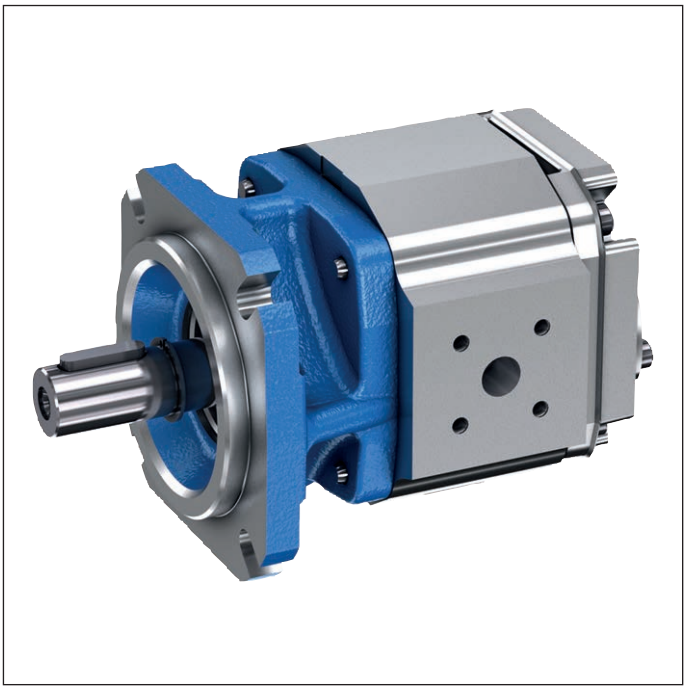
RE 10231
Edition: 2025-09
Replaces: 2014-07

rexroth
A Bosch Company

Internal gear pump

Type PGP



- Component series 2X and 3X
- Frame size 2 and 3
- Size 6 ... 32
- Maximum operating pressure 250 bar
- Displacement 6.5 ... 32.5 cm^3
- Fixed displacement
- Pump combinations

Features

- Low operating noise
- Low flow pulsation
- High efficiency even with low viscosity due to sealing gap compensation
- Long life cycle due to plain bearings and 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 with high operating pressure and 10^6 load cycles, e.g. press brakes

Contents

Ordering codes: Single pumps

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

01	Internal gear pump	**PG**
02	High-pressure pump	**P**
03	Frame size 2	**2**
	Frame size 3	**3**
04	Component series 20 ... 29 (20 ... 29: unchanged installation and mounting dimensions) - frame size 2	**2X**
	Component series 30 ... 39 (30 ... 39: unchanged installation and mounting dimensions) - frame size 3	**3X**
05	**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**
	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**

Direction of rotation

06	When looking at the shaft end, right	**R**

Shaft end

07	Cylindrical with fitting key according to ISO 3019-2, with through-drive	**E**
	Geared according to ISO 3019-1, with through-drive	**J**

Line connections

08	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 (observe compatibility of seals with hydraulic fluid used, see page 8)

09	FKM shaft seal ring	**V**

Mounting

10	4-hole mounting flange according to ISO 3019-2	**E4**
	2-hole mounting flange according to ISO 3019-1	**U2**
11	Further details in the plain text	*****

Preferred types

Type	Material number
PGP3-3X/025RE20VE4	R900086823

☞ **Notice:**
Not every combination of ordering codes is possible.
Please select the desired pump using the selection tables (page 11 ... 14) or after consultation.

Ordering codes: Pump combination

01	02		03		04		05	06	07	08		09	10
P2		/		+		/		**R**			+		

Combination

01	2-fold	**P2**

Pump 1 [1)]

02	Frame size 2	**GP2**
	Frame size 3	**GP3**

Pump 1 [1)]

03	Size 006 ... 032	e.g. **011**

Pump 2 [2)]

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

Pump 2 [2)]

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

Direction of rotation

06	When looking at the shaft end, right	**R**

Pump 1 shaft end

07	Cylindrical with fitting key according to ISO 3019-2, with through-drive	**E**
	Geared according to ISO 3019-1, with through-drive	**J**

Pump 1 line connections

08	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 line connections [2)]

09	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 1 mounting

10	4-hole mounting flange according to ISO 3019-2	**E4**
	2-hole mounting flange according to ISO 3019-1	**U2**

1) See page 2.

2) See data sheet 10213.

Function, section, symbol

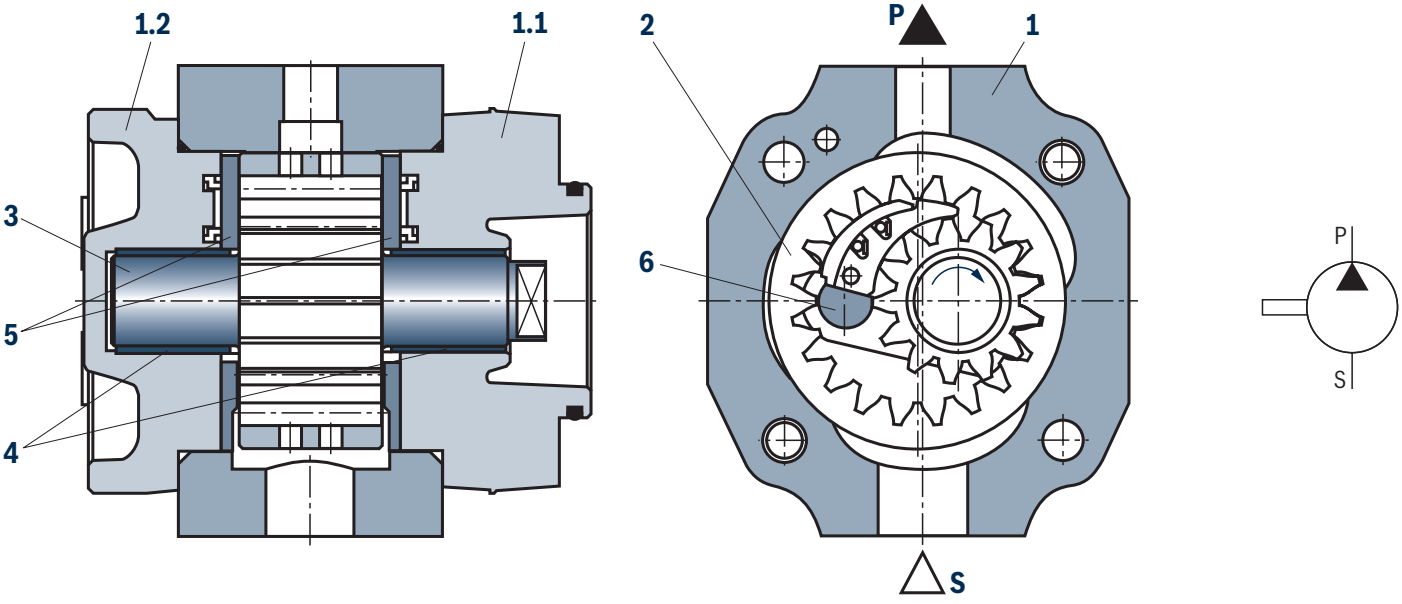
Design
Hydraulic pumps of type PGP are gap-compensated internal gear pumps with constant displacement.
They basically comprise the housing (1), bearing cover (1.1), end cover (1.2), internal gear (2), pinion shaft (3), plain bearings (4), axial washers (5) and stop pin (6), as well as the segment filler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

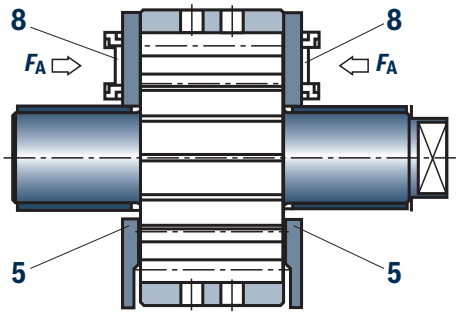
Materials used
- Housing (1), bearing cover (1.1), end cover (1.2), and axial washers (5): steel-aluminum composite
- Internal gear (2), pinion shaft (3), and stop pin (6): steel
- Plain bearing (4): copper-tin with steel back segment
- Segment (7.1) and segment support (7.2): brass alloy
- Sheet seals (7.3): plastic



Function, section

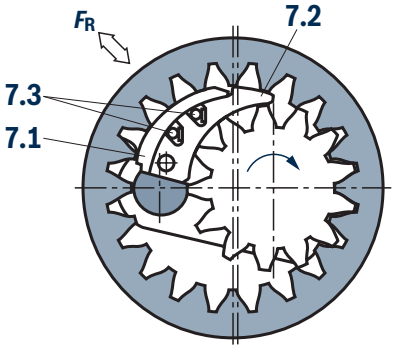
Axial compensation

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.



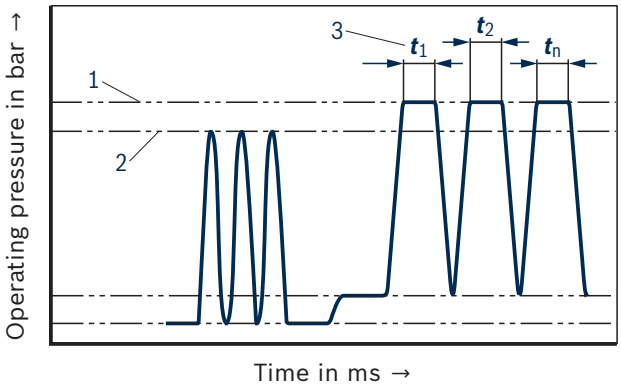
Technical data: Frame size 2
(For device application outside the specified values, please contact us!)

General						
Size	NG	6	8	11	13	16
Pump design		Internal gear pump, gap-compensated				
Type of mounting		Mounting flange				
Type of connection		Flange connection				
Mass	kg	3.0	3.1	3.3	3.5	3.6
Installation position		Preferably horizontal (suction port bottom)				
Shaft load		Radial and axial forces (e.g. belt pulley) [1]				
Direction of rotation		Right				
Minimum speed [2]	rpm	600				
Maximum speed [2]	rpm	1800				
Minimum drive power [3]	kW	0.75				
Maximum drive power	kW	See characteristic curves on page 9				
Moment of inertia	kgm^2	0.000074	0.000090	0.00012	0.00014	0.00016
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	250				
Pressure peak [4]	bar	315				
Hydraulic fluid		See table, page 8				
Hydraulic fluid temperature range	°C	–20 ... +80				
Viscosity range (hydraulic fluid temperature ≤ +80 °C) ▶ Continuous operation – up to maximum speed	mm^2/s	300 ... 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	11.0	13.3	16.0
Maximum flow rate (at 10 bar and 1450 rpm)	l/min	9.4	11.9	16.0	19.3	23.2

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 1 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.

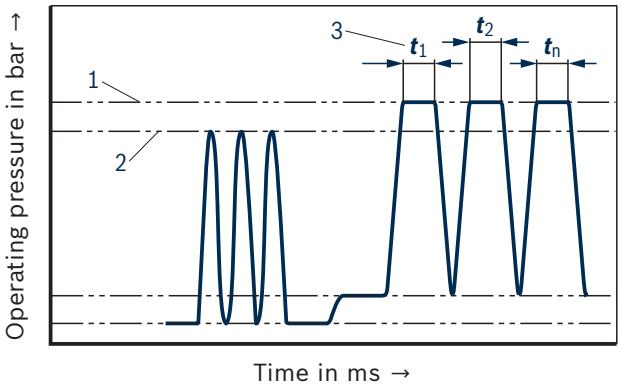
Technical data: Frame size 3
(For device application outside the specified values, please contact us!)

General				
Size	NG	20	25	32
Pump design		Internal gear pump, gap-compensated		
Type of mounting		Mounting flange		
Type of connection		Flange connection		
Mass	kg	4.3	5.1	5.5
Installation position		Preferably horizontal (suction port bottom)		
Shaft load		Radial and axial forces (e.g. belt pulley) [1]		
Direction of rotation		Right		
Minimum speed [2]	rpm	600		
Maximum speed [2]	rpm	1800		
Minimum drive power [3]	kW	1.1	1.5	1.5
Maximum drive power	kW	See characteristic curves on page 10		
Moment of inertia	kgm^2	0.00029	0.00035	0.00043
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	250		
Pressure peak [4]	bar	315	315	280
Hydraulic fluid		See table, page 8		
Hydraulic fluid temperature range	°C	–20 ... +80		
Viscosity range (hydraulic fluid temperature ≤ +80 °C) ▶ Continuous operation – up to maximum speed	mm^2/s	300 ... 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
Maximum flow rate (at 10 bar and 1450 rpm)	l/min	29.9	36.8	47.1

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 1 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

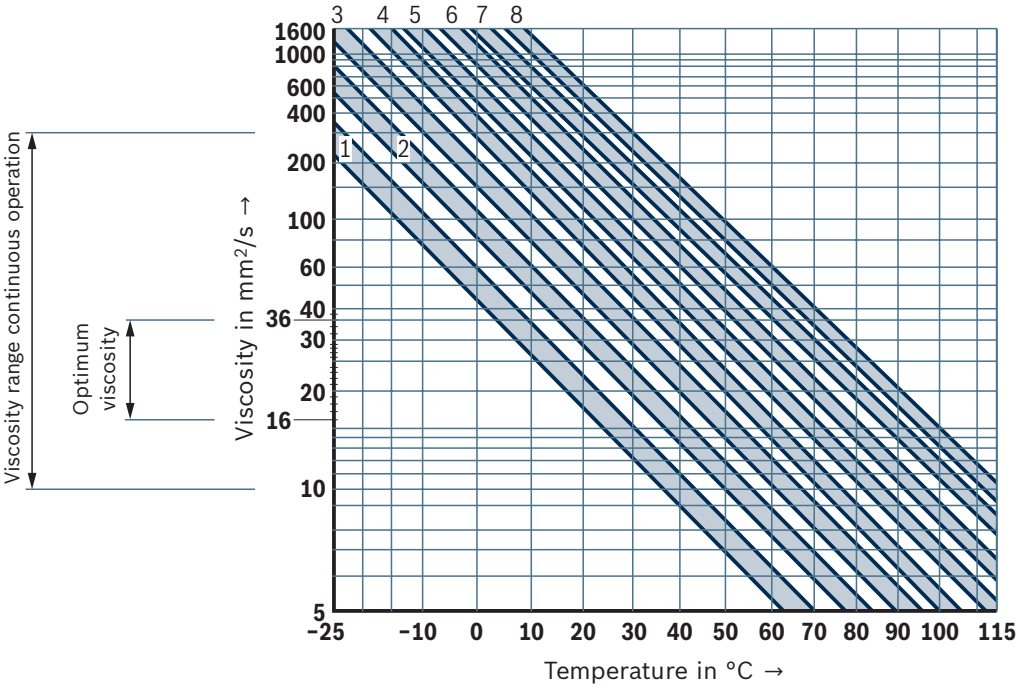
Notice:
The stated technical data were measured with HLP46, ϑ_{oil} = 50 °C and viscosity approx. 30 mm^2/s.

Technical data
(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**

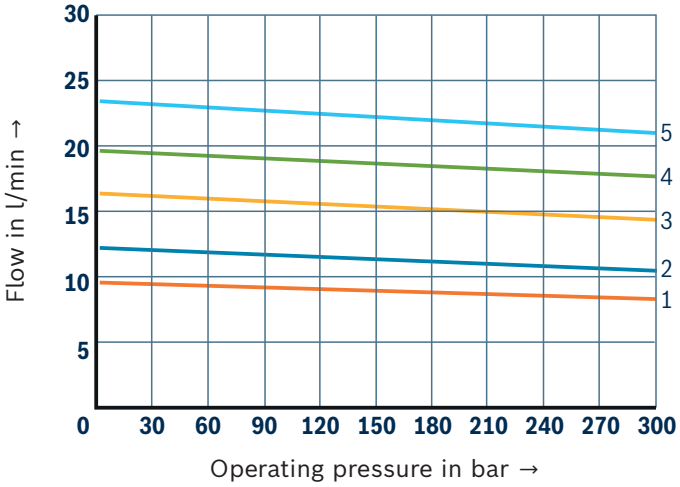
Viscosity dependent on temperature for HLP (viscosity index VI 100, double logarithmic representation)



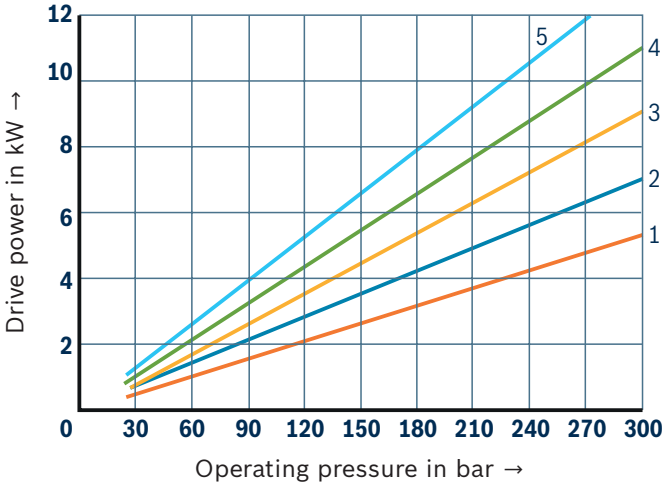
1 Viscosity class VG10
2 Viscosity class VG15
3 Viscosity class VG22
4 Viscosity class VG32
5 Viscosity class VG46
6 Viscosity class VG68
7 Viscosity class VG100
8 Viscosity class VG150

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

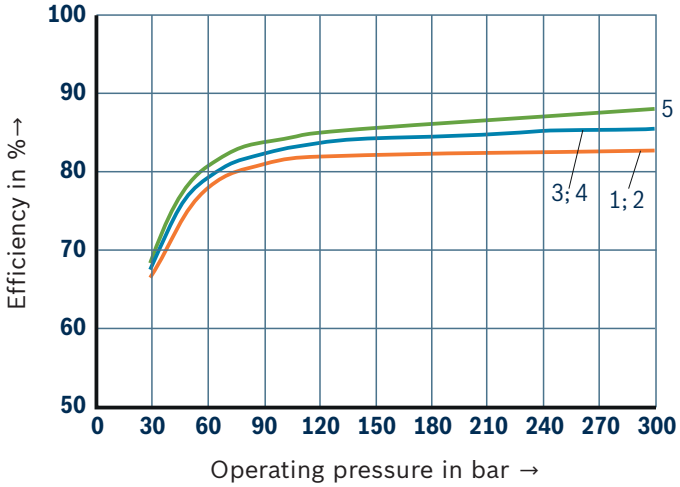
Flow



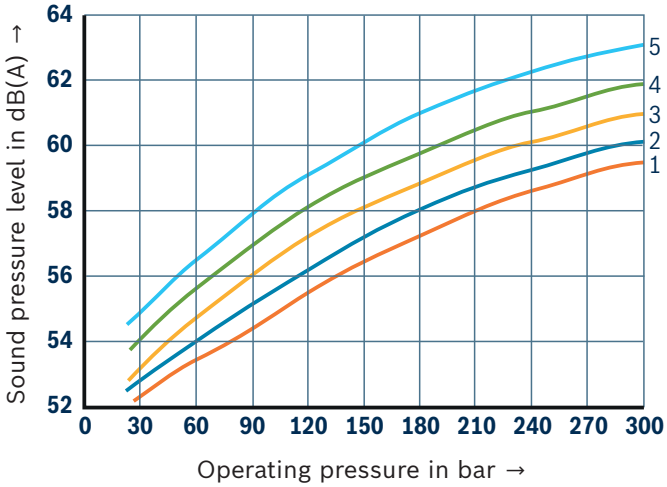
Drive power



Efficiency



Sound pressure level

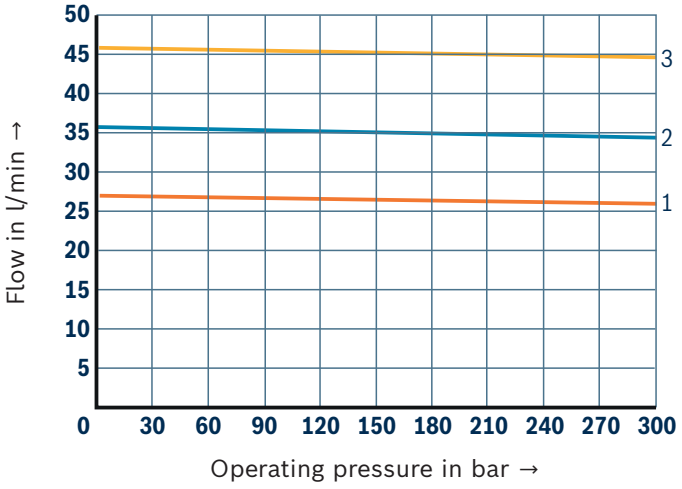


Notice:
Sound pressure level measured in the sound measuring chamber according to DIN 45635-26; distance microphone – pump = 1 m

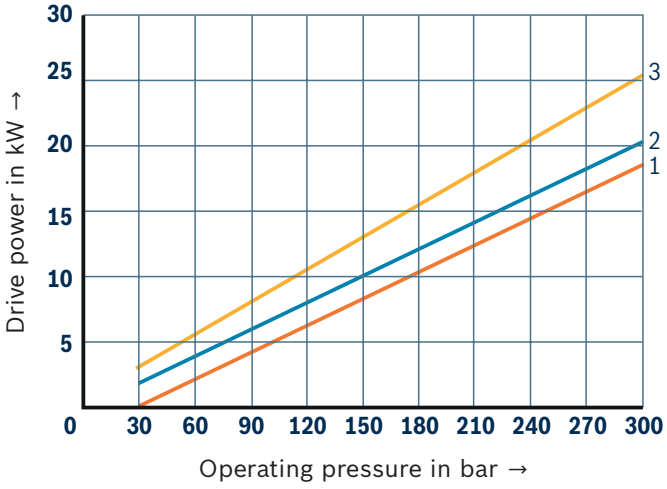
1 NG6
2 NG8
3 NG11
4 NG13
5 NG16

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

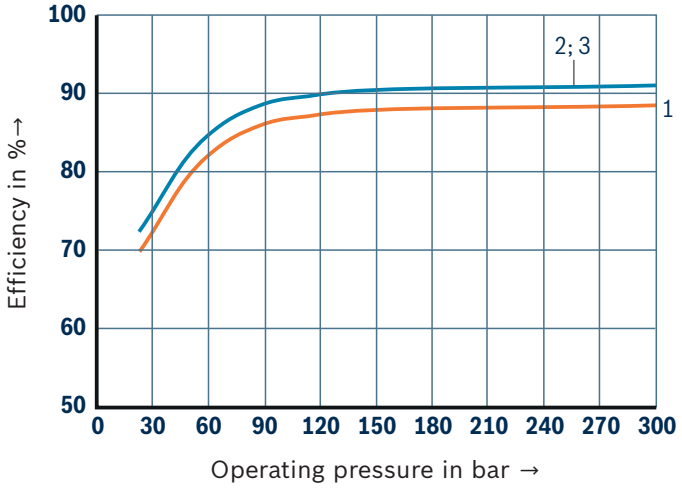
Flow



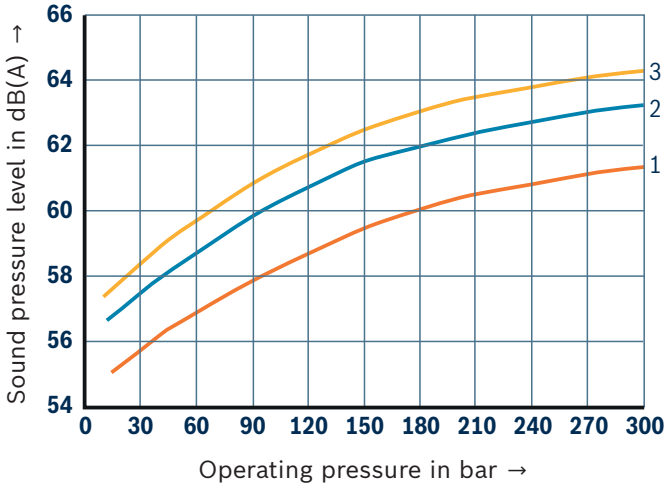
Drive power



Efficiency



Sound pressure level

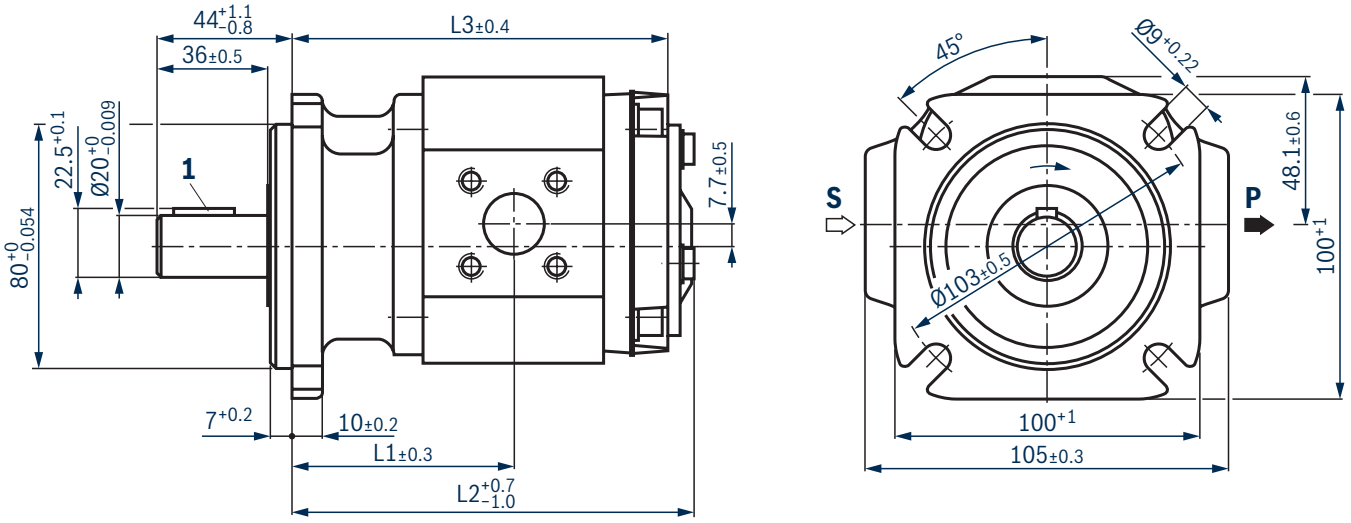


☞ **Notice:**
Sound pressure level measured in the sound measuring chamber according to DIN 45635-26; distance microphone – pump = 1 m

1 NG20
2 NG25
3 NG32

Dimensions: Frame size 2
(Dimensions in mm)

Shaft end "E" – cylindrical with fitting key and through-drive according to ISO 3019-1, E20N
Mounting "E4" – 4-hole mounting flange according to ISO 3019-1, 80B4HW



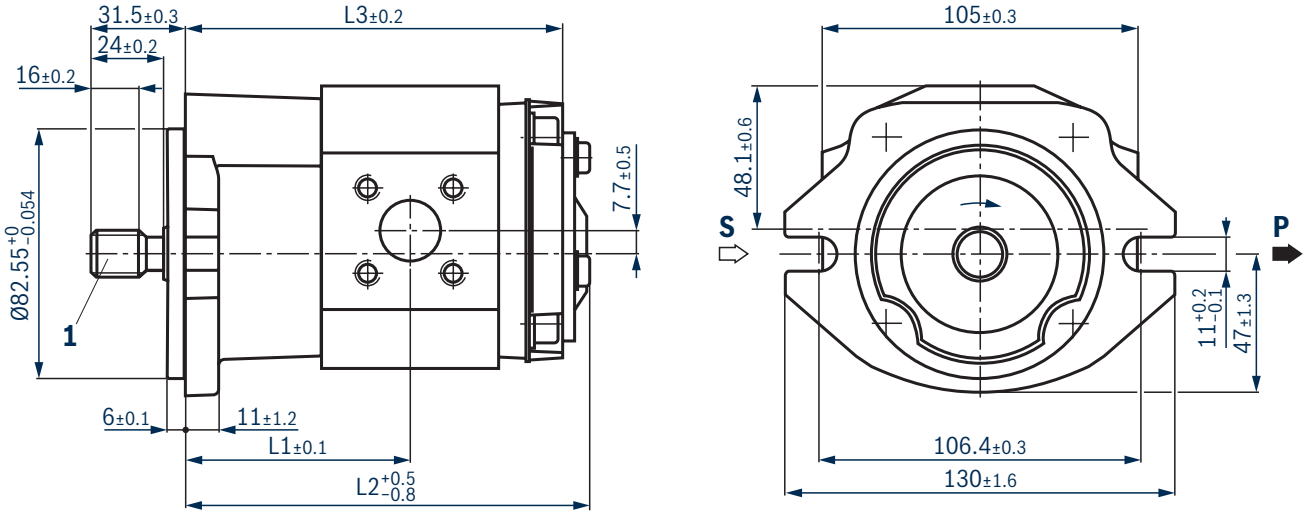
NG	L1	L2	L3	S	P	Material number	Type
6	63	115.2	104.1	Ø20 [1)]	Ø6 [2)]	R900932129	PGP2-2X/006RE20VE4
8	64.8	118.7	107.6	Ø20 [1)]	Ø8 [2)]	R900081891	PGP2-2X/008RE20VE4
11	67.5	124.2	113.1	Ø20 [1)]	Ø12 [2)]	R900932114	PGP2-2X/011RE20VE4
13	70	129.2	118.1	Ø20 [1)]	Ø12 [2)]	R900086819	PGP2-2X/013RE20VE4
16	72.5	134.2	123.1	Ø20 [1)]	Ø12 [2)]	R900932177	PGP2-2X/016RE20VE4

1 Fitting key according to DIN 6885 B6×6×25

Information:
- ▶ Line connections see page 15.
- ▶ The dimensions are nominal dimensions which are subject to tolerances.

Dimensions: Frame size 2
(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



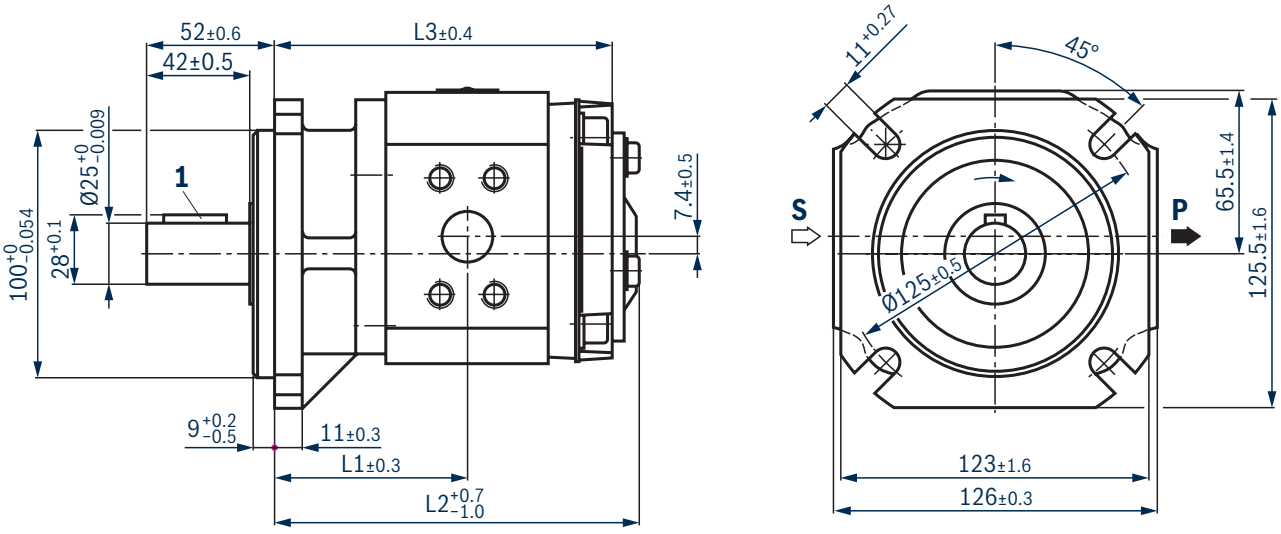
NG	L1	L2	L3	S	P	Material number	Type
6	65	117.2	106.1	Ø20 [1)]	Ø6 [2)]	R900984018	PGP2-2X/006RJ20VU2
8	66.8	120.7	109.6	Ø20 [1)]	Ø8 [2)]	R900984019	PGP2-2X/008RJ20VU2
11	69.5	126.2	115.1	Ø20 [1)]	Ø12 [2)]	R900984020	PGP2-2X/011RJ20VU2
13	72	131.2	120.1	Ø20 [1)]	Ø12 [2)]	R900984021	PGP2-2X/013RJ20VU2
16	74.5	136.2	125.1	Ø20 [1)]	Ø12 [2)]	R900984022	PGP2-2X/016RJ20VU2

1 Involute tooth system 9T – 16/32DP

Information:
- Line connections see page 15.
- The dimensions are nominal dimensions which are subject to tolerances.

Dimensions: Frame size 3
(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



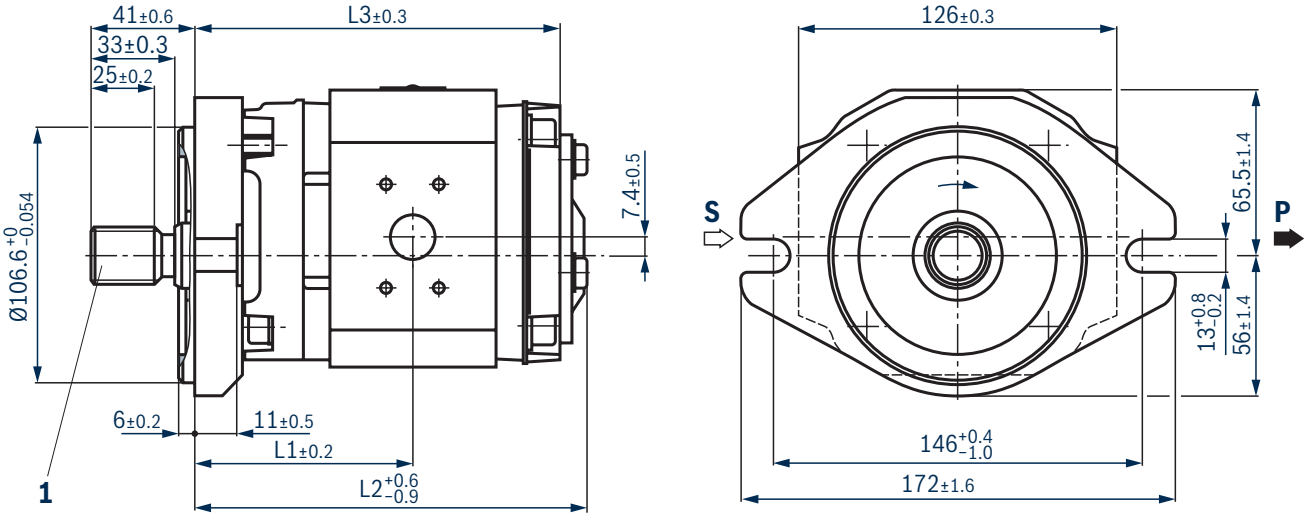
NG	L1	L2	L3	S	P	Material number	Type
20	71	137.1	126	Ø26 [1]	Ø12 [2]	R900932178	PGP3-3X/020RE20VE4
25	74	143.1	132	Ø26 [1]	Ø12 [2]	R900086823	PGP3-3X/025RE20VE4
32	78.5	152.1	141	SAE 1 1/4	SAE 3/4	R900086824	PGP3-3X/032RE07VE4

1 Fitting key according to DIN 6885 B8×7×30

Information:
- ▶ Line connections see page 15.
- ▶ The dimensions are nominal dimensions which are subject to tolerances.

Dimensions: Frame size 3
(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	L2	L3	S	P	Material number	Type
20	79.5	145.6	134.5	Ø26	Ø12	R900984025	PGP3-3X/020RJ20VU2
25	82.5	151.6	140.5	Ø26	Ø12	R900984027	PGP3-3X/025RJ20VU2
32	92	160.6	149.5	SAE 1 1/4	SAE 3/4	R900984028	PGP3-3X/032RJ07VU2

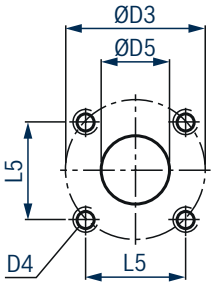
1 Involute tooth system 13T – 16/32DP

Information:
- ▶ Line connections see page 15.
- ▶ The dimensions are nominal dimensions which are subject to tolerances.

Connections: Suction port and pressure port (Dimensions in mm)

Connection "20"

NG	S (suction port)				P (pressure port)			
	L5	ØD3	D4	ØD5	L5	ØD3	D4	ØD5
6	28.3±0.2	40	M6; 10	20±0.2	24.8±0.2	35	M6; 12	6
8	28.3±0.2	40	M6; 10	20±0.2	24.8±0.2	35	M6; 12	8
11	28.3±0.2	40	M6; 10	20±0.2	24.8±0.2	35	M6; 12	12
13	28.3±0.2	40	M6; 10	20±0.2	24.8±0.2	35	M6; 12	12
16	28.3±0.2	40	M6; 10	20±0.2	24.8±0.2	35	M6; 12	12
20	28.3±0.2	55	M8; 12	26±0.2	24.8±0.2	35	M6; 12	12
25	28.3±0.2	55	M8; 12	26±0.2	24.8±0.2	35	M6; 12	12



Tightening torques M_A in Nm

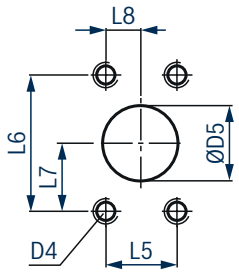
NG	D4	
	S	P
6	10	10
8	10	10
11	10	10
13	10	10
16	10	10
20	25	10
32	25	10

Connection "07"

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

Tightening torques M_A in Nm

NG	D4	
	S	P
32	49^{+5}	49^{+5}



Project planning information: general

This project planning information refers to the specific properties of the internal gear pump type PGP.

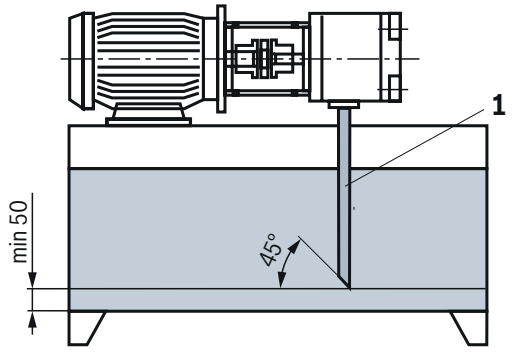
Intended use
Internal gear pumps are intended for the set-up of hydraulic drive systems in machine and plant construction.

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

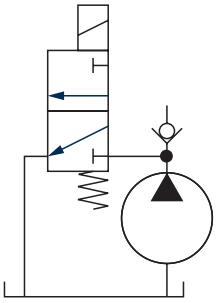
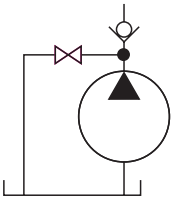
Pressure line
For pressure lines, make sure that sufficient bursting protection of the pipes, hoses and connection elements is provided. The cross-sections should be based on the maximum flow in order to avoid additional excessive load of the pump due to back pressure. Here, you must also consider the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

Pressure limitation
The internal gear pump type PGP 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 PGP, 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.
- Before operating pump combinations with different hydraulic fluid, please consult Bosch Rexroth.
- PGP+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" or "J."
- 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. PGP3 + PGF2 ⇒ front pump: PGP3-3X/032RE07VE4K)

Dimensions

- The dimensions of the connections correspond to those of single pumps (see page 15).
- The overall length of the pump combination is obtained by adding the dimensions L3 of the single pumps (see page 11 ... 14).
  - With the combination of PGP2 and PGF1, the assembly length of the PGP2 (dimension L3) increases by 4.5 mm.
  - With the combination of PGP3 and PGF2, the assembly length of the PGP3 (dimension L3) increases by 2 mm.
  - With the combination of PGP3 and PGF1, the assembly length of the PGP3 (dimension L3) increases by 12.5 mm.

Maximum drive torques in Nm

	"E"	"J"
PGP2	140	90
PGP3	230	230

Maximum through-drive torques in Nm

	"E"	"J"
PGP2	70	70
PGP3	140	140

Maintenance schedule and operational safety

For safe operation and a long life cycle of the pump, a maintenance schedule has to be developed for the power unit, the machine, or the system. The maintenance schedule must ensure that the intended or admissible operating conditions of the pump are complied with over the entire period of use.
In particular, compliance with the following operating parameters must be ensured:

- Maximum admissible degree of contamination of the hydraulic fluid
- Hydraulic fluid temperature range
- Filling level of the hydraulic fluid

Furthermore, the pump and the system have to be checked for modifications of the following parameters on a regular basis:

- Vibrations
- Noise
- Temperature difference pump – hydraulic fluid in the tank
- Foam formation in the tank
- Leak-tightness

Modifications of these parameters indicate wear of components (e.g. drive motor, coupling, pump, etc.). The cause must be identified and remedied immediately. In order to achieve high operational safety of the pump in the machine or system, we recommend checking the parameters mentioned above permanently and automatically and shutting the system off automatically in case of modifications exceeding the usual fluctuations in the intended operating range.
Plastic components of drive couplings should be replaced regularly, however, after 5 years at the latest. The relevant manufacturer's specifications must be considered and be given priority.
For preventive maintenance of the pump, we recommend having the seals replaced by an authorized Bosch Rexroth service company after a maximum operating time of 5 years.

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. In this case, we recommend separate manual bleeding, e.g. via the pump's measuring port.

SAE connection flanges
We recommend selecting the SAE connection flanges for suction and pressure connection according to AB 22-15 (with welded connection) or AB 22-13 (with threaded connection).

Miscellaneous accessories
To set up the internal gear pump type PGP on electric motors, we recommend selecting the pump carriers according to AB 41-20 and the torsionally flexible couplings according to AB 33-22.

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

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