JOHNSON PUMP
AN SPX BRAND

Instruction Manual

TopGear MAG

Magnetic Drive Internal Gear pumps

Original instructions

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

A.0500.551 – IM-TG MAG/03.00 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 MAG Magnetic Drive Gear Pumps

Types: TG MAG15-50
TG MAG23-65
TG MAG58-80
TG MAG86-100
TG MAG185-125

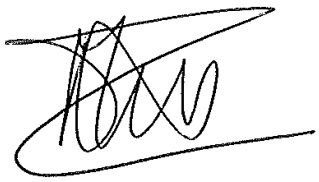
whether delivered without drive or delivered as an assembly with drive, are in conformity with the relevant provisions of the Machinery Directive 2006/42/EC, Annex I.

Manufacturer Declaration

Machinery Directive 2006/42/EC, Annex IIB

The partly completed pump (Back-Pull-Out unit), member of the product family TopGear MAG-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

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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 distributor.

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

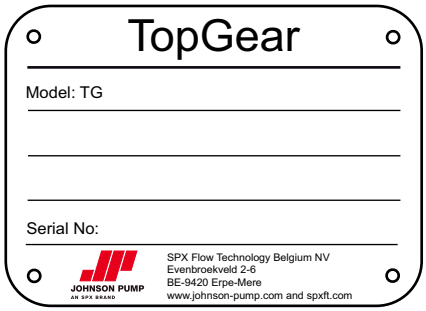
1.2 Reception, handling and storage

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.

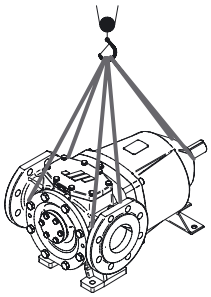
In case of damage and/or missing parts, a report should be drawn up and presented to the carrier at once. Notify your distributor.

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

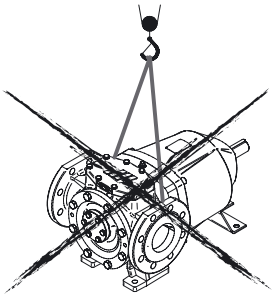


1.2.2 Handling

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



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



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 protective oil.

1.3 Safety

1.3.1 General

Personnel who have a pacemaker should not be allowed to work with the magnetic coupling! The magnetic field is sufficiently strong to affect the operation of a pacemaker. A safe distance is 3 metre!

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

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

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

- 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.

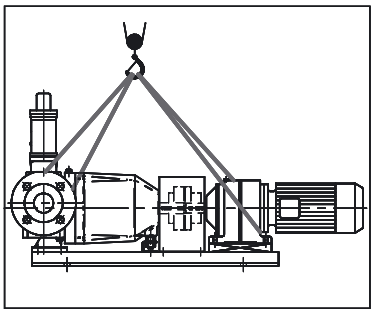
- The pump unit must not be exposed to rapid temperature changes of the liquid without prior preheating/pre-cooling. Large temperature changes can cause crack formation or explosion, which in turn can entail severe personal injuries.
- The pump must not operate above stated performance. See section 3.5 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 must never run completely dry. Dry running produces heat and can cause damage to internal parts such as bush bearings. 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 distributor.
- If the pump does not function satisfactorily, contact your distributor.

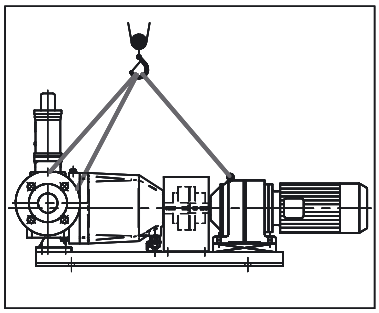
1.3.2 Pump units

1.3.2.1 Pump unit handling

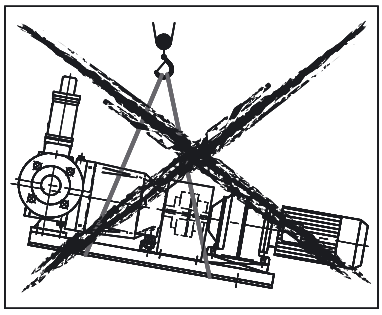
Use an overhead crane, forklift or other suitable lifting device.



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.

Personnel who have a pacemaker should not be allowed to work with the magnetic coupling!
The magnetic field is sufficiently strong to affect the operation of a pacemaker. A safe distance is 3 metre!

Always keep electronic equipment with memory, cheque cards with magnetic strips, and similar items at least 1 metre away from the coupling!

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.

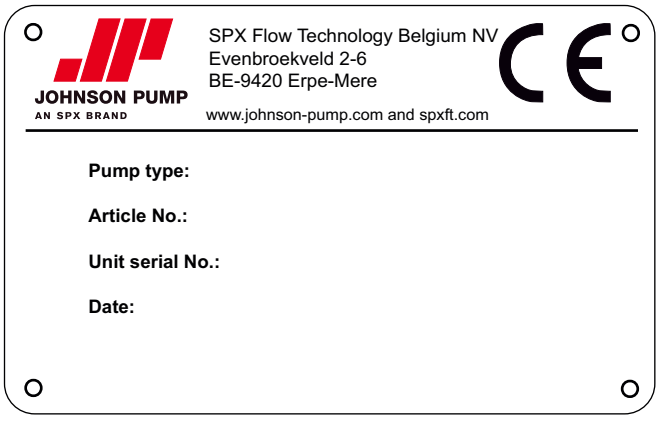
d) Reassemble the coupling guard and any other protective covers. Make sure that the screws are properly tightened.

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 distributor 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 $\left[\frac{kg}{dm^3}\right]$ ν = kinematic viscosity $\left[\frac{mm^2}{s}\right]$ = 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 SuctionHead	NPSHa	Net Positive Suction Head is the total 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 impairment 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 MAG pumps are rotary positive displacement pumps with internal gear. They are made of cast iron or stainless steel. TG MAG pumps are assembled from modular elements, which allows a variety of constructions. Different magnet coupling executions, heating/cooling options, several sleeve bearings, gear and shaft materials and mounted safety relief valve.

2.1 Type designation

The pump properties are encoded in the following type indication, which is to be found on the name-plate:

Example:
TG MAG 58-80 G2-S0C-BG2-Q-S5-S10-V-R

TG	MAG	58-80	G2	S	0C	BG	2	Q	S5	S10	V	R
1	2	3	4	5	6	7	8	9	10	11	12	13

1. Pump family code

TG = TopGear

2. Pump range name

MAG = magnetic driven pump

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

TG MAG 15-50
TG MAG 23-65
TG MAG 58-80
TG MAG 86-100
TG MAG 185-125

4. Pump material and Port connection type

G2 PN16 flanges to DIN 2533
G3 PN20 flanges to ANSI 150 lbs

R2 PN25 / PN40 flanges
R3 PN20 flanges to ANSI 150 lbs
R4 PN50 flanges to ANSI 300 lbs
R5 PN16 flanges to DIN 2533

5. Jacket options for pump cover

0 Pump cover without jackets
S Pump cover with jacket and thread connection
T Pump cover with jacket and flange connection

6. Jacket options for intermediate cover

0C Intermediate cover without heating
SC Intermediate cover with thread connection
TC Intermediate cover with flange connection

TG	MAG	58-80	G2	S	0C	BG	2	Q	S5	S10	V	R
1	2	3	4	5	6	7	8	9	10	11	12	13

7. Idler bush and idler materials

SG Idler bush in hardened steel with idler in cast iron
CG Idler bush in carbon with idler in cast iron
BG Idler bush in bronze with idler in cast iron
HG Idler bush in ceramic with idler in cast 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 hardmetal with idler in steel

BR Idler bush in bronze with idler in stainless steel
CR Idler bush in carbon with idler in stainless steel
UR Idler bush in hardmetal with idler in stainless steel
HR Idler bush in ceramic 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. Bushes on shaft materials

C Bushes in carbon
Q Bushes in silicon carbide

10. Rotor and shaft materials

S5 Rotor and shaft in nitrided carbon steel
R5 Rotor and shaft in nitrided stainless steel

11. Permanent magnet material and length of magnets (in cm)

S04 Samarium Cobalt magnets length = 40 mm
S06 Samarium Cobalt magnets length = 60 mm
S08 Samarium Cobalt magnets length = 80 mm
S10 Samarium Cobalt magnets length = 100 mm
S12 Samarium Cobalt magnets length = 120 mm
N04 Neodymium Iron Boron magnets, length = 40 mm
N06 Neodymium Iron Boron magnets, length = 60 mm
N08 Neodymium Iron Boron magnets, length = 80 mm
N10 Neodymium Iron Boron magnets, length = 100 mm
N12 Neodymium Iron Boron magnets, length = 120 mm

12. Elastomer material

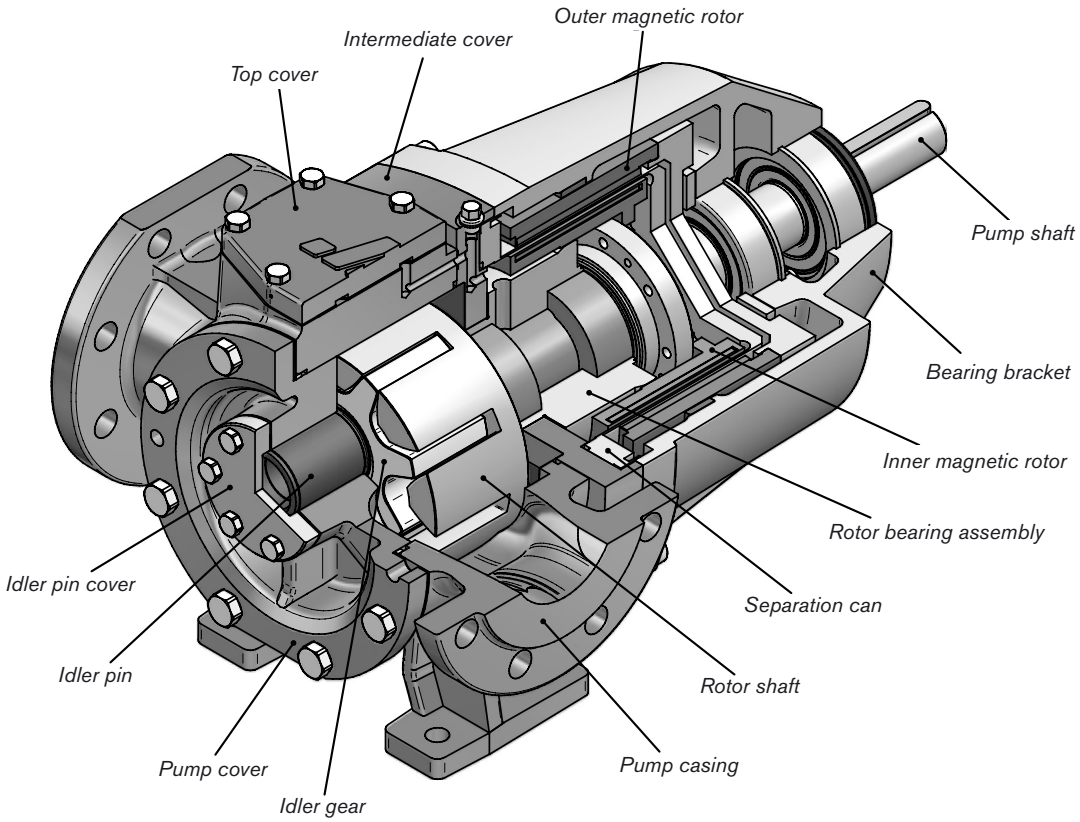
V FPM (Fluorcarbon)
X Elastomer on request

13. Sense of rotation

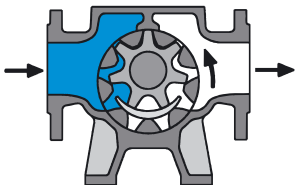
R Clockwise seen from the shaft end of the pump
L Counter-clockwise seen from the shaft end of the pump

3.0 General information and technical data

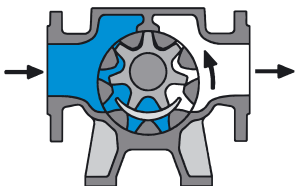
3.1 Pump standard parts



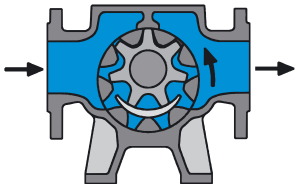
3.2 Operating principle



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



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



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

The pump is assembled to be used for flow in one direction.

3.2.1 Self-priming operation

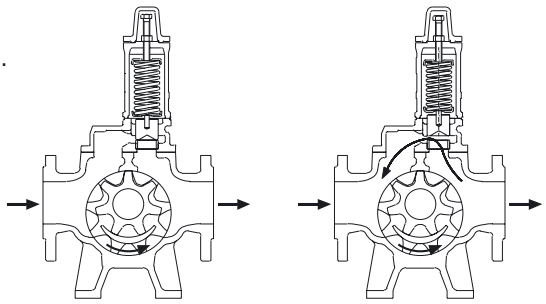
TopGear pumps are self-priming when sufficient liquid is present in the pump to fill up the clearances and the dead spaces between the teeth. (For self-priming operation see also section 3.18.5.2 Piping).

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. (See 3.19.4 Checklist – Initial start-up – Safety relief valve)

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.
- 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 overpressure must be provided.
- ***Note!*** *Do not use the safety relief valve as a flow regulator. The liquid will ciculate only through the pump and will heat up quickly.*

  Contact your distributor 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 distributor if one or several application parameters change.

Liquids not suitable for the pump can cause damage 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.

Pump size TG MAG	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)
15-50	50	40	100	14.5	1500		3.6	13.1	7.9	1.8	16	24
						1450	3.5	12.6	7.6	1.8		
23-65	65	47	115	22.5	1500		5.6	20.3	9.0	1.7	16	24
						1450	5.4	19.6	8.7	1.7		
58-80	80	60	160	55.8	1050		9.8	35.2	8.8	2.0	16	24
						960	8.9	32.1	8.0	1.8		
86-100	100	75	175	84.2	960	960	13.5	48.5	8.8	1.7	16	24
185-125	125	100	224	183.7	750		23	82.7	8.8	1.9	16	24
						725	22.2	79.9	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

Maximum viscosity = 10 000 mPas
Remark:
Figures are for Newtonian liquids at operating temperature

3.6 Pressure

For performance on pressure three kinds of pressures must be considered i.e.

Differential pressure or working pressure (p) is the pressure on which the pump normally operates. The maximum differential pressure of all TopGear MAG pumps is 16 bar.

Maximum allowable working pressure or design pressure (p.m.) is the pressure on which the pump casing is designed. It represents the maximum allowable pressure difference between internal pressure in the pump casing and the atmosphere. On TopGear MAG pumps the design is 16 bar for cast iron pump casings and 20 bar for stainless steel pump casings

Hydrostatic test pressure is the pressure on which the pump casing including separation can of the magnetic coupling is tested. For TopGear MAG pumps the hydrostatic test pressure is 24 bar.

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-weighted 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 MAG pump size	n_{max}(min-1)	Lpa (dB(A))				Ls (dB(A))
		25% n_{max}	50%n_{max}	75%n_{max}	100%n_{max}	
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-weighted 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 the table above.

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 : **$L_{corrected}$ = 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 dampen much.
- Vibrations in piping, vibrating of the baseplate etc. will make the installation produce more noise.

3.8 Maximum and minimum allowable temperature

The maximum allowable temperature of the pumped medium is 260°C but the temperature limits must be considered depending on the material used for the idler bearing bush, O-ring material and material of the permanent magnets used in the magnetic coupling. The minimum allowable temperature is -20° for cast iron and -40°C for stainless steel casing parts.

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

T-jackets are designed for use with thermal oil and apply to the DIN4754 safety standard for thermal oil transfer. This DIN standard specifies flange connections for temperature from 50°C upwards and jackets of ductile material for temperature from 200°C upwards. Both are provided in the T-design.

T-jackets could also be used for over heated steam or more dangerous media.
The flanges have a special shape with welding neck based on PN16 dimensions.
Maximum temperature: 260°C
Maximum pressure at 260°C: 12 bar

3.10 Internals

3.10.1 Bush materials

Overview of bush materials and application field

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

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

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

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

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

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

The maximum allowable temperature of the rotor shaft bearing assembly is 280°C.

3.10.3 Operation under hydrodynamic lubrication conditions

Hydrodynamic lubrication could be important criteria for bush material selection.
If the bush bearings are running under the condition of hydrodynamic lubrication there is no more material contact between bush and pin or shaft and the lifetime cycle is increased significantly.
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 MAG pump size	K.hyd
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

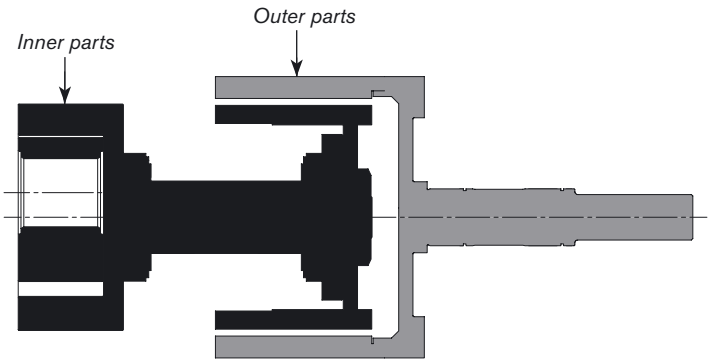
The maximum torque is limited by the maxium transmittable torque of the magnetic coupling. This means the magnetic coupling will slip through before the rotor shaft or pump shaft reach their mechanical limitations.

3.11 Mass moment of inertia

TG MAG pump size	15-50	23-65	58-80	86-100	185-125
J (10-3 x kgm²)	3.5	6.8	32	54	200

Inner parts:
Idler
Rotor shaft
Axial rotor bearings
Shaft sleeve
Inner magnetic rotor

Outer parts:
Pump shaft
Outer magnetic rotor



	Mass moment of inertia J [10^{-3} x kgm²]							
TG MAG	outer parts per lenght of magnets				inner parts per lenght of magnets			
type	40/60	80	100	120	40/60	80	100	120
15-50	22	26	-	-	8	9	-	-
23-65	22	26	-	-	10	12	-	-
58-80	66	80	93	-	46	52	58	-
86-100	72	85	99	-	65	70	76	-
185-125	248	303	358	413	230	247	264	280

3.12 Axial and radial clearances

		TG MAG pump size				
		15-50	23-65	58-80	86-100	185-125
radial clearance	max (µm)	310	320	370	380	420
	min (µm)	250	260	300	300	340
axial clearance	max (µm)	200	215	250	275	320
	min (µm)	120	125	150	165	190

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	CO (µm) axial clear. set minimum	C1 (µm) normal	C1 (µm) normal	C2 (µm)	C3 (µm)
Code Rotor		1xxx		2xxx	3xxx
Code Idler			x1xx	x2xx	x3xx
Code pump cover assembly	xxx0		xxx1	xxx2	xxx3
TG MAG 15-50	52	280	160	350	480
TG MAG 23-65	56	290	170	375	510
TG MAG 58-80	66	325	200	440	600
TG MAG 86-100	72	340	220	480	660
TG MAG 185-125	85	380	255	560	765

Please note:
On TG MAG pumps the radial rotor clearance C1 is slightly larger than on other TopGear pump families, while clearance class C2 and C3 are identical with the standard range.

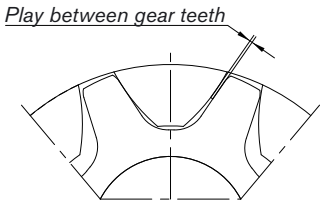
Diametral clearance on pin / idler bearing

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 MAG 15-50	150	300	450
TG MAG 23-65	160	320	480
TG MAG 58-80	240	480	720
TG MAG 86-100	275	550	825
TG MAG 185-125	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 MAG	15-50	23-65	58-80	86-100	185-125
Minimum (µm)	360	400	400	400	440
Maximum (µm)	720	800	800	800	880



3.15 Maximum size of solid particles

TG MAG	15-50	23-65	58-80	86-100	185-125
Size (µm)	80		120		150

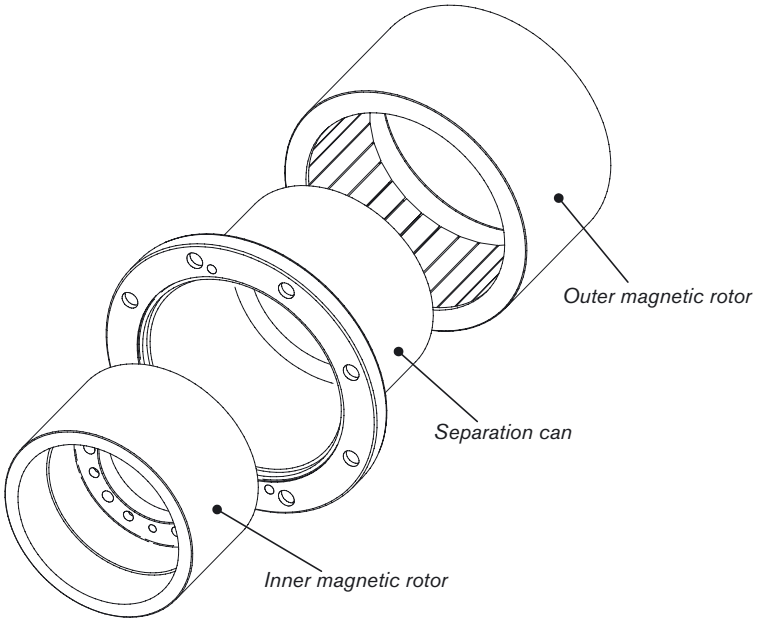
If there are metal particles in the liquid, customer must install a magnetic filter before the liquid reaches the pump.
If there are hard particles in the liquid, consult your distributor.

3.16 Components of the magnetic drive

3.16.1 Magnetic coupling

The magnetic coupling is transmitting the torque of the drive motor to the rotor shaft.
The magnetic coupling arrangement replaces a dynamic shaft seal and makes the pump 100 % leakfree.

The magnetic coupling consists of following components:



The outer magnetic rotor is assembled on the pump shaft which is driven by the motor. The inner magnetic rotor is mounted on the rotorshaft inside the wet part of the pump. The separation can is situated between the outer and inner magnetic rotor and is sealing the pump hermetically.
Permanent magnets are mounted on the inner and outer rotor of the magnetic coupling. The magnets on the inner magnetic rotor are completely encapsulated in stainless steel to prevent contact with the pumped medium. The magnets mounted on the outer rotor are open and protected against corrosion in contact with the atmosphere. The torque is transmitted by magnetic fields between inner and outer magnets which are passing through the stationary separation can. Inner and outer magnetic rotor are running synchronically without slip.

The separation can is a welded construction where the flange and bottom plate are welded to the thin walled pipe section. The can is designed for system pressures up to 25 bar. The section between the magnetic rotors is made of Hastelloy in order to minimize eddy current losses. The separation can is sealed against the intermediate cover by an O-ring.

When the torque of the pump exceeds the maximum allowable torque of the magnetic coupling, the coupling slips. The slipping of the coupling is associated with excessive heat generation and strong vibrations, which can damage the coupling permanently and destroy the bearings. Therefore the drive motor must be switched off as soon as the coupling slips due to overload. This situation can be detected by following means

- Drop in flow output
- Drop of discharge pressure
- Reduced power consumption of the drive motor

The drive motor must be stopped in order to stop the slipping of the magnetic coupling.

During normal operation heat is generated inside the magnetic coupling due to hydraulic friction and eddy currents in the wall of the separation can by the moving magnetic fields. Cooling of the coupling see chapter 3.16.3 Circulation pump.

Maximum allowable temperature and nominal torque
Samarium Cobalt (SmCo): 280°C
Neodymium Iron Boron (NdFeB): 120 °C

The type of the magnetic coupling is related to the selected pump type. There are three types of magnetic couplings with different nominal diameters to cover the five pump sizes. Each coupling type is available with magnets in different lengths and in both magnetic materials. (see table below).

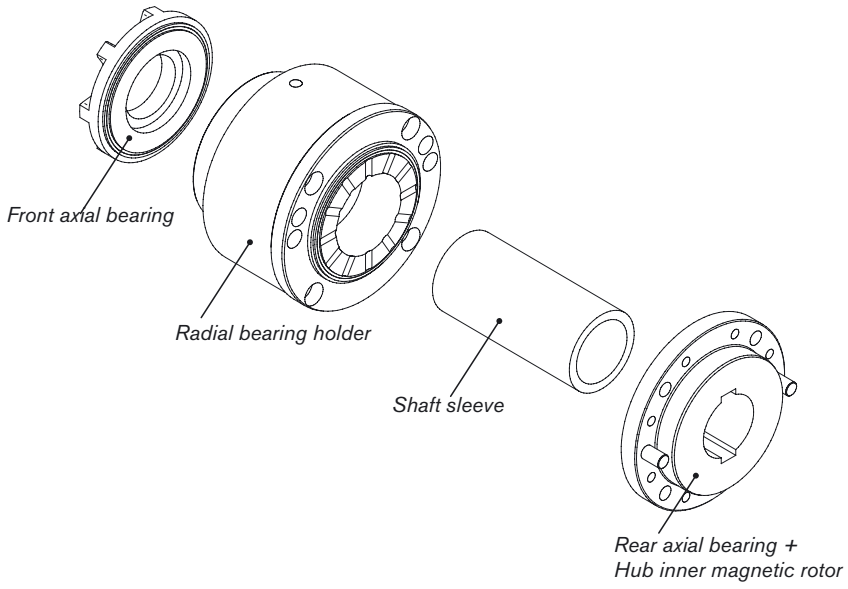
	Nominal diameter [mm]	Length of magnets [mm]				
		40	60	80	100	120
TG MAG 15-50 / 23-65	110	x	x	x	-	-
TG MAG 58-80 / 86-100	165	x	x	x	x	-
TG MAG 185-125	215	x	x	x	x	x

The material of the magnets and the required length of the magnets must be selected according to the operating conditions and the maximum allowable temperature. Please contact your disributor regarding the correct sizing of the magnetic coupling.

Material magnetic coupling parts
Inner magnetic rotor: stainless steel 1.4571
(magnets and iron parts completely encapsulated)
Outer magnetic rotor: carbon steel St52-3 equipped with SmCo or NdFeB magnets
Separation can: flange and bottom plate: stainless steel 1.4571
thin walled pipe portion: Hastelloy C4

3.16.2 Rotor bearing assembly

The rotor bearings are designed to support the radial and axial load generated by the rotor and are lubricated by the pumped liquid. The bearing assembly is supplied as a complete set, consisting of two radial bearing bushes mounted in the bearing holder, two separate axial bearing faces and a shaft sleeve. The shaft sleeve is clamped between the two axial bearings via a shaft nut and is rotating with the shaft. The front faces of the radial bearing bushes are acting as axial bearing faces. The axial bearing clearance is determined by the length of the shaft sleeve, so there is no adjustment required. That means in case of wear or damage the complete bearing assembly must be exchanged.



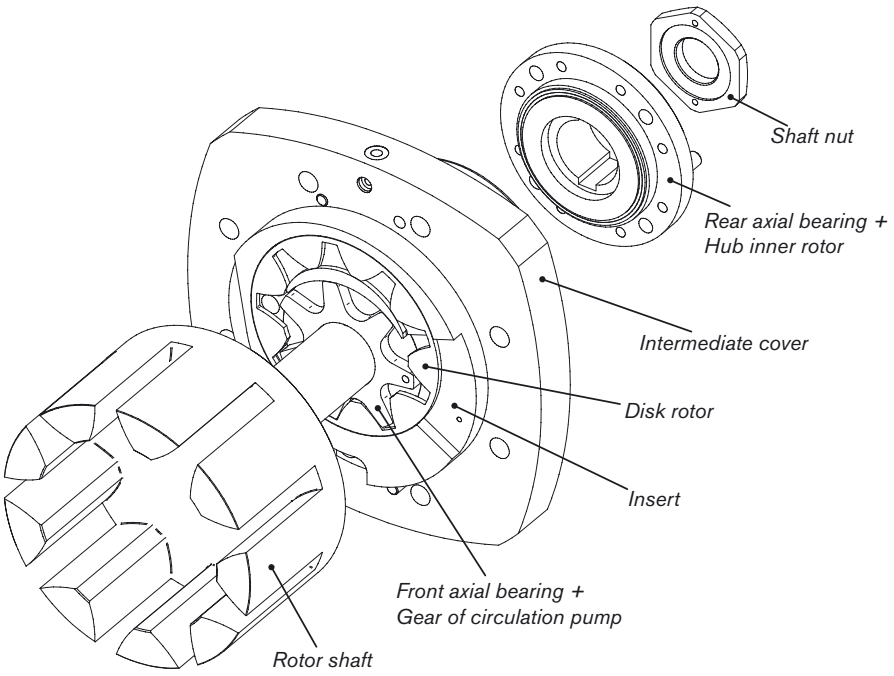
The rear axial bearing is mounted in the hub for the inner magnetic rotor, and the front axial bearing is actually part of the circulation pump supplying lubrication and cooling for the magnetic drive.

Materials rotor bearing assembly

Metal parts:	1.4460 / duplex steel
Shaft sleeve:	Silicon carbide
Axial bearing faces:	Silicon carbide
Radial bearing bushes:	Option (Q) silicon carbide
	Option (C) carbon

3.16.3 Circulation pump

To ensure proper lubrication of the rotor bearings and cooling of the magnetic coupling a circulation pump is providing a controlled flow over the magnetic drive. The liquid is flowing from the discharge side of the pump via holes and grooves in the bearing assembly and the magnetic drive back to the suction side of the pump. This circulation pump is designed as an internal gear pump where the drive gear, integrated in the front axial bearing is driving a disk rotor which is rotating in an insert, situated between rotor and intermediate cover. The insert and the complete rotor bearing assembly are mounted on the intermediate cover.



Material circulation pump parts

Pump gear:	1.4460 duplex steel
Disk rotor:	PEEK
Insert:	1.4460 duplex steel

3.16.4 Sealing rings and gaskets

The magnetic drive replaces a dynamic shaft sealing, so there are only static seals on TopGear MAG pumps. The intermediate cover, separation can and pump cover are sealed with O-rings. Standard O-ring material is FPM, but other O-ring materials can be supplied on request. The maximum allowable operating temperature and chemical resistance must be considered for selection of the O-ring material.

Max. allowable temperature for FPM (Fluorcarbon) = 200 °C

The topcover/safety relief valve is sealed with a graphite gasket and following sealing rings are used to seal plugs:

Cast iron pump casing parts:	Steel sealing rings with asbestos-free filling
Stainless steel casing parts:	PTFE sealing rings

3.17 Safety relief valve

Example

V 35 - G 10 H
1 2 3 4 5

1. Safety relief valve = V

2. Type indication = inlet diameter (in mm)

27 Safety relief valve size for TG MAG 15-50, TG MAG 23-65

35 Safety relief valve size for TG MAG 58-80

50 Safety relief valve size for TG MAG 86-100, TG MAG 185-125

3. Materials

G Safety relief valve in cast iron

R Safety relief valve in stainless steel

4. Working pressure class

4 Working pressure 1-4 bar

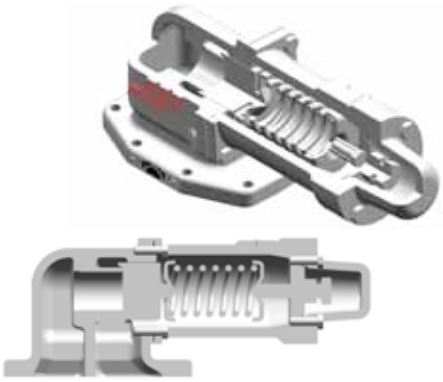
6 Working pressure 3-6 bar

10 Working pressure 5-10 bar

16 Working pressure 9-16 bar

5. Heated spring casing

H Safety relief valve heated spring casing



Safety relief valve – horizontal

Safety relief valve – vertical

3.17.1 Definition and working principle

The safety relief valve built on top of TopGear pumps is designed to protect the pump against over-pressure. It limits the differential pressure (or working pressure) of the pump.

It is a spring-loaded pressure relief valve that opens rapidly by pop action when the working pressure increases to the set pressure on which the spring is set in advance.

The safety relief valve built on top of the TopGear pump may not be used permanently opened because the liquid will be heated up very fast by viscous friction losses. All power input will go to the pumped liquid that circulates in the pump when the safety relief valve is opened and no discharge flow is given.
The single safety relief valve protects the pump only in one direction of flow.

Heating
The spring casing of the safety relief valve can by provided by a welded jacket with thread connections to heat the area around the spring. The valve body is heated together with the pump because it is mounted directly on the pump casing.

3.17.2 Materials

The safety relief valve casing is made of grey cast iron (G) or stainless steel (R). The option heated spring casing is only available for cast iron pumps; in this case the spring casing is made of steel. The internals of the safety relief valve i.e. valve, spring, spring plates and adjusting bolt, and nut is made of stainless steel.

3.17.3 Pressure

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

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

3.17.4 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

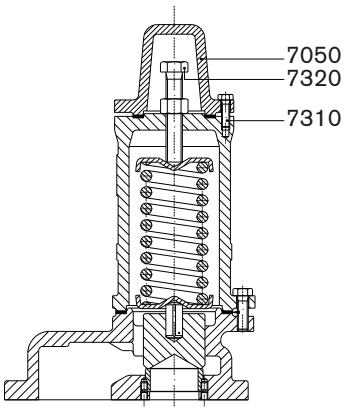
3.17.5 Safety relief valve – Relative adjustment

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

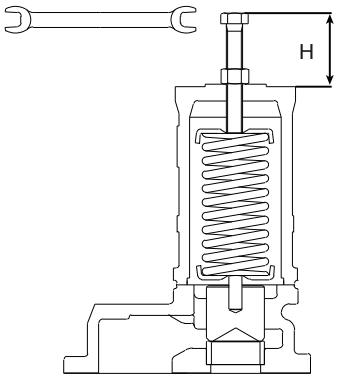
Note! *When testing the safety relief valve mounted on the pump, make sure the pressure never exceeds the set pressure of the valve + 2 bar.*

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.



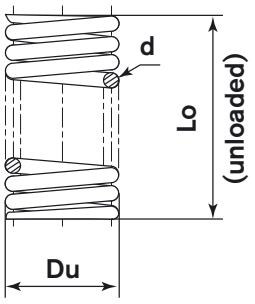
Vertical safety relief valve



Set pressure modification

Spring ratio – Safety relief valve

TG MAG pump size		Spring dimensions				
		Pressure class	Du mm	d mm	Lo mm	p/f bar/mm
15-50 23-65	Horizontal	4	37.0	4.5	93	0.21
		6	37.0	4.5	93	0.21
		10	36.5	6.0	90	0.81
		16	36.5	6.0	90	0.81
58-80	Vertical	4	4.9	7.0	124	0.32
		6	49.0	7.0	124	0.66
		10	48.6	8.0	124	0.66
		16	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
		16	62	11	109	0.86

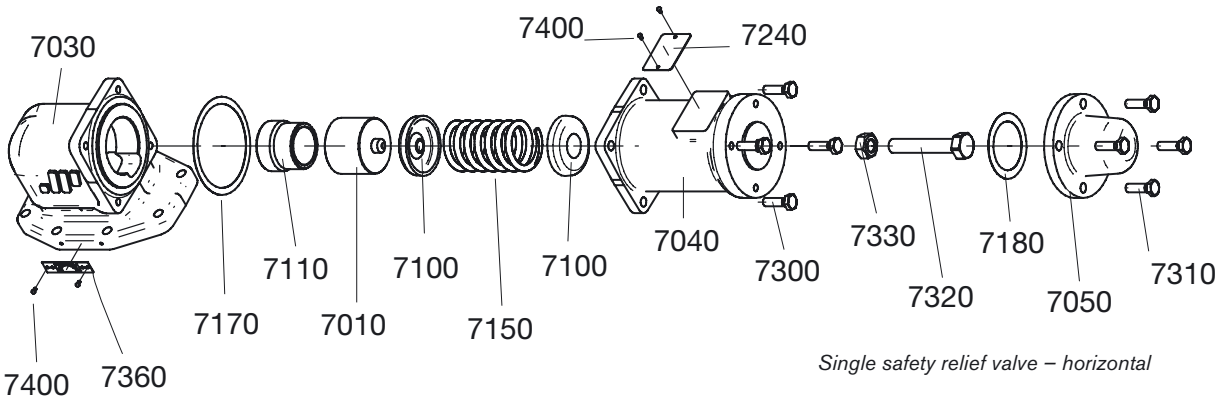


Note!
Spring ratio p/f depends upon the dimensions of the spring. It is recommended to check the dimensions prior to adjusting the pressure.

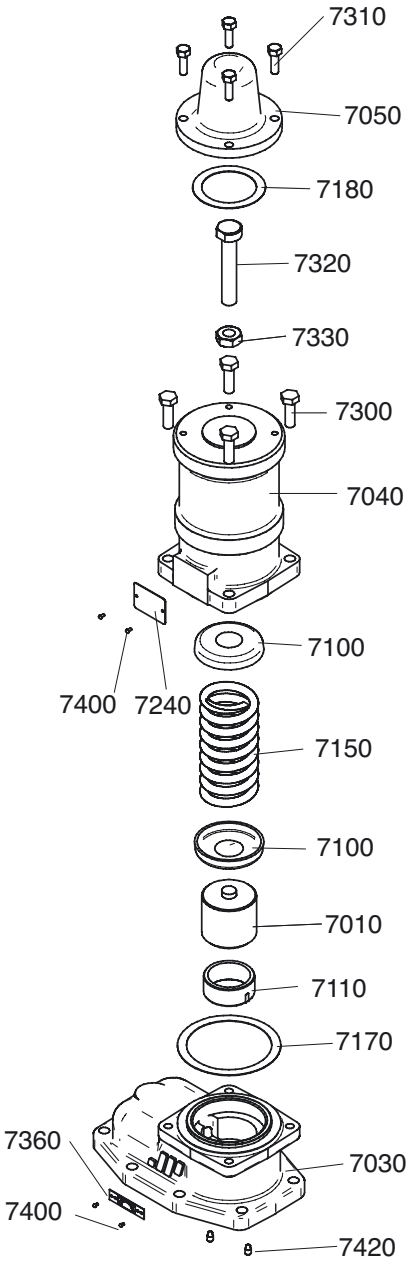
When the safety relief valve is not functioning properly, the pump must immediately be taken out of service. The safety relief valve must be checked by your distributor.

3.17.6 Sectional drawings and part lists

3.17.6.1 Single safety relief valve



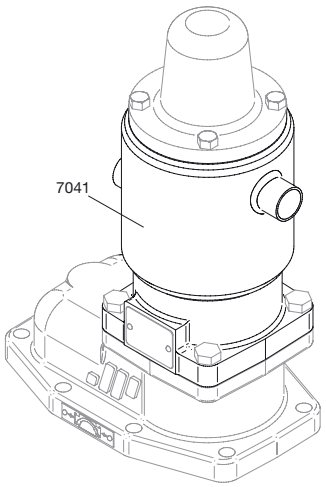
Single safety relief valve – horizontal



Single safety relief valve – vertical

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

3.17.6.2 Heated spring casing



Pos.	Description – Material	V27	V35	V50	Preventive	Overhaul
7041	Heated spring casing	1	1	1		

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 result in a loss of any right to claim damages.

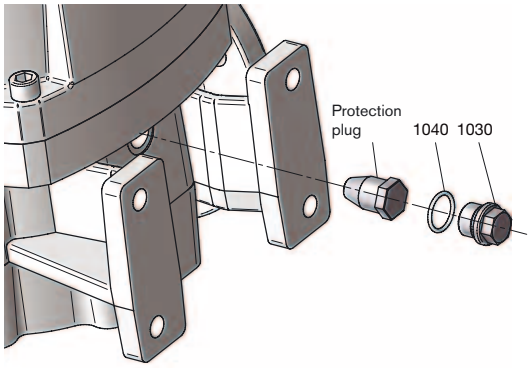
It is imperative that signs affixed to the machine, e.g. arrow indicating the direction of rotation or symbols indicating fluid connections be observed and kept legible.

Because of the presence of strong magnetic fields there are special safety instructions which must be observed.

Personnel who carry a cardiac pacemaker should not be allowed to work on a pump equipped with magnetic coupling! The magnetic field is sufficiently strong to affect the proper operation of a pacemaker, so keep a safe distance of at least 3 m.

Do not come close (not less than 1 m) to the magnetic coupling with objects equipped with magnetic data carriers such as cheque cards, computer disks, watches etc. to avoid damage and/or loss of information.

Preservation: To prevent damage during transportation, the rotor bearing is blocked on the drain hole of the pump casing with a protection plug. Remove this protection plug and place the plug (1030) together with the sealing ring (1040) on the pump in plastic bag. Check that the pump shaft can be rotated by hand. Keep the protection plug for subsequent transport, checks or repair work.



Do not subject the pump to any jolting loads. This can cause damage to the magnets or the slide bearings of the rotor shaft on account of their brittleness.

3.18.2 Location

3.18.2.1 Short suction line

Locate the pump/pump unit 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 3.18.5.2 Piping.

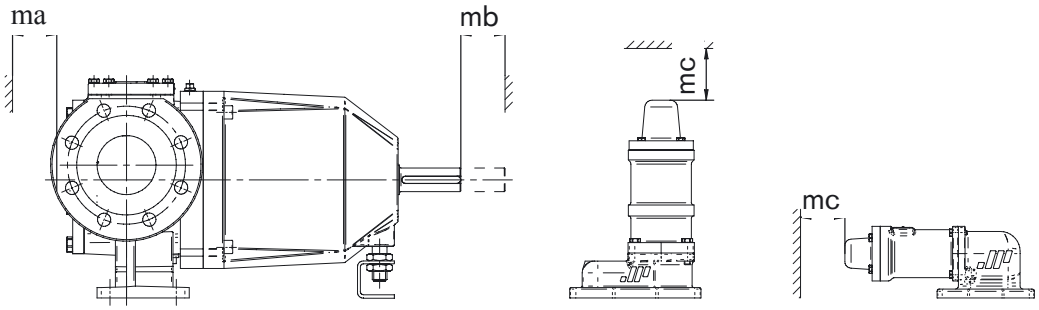
3.18.2.2 Accessibility

Sufficient space 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 (rotor shaft and magnetic coupling) 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 safety representative must provide the necessary protective means and place “Hot surfaces” notices.

When insulating the pump unit, ensure that adequate cooling is allowed for the bearing housing. This is required for cooling of the bearings and grease of the bearing bracket.
(see 3.18.7.7 Guarding of moving parts).

Protect the user against leakages and possible liquid streams.

3.18.2.5 Stability

Foundation

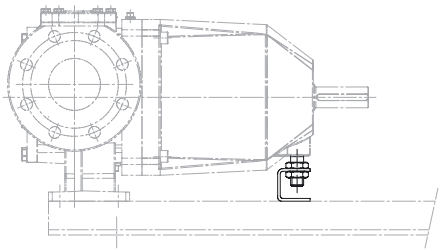
The pump unit must be installed on a base plate or on a frame placed exactly level on the foundation. The foundation must be hard, level, flat and vibration free to guarantee correct alignment of the pump/drive while operating. See also section 3.18.7 Guidelines for assembly and section 3.18.7.6 Shaft coupling.

Horizontal mounting

Pumps are to be mounted horizontally on the integral feet. Other kinds of installation have an influence on draining and filling, etc. If the pump/pump unit is installed differently, contact your distributor.

Support

The support under the bearing bracket is designed to absorb belt forces and vibrations while 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 3.18.7 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.

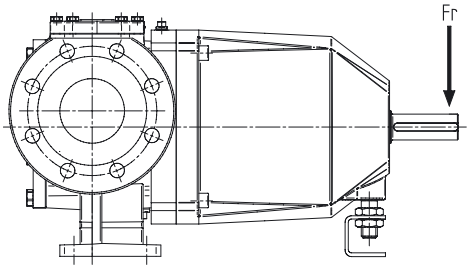
Note! *A mechanical variable speed drive requires checking of the available torque at low and high speed.*

- Frequency invertors may have limited the starting torques.
- The selection of the size and performance of the magnetic coupling depends on the output torque of the drive motor during start-up. Please verify that the maximum allowable torque of the magnetic coupling is not exceeded.

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 MAG pump size	Fr_max [N]
15-50	1000
23-65	
58-80	1800
86-100	
185-125	2500



- This force is calculated for the maxium allowable torque at the shaft end and for a bearing life of 25.000 hours.
- 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 MAG 15-50, V-belt drive can be used.

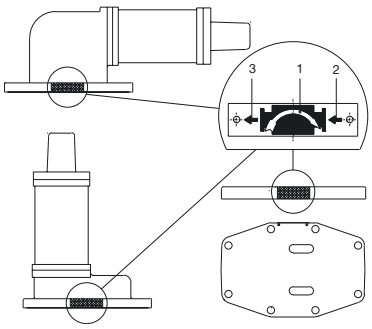
In case of V-belt drive

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 distributor for advice.

3.18.4 Shaft rotation

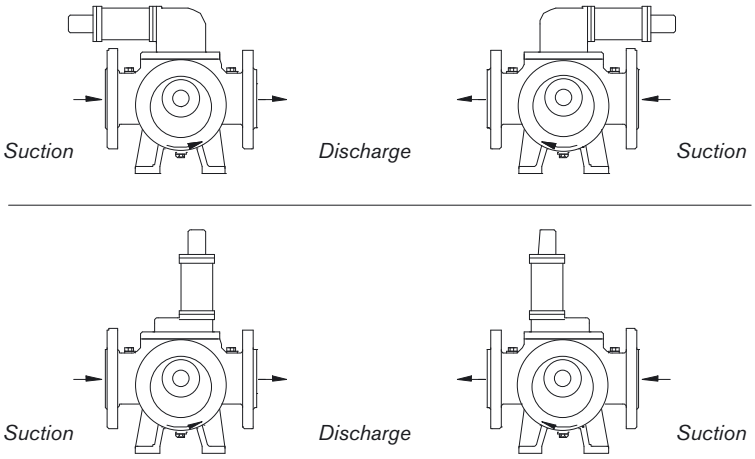
Shaft rotation determines which port of the pump is suction and which is discharge.

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

For the specified direction of rotation, see the arrow plate on the pump.



Installation of safety relief valve

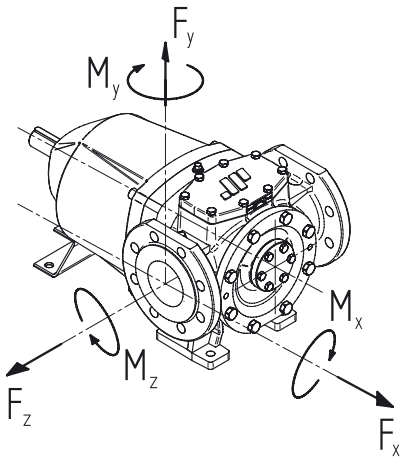
3.18.5 Suction and discharge pipes

3.18.5.1 Forces and moments

Note! *Excessive forces and moments on the connecting 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.

See table for maximum allowable forces ($F_{x, y, z}$) and moments ($M_{x, y, z}$) on the connecting 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.



TG MAG pump size	$F_{x, y, z}$ (N)	$M_{x, y, z}$ (Nm)
15-50	2600	675
23-65	2900	800
58-80	3550	1375
86-100	4100	1750
185-125	5900	3750

Check after connecting whether the shaft can move freely.

3.18.5.2 Piping

- Use piping with a diameter equal to or greater than the connection ports of the pump and with the shortest possible lengths.
- 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 enter the pump from a level higher than the pump level, the inclining 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 may occur.
- 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.

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.

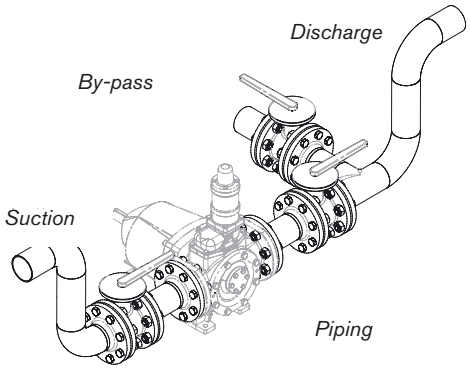
Note! *A foot valve is not recommended when pumping high viscous liquids.*

- 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.

3.18.5.3 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.



3.18.5.4 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.

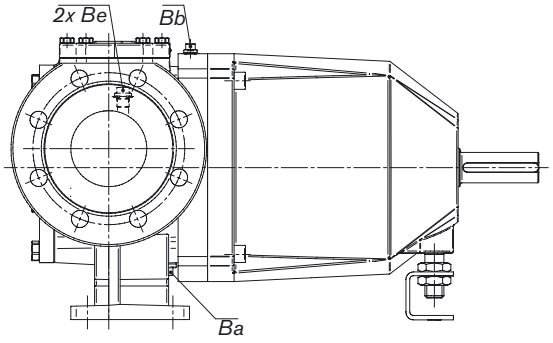
For the maximum allowable particle size see section 3.15.

3.18.6 Secondary piping

For dimensions of connections and plugs see chapter 6.0.

3.18.6.1 Drain lines

The pump is provided with a drain plug.



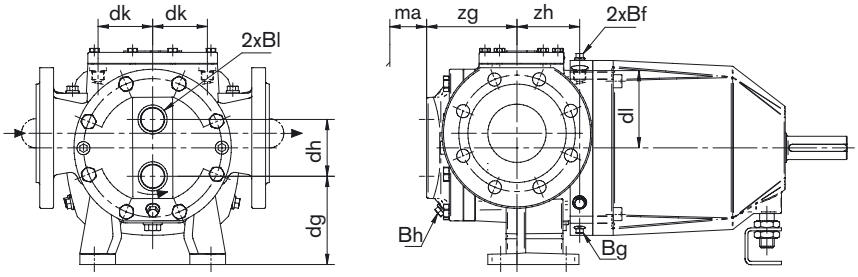
3.18.6.2 Heating jackets

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.

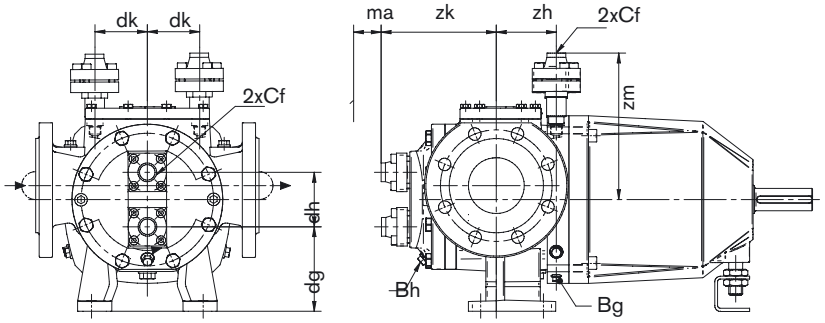
S-jacket on the pump cover



2. T-type jackets

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

T-jacket on pump cover

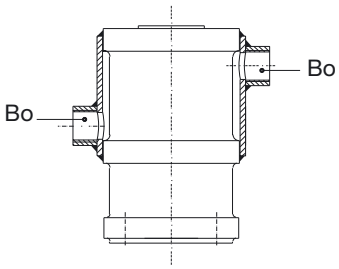


3. Jacket on pump cover

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

4. 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 Bo (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.



3.18.7 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.

3.18.7.1 Transport of pump unit

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

3.18.7.2 Foundation pump unit

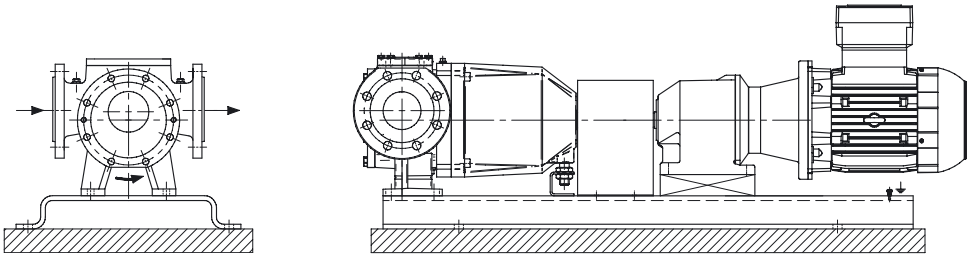
The pump unit must be installed on a base plate or on a frame placed exactly level on the foundation. The foundation must be hard, level, flat and vibration free in order to guarantee the alignment of pump/drive while operating. (See section 3.18.2.5)

3.18.7.3 Variators, Gear box, Gear motors, Motors

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

3.18.7.4 Electric motor drive

- Before connecting an electric motor to the mains check the prevailing 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.



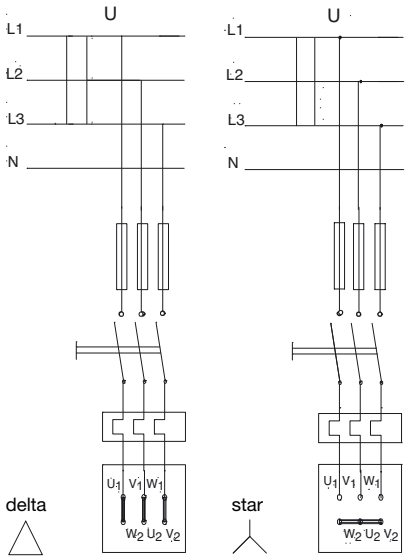
Circuit breaker
For safety work on a pump unit, install a circuit breaker as close as possible to the machine. It also is advisable to place an earth fault circuit breaker. The switching equipment must comply with prevailing regulations, as stipulated by EN 60204-1.

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, result 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



3.18.7.5 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

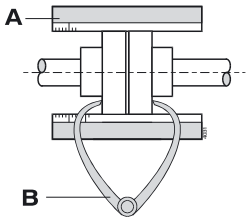
3.18.7.6 Shaft coupling

Internal gear pumps demand a relatively high starting torque. During the operation shock loads occur 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.

Fit – **without impact tool** – both halves of the coupling to the pump shaft and the motor shaft respectively.

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

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



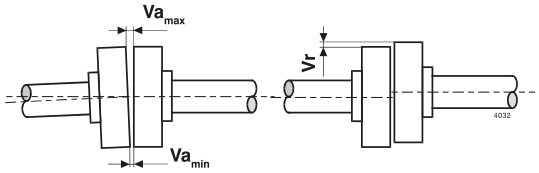
1 Place a ruler (A) on the coupling. Remove or add as many shims as is necessary to bring the electric motor to the correct height so that the straight edge touches both coupling halves over the entire length, see figure.

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

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

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

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



Alignment tolerances

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

** = coupling with spacer*

Belt drive

Belt drives also increase the loading on the shaft end and the bearings. Therefore, certain limitations must be imposed on the maximum load of the shaft, viscosity, pumping pressure and speed.
See section 3.18.3.2 Radial load on shaft end.

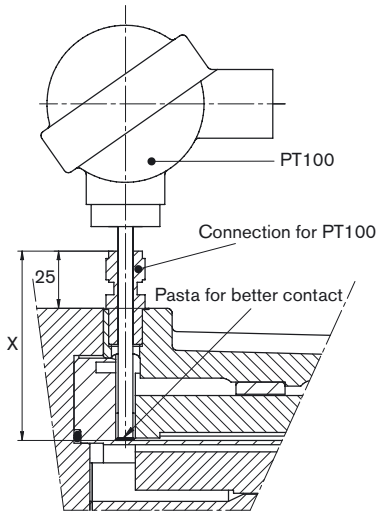
3.18.7.7 Guarding of moving parts

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.

3.18.7.8 Check temperature censor on can

In case the pump is provided with a PT100 element, the electrical connections must be made by an approved electrician.



TG MAG	X
15-50	75
23-65	75
58-80	80
86-100	80
185-125	100

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 initial lubrication of the bearing bushes. If these products are not acceptable for the pumped liquid, the pump should be cleaned thoroughly. Proceed as described in section 3.21.2.8 Draining of fluid.

3.19.2.1 Cleaning suction line

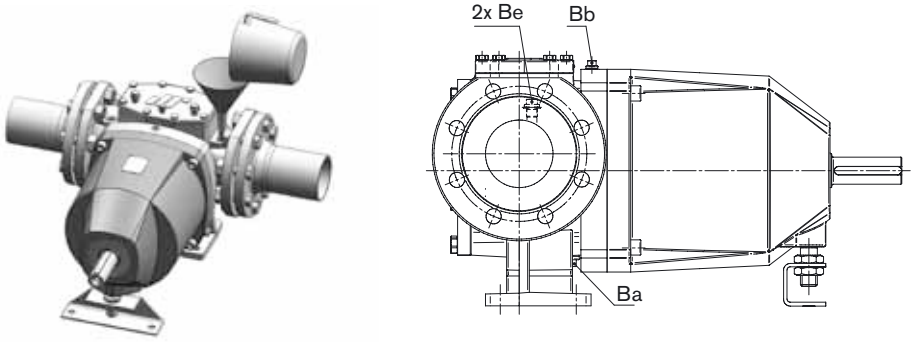
Before the TG MAG pump is put into service for the first time, the suction line must be cleaned thoroughly. **Do not use the TG MAG pump for flushing the system**, because it is not meant to pump low viscous liquids which might contain particles.

3.19.3 Venting and filling

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

If the liquid level on the suction side is below the suction flange level of the pump the pump must be filled with liquid to make priming possible.

- Unscrew filling plugs Bb and Be. Fill up the pump with liquid to be pumped via connections Be.
- Rotate the pump shaft by hand in the normal sense of rotation while filling the liquid into the pump.
- Tighten the filling plugs Be. Screw in plug Bb but not tighten it.
- Start the pump and tighten plug Bb when all air has escaped and liquid starts flowing out of this connection.



If the liquid level at the suction side is above the suction flange level of the pump vent the pump as follows:

- Loosen filling plugs Bb and Be so that air can escape.
- Open the suction side valve to let the pumped liquid flow into the pump. Rotate the pump shaft by hand in the proper sense of rotation during venting.
- Tighten the plugs Bb and Be when liquid starts flowing out of these connections.

When the TG MAG pump is brought into service for the first time or in case a new gasket for the top cover was mounted, bolts that compress the gasket must be re-tighened again after 3 – 4 days. (for tightening torques: refer to section 3.21.3.1 Nuts and bolts)

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.
- ☐ 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.

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 accidental contact re in place.
- ☐ Monitoring system is operational.

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.
- ☐ Suction and discharge valves are fully open.
- ☐ Start the pump for a short while and check the direction of rotation of the motor and that the magnetic coupling is not slipping.
- ☐ 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 the supply lines of the heating/cooling circuit if applicable.
- ☐ If solidification of the liquid must be avoided, clean the pump while the product is still in a fluid state

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. This can be prevented by closing the discharge valve after the motor has been switched off.*

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 and correct circulation pump insert).
	Magnetic coupling is slipping	7	▪	Check/correct assembly of rotor shaft and bearings and magnetic coupling
			▪	Check start-up conditions for the magnetic coupling in combination with applied electrical motor if necessary add fly-wheel or apply soft start.
			▪	Check operating parameters against break-away torque of the magnetic coupling.
			▪	Check if the pump is blocked, remove blockage.
Irregular flow	Liquid level in suction tank falls too low	8	▪	Correct liquid supply
			▪	Provide a liquid level switch
	Output too high	9	▪	Reduce pump speed/or install a smaller pump.
			▪	Install by-pass line with check-valve.
	Air sucking	10	▪	Repair leak in suction line.
	Cavitation	11	▪	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)	12	▪	Check temperature.
			▪	Check vapour pressure of liquid.
			▪	Reduce pump speed. If necessary install a larger pump.
Not enough capacity	Pump speed too low	13	▪	Increase pump speed. ***Attention!*** Do not exceed maximum speed and check NPSHr.
	Air sucking	14	▪	Repair leak in suction line.
	Cavitation	15	▪	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	16	▪	Check discharge pipe.
			▪	Increase pipe diameter.
			▪	Reduce working pressure.
			▪	Check accessories (filter, heat exchanger, etc.).
	Safety relief valve set too low	17	▪	Correct pressure setting.
	Viscosity too low	18	▪	Increase pump speed. ***Attention!*** Do not exceed maximum speed and check NPSHr.
			▪	If necessary, install a larger pump.
	Axial clearance	19	▪	Check axial clearance and correct. See section 3.21 Maintenance instructions.
	Gases come free	20	▪	Increase pump speed. ***Attention!*** Do not exceed maximum speed and check NPSHr.
			▪	Install a larger pump

Symptom	Cause	Remedy		
Not enough capacity	Liquid leaking back to suction over the magnetic coupling	21	▪	Check/correct assembly of the circulation pump arrangement
			▪	Check/adjust axial clearance of the circulation pump and rear face of the rotor
Pump too noisy Vibrations	Pump speed too high	22	▪	Reduce pump speed. If necessary, install a larger pump.
	Cavitation	23	▪	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.
	Backpressure too high	24	▪	Increase pipe diameter.
			▪	Reduce working pressure.
			▪	Check accessories (filter, heat exchanger, etc.).
	Coupling misalignment	25	▪	Check and correct alignment. Also see section 3.18 Installation.
	Vibration of base plate or pipings	26	▪	Make base plate heavier and/or affix baseplate/ pipework better.
	Ball bearings damaged or worn	27	▪	Replace ball bearings.
	Un-balance of the outer magnetic rotor	28	▪	Check/correct assembly of the outer magnetic rotor on the pump shaft
			▪	Check correct tightening of bolts, secure bolts against loosening.
Pump consumes too much power or becomes hot	Pump speed too high	29	▪	Reduce pump speed. If necesary, install a larger pump.
	Coupling misalignment	30	▪	Check and correct alignment. Also see section 3.18 Installation.
	Viscosity too high	31	▪	Increase axial clearance. See section 3.21 Maintenance instructions.
			▪	Heat pump.
			▪	Reduce pump speed.
			▪	Increase discharge pipe diameter.
	Excessive friction losses inside rotor shaft / bearing arrangement	32	▪	Check/correct axial clearance of circulation pump and rear face of the rotor
			▪	Check axial clearance of the plain bearing arrangement replace bearing if necessary
Rapid wear	Back pressure too high	33	▪	Increase pipe diameter.
			▪	Reduce working pressure.
			▪	Check accessories (filter, heat exchanger, etc.)
	Solid matter in liquid	34	▪	Filter liquid.
	Pump runs dry	35	▪	Correct liquid supply.
			▪	Provide liquid level switch or dry running protection.
			▪	Heat up liquid.
			▪	Stop or reduce air sucking.
	Corrosion	36	▪	Change pump materials or application parameters.
Motor overloading	Back pressure too high	37	▪	Increase pipe diameter.
			▪	Reduce working pressure.
			▪	Check accessories (filter, heat exchanger, etc.).
	Viscosity too high	38	▪	Increase axial clearance. See section 3.21 Maintenance instructions.
			▪	Heat pump.
			▪	Reduce pump speed.
			▪	Increase discharge pipe diameter.
	Excessive friction losses inside rotor shaft / bearing arrangement	39	▪	Check/correct axial clearance of circulation pump and rear face of the rotor
			▪	Check axial axial clearance of the plain bearing arrangement replace bearing if necessary
	Rotor shaft runs against pump cover	40	▪	Check axial axial clearance of the plain bearing arrangement replace bearing if necessary

Symptom	Cause	Remedy		
Pump leak	O-rings, sealing rings or gasket damaged or not correctly assembled	41	▪	Check condition of O-rings and assemble them correctly or replace them
			▪	Check condition and clean/repair sealing faces
			▪	Replace gasket under top cover or safety relief valve and/or sealing rings under plugs

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

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 regualtions the correct personal equipment should be used.

3.20.1.2 Disposal

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

Where applicable please disassemble the product and recycle the parts' 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 distributor.

- 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 unit.

- 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.

- Personnel who carry a cardiac pacemaker should not be allowed to work on a pump equipped with magnetic coupling!. The magnetic field is sufficiently strong to affect the proper operation of a pacemaker, so keep a safe distance of at least 3 m.

- Do not come close (not less than 1 m) to the magnetic coupling with subjects equippid with magnetic data carrier such as cheque cards, computer disks, watches etc. to avoid damage and/or loss of information.

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. Particularly remove metallic chips or any dirt which could be attracted by the components of the magnetic coupling.

3.21.2.2 Tools

For maintenance and repairs use only technically appropriate tools that are in good condition. Handle them correctly. For maintenance work on the magnetic drive use preferably tools made of non-magnetic material. Magnetic tools might be suddenly attracted by the magnetic rotors which can lead to damage of the components or personal injury.

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 and the attached markings remain visible.
- 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

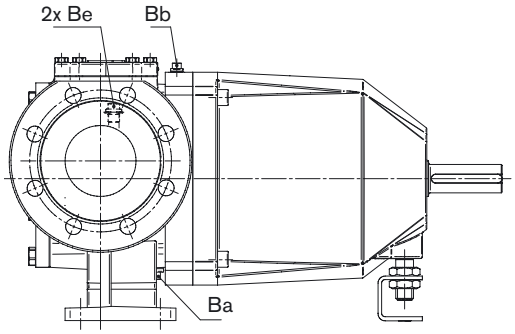
- Maintenance operations on the electric installation may be performed only by trained and qualified personnel and after disconnecting the electric power supply. Carefully follow the national safety regulations.

  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: plugs close to both flanges for purging the pump casing part
  - Bb: plug on top of the intermediate cover for purging the magnetic coupling

Note: *If toxic liquids were pumped special precautions regarding flushing/cleaning of the pump and personal protection equipment must be taken before disassembling the pump.*

- 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.
- If necessary, clean the jackets and the circuits with compressed air.
- Avoid any leakage of fluid or thermal oil into the environment.

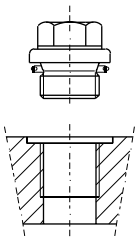
3.21.3 Specific components

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 1/8	10
M8	25	G 1/4	20
M10	51	G 1/2	50
M12	87	-	-
M16	215	-	-



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.

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 MAG pumps are equipped with 2RS ball bearings which are grease packed for life. They do not require periodical greasing. The bearings should be replaced after 25.000 operating hours.

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.

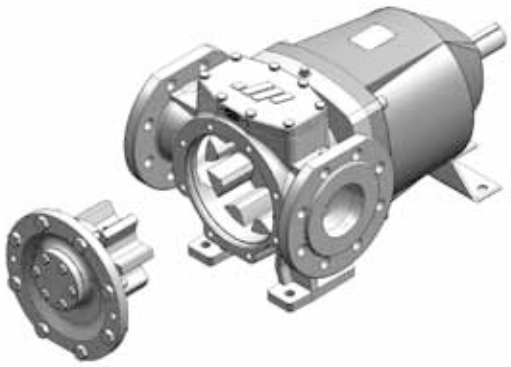
- A quick check can be done by using the front pull-out and back pull-out system. See table for maximum allowable radial clearance of the sleeve bearings.
- For replacement of the sleeve bearings contact your distributor.

TG MAG pump size	Maximum allowed radial clearances
15-50 to 23-65	0.15 mm
58-80 to 86-100	0.25 mm
185-125	0.30 mm

3.21.4 Front pull-out

The TG-pumps 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.

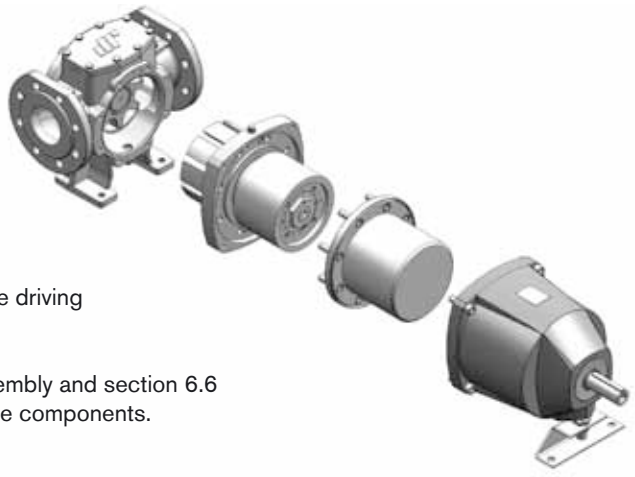


3.21.5 Back pull-out

To flush the pump or to check the rotor shaft bearing arrangement the bearing bracket with outer magnetic rotor and the rotor shaft/ bearing assembly can be 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. for the mass (weight) of the components.



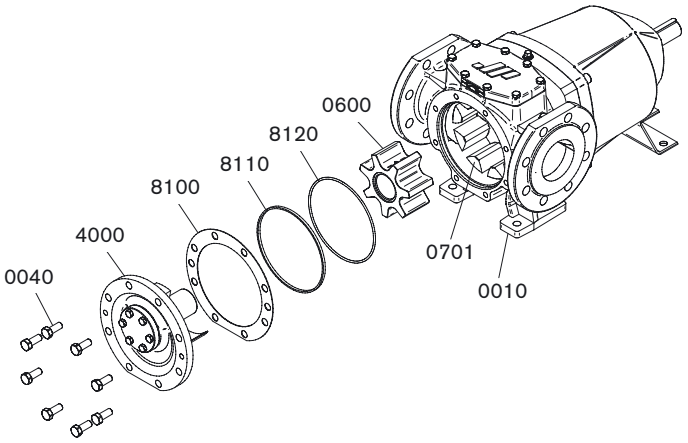
3.21.6 Clearance adjustment

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

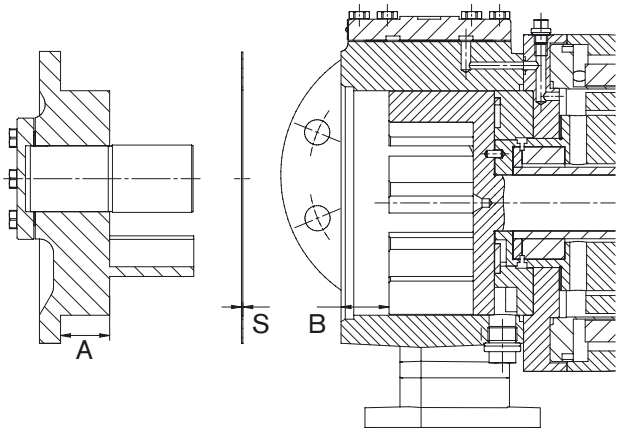
- When uniform rotor and idler wear need to be compensated by re-setting the axial clearance.
- When pumping low viscous liquids the slip can be reduced by decreasing the axial clearance.
- When the liquid is more viscous than expected, the friction inside the pump can be reduced by increasing the axial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

Proceed as follows to set the axial clearance:

1. Un-tighten tap bolts (0040) crosswise and remove them.
2. Use two tap bolts (0040) in the threaded holes in the pump cover (4000) to push off the pump cover (4000)
3. Take idler (0600) complete with bearing bush off the idler pin.
4. Remove O-ring (8120), support ring (8110) and shim (8100) from the pump cover (4000).



5. Check that the contact faces and O-ring chamber are not damaged and free of dirt. Check the condition of O-ring (8120), in case of doubt replace the O-ring with a new one.
6. Measure the distances as indicated on the sketch below



7. Calculate the required thickness of the shim (8100) between pump cover (4000) and pump casing (0010).
   S = A – B + C. Axial clearance C between rotor shaft (0701) and pump cover (4000) see table below.

TG MAG	Axial clearance C [mm]
15-50	0.120 – 0.200
23-65	0.125 – 0.215
58-80	0.150 – 0.250
86-100	0.165 – 0.275
185-125	0.190 - 0.320

8. Adjust the thickness of shim (8100) by peeling off the required number of layers
9. Place shim (8100), support ring (8110) and O-ring (8120) on the pump cover (4000).
10. Place idler (0600) complete with bearing bush on the idler pin.
11. Mount pump cover (4000) on the pump casing (0010).
12. Screw in tap bolts (0040) and tighten them crosswise to fix the pump cover (4000) on the pump casing (0010).

3.21.7 Designation of threaded connections.

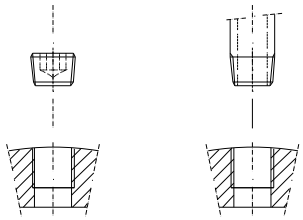
To make clear what sealing type of threaded connection is provided we denominate them according to standards ISO 7/1 and ISO 228/1 as follows.

3.21.7.1 Threaded connection Rp (example Rp 1/2)

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

Conical plug
ISO 7/1 - R 1/2

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



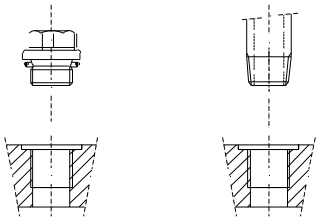
ISO 7/1	Type	Symbol	Example
Internal thread	Cynlindrical (parallel)	Rp	ISO 7/1 – Rp 1/2
External thread	Always conical (tapered)	R	ISO 7/1 – R 1/2

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 to ISO 228/1.
This connection can be sealed by a gasket. The plugs or pipe connections must be provided with a sealing collar and cylindrical external thread according to ISO 228/1 (Example ISO 228/1 - G1/2).
Plugs or pipe connections provided with conical thread according to ISO 7/1 external thread (example ISO 7/1 - R1/2) can also be used.

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

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



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

Because of the presence of strong magnetic fields there are special safety instructions which must be observed.

Personnel who carry a cardiac pacemaker should not be allowed to work on a pump equipped with magnetic coupling!. The magnetic field is sufficiently strong to affect the proper operation of a pacemaker, so keep a safe distance of at least 3 m.

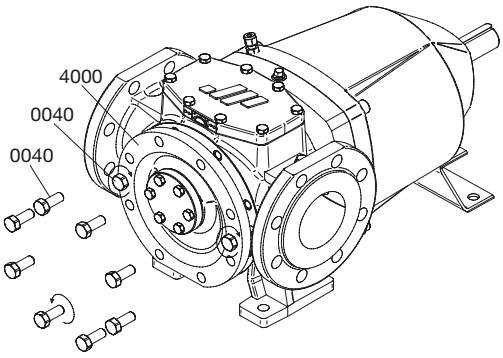
Do not come close (not less than 1 m) to the magnetic coupling with objects equippid with magnetic data carrier such as cheque cards, computer disks, watches etc. to avoid damage and/or loss of information.

Do not subject the pump to any jolting loads. This can cause damage to the magnets or the slide bearings of the rotor shaft on account of their brittleness.

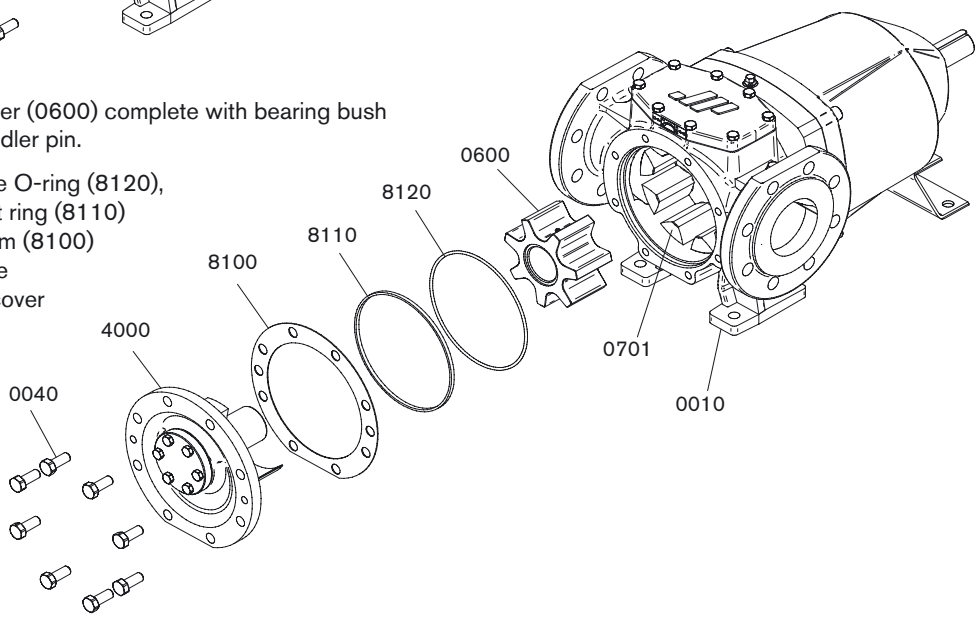
4.2 Disassembly

4.2.1 Disassembly of front-pull-out assembly

1. Un-tighten tap bolts (0040) crosswise and remove them.
2. Use two tap bolts (0040) in the threaded holes in the pump cover (4000) to push off the cover.

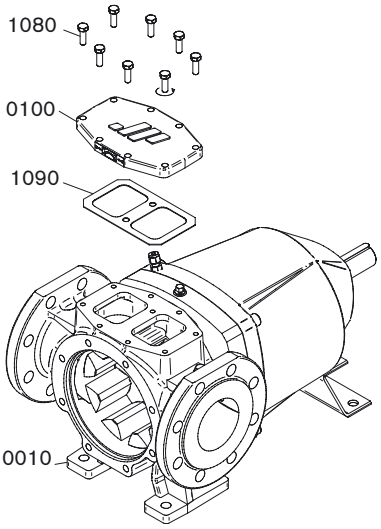


3. Take idler (0600) complete with bearing bush off the idler pin.
4. Remove O-ring (8120), support ring (8110) and shim (8100) from the pump cover (4000).



4.2.2 Disassembly of top cover (0100) or safety relief valve

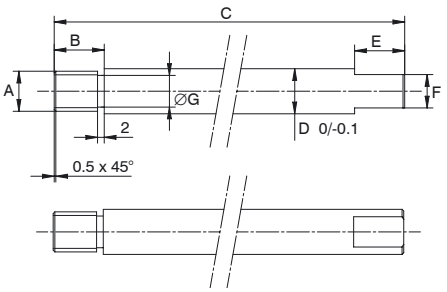
1. Un-tighten tap bolts (1080) crosswise and remove them
2. Take off top cover (0100) or safety relief valve.
3. Remove gasket (1090) and clean the sealing faces on the pump casing (0010) and top cover (0100) or safety relief valve.



4.2.3 Disassembly of bearing bracket

Removal of bearing bracket

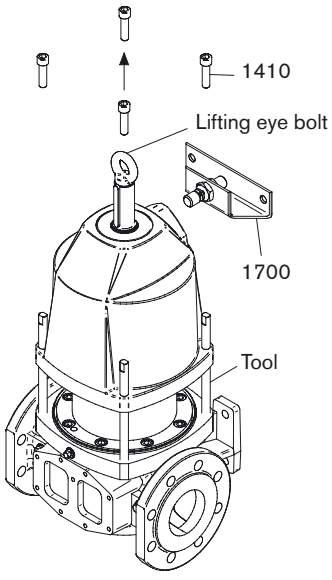
1. Place the pump in vertical position with the pump shaft pointing up on the work bench.
2. Remove bearing bracket support (1700).
3. Un-tighten cap head screws (1410) crosswise and remove them.
4. Mount the 4 guiding bars (tool) into the holes of cap head screws (1410) and screw lifting eye bolt in the shaft end.



TG MAG	A	B	C	D	E	F	G
TG MAG 15-50	M 10	12	160	10,5	10	8	7,8
TG MAG 23-65							
TG MAG 58-80	M 12	15	205	13,5	10	10	9,4
TG MAG 86-100							
TG MAG 185-125	M 16	20	240	17	10	13	13

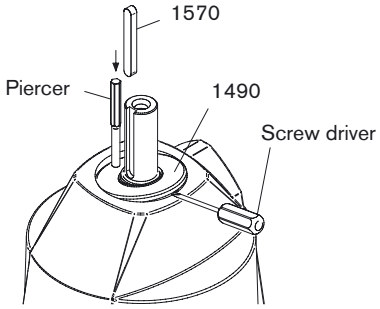
5. Lift the bearing bracket complete with pump shaft and outer magnet rotor off the pump.

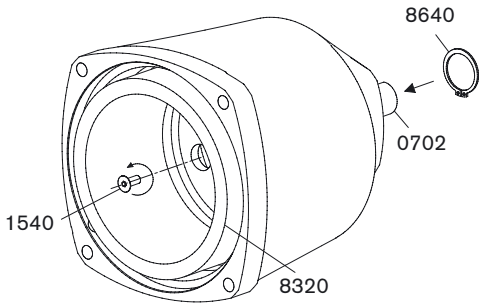
Remark: *The guiding bars are necessary to prevent that the magnets in the outer rotor are damaged during disassembly of the bearing bracket. Protect metal part with plastic tube.*



4.2.4 Disassembly of pump shaft complete

1. Remove key (1570) from the pump shaft.
2. Remove sealing segment (1490) from the bearing bracket (see picture).





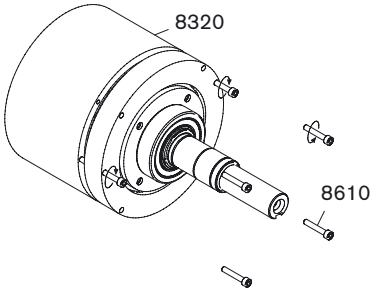
3. Remove circlip (8640) from the rear end of the shaft.
4. Un-tighten countersunk screws (1540) from the front end and remove them.

Remark: *The pump shaft (0702) can be rotated to allow access to these screws. Be careful that the spanner does not damage the magnets in the outer magnectic rotor (8320).*

5. Drive out the complete pump shaft to the front by tapping with a plastic hammer on the pump shaft (0702).

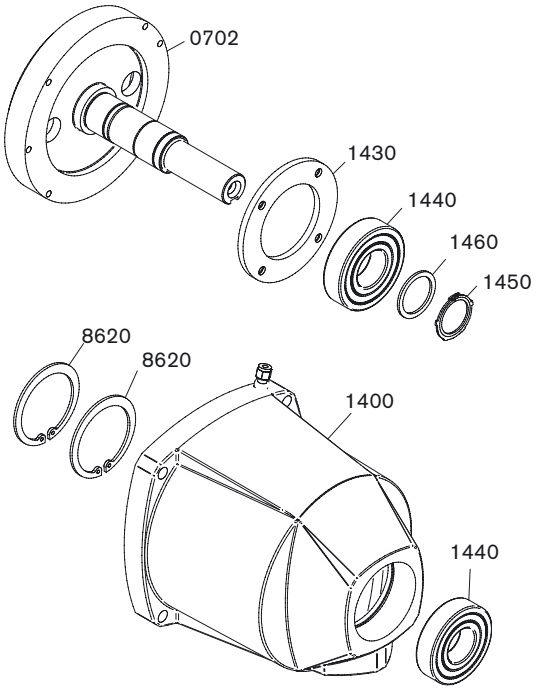
4.2.5 Disassembly of outer magnetic rotor

1. Un-tighten cap head screws (8610) crosswise and remove them.
2. Use threaded holes in the flange of the pump shaft to remove the outer magnetic rotor (8320).



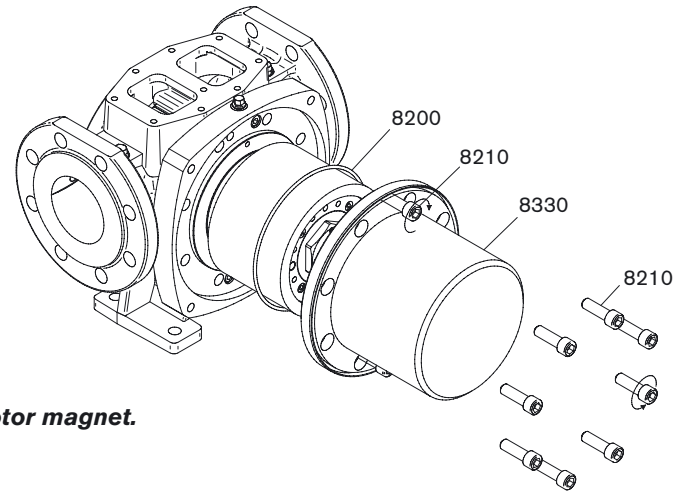
Removal of ball bearings

1. Remove circlips (1450) and support ring (1460) from the pump shaft (0702).
2. Remove the bearing (1440) from the shaft using a ball-bearing extractor.
3. Remove the bearing cover (1430) from the pump shaft (0702).
4. Remove both circlips (8620) from the bearing bracket (1400) to the front.
5. Drive out ball bearing (1440) from the bearing bracket (1400) to the rear.



4.2.6 Disassembly of separation can

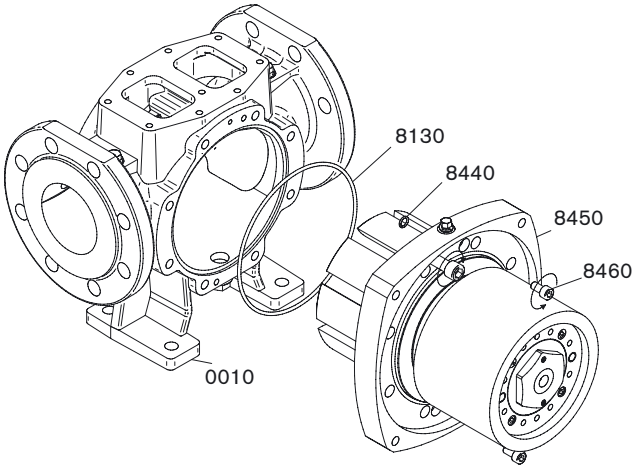
1. Un-tighten cap head screws (8210) crosswise and remove them.
2. Use two cap head screws (8210) in the threaded holes of the flange to remove the can (8330).
3. Take out O-ring (8200).



Take care not to damage the inner rotor magnet.

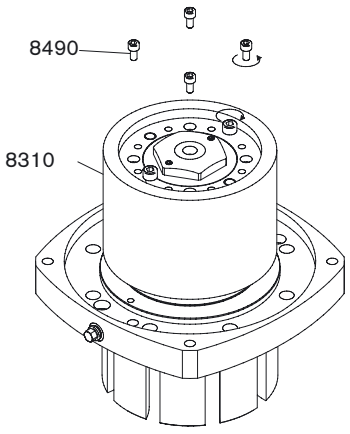
Removal of rotor and bearing assembly (back-pull-out) from the pump casing

1. Un-tighten cap head screws (8460) and remove them.
2. Use two bolts in the threaded holes of the intermediate cover (8450) to remove the complete back-pull-out assembly from the pump casing (0010).
3. Take out O-rings (8130) and (8440).

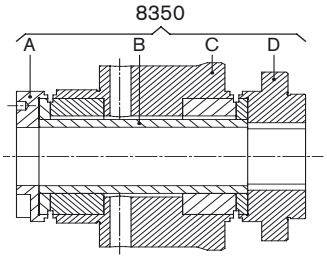


4.2.7 Disassembly of back-pull-out assembly

1. Place the back pull-out assembly on the workbench in vertical position.
2. Un-tighten cap head screws (8490) of the inner magnetic rotor (8310) crosswise and remove them.
3. Remove the inner magnetic rotor (8310) from the hub (8350-D)

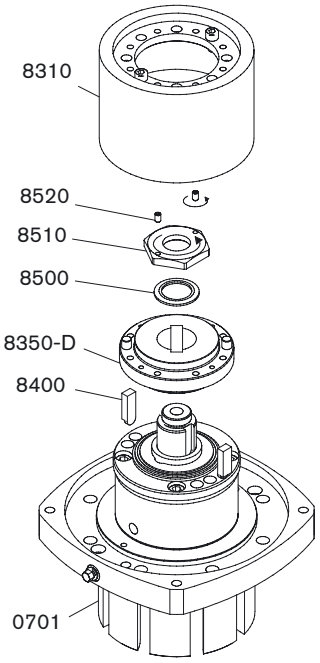


Bearing set

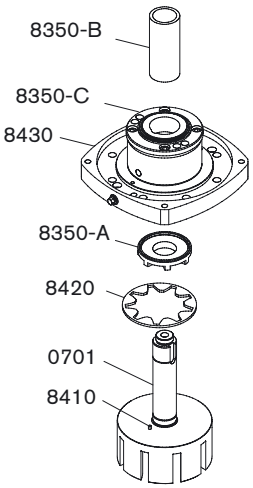


4. Un-tighten and remove the two set screws (8520) from the locking nut (8510).
5. Lock the rotor shaft (0701) against rotation by pushing a copper bar between the rotor teeth and un-tighten and remove locking nut (8510) and disc spring (8500).
6. Remove the hub (8350-D) with the rear axial bearing from the rotor shaft (0701).
7. Remove the two keys (8400) from rotor shaft (0701) using a key extractor.

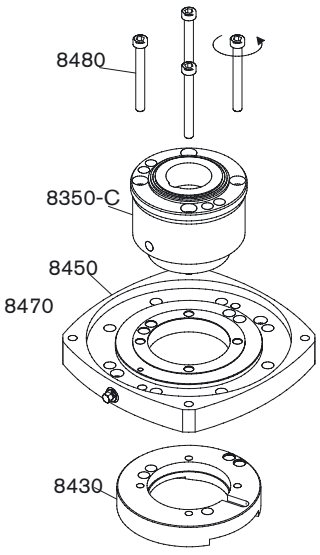
Remark: *Do not use hammer and screwdriver to remove the keys since this could damage the bearings.*



8. Remove the shaft sleeve (8350-B). Take care that shaft sleeve (8350-B) and axial bearing (8350-A) are not damaged.
9. Remove the bearing arrangement over the rotor shaft (0701), front axial bearing (8350-A) and disc rotor (8420)

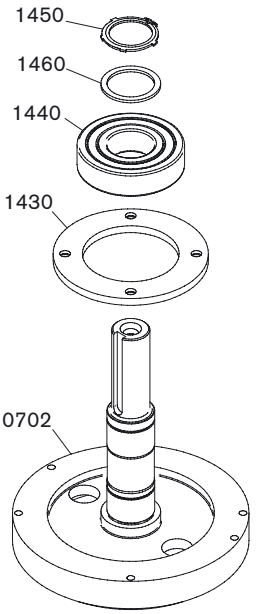


10. Un-tighten cap head screws (8480) crosswise and remove them.
11. Remove radial bearing holder (8350-C) and shim 8470 and insert (8430) from intermediate cover (8450).

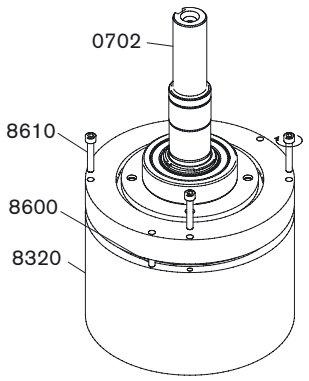


4.3 Assembly

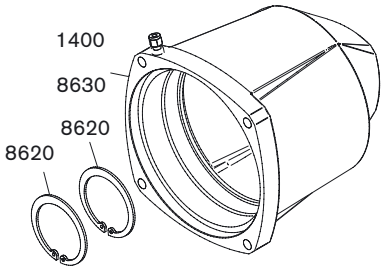
4.3.1 Assembly of bearing bracket



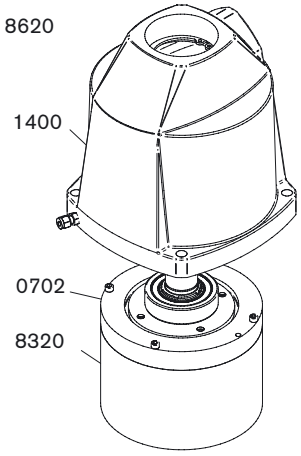
1. Place pump shaft (0702) in vertical position on the workbench.
2. Place bearing cover (1430) over pump shaft (0702). The countersunk-holes should point in the direction of the flange.
3. Assemble ball bearing (1440) on the pump shaft. Use a pipe and a plastic hammer and drive the bearing via the inner bearing ring carefully over the pump shaft (0702) until the inner bearing ring makes contact with the shaft shoulder.
4. Place support ring (1460) over the pump shaft (0702) and secure the ball bearing (1440) with circlip (1450) on the shaft. The circlip (1450) should be fitted under axial pre-load into the groove in the pump shaft (0702).



5. Mount the outer magnetic rotor (8320) on the flange of pump shaft (0702). Make sure that the locking pins (8600) are coinciding with the holes in the flange.
6. Screw cap head screws (8610) into the magnetic rotor (8320). Tighten these cap head screws (8610) with Loctite 243 crosswise with the specified torque to fix the magnetic rotor (8320) on the pump shaft (0702). (See chapter 3.21.3.1)

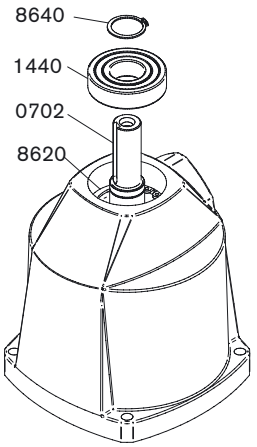


7. Mount both circlips (8620) into the bearing bracket (1400).



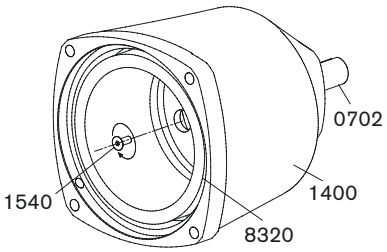
8. Support the pump shaft (0702) complete with magnetic rotor (8320) and bearing in vertical position.
9. Lower the bearing bracket (1400) over the pump shaft (0702), pushing the ball bearing (1440) into the seat in the bearing bracket until the bearing makes contact with circlip (8620).

10. Assembly the rear ball bearing (1440) on the pump shaft (0702) by driving it with a pipe and plastic hammer via the inner bearing ring until the bearing makes contact with circlip (8620).
11. Fit circlip (8640) on the pump shaft (0702).

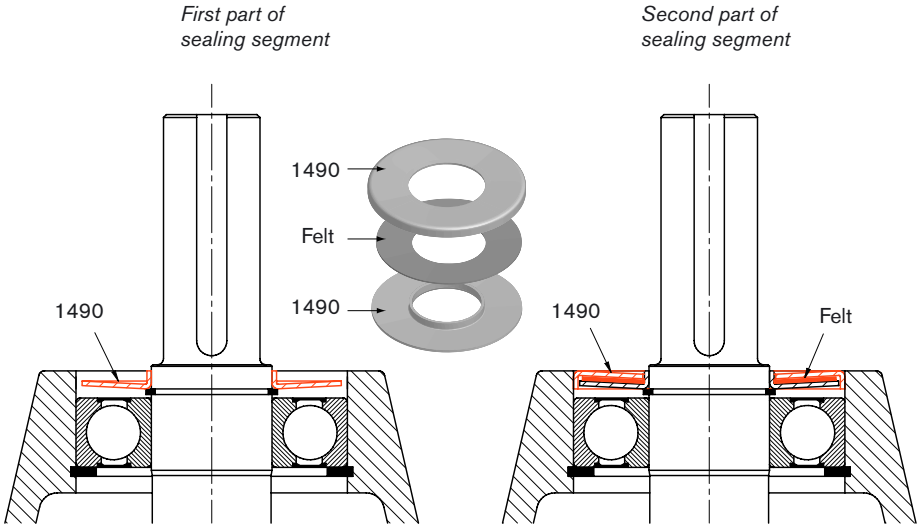


12. Place the bearing bracket (1400) on the workbench in horizontal position
13. Screw countersunk screws (1540) and tighten them crosswise to lock the front bearing.

Take care not to damage the outer rotor magnet.



14. Mount the sealing segment (1490) on the rear end according to sketch.

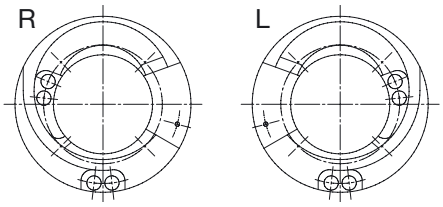


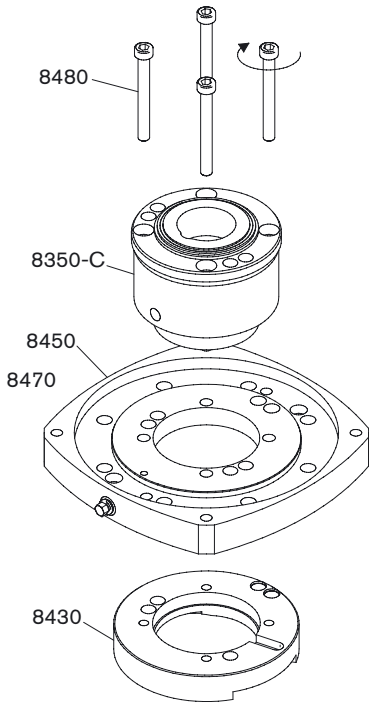
4.3.2 Pre-assembly of the back-pull-out

4.3.2.1 Adjustment of the axial clearance of the circulation pump

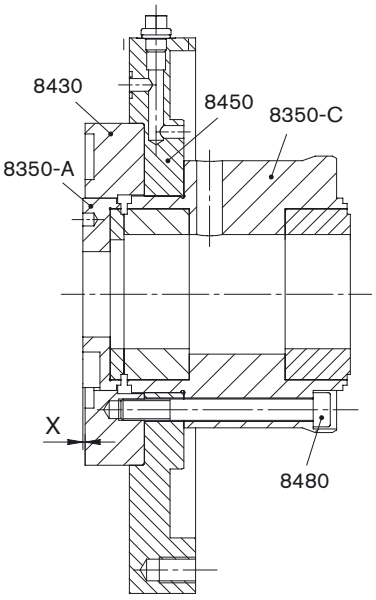
1. Place pump insert (8430) and radial bearing holder (8350-C) in the intermediate cover (8450). Do not use any shim (8470) at this stage.

   Remark: *There are two different inserts according to the sense of rotation of the pump shaft (see sketch).*





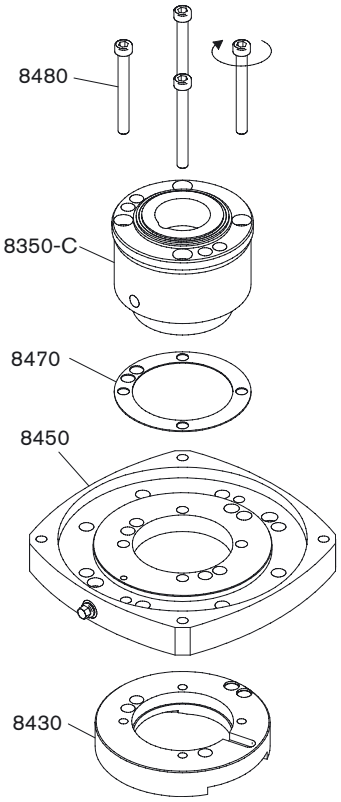
2. Fit cap head screws (8480) and tighten them crosswise to fix the radial bearing holder (8350-C) and insert (8430) to the intermediate cover (8450).



3. Mount axial bearing (8350-A) into the insert (8430). Do not use any force and be careful not to damage the bearing faces while pushing part (8350-A) in until the bearing faces are making contact.
4. Measure the distance between front face of the axial bearing holder (8350-A)(front face gear tooth) and the front face of the crescent of the pump insert (8430).
5. Calculate the required thickness of the bearing shim (8470): S = X – C.
   Axial clearance C see table below.

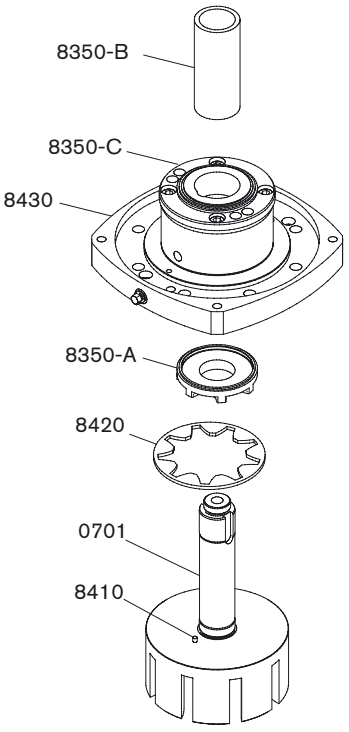
TG MAG	Axial clearance C [mm]
15-50	0.120 – 0.200
23-65	0.125 – 0.215
58-80	0.150 – 0.250
86-100	0.165 – 0.275
185-125	0.190 – 0.320

6. Peel the required number of layers off the bearing shim (8470) to adjust the thickness of the shim S to the required value.
7. Un-tighten cap head screws (8480) and remove radial bearing holder (8350-C) from the intermediate cover (8450).
8. Assemble radial bearing holder (8350-C) again in the same way with the shim placed between holder and intermediate cover (8450).
9. Place front axial bearing holder (8350-A) into the pump insert (8430) until the axial bearing faces are making contact and check if the axial clearance C of the circulation pump is correct. Dimension X should be within the range of dimension C. (See point 5).



4.3.2.2 Assembly of rotor shaft

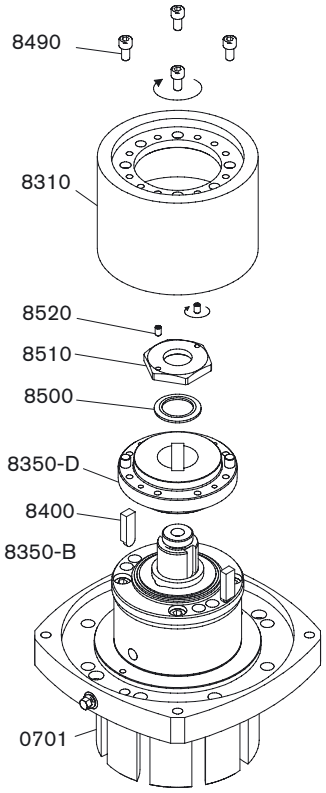
1. Place the shaft rotor on the workbench in vertical position, put a thin layer of grease on all sliding faces of the bearings.
2. Place the disk rotor (8420) into the chamber of the pump insert (8430).
3. Check that the axial contact faces of the axial bearing holder (8350-A) and shaft sleeve (8350-B) are undamaged and free of any dirt.
4. Place the disk rotor (8420), the front axial bearing holder (8350-A) and the bearing arrangement over the shaft rotor (0701). Make sure that the pin (8410) in the rear face of the rotor is fitting into the hole of the axial bearing holder (8350-A).
5. Push shaft sleeve (8350-B) carefully from the rear side into the radial bearing holder (8350-C). Do not use any force or a hammer while fitting the rotor shaft (0701) into the bearings.



Remark: *Do not use any force while mounting the shaft sleeve (8350-B) and no hammer to drive it in. These parts are very sensitive and should be handled with utmost care in order not to damage them during assembly. The parts should fit into each other smoothly and under light pressure by hand. If it is not possible to fit these parts by hand, disassemble the parts and check if the parts are not damaged or if there is any dirt between the fitting faces.*

6. Fit the keys (8400) into the rotor shaft (0701). Be careful that the keys (8400) are not hitting the shaft sleeve (8350-B) during assembly.
7. Fit rear axial bearing holder (8350-D) on the rotor shaft (0701).
8. Place spring washer (8500) on the rotor shaft (0701) as indicated on the sketch and screw on locking nut (8510).
9. Place the assembly vertically on the work bench and lock the rotor by pushing a copper bar through the rotor teeth.
10. Tighten locking nut (8510) until the shaft nut makes contact with the axial face of the rear axial bearing holder (8350-D).
11. Check the axial bearing clearance using a feeler gauge (see table below).

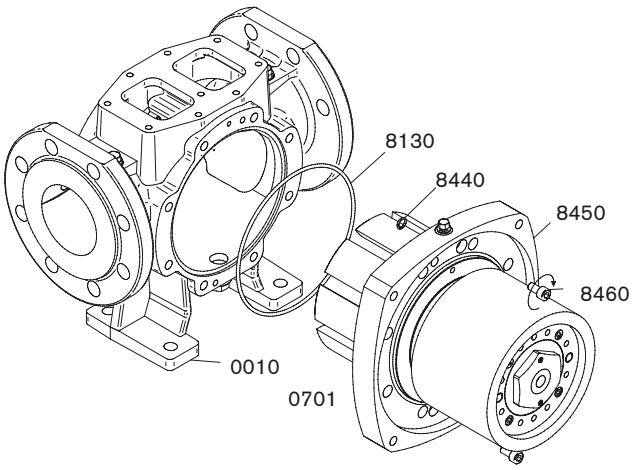
TG MAG	Axial clearance [mm]
15-50	0.11 – 0.13
23-65	
58-80	0.13 – 0.15
86-100	
185-125	0.15 – 0.18



12. Tighten set screws (8520) to secure the locking nut (8510).
13. Mount the inner magnetic rotor (8310) on the hub of the rear axial bearing holder (8350-D). Make sure that the locking pins are falling into the holes of the inner magnetic rotor (8310).
14. Screw in cap head screws (8490) and tighten them (with Loctite 243) crosswise with the specified torque (see Chapter 3.21.3.1) to fix the inner magnetic rotor (8310) on the hub.
15. Check if the rotor shaft (0701) can be turned by hand evenly and without remarkable resistance.

4.3.3 Assembly of the back-pull-out assembly to the pump casing

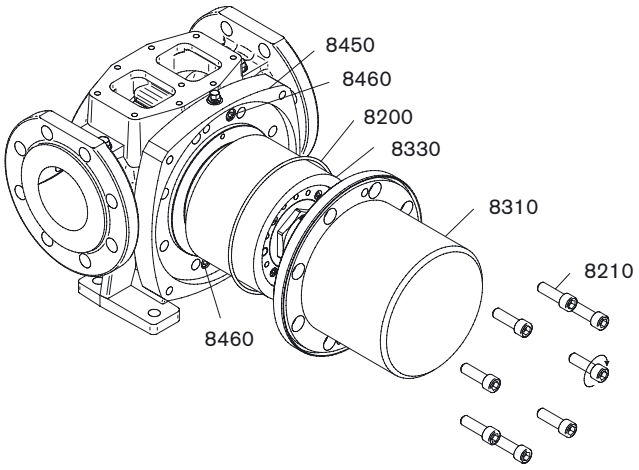
1. Check that the O-ring grooves and axial support faces are not damaged and free of dirt.
2. Cover O-ring (8130) slightly with grease and fit it into the groove in the pump casing (0010).
3. Cover O-ring (8440) slightly with grease and fit it into the groove in the intermediate casing (8450).
4. Fit the complete back-pull-out assembly carefully into the pump casing (0010). Take care of the correct position of the holes for the tightening bolts.
5. Fit cap head screws (8460) and tighten them to fix the intermediate cover (8450) to the pump casing (0010).



Remark: *The pump insert (8430) is centering the assembly in the pump casing (0010) with a tight fitting. Do not hit with a plastic hammer on the rotor shaft (0701) during assembly. If the assembly cannot be fitted by hand use long bolts to pull the intermediate cover (8450) against the pump casing (0010).*

4.3.4 Assembly of the separation can

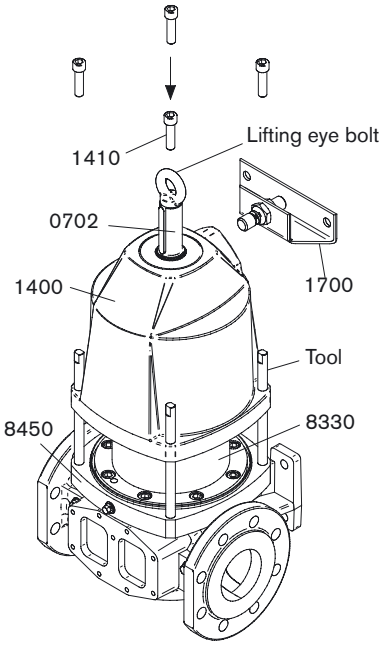
1. Check that the O-ring groove and axial support faces are not damaged and free of dirt
2. Cover O-ring (8200) slightly with grease and fit it into the groove in the separation can (8310)
3. Fit the separation can (8330) over the inner magnetic rotor (8310). Take care of the correct position of the holes for the tightening bolts and the threaded holes for disassembly. The threaded holes should be in line with the cap head screws (8460).
4. Fit cylinder screws (8210) and tighten them crosswise to fix the separation can (8330) on the intermediate cover (8450).



Remark: *The cap head screws (8210) are fixing both the intermediate cover (8450) and separation can (8330) tightly on the pump casing (0010).*

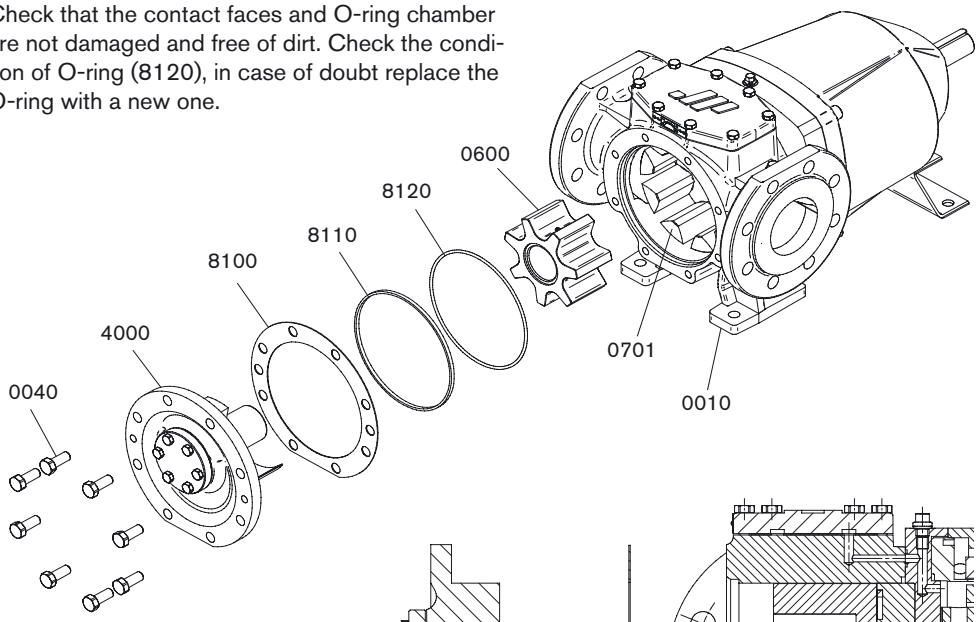
4.3.5 Assembly of the bearing bracket

1. Place the pump vertically on the workbench with the separation can (8330) pointed upwards.
2. Screw the 4 guiding pins (tool) into the threaded holes of the cap head screws (1410).
3. Screw a lifting eye bolt into the shaft end of pump shaft (0702).
4. Use a crane to fit the bearing bracket (1400) over the guiding pins to the intermediate cover from the top (see picture).
5. Remove the guiding pins and fit cap head screws (1410). Tighten cap head screws (1410) crosswise to fix the bearing bracket (1400) to the intermediate cover (8450).
6. Mount bearing bracket support (1700) to the bearing bracket (1400).

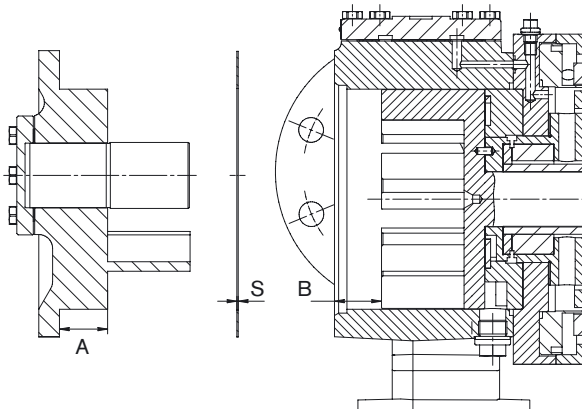


4.3.6 Assembly of the front-pull-out assembly

1. Check that the contact faces and O-ring chamber are not damaged and free of dirt. Check the condition of O-ring (8120), in case of doubt replace the O-ring with a new one.



2. Measure the distances as indicated on the sketch.



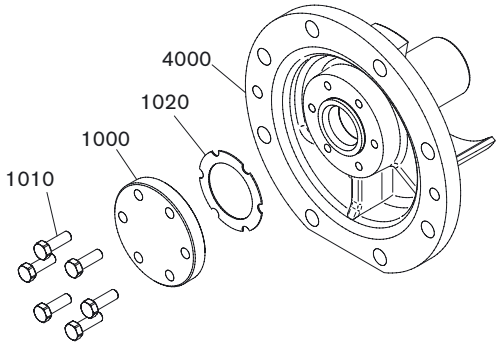
3. Calculate the required thickness of the shim (8100) between pump cover (4000) and pump casing (0010).

   S = A – B + C. Axial clearance C between rotor shaft (0701) and pump cover (4000) – see table.

TG MAG	Axial clearance C [mm]
15-50	0.120 – 0.200
23-65	0.125 – 0.215
58-80	0.150 – 0.250
86-100	0.165 – 0.275
185-125	0.190 – 0.320

4. Adjust the thickness of shim (8100) by peeling of the required number of layers.
5. Place shim (8100), support ring (8110) and O-ring (8120) on the pump cover (4000).
6. Place idler (0600) complete with bearing bush on the idler pin.
7. Mount pump cover (4000) on the pump casing (0010).
8. Screw in tap bolts (0040) and tighten them crosswise to fix the pump cover (4000) on the pump casing (0010).

9. In case of a stainless steel pump cover (4000), check if the sealing faces around the idler pin and on pin cover (1000) are not damaged and free of dirt.
10. Use a new gasket (1020) before fixing pin cover (1000) on the pump cover (4000) with tap bolts (1010). Tighten tap bolts (1010) crosswise with the specified torque.

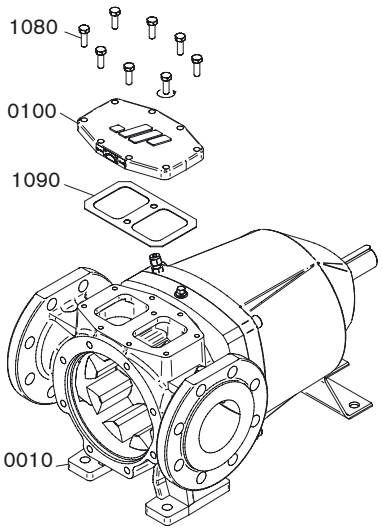


4.3.7 Assembly of top cover (0100) or safety relief valve

1. Check that the sealing faces of the pump casing (0010) and on the top cover (0100) or safety relief valve are not damaged and free of dirt.
2. Place a new gasket (1090) on the pump casing (0010).
3. Place top cover (0100) or safety relief valve on the pump casing (0010).

Remark: *The position of the top cover (0100) or safety relief valve depends on the sense of rotation. The grooves in the contact face of the top cover (0100) or safety relief valve must connect the hole in the top face of the pump casing (0010) with the suction side of the pump. The sense of rotation is indicated with an arrow on the top cover (0100) or safety relief valve.*

4. Screw in tap bolts (1080) and tighten them crosswise with the specified torque (see Chapter 3.21.3.1) to fix the top cover (0100) or safety relief valve on the pump casing (0010).



5.0 Sectional drawings and part lists

How to order spares

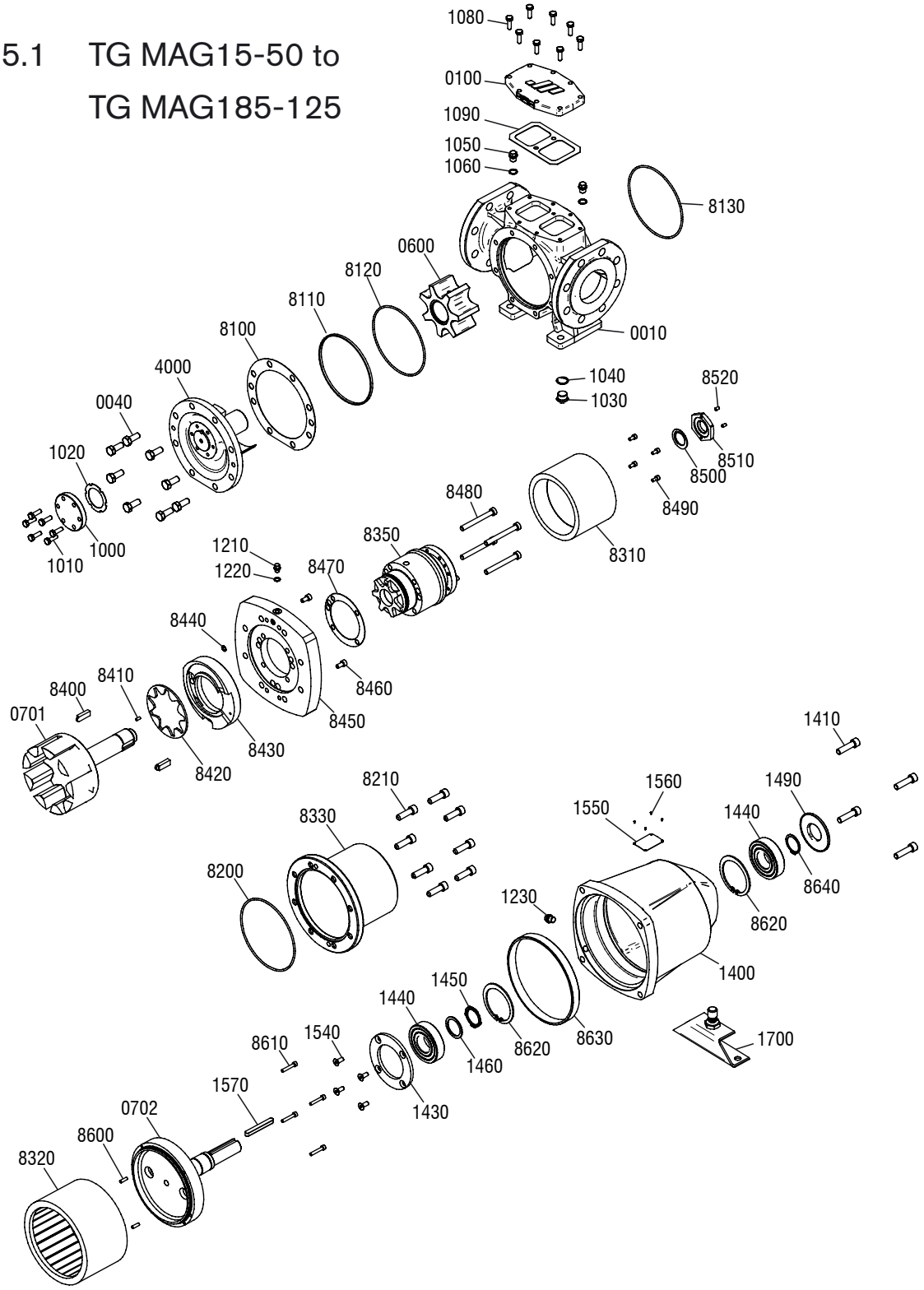
When ordering spare parts, please state:

1. Pump type and serial number (see name plate)
2. Position number, quantity and description

Example:

1. *Pump type: TG MAG58-80 G2-S0C-BG2-Q-S5-S10-V-R*
   Serial number: 2007-479401
2. *Pos 0600, 1, Idler + Bush complete*

5.1 TG MAG15-50 to TG MAG185-125



5.1.1 Hydraulic part

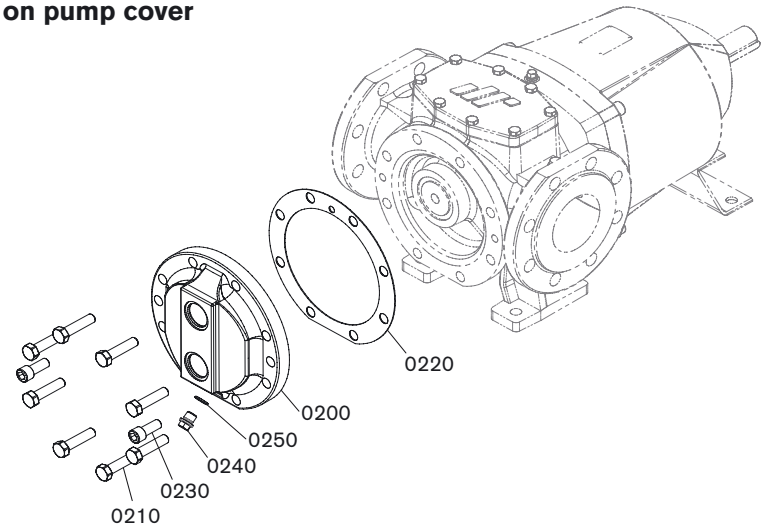
Pos.	Description	15-50	23-65	58-80	86-100	185-125	preventive	overhaul
0010	pump casing	1	1	1	1	1		
0040	tap bolt	6	6	8	8	8		
0100	top cover, complete	1	1	1	1	1		
0600	idler + bush, complete	1	1	1	1	1	x	
0701	rotor shaft	1	1	1	1	1	x	
1000	pin cover	1	1	1	1	1		
1010	tap bolt	6	6	6	6	6		
1020	gasket	1	1	1	1	1	x	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
1210	plug	1	1	1	1	1		
1220	sealing ring	1	1	1	1	1	x	x
1230	plug - for connection PT100	1	1	1	1	1		
1410	cap head screw	4	4	4	4	4		
4000	pump cover + idler pin, complete	1	1	1	1	1	x	
8100	shim	1	1	1	1	1	x	
8110	support ring	1	1	1	1	1		
8120	o-ring	1	1	1	1	1	x	x
8130	o-ring	1	1	1	1	1	x	x
8200	o-ring	1	1	1	1	1	x	x
8210	cap head screw	6	6	8	8	8		
8310	inner magnetic rotor	1	1	1	1	1	x	
8320	outer magnetic rotor	1	1	1	1	1	x	
8330	separation can	1	1	1	1	1		
8350	rotor bearing assembly	1	1	1	1	1	x	
8400	key	2	2	2	2	2		
8410	pin	1	1	1	1	1		
8420	disc rotor	1	1	1	1	1		
8430	insert	1	1	1	1	1		
8440	o-ring	1	1	1	1	1	x	x
8450	intermediate cover	1	1	1	1	1		
8460	cap head screw	2	2	2	2	2		
8470	shim	1	1	1	1	1	x	
8480	cap head screw	4	4	4	4	4		
8490	cap head screw	4	4	4	4	4		
8500	disc spring	1	1	1	1	1	x	
8510	locking nut	1	1	1	1	1		
8520	set screw	2	2	2	2	2		

5.1.2 Bearing bracket

Pos.	Description	15-50	23-65	58-80	86-100	185-125	preventive	overhaul
0702	pump shaft	1	1	1	1	1		
1400	bearing bracket	1	1	1	1	1		
1430	bearing cover	1	1	1	1	1		
1440	ball-bearing (metal cage)	2	2	2	2	2	x	x
1450	circlip	1	1	1	1	1	x	
1460	support ring	1	1	1	1	1		
1490	sealing segment	1	1	1	1	1	x	x
1540	countersunck screw	4	4	4	4	4		
1550	nameplate	1	1	1	1	1		
1560	rivet	4	4	4	4	4		
1570	key	1	1	1	1	1	x	
8600	pin	2	2	2	2	2		
8610	cap head screw	4	4	4	4	4		
8620	circlip	2	2	2	2	2	x	
8630	protection ring	1	1	1	1	1		
8640	circlip	1	1	1	1	1	x	

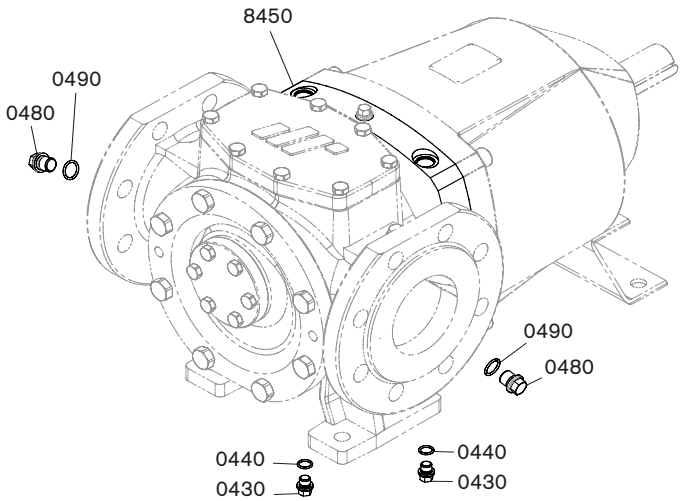
5.1.3 S-jacket options

5.1.3.1 S-Jackets on pump cover



Pos.	Description	15-50	23-65	58-80	86-100	185-125	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

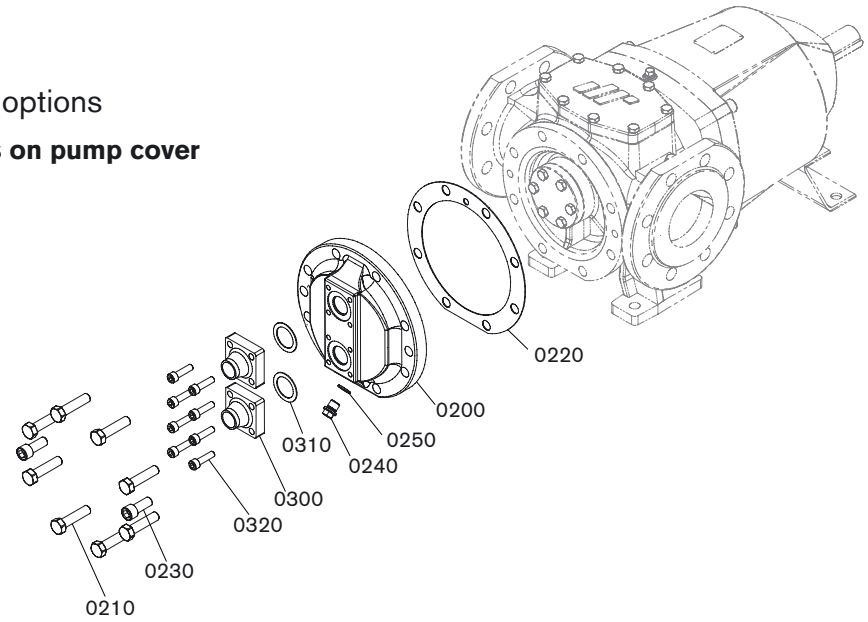
5.1.3.2 S-Jackets on intermediate cover



Pos.	Description	15-50	23-65	58-80	86-100	185-125	preventive	overhaul
8450	intermediate cover	1	1	1	1	1		
0430	plug	2	2	2	2	2		
0440	sealing ring	2	2	2	2	2	x	x
0480	plug	2	2	2	2	2		
0490	sealing ring	2	2	2	2	2	x	x

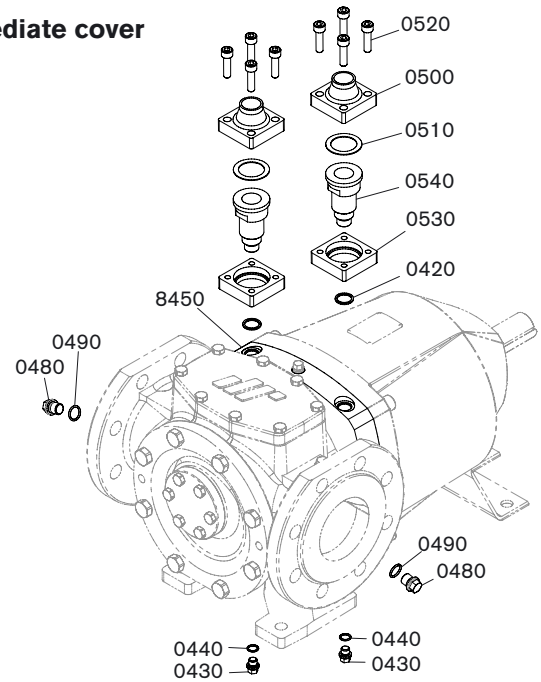
5.1.4 T-jacket options

5.1.4.1 T-jackets on pump cover



Pos.	Description	15-50	23-65	58-80	86-100	185-125	preventive	overhaul
0200	jacket cover	2	2	2	2	2		
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
0300	welding neck flange	2	2	2	2	2		
0310	gasket	2	2	2	2	2	x	x
0320	cap head screw	8	8	8	8	8		

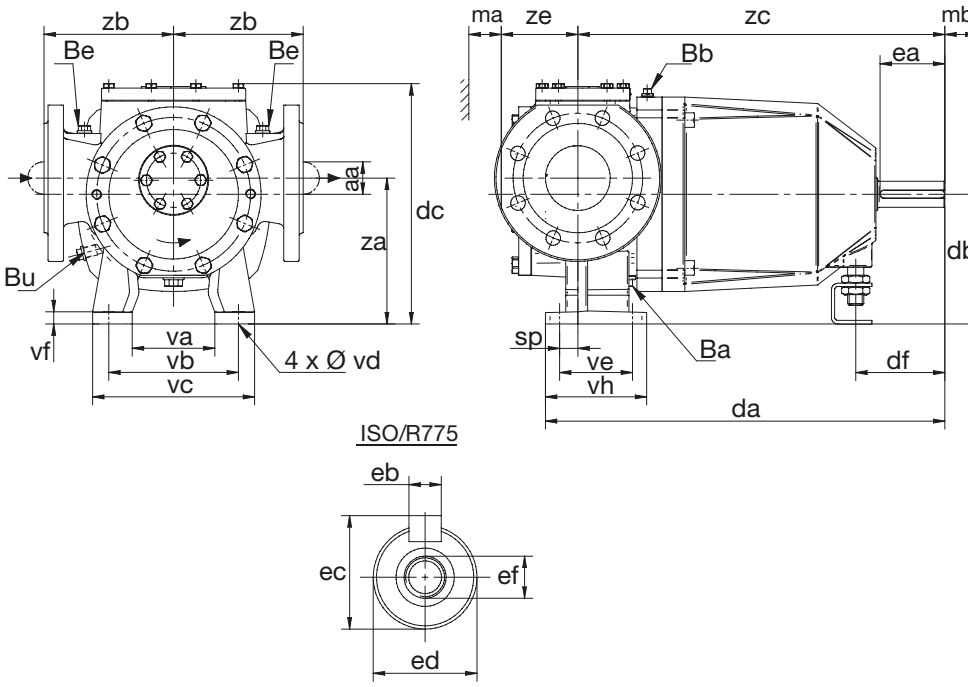
5.1.4.2 T-jackets on intermediate cover



Pos.	Description	15-50	23-65	58-80	86-100	185-125	preventive	overhaul
8450	intermediate cover	1	1	1	1	1		
0420	sealing ring	2	2	2	2	2	x	x
0430	plug	2	2	2	2	2		
0440	sealing ring	2	2	2	2	2	x	x
0480	plug	2	2	2	2	2		
0490	sealing ring	2	2	2	2	2	x	x
0500	welding neck flange	2	2	2	2	2		
0510	gasket	2	2	2	2	2	x	x
0520	cap head screw	8	8	8	8	8		
0530	flange	2	2	2	2	2		
0540	flange holder	2	2	2	2	2		

6.0 Dimensional drawings

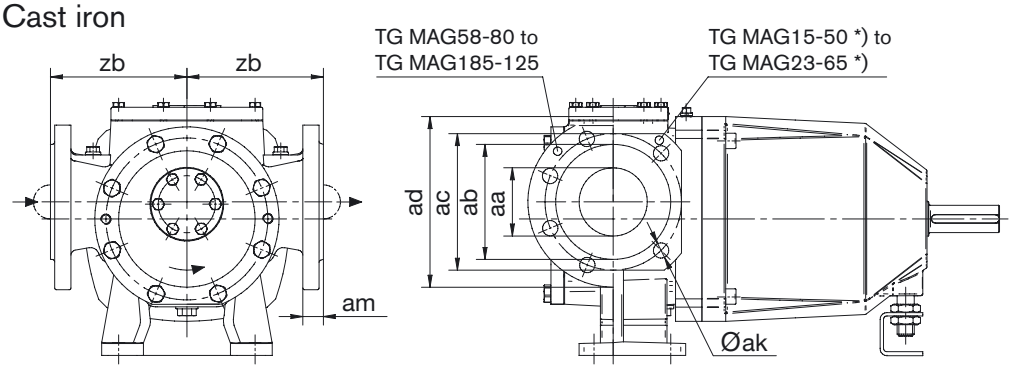
6.1 TG MAG15-50 to 185-125 pumps



TG MAG	15-50	23-65	58-80	86-100	185-125
aa	50	65	80	100	125
Ba	G 1/4	G 1/4	G 1/2	G 1/2	G 1/2
Bb	G 1/8	G 1/8	G 1/8	G 1/8	G 1/8
Be	G 1/4	G 1/4	G 1/4	G 1/4	G 1/4
Bu	G 1/4	G 1/4	G 1/4	G 1/4	G 1/4
da	389	400	493	526	633
db	112	112	160	160	200
dc	209	219	297	315	380
de	M16	M16	M20	M20	M20
df	86	86	110	110	140
ea	60	60	80	80	110
eb	8 h9	8 h9	10 h9	10 h9	14 h9
ec	31	31	35	40	51.5
ed	28 j6	28 j6	32 k6	37 k6	48 k6
ef	M10	M10	M12	M12	M16
ma	75	80	105	125	155
mb	125	125	150	160	190
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	453	476	580
ze	68	80	94	109	132

6.2 Flange connections

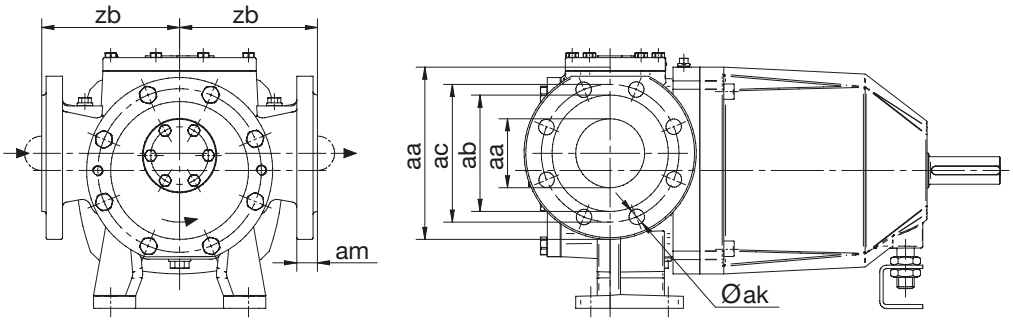
6.2.1 Cast iron



TG MAG	15-50	23-65	58-80	86-100	185-125
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 instead of rounded flanges*

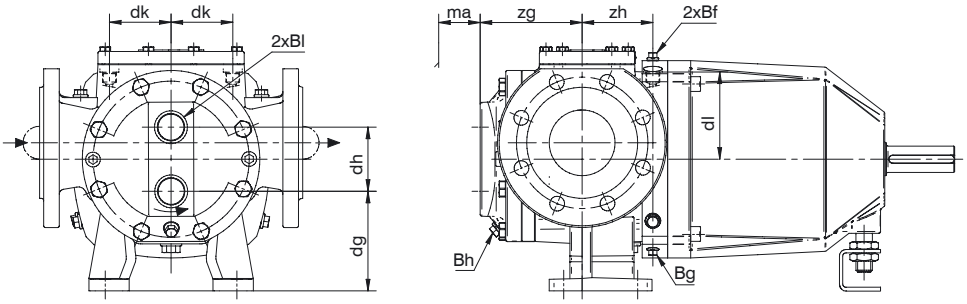
6.2.2 Stainless steel



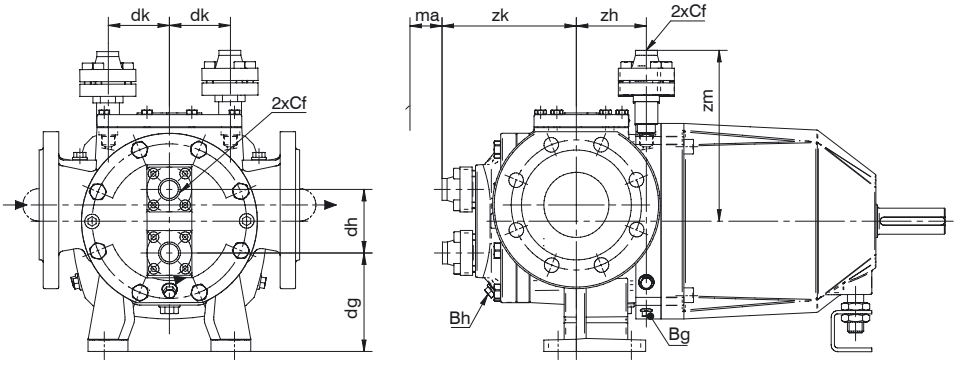
TG MAG	15-50	23-65	58-80	86-100	185-125
aa	50	65	80	100	125
ab	98	120	133	160	186
ac PN16	125	145	160	180	210
ac PN20	120.5	139.5	152.5	190.5	216
ac PN25	125	145	160	190	220
ac PN40	125	145	160	190	220
ac PN50	127	149.5	168	200	235
ad	165	187	206	238	273
ak PN16	4xd18	4xd18	8xd18	8xd18	8xd18
ak PN20	4xd18	4xd18	4xd18	8xd18	8xd22
ak PN25	4xd18	8xd18	8xd18	8xd22	8xd26
ak PN40	4xd18	8xd18	8xd18	8xd22	8xd26
ak PN50	8xd18	8xd22	8xd22	8xd22	8xd22
am	21	21	24	25	28
zb	125	125	160	180	200

6.3 Jackets

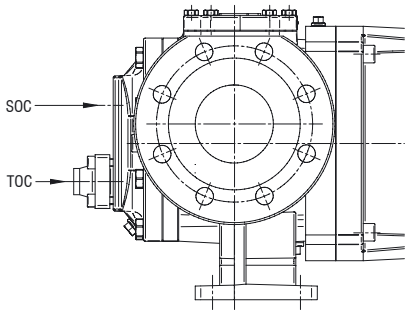
6.3.1 S-jackets with thread connections on pump cover and intermediate cover (SS)



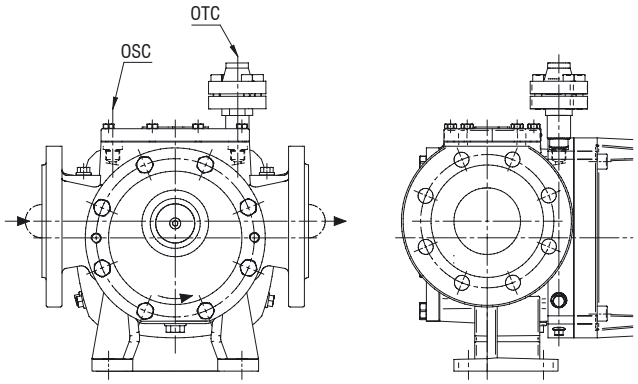
6.3.2 T-jackets with flange connections on pump cover and intermediate cover (TT)



6.3.3 Jackets with thread connections on pump cover and without jackets on intermediate cover (SOC)
Jackets with flange connections on pump cover and without jackets on intermediate cover (TOC)



6.3.4 No jackets on pump cover but jackets on intermediate cover and thread connections (OSC)
No jackets on pump cover but jackets on intermediate cover and flange connections (OTC)



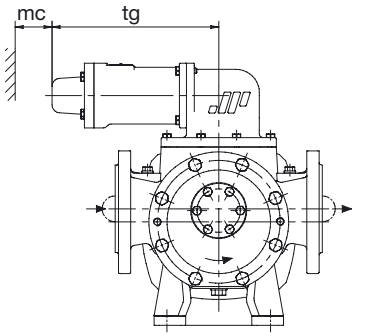
Jackets dimensions

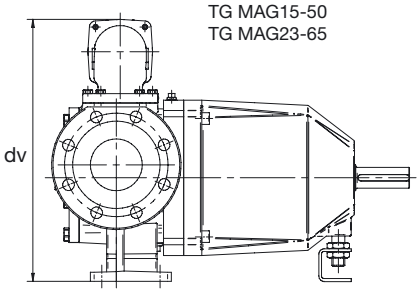
TG MAG	Mat.	15-50	23-65	58-80	86-100	185-125
Bf	G / R	G 1/4	G 1/4	G 3/8	G 3/8	G 3/8
Bg	G / R	G 1/8	G 1/8	G 1/8	G 1/8	G 1/8
Bh	G / R	G 1/4	G 1/4	G 1/4	G 1/4	G 1/4
Bl	G	G 1/2	G 1/2	G 1	G 1	G 1
	R			G 3/4	G 3/4	G 3/4
Cf	G / R	21.3 x 2	21.3 x 2	26.9 x 2.3	26.9 x 2.3	26.9 x 2.3
dg	G / R	87	84	121	115	135
dh	G / R	50	56	78	90	130
dk	G / R	56	56	75	75	100
dl	G / R	80	80	106	106	142
ma	G / R	75	80	105	125	155
zg	G / R	96	110	123	140	163
zh	G / R	65	65	86	86	126
zm	G / R	155	155	207	207	243
zk	G / R	134	148	165	182	205

6.4 Safety relief valves

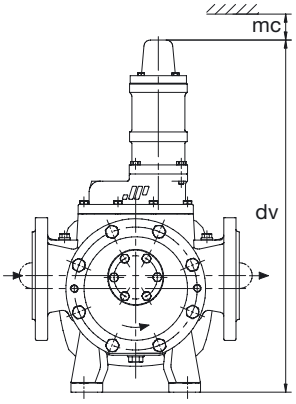
6.4.1 Single safety relief valve

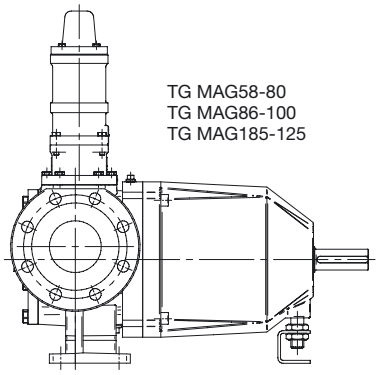
TG MAG	Mat.	15-50	23-65
dv	G	290	300
	R	293	303
mc	G / R	50	50
tg	G / R	200	200



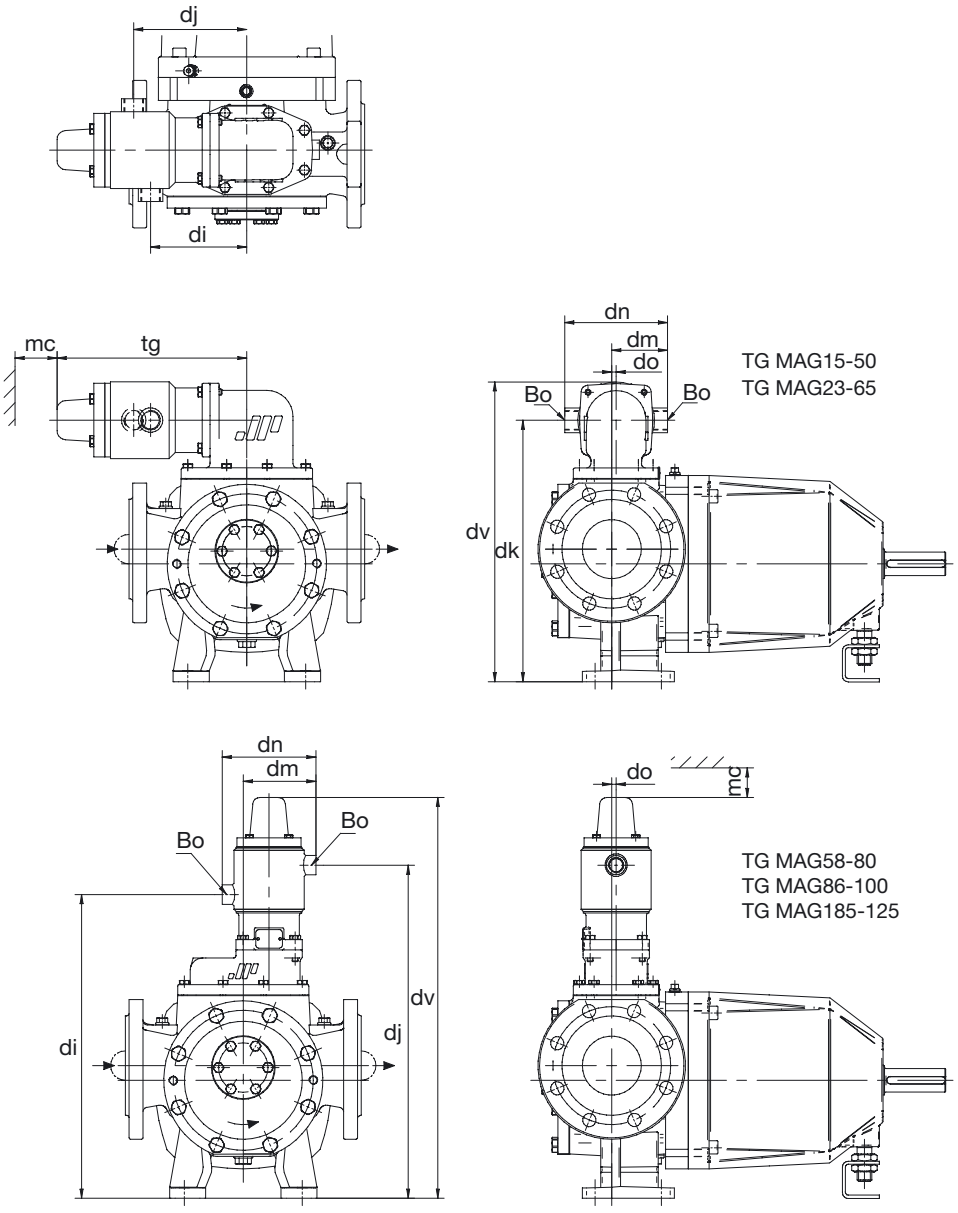


TG MAG	Mat.	58-80	86-100	185-125
dv	G	550	576	641
	R	555	581	646
mc	G / R	70	70	70
tg	G / R	-	-	-



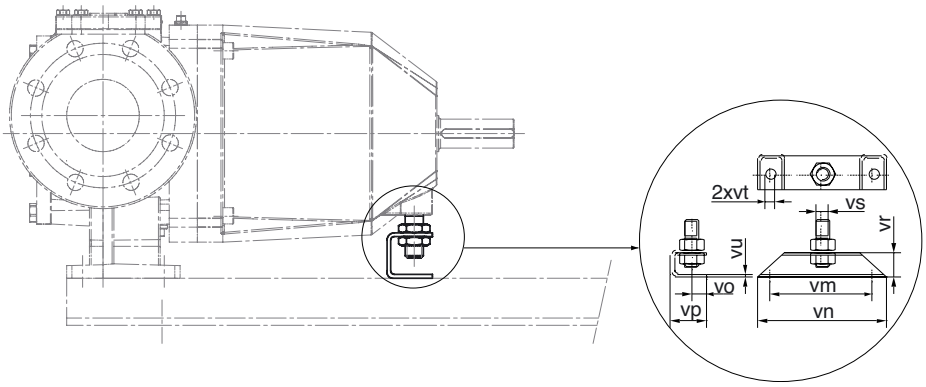


6.4.2 Heated safety relief valve



TG MAG	Mat.	15-50	23-65	58-80	86-100	185-125
Bo	G / R	G 1/2	G 1/2	G 1/2	G 1/2	G 1/2
di	G / R	101	101	418	444	509
dj	G / R	119	119	458	484	549
dk	G / R	253	263	-	-	-
dm	G / R	62	59.5	98.5	103.5	103.5
dn	G / R	111	111	127	127	127
do	G / R	6,5	4	6	8	24
dv	G	290	300	550	576	641
	R	293	303	555	581	646
mc	G / R	50	50	70	70	70
tg	G / R	200	200	-	-	-

6.5 Bracket support



TG MAG	15-50	23-65	58-80	86-100	185-125
vm	120	120	160	160	200
vn	150	150	195	195	250
vo	17	17	20	20	20
vp	40	40	50	50	50
vr	30	30	50	50	50
vs	M16	M16	M20	M20	M20
vt	12	12	14	14	14
vu	3	3	4	4	4

6.6 Weights – Mass

TG MAG	Mat.	Version	Mass	Weight	15-50	23-65	58-80	86-100	185-125
Pump (without jackets)	G		kg	daN	48	52	109	117	240
	R		kg	daN	51	55	113	125	252
Front-Pull out (pump cover + idler)	G		kg	daN	2.5	3.5	9	12	24
	R		kg	daN	3	4	10	13	26
Back-Pull out (rotor shaft/bearing + bracket)	G		kg	daN	35	35	78	81	170
	R		kg	daN	35	35	78	81	170
Jackets (supplement)		SOC	kg	daN	3	3	5	7	12
		SSC	kg	daN	3	3	5	7	12
		OSC	kg	daN	0	0	0	0	0
		TOC	kg	daN	3.5	3.5	5.5	8	13
		TTC	kg	daN	4	4	6.5	9	14
		OTC	kg	daN	0.5	0.5	1	1	1
Relief valve (supplement)	G		kg	daN	5	5	7	10	10
	R		kg	daN	5	5	8	11	11

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