

# Axial Piston Fixed Pump A2FO

RE 91401/06.2012

1/34

Replaces: 03.08

## Data sheet

|              |                                   |
|--------------|-----------------------------------|
| Series 6     |                                   |
| Size         | Nominal pressure/Maximum pressure |
| 5            | 315/350 bar                       |
| 10 to 200    | 400/450 bar                       |
| 250 to 1000  | 350/400 bar                       |
| Open circuit |                                   |



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## Features

- Fixed pump with axial tapered piston rotary group of bent-axis design, for hydrostatic drives in an open circuit
- For use in mobile and stationary applications
- The flow is proportional to the drive speed and displacement
- The drive shaft bearings are designed for the bearing service life requirements usually encountered in these areas
- High power density
- Small dimensions
- High total efficiency
- Economical design
- One-piece tapered piston with piston rings for sealing

# Ordering code for standard program

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

## Hydraulic fluid

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

## Axial piston unit

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

## Drive shaft bearing

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

## Operating mode

|    |                    |  |  |  |  |  |  |  |  |  |  |  |          |
|----|--------------------|--|--|--|--|--|--|--|--|--|--|--|----------|
| 04 | Pump, open circuit |  |  |  |  |  |  |  |  |  |  |  | <b>O</b> |
|----|--------------------|--|--|--|--|--|--|--|--|--|--|--|----------|

## Sizes (NG)

|    |   |          |           |           |           |           |           |           |           |           |           |           |           |            |            |            |            |            |            |            |            |            |
|----|---|----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| 05 | Geometric displacement, see table of values on page 7 |          |           |           |           |           |           |           |           |           |           |           |           |            |            |            |            |            |            |            |            |            |
|    |   | <b>5</b> | <b>10</b> | <b>12</b> | <b>16</b> | <b>23</b> | <b>28</b> | <b>32</b> | <b>45</b> | <b>56</b> | <b>63</b> | <b>80</b> | <b>90</b> | <b>107</b> | <b>125</b> | <b>160</b> | <b>180</b> | <b>200</b> | <b>250</b> | <b>355</b> | <b>500</b> | <b>710</b> |

## Series

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

## Index

|    |                     |  |  |  |  |  |  |  |  |  |  |  |          |
|----|---------------------|--|--|--|--|--|--|--|--|--|--|--|----------|
| 07 | NG10 to 180         |  |  |  |  |  |  |  |  |  |  |  | <b>1</b> |
|    | NG200               |  |  |  |  |  |  |  |  |  |  |  | <b>3</b> |
|    | NG5 and 250 to 1000 |  |  |  |  |  |  |  |  |  |  |  | <b>0</b> |

## Directions of rotation

|    |                       |  |  |  |  |  |  |  |  |  |  |  |                   |          |
|----|-----------------------|--|--|--|--|--|--|--|--|--|--|--|-------------------|----------|
| 08 | Viewed on drive shaft |  |  |  |  |  |  |  |  |  |  |  | clockwise         | <b>R</b> |
|    |                       |  |  |  |  |  |  |  |  |  |  |  | counter-clockwise | <b>L</b> |

## Seals

|    |                        |  |  |  |  |  |  |  |  |  |  |  |          |
|----|------------------------|--|--|--|--|--|--|--|--|--|--|--|----------|
| 09 | FKM (fluor-caoutchouc) |  |  |  |  |  |  |  |  |  |  |  | <b>V</b> |
|----|------------------------|--|--|--|--|--|--|--|--|--|--|--|----------|

## Drive shafts

|                             |                                  |          |           |           |           |           |           |           |           |           |           |           |           |            |            |            |            |            |                    |          |
|-----------------------------|----------------------------------|----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|------------|------------|------------|------------|------------|--------------------|----------|
|                             |                                  | <b>5</b> | <b>10</b> | <b>12</b> | <b>16</b> | <b>23</b> | <b>28</b> | <b>32</b> | <b>45</b> | <b>56</b> | <b>63</b> | <b>80</b> | <b>90</b> | <b>107</b> | <b>125</b> | <b>160</b> | <b>180</b> | <b>200</b> | <b>250 to 1000</b> |          |
| 10                          | Splined shaft<br>DIN 5480        | -        | ●         | ●         | ●         | ●         | ●         | ●         | -         | ●         | ●         | ●         | ●         | ●          | ●          | ●          | ●          | ●          | -                  | <b>A</b> |
|                             |                                  | -        | ●         | ●         | -         | ●         | ●         | -         | ●         | ●         | -         | ●         | -         | ●          | -          | ●          | -          | -          | ●                  | <b>Z</b> |
|                             | Parallel keyed shaft<br>DIN 6885 | ●        | ●         | ●         | ●         | ●         | ●         | -         | ●         | ●         | ●         | ●         | ●         | ●          | ●          | ●          | ●          | ●          | -                  | <b>B</b> |
|                             |                                  | -        | ●         | ●         | -         | ●         | ●         | -         | ●         | ●         | -         | ●         | -         | ●          | -          | ●          | -          | -          | ●                  | <b>P</b> |
| Conical shaft <sup>1)</sup> | ●                                | -        | -         | -         | -         | -         | -         | -         | -         | -         | -         | -         | -         | -          | -          | -          | -          | -          | <b>C</b>           |          |

## Mounting flanges

|    |            |        |                 |                    |
|----|------------|--------|-----------------|--------------------|
|    |            |        | <b>5 to 250</b> | <b>355 to 1000</b> |
| 11 | ISO 3019-2 | 4-hole | ●               | -                  |
|    |            | 8-hole | -               | ●                  |

● = Available      ○ = On request      - = Not available      ■ = Preferred program

1) Conical shaft with threaded pin and woodruff key (DIN 6888). The torque must be transmitted via the tapered press fit.

## Ordering code for standard program

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

### Port plates for service lines<sup>2)</sup>

|    |  | 5 | 10 to 16 | 23 to 250 | 355 to 1000 |           |
|----|--|---|----------|-----------|-------------|-----------|
| 12 | SAE flange port A/B at side and<br>SAE flange port S at rear | - | -        | ●         | -           | <b>05</b> |
|    | Threaded port A/B at side and threaded port S at rear        | - | ●        | -         | -           | <b>06</b> |
|    | SAE flange ports A/B and S at rear                           | - | -        | -         | ●           | <b>11</b> |
|    | Threaded ports A/B and S at side                             | ● | -        | -         | -           | <b>07</b> |

### Standard / special version

|    |  |           |
|----|--|-----------|
| 13 | Standard version (without code)  |           |
|    | Standard version with installation variants, e. g. T ports against standard open or closed | <b>-Y</b> |
|    | Special version  | <b>-S</b> |

● = Available    ○ = On request    - = Not available     = Preferred program

<sup>2)</sup> Fastening thread or threaded ports, metric

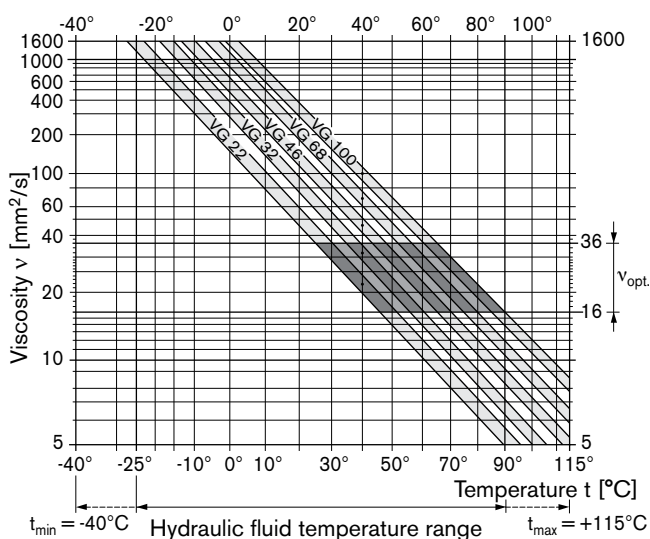
# Technical data

## Hydraulic fluid

Before starting project planning, please refer to our data sheets RE 90220 (mineral oil), RE 90221 (environmentally acceptable hydraulic fluids), RE 90222 (HFD hydraulic fluids) and RE 90223 (HFA, HFB, HFC hydraulic fluids) for detailed information regarding the choice of hydraulic fluid and application conditions.

The fixed pump A2FO is not suitable for operation with HFA hydraulic fluid. If HFB, HFC or HFD or environmentally acceptable hydraulic fluids are used, the limitations regarding technical data or other seals must be observed.

### Selection diagram



### Details regarding the choice of hydraulic fluid

The correct choice of hydraulic fluid requires knowledge of the operating temperature in relation to the ambient temperature: in an open circuit, the reservoir temperature.

The hydraulic fluid should be chosen so that the operating viscosity in the operating temperature range is within the optimum range ( $\nu_{opt}$  see shaded area of the selection diagram). We recommend that the higher viscosity class be selected in each case.

Example: At an ambient temperature of  $X$  °C, an operating temperature of 60 °C is set in the circuit. In the optimum operating viscosity range ( $\nu_{opt,1}$  shaded area), this corresponds to the viscosity classes VG 46 or VG 68; to be selected: VG 68.

### Note

The case drain temperature, which is affected by pressure and speed, can be higher than the reservoir temperature. At no point of the component may the temperature be higher than 115 °C. The temperature difference specified below is to be taken into account when determining the viscosity in the bearing.

If the above conditions cannot be maintained due to extreme operating parameters, we recommend flushing the case at port U (sizes 250 to 1000).

### Viscosity and temperature of hydraulic fluid

|  | Viscosity [mm <sup>2</sup> /s]              | Temperature  | Comment  |
|--|---|--|--|
| Transport and storage at ambient temperature |   | $T_{min} \geq -50$ °C<br>$T_{opt} = +5$ °C to $+20$ °C | factory preservation: up to 12 months with standard, up to 24 months with long-term  |
| (Cold) start-up <sup>1)</sup>                | $\nu_{max} = 1600$                          | $T_{St} \geq -40$ °C                                   | $t \leq 3$ min, without load ( $p \leq 50$ bar),<br>$n \leq 1000$ rpm (for sizes 5 to 200),<br>$n \leq 0.25 \cdot n_{nom}$ (for sizes 250 to 1000) |
| Permissible temperature difference           |   | $\Delta T \leq 25$ K                                   | between axial piston unit and hydraulic fluid  |
| Warm-up phase                                | $\nu < 1600$ to 400                         | $T = -40$ °C to $-25$ °C                               | at $p \leq 0.7 \cdot p_{nom}$ , $n \leq 0.5 \cdot n_{nom}$ and $t \leq 15$ min   |
| Operating phase                              |   |  |  |
| Temperature difference                       |   | $\Delta T = \text{approx. } 12$ K                      | between hydraulic fluid in the bearing and at port T.  |
| Maximum temperature                          |   | 115 °C<br>103 °C                                       | in the bearing<br>measured at port T   |
| Continuous operation                         | $\nu = 400$ to 10<br>$\nu_{opt} = 36$ to 16 | $T = -25$ °C to $+90$ °C                               | measured at port T,<br>no restriction within the permissible data  |
| Short-term operation <sup>2)</sup>           | $\nu_{min} \geq 7$                          | $T_{max} = +103$ °C                                    | measured at port T, $t < 3$ min, $p < 0.3 \cdot p_{nom}$   |
| FKM shaft seal <sup>1)</sup>                 |   | $T \leq +115$ °C                                       | see page 5   |

1) At temperatures below  $-25$  °C, an NBR shaft seal is required (permissible temperature range:  $-40$  °C to  $+90$  °C).

2) Sizes 250 to 1000, please contact us.

# Technical data

## 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.

To ensure the functional reliability of the axial piston unit, a gravimetric analysis of the hydraulic fluid is necessary to determine the amount of solid contaminant and to determine the cleanliness level according to ISO 4406. A cleanliness level of at least 20/18/15 is to be maintained.

At very high hydraulic fluid temperatures (90 °C to maximum 115 °C), a cleanliness level of at least 19/17/14 according to ISO 4406 is necessary.

If the above classes cannot be achieved, please contact us.

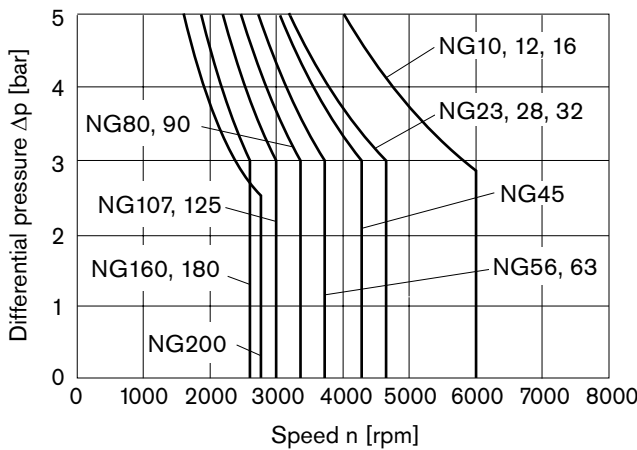
## Shaft seal

### Permissible pressure loading

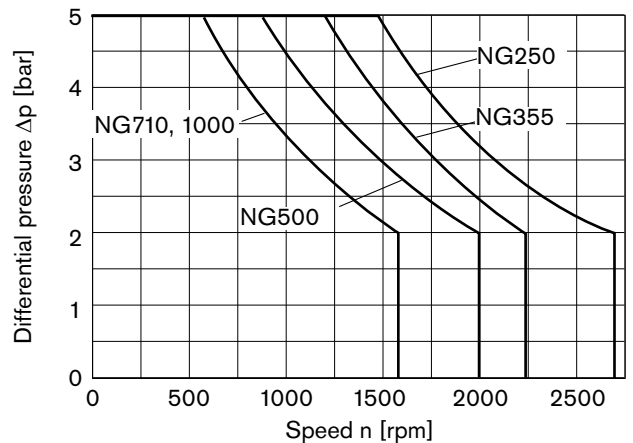
The service life of the shaft seal is influenced by the speed of the axial piston unit and the case drain pressure (case pressure). The mean differential pressure of 2 bar between the case and the ambient pressure may not be enduringly exceeded at normal operating temperature. For a higher differential pressure at reduced speed, see diagram. Momentary pressure spikes ( $t < 0.1$  s) of up to 10 bar are permitted. The service life of the shaft seal decreases with an increase in the frequency of pressure spikes.

The case pressure must be equal to or higher than the ambient pressure.

### Sizes 10 to 200



### Sizes 250 to 1000



The values are valid for an ambient pressure  $p_{abs} = 1$  bar.

### Temperature range

The FKM shaft seal may be used for case drain temperatures from -25 °C to +115 °C.

### Note

For application cases below -25 °C, an NBR shaft seal is required (permissible temperature range: -40 °C to +90 °C). State NBR shaft seal in plain text when ordering. Please contact us.

### Direction of flow

#### Direction of rotation, viewed on drive shaft

|           |                   |
|-----------|-------------------|
| clockwise | counter-clockwise |
| S to B    | S to A            |

### Long-life bearing

#### Sizes 250 to 1000

For long service life and use with HF hydraulic fluids. Identical external dimensions as motor with standard bearings. Subsequent conversion to long-life bearings is possible. Bearing and case flushing via port U is recommended.

#### Flushing flow (recommended)

| NG                            | 250 | 355 | 500 | 710 | 1000 |
|-------------------------------|-----|-----|-----|-----|------|
| $Q_{v \text{ flush}}$ (L/min) | 10  | 16  | 16  | 16  | 16   |

# Technical data

## Operating pressure range

(operating with mineral oil)

### Pressure at service line port A or B

Size 5

Nominal pressure  $p_{nom}$  \_\_\_\_\_ 315 bar absolute  
 Maximum pressure  $p_{max}$  \_\_\_\_\_ 350 bar absolute  
 Single operating period \_\_\_\_\_ 10 s  
 Total operating period \_\_\_\_\_ 300 h

Sizes 10 to 200

Nominal pressure  $p_{nom}$  \_\_\_\_\_ 400 bar absolute  
 Maximum pressure  $p_{max}$  \_\_\_\_\_ 450 bar absolute  
 Single operating period \_\_\_\_\_ 10 s  
 Total operating period \_\_\_\_\_ 300 h

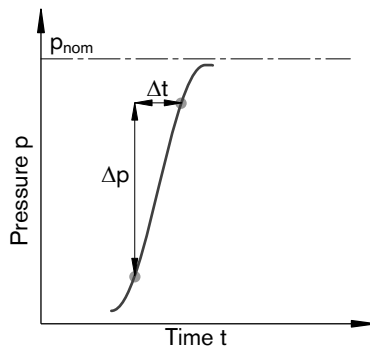
Sizes 250 to 1000

Nominal pressure  $p_{nom}$  \_\_\_\_\_ 350 bar absolute  
 Maximum pressure  $p_{max}$  \_\_\_\_\_ 400 bar absolute  
 Single operating period \_\_\_\_\_ 10 s  
 Total operating period \_\_\_\_\_ 300 h

Minimum pressure (high-pressure side) \_\_\_\_\_ 25 bar absolute

### Rate of pressure change $R_{A max}$

Without pressure-relief valve \_\_\_\_\_ 16000 bar/s



### Pressure at suction port S (inlet)

Minimum pressure  $p_{S min}$  \_\_\_\_\_ 0.8 bar absolute

Maximum pressure  $p_{S max}$  \_\_\_\_\_ 30 bar absolute

### Note

Values for other hydraulic fluids, please contact us.

## Definition

### Nominal pressure $p_{nom}$

The nominal pressure corresponds to the maximum design pressure.

### Maximum pressure $p_{max}$

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.

### Minimum pressure (high-pressure side)

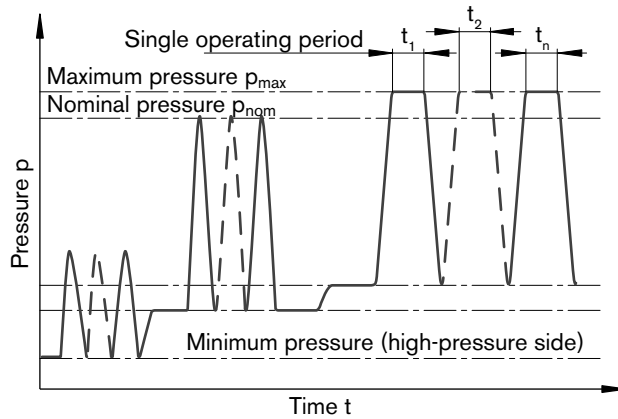
Minimum pressure at the high-pressure side (A or B) which is required in order to prevent damage to the axial piston unit.

### Minimum pressure (inlet)

Minimum pressure at suction port S (inlet) which is required in order to prevent damage to the axial piston unit. The minimum pressure is dependent on the speed of the axial piston unit (see diagram on page 7).

### Rate of pressure change $R_A$

Maximum permissible rate of pressure rise and reduction during a pressure change over the entire pressure range.



Total operating period =  $t_1 + t_2 + \dots + t_n$

# Technical data

**Table of values** (theoretical values, without efficiency and tolerances; values rounded)

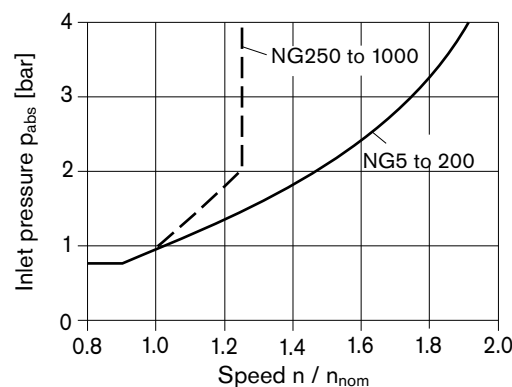
| Size                                   | NG                   |                    | 5       | 10                 | 12     | 16     | 23     | 28     | 32     | 45     | 56     | 63     | 80     |     |
|--|----------------------|--------------------|---------|--------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-----|
| Displacement geometric, per revolution | $V_g$                | cm <sup>3</sup>    | 4.93    | 10.3               | 12     | 16     | 22.9   | 28.1   | 32     | 45.6   | 56.1   | 63     | 80.4   |     |
| Speed maximum <sup>1)</sup>            | $n_{nom}$            | rpm                | 5600    | 3150               | 3150   | 3150   | 2500   | 2500   | 2500   | 2240   | 2000   | 2000   | 1800   |     |
|  | $n_{max}^{2)}$       | rpm                | 8000    | 6000               | 6000   | 6000   | 4750   | 4750   | 4750   | 4250   | 3750   | 3750   | 3350   |     |
| Flow at $n_{nom}$                      | $q_v$                | L/min              | 27.6    | 32                 | 38     | 50     | 57     | 70     | 80     | 102    | 112    | 126    | 145    |     |
| Power at                               | $\Delta p = 350$ bar | P                  | kW      | 14.5 <sup>4)</sup> | 19     | 22     | 29     | 33     | 41     | 47     | 60     | 65     | 84     |     |
|  | $\Delta p = 400$ bar | P                  | kW      | –                  | 22     | 25     | 34     | 38     | 47     | 53     | 68     | 75     | 96     |     |
| Torque <sup>3)</sup>                   |                      |                    |         |                    |        |        |        |        |        |        |        |        |        |     |
| at $V_g$ and                           | $\Delta p = 350$ bar | T                  | Nm      | 24.7 <sup>4)</sup> | 57     | 67     | 89     | 128    | 157    | 178    | 254    | 313    | 351    | 448 |
|  | $\Delta p = 400$ bar | T                  | Nm      | –                  | 66     | 76     | 102    | 146    | 179    | 204    | 290    | 357    | 401    | 512 |
| Rotary stiffness                       | c                    | kNm/rad            | 0.63    | 0.92               | 1.25   | 1.59   | 2.56   | 2.93   | 3.12   | 4.18   | 5.94   | 6.25   | 8.73   |     |
| Moment of inertia for rotary group     | $J_{GR}$             | kgm <sup>2</sup>   | 0.00006 | 0.0004             | 0.0004 | 0.0004 | 0.0012 | 0.0012 | 0.0012 | 0.0024 | 0.0042 | 0.0042 | 0.0072 |     |
| Maximum angular acceleration           | $\alpha$             | rad/s <sup>2</sup> | 5000    | 5000               | 5000   | 5000   | 6500   | 6500   | 6500   | 14600  | 7500   | 7500   | 6000   |     |
| Case volume                            | V                    | L                  |         | 0.17               | 0.17   | 0.17   | 0.20   | 0.20   | 0.20   | 0.33   | 0.45   | 0.45   | 0.55   |     |
| Mass (approx.)                         | m                    | kg                 | 2.5     | 6                  | 6      | 6      | 9.5    | 9.5    | 9.5    | 13.5   | 18     | 18     | 23     |     |

| Size                                   | NG                   |                    | 90     | 107    | 125    | 160    | 180    | 200    | 250   | 355   | 500   | 710  | 1000 |      |
|--|----------------------|--------------------|--------|--------|--------|--------|--------|--------|-------|-------|-------|------|------|------|
| Displacement geometric, per revolution | $V_g$                | cm <sup>3</sup>    | 90     | 106.7  | 125    | 160.4  | 180    | 200    | 250   | 355   | 500   | 710  | 1000 |      |
| Speed maximum <sup>1)</sup>            | $n_{nom}$            | rpm                | 1800   | 1600   | 1600   | 1450   | 1450   | 1550   | 1500  | 1320  | 1200  | 1200 | 950  |      |
|  | $n_{max}^{2)}$       | rpm                | 3350   | 3000   | 3000   | 2650   | 2650   | 2750   | 1800  | 1600  | 1500  | 1500 | 1200 |      |
| Flow at $n_{nom}$                      | $q_v$                | L/min              | 162    | 171    | 200    | 233    | 261    | 310    | 375   | 469   | 600   | 852  | 950  |      |
| Power at                               | $\Delta p = 350$ bar | P                  | kW     | 95     | 100    | 117    | 136    | 152    | 181   | 219   | 273   | 350  | 497  | 554  |
|  | $\Delta p = 400$ bar | P                  | kW     | 108    | 114    | 133    | 155    | 174    | 207   | –     | –     | –    | –    |      |
| Torque <sup>3)</sup>                   |                      |                    |        |        |        |        |        |        |       |       |       |      |      |      |
| at $V_g$ and                           | $\Delta p = 350$ bar | T                  | Nm     | 501    | 594    | 696    | 893    | 1003   | 1114  | 1393  | 1978  | 2785 | 3955 | 5570 |
|  | $\Delta p = 400$ bar | T                  | Nm     | 573    | 679    | 796    | 1021   | 1146   | 1273  | –     | –     | –    | –    |      |
| Rotary stiffness                       | c                    | kNm/rad            | 9.14   | 11.2   | 11.9   | 17.4   | 18.2   | 57.3   | 73.1  | 96.1  | 144   | 270  | 324  |      |
| Moment of inertia for rotary group     | $J_{GR}$             | kgm <sup>2</sup>   | 0.0072 | 0.0116 | 0.0116 | 0.0220 | 0.0220 | 0.0353 | 0.061 | 0.102 | 0.178 | 0.55 | 0.55 |      |
| Maximum angular acceleration           | $\alpha$             | rad/s <sup>2</sup> | 6000   | 4500   | 4500   | 3500   | 3500   | 11000  | 10000 | 8300  | 5500  | 4300 | 4500 |      |
| Case volume                            | V                    | L                  | 0.55   | 0.8    | 0.8    | 1.1    | 1.1    | 2.7    | 2.5   | 3.5   | 4.2   | 8    | 8    |      |
| Mass (approx.)                         | m                    | kg                 | 23     | 32     | 32     | 45     | 45     | 66     | 73    | 110   | 155   | 325  | 336  |      |

- The values are valid:
  - at an absolute pressure  $p_{abs} = 1$  bar at suction port S
  - for the optimum viscosity range from  $v_{opt} = 16$  to  $36$  mm<sup>2</sup>/s
  - with hydraulic fluid based on mineral oils
- Maximum speed (limiting speed) with increased inlet pressure  $p_{abs}$  at suction port S, see adjacent diagram.
- Torque without radial force, with radial force see page 8
- Torque at  $\Delta p = 315$  bar

### Note

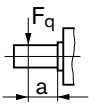
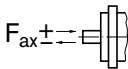
Operation above the maximum values or below the minimum values may result in a loss of function, a reduced service life or in the destruction of the axial piston unit. Other permissible limit values, with respect to speed variation, reduced angular acceleration as a function of the frequency and the permissible start up angular acceleration (lower than the maximum angular acceleration) can be found in data sheet RE 90261.

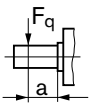
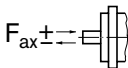


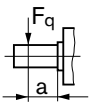
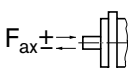
# Technical data

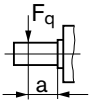
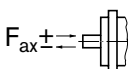
## Permissible radial and axial forces of the drive shafts

(splined shaft and parallel keyed shaft)

| Size   | NG  |                      | 5    | 5 <sup>3)</sup> | 10  | 10  | 12  | 12  | 16  | 23  | 23  |     |
|--|---|----------------------|------|-----------------|-----|-----|-----|-----|-----|-----|-----|-----|
| Drive shaft  | $\emptyset$   | mm                   | 12   | 12              | 20  | 25  | 20  | 25  | 25  | 25  | 30  |     |
| Maximum radial force <sup>1)</sup><br>at distance a<br>(from shaft collar) |  | $F_{q \max}$         | kN   | 1.6             | 1.6 | 3.0 | 3.2 | 3.0 | 3.2 | 3.2 | 5.7 | 5.4 |
|  |   | a                    | mm   | 12              | 12  | 16  | 16  | 16  | 16  | 16  | 16  | 16  |
| with permissible torque  | $T_{\max}$  | Nm                   | 24.7 | 24.7            | 66  | 66  | 76  | 76  | 102 | 146 | 146 |     |
| $\triangleq$ permissible pressure $\Delta p$                               | $\Delta p_{\text{perm}}$  | bar                  | 315  | 315             | 400 | 400 | 400 | 400 | 400 | 400 | 400 |     |
| Maximum axial force <sup>2)</sup>  |  | $+F_{\text{ax max}}$ | N    | 180             | 180 | 320 | 320 | 320 | 320 | 500 | 500 |     |
|  |   | $-F_{\text{ax max}}$ | N    | 0               | 0   | 0   | 0   | 0   | 0   | 0   | 0   |     |
| Permissible axial force per bar operating pressure                         | $\pm F_{\text{ax perm/bar}}$  | N/bar                | 1.5  | 1.5             | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 5.2 | 5.2 |     |

| Size   | NG   |                      | 28  | 28  | 32  | 45  | 56  | 56 <sup>4)</sup> | 56  | 63  | 80   |
|--|--|----------------------|-----|-----|-----|-----|-----|------------------|-----|-----|------|
| Drive shaft  | $\emptyset$  | mm                   | 25  | 30  | 30  | 30  | 30  | 30               | 35  | 35  | 35   |
| Maximum radial force <sup>1)</sup><br>at distance a<br>(from shaft collar) |   | $F_{q \max}$         | kN  | 5.7 | 5.4 | 5.4 | 7.6 | 9.5              | 7.8 | 9.1 | 11.6 |
|  |  | a                    | mm  | 16  | 16  | 16  | 18  | 18               | 18  | 18  | 18   |
| with permissible torque  | $T_{\max}$   | Nm                   | 179 | 179 | 204 | 290 | 357 | 294              | 357 | 401 | 512  |
| $\triangleq$ permissible pressure $\Delta p$                               | $\Delta p_{\text{perm}}$   | bar                  | 400 | 400 | 400 | 400 | 400 | 330              | 400 | 400 | 400  |
| Maximum axial force <sup>2)</sup>  |  | $+F_{\text{ax max}}$ | N   | 500 | 500 | 500 | 630 | 800              | 800 | 800 | 1000 |
|  |  | $-F_{\text{ax max}}$ | N   | 0   | 0   | 0   | 0   | 0                | 0   | 0   | 0    |
| Permissible axial force per bar operating pressure                         | $\pm F_{\text{ax perm/bar}}$   | N/bar                | 5.2 | 5.2 | 5.2 | 7.0 | 8.7 | 8.7              | 8.7 | 8.7 | 10.6 |

| Size   | NG  |                      | 80 <sup>4)</sup> | 80   | 90   | 107  | 107  | 125  | 160  | 160  | 180  |      |
|--|---|----------------------|------------------|------|------|------|------|------|------|------|------|------|
| Drive shaft  | $\emptyset$   | mm                   | 35               | 40   | 40   | 40   | 45   | 45   | 45   | 50   | 50   |      |
| Maximum radial force <sup>1)</sup><br>at distance a<br>(from shaft collar) |  | $F_{q \max}$         | kN               | 11.1 | 11.4 | 11.4 | 13.6 | 14.1 | 14.1 | 18.1 | 18.3 | 18.3 |
|  |   | a                    | mm               | 20   | 20   | 20   | 20   | 20   | 20   | 25   | 25   | 25   |
| with permissible torque  | $T_{\max}$  | Nm                   | 488              | 512  | 573  | 679  | 679  | 796  | 1021 | 1021 | 1146 |      |
| $\triangleq$ permissible pressure $\Delta p$                               | $\Delta p_{\text{perm}}$  | bar                  | 380              | 400  | 400  | 400  | 400  | 400  | 400  | 400  | 400  |      |
| Maximum axial force <sup>2)</sup>  |  | $+F_{\text{ax max}}$ | N                | 1000 | 1000 | 1000 | 1250 | 1250 | 1250 | 1600 | 1600 | 1600 |
|  |   | $-F_{\text{ax max}}$ | N                | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| Permissible axial force per bar operating pressure                         | $\pm F_{\text{ax perm/bar}}$  | N/bar                | 10.6             | 10.6 | 10.6 | 12.9 | 12.9 | 12.9 | 16.7 | 16.7 | 16.7 |      |

| Size   | NG  |                      | 200  | 250           | 355               | 500               | 710               | 1000              |                   |
|--|---|----------------------|------|---------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| Drive shaft  | $\emptyset$   | mm                   | 50   | 50            | 60                | 70                | 90                | 90                |                   |
| Maximum radial force <sup>1)</sup><br>at distance a<br>(from shaft collar) |  | $F_{q \max}$         | kN   | 20.3          | 1.2 <sup>6)</sup> | 1.5 <sup>6)</sup> | 1.9 <sup>6)</sup> | 3.0 <sup>6)</sup> | 2.6 <sup>6)</sup> |
|  |   | a                    | mm   | 25            | 41                | 52.5              | 52.5              | 67.5              | 67.5              |
| with permissible torque  | $T_{\max}$  | Nm                   | 1273 | <sup>5)</sup> | <sup>5)</sup>     | <sup>5)</sup>     | <sup>5)</sup>     | <sup>5)</sup>     |                   |
| $\triangleq$ permissible pressure $\Delta p$                               | $\Delta p_{\text{perm}}$  | bar                  | 400  | <sup>5)</sup> | <sup>5)</sup>     | <sup>5)</sup>     | <sup>5)</sup>     | <sup>5)</sup>     |                   |
| Maximum axial force <sup>2)</sup>  |  | $+F_{\text{ax max}}$ | N    | 1600          | 2000              | 2500              | 3000              | 4400              | 4400              |
|  |   | $-F_{\text{ax max}}$ | N    | 0             | 0                 | 0                 | 0                 | 0                 | 0                 |
| Permissible axial force per bar operating pressure                         | $\pm F_{\text{ax perm/bar}}$  | N/bar                | 16.7 | <sup>5)</sup> | <sup>5)</sup>     | <sup>5)</sup>     | <sup>5)</sup>     | <sup>5)</sup>     |                   |

1) With intermittent operation

2) Maximum permissible axial force during standstill or when the axial piston unit is operating in non-pressurized condition.

3) Conical shaft with threaded pin and woodruff key (DIN 6888)

4) Restricted technical data only for splined shaft

5) Please contact us.

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

### Note

Influence of the direction of the permissible axial force:

$+F_{\text{ax max}}$  = Increase in service life of bearings

$-F_{\text{ax max}}$  = Reduction in service life of bearings (avoid)

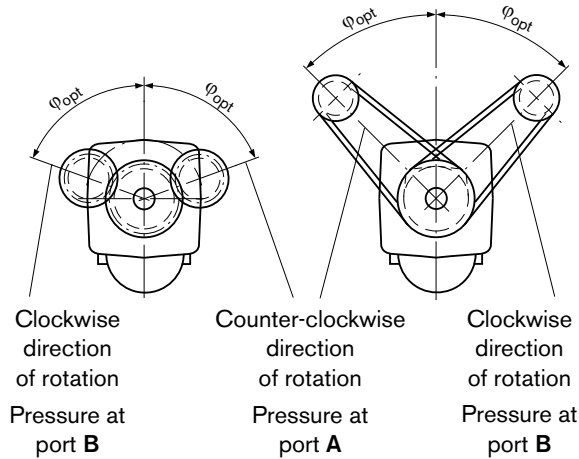


# Technical data

## 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 | V-belt output  |
|-------------|--------------------|----------------|
| <b>NG</b>   | $\Phi_{opt}$       | $\Phi_{opt}$   |
| 5 to 180    | $\pm 70^\circ$     | $\pm 45^\circ$ |
| 200 to 1000 | $\pm 45^\circ$     | $\pm 70^\circ$ |



## Determining the operating characteristics

Flow  $q_v = \frac{V_g \cdot n \cdot \eta_v}{1000}$  [L/min]

Torque  $T = \frac{V_g \cdot \Delta p}{20 \cdot \pi \cdot \eta_{mh}}$  [Nm]

Power  $P = \frac{2 \pi \cdot T \cdot n}{60000} = \frac{q_v \cdot \Delta p}{600 \cdot \eta_t}$  [kW]

$V_g$  = Displacement per revolution in  $cm^3$

$\Delta p$  = Differential pressure in bar

$n$  = Speed in rpm

$\eta_v$  = Volumetric efficiency

$\eta_{mh}$  = Mechanical-hydraulic efficiency

$\eta_t$  = Total efficiency ( $\eta_t = \eta_v \cdot \eta_{mh}$ )

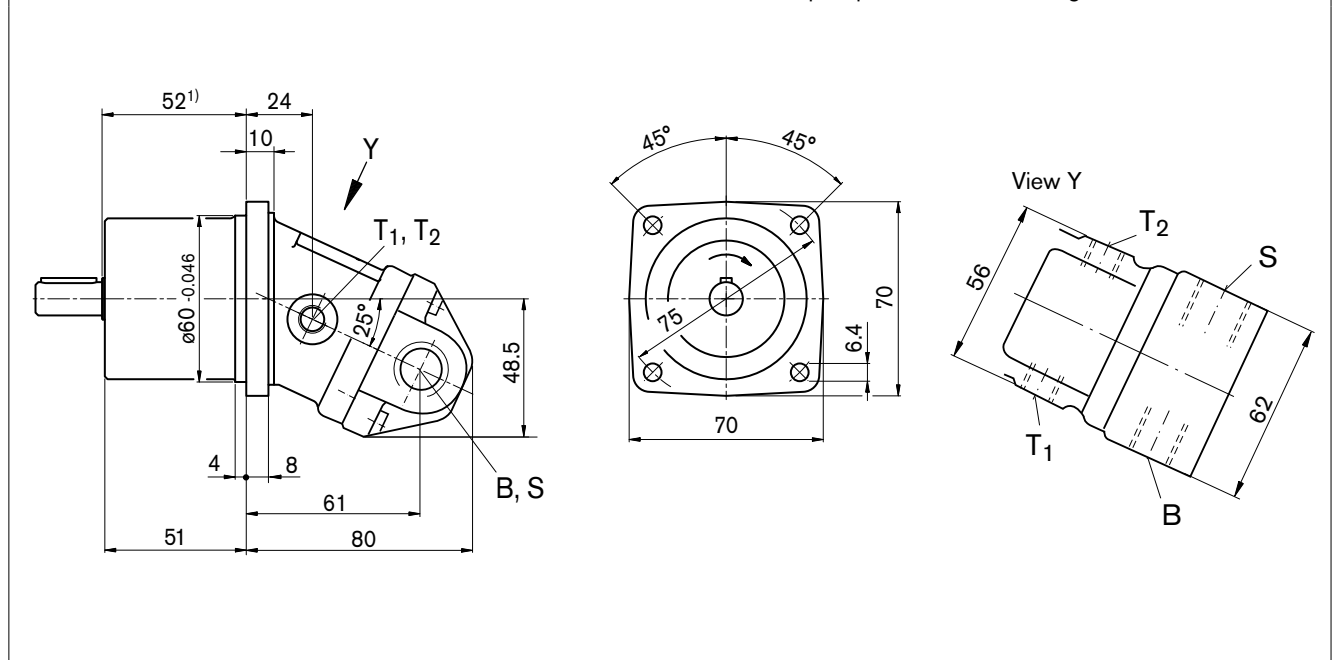


# Dimensions size 5

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

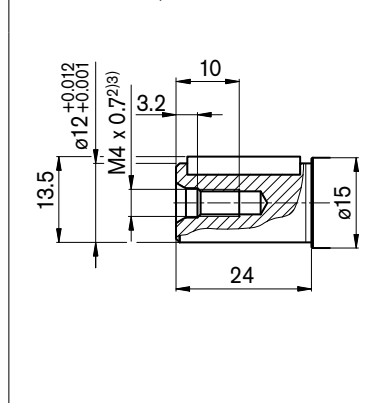
## Port plate 07 – Threaded ports A/B and S at side

Illustration: cw direction of rotation (on version "ccw direction of rotation" the port plate is rotated through 180°)

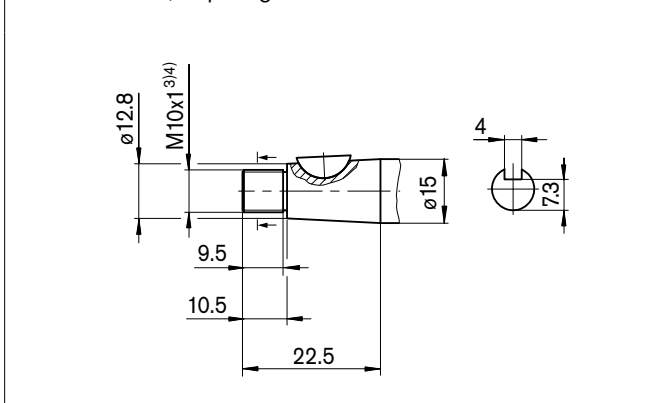


## Drive shafts

**B** Parallel keyed shaft  
DIN 6885, A4x4x20



**C** Conical shaft with threaded pin and woodruff key, 3x5  
(DIN 6888), (tapering 1:10)



## Ports

| Designation    | Port for     | Standard <sup>6)</sup> | Size <sup>3)</sup> | Maximum pressure [bar] <sup>5)</sup> | State <sup>7)</sup> |
|----------------|--------------|------------------------|--------------------|--------------------------------------|---------------------|
| B (A)          | Service line | DIN 3852               | M18 x 1.5; 12 deep | 350                                  | O                   |
| S              | Suction line | DIN 3852               | M22 x 1.5; 14 deep | 30                                   | O                   |
| T <sub>1</sub> | Drain line   | DIN 3852               | M10 x 1; 8 deep    | 3                                    | O                   |
| T <sub>2</sub> | Drain line   | DIN 3852               | M10 x 1; 8 deep    | 3                                    | O                   |

1) To shaft collar

2) Center bore according to DIN 332 (thread according to DIN 13)

3) Observe the general instructions on page 34 for the maximum tightening torques.

4) Thread according to DIN 3852, maximum tightening torque: 30 Nm

5) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.

6) The spot face can be deeper than specified in the appropriate standard.

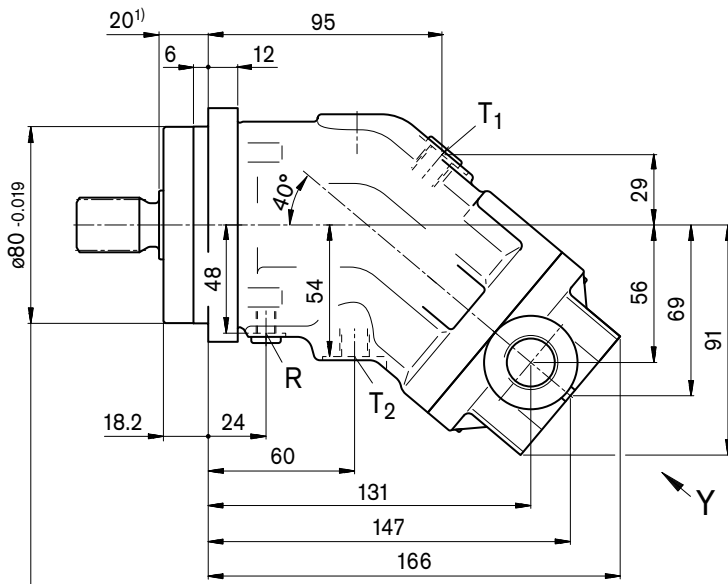
7) O = Must be connected (plugged on delivery)

# Dimensions sizes 10, 12, 16

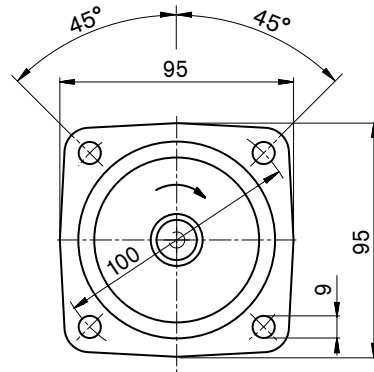
Before finalizing your design, request a binding installation drawing. Dimensions in mm.

**Port plate 06** – Threaded port A/B at side and threaded port S at rear

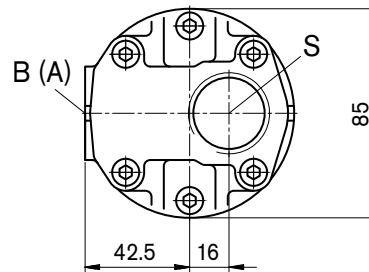
Illustration: cw direction of rotation (on version "ccw direction of rotation" the port plate is rotated through 180°)



Flange  
similar to ISO 3019-2



View Y



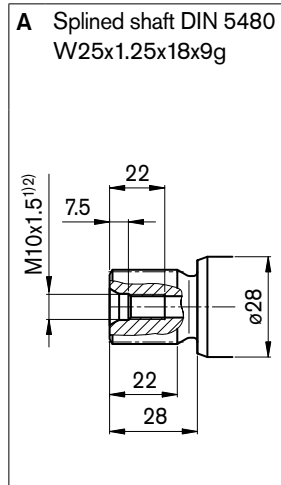
1) To shaft collar

# Dimensions sizes 10, 12, 16

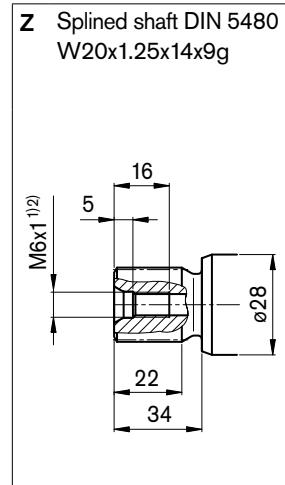
Before finalizing your design, request a binding installation drawing. Dimensions in mm.

## Drive shafts

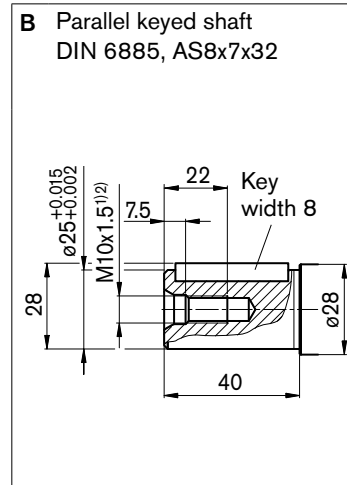
### Sizes 10, 12, 16



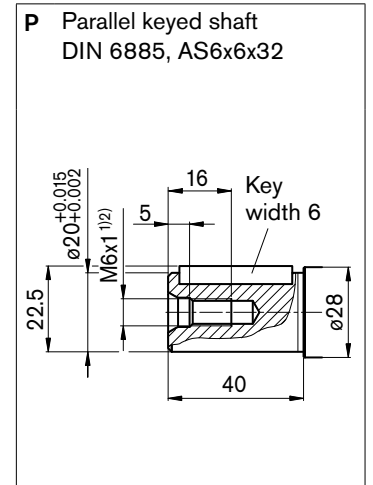
### NG10, 12



### Sizes 10, 12, 16



### NG10, 12



## Ports

| Designation    | Port for     | Standard <sup>5)</sup> | Size <sup>2)</sup> | Maximum pressure [bar] <sup>3)</sup> | State <sup>6)</sup> |
|----------------|--------------|------------------------|--------------------|--------------------------------------|---------------------|
| B (A)          | Service line | DIN 3852               | M22 x 1.5; 14 deep | 450                                  | O                   |
| S              | Suction line | DIN 3852               | M33 x 2; 18 deep   | 30                                   | O                   |
| T <sub>1</sub> | Drain line   | DIN 3852               | M12 x 1.5; 12 deep | 3                                    | X <sup>4)</sup>     |
| T <sub>2</sub> | Drain line   | DIN 3852               | M12 x 1.5; 12 deep | 3                                    | O <sup>4)</sup>     |
| R              | Air bleed    | DIN 3852               | M8 x 1; 8 deep     | 3                                    | X                   |

1) Center bore according to DIN 332 (thread according to DIN 13)

2) Observe the general instructions on page 34 for the maximum tightening torques.

3) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.

4) Depending on installation position, T<sub>1</sub> or T<sub>2</sub> must be connected (see also installation instructions on pages 32 and 33).

5) The spot face can be deeper than specified in the appropriate standard.

6) O = Must be connected (plugged on delivery)

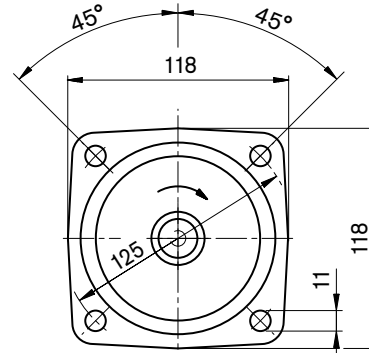
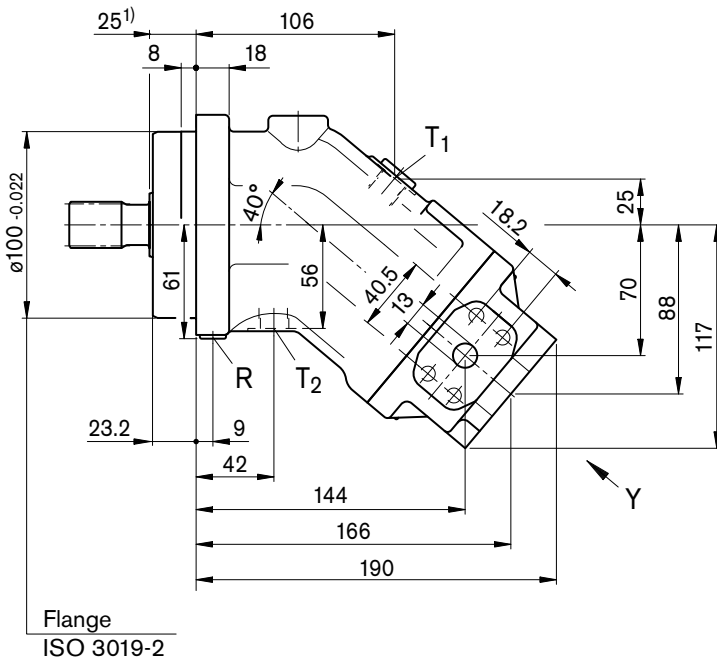
X = Plugged (in normal operation)

# Dimensions sizes 23, 28, 32

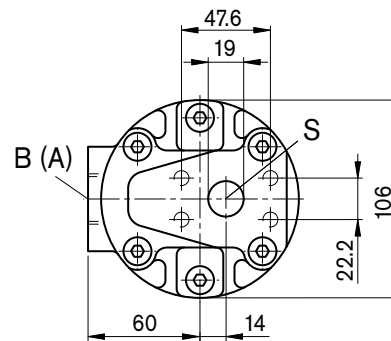
Before finalizing your design, request a binding installation drawing. Dimensions in mm.

Port plate 05 – SAE flange port A/B at side and SAE flange port S at rear

Illustration: cw direction of rotation (on version "ccw direction of rotation" the port plate is rotated through 180°)



View Y



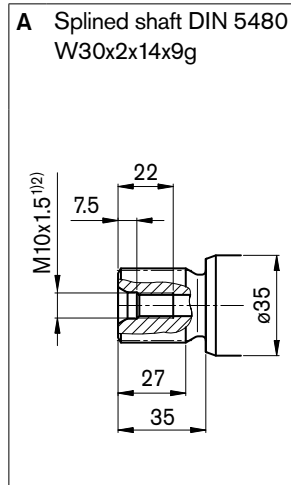
1) To shaft collar

# Dimensions sizes 23, 28, 32

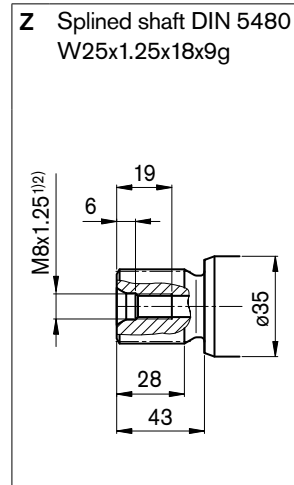
Before finalizing your design, request a binding installation drawing. Dimensions in mm.

## Drive shafts

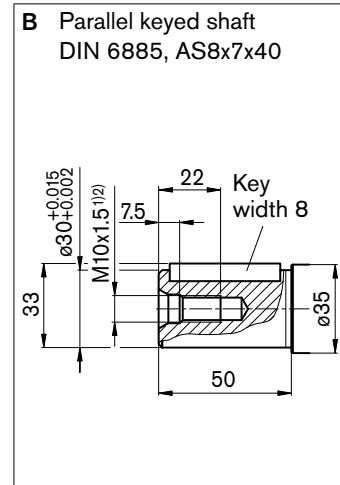
### Sizes 23, 28, 32



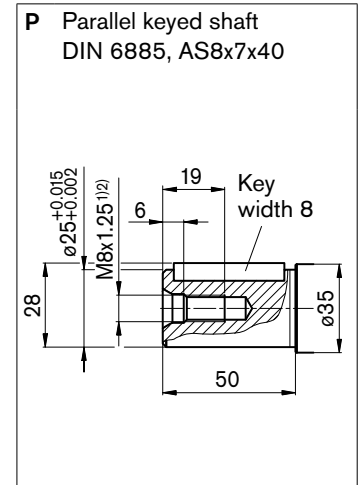
### NG23, 28



### Sizes 23, 28, 32



### NG23, 28



## Ports

| Designation    | Port for                             | Standard                         | Size <sup>2)</sup>           | Maximum pressure [bar] <sup>3)</sup> | State <sup>7)</sup> |
|----------------|--------------------------------------|----------------------------------|------------------------------|--------------------------------------|---------------------|
| B (A)          | Service line<br>Fastening thread B/A | SAE J518 <sup>5)</sup><br>DIN 13 | 1/2 in<br>M8 x 1.25; 15 deep | 450                                  | O                   |
| S              | Suction line<br>Fastening thread     | SAE J518 <sup>5)</sup><br>DIN 13 | 3/4 in<br>M10 x 1.5; 17 deep | 30                                   | O                   |
| T <sub>1</sub> | Drain line                           | DIN 3852 <sup>6)</sup>           | M16 x 1.5; 12 deep           | 3                                    | X <sup>4)</sup>     |
| T <sub>2</sub> | Drain line                           | DIN 3852 <sup>6)</sup>           | M16 x 1.5; 12 deep           | 3                                    | O <sup>4)</sup>     |
| R              | Air bleed                            | DIN 3852 <sup>6)</sup>           | M10 x 1; 12 deep             | 3                                    | X                   |

1) Center bore according to DIN 332 (thread according to DIN 13)

2) Observe the general instructions on page 34 for the maximum tightening torques.

3) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.

4) Depending on installation position, T<sub>1</sub> or T<sub>2</sub> must be connected (see also installation instructions on pages 32 and 33).

5) Only dimensions according to SAE J518, metric fastening thread is a deviation from standard.

6) The spot face can be deeper than specified in the appropriate standard.

7) O = Must be connected (plugged on delivery)

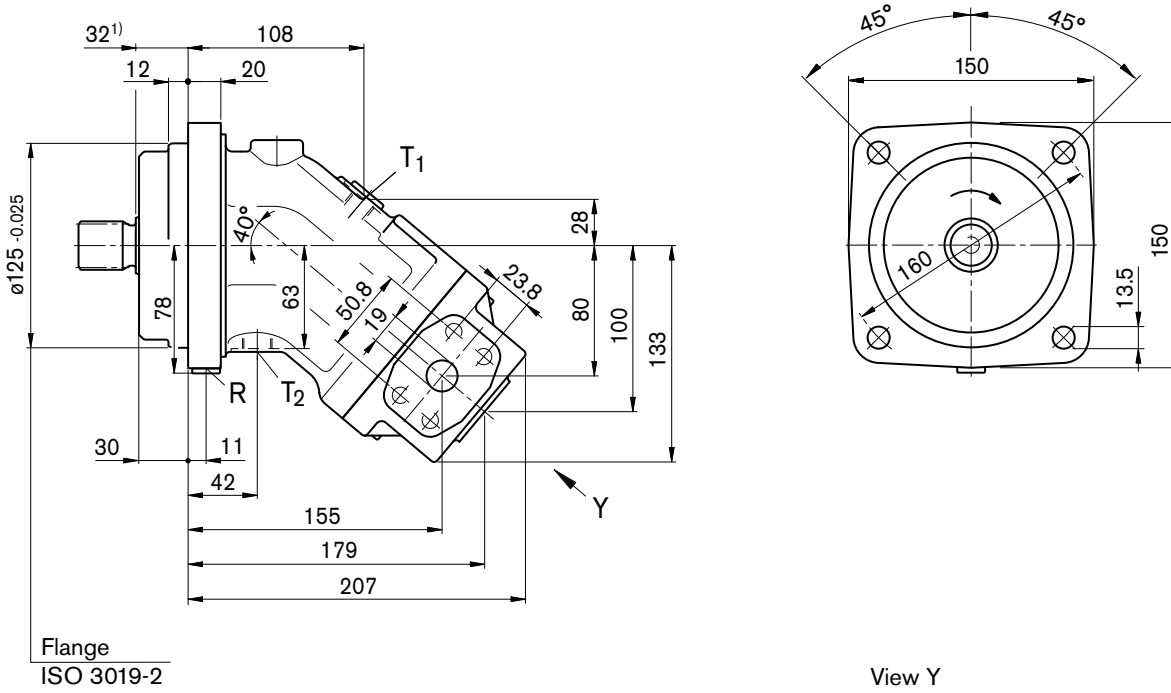
X = Plugged (in normal operation)

# Dimensions size 45

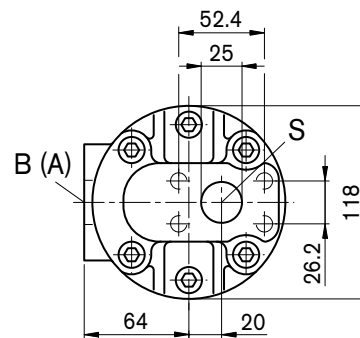
Before finalizing your design, request a binding installation drawing. Dimensions in mm.

Port plate 05 – SAE flange port A/B at side and SAE flange port S at rear

Illustration: cw direction of rotation (on version "ccw direction of rotation" the port plate is rotated through 180°)



View Y



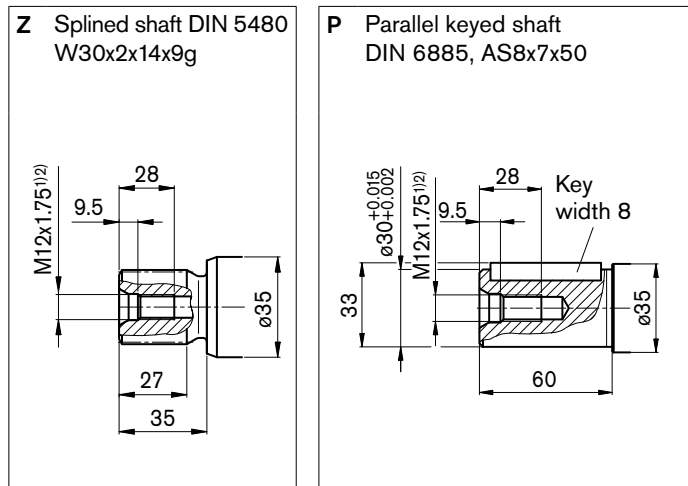
1) To shaft collar



# Dimensions size 45

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

## Drive shafts



## Ports

| Designation    | Port for                             | Standard                         | Size <sup>2)</sup>           | Maximum pressure [bar] <sup>3)</sup> | State <sup>7)</sup> |
|----------------|--------------------------------------|----------------------------------|------------------------------|--------------------------------------|---------------------|
| B (A)          | Service line<br>Fastening thread B/A | SAE J518 <sup>5)</sup><br>DIN 13 | 3/4 in<br>M10 x 1.5; 17 deep | 450                                  | O                   |
| S              | Suction line<br>Fastening thread     | SAE J518 <sup>5)</sup><br>DIN 13 | 1 in<br>M10 x 1.5; 17 deep   | 30                                   | O                   |
| T <sub>1</sub> | Drain line                           | DIN 3852 <sup>6)</sup>           | M18 x 1.5; 12 deep           | 3                                    | X <sup>4)</sup>     |
| T <sub>2</sub> | Drain line                           | DIN 3852 <sup>6)</sup>           | M18 x 1.5; 12 deep           | 3                                    | O <sup>4)</sup>     |
| R              | Air bleed                            | DIN 3852 <sup>6)</sup>           | M12 x 1.5; 12 deep           | 3                                    | X                   |

1) Center bore according to DIN 332 (thread according to DIN 13)

2) Observe the general instructions on page 34 for the maximum tightening torques.

3) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.

4) Depending on installation position, T<sub>1</sub> or T<sub>2</sub> must be connected (see also installation instructions on pages 32 and 33).

5) Only dimensions according to SAE J518, metric fastening thread is a deviation from standard.

6) The spot face can be deeper than specified in the appropriate standard.

7) O = Must be connected (plugged on delivery)

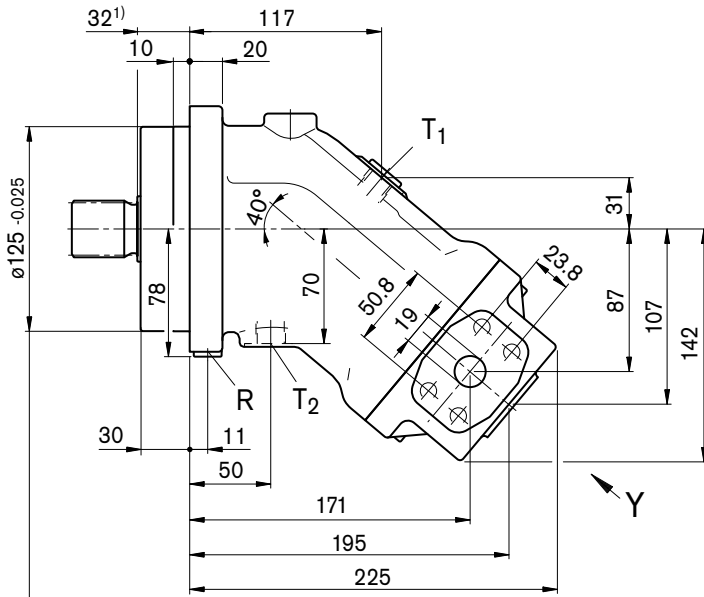
X = Plugged (in normal operation)

# Dimensions sizes 56, 63

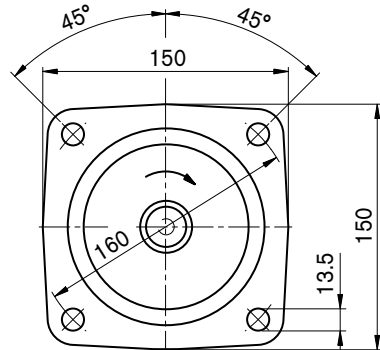
Before finalizing your design, request a binding installation drawing. Dimensions in mm.

Port plate 05 – SAE flange port A/B at side and SAE flange port S at rear

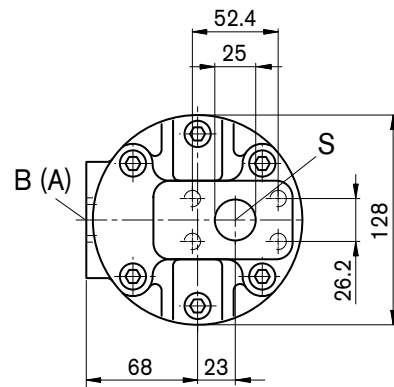
Illustration: cw direction of rotation (on version "ccw direction of rotation" the port plate is rotated through 180°)



Flange  
ISO 3019-2



View Y



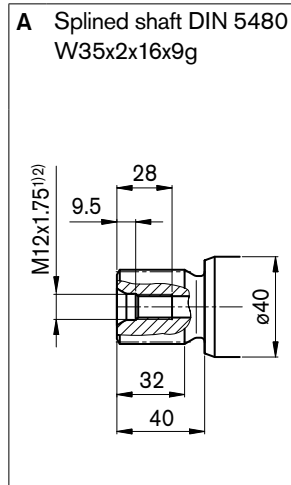
1) To shaft collar

# Dimensions sizes 56, 63

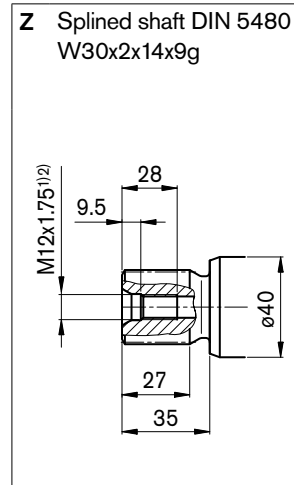
Before finalizing your design, request a binding installation drawing. Dimensions in mm.

## Drive shafts

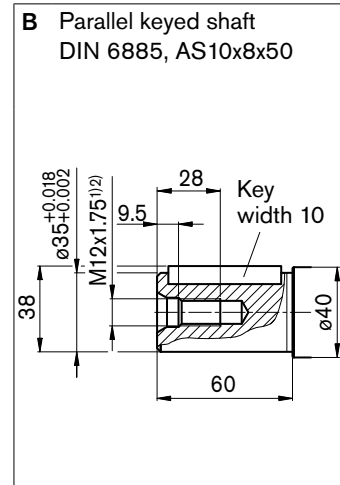
### NG56, 63



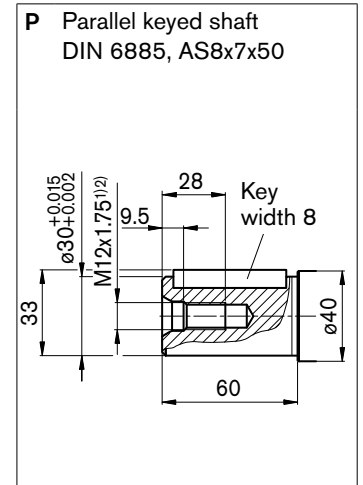
### NG56



### NG56, 63



### NG56



## Ports

| Designation    | Port for                             | Standard                         | Size <sup>2)</sup>           | Maximum pressure [bar] <sup>3)</sup> | State <sup>7)</sup> |
|----------------|--------------------------------------|----------------------------------|------------------------------|--------------------------------------|---------------------|
| B (A)          | Service line<br>Fastening thread B/A | SAE J518 <sup>5)</sup><br>DIN 13 | 3/4 in<br>M10 x 1.5; 17 deep | 450                                  | O                   |
| S              | Suction line<br>Fastening thread     | SAE J518 <sup>5)</sup><br>DIN 13 | 1 in<br>M10 x 1.5; 17 deep   | 30                                   | O                   |
| T <sub>1</sub> | Drain line                           | DIN 3852 <sup>6)</sup>           | M18 x 1.5; 12 deep           | 3                                    | X <sup>4)</sup>     |
| T <sub>2</sub> | Drain line                           | DIN 3852 <sup>6)</sup>           | M18 x 1.5; 12 deep           | 3                                    | O <sup>4)</sup>     |
| R              | Air bleed                            | DIN 3852 <sup>6)</sup>           | M12 x 1.5; 12 deep           | 3                                    | X                   |

1) Center bore according to DIN 332 (thread according to DIN 13)

2) Observe the general instructions on page 34 for the maximum tightening torques.

3) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.

4) Depending on installation position, T<sub>1</sub> or T<sub>2</sub> must be connected (see also installation instructions on pages 32 and 33).

5) Only dimensions according to SAE J518, metric fastening thread is a deviation from standard.

6) The spot face can be deeper than specified in the appropriate standard.

7) O = Must be connected (plugged on delivery)

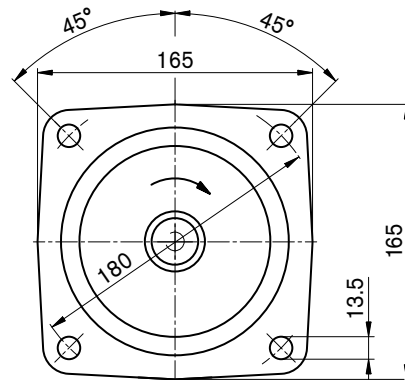
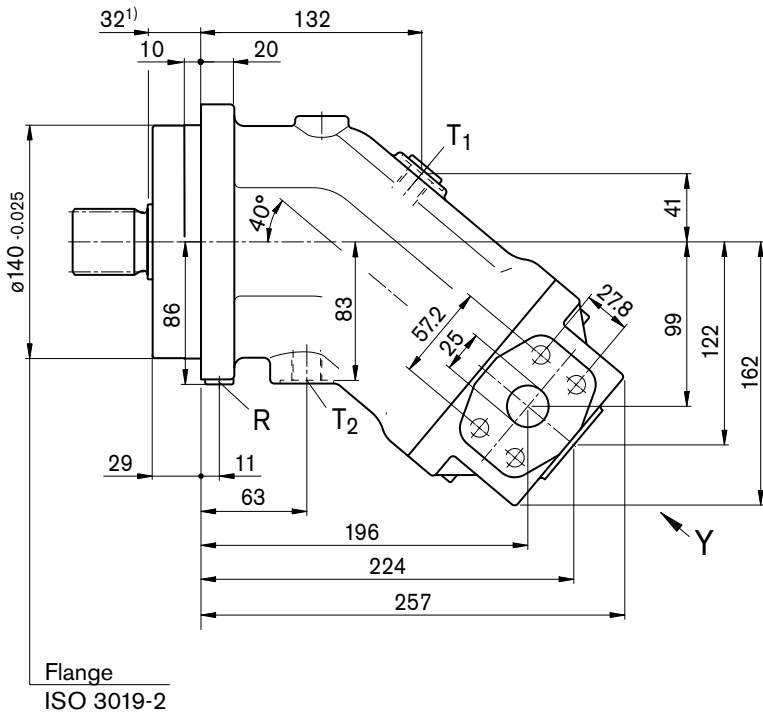
X = Plugged (in normal operation)

# Dimensions sizes 80, 90

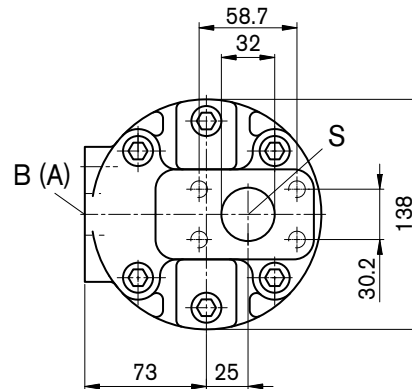
Before finalizing your design, request a binding installation drawing. Dimensions in mm.

Port plate 05 – SAE flange port A/B at side and SAE flange port S at rear

Illustration: cw direction of rotation (on version "ccw direction of rotation" the port plate is rotated through 180°)



View Y



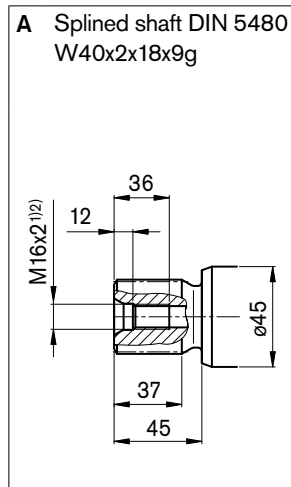
1) To shaft collar

# Dimensions sizes 80, 90

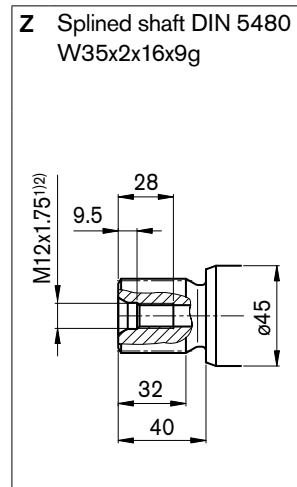
Before finalizing your design, request a binding installation drawing. Dimensions in mm.

## Drive shafts

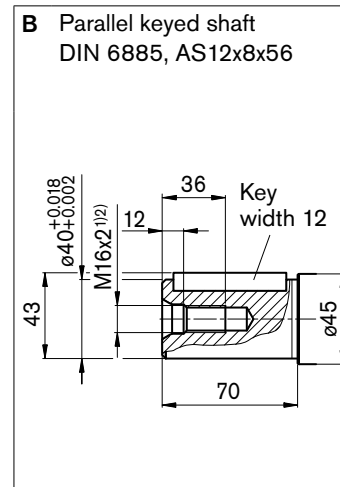
### NG80, 90



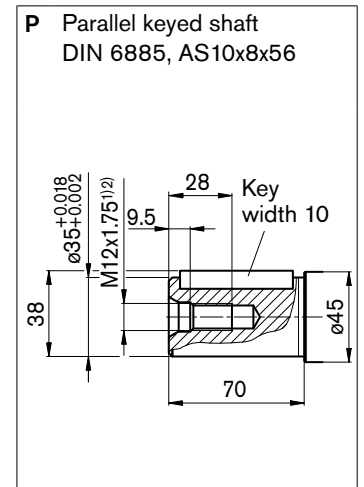
### NG80



### NG80, 90



### NG80



## Ports

| Designation    | Port for                             | Standard                         | Size <sup>2)</sup>             | Maximum pressure [bar] <sup>3)</sup> | State <sup>7)</sup> |
|----------------|--------------------------------------|----------------------------------|--------------------------------|--------------------------------------|---------------------|
| B (A)          | Service line<br>Fastening thread B/A | SAE J518 <sup>5)</sup><br>DIN 13 | 1 in<br>M12 x 1.5; 17 deep     | 450                                  | O                   |
| S              | Suction line<br>Fastening thread     | SAE J518 <sup>5)</sup><br>DIN 13 | 1 1/4 in<br>M10 x 1.5; 17 deep | 30                                   | O                   |
| T <sub>1</sub> | Drain line                           | DIN 3852 <sup>6)</sup>           | M18 x 1.5; 12 deep             | 3                                    | X <sup>4)</sup>     |
| T <sub>2</sub> | Drain line                           | DIN 3852 <sup>6)</sup>           | M18 x 1.5; 12 deep             | 3                                    | O <sup>4)</sup>     |
| R              | Air bleed                            | DIN 3852 <sup>6)</sup>           | M12 x 1.5; 12 deep             | 3                                    | X                   |

1) Center bore according to DIN 332 (thread according to DIN 13)

2) Observe the general instructions on page 34 for the maximum tightening torques.

3) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.

4) Depending on installation position, T<sub>1</sub> or T<sub>2</sub> must be connected (see also installation instructions on pages 32 and 33).

5) Only dimensions according to SAE J518, metric fastening thread is a deviation from standard.

6) The spot face can be deeper than specified in the appropriate standard.

7) O = Must be connected (plugged on delivery)

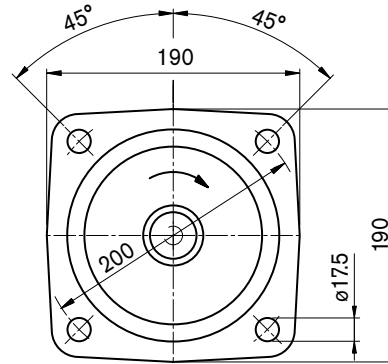
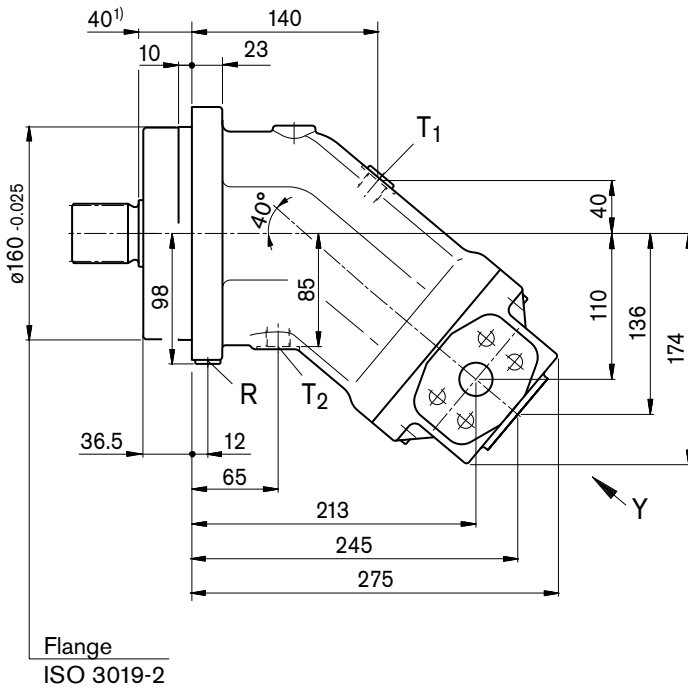
X = Plugged (in normal operation)

# Dimensions sizes 107, 125

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

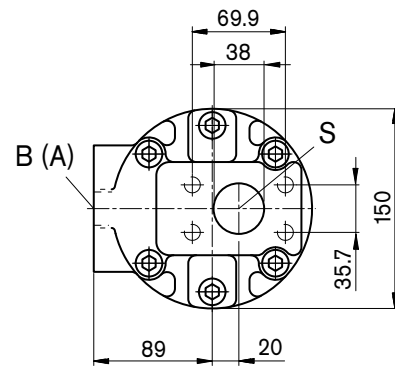
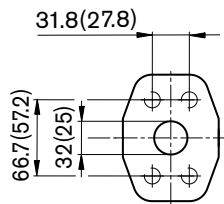
Port plate 05 – SAE flange port A/B at side and SAE flange port S at rear

Illustration: cw direction of rotation (on version "ccw direction of rotation" the port plate is rotated through 180°)



View Y

Detail: port A/B  
(dimensions in brackets for size 107)



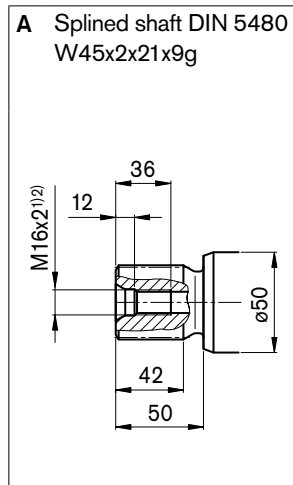
1) To shaft collar

# Dimensions sizes 107, 125

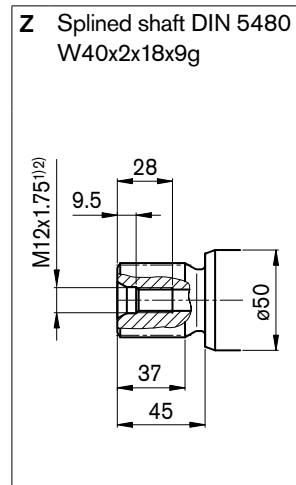
Before finalizing your design, request a binding installation drawing. Dimensions in mm.

## Drive shafts

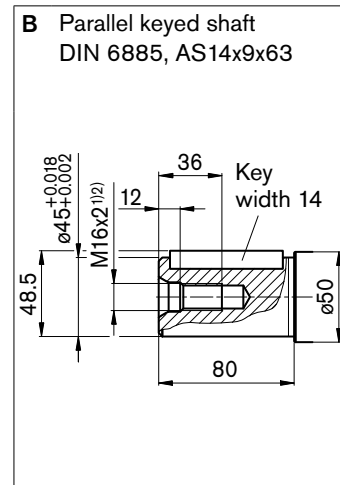
### NG107, 125



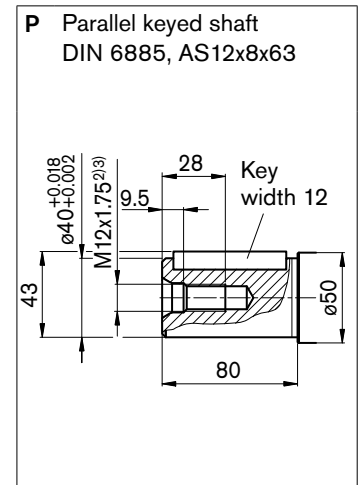
### NG107



### NG107, 125



### NG107



## Ports

| Designation    | Port for             | Standard               | Size <sup>2)</sup>  | Maximum pressure [bar] <sup>3)</sup> | State <sup>7)</sup> |
|----------------|----------------------|------------------------|---|--------------------------------------|---------------------|
| B (A)          | Service line         | SAE J518 <sup>5)</sup> | 1 in (size 107)<br>1 1/4 in (size 125)                        | 450                                  | O                   |
|                | Fastening thread B/A | DIN 13                 | M12 x 1.75; 17 deep (size 107)<br>M14 x 2; 19 deep (size 125) |                                      |                     |
| S              | Suction line         | SAE J518 <sup>5)</sup> | 1 1/2 in  | 30                                   | O                   |
|                | Fastening thread     | DIN 13                 | M12 x 1.75; 20 deep   |                                      |                     |
| T <sub>1</sub> | Drain line           | DIN 3852 <sup>6)</sup> | M18 x 1.5; 12 deep  | 3                                    | X <sup>4)</sup>     |
| T <sub>2</sub> | Drain line           | DIN 3852 <sup>6)</sup> | M18 x 1.5; 12 deep  | 3                                    | O <sup>4)</sup>     |
| R              | Air bleed            | DIN 3852 <sup>6)</sup> | M14 x 1.5; 12 deep  | 3                                    | X                   |

1) Center bore according to DIN 332 (thread according to DIN 13)

2) Observe the general instructions on page 34 for the maximum tightening torques.

3) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.

4) Depending on installation position, T<sub>1</sub> or T<sub>2</sub> must be connected (see also installation instructions on pages 32 and 33).

5) Only dimensions according to SAE J518, metric fastening thread is a deviation from standard.

6) The spot face can be deeper than specified in the appropriate standard.

7) O = Must be connected (plugged on delivery)

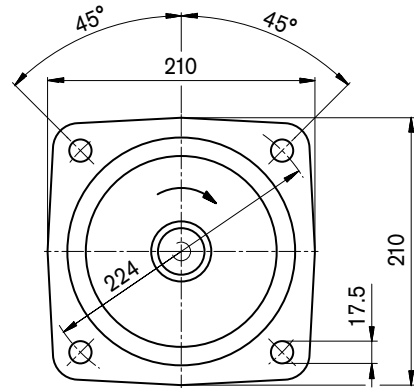
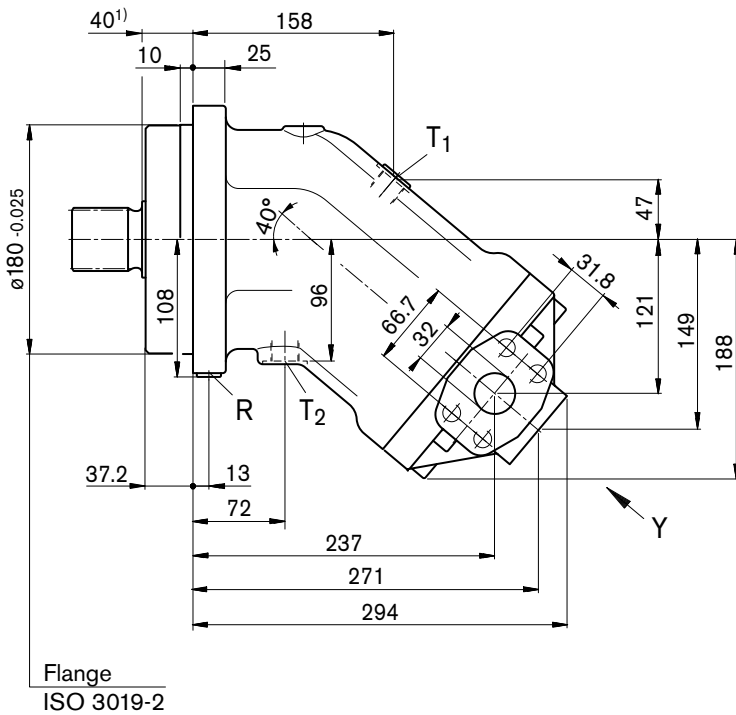
X = Plugged (in normal operation)

# Dimensions sizes 160, 180

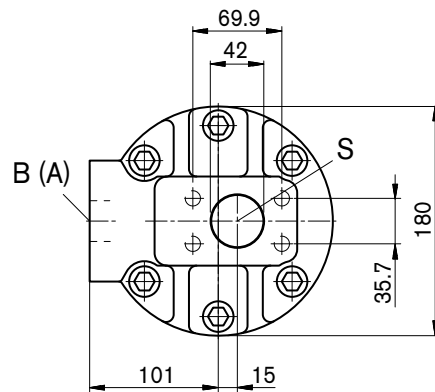
Before finalizing your design, request a binding installation drawing. Dimensions in mm.

Port plate 05 – SAE flange port A/B at side and SAE flange port S at rear

Illustration: cw direction of rotation (on version "ccw direction of rotation" the port plate is rotated through 180°)



View Y



1) To shaft collar

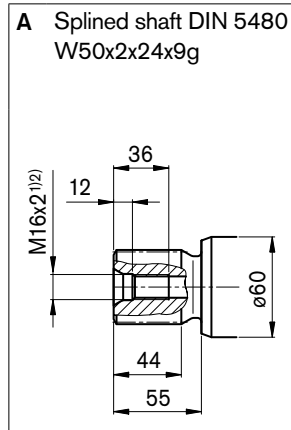


# Dimensions sizes 160, 180

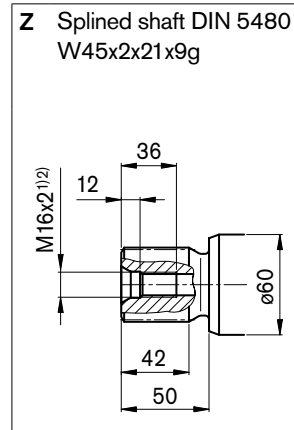
Before finalizing your design, request a binding installation drawing. Dimensions in mm.

## Drive shafts

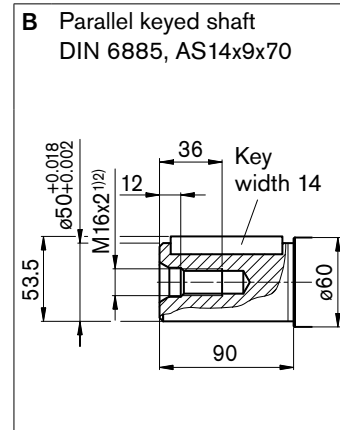
### NG160, 180



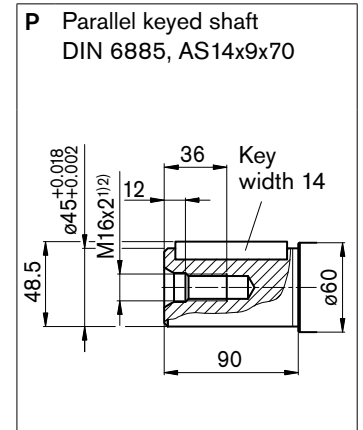
### NG160



### NG160, 180



### NG160



## Ports

| Designation    | Port for                             | Standard                         | Size <sup>2)</sup>              | Maximum pressure [bar] <sup>3)</sup> | State <sup>7)</sup> |
|----------------|--------------------------------------|----------------------------------|---------------------------------|--------------------------------------|---------------------|
| B (A)          | Service line<br>Fastening thread B/A | SAE J518 <sup>5)</sup><br>DIN 13 | 1 1/4 in<br>M14 x 2; 19 deep    | 450                                  | O                   |
| S              | Suction line<br>Fastening thread     | SAE J518 <sup>5)</sup><br>DIN 13 | 1 1/2 in<br>M12 x 1.75; 20 deep | 30                                   | O                   |
| T <sub>1</sub> | Drain line                           | DIN 3852 <sup>6)</sup>           | M22 x 1.5; 14 deep              | 3                                    | X <sup>4)</sup>     |
| T <sub>2</sub> | Drain line                           | DIN 3852 <sup>6)</sup>           | M22 x 1.5; 14 deep              | 3                                    | O <sup>4)</sup>     |
| R              | Air bleed                            | DIN 3852 <sup>6)</sup>           | M14 x 1.5; 12 deep              | 3                                    | X                   |

1) Center bore according to DIN 332 (thread according to DIN 13)

2) Observe the general instructions on page 34 for the maximum tightening torques.

3) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.

4) Depending on installation position, T<sub>1</sub> or T<sub>2</sub> must be connected (see also installation instructions on pages 32 and 33).

5) Only dimensions according to SAE J518, metric fastening thread is a deviation from standard.

6) The spot face can be deeper than specified in the appropriate standard.

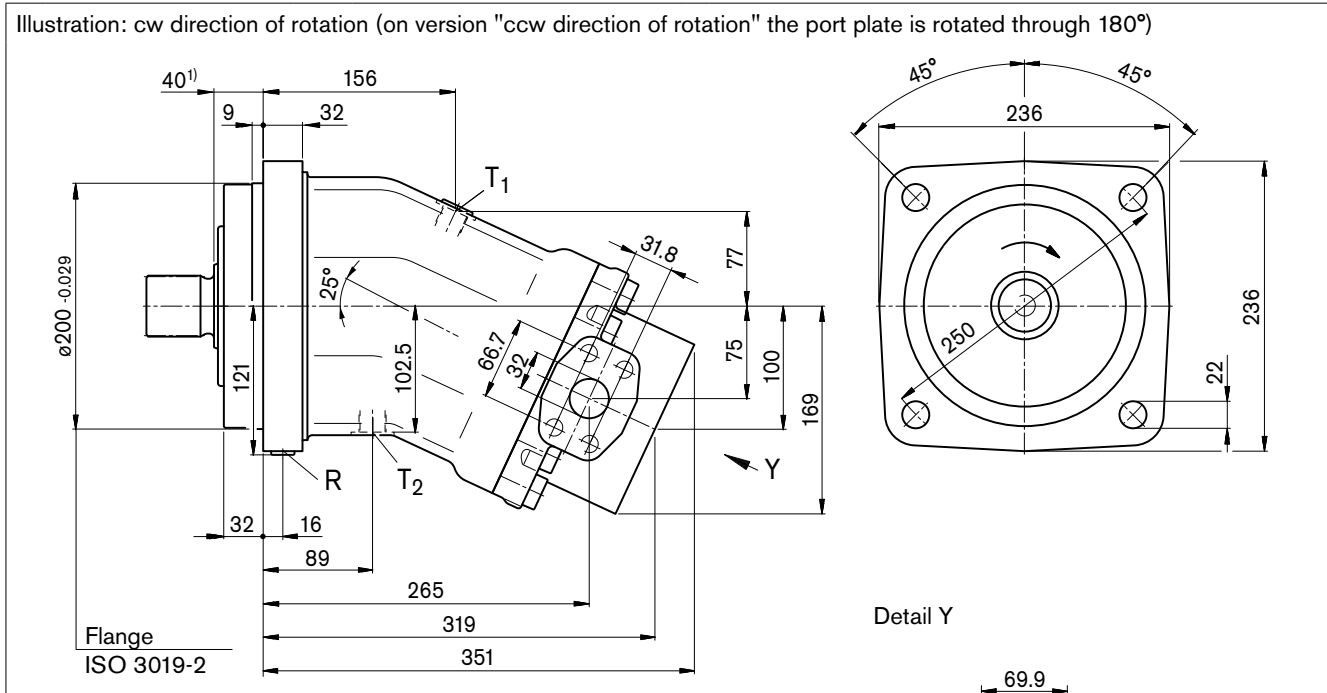
7) O = Must be connected (plugged on delivery)

X = Plugged (in normal operation)

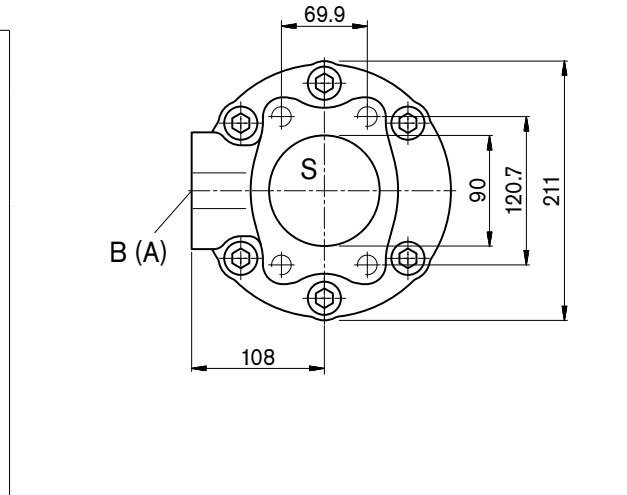
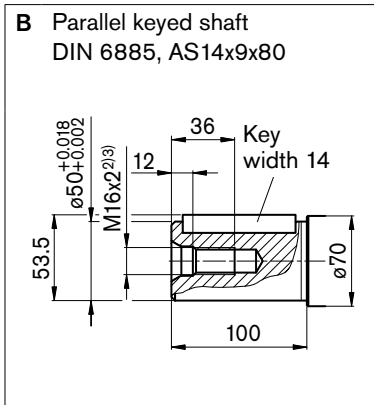
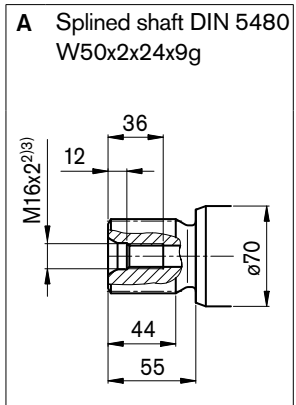
# Dimensions size 200

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

## Port plate 05 – SAE flange port A/B at side and SAE flange port S at rear



### Drive shafts



### Ports

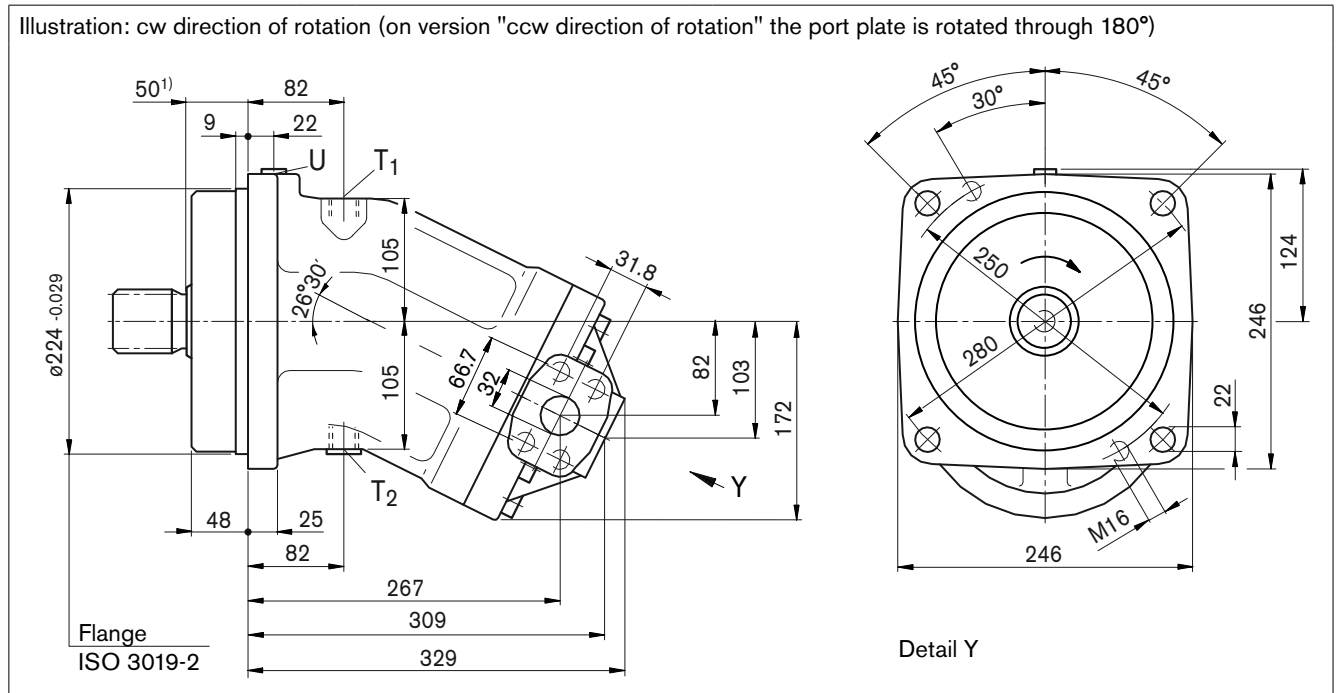
| Designation    | Port for                             | Standard                          | Size <sup>(3)</sup>          | Maximum pressure [bar] <sup>(4)</sup> | State <sup>(8)</sup> |
|----------------|--------------------------------------|-----------------------------------|------------------------------|---------------------------------------|----------------------|
| B (A)          | Service line<br>Fastening thread B/A | SAE J518 <sup>(6)</sup><br>DIN 13 | 1 1/4 in<br>M14 x 2; 19 deep | 450                                   | O                    |
| S              | Suction line<br>Fastening thread     | SAE J518 <sup>(6)</sup><br>DIN 13 | 3 1/2 in<br>M16 x 2; 24 deep | 30                                    | O                    |
| T <sub>1</sub> | Drain line                           | DIN 3852 <sup>(7)</sup>           | M22 x 1.5; 14 deep           | 3                                     | X <sup>(5)</sup>     |
| T <sub>2</sub> | Drain line                           | DIN 3852 <sup>(7)</sup>           | M22 x 1.5; 14 deep           | 3                                     | O <sup>(5)</sup>     |
| R              | Air bleed                            | DIN 3852 <sup>(7)</sup>           | M14 x 1.5; 12 deep           | 3                                     | X                    |

- 1) To shaft collar
- 2) Center bore according to DIN 332 (thread according to DIN 13)
- 3) Observe the general instructions on page 34 for the maximum tightening torques.
- 4) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
- 5) Depending on installation position, T<sub>1</sub> or T<sub>2</sub> must be connected (see also installation instructions on pages 32 and 33).
- 6) Only dimensions according to SAE J518, metric fastening thread is a deviation from standard.
- 7) The spot face can be deeper than specified in the appropriate standard.
- 8) O = Must be connected (plugged on delivery)  
X = Plugged (in normal operation)

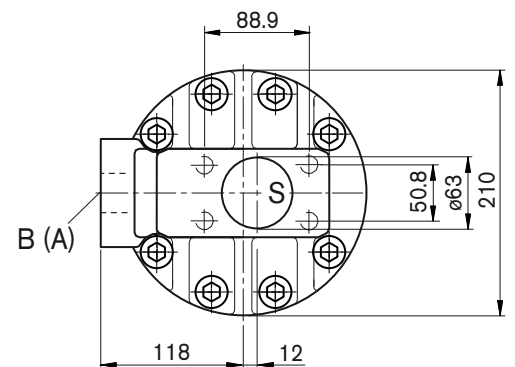
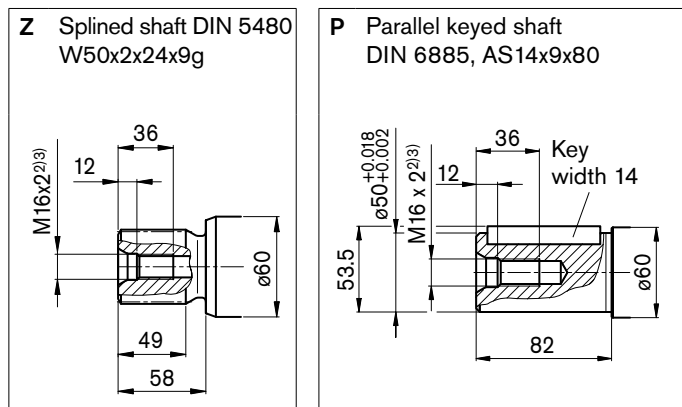
# Dimensions size 250

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

## Port plate 05 – SAE flange port A/B at side and SAE flange port S at rear



## Drive shafts



## Ports

| Designation    | Port for                             | Standard                         | Size <sup>3)</sup>              | Maximum pressure [bar] <sup>4)</sup> | State <sup>8)</sup> |
|----------------|--------------------------------------|----------------------------------|---------------------------------|--------------------------------------|---------------------|
| B (A)          | Service line<br>Fastening thread B/A | SAE J518 <sup>6)</sup><br>DIN 13 | 1 1/4 in<br>M14 x 2; 19 deep    | 400                                  | O                   |
| S              | Suction line<br>Fastening thread     | SAE J518 <sup>6)</sup><br>DIN 13 | 2 1/2 in<br>M12 x 1.75; 17 deep | 30                                   | O                   |
| T <sub>1</sub> | Drain line                           | DIN 3852 <sup>7)</sup>           | M22 x 1.5; 14 deep              | 3                                    | O <sup>5)</sup>     |
| T <sub>2</sub> | Drain line                           | DIN 3852 <sup>7)</sup>           | M22 x 1.5; 14 deep              | 3                                    | X <sup>5)</sup>     |
| U              | Bearing flushing                     | DIN 3852 <sup>7)</sup>           | M14 x 1.5; 12 deep              | 3                                    | X                   |

1) To shaft collar

2) Center bore according to DIN 332 (thread according to DIN 13)

3) Observe the general instructions on page 34 for the maximum tightening torques.

4) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.

5) Depending on installation position, T<sub>1</sub> or T<sub>2</sub> must be connected (see also installation instructions on pages 32 and 33).

6) Only dimensions according to SAE J518, metric fastening thread is a deviation from standard.

7) The spot face can be deeper than specified in the appropriate standard.

8) O = Must be connected (plugged on delivery)

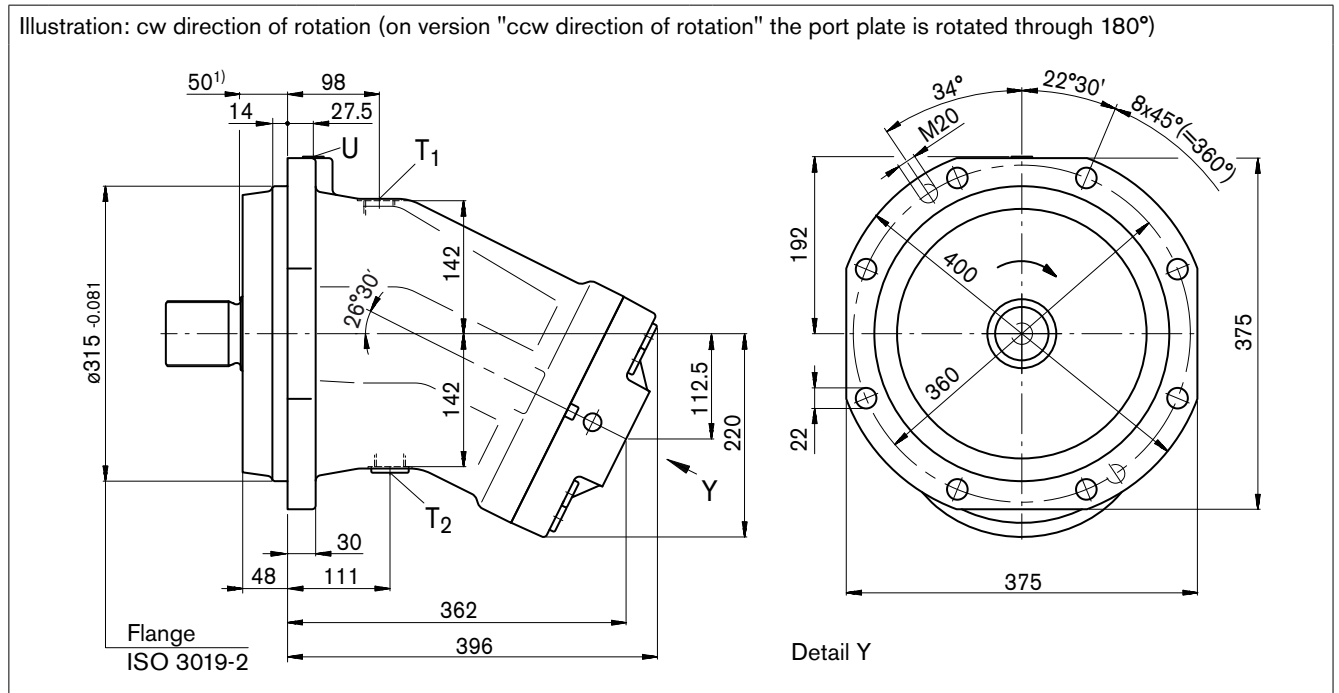
X = Plugged (in normal operation)



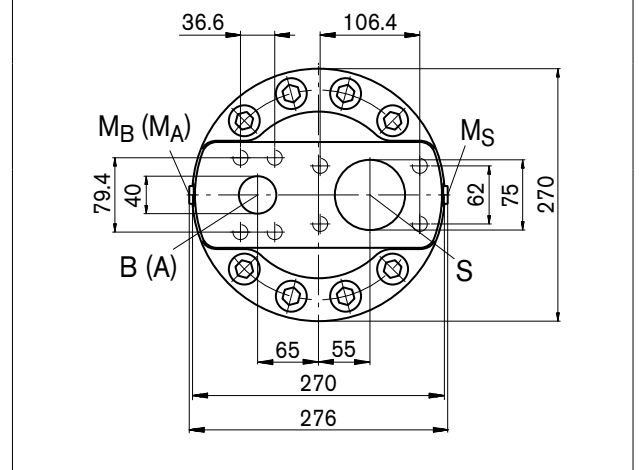
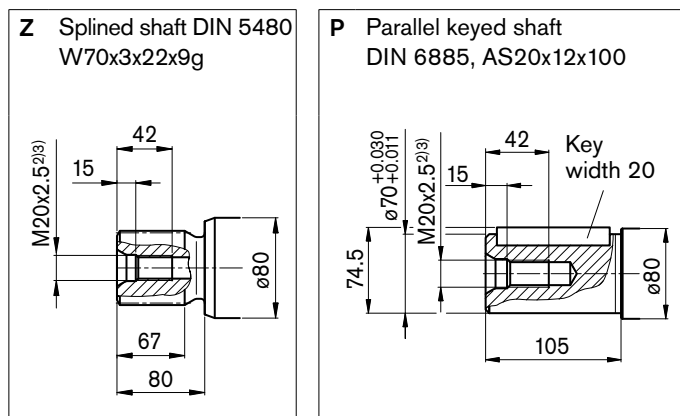
# Dimensions size 500

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

## Port plate 11 – SAE flange ports A/B and S at rear



## Drive shafts



## Ports

| Designation                     | Port for                          | Standard                         | Size <sup>3)</sup>           | Maximum pressure [bar] <sup>4)</sup> | State <sup>8)</sup> |
|---------------------------------|-----------------------------------|----------------------------------|------------------------------|--------------------------------------|---------------------|
| B (A)                           | Service line fastening thread B/A | SAE J518 <sup>6)</sup><br>DIN 13 | 1 1/2 in<br>M16 x 2; 21 deep | 400                                  | O                   |
| S                               | Suction line fastening thread     | SAE J518 <sup>6)</sup><br>DIN 13 | 3 in<br>M16 x 2; 24 deep     | 30                                   | O                   |
| T <sub>1</sub>                  | Drain line                        | DIN 3852 <sup>7)</sup>           | M33 x 2; 18 deep             | 3                                    | O <sup>5)</sup>     |
| T <sub>2</sub>                  | Drain line                        | DIN 3852 <sup>7)</sup>           | M33 x 2; 18 deep             | 3                                    | X <sup>5)</sup>     |
| U                               | Bearing flushing                  | DIN 3852 <sup>7)</sup>           | M18 x 1.5; 12 deep           | 3                                    | X                   |
| M <sub>A</sub> , M <sub>B</sub> | Operating pressure measurement    | DIN 3852 <sup>7)</sup>           | M14 x 1.5; 12 deep           | 400                                  | X                   |
| M <sub>S</sub>                  | Suction pressure measurement      | DIN 3852 <sup>7)</sup>           | M14 x 1.5; 12 deep           | 30                                   | X                   |

1) To shaft collar

2) Center bore according to DIN 332 (thread according to DIN 13)

3) Observe the general instructions on page 34 for the maximum tightening torques.

4) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.

5) Depending on installation position, T<sub>1</sub> or T<sub>2</sub> must be connected (see also installation instructions on pages 32 and 33).

6) Only dimensions according to SAE J518, metric fastening thread is a deviation from standard.

7) The spot face can be deeper than specified in the appropriate standard.

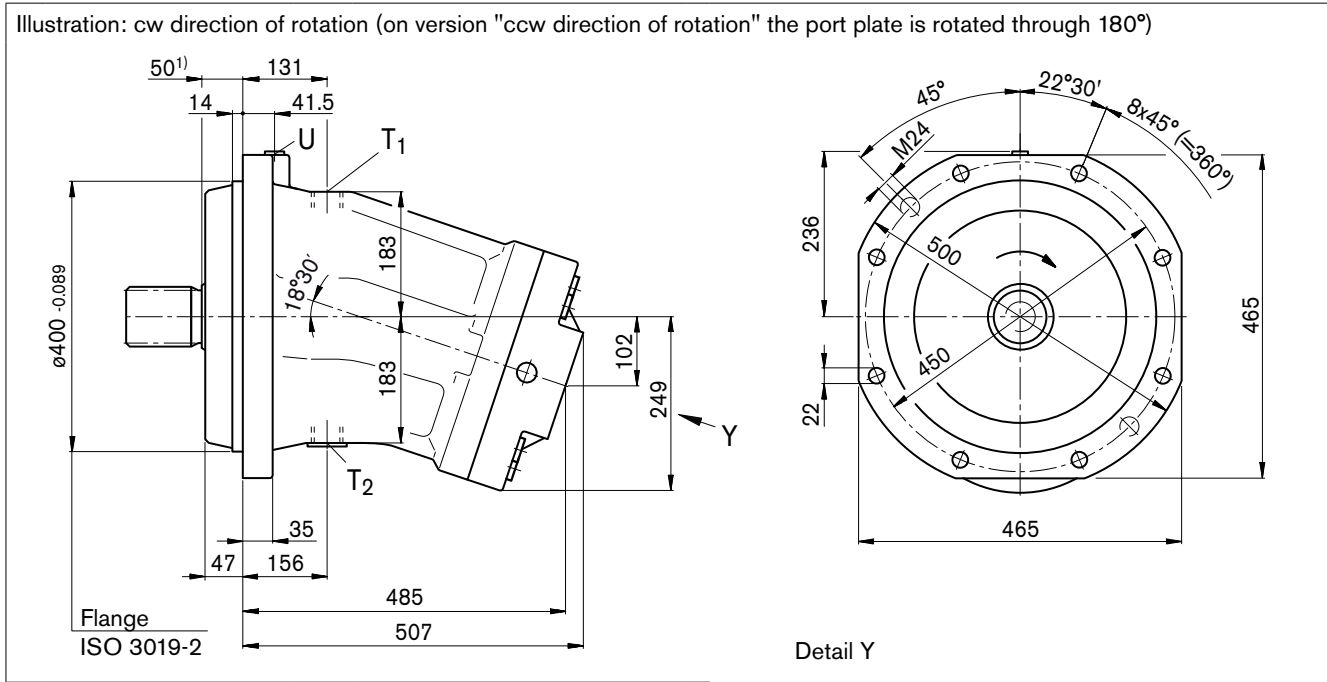
8) O = Must be connected (plugged on delivery)

X = Plugged (in normal operation)

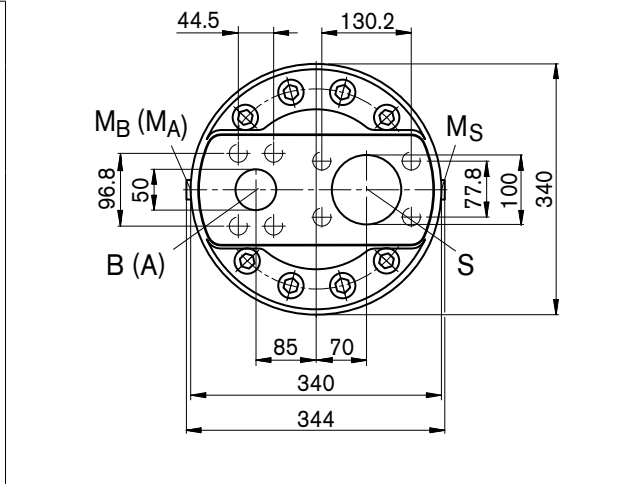
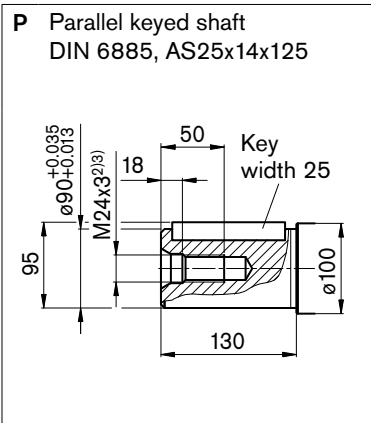
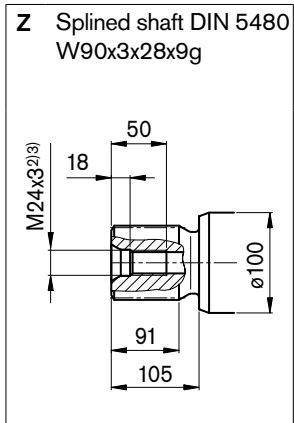
# Dimensions size 710

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

## Port plate 11 – SAE flange ports A/B and S at rear



## Drive shafts



## Ports

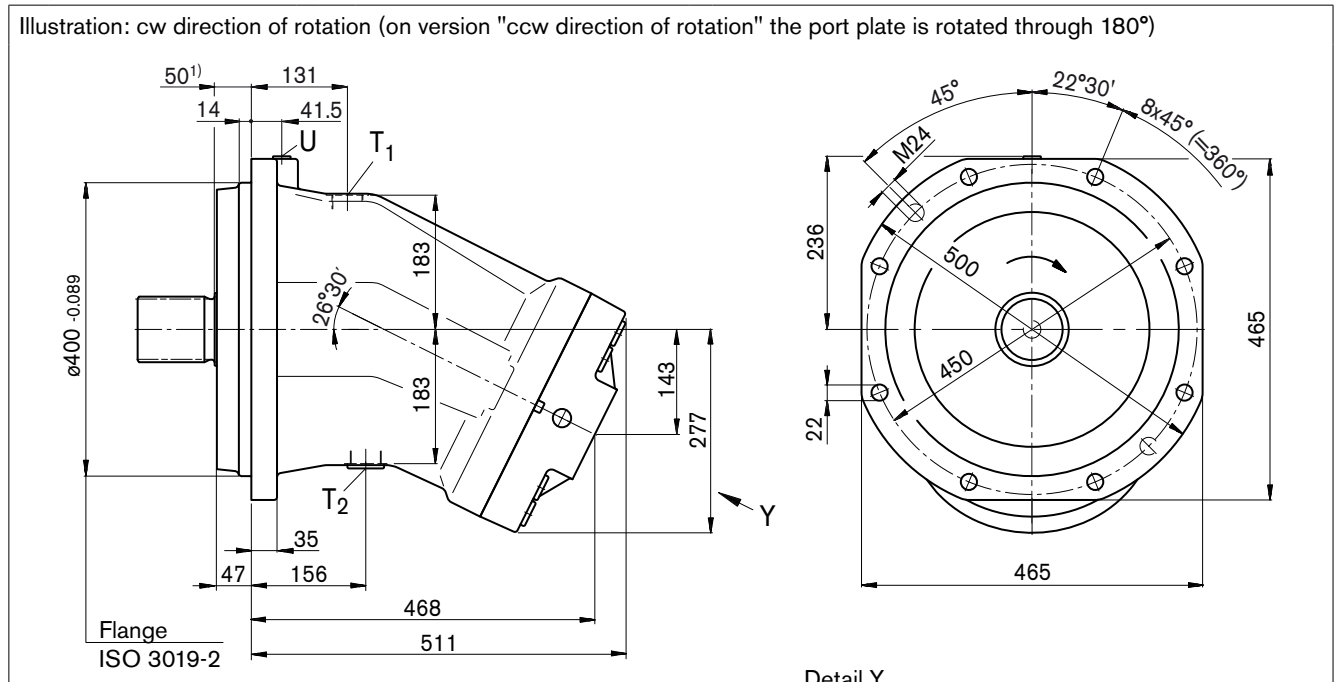
| Designation                     | Port for                             | Standard                         | Size <sup>3)</sup>         | Maximum pressure [bar] <sup>4)</sup> | State <sup>8)</sup> |
|---------------------------------|--------------------------------------|----------------------------------|----------------------------|--------------------------------------|---------------------|
| B (A)                           | Service line<br>Fastening thread B/A | SAE J518 <sup>6)</sup><br>DIN 13 | 2 in<br>M20 x 2.5; 30 deep | 400                                  |                     |
| S                               | Suction line<br>Fastening thread     | SAE J518 <sup>6)</sup><br>DIN 13 | 4 in<br>M16 x 2; 24 deep   | 30                                   | O                   |
| T <sub>1</sub>                  | Drain line                           | DIN 3852 <sup>7)</sup>           | M42 x 2; 20 deep           | 3                                    | O <sup>5)</sup>     |
| T <sub>2</sub>                  | Drain line                           | DIN 3852 <sup>7)</sup>           | M42 x 2; 20 deep           | 3                                    | X <sup>5)</sup>     |
| U                               | Bearing flushing                     | DIN 3852 <sup>7)</sup>           | M18 x 1.5; 12 deep         | 3                                    | X                   |
| M <sub>A</sub> , M <sub>B</sub> | Measuring operating pressure         | DIN 3852 <sup>7)</sup>           | M14 x 1.5; 12 deep         | 400                                  | X                   |
| M <sub>S</sub>                  | Measuring suction pressure           | DIN 3852 <sup>7)</sup>           | M14 x 1.5; 12 deep         | 30                                   | X                   |

- To shaft collar
- Center bore according to DIN 332 (thread according to DIN 13)
- Observe the general instructions on page 34 for the maximum tightening torques.
- Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
- Depending on installation position, T<sub>1</sub> or T<sub>2</sub> must be connected (see also installation instructions on pages 32 and 33).
- Only dimensions according to SAE J518, metric fastening thread is a deviation from standard.
- The spot face can be deeper than specified in the appropriate standard.
- O = Must be connected (plugged on delivery)  
X = Plugged (in normal operation)

# Dimensions size 1000

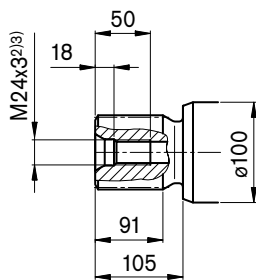
Before finalizing your design, request a binding installation drawing. Dimensions in mm.

## Port plate 11 – SAE flange ports A/B and S at rear

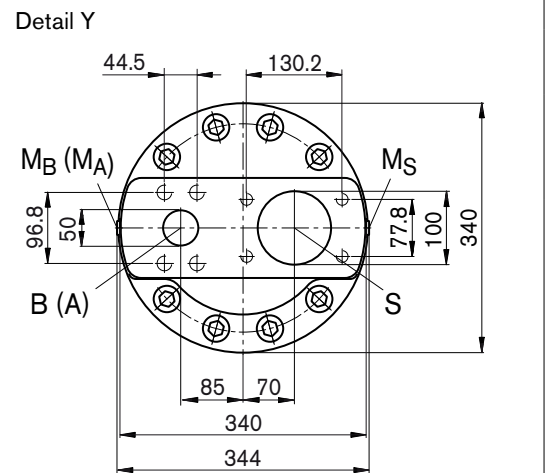
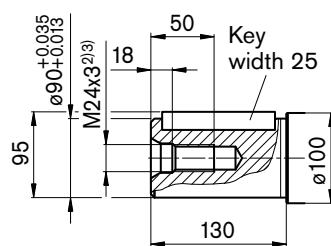


## Drive shafts

**Z** Splined shaft DIN 5480  
W90x3x28x9g



**P** Parallel keyed shaft  
DIN 6885, AS25x14x125



## Ports

| Designation                     | Port for                             | Standard                         | Size <sup>3)</sup>         | Maximum pressure [bar] <sup>4)</sup> | State <sup>8)</sup> |
|---------------------------------|--------------------------------------|----------------------------------|----------------------------|--------------------------------------|---------------------|
| B (A)                           | Service line<br>fastening thread B/A | SAE J518 <sup>6)</sup><br>DIN 13 | 2 in<br>M20 x 2.5; 30 deep | 400                                  |                     |
| S                               | Suction line<br>fastening thread     | SAE J518 <sup>6)</sup><br>DIN 13 | 4 in<br>M16 x 2; 24 deep   | 30                                   | O                   |
| T <sub>1</sub>                  | Drain line                           | DIN 3852 <sup>7)</sup>           | M42 x 2; 20 deep           | 3                                    | O <sup>5)</sup>     |
| T <sub>2</sub>                  | Drain line                           | DIN 3852 <sup>7)</sup>           | M42 x 2; 20 deep           | 3                                    | X <sup>5)</sup>     |
| U                               | Bearing flushing                     | DIN 3852 <sup>7)</sup>           | M18 x 1.5; 12 deep         | 3                                    | X                   |
| M <sub>A</sub> , M <sub>B</sub> | Measuring operating pressure         | DIN 3852 <sup>7)</sup>           | M14 x 1.5; 12 deep         | 400                                  | X                   |
| M <sub>S</sub>                  | Measuring suction pressure           | DIN 3852 <sup>7)</sup>           | M14 x 1.5; 12 deep         | 30                                   | X                   |

1) To shaft collar

2) Center bore according to DIN 332 (thread according to DIN 13)

3) Observe the general instructions on page 34 for the maximum tightening torques.

4) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.

5) Depending on installation position, T<sub>1</sub> or T<sub>2</sub> must be connected (see also installation instructions on pages 32 and 33).

6) Only dimensions according to SAE J518, metric fastening thread is a deviation from standard.

7) The spot face can be deeper than specified in the appropriate standard.

8) O = Must be connected (plugged on delivery)

X = Plugged (in normal operation)

# Installation instructions

## General

During commissioning and operation, the axial piston unit must be filled with hydraulic fluid and air bled. This must also be observed following a relatively long standstill as the axial piston unit may drain back to the reservoir via the hydraulic lines.

Particularly in the installation position "drive shaft upwards" filling and air bleeding must be carried out completely as there is, for example, a danger of dry running.

The case drain fluid in the motor housing must be directed to the reservoir via the highest available drain port ( $T_1$ ,  $T_2$ ).

For combinations of multiple units, make sure that the respective case pressure in each unit is not exceeded. In the event of pressure differences at the drain ports of the units, the shared drain line must be changed so that the minimum permissible case pressure of all connected units is not exceeded in any situation. If this is not possible, separate drain lines must be laid if necessary.

To achieve favorable noise values, decouple all connecting lines using elastic elements and avoid above-reservoir installation.

In all operating conditions, the suction and drain lines must flow into the reservoir below the minimum fluid level. The permissible suction height  $h_S$  results from the overall loss of pressure; it must not, however, be higher than  $h_{S \max} = 800 \text{ mm}$ . The minimum suction pressure at port S must also not fall below 0.8 bar absolute during operation and during cold start.

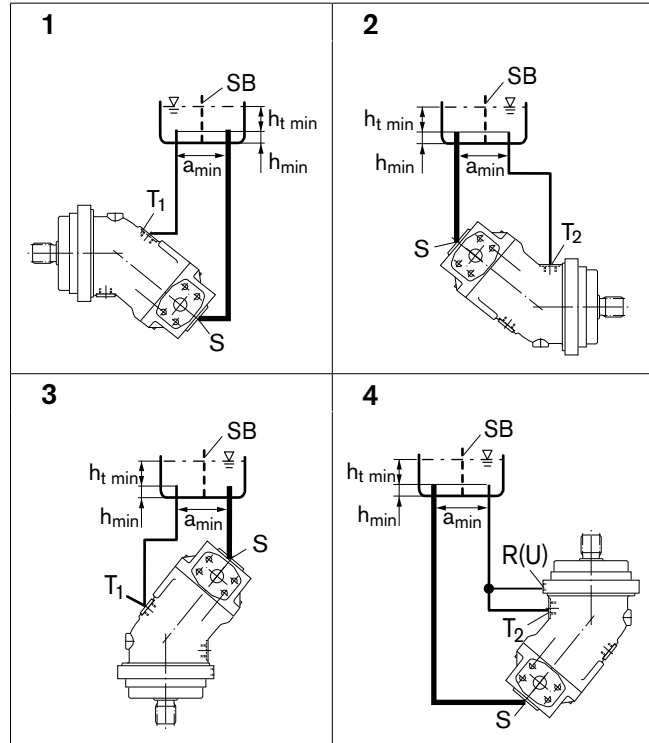
## Installation position

See the following examples 1 to 8. Further installation positions are possible upon request.

Recommended installation positions: 1 and 2.

### Below-reservoir installation (standard)

Below-reservoir installation means that the axial piston unit is installed outside of the reservoir below the minimum fluid level.



| Installation position | Air bleed | Filling |
|-----------------------|-----------|---------|
| 1                     | –         | $T_1$   |
| 2                     | –         | $T_2$   |
| 3                     | –         | $T_1$   |
| 4                     | R (U)     | $T_2$   |

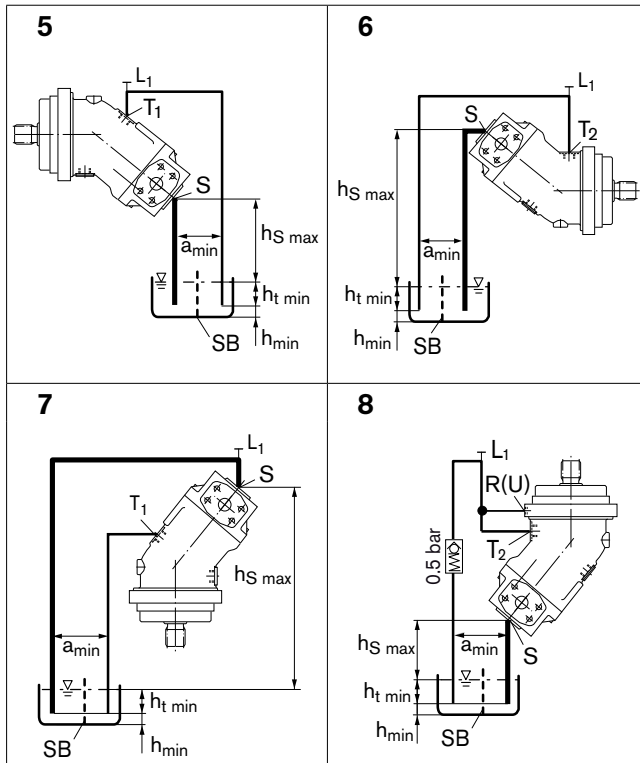


# Installation instructions

## 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 bleed      | Filling                          |
|-----------------------|----------------|----------------------------------|
| 5                     | L <sub>1</sub> | T <sub>1</sub> (L <sub>1</sub> ) |
| 6                     | L <sub>1</sub> | T <sub>2</sub> (L <sub>1</sub> ) |
| 7                     | L <sub>1</sub> | T <sub>1</sub> (L <sub>1</sub> ) |
| 8                     | R (U)          | T <sub>2</sub> (L <sub>1</sub> ) |

L<sub>1</sub> Filling / air bleed

R Air bleed port

U Bearing flushing / air bleed port

S Suction port

T<sub>1</sub>, T<sub>2</sub> Drain port

$h_{t \min}$  Minimum required immersion depth (200 mm)

$h_{\min}$  Minimum required spacing to reservoir bottom (100 mm)

SB Baffle (baffle plate)

$h_{S \max}$  Maximum permissible suction height (800 mm)

$a_{\min}$  When designing the reservoir, ensure adequate space between the suction line and the drain line. This prevents the heated, return flow from being drawn directly back into the suction line.

## General instructions

- The pump A2FO is designed to be used in open circuits.
- The project planning, installation and commissioning of the axial piston unit requires the involvement of qualified personnel.
- Before using the axial piston unit, please read the corresponding instruction manual completely and thoroughly. If necessary, these can be requested from Bosch Rexroth.
- 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).
- Depending on the operating conditions of the axial piston unit (operating pressure, fluid temperature), the characteristic may shift.
- Service line ports:
  - The ports and fastening threads are designed for the specified maximum pressure. The machine or system manufacturer must ensure that the connecting elements and lines correspond to the specified application conditions (pressure, flow, hydraulic fluid, temperature) with the necessary safety factors.
  - The service line ports and function ports can only be used to accommodate hydraulic lines.
- The data and notes contained herein must be adhered to.
- The product is not approved as a component for the safety concept of a general machine according to ISO 13849.
- A pressure-relief valve is to be fitted in the hydraulic system.
- The following tightening torques apply:
  - Fittings:
    - Observe the manufacturer's instructions regarding tightening torques of the fittings used.
  - Mounting bolts:
    - For mounting bolts with metric ISO thread according to DIN 13 or with thread according to ASME B1.1, we recommend checking the tightening torque in individual cases in accordance with VDI 2230.
  - Female threads in the axial piston unit:
    - The maximum permissible tightening torques  $M_{G \max}$  are maximum values for the female threads and must not be exceeded. For values, see the following table.
  - Threaded plugs:
    - For the metallic threaded plugs supplied with the axial piston unit, the required tightening torques of threaded plugs  $M_V$  apply. For values, see the following table.

| Ports    |                | Maximum permissible tightening torque of the female threads $M_{G \max}$ | Required tightening torque of the threaded plugs $M_V$ <sup>1)</sup> | WAF hexagon socket in the threaded plugs |
|----------|----------------|--|--|--|
| Standard | Size of thread |  |  |  |
| DIN 3852 | M8 x 1         | 10 Nm  | 7 Nm   | 3 mm                                     |
|          | M10 x 1        | 30 Nm  | 15 Nm <sup>2)</sup>  | 5 mm                                     |
|          | M12 x 1.5      | 50 Nm  | 25 Nm <sup>2)</sup>  | 6 mm                                     |
|          | M14 x 1.5      | 80 Nm  | 35 Nm  | 6 mm                                     |
|          | M16 x 1.5      | 100 Nm   | 50 Nm  | 8 mm                                     |
|          | M18 x 1.5      | 140 Nm   | 60 Nm  | 8 mm                                     |
|          | M22 x 1.5      | 210 Nm   | 80 Nm  | 10 mm                                    |
|          | M33 x 2        | 540 Nm   | 225 Nm   | 17 mm                                    |
|          | M42 x 2        | 720 Nm   | 360 Nm   | 22 mm                                    |

1) The tightening torques apply for screws in the "dry" state as received on delivery and in the "lightly oiled" state for installation.

2) In the "lightly oiled" state, the  $M_V$  is reduced to 10 Nm for M10 x 1 and 17 Nm for M12 x 1.5.