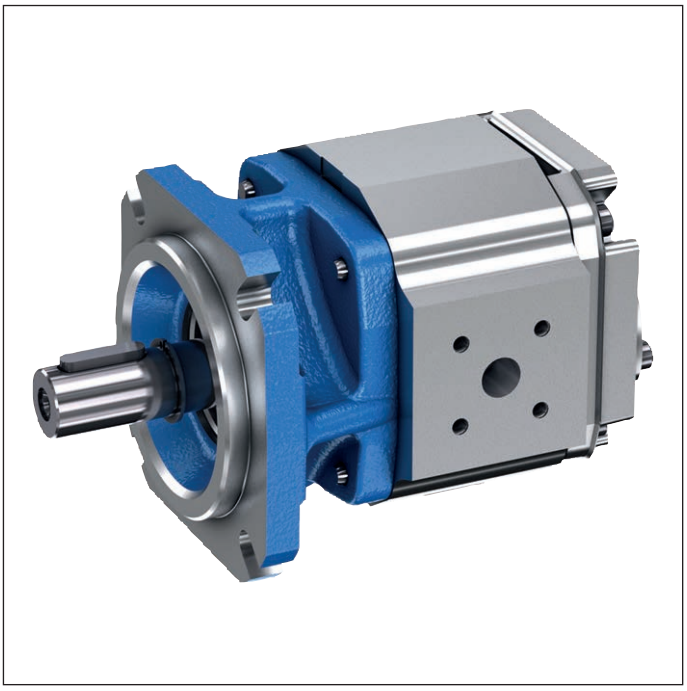
RE 10213
Edition: 2025-09
Replaces: 05.15

rexroth
A Bosch Company

Internal gear pump

Type PGF



- Component series 2X and 3X
- Frame size 1, 2, and 3
- Size 1.7 ... 40
- Maximum operating pressure 210 bar
- Displacement 1.7 ... 40 cm^3
- Fixed displacement
- Pump combinations

Features

- Low operating noise
- Low flow pulsation
- High efficiency even with low viscosity due to sealing gap compensation
- Suitable for broad viscosity and speed ranges
- Very good suction characteristic
- Can be combined with internal gear pumps, vane pumps and axial piston pumps
- Application:
  - Drives in the small and medium power and pressure range in (industrial) applications, e.g. machine tools.
  - With high operating pressure for fatigue-resistant drives in mobile applications, e.g. lifting equipment, fans and spreaders.

Contents

Ordering codes: Single pumps

01	02	03		04		05	06	07	08	09	10	11	12
PG	**F**		**–**		**/**					**V**			*****

01	Internal gear pump	**PG**

02	Medium pressure pump	**F**

03	Frame size 1	**1**
	Frame size 2	**2**
	Frame size 3	**3**

04	Component series 20 ... 29 (20 ... 29: unchanged installation and connection dimensions) (frame size 1 and 2)	**2X**
	Component series 30 ... 39 (30 ... 39: unchanged installation and connection dimensions) (frame size 3)	**3X**

Size

05	**Frame size 1**	
	Size 1.7 (displacement 1.7 cm^3)	**1.7**
	Size 2.2 (displacement 2.2 cm^3)	**2.2**
	Size 2.8 (displacement 2.8 cm^3)	**2.8**
	Size 3.2 (displacement 3.2 cm^3)	**3.2**
	Size 4.1 (displacement 4.1 cm^3)	**4.1**
	Size 5.0 (displacement 5.0 cm^3)	**5.0**
	Frame size 2	
	Size 6 (displacement 6.5 cm^3)	**006**
	Size 8 (displacement 8.2 cm^3)	**008**
	Size 11 (displacement 11.0 cm^3)	**011**
	Size 13 (displacement 13.3 cm^3)	**013**
	Size 16 (displacement 16.0 cm^3)	**016**
	Size 19 (displacement 18.9 cm^3)	**019**
	Frame size 3	
	Size 20 (displacement 20.6 cm^3)	**020**
	Size 25 (displacement 25.4 cm^3)	**025**
	Size 32 (displacement 32.5 cm^3)	**032**
	Size 40 (displacement 40.5 cm^3)	**040**

Direction of rotation

06	When looking at the drive shaft, right	**R**
	When looking at the drive shaft, left	**L**

Shaft end

07	Cylindrical with fitting key according to ISO 3019-2, without through-drive	**A**
	Cylindrical with fitting key according to ISO 3019-2, with through-drive	**E**
	Cylindrical with involute tooth system according to ISO 3019-1, with through-drive	**J**
	With 2-face driver, with through-drive	**L**
	Conical 1:5 with spline shaft profile for truck ancillary output, similar to ISO 14, with through-drive	**O**

Line connections

08	Suction and pressure port, pipe thread according to ISO 228-1	**01**
	Suction and pressure port, rectangular according to ISO 6162-1, metric mounting thread	**07**
	Suction and pressure port, square according to DIN 3901 and 3902, metric mounting thread	**20**

Seal material

09	FKM shaft seal ring	**V**

Ordering codes: Single pumps

01	02	03		04		05	06	07	08	09	10	11	12
PG	**F**		**–**		**/**					**V**			*****

Mounting

10	2-hole mounting flange according to ISO 3019-1	**U2**
	4-hole mounting flange according to ISO 3019-2	**E4**
	2-hole mounting, centering 32 mm (frame size 1), centering 52 mm (frame sizes 2 and 3)	**M**
	2-hole mounting, centering 45.24 mm	**P1**
	4-hole mounting flange according to ISO 7653-1985 (special version)	**K4**

Option

11	Standard	**No code**
	End cover for attachment of the next smaller frame size	**K**
12	Further details in the plain text	*****

☞ **Notice:**
Not every combination of ordering codes is possible.
Please select the desired pump using the selection tables (page 15 ... 28) or after consultation.

Ordering codes: Pump combination

01	02		03		04		05		06		07	08	09	10		11	12		13	14	15
		/		+		/		+		/					+	L		+	L		

Combination

01	2-fold	**P2**
	3-fold	**P3**

Pump 1 [1)]

02	Frame size	e.g. **GF2**

Pump 1 [1)]

03	Size e.g. 16	e.g. **016**

Pump 1 [1)]

04	Frame size e.g. GF2	e.g. **GF2**

Pump 2 [2)]

05	Size e.g. 11	e.g. **011**

Pump 3 [2)]

06	Frame size e.g. GF1	e.g. **GF1**

Pump 3 [2)]

07	Size e.g. 2.8	e.g. **2.8**

Direction of rotation

08	When looking at shaft end, right	**R**
	When looking at shaft end, left	**L**

Pump 1 shaft end

09	Cylindrical with fitting key according to ISO 3019-2, with through-drive	**E**
	Cylindrical with involute tooth system according to ISO 3019-1, with through-drive	**J**
	With 2-face driver, with through-drive	**L**

Pump 1 line connections

10	Suction and pressure port, pipe thread according to ISO 228-1	**01**
	Suction and pressure port, rectangular according to ISO 6162-1, metric mounting thread	**07**
	Suction and pressure port, square according to DIN 3901 and 3902, metric mounting thread	**20**

Pump 2 shaft end

11	Dihedral for claw coupling, with through-drive	**L**

Pump 2 line connections

12	Suction and pressure port, pipe thread according to ISO 228-1	**01**
	Suction and pressure port, rectangular according to ISO 6162-1, metric mounting thread	**07**
	Suction and pressure port, square according to DIN 3901 and 3902, metric mounting thread	**20**

Pump 3 shaft end

13	Dihedral for claw coupling, with through-drive	**L**

Pump 3 line connections

14	Suction and pressure port, pipe thread according to ISO 228-1	**01**
	Suction and pressure port, rectangular according to ISO 6162-1, metric mounting thread	**07**
	Suction and pressure port, square according to DIN 3901 and 3902, metric mounting thread	**20**

Ordering codes: Pump combination

01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
		/		+		/		+		/									+	L		+	L		

Pump 1 mounting

15	2-hole mounting flange according to ISO 3019-1	**U2**
	4-hole mounting flange according to ISO 3019-2	**E4**
	2-hole mounting, centering 32 mm (frame size 1), centering 52 mm (frame sizes 2 and 3)	**M**
	4-hole mounting flange according to ISO 7653-1985 (special version)	**K4**

[1] Details see page 2.

Function, section, symbol

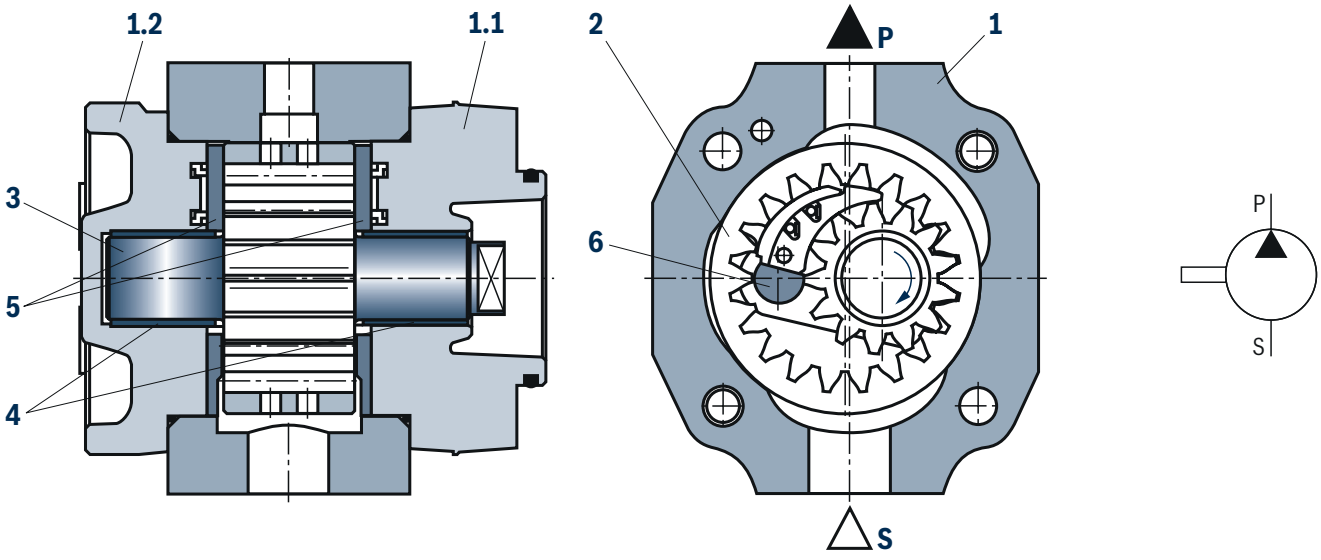
Design
Hydraulic pumps of type PGF are gap-compensated internal gear pumps with constant displacement.
They basically comprise the housing (1), bearing cover (1.1), end cover (1.2), internal gear (2), pinion shaft (3), plain bearings (4), axial washers (5) and stop pin (6), as well as the segment filler element (7) consisting of the segment (7.1), segment support (7.2) and the sheet seals (7.3).

Suction and displacement procedure
The hydrodynamically supported pinion shaft (3) drives the internally geared internal gear (2) in the displayed direction of rotation.
During the rotation, there is a volume increase over an angle of approx. 180° in the suction range. This results in underpressure, and hydraulic fluid flows into the chambers.
The sickle-shaped segment filler element (7) separates the suction and pressure chamber. In the pressure chamber, the teeth of the pinion shaft (3) re-engage in the space between the teeth of the internal gear (2). The hydraulic fluid is displaced via the pressure channel (P).

Hydrodynamic and hydrostatic mounting
The pinion shaft (3) is supported by hydrodynamically lubricated radial plain bearings (4).
The internal gear (2) is mounted hydrostatically in the housing.

Gear tooth system
The gear tooth system with involute edges has a large meshing length for little flow and pressure pulsation and thus guarantees low-noise running.

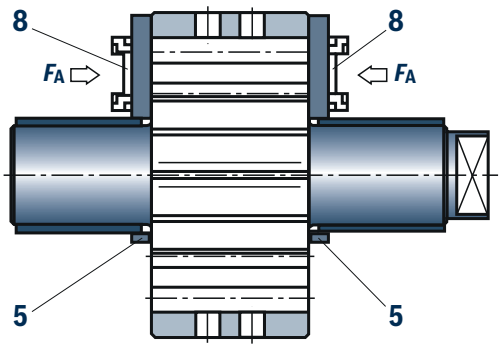
Materials used
- Housing (1), bearing cover (1.1), end cover (1.2) and axial washers (5): Aluminum alloy
- Internal gear (2), pinion shaft (3) and stop pin (6): Steel
- Plain bearings (4): Copper-tin with steel back segment
- Segment (7.1) and segment support (7.2): Brass alloy
- Sheet seals (7.3): Plastic



Function, section

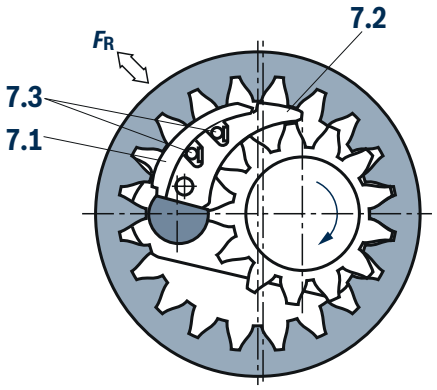
Axial compensation

The axial compensation force F_A acts in the area of the pressure chamber and is generated with the pressure field (8) in the axial washers (5). As a result, the axial longitudinal gaps between the rotating and the fixed parts are extremely small and ensure perfect axial sealing of the pressure chamber.



Radial compensation

The radial compensation force F_R acts on the segment (7.1) and segment support (7.2).
The area ratios and the position of the sheet seals (7.3) between the segment and segment support are designed so that an almost leakage-gap-free seal is achieved between the internal gear (2), segment filler element (7), and pinion shaft (3).
Spring elements under the sheet seal (7.3) ensure sufficient contact pressure, even with very low pressures.



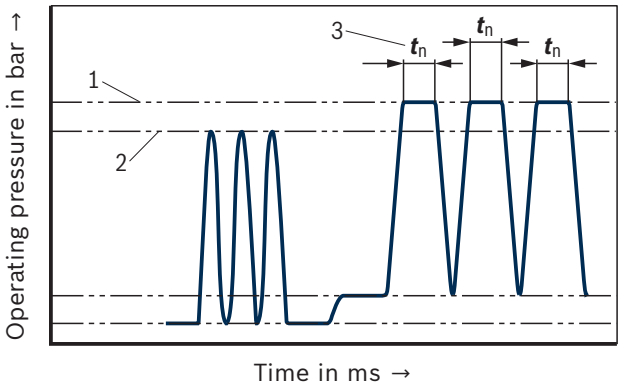
Technical data: Frame size 1
(For device application outside the specified values, please contact us!)

General							
Size	NG	1.7	2.2	2.8	3.2	4.1	5.0
Pump design		Internal gear pump, gap-compensated					
Type of mounting		Mounting flange					
Type of connection		Flange connection					
Mass	kg	1.8	1.8	1.8	1.9	2.0	2.0
Installation position		Preferably horizontal (suction port bottom)					
Shaft load		Radial and axial forces (e.g. belt pulley) [1]					
Direction of rotation		Right or left					
Minimum speed [2]	rpm	600					
Maximum speed [2]	rpm	4500	3600	4000	3600	3600	3600
Minimum drive power [3]	kW	0.75	0.75	0.75	0.75	0.75	0.75
Maximum drive power	kW	See characteristic curves on page 12					
Moment of inertia	kgm^2	0.000012	0.000013	0.000015	0.000017	0.000021	0.000026
Ambient temperature range	°C	–20 ... +60					

Hydraulic							
Minimum suction pressure (load-free)	bar	0.6					
Maximum suction pressure (load-free)	bar	3					
Maximum operating pressure	bar	180	210	210	210	210	180
Pressure peak [4]	bar	210	250	250	250	250	210
Hydraulic fluid		See table, page 11					
Hydraulic fluid temperature range	°C	–20 ... +100					
Viscosity range (hydraulic fluid temperature ≤ +100 °C)							
▶ Continuous operation							
– up to speed 1800 rpm	mm^2/s	300 ... 10					
– up to maximum speed	mm^2/s	100 ... 10					
▶ Optimal operating range							
– up to maximum speed	mm^2/s	36 ... 16					
Admissible start viscosity	mm^2/s	2000 [5]					
Maximum admissible degree of contamination of the hydraulic fluid; cleanliness class according to ISO 4406 (c)		Class 20/18/15 [6]					
Displacement (geometrical)	cm^3	1.7	2.2	2.8	3.2	4.1	5.0
Maximum flow rate (at 10 bar and 1450 rpm)	l/min	2.4	3.2	4.1	4.6	6.0	7.2

1) Only after consultation
2) Speeds at permanent operating pressure or maximum drive power and absolute pressure 1 bar at the suction port
3) At maximum suction pressure ≈ 1 bar
4) Maximum single operating period $t_{n\,max}$ = 6 s at maximum 15% of the duty cycle and maximum 2 x 10^6 load cycles.
5) Speed range 600 to 1800 rpm; hydraulic fluid temperature ≥ -20 °C; duration ≤3 min; without load (operating pressure ≤30 bar).
6) The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and at the same time increases the life cycle of the components.

Pressure definition



1 Pressure peak
2 Maximum operating pressure
3 Single operating period

☞ **Notice:**
The stated technical data were measured with HLP46, ϑ_{oil} = 50 °C and viscosity approx. 30 mm^2/s.

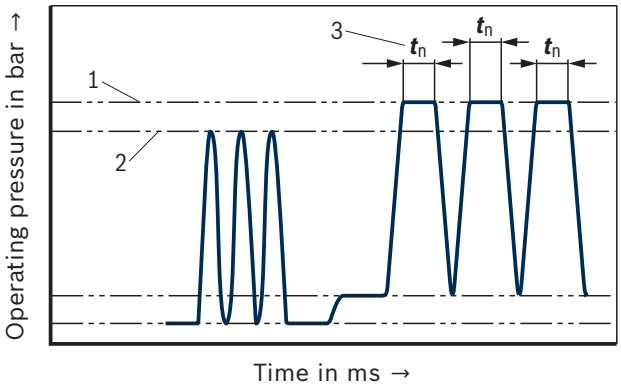
Technical data: Frame size 2
(For device application outside the specified values, please contact us!)

General							
Size	NG	6.3	8	11	13	16	19
Pump design		Internal gear pump, gap-compensated					
Type of mounting		Mounting flange					
Type of connection		Flange connection					
Mass	kg	4.2	4.2	4.5	4.6	4.8	4.9
Installation position		Preferably horizontal (suction port bottom)					
Shaft load		Radial and axial forces (e.g. belt pulley) [1]					
Direction of rotation		Right or left					
Minimum speed [2]	rpm	600					
Maximum speed [2]	rpm	3600	3600	3600	3600	3600	3600
Minimum drive power [3]	kW	0.75	0.75	0.75	0.75	0.75	1.1
Maximum drive power	kW	See characteristic curves on page 13					
Moment of inertia	kgm^2	0.000074	0.000090	0.00012	0.00014	0.00016	0.00019
Ambient temperature range	°C	–20 ... +60					

Hydraulic							
Minimum suction pressure (load-free)	bar	0.6					
Maximum suction pressure (load-free)	bar	3					
Maximum operating pressure	bar	210	210	210	210	210	210
Pressure peak [4]	bar	250	250	250	250	250	250
Hydraulic fluid		See table, page 11					
Hydraulic fluid temperature range	°C	–20 ... +100					
Viscosity range (hydraulic fluid temperature ≤ +100 °C) ▶ Continuous operation							
– up to speed 1800 rpm	mm^2/s	300 ... 10					
– up to maximum speed	mm^2/s	100 ... 10					
▶ Optimal operating range							
– up to maximum speed	mm^2/s	36 ... 16					
Admissible start viscosity	mm^2/s	2000 [5]					
Maximum admissible degree of contamination of the hydraulic fluid; cleanliness class according to ISO 4406 (c)		Class 20/18/15 [6]					
Displacement (geometrical)	cm^3	6.5	8.2	11	13.3	16	18.9
Maximum flow rate (at 10 bar and 1450 rpm)	l/min	9.4	11.9	16	19.3	23.3	27.4

1) Only after consultation
2) Speeds at permanent operating pressure or maximum drive power and absolute pressure 1 bar at the suction port
3) At maximum suction pressure ≈ 1 bar
4) Maximum single operating period $t_{n\,max}$ = 6 s at maximum 15% of the duty cycle and maximum 2 x 10^6 load cycles.
5) Speed range 600 to 1800 rpm; hydraulic fluid temperature ≥ -20 °C; duration ≤3 min; without load (operating pressure ≤30 bar).
6) The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and at the same time increases the life cycle of the components.

Pressure definition



1 Pressure peak
2 Maximum operating pressure
3 Single operating period

☞ **Notice:**
The stated technical data were measured with HLP46, ϑ_{oil} = 50 °C and viscosity approx. 30 mm^2/s.

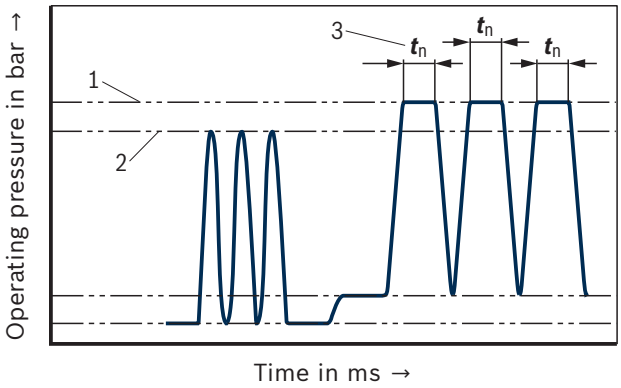
Technical data: Frame size 3
(For device application outside the specified values, please contact us!)

General					
Size	NG	20	25	32	40
Pump design		Internal gear pump, gap-compensated			
Type of mounting		Mounting flange			
Type of connection		Flange connection			
Mass	kg	4.8	4.9	5.3	5.6
Installation position		Preferably horizontal (suction port bottom)			
Shaft load		Radial and axial forces (e.g. belt pulley) [1]			
Direction of rotation		Right or left			
Minimum speed [2]	rpm	500			
Maximum speed [2]	rpm	3600	3200	3000	2500
Minimum drive power [3]	kW	1.1	1.5	1.5	1.5
Maximum drive power	kW	See characteristic curves on page 14			
Moment of inertia	kgm^2	0.00029	0.00035	0.00043	0.00053
Ambient temperature range	°C	–20 ... +60			

Hydraulic					
Minimum suction pressure (load-free)	bar	0.6			
Maximum suction pressure (load-free)	bar	3			
Maximum operating pressure	bar	210	210	210	180
Pressure peak [4]	bar	250	250	250	210
Hydraulic fluid		See table, page 11			
Hydraulic fluid temperature range	°C	–20 ... +100			
Viscosity range (hydraulic fluid temperature ≤ +100 °C)					
▶ Continuous operation					
– up to speed 1800 rpm	mm^2/s	300 ... 10			
– up to maximum speed	mm^2/s	100 ... 10			
▶ Optimal operating range					
– up to maximum speed	mm^2/s	36 ... 16			
Admissible start viscosity	mm^2/s	2000 [5]			
Maximum admissible degree of contamination of the hydraulic fluid; cleanliness class according to ISO 4406 (c)		Class 20/18/15 [6]			
Displacement (geometrical)	cm^3	20.6	25.4	32.5	40.5
Maximum flow rate (at 10 bar and 1450 rpm)	l/min	29.9	36.8	47.1	58.7

1) Only after consultation
2) Speeds at permanent operating pressure or maximum drive power and absolute pressure 1 bar at the suction port
3) At maximum suction pressure ≈ 1 bar
4) Maximum single operating period $t_{n\,max}$ = 6 s at maximum 15% of the duty cycle and maximum 2 x 10^6 load cycles.
5) Speed range 500 to 1800 rpm; hydraulic fluid temperature ≥ -20 °C; duration ≤3 min; without load (operating pressure ≤30 bar).
6) The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and at the same time increases the life cycle of the components.

Pressure definition



1 Pressure peak
2 Maximum operating pressure
3 Single operating period

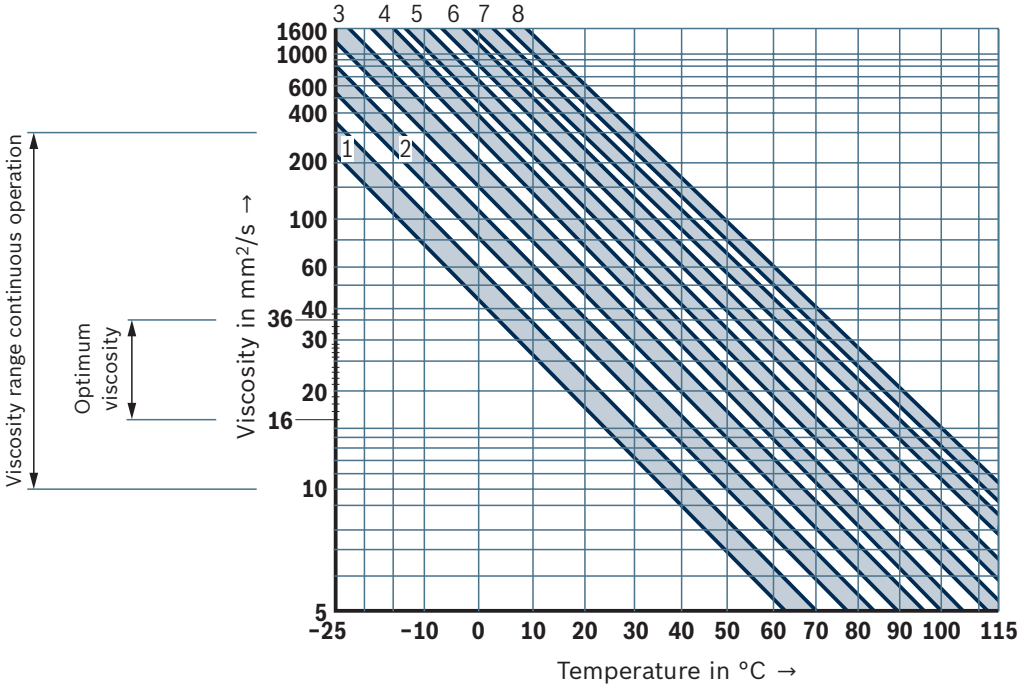
☞ **Notice:**
The stated technical data were measured with HLP46, ϑ_{oil} = 50 °C and viscosity approx. 30 mm^2/s.

Technical data
(For device application outside the specified values, please contact us!)

Hydraulic fluid		Classification	Suitable sealing materials	Standards	Data sheet
Mineral oils		HL, HLP	FKM	DIN 51524	90220
Bio-degradable	▶ Insoluble in water	HEES, HEPR	FKM	ISO 15380	90221

☞ **Important information on hydraulic fluids:**
- ▶ For further information, application notes and application requirements for selecting hydraulic fluids, operational behavior as well as disposal and environmental protection, see the data sheets above or contact us.
- ▶ The hydraulic fluid should be selected so that the operating viscosity is in the optimum range in the operating temperature range (see viscosity-temperature diagram).
- ▶ **Additional hydraulic fluids upon request**

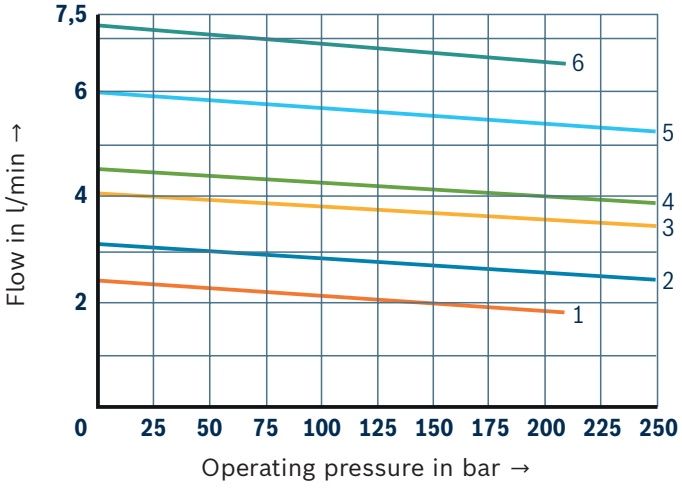
Viscosity dependent on temperature for HLP (viscosity index VI 100, double logarithmic representation)



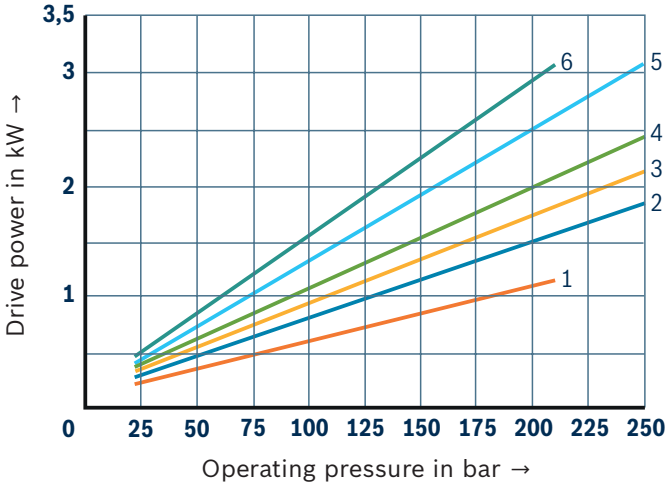
1 Viscosity class VG10
2 Viscosity class VG15
3 Viscosity class VG22
4 Viscosity class VG32
5 Viscosity class VG46
6 Viscosity class VG68
7 Viscosity class VG100
8 Viscosity class VG150

Characteristic curves: Frame size 1
(measured with HLP46, v = 46 mm²/s, ϑ_{oil} = 40±5 °C, n = 1450 rpm)

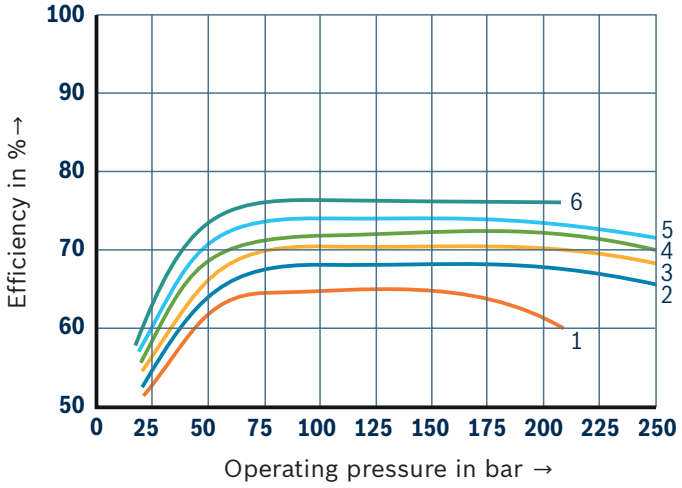
Flow



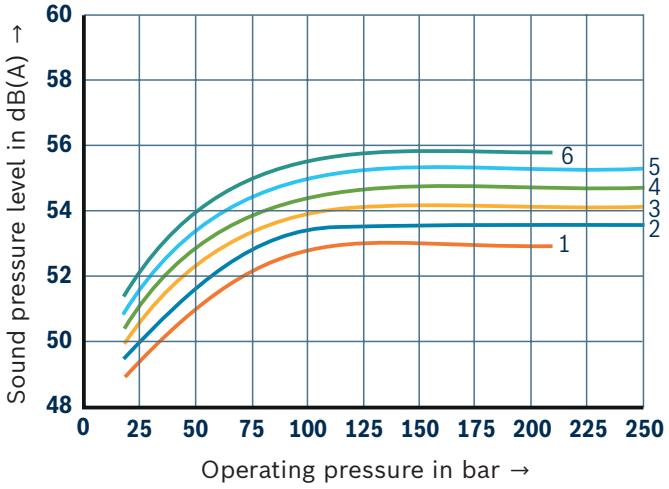
Drive power



Efficiency



Sound pressure level

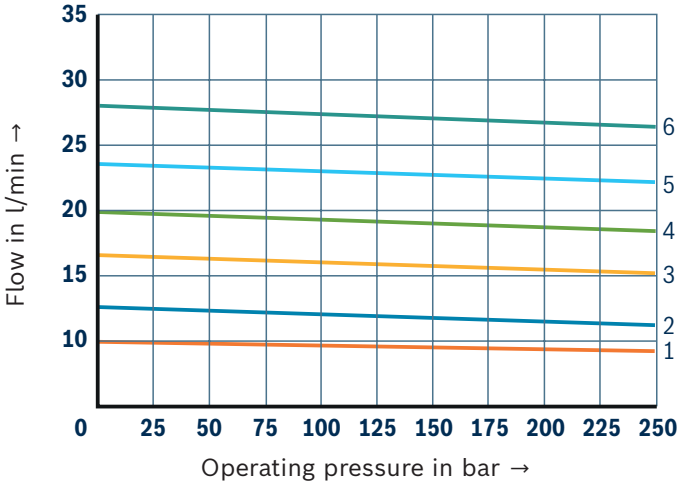


Notice:
Sound pressure level measured in the sound measuring chamber according to DIN 45635-26; distance microphone – pump = 1 m

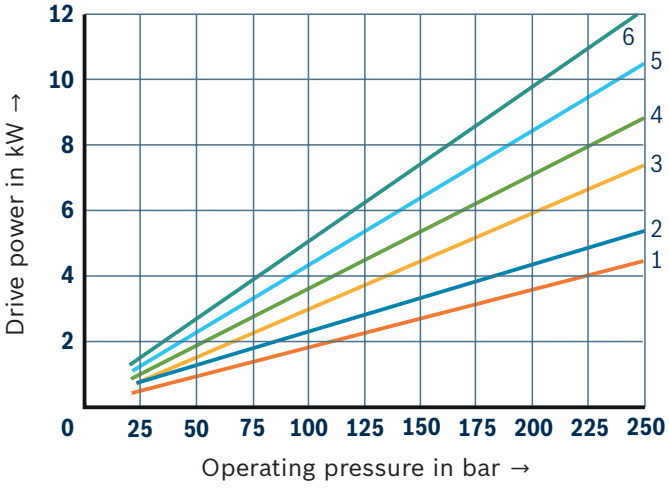
1 NG1.7
2 NG2.2
3 NG2.8
4 NG3.2
5 NG4.1
6 NG5

Characteristic curves: Frame size 2
(measured with HLP46, $\boldsymbol{v}$ = 46 mm²/s, ϑ_{oil} = 40±5 °C, $\boldsymbol{n}$ = 1450 rpm)

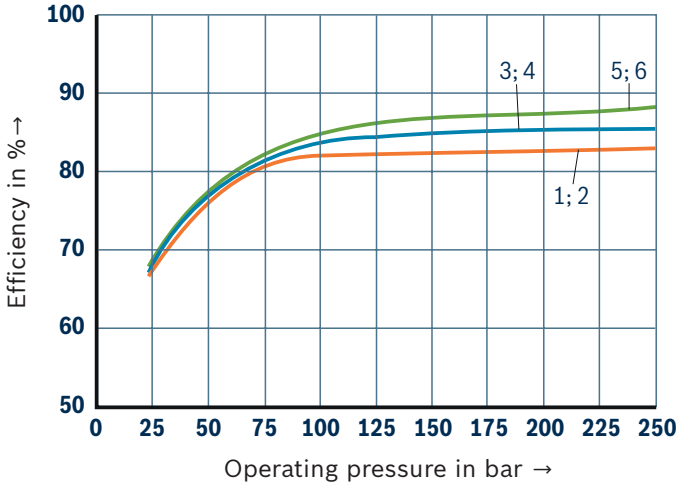
Flow



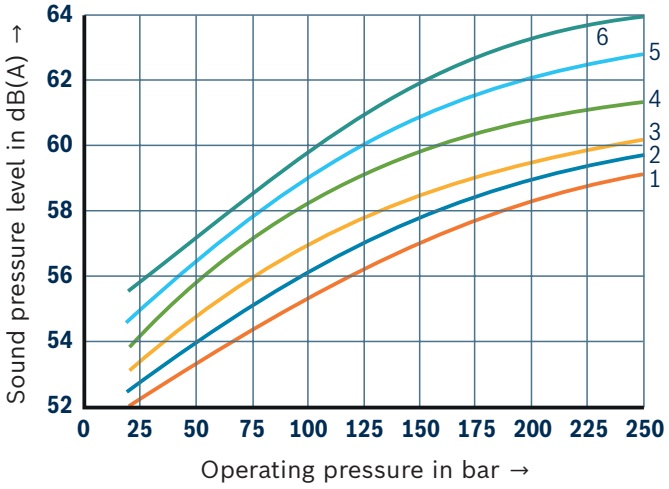
Drive power



Efficiency



Sound pressure level

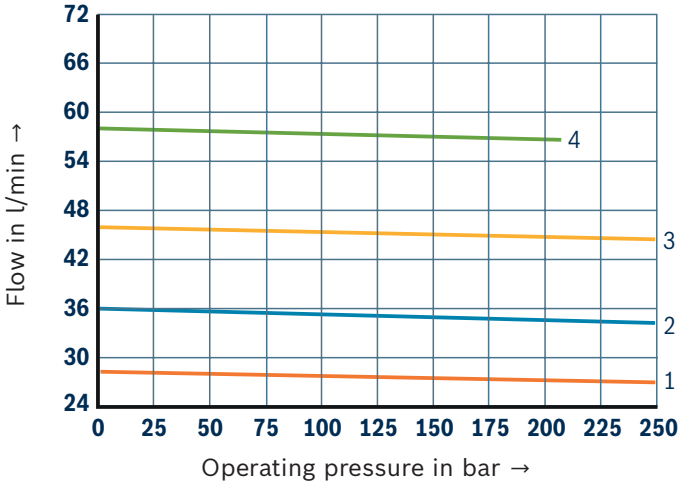


Notice:
Sound pressure level measured in the sound measuring chamber according to DIN 45635-26; distance microphone – pump = 1 m

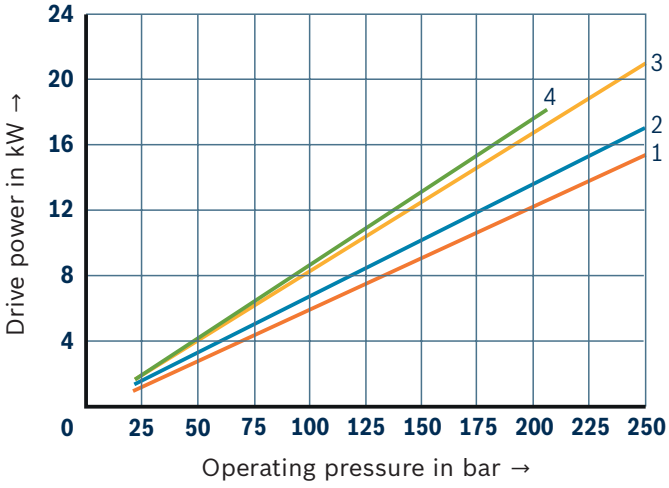
1 NG6.3
2 NG8
3 NG11
4 NG13
5 NG16
6 NG19

Characteristic curves: Frame size 3
(measured with HLP46, v = 46 mm²/s, ϑ_{oil} = 40±5 °C, n = 1450 rpm)

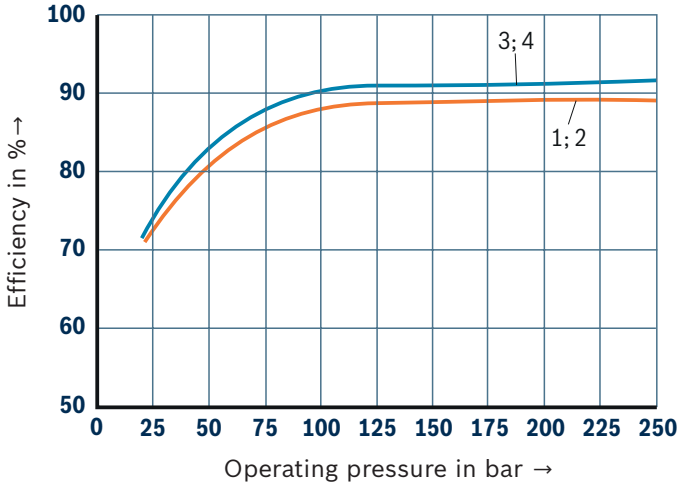
Flow



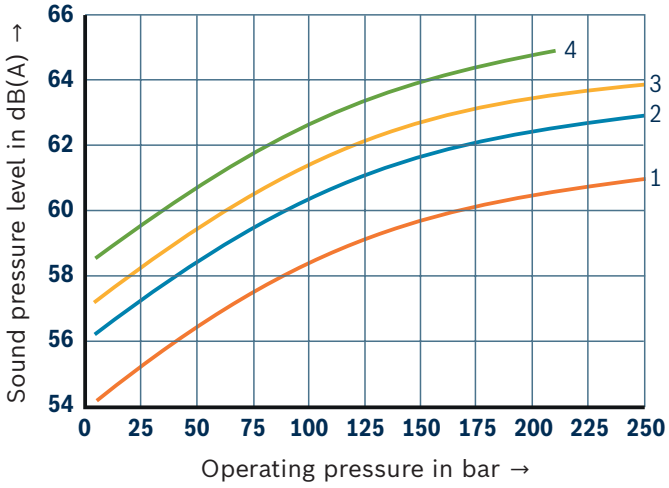
Drive power



Efficiency



Sound pressure level

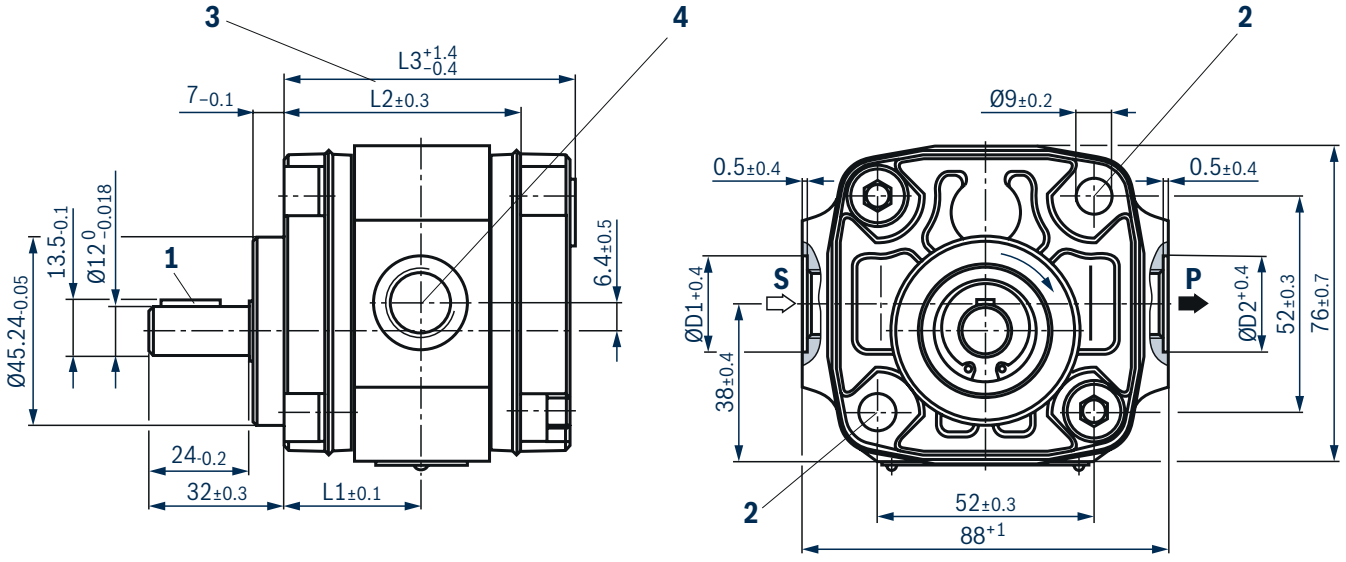


☞ **Notice:**
Sound pressure level measured in the sound measuring chamber according to DIN 45635-26; distance microphone – pump = 1 m

1 NG20
2 NG25
3 NG32
4 NG40

Dimensions: Frame size 1 – version "RA01VP1" (clockwise) (Dimensions in mm)

Shaft end "A" – cylindrical with fitting key according to ISO 3019-2, E12N
Mounting "P1" – 2-hole mounting flange, centering diameter 45.24 mm



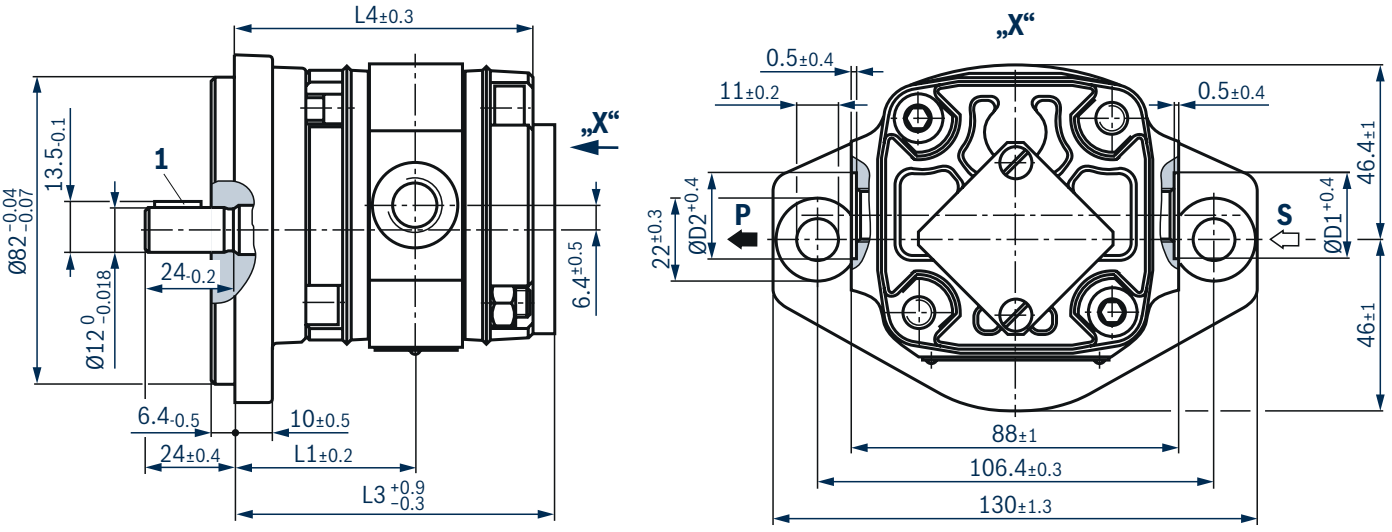
NG	L1	L2	L3	ØD1	ØD2	S	P	Material number	Type
1.7	29.6	49.1	61.1	23	23	G 1/4; 14	G 1/4; 12.5	R900932132	PGF1-2X/1.7RA01VP1
2.2	29.6	49.1	61.1	23	23	G 1/4; 14	G 1/4; 12.5	R900932133	PGF1-2X/2.2RA01VP1
2.8	30.7	51.4	63.4	26	23	G 3/8; 14	G 1/4; 12.5	R900932134	PGF1-2X/2.8RA01VP1
3.2	31.5	53.0	65	26	23	G 3/8; 14	G 1/4; 12.5	R900932135	PGF1-2X/3.3RA01VP1
4.1	33.4	56.7	68.7	26	26	G 3/8; 14	G 3/8; 12.5	R900932136	PGF1-2X/4.1RA01VP1
5	35.2	60.4	72.4	27	26	G 1/2; 14	G 3/8; 12.5	R900932137	PGF1-2X/5.0RA01VP1

1 Fitting key according to DIN 6885 B4 x 4 x 14
2 Through hole for hexagon socket head cap screw M8 DIN 912, tightening torque M_A = 25^{+5} Nm
3 Clamping length
4 Connection "01"

Notice:
The dimensions are nominal dimensions which are subject to tolerances.

Dimensions: Frame size 1 – version "RE01VU2" (clockwise) (Dimensions in mm)

Shaft end "E" – cylindrical with fitting key and through-drive according to ISO 3019-2, E12N
Mounting "U2" – 2-hole mounting flange according to ISO 3019-1**,** 82-2



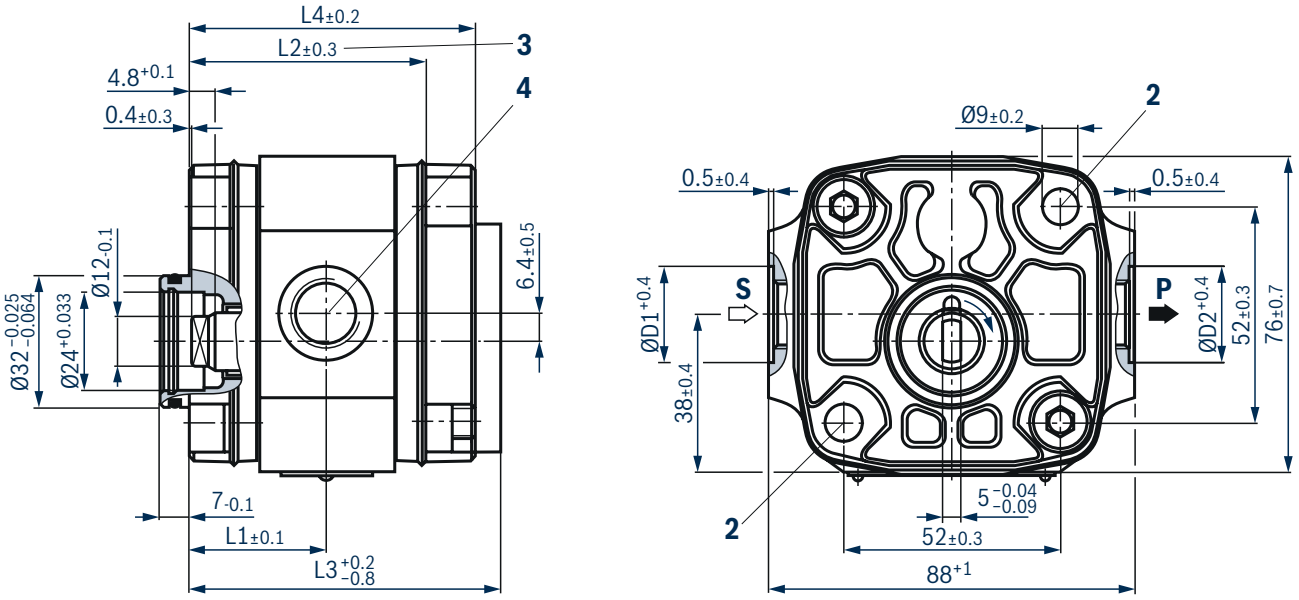
NG	L1	L3	L4	ØD1	ØD2	S	P	Material number	Type
1.7	48.6	85.7	79.7	23	23	G 1/4; 14	G 1/4; 12.5	R900086159	PGF1-2X/1.7RE01VU2
2.2	48.6	85.7	79.7	23	23	G 1/4; 14	G 1/4; 12.5	R900086160	PGF1-2X/2.2RE01VU2
2.8	49.7	88.0	82.0	26	23	G 3/8; 14	G 1/4; 12.5	R900086161	PGF1-2X/2.8RE01VU2
3.2	50.5	89.6	83.6	26	23	G 3/8; 14	G 1/4; 12.5	R900086162	PGF1-2X/3.3RE01VU2
4.1	52.4	93.3	87.3	26	26	G 3/8; 14	G 3/8; 12.5	R900086163	PGF1-2X/4.1RE01VU2
5	54.2	97.0	91.0	27	26	G 1/2; 14	G 3/8; 12.5	R900086164	PGF1-2X/5.0RE01VU2

1 Fitting key according to DIN 6885 B4 x 4 x 14

Notice:
The dimensions are nominal dimensions which are subject to tolerances.

Dimensions: Frame size 1 – version "RL01VM" (clockwise); "LL01VM" (counterclockwise) (Dimensions in mm)

Shaft end "L" – 2-face driver and through-drive
Mounting "M" – 2-hole attachment, centering diameter 32 mm (central or back pump)



NG	L1	L2	L3	L4	ØD1	ØD2	S	P	Material number	Type
1.7	29.6	49.1	66.7	60.7	23	23	G 1/4; 14	G 1/4; 12.5	R900086165	PGF1-2X/1.7RL01VM
									R900932093	PGF1-2X/1.7LL01VM
2.2	29.6	49.1	66.7	60.7	23	23	G 1/4; 14	G 1/4; 12.5	R900086166	PGF1-2X/2.2RL01VM
									R900932094	PGF1-2X/2.2LL01VM
2.8	30.7	51.4	69.0	63.0	26	23	G 3/8; 14	G 1/4; 12.5	R900932138	PGF1-2X/2.8RL01VM
									R900951293	PGF1-2X/2.8LL01VM
3.2	31.5	53.0	70.6	64.6	26	23	G 3/8; 14	G 1/4; 12.5	R900086168	PGF1-2X/3.3RL01VM
									R900951294	PGF1-2X/3.3LL01VM
4.1	33.4	56.7	74.3	68.3	26	26	G 3/8; 14	G 3/8; 12.5	R900086169	PGF1-2X/4.1RL01VM
									R900088913	PGF1-2X/4.1LL01VM
5	35.2	60.4	78.0	72.0	27	26	G 1/2; 14	G 3/8; 12.5	R900086170	PGF1-2X/5.0RL01VM

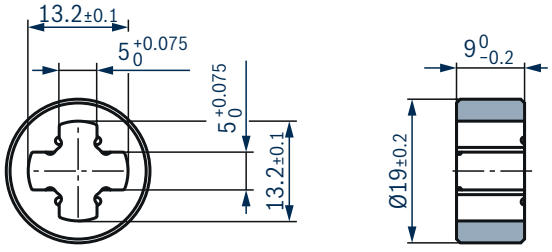
2 Through hole for hexagon socket head cap screw M8 DIN 912, tightening torque M_A = 25^{+5} Nm

3 Clamping length

4 Connection "01"

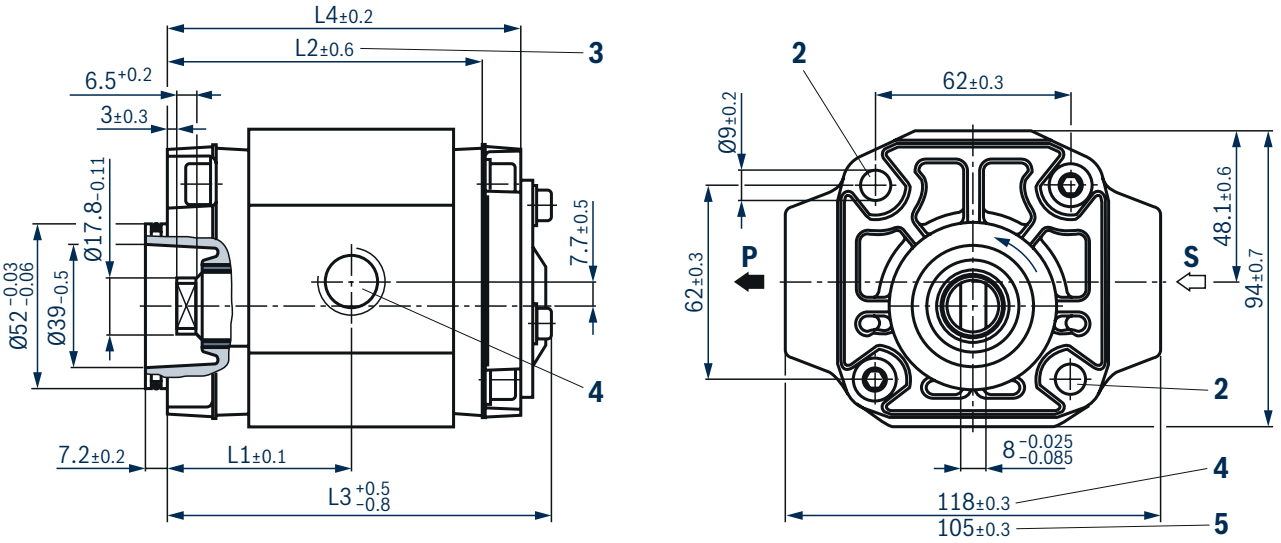
Notice:
The dimensions are nominal dimensions which are subject to tolerances.

2-face driver (included in scope of delivery)



Dimensions: Frame size 2 – version "RL01VM" (clockwise); "LL01VM" (counterclockwise) (Dimensions in mm)

Shaft end "L" – 2-face driver and through-drive
Mounting "M" – 2-hole attachment, centering diameter 52 mm (central or back pump)



NG	L1	L2	L3	L4	Connection		Material number	Type
					Standard	Optional		
6.3	46	76	98.7	87.1	"01"	"20"	R900567307	PGF2-2X/006RL01VM
							R900066012	PGF2-2X/006LL01VM
8	47.8	79.5	102.2	90.6	"01"	"20"	R900563291	PGF2-2X/008RL01VM
							R900070239	PGF2-2X/008LL01VM
11	50.5	85	107.7	96.1	"01"	"20"	R900561146	PGF2-2X/011RL01VM
							R900079232	PGF2-2X/011LL01VM
13	53	90	112.7	101.1	"20"	"01"	R900049570	PGF2-2X/013RL01VM
							R900058674	PGF2-2X/013LL01VM
16	55.5	95	117.7	106.1	"20"	"01"	R900064718	PGF2-2X/016RL01VM
							R900983463	PGF2-2X/016LL01VM
19	58.5	101	123.7	112.1	"20"	"01"	R900932243	PGF2-2X/019RL01VM
							R900983464	PGF2-2X/019LL01VM

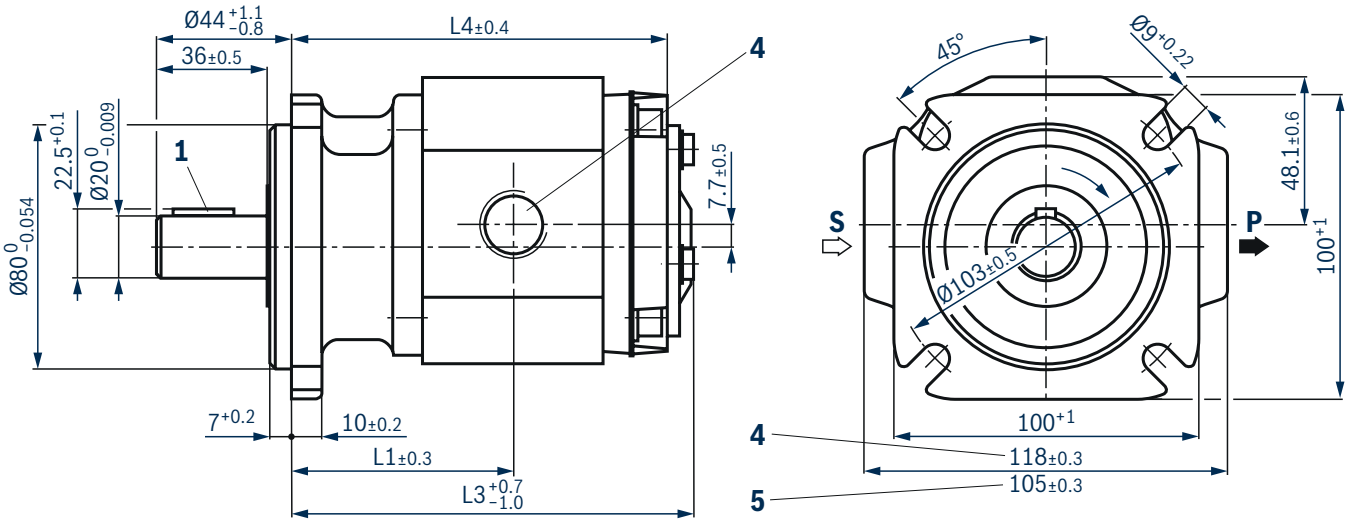
2 Through hole for hexagon socket head cap screw M8 DIN 912, tightening torque M_A = 25+5 Nm
3 Clamping length
4 Connection "01"
5 Connection "20"

Notice:
The dimensions are nominal dimensions which are subject to tolerances.

Connections and **drivers** see page 21.

Dimensions: Frame size 2 – version "RE01VE4" (clockwise) (Dimensions in mm)

Shaft end "E" – cylindrical with fitting key and through-drive according to ISO 3019-2, E20N
Mounting "E4" – 4-hole mounting flange according to ISO 3019-2**,** 80B4HW



NG	L1	L3	L4	Connection		Material number	Type
				Standard	Optional		
6.3	63	115.7	104.1	"01"	"20"	R900932265	PGF2-2X/006RE01VE4
8	64.8	119.2	107.6	"01"	"20"	R900932266	PGF2-2X/008RE01VE4
11	67.5	124.7	113.1	"01"	"20"	R900932271	PGF2-2X/011RE01VE4
13	70	129.7	118.1	"20"	"01"	R900943181	PGF2-2X/013RE01VE4
16	72.5	134.7	123.1	"20"	"01"	R900932193	PGF2-2X/016RE01VE4
19	75.5	140.7	129.1	"20"	"01"	R900943182	PGF2-2X/019RE01VE4

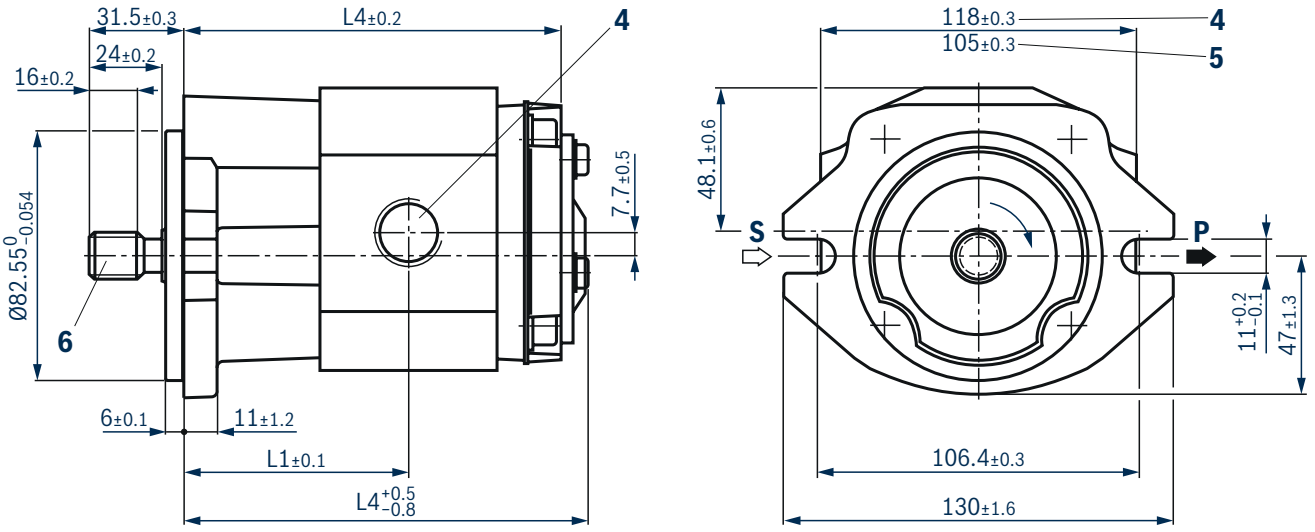
1 Fitting key according to DIN 6885 B6 x 6 x 25
4 Connection "01"
5 Connection "20"

☞ **Notice:**
The dimensions are nominal dimensions which are subject to tolerances.

Connections see page 21.

Dimensions: Frame size 2 – version "RJ01VU2" (clockwise); "LJ01VU2" (counterclockwise) (Dimensions in mm)

Shaft end "J" – cylindrical with involute tooth system and through-drive according to ISO 3019-1, 16-4
Mounting "U2" – 2-hole mounting flange according to ISO 3019-1, 82-2



NG	L1	L3	L4	Connection		Material number	Type
				Standard	Optional		
6.3	65	117.7	106.1	"01"	"20"	R900931660	PGF2-2X/006RJ01VU2
						R900247697	PGF2-2X/006LJ01VU2
8	66.8	121.2	109.6	"01"	"20"	R900953363	PGF2-2X/008RJ01VU2
						R900247698	PGF2-2X/008LJ01VU2
11	69.5	126.7	115.1	"01"	"20"	R900938281	PGF2-2X/011RJ01VU2
						R900247699	PGF2-2X/011LJ01VU2
13	72	131.7	120.1	"20"	"01"	R900932264	PGF2-2X/013RJ01VU2
						R900969259	PGF2-2X/013LJ01VU2
16	74.5	136.7	125.1	"20"	"01"	R900932085	PGF2-2X/016RJ01VU2
						R900936173	PGF2-2X/016LJ01VU2
19	77.5	142.7	131.1	"20"	"01"	R900022882	PGF2-2X/019RJ01VU2
						R900984300	PGF2-2X/019LJ01VU2

4 Connection "01"
5 Connection "20"
6 Involute tooth system 9T – 16/32DP

Notice:
The dimensions are nominal dimensions which are subject to tolerances.

Connections see page 21.

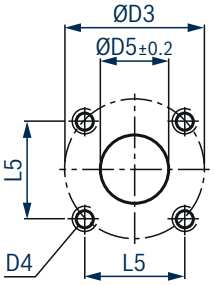
Dimensions: Frame size 2
(Dimensions in mm)

Connection "01"

NG	S	P
6.3	G 3/4; 16	G 1/2; 14
8	G 3/4; 16	G 1/2; 14
11	G 3/4; 16	G 1/2; 14
13	G 3/4; 16	G 1/2; 14
16	G 1; 18	G 1/2; 14
19	G 1; 18	G 1/2; 14

Connection "20"

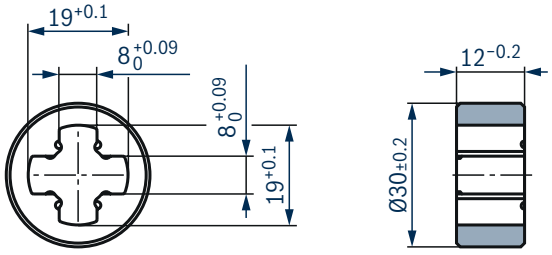
NG	S				P			
	L5	ØD3	D4	ØD5	L5	ØD3	D4	ØD5
6.3	28.3±0.2	40	M6; 10	20	24.8±0.2	35	M6; 12	12
8	28.3±0.2	40	M6; 10	20	24.8±0.2	35	M6; 12	12
11	28.3±0.2	40	M6; 10	20	24.8±0.2	35	M6; 12	12
13	28.3±0.2	40	M6; 10	20	24.8±0.2	35	M6; 12	12
16	28.3±0.2	40	M6; 10	20	24.8±0.2	35	M6; 12	12
19	38.9±0.3	55	M8; 12	26	24.8±0.2	35	M6; 12	12



Tightening torques M_A in Nm

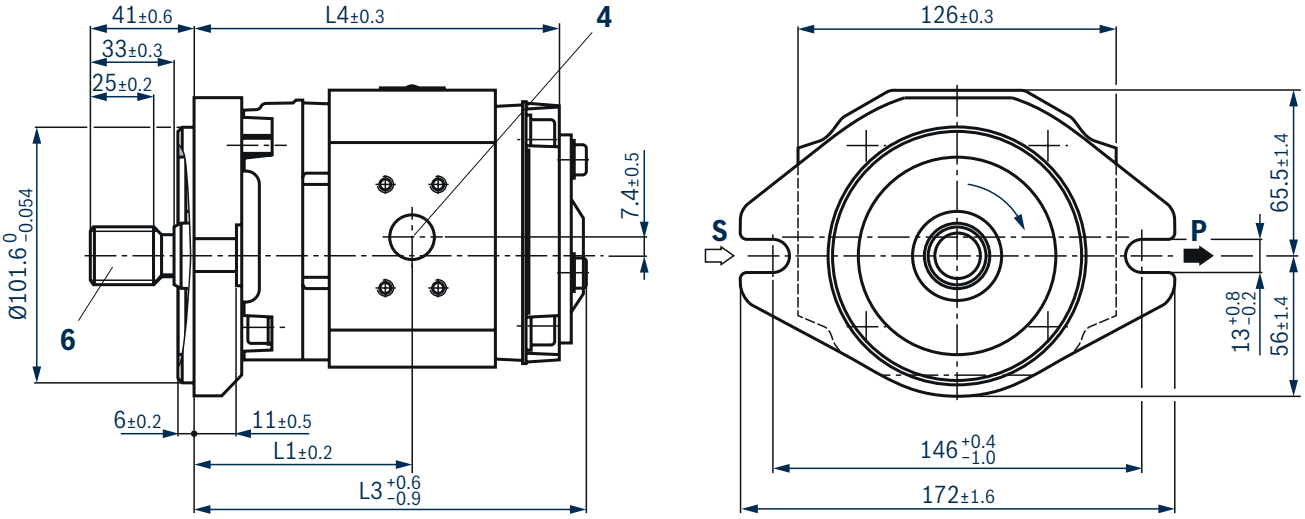
NG	D4	
	S	P
6.3	10	10
8	10	10
11	10	10
13	10	10
16	10	10
19	25	10

2-face driver (included in scope of delivery)



Dimensions: Frame size 3 – version "RJ07VU2" (clockwise); "LJ01VU2" (counterclockwise) (Dimensions in mm)

Shaft end "J" – cylindrical with involute tooth system and through-drive according to ISO 3019-1, 22-4
Mounting "U2" – 2-hole mounting flange according to ISO 3019-1**,** 101-2



NG	L1	L3	L4	Connection		Material number	Type
				Standard	Optional		
20	79.5	146.1	134.5	"07"	"20"	R900983792	PGF3-3X/020RJ07VU2
						R900948466	PGF3-3X/020LJ07VU2
25	82.5	152.1	140.5	"07"	"20"	R900029617	PGF3-3X/025RJ07VU2
						R900950057	PGF3-3X/025LJ07VU2
32	87	161.1	149.5	"07"	"20"	R900029561	PGF3-3X/032RJ07VU2
						R900984213	PGF3-3X/032LJ07VU2
40	92	171.1	159.5	"07"	–	R900931426	PGF3-3X/040RJ07VU2
						R900969266	PGF3-3X/040LJ07VU2

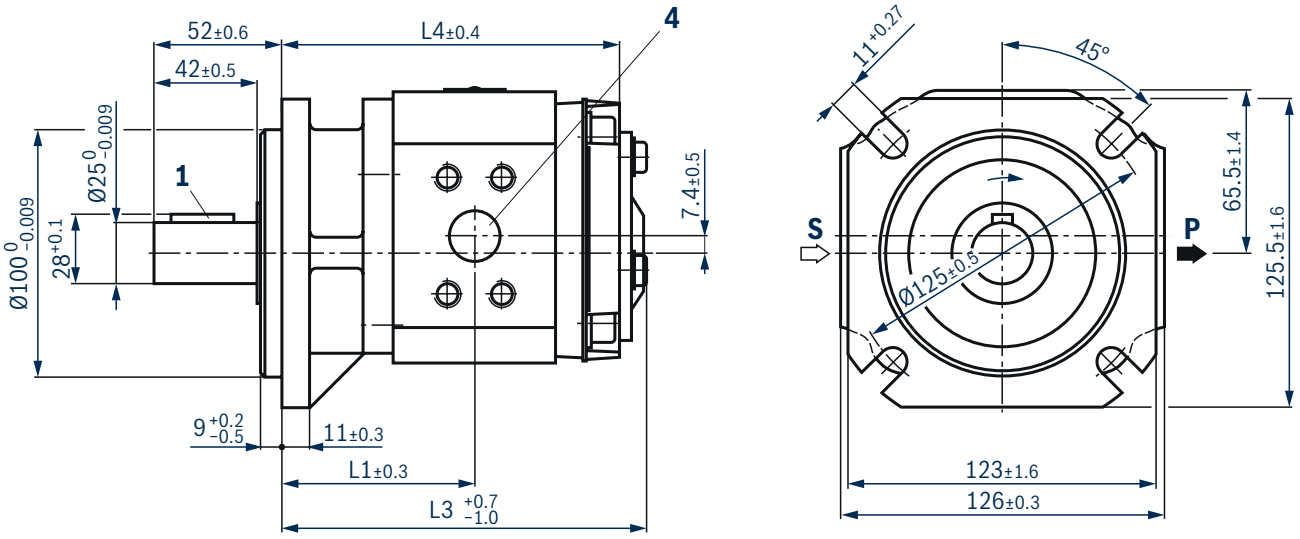
4 Connection "07"
6 Involute tooth system 13T – 16/32DP

Notice:
The dimensions are nominal dimensions which are subject to tolerances.

Connections see page 26.

Dimensions: Frame size 3 – version "RE07VE4" (clockwise) (Dimensions in mm)

Shaft end "E" – cylindrical with fitting key and through-drive according to ISO 3019-2, E25N
Mounting "E4" – 4-hole mounting flange according to ISO 3019-2, 100B4SW



NG	L1	L3	L4	Connection		Material number	Type
				Standard	Optional		
20	71	137.6	126	"07"	"20"	R900063299	PGF3-3X/020RE07VE4
25	74	143.6	132	"07"	"20"	R900932088	PGF3-3X/025RE07VE4
32	78.5	152.6	141	"07"	"20"	R900932112	PGF3-3X/032RE07VE4
40	83.5	162.6	151	"07"	–	R900932111	PGF3-3X/040RE07VE4

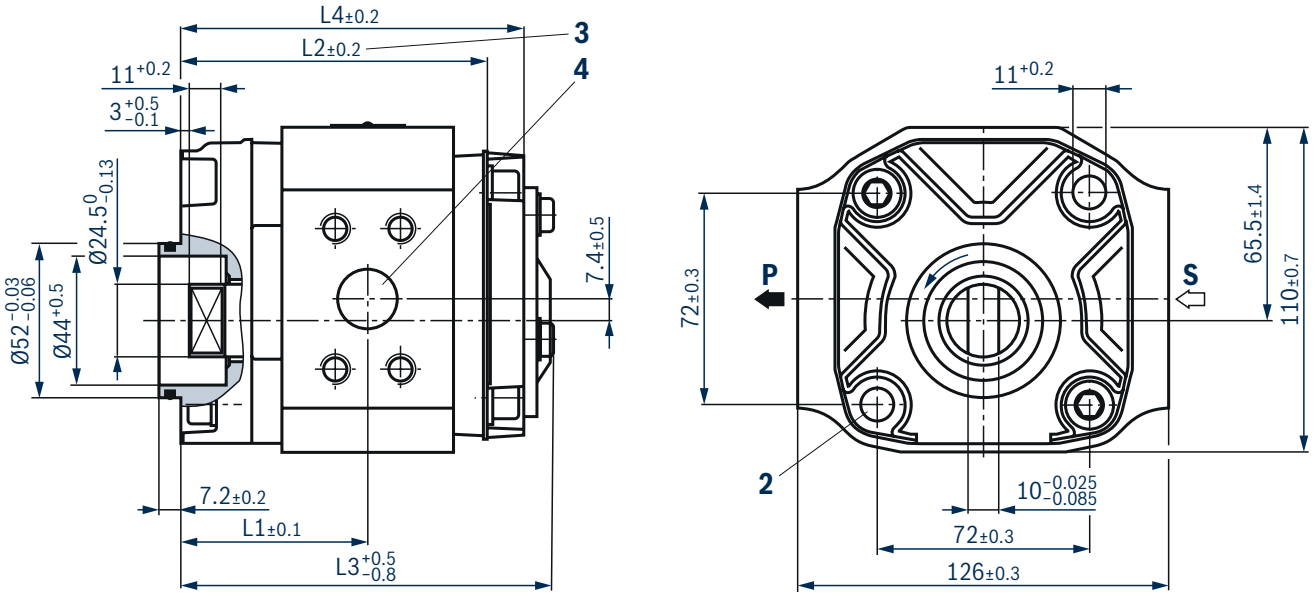
1 Fitting key according to DIN 6885 B8 x 7 x 30
4 Connection "07"

Notice:
The dimensions are nominal dimensions which are subject to tolerances.

Connections see page 26.

Dimensions: Frame size 3 – version "RL07VM" (clockwise); "LL07VM" (counterclockwise) (Dimensions in mm)

Shaft end "L" – 2-face driver and through-drive
Mounting "M" – 2-hole attachment, centering diameter 52 mm (central or back pump)



NG	L1	L2	L3	L4	Connection		Material number	Type
					Standard	Optional		
20	60.5	99.5	127.2	115.5	"07"	"20"	R900073539	PGF3-3X/020RL07VM
							R900758721	PGF3-3X/020LL07VM
25	63.5	105.5	133.1	121.5	"07"	"20"	R900932121	PGF3-3X/025RL07VM
							R900960119	PGF3-3X/025LL07VM
32	68	114.5	142.1	130.5	"07"	"20"	R900074369	PGF3-3X/032RL07VM
							R900034370	PGF3-3X/032LL07VM
40	73	124.5	152.1	140.5	"07"	–	R900083281	PGF3-3X/040RL07VM
							R900058224	PGF3-3X/040LL07VM

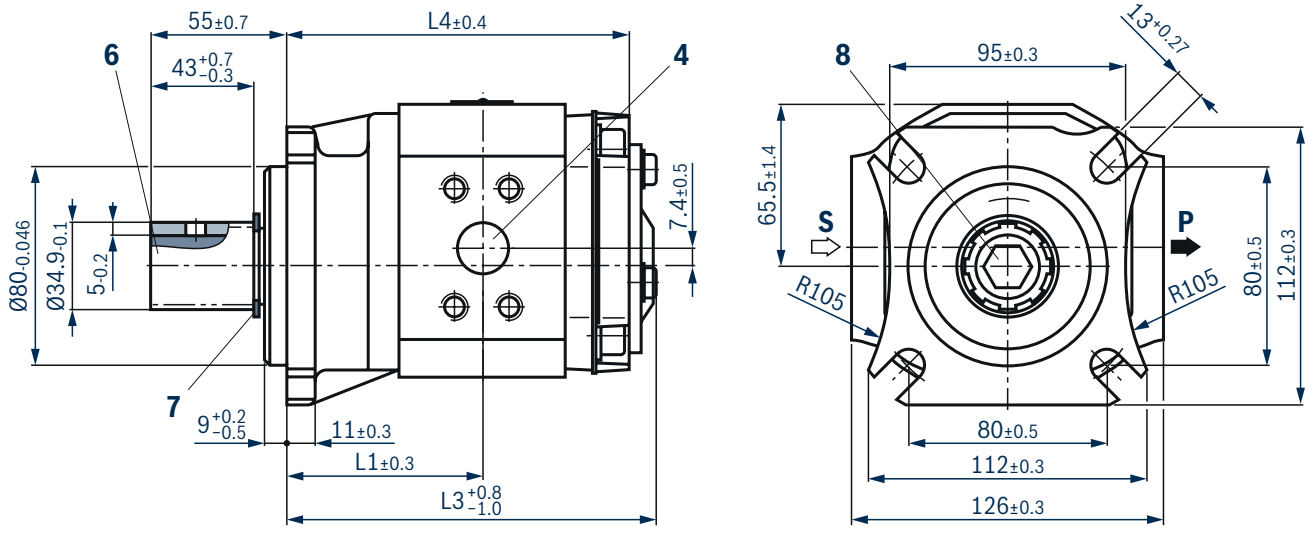
2 Through hole for hexagon socket head cap screw M10 DIN 912, tightening torque M_A = 49^{+5} Nm
3 Clamping length
4 Connection "07"

Notice:
The dimensions are nominal dimensions which are subject to tolerances.

Connections and **drivers** see page 26.

Dimensions: Frame size 3 – version "RO07VK4" (clockwise); "LO07VK4" (counterclockwise) (Dimensions in mm)

Shaft end "O" – conical 1:5 with spline shaft profile for truck ancillary output and through-drive similar to ISO 14
Mounting "K4" – 4-hole mounting flange for truck ancillary output according to ISO 7653-1985 (special version)



NG	L1	L3	L4	Connection		Material number	Type
				Standard	Optional		
20	71	137.1	126	"07"	"20"	R900969302	PGF3-3X/020RO07VK4
						R900619706	PGF3-3X/020LO07VK4
25	74	143.1	132	"07"	"20"	R900943169	PGF3-3X/025RO07VK4
						R900619710	PGF3-3X/025LO07VK4
32	78.5	152.1	141	"07"	"20"	R900943168	PGF3-3X/032RO07VK4
						R900943167	PGF3-3X/032LO07VK4

4 Connection "07"
6 Spline shaft profile B8 x 32 x 35 (attached sleeve)
7 Locking ring 30 x 1.5; DIN 471
8 Internal hexagon SW17, tightening torque M_A = 170^{+25} Nm

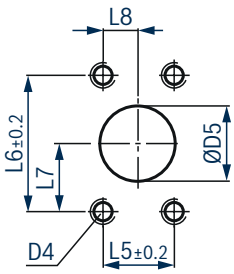
Notice:
The dimensions are nominal dimensions which are subject to tolerances.

Connections see page 26.

Dimensions: Frame size 3
(Dimensions in mm)

Connection "07"

NG	S (SAE 1 1/4)						P (SAE 3/4)					
	L5	L6	L7	L8	D4	ØD5	L5	L6	L7	L8	D4	ØD5
20	30.2	58.7	29.35	15.1	M10; 15	32±0.3	22.2	47.6	23.8	11.1	M10; 15	16±0.2
25	30.2	58.7	29.35	15.1	M10; 15	32±0.3	22.2	47.6	23.8	11.1	M10; 15	16±0.2
32	30.2	58.7	29.35	15.1	M10; 15	32±0.3	22.2	47.6	23.8	11.1	M10; 15	20±0.2
40	30.2	58.7	29.35	15.1	M10; 15	32±0.3	22.2	47.6	23.8	11.1	M10; 15	20±0.2

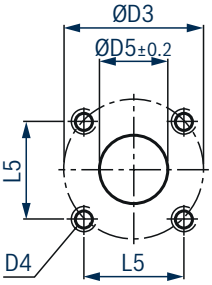


Tightening torques M_A in Nm

NG	D4	
	S	P
20	49+5	49+5
25	49+5	49+5
32	49+5	49+5
40	49+5	49+5

Connection "20"

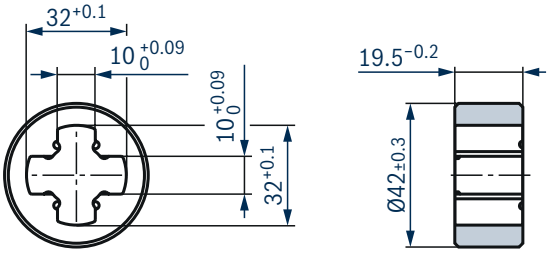
NG	S				P			
	L5	ØD3	D4	ØD5	L5	ØD3	D4	ØD5
20	38.9±0.3	55	M8; 12	26	24.8±0.2	35	M6; 10	12
25	38.9±0.3	55	M8; 12	26	24.8±0.2	35	M6; 10	12
32	38.9±0.3	55	M8; 12	26	38.9±0.3	55	M8; 12	20



Tightening torques M_A in Nm

NG	D4	
	S	P
20	25	10
25	25	10
32	25	25

2-face driver (included in scope of delivery)



Project planning information: general

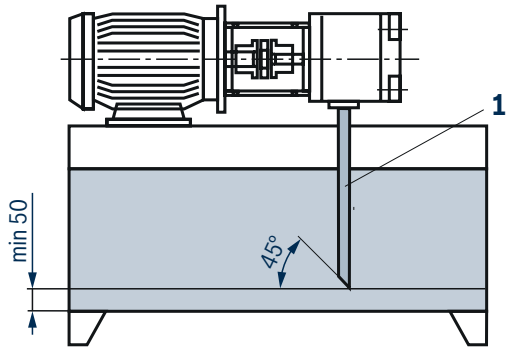
Intended use
Internal gear pumps are intended for the set-up of hydraulic drive systems in machine and plant construction.

Technical data
The plant or machine manufacturer must ensure compliance with the admissible technical data and operating conditions. The pump itself does not contain a device to prevent operation outside the admissible data.
All specified technical performance features are average values and apply with the specified boundary conditions. In case of modifications to the basic conditions (e.g. viscosity), the technical data may change as well. Distribution corresponding to the relevant state of the art is possible.
Operating the pump outside of the admissible technical data is possible to a certain extent, however, this requires the explicit written approval of Bosch Rexroth.

Project planning information: Hydraulic project planning

Suction line
The line cross-sections must be rated for the intended volume flows in such a way that an optimum suction speed of 0.6 ... 1.2 m/s is achieved on average.
The suction speed must not exceed a maximum value of 2 m/s.
The suction cross-sections at the pump itself are dimensioned for the maximum flow and can therefore only be used as reference. In case of continuous operation with speeds lower than the admissible maximum speed, the suction tube diameter is to be dimensioned smaller than the suction port of the pump in accordance with the actual suction speed.
All in all, the suction line is to be designed so that the admissible inlet operating pressure is complied with.
Bends and the combination of the suction pipes of several pumps are to be avoided. If a suction filter has to be used, it has to be ensured on the system side that the lowest admissible inlet operating pressure is not exceeded even when the filter is contaminated.
Please ensure air tightness of the transitions and dimensional stability of the suction tube relative to the external air pressure.

The immersion depth of the suction pipe should be as large as possible (at least 100 mm with lowest hydraulic fluid level). Dependent on the internal pressure of the container, the viscosity of the hydraulic fluid and the flow ratio in the container, no vortex must form even at maximum volume flow. Otherwise, there is the risk of air being sucked in. Return flow and leakage fluid must not be sucked back in immediately.



1 Suction line

Project planning information: Hydraulic project planning

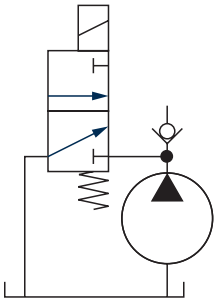
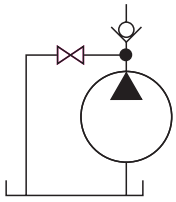
Pressure line
For pressure lines, make sure that sufficient bursting protection of the pipes, hoses and connection elements is provided. The cross-sections should be based on the maximum flow in order to avoid additional excessive load of the pump due to back pressure. Here, you must also consider the pipe losses over the entire pressure line length and other line resistances (e.g. bends, pressure filters).

Pressure limitation
The internal gear pump type PGF does not contain any devices to maintain the maximum operating pressure. The setting and limiting of the admissible operating pressure has to be ensured on the system side.
The pressure relief valves necessary for that purpose are to be designed considering the maximum flow and the existing pressure increase speed so that the admissible intermittent operating pressure is not exceeded.

Pressure holding function
In the variable-speed drive, the pump can temporarily also be operated below the specified minimum speed, in the pressure holding function. The holding time and the speed necessary for that purpose results dependent on the operating viscosity and the pressure level. For the design, please contact Bosch Rexroth's technical sales department.
In the deactivated state (speed = 0), a leakage flow streams through the pump back into the tank, dependent on the load pressure. If this is to be prevented, a check valve has to be used.
When using a check valve, please observe the information for bleeding.

Bleeding option for commissioning
For internal gear pumps type PGF, a manual or switchable bleeding option must be provided for initial commissioning or re-commissioning after maintenance and repair work. The bleeding point must be placed in the pressure line in front of the first valve or check valve. Bleeding must only be effected with a maximum counter pressure of 0.2 bar.

Examples of bleeding circuits

Switchable bleeding	Manually operated bleeding
	

Project planning information: Mechanical project planning

Disassembly and installation option
For disassembling and mounting the pump on the drive, accessibility has to be ensured on the system side by means of suitable lifting gear. Provide screws of property class 8.8 or 10.9 for mounting purposes.

Mounting
The screws must be accessible on the machine side so that the required tightening torque can be applied.
The tightening torque of the screws is based on the operating conditions and involved elements of the screw connection and must be specified by the manufacturer in the power unit, machine or system project planning.

Tank
In the tank construction or the selection of suitable standard tanks, the following requirements are to be observed:

- Selection of the largest tank volume possible, dependent on the continuous or average flow, to allow for the separation of air bubbles by means of sufficient duration time of the hydraulic fluid in the tank. The air release capacity of the hydraulic fluid used is also of importance.
- Provision of settling zones for the hydraulic fluid in the tank in order to allow for air release.
- Provision of guiding plates in order to allowing for the deposit of contamination at the tank bottom outside the pump suction area.
- Large dimensioning of the tank surfaces dependent on the heat output to be dissipated via the tank walls.

Required power unit functions
Hydraulic power units should at least be equipped with the following features:

- Tanks, where the internal pressure corresponds to the ambient pressure in accordance with the design, must be equipped with breathing filters for pressure equalization purposes.
- The hydraulic fluid should only be filled in using filling connections excluding filling with unfiltered hydraulic fluid.
- The ingress of contamination or humidity must be avoided. When used in highly contaminated environments, the container should be pre-pressurised using air pressure. If external cleaning of the tank is intended or to be expected during the period of use, select tank fittings for pipes, lines, or hoses that ensure safe sealing against external pressurization with water jet.

Place of installation and environmental conditions
For a place of installation at a geodetic altitude of more than 1000 m, the pump must be installed in or below the tank, or the tank must be pre-pressurised using compressed air, to ensure the admissible minimum inlet pressure is maintained. A short suction line with large cross-section must be selected; bends should not be used.
When installing the pump more than 10 m below the tank, the reduction of the inlet pressure to the maximum admissible value must be ensured by means of additional measures.
When operating the pump in salt-containing or corrosive environments, or when pressure loading with strongly abrasive substances is possible, make sure on the system side that the shaft seal ring and the sealing area of the shaft do not make direct contact with the environment.

Drive
Electric motor + pump carrier + coupling + pump
No radial and axial forces on the pump drive shaft admissible.
Motor and pump must be exactly aligned.
Always use a coupling that is suitable for compensating shaft displacements.

Installation position

- Horizontal, suction port facing downwards preferred
- Vertical, upwards shaft when installed in tank

Pump combination

- For pump combinations, make sure that the admissible operating data for the relevant pump type are complied with in every stage.
- The combined pumps must all have the same direction of rotation.
- The pump with the highest torque, variable displacement pumps or pumps with intermittent load should be provided as the first stage in the pump combination.
- Formula for torque (input shaft)

$$T = \frac{\Delta p \times V \times 0.0159}{\eta_{\text{hydr.-mech.}}}$$

T	Torque in Nm
Δp	Operating pressure in bar
V	Displacement in cm^3
η	Hydraulic mechanical efficiency

- The maximum through-drive torque must be checked by the project planner for every application. This is also true for already existing (coded) pump combinations.
- The total of the torques in a pump combination must not exceed the maximum drive torque.
- Joint aspiration is not possible.
- For reasons of strength and stability, we recommend the ISO 4-hole mounting flange according to VDMA "E4" for combinations of three or more pumps
- Before operating pump combinations with different hydraulic fluid, please consult Bosch Rexroth.
- PGF combinations are mounted without combination parts and are not sealed against each other.

Selection

- The shaft design of the front pump must be "E", "J" or "L."
- The shaft design of the middle pump must be "L."
- If a pump of the next smaller frame size is to be attached, the first pump must have the designation "K" at the end (e.g. PGF3 + PGF2 ⇒ front pump: PGF3-3X/032RJ07VU2K)

Dimensions

- The dimensions of the connections correspond to those of single pumps (see page 15 ... 28).
- The overall length of the pump combination is obtained by adding the dimensions L4 of the single pumps (see page 15 ... 28).
  - With the combination of PGF2 and PGF1, the assembly length of the PGF2 (dimension L4) increases by 4.5 mm.
  - With the combination of PGF3 and PGF2, the assembly length of the PGF3 (dimension L4) increases by 2 mm.
  - With the combination of PGF3 and PGF1, the assembly length of the PGF3 (dimension L4) increases by 12.5 mm.

Maximum drive torques in Nm

	"L"	"A"	"E"	"J"	"O"
PGF1	14	30	30	–	–
PGF2	70	95	140	90	–
PGF3	140	–	230	230	260

Maximum through-drive torques in Nm

	Shaft end		
	"L"	"E"	"J"
PGF1	14	14	–
PGF2	70	70	70
PGF3	140	140	140

Accessories

Pump safety block
To limit the operating pressure and to ensure depressurized circulation of the pump, we recommend our pump safety blocks type DBA according to data sheet 25891.
However, automatic bleeding during commissioning is not possible using pump safety blocks of type DBA.
We recommend separate, manual bleeding in this case.

Further information

▶ Hydraulic fluids on mineral oil basis	Data sheet 90220
▶ Environmentally compatible hydraulic fluids	Data sheet 90221
▶ Pump safety block	Data sheet 25891
▶ Information on available spare parts	www.boschrexroth.com/spc

Notes

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