 32 | 40 | 45 | 55 |
| Section width (mm) | 8 | 8 | 10 | 10 | 10 |
| Number of rings | see 5.2.5.7 | | | | |

*Dimensions in mm*




*Reverted packing (improved execution)*

On this improved execution, the gland packing area can be filled with grease from the outside before the pump is actually started. This prevents the chocolate from entering this area until the packing is properly adjusted. Otherwise, in case chocolate with sugar content is entering the gland packing area, it would caramelize/burn at the inside and the shaft sealing would become immediately un-effective even if the gland is tightened harder afterwards. To allow this pre-lubrication of the gland packing area, we have added a lantern ring with external grease nipple behind the first packing ring. Please note that the lubricant must be food-approved and compatible with the product pumped.

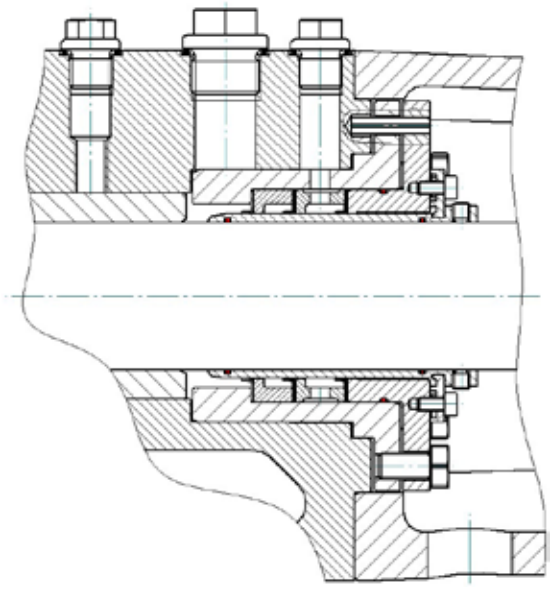
***Note!*** The packing is lightly tightened by hand at the factory. When pumping chocolate, the packing needs to be tightened bit by bit at the initial start-up in order to achieve the utmost minimum of leakage, just enough to lubricate the packing rings. Excessively leaking chocolate can overheat in the packing, causing caramelisation, resulting in extra wear of the packing.

## 3.17.5 Triple PTFE lip-seal cartridge

As from the first of July 2015, this new shaft sealing option (TCL TV) is available on the TopGear GM and H range. This new shaft sealing option can be used for pumping products with a viscosity of more than 5.000 mPas as alternative for double mechanical seals omitting the need for an expensive pressurized quench system. This option can be used for medium temperatures up to 220 °C and a maximum pressure of 16 bar.

**Benefits:**

- Cartridge system – easy to assemble
- Independent of sense of rotation
- Low friction and limited dry-running capabilities
- Lip-seals with outstanding chemical resistance
- No need for pressurized quench system
- Non-clogging in viscous media
- Low pressure quench and/or leak detection between 2nd and 3rd lip-seal
- Repair kits available for on-site maintenance



**Materials:**

- Casing and insert: Duplex steel
- Shaft sleeve: Cementation steel
- Lip seals: GARLOCK Gylon-B (PTFE)
- O-rings: Fluoroelastomer FKM (Viton).

## 3.17 Safety relief valve

### Example

V 35 - G 10 H
1 2 3 4 5

**1. Safety relief valve = V**

**2. Type indicating = inlet diameter (in mm)**

| | |
|---|---|
| 18 | Safety relief valve size for TG H2-32, TG H3-32, TG H6-40 |
| 27 | Safety relief valve size for TG H15-50, TG H23-65 |
| 35 | Safety relief valve size for TG H58-80 |
| 50 | Safety relief valve size for TG H86-100, TG H185-125 |
| 60 | Safety relief valve for TG H360-150 |

**3. Materials**

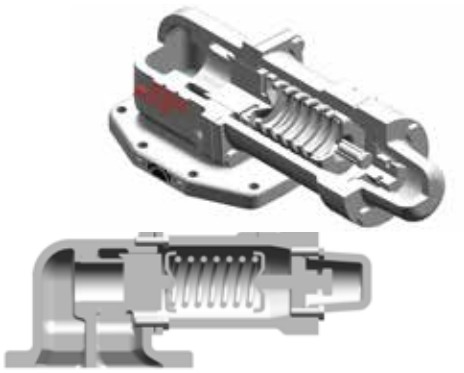
| | | |
|---|---|---|
| G | Safety relief valve in cast iron | (not for foodapplications) |
| S | Safety relief valve in steel | (not for foodapplications) |
| R | Safety relief valve in stainless steel | (for foodapplications) |

**4. Working pressure class**

| | |
|---|---|
| 4 | Working pressure 1-4 bar |
| 6 | Working pressure 3-6 bar |
| 10 | Working pressure 5-10 bar |
| 16 | Working pressure 9-16 bar |

**5. Heated spring casing**

| | |
|---|---|
| H | Safety relief valve heated spring casing |



*Safety relief valve – horizontal*

*Safety relief valve – vertical*

### 3.17.1 Pressure

Safety relief valves are divided into 4 working pressure classes i.e. 4, 6, 10 and 16 indicating the maximum working pressure for that valve. Each class has a standard set pressure at 1 bar above the indicated maximum working pressure. The set pressure can be set lower on request never higher.

| Working pressure class | 4 | 6 | 10 | 16 |
|---|---|---|---|---|
| Standard set pressure (bar) | 5 | 7 | 11 | 17 |
| Working pressure range (bar) | 1 – 4 | 3 – 6 | 5 – 10 | 9 – 16 |
| Set pressure range (bar) | 2 – 5 | 4 – 7 | 6 – 11 | 10 – 17 |

### 3.17.2 Heating

Heating version is only available on the steel (S) relief valve. The weld on jacket is provided with 2 thread connections. Flange connections are not available.

Maximum temperature: 200°C
Maximum pressure: 10 bar

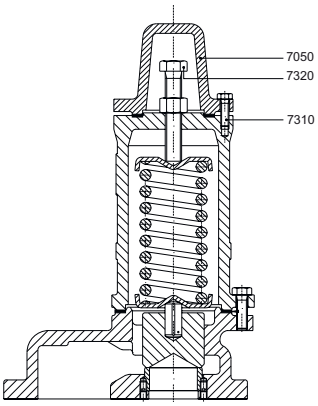
## 3.17.3 Safety relief valve – Relative adjustment

Adjustment of the standard setting pressure is performed at the factory.

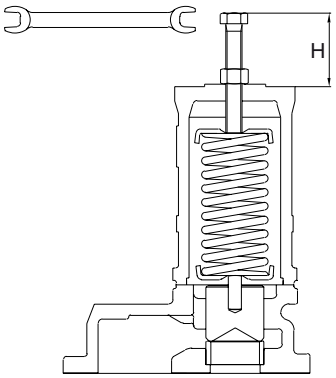
***Note!*** *When testing the safety relief valve mounted on the pump, make sure the pressure never exceeds the set pressure of the valve + 2 bar.*

To adjust the standard opening pressure, proceed as follows:

1. Loosen the tap bolts (7310).
2. Remove cover (7050).
3. Take the measurement of dimensions of H.
4. Read spring ratio in the below table and determine the distance over which the adjusting bolt (7320) must be loosened or tightened.

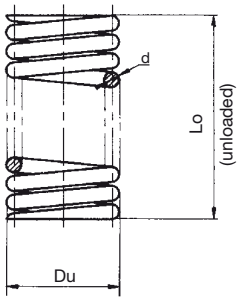



*Vertical safety relief valve*




*Set pressure modification*

**Spring ratio – Safety relief valve**

| TG H pump size | | Spring dimensions | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Pressure class | Du mm | d mm | Lo mm | p/f bar/mm | ΔH [mm] in order to adjust by 1 bar | |
| 2-32<br>3-32<br>6-40 | Horizontal | 4 | 25.5 | 3.0 | 64 | 0.26 | 3.85 |  |
| | | 6 | 25.5 | 3.5 | 66 | 0.43 | 2.33 | |
| | | 10 | 25.5 | 4.5 | 60 | 1.72 | 0.58 | |
| | | 16 | 25.5 | 4.5 | 60 | 1.72 | 0.58 | |
| 15-50<br>23-65 | | 4 | 37.0 | 4.5 | 93 | 0.21 | 4.76 | |
| | | 6 | 37.0 | 4.5 | 93 | 0.21 | 4.76 | |
| | | 10 | 36.5 | 6.0 | 90 | 0.81 | 1.23 | |
| | | 16 | 36.5 | 6.0 | 90 | 0.81 | 1.23 | |
| 58-80 | Vertical | 4 | 49.0 | 7.0 | 124 | 0.32 | 3.13 | |
| | | 6 | 49.0 | 7.0 | 124 | 0.32 | 3.13 | |
| | | 10 | 48.6 | 8.0 | 124 | 0.66 | 1.52 | |
| | | 16 | 48.6 | 8.0 | 124 | 0.66 | 1.52 | |
| 86-100<br>185-125 | | 4 | 49.0 | 7.0 | 124 | 0.16 | 6.25 | |
| | | 6 | 48.6 | 8.0 | 124 | 0.33 | 3.03 | |
| | | 10 | 49.0 | 9.0 | 120 | 0.55 | 1.82 | |
| | | 16 | 62 | 11 | 109 | 0.86 | 1.16 | |
| 360-150 | | 4 | 82 | 11 | 200 | 0.12 | 8.33 | |
| | | 6 | 82 | 11 | 200 | 0.12 | 8.33 | |
| | | 10 | 84 | 12 | 200 | 0.19 | 5.26 | |
| | | 16 | 88 | 14 | 200 | 0.32 | 3.13 | |



*Example: adjust the standard set pressure of a V35-G10 valve (for pump size 58-80) to 8 bar.*

- ⇨ *Standard set pressure of V35-G10 = 11 bar (see table under 3.18.1)*
- ⇨ *Difference between actual set pressure and desired set pressure = 11 - 8 = 3 bar*
- ⇨ *ΔH to loosen the adjusting bolt = 3 x 1.52 mm (see table above) = 4.56 mm*

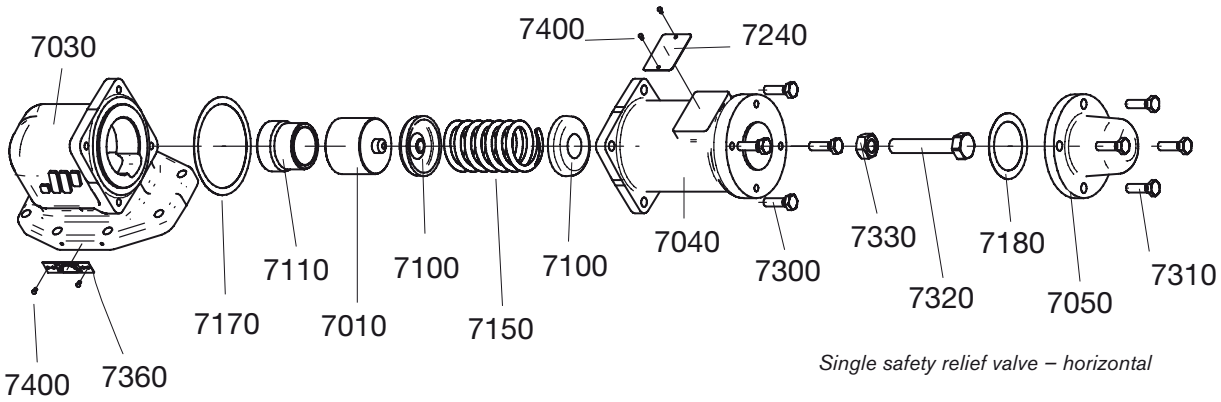
***Note!***

The *spring ratio p/f depends upon the dimensions of the spring. Check these dimensions if necessary (see table above).*

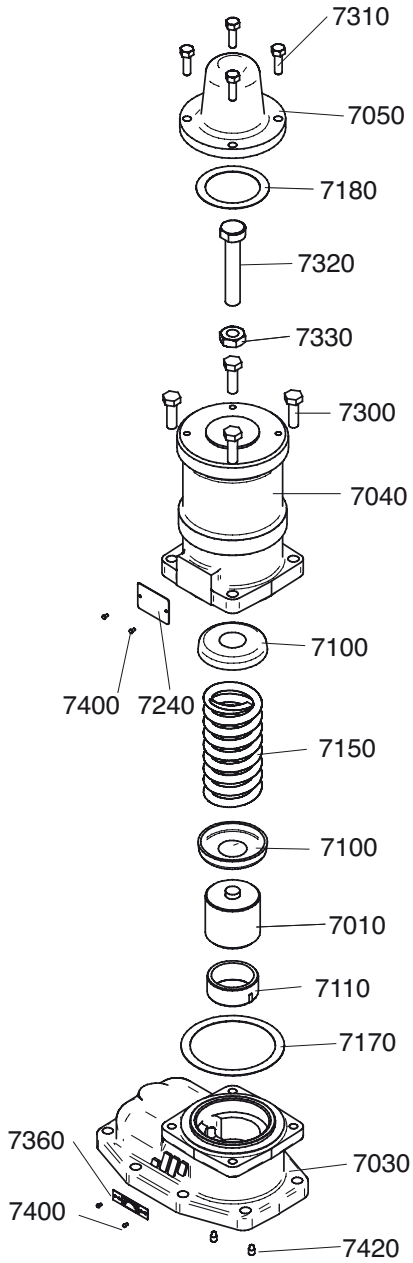
When the safety relief valve is not functioning properly, the pump must immediately be taken out of service. The safety relief valve must be checked by your local distributor.

## 3.17.4 Sectional drawings and part lists

### 3.17.4.1 Single safety relief valve



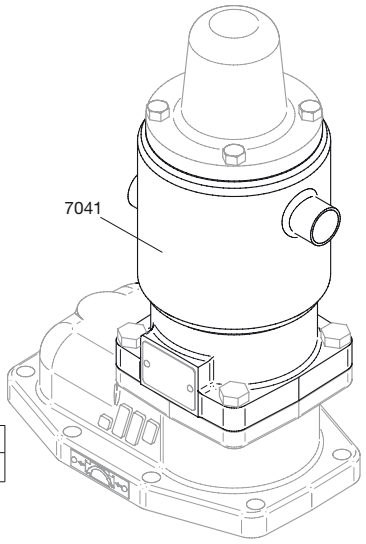

*Single safety relief valve – horizontal*




*Single safety relief valve – vertical*

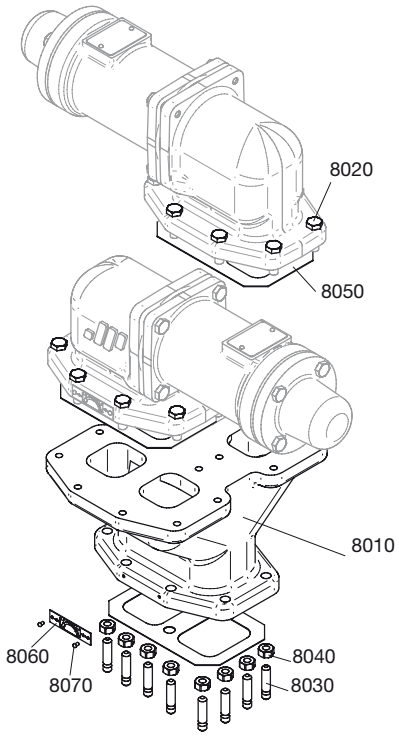
| Pos. | Description | V18 | V27 | V35 | V50 | V60 | Preventive | Overhaul |
|---|---|---|---|---|---|---|---|---|
| 7010 | Valve | 1 | 1 | 1 | 1 | 1 | | |
| 7030 | Valve casing | 1 | 1 | 1 | 1 | 1 | | |
| 7040 | Spring casing | 1 | 1 | 1 | 1 | 1 | | |
| 7050 | Cover | 1 | 1 | 1 | 1 | 1 | | |
| 7100 | Spring plate | 2 | 2 | 2 | 2 | 2 | | |
| 7110 | Valve seat | 1 | 1 | 1 | 1 | 1 | | |
| 7150 | Spring | 1 | 1 | 1 | 1 | 1 | | |
| 7170 | Flat gasket | 1 | 1 | 1 | 1 | 1 | x | x |
| 7180 | Flat gasket | 1 | 1 | 1 | 1 | 1 | x | x |
| 7240 | Name plate | 1 | 1 | 1 | 1 | 1 | | |
| 7300 | Tap bolt | 3 | 4 | 4 | 4 | 4 | | |
| 7310 | Tap bolt | 3 | 4 | 4 | 4 | 4 | | |
| 7320 | Adjusting screw | 1 | 1 | 1 | 1 | 1 | | |
| 7330 | Hexagonal nut | 1 | 1 | 1 | 1 | 1 | | |
| 7360 | Arrow plate | 1 | 1 | 1 | 1 | 1 | | |
| 7400 | Rivet | 4 | 4 | 4 | 4 | 4 | | |
| 7420 | Set screw | – | – | 2 | 2 | 2 | | |

### 3.17.4.2 Heated spring casing

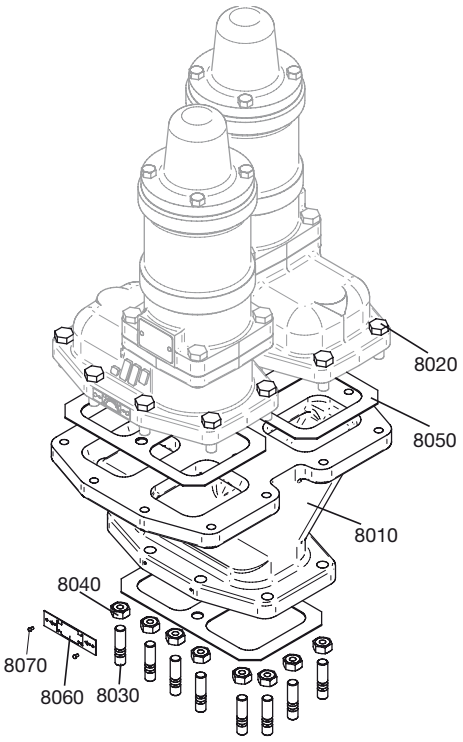



| Pos. | Description | V18 | V27 | V35 | V50 | V60 | Preventive | Overhaul |
|---|---|---|---|---|---|---|---|---|
| 7041 | Heated spring casing | N/A | 1 | 1 | 1 | 1 | | |

### 3.17.4.3 Double safety relief valve




*Double safety relief valve – horizontal*




*Double safety relief valve – vertical*

| Pos. | Description | V18 | V27 | V35 | V50 | V60 | Preventive | Overhaul |
|---|---|---|---|---|---|---|---|---|
| 8010 | Y-casing | N/A | 1 | 1 | 1 | 1 | | |
| 8020 | Cylindrical head screw | | 16 | 16 | 16 | 16 | | |
| 8030 | Stud bolt | | 8 | 8 | 8 | 8 | | |
| 8040 | Hexagonal nut | | 8 | 8 | 8 | 8 | | |
| 8050 | Flat gasket | | 3 | 3 | 3 | 3 | x | x |
| 8060 | Arrow plate | | 1 | 1 | 1 | 1 | | |
| 8070 | Rivet | | 2 | 2 | 2 | 2 | | |

# 3.18 Installation

## 3.18.1 General

This manual gives basic instructions which are to be observed during installation of the pump. It is therefore important that this manual is read by the responsible personnel prior to assembly and afterward to be kept available at the installation site.

The instructions contain useful and important information allowing the pump/pump unit to be properly installed. They also contain important information to prevent possible accidents and serious damage prior to commissioning and during operation of the installation.

Non-compliance with the safety instructions may produce a risk to the personnel as well as to the environment and the machine, and results in a loss of any right to claim damages.

It is imperative that signs affixed to the machine, e.g. arrow indicating the direction of rotation or symbols indicating fluid connections is observed and kept legible.

## 3.18.2 Location

### 3.18.2.1 Short suction line

Locate the pump/pumpunit as close as possible to the liquid source and if possible below the liquid supply level. The better the suction conditions, the better the performance of the pump. See also section 3.18.6.2 Piping.

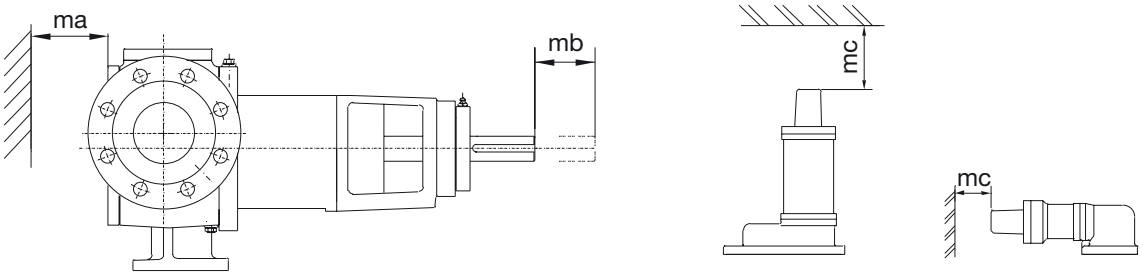
### 3.18.2.2 Accessibility

Sufficient room should be left around the pump/pump unit to allow proper inspection, pump isolation and maintenance.

Sufficient space should be left in front of the pump to enable disassembly of the pump cover, idler and idler pin.

- For loosening pump cover refer to **ma**
- For disassembling rotating parts (pump shaft and sealing) refer to **mb**
- To adjust pressure of safety relief valve refer to **mc**

For dimensions of ma, mb, mc see chapter 6.0.




It is imperative that the operating device of pump and/or pump unit is always accessible (also during operation).

### 3.18.2.3 Outdoor installation

The TopGear pump may be installed in the open, the ball-bearings are sealed by rubber V-joints protecting the pump against dripping water. In very wet conditions we advice to install a roof.

### 3.18.2.4 Indoor installation

Locate the pump so that the motor can be vented properly. Prepare the motor for operation according to instructions provided by the motor manufacturer.

When flammable or explosive products are pumped, a proper earthing should be provided. The components of the unit should be connected with earthing bridges to reduce the danger arising from static electricity.
Use explosion free or explosion proof motors according to local regulations. Provide suitable coupling guards and suitable couplings.

**Excessive temperatures**
Depending on the fluid being pumped, high temperatures may be reached inside and around the pump. From 60°C onwards the responsible person must provide the necessary protective means and place “Hot surfaces” notices.

When insulating the pump unit, ensure that adequate cooling is allowed from the bearing housing. This is required for cooling of the bearings and grease of the bearing bracket (see 3.18.9.7 Guarding of moving parts).

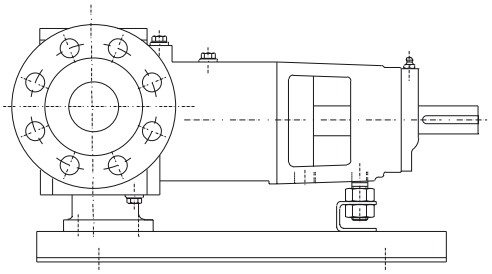
Protect the user against leakages and possible liquid streams.

### 3.18.2.5 Stability

**Foundation**
The pump unit must be installed on a base plate or on a frame placed exactly level on the foundation. The foundation must be hard, level, flat and vibration free to guarantee correct alignment of the pump/drive while operating. See also section 3.18.9 Guidelines for assembly and section 3.18.9.6 Shaft coupling.

**Horizontal mounting**
Pumps are to be mounted horizontally on the integral feet. Other kinds of installation have an influence on draining, filling and functioning of the mechanical seal, etc. If the pump/pump unit is installed differently, contact your local supplier.

**Support**
Nevertheless the feet underneath the pump casing make the pump very stable, an extra support is placed under the bearing bracket. Especially when driven by V-belt and/or a combustion engine this extra support close to the coupling is needed. It is designed to absorb the belt forces and vibrations whilst letting the pump shaft expand freely along its axis.



## 3.18.3 Drives

If a bare shaft pump is supplied, the user is responsible for the drive and the assembling with the pump. The user also must provide guarding of moving parts. See also section 3.18.9 Guidelines for assembly.

### 3.18.3.1 Starting torque

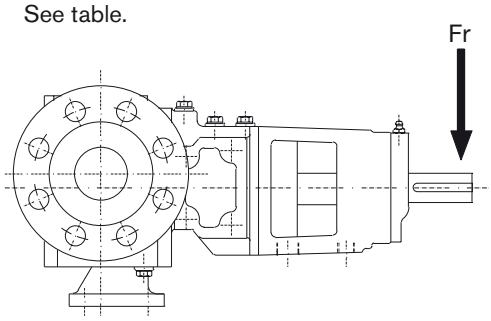
- The starting torque of internal gear pumps is almost identical to the nominal torque.
- Take care that the motor has a sufficiently large starting torque. Therefore choose a motor with a capacity 25% higher than the pump power consumption.

***Note!*** *A mechanical variable speed drive requires checking of the available torque at low and high speed.*

- Frequency invertors may have limited the starting torques.
- Also verify that the maximum allowable torque at the pump shaft is not exceeded (see section 3.10.4). In critical cases a torque-limiting device such as a slip or break coupling can be provided.

### 3.18.3.2 Radial load on shaft end

The shaft end of the pump shaft may be loaded in radial sense with the maximum radial force (Fr). See table.




| TG H pump size | Fr (N) - max |
|---|---|
| 2-32/3-32 | 400 |
| 6-40 | 700 |
| 15-50/23-65 | 1000 |
| 58-80/86-100 | 2000 |
| 185-125 | 3000 |
| 360-150 | 6000 |

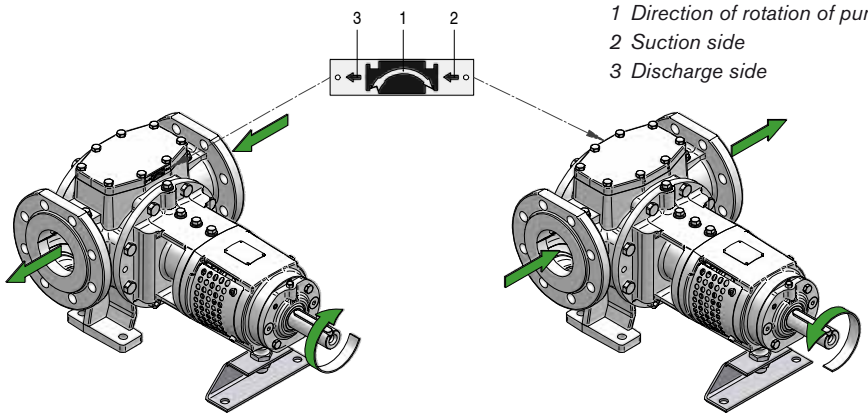
- This force is calculated on the maximum allowable torque and the maximum allowable working pressure of the pump.
- In case a direct drive with a flexible coupling is used, the indicated force will not be exceeded when pump and drive are well aligned.
- Starting with the TG H15-50, V-belt drive can be used.

***In case of V-belt drive***

The maximum allowable radial force Fr as indicated in the table may be chosen higher but must be calculated case by case in function of pressure, torque and size of the pulley. Consult your local supplier for advice.

## 3.18.4 Shaft rotation for pump without safety relief valve

The shaft rotation determines which port of the pump is suction and which is discharge.
The relation between the shaft rotation and the suction/discharge side is indicated by the rotation arrow plate attached at the top cover of a pump without safety relief valve.

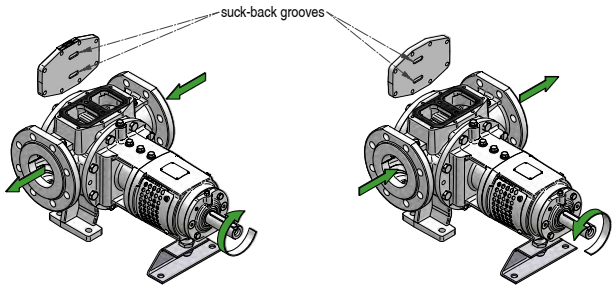



*1 Direction of rotation of pump shaft*
*2 Suction side*
*3 Discharge side*

***Note!*** *Shaft rotation is always viewed from the shaft end towards the pump.*
*Unless otherwise specified on the order, TopGear pumps are built at the factory for clockwise rotation (left figure above), which we define as the standard direction of rotation.*

The small arrows 2 and 3 indicate the flow direction of the pumped liquid.
Always make sure that shaft rotation corresponds with the position of the discharge and suction ports and the direction indicated by the rotation arrow plate.

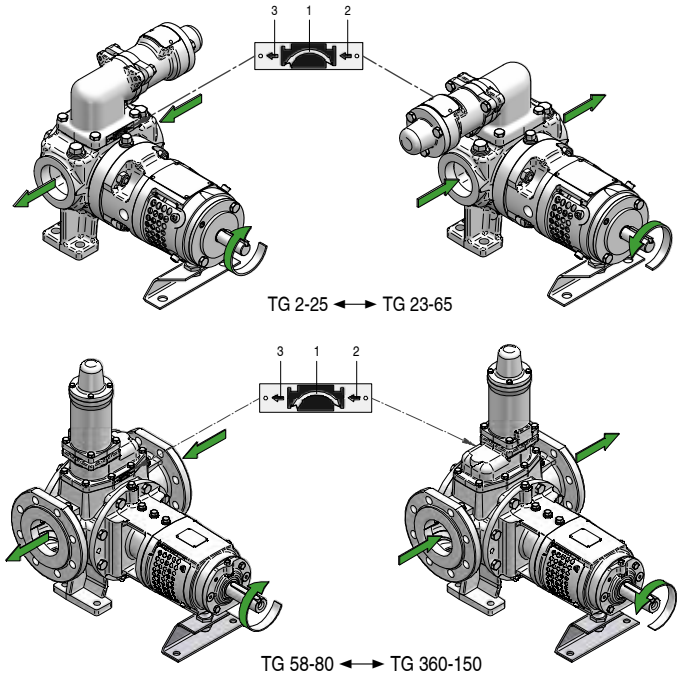
If the shaft rotation is correct in relation to the port position but different from the direction indicated by rotation arrow plate, the top cover must be disassembled and turned around by 180°. The two suck-back grooves will help to evacuate air or gases during start-up or whilst running. As they only function in one direction of rotation, the top cover should be positioned in such a way that the suck-back grooves are placed towards the suction side.In case of doubt, contact your local distributor.




If the pump rotates in both directions, the top cover should be positioned in such a way that the suck-back grooves are placed towards the most used suction side.

## 3.18.5 Shaft rotation for pump with safety relief valve

The shaft rotation determines which port of the pump is suction and which is discharge.
The relation between the shaft rotation and the suction/discharge side is indicated by the rotation arrow plate attached at the valve casing of the safety relief valve.



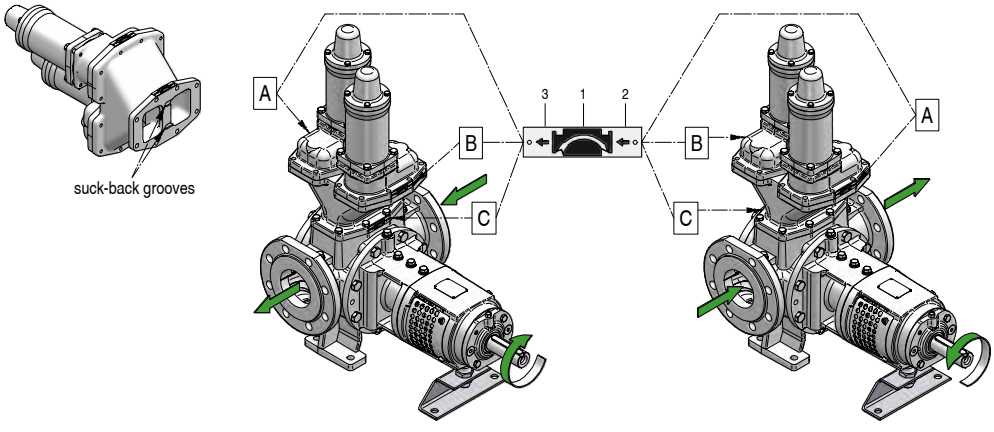

*1 Direction of rotation of pump shaft*
*2 Suction side*
*3 Discharge side*

***Note!*** *Shaft rotation is always viewed from the shaft end towards the pump.*
*Unless otherwise specified on the order, TopGear pumps are built at the factory for clockwise rotation (left figures above), which we define as the standard direction of rotation.*

The small arrows 2 and 3 indicate the flow direction of the pumped liquid.
Always make sure that shaft rotation corresponds with the position of the discharge and suction ports and the direction indicated by the rotation arrow plate.

If the shaft rotation is correct in relation to the port position but different from the direction indicated by rotation arrow plate, the safety relief valve must be disassembled and turned around by 180°.

If the pump rotates in both directions, a double safety relief valve is required.
When a double safety relief valve is installed three arrow plates are attached – one on each valve




(A and B) indicating the liquid flow direction of each valve (small arrows 2 and 3) and one on the Y-casing (C) indicating the most favourable direction of rotation of the pump (arrow 1).

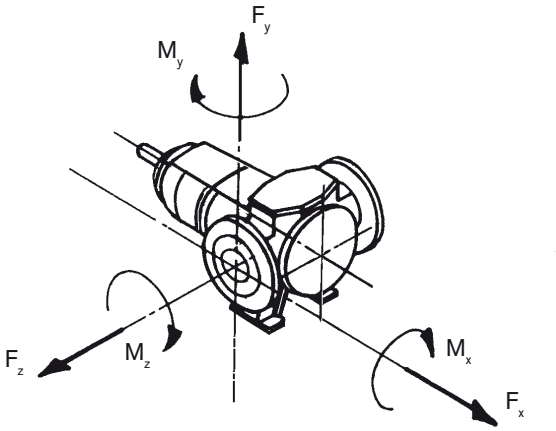
The two suck-back grooves will help to evacuate air or gases during start-up or whilst running. As they only function in one direction of rotation, the Y-casing should be positioned in such a way that the suck-back grooves are placed towards the most used suction side.
In case of doubt, contact your local distributor.

Be sure that the safety relief valves are mounted opposite each other so that the arrow plates on the safety relief valves (A and B) are indicating opposite liquid flow directions.

## 3.18.6 Suction and discharge pipes

### 3.18.6.1 Forces and moments

***Note!*** *Excessive forces and moments on the nozzle flanges derived from piping can cause mechanical damage to pump or pump unit.*
*Pipes should therefore be connected in line, limiting the forces on the pump connections.*
*Support the pipes and make sure they remain stress-free during operation of the pump.*




| TG H pump size | $F_{x, y, z}$ (N) | $M_{x, y, z}$ (Nm) |
|---|---|---|
| 2-32 | 4100 | 650 |
| 3-32 | 4100 | 650 |
| 6-40 | 4400 | 770 |
| 15-50 | 5200 | 1350 |
| 23-65 | 5800 | 1600 |
| 58-80 | 7100 | 2750 |
| 86-100 | 8200 | 3500 |
| 185-125 | 11800 | 7500 |
| 360-150 | 21200 | 14300 |

See table for maximum allowable forces ($F_{x, y, z}$) and moments ($M_{x, y, z}$) on the nozzle flanges *with pump on a solid foundation (e.g. grouted base plate or solid frame).*

When pumping hot liquids attention should be given to forces and moments caused by thermal expansion in which case expansion joints should be installed.

Check after connecting whether the shaft can move freely.

### 3.18.6.2 Piping

- Use piping with an equal diameter than the connection ports of the pump and shortest possible.
- The pipe diameter has to be calculated in function of the liquid parameters and the installation parameters. If necessary use larger diameters to limit pressure losses.
- If the fluid to be pumped is viscous, pressure losses in the suction and discharge lines may increase considerably. Other piping components like valves, elbows, strainers, filters and foot valve also cause pressure losses.
- Diameters, length of piping and other components should be selected in such a way that the pump will operate without causing mechanical damage to the pump/pump unit, taking into account the minimum required inlet pressure, the maximum allowable working pressure and the installed motor power and torque.
- Check the tightness of the pipes after connection.

**Suction piping**

- Liquids should preferably enter the pump from a level higher than the pump level. In case the liquid should be sucked from a level lower than the pump level, the inclining suction pipe should rise upwards towards the pump without any air pockets.
- A too small diameter or a too long suction pipe, a too small or blocked strainer will increase pressure losses so that the NPSHa (NPSH available) becomes smaller than the NPSH (NPSH required).

  Cavitation will occur, causing noise and vibrations. Mechanical damage to pump and pump unit is not excluded.
- When a suction strainer or filter is installed pressure losses in the suction line must be checked constantly. Also check if the inlet pressure at the suction flange of the pump is still sufficiently high.
- When the pump works in both directions, pressure losses must be calculated for both directions.

**Self-priming operation**
At the start sufficient liquid must be available in the pump filling up the internal clearance volume and the dead spaces, allowing the pump to build up a pressure difference.

Therefore, for pumping low viscosity fluids, a foot valve with the same or larger diameter than the suction pipe must be installed or the pump can be installed without foot-valve but in U-line.

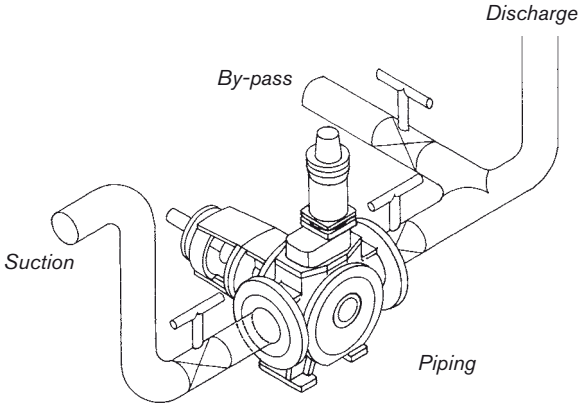
***Note!*** *A foot valve is not recommended when pumping high viscous liquids.*

- To remove air and gases from suction line and pump, counter pressure at the discharge side must be reduced. In case of self-priming operation, start-up of the pump should be performed with open and empty discharge line allowing air or gases to escape at low back pressure.
- Another possibility in case of long lines or when a non-return valve is installed in the discharge line, is to install a by-pass with isolating valve close to the discharge side of the pump. This valve will be opened in case of priming and allows air or gas evacuation at low back pressure.
  The bypass should be lead back to the supply tank – not to the suction port.

### 3.18.6.3 Isolating valves

To allow proper maintenance it is necessary to be able to isolate the pump. Isolation can be done by installing valves in suction and discharge lines.

- These valves must have a cylindrical passage of the same diameter of the piping (full bore). (Gate or ball valves are preferable).
- When operating the pump, the valves must be opened completely. The output must never be regulated by means of closing valves in suction or discharge pipes.
  It must be regulated by changing shaft speed or by re-routing the media over a by-pass back to the supply tank.




### 3.18.6.4 Strainer

Foreign particles can seriously damage the pump. Avoid the entry of these particles by installing a strainer.

- When selecting the strainer attention should be given to the size of the openings so that pressure losses are minimised. The cross-sectional area of the strainer must be three times that of the suction pipe.
- Install the strainer in such a way that maintenance and cleaning are possible.
- Make sure that the pressure drop in the strainer is calculated with the right viscosity. Heat the strainer if necessary to reduce viscosity and pressure drop.

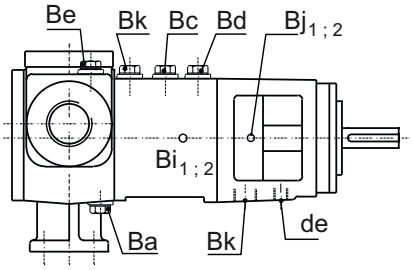
For the maximum allowable particle size see section 3.15.

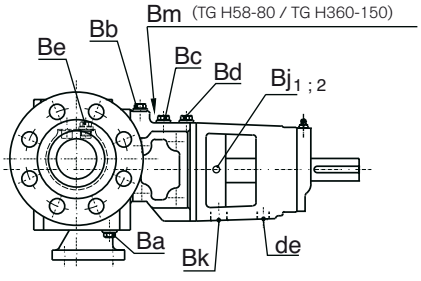
## 3.18.7 Secondary piping

For dimensions of connections and plugs see chapter 6.0.

### 3.18.7.1 Drain lines

The pump is provided with drain plugs.



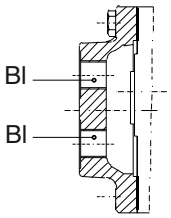
### 3.18.7.2 Heating jackets

#### 1. S-type jackets

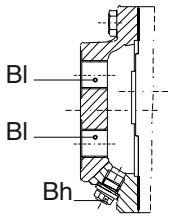
The S-jackets are designed for use with saturated steam (max 10 bar, 180°C) or with non-dangerous media. They are provided with threaded connections Bl (see chapter 6.0 for the dimensions).

The connection can be done by threaded pipes or pipe connections with sealing in the thread (conical thread applying ISO 7/1) or sealed outside the thread by means of flat gaskets (cylindrical thread applying ISO 228/1). Thread type see section 3.21.7.

***S-jacket on pump cover***

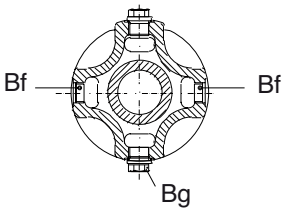



*H2-32/H3-32*

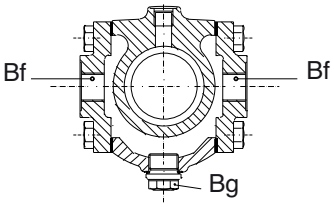



*H6-40 – H360-150*

***S-jacket around shaft area***




*H2-32/H3-32*

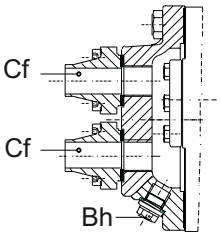



*H6-40 – H360-150*

#### 2. T-type jackets

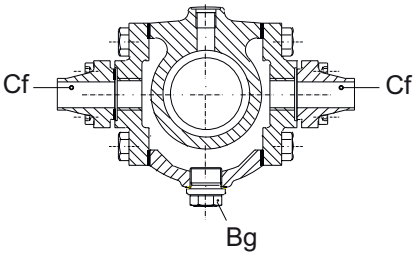
The T-jackets are provided with special steel flanges (delivered with the pump) on which the pipes should be welded properly by qualified personnel. The jackets are made of nodular iron or other ductile material. **For pipe dimensions of Cf see chapter 6.0.**

***T-jacket on pump cover***




*H6-40 – H360-150*

***T-jacket around shaft area***




*H6-40 – H360-150*

#### 3. Jacket on pump cover

In case of steam supply, connect the supply line at the highest position and the return line to the lowest position so that condensed water will be drained via the lowest line. In case of liquid supply, the positions are not important. A drain plug Bh is provided and can be considered as a drain line (TG H6-40 – TG H360-150).

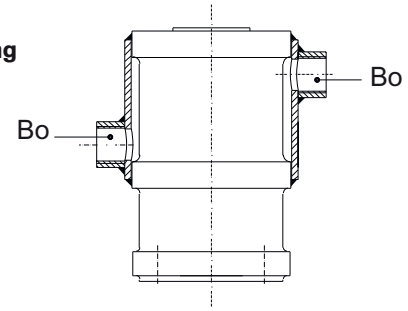
**4. Jacket around the shaft seal**

Connect the supply and the return line to both connections on the intermediate casing. A drain plug is provided in the intermediate casing at the bottom side (Bg). In case of steam supply this drain can be connected to a drain line to evacuate condensed water.

***Note!*** *After connection check the tightness of the heating circuit and vent it properly.*

**5. Jackets on safety relief valve – around spring casing**

The jackets on the safety relief valve are designed for use with saturated steam (max 10 bar, max 180°C) or with non-dangerous media (max 10 bar, max 200°C). They are provided with threaded connections Bo (see chapter 6.0 for dimensions). The connection can be done with threaded pipes or pipe connections with sealing in the thread (conical thread applying ISO 7/1). Thread type see section 3.21.7.




In case of steam supply, connect the supply line at the highest position and the return line to the lowest position so that condensed water will be drained via the lowest line. In case of liquid supply, the positions are not important.

## 3.18.8 Flush/quench media

When the shaft sealing needs flushing or quenching, it is the responsibility of the user to select the appropriate media and to provide the necessary piping and accessories (valves, etc.) which are necessary to ensure a proper functioning of shaft seal.

When installing a flush or quench circuit always use the lowest connection as inlet and the highest one as outlet (in case of two side connection). This will facilitate the evacuation of air or gases if any.

**Flush/Quench media selection**

Attention should be given to the compatibility of the pumped liquid with the flush/quench media. Choose the sealing liquid so that unwanted chemical reactions are avoided. Also check the chemical resistance and the maximum allowable temperature of the materials of construction and the elastomers. In case of doubt, contact your local supplier.

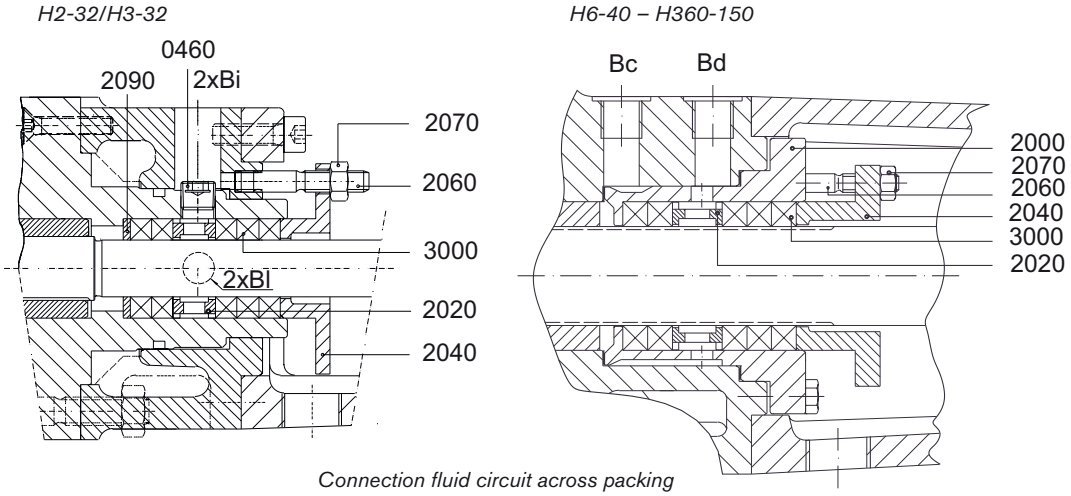
### 3.18.8.1 Packing

Shaft gland packing can be quenched using one connection or flushed using two connections via the lantern ring of the stuffing box.

**One quenched connection**

Quench media is fed to one connection when:

- In the case of a self-priming pump air suction through the packing (3000) has to be avoided or when packing rings need lubrication in order to avoid running dry. Connect the lantern ring (2020) to the discharge flange or to another liquid via **Bd** or Bi.




*Connection fluid circuit across packing*

- When at a high discharge pressure packing (3000) must be relieved. Connect the suction flange via **Bd** or Bi.
  Be sure the pressure in the lantern ring area is above atmosphere pressure to avoid air sucking through the last packing rings which makes the packing running dry.
- The pumped liquid must be quenched to avoid contact with the atmosphere (when this liquid is corrosive or poisonous) or when build up of residues of abrasive liquids against the packing must be avoided.
  Connect a clean, different liquid (e.g. water) via Bd or Bi at a pressure which is higher than the pressure existing before the packing.
  A slight quantity of this liquid will leak into the process liquid.

**Two flushed connections**
Flushing media requires two connections to provide in and out. This arrangement is used:

- To drain leaking or to cool or heat packing (3000). Connect inlet with **Bc** or Bi and outlet with **Bd** or Bj. Both pumped liquid and another media can be used as flush media.

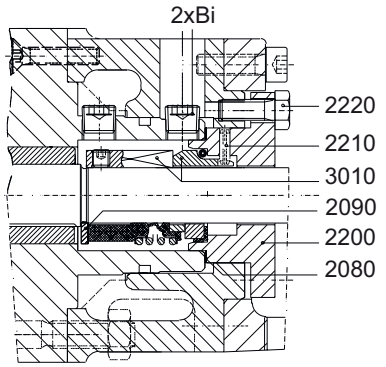
### 3.18.8.2 Single Mechanical seal

To guarantee lubrication and cooling of the sliding faces, let a media circulate along the mechanical seal. Proceed as follows:

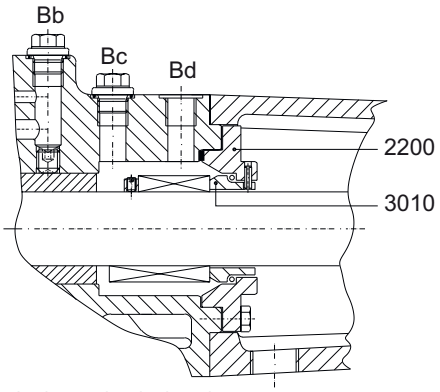
**One connection point**
- Connect suction or discharge flange with connection **Bd** or Bi.

**Two connection points**
- Connect discharge flange with connection **Bd** or Bi and suction flange with connection **Bc**.
- Provide piping with accessories to reduce flow.
- In case of either one or two connection points, **Bc** can be used as filling and air release plug.

*H2-32/H3-32*




*H6-40 – H360-150*



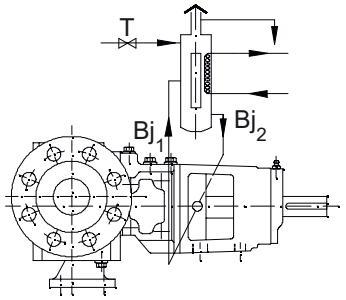

*Connection fluid circuit across single mechanical seal*

### 3.18.8.3 Double mechanical seal – Tandem arrangement

For lubrication and cooling of the sliding faces at liquid side of this shaft sealing, proceed as described in section “single mechanical seal”.

Provide via Bj the supply of a media quenching the mechanical seal at atmosphere side. Install the quench media reservoir at a height of maximum 1 metre above the pump and let the media circulate without pressure or at least without overpressure. Supply from an open tank will do thanks to the Thermo siphon principle.

Pressure of the quench media must be reduced in order to avoid the mechanical seal from being pushed open.

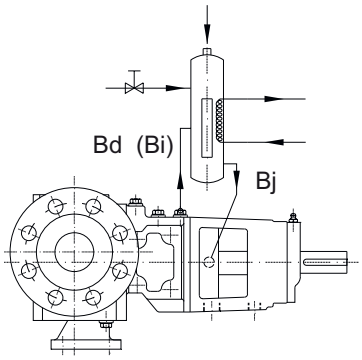



*Circulation of flush media without pressure (GG)*

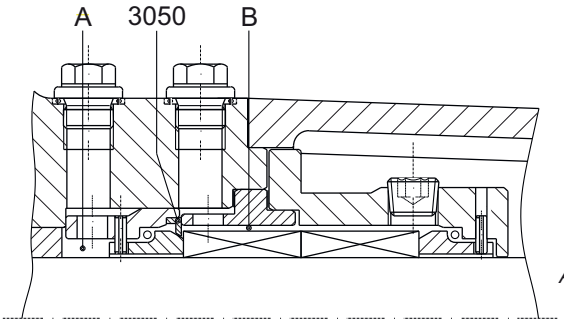
For other possibilities of connection, refer to section 3.18.8.6 Secondary connections.

### 3.18.8.4 Double mechanical seal – Back-to-back arrangement

- Use connection **Bd** or Bi as the outlet of quench media and one of the connections Bj as the inlet.
- Use connection Bc as filling and air release plug (this is not possible with H2-32/H3-32 and with jackets around the shaft seal area).
- Let the media circulate between the sliding faces (B) at 1-2 bar overpressure with regard to the pressure in the sealing space at pump side (A).
  Under normal circumstances the pressure in the sealing space (A) is equal to the suction pressure plus half the differential pressure (Δp).




**Locking ring**
At the first mechanical seal (liquid side) an axial locking ring can be mounted (also consult section 4.7.7.3 or EN12756 (DIN24960).

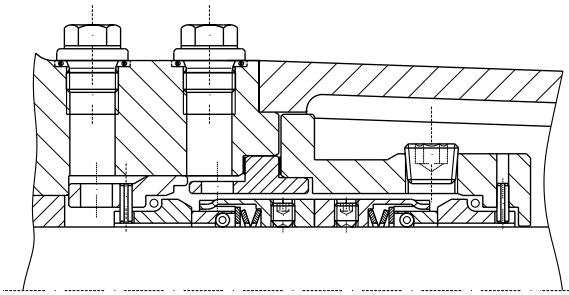



*Axial locking ring at the first mechanical seal*

This locking ring prevents the static part of the mechanical seal from being pushed out of its seat in case quench pressure (B) falls back or drops out.

This locking ring must be adapted to the static ring and must be delivered together with the mechanical seal.

Some mechanical seals are designed in such a way that the stationary ring can not be pushed out of its seat. In that case, there's no need to fit a locking ring.



*Design double mechanical seal without locking ring*

### 3.18.8.5 Cartridge mechanical seal

The cartridge mechanical seal can be delivered in several configurations:

- Single mechanical seal with throttle bush (leak control or steam quench) (GCT)
- Single mechanical seal with lipseal (liquid quench)(GCQ)
- Double seal arrangements (GCD)
- Triple lip-seal (LCT TV / LCT XX):
  low pressure quench and/or leak detection between 2rd and 3rd lip-seal

For details and flush/quench connections, see figure in section 4.7.7.4.

### 3.18.8.6 Secondary connections

Several connection types for circulation, quench or flush on shaft sealing are possible in accordance to ISO-code or to API-plan.

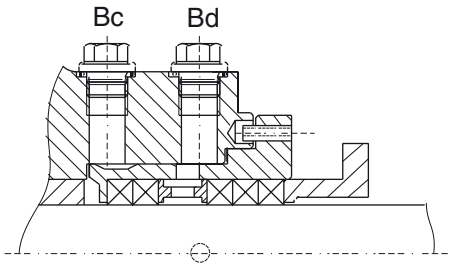
Overview possible configurations for shaft seal circulation, quench and flushing.

| Shaft sealing | ISO 5199 code | API 610 plan |
|---|---|---|
| PQ | 02,03,04,05,06,07,08,09,10,11,12,13 | 2,11,12,13,21,22,23,31,32,41,51,52,53,54,61,62 |
| GS | 02,03,04,05,06,07,08 | 2,11,12,13,21,22,23,31,32,41 |
| GG, GCT, GCQ, GCD-tandem | 02,03,04,05,06,07,08,09,10,13 | 2,11,12,13,21,22,23,31,32,41,51,52,61,62 |
| GD,GCD | 08,09,11,12,13 | 51,53,54,62 |

**Examples:**

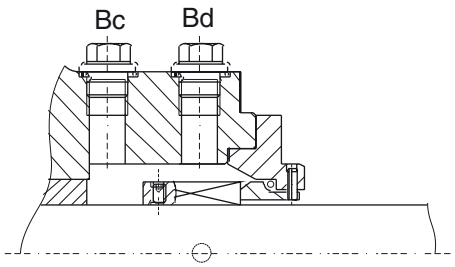
**API plan 02/ ISO code 00 – Circulation not provided - but possible**
Connections are plugged and can be used for possible future venting of the shaft sealing space or to connect circulation or flushing. This configuration is standard in TopGear H-range.

PQ




2xBi (TG H2-32/3-32)

GS

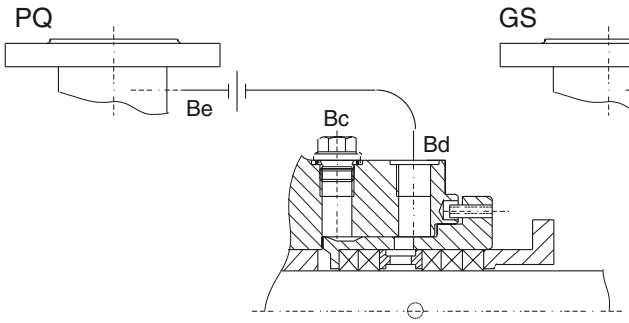



2xBi (TG H2-32/3-32)

**API plans 11, 13, 21/ ISO codes 02, 03, 06, 07 – Circulation pumped liquid**
Recirculation of the pumped product through an orifice either from the pump discharge to the shaft seal chamber or from the shaft seal chamber to the pump suction side. The fluid returns internally. Some restriction is needed to reduce capacity.

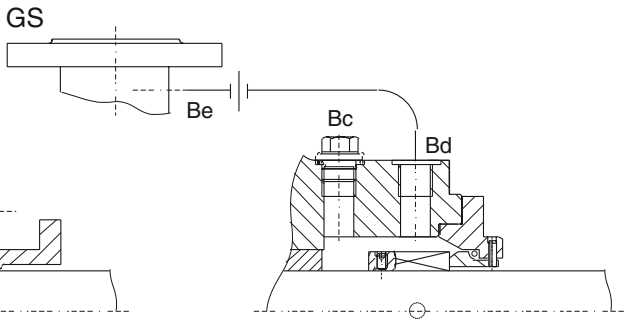
For viscous pumped liquid it is favourable for easy evacuating of air to connect the seal chamber to the pump suction provided the suction pressure is near or above atmospheric pressure and there is no danger that air is sucked through the seal.

PQ




2xBi (TG H2-32/3-32)

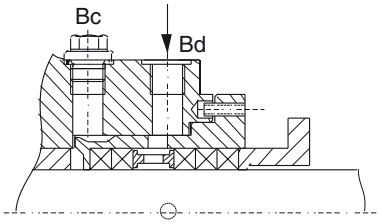
GS



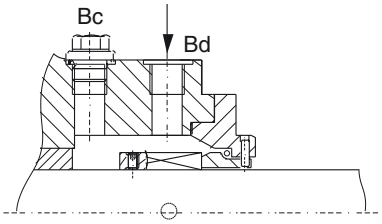

2xBi (TG H2-32/3-32)

**API plans 12, 22, 31, 32, 41/ ISO codes 04, 05, 08, 09 – Clean flush**
A flow of clean fluid to the seal chamber. The fluid can be either pumped fluid recirculating through a strainer or cyclone separator and orifice, or a clean compatible fluid injected from an external source. This media comes into contact with the pumped liquid, so it must be compatible with it.

PQ

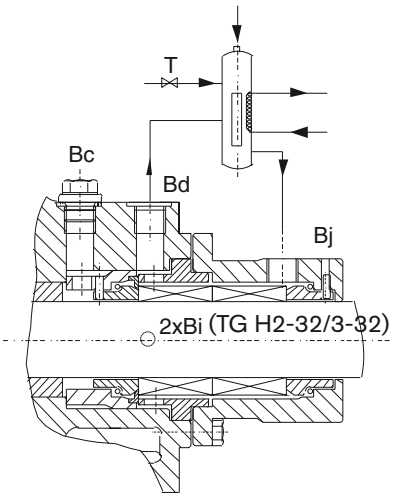



GS

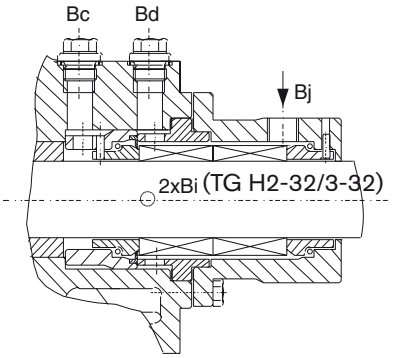



## Pressurised barrier (double seal)
A pressurised barrier fluid from an external reservoir or circuit is connected to the shaft seal chamber. The barrier fluid must be clean and compatible with the fluid being pumped.

**API plans 53, 54/ ISO codes 09, 11, 12**
**Circulating quench**




**API plans 51, 62/ ISO codes 08, 13**
**Non-circulating quench**

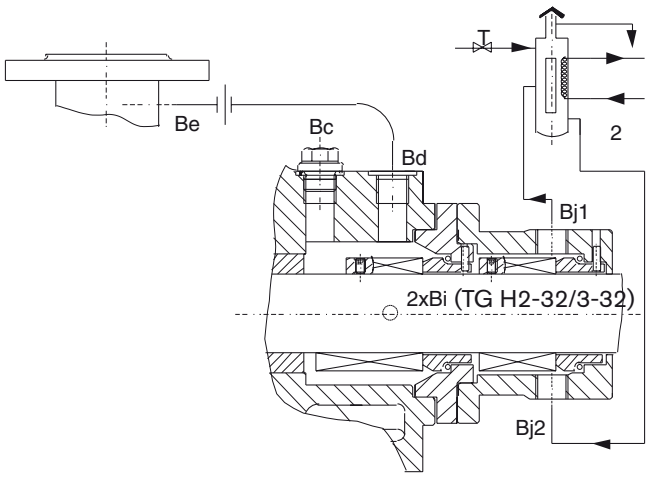



**API plan 61/ ISO code 03 – Leakage check and containment**
(Single cartridge mechanical seal Cartex TN3 GCT)
In case the seal chamber is not connected, it serves as a seal leakage control (leakage through the first shaft seal). The seal chamber can be connected to a pipe which drains the leakage. Because risks of dry running the arrangement is only advised for single mechanical cartridge seal.

**API plans 51, 62/ ISO codes 08, 09, 13, 03 – Static quench**
(Double mechanical seal tandem GG, Single cartridge mechanical seal Cartex TN3 GCT, Single Cartridge mechanical seal Cartex QN3 GCQ, Double cartridge mechanical seal Cartex DN3 GCD).
A clean, non-pressurised quench medium (liquid or steam) flowing from an external source can be connected.

**API plan 52/ ISO codes 10, 03 – Circulating quench**

A non-pressurised barrier fluid is connected, flowing from an external source and circulating between both shaft seals.




## 3.18.9 Guidelines for assembly

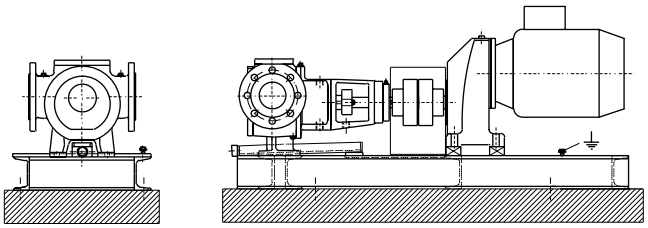
When a bare shaft pump is delivered, the assembly with drive is the responsibility of the user. The user also must provide all necessary devices and equipment allowing a safe installation and commissioning of the pump.

### 3.18.9.1 Transport of pump unit

- Prior to lifting and transporting a pump unit, make sure that the packaging is of sturdy enough construction is and will not be damaged during transport.
- Use crane hooks in the base plate or the frame. (See chapter 1.0.)

### 3.18.9.2 Foundation pump unit

The pump unit must be installed on a base plate or on a frame placed exactly level on the foundation. The foundation must be hard, level, flat and vibration free in order to guarantee the alignment of pump/drive while operating. (See section 3.18.2.5)



### 3.18.9.3 Variators, Gear box, Gear motors, Motors

Consult the supplier's instruction manual included with the delivery.
Contact the pump supplier if the manual is not included.

### 3.18.9.4 Electric motor drive

- Before connecting an electric motor to the mains check the current local regulations of your electricity provider as well as the EN 60204-1 standard.
- Leave the connecting of electric motors to qualified personnel. Take the necessary measures to prevent damage to electrical connections and wiring.

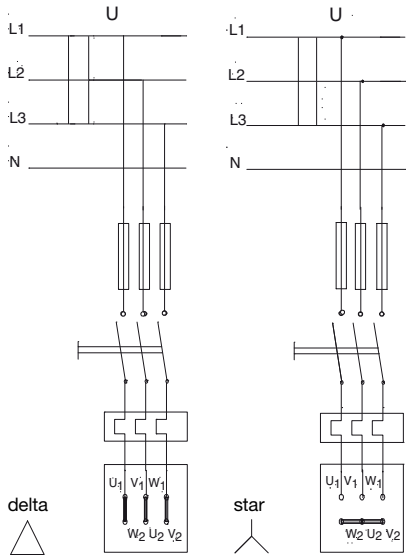
**Circuit breaker**
For safety work on a pump unit, install a circuit breaker as close as possible to the machine. It also is advisable to place an earth leakage switch. The switching equipment must comply with current regulations, as stipulated by EN 60204-1.

**Motor overload protection**
To protect the motor against overloads and short-circuits a thermal or thermo-magnetic circuit breaker must be incorporated. Adjust the switch for the nominal current absorbed by the motor.

**Connection**
- Do not use a star-delta circuit with electric motors due to the required high starting torque.
- For single-phase alternating current, use motors with a “reinforced” starting torque.
- Ensure a sufficiently high starting torque for frequency-controlled motors and adequate cooling of the motor at low speeds. If necessary, install a motor with forced ventilation.

*Electrical equipment, terminals and components of control systems may still carry live current when at rest. Contact with these may be fatal, resulting in serious injury or cause irreparable material damage.*

| Line | Motor | |
|---|---|---|
| U (volt) | 230/400 V | 400 V |
| 3 x 230 V | delta | – |
| 3 x 400 V | star | delta |




### 3.18.9.5 Combustion engines

When using a combustion engine in the pump unit, see the engine instruction manual included in the delivery. Contact the pump supplier if the manual is not included.
Irrespective of this manual the following must be respected for all combustion engines:

- Compliance with local safety regulations
- The exhaust of combustion gases must be screened to avoid contact
- The starter must be uncoupled automatically once the engine has started
- The pre-set maximum number of engine revolutions may not be modified
- Before starting the engine, the oil level must be checked

***Note!***
- Never run the engine in a closed area
- Never refuel the engine while it is still running

### 3.18.9.6 Shaft coupling

Internal gear pumps demand a relatively high starting torque. During the operation shock loads are occurring due to pulsations inherent to the gear pump principle. Therefore, choose a coupling which is 1.5 times the torque recommended for normal constant load.

**Alignment**

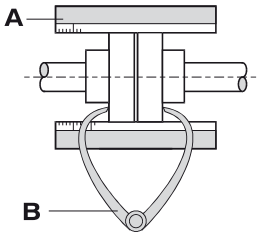
The pump and motor shafts of complete units are accurately pre-aligned in the factory.
After installation of the pump unit, the pump and motor shaft alignment must be checked and re-aligned if necessary.

**Alignment of the coupling halves may only take place by moving the electric motor!**

1 Place a ruler (A) on the coupling. Remove or add as many shims as is necessary to bring the electric motor to the correct height so that the straight edge touches both coupling halves over the entire length, see figure.

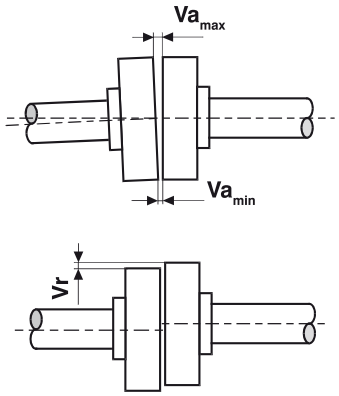
2 Repeat the same check on both sides of the coupling at the height of the shaft. Move the electric motor so that the straight edge touches both coupling halves over the entire length.

3 To be certain the check is also undertaken using external callipers (B) at 2 corresponding points on the sides of the coupling halves, see figure.




4 Repeat this check at operating temperature and spend time achieving minimum alignment deviation.

5 Fit the protecting guard. See the figure below and the corresponding table for the maximum allowed tolerances for aligning the coupling halves.




| Alignment tolerances | | | | | | |
|---|---|---|---|---|---|---|
| External diameter of coupling [mm] | Va | | | | $Va_{max}$ - $Va_{min}$ [mm] | $Vr_{max}$ [mm] |
| | min [mm] | | max [mm] | | | |
| 81-95 | 2 | 5* | 4 | 6* | 0.15 | 0.15 |
| 96-110 | 2 | 5* | 4 | 6* | 0.18 | 0.18 |
| 111-130 | 2 | 5* | 4 | 6* | 0.21 | 0.21 |
| 131-140 | 2 | 5* | 4 | 6* | 0.24 | 0.24 |
| 141-160 | 2 | 6* | 6 | 7* | 0.27 | 0.27 |
| 161-180 | 2 | 6* | 6 | 7* | 0.30 | 0.30 |
| 181-200 | 2 | 6* | 6 | 7* | 0.34 | 0.34 |
| 201-225 | 2 | 6* | 6 | 7* | 0.38 | 0.38 |

** = coupling with spacer*

**Belt drive**

Belt drives also increase the loading on the shaft end and the bearings. Therefore, certain limitations must be imposed on the maximum load of the shaft, viscosity, pumping pressure and speed.

### 3.18.9.7 Guarding of moving parts

Before commissioning the pump, place a protective guard over the coupling or belt drive. This guard must comply with the EN 953 design and construction standard.

For pumps operating at temperatures above 100°C, ensure that bearing bracket and bearings are cooled sufficiently by the surrounding air. Openings in the bearing bracket must not be guarded if the rotating parts do not have any projections (keys or keyways) which could cause injury (see prEN809). This simplifies the inspection and maintenance of the shaft seal.

# 3.19 Instructions for start-up

## 3.19.1 General

The pump can be put into service when all arrangements described in chapter 3.18 Installation have been made.

- **Prior to commissioning, responsible operators have to be fully informed on proper operation of the pump/pump unit and the safety instructions. This instruction manual must at all times be available to the personnel.**
- **Prior to commissioning, the pump/pump unit must be checked for visible damage. Damage or unexpected changes must be reported immediately to the plant operator.**

## 3.19.2 Cleaning the pump

There may be residual mineral oil inside the pump deriving from the pump testing and the initially lubricating of the bearing bushes. If these products are not acceptable for the pumped liquid, the pump should be cleaned thoroughly. Proceed as described in section 3.21.2.8 Draining of fluid.

***Remark:*** *pumps made for food applications are preserved with a food grade oil. The oil used is a NSF H3 approved oil (soluble). Nevertheless the oil is NSF H3 approved, the pump should be cleaned thoroughly before the initial start-up.*

### 3.19.2.1 Cleaning suction line

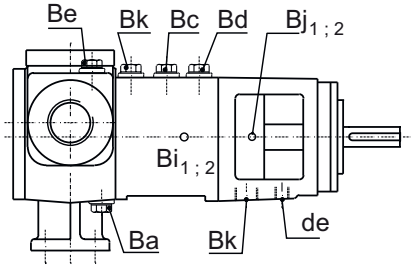
When the TG pump is put into service for the first time, suction line must be cleaned thoroughly. Do not use the pump. The TG pump is not meant to pump low viscosity liquids with impurities.

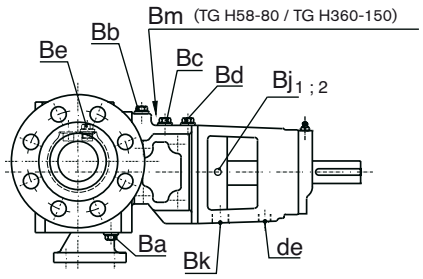
## 3.19.3 Venting and filling

To operate properly the pump should be vented and filled with the liquid to be pumped before the initial start-up:

- Unscrew the filling plug Bb, Bc, Be and Bd.
  Fill up the pump with the liquid to be pumped.
  *At the same time the pump will be vented.*
- Tighten the filling plugs.
- When the TG pump is brought into service for the first time or in case new gaskets are mounted, bolts that compress gaskets must after 3 - 4 days be tightened again
  (for tightening torques see section 3.21.3.1).

*Filling up the pump*



## 3.19.4 Checklist – Initial start-up

After thorough servicing or when the pump is to be put into service for the first time (initial start-up) the following checklist must be observed:

### Supply and discharge line

- ☐ Suction and discharge pipes are cleaned.
- ☐ Suction and discharge pipes are checked for leaks.
- ☐ Suction pipe is protected properly to prevent the ingress of foreign bodies.

### Characteristics

- ☐ The characteristics of the pump unit and safety relief valve to be checked (pump type – see name plate, RPM, working pressure, effective power, working temperature, direction of rotation, NPSHr etc.).

### Electrical installation

- ☐ Electrical installation complies with local regulations
- ☐ Motor voltage corresponds with mains voltage. Check terminal board.
- ☐ Make sure that the starting torque is sufficiently high (no star/delta starting will be used).
- ☐ Motor protection is adjusted properly.
- ☐ Direction of motor rotation corresponds with direction of pump rotation.
- ☐ Motor rotation (detached from unit) is checked.

### Safety relief valve

- ☐ Safety relief valve (on pump or in piping) is installed
- ☐ Safety relief valve is positioned correctly. Flow direction of safety relief valve corresponds with suction and discharge lines.
- ☐ Make sure a double safety relief valve is installed when the pump has to operate in two directions.
- ☐ The set pressure of the safety relief valve is checked (see nameplate).

### Jackets

- ☐ Jackets are installed.
- ☐ Maximum pressure and temperature of the heating/cooling media have been checked.
- ☐ The appropriate heating media or coolant is installed and connected.
- ☐ The installation complies with the safety standards.

### Shaft sealing

- ☐ Heating or cooling circuit has been checked for leakages.
- ☐ Pressure, temperature, nature and connections of flush or quench media has been checked.
- ☐ If a double mechanical seal mounted in back-to-back configuration, buffer media must be pressurized prior to starting the pump.
- ☐ When using the PR-version (reverted packing) for chocolate applications:
  The packing is lightly tightened by hand at the factory. When pumping chocolate, the packing needs to be tightened bit by bit at the initial start-up in order to achieve the utmost minimum of leakage, just enough to lubricate the packing rings. Excessively leaking chocolate can overheat in the packing, causing caramelisation, resulting in extra wear of the packing. Check if the external grease supply is into service in order to lubricate the bush bearing at the start-up.

### Drive

- ☐ Alignment of pump, motor, gearbox etc. is checked.

**Protection**

☐ All guards and safety devices (coupling, rotating parts, excessive temperature) are in place and operative.

☐ In case of pumps that may reach working temperatures of 60°C or more, ensure sufficient safety guards against occasional touching are in place.

## 3.19.5 Start-up

When the pump is to be put into service the following checklist and procedure must be observed:

☐ Pump is filled with liquid.

☐ Pump is sufficiently preheated.

☐ Quench media is present. Can it circulate freely?
(***Attention***: *If you have a GD-configuration, is the seal pressurized?)*

☐ Suction and discharge valves are fully open.

☐ Start the pump for a short while and check the direction of rotation of the motor.

☐ Start the pump and check suction of liquid (suction pressure).

☐ RPM of the pump is checked.

☐ Discharge pipe and seal are checked for leaks.

☐ Proper operation of the pump is verified.

☐ If leakage (PO and PQ versions) of gland packing is too heavy, adjust (tighten) the gland pressure.

When using the PR-version (reverted packing) for chocolate applications, the packing needs to be tightened bit by bit at the (initial) start-up in order to achieve the utmost minimum of leakage, just enough to lubricate the packing rings. Excessively leaking chocolate can overheat in the packing, causing caramelisation, resulting in extra wear of the packing. Check if the external grease supply is into service in order to lubricate the bush bearing at the start-up.

## 3.19.6 Shut-down

When the pump is to be put out of service the following procedure must be observed:

☐ Turn the motor off.

☐ Close all auxiliary service lines (heating/cooling circuit, circuit for flush/quench medium).

☐ If solidifying of the liquid must be avoided, clean the pump while the product is still fluid.

Also see section 3.21 Maintenance instructions

***Note!*** *When the liquid flows back from the discharge pipe to the pump, the pump may rotate in the opposite direction. Closing the discharge line valve during the last rotation cycles can prevent this.*

## 3.19.7 Abnormal operation

***Note!*** *In case of abnormal operation or when troubles occur the pump must be taken out of service immediately. Inform all responsible personnel.*

☐ Prior to restarting the pump, determine the reason for the problem and solve the problem.

## 3.20 Trouble shooting

| Symptom | Cause | Remedy | | |
|---|---|---|---|---|
| No flow<br>Pump not priming | Suction lift too high | 1 | ▪ | Reduce difference between pump and suction tank level. |
| | | | ▪ | Increase suction pipe diameter. |
| | | | ▪ | Reduce length and simplify suction pipe (use as few elbows and other fittings as possible). Also see section 3.18 Installation. |
| | Air leak in suction line | 2 | ▪ | Repair leak. |
| | Very low viscosity | 3 | ▪ | Increase pump speed and reduce axial clearance (see section 3.21 Maintenance instructions). |
| | Suction strainer or filter clogged | 4 | ▪ | Clear suction strainer or filter. |
| | Pump casing incorrectly installed after repair | 5 | ▪ | Install pump casing correctly. See section 3.18 Installation. |
| | Wrong direction of rotation of motor | 6 | ▪ | For 3-phase drivers change 2 connections. |
| | | | ▪ | Change suction and discharge opening. (***Attention!*** Check the location of the safety relief valve). |
| Pump stalls or irregular flow | Liquid level in suction tank falls too low | 7 | ▪ | Correct liquid supply |
| | | | ▪ | Provide a level switch |
| | Output too high | 8 | ▪ | Reduce pump speed/or install a smaller pump. |
| | | | ▪ | Install by-pass line with check-valve. |
| | Air sucking | 9 | ▪ | Repair leak in suction line. |
| | | | ▪ | Check or replace shaft seal. |
| | | | ▪ | Check/provide quench on shaft seal. |
| | | | ▪ | Connect plug Bb to the pump discharge in order to increase the pressure in the sealing box. |
| | Cavitation | 10 | ▪ | Reduce difference between pump and suction tank level. |
| | | | ▪ | Increase suction pipe diameter. |
| | | | ▪ | Reduce length and simplify suction pipe (use as few elbows and other fittings as possible). Also see chapter 3.18 Installation. |
| | Liquid vaporises in pump (e.g. by heating up) | 11 | ▪ | Check temperature. |
| | | | ▪ | Check vapour pressure of liquid. |
| | | | ▪ | Reduce pump speed. If necessary install a larger pump. |
| Not enough capacity | Pump speed too low | 12 | ▪ | Increase pump speed. ***Attention!*** Do not exceed maximum speed and check NPSHr. |
| | Air sucking | 13 | ▪ | Repair leak in suction line. |
| | | | ▪ | Check or replace shaft seal. |
| | | | ▪ | Check/provide a quench in the shaft seal. |
| | | | ▪ | Connect plug Bb to the pump discharge in order to increase the pressure in the sealing box. |
| | Cavitation | 14 | ▪ | Reduce difference between pump and suction tank level. |
| | | | ▪ | Increase suction pipe diameter. |
| | | | ▪ | Reduce length and simplify suction pipe (use as few elbows and other fittings as possible). Also see section 3.18 Installation. |
| | Back pressure too high | 15 | ▪ | Check discharge pipe. |
| | | | ▪ | Increase pipe diameter. |
| | | | ▪ | Reduce working pressure. |
| | | | ▪ | Check accessories (filter, heat exchanger, etc.). |
| | Safety relief valve set too low | 16 | ▪ | Correct pressure setting. |

| Symptom | Cause | Remedy | | |
|---|---|---|---|---|
| Not enough capacity | Viscosity too low | 17 | ▪ | Increase pump speed. ***Attention!*** Do not exceed maximum speed and check NPSHr. |
| | | | ▪ | If necessary, install a larger pump. |
| | ▪ | | ▪ | If pump is heated by means of heating jackets or electrical heating, reduce the heating input. |
| | Axial clearance | 18 | ▪ | Check axial clearance and correct.<br>See section 3.21 Maintenance instructions. |
| | Gases come free | 19 | ▪ | Increase pump speed. ***Attention!*** Do not exceed maximum speed and check NPSHr. |
| | | | ▪ | Install a larger pump |
| Pump too noisy | Pump speed too high | 20 | ▪ | Reduce pump speed.<br>If necessary, install a larger pump. |
| | Cavitation | 21 | ▪ | Reduce difference between pump and suction tank level. |
| | | | ▪ | Increase suction pipe diameter. |
| | | | ▪ | Reduce length and simplify suction pipe (use as few elbows and other fittings as possible).<br>Also see section 3.18 Installation. |
| | Back pressure too high | 22 | ▪ | Increase pipe diameter. |
| | | | ▪ | Reduce working pressure. |
| | | | ▪ | Check accessories (filter, heat exchanger, etc.). |
| | Coupling misalignment | 23 | ▪ | Check and correct alignment.<br>Also see section 3.18 Installation. |
| | Vibration of base plate or pipings | 24 | ▪ | Make base plate heavier and/or fix base plate/ pipe work better. |
| | Ball bearings damaged or worn | 25 | ▪ | Replace ball bearings. |
| Pump consumes too much power or becomes hot | Pump speed too high | 26 | ▪ | Reduce pump speed.<br>If necessary, install a larger pump. |
| | Gland packing too tight | 27 | ▪ | Check or replace gland packing. |
| | Coupling misalignment | 28 | ▪ | Check and correct alignment.<br>Also see section 3.18 Installation. |
| | Viscosity too high | 29 | ▪ | Increase axial clearance.<br>See section 3.21 Maintenance instructions. |
| | | | ▪ | Heat pump. |
| | | | ▪ | Reduce pump speed. |
| | | | ▪ | Increase discharge pipe diameter. |
| Rapid wear | Back pressure too high | 30 | ▪ | Increase pipe diameter. |
| | | | ▪ | Reduce working pressure. |
| | | | ▪ | Check accessories (filter, heat exchanger, etc.) |
| | Solid matter in liquid | 31 | ▪ | Filter liquid. |
| | Pump runs dry | 32 | ▪ | Correct liquid supply. |
| | | | ▪ | Provide level switch or dry running protection. |
| | | | ▪ | Heat up liquid. |
| | | | ▪ | Stop or reduce air sucking. |
| | Corrosion | 33 | ▪ | Change pump materials or application parameters. |
| Motor overloading | Back pressure too high | 34 | ▪ | Increase pipe diameter. |
| | | | ▪ | Reduce working pressure. |
| | | | ▪ | Check accessories (filter, heat exchanger, etc.). |
| | Gland packing too tight | 35 | ▪ | Check and replace gland packing. |
| | Viscosity too high | 36 | ▪ | Increase axial clearance.<br>See section 3.21 Maintenance instructions. |
| | | | ▪ | Heat pump. |
| | | | ▪ | Reduce pump speed. |
| | | | ▪ | Increase discharge pipe diameter. |
| Pump leak | Gland packing leaks excessively | 37 | ▪ | Check or replace gland packing. |
| | Mechanical seal leaks | 38 | ▪ | Replace mechanical seal. |

| Symptom | Cause | Remedy | | |
|---|---|---|---|---|
| Rapid wear of the mechanical seal | Viscosity too high | 39 | ▪ | Heat the pump. |
| | | | ▪ | Install a double mechanical seal |
| | Bad de-aerating/ dry running | 40 | ▪ | Fill pump with liquid |
| | | | ▪ | Check position of relief valve or top cover. |
| | Temperature too high | 41 | ▪ | Reduce temperature. |
| | | | ▪ | Install suitable mechanical seal |
| | Too long priming period/ dry running | 42 | ▪ | Reduce suction line. |
| | | | ▪ | Provide dry running protection. |
| | | | ▪ | Check maximum allowable dry running speed for the mechanical seal. |
| | Liquid is abrasive | 43 | ▪ | Filter or neutralise liquid. |
| | | | ▪ | Install a double mechanical seal with hard seal faces and barrier liquid. |

***Note!*** *If symptoms persist, the pump must be taken out of service immediately. Contact your local supplier.*

## 3.20.1 Instructions for re-using and disposal

### 3.20.1.1 Re-use

Re-use or putting the pump out of service should only be undertaken after complete draining and cleaning of the internal parts.

***Note!***
*When doing so, observe adequate safety regulations and take environmental protection measures. Liquids should be drained and following local safety regulations the correct personal equipment should be used.*

### 3.20.1.2 Disposal

Disposal of the pump should only be done after it has been completely drained.
Proceed according to local regulations.

Where applicable please disassemble the product and recycle the part's material.

## 3.21 Maintenance instructions

### 3.21.1 General

This chapter only describes operations that can be performed on-site for normal maintenance. For maintenance and repair requiring a workshop contact your local supplier.

- Insufficient, wrong and/or irregular maintenance can lead to malfunctions in the pump, high repair costs and long-term inoperability. Therefore, you should carefully follow the guidelines given in this chapter.

  During maintenance operations on the pump due to inspections, preventive maintenance or removal from the installation, always follow the prescribed procedures.

  Non-compliance with these instructions or warnings may be dangerous for the user and/or seriously damage the pump/pump group.

- Maintenance operations should be performed by qualified personnel only. Always wear the required safety clothing, providing protection against high temperatures and harmful and/or corrosive fluids. Make sure that the personnel read the entire instruction manual and, in particular, indicate those sections concerning the work at hand.

- SPX is not responsible for accidents and damage caused by non-compliance with the guidelines.

### 3.21.2 Preparation

#### 3.21.2.1 Surroundings (on site)

Because certain parts have very small tolerances and/or are vulnerable, a clean work environment must be created during on-site maintenance.

#### 3.21.2.2 Tools

For maintenance and repairs use only technically appropriate tools that are in good condition.Handle them correctly.

#### 3.21.2.3 Shut-down

Before commencing the maintenance and inspection activities the pump must be taken out of service. The pump/pump unit must be fully depressurized. If the pumped fluid permits, let the pump cool down to the surrounding temperature.

#### 3.21.2.4 Motor safety

Take appropriate steps to prevent the motor from starting while you are still working on the pump. This is particularly important for electric motors that are started from a distance.
Follow the below described procedure:

- Set the circuit breaker at the pump to “off”.
- Turn the pump off at the control box.
- Secure the control box or place a warning sign on the control box.
- Remove the fuses and take them with you to the place of work.
- Do not remove the protective guard around the coupling until the pump has come to a complete standstill.

#### 3.21.2.5 Conservation

If the pump is not to be used for longer periods:

- First drain the pump.
- Then treat the internal parts with VG46 mineral oil or other preservering liquid (e.g. food grade oil for food applications).
- The pump must be operated briefly once a week or alternatively the shaft must be turned a full turn once a week. This ensures proper circulation of the protective oil.

### 3.21.2.6 External cleaning

- Keep the surface of the pump as clean as possible. This simplifies inspection, the attached markings remain visible and grease nipples are not forgotten.
- Make sure cleaning products do not enter the ball bearing space. Cover all parts that must not come into contact with fluids. In case of sealed bearings, cleaning products must not attack rubber gaskets. Never spray the hot parts of a pump with water, as certain components may crack due to the sudden cooling and the fluid being pumped may spray into the environment.

### 3.21.2.7 Electrical installation

- Maintenance operations on the electric installation may be performed only by trained and qualified personnel and after disconnecting the electric power supply. Carefully follow the national safety regulations.

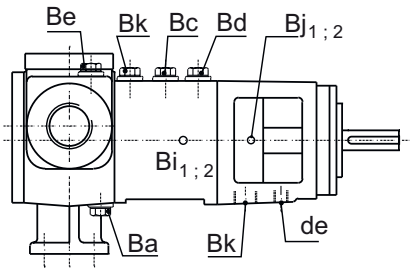
  Respect the above-mentioned regulations if performing work while the power supply is still connected.
- Check if electrical devices to be cleaned have a sufficient degree of protection (e.g. IP54 means protection against dust and splashing water but not against water jets). See EN 60529. Choose an appropriate method for cleaning the electrical devices.
- Replace defective fuses only with original fuses of the prescribed capacity.
- After each maintenance session check the components of the electrical installation for visible damage and repair them if necessary.

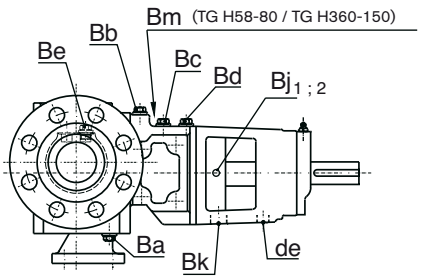
### 3.21.2.8 Draining of fluid

- Close off the pressure and suction lines as close as possible to the pump.
- If the fluid being pumped does not solidify, let the pump cool down to the ambient temperature before drainage.

- For fluids that solidify or become very viscous at ambient temperature, it is best to empty the pump immediately after shutting down by separating it from the piping. Always wear safety goggles and gloves.

- Protect yourself with a protective cap. The fluid may spray out of the pump.
- Open the venting plugs Be, Bb, Bc and Bd.
- If no drain line is provided, take precautions so that the liquid is not contaminating the environment.
- Open the drain plug Ba at the bottom of the pump housing.
- Let drain the liquid by gravity.
- Purge pump spaces with flush media or cleaning liquid by connecting a purge system to the following inlet openings:
  - Ba, Be: the displacement part
  - Ba, Bb: space behind rotor
  - Ba, Bd: space behind bearing bush and first mechanical seal in case of GS, GG and GC shaft sealing versions
  - Ba, Bc: space behind bearing bush and before the mechanical seal box in case of GD shaft sealing version
  - Bc, Bd: packing area and lantern ring in case of PQ shaft sealing version
- Re-assemble the plugs and close the valves, if any.



### 3.21.2.9 Fluid circuits

- Depressurize the jackets and the retaining fluid circuits.
- Uncouple the connections to the jackets and to the circulating or flush/quench media circuits.
- If necessary, clean the jackets and the circuits with compressed air.
- Avoid any leakage of fluid or thermal oil into the environment.

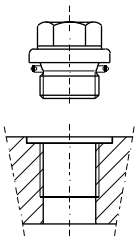
## 3.21.3 Specific components

### 3.21.3.1 Nuts and bolts

Nuts and bolts showing damage or parts with defective threading must be removed and replaced with parts belonging to the same fixation class as soon as possible.

- Preferably use a torque wrench for tightening.
- For the tightening torques, see table below.

| Bolt | Ma (Nm) 8.8 / A4 | Plug with edge and flat seal | Ma (Nm) |
|---|---|---|---|
| M6 | 10 | G 1/4 | 20 |
| M8 | 25 | G 1/2 | 50 |
| M10 | 51 | G 3/4 | 80 |
| M12 | 87 | G 1 | 140 |
| M16 | 215 | G 1 1/4 | 250 |
| M20 | 430 | | |
| M24 | 740 | | |
| M30 | 1500 | | |



*Plug with edge and elastic washer*

### 3.21.3.2 Plastic or rubber components

- Do not expose components made of rubber or plastic (cables, hoses, seals) to the effects of oils, solvents, cleaning agents or other chemicals unless they are suitable.
- These components must be replaced if they show signs of expansion, shrinkage, hardening or other damage.

### 3.21.3.3 Flat gaskets

- Never re-use flat gaskets.
- Always replace the flat gaskets and elastic rings under the plugs with genuine spares from SPX.

### 3.21.3.4 Filter or suction strainer

Any filters or suction strainers at the bottom of the suction line must be cleaned regularly.
***Note!*** *A clogged filter in the suction piping may result in insufficient suction pressure at the inlet. Clogged filter in the discharge line may result in higher discharge pressure.*

### 3.21.3.5 Anti-friction bearings

TG H2-32 and TG H3-32 pumps are equipped with 2RS ball bearings which are grease packed for life. They do not require periodically greasing.

Starting with pump size TG H6-40, the pumps are equipped with ball bearings which could be greased periodically through a grease nipple at the bearing cover.

**Recommended greases (Also consult supplier !)**

| Supplier | NLGI-2 | NLGI-3 |
|---|---|---|
| BP | LS2 | LS3 |
| Chevron | Polyurea EP grease-2 | |
| Esso | BEACON 2 (*) | BEACON 3 |
| | BEACON EP2 (*) | UNIREX N3 (*) |
| Fina | LICAL EP2 | CERAN HV |
| | MARSON L2 | |
| Gulf | Crown Grease No.2 | Crown Grease No.3 |

| Supplier | NLGI-2 | NLGI-3 |
|---|---|---|
| Mobil | Mobilux EP2 | |
| SKF | LGMT2 | LGMT3 |
| | | LGHQ3 (*) |
| Shell | ALVANIA R2 | ALVANIA R3 |
| | DARINA GREASE R2 | |
| Texaco | Multifak EP-2 | |
| Total | MULTIS EP 2 (*) | |

*(*) Lubricants recommended by SPX.*

The standard “multi-purpose” grease (consistent class NLGI-2) is suitable for temperatures up to 120°C.

For higher temperatures the standard grease should be replaced by a high temperature grease (consistent class NLGI-3). This grease is, depending on the make, suitable for temperatures up to 150°C or 180°C.

When a pump will be applied in a system or under conditions facing extremely high or low temperatures, the selection of the proper lubricant and correct lubrication interval should be made in consideration with your grease supplier.

Do not mix different grades, different makes of grease together. Such a mix can cause severe damage. Consult your local grease supplier.

**Relubrication**

- Starting with pump size TG H6-40, the ball bearings require lubrication through the grease nipple every 5000 running hours or every 12 months (which occurs first).
- Add a correct grade of grease (see 3.21.3.5). Do not overfill (see table below).

| TG H pump type | Bearing type | Grease quantity (gram) |
|---|---|---|
| 2-32 | 3302-2RS | No relubrication |
| 3-32 | 3302-2RS | No relubrication |
| 6-40 | 3204 or 5204A | 5 |
| 15-50 | 3206 or 5206A | 10 |
| 23-65 | 3206 or 5206A | 10 |
| 58-80 | 3307 or 5307A | 15 |
| 86-100 | 3308 or 5308A | 20 |
| 185-125 | 3310 or 5310A | 25 |
| 360-150 | 7312 BECBJ paired | 40 |

The ball bearing type 2RS are grease filled for life and need not to be relubricated.
Both ranges ISO 3000 range and American AFBMA 5000 range are possible and have the same built in dimensions.

- When the anti-friction bearing has been relubricated 4 times it needs to be cleaned. Replace the old grease with new one or renew the anti-friction bearings.
- In the case of high temperatures, anti-friction bearings must be relubricated every 500 to 1000 running hours:
  - when using grease of NLGI-2 class: for service temperatures > 90°C
  - when using grease of NLGI-3 class: for service temperatures > 120°C
- When the load is extremely high, in case the grease looses much oil, anti-friction bearings need relubrication after each peak service. We recommend relubricating while the pump is still operating but after the peak load has occurred.

### 3.21.3.6 Sleeve bearings

We recommend checking the pump regularly for wear on the gear wheels and sleeve bearings to avoid excessive wear of other parts.

- A quick check can be done by using the front pull-out and back pull-out system. See table for maximum allowable radial clearance of the sleeve bearings.
- For replacement of the sleeve bearings contact your local supplier.

| TG H pump size | Maximum allowed radial clearances |
|---|---|
| 2-32 to 6-40 | 0.10 mm |
| 15-50 to 23-65 | 0.15 mm |
| 58-80 to 86-100 | 0.25 mm |
| 185-125 | 0.30 mm |
| 360-150 | 0.35 mm |

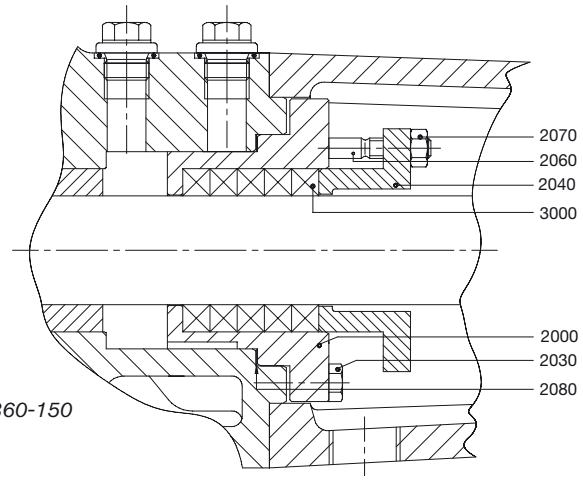
### 3.21.3.7 Shaft seals

#### A. Gland packing PO

- For pumps with gland packing, regularly check the packing for leaks. A slight leakage is normal.
- Regularly check connections on the lantern ring (if applicable).
- If the gland packing leaks excessively or when the pump needs serve, the old packing rings must be replaced. This can be done without disassembling bearing and bearing bracket.

**1. Gland packing disassembly**

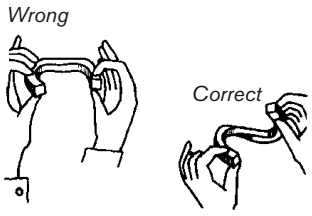
1. Loosen the gland nuts (2070).
2. Push back the gland (2040) as far as possible.
3. Remove the old packing (3000) rings using a packing extractor.
4. Thoroughly clean intermediate casing and shaft.



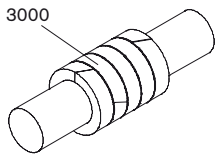

*TG H6-40 – TG H360-150*

**2. Gland packing assembly**

1. First bend and twist the packing ring as shown in the figure.
2. Wrap it around the pump shaft and press the ring firmly against the bottom.
   - Use packing seals with the right dimensions
   - Do not use a sharp object to push the ring into place as this may cut the ring (e.g. a screwdriver). Use a halved section of piping of the correct size instead.
3. Place the following rings in the same way. Push them down one by one. Take care that the cuts in subsequent rings are rotated at 90 intervals.
4. After all packing rings have been mounted, push the gland (2040) against the last mounted packing ring and tighten the nuts cross-wise by hand.




*Bending and twisting packing rings*




*TG H6-40 to TG H360-150: 5 pcs*

**Do not overtighten the nuts!**

To avoid running dry, shaft gland packing must always leak a little.

**3. Running-in of the pump**

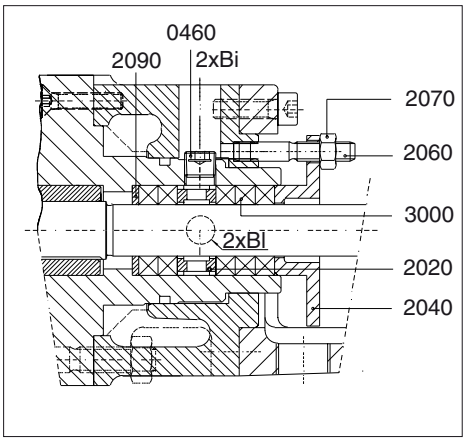
1. Fill the pump and start it up.
2. Allow the new packing rings to run in for a few hours.
   ***Note!*** *During this time the gland packing will leak more than usual!*
3. While running-in the pump check that it is not overheating. Pay attention to the rotating shaft!
4. After the running-in period slightly tighten the gland nuts cross-wise, until the gland packing does not leak more than a few drops per minute.

## B. Gland packing PQ

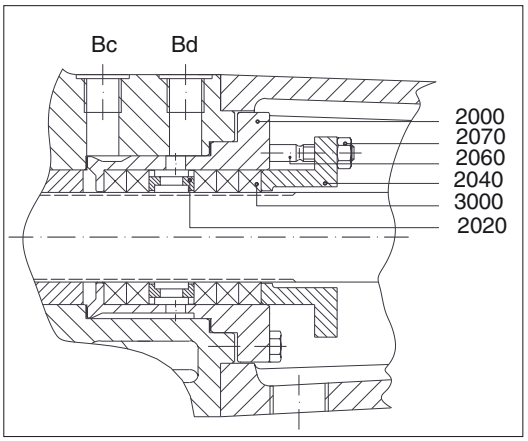
- For pumps with gland packing, regularly check the packing for leaks. A slight leakage is normal.
- Regularly check connections on the lantern ring (if applicable).
- If the gland packing leaks excessively or when the pump needs serve, the old packing rings must be replaced. This can be done without disassembling bearing and bearing bracket.

### 1. Gland packing disassembly

1. Loosen the gland nuts (2070).
2. Push back the gland (2040) as far as possible.
3. Remove the old packing (3000) rings using a packing extractor.
4. The lantern ring (2020) which has grooves at its outer diameter can be removed with the aid of a small hook or a packing extractor.
5. Thoroughly clean intermediate casing and shaft.




*TG H2-32 – TG H3-32*

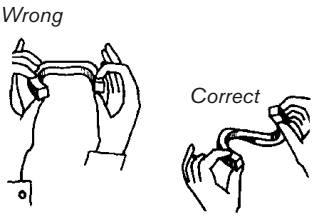



*TG H6-40 – TG H360-150*

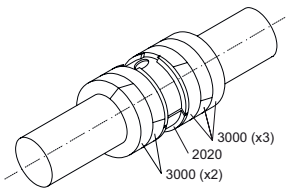
### 2. Gland packing assembly

1. First bend and twist the packing ring as shown in the figure.
2. Wrap it around the pump shaft and press the ring firmly against the bottom.
   - Use packing seals with the right dimensions
   - Do not use a sharp object to push the ring into place as this may cut the ring (e.g. a screwdriver). Use a halved section of piping of the correct size instead.
3. Place the following rings in the same way. Push them down one by one. Take care that the cuts in subsequent rings are rotated at 90 intervals.
4. After all packing rings have been mounted, push the gland (2040) against the last mounted packing ring and tighten the nuts cross-wise by hand.
   **Do not overtighten the nuts !**

   To avoid running dry, shaft gland packing must always leak a little.




*Bending and twisting packing rings*




### 3. Running-in of the pump

1. Fill the pump and start it up.
2. Allow the new packing rings to run in for a few hours.
   ***Note!*** *During this time the gland packing will leak more than usual!*
3. While running-in the pump check that it is not overheating. Pay attention to the rotating shaft!
4. After the running-in period slightly tighten the gland nuts cross-wise, until the gland packing does not leak more than a few drops per minute.

### C. Reverted packing PR

When pumping chocolate, the packing needs to be tightened bit by bit at the (initial) start-up in order to achieve the utmost minimum of leakage, just enough to lubricate the packing rings. Excessively leaking chocolate can overheat in the packing, causing caramelisation, resulting in extra wear of the packing. If the packing leaks excessively or when the pump needs serve, the old packing rings must be replaced. This can only be done by disassembling bearing and bearing bracket.

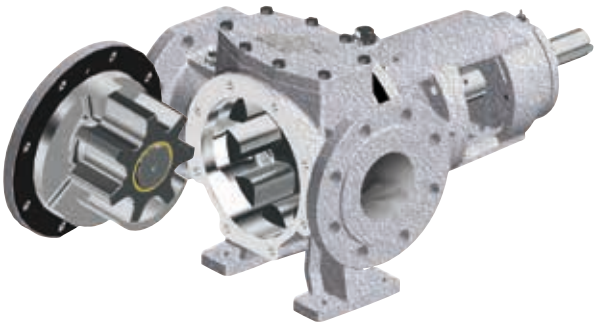
Regularly check the external grease supply in order to make sure that bush bearing is sufficiently greased, especially at start-up. Pay attention to the compatibility of the grease with the pumped liquid.

### D. Mechanical seal

If the mechanical seal leaks excessively, it must be replaced with one of the same type.

***Note!*** *The materials of the mechanical seal are selected strictly in accordance with the nature of the pumped liquid and the operating conditions. Thus the pump must only handle the liquid for which it was purchased. If the liquid or operating conditions are changed, a mechanical seal suitable for the new operating conditions must be fitted.*

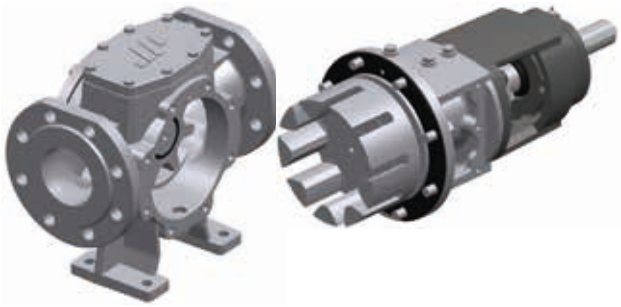
## 3.21.4 Front pull-out



The TG-pumps also have a front pull-out system. To remove liquid residues or to check the idler bearing for wear, the pump cover can be pulled out from the pump housing without disconnecting suction and discharge pipes.

See chapters 4.0 Disassembly/Assembly and section 6.6 Weights.

## 3.21.5 Back pull-out



To flush the pump or to check the sleeve bearing for wear the bearing bracket with intermediate casing, shaft and rotor can be easily pulled out backwards without disconnecting the suction and discharge pipes. When a spacer coupling is used, the driving mechanism need not be moved.

See chapters 4.0 Disassembly/Assembly and section 6.6 Weights.

## 3.21.6 Clearance adjustment

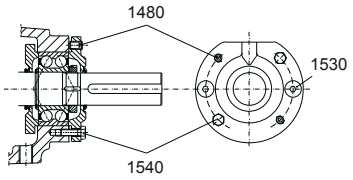
The TG-pumps are delivered with the correct axial clearance setting. In some cases, however, the axial clearance needs to be adjusted:

- When uniform rotor and idler wear need to be compensated.
- When the flow is too low pumping low viscous liquids and the slip has to be reduced.
- When the liquid is more viscous than expected, the friction inside the pump can be reduced by increasing the axial clearance.

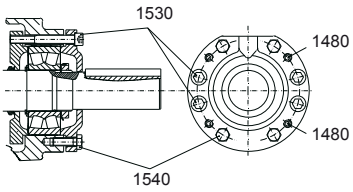
| Nominal axial clearance | |
|---|---|
| **TG H pump size** | **($s_{ax}$) [mm]** |
| 2-32 – 6-40 | 0.10 – 0.15 |
| 15-50 – 23-65 | 0.10 – 0.20 |
| 58-80 – 86-100 | 0.15 – 0.25 |
| 185-125 – 360-150 | 0.20 – 0.40 |

Proceed as follows to set the axial clearance:

1. Loosen the set screws (1480).
2. Tighten the bolts (1540).
3. The pump shaft with roller bearing and rotor will be pushed against the pump cover. The axial clearance is then zero.
4. Install a gauge on the bearing bracket.
5. Position the feeler gauge against the shaft end and initialise the gauge.
6. Loosen the bolts (1540) and tighten the set screws (1480) thus pushing rotor and roller bearing backwards.
7. Tighten the set screws until the distance between shaft end and bearing bracket has been increased by the required clearance.
8. Lock the shaft again by tightening the bolts (1540). The set clearance may be changed again. Therefore, when pushing the shaft end backwards, the clearance should be enlarged by 0.02 mm.




*TG H2-32 – TG H185-125*




*TG H360-150*

## 3.21.7 Designation of threaded connections

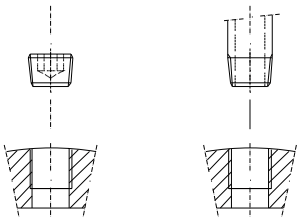
To make clear what sealing type of threaded connection is provided we denominate them according to standards ISO 7/1 and ISO 228/1 as follows.

### 3.21.7.1 Threaded connection Rp (example Rp 1/2)

If no flattened sealing face is provided we call the connection Rp accordingly ISO 7/1. This connection has to be sealed in the thread.The plugs or pipe connections must be provided with conical thread according to ISO 7/1 external thread (example ISO 7/1 – R1/2).

Conical plug
ISO 7/1 - R 1/2

Conical pipe end
ISO 7/1 - R 1/2



| ISO 7/1 | Type | Symbol | Example |
|---|---|---|---|
| Internal thread | Cynlindrical (parallel) | Rp | ISO 7/1 – Rp 1/2 |
| External thread | Always conical (tappered) | R | ISO 7/1 – R 1/2 |

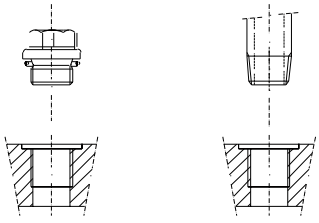
### 3.21.7.2 Threaded connection G (example G 1/2)

If the threaded connection is provided of a flattened sealing face we call it G according ISO 228/1. This connection can be sealed by a gasket. The plugs or pipe connections must be provided with a sealing collar and cylindrical external thread according to ISO 228/1 (Example ISO 228/1 - G1/2).

Plugs or pipe connections provided with conical thread according to ISO 7/1 external thread (example ISO 7/1 – R1/2) can also be used.

Plug with collar
ISO 228/1 - G 1/2

Conical pipe end
ISO 7/1 - R 1/2



| ISO 228/1 | Clearance class | Symbol | Example |
|---|---|---|---|
| Internal thread | Only one class | G | ISO 228/1 – G 1/2 |
| External thread | Class A (standard) | G | ISO 228/1 – G 1/2 |
| | Class B (extra clearance) | G...B | ISO 228/1 – G 1/2 B |
| **ISO 7/1** | **Type** | **Symbol** | **Example** |
| External thread | Always conical (tappered) | R | ISO 7/1 – R 1/2 |

# 4.0 Instructions for assembly and disassembly

## 4.1 General

Insufficient or wrong assembly and disassembly can lead to the pump malfunctioning, high repair costs and long-term inoperability. Contact your local supplier for information.

Disassembly and assembly may only be carried out by trained personnel. Such personnel should be familiar with the pump and follow the instructions below.

Non-compliance with the instructions or neglecting warnings can damage the user or lead to severe damage to pump and/or pump unit. SPX is not liable for accidents and damage resulting from such neglect.

## 4.2 Tools

| | |
|---|---|
| - Set of nut spanners | Width 8 - width 30 |
| - Set of hexagonal spanners | Width 2 - width 14 |
| - Shaft nut spanner | HN 2-4-6-7-8-10-12 |
| - Screwdriver | |
| - Anti-recoil hammer | Rubber, plastic, lead... |
| - Carton, paper, shammy | |
| - Packing extractor | For version PQ, PO, PR |
| - Coupling extractor | |
| - Ball bearing extractor | |
| - Assembly oil | For example Shell ONDINA 15<br>Esso BAYOL 35 |
| or lubricant | For example OKS 477 |
| - Loctite 241 | Max. temperature = 150°C |
| - Loctite 648 | Heat resistant type |
| - Ball bearing grease | For type see section 3.21.3.5 |
| - Measuring tool for adjustment of the axial clearance | Also see section 3.21.6 |
| - Measuring tool to measure the height of the adjusting screw of the safety valve | Also see section 3.17.3 |

## 4.3 Preparation

All activities described in this chapter need to be executed in a workshop suitable for repairs or a mobile workshop, arranged in the working environment.

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

Always follow the instructions in section 3.21 with regard to:

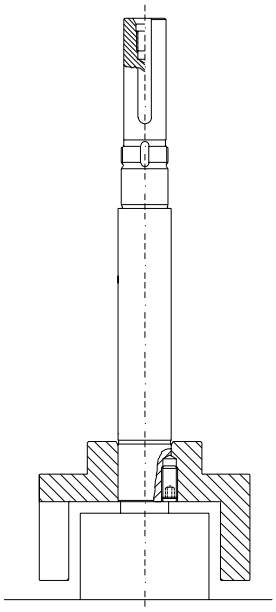
- taking the pump out of service
- assembly of packing rings
- disassembly of the pump from the system
- lubrication of the bearings
- back pull-out and front pull-out
- adjusting axial clearance
- adjusting safety relief valve

## 4.4 After disassembly

- After each disassembly carefully clean the parts and check them for damage, if any. Replace all damaged parts.
- Replace damaged parts with original components.
- When assembling, use new graphite gaskets. Never use flat gaskets that have been used previously.

## 4.5 Anti-friction bearings

### 4.5.1 General

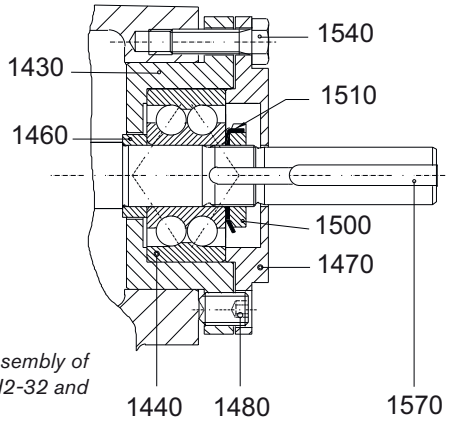


- Never re-use a disassembled bearing or a disassembled lock plate!
- For disassembly and assembly of the bearing (and coupling). use correct tools in order to inspect the pump without any shock loads. Shocks can damage the crisp material of bush bearings and mechanical seal.
- The anti-friction bearing has an interference fit on the pump shaft and a clearance fit in the bearing bracket.
- The anti-friction bearing can easily be mounted when heated to 80°C so that it slides on the pump shaft.
- Always push on the inner ring of the bearing. Pushing on the outer ring may damage the rolling parts between rotor and shaft.
- Support pump shaft at rotor side, not the rotor! Axial force on rotor - pump shaft may damage the shrunk connection.
- Anti-friction bearings type 2RS of TG H2-32 and TG H3-32 are sealed and greased for life. Bearings of the other pump sizes are to be greased at the cage.

***Note!*** *Add a correct grade and the appropriate type of grease. Do not overfill.*

### 4.5.2 TG H2-32 and TG H3-32 disassembly

1. First disassemble the flexible coupling half using a coupling extractor.
2. Remove key (1570), set screws (1480) and tap bolts (1540).
3. Remove the bearing cover (1470).
4. Softly tap the lip of the locking washer (1510) out of the groove of the locking nut (1500).
5. Loosen locking nut (1500) and remove it from the shaft.
6. Remove locking washer (1510).
7. Remove the bearing together with the bearing housing (1430) from the pump shaft. Use an appropriate extractor.
8. Disassemble the support ring (1460).



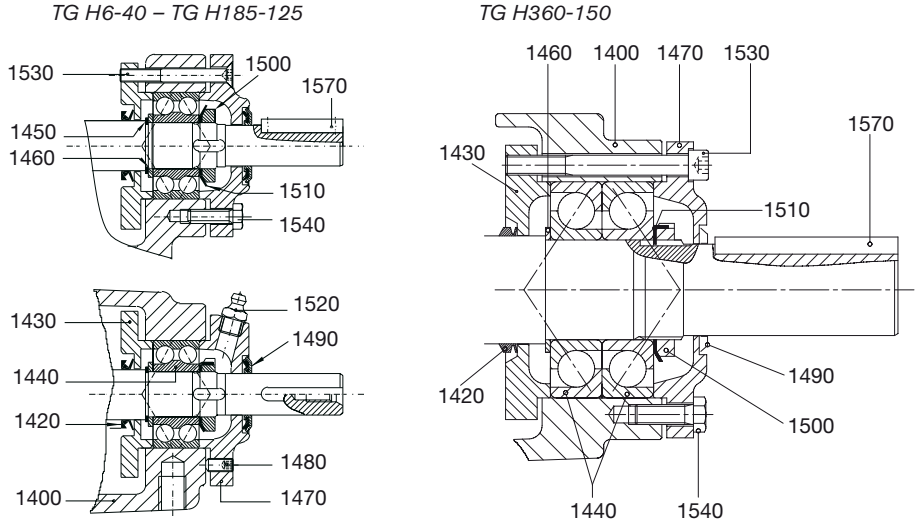

*Disassembly and assembly of rolling bearing TG H2-32 and TG H3-32*

### 4.5.3 TG H2-32 and TG H3-32 assembly

1. Place bearing housing (1430) and support ring (1460) on the pump shaft.
2. Fit a new bearing (1440) on the pump shaft, against the support ring (1460).
3. Fit a new locking washer (1510).
4. Fit the locking nut (1500) and fix it by folding a lip of the locking washer (1510) into one of the grooves of the locking nut (1500).
5. Place the outer bearing cover against the bearing.
6. Fit set screws (1480) and tap bolts (1540).
7. Adjust axial clearance (please refer to chapter 3.21.6).
8. Fit the key (1570) and the flexible coupling half.

## 4.5.4 TG H6-40 to TG H360-150 disassembly

1. First disassemble the flexible coupling half with the aid of a coupling extractor.
2. Remove key (1570), set screws (1480), tap bolts (1540) and long screws (1530).
3. Remove the outer bearing cover (1470) and the V-seal (1490).
4. Detach bearing bracket (1400).
5. Softly tap the lip of the locking washer (1510) out of the groove of the locking nut (1500).
6. Loosen the locking nut (1500) and remove it from the pump shaft.
7. Remove locking washer (1510).
8. Push the inner bearing cover (1430) and the V-seal (1420) away from the bearing.
9. Remove the bearing(s) (1440) from the pump shaft using the appropriate extractor.
10. Disassemble support ring (1460), outer circlips (1450) (only TG H6-40 to TG H23-65), inner bearing cover (1430) and V-seal (1420).




*Rolling bearings TG H6-40 – TG H360-150*

## 4.5.5 TG H6-40 to TG H360-150 assembly

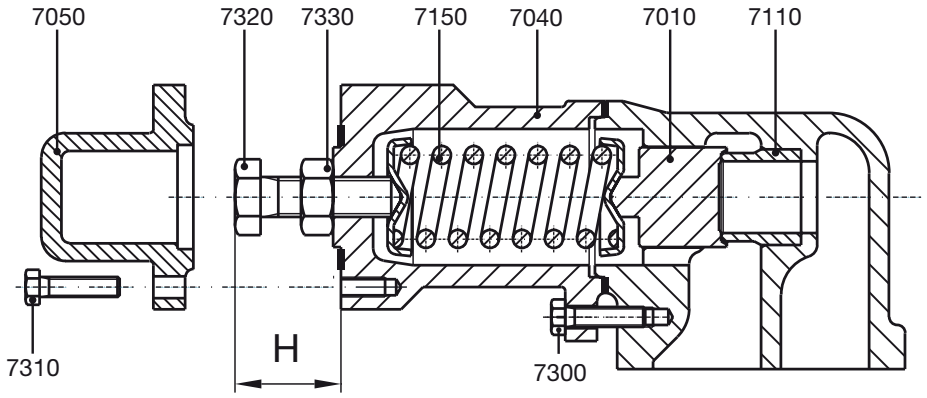
1. Place the V-seal (1420) and the inner bearing cover (1430) on the pump shaft.
2. Fit the outer circlips (1450) (only TG H6-40 to TG H23-65) and the support ring (1460) on the pump shaft.
3. Fit a new bearing (1440) on the shaft. Push it against the support ring (1460).
4. In case of TG H360-150 two ball bearings (1440) are fit paired in O-configuration.
5. Fit a new locking washer (1510).
6. Fit the locking nut (1500) and fix it by folding a lip of the locking washer into one of the grooves of the locking nut (1500).
7. Grease the bearing.
8. Clean the bearing bracket (1400). Fit it on the intermediate casing with the aid of screws (1410).
9. Place both the outer and the inner bearing cover against the bearing. Hold both covers together with the aid of long screws (1530).
10. Fit set screws (1480) and tap bolts (1540).
11. Adjust axial clearance (see section 3.21.6).
12. Fit the V-seal (1490), key (1570) and the flexible coupling half.

## 4.6 Relief valve

- The relief valve may not be disassembled before the spring has been released completely
- **Before releasing the spring, measure the position of the adjusting bolt, so that the spring afterwards can be adjusted to its original opening pressure**

### 4.6.1 Disassembly

- Undo the screws (7310) and the cover (7050).
- Measure and record the exact position of the adjusting bolt (7320). (See dimension H).
- Loosen nut (7330) and adjusting screw (7320) until the spring (7150) has been completely released.
- Remove spring casing (7040) by loosening the screws (7300).
- Spring (7150), valve (7010) and valve seat (7110) are now accessible.




*Assembly and disassembly of the safety relief valve*

### 4.6.2 Assembly

- Check the sealing face of both valve seat (7110) and valve (7010).
- In case of a slightly damaged surface, this can be rubbed with an appropriate emery paste. In case of severe damage however, valve seat (pay attention to shrink fit) and valve must be replaced.
- Always mount a correct type of spring with the original dimensions and an appropriate adjusting screw (see section 3.17.3).
- Fit spring casing (7040) and bolts (7300).
- Fit adjusting screw (7320) and nut (7330), screwing the adjusting screw to measured distance H.
- Fix this position by tightening the nut (7330).

***Remark:*** *When another type of spring and/or adjusting bolt is mounted, the opening pressure of the relief valve must be adjusted hydraulically.*

- Fit cover (7050) and screws (7310).

# 4.7 Mechanical seal

Guidelines for assembly and adjustment of the mechanical seal – pump types GS, GG and GD.

## 4.7.1 General

- All personnel responsible for maintenance, inspection and assembly must be adequately qualified.
- Use specific instructions coming with the mechanical seal which is to be assembled/adjusted.
- The assembling and adjusting of mechanical seals must be performed in a clean workshop.
- Use technically appropriate tools that are in good condition. Handle them correctly.

## 4.7.2 Preparation

Check if the mechanical seal to be mounted has the appropriate size and construction and verify if it can be assembled according to the following instructions:

- Adjusting dimensions are based on standard EN12756 (DIN24960) mechanical seals, on standard axial clearance and standard pump parts.
- With pump versions GS, GG (except sizes TG H2-32 and TG H3-32) the length of the first mechanical seal can be equal to that of EN (DIN) L1K (short version) or that of EN (DIN) L1N (long version). The second mechanical seal of version GG always has a short length equal to DIN-L1K. The TG H2-32 and TG H3-32 allow only short L1K EN12756 (DIN24960) mechanical seals.
- Version GD always has both mechanical seals with the short length equal to EN (DIN) L1K.
- If the mechanical seal length is not according to EN12756 (DIN24960) the built-in length and distance have to be recalculated (with the aid of data given in table 4.7.7.1).
- With double mechanical seal version GD (back to back) problems can occur when assembling a seal which is shorter than L1K. In such cases some parts will have to be changed.
- Assemble the mechanical seal with pump in a vertical position with the pump cover downwards. Follow the assembling sequence as described below.
- The mechanical seal has to be adjusted without axial clearance between pum pcover and rotor. Both rotor and shaft are pushed against the pum pcover.
  - The standard axial clearance is included in the adjusting distance X and Y (for X see table 4.7.7.1 and for Y see table 4.7.3).
  - Check the shaft surface. Protect any sharp edge with tape or any other appropriate tool.

## 4.7.3 Special tools

- Conical protection bush (9010).
- Adjusting plate for adjusting distance Y=1 mm (9020) for version GG.
- Adjusting tools for adjusting distance Y (9040) for version GD.
- Adjusting blocks of different height to compose adjusting height X (versions GS and GG).
- Set of tap bolts for temporary fixation of the seal cover or tools (9030 and 9050).
- Recommended lubricant: OKS477 (also appropriate for EP rubber)
- Shammy

**Special tools for assembly of mechanical seal**

| For version | Item | Nos. | For TG H pump size | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | 2-32/3-32 | 6-40 | 15-50/23-65 | 58-80 | 86-100 | 185-125 | 360-150 |
| GS, GG, GD | 9010 | 1 | x | x | x | x | x | x | x |
| GS | 9020 | 2 | Adjusting distance Y in mm | | | | | | |
| | | | – | 1 | 1 | 1 | 1 | 1 | 1 |
| | 9030 | 2 | – | M6x10 | M6x16 | M8x20 | M8x20 | M8x25 | M10x30 |
| GD | 9040 | 1 | Adjusting distance Y in mm | | | | | | |
| | | | 0.6 | 8.9 | 11.9 | 10.3 | 10.8 | 10.3 | 12.2 |
| | 9050 | 2 | M6x10 | M6x20 | M6x20 | M8x20 | M8x20 | M8x20 | M10x25 |

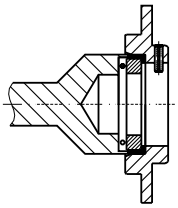
Used symbols:
A: Measuring distance from bush bearing to casing
X: Adjusting distance to be measured from first mechanical seal with GS and GG (see table 4.7.7.1)
Y: Adjusting distance from second mechanical seal with GG and GD (see table 4.7.3)

### 4.7.4 General instructions during assembly

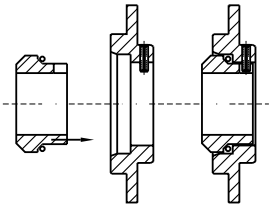
- Do not touch the mechanical seal faces with hand or fingers. Fingerprints can make the mechanical seal untight. Clean the seal faces if necessary. Use a shammy.
- If the mechanical seal faces are made of non self-lubricating material, it is recommended to lubricate the faces a little with the pumped liquid or with thin oil. **Do not use grease!**
- Lubricate the O-rings when assembling. Take care of compliance of the lubricant and the rubber material. **Never use mineral oil using EP rubber O-rings.**
- When fitting PTFE sealings the shaft must be very smooth. Assembly of solid PTFE sealings can be facilitated by heating the stationary ring in water at 100°C during 15 minutes. Pre-assemble the rotary ring on a dummy shaft and heat both ring and shaft in water at 100°C during 15 minutes. Then let everything cool off. To be tight, PTFE seals must rest for approx. 2 hours, so that the O-ring remains in its new shape.
- In cases where the mechanical seal is provided with fixing screws to fix the rotating part on the shaft, it is recommended to screw out the fixing screws, degrease both holes and screws and lock them with Loctite (usual type 241 or heat-resistant type 648).
- If the mechanical seal is not provided with a set screw - e.g. Sealol type 043, or Burgmann MG12, a set ring with set screws must be provided. Take the set screws out of the set ring and degrease both holes and screws of the set ring.

***Remark:*** The set ring that is delivered by SPX guarantees a reliable fixation. There is no danger it will be loosened by alternating loads. SPX cannot guarantee a reliable fixation with other set rings.

### 4.7.5 Assembly of the stationary seat

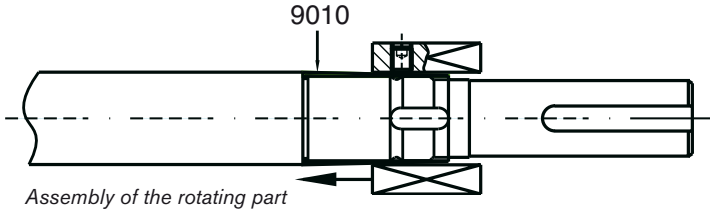


1. Fit the stationary seat(s) into the casing.
2. Use appropriate tools to push the seat perpendicularly in its housing.
3. Protect the seat face with a piece of paper or hardboard and lubricate the rubber sealing elements with a lubricant. This will facilitate the assembly.
   ***Attention: Do not use mineral oil for EP rubber.***
4. Check the perpendicularity of the seat face to the shaft-rotating axis after assembling.



### 4.7.6 Assembly of the rotating part

1. Lubricate the shaft a little with a lubricant.
   ***Attention for EP rubber: Do not use mineral oil!***
2. Protect the sharp edges of the shaft with tape or another protecting tool.
3. Use a conical assembling bush (9010) on the shaft step (see figure).
4. Push the rotating parts against the adjusting shoulder or set ring.
5. Provide the set screws with a drop heat-resistant Loctite and fit the set screws in the rotating part. Tighten the screws.



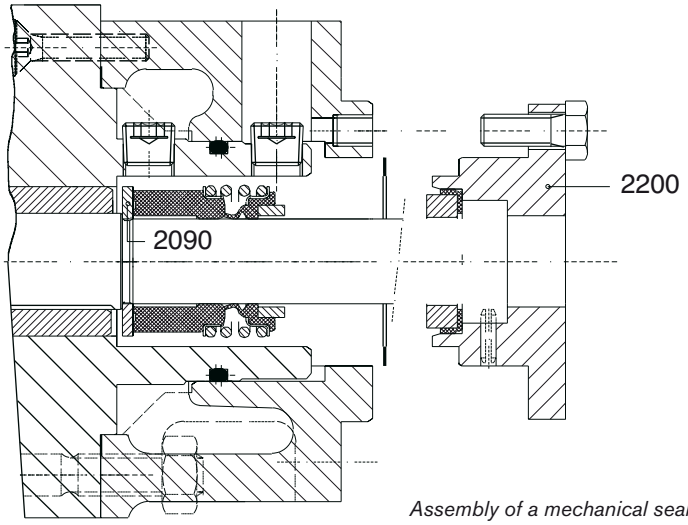

*Assembly of the rotating part*

## 4.7.7 Adjustment of mechanical seal

### 4.7.7.1 GS – Single mechanical seal

**1. Mechanical seal without set screws (e.g. Sealol type 043 and Burgmann type MG12) – Pump size TG H2-32 and TG H3-32**

The mechanical seal is mounted against a shoulder ring (2090), see figure.
Adjusting is not necessary if the built in length of the mechanical seal corresponds to EN12756 (DIN24960) $L_{1K}$ length. If the mechanical seal built in length is shorter than $L_{1K}$ the shoulder ring width must then be adapted to the correct built in length.



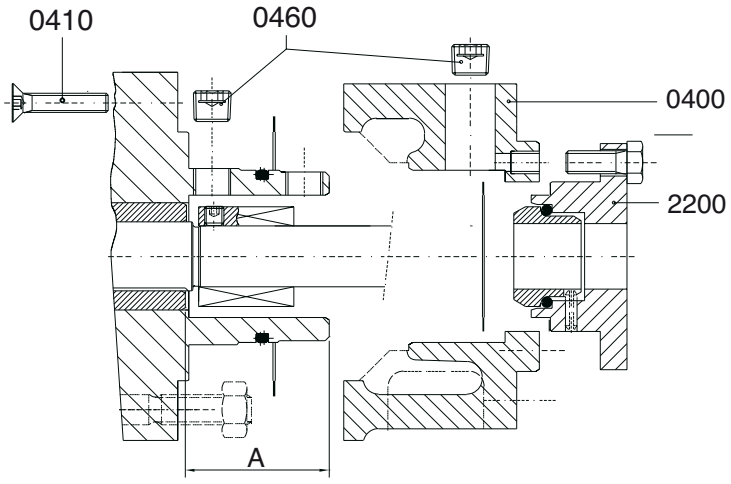

*Assembly of a mechanical seal without set ring*

**2. Mechanical seal fixed on pump shaft by means of set screws**

**A. Sizes TG H2-32 and TG H3-32**

To be able to assemble and to adjust those types of mechanical seal the jacket cover (0400) and plugs (0460) must be removed as shown in the figure below.
In general the shoulder ring (2090) cannot be used because the fixed width of the shoulder ring does not allow the narrow tolerances necessary for this type of mechanical seal.

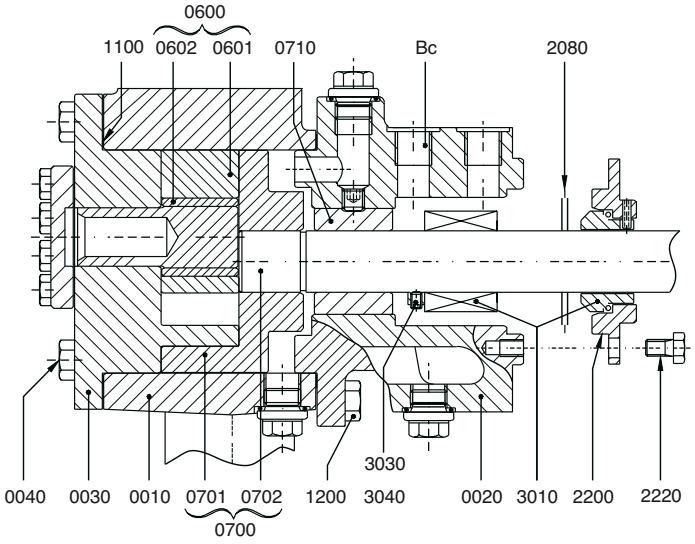
Adjust first the rotating part of the mechanical seal and fix it on the pump shaft by means of the set screws. Once adjusted and fixed the assembling can be continued as shown in the figure. Seal the plugs (0460) with a resin sealant suitable for higher temperature (e.g. Loctite 648). Adjusting method is the same as for the bigger pumps and is described in the next paragraphs.

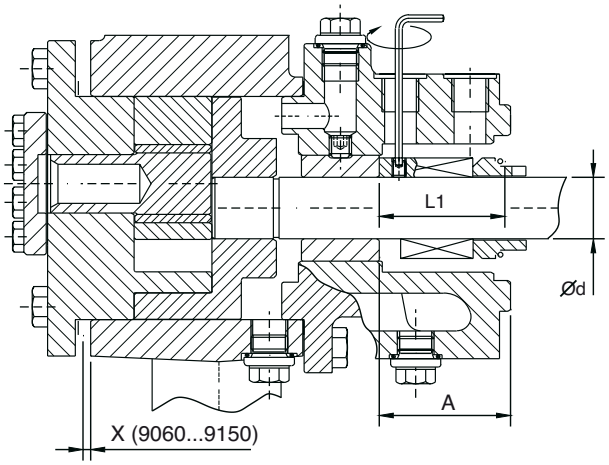


**B. Sizes TG H6-40 to TG H360-150**

The mechanical seal must always be adjusted and fixed on the pump shaft by means of set screws. For mechanical seal without set screws (e.g. Sealol, type 043 and Burgmann type MG12) a special set ring with fixing screws (3030 and 3040) must be used for adjusting the mechanical seal on the pump shaft.

1. Measure distance A.
2. Look for distance X in table. If length of mechanical seal differs from standard L1K or L1N, recalculate X with data from table on page 71.
3. Place the pre-mounted pump cover (0030) on the working bench.
4. Mount gasket (1100).
5. Place at equal distance 2 or 3 adjusting distance blocks of height X on the gasket (1100). Height accuracy of X passes in steps of 0.25 mm.
6. Mount the pump casing (0010).
7. Mount idler with bush (0600) and rotor with shaft (0700).
8. Push the rotor with shaft against the pump cover (0030).
9. Assemble the rotating mechanical seal part (3010) or the set ring (3030).
10. Tighten set screws and secure screws with Loctite.
11. If a set ring (3030) is used, mount the rotating part of the mechanical seal (3010) now.
12. Remove the distance blocks.
13. Assemble the pump cover (0030) with the aid of bolts.
14. Check the smoothness of the seal faces. Clean face if necessary.
15. Lubricate the face with a drop of thin oil or pumped liquid. **Do not lubricate a carbon face!**
16. Assemble gasket (2080) and mechanical seal cover (2200) with the pre-mounted seat.



## Values for recalculation of adjusting distance X

| TG H pump type | Shaft d [mm] | EN12756 (DIN24960) KU (short type) | | | EN12756 (DIN24960) NU (long type) | |
|---|---|---|---|---|---|---|
| | | $l_{1k}$ [mm] | B | B (with set ring) | $L_{1N\text{-}max}$ [mm] | B |
| 2-32/3-32 | 16 | 35 | 46.1 | 0 | – | – |
| 6-40 | 22 | 35.7 | 34.7 | 44.7 | 45 | 42.2 |
| 15-50/23-65 | 32 | 42.5 | 36.7 | 46.7 | 55 | 49.2 |
| 58-80 | 40 | 45 | 35.7 | 45.7 | 55 | 45.7 |
| 86-100 | 45 | 45 | 36.3 | 46.3 | 60 | 51.3 |
| 185-125 | 55 | 47.5 | 34.3 | 44.2 | 70 | 56.8 |
| 360-150 | 65 | 52.5 | 36.3 | 46.3 | 80 | 63.8 |

Standard length ($L_{1k}$ or $L_{1N\text{-}max}$) :
A = measured
X = A - B

With non-standard length = L :
A = measured – for B see EN (DIN) KU
$X = A - B - L + L_{1k}$

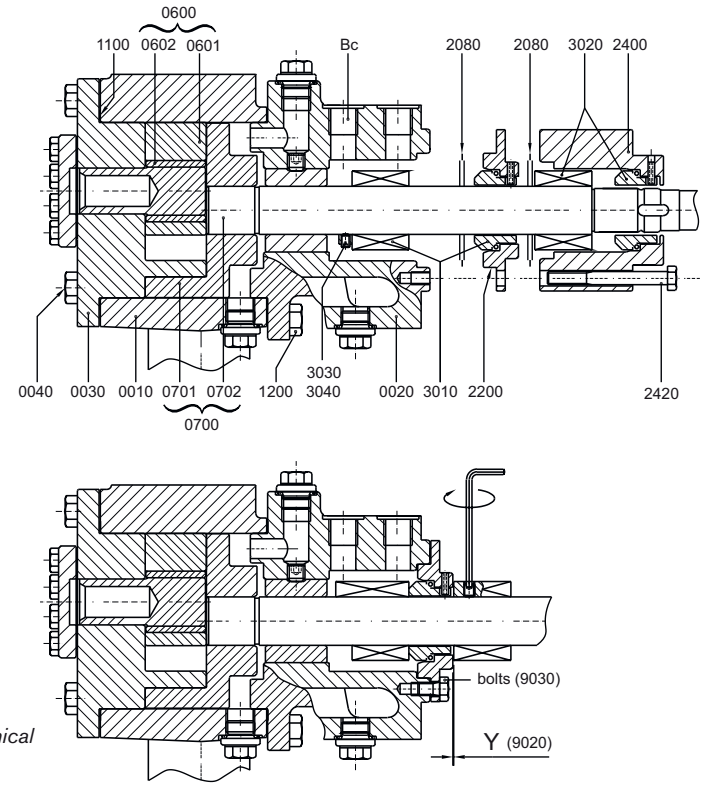
## Thickness dimensions for composition of adjustment height X

| Shaft seal GS & GG | | | | For EN (DIN) KU mechanical seal | | | | | | | For EN (DIN) NU mechanical seal | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Dimension A [mm] | | | | TG H 2-32/ 3-32 | TG H 6-40 | TG H 15-50/ 23-65 | TG H 58-80 | TG H 86-100 | TG H 185-125 | TG H 360-150 | TG H 6-40 | TG H 15-50/ 23-65 | TG H 58-80 | TG H 80-100 | TG H 185-125 | TG H 360-150 |
| Measured | | | | | | | | | | | | | | | | |
| lower limit | higher limit | A main | B: | 46.13 | 34.68 | 36.7 | 35.73 | 36.28 | 34.33 | 36.33 | 42.18 | 49.2 | 45.73 | 51.28 | 56.78 | 63.83 |
| | | | | Adjusting height X [mm] | | | | | | | Adjusting height X [mm] | | | | | |
| 48.65 | 48.90 | 48.78 | | 2.65 | | | | | | | | | | | | |
| 48.90 | 49.15 | 49.03 | | 2.90 | | | | | | | | | | | | |
| 49.15 | 49.40 | 49.28 | | 3.15 | | | | | | | | | | | | |
| 49.40 | 49.65 | 49.53 | | 3.40 | | | | | | | | | | | | |
| 49.65 | 49.90 | 49.78 | | 3.65 | | | | | | | | | | | | |
| 46.20 | 46.45 | 46.33 | | | 11.65 | | | | | | 4.15 | | | | | |
| 46.45 | 46.70 | 46.58 | | | 11.90 | | | | | | 4.40 | | | | | |
| 46.70 | 46.95 | 46.83 | | | 12.15 | | | | | | 4.65 | | | | | |
| 46.95 | 47.20 | 47.08 | | | 12.40 | | | | | | 4.90 | | | | | |
| 47.20 | 47.45 | 47.33 | | | 12.65 | | | | | | 5.15 | | | | | |
| 47.45 | 47.70 | 47.58 | | | 12.90 | | | | | | 5.40 | | | | | |
| 53.00 | 53.25 | 53.15 | | | | 16.45 | | | | | | 3.95 | | | | |
| 53.25 | 56.50 | 53.40 | | | | 16.70 | | | | | | 4.20 | | | | |
| 53.50 | 53.75 | 53.65 | | | | 16.95 | | | | | | 4.45 | | | | |
| 53.75 | 54.00 | 53.90 | | | | 17.20 | | | | | | 4.70 | | | | |
| 54.00 | 54.25 | 54.15 | | | | 17.45 | | | | | | 4.95 | | | | |
| 54.25 | 54.50 | 54.40 | | | | 17.70 | | | | | | 5.20 | | | | |
| 54.50 | 54.75 | 54.65 | | | | 17.95 | | | | | | 5.45 | | | | |
| 54.75 | 55.00 | 54.90 | | | | 18.20 | | | | | | 5.70 | | | | |
| 56.40 | 56.65 | 56.53 | | | | | 20.80 | | | | | | 10.80 | | | |
| 56.65 | 56.90 | 56.78 | | | | | 21.05 | | | | | | 11.05 | | | |
| 56.90 | 57.15 | 57.03 | | | | | 21.30 | | | | | | 11.30 | | | |
| 57.15 | 57.40 | 57.28 | | | | | 21.55 | | | | | | 11.55 | | | |
| 57.40 | 57.65 | 57.53 | | | | | 21.80 | | | | | | 11.80 | | | |
| 57.65 | 57.90 | 57.78 | | | | | 22.05 | | | | | | 12.05 | | | |
| 57.90 | 58.15 | 58.03 | | | | | 22.30 | | | | | | 12.30 | | | |
| 58.15 | 58.40 | 58.28 | | | | | 22.55 | | | | | | 12.55 | | | |
| 55.30 | 55.55 | 55.43 | | | | | | 19.15 | | | | | | 4.15 | | |
| 55.55 | 55.80 | 55.68 | | | | | | 19.40 | | | | | | 4.40 | | |
| 55.80 | 56.05 | 55.93 | | | | | | 19.65 | | | | | | 4.65 | | |
| 56.05 | 56.30 | 56.18 | | | | | | 19.90 | | | | | | 4.90 | | |
| 56.30 | 56.55 | 56.43 | | | | | | 20.15 | | | | | | 5.15 | | |
| 56.55 | 56.80 | 56.68 | | | | | | 20.40 | | | | | | 5.40 | | |
| 56.80 | 57.05 | 56.93 | | | | | | 20.65 | | | | | | 5.65 | | |
| 57.05 | 57.30 | 57.18 | | | | | | 20.90 | | | | | | 5.90 | | |
| 57.30 | 57.55 | 57.43 | | | | | | 21.15 | | | | | | 6.15 | | |
| 58.30 | 58.55 | 58.43 | | | | | | | 24.10 | | | | | | 1.65 | |
| 58.55 | 58.80 | 58.68 | | | | | | | 24.35 | | | | | | 1.90 | |
| 58.80 | 59.05 | 58.93 | | | | | | | 24.60 | | | | | | 2.15 | |
| 59.05 | 59.30 | 59.18 | | | | | | | 24.85 | | | | | | 2.40 | |
| 59.30 | 59.55 | 59.43 | | | | | | | 25.10 | | | | | | 2.65 | |
| 59.55 | 59.80 | 59.68 | | | | | | | 25.35 | | | | | | 2.90 | |
| 59.80 | 60.05 | 59.93 | | | | | | | 25.60 | | | | | | 3.15 | |
| 60.05 | 60.30 | 60.18 | | | | | | | 25.85 | | | | | | 3.40 | |
| 60.30 | 60.55 | 60.43 | | | | | | | 26.10 | | | | | | 3.65 | |
| 66.30 | 66.55 | 66.43 | | | | | | | | 32.10 | | | | | | 9.65 |
| 66.55 | 66.80 | 66.68 | | | | | | | | 32.35 | | | | | | 9.90 |
| 66.80 | 67.05 | 66.93 | | | | | | | | 32.60 | | | | | | 10.15 |
| 67.05 | 67.30 | 67.18 | | | | | | | | 32.85 | | | | | | 10.40 |
| 67.30 | 67.55 | 67.43 | | | | | | | | 33.10 | | | | | | 10.65 |
| 67.55 | 67.80 | 67.68 | | | | | | | | 33.35 | | | | | | 10.90 |
| 67.80 | 68.05 | 67.93 | | | | | | | | 33.60 | | | | | | 11.15 |
| 68.05 | 68.30 | 68.18 | | | | | | | | 33.85 | | | | | | 11.40 |
| 68.30 | 68.55 | 68.43 | | | | | | | | 34.10 | | | | | | 11.65 |

***Remark:*** *EN (DIN) KU mechanical seal with set ring: substract width of set ring from adjusting height X (normal width of set ring = 10 mm)*

### 4.7.7.2 GG – Double mechanical seal tandem

1. Assemble the first mechanical seal using the same procedure as a single mechanical seal, type GS (see section 4.7.7.1).
2. Fix the mechanical seal cover (2200) with 2 bolts (9030) without tightening them. Leave the gasket (2080) uncompressed.




*Assembly of double mechanical seal in tandem (GG)*

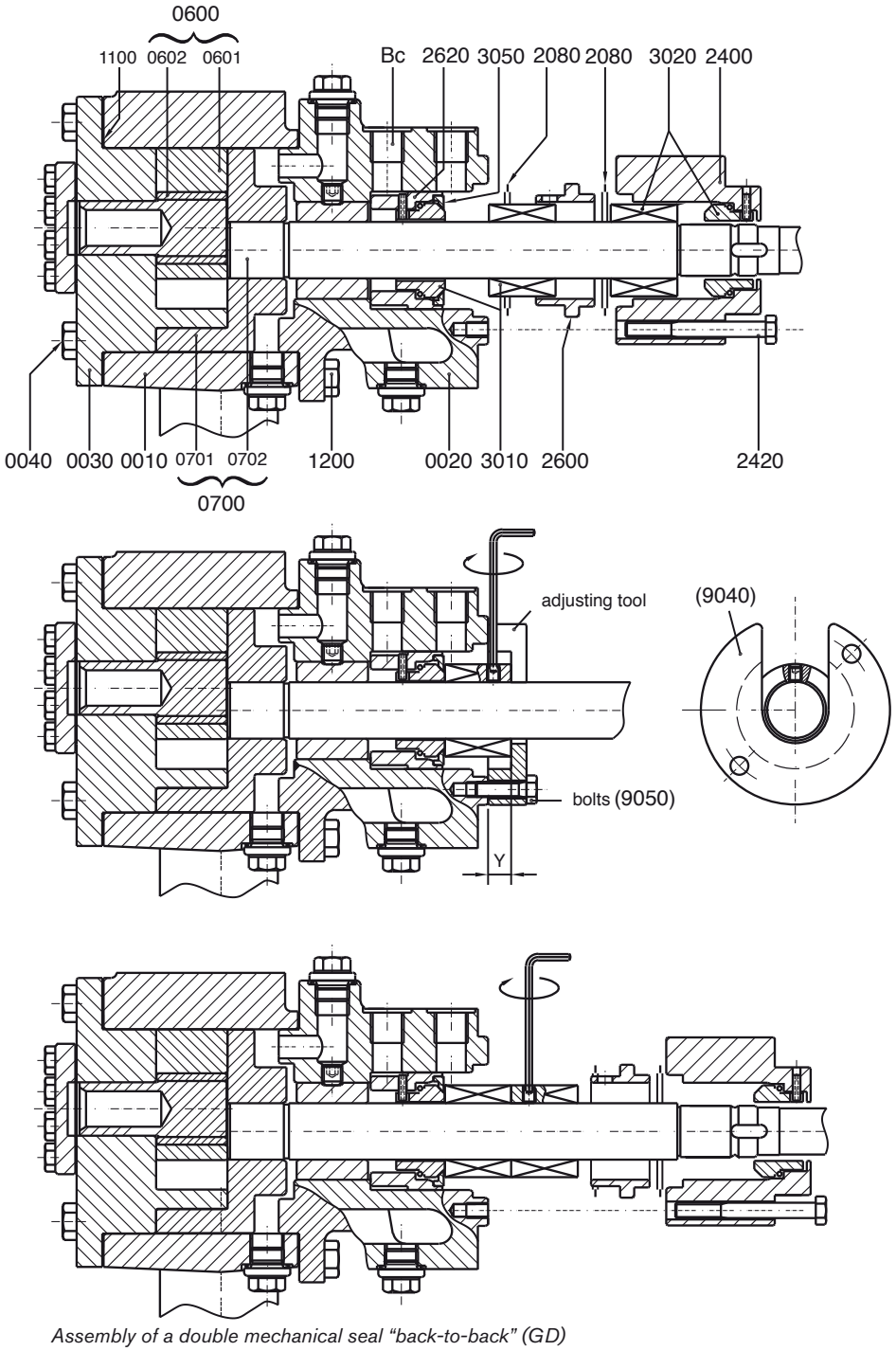
3. Place 2 distance plates (9020) of 1 mm thickness (Y=1 mm) on the sealing cover (not for TG H2-32 and TG H3-32, if Y=0).
4. Assemble the second mechanical seal (3020).
5. Remove the distance plate (9020) and the two bolts (9030).
6. Mount second gasket (2080) and mechanical seal casing (2400).

### 4.7.7.3 GD – Double mechanical seal "Back-to-back"

1. Assemble pump casing (0010) with pump cover (0030), idler complete (0600), rotor with shaft (0700) and pre-assembled intermediate casing (0020).
2. Tighten bolts (0040/0210 and 1200).
3. Pre-mount the stationary seats into the intermediate casing (0020) and into the seal cover (2400).
4. Place the pump in a vertical position with pump cover downwards and push both rotor and shaft against the pump cover.
5. Fit the lock ring (3050) if any.
6. Check the smoothness of the seal faces. Clean the face if necessary.
7. Lubricate the faces with a drop of thin oil or pumped liquid. **Do not lubricate a carbon face!**
8. Mount the rotating seal part of the first mechanical seal (3010).
9. Adjust the seal length on distance Y by means of a special U-shaped tool (9040).

   (See 4.7.3 Special tools).

10. Lock the adjusting tool by means of 2 bolts (9050).
11. Tighten the screws of the mechanical seal and secure them with Loctite.
12. Remove the adjusting tool (9040) and the two bolts (9050).
13. Assemble the rotating part of the second mechanical seal (3020). Push it against the first mechanical seal and secure the fixing screws with Loctite.
14. Check the smoothness of the seal faces. Clean the face if necessary.
15. Lubricate the faces with a drop of thin oil or pumped liquid. Do not lubricate a carbon face!
16. Fit gasket (2080), distance ring (2600), second gasket (2080) and seal cover (2400) with the pre-mounted seat.




*Assembly of a double mechanical seal "back-to-back" (GD)*

### 4.7.7.4 GC – Mechanical seal cartridge

#### A. General

1. Clean the shaft and casing and check if sealing faces are in good condition.
   Use always a new gasket (2080) that is in good condition.
   Ensure that the auxiliary connection openings are in the good position and accessible for use.
   For exact position, see the figures and detailed instructions in the next paragraphs.
2. Lubricate the O-ring inside the shaft sleeve (for lubricant see sections 4.7.4 and 4.7.5).
   Use a conical assembling bush (9010) on the shaft step (see section 4.7.6).
   Put the cartridge on the shaft and assemble to the pump casing.
3. Bolt the cartridge seal plate securely to the pump housing.
   To allow the shaft turning during assembling remove the black coloured assembling jig but keep the non-coloured jigs in place. The jigs secure the right axial position of the mechanical seal and center the shaft sleeve.
4. Continue assembling of the pump and adjust axial pump clearance (see section 3.21.6).
5. Fix the shaft sleeve of the cartridge seal to the pump shaft by means of the fixing set screws. Secure the set screws with Loctite. Once the cartridge is fixed to the pump shaft and to the pump housing all assembling jigs must be removed. Keep the jigs in a safe place to reassemble the cartridge seal in case of disassembly for repair.
6. Plastic caps on threaded connection openings should be removed before commissioning.
7. Take the necessary safety precautions to prevent injuries during operation and maintenance by accident, e.g. liquid or steam emissions, contact with rotating parts and hot surfaces.

#### B. Single mechanical seal cartridge Burgmann QN3 and TN3

1. Position the cartridge according to the next figures.
2. Position the drain connection of the TN3 (1x NPT 1/8) always to the bottom.
3. On QN3 cartridge the drain connection (1x NPT 1/8) must always be plugged off or connected to a closed drain line. The normal position is to the bottom and allows drainage of quench liquid.
4. If turned to the top the opening NPT 1/8 can be used as a vent but in that case the bracket must be provided by an extra access hole.

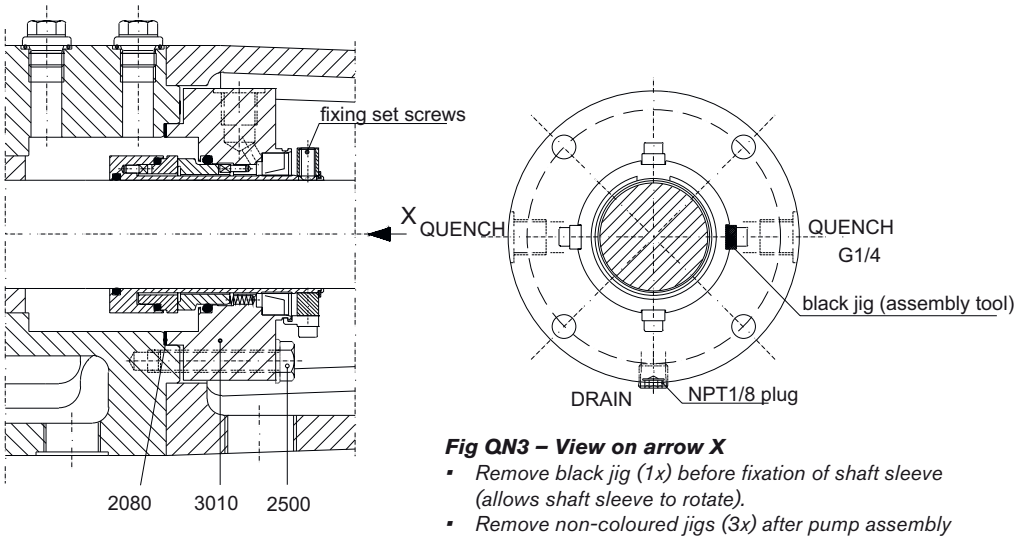



***Fig QN3 – View on arrow X***

- *Remove black jig (1x) before fixation of shaft sleeve (allows shaft sleeve to rotate).*
- *Remove non-coloured jigs (3x) after pump assembly and adjusting axial clearance.*

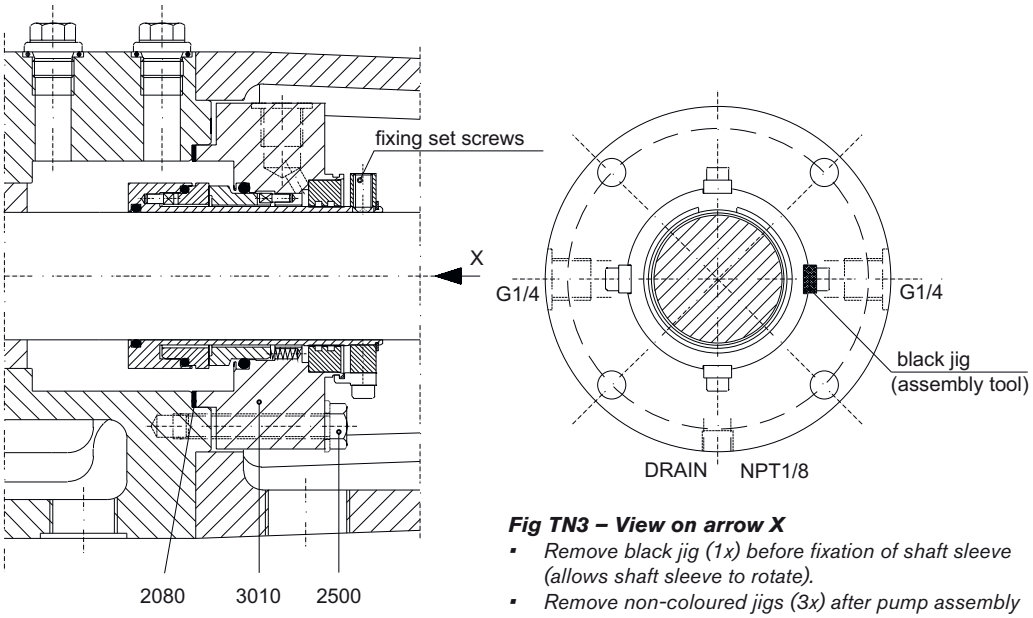



***Fig TN3 – View on arrow X***

- *Remove black jig (1x) before fixation of shaft sleeve (allows shaft sleeve to rotate).*
- *Remove non-coloured jigs (3x) after pump assembly and adjusting axial clearance.*

**TN3 cartridge used with steam quench**

If the TN3 cartridge is used with steam quench connect steam and condense line according to fig TN3 Steam.

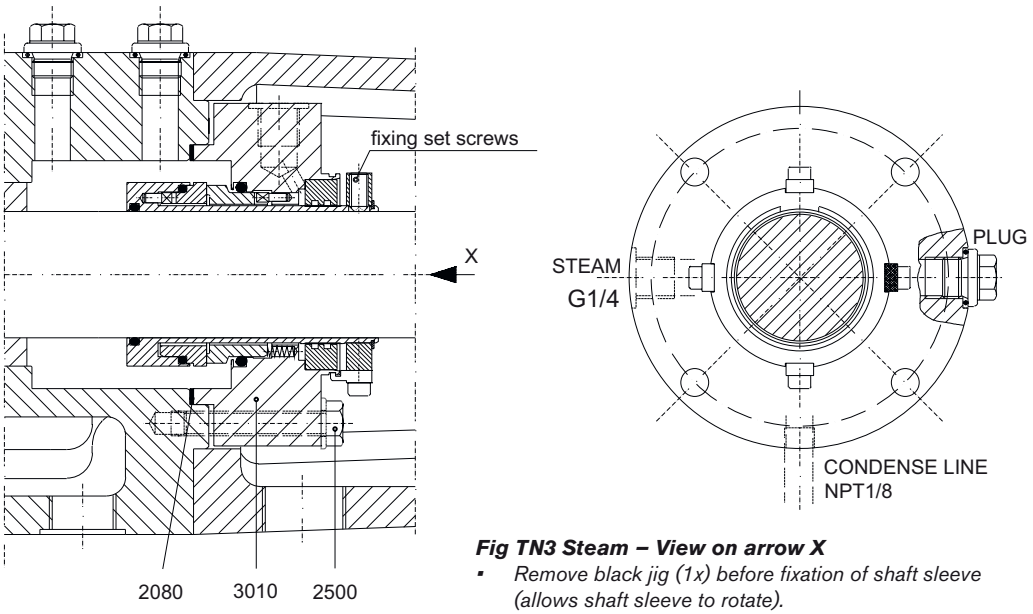



***Fig TN3 Steam – View on arrow X***

- *Remove black jig (1x) before fixation of shaft sleeve (allows shaft sleeve to rotate).*
- *Remove non-coloured jigs (3x) after pump assembly and adjusting axial clearance.*

1. The steam can been connected to one G1/4 opening at the left or the right side of the bracket. The opposite G1/4 opening must be plugged off.
2. A condense line can been connected to the NPT 1/8 opening if any; otherwise allow this NPT 1/8 opening to open so allowing steam to expel into the atmosphere.
   Steam pressure must be released in such a way that only a small stream of steam is expelled into to the atmosphere.
3. Take the necessary safety precautions to prevent injuries by steam during operation and maintenance.

**C. Double Mechanical seal cartridge Burgmann DN3**

1. Position the cartridge according to fig DN3.
2. Position the G1/4 openings marked OUT and IN according to the direction of rotation of the pump shaft. To define the exact direction of rotation look on the pump shaft (see also 3.18.4). The OUT opening must be positioned at the highest top position to allow evacuation of air and gases.
3. In case the pump shall run in both directions of rotations the OUT and IN opening shall be placed following the most used or most critical direction of rotation. In case of doubt consult your supplier or Burgmann.

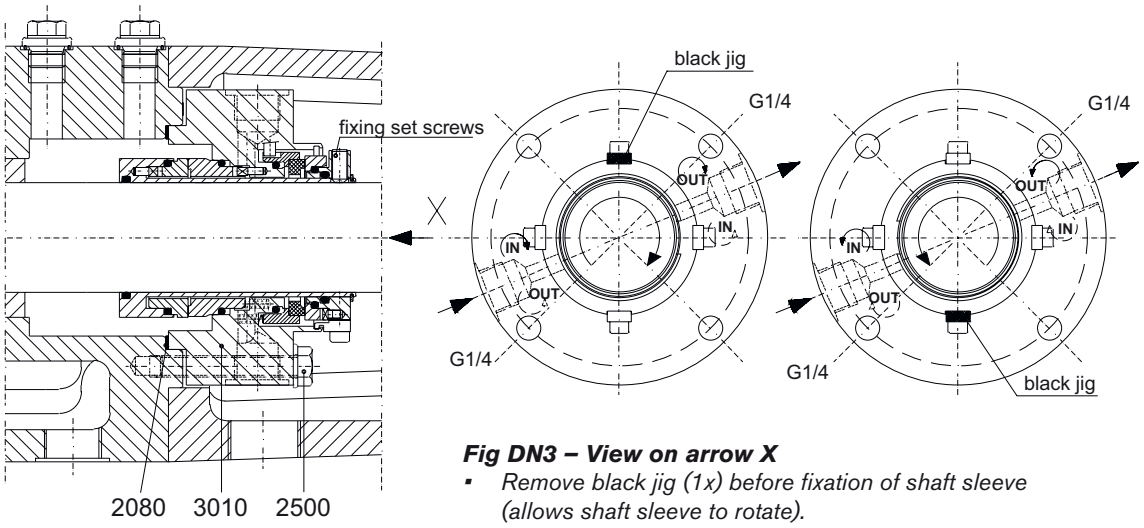



***Fig DN3 – View on arrow X***

- *Remove black jig (1x) before fixation of shaft sleeve (allows shaft sleeve to rotate).*
- *Remove non-coloured jigs (3x) after pump assembly and adjusting axial clearance.*

4. Always provide a liquid quench.

   If the liquid quench is non-pressurized or the pressure is lower than the pressure in the shaft seal box the double mechanical seal acts as a tandem seal arrangement.

   If the liquid quench is pressurized the double mechanical seal acts as a back to back arrangement. In such cases the pressure of the liquid quench must be 10% higher than the maximum pressure in the shaft seal box.

   Do not give too much over pressure i.e. 1.5 bar above pressure of the shaft seal box is recommended as maximum.

   Under normal circumstances the pressure in the shaft seal box is equal to the suction pressure plus the half-differential pressure ($\Delta p$). In case of doubt measure the pressure in the shaft seal box or consult your supplier.

5. For arrangement of liquid quench see 3.18.8.3 (non-pressurized quench) and 3.18.8.4 (pressurized quench) or consult your pump supplier or Burgmann.

***Remark:*** Double cartridge mechanical seals can also be delivered for gas quench (= special execution). In such cases, follow the special instructions that will be received with the cartridge.

**D. Triple lip-seal cartridge**

The entire cartridge can be disassembled from the bareshaft pump as one single seal unit. Further disassembly of the unit requires an SPX service intervention and/or support.

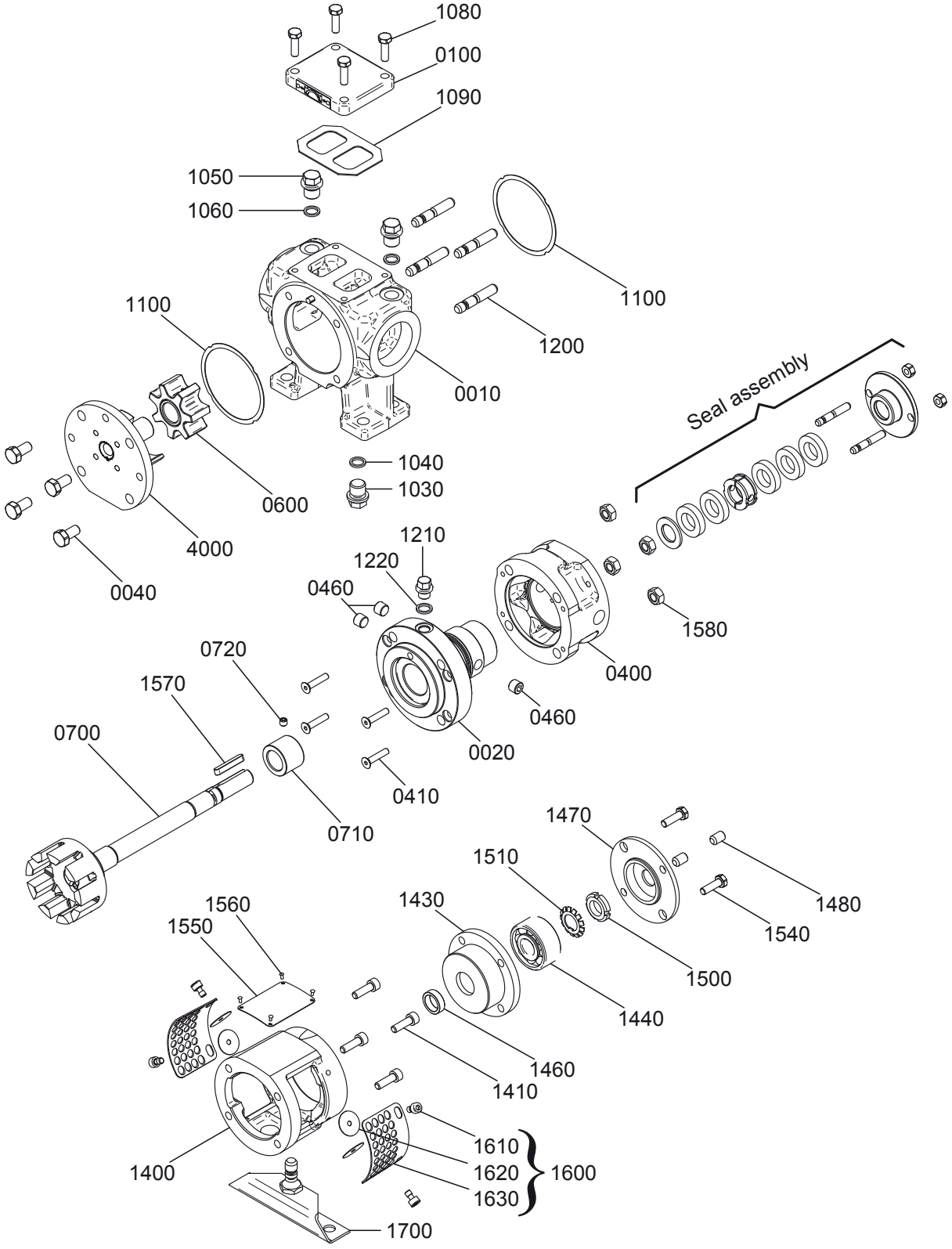
# 5.0 Sectional drawings and part lists

**How to order spares**

When ordering spare parts, please state:
1. Pump type and serial number (see name plate)
2. Position number, quantity and description

*Example:*
1. *Pump type: TG H58-80 R2SS BR5 BR5 PQTC*
   *Serial number: 2000-101505*
2. *Pos 0600, 1, Idler + Bush complete*

## 5.1 TG H2-32 and TG H3-32



### 5.1.1 Hydraulic part

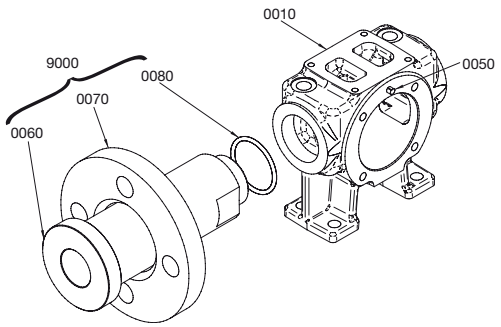
| Pos. | Description | Nos./pump | Preventive | Overhaul |
|---|---|---|---|---|
| 0010 | pump casing - thread connection | 1 | | |
| 0020 | intermediate casing | 1 | | |
| 0040 | tap bolt | 4 | | |
| 0100 | top cover, complete | 1 | | |
| 0400 | jacket cover, on shaft seal | 1 | | |
| 0410 | countersunk screw | 4 | | |
| 0460 | plug PQ version | 2 | | |
| | plug Gx version | 3 | | |
| 0600 | idler + bush, complete | 1 | x | |
| 0700 | rotor + shaft, complete | 1 | x | |
| 0710 | bush bearing, on shaft | 1 | x | |
| 0720 | set screw | 1 | | |
| 1030 | plug | 1 | | |
| 1040 | sealing ring | 1 | x | x |
| 1050 | plug | 2 | | |
| 1060 | sealing ring | 2 | x | x |
| 1080 | tap bolt | 4 | | |
| 1090 | gasket | 1 | | x |
| 1100 | gasket | 2 | x | x |
| 1200 | stud bolt | 4 | | |
| 1210 | plug | 1 | | |
| 1220 | sealing ring | 1 | x | x |
| 1570 | key | 1 | x | x |
| 1580 | nut | 4 | | |
| 4000 | pump cover | 1 | x | |

### 5.1.2 Bearing bracket

| Pos. | Description | Nos./pump | Preventive | Overhaul |
|---|---|---|---|---|
| 1400 | bearing bracket | 1 | | |
| 1410 | cap head screw | 4 | | |
| 1430 | bearing housing | 1 | | |
| 1440 | ball bearing | 1 | x | x |
| 1460 | support ring | 1 | | |
| 1470 | bearing cover | 1 | | |
| 1480 | set screw | 2 | | |
| 1500 | locking nut | 1 | | |
| 1510 | locking washer | 1 | x | x |
| 1540 | tap bolt | 2 | | |
| 1550 | nameplate | 1 | | |
| 1560 | rivet | 4 | | |
| 1600 | mesh guard, complete | 2 | | |
| *1610* | *Savetix® cap head screw - st. steel* | *4* | | |
| *1620* | *Savetix® washer - st. steel* | *4* | | |
| *1630* | *mesh guard - st. steel* | *2* | | |
| 1610 | cap head screw | 4 | | |
| 1700 | bracket support, complete | 1 | | |

### 5.1.3 Flange connection options

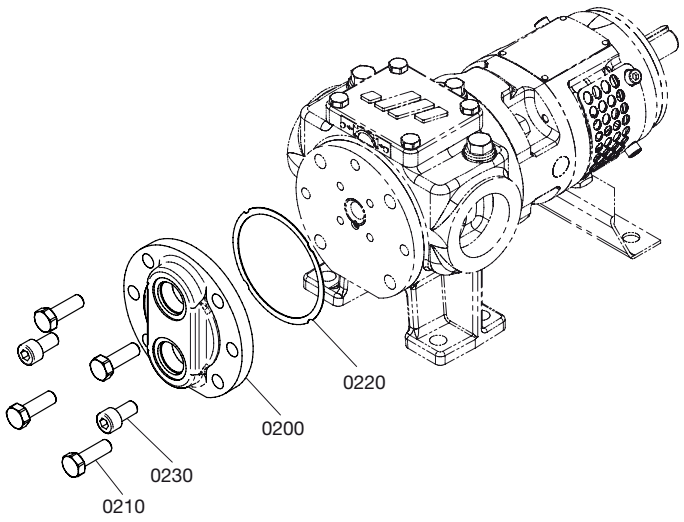
| Pos. | Description | Nos./ pump | Preventive | Overhaul |
|---|---|---|---|---|
| 0010 | R1: pump casing | 1 | | |
| 0050 | pin stainless steel | 1 | | |
| Screwed on flanges (optionally) | | | | |
| 9000 | screw on flanges | 1 | | |
| 0060 | collar piece | 2 | | |
| 0070 | loose flange | 2 | | |
| 0080 | sealing ring | 2 | x | x |



## 5.1.4 S-jacket options

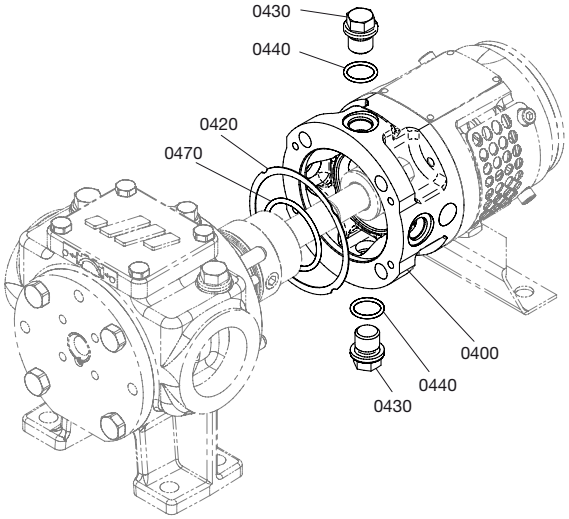
### 5.1.4.1 S-jacket on pump cover

| Pos. | Description | Nos./ pump | Preventive | Overhaul |
|---|---|---|---|---|
| 0200 | jacket cover | 1 | | |
| 0210 | tap bolt | 4 | | |
| 0220 | gasket | 1 | x | x |
| 0230 | cap head screw | 2 | | |




### 5.1.4.2 S-jacket around shaft seal

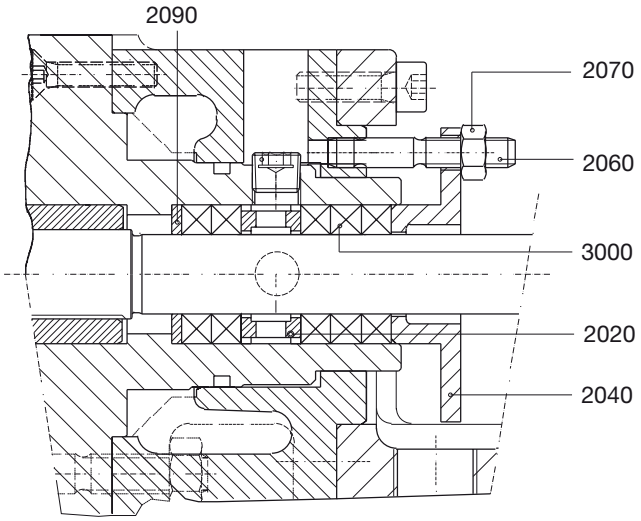
| Pos. | Description | Nos./ pump | Preventive | Overhaul |
|---|---|---|---|---|
| 0400 | jacket cover | 1 | | |
| 0420 | gasket | 1 | x | x |
| 0430 | plug | 2 | | |
| 0440 | sealing ring | 2 | x | x |
| 0470 | O-ring | 1 | x | x |




## 5.1.5 Seal options

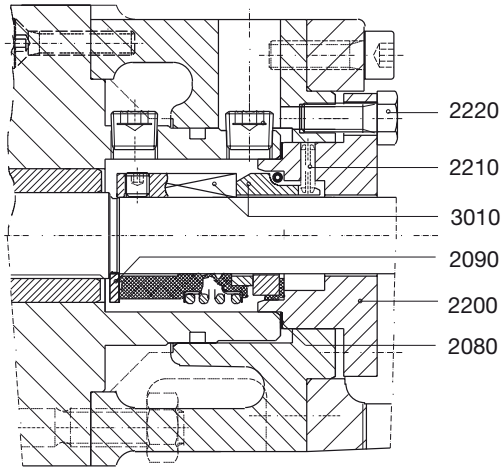
### 5.1.5.1 Packing rings – PQ

| Pos. | Description | Nos./ pump | Preventive | Overhaul |
|---|---|---|---|---|
| 2020 | lantern ring, split | 1 | | |
| 2040 | gland | 1 | | |
| 2060 | stud bolt | 2 | | |
| 2070 | nut | 2 | | |
| 2090 | support ring | 1 | | |
| 3000 | packing ring | 5 | x | x |



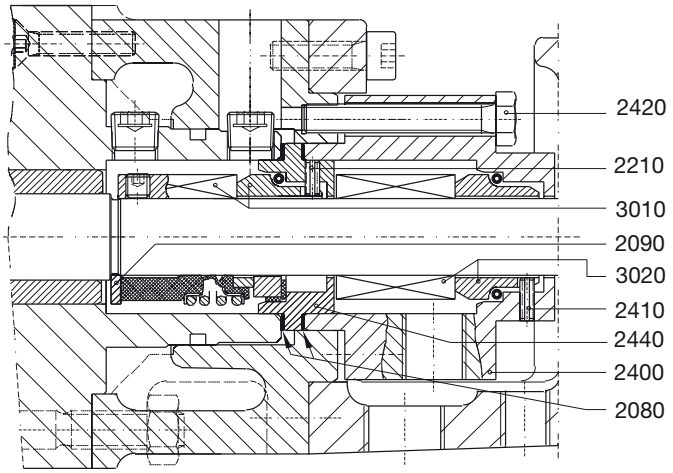
### 5.1.5.2 Single mechanical seal – GS

| Pos. | Description | Nos./ pump | Preventive | Overhaul |
|---|---|---|---|---|
| 2080 | gasket | 1 | x | x |
| 2090 | support ring (optional) | 1 | | |
| 2200 | seal cover | 1 | | |
| 2210 | pin | 1 | | |
| 2220 | tap bolt | 4 | | |
| 3010 | mechanical seal | 1 | x | x |



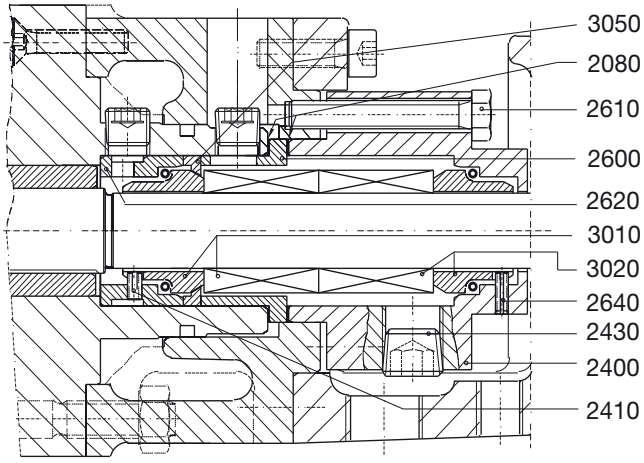

### 5.1.5.3 Double mechanical seal tandem – GG

| Pos. | Description | Nos./ pump | Preventive | Overhaul |
|---|---|---|---|---|
| 2080 | gasket | 2 | x | x |
| 2090 | support ring (optional) | 1 | | |
| 2210 | pin | 1 | | |
| 2400 | seal cover | 1 | | |
| 2410 | pin | 1 | | |
| 2420 | tap bolt | 4 | | |
| 2440 | seat housing | 1 | | |
| 3010 | mechanical seal | 1 | x | x |
| 3020 | mechanical seal | 1 | x | x |

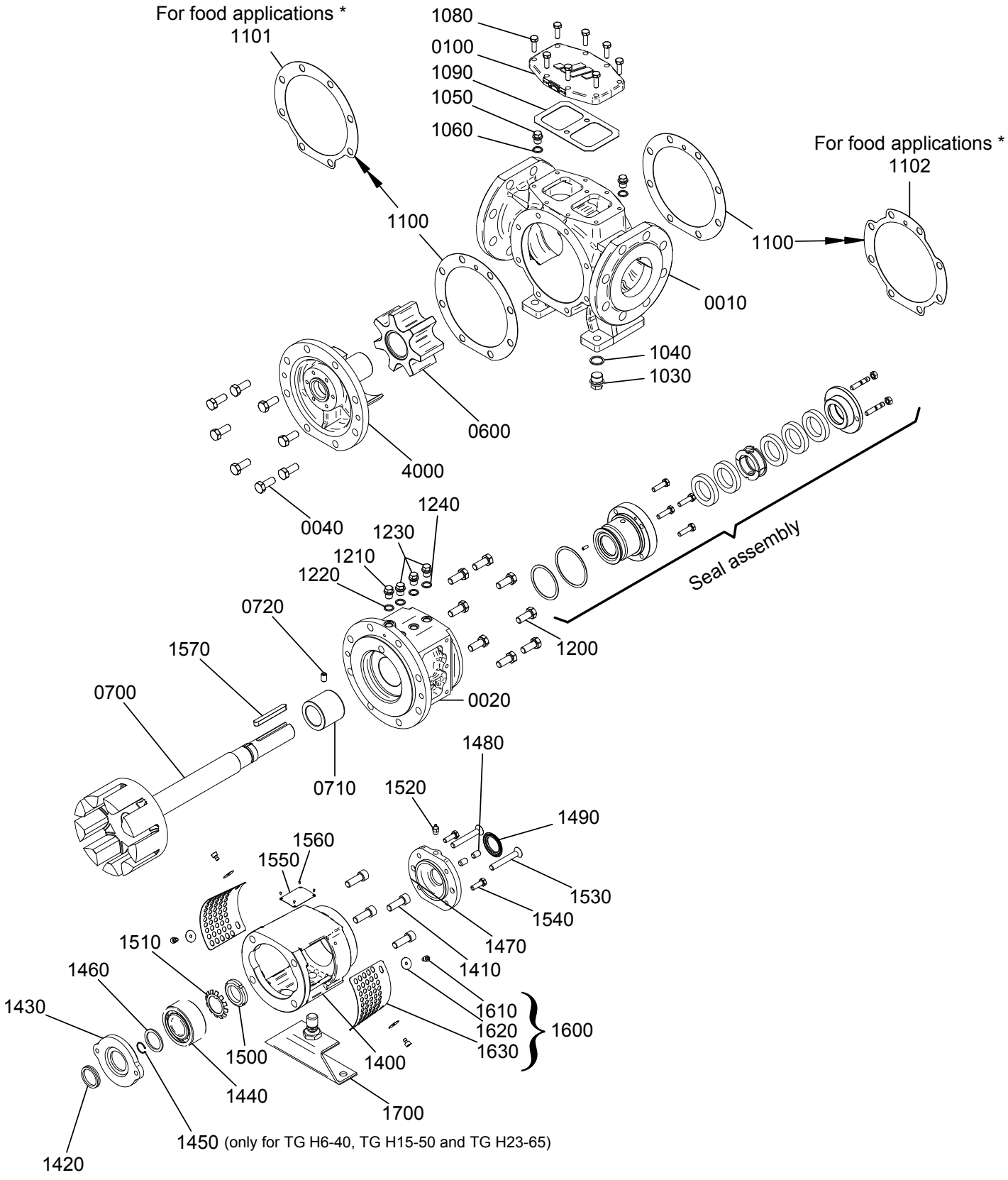



### 5.1.5.4 Double mechanical seal back-to-back – GD

| Pos. | Description | Nos./ pump | Preventive | Overhaul |
|---|---|---|---|---|
| 2080 | gasket | 2 | x | x |
| 2400 | seal cover | 1 | | |
| 2410 | pin | 1 | | |
| 2430 | plug | 2 | | |
| 2600 | spacer ring | 1 | | |
| 2610 | tap bolt | 4 | | |
| 2620 | seat housing | 1 | | |
| 2640 | pin | 1 | | |
| 3010 | mechanical seal | 1 | x | x |
| 3020 | mechanical seal | 1 | x | x |
| 3050 | retaining ring (optional) | 1 | | |



## 5.2 TG H6-40 to TG H360-150




** for food applications: shape of gaskets follows the shape onto the pump casing*

## 5.2.1 Hydraulic part

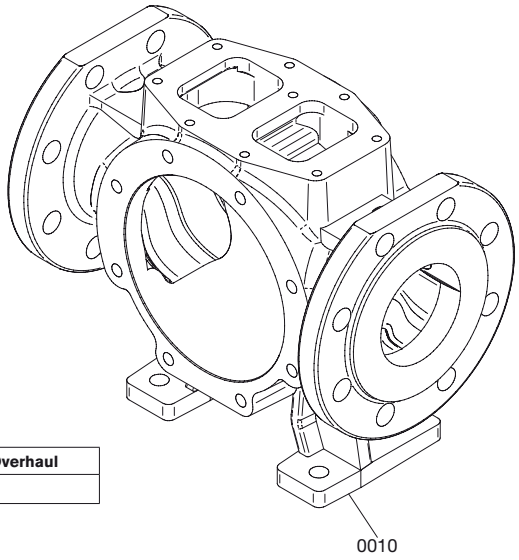
| Pos. | Description | H6-40 | H15-50 | H23-65 | H58-80 | H86-100 | H185-125 | H360-150 | Preventive | Overhaul |
|---|---|---|---|---|---|---|---|---|---|---|
| 0010 | pump casing | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | |
| 0020 | intermediate casing | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | |
| 0040 | tap bolt | 4 | 6 | 6 | 8 | 8 | 8 | 12 | | |
| 0100 | top cover, complete | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | |
| 0600 | idler + bush, complete | 1 | 1 | 1 | 1 | 1 | 1 | 1 | x | |
| 0700 | rotor + shaft, complete | 1 | 1 | 1 | 1 | 1 | 1 | 1 | x | |
| 0710 | bush bearing, on shaft | 1 | 1 | 1 | 1 | 1 | 1 | 1 | x | |
| 0720 | set screw | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | |
| 1030 | plug | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | |
| 1040 | sealing ring | 1 | 1 | 1 | 1 | 1 | 1 | 1 | x | x |
| 1050 | plug | 2 | 2 | 2 | 2 | 2 | 2 | 2 | | |
| 1060 | sealing ring | 2 | 2 | 2 | 2 | 2 | 2 | 2 | x | x |
| 1080 | tap bolt | 4 | 8 | 8 | 8 | 8 | 8 | 8 | | |
| 1090 | gasket | 1 | 1 | 1 | 1 | 1 | 1 | 1 | x | x |
| 1100* | gasket | 2 | 2 | 2 | 2 | 2 | 2 | 2 | x | x |
| *1101** | *gasket* | *1* | *1* | *1* | *1* | *1* | *1* | *1* | *x* | *x* |
| *1102** | *gasket* | *1* | *1* | *1* | *1* | *1* | *1* | *1* | *x* | *x* |
| 1200 | tap bolt | - | 6 | 6 | 6 | 6 | 8 | 12 | | |
| | stud bolt | 4 | - | - | - | - | - | - | | |
| | cap head screw | - | - | - | 2 | 2 | - | - | | |
| 1210 | plug | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | |
| 1220 | sealing ring | 1 | 1 | 1 | 1 | 1 | 1 | 1 | x | x |
| 1230 | plug | 2 | 2 | 2 | 3 | 3 | 3 | 3 | | |
| 1240 | sealing ring | 2 | 2 | 2 | 3 | 3 | 3 | 3 | x | x |
| 1570 | key | 1 | 1 | 1 | 1 | 1 | 1 | 1 | x | x |
| 1580 | nut | 4 | - | - | - | - | - | - | | |
| 4000 | pump cover + idler pin, complete | 1 | 1 | 1 | 1 | 1 | 1 | 1 | x | |

* *pos. 1100 applies for non-food pumps (2x per pump)*
*pos. 1101 and 1102 applies for food pumps (1 of each per pump)*

## 5.2.2 Bearing bracket

| Pos. | Description | H6-40 | H15-50 | H23-65 | H58-80 | H86-100 | H185-125 | H360-150 | Preventive | Overhaul |
|---|---|---|---|---|---|---|---|---|---|---|
| 1400 | bearing bracket | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | |
| 1410 | cap head screw | 4 | 4 | 4 | 4 | 4 | 4 | 4 | | |
| 1420 | V-seal | 1 | 1 | 1 | 1 | 1 | 1 | 1 | x | x |
| 1430 | bearing cover | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | |
| 1440 | ball-bearing - steel & metal cage | 1 | 1 | 1 | 1 | 1 | 1 | 2 | x | x |
| 1450 | circlip | 1 | 1 | 1 | - | - | - | - | x | |
| 1460 | support ring | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | |
| 1470 | bearing cover | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | |
| 1480 | set screw | 2 | 2 | 2 | 2 | 2 | 2 | 4 | | |
| 1490 | V-seal | 1 | 1 | 1 | 1 | 1 | 1 | 1 | x | x |
| 1500 | locking nut | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | |
| 1510 | locking washer | 1 | 1 | 1 | 1 | 1 | 1 | 1 | x | x |
| 1520 | grease nipple | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | |
| 1530 | countersunck screw | 2 | 2 | 2 | 2 | 2 | 2 | 4 | | |
| 1540 | tap bolt | 2 | 2 | 2 | 2 | 2 | 2 | 4 | | |
| 1550 | nameplate | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | |
| 1560 | rivet | 4 | 4 | 4 | 4 | 4 | 4 | 4 | | |
| 1600 | mesh guard, complete | 2 | 2 | 2 | 2 | 2 | 2 | 2 | | |
| *1610* | *Savetix® cap head screw - st. steel* | *4* | *4* | *4* | *4* | *4* | *4* | *4* | | |
| *1620* | *Savetix® washer - st. steel* | *4* | *4* | *4* | *4* | *4* | *4* | *4* | | |
| *1630* | *mesh guard - st. steel* | *2* | *2* | *2* | *2* | *2* | *2* | *2* | | |
| 1610 | cap head screw | 4 | 4 | 4 | 4 | 4 | 4 | 4 | | |
| 1700 | bracket support, complete | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | |

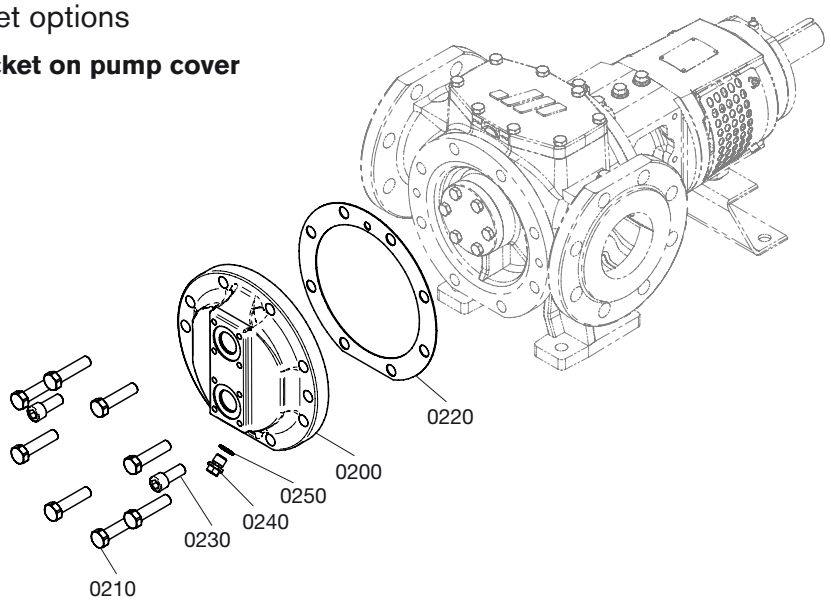
## 5.2.3 Flange connection options




| Pos. | Description | Nos./pump | Preventive | Overhaul |
|---|---|---|---|---|
| 0010 | pump casing | 1 | | |

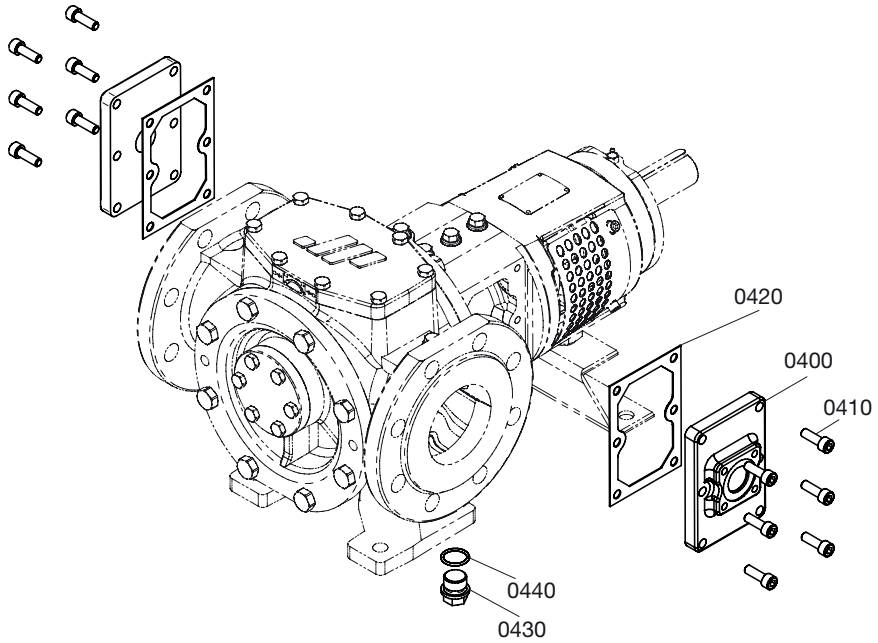
## 5.2.4 Jacket options

### 5.2.4.1 S-jacket on pump cover



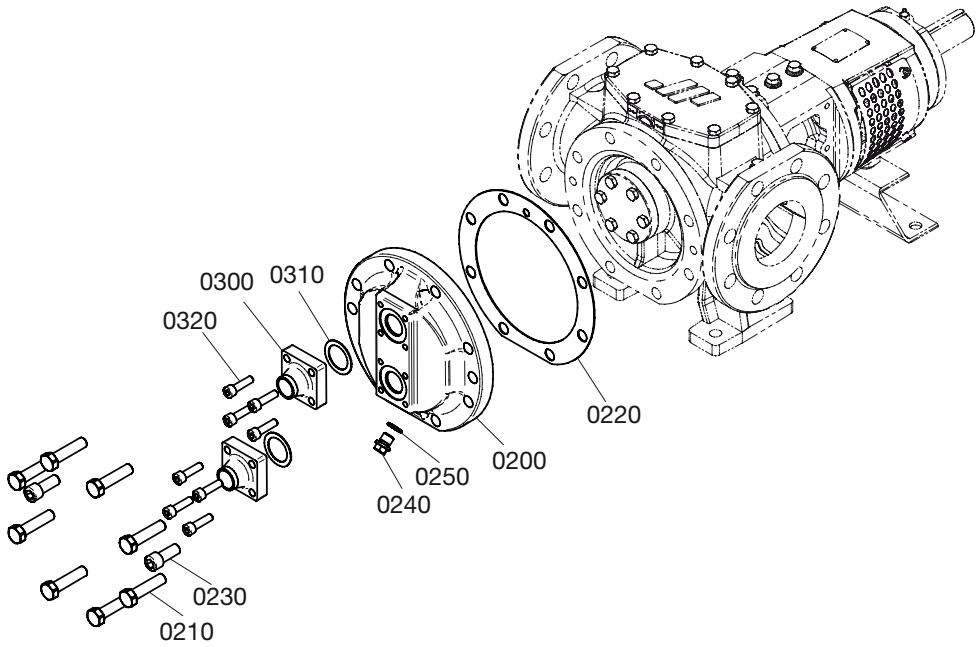

| Pos. | Description | H6-40 | H15-50 | H23-65 | H58-80 | H86-100 | H185-125 | H360-150 | Preventive | Overhaul |
|---|---|---|---|---|---|---|---|---|---|---|
| 0200 | jacket cover, on front | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | |
| 0210 | tap bolt | 4 | 6 | 6 | 8 | 8 | 8 | 12 | | |
| | cap head screw | - | 6 | 6 | - | - | - | - | | |
| 0220 | gasket | 1 | 1 | 1 | 1 | 1 | 1 | 1 | x | x |
| 0230 | cap head screw | 4 | - | - | 2 | 2 | 4 | 6 | | |
| | tap bolt | - | 6 | 6 | - | - | - | - | | |
| 0240 | plug | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | |
| 0250 | sealing ring | 1 | 1 | 1 | 1 | 1 | 1 | 1 | x | x |

### 5.2.4.2 S-jacket around shaft seal



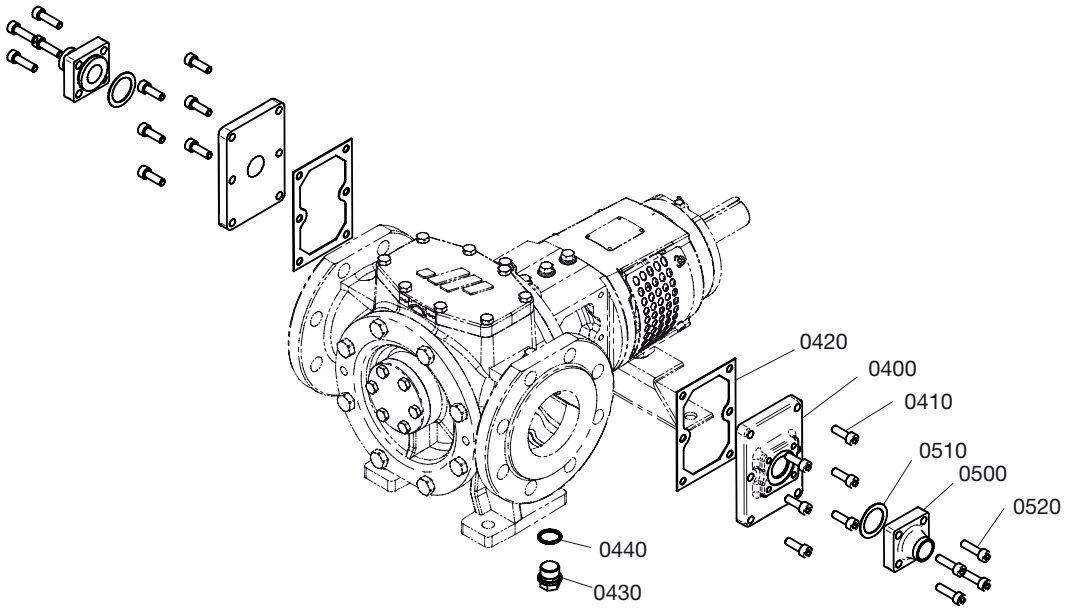

| Pos. | Description | H6-40 | H15-50 | H23-65 | H58-80 | H86-100 | H185-125 | H360-150 | Preventive | Overhaul |
|---|---|---|---|---|---|---|---|---|---|---|
| 0400 | jacket cover, on shaft seal | 2 | 2 | 2 | 2 | 2 | 2 | 2 | | |
| 0410 | cap head screw | 8 | 8 | 8 | 12 | 12 | 12 | 12 | | |
| 0420 | gasket | 2 | 2 | 2 | 2 | 2 | 2 | 2 | x | x |
| 0430 | plug | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | |
| 0440 | sealing ring | 1 | 1 | 1 | 1 | 1 | 1 | 1 | x | x |

### 5.2.4.3 T-jackets with flange connections on pump cover




| Pos. | Description | H6-40 | H15-50 | H23-65 | H58-80 | H86-100 | H185-125 | H360-150 | Preventive | Overhaul |
|---|---|---|---|---|---|---|---|---|---|---|
| 0200 | jacket cover, on front | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | |
| 0210 | tap bolt | 4 | - | - | 8 | 8 | 8 | 12 | | |
| | cap head screw | - | 6 | 6 | - | - | - | - | | |
| 0220 | gasket | 1 | 1 | 1 | 1 | 1 | 1 | 1 | x | x |
| 0230 | cap head screw | 2 | - | - | 2 | 2 | 4 | 6 | | |
| | tap bolt | - | 2 | 2 | - | - | - | - | | |
| 0240 | plug | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | |
| 0250 | sealing ring | 1 | 1 | 1 | 1 | 1 | 1 | 1 | x | x |
| 0300 | welding neck flange | 2 | 2 | 2 | 2 | 2 | 2 | 2 | | |
| 0310 | gasket | 2 | 2 | 2 | 2 | 2 | 2 | 2 | x | x |
| 0320 | cap head screw | 8 | 8 | 8 | 8 | 8 | 8 | 8 | | |

### 5.2.4.4 T-jackes with flange connections around shaft seal

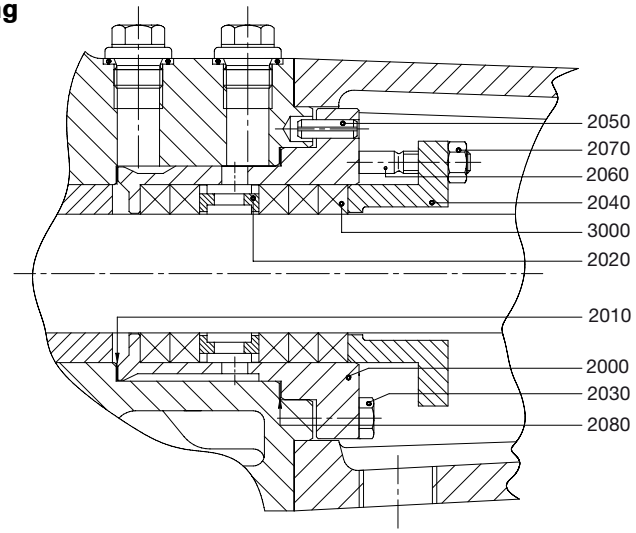



| Pos. | Description | H6-40 | H15-50 | H23-65 | H58-80 | H86-100 | H185-125 | H360-150 | Preventive | Overhaul |
|---|---|---|---|---|---|---|---|---|---|---|
| 0400 | jacket cover, on shaft seal | 2 | 2 | 2 | 2 | 2 | 2 | 2 | | |
| 0410 | cap head screw | 8 | 8 | 8 | 12 | 12 | 12 | 12 | | |
| 0420 | gasket | 2 | 2 | 2 | 2 | 2 | 2 | 2 | x | x |
| 0430 | plug | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | |
| 0440 | sealing ring | 1 | 1 | 1 | 1 | 1 | 1 | 1 | x | x |
| 0500 | welding neck flange | 2 | 2 | 2 | 2 | 2 | 2 | 2 | | |
| 0510 | gasket | 2 | 2 | 2 | 2 | 2 | 2 | 2 | x | x |
| 0520 | cap head screw | 8 | 8 | 8 | 8 | 8 | 8 | 8 | | |

## 5.2.5 Shaft seal options

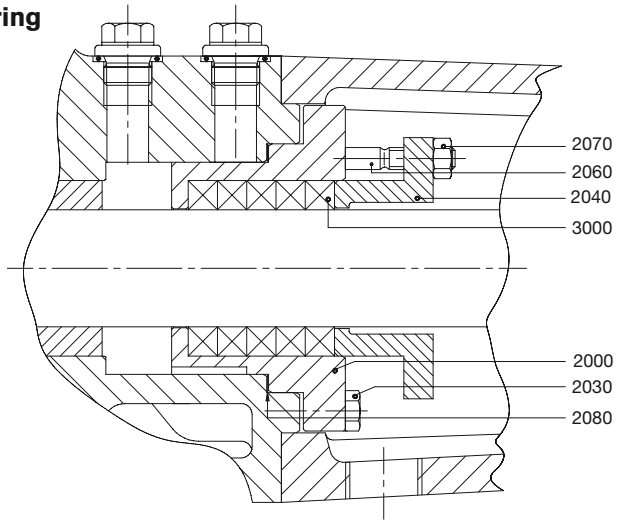
### 5.2.5.1 Packing rings PQ with lantern ring

| Pos. | Description | Nos./ pump | Preventive | Overhaul |
|---|---|---|---|---|
| 2000 | stuffing box housing | 1 | | |
| 2010 | gasket | 1 | x | x |
| 2020 | lantern ring, split | 1 | | |
| 2030 | tap bolt | 4 | | |
| 2040 | gland | 1 | | |
| 2050 | pin | 1 | | |
| 2060 | stud bolt | 2 | | |
| 2070 | nut | 2 | | |
| 2080 | gasket | 1 | x | x |
| 3000 | packing ring | 5 | x | x |



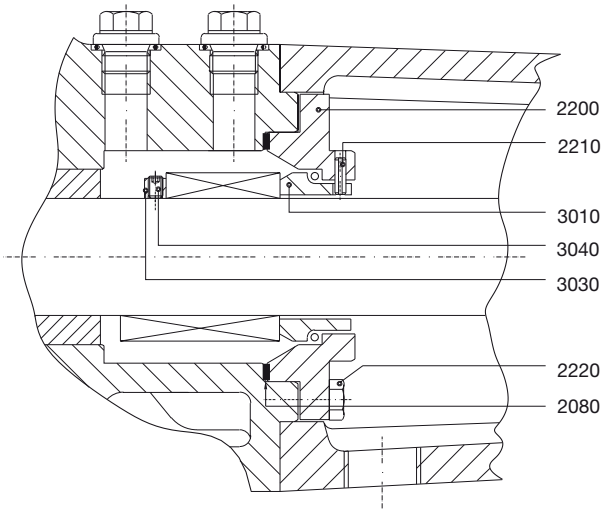

### 5.2.5.2 Packing rings PO without lantern ring

| Pos. | Description | Nos./ pump | Preventive | Overhaul |
|---|---|---|---|---|
| 2000 | stuffing box housing | 1 | | |
| 2030 | tap bolt | 4 | | |
| 2040 | gland | 1 | | |
| 2060 | stud bolt | 2 | | |
| 2070 | nut | 2 | | |
| 2080 | gasket | 1 | x | x |
| 3000 | packing ring | 5 | x | x |

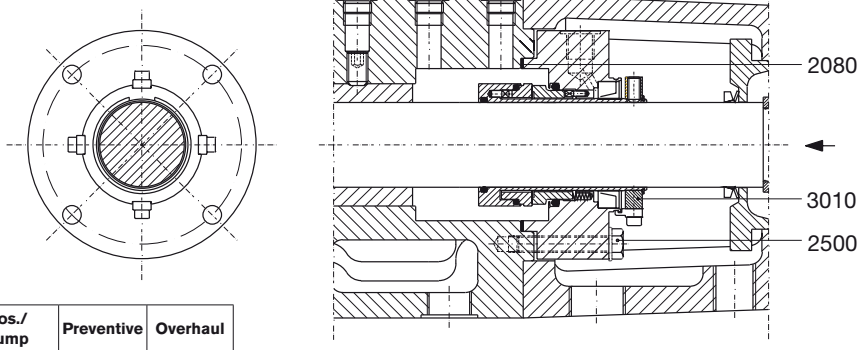



### 5.2.5.3 Single mechanical seal – GS

| Pos. | Description | Nos./ pump | Preventive | Overhaul |
|---|---|---|---|---|
| 2080 | gasket | 1 | x | x |
| 2200 | seal cover | 1 | | |
| 2210 | pin | 1 | | |
| 2220 | tap bolt | 4 | | |
| 3010 | mechanical seal | 1 | x | x |
| 3030 | set ring (optional) | 1 | | |
| 3040 | set screw (optional) | 2 | | |



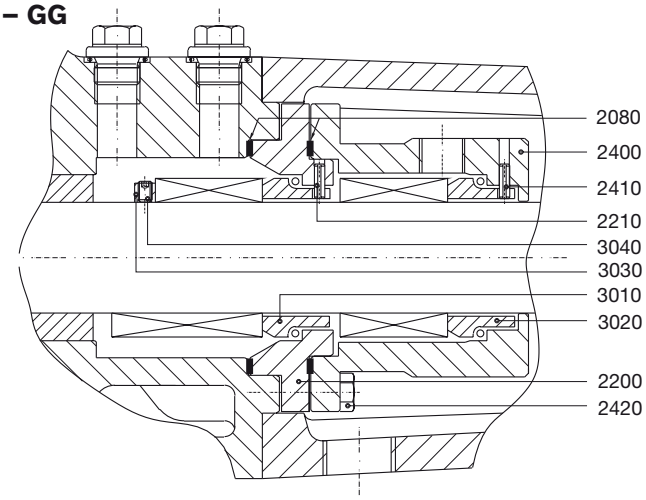
### 5.2.5.4 Cartridge mechanical seal – GC




| Pos. | Description | Nos./ pump | Preventive | Overhaul |
|---|---|---|---|---|
| 2080 | gasket | 1 | x | x |
| 2500 | tap bolt | 4 | | |
| 3010 | cartridge mechanical seal | 1 | x | x |

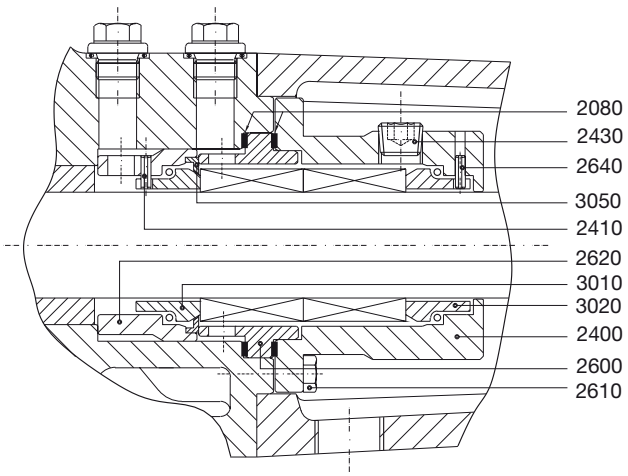
### 5.2.5.5 Double mechanical seal tandem – GG

| Pos. | Description | Nos./ pump | Preventive | Overhaul |
|---|---|---|---|---|
| 2080 | gasket | 2 | x | x |
| 2200 | seal cover | 1 | | |
| 2210 | pin | 1 | | |
| 2400 | seal cover | 1 | | |
| 2410 | pin | 1 | | |
| 2420 | tap bolt | 4 | | |
| 3010 | mechanical seal | 1 | x | x |
| 3020 | mechanical seal | 1 | x | x |
| 3030 | set ring (optional) | 1 | | |
| 3040 | set screw (optional) | 2 | | |

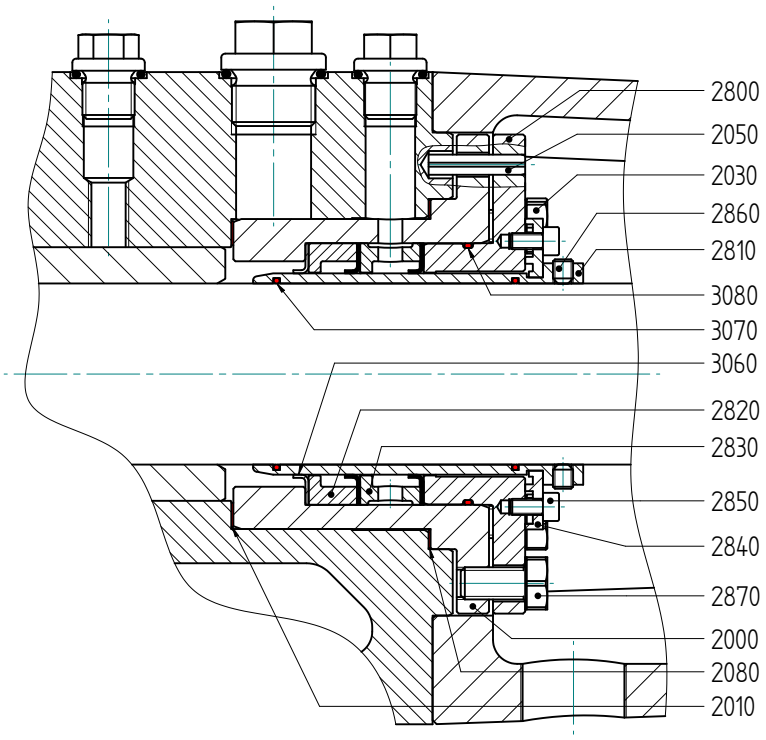



### 5.2.5.6 Double mechanical seal back-to-back – GD

| Pos. | Description | Nos./ pump | Preventive | Overhaul |
|---|---|---|---|---|
| 2080 | gasket | 2 | x | x |
| 2400 | seal cover | 1 | | |
| 2410 | pin | 1 | | |
| 2430 | plug | 2 | | |
| 2600 | spacer ring | 1 | | |
| 2610 | tap bolt | 4 | | |
| 2620 | seat housing | 1 | | |
| 2640 | pin | 1 | | |
| 3010 | mechanical seal | 1 | x | x |
| 3020 | mechanical seal | 1 | x | x |
| 3050 | retaining ring (optional) | 1 | | |

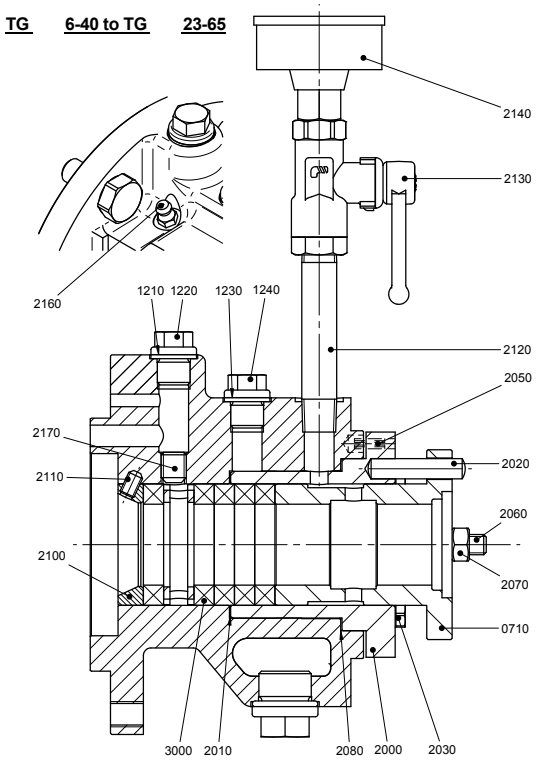


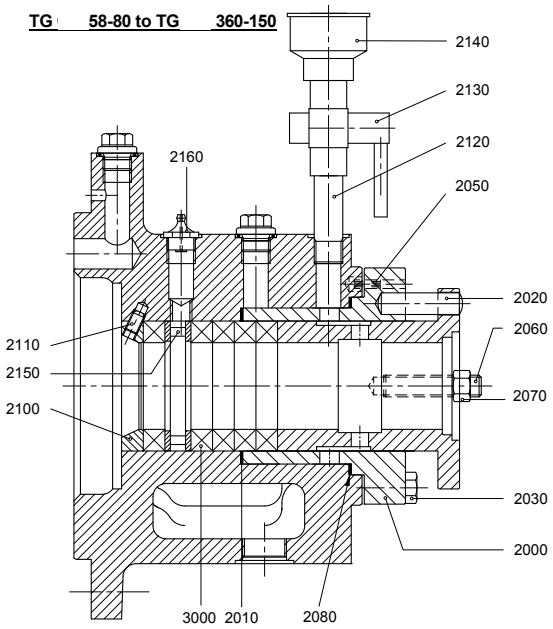
### 5.2.5.7 Cartridge mecanical seal - LCT TV (LCT XX)




| Pos. | Description | H6-40 | H15-50<br>H23-65 | H58-80<br>H86-100 | H185-125<br>H360-150 | Preventive | Overhaul |
|---|---|---|---|---|---|---|---|
| 2000 | stuffing box | 1 | 1 | | | | |
| 2010 | gasket | 1 | 1 | | | x | x |
| 2030 | tap bolt for seal | 4 | 4 | | | | |
| 2050 | pin | 1 | 1 | | | | |
| 2080 | gasket | 1 | 1 | | | x | x |
| 2800 | gland | 1 | 1 | | | | |
| 2810 | shaft sleeve | 1 | 1 | | | | |
| 2820 | support ring | 2 | 2 | | | | |
| 2830 | support ring for lubrication | 1 | 1 | | | | |
| 2840 | locking | 2 | 4 | | | | |
| 2850 | allen screw (for locking) | 2 | 4 | | | | |
| 2860 | set screw (for shaft sleeve) | 4 | 4 | | | | |
| 2870 | tap bolt (for gland and box) | 2 | 2 | | | | |
| 3060 | PTFE lip (gylon) | 3 | 3 | | | x | x |
| 3070 | o-ring (viton) | 2 | 2 | | | x | x |
| 3080 | o-ring (viton) | 1 | 1 | | | x | x |

### 5.2.5.7 Reverted packing – Chocolate version



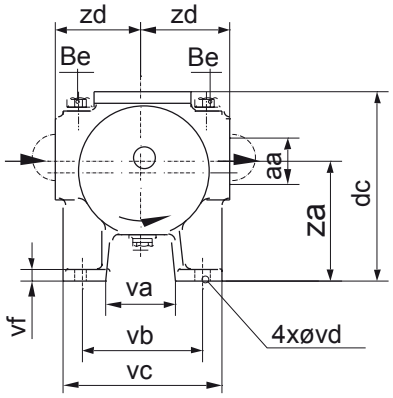



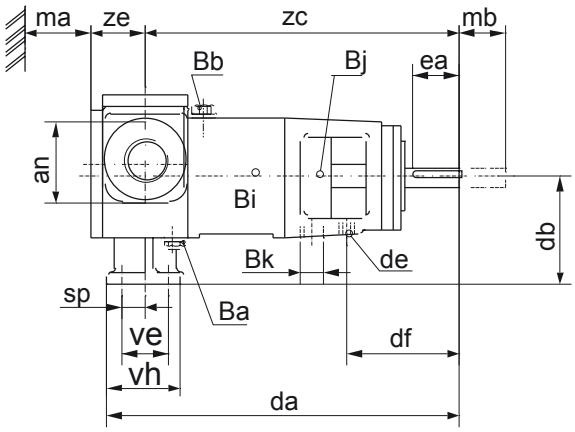

| Pos. | Description | H6-40 | H15-50 H23-65 | H58-80 H86-100 | H185-125 H360-150 | Preventive | Overhaul |
|---|---|---|---|---|---|---|---|
| 0710 | bush bearing | 1 | 1 | 1 | 1 | | |
| 2000 | stuffing box housing | 1 | 1 | 1 | 1 | | |
| 2010 | gasket | 1 | 1 | 1 | 1 | x | x |
| 2020 | dowel pin | 1 | 1 | 1 | 1 | | |
| 2030 | tap bolt | 4 | 4 | 4 | 4 | | |
| 2050 | pin | 1 | 1 | 1 | 1 | | |
| 2060 | stud bolt | 2 | 2 | 2 | 2 | | |
| 2070 | nut | 2 | 2 | 2 | 2 | | |
| 2080 | gasket | 1 | 1 | 1 | 1 | x | x |
| 2100 | support ring | 1 | 1 | 1 | 1 | | |
| 2110 | set screw | 3 | 3 | 3 | 3 | | |
| 2120 | pipe nipple | 1 | 1 | 1 | 1 | | |
| 2130 | check valve | 1 | 1 | 1 | 1 | | |
| 2140 | grease cup | 1 | 1 | 1 | 1 | | |
| 2150 | lantern ring (LR) | 1 | 1 | 1 | 1 | | |
| 2160 | grease nipple | 1 | 1 | 1 | 1 | | |
| 2170 | set screw | 1 | 1 | - | - | | |
| 3000 | packing ring | 4 | 5 | | 5 | x | x |
| | packing ring sequence | {1+LR+3} | {1+LR+4} | | {2+LR+3} | | |

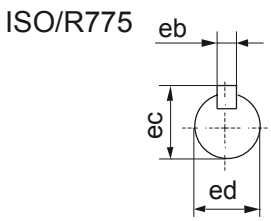
# 6.0 Dimensional drawings

## 6.1 Standard pump

### 6.1.1 TG H2-32 to TG H3-32

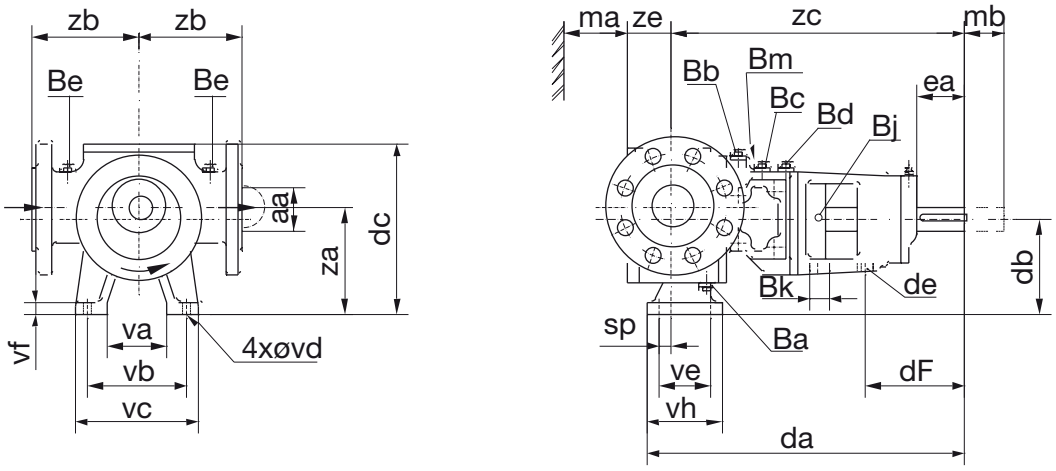


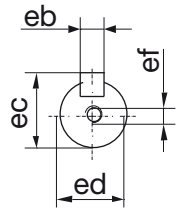




| | TG H2-32<br>TG H3-32 |
|---|---|
| aa | G 1 1/4 |
| an | 60 |
| Ba | G 1/4 |
| Bb | G 1/8 |
| Be | G 1/4 |
| Bi | Rp 1/8 |
| Bj | Rp 1/8 |
| Bk | Rp 3/8 |
| da | 246 |
| db | 80 |
| dc | 147 |
| de | M10 |
| df | 78 |
| ea | 34 |
| eb | 5 h9 |
| ec | 16 |
| ed | 14 j6 |
| ma | 50 |
| mb | 85 |
| sp | 17.5 |
| va | 51 |
| vb | 90 |
| vc | 115 |
| vd | 10 |
| ve | 35 |
| vf | 10 |
| vh | 55 |
| za | 90 |
| zc | 218 |
| zd | 65 |
| ze | 41 |

## 6.1.2 TG H6-40 to TG H360-150



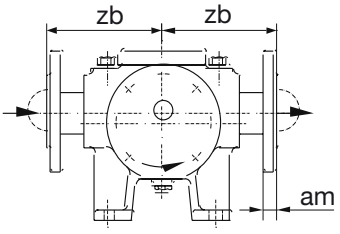

ISO/R775

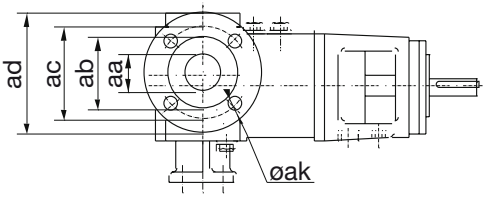



| | TG H6-40 | TG H15-50 | TG H23-65 | TG H58-80 | TG H86-100 | TG H185-125 | TG H360-150 |
|---|---|---|---|---|---|---|---|
| aa | 40 | 50 | 65 | 80 | 100 | 125 | 150 |
| Ba | G 1/4 | G 1/4 | G 1/4 | G 1/2 | G 1/2 | G 1/2 | G 3/4 |
| Bb | G 1/4 | G 1/4 | G 1/4 | G 1/4 | G 1/4 | G 1/4 | G 1/2 |
| Bc | G 1/4 | G 1/4 | G 1/4 | G 1/2 | G 1/2 | G 1/2 | G 1/2 |
| Bd | G 1/4 | G 1/4 | G 1/4 | G 1/4 | G 1/4 | G 1/4 | G 1/4 |
| Be | G 1/4 | G 1/4 | G 1/4 | G 1/4 | G 1/4 | G 1/4 | G 1/4 |
| Bj | Rp 1/4 | Rp 1/4 | Rp 1/4 | Rp 1/4 | Rp 1/4 | Rp 1/4 | Rp 1/4 |
| Bk | Rp 3/8 | Rp 1/2 | Rp 1/2 | Rp 3/4 | Rp 3/4 | Rp 3/4 | Rp 3/4 |
| Bm | – | – | – | G 1/4 | G 1/4 | G 1/4 | G 1/4 |
| da | 312 | 389 | 400 | 493 | 526 | 633 | 774 |
| db | 100 | 112 | 112 | 160 | 160 | 200 | 250 |
| dc | 191 | 209 | 219 | 297 | 315 | 380 | 468 |
| de | M12 | M16 | M16 | M20 | M20 | M20 | M20 |
| df | 78 | 126 | 126 | 159 | 162 | 204 | 199 |
| ea | 40 | 60 | 60 | 80 | 80 | 110 | 110 |
| eb | 6 h9 | 8 h9 | 8h9 | 10 h9 | 10 h9 | 14 h9 | 16 h9 |
| ec | 20.5 | 31 | 31 | 35 | 40 | 51.5 | 59 |
| ed | 18 j6 | 28 j6 | 28 j6 | 32 k6 | 37 k6 | 48 k6 | 55 m6 |
| ef | M6 | M10 | M10 | M12 | M12 | M16 | M20 |
| ma | 60 | 75 | 80 | 105 | 125 | 155 | 200 |
| mb | 80 | 75 | 80 | 100 | 115 | 155 | 185 |
| sp | 22 | 15 | 26 | 22.5 | 32 | 30.5 | 85 |
| va | 53 | 70 | 80 | 100 | 100 | 120 | 160 |
| vb | 100 | 120 | 130 | 160 | 160 | 200 | 270 |
| vc | 127 | 150 | 160 | 200 | 200 | 260 | 330 |
| vd | 12 | 12 | 12 | 14 | 14 | 18 | 22 |
| ve | 45 | 60 | 60 | 90 | 90 | 125 | 180 |
| vf | 11 | 14 | 14 | 17 | 17 | 22 | 24 |
| vh | 70 | 90 | 90 | 125 | 125 | 170 | 230 |
| za | 110 | 125 | 125 | 180 | 185 | 230 | 300 |
| zb | 100 | 125 | 125 | 160 | 180 | 200 | 240 |
| zc | 277 | 359 | 359 | 453 | 476 | 580 | 664 |
| ze | 61 | 68 | 80 | 94 | 109 | 132 | 168 |

## 6.2 Flange connections

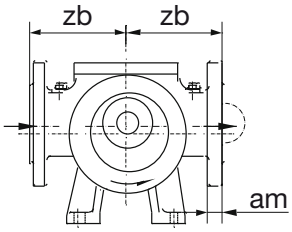
### 6.2.1 TG H2-32 to TG H3-32

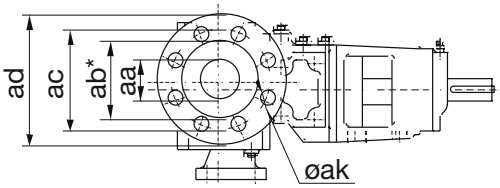



| | TG H2-32<br>TG H3-32 |
|---|---|
| aa | 32 |
| ab | 73 |
| ac PN16/25/40 | 100 |
| ac PN20 | 89 |
| ac PN50 | 98.5 |
| ad PN16/25/40 | 140 |
| ad PN20 | 120 |
| ad PN50 | 135 |
| ak PN16/25/40 | 4xd18 |
| ak PN20 | 4xd16 |
| ak PN50 | 4xd18 |
| am PN16/25/40 | 32 |
| am PN20 | 32 |
| am PN50 | 33.5 |
| zb | 220 |

### 6.2.2 TG H6-40 to TG H360-150



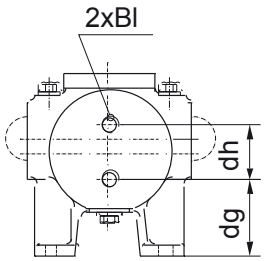

| | TG H6-40 | TG H15-50 | TG H23-65 | TG H58-80 | TG H86-100 | TG H185-125 | TG H360-150 |
|---|---|---|---|---|---|---|---|
| aa | 40 | 50 | 65 | 80 | 100 | 125 | 150 |
| ab | – (*) | 98 | 120 | 133 | 160 | 186 | 212 (*) |
| ac PN16 | 110 | 125 | 145 | 160 | 180 | 210 | 241 |
| ac PN20 | 98.5 | 120.6 | 139.7 | 152.5 | 190.5 | 216 | 241 |
| ac PN25 | 110 | 125 | 145 | 160 | 190 | 220 | 250 |
| ac PN40 | 110 | 125 | 145 | 160 | 190 | 220 | 250 |
| ac PN50 | 114.5 | 127 | 149.4 | 168.1 | 200.2 | 235 | 270 |
| ad | 150 (**) | 165 | 187 | 206 | 238 | 273 | 310 |
| ak PN16 | 4xd18 | 4xd18 | 4xd18 | 8xd18 | 8xd18 | 8xd18 | 8xd23 |
| ak PN20 | 4xd16 | 4xd18 | 4xd18 | 4xd18 | 8xd18 | 8xd22 | 8xd23 |
| ak PN25 | 4xd18 | 4xd18 | 8xd18 | 8xd18 | 8xd22 | 8xd26 | 8xd28 |
| ak PN40 | 4xd18 | 4xd18 | 8xd18 | 8xd18 | 8xd22 | 8xd26 | 8xd28 |
| ak PN50 | 4xd22 | 8xd18 | 8xd22 | 8xd22 | 8xd22 | 8xd22 | 12xd23 |
| am | 18 | 21 | 21 | 24 | 25 | 28 | 30 |
| zb | 100 | 125 | 125 | 160 | 180 | 200 | 240 |

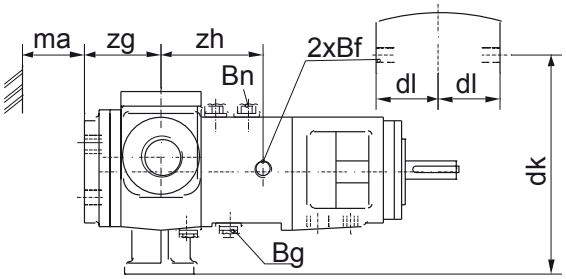
**) TG H6-40 and TG H360-150 (materials R and S): FF = Flat Flanges*
***) TG H6-40 square flanges instead of rounded flanges*

# 6.3 Jackets

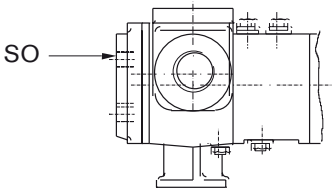
## 6.3.1 TG H2-32 and TG H3-32

Jackets for pump cover and thread connection, and jacket around shaft seal and thread connection (SS)

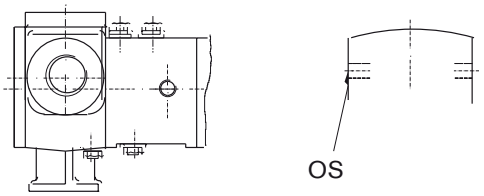



Jackets for pump cover and thread connection without jacket around shaft seal and thread connection (SO)



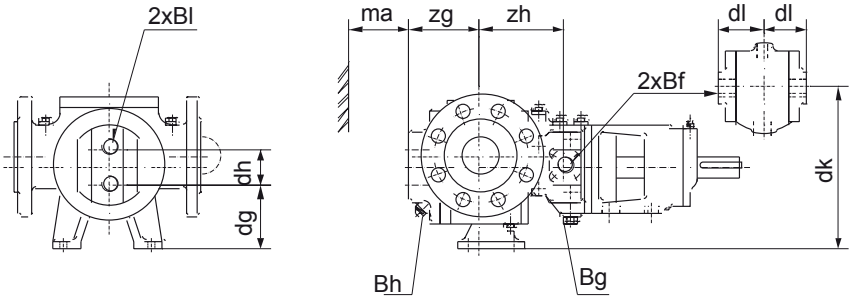

No jackets for pump cover but jacket around shaft seal and thread connection (OS)



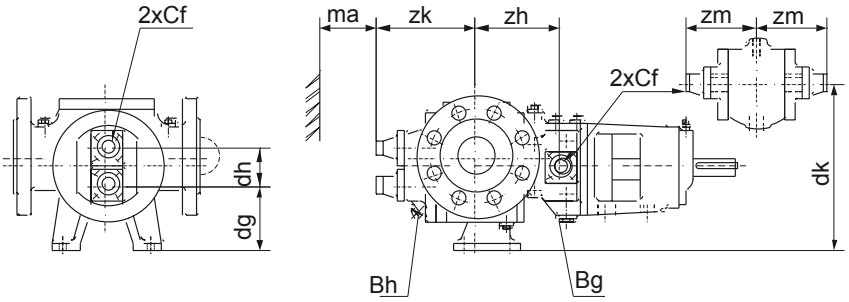

| | TG H2-32<br>TG H3-32 |
|---|---|
| Bf | G 1/4 |
| Bg | G 1/4 |
| Bl | G 1/2 |
| Bn | G 1/4 |
| dg | 59 |
| dh | 42 |
| dk | 80 |
| dl | 45 |
| ma | 50 |
| zg | 61 |
| zh | 62 |

## 6.3.2 TG H6-40 to TG H360-150

Jackets for pumpcover and thread connection and jacket around shaft seal and thread connection (SS)

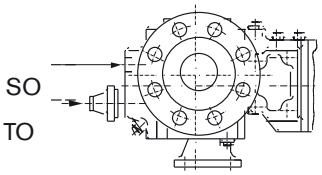



Jackets for pump cover and flange connection and jacket around shaft seal and flange connection (TT)



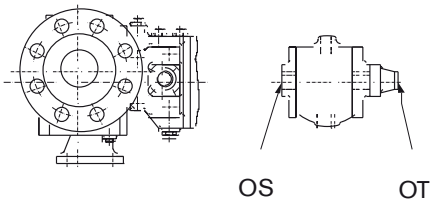

Jackets for pump cover and thread connection without jacket around shaft seal (SO)

Jackets for pump cover and flange connection without jacket around shaft seal (TO)




No jackets for pump cover but jacket around shaft seal and thread connection(OS)

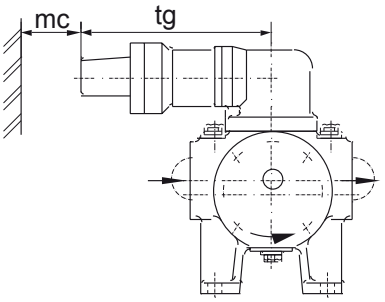
No jackets for pump cover but jacket around shaft seal and flange connection(OT)

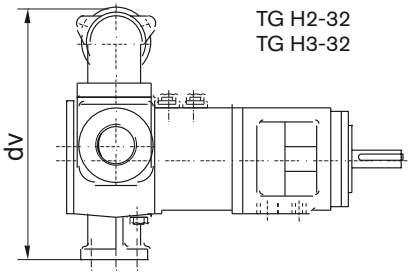



| | TG H6-40 | TG H15-50 | TG H23-65 | TG H58-80 | TG H86-100 | TG H185-125 | TG H360-150 |
|---|---|---|---|---|---|---|---|
| Bf | G 1/4 | G 1/2 | G 1/2 | G 3/4 | G 3/4 | G 3/4 | G 3/4 |
| Bg | G 1/4 | G 1/2 | G 1/2 | G 1/2 | G 1/2 | G 1/2 | G 1/2 |
| Bh | G 1/8 | G 1/4 | G 1/4 | G 1/4 | G 1/4 | G 1/4 | G 1/4 |
| Bl | G 1/4 | G 1/2 | G 1/2 | G 3/4 | G 3/4 | G 3/4 | G 3/4 |
| Cf | 17.2x1.8 | 21.3x2 | 21.3x2 | 26.9x2.3 | 26.9x2.3 | 26.9x2.3 | 26.9x2.3 |
| dg | 80 | 87 | 84 | 121 | 115 | 135 | 175 |
| dh | 40 | 50 | 56 | 78 | 90 | 130 | 150 |
| dk | 100 | 112 | 112 | 160 | 160 | 200 | 250 |
| dl | 73 | 61 | 61 | 87 | 92 | 120 | 130 |
| ma | 60 | 75 | 80 | 105 | 125 | 155 | 200 |
| zg | 82 | 96 | 110 | 123 | 140 | 163 | 200 |
| zh | 88 | 115 | 115 | 137 | 147 | 183 | 220 |
| zm | 108 | 99 | 99 | 128 | 133 | 161 | 171 |
| zk | 116 | 134 | 148 | 165 | 182 | 205 | 241 |

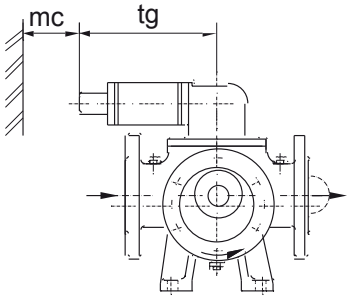
## 6.4 Safety relief valves

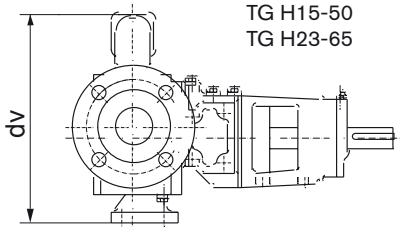
### 6.4.1 Single safety relief valve



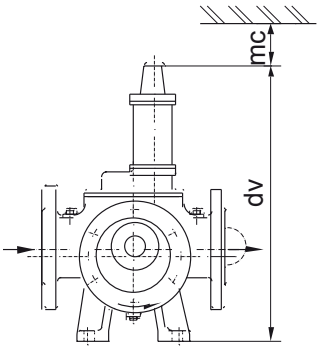



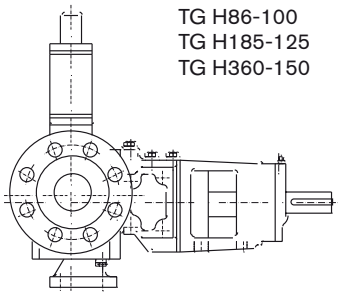

TG H2-32
TG H3-32




TG H6-40
TG H15-50
TG H23-65

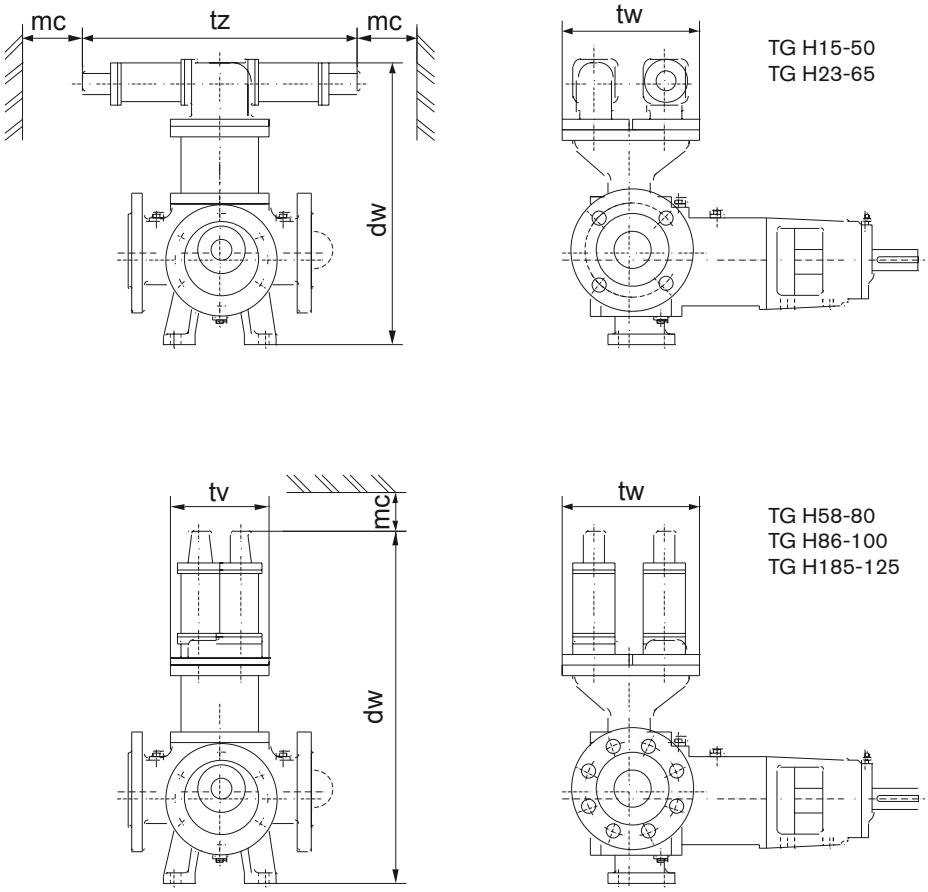


TG H58-80
TG H86-100
TG H185-125
TG H360-150

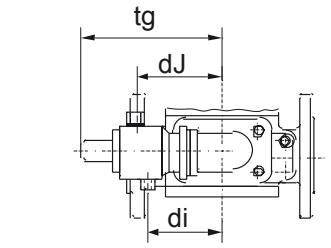
| | TG H2-32<br>TG H3-32 | TG H6-40 | TG H15-50 | TG H23-65 | TG H58-80 | TG H86-100 | TG H185-125 | TG H360-150 |
|---|---|---|---|---|---|---|---|---|
| dv | 210 | 254 | 293 | 303 | 555 | 581 | 646 | 852 |
| mc | 40 | 40 | 50 | 50 | 70 | 70 | 70 | 80 |
| tg | 145 | 145 | 200 | 200 | – | – | – | – |

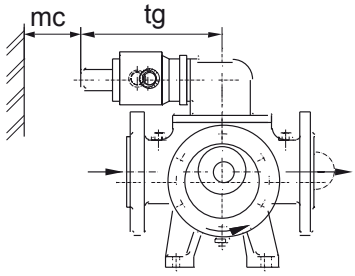
## 6.4.2 Double safety relief valve

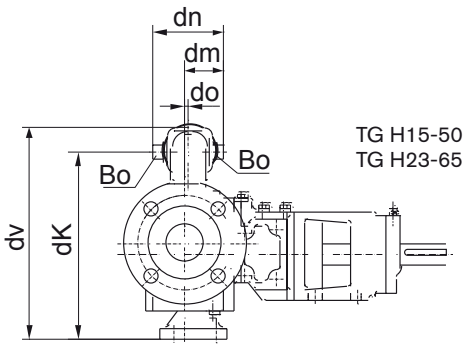


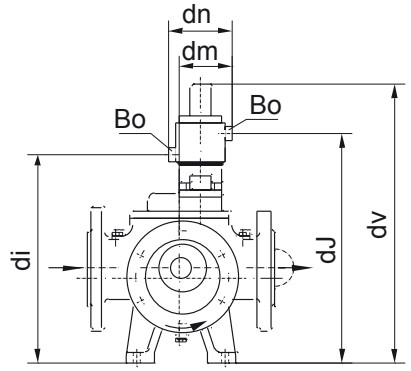

| | TG H15-50 | TG H23-65 | TG H58-80 | TG H86-100 | TG H185-125 |
|---|---|---|---|---|---|
| dw | 393 | 403 | 666 | 702 | 767 |
| mc | 50 | 50 | 70 | 70 | 70 |
| tv | – | – | 178 | 219 | 219 |
| tw | 184 | 184 | 238 | 300 | 300 |
| tz | 400 | 400 | – | – | – |

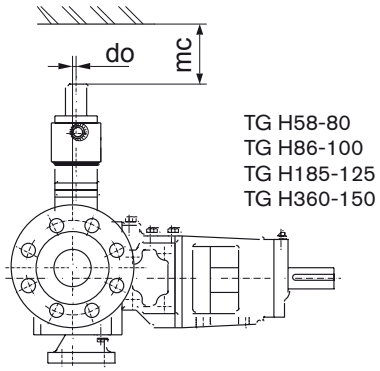
## 6.4.3 Heated safety relief valve



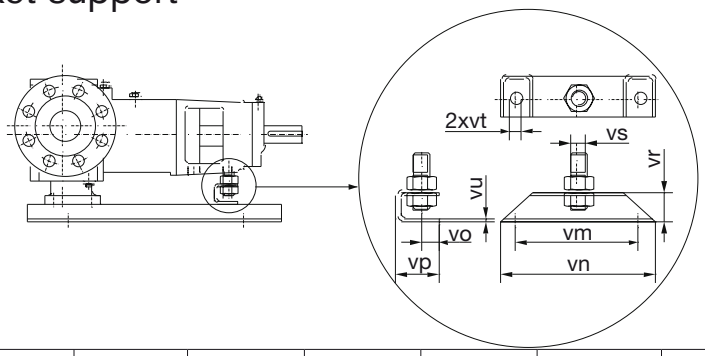




| | TG H15-50 | TG H23-65 | TG H58-80 | TG H86-100 | TG H185-125 | TG H360-150 |
|---|---|---|---|---|---|---|
| Bo | G 1/2 | G 1/2 | G 1/2 | G 1/2 | G 1/2 | G 1/2 |
| di | 101 | 101 | 418 | 444 | 509 | 618 |
| dj | 119 | 119 | 458 | 484 | 549 | 738 |
| dk | 253 | 263 | – | – | – | – |
| dm | 62 | 59.5 | 98.5 | 103.5 | 103.5 | 135 |
| dn | 115 | 115 | 127 | 127 | 127 | 170 |
| do | 6.5 | 4 | 6 | 8 | 24 | 0 |
| dv | 293 | 303 | 555 | 581 | 646 | 852 |
| mc | 50 | 50 | 70 | 70 | 70 | 80 |
| tg | 200 | 200 | – | – | – | – |

## 6.5 Bracket support




| | TG H2-32<br>TG H3-32 | TG H6-40 | TG H15-50 | TG H23-65 | TG H58-80 | TG H86-100 | TG H185-125 | TG H360-150 |
|---|---|---|---|---|---|---|---|---|
| vm | 90 | 100 | 120 | 120 | 160 | 160 | 200 | 270 |
| vn | 118 | 130 | 150 | 150 | 195 | 195 | 250 | 310 |
| vo | 10 | 17 | 17 | 17 | 20 | 20 | 20 | 20 |
| vp | 25 | 40 | 40 | 40 | 50 | 50 | 50 | 50 |
| vr | 20 | 30 | 30 | 30 | 50 | 50 | 50 | 100 |
| vs | M10 | M12 | M16 | M16 | M20 | M20 | M20 | M20 |
| vt | 10 | 12 | 12 | 12 | 14 | 14 | 14 | 18 |
| vu | 2 | 3 | 3 | 3 | 4 | 4 | 4 | 9 |

## 6.6 Weights – Mass

| | Version | Mass | Weight | TG H2-32 | TG H3-32 |
|---|---|---|---|---|---|
| Pump (without jackets) | GS | kg | daN | 8 | 9 |
| | PO/PQ | kg | daN | 9 | 10 |
| | GG/GD/GC | kg | daN | - | - |
| Front-Pull out (pump cover+idler) | | kg | daN | 1 | 1 |
| Back-Pull out (shaft+interm.casing+bracket) | | kg | daN | 6 | 6 |
| Screw on flanges (supplement) | | kg | daN | 5 | 8 |
| Jackets (supplement) | SO | kg | daN | 2 | 2 |
| | SS | kg | daN | 3 | 3 |
| | OS | kg | daN | 1 | 1 |
| Relief valve (supplement) | | kg | daN | 2 | 2 |

| | Version | Mass | Weight | TG H6-40 | TG H15-50 | TG H23-65 | TG H58-80 | TG H86-100 | TG H185-125 | TG H360-150 |
|---|---|---|---|---|---|---|---|---|---|---|
| Pump (without jackets) | GS | kg | daN | 19 | 30 | 38 | 71 | 93 | 163 | 278 |
| | PO/PQ/PR | kg | daN | 20 | 32 | 39 | 72 | 94 | 164 | 279 |
| | GG/GD/GC | kg | daN | 20 | 34 | 39 | 73 | 95 | 165 | 280 |
| Front-Pull out (pump cover+idler) | | kg | daN | 2.5 | 3 | 4 | 10 | 13 | 26 | 60 |
| Back-Pull out (shaft+interm.casing+bracket) | | kg | daN | 10 | 20 | 22 | 45 | 50 | 90 | 116 |
| Jackets (supplement) | SO | kg | daN | 2 | 3 | 3 | 5 | 7 | 12 | 16 |
| | SS | kg | daN | 3 | 4.5 | 4.5 | 8 | 10 | 18 | 22 |
| | OS | kg | daN | 1 | 1.5 | 1.5 | 3 | 3 | 6 | 6 |
| | TO | kg | daN | 2.5 | 3.5 | 3.5 | 5.5 | 8 | 13 | 21 |
| | TT | kg | daN | 4 | 5.5 | 5.5 | 9 | 12 | 20 | 28 |
| | OT | kg | daN | 1.5 | 2 | 2 | 3.5 | 4 | 7 | 7 |
| Relief valve (supplement) | | kg | daN | 2 | 5 | 5 | 8 | 11 | 11 | 24 |
| Double relief valve (supplement) | | kg | daN | - | 15 | 15 | 27 | 39 | 39 | - |

# Declaration of Compliance for food contact materials

**Manufacturer**
SPX Flow Technology Belgium NV
Evenbroekveld 2-6
BE-9420 Erpe-Mere
Belgium

We hereby certify the compliance of the materials coming into contact with food during the intended use with the general requirements as of the date of this Declaration of

**Regulation (EC) No 1935/2004 of 27 October 2004 on materials and articles intended to come into contact with food and repealing Directives 80/590/EEC and 89/109/EEC.**

This Declaration applies to the following product(s):

Product: **TopGear internal gear pump**

Configurations:

**TG GP xx-xx FD G# OS UG6 UG6 AW**
**TG GP xx-xx FD G# OS UR6 UR6 AW**
**TG GP xx-xx FD G# SS UG6 UG6 AW**
**TG GP xx-xx FD G# SS UR6 UR6 AW**

**TG GP xx-xx FD G# OS SG2 SG2 AW**
**TG GP xx-xx FD G# OS UG6 SG2 AW**
**TG GP xx-xx FD G# SS SG2 SG2 AW**
**TG GP xx-xx FD G# SS UG6 SG2 AW**

**TG GM yy-yy FD G# OO SG2 BG2 PRAW**
**TG GM yy-yy FD G# OO UG6 BG2 PRAW**
**TG GM yy-yy FD G# OO UR6 BR6 PRAW**
**TG GM yy-yy FD G# OO SG2 SG2 GS WV**
**TG GM yy-yy FD G# OO UR6 UR8 GS WV**
**TG GM yy-yy FD G# OO UG6 SG2 GS WV**

**TG GM xx-xx FD G# OS SG2 BG2 PRAW**
**TG GM xx-xx FD G# OS UG6 BG2 PRAW**
**TG GM xx-xx FD G# OS UR6 BR6 PRAW**
**TG GM xx-xx FD G# OS SG2 SG2 GS WV**
**TG GM xx-xx FD G# OS UR6 UR8 GS WV**
**TG GM xx-xx FD G# OS UG6 SG2 GS WV**

**TG GM xx-xx FD G# SS SG2 BG2 PRAW**
**TG GM xx-xx FD G# SS UG6 BG2 PRAW**
**TG GM xx-xx FD G# SS UR6 BR6 PRAW**
**TG GM xx-xx FD G# SS SG2 SG2 GS WV**
**TG GM xx-xx FD G# SS UR6 UR8 GS WV**
**TG GM xx-xx FD G# SS UG6 SG2 GS WV**

**TG H xx-xx FD R# OO UR6 BR6 PRAW**
**TG H xx-xx FD R# OO UR6 UR8 GS WV**

**TG H xx-xx FD R# SS UR6 BR6 PRAW**
**TG H xx-xx FD R# SS UR6 UR8 GS WV**

**with: xx-xx: from 6-40 to 360-150**
**yy-yy: from 6-40 to 23-65**
**# : 1, 2, 3, 4 or 5**

For materials made from plastic the following additional declarations apply:

- "Certificate of compliance with EC1935/2004 food contact" for gaskets in Gylon® by supplier Eriks+Baudoin (see page 103)
- "Certificate of compliance with EC1935/2004 food contact" for gaskets in RX Flowtite® by supplier Eriks+Baudoin (see page 104)
- "Zertifikat – Bewertung der lebensmittelrechtlichen Konformität von Stopfbuchspackungen" for packing rings in Buramex®-SF 6335 by supplier EagleBurgmann (see page 105-106)
- "Declaration acc. FDA-requirement" for mechanical seal M7N by supplier EagleBurgmann (see page 107-108)

This Declaration shall be valid for a period of three years from the date that the pump has been shipped from our production unit.

This Declaration does not modify any contractual arrangements, in particular regarding warranty and liability.

Erpe-Mere, 01 April 2014

Gerard Santema
General manager

27/09/2010

**ERIKS + BAUDOIN**

Antwerpen - *Anvers - Antwerp*
Boombekelaan 3
B-2660 Hoboken
België - *Belgique - Belgium*
tel. +32-3 829 26 11
fax. +32-3 828 39 59

# Conformiteitsattest EU1935/2004 voedingscontact

***Attestation de conformité CE 1935/2004 contact avec des denrées alimentaires***

*Certificate of compliance with EC1935/2004 food contact*

## EN 10204 2.1

*Omschrijving*
*Dénomination*
*Description*

**Gylon® BLUE 3504**

☑ AQUEOUS FOOD
☑ FATTY FOOD
☑ DRY FOOD

Wij bevestigen U, dat de door ons geleverde en hierboven beschreven goederen voldoen aan de EU1935/2004 voorschriften voor gebruik in de voedingsindustrie.

*Par la présente nous vous confirmons que la matériel livré en annexe , selon votre commande en référence , répond aux normes en vigueur suivant les spécifications de la CE1935/2004 ( Pour produits alimentaires )*

*We hereby confirm that the goods supplied with the above references are suitable for contact with food in accordance with EC1935/2004 regulation*

ERIKS nv

Koen Fierens
Kwaliteitsdienst
*Département Qualité*
*Quality Department*

Quality Control
ERIKS

20/10/2010

ERIKS+BAUDOIN
know-how makes the difference

Antwerpen - *Anvers - Antwerp*
Boombekelaan 3
B-2660 Hoboken
België - *Belgique - Belgium*
tel. +32-3 829 26 11
fax. +32-3 828 39 59

# Conformiteitsattest EU1935/2004 voedingscontact

***Attestation de conformité CE 1935/2004 contact avec des denrées alimentaires***

*Certificate of compliance with EC1935/2004 food contact*

*Omschrijving*
*Dénomination*
*Description*

**RX FLOWTITE® flange gasket material**

**Migration**

- ☑ Simulant A 100°C
- ☑ Simulant B 100°C
- ☑ Simulant C 60°C
- ☑ Simulant D 60°C

**Fitted use**

- ☑ ACQUEOUS FOOD
- ☑ FATTY FOOD
- ☑ ALCOHOLIC FOOD
- ☑ DRY FOOD

Wij bevestigen U, dat de door ons geleverde en hierboven beschreven goederen voldoen aan de EU1935/2004 voorschriften voor gebruik in de voedingsindustrie.

*Par la présente nous vous confirmons que la matériel livré en annexe , selon votre commande en référence , répond aux normes en vigueur suivant les spécifications de la CE1935/2004 ( Pour produits alimentaires )*

*We hereby confirm that the goods supplied with the above references are suitable for contact with food in accordance with EC1935/2004 regulation*

ERIKS nv

Koen Fierens
Kwaliteitsdienst
*Département Qualité*
*Quality Department*

Koen Fierens
Eriks NV

*ERIKS+BAUDOIN will make sure the origin of this material is coded 2014677 and will share any additional information when available*

Fraunhofer Institut
Verfahrenstechnik
und Verpackung

# Zertifikat

## Bewertung der lebensmittelrechtlichen Konformität von Stopfbuchspackungen

| | |
|---|---|
| Auftraggeber: | Burgmann Packings<br>Dublin 24, Ireland |
| Auftrag: | PA/4073/05 |
| Probe: | Burgmann Buramex-SF 6335 |

Die Stopfbuchspackung Burgmann Buramex-SF 6335 wird für Dichtpackungen in Lebensmittelverarbeitungsmaschinen, Rohren etc. verwendet, insbesondere zur Abdichtung rotierender Wellen etc. in Armaturen, Pumpen, Rührwerken u. a.. Die Stopfbuchse ist dabei in ein Gehäuse eingebaut und nur über einen schmalen Spalt in Verbindung mit dem Behälter oder Rohr, das das Lebensmittel enthält. Die Stopfbuchse kommt dabei nur zufällig mit Lebensmitteln in Berührung, die durch den Spalt in das Packungsgehäuse gedrückt werden oder spritzen. Die am Spalt anliegende Fläche beträgt dabei $^{2}/_{10}$ einer Kantenfläche (2 mm Breite). Dabei sind die Systeme insbesondere bei Pumpen in der Regel so angelegt, dass an die Welle im Bereich der Dichtung gelangendes Lebensmittel nach außen abtransportiert wird und nicht wieder in den Behälter zurück gelangt. Stopfbuchsen werden für Pumpen mit einem Durchsatz von mehr als 1000 l/h und Rührwerke für Füllungen von mindestens 1-2 m³ verwendet. Die Haltbarkeit der Dichtung beträgt ca. 1 Jahr. Dabei treten einschließlich der Reibungswärme Temperaturen bis 100 °C an der Stopfbuchse auf.

Die Stopfbuchspackung wurde auf lebensmittelrechtliche Konformität bezüglich der Anforderungen in USA und der europäischen Union untersucht (Prüfbericht PA/4532/05 Teil 6 vom 5.12.2005).

Fluorhaltige Verbindungen wurden über Halogensignale bei Gaschromatographie mit ECD-Detektion aus dem Ethylacetat-extrakt untersucht. Fluorverbindungen sind unter 35 µg/g Fluoräquivalente im Material. Da es sich bei der Stopfbuchspackung nicht um ein reines plattenförmiges PTFE handelt, ist die Anforderung an die gesamtextrahierbaren Substanzen gemäß 21 CFR §177.1550 (e) (3) (i) nicht anwendbar.

Für Dichtungen, Stopfen etc. wird die Migration auf die Gesamtmenge des möglicherweise in Kontakt kommenden Lebensmittels bezogen. Bei einer absoluten Abgabe von 59 mg bei 30 min Kontakt bei 100 °C wird der Gesamtmigrationsgrenzwert bereits bei Kontakt mit 1 kg Lebensmittel unterschritten. Bei Übergang in Chargen von 1000 l und mehr liegt die Gesamtheit der maximal übergehenden Substanzen im ppb-Bereich.

Einzelsubstanzen liegen daher erheblich darunter. In der Realität sind die Migrationen noch geringer, da Lebensmittel, das unbeabsichtigt mit der Dichtung in Kontakt kommt, üblicherweise nicht zurückgeführt sondern nach außen abgeführt wird.

Die gefundenen Substanzen können den für den direkten Lebensmittelkontakt zulässigen Paraffinen zugeordnet werden. Möglicherweise vorhandene weitere migrierfähige Komponenten liegen in jedem Fall unterhalb des Threshold of Regulation (21 CFR 170.39). Der Threshold of Regulation (TOR) wurde nach Auswertung nicht-kanzerogener und kanzerogener Effekte einer großen Anzahl repräsentativer Substanzen durch die FDA als ein spezifischer Wert der Exposition über die Ernährung festgelegt, der deutlich unter solchen Werten liegt, die typischerweise toxische Effekte induzieren. Daher sind Bedenken zur Sicherheit vernachlässigbar klein. Der TOR beträgt 0,5 µg/kg in der täglichen Nahrung. Für die Bewertung des Migrationsexperimentes wird zusätzlich der statistische Anteil der Lebensmittel im Kontakt mit den Substanzen zum Gesamtlebensmittelverzehr eingerechnet (Consumption Factor CF). Statistische Daten liegen uns nicht vor. Bei geringem Anteil und fehlender Datenlage wird mit einem Consumption Factor von 0,05 gerechnet. Dies würde einer maximalen Migration von 10 µg/kg (ppb) entsprechen. In der EU wird zur Bewertung von Stoffübergängen nicht bewerteter Substanzen durch funktionelle Barrieren die Anforderung der Nicht-Nachweisbarkeit bei einer Nachweisgrenze von 10 ppb erwartet (Entwurf Super-Regulation). Dies würde auch den niedrigsten spezifischen Migrationsgrenzwerten in der EU, wie sie für kanzerogene Monomere vorgesehen sind, entsprechen.

Schlussfolgerung: Der Einsatz der Stopfbuchspackung bei Lebensmittelverarbeitungsmaschinen ist konform mit den Anforderungen der Lebensmittelsicherheit gemäß US 21 CFR 170.3 (i) und Artikel 3 der EU-Rahmenverordnung 1935/2004.

Fraunhofer Institut
Verfahrenstechnik
und Verpackung

Freising, den 21.12.2005

Dr. Roland Franz
(Prüfleiter Migration)

Dr. Angela Störmer
(stellv. Prüfleiterin Migration)

EagleBurgmann®

# Bestätigung gemäß FDA-Forderung
## Confirmation acc. FDA-requirement
## Confirmation suivant la prescription FDA

| | |
|---|---|
| Beleg-Nr<br>Cert.-no. | 1 |
| Seite<br>Page | 1 von 2<br>of |

| | | | |
|---|---|---|---|
| **Besteller:**<br>Customer:<br>Client: | EagleBurgmann Belgium BVBA | **Best.-Nr./ Datum:**<br>Order-no./ date:<br>No.de commande: | **B104898 / 30.11.2010** |
| | | **Besteller-Auftr.-Nr.:**<br>Order.no.(Customer):<br>No.de command (client): | 389607 |
| **Hersteller:**<br>Manufacturer:<br>Fabricant: | **EagleBurgmann Germany** | **Kommission:**<br>Commission.-no.:<br>No.de commande: | **A70 968** |
| **Gegenstand:**<br>Object:<br>Désignation: | Gleitringdichtung<br>Mechanical seal<br>Garniture mécanique d'étanchétié | **Zeichn.-Nr.:**<br>Drawing-no.:<br>No. de plan: | M7N/40-00 (002391 047) |
| **Fabr.-Nr.:**<br>Fabr.-no.:<br>No.de fabrication: | --- | **Stück:**<br>Quantity:<br>Nombre: | 6 |
| **Einzelteil:**<br>component Part:<br>pièce détachée: | Gleitringe und Gegenringe<br>Seal faces and Stationary seats<br>Grains tournants et Contre-grains | **Werkstoffe:**<br>Materials:<br>Materiaux: | **Buka 22 (Q1, Q12)**<br>**Buka 20 (Q2, Q22)** |

## Bestätigung / Confirmation / Confirmation

Hiermit bestätigen wir, daß EagleBurgmann Gleitringe und Gegenringe aus den Werkstoffen Buka 20 / Buka 22 gemäß FDA-Information vom 24.05.1989 lebensmitteltauglich sind.

Herewith we certify that EagleBurgmann seal faces and stationary seats made of material Buka 20 / Buka 22 can be used in food applications in accordance with the FDA-information of may, 24.1989.

Nous confirmons par la présente que les grains tournants et les contre-grains en Buka 20 / Buka 22 de EagleBurgmann sont convenables pour l´alimentation selon la information FDA du 24.05.1989.

## Bemerkungen / Remarks / Remarques

Buka 22 = SiC, Siliziumkarbid, drucklos gesintert / Silicon carbide pressureless sintered, Carbure de silicium, fritté sans pression

Buka 20 = SiC-Si, Siliziumkarbid, reaktionsgebunden / Silicon carbide reaction bonded, Carbure de silicium dép. de la réaction

EagleBurgmann Germany
GmbH & Co. KG
82502 Wolfratshausen
Telefon 08171/23-0
Telefax 08171/23-1214
www.eagleburgmann.com

Wolfratshausen, den 22.01.2011

Träger

EagleBurgmann QPD 3

EagleBurgmann®

# Bestätigung gemäß FDA-Forderung
## Confirmation acc. FDA-requirement (CFR 21)
## Confirmation suivant la prescription FDA

| | |
|---|---|
| Beleg-Nr<br>Cert.-no. | 1 |
| Seite<br>Page | 2 von of 2 |

| | | | |
|---|---|---|---|
| **Besteller:**<br>Customer:<br>Client: | EagleBurgmann Belgium BVBA | **Best.-Nr./ Datum:**<br>Order-no./ date:<br>No.de commande: | **B104898 / 30.11.2010** |
| | | **Besteller-Auftr.-Nr.:**<br>Order.no.(Customer):<br>No.de command (client): | 389607 |
| **Hersteller:**<br>Manufacturer:<br>Fabricant: | **EagleBurgmann Germany** | **Kommission:**<br>Commission.-no.:<br>No.de commande: | **A70 968** |
| **Gegenstand:**<br>Object:<br>Désignation: | Gleitringdichtung<br>Mechanical seal<br>Garniture mécanique d'étanchétié | **Zeichn.-Nr.:**<br>Drawing-no.:<br>No. de plan: | M7N/40-00 (002391 047) |
| **Fabr.-Nr.:**<br>Fabr.-no.:<br>No.de fabrication: | --- | **Stück:**<br>Quantity:<br>Nombre: | 6 |
| **Einzelteil:**<br>component Part:<br>pièce détachée: | Runddichtringe<br>O-rings<br>Joints toriques | **Werkstoffe:**<br>Materials:<br>Materiaux: | **V16** |

## Bestätigung / Confirmation / Confirmation

Hiermit bestätigen wir, daß EagleBurgmann Runddichtringe aus Werkstoff V16 den Anforderungen gemäß FDA-Vorschrift "Code of Federal Regulation, Title (CFR 21), § 177.2600" entsprechen.

Herewith we certify that EagleBurgmann O-rings made of material V16 fulfill the requirements of FDA-regulation "Code of Federal Regulation, Title (CFR 21), § 177.2600".

Nous confirmons par la présente que les joints toriques EagleBurgmann en V16 sont conformes aux demandes selon la prescription FDA "Code of Federal Regulation, Title (CFR 21), § 177.2600".

## Bemerkungen / Remarks / Remarques

V16 = Fluor-Kautschuk /
Fluorcarbon rubber /
Elastomère en carbone fluoré

EagleBurgmann Germany
GmbH & Co. KG
82502 Wolfratshausen
Telefon 08171/23-0
Telefax 08171/23-1214
www.eagleburgmann.com

Wolfratshausen, den 22.01.2011

Träger

Eagle Burgmann QPD 3

# TopGear H

**INTERNAL GEAR PUMPS**

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E: johnson-pump.be@spxflow.com



Please contact your local sales representative for product availability in your region. For more information visit www.spx.com.

ISSUED 10/2015 A.0500.351 EN