Rexroth
Bosch Group

Internal gear pump, fixed displacement

RE 10231/06.05 1/12
Replaces: 11.99

Type PGP

Frame sizes 2 and 3
Component series: 2X (FS2)
3X (FS3)
Maximum operating pressure 350 bar
Maximum displacement 6 to 32 cm^3

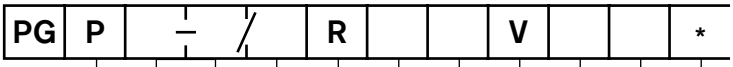

H7065

Table of contents

Features

- Fixed displacement
- Low operating noise
- Little flow pulsation
- High efficiency also at low viscosity due to sealing gap compensation
- Long service life due to plain bearings and sealing gap compensation
- Suitable for a wide viscosity and speed range
- Excellent suction characteristics
- Can be combined with PGH and PGF internal gear pumps as well as vane and axial piston pumps

Ordering code



Series
High pressure pump **= P**

Frame size – component series
FS2 **= 2–2X**
(Component series 20 to 29: unchanged installation and connection dimensions)
FS3 **= 3–3X**
(Component series 30 to 39: unchanged installation and connection dimensions)

Size	Displacement/revolution Size		
FS2	6.3	6.5 cm³	**= 006**
	8.0	8.2 cm³	**= 008**
	11.0	11.0 cm³	**= 011**
	13.0	13.3 cm³	**= 013**
	16.0	16.0 cm³	**= 016**
FS3	20.0	20.6 cm³	**= 020**
	22.0	22.2 cm³	**= 022**
	25.0	25.4 cm³	**= 025**
	32.0	32.5 cm³	**= 032**

Direction of rotation (viewed to shaft end)
R = Clockwise

Shaft versions
E = Cylindrical with output
J = SAE involute spline with output

07 = SAE flange connection, FS3 only

Suction and pressure port
20 = Square flange connection to DIN 3901 or 3902, metric mounting thread

Seal material
V = FKM seals

Mounting flange centring
E4 = 4-hole mounting flange to ISO 3019/2 and VDMA 24560 part 1
U2 = SAE 2-hole mounting flange

Option
K = Suitable for mounting a PGF pump of the next smaller frame size

Further details in clear text

Please note!

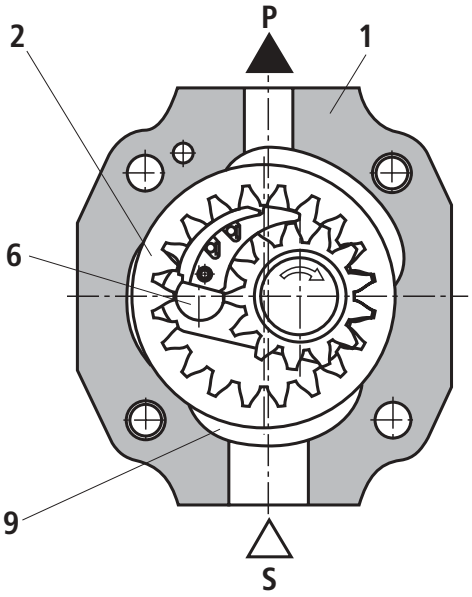
Not all variants according to the type code are possible! Please select the desired pump on the basis of the selection tables (standard types, pages 7 to 9) or consult Bosch Rexroth!

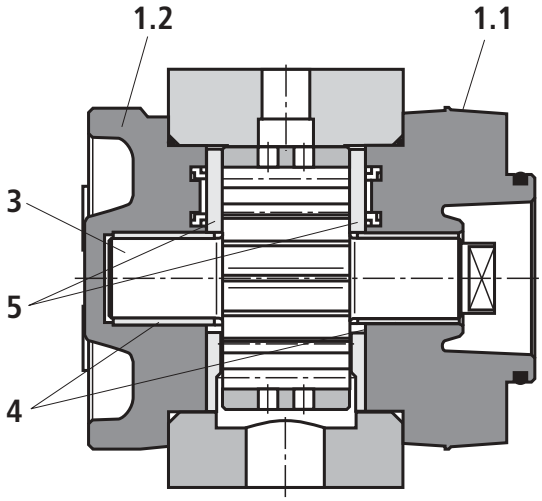
Special options (e.g. integrated valve technology) are possible on enquiry.

Order example: PGP3–3X/025RE20VE4

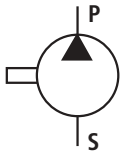
Material number: R900086823

Function, section, symbol





Symbol



Design

Hydraulic pumps of type PGF are leakage gap-compensated internal gear pumps with fixed displacement.

They basically consist of housing (1), bearing cover (1.1), end cover (1.2), internal gear (2), pinion shaft (3), plain bearings (4), axial plates (5), abutment pin (6) as well as segment assembly (7), which comprises segment (7.1), segment carrier (7.2) and sealing rolls (7.3).

Suction and displacement process

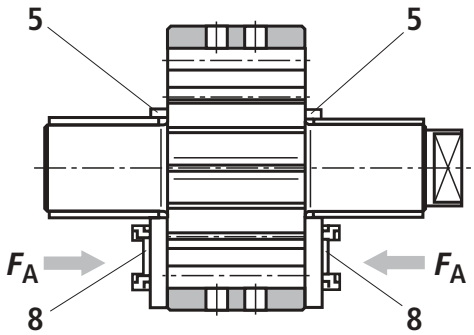
Pinion shaft (3) which is supported on hydrodynamic bearings drives internal gear (2) in the direction of rotation shown.

During rotation, the volume increases in the suction area within an angle of approx. 180 °. A negative pressure develops and fluid flows into the chambers.

The sickle-shaped segment assembly (7) separates the suction chamber from the pressure chamber. Within the pressure chamber, the teeth of pinion shaft (3) mesh with the teeth spaces of internal gear (2). The fluid is then displaced via pressure channel (P).

Axial compensation

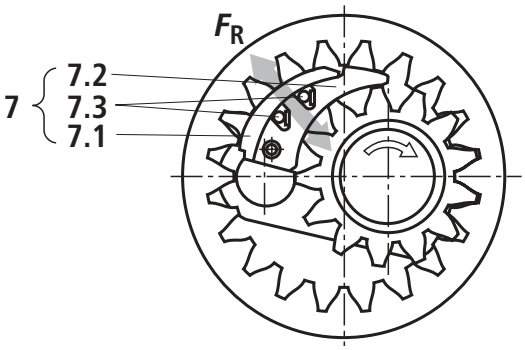
Axial compensation force F_A acts within the pressure chamber and is generated by pressure field (8) in axial plates (5).



Axial longitudinal gaps between rotating and fixed parts are therefore extremely small, which ensures optimum axial sealing of the pressure chamber.

Radial compensation

Radial compensation force F_R acts on segment (7.1) and segment carrier (7.2).



The area ratios and the position of sealing rolls (7.3) between the segment and the segment carrier are designed so that largely leakage-gap-free sealing is achieved between internal gear (2), segment assembly (7) and pinion shaft (3).

Spring elements under sealing rolls (7.3) ensure adequate contact pressure, even at very low pressures.

Hydrodynamic and hydrostatic bearings

The forces acting on pinion shaft (3) are absorbed by hydrodynamically lubricated radial plain bearings (4), and those acting on internal gear (2) are absorbed by hydrostatic bearing (9).

Gearing

The gear teeth are of involute design. Their long meshing length results in little flow and pressure pulsation; these low pulsation rates greatly contribute low-noise operation.

Technical data (for applications outside these parameters, please consult us!)

General

Design			Internal gear pump, gap-compensated				
Type			PGP				
Type of mounting			2-hole direct mounting, SAE 2-hole mounting flange to ISO 3019/1, 4-hole mounting flange to VDMA 24560 part 1 and ISO 3019/2				
Pipe connections			Square flange connection; SAE flange connection				
Installation orientation			Optional				
Shaft loading			Radial and axial forces (e.g. pulley) **only** after consultation				
Direction of rotation (viewed to shaft end)			Clockwise – **not** reversing!				
Frame size			**FS2**				
Size	Size		6.3	8	11	13	16
Weight	m	kg	3.0	3.1	3.3	3.5	3.6
Speed range	n_{min}	min^{-1}	600				
	n_{max}	min^{-1}	1800				
Displacement	V	cm^3	6.5	8.2	11	13.3	16
Flow [1]	q_V	L/min	9.4	11.9	16	19.3	23.2
Operating pressure, absolute – Inlet	p	bar	0.8 to 2				
– Outlet, continuous	p_{max}	bar	250				
– Outlet, intermittent [4]	p_{max}	bar	315 [2] / 350 [3]				
Frame size			**FS3**				
Size			20	22	25	32	
Weight	m	kg	4.3	4.7	5.1	5.5	
Speed range	n_{min}	min^{-1}	600				
	n_{max}	min^{-1}	1800				
Displacement	V	cm^3	20.6	22.2	25.4	32.5	
Flow [1]	q_V	L/min	29.9	32.2	36.8	47.1	
Operating pressure, absolute – Inlet	p	bar	0.8 to 2				
– Outlet, continuous	p_{max}	bar	250				
– Outlet, intermittent [4]	p_{max}	bar	315 [2] / 350 [3]			280 [2] / 315 [3]	
Hydraulic fluid			HL mineral oil to DIN 51524 part 1 / HLP mineral oil to DIN 51524 part 2 **Please observe our regulations according to data sheet RE 07075!** **Other hydraulic fluids on enquiry!**				
Hydraulic fluid temperature range		°C	– 10 to + 80; for other temperatures, please consult us!				
Ambient temperature range		°C	– 20 to + 60				
Viscosity range		mm^2/s	10 to 300; permissible starting viscosity 2000 (only at pressureless circulation)				
Max. permissible degree of contamination of the hydraulic fluid cleanliness class to ISO 4401 (c)			Class 20/18/15 [5]				

[1] Measured at $n = 1450\ min^{-1}$

[2] Maximum number of load cycles 10 x 10^6, duration max. 6 s, but not longer than 15% of duty cycle

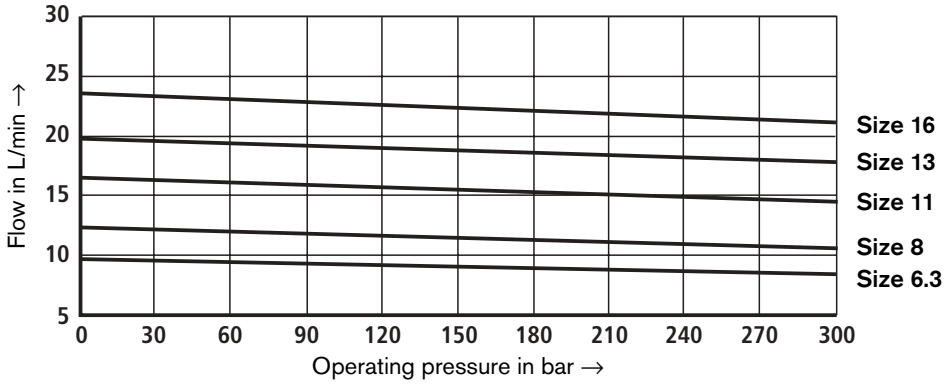
[3] Maximum number of load cycles 10 x 10^6, duration max. 1 s, but not longer than 10% of duty cycle

[4] Caution, this value must also not be exceeded by pressure peaks.

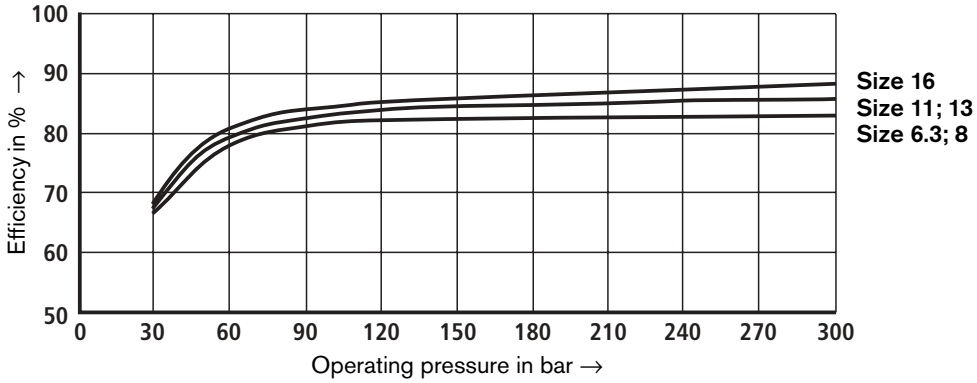
[5] The cleanliness classes specified for components must be adhered to in hydraulic systems. Effective filtration prevents malfunction and, at the same time, prolongs the service life of components.
For the selection of filters, see data sheets RE 50070, RE 50076, RE 50081, RE 50086 and RE 50088.

Average characteristic curve values of frame size 2 (measured at $n = 1450\ min^{-1}$; $\nu = 46\ mm^2/s$ and $\vartheta = 40\ °C$)

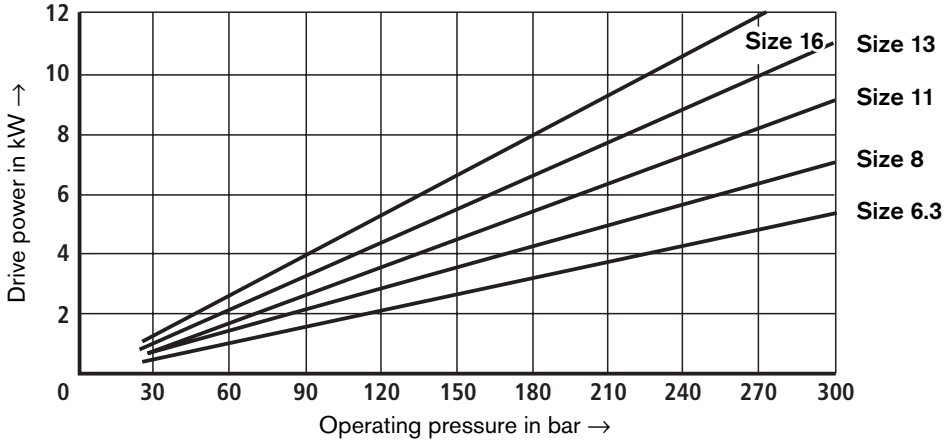
Flow



Efficiency



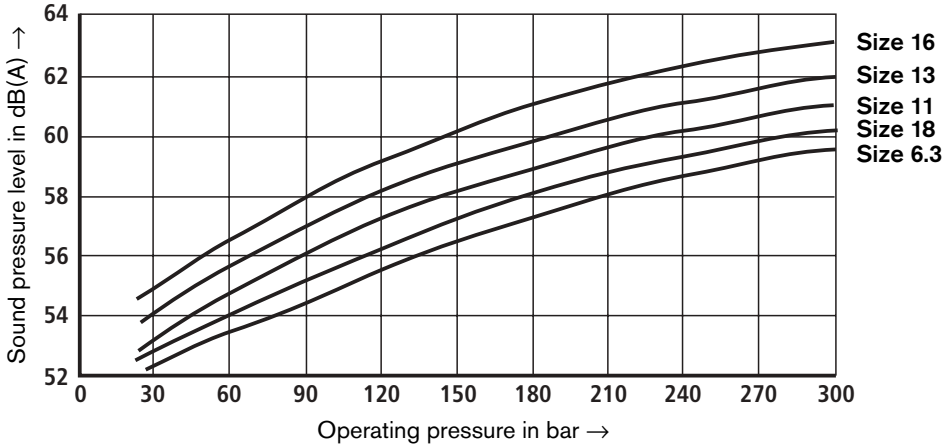
Drive power



Sound pressure level

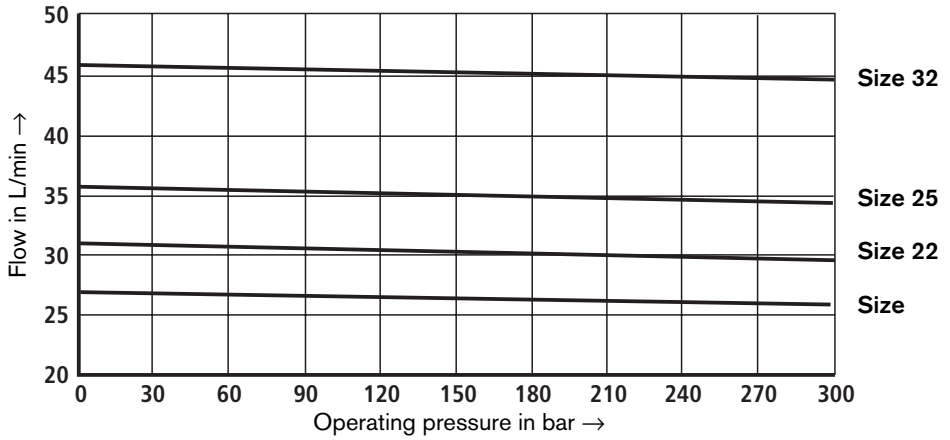
Measured in an anechoic chamber in line with DIN 45635, page 26

Distance between microphone and pump = 1 m

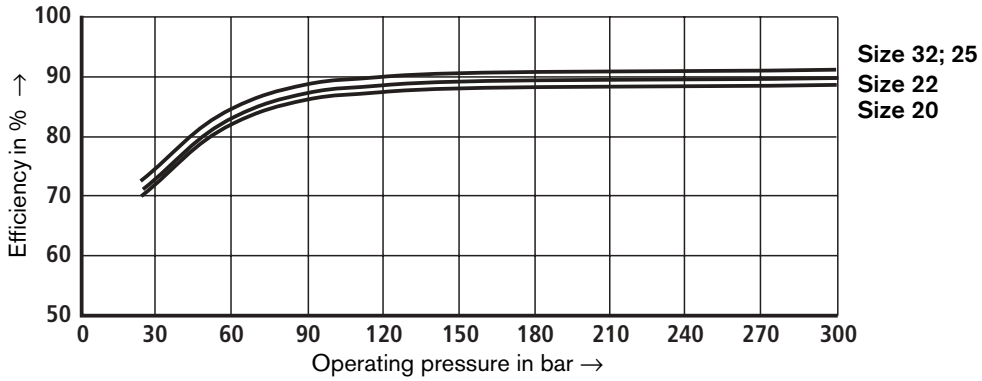


Average characteristic curve values of frame size 3 (measured at $n = 1450\ min^{-1}$; $\nu = 46\ mm^2/s$ and $\vartheta = 40\ °C$)

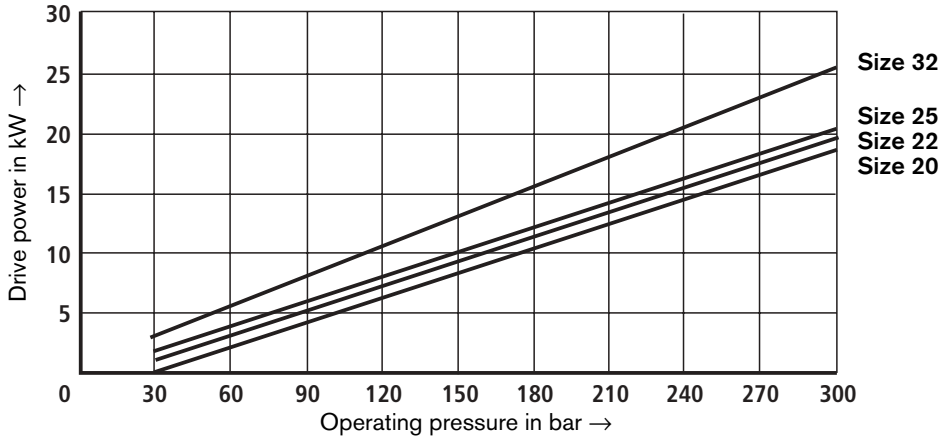
Flow



Efficiency



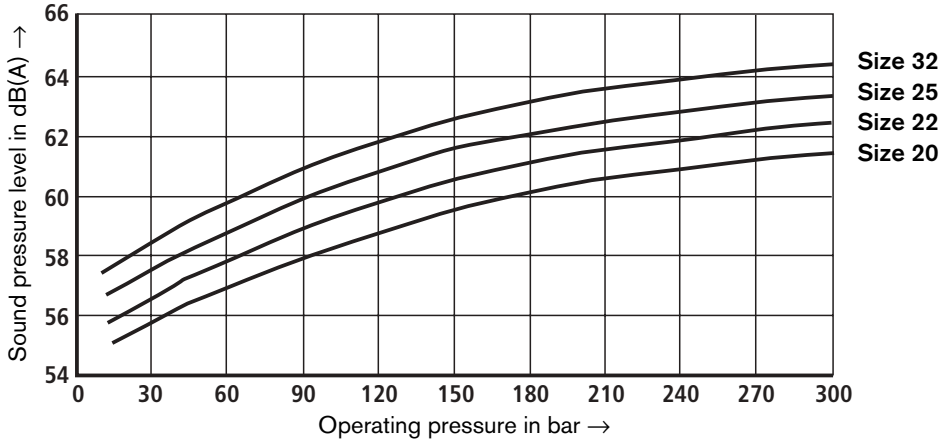
Drive power



Sound pressure level

Measured in an anechoic chamber in line with DIN 45635, page 26

Distance between microphone and pump = 1 m

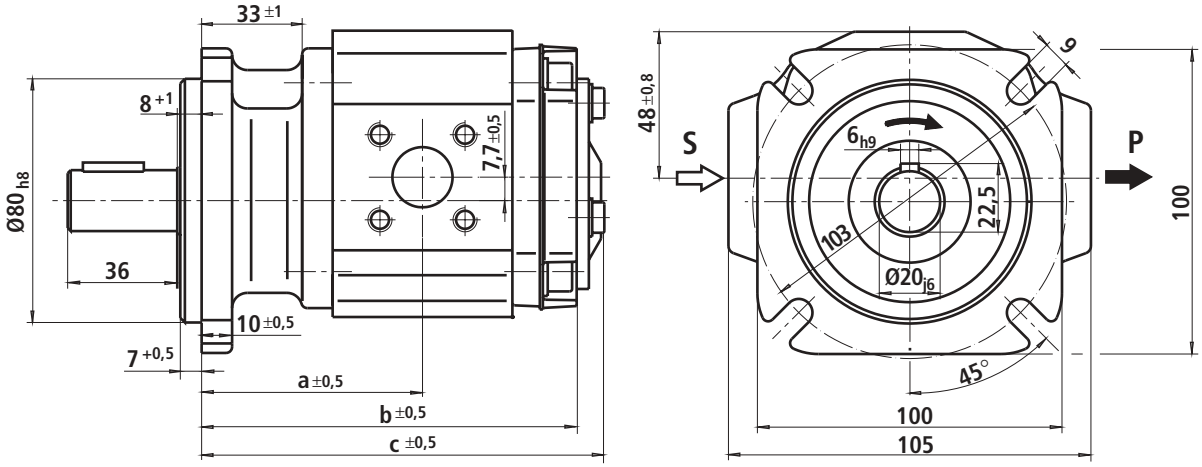


Unit dimensions and selection tables for frame size 2 (nominal dimensions in mm)

PGP2-2X/...RE20VE4 (cylindrical drive shaft with output, clockwise rotation)

Type **Size**	Material no.	Ports		Dimensions		
		S (suction)	**P** (pressure)	**a**	**b**	**c**
PGP2-2X/ **006** RE20VE4	R900932129	Ø20, PC Ø40 [1]	Ø6, PC Ø35 [2]	63	104	114
PGP2-2X/ **008** RE20VE4	R900081891	Ø20, PC Ø40 [1]	Ø8, PC Ø35 [2]	64.8	107.5	117.5
PGP2-2X/ **011** RE20VE4	R900932114	Ø20, PC Ø40 [1]	Ø12, PC Ø35 [2]	67.5	113	123
PGP2-2X/ **013** RE20VE4	R900086819	Ø20, PC Ø40 [1]	Ø12, PC Ø35 [2]	70	118	128
PGP2-2X/ **016** RE20VE4	R900932177	Ø20, PC Ø40 [1]	Ø12, PC Ø35 [2]	72.5	123	133

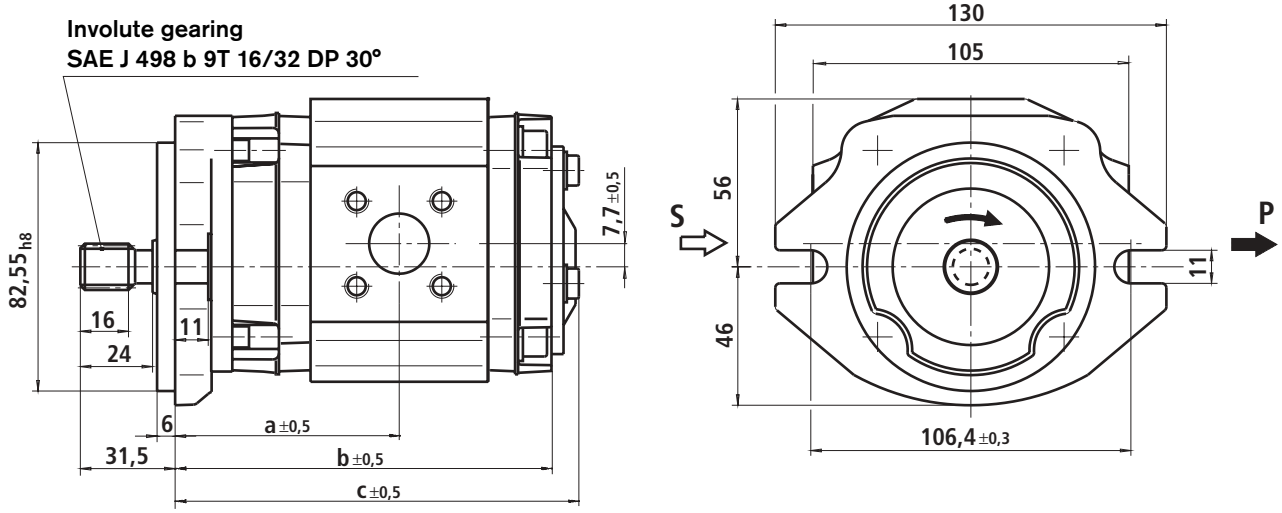
PC = pitch circle [1] mounting thread M6; 9 deep [2] mounting thread M6; 12 deep



PGP2-2X/...RJ20VU2 (splined drive shaft with output, clockwise rotation)

Type **Size**	Material no.	Ports		Dimensions		
		S (suction)	**P** (pressure)	**a**	**b**	**c**
PGP2-2X/ **006** RJ20VU2	R900984018	Ø20, PC Ø40 [1]	Ø6, PC Ø35 [2]	65	106	116
PGP2-2X/ **008** RJ20VU2	R900984019	Ø20, PC Ø40 [1]	Ø8, PC Ø35 [2]	67	109.5	119.5
PGP2-2X/ **011** RJ20VU2	R900984020	Ø20, PC Ø40 [1]	Ø12, PC Ø35 [2]	69.5	115	125
PGP2-2X/ **013** RJ20VU2	R900984021	Ø20, PC Ø40 [1]	Ø12, PC Ø35 [2]	72	120	130
PGP2-2X/ **016** RJ20VU2	R900984022	Ø20, PC Ø40 [1]	Ø12, PC Ø35 [2]	74.5	125	135

PC = pitch circle [1] mounting thread M6; 9 deep [2] mounting thread M6; 12 deep

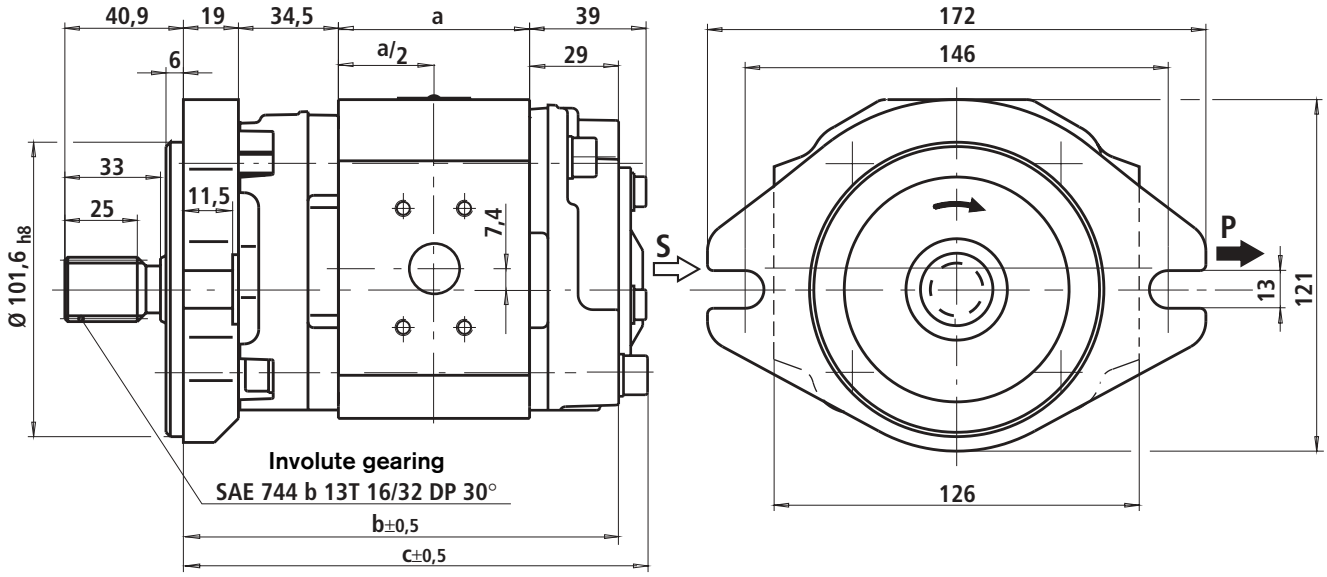


Unit dimensions and selection tables for size 3 (nominal dimensions in mm)

PGP3-3X/...RJ..VU2 (splined shaft with output, clockwise rotation)

Type **Size**	Material no.	Ports		Dimensions		
		S (suction)	**P** (pressure)	**a**	**b**	**c**
PGP3-3X/ **020** RJ20VU2	R900984025	Ø20, PC Ø55 [1]	Ø12, PC Ø35 [2]	52	134.5	144.5
PGP3-3X/ **022** RJ20VU2	R900984026	Ø20, PC Ø55 [1]	Ø12, PC Ø35 [2]	54	136.5	146.5
PGP3-3X/ **025** RJ20VU2	R900984027	Ø20, PC Ø55 [1]	Ø12, PC Ø35 [2]	58	140.5	150.5
PGP3-3X/ **032** RJ07VU2	R900984028	SAE 1 1/4" S [3]	SAE 3/4" S [3]	67	149.5	159.5

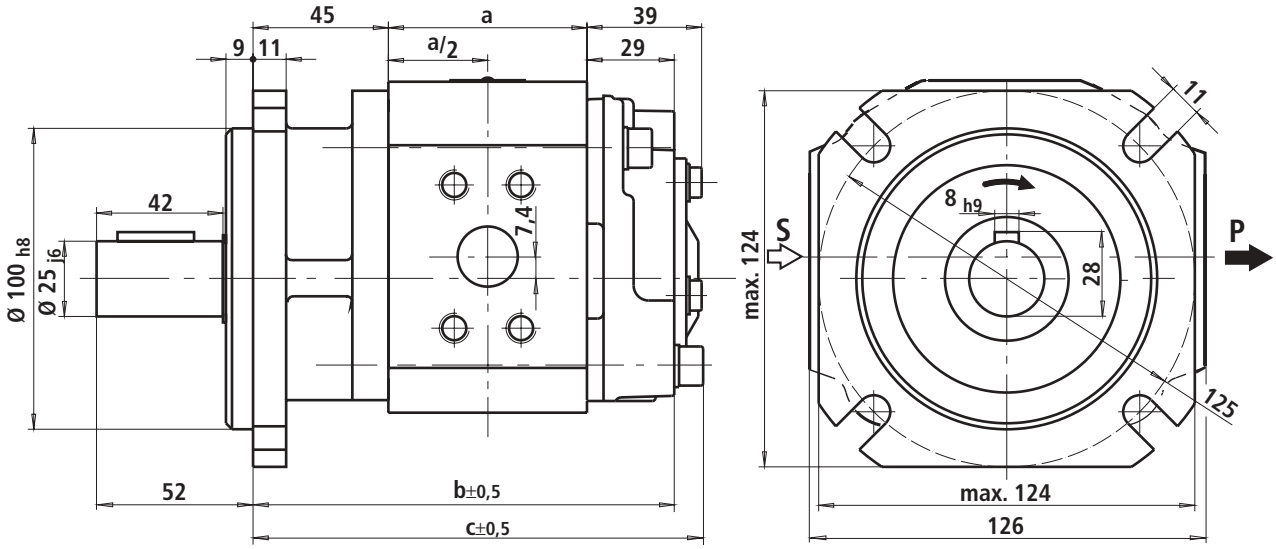
PC = pitch circle [1] mounting thread M8; 12 deep [2] mounting thread M6; 12 deep [3] standard pressure series



PGP3-3X/...RE..VE4 (cylindrical drive shaft, clockwise rotation)

Type **Size**	Material no.	Ports		Dimensions		
		S (suction)	**P** (pressure)	**a**	**b**	**c**
PGP3-3X/ **020** RE20VE4	R900932178	Ø20, PC Ø55 [1]	Ø12, PC Ø35 [2]	52	126	136
PGP3-3X/ **022** RE20VE4	R900080776	Ø20, PC Ø55 [1]	Ø12, PC Ø35 [2]	54	128	138
PGP3-3X/ **025** RE20VE4	R900086823	Ø20, PC Ø55 [1]	Ø12, PC Ø35 [2]	58	132	142
PGP3-3X/ **032** RE07VE4	R900086824	SAE 1 1/4" S [3]	SAE 3/4" S [3]	67	141	151

PC = pitch circle [1] mounting thread M8; 12 deep [2] mounting thread M6; 12 deep [3] standard pressure series



Multiple pumps – ordering code

Double = **P2**

Series of 1st pump
PGP, see page 2

Size of 1st pump
PGP, see page 2

Series of 2nd pump
PGF, see RE 10213

Size of 2nd pump
PGF, see RE 10213

Direction of rotation (viewed to shaft end)
Clockwise = **R**

Further details in clear text

Mounting flange for 1st pump
E4 [1] = 4-hole mounting flange to ISO 3019/2 and VDMA 24560 part 1
U2 [2] = SAE 2-hole mounting flange

Pipe connection of 2nd pump
20 = Square flange connection to DIN 3901 or 3902, metric mounting thread
07 = SAE flange connection

Pipe connection of 1st pump
20 = Square flange connection to DIN 3901 or 3902, metric mounting thread
07 = SAE flange connection

Shaft version of 1st pump
E = Cylindrical, with output
J = SAE involute splined shaft with output

[1] only in conjunction with cylindrical shaft
[2] only in conjunction with splined shaft

Order example: P2GP3/032+GF2/008RE07+20E4
Triple pump on enquiry

Multiple pumps – engineering notes

- The general technical data are identical with those of the single pumps (PGP, see page 4; PGF, see RE 10213).
- Combined pumps must all have the same direction of rotation.
- The pump that is subjected to the greatest loads should be provided as first pump.
- The engineer must verify the maximum troughdrive torque for each application. This is also valid for existing (coded) multiple pumps.
- The drive torque of a pump stage can be calculated as follows:

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

T : drive torque in Nm
Δp : operating pressure in bar
V : displacement in cm^3
η : hydraulic-mechanical efficiency

Permissible maximum torques in Nm:

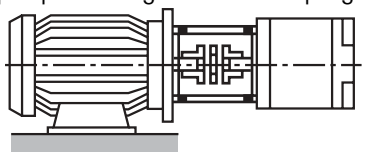
	Input side			Output side
	Cylindrical shaft ..E	Splined shaft ..J	Double-faced for claw coupling ..N	
PGP2	140	140	70	70
PGP3	230	230	140	140
PGF2	140	140	70	70
PGF3	230	230	140	140

- Common suction is **not** possible.
- The pumps are not sealed against each other.
- Rear pumps must have shaft version “N“ (double face).
- Front pumps must have shaft version “E“ (cylindrical) or “J“ (splined).
- Multiple pumps PGP and PGF are mounted without combination parts.
- The total length of the pump is obtained by adding the longitudinal dimensions “b” of the individual pumps.
(PGP, see pages 7 to 9, PGF, see RE 10213)

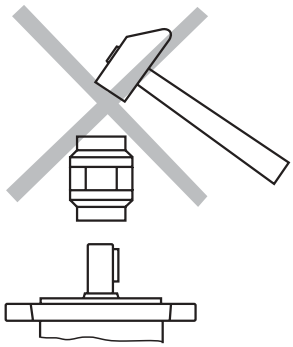
Installation notes

Drive

El. motor + pump mounting bracket + coupling + pump

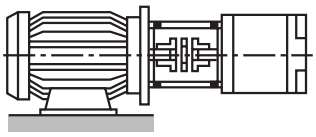


- No radial and axial forces permitted on the pump drive shaft!
- Motor and pump must be exactly aligned!
- Always use a coupling that is suitable for compensating for shaft offsets!
- When installing the coupling, avoid axial forces, that is, **do not hammer or press the coupling onto the shaft!** Use the female thread of the drive shaft!

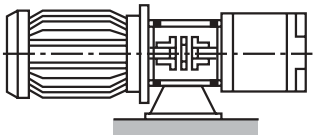


Installation orientation

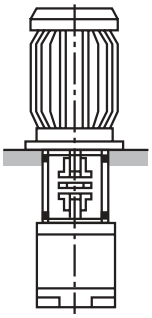
B3



B5



V1



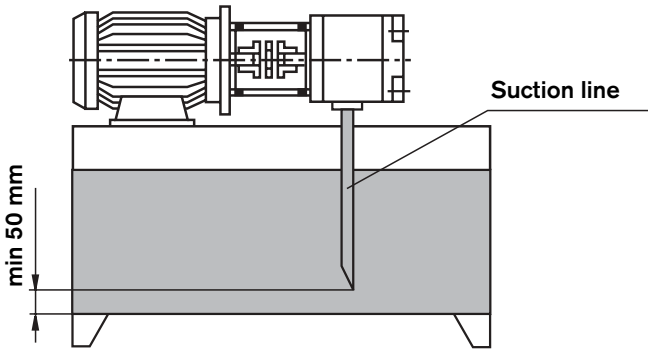
Fluid tank

- Adjust the useful capacity of the tank to the operating conditions
- The permissible fluid temperature must not be exceeded; if required, provide cooler

Lines and connections

- Remove protective plug from pump
- We recommend the use of seamless precision steel pipes according to DIN 2391 and pipe connections that can be loosened
- Select the clear width of pipes according to the connections (suction velocity 1 to 1.5 m/s)
- For inlet pressure, see page 4
- Thoroughly clean pipes and fittings before their installation

Recommendation for piping



- The returning oil must **under no circumstances** be re-aspired directly, i.e. select the largest possible distance between suction and return line
- The return oil outlet must always be immersed in the oil
- Ensure suction-tight installation of the pipes

Filters

- If possible, use return line or pressure filters.
  (Use suction filters only in conjunction with an underpressure switch/clogging indicator)

Hydraulic fluid

- Please observe our regulations according to data sheet RE 07075
- We recommend the use of branded hydraulic oils
- Different oil grades must not be mixed, since this can result in decomposition and deterioration of the lubricating properties
- The fluid must be changed at certain intervals depending on the operating conditions. This involves cleaning of the fluid tank from residues.

Commissioning notes

Preparations

- Check whether the system is thoroughly and properly installed.
- Fill the hydraulic fluid only in through filters with the required minimum retention rate.
- Fill the pump completely with hydraulic fluid via the suction or pressure tube.
- Check direction of rotation of the motor for compliance with the direction of rotation according to the pump type.

Bleeding

- Open the bleeding port of the system by hand or change over to circulation at zero pressure in accordance with the operating instructions of the system. During bleeding, the pressureless discharge of entrapped air must be ensured.
- To bleed the pump, briefly switch the motor on and then switch it immediately off again (inching mode). Repeat this process until the pump is completely bled.
- Re-close the open bleeding ports by hand.

Commissioning

- When it is ensured that the pump is completely bled, switch the motor on. Let the pump run at zero pressure until the system is completely bled. For system bleeding, observe the operating instructions for the system.
- Commission the system according to the operating instructions and load pumps.
- After some time in operation, check the hydraulic fluid in the tank for bubbles or foaming on the surface.

Operation

- During operation, take note of changes in the noise emission. Due to warming up of the operating medium, a slight increase in the noise level is normal. A remarkable increase in the noise level or brief, stochastic changes in the noise characteristics can indicate the aspiration of air. In the case of too short suction pipes or low oil levels of the operating medium, air can also be sucked in through a vortex.
- Changes in the operating velocities, temperatures, increase in noise or power requirement indicate wear or damage to the system or the pump.

Re-commissioning

- Inspect the pump and system for leakage. Loss of oil indicates leakage below the hydraulic fluid level. An increased hydraulic fluid level in the tank indicates leakage above the hydraulic fluid level.
- When the pump is arranged above the hydraulic fluid level, the pump can drain via leaking points, e.g. a worn-out shaft seal ring. In this case, it must be bled again during re-commissioning. Have the damage repaired.
- After repair and maintenance were carried out, re-bleeding is required.
- Switch the motor on when the system is in flawless condition.

General

- Pumps delivered by us are tested for function and performance. Never make any changes of whatever nature to the pump, otherwise the warranty will become void!
- Repairs may only be carried out by the manufacturer or his authorised dealers and agencies. Repairs carried out by the customer are not covered by the warranty.

⚠ Important notes

- Adjustments, maintenance and repair of the pump may only be carried out by authorised, trained and instructed personnel!
- The pump may only be operated within the permissible limits (see page 4).
- The pump may only be operated when in perfect condition!
- When work is to be carried out on the pump, the system must be switched off and depressurised!
- Unauthorised conversions or changes that affect safety and function are not permitted!
- Attach protective guards (e.g. coupling protection) and do not remove any existing protective equipment!
- Make sure that all fixing screws are always properly tightened (observe prescribed tightening torque)!
- The generally valid safety regulations and regulations for the prevention of accidents must be strictly observed!

Engineering notes

Comprehensive notes and suggestions can be found in The Hydraulic Trainer, Volume 3 RE 00281, "notes on the planning and design of hydraulic systems".

When using internal gear pumps, provide an additional manual, switchable or automatic bleeding option. The bleed point for manual bleeding must be provided in the pressure line upstream of the first valve or check valve in order that bleeding can be carried out at zero pressure.

Technical data

All technical data given depend on manufacturing tolerances and are valid in conjunction with certain boundary conditions.

Please note that certain deviations are therefore possible, and that technical data may vary under certain boundary conditions (e.g. viscosity).

Characteristic curves

When dimensioning the drive motor, observe the max. permissible operating data on the basis of the characteristic curves shown on pages 5 and 6.

Sound pressure level

The sound pressure level values shown on pages 5 and 6 were measured in line with DIN 45635, page 26. This means that only the noise emitted by the pump is shown. Influences by the surroundings (such as place of installation, piping, etc.) were eliminated.

The values always refer to only one pump.

With internal gear pumps, the excitation of valves, pipes, machine parts, etc. is very low due to the low flow pulsation (approx. 2 to 3 %).

Nevertheless, under unfavourable conditions, the sound pressure level at the place of installation of the power unit can be 5 to 10 dB(A) higher than the values of the pump itself.

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