HA2FO Series
Axial piston fixed pump

Product show and brief introduction

Open circuits

Series 6
Sizes 10...180
Nominal pressure 400 bar
Peak pressure 450 bar



Features

- Fixed pump with axial tapered piston rotary group of bent-axis design, for hudrostatic drives in an open circuit
- For use in mobile and staionary applications
- The flow is proportional to the drive speed and displacment
- 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

HA2F	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 servise lines
HA2F: Bent-axis design, fixed	O: Pump, open circuits	10 12 16 23 28 32 45 56 63 80 90 107 125 160 180	6	1	(Viewed on drive shaft) R: Clockwise L: Counter-clockwise √	P: NBR (nitrl-caoutchouc) V: FKM (fluor-caoutchouc)	See below	B: 4-hole ISO 3019-2	See below

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[1)]

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 Sat 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 HA2FO fixed displacement pump is suitable for use with mineral oil

Viscosity range

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

V_{opt} = optimum viscosity16...36mm²/s

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

Limits of viscosity range

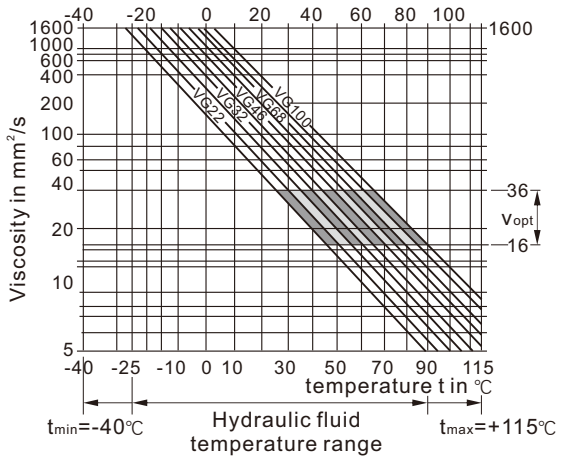
The following values apply in extreme cases:

Vmin = 5 mm²/s
short term(t < 3 min)at max.permitted temperature
tmax=115℃

Vmax = 1600 mm²/s
short term(t < 3 min) with cold start (P < 30 bar,
n≤ 1000 rpm t_{min}=-40°C)

Note that the maximun 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.

Setlection 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 fliuid should be selected so that within the operating temperature range, the operating viscosity lies within the optimun 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℃ an operating temperature of 60℃ is set in the circuit. In the optimun operating viscosity range(V_{opt}; shaded area) this corresponds to the viscosity classes VG 46 or VG68; to be selected: VG 68.

Please note: The leakage fluid temperature, which is affected by pressure and rotational spaad,is always higher than the tank temperature . At no point in the system may the temperature be higher than 115℃.

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℃ to max.115℃),a cleanliness level of at least

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

Operational pressure range

Inlet

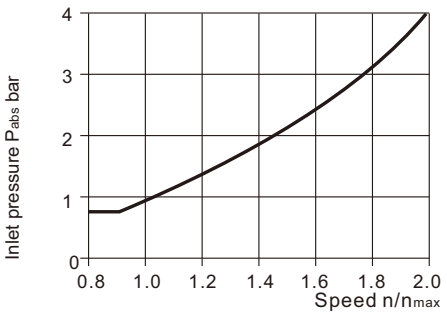
Pressure at port S
The minmum inlet pressure depends on speed. The following limits must not be exceeded.

$P_{abs\ min}$ ——— 0.8 bar

$P_{abs\ max}$ ——— 30 bar

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 $n_{max\ perm.}$(speed limit)
—min. permissble 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	400 bar	350 bar
Peak pressure P_{max}	450 bar	400 bar

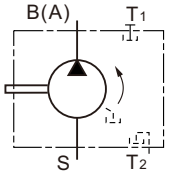
Direction of flow

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

Teble of values (the oretical values, ignoring η_{min} and η_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
		$n_{max\ limit}$ [2]	rpm	6000	6000	6000	4750	4750	4750	4250
Flow max.	at n_{max}	q_{vmax}	L/min	32.4	37.8	50	57	70	80	102
Power at	ˇP= 350 bar	P_{max}	Nm/bar	18.9	22	29.2	33	41	47	59.5
	ˇP= 400 bar	P_{max}	Nm	21.6	25	34	38	47	53	68
Torque at	ˇP= 350 bar	T	Nm	57	67	88	126	156	178	254
	ˇP= 400 bar	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
		$n_{max\ limit}$ [2]	rpm	3750	3750	3350	3350	3000	3000	2650	2650
Flow max.	at n_{max}	q_{vmax}	L/min	112	126	144	162	170	200	232	261
Power at	ˇP= 350 bar	P_{max}	Nm/bar	65	73.5	84	95	100	117	135	152
	ˇP= 400 bar	P_{max}	Nm	75	84	96	108	114	133	155	174
Torque at	ˇP= 350 bar	T	Nm	312	350	445	501	594	696	893	1003
	ˇP= 400 bar	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_{abs}) of 1 bar 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_{abs} > 1 bar) the rotational speeds can be increased to the max.admissible speeds $n_{max\ limit}$ (speed limits)

Determining the size

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

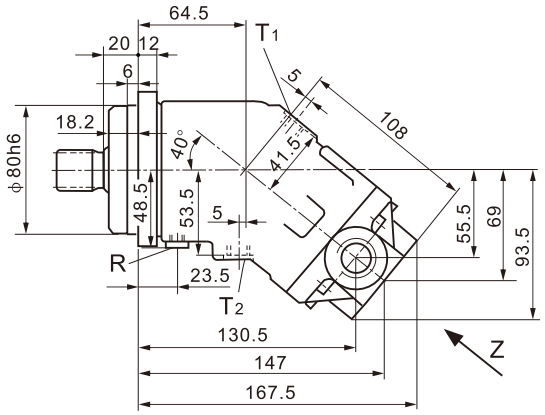
Torque $T = \frac{V_g \times \triangle P}{20\pi \times \eta_{mh}}$ [Nm]

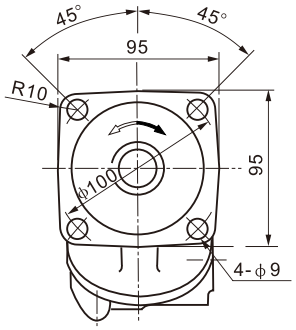
Power $P = \frac{2\pi \times T \times n}{60000} = \frac{q_v \times \triangle P}{600 \times \eta_t}$ [kW]

V_g = Displacement per revolution in mL/r
$\triangle P$ = Differential pressure in bar
n = Speed in rpm
η_v = Volumetric efficiency
η_{mh} = Mechanical-hydraulic efficiency
η_t = Overall efficiency

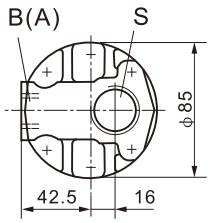
Installation dimensions Size 10,12,16

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





View Z

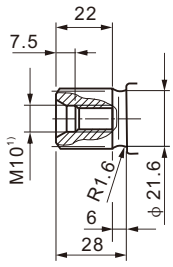


Ports

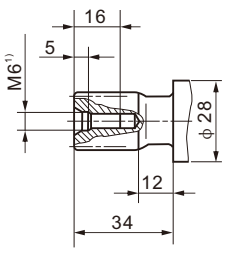
B(A)	Service line port	M22×1.5
S	Suction port	M33×2
T_1,T_2	Case drain ports (T_1 plugged)	M12×1.5
R	Air bleed (plugged)	M8×1

Shaft ends

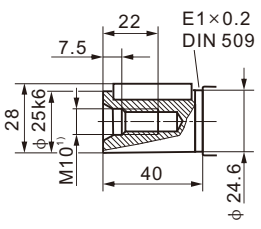
Sizes 10,12,16
A Splined shaft DIN 5480
W25×1.25×30×18×9g
P_N = 400 bar



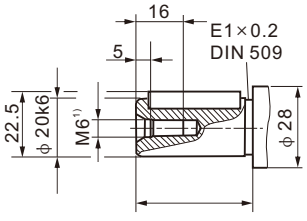
Sizes 10,12
Z Splined shaft DIN 5480
W20×1.25×30×14×9g
P_N = 400 bar



Sizes 10,12,16
B Parallel keyed shaft,
DIN 6885, AS8×7×32
P_N = 350 bar



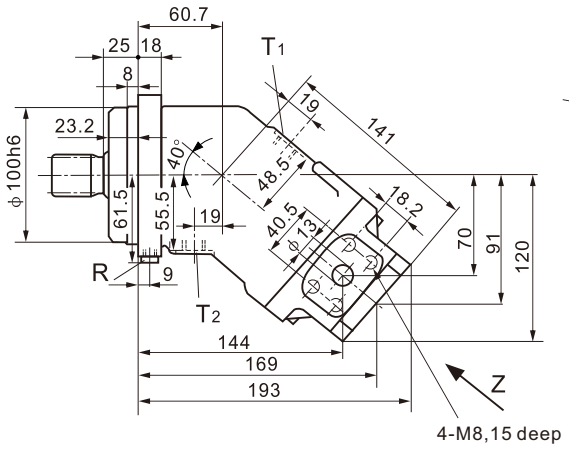
Sizes 10,12
P Parallel keyed shaft
DIN 6885, A6×6×32
P_N = 350 bar

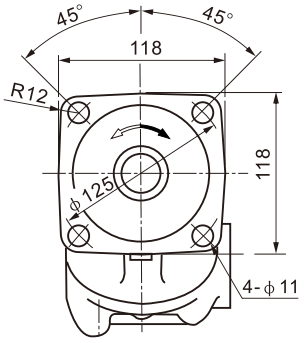


1) centering bore according to DIN 332 (thread according to DIN 13)

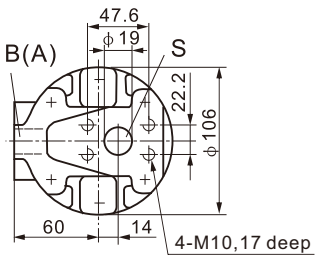
Installation dimensions Size 23,28,32

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





View Z

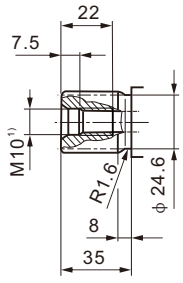


Ports

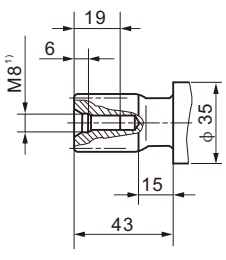
B(A)	Service line port (high pressure series)	SAE 1/2 "
S	Suction port (standard pressure series)	SAE 3/4 "
T_1, T_2	Case drain ports (T_1 plugged)	M16×1.5
R	Air bleed (plugged)	M10×1

Shaft ends

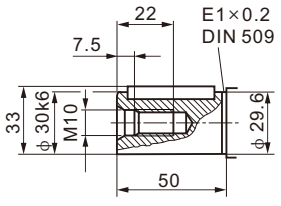
Sizes 23,28,32
A Splined shaft DIN 5480
W30×2×30×14×9g
P_N = 400 bar



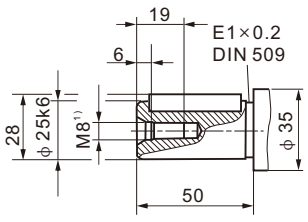
Sizes 23,28
Z Splined shaft DIN 5480
W25×1.25×30×18×9g
P_N = 400 bar



Sizes 23,28,32
B Parallel keyed shaft,
DIN 6885, AS8×7×40
P_N = 350 bar



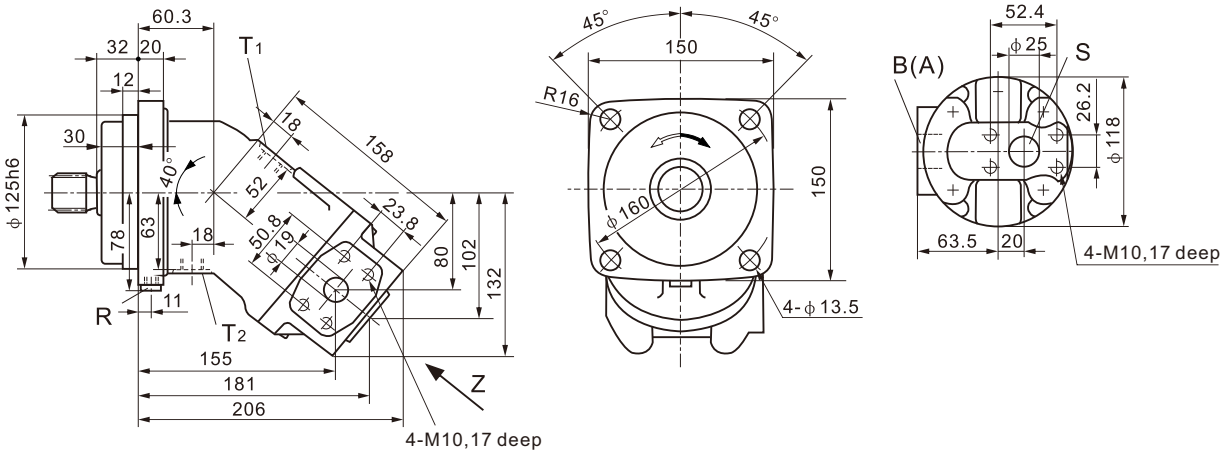
Sizes 23,28
P Parallel keyed shaft
DIN 6885, AS8×7×40
P_N = 350 bar



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

Installation dimensions Size 45

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

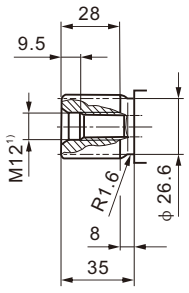


Ports

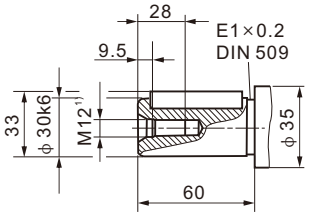
B(A)	Service line port (high pressure series)	SAE 3/4 "
S	Suction port (standard pressure series)	SAE 1 "
T_1,T_2	Case drain ports (T_1 plugged)	M18×1.5
R	Air bleed (plugged)	M12× 1.5

Shaft ends

Size 45
Z Splined shaft DIN 5480
W30×2×30×14×9g
P_N = 400 bar



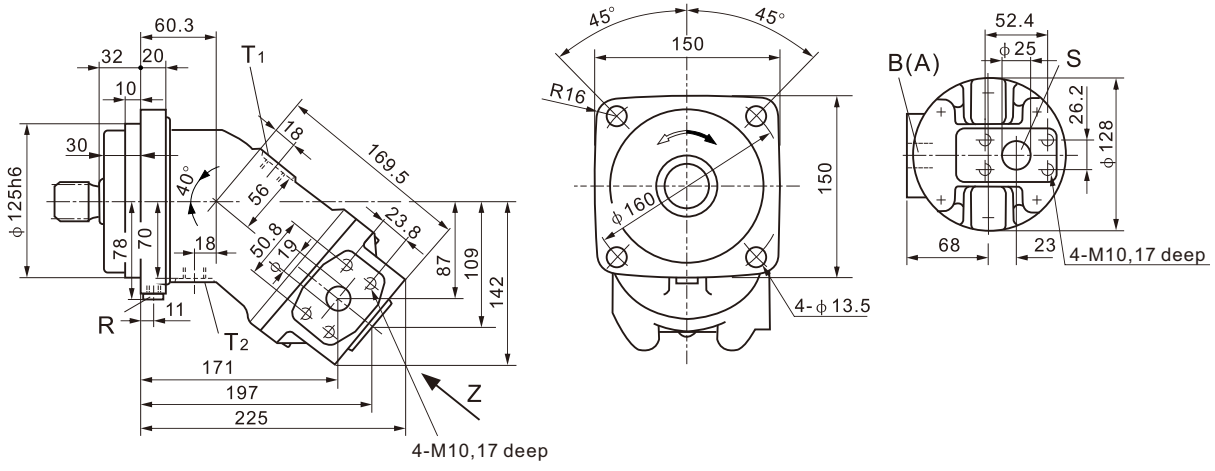
Size 45
P Parallel keyed shaft
DIN 6885, AS8×7×50
P_N = 350 bar



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_1, T_2	Case drain ports (T_1 plugged)	M18×1.5
R	Air bleed (plugged)	M12× 1.5

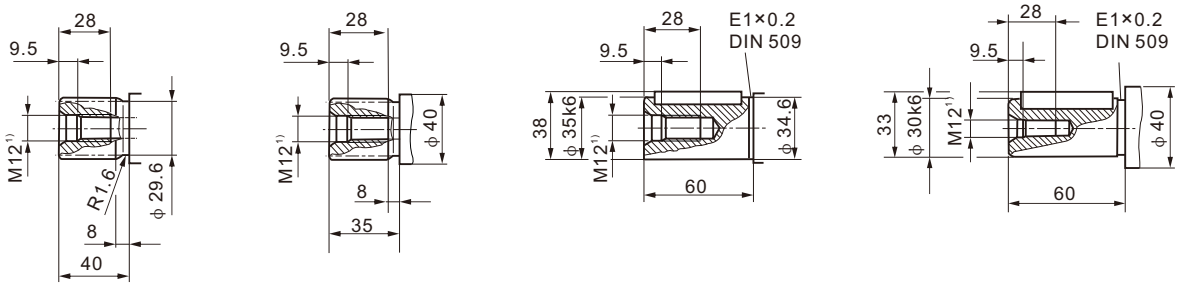
Shaft ends

Sizes 56,63
A Splined shaft DIN 5480
W35×2×30×16×9g
P_N = 400 bar

Size 56
Z Splined shaft DIN 5480
W30×2×30×14×9g
P_N = 350 bar

Sizes 56,63
B Parallel keyed shaft,
DIN 6885, AS10×8×50
P_N = 350 bar

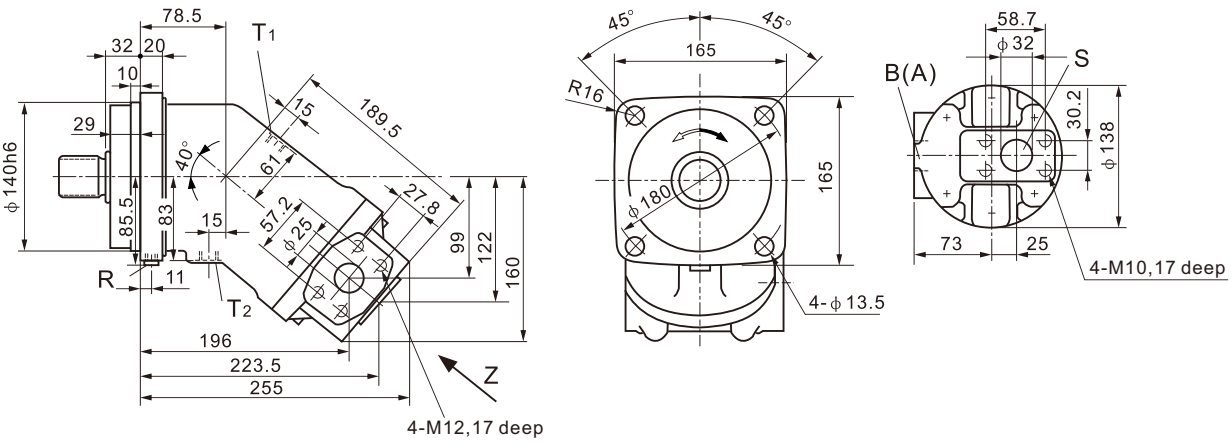
Size 56
P Parallel keyed shaft
DIN 6885, AS8×7×50
P_N = 350 bar



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°

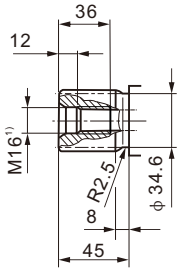


Ports

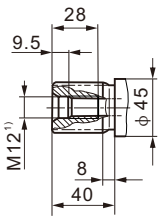
B(A)	Service line port (high pressure series)	SAE 1 "
S	Suction port (standard pressure series)	SAE 1 1/4 "
T_1,T_2	Case drain ports (T_1 plugged)	M18×1.5
R	Air bleed (plugged)	M12× 1.5

Shaft ends

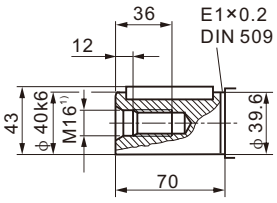
Sizes 80,90
A Splined shaft DIN 5480
W40×2×30×18×9g
P_N = 400 bar



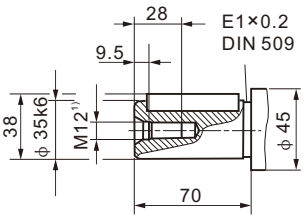
Size 80
Z Splined shaft DIN 5480
W35×2×30×16×9g
P_N = 400 bar



Sizes 80,90
B Parallel keyed shaft,
DIN 6885, AS12×8×56
P_N = 350 bar



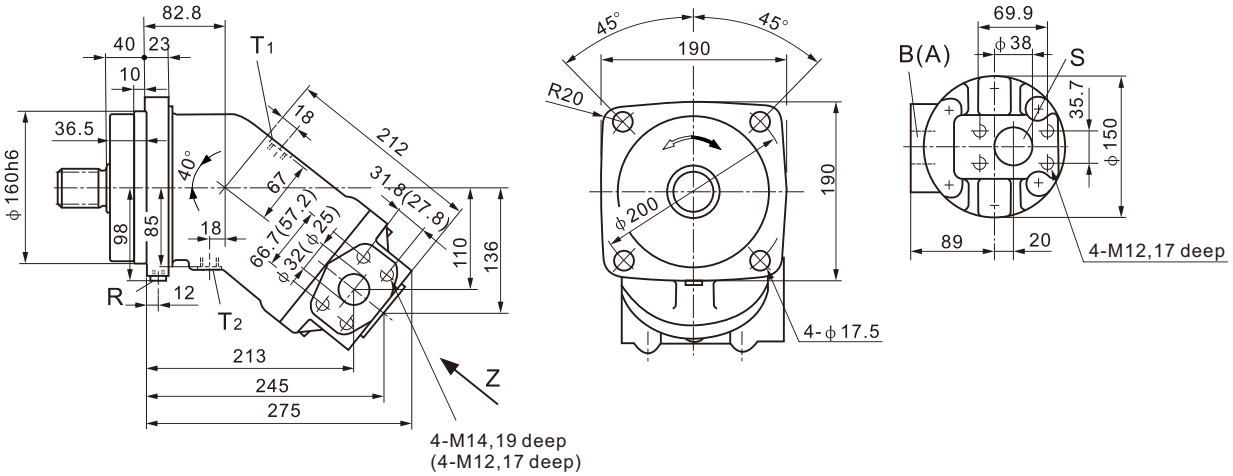
Size 80
P Parallel keyed shaft
DIN 6885, AS10×8×56
P_N = 350 bar



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

Installation dimensions Size 107,125

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



(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_1, T_2	Case drain ports (T_1 plugged)	M18×1.5
R	Air bleed (plugged)	M14× 1.5

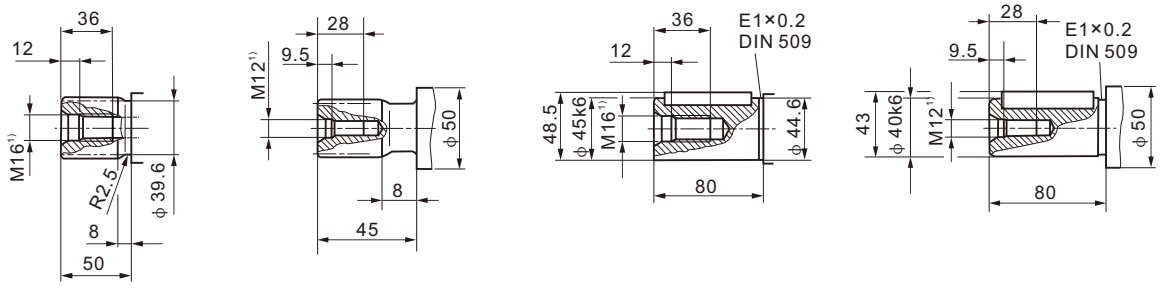
Shaft ends

Sizes 107,125
A Splined shaft DIN 5480
W45×2×30×21×9g
P_N = 400 bar

Size 107
Z Splined shaft DIN 5480
W40×2×30×18×9g
P_N = 400 bar

Sizes 107,125
B Parallel keyed shaft,
DIN 6885, As14×9×63
P_N = 350 bar

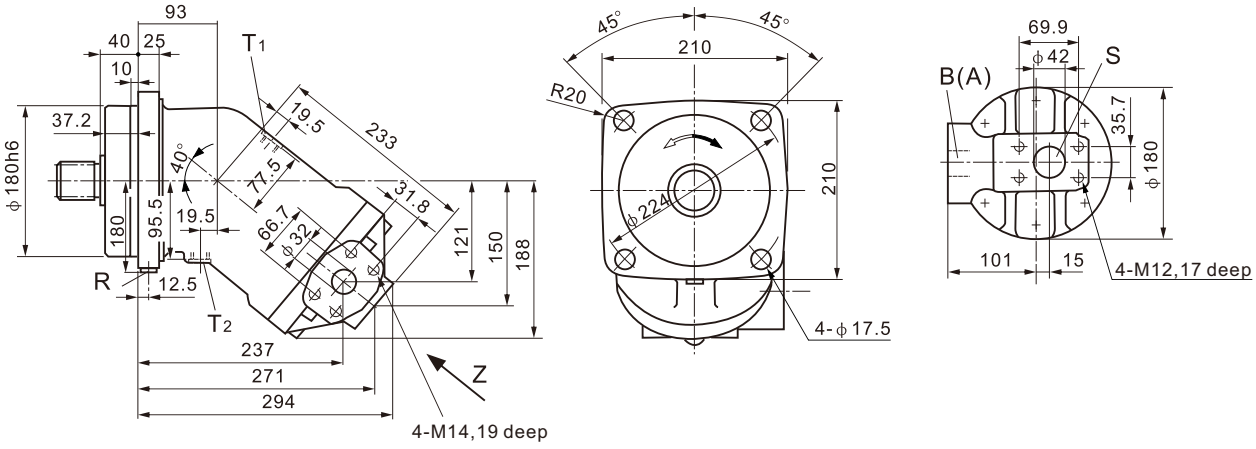
Size 107
P Parallel keyed shaft
DIN 6885, AS12×8×63
P_N = 350 bar



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°

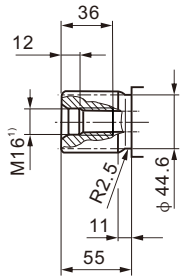


Ports

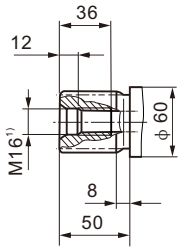
B(A)	Service line port (high pressure series)	SAE 1 1/4 "
S	Suction port (standard pressure series)	SAE 1 1/2 "
T_1, T_2	Case drain ports (T_1 plugged)	M22×1.5
R	Air bleed (plugged)	M14× 1.5

Shaft ends

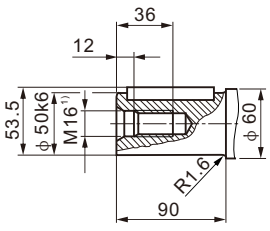
Sizes 160,180
A Splined shaft DIN 5480
W50×2×30×24×9g
P_N = 400 bar



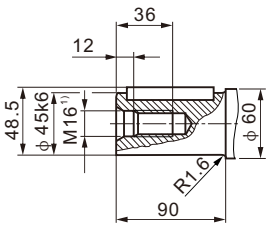
Size 160
A Splined shaft DIN 5480
W45×2×30×21×9g
P_N = 400 bar



Sizes 160,180
P Parallel keyed shaft
DIN 6885, AS14×9×70
P_N = 350 bar



Size 160
P Parallel keyed shaft
DIN 6885, AS14×9×70
P_N = 350 bar



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 bellow 0.8 bar 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 0.5 bar) in the leakage line can prevent the system emptying through the line.

→ Note: min.admissible pressure at port S.

