JOHNSON PUMP
AN SPX BRAND

Instruction Manual

TopGear GS

Internal Gear pumps

Original instructions

Read and understand this manual prior to operating or servicing this product.

A.0500.501 – IM-TGGS/05.00 EN (06/2011)

SPX®

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 GS-range Gear Pumps

Types: TG GS2-25
TG GS3-32
TG GS6-40
TG GS15-50
TG GS23-65
TG GS58-80
TG GS86-100
TG GS185-125

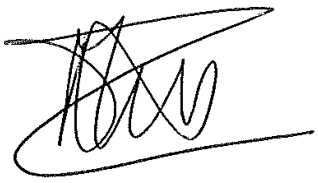
whether delivered without drive or delivered as an assembly with drive, are in conformity with the relevant provisions of the Machinery Directive 2006/42/EC, Annex I.

Manufacturer Declaration

Machinery Directive 2006/42/EC, Annex IIB

The partly completed pump (Back-Pull-Out unit), member of the product family TopGear GS-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, 29 December 2009



Frédéric Mus
General Manager

Contents

1.0 Introduction 7
1.1 General 7
1.2 Reception, handling and storage 7
1.2.1 Reception 7
1.2.2 Handling 7
1.2.3 Storage 7
1.3 Safety 8
1.3.1 General 8
1.3.2 Pump units 9
1.3.2.1 Pump unit handling 9
1.3.2.2 Installation 9
1.3.2.3 Before commissioning the pump unit 10
1.3.2.4 Disassembly/assembly of the coupling guard 10
1.3.2.5 Name plate – CE Declaration of Conformity 10
1.4 Technical conventions 11

2.0 Pump description 12
2.1 Type designation 12

3.0 General technical information 14
3.1 Pump standard parts 14
3.2 Operating principle 14
3.2.1 Self-priming operation 15
3.2.2 Safety relief valve – Working principle 15
3.3 Sound 15
3.4 General performance 15
3.5 Main characteristics 16
3.6 Pressure 17
3.7 Sound level 17
3.7.1 Sound level of a pump without drive 17
3.7.2 The sound level of the pump unit 18
3.7.3 Influences 18
3.8 Maximum temperature 18
3.9 Jacket options 18
3.10 Internals 19
3.10.1 Bush materials 19
3.10.2 Maximum temperature of internals 19
3.10.3 Operation under hydrodynamic lubrication conditions 19
3.10.4 Maximum torque of pump shaft and rotor material combination 20
3.11 Mass moment of inertia 20
3.12 Axial and radial clearances 20
3.13 Extra clearances 21
3.14 Play between gear teeth 22
3.15 Maximum size of solid particles 22
3.16 Shaft sealing 22

3.17 Safety relief valve 23
3.17.1 Pressure 24
3.17.2 Heating 24
3.17.3 Safety relief valve – Relative adjustment 24
3.17.4 Sectional drawings and part lists 26
3.17.4.1 Single safety relief valve 26
3.17.4.2 Heated spring casing 27
3.17.4.3 Double safety relief valve 27
3.18 Installation 28
3.18.1 General 28
3.18.2 Location 28
3.18.2.1 Short suction line 28
3.18.2.2 Accessibility 28
3.18.2.3 Outdoor installation 28
3.18.2.4 Indoor installation 29
3.18.2.5 Stability 29
3.18.3 Drives 29
3.18.3.1 Starting torque 29
3.18.3.2 Radial load on shaft end 30
3.18.4 Shaft rotation 30
3.18.5 Double safety relief valve 31
3.18.6 Suction and discharge pipes 31
3.18.6.1 Forces and moments 31
3.18.6.2 Piping 32
3.18.6.3 Isolating valves 33
3.18.6.4 Strainer 33
3.18.7 Secondary piping 33
3.18.7.1 Drain lines 33
3.18.7.2 Heating jackets 34
3.18.8 Flush/quench media 34
3.18.9 Guidelines for assembly 35
3.18.9.1 Transport of pump unit 35
3.18.9.2 Foundation pump unit 35
3.18.9.3 Variators, Gear box, Gear motors, Motors 35
3.18.9.4 Electric motor drive 35
3.18.9.5 Combustion engines 36
3.18.9.6 Shaft coupling 36
3.18.9.7 Guarding of moving parts 36
3.19 Instructions for start-up 37
3.19.1 General 37
3.19.2 Cleaning the pump 37
3.19.2.1 Cleaning suction line 37
3.19.3 Venting and filling 37
3.19.4 Checklist – Initial start-up 38
3.19.5 Start-up 39
3.19.6 Shut-down 39
3.19.7 Abnormal operation 39
3.20 Trouble shooting 40
3.20.1 Instructions for re-using and disposal 42
3.20.1.1 Re-use 42
3.20.1.2 Disposal 42

3.21 Maintenance instructions 43
3.21.1 General 43
3.21.2 Preparation 43
3.21.2.1 Surroundings (on site) 43
3.21.2.2 Tools 43
3.21.2.3 Shut-down 43
3.21.2.4 Motor safety 43
3.21.2.5 Conservation 43
3.21.2.6 External cleaning 44
3.21.2.7 Electrical installation 44
3.21.2.8 Draining of fluid 44
3.21.2.9 Fluid circuits 44
3.21.3 Specific components 45
3.21.3.1 Nuts and bolts 45
3.21.3.2 Plastic or rubber components 45
3.21.3.3 Flat gaskets 45
3.21.3.4 Filter or suction strainer 45
3.21.3.5 Anti-friction bearings 45
3.21.3.6 Sleeve bearings 46
3.21.3.7 Shaft seal – Mechanical seal 46
3.21.4 Front pull-out 47
3.21.5 Back pull-out 47
3.21.6 Clearance adjustment 47
3.21.7 Designation of threaded connections. 48
3.21.7.1 Threaded connection Rp (example Rp 1/2) 48
3.21.7.2 Threaded connection G (example G 1/2) 48

4.0 Instructions for assembly and disassembly 49
4.1 General 49
4.2 Tools 49
4.3 Preparation 49
4.4 After disassembly 49
4.5 Anti-friction bearings 50
4.5.1 General 50
4.5.2 TG GS2-25, TG GS3-32 and TG GS6-40 disassembly 50
4.5.3 TG GS2-25, TG GS3-32 and TG GS6-40 assembly 50
4.5.4 TG GS15-50 to TG GS185-125 disassembly 51
4.5.5 TG GS15-50 to TG GS185-125 assembly 51
4.6 Mechanical seal 52
4.6.1 General 52
4.6.2 Preparation 52
4.6.3 Special tools 52
4.6.4 General instructions during assembly 52
4.6.5 Assembly of the rotating part 52
4.6.6 Assembly of the stationary seat 53
4.7 Pumps 53
4.7.1 General 53
4.7.2 TG GS2-25/TG GS3-32/TG GS6-40 53
4.7.3 TG GS15-50/TG GS23-65 54
4.7.4 TG GS58-80/ TG GS86-100/ TG GS 185-125 55
4.8 Relief valve 56
4.8.1 Disassembly 56
4.8.2 Assembly 56

5.0 Sectional drawings and part lists....57
5.1 TG GS2-25 to TG GS6-40....57
5.1.1 Hydraulic part....58
5.1.2 Bearing bracket....58
5.1.3 Flange connection options....58
5.1.4 Jacket....59
5.1.5 Single Mechanical seal....59
5.2 TG GS15-50 to TG GS185-125....60
5.2.1 Hydraulic part....61
5.2.2 Bearing bracket....61
5.2.3 Jacket....62
5.2.4 Single mechanical seal....62

6.0 Dimensional drawings....63
6.1 Standard pump....63
6.1.1 TG GS2-25 to TG GS6-40....63
6.1.2 TG GS15-50 to TG GS185-125....64
6.2 Flange connections....65
6.2.1 TG GS2-25 to TG GS6-40....65
6.2.2 TG GS15-50 to TG GS185-125....65
6.3 Jackets (S) on pump cover and thread connection....66
6.3.1 TG GS2-25 to TG GS6-40....66
6.3.2 TG GS 15-50 to TG GS185-125....66
6.4 Safety relief valves....67
6.4.1 Single safety relief valve....67
6.4.2 Double safety relief valve....67
6.4.3 Heated safety relief valve....68
6.5 Bracket support....69
6.6 Weights – Mass....69

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.

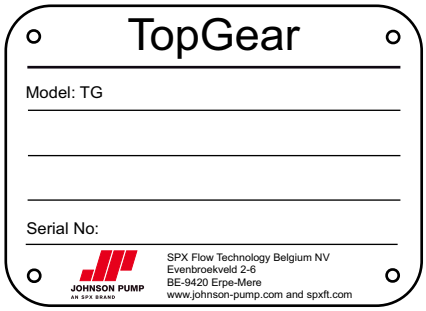
1.2 Reception, handling and storage

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.

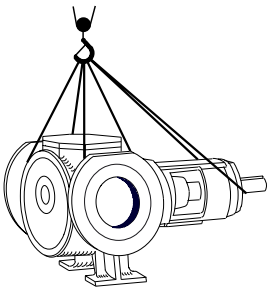
In case of damage and/or missing parts, a report should be drawn up and presented to the carrier at once. Notify your local supplier.

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

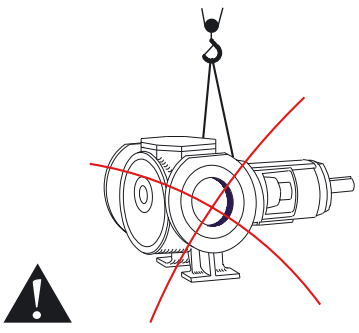


1.2.2 Handling

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.

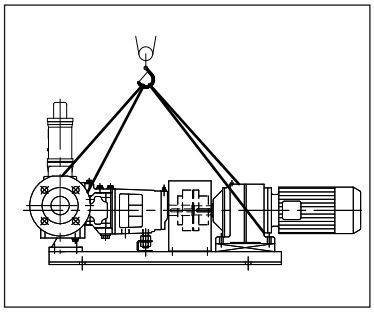
- The pump unit must not be exposed to rapid temperature changes of the liquid without prior pre-heating/pre-cooling. Big temperature changes can cause crack formation or explosion, which in turn can entail severe personal injuries.
- The pump must not operate above stated performance. See section 3.5 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.

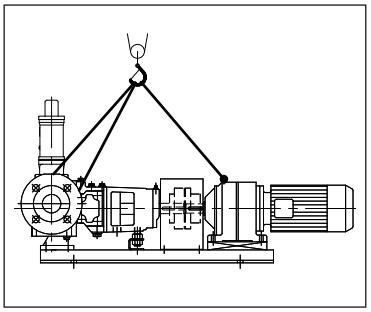
1.3.2 Pump units

1.3.2.1 Pump unit handling

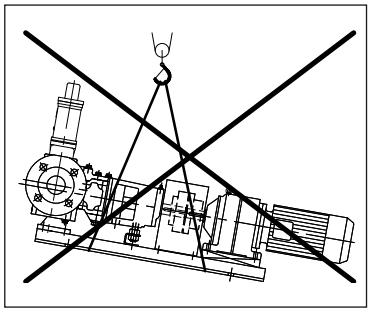
Use an overhead crane, forklift or other suitable lifting device.



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.

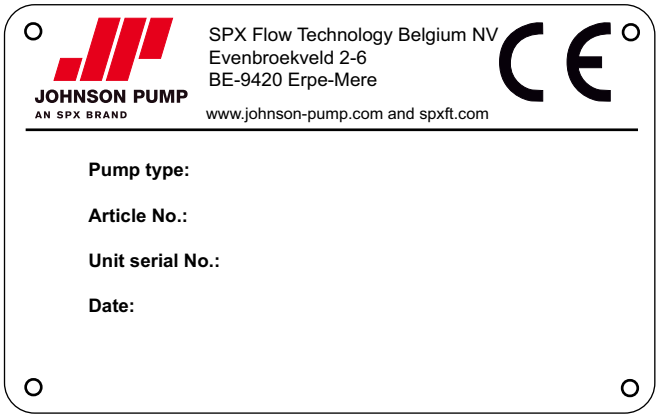
d) Reassemble the coupling guard and any other protective covers. Make sure that the screws are properly tightened.

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	μ	mPa.s = cP (Centipoise)
Kinematic viscosity	$\nu = \frac{\mu}{\rho}$	ρ = density $\frac{[kg]}{dm^3}$ ν = kinematic viscosity $[\frac{mm^2}{s}]$ = cSt (Centistokes)
Note! *In this manual only dynamic viscosity is used.*		
Pressure	p	[bar]
	Δp	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 toal absolute inlet pressure at the pump suction connection, minus the vapour pressure of the pumped liquid. NPSHa is expressed in meter liquid column. 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 impairement due to cavitation within the pump at rate capacity. 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/GS pumps are rotary positive displacement pumps with internal gear. They are made of cast iron. TG GS pumps: heating / cooling jackets (steam), 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	GS	58-80	G	2	S	SG	2	G1	AV
1	2	3	4	5	6	7	8	9	10

1. Pump family name

TG = TopGear

2. Pump range name

G = General purpose

S = Single mechanical seal - shaft bearings outside the liquid

3. Hydraulics indicated with displacement volume per 100 revolution (in dm^3) and nominal port diameter (in mm)

TG GS2-25
TG GS3-32
TG GS6-40
TG GS15-50
TG GS23-65
TG GS58-80
TG GS86-100
TG GS185-125

4. Pump material

G Pump in cast iron

5. Port connection type

1 Thread connections
2 PN16 flanges to DIN2533
3 PN20 flanges to ANSI 150 lbs

6. Jacket options for pump cover

O Pump cover without jackets
S Pump cover with jacket and thread connection

Example:

TG	GS	58-80	G	2	S	SG	2	G1	AV
1	2	3	4	5	6	7	8	9	10

7. 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

8. Idler pin materials

2 Idler pin in hardened steel
5 Idler pin in nitrided stainless steel
6 Idler pin in hard coated stainless steel

9. Rotor and shaft materials

G1 Rotor in iron and shaft in steel
N1 Rotor in nitrided nodular iron and shaft in steel
R1 Rotor in stainless steel and shaft in steel

10. Shaft seal arrangement

Single mechanical seal Burgmann type MG12

AV Single mech. seal Burgmann MG12 Carbon/SiC/FPM (Fluorocarbon)
WV Single mech. seal Burgmann MG12 SiC/SiC/FPM (Fluorocarbon)

Single mechanical seal Burgmann type M7N

HV Single mech. seal Burgmann M7N SiC/Carbon/FPM (Fluorocarbon)
HT Single mech. seal Burgmann M7N SiC/Carbon/PTFE-wrapped
WV Single mech. seal Burgmann M7N SiC/SiC/FPM (Fluorocarbon)
WT Single mech. seal Burgmann M7N SiC/SiC/PTFE-FFKM

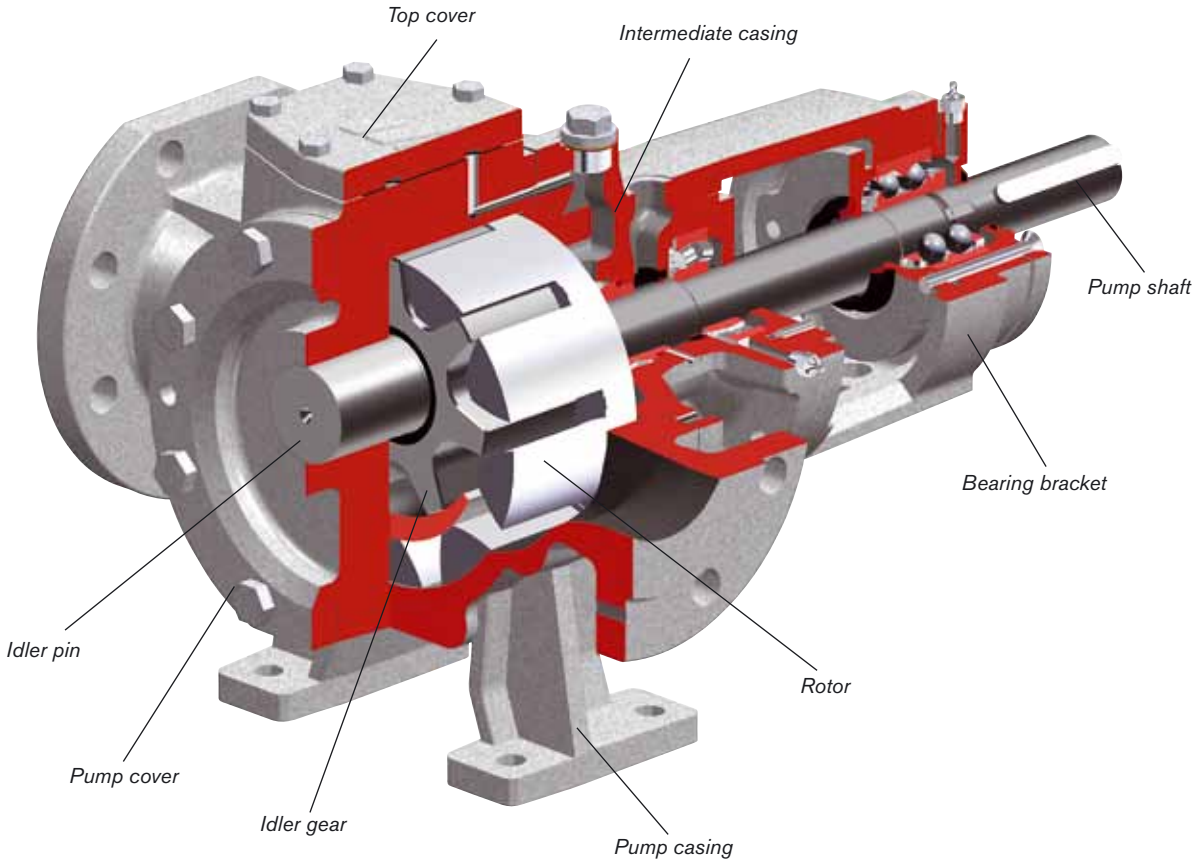
Remark: EPDM and FFKM (Chemraz®) O-ring sets available on request

Single mechanical seal option without mechanical seal

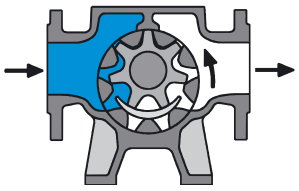
XX Single seal parts – seal on request

3.0 General technical information

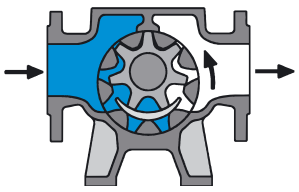
3.1 Pump standard parts



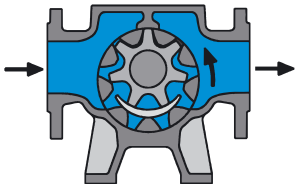
3.2 Operating principle



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 are 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

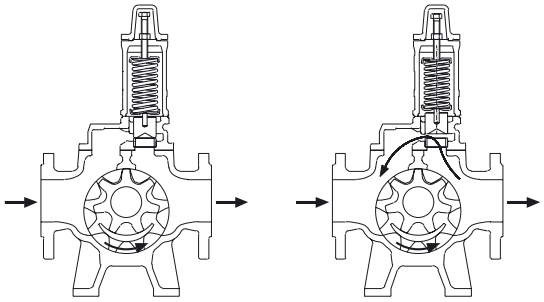
TopGear pumps are self-priming when sufficient liquid is present in the pump to fill up the clearances and the dead spaces between the teeth. (For self-priming operation see also section 3.18.6.2 Piping).

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 (Δp) 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 GS 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.test (bar)
2-25	25	13.5	65	1.83	1800		0.5	2.0	6.1	0.7	10	15
						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	10	15
						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	10	15
						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	10	15
						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	10	15
						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	10	15
						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	10	15
185-125	125	100	224	185	750		23	83	8.8	1.9	10	15
						725	22	80	8.5	1.8		

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.test : hydrostatic test pressure

Maximum viscosity

Shaft sealing type	Maximum viscosity (mPa.s) *)
	GS
Single mechanical seal	
GS with Burgmann MG12	**3 000**
GS with Burgmann M7N	**5 000**

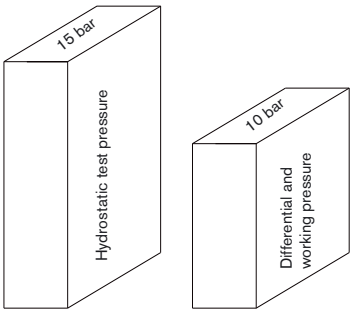
**) Remark:*
Figures are for Newtonian liquids at operating temperature. The maximum allowable viscosity between the sliding faces of the mechanical seal depends on nature of liquid (Newtonian, plastic etc.), the sliding speed of the seal faces and the mechanical seal construction.

3.6 Pressure

Differential pressure or working pressure (p) is the pressure on which the pump normally operates. TopGear GS-line has the maximum differential pressure at 10 bar.

The hydrostatic test pressure is 1.5 times the differential pressure i.e.:
TopGear GS-line has the hydrostatic test pressure at 15 bar.

Following figure gives a graphical presentation of the several kinds 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 GS Pump size	n_{max}(min-1)	Lpa (dB(A))				Ls (dB(A))
		25% n_{max}	50%n_{max}	75%n_{max}	100%n_{max}	
2-25	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

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 acts 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:

$L_1 - L_2$	0	1	2	3	4	5	6
$L[f(L_1 - L_2)]$	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 : $\mathbf{L_{corrected} = 1.4\ dB(A)}$

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 baseplate etc. will make the installation produce more noise.

3.8 Maximum temperature

Overall temperature of **TopGear GS pumps** is 200°C. The temperature is limited because of the position of the roller bearing close to the pump. Higher temperature could be a problem for grease lubrication and life time of these bearing.

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

Material: Cast iron GG25

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)	Yes	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

Because the overall temperature of TopGear GS pumps is limited to 200°C, there are no extra temperature restrictions for internals.

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 GS pump size	**K.hyd**
2-25	6000
3-32	7500
6-40	5500
15-50	6250
23-65	4000
58-80	3750
86-100	3600
185-125	2500

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 GS 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
2-25	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

The nominal torque (Mn) has to be checked for the normal working conditions and the installed nominal motor torque (M n.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 GS	2-25	3-32	6-40	15-50	23-65	58-80	86-100	185-125
J (10-3 x kgm2)	0.25	0.30	0.75	3.5	6.8	32	54	200

3.12 Axial and radial clearances

TG GS	2-25	3-32	6-40	15-50	23-65	58-80	86-100	185-125
Minimum (µm)	80	80	90	120	125	150	165	190
Maximum (µm)	134	134	160	200	215	250	275	320

3.13 Extra clearances

To handle extra clearances following clearance classes are defined:

C0 = Pump cover axial clearance set at minimum
C1 = Standard clearance (not indicated because standard)
C2 = ~2 x standard clearance
C3 = 3 x standard clearance

To indicate required clearances a code of 4 digits, xxxx, is given on the order.
The figure ''1'' stands always 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 pc 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 GS2-25	35	107	235	320
TG GS3-32	35	107	235	320
TG GS6-40	40	125	275	375
TG GS15-50	52	160	350	480
TG GS23-65	56	170	375	510
TG GS58-80	66	200	440	600
TG GS86-100	72	220	480	660
TG GS185-125	85	255	560	765

Diametral clearance on pin / idler bearing

Pump size	C1 (µm) normal	C2 (µm) = 2 x C1	C3 (µm) = 3 x C1
Code for adapted 6 material pin (2 or 3) *)	xx1x	xx2x	xx3x
Code for adapted bronze idler bush (Y or Z) **)	xx1x	xxYx	xxZx
TG GS2-25	90	180	270
TG GS3-32	90	180	270
TG GS6-40	110	220	330
TG GS15-50	150	300	450
TG GS23-65	160	320	480
TG GS58-80	240	480	720
TG GS86-100	275	550	825
TG GS185-125	325	650	975

The extra clearances are realised as follows:

Rotor and Idler: By extra machining of outside diameter (code 2, 3); or standard = 1

Pump cover: By adjusting during assembly (code 0, 2 , 3); or standard = 1

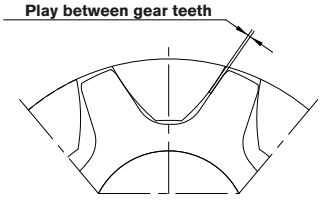
Idler pin / bush bearing; 2 cases are possible: (standard = 1)

*) case 1: by providing a special pin (6 material) with adapted pin diameter (code 2 or 3)

**) case 2: by providing a special bronze bush with adapted inside bush diameter (code Y or Z).

3.14 Play between gear teeth

TG GS	2-25	3-32	6-40	15-50	23-65	58-80	86-100	185-125
Minimum (µm)	320	320	320	360	400	400	400	440
Maximum (µm)	640	640	640	720	800	800	800	880



3.15 Maximum size of solid particles

TG GS	2-25	3-32	6-40	15-50	23-65	58-80	86-100	185-125
Size (µm)	80	80	90	120	125	150	165	190

3.16 Shaft sealing

Mechanical seal according to EN12756 (DIN24960) – General information

In TopGear TG GS the short EN12756 (DIN24960) single mechanical seal can be built in.
The mechanical seal is set against the rotor shoulder.

TG GS pump size	2-25 3-32	6-40	15-50 23-65	58-80 86-100	185-125
Shaft diameter	18	22	35	40	55
Short EN12756 (DIN 24960)	KU018	KU022	KU035	KU040	KU055
L-1K (short KU)	37.5	37.5	42.5	45	47.5

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

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.

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 GS2-25, TG GS3-32, TG GS6-40

27 Safety relief valve size for TG GS15-50, TG GS23-65

35 Safety relief valve size for TG GS58-80

50 Safety relief valve size for TG GS86-100, TG GS185-125

3. Materials

G Safety relief valve in cast iron

4. Working pressure class

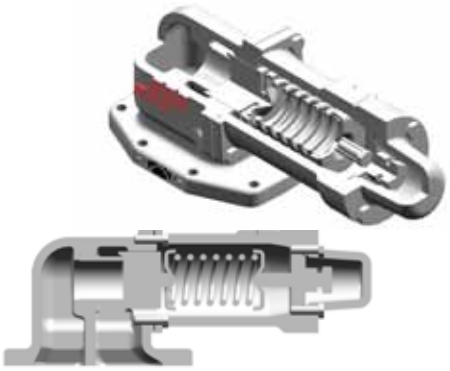
4 Working pressure 1-4 bar

6 Working pressure 3-6 bar

10 Working pressure 5-10 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 3 working pressure classes i.e. 4, 6 and 10 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
Standard set pressure (bar)	5	7	11
Working pressure range (bar)	1 – 4	3 – 6	5 – 10
Set pressure range (bar)	2 – 5	4 – 7	6 – 11

3.17.2 Heating

The weld on spring casing is provided with 2 thread connections. Flange connections are not available.

Maximum temperature: 200°C
Maximum pressure: 10 bar

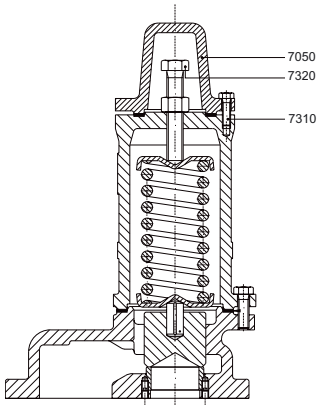
3.17.3 Safety relief valve – Relative adjustment

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

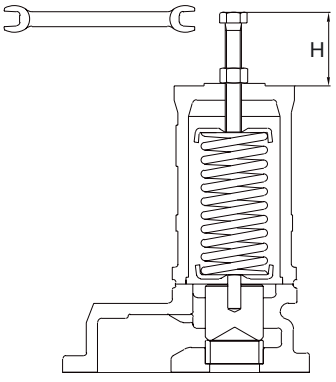
Note! *When testing the safety relief valve mounted on the pump, make sure the pressure never exceeds the set pressure of the valve + 2 bar.*

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.

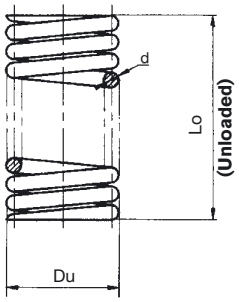


Vertical safety relief valve



Set pressure modification

Spring ratio – Safety relief valve

TG GS pump size		Spring dimensions					
		Pressure class	Du mm	d mm	Lo mm	p/f bar/mm	
2-25 3-32 6-40	Horizontal	4	25.5	3.0	64	0.26	
		6	25.5	3.5	66	0.43	
		10	25.5	4.5	60	1.72	
15-50 23-65		4	37.0	4.5	93	0.21	
		6	37.0	4.5	93	0.21	
		10	36.5	6.0	90	0.81	
58-80	Vertical	4	49.0	7.0	124	0.32	
		6	49.0	7.0	124	0.32	
		10	48.6	8.0	124	0.66	
86-100 185-125		4	49.0	7.0	124	0.16	
		6	48.6	8.0	124	0.33	
		10	49.0	9.0	120	0.55	

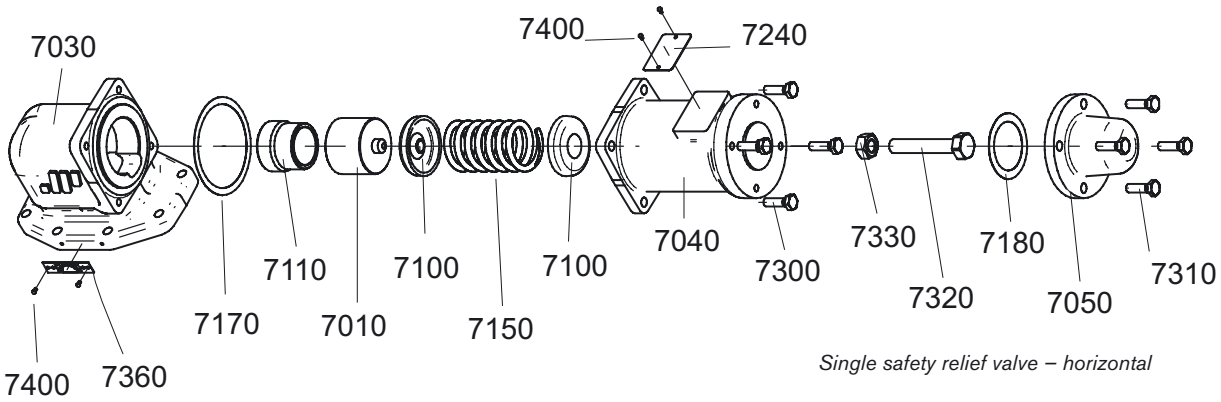
Note!

Spring ratio p/f depends upon the dimensions of the spring. It is recommended to check the dimensions prior to adjusting the pressure.

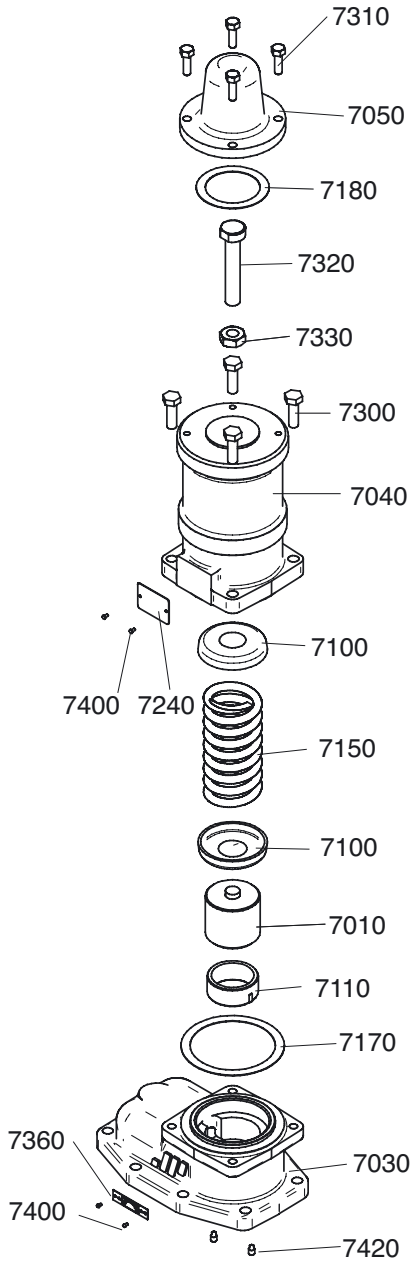
When the safety relief valve is not functioning properly, the pump must immediately be taken out of service. The safety relief valve must be checked by your local supplier.

3.17.4 Sectional drawings and part lists

3.17.4.1 Single safety relief valve



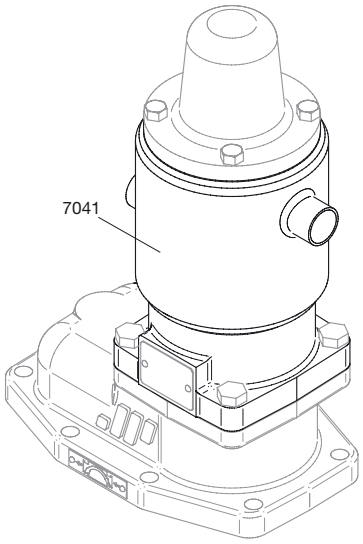
Single safety relief valve – horizontal



Single safety relief valve – vertical

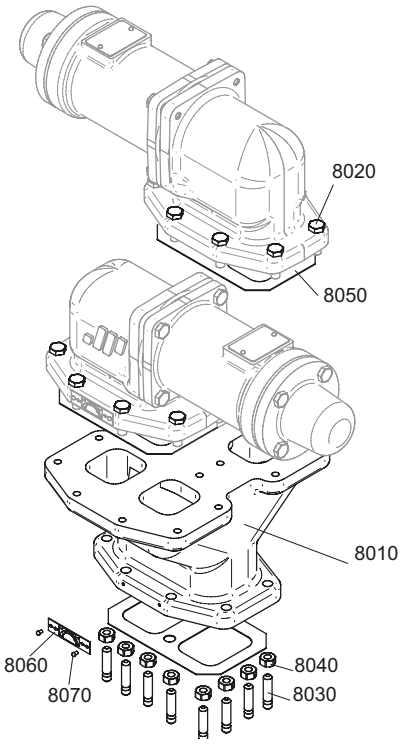
Pos.	Description	V18	V27	V35	V50	Preventive	Overhaul
7010	Valve	1	1	1	1		
7030	Valve casing	1	1	1	1		
7040	Spring casing	1	1	1	1		
7050	Cover	1	1	1	1		
7100	Spring plate	2	2	2	2		
7110	Valve seat	1	1	1	1		
7150	Spring	1	1	1	1		
7170	Flat gasket	1	1	1	1	x	x
7180	Flat gasket	1	1	1	1	x	x
7240	Name plate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

3.17.4.2 Heated spring casing

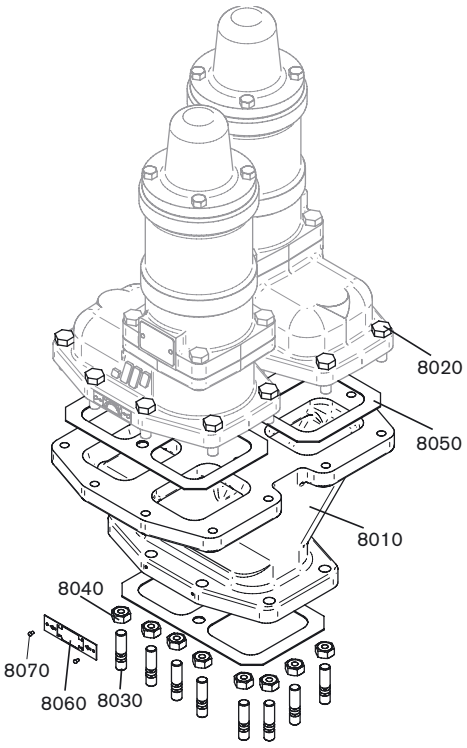


Pos.	Description	V18	V27	V35	V50	Preventive	Overhaul
7041	Heated spring casing	N/A	1	1	1		

3.17.4.3 Double safety relief valve



Double safety relief valve – horizontal



Double safety relief valve – vertical

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

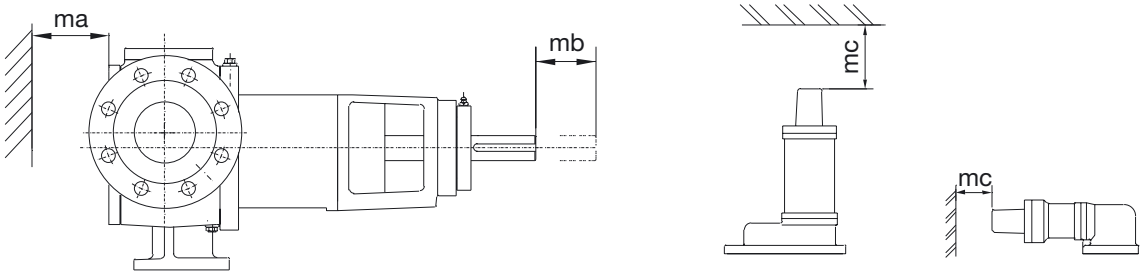
3.18.2.2 Accessibility

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).

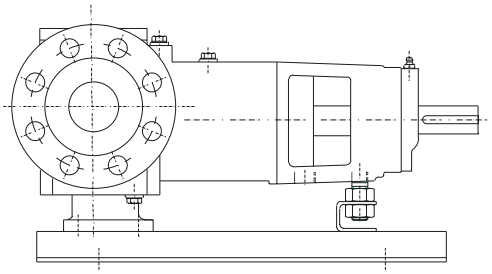
Protect the user against leakages and possible liquid streams.

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, 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

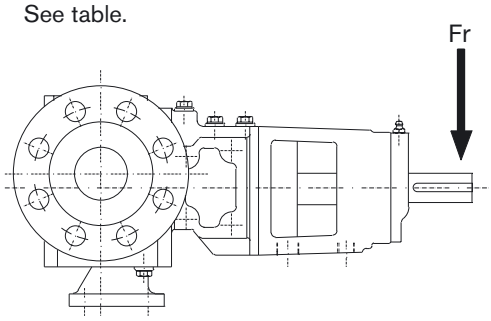
- The starting torque of internal gear pumps is almost identical to the nominal torque.
- Take care that the motor has a sufficiently large starting torque. Therefore choose a motor with a capacity 25% higher than the pump power consumption.

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 GS pump size	Fr (N) - max
2-25/3-32	400
6-40	700
15-50/23-65	1000
58-80/86-100	2000
185-125	3000

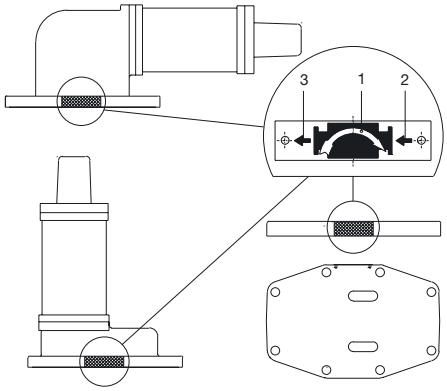
- This force is calculated on the maximum allowable torque and the maximum allowable working pressure of the pump.
- In case a direct drive with a flexible coupling is used, the indicated force will not be exceeded when pump and drive are well aligned.
- Starting with the TG GS15-50, V-belt drive can 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.

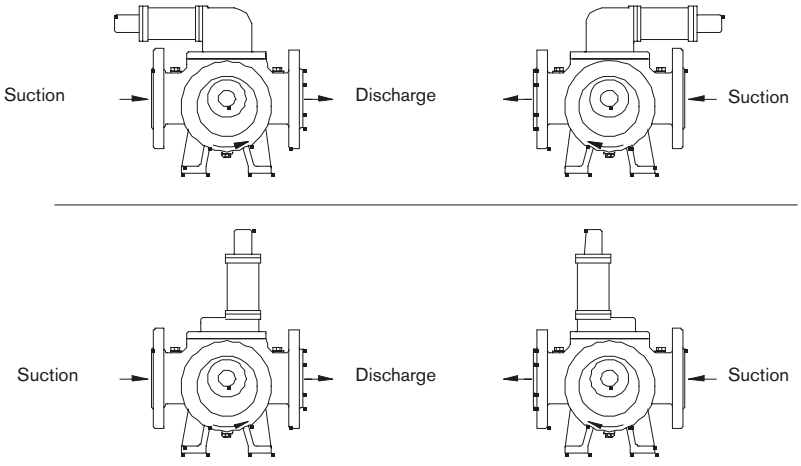
3.18.4 Shaft rotation

Shaft rotation determines which port of the pump is suction and which is discharge.
Relation between shaft rotation and suction/discharge side is indicated by the rotation arrow plate attached at the relief valve or the top cover.
The small arrows 2 and 3 indicate the flow direction of the pumped liquid.
Always make sure that the pump rotates in the direction indicated by the rotation arrow plate.



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

If the pump rotates in the opposite direction, the safety relief valve or top cover must be disassembled and turned around by 180°. If the pump rotates in both directions, a double safety relief valve is required.



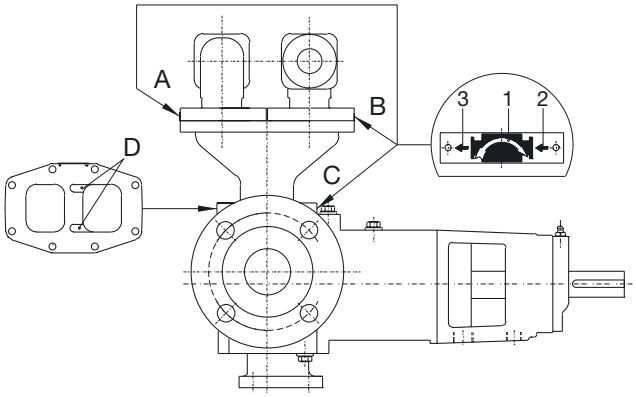
Installation of safety relief valve

3.18.5 Double safety relief valve

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 (D) 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 (D) are placed towards the most used suction side. In case of doubt, contact your local supplier.

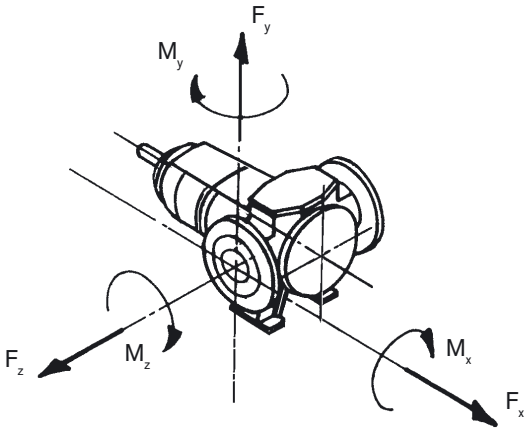
Be sure that the safety relief valves are mounted opposite each other so that the arrow plates on the safety relief valves (A and B) are indicating opposite liquid flow directions.



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 GS pump size	$F_{x, y, z}$ (N)	$M_{x, y, z}$ (Nm)
2-25	2000	315
3-32	2050	325
6-40	2200	385
15-50	2600	675
23-65	2900	800
58-80	3550	1375
86-100	4100	1750
185-125	5900	3750

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.

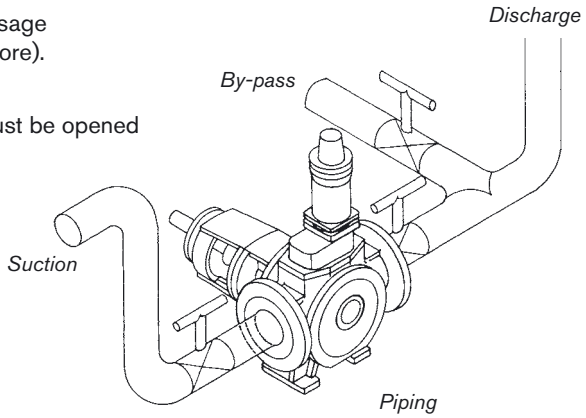
Note! *A foot valve is not recommended when pumping high viscous liquids.*

- 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 backpressure.
- 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 backpressure.
  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.

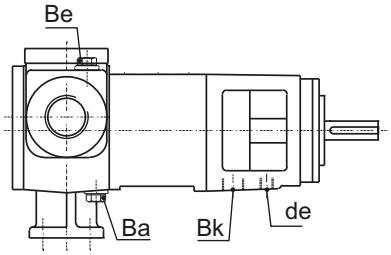
For the maximum allowable particle size see section 3.15.

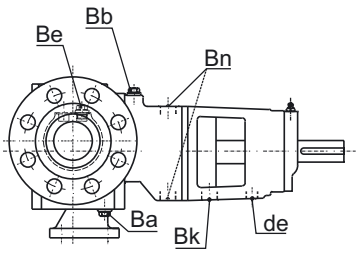
3.18.7 Secondary piping

For dimensions of connections and plugs see chapter 6.0.

3.18.7.1 Drain lines

The pump is provided with drain plugs.





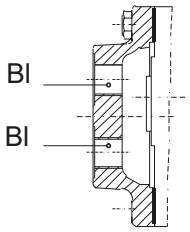
3.18.7.2 Heating jackets

1. S-type jackets

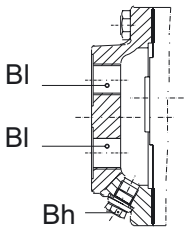
The S-jackets are designed for use with saturated steam (max 10 bar, 180°C) or with non-dangerous media. They are provided with threaded connections Bl (see chapter 6.0 for the dimensions).

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



GS2-25/GS23-65



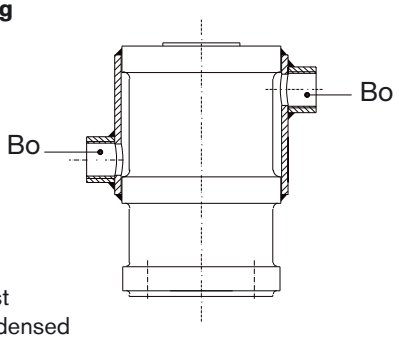
GS58-80/GS185-125

2. 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 GS58-80 to TG GS185-125).

3. Jackets on safety relief valve – around spring casing

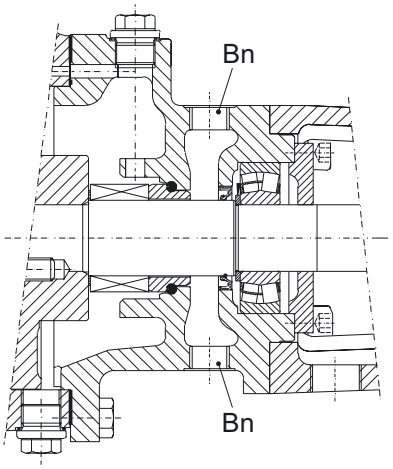
The jackets on the safety relief valve are designed for use with saturated steam (max 10 bar, 180°C) or with non dangerous media. They are provided with threaded connections B0 (see chapter 6.0 for dimensions).
The connection can be done by threaded pipes or pipe connections with sealing in the thread (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

The TopGear GS pumps from size TG GS15-50 and higher are provided of a flush/quench room behind the mechanical seal with threaded connections Bn at top and at bottom.
The room can be connected to a tank supply installed above pump level or to an external flush/quench supply line at low pressure (max. pressure 0.5 bar) and/or to a drain line. It is also possible to connect both connections to a cleaning line – supply at top and drain at bottom – to clean regularly the room from medium leacking trough the mechanial seal.



Attention should be given to compatibility of flush/quench medium towards

- nitril rubber of radial lipring
- ball bearing grease because medium could leack in very small quantities towards the ball bearing.

Use for example clean lubrication oil ISO VG32.

3.18.9 Guidelines for assembly

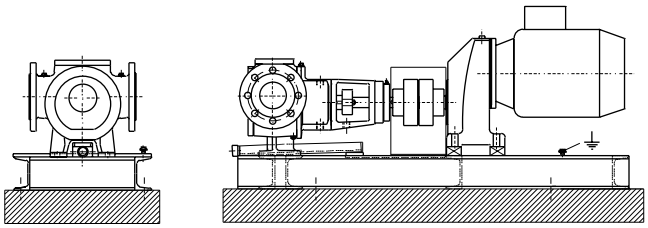
When a bare shaft pump is delivered, the assembly with drive is the responsibility of the user. The user also must provide all necessary devices and equipment allowing a safe installation and commissioning of the pump.

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.

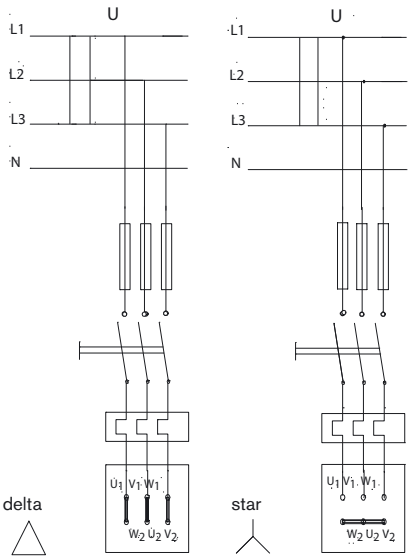
Motor overload protection

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.

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 throughly. Proceed as described in section 3.21.2.8 Draining of fluid.

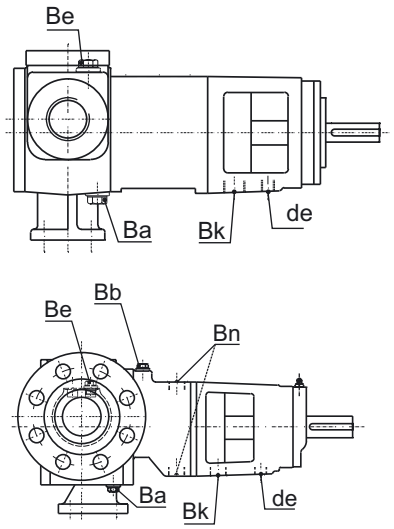
3.19.2.1 Cleaning suction line

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 and Be. 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 (pumptype – 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

- ☐ Pressure, temperature, nature and connections of flush or quench media has been checked.

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?
- ☐ 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.

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 ca 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 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.
	Axial clearance	18	▪	Check axial clearance and correct. 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. 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). 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. Also see section 3.18 Installation.
	Vibration of base plate or pipings	24	▪	Make baseplate heavier and/or fix base plate/ pipework 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. If necessary, install a larger pump.
	Coupling misalignment	27	▪	Check and correct alignment. Also see section 3.18 Installation.
	Viscosity too high	28	▪	Increase axial clearance. See section 3.21 Maintenance instructions.
			▪	Heat pump.
			▪	Reduce pump speed.
			▪	Increase discharge pipe diameter.
Rapid wear	Back pressure too high	29	▪	Increase pipe diameter.
			▪	Reduce working pressure.
			▪	Check accessories (filter, heat exchanger, etc.)
	Solid matter in liquid	30	▪	Filter liquid.
	Pump runs dry	31	▪	Correct liquid supply.
			▪	Provide level switch or dry running protection.
			▪	Heat up liquid.
			▪	Stop or reduce air sucking.
	Corrosion	32	▪	Change pump materials or application parameters.
Motor overloading	Back pressure too high	33	▪	Increase pipe diameter.
			▪	Reduce working pressure.
			▪	Check accessories (filter, heat exchanger, etc.).
	Viscosity too high	34	▪	Increase axial clearance. See section 3.21 Maintenance instructions.
			▪	Heat pump.
			▪	Reduce pump speed.
			▪	Increase discharge pipe diameter.
Pump leak	Mechanical seal leaks	35	▪	Replace mechanical seal.

Symptom	Cause	Remedy		
Rapid wear of the mechanical seal	Viscosity too high	36	▪	Heat the pump.
	Bad de-aerating/ dry running	37	▪	Fill pump with liquid
			▪	Check position of relief valve or top cover.
	Temperature too high	38	▪	Reduce temperature.
			▪	Install suitable mechanical seal.
	Too long priming period/ dry running	39	▪	Reduce suction line.
			▪	Provide dry running protection.
			▪	Check maximum allowable dry running speed for the mechanical seal.
	Liquid is abrasive	40	▪	Filter or neutralise 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.

When 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.
- 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.

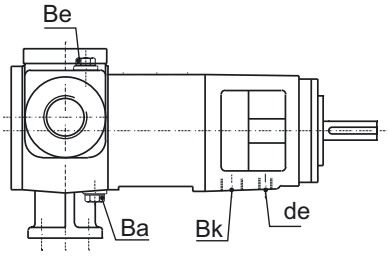
  Respect the above-mentioned regulations if performing work while the power supply is still connected.
- Check if electrical devices to be cleaned have a sufficient degree of protection (e.g. IP54 means protection against dust and splashing water but not against water jets). See EN 60529. Choose an appropriate 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.

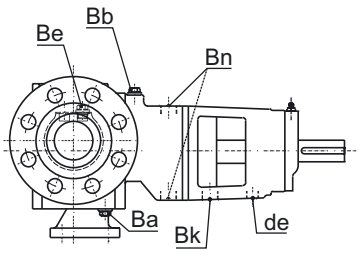
3.21.2.8 Draining of fluid

- 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 and Bb.
- 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 shaft sealing versions





- 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.

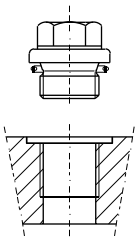
3.21.3 Specific components

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 GS2-25, TG GS3-32 and TG GS6-40 pumps are equipped with 2RS ball bearings which are grease packed for life. They do not require periodically greasing.

Starting with pump size TG GS15-50, 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-22	

* *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 GS15-50, 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 GS pump size	2-25/3-32	6-40	15-50/23-65	58-80/86-100	185-125
Rotor side	6303-2RS1	6304-2RS1	RNA4906 +IR30/35/20	21307	21310
Shaft end side ISO AFBMA	6303-2RS1	6304-2RS1	3206A 5206A	3307A 5307A	3310A 5310A
Grease quantity (gram)	–	–	10	15	25

The ball bearing type 2RS1 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 GS pump size	Maximum allowed radial clearances
2-25 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

3.21.3.7 Shaft seal – 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.

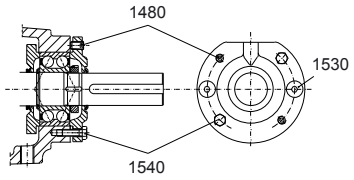
3.21.6 Clearance adjustment

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 GS pump size	**(s_{ax}) [mm]**
2-25 to 6-40	0.10 – 0.15
15-50 to 23-65	0.10 – 0.20
58-80 to 86-100	0.15 – 0.25
185-125	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.

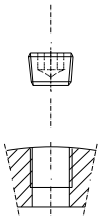
3.21.7 Designation of threaded connections.

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.

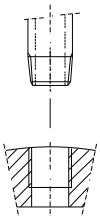
3.21.7.1 Threaded connection Rp (example Rp 1/2)

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 - R1/2



Conical pipe end
ISO 7/1 - R1/2



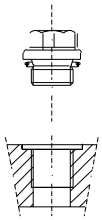
ISO 7/1	Type	Symbol	Example
Internal thread	Cynlindrical (parallel)	Rp	ISO 7/1 – Rp 1/2
External thread	Always conical (tappered)	R	ISO 7/1 – R 1/2

3.21.7.2 Threaded connection G (example G 1/2)

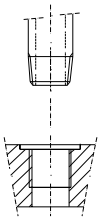
If the threaded connection is provided of a flattened sealing face we call it G according ISO 228/1. This connection can be sealed by a gasket. The plugs or pipe connections must be provided with a sealing collar and cylindrical external thread according to ISO 228/1 (Example ISO 228/1 - G1/2).

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 - G1/2



Conical pipe end
ISO 7/1 - R1/2



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
- Screw driver	
- Anti-recoil hammer	Rubber, plastic, lead
- Carton, paper, shammy	
- Coupling extractor	
- Ball bearing extractor	
- Assembly oil	For example Shell ONDINA 15 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:

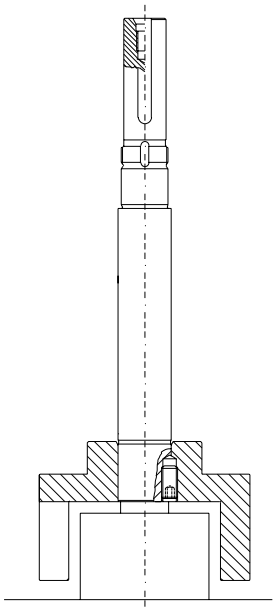
- taking the pump out of service
- back pull-out and front pull-out
- disassembly of the pump from the system
- lubrication of the bearings
- adjusting axial clearance
- adjusting safety relief valve

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

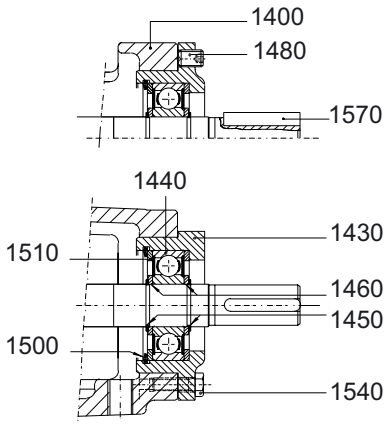


- Never re-use a disassembled bearing or a disassembled lock plate!
- For disassembly and assembly of the bearing (and coupling), use correct tools in order to inspect the pump without any shock loads. Shocks can damage the crisp material of bush bearings and mechanical seal.
- The anti-friction bearing 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 GS2-25, TG GS3-32 and TG GS6-40 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 GS2-25, TG GS3-32 and TG GS6-40 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 inner circlips (1500) and the support rings (1510).
4. The bearing housing (1430) can now been removed.
5. Detach bearing bracket (1400) by loosening the screws (1410).
6. Remove outer circlips (1450) and the support ring (1460) from the shaft.
7. Remove the ball bearing (1440) from the shaft. Use an appropriate extractor.



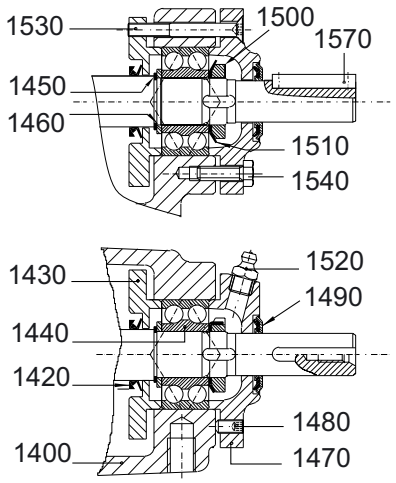
Disassembly and assembly of rolling bearing TG GS2-25/3-32/6-40

4.5.3 TG GS2-25, TG GS3-32 and TG GS6-40 assembly

1. Assemble bearing bracket (1400) with the screws (1410).
2. Fit a new ball bearing (1440) in the bearing housing (1430) together with support rings (1510) and inner circlips (1500).
3. Place one outer circlip (1450) and one support ring (1460) on the shaft.
4. Fit the assembled ball bearing together with the bearing housing on the shaft against the support ring (1460). Push with an appropriate tool on the inner bearing ring. Fit the second support ring (1460) and the second outer circlip (1450) on the shaft.
5. Fit set screws (1480) and tap bolts (1540).
6. Adjust axial clearance (see section 3.21.6).
7. Fit the key (1570) and the flexible coupling half.

4.5.4 TG GS15-50 to TG GS185-125 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 (1440) from the pump shaft using the appropriate extractor.
10. Disassemble support ring (1460), outer circlips (1450), inner bearing cover (1430) and V-seal (1420).



Disassembly and assembly of rolling bearing TG GS15-50 to 185-125

4.5.5 TG GS15-50 to TG GS185-125 assembly

1. Place the V-seal (1420) and the inner bearing cover (1430) on the pump shaft.
2. Fit the outer circlips (1450) 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. Fit a new locking washer (1510).
5. 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).
6. Grease the bearing.
7. Clean the bearing bracket (1400). Fit it on the intermediate casing with the aid of screws (1410).
8. Place both the outer and the inner ball bearing cover against the bearing. Hold both covers together with the aid of long screws (1530).
9. Fit set screws (1480) and tap bolts (1540).
10. Adjust axial clearance (see section 3.21.6).
11. Fit the V-seal (1490), key (1570) and the flexible coupling half.

4.6 Mechanical seal

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

4.6.1 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.

4.6.2 Preparation

Check if the mechanical seal to be mounted has the appropriate size and construction and verify if it can be assembled. The short EN12756 (DIN24960) single mechanical seal can be built in. The mechanical seal is set against the rotor shoulder.

TG GS pump size	**2-25 2-32**	**6-40**	**15-50 23-65**	**58-80 86-100**	**185-125**
Shaft diameter	18	22	35	40	55
Short EN12756 (DIN24960)	KU018	KU022	KU035	KU040	KU055
L-1K (short KU)	37.5	37.5	42.5	45	47.5

Dimensions in mm

4.6.3 Special tools

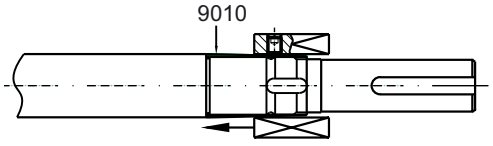
- Conical protection bush (9010)
- Shammy

4.6.4 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 appox. 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).

4.6.5 Assembly of the rotating part

- Lubricate the shaft a little with a lubricant.
  Attention for EP rubber: do not use mineral oil!
- Protect the sharp edges of the shaft with tape or another protecting tool.
- Use a conical assembling bush (9010) on the shaft step (see figure).
- Push the rotating parts against the rotor shoulder.



- Provide the set screws with a drop heat-resistant Loctite and fit the set screws in the rotating part. Tighten the screws.

4.6.6 Assembly of the stationary seat

- Fit the stationary seat(s) into the casing.
- Use appropriate tools to push the seat perpendiculaly in its housing.
- 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.
- Check the perpendicularity of the seat face to the shaft rotating axis afte assembling.

4.7 Pumps

4.7.1 General

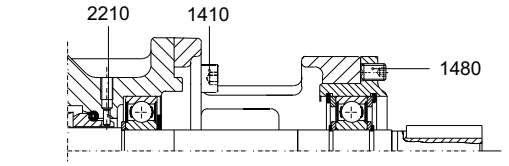
Note! T*o avoid damaging of carbon or ceramic shaft sealing parts the rotor with shaft must remain centered in the pump casing. Therefore the pump cover (4000) and the idler (0600) should be removed and the shaft be pushed to the front instead of disconnecting and removing the intermediate part (0020) during the disassembly of the second ball bearing (2250).*

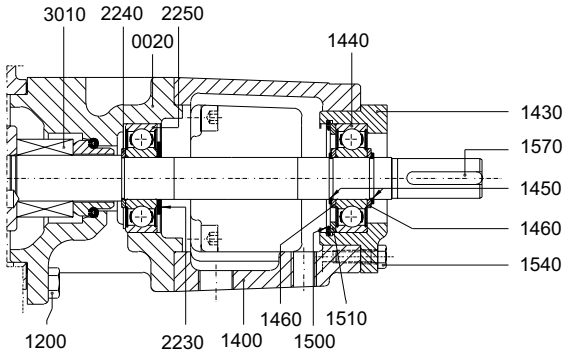
- Always replace damaged parts with original parts.
- At every disassembly new graphite gaskets must be used. Never re-use gaskets.

4.7.2 TG GS2-25/TG GS3-32/TG GS6-40

Disassembly

1. Remove ball bearing (1440) and bearing bracket (1400) as described in bearing disassembly, section 4.5.2.
2. Remove pump cover (4000) and idler (0600).
3. Remove outer circlips (2230) from the shaft.
4. Push the shaft with rotor (0700) to the front using the appropriate pusher or extractor.
5. When the bearing is released from this press fit, move the shaft backwards again so that the ball bearing (2250) comes free.
   Extract now the bearing over the other press fit at ball bearing (1440) location using the appropriate extractor and remove it.
6. Remove outer circlips or support ring (2240) from the shaft.
7. Detach intermediate casing (0020) by loosening the screws (1200) and remove it.





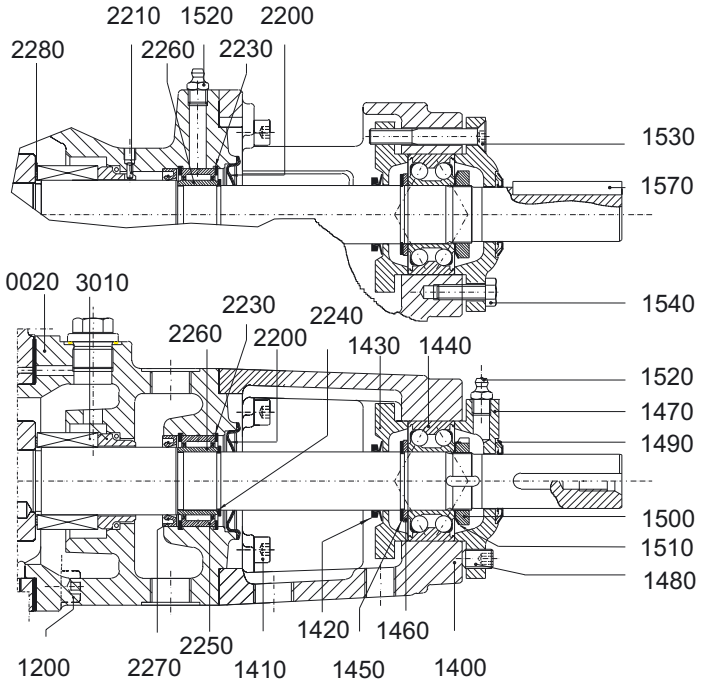
Assembly

1. First assemble seal (3010), see sections 4.6.5 and 4.6.6.
   Fit the intermediate casing (0020) and tighten bolts (1200).
2. Locate the circlips or support ring (2240) on the shaft.
3. Fix the ball bearing (2250) on the shaft against the circlips or support ring (2240).
4. Push on the inner ring of the ball bearing.
5. Fix the circlip (2230) that spanns on the shaft and push it against the ball bearing.

4.7.3 TG GS15-50/TG GS23-65

Dissasembly

1. Remove ball bearing (1440) and bearing bracket (1400) as described in bearing disassembly, section 4.5.4.
2. Remove pump cover (4000) and idler (0600).
3. Remove bearing cover (2200), outer circlips (2240) from the shaft.
4. Push the shaft with rotor (0700) and lock the inner needle bearing ring (2260) towards the front.
5. Detach intermediate casing (0020) by loosening the screws (1200) and remove.
6. Remove lip seal (2270), inner circlips (2230) and outer part of the needle bearing (2250).
7. Remove outer circlips (2240) and inner part of the needle bearing (2260) from the shaft.



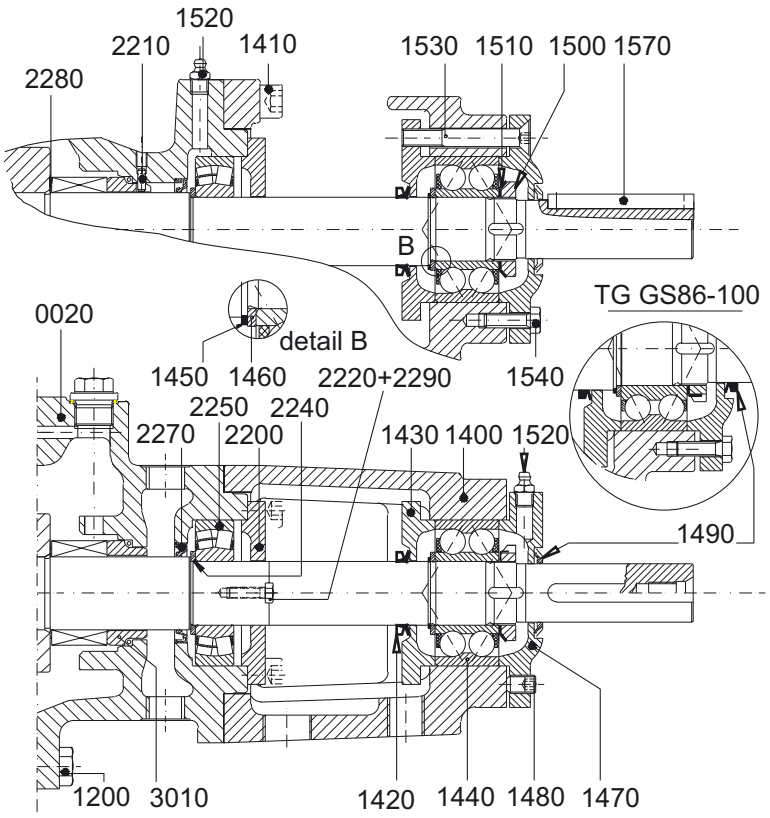
Assembly

1. First assemble seal (3010) and shim ring (2280), see sections 4.6.5 and 4.6.6.
   Fit the intermediate casing (0020) and tighten bolts (1200).
2. Fit the lip seal (2270) using the conical assembling bush again.
   Lubricate the lip seal with a lubricant to facilitate the assembly.
3. Grease the needle bearing outer parts (2250) before fitting.
4. Fit one inner circlip (2230), the needle bearing (2250) and the other second inner circlip (2230).
5. Fit the inner ring of the needle bearing (2260) on the shaft using an appropriate tool.
6. Fit the outer circlip (2240) on the shaft in the shaft groove.
7. Fit the bearing cover (2200).

4.7.4 TG GS58-80/ TG GS86-100/ TG GS 185-125

Disassembly

1. Remove ball bearing (1440) and bearing bracket (1400) as described in bearing disassembly, section 4.5.4.
2. Remove pump cover (4000) and idler (0600).
3. Detach bearing cover (2200) by loosening screws (2220) and remove them together with the washers (2290).
4. Push the shaft with rotor (0700) to the front using the appropriate pusher or extractor.
5. When the bearing is released from the this press fit, move the shaft again backwards so that the roller bearing (2250) comes free. Extract now the bearing over the other press fit at the ball bearing (1440) location using the appropriate extractor and remove.
6. Remove support ring (2240) from the shaft.
7. Detach intermediate casing (0020) by loosening the screws (1200) and remove.



Assembly

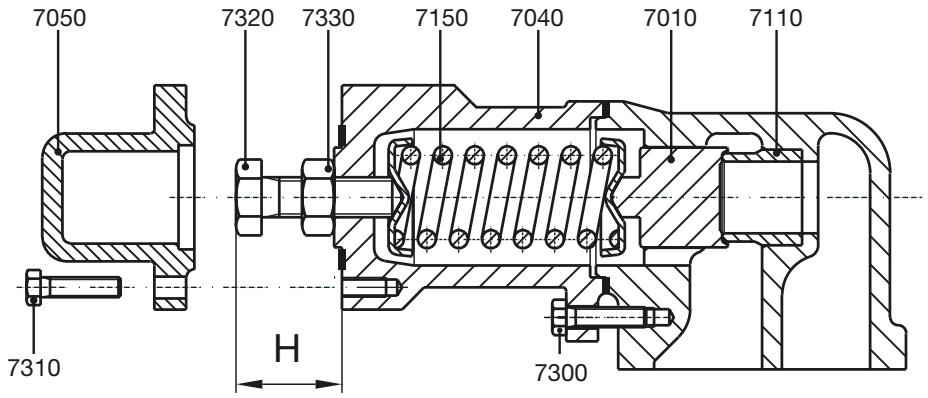
1. First assemble seal (3010) and shim ring (2280), see sections 4.6.5 and 4.6.6.
   Fit the intermediate casing (0020) and tighten bolts (1200).
2. Fit the lip seal (2270) using the conical assembling bush again.
   Lubricate the lip seal with a lubricant to facilitate assembly.
3. Fit support ring (2240).
4. Grease the roller bearing (2250) before fitting.
5. Fit the roller bearing (2250), push on inner and outer ring at the same time using an appropriate tool.
6. Fit bearing cover (2200) together with the washers (2290) and screws (2220).

4.8 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**

4.8.1 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

4.8.2 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 scew 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).

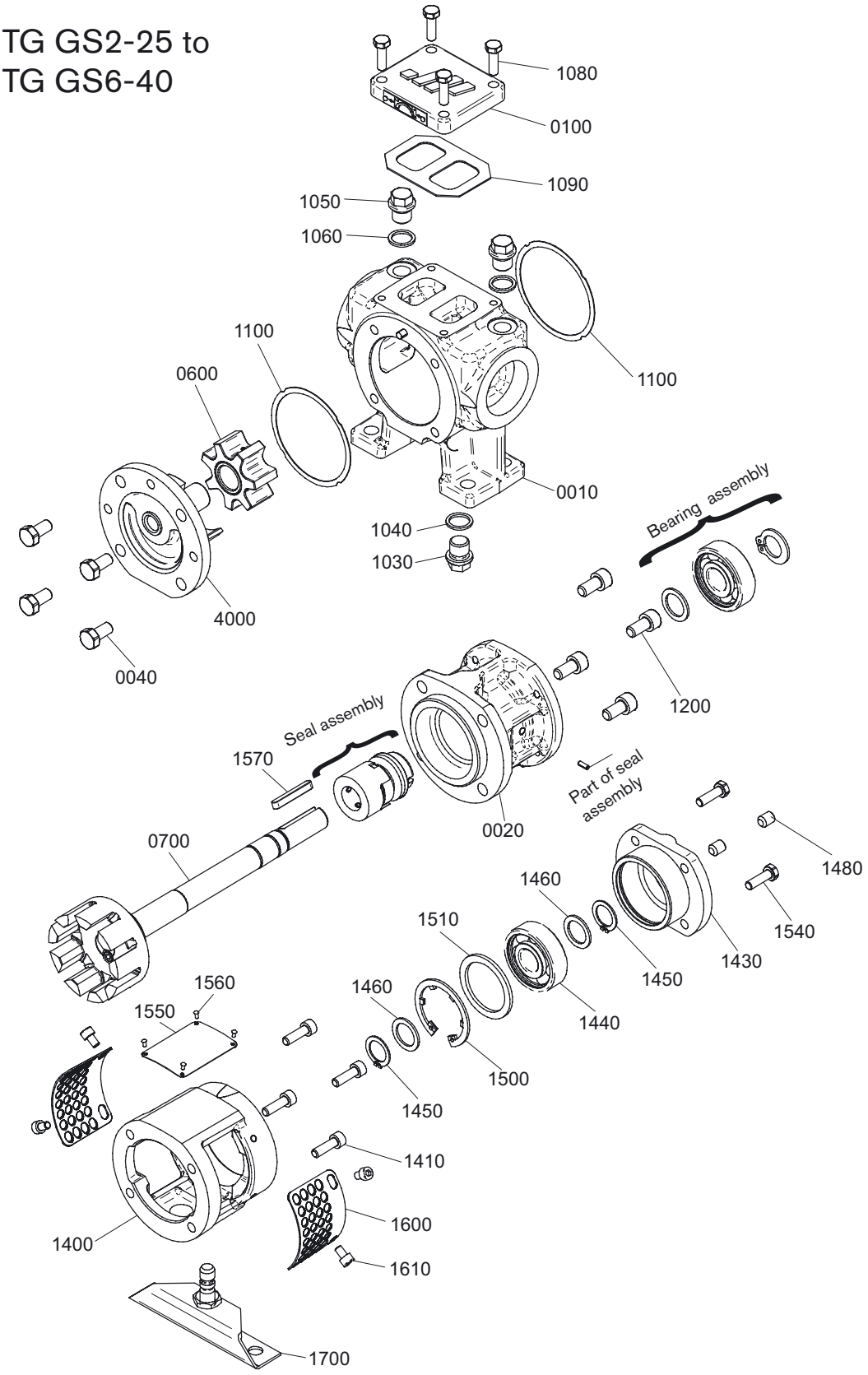
5.0 Sectional drawings and part lists

How to order spares

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

Example:
1. *Pump type: TG GS58-80G2SSG2G1AV*
   Serial number: 2000-101505
2. *Pos 0600, 1, Idler + Bush complete*

5.1 TG GS2-25 to TG GS6-40



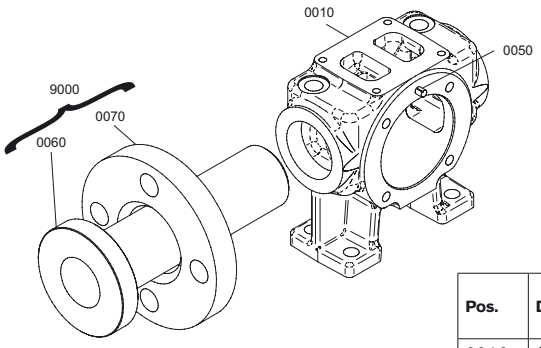
5.1.1 Hydraulic part

Pos.	Description	GS2-25	GS3-32	GS6-40	preventive	overhaul
0010	pump casing	1	1	1		
0020	Intermediate casing	1	1	1		
0040	tap bolt	4	4	4		
0100	top cover, complete	1	1	1		
0600	idler + bush, complete	1	1	1	x	
0700	rotor + shaft, complete	1	1	1	x	
1030	plug	1	1	1		
1040	sealing ring	1	1	1	x	x
1050	plug	2	2	2		
1060	sealing ring	2	2	2	x	x
1080	tap bolt	4	4	4		
1090	gasket	1	1	1	x	x
1100	gasket	2	2	2	x	x
1200	screw	4	4	4		
1570	key	1	1	1	x	x
4000	pump cover + idler pin, complete	1	1	1	x	

5.1.2 Bearing bracket

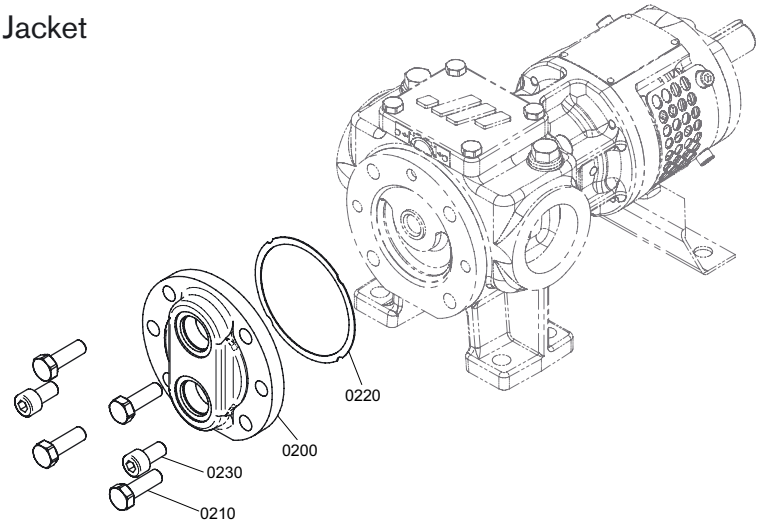
Pos.	Description	GS2-25	GS3-32	GS6-40	preventive	overhaul
1400	bearing bracket	1	1	1		
1410	cap head screw	4	4	4		
1430	bearing housing	1	1	1		
1440	ball bearing	1	1	1	x	x
1450	circlip	2	2	2		
1460	support ring	2	2	2		
1480	set screw	2	2	2		
1500	circlip	1	1	1		
1510	support ring	1	1	1		
1540	tap bolt	2	2	2		
1550	nameplate	1	1	1		
1560	rivet	4	4	4		
1600	mesh guard	2	2	2		
1610	cap head screw	4	4	4		
1700	bracket support, complete	1	1	1		

5.1.3 Flange connection options



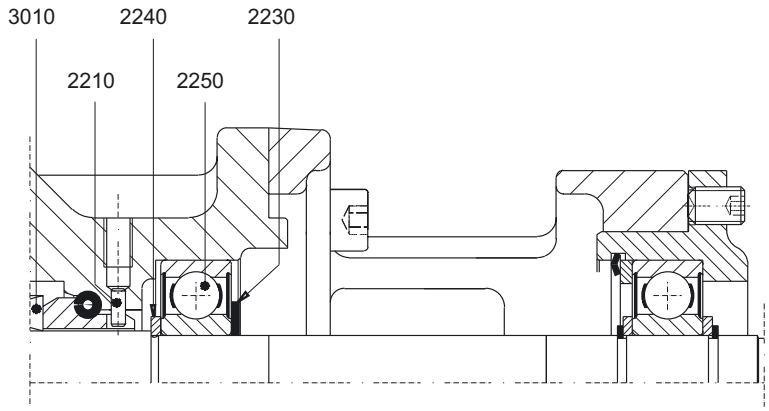
Pos.	Description	GS2-25 GS3-32 GS6-40	preventive	overhaul
0010	G1: pump casing	1		
0050	pin - steel	1		
Screwed on flanges (optionally)				
9000	screw on flanges	1		
0060	collar piece	2		
0070	loose flange	2		

5.1.4 Jacket



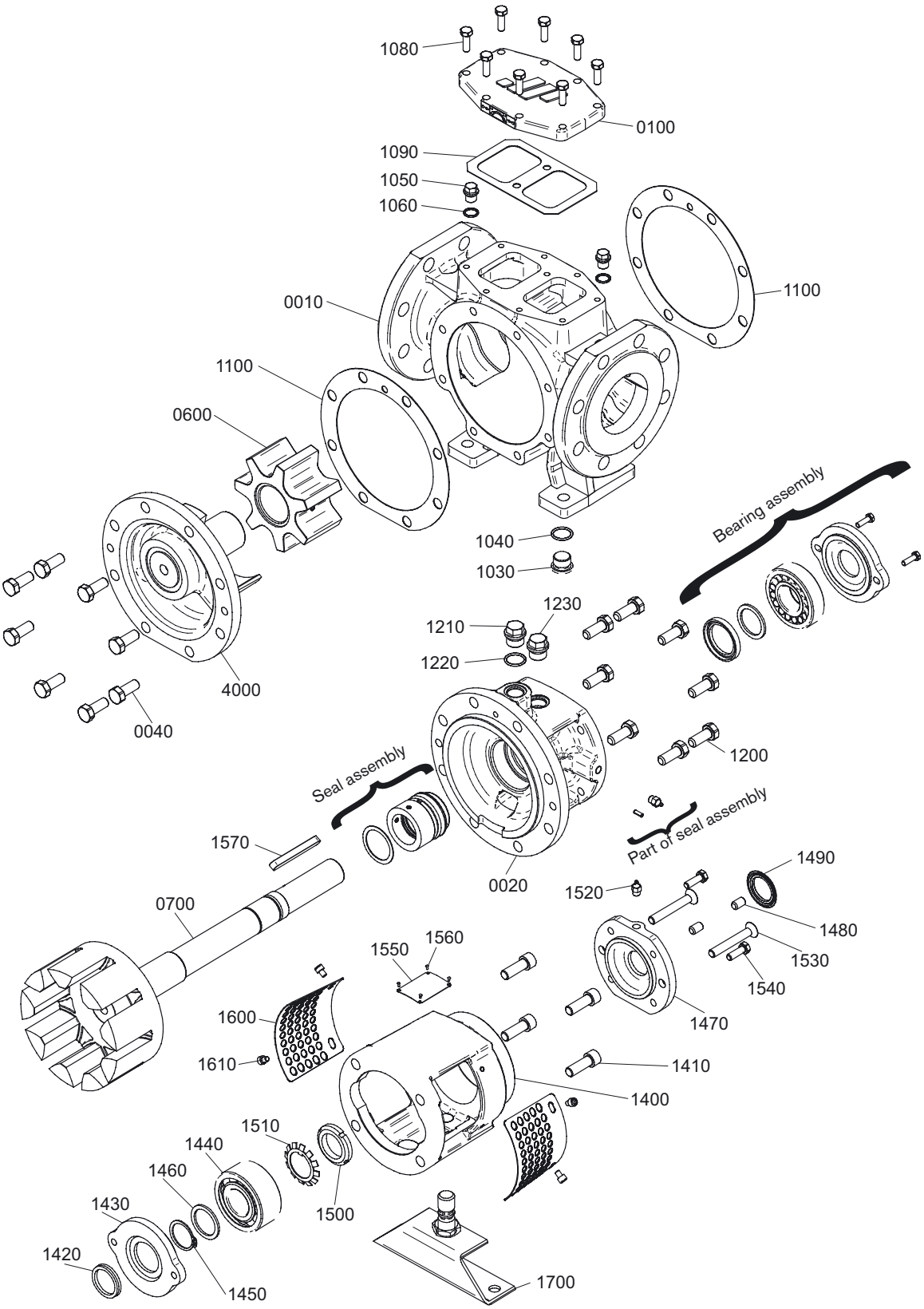
Pos.	Description	GS2-25	GS3-32	GS6-40	preventive	overhaul
0200	jacket cover	1	1	1		
0210	tap bolt	4	4	4		
0220	gasket	1	1	1	x	x
0230	cap head screw	2	2	2		

5.1.5 Single Mechanical seal



Pos.	Description	GS2-25	GS3-32	GS6-40	preventive	overhaul
2210	pin	1	1	1		
2230	circlip	1	1	1		
2240	support ring	1	1	1		
2250	ball bearing	1	1	1	x	x
3010	mechancial seal	1	1	1	x	x

5.2 TG GS15-50 to TG GS185-125



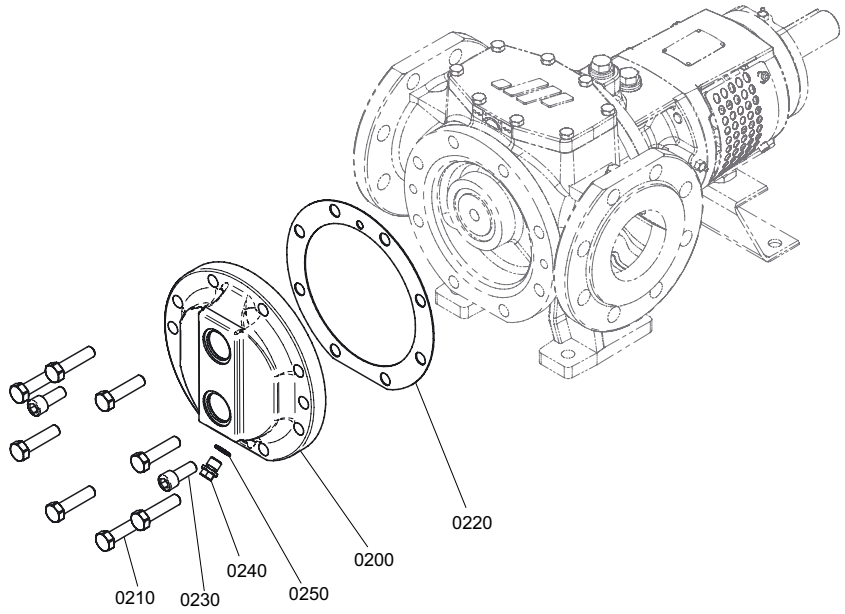
5.2.1 Hydraulic part

Pos.	Description	GS15-50	GS23-65	GS58-80	GS86-100	GS185-125	preventive	overhaul
0010	pump casing	1	1	1	1	1		
0020	Intermediate casing	1	1	1	1	1		
0040	tap bolt	6	6	8	8	8		
0100	top cover complete	1	1	1	1	1		
0600	idler + bush, complete	1	1	1	1	1	x	
0700	rotor + shaft, complete	1	1	1	1	1	x	
1030	plug	1	1	1	1	1		
1040	sealing ring	1	1	1	1	1	x	x
1050	plug	2	2	2	2	2		
1060	sealing ring	2	2	2	2	2	x	x
1080	tap bolt	8	8	8	8	8		
1090	gasket	1	1	1	1	1	x	x
1100	gasket	2	2	2	2	2	x	x
1200	screw	6	6	8	8	8		
1210	plug	1	1	1	1	1		
1220	sealing ring	1	1	1	1	1	x	x
1230	plug	1	1	1	1	1		
1570	key	1	1	1	1	1	x	x
4000	pump cover + idler pin, complete	1	1	1	1	1	x	

5.2.2 Bearing bracket

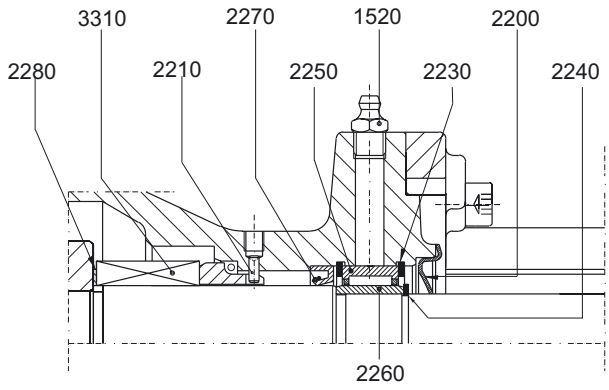
Pos.	Description	GS15-50	GS23-65	GS58-80	GS86-100	GS185-125	preventive	overhaul
1400	bearing bracket	1	1	1	1	1		
1410	cap head screw	4	4	4	4	4		
1420	V-seal	1	1	1	1	1	x	x
1430	bearing cover	1	1	1	1	1		
1440	ball bearing	1	1	1	1	1	x	x
1450	circlip	1	1	1	1	1		x
1460	support ring	1	1	1	1	1		
1470	bearing cover	1	1	1	1	1		
1480	set screw	2	2	2	2	2		
1490	V-seal	1	1	1	1	1	x	x
1500	locking nut	1	1	1	1	1		
1510	locking washer	1	1	1	1	1	x	x
1520	grease nipple	1	1	1	1	1		
1530	countersunck screw	2	2	2	2	2		
1540	tap bolt	2	2	2	2	2		
1550	name plate	1	1	1	1	1		
1560	rivet	4	4	4	4	4		
1600	mesh guard	2	2	2	2	2		
1610	cap head screw	4	4	4	4	4		
1700	bracket support, complete	1	1	1	1	1		

5.2.3 Jacket

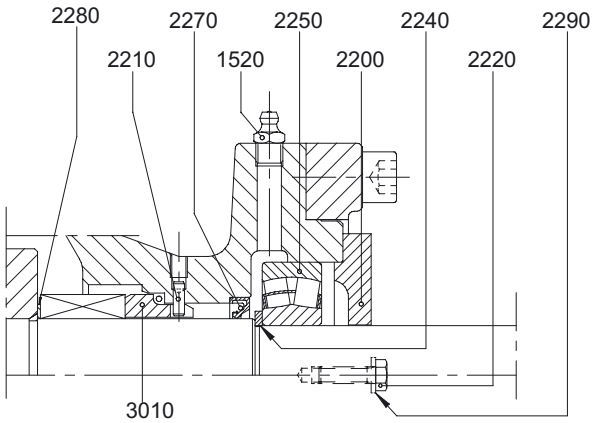


Pos.	Description	GS15-50	GS23-65	GS58-80	GS86-100	GS185-125	preventive	overhaul
0200	jacket cover	1	1	1	1	1		
0210	tap bolt	6	6	8	8	8		
0220	gasket	1	1	1	1	1	x	x
0230	cap head screw	2	2	2	2	4		
0240	plug	1	1	1	1	1		
0250	sealing ring	1	1	1	1	1	x	x

5.2.4 Single mechanical seal



TG GS15-50 and TG GS23-65



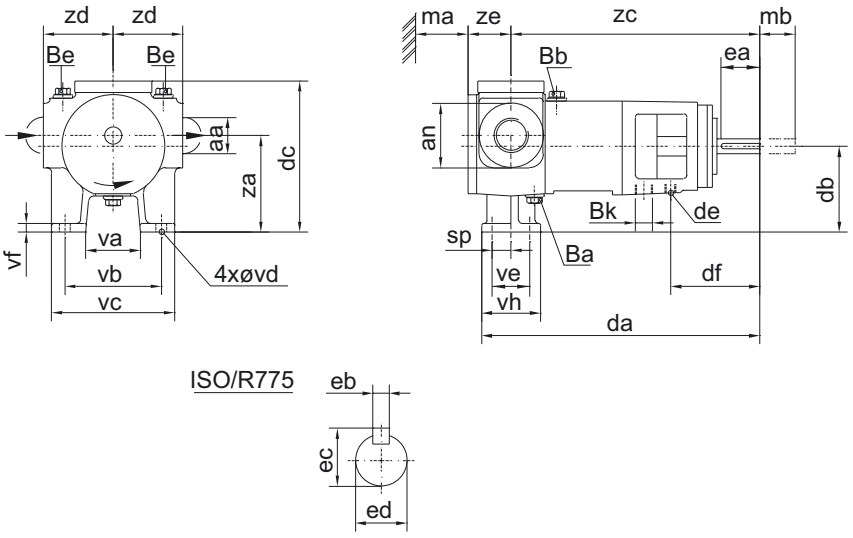
TG GS58-80 to TG GS185-125

Pos.	Description	GS15-50	GS23-65	GS58-80	GS86-100	GS185-125	preventive	overhaul
1520	grease nipple	1	1	1	1	1		
2200	bearing cover	1	1	1	1	1		
2210	pin	1	1	1	1	1		
2220	tap bolt	–	–	2	2	2		
2230	circlip	2	2	–	–	–		
2240	circlip	1	1	1	1	1		
2250	needle bearing, outer components	1	1	–	–	–	x	x
	roller bearing	–	–	1	1	1	x	x
2260	needle bearing, inner ring	1	1	–	–	–	x	x
2270	lip seal	1	1	1	1	1	x	x
2280	shim ring	1	1	1	1	1		
2290	washer	2	2	2	2	2	x	x
3010	mechanical seal	1	1	1	1	1	x	x

6.0 Dimensional drawings

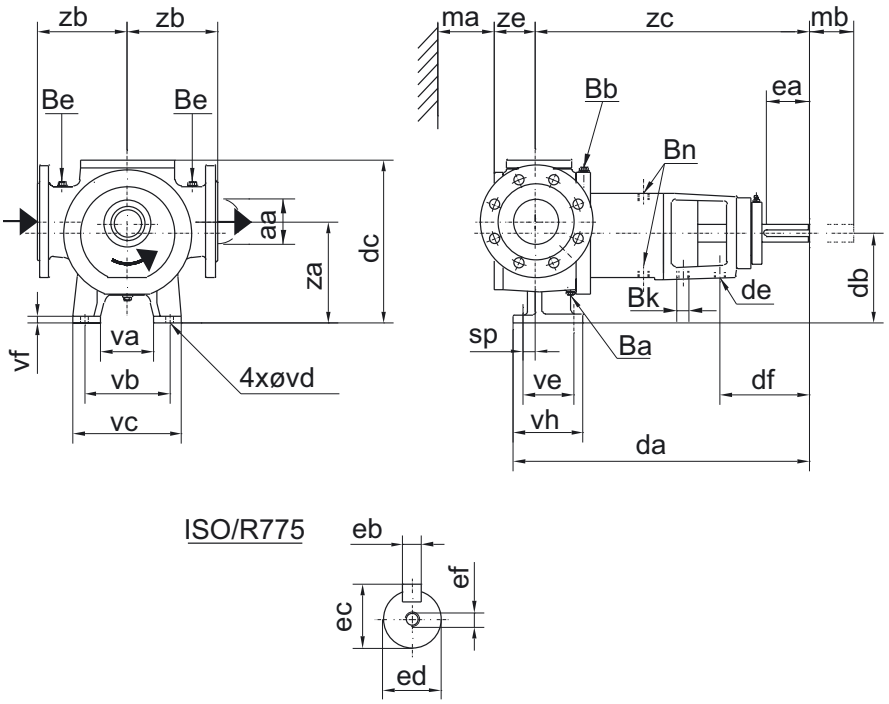
6.1 Standard pump

6.1.1 TG GS2-25 to TG GS6-40



	TG GS2-25	TG GS3-32	TG GS6-40
aa	G 1	G 1 1/4	G 1 1/2
an	60		70
Ba	G 1/4		G 1/4
Be	G 1/4		G 1/4
Bk	Rp 3/8		Rp 3/8
da	246		293
db	80		100
dc	147		179
de	M10		M12
df	81		88
ea	39		40
eb	5 h9		6 h9
ec	18		21.5
ed	16 j6		19 j6
ma	50		60
mb	50		60
sp	17,5		22
va	51		53
vb	90		100
vc	115		127
vd	10		12
ve	35		45
vf	10		11
vh	55		70
za	90		110
zc	218		258
zd	65		80
ze	46		54

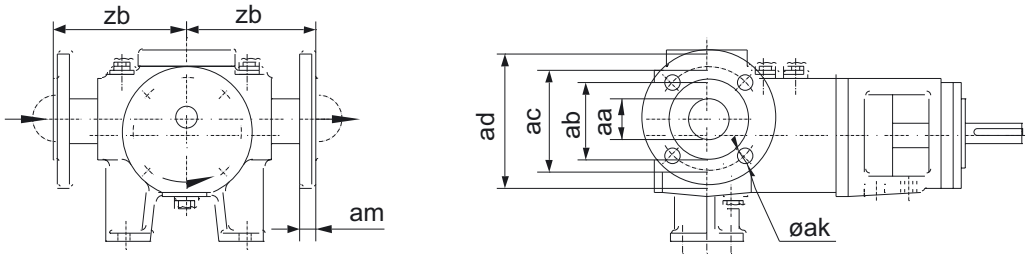
6.1.2 TG GS15-50 to TG GS185-125



	TG GS15-50	TG GS23-65	TG GS58-80	TG GS86-100	TG GS185-125
aa	50	65	80	100	125
Ba	G 1/4	G 1/4	G 1/2	G 1/2	G 1/2
Bb	G 1/2	G 1/2	G 1/2	G 1/2	G 1/2
Be	G 1/4	G 1/4	G 1/4	G 1/4	G 1/4
Bk	Rp 1/2	Rp 1/2	Rp 3/4	Rp 3/4	Rp 3/4
Bn	Rp 1/2	Rp 1/2	Rp 1/2	Rp 1/2	Rp 1/2
da	389	400	479	499	623
db	112	112	160	160	200
dc	209	219	297	315	380
de	M16	M16	M20	M20	M20
df	126	126	159	162	204
ea	60	60	80	80	110
eb	8 h9	8h9	10 h9	10 h9	14 h9
ec	31	31	35	35	51.5
ed	28 j6	28 j6	32 k6	32 k6	48 k6
ef	M10	M10	M12	M12	M16
ma	75	80	105	125	155
mb	75	80	100	115	155
sp	15	26	22.5	32	30.5
va	70	80	100	100	120
vb	120	130	160	160	200
vc	150	160	200	200	260
vd	12	12	14	14	18
ve	60	60	90	90	125
vf	14	14	17	17	22
vh	90	90	125	125	170
za	125	125	180	185	230
zb	125	125	160	180	200
zc	359	359	439	449	570
ze	61	70	81	91	116

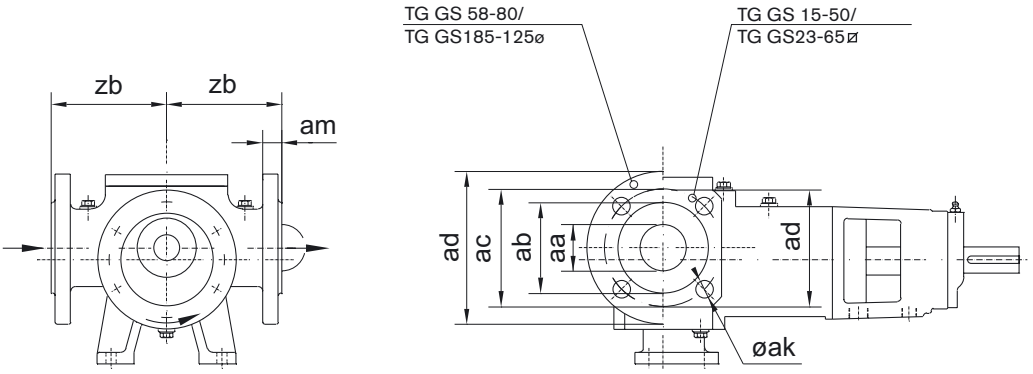
6.2 Flange connections

6.2.1 TG GS2-25 to TG GS6-40



	TG GS2-25	TG GS3-32	TG GS6-40
aa	25	32	40
ab	65	76	84
ac PN16	85	100	110
ac PN20	79.5	89	98.5
ad PN16	115	140	150
ad PN20	110	120	130
ak PN16	4xd14	4xd18	4xd18
ak PN20	4xd16	4xd16	4xd16
am PN16	30	32	32
am PN20	30	32	33
zb	190	220	200

6.2.2 TG GS15-50 to TG GS185-125

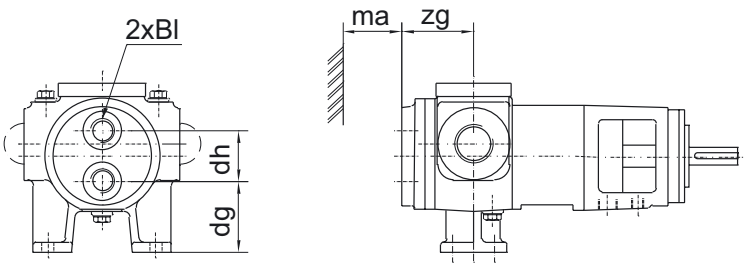


	TG GS15-50	TG GS23-65	TG GS58-80	TG GS86-100	TG GS185-125
aa	50	65	80	100	125
ab	100	118	135	153	180
ac PN16	125	145	160	180	210
ac PN20	120.5	139.5	152.5	190.5	216
ad	125 *)	145 *)	200	220	250
ak PN16	4xd18	4xd18	8xd18	8xd18	8xd18
ak PN20	4xd18	4xd18	4xd18	8xd18	8xd22
am	21	21	24	25	28
zb	125	125	160	180	200

**) Square flanges in stead of rounded flanges*

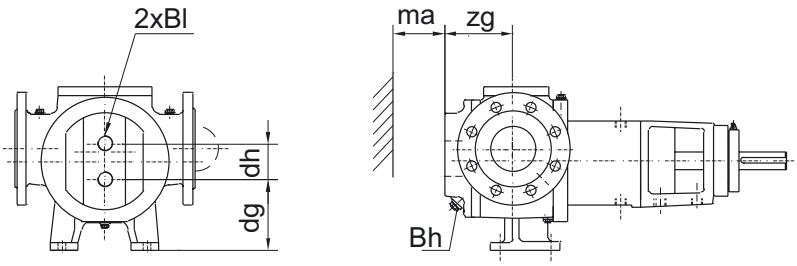
6.3 Jackets (S) on pump cover and thread connection

6.3.1 TG GS2-25 to TG GS6-40



	TG GS2-25	TG GS3-32	TG GS6-40
Bl	G 1/2		G 3/4
dg	59		75
dh	42		50
ma	50		60
zg	61		76

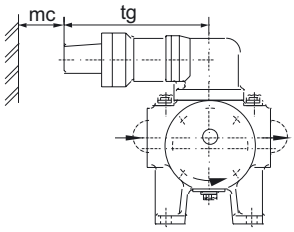
6.3.2 TG GS 15-50 to TG GS185-125

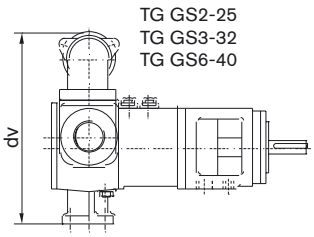


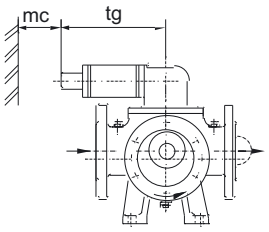
	TG GS15-50	TG GS23-65	TG GS58-80	TG GS86-100	TG GS185-125
Bl	G 3/4	G 3/4	G 1	G 1	G 1
Bh	–	–	G 1/4	G 1/4	G 1/4
dg	87	87	121	115	135
dh	50	50	78	90	130
ma	75	80	105	125	155
zg	85	96	123	140	163

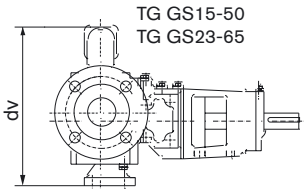
6.4 Safety relief valves

6.4.1 Single safety relief valve

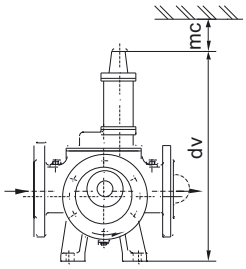


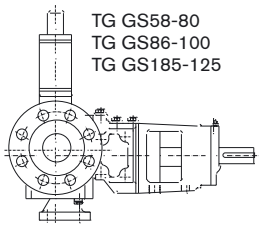




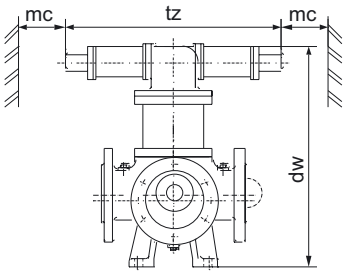


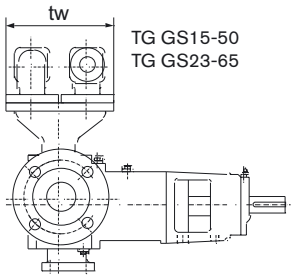
TG GS pump size	dv	mc	tg
2-25 3-32	202	40	145
6-40	234	40	145
15-50	290	50	200
23-65	300	50	200
58-80	550	70	–
86-100	576	70	–
185-125	641	70	–

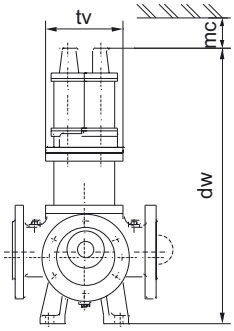


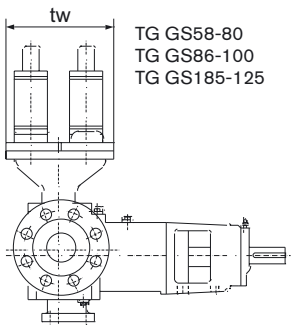


6.4.2 Double safety relief valve



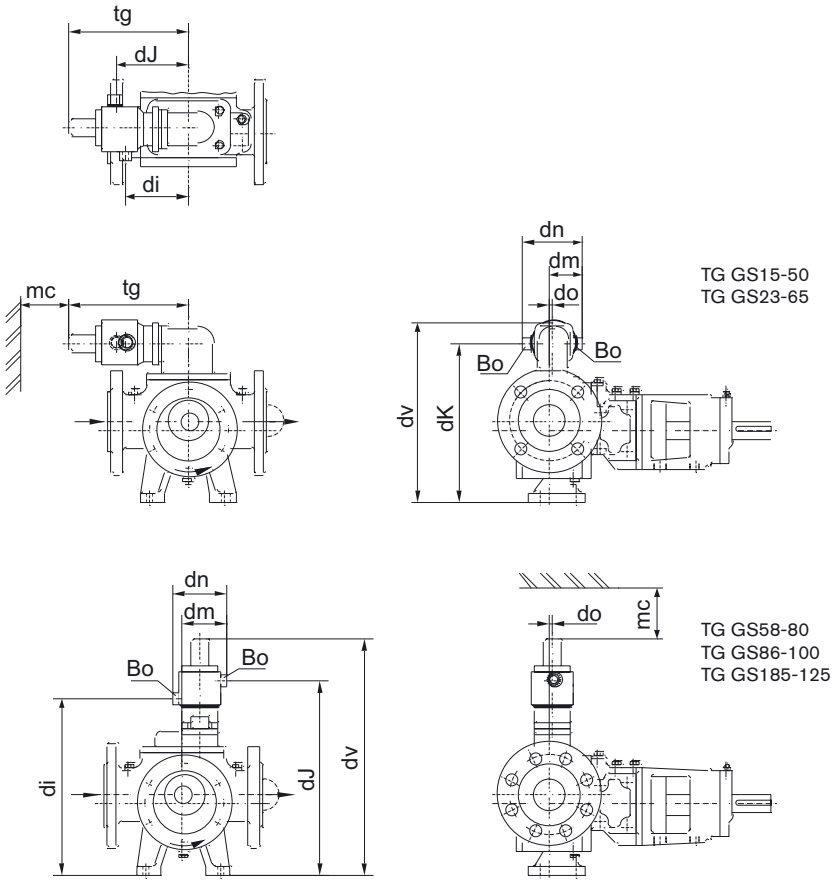






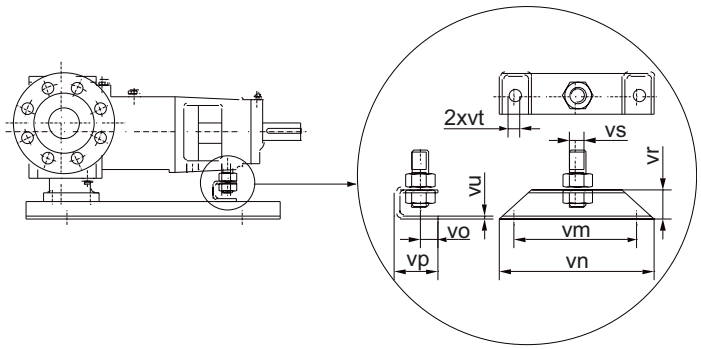
TG GS pump size	dw	mc	tv	tw	tz
15-50	390	50	–	184	400
23-65	400	50	–	184	400
58-80	661	70	178	238	–
86-100	697	70	219	300	–
185-125	762	70	219	300	–

6.4.3 Heated safety relief valve



	TG GS15-50	TG GS23-65	TG GS58-80	TG GS86-100	TG GS185-125
Bo	G 1/2	G 1/2	G 1/2	G 1/2	G 1/2
di	101	101	418	444	509
dj	119	119	458	484	549
dk	253	263	–	–	–
dm	62	59.5	98.5	103.5	103.5
dn	115	115	127	127	127
do	6.5	4	6	8	24
dv	290	300	550	576	641
mc	50	50	70	70	70
tg	200	200	–	–	–

6.5 Bracket support



	TG GS2-25 TG GS3-32	TG GS6-40	TG GS15-50	TG GS23-65	TG GS58-80	TG GS86-100	TG GS185-125
vm	90	100	120	120	160	160	200
vn	118	130	150	150	195	195	250
vo	10	17	17	17	20	20	20
vp	25	40	40	40	50	50	50
vr	20	30	30	30	50	50	50
vs	M10	M12	M16	M16	M20	M20	M20
vt	10	12	12	12	14	14	14
vu	2	3	3	3	4	4	4

6.6 Weights – Mass

	Mass	Weight	TG GS2-25	TG GS3-32	TG GS6-40
Pump (without jackets)	kg	daN	8	8	14
Front-Pull out (pump cover+idler)	kg	daN	1	1	1.6
Back-Pull Out (shaft+interm. casing+bracket)	kg	daN	6	6	10
Screw on flanges (supplement)	kg	daN	4	5	8
Jackets (supplement)	kg	daN	1	1	1
Relief valve (supplement)	kg	daN	2	2	2
Double relief valve (supplement)	kg	daN	–	–	–

	Mass	Weight	TG GS15-50	TG GS23-65	TG GS58-80	TG GS86-100	TG GS185-125
Pump (without jackets)	kg	daN	30	34	63	75	146
Front-Pull out (pump cover+idler)	kg	daN	3	4	10	13	26
Back-Pull Out (shaft+interm. casing+bracket)	kg	daN	20	22	45	50	901
Screw on flanges (supplement)	kg	daN	–	–	–	–	–
Jackets (supplement)	kg	daN	2	3	13	13	12
Relief valve (supplement)	kg	daN	5	5	7	10	10
Double relief valve (supplement)	kg	daN	13	13	24	36	36

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