

## A2FO Series Axial piston fixed pump

### ■ Product show and brief introduction

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#### Open circuits

Series 6  
Sizes 10...180  
Nominal pressure 40MPa  
Peak pressure 45MPa



### ■ Features

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- 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

## Model Code

A2F	O	80	/6	1	R	-P	A	B	05
Axial piston unit	Operating mode	Sizes	Series	Index	Directions of rotation	Seals	Drive shafts	Mounting flanges	port plates for service lines
A2F: Bent-axis design, fixed	O: Pump, open circuits	10	6	1	(Viewed on drive shaft)  R: Clockwise  L: Counter-clockwise	P: NBR (nitril-caoutchouc)  V: FKM (fluor-caoutchouc)	See below	B: 4-hole ISO 3019-2	See below
		12							
		16							
		23							
		28							
		32							
		45							
		56							
		63							
		80							
90									
107									
125									
160									
180									

## Drive shafts

Size		10	12	16	23	28	32	45	56	63	80	90	107	125	160	180
Spined shaft DIN 5480	A	✓	✓	✓	✓	✓	✓	/	✓	✓	✓	✓	✓	✓	✓	✓
	Z	✓	✓	/	✓	✓	/	✓	✓	/	✓	/	✓	/	✓	/
Parallel keyed shaft, DIN 6885	B	✓	✓	✓	✓	✓	✓	/	✓	✓	✓	✓	✓	✓	✓	✓
	P	✓	✓	/	✓	✓	/	✓	✓	/	✓	/	✓	/	✓	/

## Port plates for service lines<sup>1)</sup>

Size	10	12	16	23	28	32	45	56	63	80	90	107	125	160	180
05: SAE flange port A/B at side and SAE flange port S at rear	/	/	/	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
06: Threaded port A/B at side and threaded port S at rear	✓	✓	✓	/	/	/	/	/	/	/	/	/	/	/	/

✓ = available    / = not available

1) fastening threads resp. threaded ports are metric

## Technical Data

### Hydraulic fluid

The A2FO fixed displacement pump is suitable for use with mineral oil

### Viscosity range

We recommend that a viscosity (at operating temperature) for optimum efficiency and service life purposes of

$$V_{opt} = \text{optimum viscosity } 16 \dots 36 \text{ mm}^2/\text{s}$$

Be chosen, taken the tank temperature (open circuit) into account.

### Limits of viscosity range

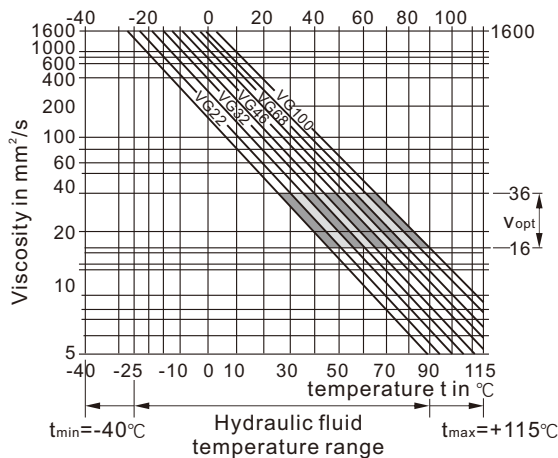
The following values apply in extreme cases:

$V_{min} = 5 \text{ mm}^2/\text{s}$   
short term ( $t < 3 \text{ min}$ ) at max. permitted temperature  
 $t_{max} = 115^\circ\text{C}$

$V_{max} = 1600 \text{ mm}^2/\text{s}$   
short term ( $t < 3 \text{ min}$ ) with cold start ( $P < 3 \text{ MPa}$ ,  
 $n \leq 1000 \text{ rpm}$ ,  $t_{min} = -40^\circ\text{C}$ )

Note that the maximum hydraulic fluid temperature must not be exceeded locally either (e.g. bearing area). The temperature in the bearing area is depending on pressure and speed up to 12 K higher than the average case drain temperature.

### Selection diagram



### Details regarding the choice of hydraulic fluid

The correct selection of hydraulic fluid requires knowledge of the operating temperature in relation to the ambient temperature, in an open circuit the tank temperature.

The hydraulic fluid should be selected so that within the operating temperature range, the operating viscosity lies within the optimum range ( $V_{opt}$ ) (see shaded section of the selection diagram). We recommend that the highest possible viscosity range should be chosen in each case.

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

Please note: The leakage fluid temperature, which is affected by pressure and rotational speed, is always higher than the tank temperature. At no point in the system may the temperature be higher than  $115^\circ\text{C}$ .

### Filtration

The finer the filtration, the cleaner the fluid and the longer the service life of the axial piston unit.

To ensure proper function of the axial piston unit, the hydraulic fluid must have a cleanliness level of at least

20/18/15 according to ISO 4406.

At very high hydraulic fluid temperatures ( $90^\circ\text{C}$  to max.  $115^\circ\text{C}$ ), a cleanliness level of at least

19/17/14 according to ISO 4406 is required.

### Operational pressure range

#### Inlet

Pressure at port S

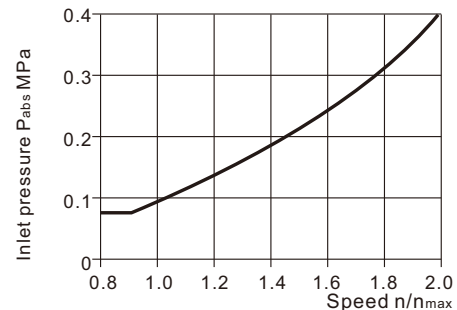
The minimum inlet pressure depends on speed. The following limits must not be exceeded.

$P_{abs \text{ min}}$  \_\_\_\_\_ 0.08 MPa

$P_{abs \text{ max}}$  \_\_\_\_\_ 3 MPa

### Minimum inlet pressure at suction port S with increased speed

In order to avoid damage of the pump a minimum inlet pressure at the suction port must be assured. The minimum inlet pressure is related to the rotational speed of the fixed pump.



Note:

- max. permissible speed  $n_{max \text{ perm.}}$  (speed limit)
- min. permissible inlet pressure at port S
- admissible values for the drive shaft seal

### Outlet

Maximum pressure on port A or B (pressure data according to DIN 24312)

	Shaft end A, Z	Shaft end B, P
Nominal pressure $P_N$	40 MPa	35 MPa
Peak pressure $P_{max}$	45 MPa	40 MPa

### Direction of flow

Direction of rotation, viewed on shaft end

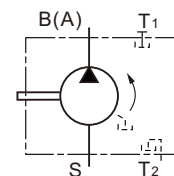
clockwise \_\_\_\_\_ counter-clockwise \_\_\_\_\_

S to B \_\_\_\_\_ S to A \_\_\_\_\_

### Symbol

#### Connections

- A, B Service line port
- S Suction port
- $T_1, T_2$  Drain ports



## Technical Data

- Table of values (theoretical values, ignoring  $\eta_{\min}$  and  $\eta_v$ ; values rounded)

Size			10	12	16	23	28	32	45	
Displacement	$V_g$	mL/r	10.3	12	16	22.9	28.1	32	45.6	
Speed max	$N_{\max}^{1)}$	rpm	3150	3150	3150	2500	2500	2500	2240	
	$n_{\max \text{ limit}}^{2)}$	rpm	6000	6000	6000	4750	4750	4750	4250	
Flow max.	at $n_{\max}$	$Q_{v\max}$	L/min	32.4	37.8	50	57	70	80	102
Power at	$\Delta P=35 \text{ MPa}$	$P_{\max}$	Nm/MPa	18.9	22	29.2	33	41	47	59.5
	$\Delta P=40 \text{ MPa}$	$P_{\max}$	Nm	21.6	25	34	38	47	53	68
Torque at	$\Delta P=35 \text{ MPa}$	T	Nm	57	67	88	126	156	178	254
	$\Delta P=40 \text{ MPa}$	T	Nm	65	76	101	145	178	203	290
Filling capacity		L	0.17	0.17	0.17	0.20	0.20	0.20	0.33	
Mass(approx.)	m	kg	6	6	6	9.5	9.5	9.5	13.5	

Size			56	63	80	90	107	125	160	180	
Displacement	$V_g$	mL/r	56.1	63	80.4	90	106.7	125	160.4	180	
Speed max	$N_{\max}^{1)}$	rpm	2000	2000	1800	1800	1600	1600	1450	1450	
	$n_{\max \text{ limit}}^{2)}$	rpm	3750	3750	3350	3350	3000	3000	2650	2650	
Flow max.	at $n_{\max}$	$Q_{v\max}$	L/min	112	126	144	162	170	200	232	261
Power at	$\Delta P=35 \text{ MPa}$	$P_{\max}$	Nm/MPa	65	73.5	84	95	100	117	135	152
	$\Delta P=40 \text{ MPa}$	$P_{\max}$	Nm	75	84	96	108	114	133	155	174
Torque at	$\Delta P=35 \text{ MPa}$	T	Nm	312	350	445	501	594	696	893	1003
	$\Delta P=40 \text{ MPa}$	T	Nm	356	400	511	572	678	795	1020	1145
Filling capacity		L	0.45	0.45	0.55	0.55	0.8	0.8	1.1	1.1	
Mass(approx.)	m	kg	18	18	23	23	32	32	45	45	

1) the values shown are valid for an absolute pressure ( $P_{\text{abs}}$ ) of 0.1 MPa at the suction inlet S and when operated on mineral oil (with a specific mass of 0.88kg/L).

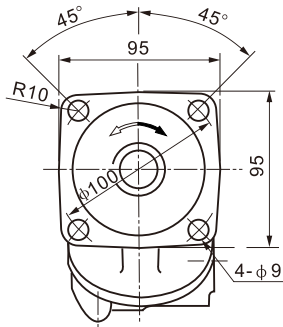
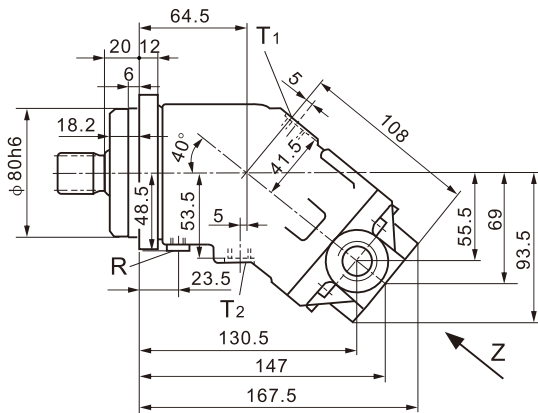
2) by increase of the input pressure ( $P_{\text{abs}} > 0.1 \text{ MPa}$ ) the rotational speeds can be increased to the max.admissible speeds  $n_{\max \text{ limit}}$  (speed limits)

### Determining the size

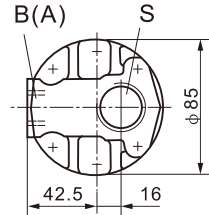
Flow	$q_v = \frac{V_g \times n \times \eta_v}{1000}$	[L/min]	$V_g$ = Displacement per revolution in mL/r
			$\Delta P$ = Differential pressure in MPa
Torque	$T = \frac{V_g \times \Delta P}{20\pi \times \eta_{mh}}$	[Nm]	$n$ = Speed in rpm
			$\eta_v$ = Volumetric efficiency
			$\eta_{mh}$ = Mechanical-hydraulic efficiency
Power	$P = \frac{2\pi \times T \times n}{60000} = \frac{q_v \times \Delta P}{600 \times \eta_i}$	[kW]	$\eta_i$ = Overall efficiency

**Installation dimensions** Size 10,12,16

Counter-clockwise rotation:  
port plate is rotated through 180°



View Z

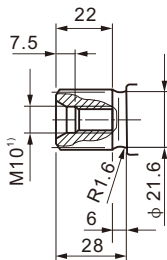


**Ports**

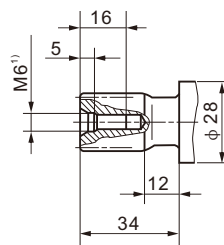
B(A)	Service line port	M22×1.5
S	Suction port	M33×2
T <sub>1</sub> , T <sub>2</sub>	Case drain ports (T, plugged)	M12×1.5
R	Air bleed (plugged)	M8×1

**Shaft ends**

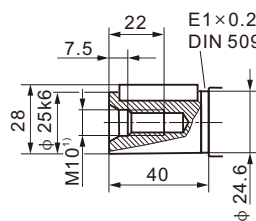
Sizes 10,12,16  
A Splined shaft DIN 5480  
W25×1.25×30×18×9g  
PN = 40 MPa



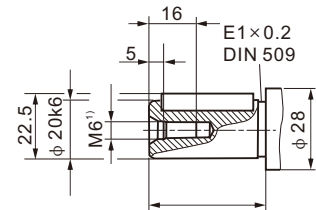
Sizes 10,12  
Z Splined shaft DIN 5480  
W20×1.25×30×14×9g  
PN = 40 MPa



Sizes 10,12,16  
B Parallel keyed shaft,  
DIN 6885, AS8×7×32  
PN = 35 MPa

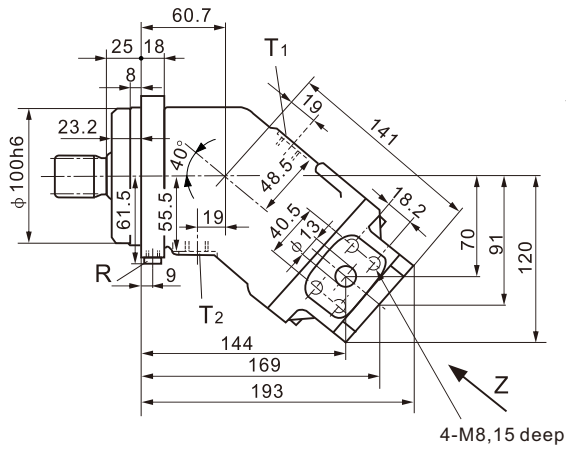


Sizes 10,12  
P Parallel keyed shaft  
DIN 6885, A6×6×32  
PN = 35 MPa

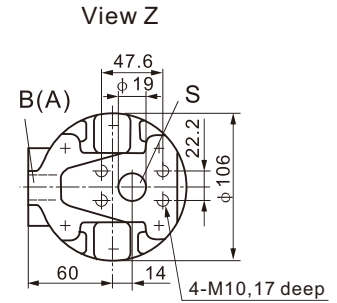
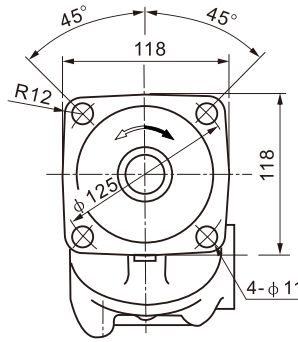


1) centering bore according to DIN 332 (thread according to DIN 13)

**Installation dimensions** Size 23,28,32



Counter-clockwise rotation:  
port plate is rotated through 180°



**Ports**

B(A)	Service line port (high pressure series)	SAE 1/2 "
S	Suction port (standard pressure series)	SAE 3/4 "
T <sub>1</sub> , T <sub>2</sub>	Case drain ports (T <sub>1</sub> plugged)	M16×1.5
R	Air bleed (plugged)	M10×1

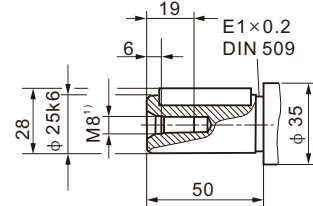
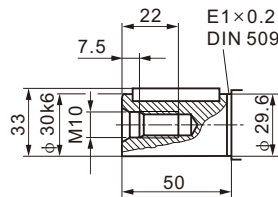
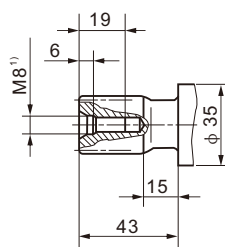
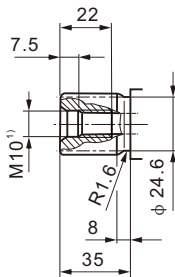
**Shaft ends**

Sizes 23,28,32  
A Splined shaft DIN 5480  
W30×2×30×14×9g  
P<sub>N</sub> = 40 MPa

Sizes 23,28  
Z Splined shaft DIN 5480  
W25×1.25×30×18×9g  
P<sub>N</sub> = 40 MPa

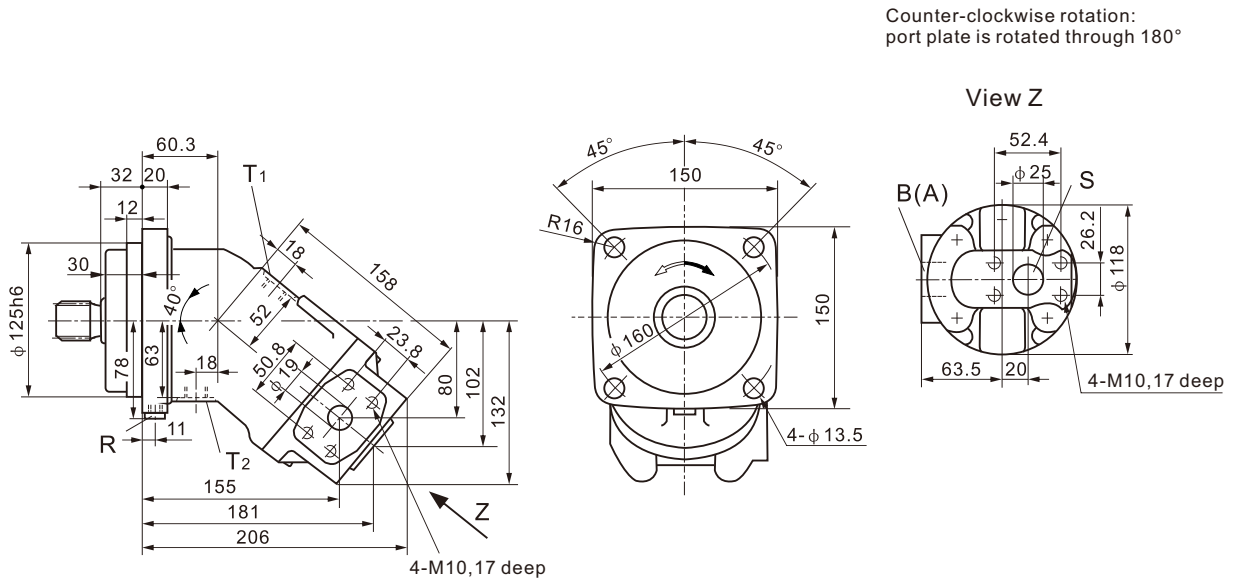
Sizes 23,28,32  
B Parallel keyed shaft,  
DIN 6885, AS8×7×40  
P<sub>N</sub> = 35 MPa

Sizes 23,28  
P Parallel keyed shaft  
DIN 6885, AS8×7×40  
P<sub>N</sub> = 35 MPa



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

**Installation dimensions** Size 45

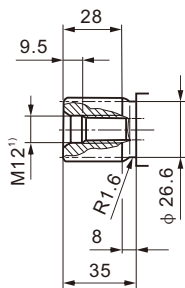


**Ports**

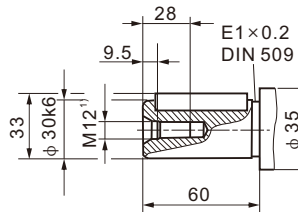
B(A)	Service line port (high pressure series)	SAE 3/4 "
S	Suction port (standard pressure series)	SAE 1 "
T <sub>1</sub> , T <sub>2</sub>	Case drain ports (T, plugged)	M18×1.5
R	Air bleed (plugged)	M12×1.5

**Shaft ends**

Size 45  
Z Splined shaft DIN 5480  
W30×2×30×14×9g  
P<sub>N</sub> = 40 MPa



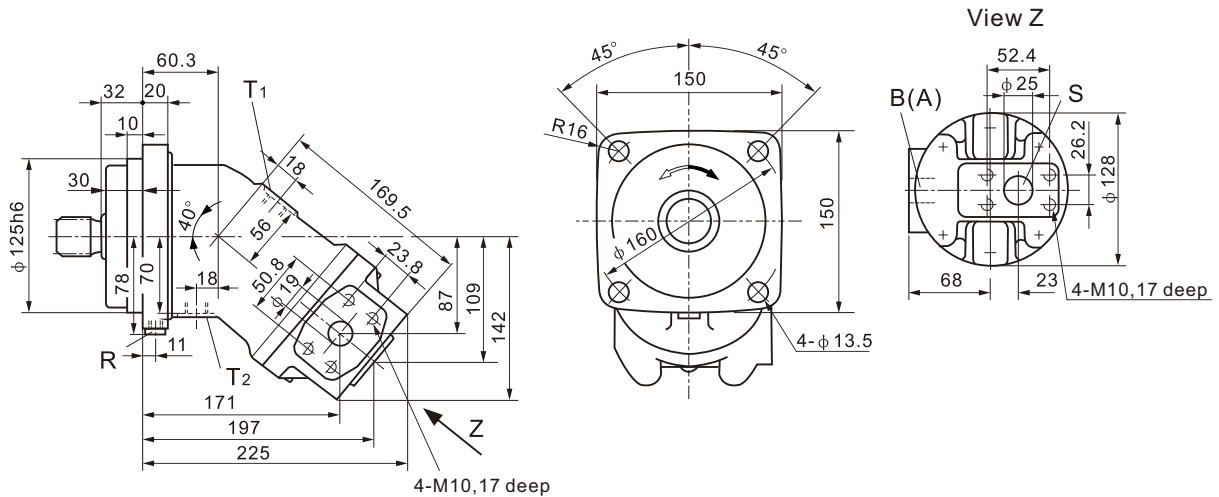
Size 45  
P Parallel keyed shaft  
DIN 6885, AS8×7×50  
P<sub>N</sub> = 35 MPa



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

**Installation dimensions** Size 56,63

Counter-clockwise rotation:  
port plate is rotated through 180°



**Ports**

B(A)	Service line port (high pressure series)	SAE 3/4 "
S	Suction port (standard pressure series)	SAE 1 "
T <sub>1</sub> , T <sub>2</sub>	Case drain ports (T <sub>1</sub> plugged)	M18×1.5
R	Air bleed (plugged)	M12×1.5

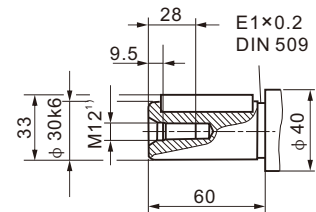
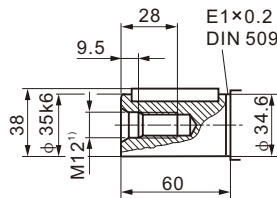
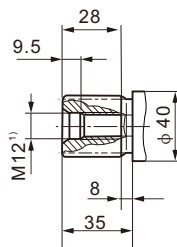
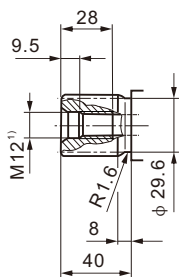
**Shaft ends**

Sizes 56,63  
A Splined shaft DIN 5480  
W35×2×30×16×9g  
P<sub>N</sub> = 40 MPa

Size 56  
Z Splined shaft DIN 5480  
W30×2×30×14×9g  
P<sub>N</sub> = 35 MPa

Sizes 56,63  
B Parallel keyed shaft,  
DIN 6885, AS10×8×60  
P<sub>N</sub> = 35 MPa

Size 56  
P Parallel keyed shaft  
DIN 6885, AS8×7×50  
P<sub>N</sub> = 35 MPa

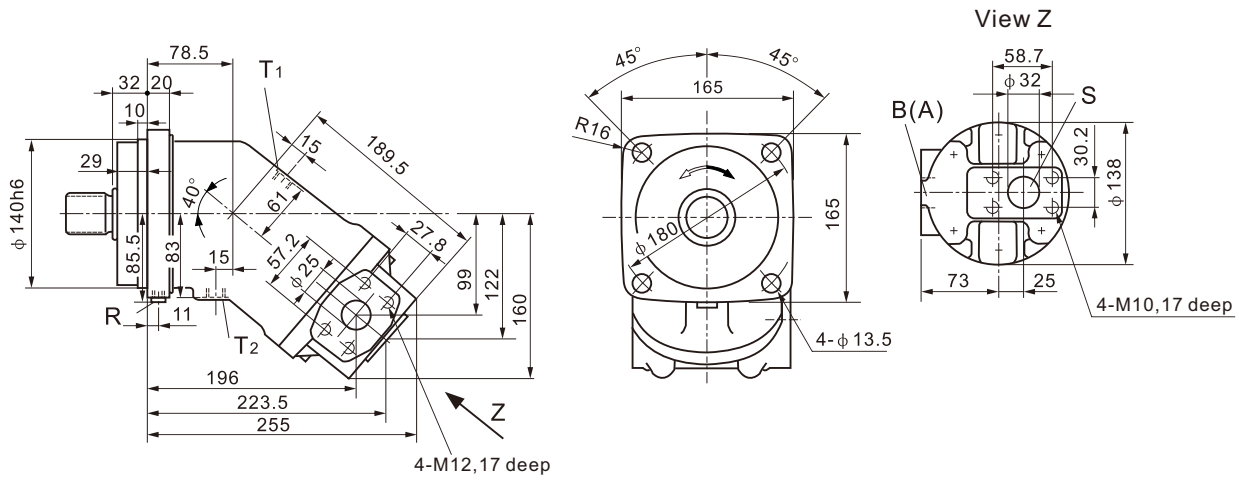


1) centering bore according to DIN 332 (thread according to DIN 13)



**Installation dimensions** Size 80,90

Counter-clockwise rotation:  
port plate is rotated through 180°



**Ports**

B(A)	Service line port (high pressure series)	SAE 1 "
S	Suction port (standard pressure series)	SAE 1 1/4 "
T <sub>1</sub> , T <sub>2</sub>	Case drain ports (T <sub>1</sub> plugged)	M18×1.5
R	Air bleed (plugged)	M12×1.5

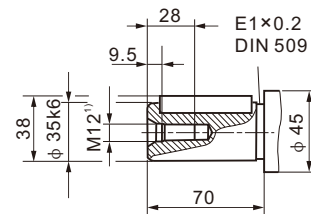
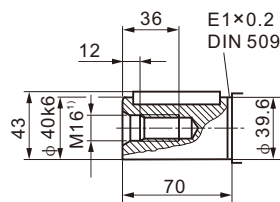
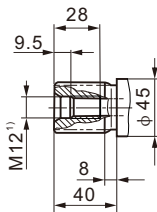
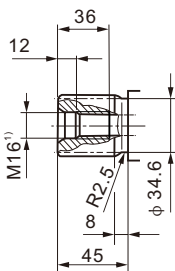
**Shaft ends**

Sizes 80,90  
A Splined shaft DIN 5480  
W40×2×30×18×9g  
PN = 40 MPa

Size 80  
Z Splined shaft DIN 5480  
W35×2×30×16×9g  
PN = 40 MPa

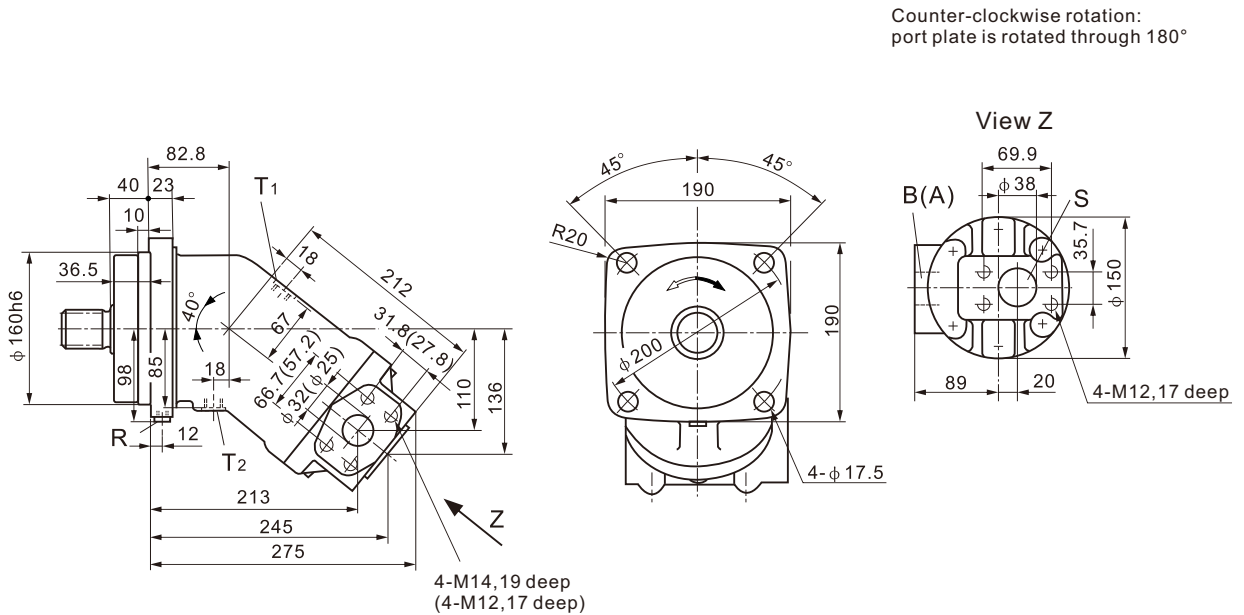
Sizes 80,90  
B Parallel keyed shaft,  
DIN 6885, AS12×8×56  
PN = 35 MPa

Size 80  
P Parallel keyed shaft  
DIN 6885, AS10×8×56  
PN = 35 MPa



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

**Installation dimensions** Size 107,125



(dimensions for size 107 in bracket)

**Ports**

B(A)	Service line ports (high pressure series)	SAE 11/4 " (1 " )
S	Suction port (standard pressure series)	SAE 1 1/2 "
T <sub>1</sub> , T <sub>2</sub>	Case drain ports (T <sub>1</sub> , plugged)	M18×1.5
R	Air bleed (plugged)	M14×1.5

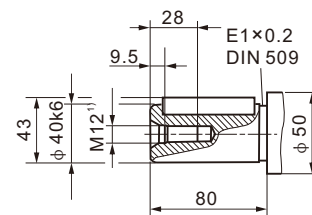
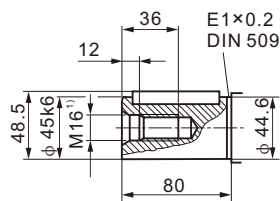
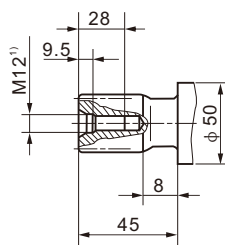
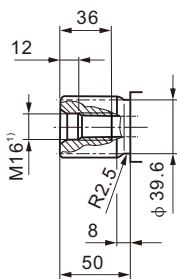
**Shaft ends**

Sizes 107,125  
A Splined shaft DIN 5480  
W45×2×30×21×9g  
P<sub>N</sub> = 40 MPa

Size 107  
Z Splined shaft DIN 5480  
W40×2×30×18×9g  
P<sub>N</sub> = 40 MPa

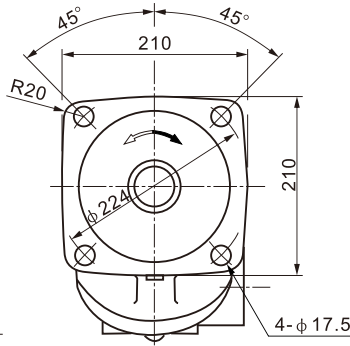
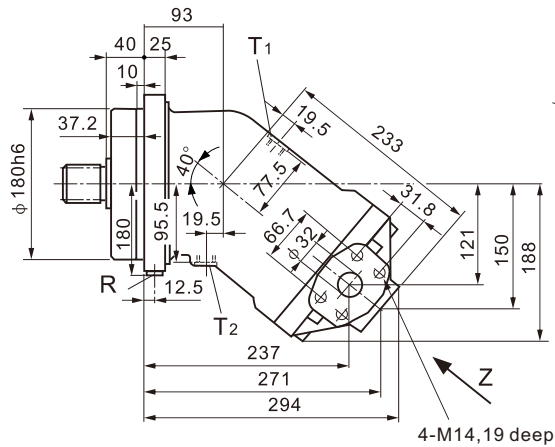
Sizes 107,125  
B Parallel keyed shaft,  
DIN 6885, As14×9×63  
P<sub>N</sub> = 35 MPa

Size 107  
P Parallel keyed shaft  
DIN 6885, AS12×8×63  
P<sub>N</sub> = 35 MPa



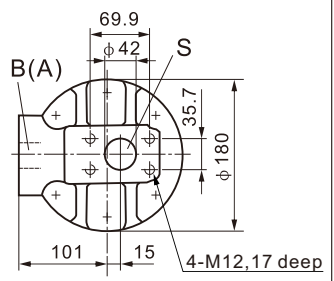
1) centering bore according to DIN 332 (thread according to DIN 13)

**Installation dimensions** Size 160,180



Counter-clockwise rotation:  
port plate is rotated through 180°

View Z



**Ports**

B(A)	Service line port (high pressure series)	SAE 1 1/4 "
S	Suction port (standard pressure series)	SAE 1 1/2 "
T <sub>1</sub> , T <sub>2</sub>	Case drain ports (T <sub>1</sub> plugged)	M22×1.5
R	Air bleed (plugged)	M14×1.5

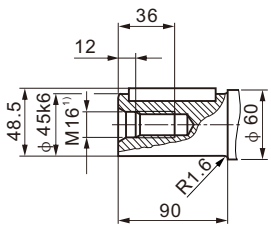
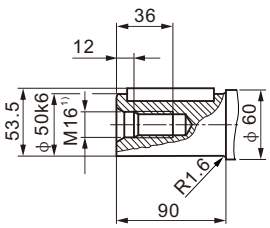
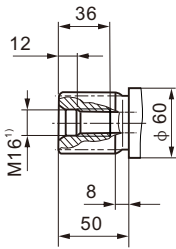
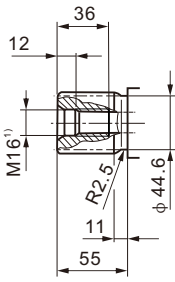
**Shaft ends**

Sizes 160,180  
A Splined shaft DIN 5480  
W50×2×30×24×9g  
P<sub>N</sub> = 40 MPa

Size 160  
A Splined shaft DIN 5480  
W45×2×30×21×9g  
P<sub>N</sub> = 40 MPa

Sizes 160,180  
P Parallel keyed shaft  
DIN 6885, AS14×9×70  
P<sub>N</sub> = 35 MPa

Size 160  
P Parallel keyed shaft  
DIN 6885, AS14×9×70  
P<sub>N</sub> = 35 MPa



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

## Installation and Commissioning Notes

### General

The pump case must be completely filled up with hydraulic fluid during startup and during operation (filling the case chamber). The pump must be started up at low speed and no load until the system has been bled completely.

If stopped for an extended period, fluid may drain out of the case through the service lines. When restarting, make sure that the case contains sufficient fluid.

The leakage fluid inside the case chamber must be drained off to the tank through the highest case drain port. The min. suction pressure at port S must not fall below 0.08 MPa absolute.

### Installation position

Optional

#### Installation below the tank

Pump below min. fluid level in the tank (standard)

- Fill axial piston pump before startup via the highest case drain port
- Additional measures required for installation position 2 (shaft facing up); with installation position 2, make sure that the pump case is completely full before starting up. Bleed at port R. An air pocket in the bearing area is leading to damage of the axial piston pump.
- Recommendation: Fill up suction lines.
- Run the pump at low speed until the system is bled completely.
- Minimum immersion depth of leakage line in tank: 200mm (relative to the min. fluid level in the tank).

#### Installation above the tank

Pump above minimum fluid level in tank

→ Proceed in same way as below the tank installation.

→ Additional measures for installation position 1 and 2.  
If stopped for an extended period, fluid may drain out of the case chamber through the service lines (air enters through the shaft seal). The bearing will therefore not be properly lubricated when the pump is started up again. Fill the axial piston pump before restarting via the highest case drain port. Installation position 2: bleed at port R.

→ Additional measures required for installation position 2 (shaft facing up):  
In this installation position the bearings will not be properly lubricated, even if there is still some fluid in the case chamber. Putting a non-return valve (opening pressure 0.05 MPa) in the leakage line can prevent the system emptying through the line.

→ Note: min. admissible pressure at port S.

