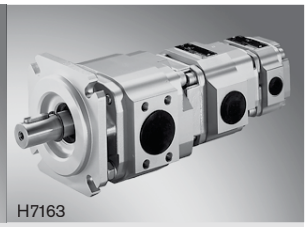
# Internal Gear Pump, Fixed Displacement PGF

**RE 10213/05.12** 1/20
Replaces: 04.05

**Type PGF**


H7158
Type PGF1… for direct mounting


H7163
Type PGF3… 3-fold combination

Frame sizes 1, 2 and 3
Component series: 2X (BG1 and 2)
3X (BG3)
Maximum operating pressure 250 bar
Maximum displacement 1.7 to 40 $cm^3$

## Contents



## Features

- Fixed displacement
- Low operating noise
- Low flow pulsation
- High efficiency even at low viscosity due to sealing gap compensation
- Long service life due to slide bearings and sealing gap compensation
- Suitable for a wide viscosity and speed range
- Excellent suction characteristics
- All frame sizes and sizes can be combined with each other
- Can be combined with PGH internal gear pumps, PV7 vane pumps and axial piston pumps
- Valve technology can be integrated in the cover on request
- Use:
  For drives in the medium-output and medium-pressure range in industrial applications, such as machine tools.
  At high operating pressure for endurant drives in mobile applications, such as lifting devices, fans and spreaders.

## Ordering code

| PG | F | – | / | | | | | | | * |
|---|---|---|---|---|---|---|---|---|---|---|

**Series**
Medium-pressure pump = **F**

**Frame size - component series**
BG1 – component series 2X = **1–2X**
(component series 20 to 29: unchanged installation and connection dimensions)
BG2 – component series 2X = **2–2X**
(component series 20 to 29: unchanged installation and connection dimensions)
BG3 – component series 3X = **3–3X**
(component series 30 to 39: unchanged installation and connection dimensions)

| Size | NG | Displacement/revolution | |
|---|---|---|---|
| **BG1** | 1.7 | 1.7 $cm^3$ | **= 1.7** |
| | 2.2 | 2.2 $cm^3$ | **= 2.2** |
| | 2.8 | 2.8 $cm^3$ | **= 2.8** |
| | 3.2 | 3.2 $cm^3$ | **= 3.2** |
| | 4.1 | 4.1 $cm^3$ | **= 4.1** |
| | 5.0 | 5.0 $cm^3$ | **= 5.0** |
| **BG2** | 6.3 | 6.5 $cm^3$ | **= 006** |
| | 8.0 | 8.2 $cm^3$ | **= 008** |
| | 11.0 | 11.0 $cm^3$ | **= 011** |
| | 13.0 | 13.3 $cm^3$ | **= 013** |
| | 16.0 | 16.0 $cm^3$ | **= 016** |
| | 19.0 | 18.9 $cm^3$ | **= 019** |
| | 22.0 | 22.0 $cm^3$ | **= 022** |
| **BG3** | 20.0 | 20.6 $cm^3$ | **= 020** |
| | 25.0 | 25.4 $cm^3$ | **= 025** |
| | 32.0 | 32.5 $cm^3$ | **= 032** |
| | 40.0 | 40.5 $cm^3$ | **= 040** |

**Ordering example:** **PGF2–2X/011RE01VE4**
**Material number:** **R900932271**

Not all of the variants according to the type code are possible! Please select the desired pump on the basis of the selection tables (preferred types, pages 9 to 17 ) or consult Bosch Rexroth!

Special options are available on request, e.g., integrated pressure-relief valves.

**Direction of rotation** (viewed to shaft end)
**R =** Clockwise
**L =** Counter-clockwise

**Shaft versions**
**A =** Cylindrical
**E =** Cylindrical with output drive
**J =** Involute splines with output drive
**N =** Two flats for claw coupling
**L =** Two flats for claw coupling with output drive
**O =** Conical with output drive 1 : 5

**Suction and pressure port**
**01 =** Pipe thread according to ISO 228/1 (BSP)
**07 =** SAE flange port
**20 =** Square flange port according to DIN 3901 or DIN 3902, metric fastening thread

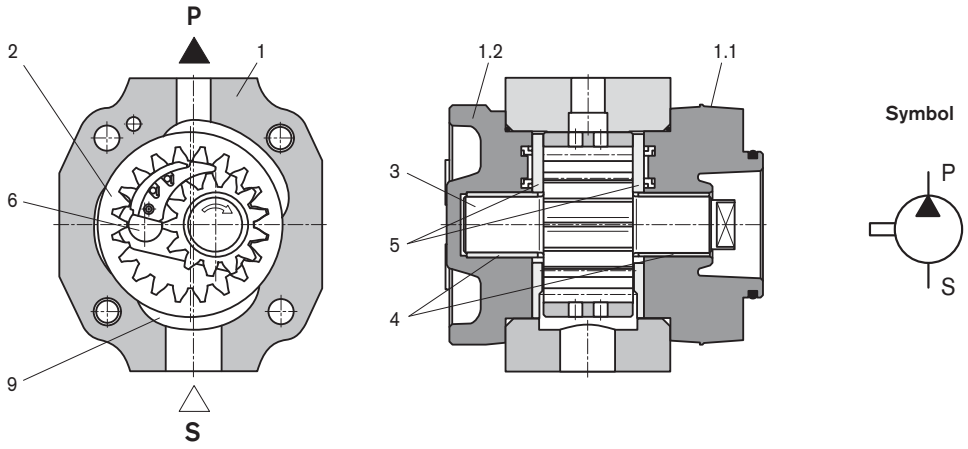
**Seal material**
**V =** FKM seals

**Mounting-flange centering**
**K4 =** Special flange according to ISO 7653-1985 (for truck PTO)
**E4 =** 4-hole mounting flange according to ISO 3019/2 and VDMA 24560 Part 1
**U2 =** SAE-2-hole-mounting flange
**M =** 2-hole mounting, centering Ø 32 mm (BG1), centering Ø 52 mm (BG2 and 3)
**P =** 2-hole mounting, centering Ø 50 mm
**P1 =** 2-hole mounting, centering Ø 45.24 mm
**P2 =** 2-hole mounting, centering Ø 63 mm

**Options**
**N =** Anticavitation valve
**K =** Cover for mounting the next-smaller size

Further details in clear text

## Functions, section, symbol




### Design

PGF hydraulic pumps are leak gap-compensated internal gear pumps with a fixed displacement.

They consist basically of: housing (1), bearing cover (1.1), cover (1.2), ring gear (2), pinion shaft (3), slide bearings (4), axial discs (5) and stop pin (6) as well as the segment assembly (7) which is composed of a segment (7.1), segment carrier (7.2) and the sealing rolls (7.3).

### Suction and displacement process

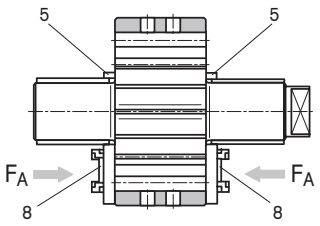
The hydrodynamically supported pinion shaft (3) drives the internally toothed ring gear (2) in the direction of rotation shown.

During rotation, the volume is increased in the suction area over an angle of approx. 180 °. A negative pressure is generated 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 the pinion shaft (3) mesh with the tooth spaces of the ring gear (2). The fluid is then displaced through the pressure channel (P).

### Axial compensation

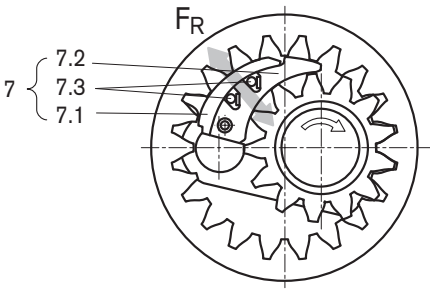
The axial compensation force $F_A$ acts in the area of the pressure chamber and is generated by the pressure zone (8) in the axial discs (5).




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

### Radial compensation

The radial compensation force $F_R$ acts on the segment (7.1) and segment carrier (7.2).




The area ratios and the position of the sealing rolls (7.3) between the segment and segment carrier are designed to provide virtually gap-free sealing between the ring gear (2), the segment assembly (7) and the pinion shaft (3).

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

### Hydrodynamic and hydrostatic bearing

The forces acting on the pinion shaft (3) are absorbed by hydrodynamically lubricated radial slide bearings (4) while those acting on the ring gear (2) are absorbed by the hydrostatic bearing (9).

### Splines

Involute splining was selected for the gear. Their long length of contact results in a low flow and pressure pulsation; these low pulsation rates greatly contribute to the low-noise operation.

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

### General

| | |
|---|---|
| Design | Internal gear pump, gap-compensated |
| Type | PGF |
| Type of mounting | 2-hole mounting, SAE 2-hole mounting flange according to ISO 3019/1,<br>4-hole mounting flange according to VDMA 24560 Part 1 and ISO 3019/2 |
| Pipe connections | Square flange port; SAE flange port; pipe thread according to ISO 228/1 |
| Installation position | Arbitrary |
| Shaft loading | Radial and axial forces (e.g., belt pulley) **only** after consultation |
| Direction of rotation (viewed to shaft end) | Clockwise or counter-clockwise – **not** reversing! |

| **Frame size** | **BG** | | **PGF1** | | | | | |
|---|---|---|---|---|---|---|---|---|
| Size | NG | | 1.7 | 2.2 | 2.8 | 3.2 | 4.1 | 5.0 |
| Weight | $m$ | kg | 0.8 | 0.9 | 1.0 | 1.0 | 1.1 | 1.3 |
| Speed range[1)] | $n_{min}$ | rpm | 600 | | | | | |
| Displacement | $V$ | $cm^3$ | 1.7 | 2.2 | 2.8 | 3.2 | 4.1 | 5.0 |
| Flow[2)] | $q_V$ | l/min | 2.4 | 3.2 | 4.1 | 4.6 | 6.0 | 7.2 |
| Moment of inertia (at drive axle) | J | $kgm^2$ | 0.000012 | 0.000013 | 0.000015 | 0.000017 | 0.000021 | 0.000026 |
| Operating pressure, absolute<br>Inlet | $p$ | bar | 0.6 to 3 | | | | | |
| Outlet, continuous | $p_{max}$ | bar | 180 | 210 | 210 | 210 | 210 | 180 |
| Outlet, intermittent[3)] | $p_{max}$ | bar | 210 | 250 | 250 | 250 | 250 | 210 |
| Minimum required drive power at $\Delta p \approx 1$ bar | | kW | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 |

| **Frame size** | **BG** | | **PGF2** | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Size | NG | | 6.3 | 8 | 11 | 13 | 16 | 19 | 22 |
| Weight | $m$ | kg | 2.1 | 2.2 | 2.4 | 2.6 | 2.7 | 2.9 | 3.1 |
| Speed range[1)] | $n_{min}$ | rpm | 600 | | | | | | 600 |
| | $n_{max}$ | rpm | 3600 | | | | | | 3000 |
| Displacement | $V$ | $cm^3$ | 6.5 | 8.2 | 11 | 13.3 | 16 | 18.9 | 22 |
| Flow[2)] | $q_V$ | l/min | 9.4 | 11.9 | 16 | 19.3 | 23.3 | 27.4 | 31.9 |
| Moment of inertia (at drive axle) | J | $kgm^2$ | 0.000074 | 0.000090 | 0.00012 | 0.00014 | 0.00016 | 0.00019 | 0.00022 |
| Operating pressure, absolute<br>Inlet | $p$ | bar | 0.6 to 3 | | | | | | |
| Outlet, continuous | $p_{max}$ | bar | 210 | 210 | 210 | 210 | 210 | 210 | 180 |
| Outlet, intermittent[3)] | $p_{max}$ | bar | 250 | 250 | 250 | 250 | 250 | 250 | 210 |
| Minimum required drive power at $\Delta p \approx 1$ bar | | kW | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 1.1 | 1.1 |

For footnotes, see page 5

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

| Frame size | BG | | PGF3 | | | |
|---|---|---|---|---|---|---|
| Size | NG | | 20 | 25 | 32 | 40 |
| Weight[4)] | $m$ | kg | 0.8 | 1.0 | 1.0 | 1.1 |
| Speed range[1)] | $n_{min}$ | rpm | 500 | | | |
| | $n_{max}$ | rpm | 3600 | 3200 | 3000 | 2500 |
| Displacement | $V$ | $cm^3$ | 20.6 | 25.4 | 32.5 | 40.5 |
| Flow[2)] | $q_V$ | l/min | 29.9 | 36.8 | 47.1 | 58.7 |
| Moment of inertia (at drive axle) | J | $kgm^2$ | 0.00029 | 0.00035 | 0.00043 | 0.00053 |
| Operating pressure, absolute | | | | | | |
| Inlet | $p$ | bar | 0.6 to 3 | | | |
| Outlet, continuous | $p_{max}$ | bar | 210 | 210 | 210 | 180 |
| Outlet, intermittent[3)] | $p_{max}$ | bar | 250 | 250 | 250 | 210 |
| Minimum required drive power at $\Delta p \approx 1$ bar | | kW | 1.1 | 1.5 | 1.5 | 1.5 |

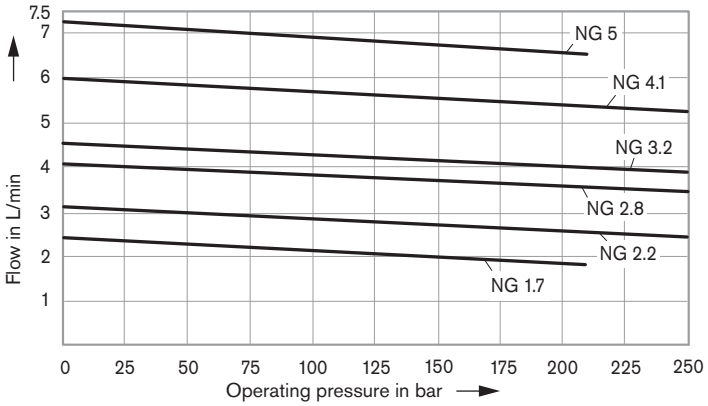
## Hydraulic

| | | |
|---|---|---|
| Hydraulic fluid[5)] | | HL mineral oil according to 51524 Part 1 / HLP - mineral oil according to DIN 51524 Part 2<br>HEES fluids according to DIN ISO 15380<br>HEPR fluids according to DIN ISO 15380<br>**Please note our specification according to data sheet RE90220!** |
| Hydraulic fluid temperature range | °C | – 20 to + 100; 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 |
| Maximum permissible degree of contamination of the hydraulic fluid<br>Cleanliness level according to ISO 4406 (c) | | Class 20/18/15[6)] |
| Permissible radial loading of the pinion shaft | | On request |

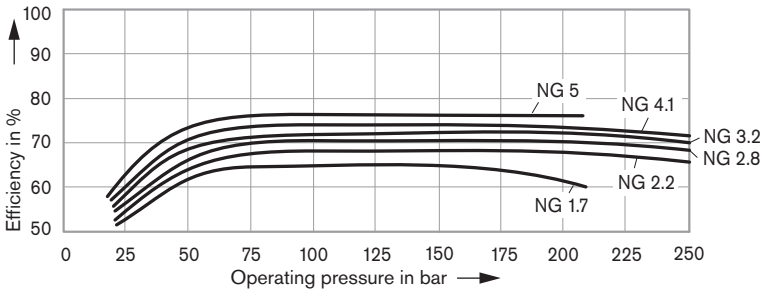
1) For other speeds, please consult us (e.g., impulse control)
2) Measured at $n = 1450$ rpm and $p = 10$ bar
3) Max 6 s, up to 15% of actuated time, max. $2 \cdot 10^6$ load cycles
4) For pumps with 2-hole mounting as flanged version
   – Frame size 2 approx. 0.9 kg heavier
   – Frame size 3 approx. 1.0 kg heavier
5) Other fluids on request
6) Cleanliness levels specified for the components must be maintained in the hydraulic systems. Effective filtration prevents malfunctions and simultaneously extends the service life of the components.

## Mean characteristic curve values for frame size 1 (measured at n = 1450 rpm; ν = 46 mm²/s and ϑ = 40 °C)

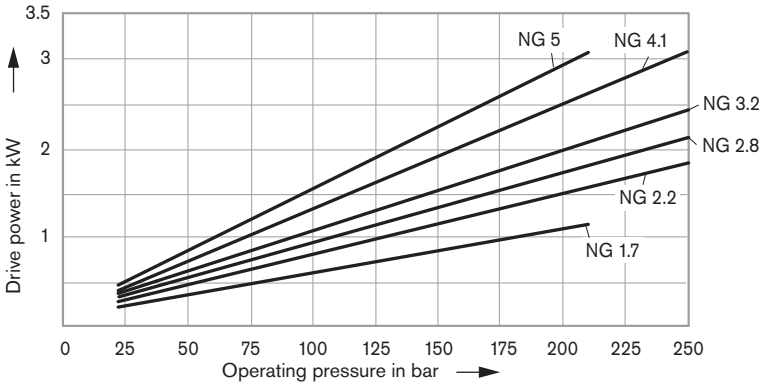
**Flow**




**Efficiency**



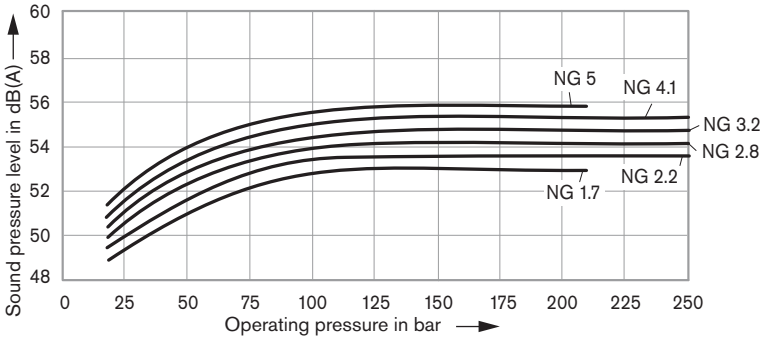

**Drive power**




**Sound pressure level**

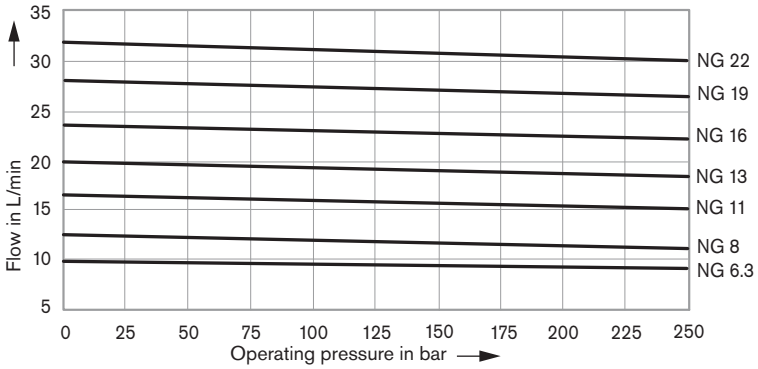
Measured in sound-absorbent acoustic room on the basis of DIN 45635, sheet 26

Distance between microphone – pumps = 1 m

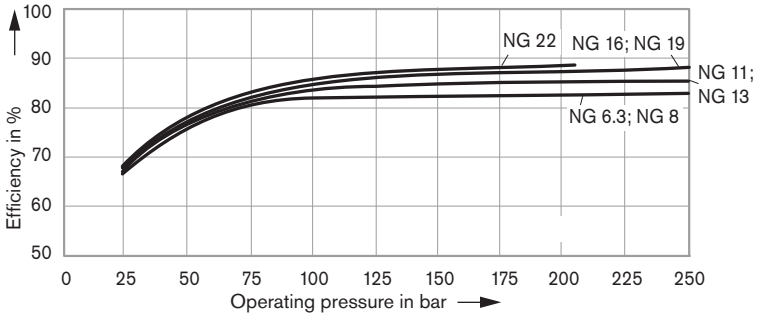


## Mean characteristic curve values for frame size 2 (measured at n = 1450 rpm; ν = 46 mm²/s and ϑ = 40 °C)

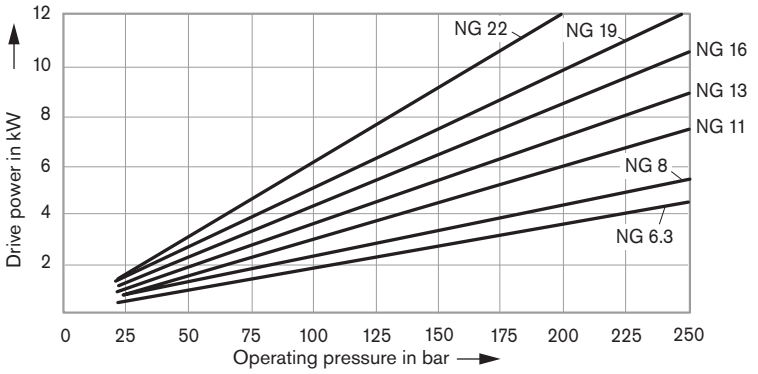
**Flow**




**Efficiency**



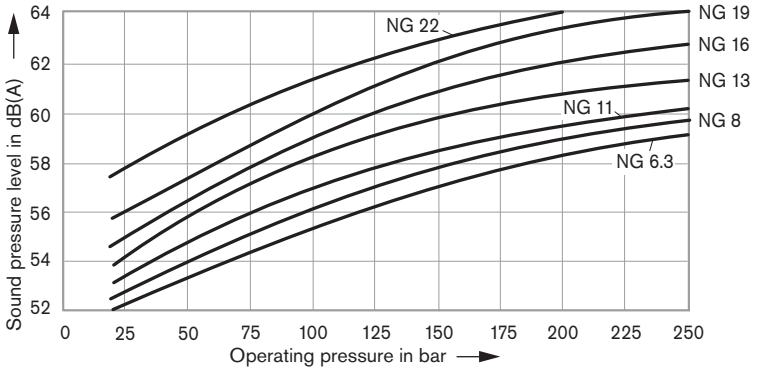

**Drive power**




**Sound pressure level**

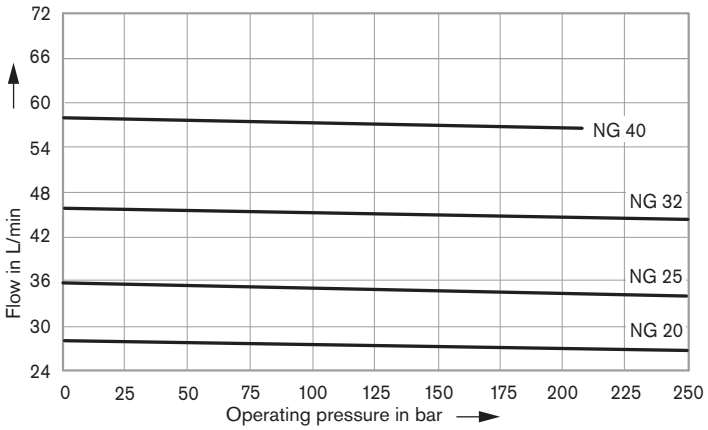
Measured in sound-absorbent acoustic room on the basis of DIN 45635, sheet 26

Distance between microphone – pumps = 1 m

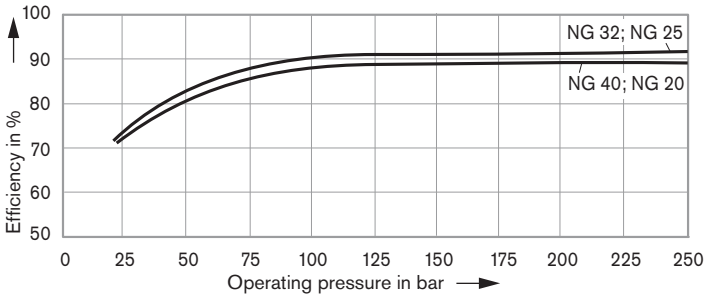


## Mean characteristic curve values for frame size 3 (measured at n = 1450 rpm; ν = 46 mm2/s and ϑ = 40 °C)

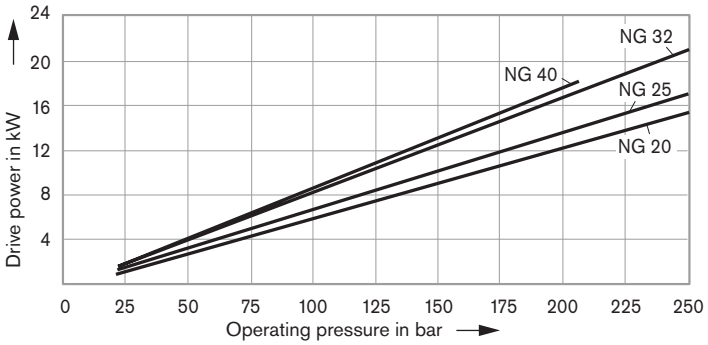
**Flow**




**Efficiency**



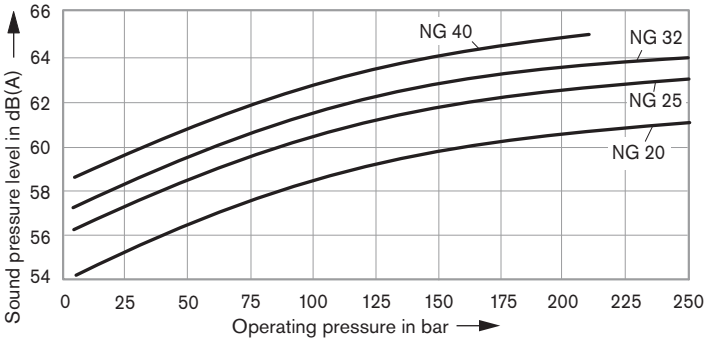

**Drive power**




**Sound pressure level**

Measured in sound-absorbent acoustic room on the basis of DIN 45635, sheet 26

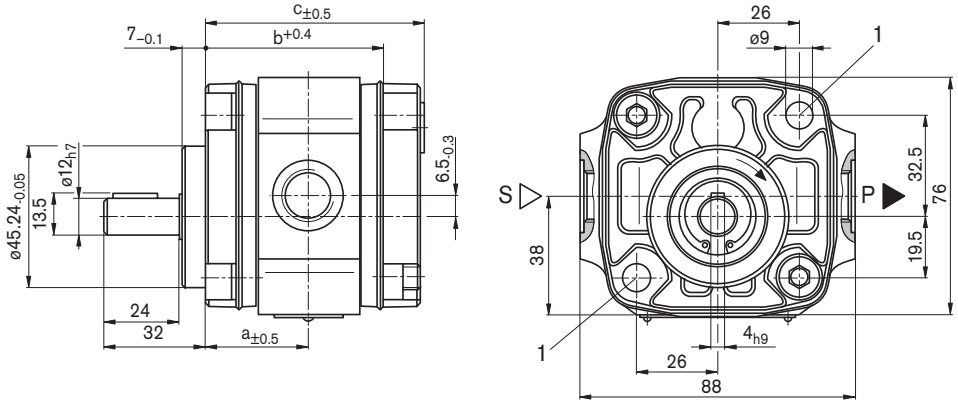
Distance between microphone – pumps = 1 m



## Unit dimensions and selection tables for frame size 1 (nominal dimensions in mm)

**PGF1-2X/ ... RA01VP1** (cylindrical drive shaft, without through drive)

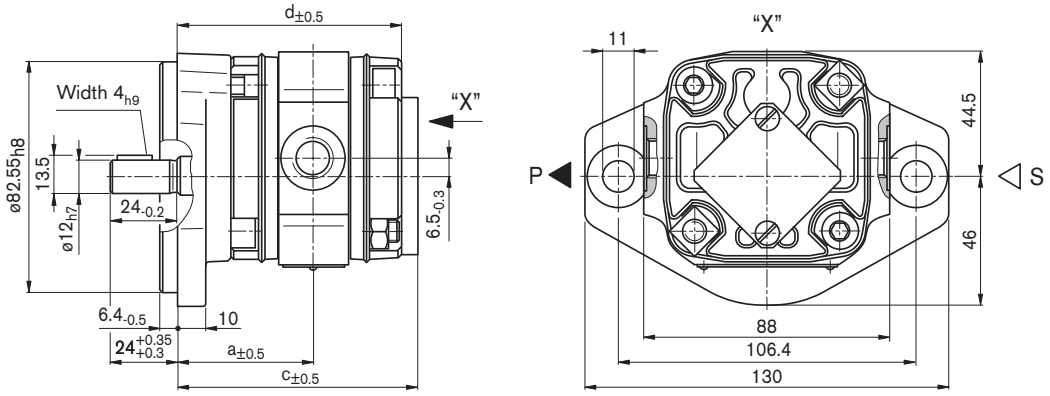
| Type NG | Material no. "R" clockwise | Dimensions a | b | c | S | P |
|---|---|---|---|---|---|---|
| PGF1-2X/ **1.7** RA01VP1 | R900932132 | 29.6 | 49.1 | 62.5 | G 1/4; 14 | G 1/4; 12.5 |
| PGF1-2X/ **2.2** RA01VP1 | R900932133 | 29.6 | 49.1 | 62.5 | G 1/4; 14 | G 1/4; 12.5 |
| PGF1-2X/ **2.8** RA01VP1 | R900932134 | 30.7 | 51.4 | 64.8 | G 3/8; 14 | G 1/4; 12.5 |
| PGF1-2X/ **3.2** RA01VP1 | R900932135 | 31.5 | 53.0 | 66.4 | G 3/8; 14 | G 1/4; 12.5 |
| PGF1-2X/ **4.1** RA01VP1 | R900932136 | 33.4 | 56.7 | 70.1 | G 3/8; 14 | G 3/8; 12.5 |
| PGF1-2X/ **5.0** RA01VP1 | R900932137 | 35.2 | 60.4 | 74.4 | G 1/2; 14 | G 3/8; 12.5 |




**1** Through hole for M8 DIN 912 socket-head screw, tightening torque $M_A$ = 25 (+5) Nm
b = Clamping length

**PGF1-2X/ ... RE01VU2** (cylindrical drive shaft, with through drive)

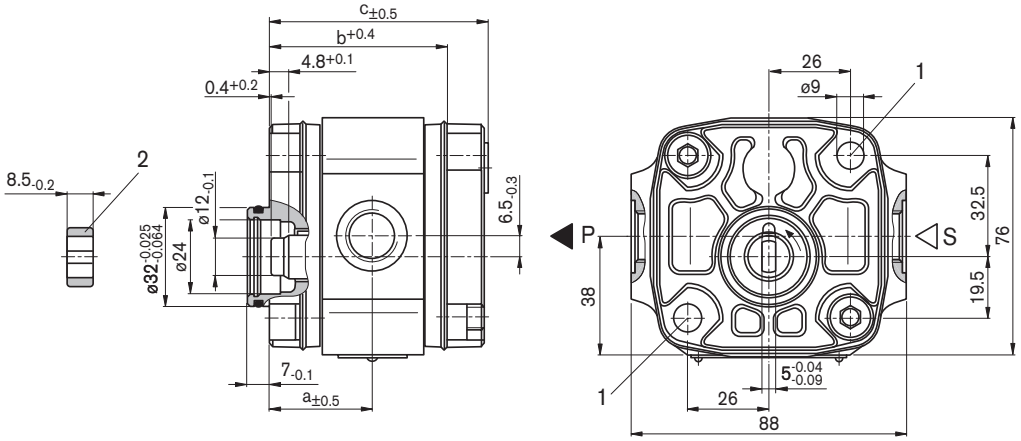
| Type NG | Material no. "R" clockwise | Dimensions a | c | d | S | P |
|---|---|---|---|---|---|---|
| PGF1-2X/ **1.7** RE01VU2 | R900086159 | 48.6 | 85.7 | 79.7 | G 1/4; 14 | G 1/4; 12.5 |
| PGF1-2X/ **2.2** RE01VU2 | R900086160 | 48.6 | 85.7 | 79.7 | G 1/4; 14 | G 1/4; 12.5 |
| PGF1-2X/ **2.8** RE01VU2 | R900086161 | 49.7 | 88.0 | 82.0 | G 3/8; 14 | G 1/4; 12.5 |
| PGF1-2X/ **3.2** RE01VU2 | R900086162 | 50.5 | 89.6 | 83.6 | G 3/8; 14 | G 1/4; 12.5 |
| PGF1-2X/ **4.1** RE01VU2 | R900086163 | 52.4 | 93.2 | 87.2 | G 3/8; 14 | G 3/8; 12.5 |
| PGF1-2X/ **5.0** RE01VU2 | R900086164 | 54.2 | 97.0 | 91.0 | G 1/2; 14 | G 3/8; 12.5 |



## Unit dimensions and selection tables for frame size 1 (nominal dimensions in mm)

**PGF1-2X/ … LN01VM** (drive shaft for claw coupling, without through drive); rear pump

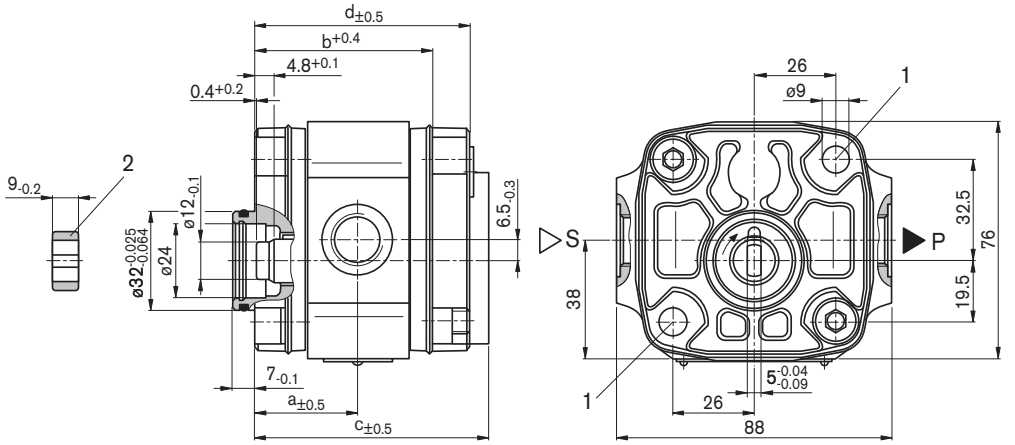
| Type | NG | Material no. "L" counter-clockwise | Dimensions a | b | c | S | P |
|---|---|---|---|---|---|---|---|
| PGF1-2X/ | **1.7** LN01VM | R900086147 | 29.6 | 49.1 | 62.5 | G 1/4; 14 | G 1/4; 12.5 |
| PGF1-2X/ | **2.2** LN01VM | R900086148 | 29.6 | 49.1 | 62.5 | G 1/4; 14 | G 1/4; 12.5 |
| PGF1-2X/ | **2.8** LN01VM | R900086149 | 30.7 | 51.4 | 64.8 | G 3/8; 14 | G 1/4; 12.5 |
| PGF1-2X/ | **3.2** LN01VM | R900086150 | 31.5 | 53.0 | 66.4 | G 3/8; 14 | G 1/4; 12.5 |
| PGF1-2X/ | **4.1** LN01VM | R900932131 | 33.4 | 56.7 | 70.1 | G 3/8; 14 | G 3/8; 12.5 |




**1** Through hole for M8 DIN 912 socket-head screw, tightening torque $M_A$ = 25 (+5) Nm
**2** Follower, material no. **R900984336** included in the delivery contents
b = Clamping length

**PGF1-2X/ …** $\frac{R}{L}$ **L01VM** (drive shaft for claw coupling, with through drive); middle or rear pump

| Type | NG | Material no. "R" clockwise | Material no. "L" counter-clockwise | Dimensions a | b | c | d | S | P |
|---|---|---|---|---|---|---|---|---|---|
| PGF1-2X/ | **1.7.** L01VM | R900086165 | R900932093 | 29.6 | 49.1 | 67.2 | 61.1 | G 1/4; 14 | G 1/4; 12.5 |
| PGF1-2X/ | **2.2.** L01VM | R900086166 | R900932094 | 29.6 | 49.1 | 67.2 | 61.1 | G 1/4; 14 | G 1/4; 12.5 |
| PGF1-2X/ | **2.8.** L01VM | R900932138 | R900051293 | 30.7 | 51.4 | 69.4 | 63.4 | G 3/8; 14 | G 1/4; 12.5 |
| PGF1-2X/ | **3.2.** L01VM | R900086168 | R900051294 | 31.5 | 53.0 | 71.0 | 65.0 | G 3/8; 14 | G 1/4; 12.5 |
| PGF1-2X/ | **4.1.** L01VM | R900086169 | R900088913 | 33.4 | 56.7 | 74.7 | 68.7 | G 3/8; 14 | G 3/8; 12.5 |
| PGF1-2X/ | **5.0.** L01VM | R900086170 | R900051295 | 35.2 | 60.4 | 78.4 | 72.4 | G 1/2; 14 | G 3/8; 12.5 |

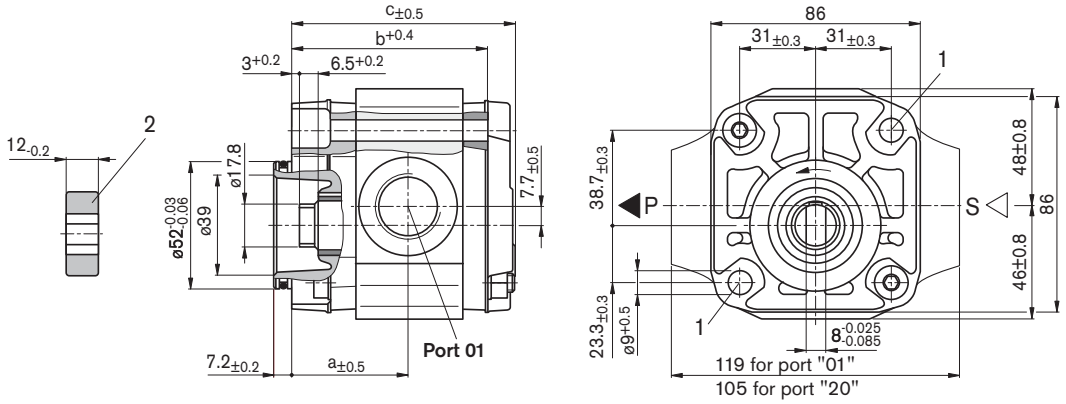



**1** Through hole for M8 DIN 912 socket-head screw, tightening torque $M_A$ = 25 (+5) Nm
**2** Follower, material no. **R900984336** included in the delivery contents
b = Clamping length

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

**PGF2-2X/ ... LN...VM** (drive shaft for claw coupling, without through drive); rear pump

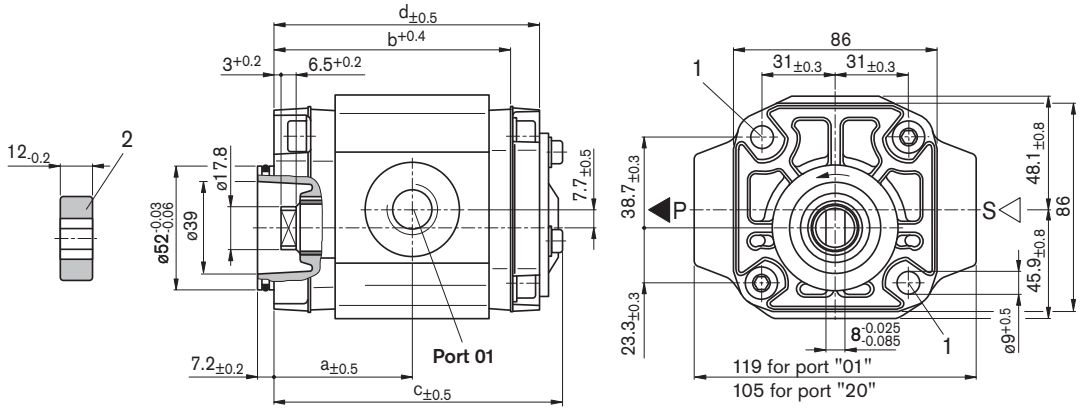
| Type NG | Material no. "L" counter-clockwise | Dimensions a | b | c | S | P |
|---|---|---|---|---|---|---|
| PGF2-2X/ **006** LN01VM | R900563948 | 46 | 76 | 87 | G 3/4; 16 | G 1/2; 14 |
| PGF2-2X/ **008** LN01VM | R900062364 | 47.5 | 79.5 | 90.5 | G 3/4; 16 | G 1/2; 14 |
| PGF2-2X/ **011** LN01VM | R900077364 | 50.5 | 85 | 96 | G 3/4; 16 | G 1/2; 14 |
| PGF2-2X/ **013** LN20VM | R900034010 | 53 | 90 | 101 | ø20, PC ø40[1)] | ø12, PC ø35[1)] |
| PGF2-2X/ **016** LN20VM | R900033354 | 55.5 | 95 | 106 | ø20, PC ø40[1)] | ø12, PC ø35[1)] |
| PGF2-2X/ **019** LN20VM | R900932120 | 58.5 | 101 | 112 | ø20, PC ø40[1)] | ø12, PC ø35[1)] |
| PGF2-2X/ **022** LN20VM | R900081192 | 61.5 | 107 | 118 | ø20, PC ø40[1)] | ø12, PC ø35[1)] |




**1** Through hole for M8 DIN 912 socket-head screw, tightening torque $M_A$ = 25 (+5) Nm
**2** Follower, material no. **R900984336** included in the delivery contents
b = Clamping length

**PGF2-2X/ ... $\frac{R}{L}$ L...VM** (drive shaft for claw coupling, with through drive); middle or rear pump

| Type NG | Material no. "R" clockwise | Material no. "L" counter-clockwise | Dimensions a | b | c | d | S | P |
|---|---|---|---|---|---|---|---|---|
| PGF2-2X/ **006.** L01VM | R900567307 | R900066012 | 46 | 76 | 99 | 89 | G 3/4; 16 | G 1/2; 14 |
| PGF2-2X/ **008.** L01VM | R900563291 | R900070239 | 47.5 | 79.5 | 102.5 | 92.5 | G 3/4; 16 | G 1/2; 14 |
| PGF2-2X/ **011.** L01VM | R900561146 | R900079232 | 50.5 | 85 | 106 | 98 | G 3/4; 16 | G 1/2; 14 |
| PGF2-2X/ **013.** L20VM | R900049570 | R900058674 | 53 | 90 | 113 | 103 | ø20, PC ø40[1)] | ø12, PC ø35[1)] |
| PGF2-2X/ **016.** L20VM | R900064718 | R900983463 | 55.5 | 95 | 118 | 108 | ø20, PC ø40[1)] | ø12, PC ø35[1)] |
| PGF2-2X/ **019.** L20VM | R900932243 | R900983464 | 58.5 | 101 | 124 | 114 | ø20, PC ø40[1)] | ø12, PC ø35[1)] |
| PGF2-2X/ **022.** L20VM | R900932186 | R900983933 | 61.5 | 107 | 130 | 120 | ø20, PC ø40[1)] | ø12, PC ø35[1)] |



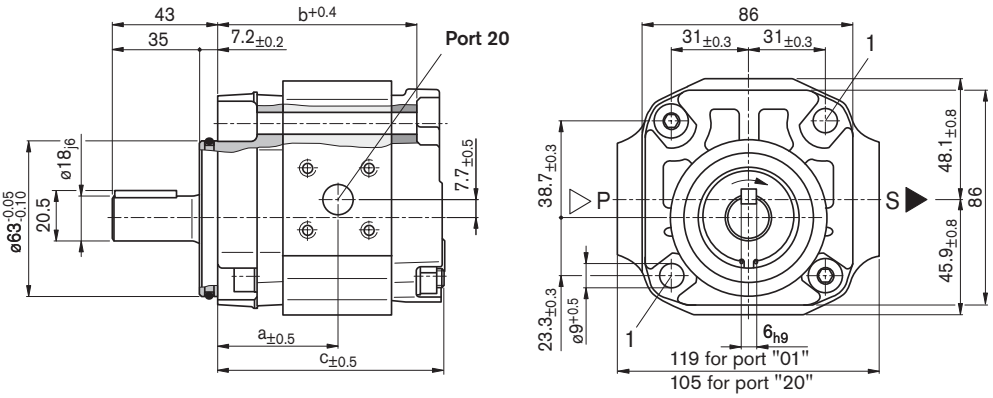

**1** Through hole for M8 DIN 912 socket-head screw, tightening torque $M_A$ = 25 (+5) Nm
**2** Follower, material no. **R900984336** included in the delivery contents
b = Clamping length

1) PC = pitch circle

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

**PGF2-2X/ … RA …VP2** (cylindrical drive shaft, without through drive)

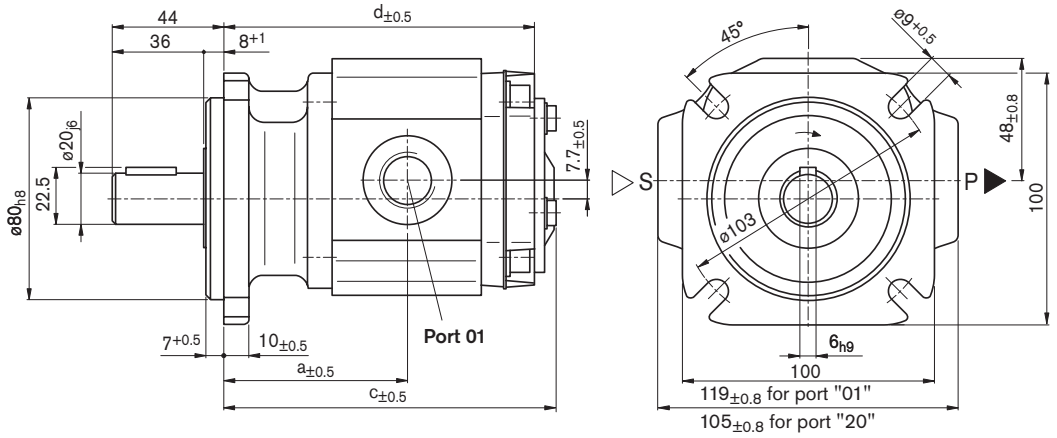
| Type | NG | Material no. "R" clockwise | Dimensions a | b | c | S | P |
|---|---|---|---|---|---|---|---|
| PGF2-2X/ | **006** | RA01VP2 | R900932272 | 46 | 76 | 87 | G 3/4; 16 | G 1/2; 14 |
| PGF2-2X/ | **008** | RA01VP2 | R900564037 | 47.8 | 79.5 | 90.5 | G 3/4; 16 | G 1/2; 14 |
| PGF2-2X/ | **011** | RA01VP2 | R900568523 | 50.5 | 85 | 96 | G 3/4; 16 | G 1/2; 14 |
| PGF2-2X/ | **013** | RA20VP2 | R900032712 | 53 | 90 | 101 | ø20, PC ø40[1)] | ø12, PC ø35[1)] |
| PGF2-2X/ | **016** | RA20VP2 | R900932275 | 55.5 | 95 | 106 | ø20, PC ø40[1)] | ø12, PC ø35[1)] |
| PGF2-2X/ | **019** | RA20VP2 | R900571401 | 58.5 | 101 | 112 | ø20, PC ø40[1)] | ø12, PC ø35[1)] |




**1** Through hole for M8 DIN 912 socket-head screw, tightening torque $M_A$ = 25 (+5) Nm
b = Clamping length

**PGF2-2X/ … RE …VE4** (cylindrical drive shaft, with through drive)

| Type | NG | Material no. "R" clockwise | Dimensions a | c | d | S | P |
|---|---|---|---|---|---|---|---|
| PGF2-2X/ | **006** | RE01VE4 | R900932265 | 63 | 114 | 104 | G 3/4; 16 | G 1/2; 14 |
| PGF2-2X/ | **008** | RE01VE4 | R900932266 | 64.3 | 117.5 | 107.5 | G 3/4; 16 | G 1/2; 14 |
| PGF2-2X/ | **011** | RE01VE4 | R900932271 | 67.5 | 123 | 113 | G 3/4; 16 | G 1/2; 14 |
| PGF2-2X/ | **013** | RE20VE4 | R900943181 | 70 | 128 | 118 | ø20, PC ø40[1)] | ø12, PC ø35[1)] |
| PGF2-2X/ | **016** | RE20VE4 | R900932193 | 72.5 | 133 | 123 | ø20, PC ø40[1)] | ø12, PC ø35[1)] |
| PGF2-2X/ | **019** | RE20VE4 | R900943182 | 75.5 | 139 | 129 | ø26, PC ø55[1)] | ø12, PC ø35[1)] |
| PGF2-2X/ | **022** | RE20VE4 | R900932126 | 78.5 | 144 | 134 | ø26, PC ø55[1)] | ø12, PC ø35[1)] |



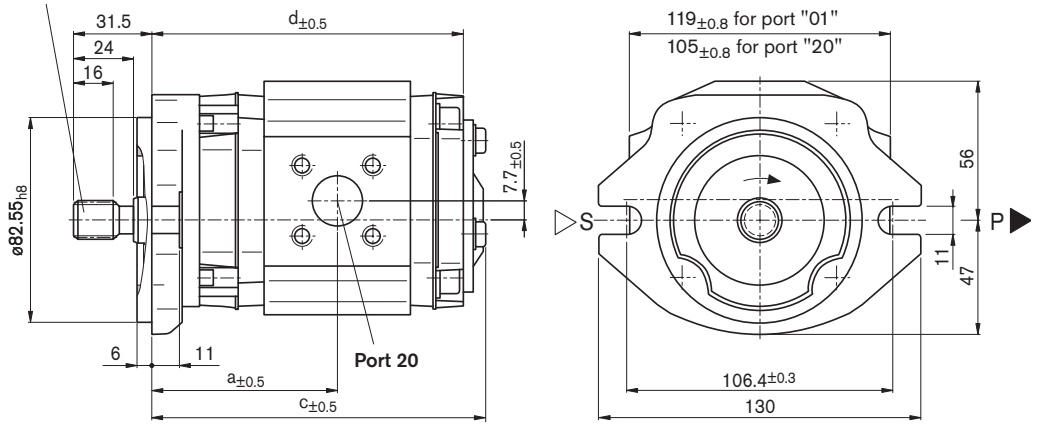

1) PC = pitch circle

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

**PGF2-2X/ ...$^{R}_{L}$J.VU2** (splined drive shaft, with through drive)

| Type | NG | Material no. "R" clockwise | Material no. "L" counter-clockwise | Dimensions a | c | d | S | P |
|---|---|---|---|---|---|---|---|---|
| PGF2-2X/ | **006** RJ01VU2 | R900931660 | R900247697 | 65 | 116 | 106 | G 3/4; 16 | G 1/2; 14 |
| PGF2-2X/ | **008** RJ01VU2 | R900953363 | R900247698 | 67 | 119.5 | 109.5 | G 3/4; 16 | G 1/2; 14 |
| PGF2-2X/ | **011** RJ01VU2 | R900247699 | R900079232 | 69.5 | 125 | 115 | G 3/4; 16 | G 1/2; 14 |
| PGF2-2X/ | **013** RJ20VU2 | R900932264 | R900969259 | 72 | 130 | 120 | ø20, PC ø40[1] | ø12, PC ø35[1] |
| PGF2-2X/ | **016** RJ20VU2 | R900932085 | R900936173 | 74.5 | 135 | 125 | ø20, PC ø40[1] | ø12, PC ø35[1] |
| PGF2-2X/ | **019** RJ20VU2 | R900022882 | R900984300 | 77.5 | 141 | 131 | ø20, PC ø40[1] | ø12, PC ø35[1] |
| PGF2-2X/ | **022** RJ20VU2 | R900054053 | R900935718 | 80.5 | 147 | 137 | ø20, PC ø40[1] | ø12, PC ø35[1] |

Involute spline
SAE J 498 b 9T 16/32 DP[2]



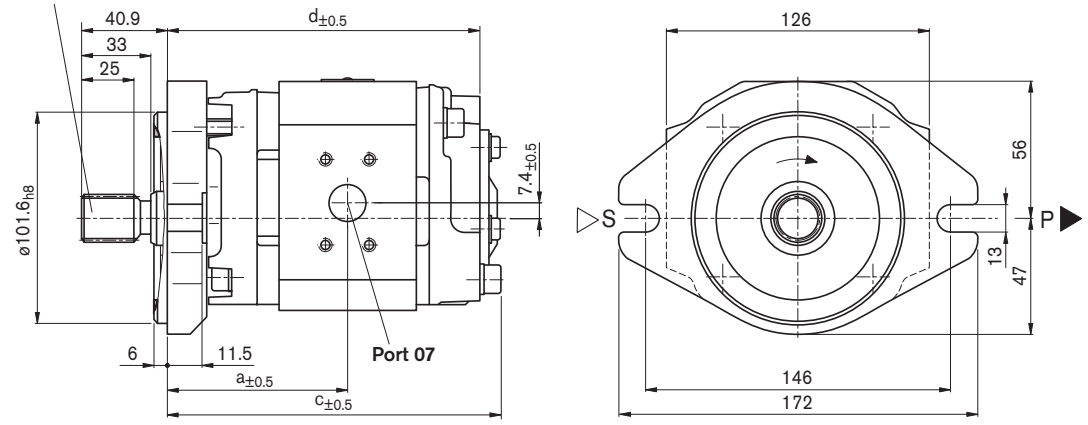

1) PC = pitch circle
2) ANSI B92.1a-1976, 30° pressure angle, flat root, flank centering, tolerance 5

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

**PGF3-3X/ …$^{R}_{L}$ J07VU2** (splined drive shaft, with through drive)

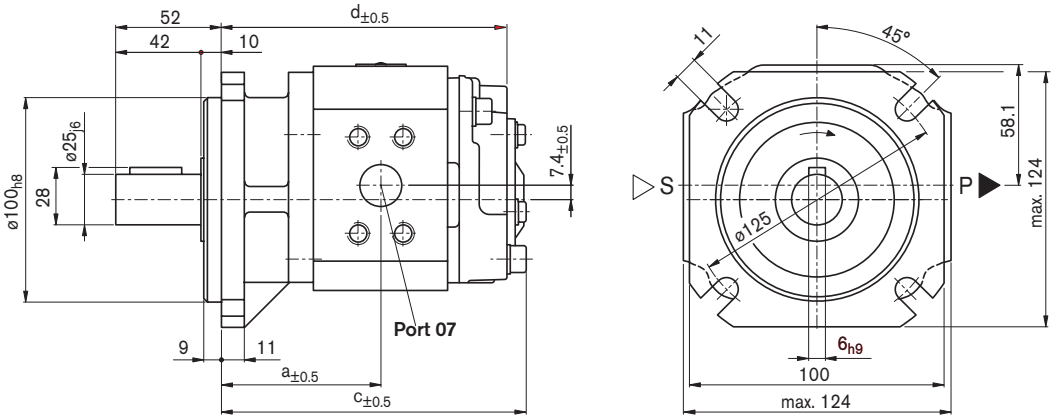
| Type NG | Material no. "R" clockwise | Material no. "L" counter-clockwise | Dimensions a | c | d | S | P |
|---|---|---|---|---|---|---|---|
| PGF3-3X/ **020.** J07VU2 | R900983792 | R900948466 | 79.5 | 144.5 | 134.5 | SAE 1 1/4“ | SAE 3/4“ |
| PGF3-3X/ **025.** J07VU2 | R900950057 | R900568523 | 82.5 | 150.5 | 140.5 | SAE 1 1/4“ | SAE 3/4“ |
| PGF3-3X/ **032.** J07VU2 | R900029561 | R900984213 | 87 | 159.5 | 149.5 | SAE 1 1/4“ | SAE 3/4“ |
| PGF3-3X/ **040.** J07VU2 | R900969266 | R900932275 | 92 | 169.5 | 159.5 | SAE 1 1/4“ | SAE 3/4“ |

Involute spline
SAE J498 b 13T 16/32 DP[1)]




**PGF3-3X/ … RE07VE4** (cylindrical drive shaft, with through drive)

| Type NG | Material no. "R" clockwise | Dimensions a | c | d | S | P |
|---|---|---|---|---|---|---|
| PGF3-3X/ **020** RE07VE4 | R900063299 | 71 | 136 | 126 | SAE 1 1/4“ | SAE 3/4“ |
| PGF3-3X/ **025** RE07VE4 | R900932088 | 74 | 142 | 132 | SAE 1 1/4“ | SAE 3/4“ |
| PGF3-3X/ **032** RE07VE4 | R900932112 | 78.5 | 151 | 141 | SAE 1 1/4“ | SAE 3/4“ |
| PGF3-3X/ **040** RE07VE4 | R900932111 | 83.5 | 161 | 151 | SAE 1 1/4“ | SAE 3/4“ |

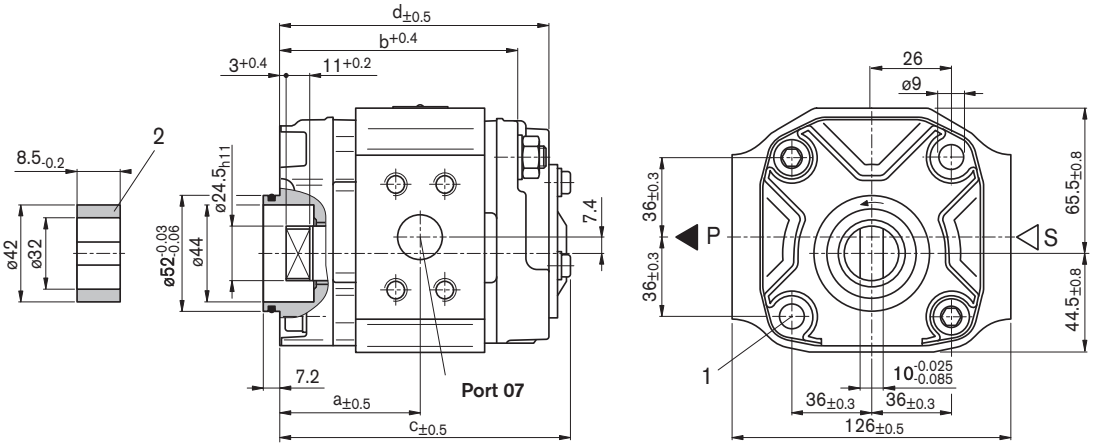



1) ANSI B92.1a-1976, 30° pressure angle, flat root, flank centering, tolerance 5

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

**PGF3-3X/ ...$^{R}_{L}$ L07VM** (drive shaft for claw coupling, with through drive), middle or rear pump

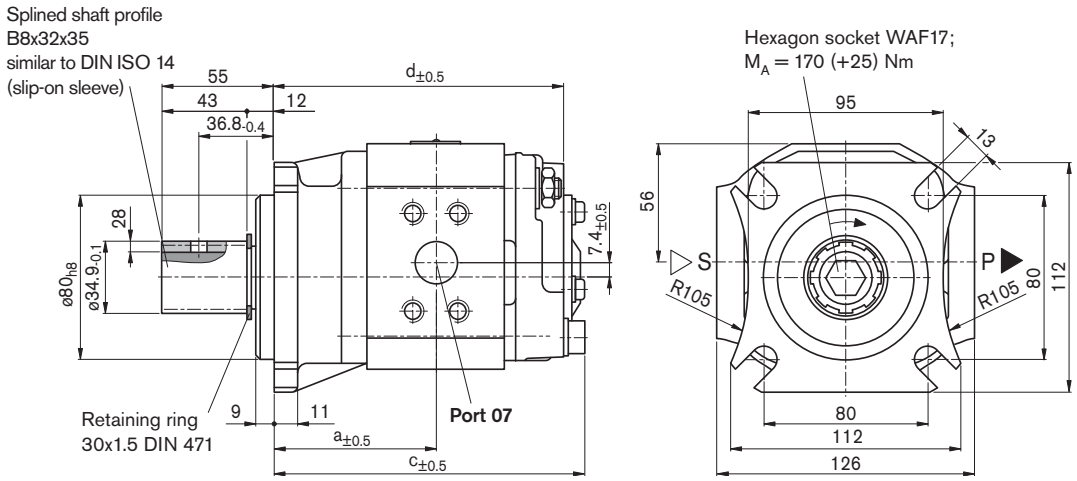
| Type | NG | Material no. "R" clockwise | Material no. "L" counter-clockwise | Dimensions a | b | c | d | S | P |
|---|---|---|---|---|---|---|---|---|---|
| PGF3-3X/ | **020.** L07VM | R900073539 | R900758721 | 60.5 | 101.5 | 125.5 | 115.5 | SAE 1 1/4“ | SAE 3/4“ |
| PGF3-3X/ | **025.** L07VM | R900932121 | R900960119 | 63.5 | 107.5 | 131.5 | 121.5 | SAE 1 1/4“ | SAE 3/4“ |
| PGF3-3X/ | **032.** L07VM | R900074369 | R900034370 | 68 | 116.5 | 140.5 | 130.5 | SAE 1 1/4“ | SAE 3/4“ |
| PGF3-3X/ | **040.** L07VM | R900083281 | R900058224 | 73 | 126.5 | 150.5 | 140.5 | SAE 1 1/4“ | SAE 3/4“ |




**1** Through hole for M10 DIN 912 socket-head screw; tightening torque $M_A$ = 49 (+5) Nm
**2** Follower, material no. **R900984336** included in the delivery contents
b = Clamping length

**PGF3-3X/ ...$^{R}_{L}$ O07VK4** (conical drive shaft, with through drive)

| Type | NG | Material no. "R" clockwise | Material no. "L" counter-clockwise | Dimensions a | c | d | S | P |
|---|---|---|---|---|---|---|---|---|
| PGF3-3X/ | **020.** O07VK4 | R900969302 | R900619706 | 71 | 136.5 | 126 | SAE 1 1/4“ | SAE 3/4“ |
| PGF3-3X/ | **025.** O07VK4 | R900943169 | R900619710 | 74 | 142.5 | 132 | SAE 1 1/4“ | SAE 3/4“ |
| PGF3-3X/ | **032.** O07VK4 | R900943168 | R900943167 | 78.5 | 151.5 | 141 | SAE 1 1/4“ | SAE 3/4“ |



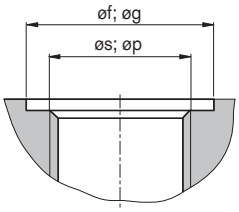
## Suction and pressure ports (nominal dimensions in mm)

**PGF1, port type 01**
**Pipe thread according to ISO 228/1**

| | Suction port dimensions | | Pressure port dimensions | |
|---|---|---|---|---|
| NG | s | f | p | g |
| 1.7 | G 1/4; 14 | 23 | G 1/4; 12.5 | 23 |
| 2.2 | G 1/4; 14 | 23 | G 1/4; 12.5 | 23 |
| 2.8 | G 3/8; 14 | 26 | G 1/4; 12.5 | 23 |
| 3.2 | G 3/8; 14 | 26 | G 1/4; 12.5 | 23 |
| 4.1 | G 3/8; 14 | 26 | G 3/8; 12.5 | 26 |
| 5.0 | G 1/2; 14 | 27 | G 3/8; 12.5 | 26 |

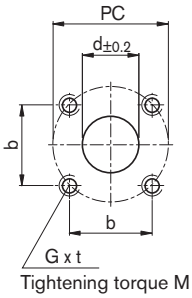
**PGF2, port type 01**
**Pipe thread according to ISO 228/1**

| | Suction port dimensions | | Pressure port dimensions | |
|---|---|---|---|---|
| NG | s | f | p | g |
| 006 | G 3/4; 16 | 35 | G 1/2; 14 | 35 |
| 008 | G 3/4; 16 | 35 | G 1/2; 14 | 35 |
| 011 | G 3/4; 16 | 35 | G 1/2; 14 | 35 |
| 013 | G 3/4; 16 | 35 | G 1/2; 14 | 35 |
| 016 | G 1; 18 | 40 | G 1/2; 14 | 35 |
| 019 | G 1; 18 | 40 | G 1/2; 14 | 35 |
| 022 | G 1; 18 | 40 | G 1/2; 14 | 35 |




**PGF2, port type 20 square flange port**

| | Suction port dimensions | | | | | | Pressure port dimensions | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NG | d | b | PC | Thread | t | M in Nm | d | b | PC | Thread | t | M in Nm |
| 006 | 20 | 28.3 | 40 | M6 | 10 | 10 | 12 | 24.8 | 35 | M6 | 12 | 10 |
| 008 | 20 | 28.3 | 40 | M6 | 10 | 10 | 12 | 24.8 | 35 | M6 | 12 | 10 |
| 011 | 20 | 28.3 | 40 | M6 | 10 | 10 | 12 | 24.8 | 35 | M6 | 12 | 10 |
| 013 | 20 | 28.3 | 40 | M6 | 10 | 10 | 12 | 24.8 | 35 | M6 | 12 | 10 |
| 016 | 20 | 28.3 | 40 | M6 | 10 | 10 | 12 | 24.8 | 35 | M6 | 12 | 10 |
| 019 | 26 | 38.9 | 55 | M8 | 12 | 25 | 12 | 24.8 | 35 | M6 | 12 | 10 |
| 022 | 26 | 38.9 | 55 | M8 | 12 | 25 | 12 | 24.8 | 35 | M6 | 12 | 10 |



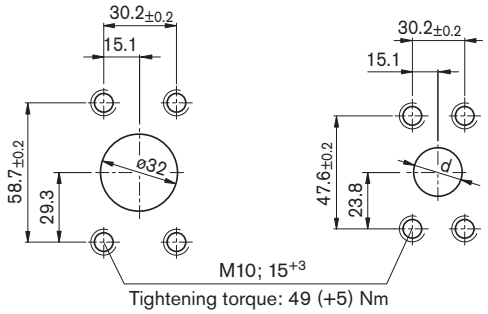

**PGF3, port type 20 square flange port**

| | Suction port dimensions | | | | | | Pressure port dimensions | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NG | d | b | PC | Thread | t | M in Nm | d | b | PC | Thread | t | M in Nm |
| 020 | 26 | 38.9 | 55 | M8 | 12 | 25 | 12 | 24.8 | 35 | M6 | 10 | 10 |
| 025 | 26 | 38.9 | 55 | M8 | 12 | 25 | 12 | 24.8 | 35 | M6 | 10 | 10 |
| 032 | 26 | 38.9 | 55 | M8 | 12 | 25 | 20 | 38.9 | 55 | M8 | 12 | 25 |
| 040 | 26 | 38.9 | 55 | M8 | 12 | 25 | 26 | 38.9 | 55 | M8 | 12 | 25 |

**PGF3, port type 07 SAE flange port**

| Suction port SAE 1 1/4" S | Pressure port SAE 3/4" S |
|---|---|

| NG | d |
|---|---|
| 020 | 16 |
| 025 | 16 |
| 032 | 20 |
| 040 | 20 |



## Multiple pumps – ordering code

| P3 | GF2/022 | + | GF2/011 | + | GF1/2.8 | R | E | 20 | + | 20 | + | 01 | E4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

- Internal gear pumps (e.g.) Double = **P2** Triple = **P3**
- Series of first pump
- Size of first pump
- Series of second pump
- Size of second pump
- Series of third pump
- Size of third pump
- Direction of rotation
- Shaft variant of first pump
- Line port of first pump
- Line port of second pump
- Line port of third pump
- Mounting flange of first pump

## Multiple pumps – engineering notes

- The same general technical data apply as for single pumps (see pages 4 and 5).
- Combined pumps must all have the same direction of rotation.
- The pump that is subjected to the greatest loads should be the first pump.
- The engineer must verify the maximum through-drive torque for every application. This also applies for existing (coded) multiple pumps.

Maximum **drive torques** in Nm

| Shaft | N | L | A | E | J |
|---|---|---|---|---|---|
| **PGF1** | 14 | 14 | 30 | 30 | – |
| **PGF2** | 70 | 70 | 70 | 140 | 140 |
| **PGF3** | 140 | 140 | – | 230 | 230 |

- Common suction is **not** possible.
- For reasons of strength and stability, we recommend the use of ISO 4-hole mounting flanges to VDMA "E4" for combinations of three or more pumps

### Selection

- The front pump must have shaft version E, J or L.
- The middle pump must have shaft version L.
- The rear pump must have shaft version N.
- If a pump of the next smaller frame size is to be mounted, the designation of the first pump must end with "K" (e.g., PGF3 + PGF2 ⇒ front pump: PGF3-3X/032RJ07VU2**K**)

- The drive torque of a pump stage is 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

Maximum **output torques** in Nm

| Shaft | L | E | J |
|---|---|---|---|
| **PGF1** | 14 | 14 | – |
| **PGF2** | 70 | 70 | 70 |
| **PGF3** | 140 | 140 | 140 |

- Before operating pump combinations with different media, please consult Rexroth Hydraulics.
- PGF combinations are assembled without combination parts.
- The pumps are not sealed from each other.

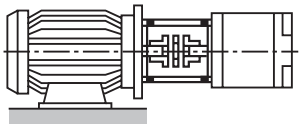
### Dimensions

- The dimensions of the ports are the same as for single pumps (see page 18).
- The total length of the pump combination is calculated by adding up dimensions "d" of the single pumps (see pages 9 to 17).
- With the combination of PGF2 and PGF1, the installation length of the PGF2 (dimension d) increases by 4.5 mm. With the combination of PGF3 and PGF2, the installation length of the PGF3 (dimension d) increases by 2 mm. With the combination of PGF3 and PGF1, the installation length of the PGF3 (dimension d) increases by 12.5 mm.

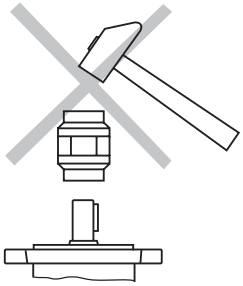
## Installation instructions

### Drive

Electric motor + pump support + coupling + pump

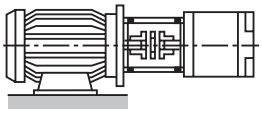


- No radial or axial forces permissible on the pump drive shaft!
- Motor and pump must be exactly aligned!
- Always use a coupling that is suitable for compensating shaft offsets!
- When installing the coupling, avoid axial forces, i.e., **when installing, do not hammer or press the coupling onto the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

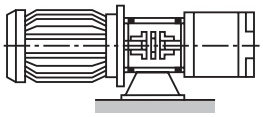


### Installation positions

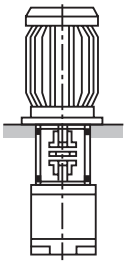
**B3**



**B5**



**V1**



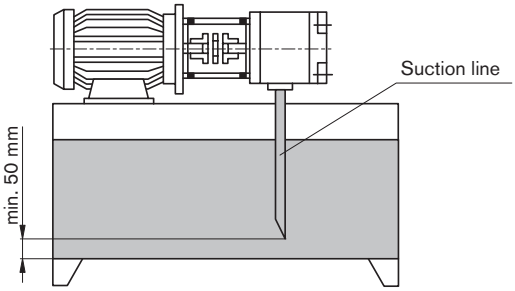
### Fluid tank

- Adjust the usable capacity of the tank to the operating conditions
- The permissible fluid temperature must not be exceeded; provide a cooler if necessary

### Lines and ports

- Remove protective plug from the pump
- We recommend the use of seamless, precision steel pipes according to DIN 2391 and detachable pipe connections
- Select the clear width of pipes according to the ports (suction speed 0.6 to 1.2 m/s)
- For inlet pressure, see pages 4 and 5
- Thoroughly clean pipelines and fittings prior to installing

### Recommendation for piping




- **Under no circumstances** returning fluid may be reaspired directly, i.e., select the largest possible distance between suction line and return line
- The return drain must always be below the oil level
- Ensure suction-tight installation of the pipelines

### Filters

- If possible, use return-line filter or pressure filters. (Only use suction filters in combination with underpressure switch/contamination indicator)

### Hydraulic fluid

- Please observe our specification according to data sheet RE90220
- We recommend the use of name-brand hydraulic fluids
- Different oil types must not be mixed together as this may result in decomposition and deterioration of the lubricity
- The hydraulic fluid must be changed at certain intervals depending on the operating conditions. This involves cleaning residues from the fluid tank.

## 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 the direction of rotation of the motor for compliance with the direction of rotation according to the pump type.

**Air bleeding**
- Open the air bleeding port on the system by hand or change over to circulation at zero pressure in accordance with the instruction manual of the system. During air bleeding, the pressureless transportation of entrapped air must be ensured.
- To air bleed the pump, briefly switch the motor on and then switch it immediately off again (inching mode). Repeat this process until it is ensured that the pump has been completely air bled.
- Close the open air bleeding ports by hand..

**Commissioning**
- Once it is ensured that the pump has been completely air bled, switch on the motor. Let the pump run at zero pressure until the system is completely air bled. For air bleeding the system, observe the instruction manual for the system.
- Commission the system according to the instruction manual and let the pump run under load.
- After some time in operation, check the hydraulic fluid in the reservoir for bubbles or the formation of foam on the surface.

**Operation**
- During operation, take note of changes in the noise emissions. A slight increase in the noise level is normal due to warming up of the operating medium. A significant increase in the noise level or brief, stochastic changes in the noise characteristics may indicate the aspiration of air. If the suction pipes are too short or the fill level of the operating medium is too low, air can also be aspired via a vortex.
- Changes in operating speeds, temperatures, increase in the noise level or power consumption indicate wear or damage to the system or pump.

**Recommissioning**
- Inspect the pump and system for leakage. Loss of oil indicates leakage below the hydraulic fluid level. An increased hydraulic fluid level in the reservoir indicates leakage above the hydraulic fluid level.
- If the pump is arranged above the hydraulic fluid level, the pump can drain due to leakages, for example due to a worn-out shaft seal ring. In this case, air bleeding is again required during recommissioning. Have the damage repaired.
- Air bleeding must again be performed following repair and maintenance work.
- Switch on the motor when the system is in flawless condition.

**General**
- Pumps delivered by us are tested for function and performance. No changes of any nature may be made to the pump; the warranty is otherwise rendered void!
- Repairs may only be carried out by the manufacturer or his authorized dealers and subsidiaries. Repairs carried out by the customer are not covered by any warranty.

**⚠ Important notes**
- Installation, maintenance and repair of the pump may only be carried out by authorized, trained and instructed personnel!
- The pump may only be operated at the permissible data (see pages 4 and 5)!
- The pump may only be operated when in perfect condition!
- During all work on the pump, depressurize the system!
- Unauthorized conversions or changes that affect safety and function are not permissible!
- Mount safety devices (e.g., coupling protection) and do not remove any existing safety devices and equipment!
- Always ensure the proper fit of all mounting bolts! (Observe specified tightening torque!)
- The generally valid safety and accident prevention regulations must be observed!

## Engineering notes

When using internal gear pumps, provide an additional manual, switchable or automatic air bleeding option. The air bleeding point for manual air bleeding must be provided in the pressure line upstream of the first valve or check valve to ensure air bleeding can be performed at zero pressure.

### Technical data

All technical data given are dependent on manufacturing tolerances and are valid with certain boundary conditions.

Note that certain deviations are therefore possible and that technical data may vary when boundary conditions (e.g., viscosity) change.

### Characteristic curves

When dimensioning the drive motor, observe the maximum possible application data on the basis of the characteristic curves shown on pages 6 to 8.

### Sound pressure level

The values for sound pressure level shown on pages 6 to 8 were measured on the basis of DIN 45635, sheet 26. This means that only the noise emitted by the pump is shown. Ambient influences (installation site, piping etc.) were not taken into account.

These values always refer to only one pump.

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

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

### Pump combinations

Internal gear pumps of the PGF series can be combined to form multiple pumps. In this case, please observe the permissible through-drive torques (see engineering aid for multiple pumps). The hydraulic fluid of the respective pump stages is not separated by shaft seals.

**Caution!**
The operation of multiple pumps with different hydraulic fluids is only possible after consultation.