

# Bosch Rexroth A2FM12/61W-VPB040 \*GO2EU\* axial piston fixed motor

Manufacturer: Bosch Rexroth  
Manufacturer part number / published order designation: R902230008  
Published model: A2FM12/61W-VPB040 \*GO2EU\*

## About this compilation

Prepared by Hydmaster from selected manufacturer documentation. Original technical pages follow without cropped drawings, rewritten data or altered units. This cover and index are Hydmaster editorial material, not a manufacturer-issued exact-execution datasheet.

Coverage: selected pages relevant to the identified size and configuration. Other options or neighbouring models retained on an original page apply only where explicitly identified.

## Execution notes and conditions

No universal maximum motor speed/pressure/flow asserted. Source pressure definitions, duty restrictions, shaft loads and case/inlet pressure conditions retained.

Manufacturer family images are representative; not exact article-dimensional drawings.

Factorycard Maxflow0 omitted as unspecified placeholder.

## Source-page index

Source page numbers below are physical pages of each complete original PDF. The original printed page labels and technical content remain unchanged. Compiled page numbers count this cover/index.

### Source A: Bosch Rexroth A2Fm Series 6X Technical Data

| Original pages | Compiled pages | Relevant content                                                                                                                                                                                                    |
|----------------|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1-10           | 2-11           | Family operating conditions, hydraulic fluids, pressure/speed restrictions, characteristics, installation and safety; other options are not assigned to this article                                                |
| 12-13          | 12-13          | Exact size12 body and existing shaftP geometry; NG16 exclusion applies only to Z/P, not this A/B shaft; Actual plate03/04 threaded working-port arrangement and metric ports, drain ports and connection conditions |
| 32-34          | 14-16          | Family operating conditions, hydraulic fluids, pressure/speed restrictions, characteristics, installation and safety; other options are not assigned to this article                                                |

# Axial piston fixed motor

## A2FM series 6x



- ▶ All-purpose high pressure motor
- ▶ Size 5 ... 1000
- ▶ Nominal pressure up to 400 bar
- ▶ Maximum pressure up 450 bar
- ▶ Open and closed circuits
- ▶ Metric version

### Features

- ▶ Large variety of available nominal sizes allows exact adjustment to the application
- ▶ High power density
- ▶ Very high total efficiency
- ▶ High starting efficiency
- ▶ Working ports SAE flange or thread
- ▶ Optional with integrated pressure relief valve
- ▶ Optional with mounted additional valve: counterbalance valve (BVD/BVE), flushing and boost-pressure valve
- ▶ Bent-axis design

### Contents

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## Type codes

| 01 | 02         | 03 | 04       | 05 | 06       | 07       | 08 | 09       | 10       | 11       | 12 | 13 | 14 | 15 |
|----|------------|----|----------|----|----------|----------|----|----------|----------|----------|----|----|----|----|
|    | <b>A2F</b> |    | <b>M</b> |    | <b>/</b> | <b>6</b> |    | <b>W</b> | <b>-</b> | <b>V</b> |    |    |    |    |

### Hydraulic fluid

|    |                                                                                                              |                                                                    |
|----|--------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------|
| 01 | Mineral oil and HFD. HFD for sizes 250 to 1000 only in combination with long-life bearing "L" (without code) |                                                                    |
|    | HFB-, HFC-hydraulic fluid                                                                                    | Sizes 5 to 200 (without code)                                      |
|    |                                                                                                              | Sizes 250 to 1000 (only in combination with long-life bearing "L") |
|    |                                                                                                              | <b>E-</b>                                                          |

### Axial piston unit

|    |                         |            |
|----|-------------------------|------------|
| 02 | Bent-axis design, fixed | <b>A2F</b> |
|----|-------------------------|------------|

### Drive shaft bearing

|    |                                 | 5-200 | 250-500 | 710-1000 |          |
|----|---------------------------------|-------|---------|----------|----------|
| 03 | Standard bearing (without code) | •     | •       | -        |          |
|    | Long-life bearing               | -     | •       | •        | <b>L</b> |

### Operating mode

|    |       |          |
|----|-------|----------|
| 04 | Motor | <b>M</b> |
|----|-------|----------|

### Sizes (NG)<sup>1)</sup>

|    |                                              |                                                                     |
|----|----------------------------------------------|---------------------------------------------------------------------|
| 05 | Geometric displacement (see table of values) |                                                                     |
|    |                                              | <b>5 10 12 16 23 28 32 107 125 160 180 200 250 355 500 710 1000</b> |

### Series

|    |  |          |
|----|--|----------|
| 06 |  | <b>6</b> |
|----|--|----------|

### Index

|    |  |                       |          |
|----|--|-----------------------|----------|
| 07 |  | Size 10 to 180        | <b>1</b> |
|    |  | Size 200              | <b>3</b> |
|    |  | Size 5 and 250 o 1000 | <b>0</b> |

### Direction of rotation

|    |                                      |          |
|----|--------------------------------------|----------|
| 08 | Viewed on drive shaft, bidirectional | <b>W</b> |
|----|--------------------------------------|----------|

### Seal material

|    |                       |          |
|----|-----------------------|----------|
| 09 | FKM (fluoroelastomer) | <b>V</b> |
|----|-----------------------|----------|

### Drive shaft

|    |                               | 5 | 10 | 12 | 16 | 23 | 28 | 32 | 107 | 125 | 160 | 180 | 200 | 250-1000 |          |
|----|-------------------------------|---|----|----|----|----|----|----|-----|-----|-----|-----|-----|----------|----------|
| 10 | Splined shaft DIN 5480        | - | •  | •  | •  | •  | •  | •  | •   | •   | •   | •   | •   | -        | <b>A</b> |
|    |                               | - | •  | •  | -  | •  | •  | -  | •   | -   | •   | -   | -   | •        | <b>Z</b> |
|    | Parallel keyed shaft DIN 6885 | • | •  | •  | •  | •  | •  | •  | •   | •   | •   | •   | •   | -        | <b>B</b> |
|    |                               | - | •  | •  | -  | •  | •  | -  | •   | -   | •   | -   | -   | •        | <b>P</b> |
|    | Conical shaft <sup>2)</sup>   | • | -  | -  | -  | -  | -  | -  | -   | -   | -   | -   | -   | -        | <b>C</b> |

### Mounting flange

|    |            | 5-250 | 355-1000 |          |
|----|------------|-------|----------|----------|
| 11 | ISO 3019-2 |       |          |          |
|    | 4-hole     | •     | -        | <b>B</b> |
|    | 8-hole     | -     | •        | <b>H</b> |

• = Available    ◦ = On request    - = Not available

<sup>1)</sup> Sizes 45, 56, 63, 80, 90 see data sheet 91071 (A2FM series 70)

<sup>2)</sup> Tapered shaft with threaded pin and woodruff key (DIN 6888). The torque must be transmitted via the tapered press fit.

| 01 | 02         | 03 | 04       | 05 | 06       | 07       | 08 | 09       | 10       | 11       | 12 | 13 | 14 | 15 |
|----|------------|----|----------|----|----------|----------|----|----------|----------|----------|----|----|----|----|
|    | <b>A2F</b> |    | <b>M</b> |    | <b>/</b> | <b>6</b> |    | <b>W</b> | <b>-</b> | <b>V</b> |    |    |    |    |

**Working ports**

|    |                                                                                  |        | 5 | 10-16 | 23 | 28-32 | 107-125 | 160-180 | 200 | 250 | 355-500         | 710-1000 |     |
|----|----------------------------------------------------------------------------------|--------|---|-------|----|-------|---------|---------|-----|-----|-----------------|----------|-----|
| 12 | SAE working ports<br><b>A</b> and <b>B</b> at rear                               | 01     | 0 | -     | -  | •     | •       | •       | •   | •   | •               | •        | 010 |
|    |                                                                                  |        | 7 | -     | -  | -     | -       | -       | -   | -   | •               | -        | 017 |
|    | SAE working ports<br><b>A</b> and <b>B</b> at side, opposite                     | 02     | 0 | -     | -  | •     | •       | •       | -   | •   | -               | -        | 020 |
|    |                                                                                  |        | 7 | -     | -  | -     | -       | •       | •   | -   | •               | -        | 027 |
|    | Threaded ports<br><b>A</b> and <b>B</b> at side, opposite                        | 03     | 0 | •     | •  | •     | •       | -       | -   | -   | -               | -        | 030 |
|    |                                                                                  |        |   |       |    |       |         |         |     |     |                 |          |     |
|    | Threaded ports<br><b>A</b> and <b>B</b> at side and at rear <sup>1)</sup>        | 04     | 0 | -     | •  | •     | •       | -       | -   | -   | -               | -        | 040 |
|    |                                                                                  |        |   |       |    |       |         |         |     |     |                 |          |     |
|    | SAE working ports, <b>A</b> and <b>B</b> at bottom                               | 10     | 0 | -     | -  | -     | •       | •       | •   | -   | -               | -        | 100 |
|    |                                                                                  |        |   |       |    |       |         |         |     |     |                 |          |     |
|    | Port plate<br>with pressure relief valves<br>for mounting a counterbalance valve | BVD 17 | 1 | -     | -  | -     | -       | •       | -   | -   | -               | -        | 171 |
|    |                                                                                  |        |   |       |    |       |         |         |     |     |                 |          | 178 |
|    |                                                                                  | 18     | 8 | -     | -  | -     | •       | •       | •   | -   | -               | -        | 181 |
|    |                                                                                  | BVE 18 |   | -     | -  | -     | -       | •       | •   | -   | - <sup>2)</sup> | -        | 188 |
|    | Port plate with pressure relief valves                                           | 19     | 1 | -     | -  | -     | •       | •       | •   | -   | -               | -        | 191 |
|    |                                                                                  |        | 2 | -     | -  | -     | •       | •       | •   | -   | -               | -        | 192 |

**Valves**

|                                                          |          |
|----------------------------------------------------------|----------|
| Without valve                                            | <b>0</b> |
| Pressure-relief valves (without pressure boost facility) | <b>1</b> |
| Pressure-relief valves (with pressure boost facility)    | <b>2</b> |
| Flushing and boost pressure valve mounted                | <b>7</b> |
| Counterbalance valve BVD/BVE mounted <sup>3)</sup>       | <b>8</b> |

**Speed sensors**

|    |                                        | 5-16 | 23-180 | 200 | 250-1000 <sup>4)</sup> |          |
|----|----------------------------------------|------|--------|-----|------------------------|----------|
| 13 | Without speed sensor (without code)    | •    | •      | •   | •                      |          |
|    | Prepared for HDD speed sensor          | -    | -      | -   | •                      | <b>F</b> |
|    | HDD speed sensor mounted <sup>5)</sup> | -    | -      | -   | •                      | <b>H</b> |
|    | Prepared for DSA speed sensor          | -    | •      | •   | ○                      | <b>U</b> |
|    | Speed sensor DSA mounted <sup>5)</sup> | -    | •      | •   | ○                      | <b>V</b> |

**Special version** (only sizes 28 to 180)

|    |                                                               |          |
|----|---------------------------------------------------------------|----------|
| 14 | Standard version (without code)                               |          |
|    | Special version for slew drives (standard with port plate 19) | <b>J</b> |

**Standard / special version**

|    |                                                                                                  |           |
|----|--------------------------------------------------------------------------------------------------|-----------|
| 15 | Standard version (without code)                                                                  |           |
|    | Standard version with installation variants, e. g. <b>T</b> ports against standard open or close | <b>-Y</b> |
|    | Special version                                                                                  | <b>-S</b> |

• = Available    ○ = On request    - = Not available

<sup>1)</sup> Threaded ports at the sides plugged with threaded plugs.

<sup>2)</sup> Please contact us.

<sup>3)</sup> Specify ordering code of counterbalance valve according to data sheet 95522 (BVD) respectively data sheet 95526 (BVE) separately.

<sup>4)</sup> Size 710 please contact us.

<sup>5)</sup> Specify ordering code of sensor according to data sheet 95133 (DSA) respectively data sheet 95135 (HDD) separately.

**Notice**

- ▶ Please note the project planning notes in chapter Project planning notes
- ▶ Please note that not all type code combinations are available although the individual functions are marked as being available

## Technical data

**Table of values**

| Size                                   |                |                    | 5       | 10     | 12     | 16     | 23     | 28     | 32     | 107    | 125    | 160   | 180   |
|----------------------------------------|----------------|--------------------|---------|--------|--------|--------|--------|--------|--------|--------|--------|-------|-------|
| Displacement geometric, per revolution | $V_g$          | cm <sup>3</sup>    | 4.93    | 10.3   | 12     | 16     | 22.9   | 28.1   | 32     | 106.7  | 125    | 160.4 | 180   |
| Nominal pressure                       | $p_{nom}$      | bar                | 315     | 400    | 400    | 400    | 400    | 400    | 400    | 400    | 400    | 400   | 400   |
| Maximum pressure                       | $p_{max}$      | bar                | 350     | 450    | 450    | 450    | 450    | 450    | 450    | 450    | 450    | 450   | 450   |
| Maximum speed                          | $n_{nom}^{1)}$ | rpm                | 10000   | 8000   | 8000   | 8000   | 6300   | 6300   | 6300   | 4000   | 4000   | 3600  | 3600  |
|                                        | $n_{max}^{2)}$ | rpm                | 11000   | 8800   | 8800   | 8800   | 6900   | 6900   | 6900   | 4400   | 4400   | 4000  | 4000  |
| Inlet flow <sup>3)</sup> at $n_{nom}$  | $q_v$          | l/min              | 49      | 82     | 96     | 128    | 144    | 177    | 202    | 427    | 500    | 577   | 648   |
| Torque <sup>4)</sup> at $p_{nom}$      | M              | Nm                 | 24.7    | 66     | 76     | 102    | 146    | 179    | 204    | 679    | 796    | 1021  | 1146  |
| Rotary stiffness                       | c              | kNm/rad            | 0.63    | 0.92   | 1.25   | 1.59   | 2.56   | 2.93   | 3.12   | 11.2   | 11.9   | 17.4  | 18.2  |
| Moment of inertia for rotary group     | $J_{TW}$       | kg·m <sup>2</sup>  | 0.00006 | 0.0004 | 0.0004 | 0.0004 | 0.0012 | 0.0012 | 0.0012 | 0.0116 | 0.0116 | 0.022 | 0.022 |
| Maximum angular acceleration           | $\alpha$       | rad/s <sup>2</sup> | 5000    | 5000   | 5000   | 5000   | 6500   | 6500   | 6500   | 4500   | 4500   | 3500  | 3500  |
| Case volume                            | V              | l                  |         | 0.17   | 0.17   | 0.17   | 0.2    | 0.2    | 0.2    | 0.8    | 0.8    | 1.1   | 1.1   |
| Weight (approx.)                       | m              | kg                 | 2.5     | 5.4    | 5.4    | 5.4    | 9.5    | 9.5    | 9.5    | 32     | 32     | 45    | 45    |

| Size                                   |                |                    | 200    | 250   | 355   | 500   | 710  | 1000 |
|----------------------------------------|----------------|--------------------|--------|-------|-------|-------|------|------|
| Displacement geometric, per revolution | $V_g$          | cm <sup>3</sup>    | 200    | 250   | 355   | 500   | 710  | 1000 |
| Nominal pressure                       | $p_{nom}$      | bar                | 400    | 350   | 350   | 350   | 350  | 350  |
| Maximum pressure                       | $p_{max}$      | bar                | 450    | 400   | 400   | 400   | 400  | 400  |
| Maximum speed                          | $n_{nom}^{1)}$ | rpm                | 2750   | 2700  | 2240  | 2000  | 1600 | 1800 |
|                                        | $n_{max}^{2)}$ | rpm                | 3000   |       |       |       |      |      |
| Inlet flow <sup>3)</sup> at $n_{nom}$  | $q_v$          | l/min              | 550    | 675   | 795   | 1000  | 1136 | 1600 |
| Torque <sup>4)</sup> at $p_{nom}$      | M              | Nm                 | 1273   | 1393  | 1978  | 2785  | 3955 | 5570 |
| Rotary stiffness                       | c              | kNm/rad            | 57.3   | 73.1  | 96.1  | 144   | 270  | 324  |
| Moment of inertia for rotary group     | $J_{TW}$       | kg·m <sup>2</sup>  | 0.0353 | 0.061 | 0.102 | 0.178 | 0.55 | 0.55 |
| Maximum angular acceleration           | $\alpha$       | rad/s <sup>2</sup> | 11000  | 10000 | 8300  | 5500  | 4300 | 4500 |
| Case volume                            | V              | l                  | 2.7    | 2.5   | 3.5   | 4.2   | 8    | 8    |
| Weight (approx.)                       | m              | kg                 | 66     | 73    | 110   | 155   | 325  | 336  |

<sup>1)</sup> These values are valid at:

- for the optimum viscosity range from  $\nu_{opt} = 36$  to  $16 \text{ mm}^2/\text{s}$
- with hydraulic fluid based on mineral oils

<sup>2)</sup> Intermittent maximum speed: overspeed for unload and overhauling processes,  $t < 5 \text{ s}$  and  $\Delta p < 150 \text{ bar}$

<sup>3)</sup> Restriction of input flow with counterbalance valve

<sup>4)</sup> Torque without radial force, with radial force see table "Permissible radial and axial forces of the drive shafts"

### Note

- The values in the table are theoretical values, without consideration of efficiencies and tolerances. The values are rounded.
- Exceeding the maximum or falling below the minimum permissible values can lead to a loss of function, a reduction in operational service life or total destruction

of the axial piston unit. Other permissible limit values, such as speed variation, reduced angular acceleration as a function of the frequency and the permissible angular acceleration at start (lower than the maximum angular acceleration) can be found in data sheet 90261.

## Speed range

No limit to minimum speed  $n_{\min}$ . If uniformity of motion is required, speed  $n_{\min}$  must not be less than 50 rpm.

| Determining the operating characteristics |                                                                                             |         |
|-------------------------------------------|---------------------------------------------------------------------------------------------|---------|
| Inlet flow                                | $q_v = \frac{V_g \times n}{1000 \times \eta_v}$                                             | [l/min] |
| Rotational speed                          | $n = \frac{q_v \times 1000 \times \eta_v}{V_g}$                                             | [rpm]   |
| Torque                                    | $M = \frac{V_g \times \Delta p \times \eta_{hm}}{20 \times \pi}$                            | [Nm]    |
| Power                                     | $P = \frac{2 \pi \times M \times n}{60000} = \frac{q_v \times \Delta p \times \eta_v}{600}$ | [kW]    |

## Key

|             |                                                        |
|-------------|--------------------------------------------------------|
| $V_g$       | Displacement per revolution [cm <sup>3</sup> ]         |
| $\Delta p$  | Differential pressure [bar]                            |
| $n$         | Rotational speed [rpm]                                 |
| $\eta_v$    | Volumetric efficiency                                  |
| $\eta_{hm}$ | Hydraulic-mechanical efficiency                        |
| $\eta_t$    | Total efficiency ( $\eta_t = \eta_v \cdot \eta_{hm}$ ) |

## Hydraulic fluids

The axial piston unit is designed for operation with mineral oil HLP according to DIN 51524.

Application instructions and requirements for hydraulic fluids should be taken from the following data sheets before the start of project planning:

- 90220: Hydraulic fluids based on mineral oils and related hydrocarbons
- 90221: Environmentally acceptable hydraulic fluids
- 90222: Fire-resistant, water-free hydraulic fluids (HFDR, HFUD)

- 90223: Fire-resistant, water-containing hydraulic fluids (HFAE, HFAS, HFB, HFC)
- 90225: Restricted technical data for operation with fire-resistant hydraulic fluids

## Viscosity and temperature of hydraulic fluids

|                      | Viscosity                                     | Shaft seal        | Temperature <sup>1)</sup>                        | Comment                                                                                                                                                                                                                                                  |
|----------------------|-----------------------------------------------|-------------------|--------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Cold start           | $v_{\max} \leq 1600 \text{ mm}^2/\text{s}$    | NBR <sup>2)</sup> | $\vartheta_{St} \geq -40 \text{ }^\circ\text{C}$ | $t \leq 3 \text{ min}$ , without load ( $p \leq 50 \text{ bar}$ ), $n \leq 1000 \text{ rpm}$ (size 5 to 200), $n \leq 0.25 \cdot n_{nom}$ (size 250 to 1000), permissible temperature difference between axial piston unit and hydraulic fluid max. 25 K |
|                      |                                               | FKM               | $\vartheta_{St} \geq -25 \text{ }^\circ\text{C}$ |                                                                                                                                                                                                                                                          |
| Warm-up phase        | $v = 400 \dots 1600 \text{ mm}^2/\text{s}$    |                   |                                                  | $t \leq 15 \text{ min}$ , $p \leq 0.7 \cdot p_{nom}$ and $n \leq 0.5 \cdot n_{nom}$                                                                                                                                                                      |
| Continuous operation | $v = 10 \dots 400 \text{ mm}^2/\text{s}^{3)}$ | NBR <sup>2)</sup> | $\vartheta \leq +78 \text{ }^\circ\text{C}$      | measured at port <b>T</b>                                                                                                                                                                                                                                |
|                      | $v_{opt} = 16 \dots 36 \text{ mm}^2/\text{s}$ | FKM               | $\vartheta \leq +103 \text{ }^\circ\text{C}$     | range of optimum operating viscosity and efficiency                                                                                                                                                                                                      |
| Short-term operation | $v_{min} = 7 \dots 10 \text{ mm}^2/\text{s}$  | NBR <sup>2)</sup> | $\vartheta \leq +78 \text{ }^\circ\text{C}$      | $t \leq 3 \text{ min}$ , $p \leq 0.3 \cdot p_{nom}$                                                                                                                                                                                                      |
|                      |                                               | FKM               | $\vartheta \leq +103 \text{ }^\circ\text{C}$     | measured at port <b>T</b>                                                                                                                                                                                                                                |

<sup>1)</sup> If the specified temperatures cannot be maintained due to extreme operating parameters, please contact us.

<sup>2)</sup> Special version, please contact us.

<sup>3)</sup> Equates e.g. with the VG 46 a temperature range of +5 °C to +85 °C (see selection diagram)

## Note

To reduce high temperature of the hydraulic fluid in the axial piston unit we recommend the use of a flushing and boost pressure valve (see chapter Extended functions and versions).

Dependent on the unit size flushing the case at port U can be carried out alternatively.

### Selection of hydraulic fluid

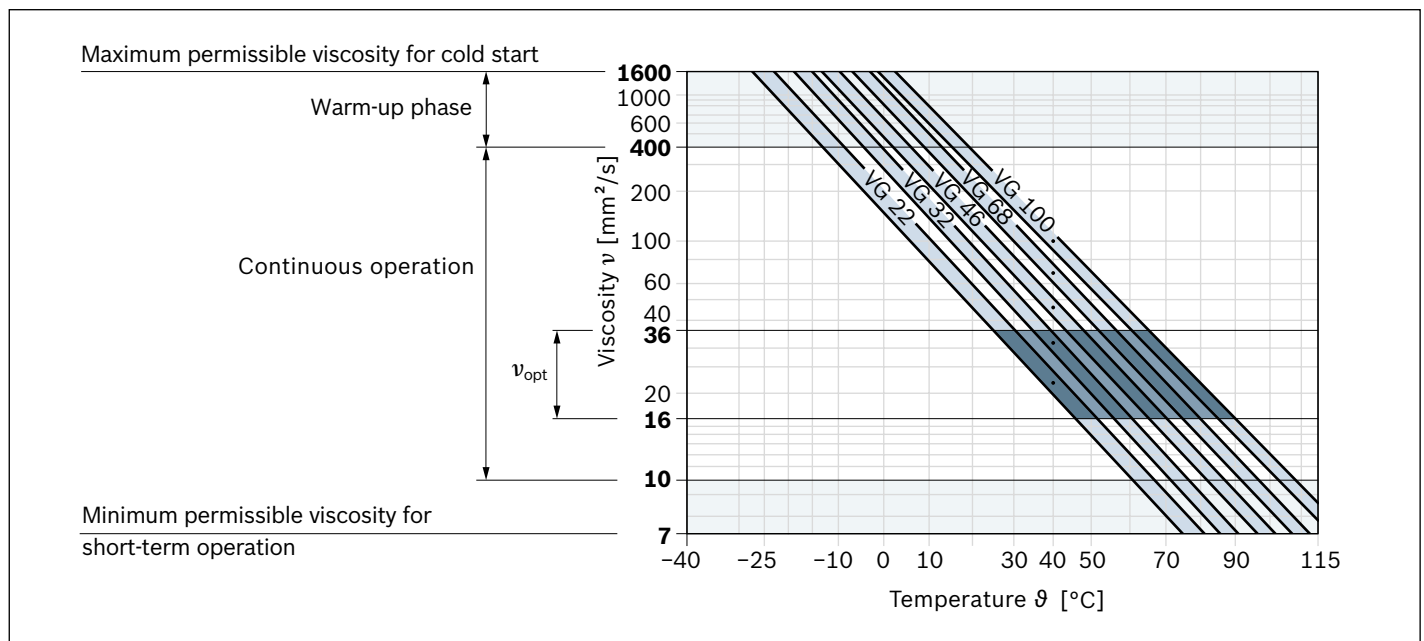
Bosch Rexroth evaluates hydraulic fluids on the basis of the Fluid Rating according to the technical data sheet 90235.

Hydraulic fluids with positive evaluation in the Fluid Rating are provided in the following technical data sheet:

- 90245: Bosch Rexroth Fluid Rating List for Rexroth hydraulic components (pumps and motors)

The hydraulic fluid should be selected so that the operating viscosity in the operating temperature range is within the optimum range ( $v_{opt}$ ; see selection diagram).

### Selection diagram



### Filtration of the hydraulic fluid

Finer filtration improves the cleanliness level of the hydraulic fluid, which increases the service life of the axial piston unit.

A cleanliness level of at least 20/18/15 is to be maintained according to ISO 4406.

At a hydraulic fluid viscosity of less than 10 mm<sup>2</sup>/s (e.g. due to high temperatures in short-term operation) at the drain port, a cleanliness level of at least 19/17/14 according to ISO 4406 is required.

For example, the viscosity is 10 mm<sup>2</sup>/s at:

- HLP 32 at a temperature of 73°C
- HLP 46 at a temperature of 85°C

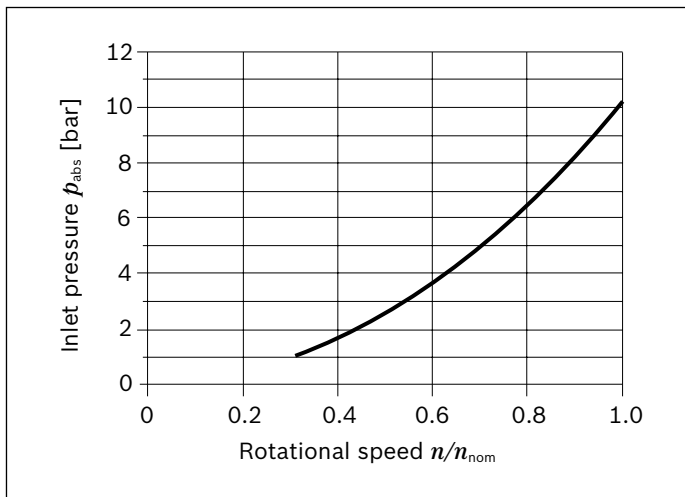
## Operating pressure range

| Pressure at working port A or B (high-pressure side) |                      |                     | Definition                                                                                                                                                                                                                                                                                                          |
|------------------------------------------------------|----------------------|---------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Nominal pressure                                     | $p_{nom}$            | see table of values | The nominal pressure corresponds to the maximum design pressure.                                                                                                                                                                                                                                                    |
| Maximum pressure                                     | $p_{max}$            | see table of values | The maximum pressure corresponds to the maximum operating pressure within the single operating period. The sum of the single operating periods must not exceed the total operating period.                                                                                                                          |
| Single operating period                              |                      | 10 s                |                                                                                                                                                                                                                                                                                                                     |
| Total operating period                               |                      | 300 h               |                                                                                                                                                                                                                                                                                                                     |
| Minimum pressure                                     | $p_{HP\ min}$        | 25 bar              | Minimum pressure on high-pressure side (port <b>A</b> or <b>B</b> ) required to prevent damage to the axial piston unit.                                                                                                                                                                                            |
| Minimum pressure at inlet (pump operating mode)      | $p_{E\ min}$         | see diagram         | To prevent damage to the axial piston motor in pump mode (change of high-pressure side with unchanged direction of rotation, e.g. when braking), a minimum pressure must be guaranteed at the working port (inlet). The minimum pressure depends on the rotational speed and displacement of the axial piston unit. |
| Total pressure                                       | $p_{Su}$             | 700 bar             | The summation pressure is the sum of the pressures at both work ports ( <b>A</b> and <b>B</b> ).                                                                                                                                                                                                                    |
| Rate of pressure change                              |                      |                     | Definition                                                                                                                                                                                                                                                                                                          |
| with integrated pressure relief valve                | $R_{A\ max}$         | 9000 bar/s          | Maximum permissible rate of pressure build-up and reduction during a pressure change over the entire pressure range.                                                                                                                                                                                                |
| without pressure relief valve                        | $R_{A\ max}$         | 16000 bar/s         |                                                                                                                                                                                                                                                                                                                     |
| Case pressure at port T                              |                      |                     | Definition                                                                                                                                                                                                                                                                                                          |
| Continuous differential pressure                     | $\Delta p_{T\ cont}$ | 2 bar               | Maximum averaged differential pressure at the shaft seal (case to ambient)                                                                                                                                                                                                                                          |
| Pressure peaks                                       | $p_{T\ peak}$        | 10 bar              | $t < 0.1\ s$                                                                                                                                                                                                                                                                                                        |

### Note

- ▶ Working pressure range valid when using hydraulic fluids based on mineral oils. Values for other hydraulic fluids, please contact us.

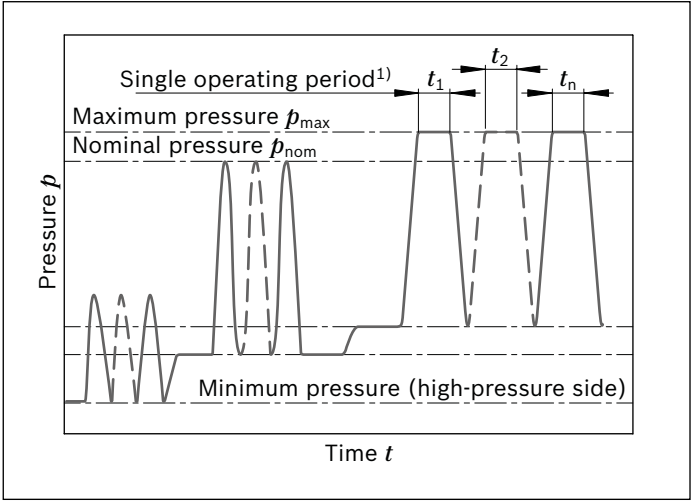
### Minimum pressure at inlet (pump operating mode)



This diagram is only valid for the optimum viscosity range of  $\nu_{opt} = 16$  to  $36\ mm^2/s$ .

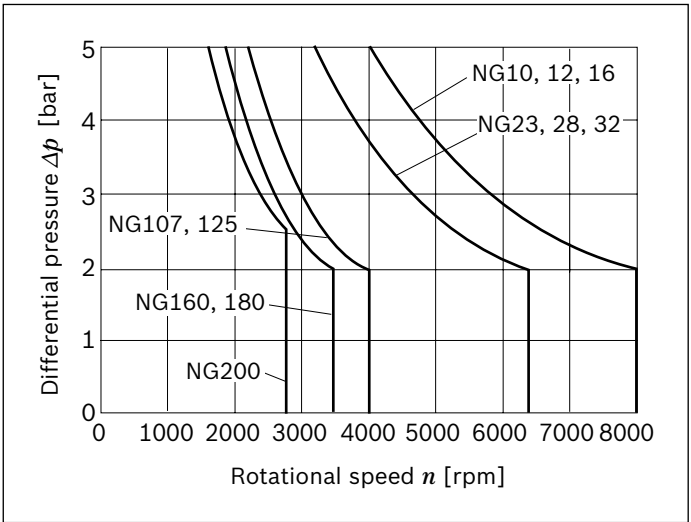
If the above mentioned conditions cannot be ensured, please contact us.

Pressure definition



<sup>1)</sup> Total operating period =  $t_1 + t_2 + \dots + t_n$

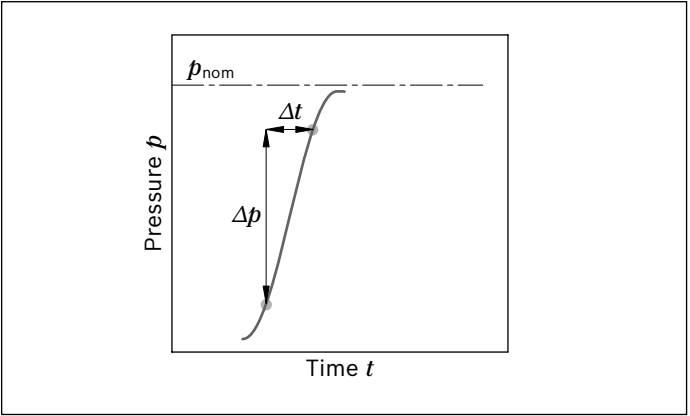
Maximum differential pressure at the shaft seal,  
size 10 ... 200



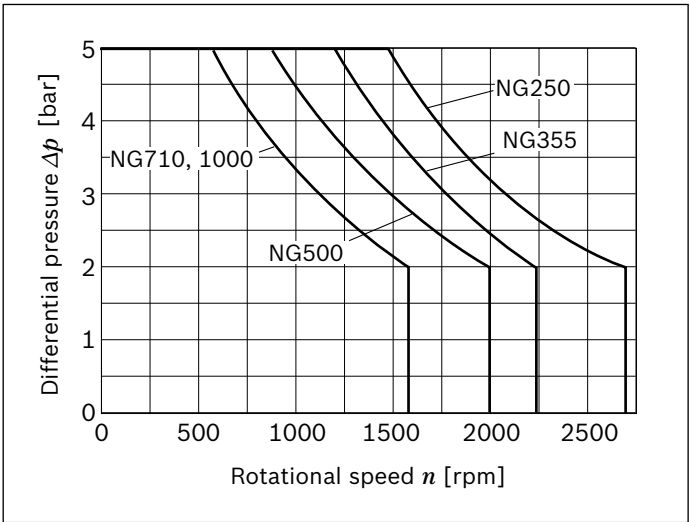
Note

- The service life of the shaft seal is influenced by the speed of the axial piston unit and the case pressure.
- The service life decreases with an increase of the mean differential pressure between the case and the ambient pressure and with a higher frequency of pressure spikes.
- The case pressure must be equal to or higher than the ambient pressure.

Rate of pressure change



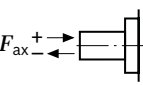
Maximum differential pressure at the shaft seal,  
size 250 ... 1000

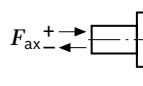


Direction of flow

| Direction of rotation, viewed on drive shaft |                   |
|----------------------------------------------|-------------------|
| clockwise                                    | counter-clockwise |
| <b>A to B</b>                                | <b>B to A</b>     |

## Permissible radial and axial forces of the drive shaft

| Size                                                                  |                                                                                                     | 5    | 10   |      | 12   |      | 16   | 23   |      | 28   |      | 32   | 107  |      |
|-----------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Drive shaft                                                           | Code                                                                                                | B, C | Z, P | A, B | Z, P | A, B | A, B | Z, P | A, B | Z, P | A, B | A, B | Z, P | A, B |
|                                                                       | Ø mm                                                                                                | 12   | 20   | 25   | 20   | 25   | 25   | 25   | 30   | 25   | 30   | 30   | 40   | 45   |
| Maximum radial force at distance a (from shaft collar)                |  $F_{q \max}$ kN   | 1.6  | 3    | 3.2  | 3    | 3.2  | 3.2  | 5.7  | 5.4  | 5.7  | 5.4  | 5.4  | 13.6 | 14.1 |
|                                                                       | a mm                                                                                                | 12   | 16   | 16   | 16   | 16   | 16   | 16   | 16   | 16   | 16   | 16   | 20   | 20   |
| Permitted torque at $F_{q \max}$                                      | $T_{q \max}$ Nm                                                                                     | 24.7 | 66   | 66   | 76   | 76   | 102  | 146  | 146  | 179  | 179  | 204  | 679  | 679  |
| Permitted differential pressure at $F_{q \max}$                       | $\Delta p_{q \max}$ bar                                                                             | 315  | 400  | 400  | 400  | 400  | 400  | 400  | 400  | 400  | 400  | 400  | 400  | 400  |
| Maximum axial force, when standstill or in non-pressurized conditions |  $+ F_{ax \max}$ N | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
|                                                                       | $- F_{ax \max}$ N                                                                                   | 180  | 320  | 320  | 320  | 320  | 320  | 500  | 500  | 500  | 500  | 500  | 1250 | 1250 |
| Maximum axial force, per bar operating pressure                       | $+ F_{ax \max}$ N/bar                                                                               | 1.5  | 3    | 3    | 3    | 3    | 3    | 5.2  | 5.2  | 5.2  | 5.2  | 5.2  | 12.9 | 12.9 |

| Size                                                                  |                                                                                                       | 125  | 160  |      | 180  | 200  | 250               | 355               | 500               | 710             | 1000              |
|-----------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|------|------|------|------|------|-------------------|-------------------|-------------------|-----------------|-------------------|
| Drive shaft                                                           | Code                                                                                                  | A, B | Z, P | A, B | A, B | A, B | Z, P              | Z, P              | Z, P              | Z, P            | Z, P              |
|                                                                       | Ø mm                                                                                                  | 45   | 45   | 50   | 50   | 50   | 50                | 60                | 70                | 90              | 90                |
| Maximum radial force at distance a (from shaft collar)                |  $F_{q \max}$ kN     | 14.1 | 18.1 | 18.3 | 18.3 | 20.3 | 1.2 <sup>1)</sup> | 1.5 <sup>1)</sup> | 1.9 <sup>1)</sup> | 3 <sup>1)</sup> | 2.6 <sup>1)</sup> |
|                                                                       | a mm                                                                                                  | 20   | 25   | 25   | 25   | 25   | 41                | 52.5              | 52.5              | 67.5            | 67.5              |
| Permitted torque at $F_{q \max}$                                      | $T_{q \max}$ Nm                                                                                       | 796  | 1021 | 1021 | 1146 | 1273 |                   |                   |                   |                 |                   |
| Permitted differential pressure at $F_{q \max}$                       | $\Delta p_{q \max}$ bar                                                                               | 400  | 400  | 400  | 400  | 400  |                   |                   |                   |                 |                   |
| Maximum axial force, when standstill or in non-pressurized conditions |  $+ F_{ax \max}$ N | 0    | 0    | 0    | 0    | 0    | 0                 | 0                 | 0                 | 0               | 0                 |
|                                                                       | $- F_{ax \max}$ N                                                                                     | 1250 | 1600 | 1600 | 1600 | 1600 | 2000              | 2500              | 3000              | 4400            | 4400              |
| Maximum axial force, per bar operating pressure                       | $+ F_{ax \max}$ N/bar                                                                                 | 12.9 | 16.7 | 16.7 | 16.7 | 16.7 |                   |                   |                   |                 |                   |

<sup>1)</sup> When at a standstill or when axial piston unit operating in non-pressurized conditions. Higher forces are permissible when under pressure, please contact us.

### General instructions

- The values given are maximum values and do not apply to continuous operation.
- The axial force in direction  $-F_{ax}$  is to be avoided as the service life of the bearing is reduced.
- Special requirements apply in the case of belt drives. Please contact us.

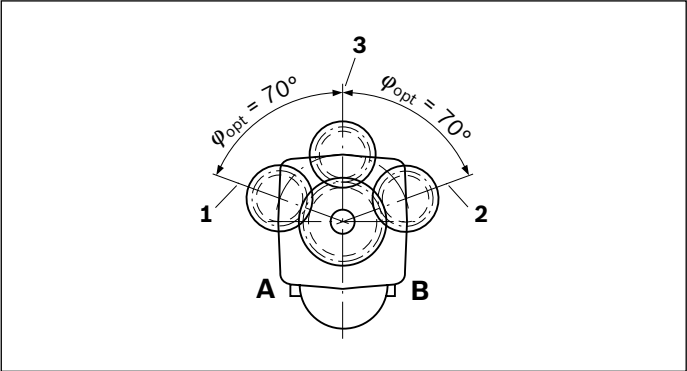
### Notes for sizes 250 ... 1000:

- In case of radial forces limited performance data is valid. Please contact us.
- In case of axial forces during operation of the unit please contact us.

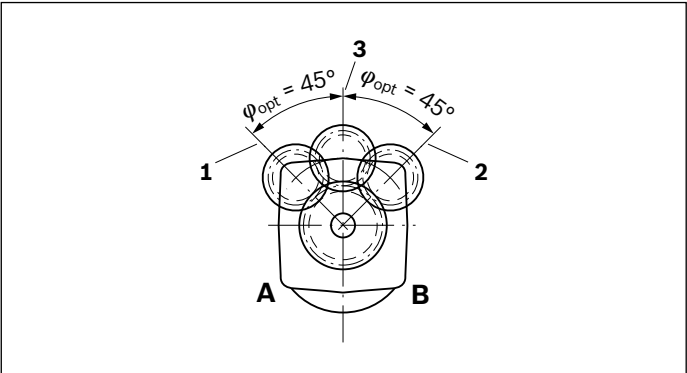
**Effect of radial force  $F_q$  on the service life of bearings**

By selecting a suitable direction of radial force  $F_q$  the load on the bearings caused by the internal rotary group forces can be reduced, thus optimizing the service life of the bearings. Recommended position of mating gear is dependent on direction of rotation. Examples:

**Toothed gear drive, size 5 ... 180**



**Toothed gear drive, size 200 ... 1000**



- 1 Direction of rotation "counter-clockwise", pressure at port **B**
- 2 Direction of rotation "clockwise", pressure at port **A**
- 3 Direction of rotation "bidirectional"

**Long-life bearing**

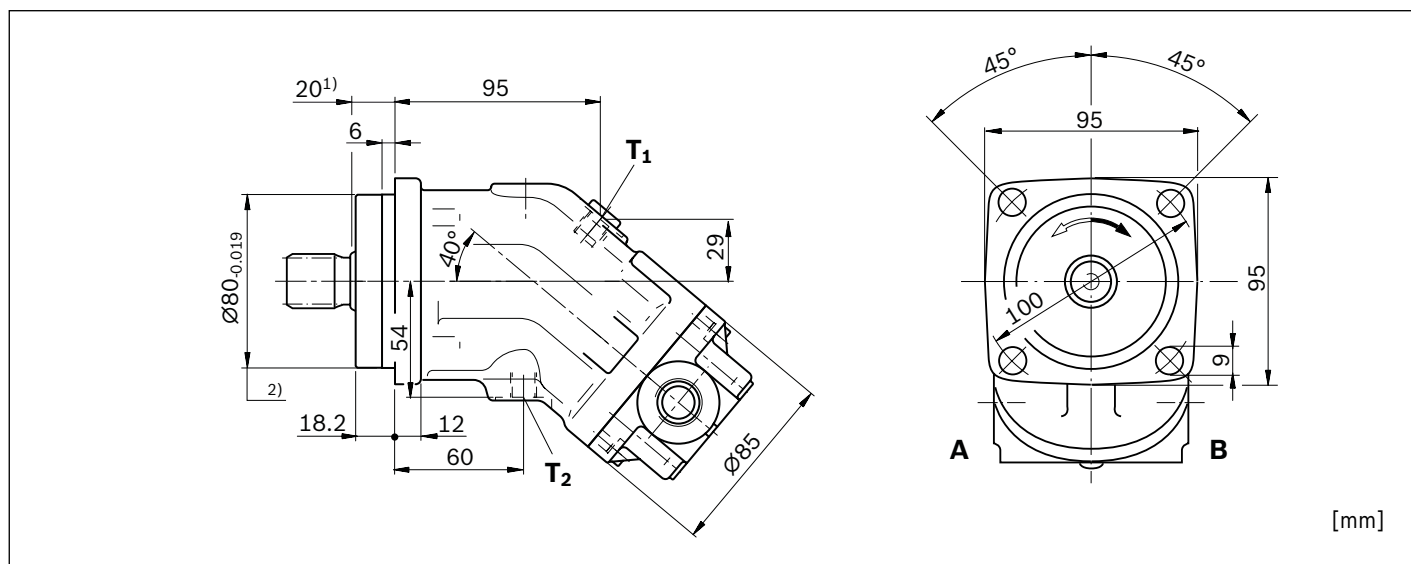
**Size 250 to 1000**

For long life cycle and use with HF hydraulic fluids. Identical external dimensions as design with standard bearing. Subsequent modification to long-life bearing is possible. Bearing and housing flushing via connection **U** is recommended.

**Bearing flushing**

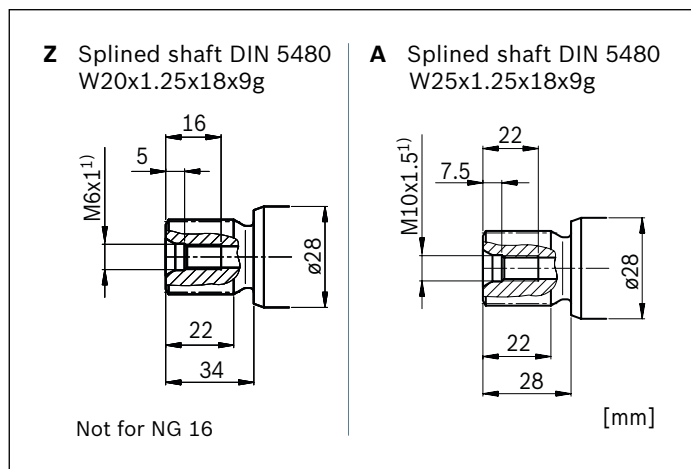
**Flushing flow (recommended)**

| Size                      | 250 | 355 | 500 | 710 | 1000 |
|---------------------------|-----|-----|-----|-----|------|
| Flushing flow $q_v$ l/min | 10  | 16  | 16  | 16  | 16   |



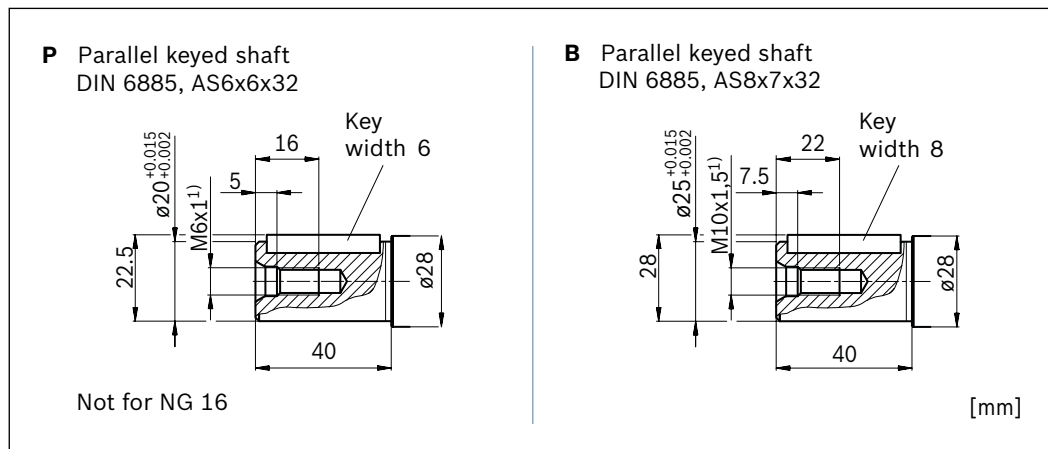
2) Flange similar to ISO 3019-2

### Drive shafts Z and A



<sup>1)</sup> Center bore according to DIN 332 (thread according to DIN 13)

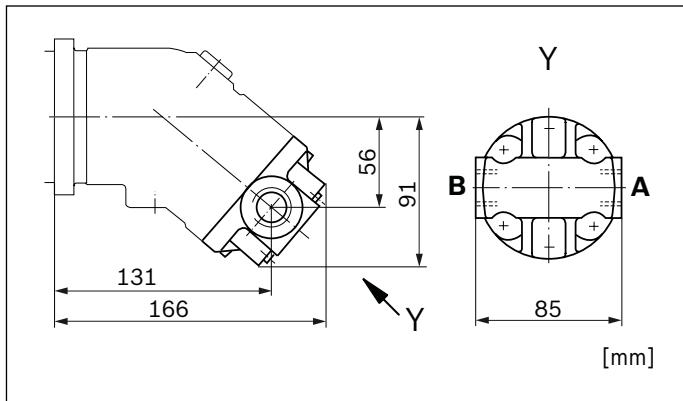
### Drive shafts P and B



<sup>1)</sup> Center bore according to DIN 332 (thread according to DIN 13)

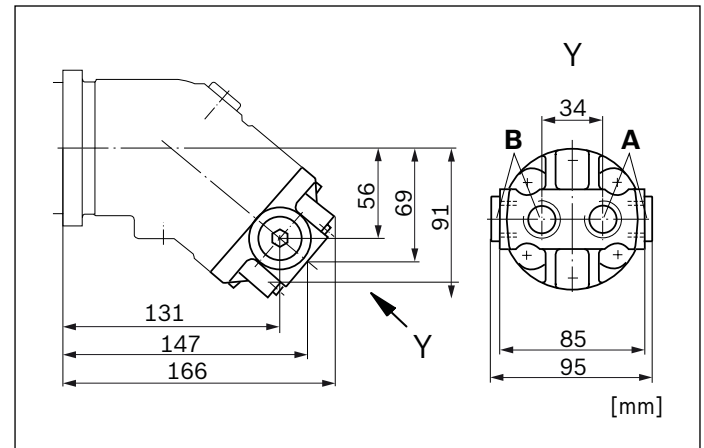
### Port plate 03

Threaded ports at side, opposite



### Port plate 04

Threaded ports at side and rear



### Ports

| Size                            |                                 | 10                                                        | 12 | 16 |
|---------------------------------|---------------------------------|-----------------------------------------------------------|----|----|
| <b>A, B</b> Working port        | Size                            | M22 × 15; 14 mm deep                                      |    |    |
|                                 | Standard <sup>1)</sup>          | DIN 3852                                                  |    |    |
|                                 | State on delivery <sup>2)</sup> | With protective cover (must be connected)                 |    |    |
| <b>T<sub>1</sub></b> Drain port | Size                            | M12 × 15; 12 mm deep                                      |    |    |
|                                 | Standard <sup>1)</sup>          | DIN 3852                                                  |    |    |
|                                 | State on delivery <sup>3)</sup> | Plugged (observe installation instructions)               |    |    |
| <b>T<sub>2</sub></b> Drain port | Size                            | M12 × 15; 12 mm deep                                      |    |    |
|                                 | Standard <sup>1)</sup>          | DIN 3852                                                  |    |    |
|                                 | State on delivery <sup>3)</sup> | With protective cover (observe installation instructions) |    |    |

<sup>1)</sup> The spot face can be deeper than specified in the appropriate standard.

<sup>2)</sup> Unless otherwise specified: In case of connection plate 04 ports at the sides plugged. Other layouts on request.

<sup>3)</sup> Unless otherwise specified. Other layouts on request.

## Project planning information

### Installation information

#### General information

- ▶ During commissioning and during operation, the axial piston unit must be filled with hydraulic fluid and bled. This must also be observed during longer standstill as the axial piston unit might drain itself via the hydraulic lines.
  - ▶ Complete filling and bleeding must especially be ensured with the “Drive shaft upwards” installation position as there is, for example, the risk of running dry.
  - ▶ The leakage in the housing area must be discharged to the tank via the highest-located drain port (**T1**, **T2**).
- ▶ If one joint drain line is used for several units, it is to be ensured that the relevant housing pressure is not exceeded. The joint drain line must be dimensioned so that the maximum admissible housing pressure of all connected units is not exceeded in any operating state, particularly during cold start. If this is not possible, separate drain lines have to be laid, if necessary.
  - ▶ In order to achieve favorable noise values, all connection lines are to be decoupled using elastic elements and over-tank installation is to be avoided.
  - ▶ The tank line must lead into the tank below the minimum liquid level in every operating state.

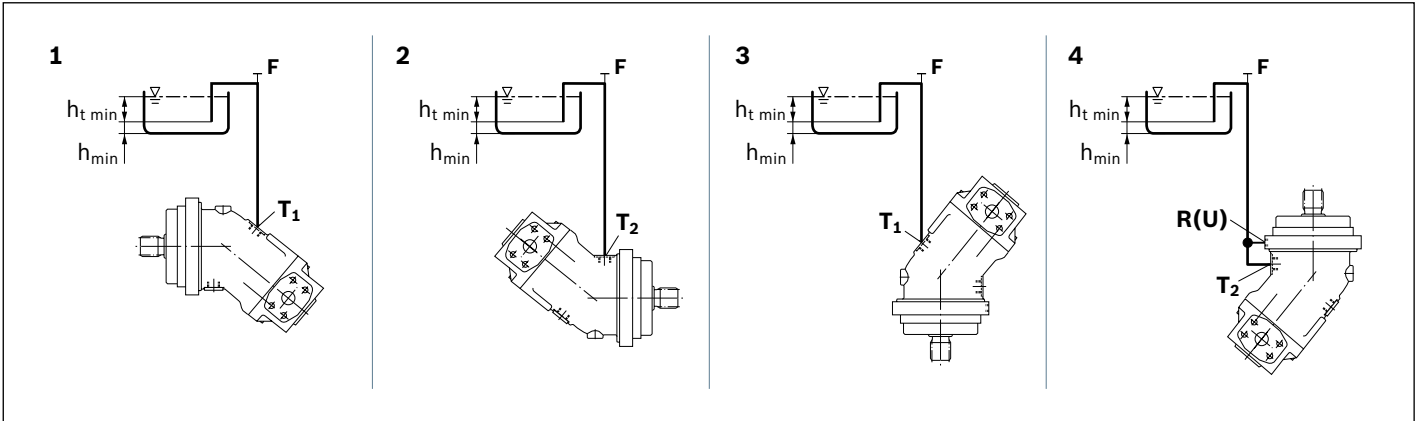
#### Installation position

See the following examples **1** to **8**.  
Further installation positions are possible upon request.  
Recommended installation position: **1** and **2**.

**Note**  
For installation position **4** and **8** "shaft upwards" an air bleed port **R** is required (specify in plain text when ordering, special version).  
With sizes 250 to 1000, port **U** is provided as standard in the area near the bearings for air bleeding.

#### Below-tank installation (standard)

Below-tank installation is at hand if the axial piston unit is installed below the minimum liquid level outside the tank.

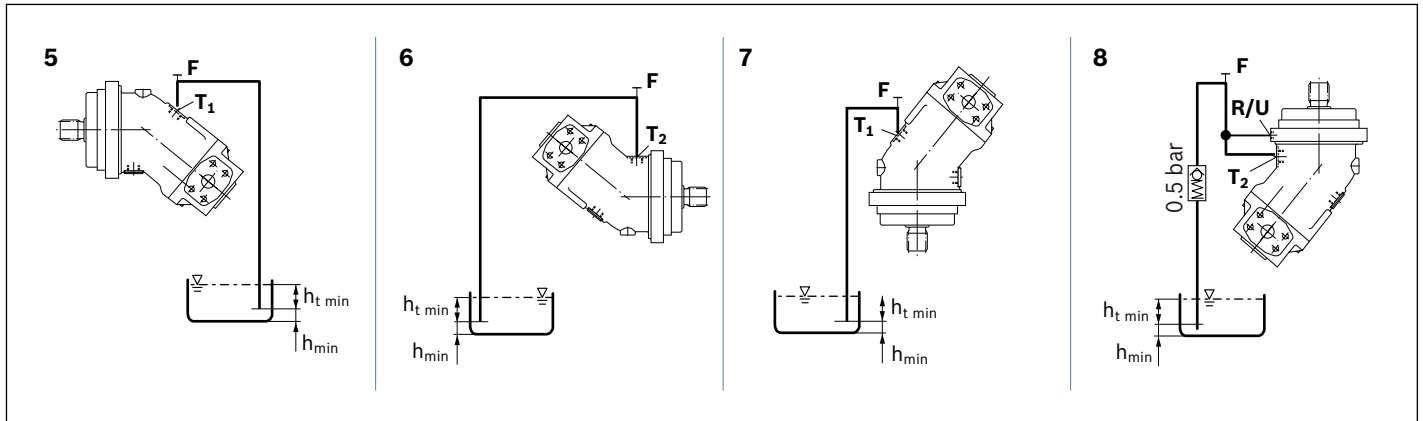


| Installation position | Air bleeding | Filling        |
|-----------------------|--------------|----------------|
| 1                     | F            | T <sub>1</sub> |
| 2                     | F            | T <sub>2</sub> |
| 3                     | F            | T <sub>1</sub> |
| 4                     | R (U)        | T <sub>2</sub> |

### Above-reservoir installation

Above-reservoir installation means that the axial piston unit is installed above the minimum fluid level of the reservoir.

Recommendation for installation position **8** (drive shaft upward): A check valve in the drain line (cracking pressure 0,5 bar) can prevent draining of the pump housing.



| Installation position | Air bleeding | Filling                  |
|-----------------------|--------------|--------------------------|
| 5                     | <b>F</b>     | <b>T<sub>1</sub> (F)</b> |
| 6                     | <b>F</b>     | <b>T<sub>2</sub> (F)</b> |
| 7                     | <b>F</b>     | <b>T<sub>1</sub> (F)</b> |
| 8                     | <b>R (U)</b> | <b>T<sub>2</sub> (F)</b> |

#### Key

|                                     |                                                       |
|-------------------------------------|-------------------------------------------------------|
| <b>F</b>                            | Filling / Air bleeding                                |
| <b>R</b>                            | Air bleed port                                        |
| <b>U</b>                            | Bearing flushing / air bleed port                     |
| <b>T<sub>1</sub>, T<sub>2</sub></b> | Drain port                                            |
| $h_{t \min}$                        | Minimum required immersion depth (200 mm)             |
| $h_{\min}$                          | Minimum required spacing to reservoir bottom (100 mm) |

**Note:** Connection **F** is part of the external piping and must be provided on the customer side to simplify the filling and bleeding.

## General project planning notes

- ▶ The axial piston motor is designed to be used in open and closed circuits.
- ▶ The project planning, installation and commissioning of the axial piston unit require the involvement of qualified skilled personnel.
- ▶ Before using the axial piston unit, please read the corresponding instruction manual completely and thoroughly. If necessary, request it from Bosch Rexroth.
- ▶ Before finalizing your design, request a binding installation drawing.
- ▶ The specified datas and notes must be observed.
- ▶ Preservation: Our axial piston units are supplied as standard with preservative protection for a maximum of 12 months. If longer preservative protection is required (maximum 24 months), please specify this in plain text when placing your order. The preservation times are valid under optimal storage conditions. Details of these conditions can be found in the data sheet 90312 or the instruction manual.
- ▶ Not all versions of the product are approved for use in a safety function according to ISO 13849. Please consult the responsible contact person at Bosch Rexroth if you require reliability parameters (e.g. MTTF<sub>D</sub>) for functional safety.
- ▶ A pressure relief valve is to be provided in the hydraulic system.
- ▶ Observe the instructions in the instruction manual regarding tightening torques of connection threads and other threaded joints used.
- ▶ The notes in the instruction manual on tightening torques of the port threads and other screw joints must be observed.
- ▶ The ports and fastening threads are designed for the permissible maximum pressure  $p_{\max}$  (see instruction manual). The machine or system manufacturer must ensure that the connecting elements and lines correspond to the specified operating conditions (pressure, flow, hydraulic fluid, temperature) with the necessary safety factors.
- ▶ The working ports and function ports are designated only to accommodate hydraulic lines.

## Safety Instructions

- ▶ During and shortly after operation, there is a risk of burns on the axial piston unit. Take appropriate safety measures (e.g. by wearing protective clothing).
- ▶ In certain conditions, moving parts in high pressure relief valves might get stuck in an undefined position due to contamination (e.g. contaminated hydraulic fluid). This can result in restriction or loss of load holding functions in lifting winches. Therefore it is the machine and/or system manufacturers responsibility to make sure that the load can always be put in a safe mode if needed. Also, he needs to ensure that these measures are properly implemented.

## Accessories

| Product                                  | Refer to document |
|------------------------------------------|-------------------|
| <b>Counterbalance valve</b><br>BVD 20-25 | RE 95522          |
| <b>Counterbalance valve</b><br>BVE 25    | RE 95526          |
| <b>Speed sensor</b><br>DSA               | RE 95133          |
| <b>Speed sensor</b><br>HDD               | RE 95135          |

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