Rexroth
Bosch Group

Internal gear pump, fixed displacement

RE 10229/12.11 1/12

Type PGM

Frame size 4 and 5
Component series: 3X
Maximum operating pressure 210 bar
Maximum displacement volume 125 cm^3

Table of contents

Features

- Fixed displacement
- Low operating noise
- Little flow pulsation
- High efficiency also at low speed and viscosity due to sealing gap compensation
- Suitable for broad viscosity and speed ranges
- Use:
  For variable speed drives with a large number of load cycles, e.g. plastics processing machines

Information on available spare parts:
www.boschrexroth.com/spc

Ordering code: Single pumps

PG	M	–3X/						*

Series
Medium pressure pump **= M**

Frame size
Frame size 4 **= 4**
Frame size 5 **= 5**

Component series: Component series 30 to 39 (30 to 39: Unchanged installation and connection dimensions) **= 3X**

Size	Size	Displacement/rotation	
Frame size 4	25	25.30 cm³	**= 025**
	32	32.70 cm³	**= 032**
	40	40.10 cm³	**= 040**
	50	50.70 cm³	**= 050**
	63	64.70 cm³	**= 063**
Frame size 5	80	81.40 cm³	**= 080**
	100	100.20 cm³	**= 100**
	125	125.30 cm³	**= 125**

R = **Direction of rotation** (looking at the shaft end) Clockwise

A = **Shaft design** Cylindrical

11 = **Line connection** [1] SAE flange high pressure series

V = **Seal material** FKM seals

U2 = **Type of connection** SAE 2-hole mounting flange

Further details in the plain text

[1] The suction ports have all been designed in standard pressure series (dimensions see page 8).

Please select the desired pump using the selection tables (pages 6 and 7) or after consultation with Bosch Rexroth.

Preferred types PGM4-3X	
Type	Material no.
PGM4-3X/025RA11VU2	R901283398
PGM4-3X/032RA11VU2	R901283399
PGM4-3X/040RA11VU2	R901283400
PGM4-3X/050RA11VU2	R901283401
PGM4-3X/063RA11VU2	R901283402

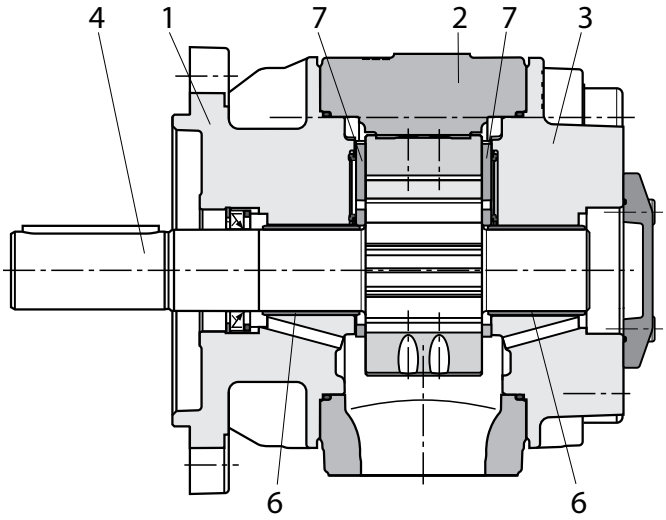
Preferred types PGM5-3X	
Type	Material no.
PGM5-3X/080RA11VU2	R901283403
PGM5-3X/100RA11VU2	R901283404
PGM5-3X/125RA11VU2	R901283405

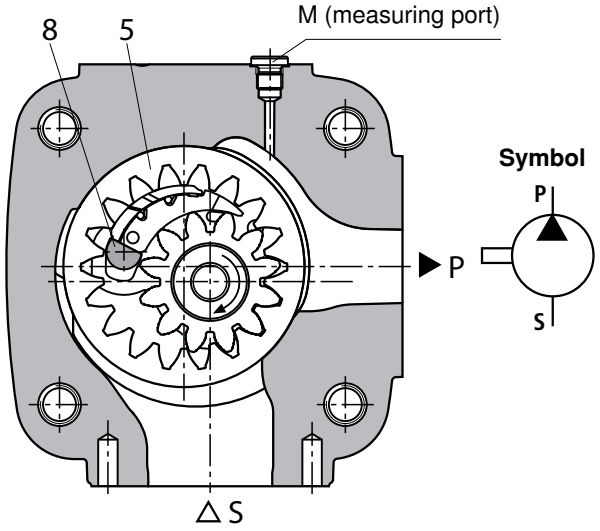
Function, section, symbol

Set-up

Hydraulic pumps of type PGM.-3X are gap-compensated internal gear pumps with constant displacement.

They basically comprise of: Mounting flange (1), housing (2), cover (3), pinion shaft (4), internal gear (5), plain bearings (6), axial washers (7) and stop pin (8) as well as the radial compensation consisting of segment (9), segment support (10) and the seal rolls (11).





Suction and displacement procedure

The hydrodynamically mounted pinion shaft (4) drives the toothed internal gear (5) in the direction of rotation shown.

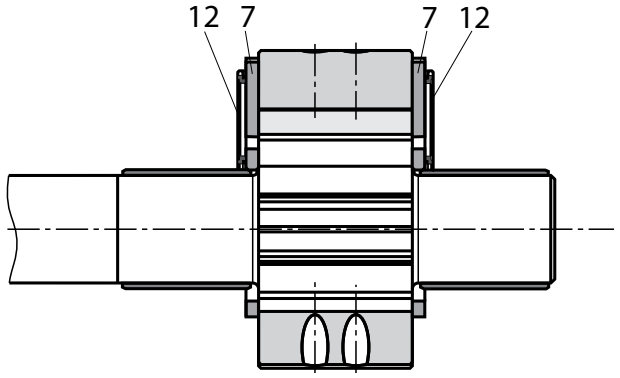
The tooth clearances opening in the suction range suck in the hydraulic fluid. The hydraulic fluid is transported inside the tooth clearances of pinion and internal gear, from the suction range (S) into the pressure range (P).

There, the hydraulic fluid is displaced from the closing tooth clearances and delivered into the pressure port (P).

Suction and pressure range are separated by the radial compensation elements (9 to 11) and the tooth engagement between internal gear and pinion shaft.

Axial compensation

The displacement chamber in the pressure range is axially sealed by axial washers (7).

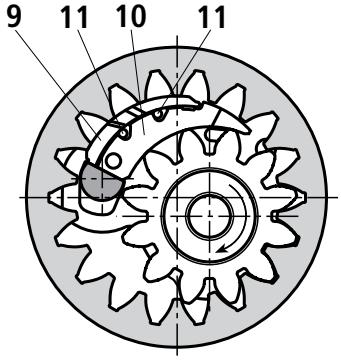


To the sides of the axial washers facing away from the displacement area a pressure field (12) is applied. These fields balance the axial washers vis-à-vis the displacement area, which results in a perfect sealing with low mechanical losses.

Radial compensation

The radial compensation elements consist of segment (9), segment support (10) and seal rolls (11).

Segment (9) and segment support (10) are arranged in the pressure field so that the resulting compressive force is basically accepted by the stop pin.



A small compressive force component presses segment and segment support onto the tooth tips of pinion shaft and internal gear and in this way provides for the separation of the pressure range from the suction range with automatic clearance adjustment.

This is the prerequisite for constantly high volumetric efficiency during the entire operating time.

The clearance adjustment of segment and segment support is made possible by the seal rolls located inbetween.

Hydrodynamic and hydrostatic mounting

The pinion shaft (4) is accepted by hydrodynamically lubricated radial plain bearings (6).

The internal gear (5) 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.

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

general

Design	Internal gear pump, gap-compensated
Type of connection	SAE 2-hole flange according to ISO 3019-1
Line connection	Flange port
Shaft load	Radial and axial forces (e.g. belt pulley) **only** after coordination
Direction of rotation (looking at the shaft end)	Clockwise

hydraulic

Hydraulic fluid		HLP mineral oil according to DIN 51524 part 2 **Please observe our specifications according to data sheet RE 90220**
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 (to n = 1800 min^{-1}) 10 to 100 (to n = 3000 min^{-1}) 2000 admissible start viscosity (400 to 1800 min^{-1})
Max. admissible degree of contamination of the hydraulic fluid Cleanliness class according to ISO 4406 (c)		Class 20/18/15 [1)]

[1)] 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 service life of the components. For the selection of filters, see data sheets RE 50070, RE 50076, RE 50081, RE 50086, and RE 50088.

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

Frame size	Frame size		PGM4				
Size	Size		25	32	40	50	63
Weight	m	kg	14.5	15	16	17	18
Speed range	n_{min}	min^{-1}	200	200	200	200	200
	n_{max}	min^{-1}	3000	3000	3000	3000	3000
Displacement	V	cm^3	25.3	32.7	40.1	50.7	65.5
Flow[1]	q_V	l/min	36.3	46.9	57.6	72.8	94.0
Weight moment of inertia (around drive axis)	J	kgm^2	0.00044	0.00055	0.00066	0.00081	0.00102
Power consumption min. required drive power (with p ≈ 1 bar)	P_{zu}	kW	1.1	1.1	1.1	1.5	1.5
Operating pressure, absolute – Input	p	bar	0.8 to 2 (shortly, upon start 0.6 bar)				
Nominal pressure	p_N						
– Output, permanent	p_N		175				
intermittent [2]	p_{max}	bar	210				

Frame size	Frame size		PGM5		
Size	Size		80	100	125
Weight	m	kg	43.5	45.5	48
Speed range	n_{min}	min^{-1}	200	200	200
	n_{max}	min^{-1}	3000	3000	3000
Displacement	V	cm^3	81.4	100.2	125.3
Flow[1]	q_V	l/min	116.9	143.8	179.8
Weight moment of inertia (around drive axis)	J	kgm^2	0.00289	0.00329	0.00407
Power consumption min. required drive power (with p ≈ 1 bar)	P_{zu}	kW	2.2	3	4
Operating pressure, absolute – Input	p	bar	0.8 to 2 (shortly, upon start 0.6 bar)		
Nominal pressure					
– Output, permanent	p_N	bar	175		
intermittent [2]	p_{max}	bar	210		

[1] Measured with n = 1450 min^{-1}, p = 10 bar and = 30 mm^2/s

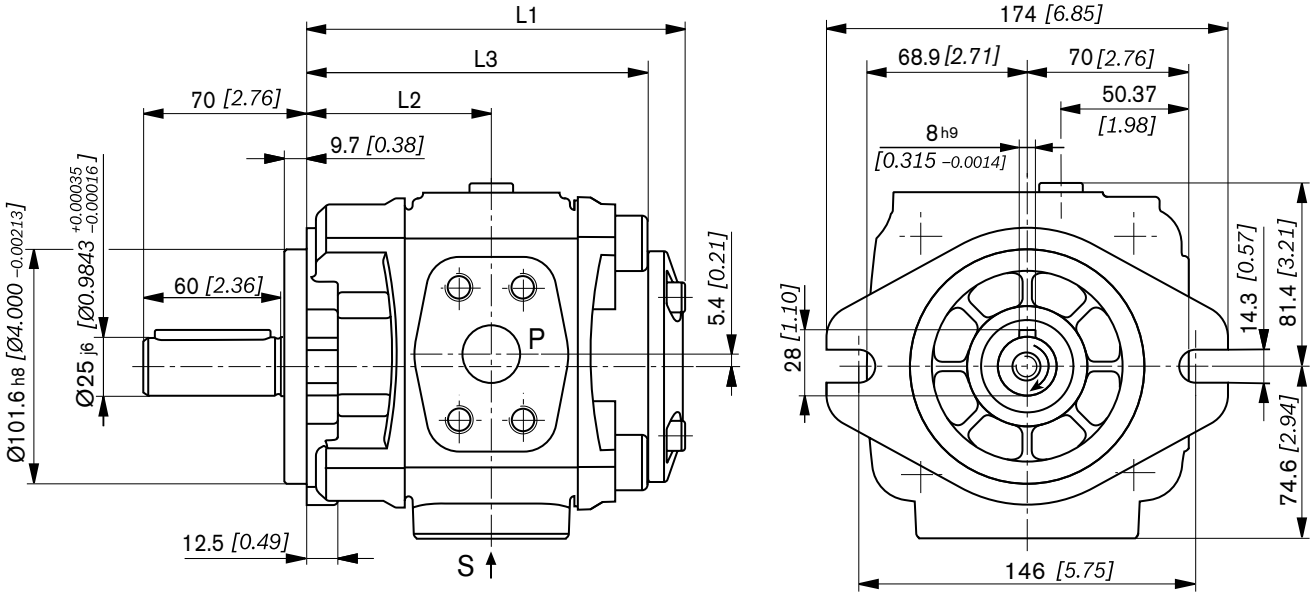
[2] Max. 10 s, max. 50 % of the duty cycle

Unit dimensions of size 4 (dimensions in mm *[inch]*)

PGM4-3X/...RA...VU2

Drive shaft cylindrical, SAE 2-hole mounting flange

Type **Size**	Material no.	**L1**	**L2**	**L3**	**S**[1)]	**P**[1)]
PGM4-3X/025RA11VU2	R901283398	150 *[5.91]*	73 *[2.87]*	134 *[5.28]*	1 1/4" S	3/4" H
PGM4-3X/032RA11VU2	R901283399	157 *[6.18]*	76.5 *[3.01]*	141 *[5.55]*	1 1/2" S	1" H
PGM4-3X/040RA11VU2	R901283400	164 *[6.46]*	80 *[3.15]*	148 *[5.83]*	1 1/2" S	1" H
PGM4-3X/050RA11VU2	R901283401	174 *[6.85]*	85 *[3.35]*	158 *[6.22]*	2" S	1" H
PGM4-3X/063RA11VU2	R901283402	188 *[7.40]*	92 *[3.62]*	172 *[6.77]*	2" S	1 1/4" H



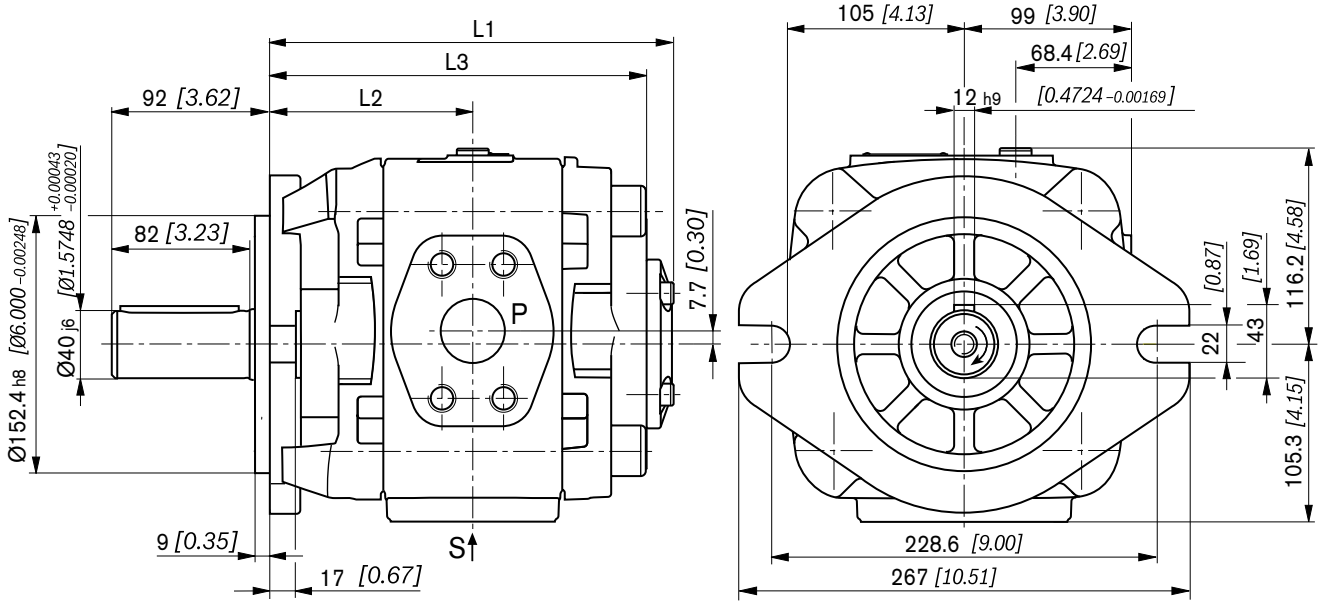
[1)] S = standard pressure series, H = high pressure series;
exact dimensions see table page 8

Unit dimensions of size 5 (dimensions in mm *[inch]*)

PGM5-3X/...RA...VU2

Drive shaft cylindrical, SAE 2-hole mounting flange

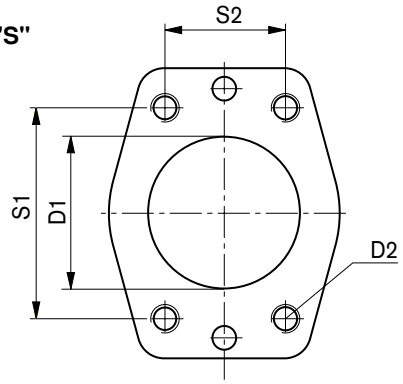
Type Size	Material no.	L1	L2	L3	S[1)]	P[1)]
PGM5-3X/080RA11VU2	R901283403	218 *[8.58]*	109.5 *[4.31]*	202 *[7.95]*	2" S	1 1/4" H
PGM5-3X/100RA11VU2	R901283404	227 *[8.94]*	114 *[4.49]*	211 *[8.31]*	2 1/2" S	1 1/2" H
PGM5-3X/125RA11VU2	R901283405	239 *[9.41]*	120 *[4.72]*	223 *[8.78]*	2 1/2" S	1 1/2" H



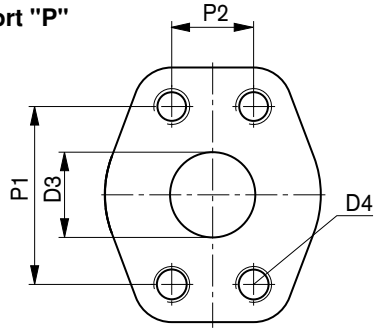
1) S = standard pressure series, H = high pressure series;
exact dimensions see table page 8

Ports (dimensions in mm *[inch]*)

Suction port "S"

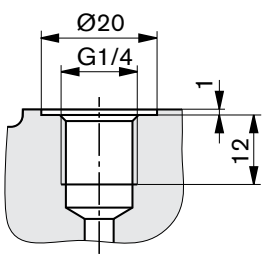


Pressure port "P"

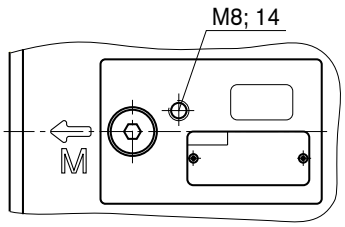


Frame size	Size	Porting pattern / suction port S	D1	D2	S1	S2	Porting pattern / pressure port P	D3	D4	P1	P2
4	**025**	1 1/4" 4000 PSI	Ø32 *[Ø1.260]*	M10; 18	58.7 *[2.311]*	30.2 *[1.189]*	3/4" 6000 PSI	Ø19 *[Ø0.748]*	M10; 18	50.8 *[2.000]*	23.8 *[0.937]*
	032	1 1/2" 3000 PSI	Ø38 *[Ø1.496]*	M12; 21	69.9 *[2.752]*	35.7 *[1.406]*	1" 6000 PSI	Ø25.4 *[Ø1.000]*	M12; 23	57.2 *[2.252]*	27.8 *[1.094]*
	040	1 1/2" 3000 PSI	Ø38 *[Ø1.496]*	M12; 21	69.9 *[2.752]*	35.7 *[1.406]*	1" 6000 PSI	Ø25.4 *[Ø1.000]*	M12; 23	57.2 *[2.252]*	27.8 *[1.094]*
	050	2" 3000 PSI	Ø51 *[Ø2.008]*	M12; 21	77.8 *[3.063]*	42.9 *[1.689]*	1" 6000 PSI	Ø25.4 *[Ø1.000]*	M12; 23	57.2 *[2.252]*	27.8 *[1.094]*
	063	2" 3000 PSI	Ø51 *[Ø2.008]*	M12; 21	77.8 *[3.063]*	42.9 *[1.689]*	1 1/4" 6000 PSI	Ø32 *[Ø1.260]*	M12; 20	66.6 *[2.622]*	31.8 *[1.252]*
5	**080**	2" 3000 PSI	Ø51 *[Ø2.008]*	M12; 21	77.8 *[3.063]*	42.9 *[1.689]*	1 1/4" 6000 PSI	Ø32 *[Ø1.260]*	M12; 21	66.6 *[2.622]*	31.8 *[1.252]*
	100	2 1/2" 2500 PSI	Ø64 *[2.520]*	M12; 23	88.9 *[3.500]*	50.8 *[2.000]*	1 1/2" 6000 PSI	Ø38 *[Ø1.496]*	M16; 30	79.3 *[3.122]*	36.5 *[1.437]*
	125	2 1/2" 2500 PSI	Ø64 *[2.520]*	M12; 23	88.9 *[3.500]*	50.8 *[2.000]*	1 1/2" 6000 PSI	Ø38 *[Ø1.496]*	M16; 30	79.3 *[3.122]*	36.5 *[1.437]*

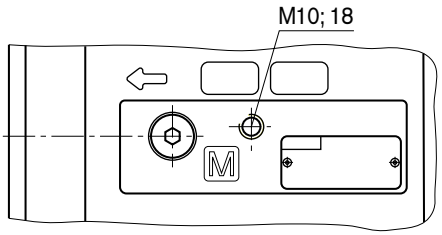
Measuring port PGM4-3X/... and PGM5-3X/...



Transport thread PGM4-3X/...



Transport thread PGM5-3X/...



Project planning information

1. General notes:

This project planning information refers to the specific properties of the Rexroth PGM.-3X internal gear pump.

Comprehensive general information and suggestions are contained in the hydraulics trainer, edition 3 "Project planning information and design of hydraulic systems", RE 00281.

1.1 Intended use

Rexroth internal gear pumps are intended for the set-up of hydraulic drive systems in mechanical engineering and plant construction. During project planning, the basic principles of the EU Machinery Directive or comparable national regulations outside the EU have to be observed.

They must not be used in explosive environments in accordance with directive 94/9/EC (ATEX).

1.2 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 boundary 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 (pages 4, 5) is possible to a certain extent, however, this requires the explicit written approval by Bosch Rexroth.

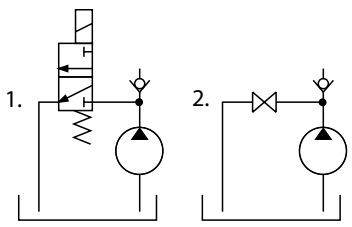
2. Hydraulic project planning

2.1 Bleeding option for commissioning

For Rexroth internal gear pumps PGM.-3X, a manual or switchable bleeding option for the initial start-up or any recommissioning after maintenance and repair works is to be provided. As bleeding point, you can use the measurement port (M) located at the pump. Otherwise, the bleeding point has to be put into the pressure line in front of the first valve or check valve. Bleeding may only be effected with a maximum counter pressure of 0.2 bar.

Examples of bleedings circuits:

1. Switchable bleeding
2. Manually operated bleeding



2.2 Suction line

The line cross-sections have to be dimensioned for the designed flows in a manner that an ideal suction speed of 0.6 to 1.2 m/s is achieved on average. The suction speed must not exceed a maximum value of 2 m/s.

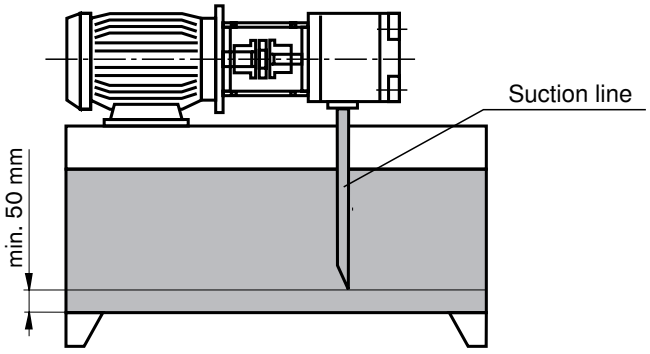
The suction cross-sections at the pump itself are designed for the maximum flow and can therefore only be used as reference. In case of continuous operation with speeds lower than the admissible maximum speed, the suction tube diameter is to be dimensioned smaller than the suction port of the pump in 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 (0.8 to 2 bar abs.)! Bends and the combination of the suction pipes of several pumps are to be avoided. If suction filters have 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 hose as regards to the external air pressure.

The immersion depth of the suction pipe should be as large as possible. Depending on the internal tank pressure, the viscosity of the hydraulic fluid and the flow ratios within the tank, no vortex must be formed even during maximum flow. Otherwise, there is the risk that air is sucked in.

We recommend selecting suction tubes according to AB 23-03.



Project planning information

2.3 Pressure line

With pressure lines, sufficient bursting protection of the tubes, hoses and connection elements has to be ensured. The cross-sections should be based on the maximum flow in order to avoid additional excessive load of the pump due to backpressure. Here, you must also consider the pipe losses over the entire pressure line length and other line resistances (e.g. bends, pressure filters).

2.4 Pressure limitation

The PGM internal gear pump does not comprise any device for compliance with the maximum operating pressure. Setting and limiting 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.

2.5 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 depending 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 flows through the pump back into the tank, depending 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 on bleeding in chapter 2.1.

3. Mechanical project planning

3.1 Disassembly and mounting option

For disassembling and mounting the pump on the drive, accessibility has to be provided for on the system side by means of suitable lifting gear. Please consider particularly the weight of frame size PGM5 (see "Technical data", page 5).

Screws of property class 8.8 or 10.9 have to be provided for mounting purposes.

3.2 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 has to be specified by the manufacturer in the power unit, machine or system project planning.

3.3 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, depending on the continuous or average flow, in order to allow 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 allow deposition of contamination at the tank bottom outside the pump suction area.
- Large dimensioning of the tank surfaces depending on the heat output to be dissipated via the tank walls.

3.4 Required power unit functions

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

- Tanks, the internal pressure of which corresponds to the ambient pressure in accordance with the design, have to be equipped with ventilation filters for pressure compensation 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. In case of use in highly contaminated environments, the tank must to this end be pre-tensioned by means of air pressure. If cleaning of the external tank side is intended or to be expected during the period of use, tank fittings for tubes, lines, or hoses have to be selected, which ensure safe seal against external pressurization with water jet.

3.5 Place of installation and ambient conditions

With places of installation from a geodetic height of more than 1000 m, the pump is to be arranged in or below the tank or the tank is to be pre-tensioned by means of compressed air in order to comply with the admissible minimum inlet pressure. A short suction line with large cross-section has to be selected, bends should not be used.

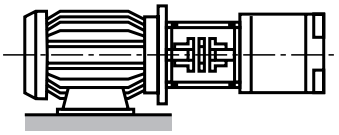
When installing the pump more than 10 m below the tank, the reduction of the inlet pressure to the maximum admissible value has to be ensured by means of additional measures.

When operating the pump in salt-containing or corrosive environments or when pressurization with strongly abrasive substances is possible, it has to be ensured on the system side that the shaft seal ring and the sealing area of the shaft do not make direct contact with the environment.

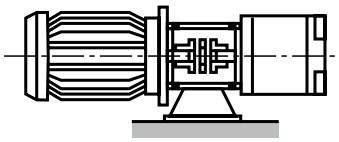
Project planning information

3.6 Installation positions

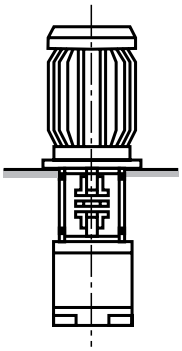
IM B3



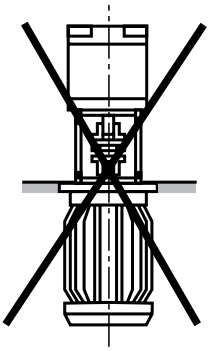
IM B5



IM V1



IM V2



⚠ Attention!

Installation position motor at bottom and pump at top (e.g. IM V2) is not admissible!

4. Maintenance schedule and operational safety

For safe operation and a long service life 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 has to be ensured:

- The required oil cleanliness
- The operating temperature range
- The hydraulic fluid filling level

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-proofness

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 continuously and automatically and shutting the system down 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 after a maximum operating period of 5 years by an authorized Bosch Rexroth service company.

5. Accessories

5.1 SAE connection flanges

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

5.2 Pump safety block

For limiting the operating pressure and for the pump circulation at zero pressure, we recommend our pump safety blocks type DBA… according to RE 25890.

Automatic bleeding during start-up is, however, not possible via DBA blocks. In this connection, we recommend a separate manual or automatic bleeding, e.g. via the pump‘s measurement port (see page 9)!

5.3 Other accessories

To install the Rexroth PGM.-3X internal gear pump on electric motors, we recommend selecting the pump mounting brackets according to AB 41-20 and torsionally flexible couplings according to AB 33-22.

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